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

SHAILEN P. BHATT
SECRETARY

September 24, 2013

Mr. Scott Lobdell
Van Cleef Engineering Associates, Inc.
630 Churchmans Road
Suite 105
Newark, DE 19702

Dear Mr. Lobdell:

The enclosed Traffic Impact Study (TIS) review letter for **The Centre at Hearthstone** mixed-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 Standards and Regulations for Subdivision Streets and State Highway Access and other accepted practices and procedures for such studies. DelDOT accepts this review letter and concurs with the recommendations. 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. C. David Jamison, CDJ Engineering, Inc.
Ms. Constance C. Holland, Office of State Planning Coordination
Mr. Lawrence Lank, Director, Sussex County Planning and Zoning
Mr. Richard Carmean, City of Milford
Mr. Mir Wahed, Johnson, Mirmian & Thompson, Inc.
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T. William Brockenbrough, Jr., County Coordinator, Development Coordination
Thomas E. Meyer, Traffic Studies Manager, Traffic, DOTS
Chris Sylvester, Traffic Engineer, Traffic, DOTS
Jeff Reed, South District Engineer, Central District
Marvin Roberts, South District Public Works Supervisor, Central District
Lisa Collins, Service Development Planner, Delaware Transit Corporation
John Gaines, Project Manager, Project Development South, DOTS
Brad Saborio, Group Engineer, Project Development South, DOTS
Steve Sisson, Sussex County Subdivision Coordinator, Development Coordination
Derek Sapp, Subdivision Manager, Development Coordination
Marco Boyce, Planning Supervisor, Statewide & Regional Planning
Claudy Joinville, Project Engineer, Development Coordination

JOHNSON, MIRMIRAN & THOMPSON
*Engineering A Brighter Future®*

September 24, 2013

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

RE: Agreement No. 2048
Traffic Impact Study Services
**Task 10A-The Centre at Hearthstone Manor**

Dear Mr. Brestel:

Johnson, Mirmiran and Thompson (JMT) has completed the review of the Final Traffic Impact Study (TIS) for The Centre at Hearthstone Manor development, prepared by C. David Jamison, PE (CDJ). This review was assigned Task Number 10A. CDJ prepared the report in a manner generally consistent with DelDOT's *Standards and Regulations for Subdivision Streets and State Highway Access.*

The TIS evaluates the impacts of The Centre at Hearthstone Manor, a mixed use commercial/residential development proposed in the City of Milford, Sussex County, Delaware. The proposed development will consist of 710,200 square feet of retail space, 32,000 square feet of general office space and 164 residential condominiums. The site is to be located along the southerly side of Wilkins Road (Sussex Road 206), between Elks Lodge Road (Sussex Road 211) and Cedar Creek Road (Delaware Route 30/Sussex Road 212). The subject property is approximately 106 acres and is currently zoned Highway Commercial (C3) in the City of Milford. With the construction of the proposed development the zoning will remain the same.

Full access locations are proposed on Wilkins Road (Site Entrance A), Cedar Creek Road (Site Entrance E), and Elks Lodge Road (Site Entrance F). Per the TIS, Site Entrance E is proposed opposite the southbound Delaware Route 1 Ramp that will be constructed as part of the DelDOT SR 1/SR 30 Grade Separated Intersection project (Contract No. T200812201). Site Entrances B, C, and D are no longer proposed.

In addition to the analyses listed in the scoping letter for the TIS, DelDOT requested an additional analysis for the future build scenario. The additional analysis (which is referred to as Case 4) examines an updated entrance proposal created by Van Cleef Engineering Associates, LLC that depicts Site Entrance E to be relocated approximately 750 feet north of the southbound Delaware Route 1 Ramp. The additional analysis takes into account the future build scenario with and without the Hall Property development. The Hall Property is a commercial development proposed to be constructed at the northeast corner of the Cedar Creek Road intersection with the southbound Delaware Route 1 Ramp. Access to the Hall Property would be provided along Cedar Creek Road. Therefore, the additional analysis examines Site Entrance E

to be located opposite the Hall Property driveway. A driveway along the southbound Delaware Route 1 Ramp is also under consideration for the Hall Property. As such, a supplemental analysis is also included that takes into account the provision of a right in only driveway for the Hall Property along the southbound Delaware Route 1 Ramp. It should be noted that the Hall Property was not included in the TIS as a committed development because a site plan has not yet been submitted to DelDOT. However, it is acknowledged that some commercial proposal is expected to develop on this land and will need to be accommodated.

DelDOT currently has two relevant projects within the study area, the US 113 North/South Study and the SR 1, SR 30 Grade Separated Intersection project. The purpose of the US 113 North/South Study is to identify an alignment for a continuous limited access roadway from the vicinity of Delaware Route 1 (Sussex Road 14) north of Milford to the Delaware/Maryland state line. The study also identifies improvements to major east/west routes accessed from US Route 113 (Sussex Road 113). DelDOT and the Federal Highway Administration (FHWA) have divided the US 113 North/South Study into four geographic areas. The four study areas include the Milford/Lincoln Area, the Ellendale Area, the Georgetown Area, and the Millsboro-South Area.

DelDOT formed a working group for the Milford/Lincoln Area of the US 113 North/South Study and reviewed several alternatives for bypasses around the Milford/Lincoln area as well as an on-alignment option for US Route 113. However, community consensus could not be reached and DelDOT stopped pursuing the US 113 North/South Study in the Milford/Lincoln Area in January 2008. While the US 113 North/South Study moves forward in the Ellendale, Georgetown, and Millsboro-South areas, no progress has been made in the Milford Area since July 2007 and no work is currently underway in the Milford/Lincoln area. For additional information regarding the US 113 North/South Study, please see the project website at http://www.deldot.gov/information/projects/us113/index.shtml

The SR 1, SR 30 Grade Separated Intersection project will replace the existing at-grade intersection of Delaware Route 1 and Wilkins Road with a grade-separated intersection. This will be accomplished with the construction of an overpass and connecting ramps. The northbound Delaware Route 1 access will be achieved via a ramp that will connect to Cedar Neck Road (Sussex Road 206). The southbound Delaware Route 1 access will be achieved via a ramp from Cedar Creek Road, south of the proposed overpass. Based on the plans developed by DelDOT, the southbound Delaware Route 1 Ramp would connect with Cedar Creek Road to form a three-legged unsignalized intersection. The southbound Delaware Route 1 ramp would intersect Cedar Creek Road from the east and provide one left turn lane and one channelized right turn lane. The southbound Delaware Route 1 Ramp approach would be stop-controlled. Improvements will also be made to the existing intersection of Wilkins Road and Cedar Creek Road which include the installation of a signal and auxiliary lanes to accommodate the various turning movements that occur at this location. Construction has recently started for this project and is anticipated to be completed in Spring of 2014. For additional information regarding the SR 1, SR 30 Grade Separated Intersection project, please see the project website at http://deldot.gov/information/projects/sr1_30_gsi/index.shtml

DelDOT's Corridor Capacity Program (CCPP) is a statewide program developed to maintain a road's ability to handle traffic efficiently and safely, and minimize the transportation impacts of increased economic growth. The CCPP strives to maintain the through capacity of certain arterial highways through the management of access along them. Four corridors are part of this program, including Delaware Route 1 from Dover to the south to Five Points and US Route 113 from the southern limits of the City of Milford to the Maryland State Line. There is a portion of US Route 113 that is part of the CCPP and contains one of the intersections included as part of this TIS, the US Route 113 intersection with Johnson Road/Fitzgeralds Road (Sussex Road 207). Per the CCPP, the strategy for US Route 113 is to minimize new entrances and traffic signals along the corridor and over time convert the facility to a limited access highway. Although the US Route 113 intersection with Johnson Road/Fitzgeralds Road is within the CCPP, there are no projects associated with the CCPP planned at the intersection.

In addition, DelDOT's 2012 High Risk Rural Roads Program (HRRRP) included two sites (Sites 8 and 15) that are within the project area. Site 8 is a 0.49 mile section of Johnson Road from 0.08 mile east of Fork Road to 0.26 mile east of Cedar Creek Road. Site 15 is a 0.49 mile section of Cedar Creek Road from 0.19 mile south of Johnson Road to 0.23 mile north of Fork Road. The combined Site 8/15 report included a crash summary, a speed data summary, and a sight distance review of the Cedar Creek Road intersection with Johnson Road. The suggested improvements within the report for the Cedar Creek Road intersection with Johnson Road include replacing a damaged "Stop Ahead" (W3-1) sign along the westbound Johnson Road approach as well as replacing a damaged Direction Arrow (M6-1) sign posted along the northbound Cedar Creek Road approach. Both of these improvements have been completed. The report also suggested that additional studies be conducted to identify improvements to reduce the potential for angle crashes. WR&A is in the process of conducting these additional studies.

Based on our review, 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.

| ***Intersection*** | ***Situations for which deficiencies occur*** |
|---|---|
| Johnson Road and Delaware Route 1 | 2020 Saturday with The Centre at Hearthstone Manor (Case 3) |
| Johnson Road and Cedar Creek Road | 2020 PM and Saturday with The Centre at Hearthstone Manor (Case 3) |
| Johnson Road and North Old State Road | 2020 PM with The Centre at Hearthstone Manor (Case 3) |
| Delaware Business Route 1 and 2nd Street | 2020 PM and Saturday with The Centre at Hearthstone Manor (Case 3) |
| Cedar Creek Road and Southbound Delaware Route 1 Ramp/Site Entrance E | 2020 AM, PM and Saturday with The Centre at Hearthstone Manor (Case 3) |

The intersection of Johnson Road and Delaware Route 1 would exhibit LOS deficiencies under future conditions with the construction of the proposed development during the Saturday peak hour. The LOS deficiencies would occur along the eastbound Johnson Road approach as well as along the northbound Delaware Route 1 left turn approach. The 95th percentile queue length along the eastbound Johnson Road approach is approximately 70 feet which is less than three vehicles. Similarly, the 95th percentile queue length along the northbound Delaware Route 1 left turn lane is approximately 65 feet and would be accommodated via the provided 325 feet of storage length. Furthermore, the turning volumes at the intersection may even be reduced due to the diversion to the SR 1/SR 30 grade-separated intersection. As such, we do not recommend any improvements be implemented by the developer at this intersection.

The intersection of Johnson Road and Cedar Creek Road would exhibit LOS deficiencies under future conditions with the construction of the proposed development during the weekday evening and Saturday midday peak hours. The LOS deficiencies would occur along the eastbound and westbound Johnson Road approaches to the intersection. The projected 95th percentile queue lengths under Case 3 conditions are approximately 65 feet and 95 feet along the eastbound and westbound Johnson Road approaches, respectively. The provision of a separate right turn lane along the eastbound and westbound approaches would address the LOS deficiencies. However, improvements are not recommended at the intersection since the projected queues would not obstruct any adjacent intersections. Therefore, we do not recommend any improvements be implemented by the developer at this intersection. However, we would recommend DelDOT continuously monitor the operation of this intersection.

The intersection of Johnson Road and North Old State Road (Sussex Road 213) would exhibit LOS deficiencies under future conditions with the construction of the proposed development during the weekday evening peak hour. The LOS deficiency occurs along the southbound North Old State Road approach. The projected 95th percentile queue length along the southbound approach is approximately 85 feet. The provision of a separate left turn lane and a shared through/right turn lane along the southbound approach would address the LOS deficiency. In addition, converting the Johnson Road and North Old State Road intersection to an all-way stop controlled intersection would address the LOS deficiency. Since the maximum southbound queue length during the evening peak hour is less than four vehicles we do not recommend any improvements be implemented by the developer at this intersection.

The intersection of Delaware Business Route 1 and 2nd Street would exhibit LOS deficiencies under future conditions with the construction of the proposed development during the weekday evening and Saturday midday peak hours. The LOS deficiencies would occur along the eastbound 2nd Street approach and the westbound restaurant driveway approach. The projected 95th percentile queue lengths along the eastbound 2nd Street approach under Case 3 conditions would be approximately 200 feet and 180 feet during the PM and Saturday midday peak hours, respectively. However, these conditions are not unexpected in a dense residential area. In addition, the projected queue lengths would not block adjacent intersections. Therefore, we do not recommend any improvements for this approach. Since the maximum peak hour volume on the westbound restaurant driveway approach is four vehicles with a 95th percentile queue length of approximately 25 feet, no improvements are recommended along this approach as well.

Therefore, we do not recommend any improvements be implemented by the developer at this intersection.

Per the TIS, Site Entrance E is proposed to be located opposite, though not directly aligned with, the southbound Delaware Route 1 Ramp intersection with Cedar Creek Road. With this layout, the unsignalized intersection of Cedar Creek Road and southbound Delaware Route 1 Ramp/Site Entrance E would exhibit LOS deficiencies under future conditions with the development of The Centre at Hearthstone Manor during all peak periods. The LOS deficiencies in future conditions would occur along the Site Entrance E and the southbound Delaware Route 1 ramp approaches. To address the LOS deficiency and minimize the occurrence of long queues, it is suggested that a traffic signal be installed at the intersection, the eastbound and westbound approaches to the intersection be aligned to form a standard four-legged intersection, and the southbound Delaware Route 1 Ramp approach be modified to provide separate left turn, through and right turn lanes. However, in order to form a standard four-legged intersection, additional right-of-way would need to be acquired from either the property located at the northwest quadrant of the intersection (Tax Parcel 3-30-15.00-59.01) or from the property located at the southeast quadrant of the intersection (Tax Parcel 3-30-11.00-6.00).

Though we encourage the eastbound Site Entrance E and southbound Delaware Route 1 Ramp approaches to Cedar Creek Road to be aligned, it is acknowledged that obtaining the needed right-of-way for the realignment may not be feasible. Additionally, the presence of potential archaeological sites on the southeast quadrant of the Cedar Creek Road intersection with Site Entrance E and the southbound Delaware Route 1 Ramp could lead to design constraints. Therefore, two alternative entrance configurations have been considered. One alternative includes a right in and right out entrance near the south end of the Cedar Creek Road site frontage. Enclosed Figure 1 depicts this conceptual layout for Site Entrance E. As a result of this alternative, some improvements including the installation of a traffic signal at the Site Entrance A/Wilkins Road intersection as well as the installation of a traffic signal at the Cedar Creek Road/southbound Delaware Route 1 Ramp intersection would be needed. However, this alternative was not acceptable to the developer. A discussion regarding this alternative is included within this letter.

A second alternative, proposed by the developer, configures Site Entrance E as full movement and relocates the entrance approximately 750 feet north of the southbound Delaware Route 1 Ramp. This new intersection would exhibit LOS deficiencies under future conditions during the PM and Saturday midday peak periods. To address the LOS deficiencies at this intersection, we recommend that a traffic signal be installed when the appropriate warrants are met. This new scenario is analyzed as Case 4 in this TIS review letter.

As a result of the traffic generated by The Centre at Hearthstone Manor development, there would be a high volume of northbound left turning vehicles at the intersection of Cedar Creek Road and Site Entrance E. The provision of one northbound left turn lane at this intersection would require approximately 530 feet of storage (excluding taper) per the 95$^{th}$ percentile queue length. Given there is approximately 750 feet of available space between the intersections of Site Entrance E and the southbound Delaware Route 1 Ramp (this takes into account the stop bar

locations due to the signalization of Site Entrance E), that a 100 foot taper would be required for the left turn lane, and that the southbound left turn movement at the southbound Delaware Route 1 Ramp intersection would require 195 feet of storage (excluding taper), there would not be enough space to construct both left turn lanes as required and there is the potential that the 95$^{th}$ percentile queue lengths would overlap each other within this short distance. Also, two northbound and two southbound left turn lanes would be required at the Site Entrance E intersection as a result of the potential traffic impacts from the Hall Property development. Therefore, due to the limited distance available between the Site Entrance E and southbound Delaware Route 1 Ramp intersections and the future potential development, it is recommended that two northbound left turn lanes be provided at the intersection of Cedar Creek Road/Site Entrance E, which would shorten the required storage length to 410 feet (excluding taper).

With the development of both The Centre at Hearthstone Manor and the Hall Property, the intersection of Cedar Creek Road with Site Entrance E and the Hall Property entrance would exhibit LOS deficiencies during all peak periods. To address these expected LOS deficiencies, a traffic signal should be installed when it is warranted per a signal justification study and the northbound and southbound Cedar Creek Road approaches should provide two left turn lanes, one through lane, and one right turn lane. Additionally, Site Entrance E and the proposed Hall Property entrance should provide one left turn lane, one through lane, and one right turn lane.

Enclosed Figure 2 depicts the conceptual layouts for the Site Entrance E/Cedar Creek Road intersection with and without the Hall Property entrance. As depicted on Figure 2, additional right of way (approximately 10 feet) may be needed from the westerly side of Cedar Creek Road when two left turn lanes are installed along either the northbound or southbound approaches. Furthermore, with the provision of two left turn lanes along either the northbound or southbound approaches, restriping and roadway realignment may be needed to tie into the Wilkins Road and southbound Delaware Route 1 Ramp intersections. Therefore, as part of Entrance Plan design, the developer should submit a plan depicting the limits of work and coordinate with DelDOT Subdivision Section to determine the exact intersection layout and resulting impacts along Cedar Creek Road.

With the development of The Centre at Hearthstone Manor and the Hall Property, the intersection of Cedar Creek Road and the southbound Delaware Route 1 Ramp would exhibit LOS deficiencies during the PM and Saturday midday peak periods. To address the LOS deficiencies, a traffic signal should be installed when it is warranted per a signal justification study. As such, we recommend that The Centre at Hearthstone Manor development be required to enter into a traffic signal agreement.

Additionally, the Hearthstone Manor II and the Watergate at Milford developments are currently obligated to make improvements at the intersection of Marshall Street and Elks Lodge Road/McCoy Avenue. The improvement includes the modification of the westbound Elks Lodge Road approach to provide an exclusive right turn lane. As some site traffic from The Centre at Hearthstone Manor development would travel through this intersection, the developer should be required to participate with the improvements.

All of the analysis conducted in this study was based on future traffic volumes identified in the Milford Southeast Neighborhood Master Plan. Any additional future development that was not identified in the plan could result in the need for future improvements beyond what is stated here.

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

1. The developer should improve Cedar Creek Road from the south end of the site frontage to the intersection of Cedar Creek Road/Wilkins Road to meet DelDOT's major collector road standards. These standards include, but are not limited to, two twelve-foot travel lanes and two five-foot shoulders. The developer should provide a bituminous concrete overlay to the existing travel lanes, at DelDOT's discretion. DelDOT should analyze the existing lanes' pavement section and recommend an overlay thickness to the developer's engineer if necessary.

2. The developer should improve Wilkins Road along the entire length of the site frontage to meet DelDOT's local road standards. These standards include, but are not limited to, two eleven-foot travel lanes and two five-foot shoulders. The developer should provide a bituminous concrete overlay to the existing travel lanes, at DelDOT's discretion. DelDOT should analyze the existing lanes' pavement section and recommend an overlay thickness to the developer's engineer if necessary.

3. The developer should improve Elks Lodge Road from the south end of the site frontage to the intersection of Elks Lodge Road/Wilkins Road to meet DelDOT's local road standards. These standards include, but are not limited to, two eleven-foot travel lanes and two five-foot shoulders. The developer should provide a bituminous concrete overlay to the existing travel lanes, at DelDOT's discretion. DelDOT should analyze the existing lanes' pavement section and recommend an overlay thickness to the developer's engineer if necessary. Additionally, the developer should provide a concept plan depicting the limits of the improvements along Elks Lodge Road.

4. The developer should construct a full access site entrance (Site Entrance E) on Cedar Creek Road to be consistent with the proposed lane configurations as shown in the table below:

| Approach | Current Configuration | Proposed Configuration |
|---|---|---|
| Eastbound Site Entrance E | Approach does not exist | One left turn lane and one right turn lane* |
| Northbound Cedar Creek Road | One through lane | Two left turn lanes and one through lane |
| Southbound Cedar Creek Road | One through lane | One through lane and one right turn lane |

*This approach should be designed to accommodate a future through lane

The recommended minimum storage lengths (excluding taper) of the separate left turn and right turn lanes along the Cedar Creek Road approaches are listed below.

| Approach | Left Turn Lane(s) | Right Turn Lane |
|---|---|---|
| Northbound Cedar Creek Road | 410 feet | - |
| Southbound Cedar Creek Road | - | 350 feet |

The left turn storage length is based on HCS analysis and the right turn storage length is based on DelDOT's *Standards and Regulations for Subdivision Streets and State Highway Access*. It should be noted that the storage length based on the HCS analysis for the southbound Cedar Creek Road right turn lane provides a shorter queue length than what is reported here.

5. The developer should enter into a traffic signal agreement with DelDOT for the intersection of Cedar Creek Road and Site Entrance E. The agreement should include signal heads, pedestrian signals, crosswalks and interconnection at DelDOT's discretion. The developer will be required to perform a Signal Justification Study including a peak hour and a four-hour signal warrant analysis at DelDOT's discretion. The developer should coordinate with DelDOT on the implementation and equitable cost sharing of the traffic signal.

6. In anticipation of the need for future widening of Cedar Creek Road to accommodate southbound left turn lanes at the intersection of Cedar Creek Road and Site Entrance E, the developer should dedicate to DelDOT sufficient right of way (approximately 10 feet) along the Cedar Creek Road site frontage. The specific right of way dedication needed should be determined during the Entrance Plan review process. Further, the developer should submit a plan and coordinate with DelDOT Subdivision Section to identify additional restriping and realignment modifications needed to accommodate the turn lanes.

7. The developer should enter into an agreement with DelDOT to fund an equitable portion of the striping as part of the DelDOT SR 1/SR 30 Grade Separated Intersection project (Contract No. T200812201) along the southbound Cedar Creek Road approach at the southbound Delaware Route 1 Ramp to provide a southbound left turn lane with a recommended minimum storage length (excluding taper) of 195 feet while maintaining the needed storage lengths mentioned in above Item 4. The provision of this left turn lane along with the recommendations mentioned in Item 4 would result in the elimination of the proposed two way left turn lane as part of the DelDOT SR 1/SR 30 Grade Separated Intersection project.

8. The developer should construct a full access site entrance on Wilkins Road to be consistent with the proposed lane configurations as shown in the table below:

| Approach | Current Configuration | Proposed Configuration |
|---|---|---|
| Eastbound Wilkins Road | One through lane | One left turn lane, one through lane, and one right turn lane |
| Westbound Wilkins Road | One through lane and one right turn lane | One left turn lane, one through lane, and one right turn lane |
| Northbound Site Entrance A | Approach does not exist | One shared through/left turn lane and one right turn lane |
| Southbound Homestead Boulevard | One left turn lane and one right turn lane | One left turn lane and one shared through/right turn lane |

The recommended minimum storage lengths (excluding taper) of the separate left turn and right turn lanes along the Wilkins Road approaches are listed below.

| Approach | Left Turn Lane | Right Turn Lane |
|---|---|---|
| Eastbound Wilkins Road | 210 feet | 290 feet |
| Westbound Wilkins Road | 260 feet | 145 feet |

The left turn and right turn storage lengths are based on DelDOT's *Standards and Regulations for Subdivision Streets and State Highway Access.* The storage lengths based on the HCS analysis provide shorter queue lengths than what is reported here.

9. The developer should construct a full access site entrance on Elks Lodge Road to be consistent with the proposed lane configurations as shown in the table below:

| Approach | Current Configuration | Proposed Configuration |
|---|---|---|
| Westbound Site Entrance F | Approach does not exist | One left turn lane and one right turn lane |
| Northbound Elks Lodge Road | One through lane | One through lane and one right turn lane |
| Southbound Elks Lodge Road | One through lane | One left turn lane and one through lane |

Based on DelDOT's *Standards and Regulations for Subdivision Streets and State Highway Access,* the recommended minimum storage lengths (excluding taper) are 235 feet for the southbound Elks Lodge Road left turn lane and 290 feet for the northbound Elks Lodge Road right turn lane. The storage lengths based on the HCS analysis provide shorter queue lengths than what is reported here.

10. The developer should enter into an agreement with DelDOT to fund an equitable portion of the improvements planned as part of the DelDOT SR 1/SR 30 Grade Separated

Intersection project (Contract No. T200812201) at the Wilkins Road intersection with Cedar Creek Road. The proposed configuration is shown in the table below. The Hearthstone Manor II development is expected to be responsible for part of these improvements as well. The developer should coordinate with DelDOT on the implementation and equitable cost sharing of these improvements.

| Approach | Current Configuration | Proposed Configuration |
|---|---|---|
| Eastbound Wilkins Road | One shared through/left turn/right turn lane | One left turn lane, one through lane, and one right turn lane |
| Westbound Wilkins Road | One shared through/left turn lane and one right turn lane | One left turn lane, one through lane, and one right turn lane |
| Northbound Cedar Creek Road | One shared through/left turn/right turn lane | One left turn lane, one through lane, and one right turn lane |
| Southbound Cedar Creek Road | One shared through/left turn/right turn lane | One left turn lane, one through lane, and one right turn lane |

11. The developer should enter into a traffic signal agreement with DelDOT for the intersection of Wilkins Road and Cedar Creek Road as part of the DelDOT SR 1/SR 30 Grade Separated Intersection project (Contract No. T200812201). The agreement should include signal heads, pedestrian signals, crosswalks and interconnection at DelDOT's discretion. The Hearthstone Manor II development is expected to be responsible for part of these improvements as well. The developer should coordinate with DelDOT on the implementation and equitable cost sharing of the traffic signal.

12. The developer should enter into a traffic signal agreement with DelDOT to fund an equitable portion of the signal construction at the intersection of Cedar Creek Road and the southbound Delaware Route 1 Ramp. The Hall Property development is expected to be responsible for part of these improvements as well. The agreement should include signal heads, crosswalks and interconnection at DelDOT's discretion. The developer should coordinate with DelDOT on the implementation and equitable cost sharing of the traffic signal.

13. The developer should enter into an agreement with DelDOT to fund an equitable portion of the improvements planned at the Marshall Street intersection with Elks Lodge Road/McCoy Avenue. The proposed configuration is shown in the table below. The Hearthstone Manor II and Watergate at Milford developments are expected to be responsible for part of these improvements as well. The developer should coordinate with DelDOT on the implementation and equitable cost sharing of these improvements.

| Approach | Current Configuration | Proposed Configuration |
|---|---|---|
| Eastbound McCoy Avenue | One shared through/left turn/right turn lane | No Change |
| Westbound Elks Lodge Road | One shared through/left turn/right turn lane | One shared through/left turn lane and one right turn lane |
| Northbound Marshall Street | One shared through/left turn/right turn lane | No Change |
| Southbound Marshall Street | One shared through/left turn/right turn lane | No Change |

Based on DelDOT's *Standards and Regulations for Subdivision Streets and State Highway Access*, the recommended minimum storage length (excluding taper) is 290 feet for the westbound Elks Lodge Road right turn lane.

14. The following bicycle, pedestrian, and transit improvements should be included:

    a. A minimum ten-foot wide permanent easement from the edge of the right-of-way should be dedicated to DelDOT within the site frontages along Cedar Creek Road, Wilkins Road, and Elks Lodge Road. Within this easement, a five-foot wide sidewalk that meets current AASHTO and ADA standards should be constructed. A five-foot minimum setback should be maintained from the back of curb to the sidewalk. If feasible, street trees should be provided within the buffer area.
    b. When right turn lanes are added on Cedar Creek Road, Wilkins Road and Elks Lodge Road a five-foot wide bicycle lane should also be provided through the right turn lane in order to facilitate safe and unimpeded bicycle travel. A Right Turn Yield to Bikes signs (MUTCD R4-4) should be added at the start of each right turn lane.
    c. Where internal sidewalks are located alongside of parking spaces, a buffer, physical barrier or signage should be added to eliminate vehicular overhang onto the sidewalk.
    d. ADA compliant curb ramps and marked crosswalks should be provided at the site entrance. The use of Type 3 curb ramps is discouraged.
    e. Covered bike parking racks should be provided near the building entrances.
    f. Utility covers should be moved outside of the designated bicycle lane or should be flush with the pavement.
    g. The addition of a minimum 40 feet bus pull-off area within the main internal site roadway that connects with Site Entrance A should be considered for a future Delaware Transit Corporation (DTC) route along Wilkins Road.

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.

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

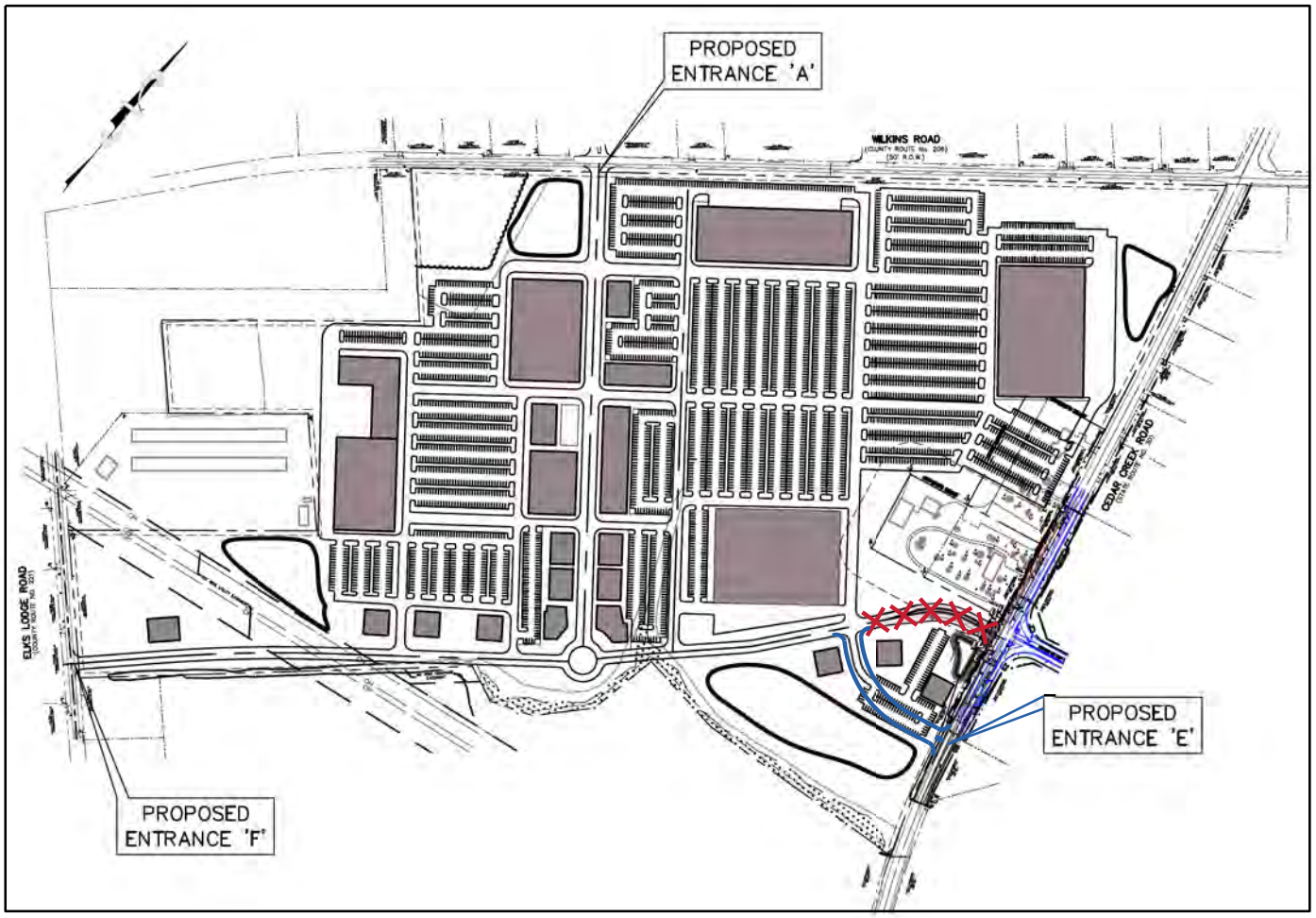
additional information regarding the work zone impact and mitigation procedures during construction please contact Mr. Adam Weiser of DelDOT's Traffic Section. Mr. Weiser can be reached at (302) 659-4073 or by email at Adam.Weiser@state.de.us.

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.

Mir Ak Wahed,
Mir Wahed, P.E., PTOE
Enclosure

CONCEPTUAL LAYOUT FOR MODIFIED ACCESS SCENARIO OF ENTRANCE "E"

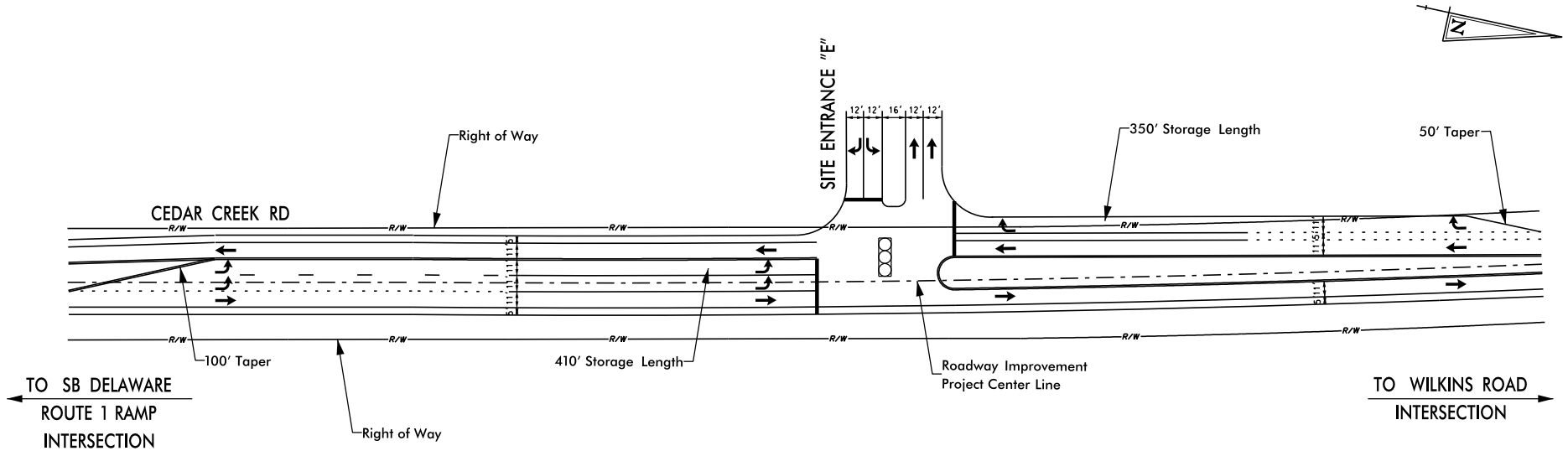



JOHNSON, MIRMIRAN & THOMPSON
*Engineering A Brighter Future*

THE CENTER AT HEARTHSTONE MANOR
TRAFFIC IMPACT STUDY
SUSSEX COUNTY, DELAWARE

| N.T.S | FIGURE 1 | SEPTEMBER, 2013 |
|---|---|---|

CONCEPTUAL LAYOUT FOR MODIFIED ACCESS SCENARIO OF SITE ENTRANCE "E" WITHOUT HALL PROPERTY

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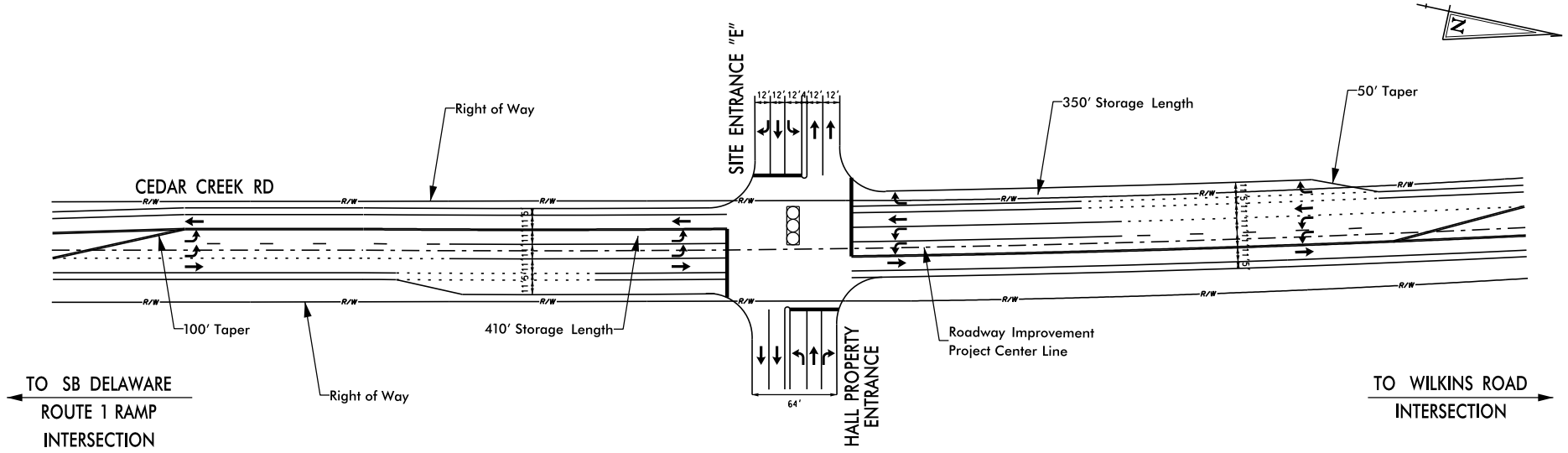



JOHNSON, MIRMIRAN & THOMPSON
*Engineering A Brighter Future*

THE CENTER AT HEARTHSTONE MANOR
TRAFFIC IMPACT STUDY
SUSSEX COUNTY, DELAWARE

| N.T.S | FIGURE 2 | SEPTEMBER, 2013 |
|---|---|---|

## General Information

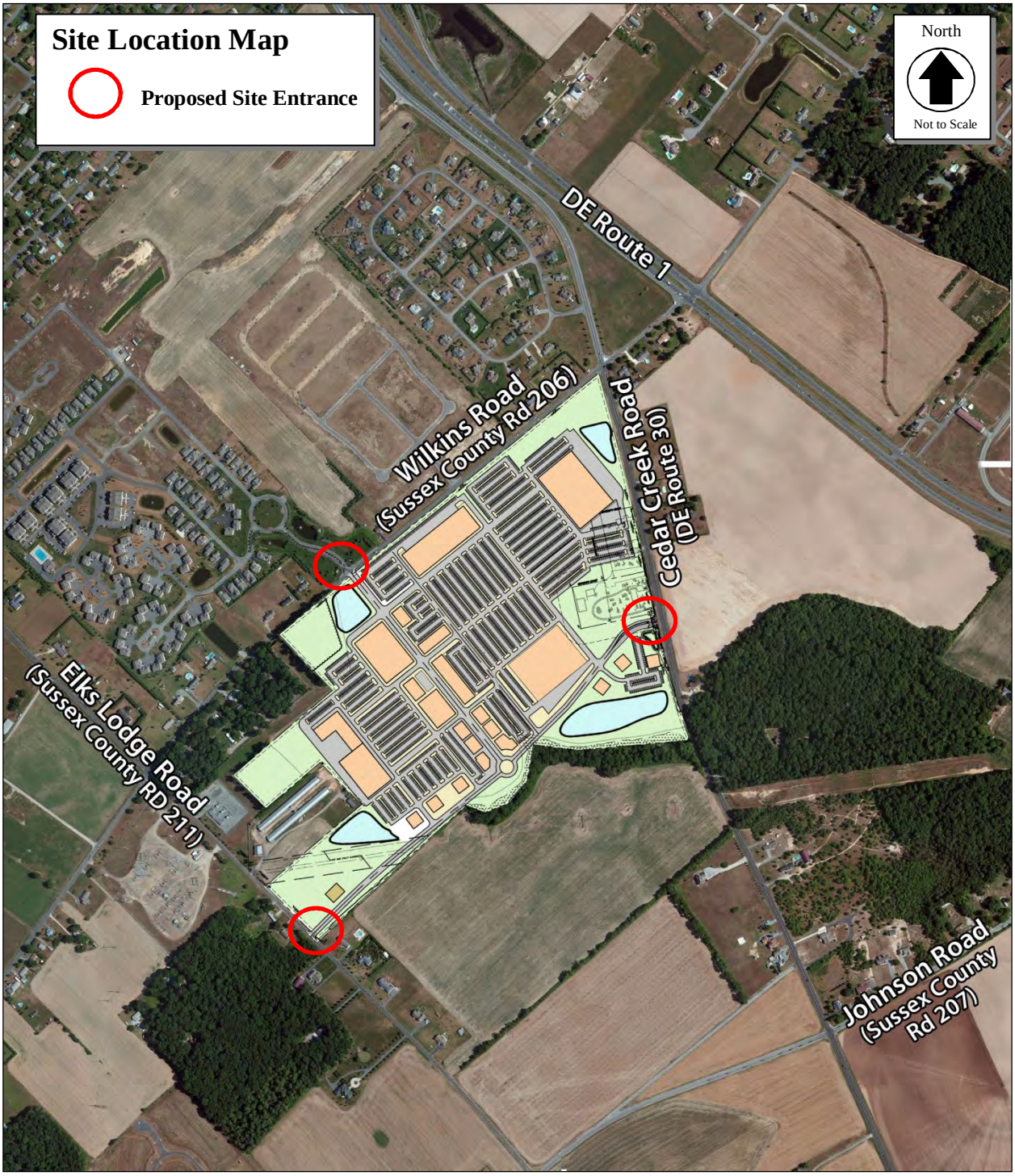
**Report date:** September, 2012.
**Prepared by:** C. David Jamison, PE.
**Prepared for:** Key Properties Group, LCC.
**Tax Parcels:** 3-30-15.00-058.00.
**Generally consistent with DelDOT's *Standards and Regulations for Subdivision Streets and State Highway Access*:** Yes.

## Project Description and Background

**Description:** 710,200 square feet of shopping center, 32,000 square feet of general office building, and 164 residential condominiums.
**Location:** The project is proposed along the southerly side of Wilkins Road (Sussex Road 206), between Elks Lodge Road (Sussex Road 211) and Cedar Creek Road (Delaware Route 30/Sussex Road 212).
**Amount of Land to be developed:** 106.21 acres of land.
**Land Use approval(s) needed:** Town Center (mixed use residential/commercial).
**Proposed completion date:** 2020.
**Proposed access locations:** Three access points are proposed, one full access entrance along Wilkins Road (Sussex Road 206), one full access entrance along Cedar Creek Road (Delaware Route 30), and one full access entrance along Elks Lodge Road (Sussex Road 211).
**Daily Traffic Volumes:**

- 2011 Average Annual Daily Traffic on Wilkins Road: 777 vehicles per day.
- 2011 Average Annual Daily Traffic on Cedar Creek Road: 4,066 vehicles per day.
- 2011 Average Annual Daily Traffic on Elks Lodge Road: 1,204 vehicles per day.

**Site Map**




**Graphic is an approximation based on the Preliminary Entrance Plan prepared by Van Cleef Engineering Associates, dated September 17, 2012.*

**Relevant and On-going Projects**

DelDOT currently has two relevant projects within the study area, the US 113 North/South Study and the SR 1, SR 30 Grade Separated Intersection project. The purpose of the US 113 North/South Study is to identify an alignment for a continuous limited access roadway from the vicinity of Delaware Route 1 (Sussex Road 14) north of Milford to the Delaware/Maryland state line. The study also identifies improvements to major east/west routes accessed from US Route 113 (Sussex Road 113). DelDOT and the Federal Highway Administration (FHWA) have divided the US 113 North/South Study into four geographic areas. The four study areas include the Milford/Lincoln Area, the Ellendale Area, the Georgetown Area, and the Millsboro-South Area.

DelDOT formed a working group for the Milford/Lincoln Area of the US 113 North/South Study and reviewed several alternatives for bypasses around the Milford/Lincoln area as well as an on-alignment option for US Route 113. However, community consensus could not be reached and DelDOT stopped pursuing the US 113 North/South Study in the Milford/Lincoln Area in January 2008. While the US 113 North/South Study moves forward in the Ellendale, Georgetown, and Millsboro-South areas, no progress has been made in the Milford Area since July 2007 and no work is currently underway in the Milford/Lincoln area. For additional information regarding the US 113 North/South Study, please see the project website at http://www.deldot.gov/information/projects/us113/index.shtml

The SR 1, SR 30 Grade Separated Intersection project will replace the existing at-grade intersection of Delaware Route 1 and Wilkins Road with a grade-separated intersection. This will be accomplished with the construction of an overpass and connecting ramps. The Northbound Delaware Route 1 access will be achieved via a ramp that will connect to Cedar Neck Road (Sussex Road 206). The southbound Delaware Route 1 access will be achieved via a ramp from Cedar Creek Road, south of the proposed overpass. Based on the plans developed by DelDOT, the southbound Delaware Route 1 Ramp would connect with Cedar Creek Road to form a three-legged unsignalized intersection. The southbound Delaware Route 1 Ramp would intersect Cedar Creek Road from the east and provide one left turn lane and one channelized right turn lane. The southbound Delaware Route 1 Ramp approach would be stop-controlled. Improvements will also be made to the existing intersection of Wilkins Road and Cedar Creek Road which include the installation of a signal and auxiliary lanes to accommodate the various turning movements that occur at this location. Construction has recently started for this project and is anticipated to be completed in Spring of 2014. For additional information regarding the SR 1, SR 30 Grade Separated Intersection project, please see the project website at http://deldot.gov/information/projects/sr1_30_gsi/index.shtml

DelDOT's Corridor Capacity Program (CCPP) is a statewide program developed to maintain a road's ability to handle traffic efficiently and safely, and minimize the transportation impacts of increased economic growth. The CCPP strives to maintain the through capacity of certain arterial highways through the management of access along them. Four corridors are part of this program, including Delaware Route 1 from Dover to the south to Five Points and US Route 113 from the southern limits of the City of Milford to the Maryland State Line. There is a portion of US Route 113 that is part of the CCPP and contains one of the intersections included as part of this TIS, the US Route 113 intersection with Johnson Road/Fitzgeralds Road (Sussex Road 207). Per the

CCPP, the strategy for US Route 113 is to minimize new entrances and traffic signals along the corridor and over time convert the facility to a limited access highway. Although the US Route 113 intersection with Johnson Road/Fitzgeralds Road is within the CCPP, there are no projects associated with the CCPP planned at the intersection.

In addition, DelDOT's 2012 High Risk Rural Roads Program (HRRRP) included two sites (Sites 8 and 15) that are within the project area. Site 8 is a 0.49 mile section of Johnson Road from 0.08 mile east of Fork Road to 0.26 mile east of Cedar Creek Road. Site 15 is a 0.49 mile section of Cedar Creek Road from 0.19 mile south of Johnson Road to 0.23 mile north of Fork Road. The combined Site 8/15 report included a crash summary, a speed data summary, and a sight distance review of the Cedar Creek Road intersection with Johnson Road. The suggested improvements within the report for the Cedar Creek Road intersection with Johnson Road include replacing a damaged "Stop Ahead" (W3-1) sign along the westbound Johnson Road approach as well as replacing a damaged Direction Arrow (M6-1) sign posted along the northbound Cedar Creek Road approach. Both of these improvements have been completed. The report also suggested that additional studies be conducted to identify improvements to reduce the potential for angle crashes. WR&A is in the process of conducting these additional studies.

**Livable Delaware**
*(Source: Delaware Strategies for State Policies and Spending, 2010)*

**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). 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. 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 the Department to focus on regional movements between towns and other population centers. 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:**

According to Livable Delaware, use of the land located within Investment Level 3 areas should promote the sale of local agricultural products in grocery stores. A supermarket is proposed as part of the development and therefore local agricultural products would have the opportunity to be sold at the proposed site. Additionally, Livable Delaware states that it may be desirable for a variety of housing types, styles, and densities in conjunction with local government comprehensive plans. Per the Milford Comprehensive Plan, a variety of housing options consisting of single family detached dwellings, villas, and condos either exist or are proposed to be built in the vicinity of the site. As such, the addition of residential condominiums would be consistent with the character of the area. Therefore, this development appears to be generally consistent with the 2010 update of the Livable Delaware "Strategies for State Policies and Spending."

**Comprehensive Plans**
*(Source: City of Milford, 2008 Comprehensive Plan)*

**City of Milford Comprehensive Plan:**
The proposed development is situated within the City of Milford. This parcel is currently zoned as Highway Commercial (C3), and it will maintain the same zoning classification in the future. This future land use is described as a variety of retail and services including sit-down restaurants.

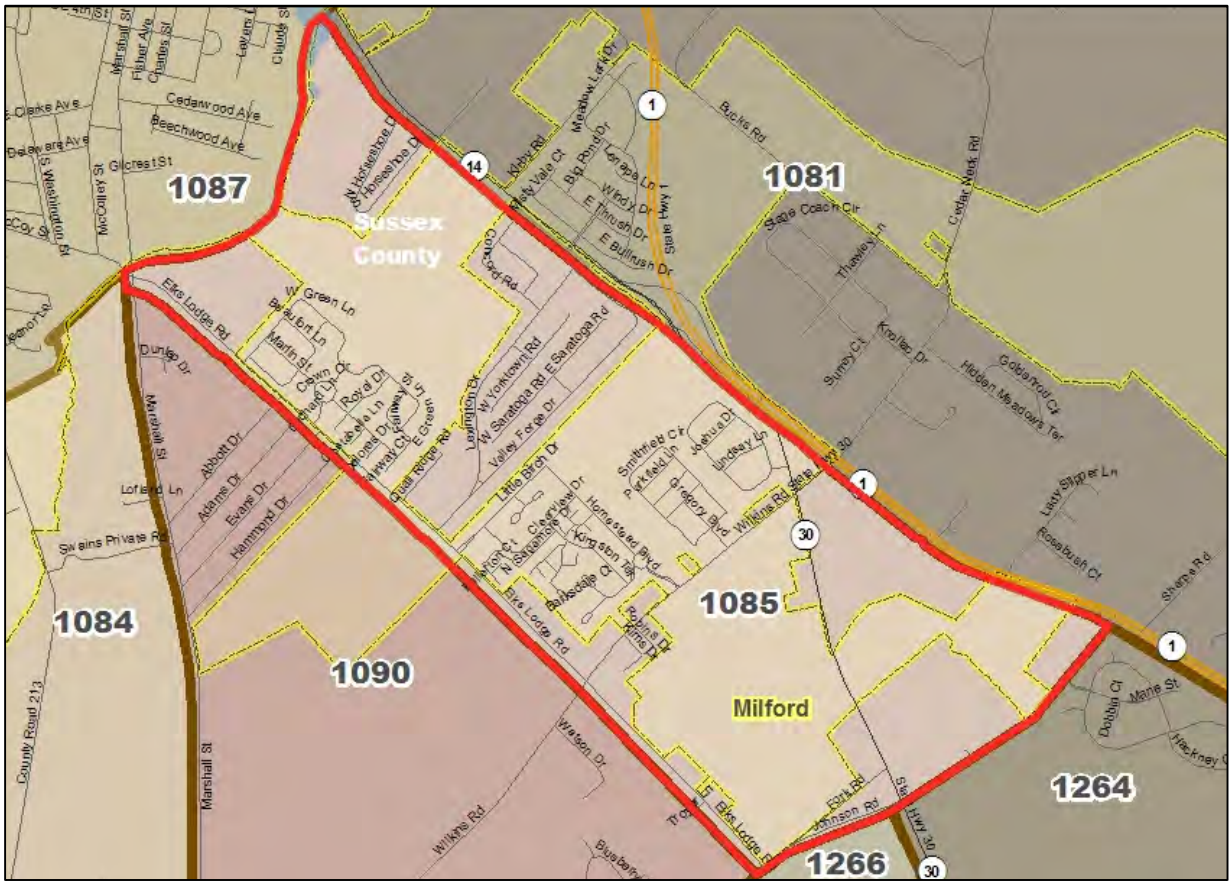
**Proposed Development's Compatibility with the City of Milford Comprehensive Plan:**

The proposed development maintains the same zoning and is generally compatible with the City's Comprehensive Plan, which includes the goal of providing a needed retail outlet for this part of the City. As such, the development is generally compatible with the City of Milford's Comprehensive Plan.

## Transportation Analysis Zones (TAZ)

**Transportation Analysis Zones (TAZ) where development would be located:** 1085

**TAZ Boundaries:**




**Current employment estimate for TAZ:** 253 in 2010
**Future employment estimate for TAZ:** 1,351 in 2040
**Current Population estimate for TAZ:** 1,108 in 2010
**Future Population estimate for TAZ:** 1,696 in 2040
**Current household estimate for TAZ:** 382 in 2010
**Future household estimate for TAZ:** 627 in 2040
**Relevant committed developments in the TAZ:** None.
**Would the addition of committed developments to current estimates exceed future projections:** No.
**Would the addition of committed developments and the proposed development to current estimates exceed future projections:** Yes.

## Trip Generation

As per the TIS and DelDOT's July 18, 2012 correspondence, the trip generation for proposed development was determined by using comparable land uses and equations contained in the ***Trip***

*Generation, 8th Edition: An ITE Informational Report*, 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:

- 710,000 square feet of Shopping Center (ITE Land Use 820)
- 32,000 square feet of General Office (ITE Land Use 710)
- 164 units of Condominiums (ITE Land Use 230)

The peak period trip generation for The Centre at Hearthstone Manor development is included in Table 1.

**Table 1**
THE CENTRE AT HEARTHSTONE MANOR TRIP GENERATION

| **Land Use** | **ADT** | **AM Peak Hour** | | | **PM Peak Hour** | | | **SAT Peak Hour** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | In | Out | Total | In | Out | Total | In | Out | Total |
| 710,000 square foot Shopping Center | 24,285 | 299 | 191 | 490 | 1,160 | 1,207 | 2,367 | 1,593 | 1,471 | 3,064 |
| Internal Capture | | 0 | 0 | 0 | 38 | 25 | 63 | 24 | 17 | 41 |
| Sub-Total (External Trips) | | 299 | 191 | 490 | 1,122 | 1,182 | 2,304 | 1,569 | 1,454 | 3,023 |
| Pass-By Trips | | 0 | 0 | 0 | 247 | 260 | 507 | 377 | 349 | 726 |
| Net Primary Trips | | 299 | 191 | 490 | 875 | 922 | 1,797 | 1,192 | 1,105 | 2,297 |
| 32,000 square feet General Office | 555 | 66 | 9 | 75 | 20 | 95 | 115 | 8 | 7 | 15 |
| Internal Capture | | 0 | 0 | 0 | 6 | 23 | 29 | 2 | 2 | 4 |
| Net Primary Trips | | 66 | 9 | 75 | 14 | 72 | 86 | 6 | 5 | 11 |
| 164 Units of Condominiums | 990 | 13 | 64 | 77 | 60 | 30 | 90 | 49 | 41 | 90 |
| Internal Capture | | 0 | 0 | 0 | 20 | 16 | 36 | 15 | 22 | 37 |
| Net Primary Trips | | 13 | 64 | 77 | 40 | 14 | 54 | 34 | 19 | 53 |
| **Net New Trips** | | **378** | **264** | **642** | **929** | **1,008** | **1,937** | **1,232** | **1,129** | **2,361** |

## Overview of TIS

**Intersections examined:**

1. Wilkins Road (Sussex Road 206)/Site Entrance A
2. Cedar Creek Road (Delaware Route 30)/Southbound Delaware Route 1 Ramp/Site Entrance E
3. Elks Lodge Road (Sussex Road 211)/Site Entrance F
9. Wilkins Road/Cedar Creek Road (Only analyzed during Cases 2 and 3 due to intersection improvement as part of the DelDOT SR 1, SR 30 Grade Separated Intersection Project)

10. Johnson Road (Sussex Road 207)/Delaware Route 1 (Sussex Road 14)
11. Johnson Road/Cedar Creek Road
12. Johnson Road/Elks Lodge Road
13. Wilkins Road/Elks Lodge Road
14. Wilkins Road/Johnson Road
15. Marshall Street (Sussex Road 225)/Johnson Road
16. North Old State Road (Sussex Road 213)/Johnson Road
17. US Route 113 (Sussex Road 113)/Johnson Road/Fitzgeralds Road (Sussex Road 207)
18. Elks Lodge Road/Marshall Street/McCoy Avenue (Sussex Road 211)
19. McCoy Avenue/Walnut Street (Sussex Road 213)
20. Delaware Route 30/Delaware Route 1 Southbound On-Ramp
21. Delaware Route 30/Kirby Road (Sussex Road 209)
22. Delaware Business Route 1/2nd Street (Sussex Road 95)
23. Delaware Business Route 1/Front Street (Delaware Route 36/Sussex Road 36)

*Note: Contrary to the direction given in the May 1, 2012 scoping letter, the TIS did not analyze intersections 4 to 8 which include Site Entrance B/Wilkins Road, Site Entrance C/Wilkins Road, Site Entrance D/Cedar Creek Road, and Wilkins Road/Cedar Neck Road/Delaware Route 1. Site Entrances B, C, and D were omitted from the analysis since those driveways were no longer proposed as part of the latest site plan. In addition, the Wilkins Road/Cedar Neck Road intersection with Delaware Route 1 was omitted as this existing at-grade intersection will be replaced with a grade-separated intersection.*

**Conditions examined:**

1. Case 1 - 2012 Existing conditions
2. Case 2 - 2020 No Build conditions without The Centre at Hearthstone Manor
3. Case 3 - 2020 Build conditions with The Centre at Hearthstone Manor
4. Case 4 – At DelDOT's request, an additional analysis that was not part of the original TIS report has been incorporated into this TIS review. Specifically, the additional analysis includes 2020 Build conditions with The Centre at Hearthstone Manor development and Site Entrance E relocated 850 feet to the north of the Cedar Creek Road intersection with the southbound Delaware Route 1 Ramp. This is evaluated for both with and without the Hall Property development.

**Peak hours evaluated:** Weekday morning, weekday evening and Saturday midday peak hours.

**Committed Developments considered:**

None.

**Intersection Descriptions**

1. **Wilkins Road (Sussex Road 206) and Site Entrance A (Proposed Full Access)/Homestead Boulevard**

   **Type of Control:** existing three-legged stop controlled intersection (T-intersection); proposed stop controlled four-legged intersection

   **Eastbound Approach:** (Wilkins Road) existing one shared through/left turn lane; proposed one shared through/left turn lane and one right turn lane

**Westbound Approach:** (Wilkins Road) existing one through lane and one right turn lane; proposed one shared through/left turn lane and one right turn lane
**Northbound Approach:** (Site Entrance A) proposed one shared through/left turn lane and one right turn lane, stop controlled
**Southbound Approach:** (Homestead Boulevard) existing one left turn lane and one right turn lane; proposed one left turn lane and one shared through/right turn lane, stop controlled

2. **Cedar Creek Road (Delaware Route 30) and Site Entrance E (Proposed Full Access)/Southbound Delaware Route 1 Ramp**
**Type of Control:** proposed three-legged stop controlled intersection (T-intersection) during Case 2; proposed four-legged intersection during Case 3
**Eastbound Approach:** (Site Entrance E) proposed one left turn lane, one through lane, and one right turn lane during Case 3
**Westbound Approach:** (Southbound Delaware Route 1 Ramp) proposed one left turn lane and one channelized right turn lane during Case 2, stop controlled; proposed one shared through/left turn lane and one channelized right turn lane during Case 3
**Northbound Approach:** (Cedar Creek Road) proposed one through lane and one channelized right turn lane during Case 2; proposed one left turn lane, one through lane, and one channelized right turn lane during Case 3
**Southbound Approach:** (Cedar Creek Road) proposed one left turn lane and one through lane during Case 2; proposed one left turn lane, one through lane, and one right turn lane during Case 3
*Note: The southbound Delaware Route 1 Ramp approach to the intersection is being constructed as part of the DelDOT SR 1, SR 30, Grade Separated Intersection project and will be completed prior to the full build out of The Centre at Hearthstone Manor development.*

3. **Elks Lodge Road (Sussex Road 211) and Site Entrance F (Proposed Full Access)**
**Type of Control:** proposed three-legged stop controlled intersection (T-intersection)
**Westbound Approach:** (Site Entrance F) proposed one left turn lane and one right turn lane, stop controlled
**Northbound Approach:** (Elks Lodge Road) proposed one through lane and one right turn lane
**Southbound Approach:** (Elks Lodge Road) proposed one shared through/left turn lane

9. **Wilkins Road and Cedar Creek Road**
**Type of Control:** existing four-legged all-way stop controlled intersection; proposed four-legged signalized intersection
**Eastbound Approach:** (Wilkins Road) existing one shared through/left turn/right turn lane; proposed one left turn lane, one through lane, and one channelized right turn lane
**Westbound Approach:** (Wilkins Road) existing one shared through/left turn lane, and one channelized right turn lane; proposed one left turn lane, one through lane, and one channelized right turn lane
**Northbound Approach:** (Cedar Creek Road) existing one shared through/left turn/right turn lane; proposed one left turn lane, one through lane, and one right turn lane

**Southbound Approach:** (Cedar Creek Road) existing one shared through/left turn/right turn lane; proposed one left turn lane, one through lane, and one right turn lane
*Note: The intersection is being improved as part of the DelDOT SR 1, SR 30, Grade Separated Intersection project and will be completed prior to the full build out of The Centre at Hearthstone Manor development.*

10. **Johnson Road (Sussex County Road 207) and Delaware Route 1 (Sussex County Road 14)**
**Type of Control:** existing three-legged stop controlled intersection (T-intersection)
**Eastbound Approach:** (Johnson Road) existing one right turn lane, stop controlled
**Northbound Approach:** (Delaware Route 1) existing one left turn lane and two through lanes
**Southbound Approach:** (Delaware Route 1) existing two through lanes and one right turn lane

11. **Johnson Road and Cedar Creek Road**
**Type of Control:** existing four-legged stop controlled intersection
**Eastbound Approach:** (Johnson Road) existing one shared through/left turn/right turn lane, stop controlled
**Westbound Approach:** (Johnson Road) existing one shared through/left turn/right turn lane, stop controlled
**Northbound Approach:** (Cedar Creek Road) existing one shared through/left turn/right turn lane
**Southbound Approach:** (Cedar Creek Road) existing one shared through/left turn/right turn lane

12. **Johnson Road and Elks Lodge Road**
**Type of Control:** existing three-legged stop controlled intersection (T-intersection)
**Eastbound Approach:** (Johnson Road) existing one shared through/left turn lane
**Westbound Approach:** (Johnson Road) existing one shared through/right turn lane
**Southbound Approach:** (Elks Lodge Road) existing one shared left turn/right turn lane, stop controlled

13. **Wilkins Road and Elks Lodge Road**
**Type of Control:** existing four-legged all-way stop controlled intersection
**Eastbound Approach:** (Wilkins Road) existing one shared through/left turn/right turn lane, stop controlled
**Westbound Approach:** (Wilkins Road) existing one shared through/left turn/right turn lane, stop controlled
**Northbound Approach:** (Elks Lodge Road) existing one shared through/left turn/right turn lane, stop controlled
**Southbound Approach:** (Elks Lodge Road) existing one shared through/left turn/right turn lane, stop controlled

14. **Wilkins Road and Johnson Road**
**Type of Control:** existing three-legged stop controlled intersection (T-intersection)
**Eastbound Approach:** (Johnson Road) existing one shared through/left turn lane

**Westbound Approach:** (Johnson Road) existing one shared through/right turn lane
**Southbound Approach:** (Wilkins Road) existing one shared left turn/right turn lane, stop controlled

15. **Marshall Street/Third Street (Sussex County Road 225) and Johnson Road**
**Type of Control:** existing four-legged signalized intersection
**Eastbound Approach:** (Johnson Road) existing one shared through/left turn/right turn lane
**Westbound Approach:** (Johnson Road) existing one shared through/left turn/right turn lane
**Northbound Approach:** (Third Street) existing one shared through/left turn/right turn lane
**Southbound Approach:** (Marshall Street) existing one shared through/left turn/right turn lane

16. **North Old State Road (Sussex County Road 213) and Johnson Road**
**Type of Control:** existing four-legged stop controlled intersection
**Eastbound Approach:** (Johnson Road) existing one shared through/left turn/right turn lane
**Westbound Approach:** (Johnson Road) existing one shared through/left turn/right turn lane
**Northbound Approach:** (North Old State Road) existing one shared through/left turn/right turn lane, stop controlled
**Southbound Approach:** (North Old State Road) existing one shared through/left turn/right turn lane, stop controlled

17. **US Route 113 (Sussex County Road 113) and Johnson Road/Fitzgeralds Road (Sussex County Road 207)**
**Type of Control:** existing four-legged signalized intersection
**Eastbound Approach:** (Fitzgeralds Road) existing one shared through/left turn lane and one channelized right turn lane
**Westbound Approach:** (Johnson Road) existing one shared through/left turn lane and one channelized right turn lane
**Northbound Approach:** (US Route 113) existing one left turn lane, two through lanes, and one channelized right turn lane
**Southbound Approach:** (US Route 113) existing one left turn lane, two through lanes, and one channelized right turn lane

18. **Elks Lodge Road/Marshall Street and McCoy Avenue (Sussex Road 211)**
**Type of Control:** existing four-legged all-way stop controlled intersection
**Eastbound Approach:** (McCoy Avenue) existing one shared through/left turn/right turn lane, stop controlled
**Westbound Approach:** (Elks Lodge Road) existing one shared through/left turn/right turn lane, stop controlled
**Northbound Approach:** (Marshall Street) existing shared through/left turn/right turn lane, stop controlled

**Southbound Approach:** (Marshall Street) existing one shared through/left turn/right turn lane, stop controlled

**19. McCoy Avenue and Walnut Street (Sussex County Road 213)**
**Type of Control:** existing three-legged stop controlled intersection (T-intersection)
**Westbound Approach:** (McCoy Avenue) existing one shared left turn/right turn lane, stop controlled
**Northbound Approach:** (Walnut Street) existing one shared through/right turn lane
**Southbound Approach:** (Walnut Street) existing one shared through/left turn lane

**20. Delaware Route 30 and Delaware Route 1 Southbound Ramp**
**Type of Control:** existing three-legged yield controlled intersection (T-intersection)
**Northbound Approach:** (Delaware Route 30) existing one through lane
**Southbound Approach:** (Delaware Route 30) existing one left turn lane, yield controlled, and one through lane
*Note: The easterly leg of the intersection is the on-ramp onto southbound Delaware Route 1.*

**21. Delaware Route 30 and Kirby Road (Sussex County Road 209)**
**Type of Control:** existing three-legged stop controlled intersection (T-intersection)
**Westbound Approach:** (Kirby Road) existing one shared left turn/right turn lane, stop controlled
**Northbound Approach:** (Delaware Route 30) existing one shared through/right turn lane
**Southbound Approach:** (Delaware Route 30) existing one shared through/left turn lane

**22. Delaware Business Route 1 and 2nd Street (Sussex County Road 95)**
**Type of Control:** existing four-legged stop controlled intersection
**Eastbound Approach:** (2nd Street) existing one shared through/left turn/right turn lane, stop controlled
**Westbound Approach:** (Restaurant Driveway) existing one shared through/left turn/right turn lane, stop controlled
**Northbound Approach:** (Delaware Business Route 1) existing one shared through/left turn/right turn lane
**Southbound Approach:** (Delaware Business Route 1) existing one shared through/left turn/right turn lane

**23. Delaware Business Route 1 and Front Street (Delaware Route 36/Sussex County Road 36)**
**Type of Control:** existing four-legged signalized intersection
**Eastbound Approach:** (Front Street) existing one shared through/left turn lane and one channelized right turn lane
**Westbound Approach:** (Front Street) existing one shared through/left turn/right turn lane
**Northbound Approach:** (Delaware Business Route 1) existing one shared through/left turn and one right turn lane

**Southbound Approach:** (Delaware Business Route 1) existing one shared through/left turn lane and one channelized right turn lane

## Alternative Improvements

If the realignment of Site Entrance E with the southbound Delaware Route 1 Ramp is not feasible at the Cedar Creek Road intersection and if it is not feasible to relocate Site Entrance E approximately 850 feet north of the Cedar Creek Road and southbound Delaware Route 1 Ramp intersection, Site Entrance E could be relocated to the south of the southbound Delaware Route 1 Ramp and be modified to a right in/right out only access. The following items should be incorporated into the site design and reflected on the record plan if this modified access design is considered. It should be noted that the following Items 1, 2, 3, and 4 would replace Items 4, 5, 6, and 7, and 8 mentioned above.

1. The developer should construct a right in and right out site entrance on Cedar Creek Road to be consistent with the proposed lane configurations as shown in the table below.

| Approach | Current Configuration | Proposed Configuration |
|---|---|---|
| Eastbound Site Entrance E | Approach does not exist | One right turn lane |
| Northbound Cedar Creek Road | One through lane | No Change |
| Southbound Cedar Creek Road | One through lane | One through lane and one right turn lane |

Based on DelDOT's *Standards and Regulations for Subdivision Streets and State Highway Access,* the recommended minimum storage lengths (excluding taper) is 350 feet for the southbound Cedar Creek Road right turn lane. The storage lengths based on the HCS analysis provide shorter queue lengths than what is reported here.

2. The developer should construct a full access site entrance on Wilkins Road to be consistent with the proposed lane configurations as shown in the table below.

| Approach | Current Configuration | Proposed Configuration |
|---|---|---|
| Eastbound Wilkins Road | One through lane | One left turn lane, one through lane, and one right turn lane |
| Westbound Wilkins Road | One through lane and one right turn lane | One left turn lane, one through lane, and one right turn lane |
| Northbound Site Entrance A | Approach does not exist | One left turn lane, one through lane, and one right turn lane |
| Southbound Homestead Boulevard | One left turn lane and one right turn lane | One left turn lane and one shared through/right turn lane |

The recommended minimum storage lengths (excluding taper) are 440 feet for the westbound Wilkins Road left turn lane and 350 feet for the eastbound Wilkins Road right

turn lane. The storage lengths based on the HCS analysis provide shorter queue lengths than what is reported here.

3. The developer should enter into a traffic signal agreement with DelDOT to fund an equitable portion of the signal construction at the intersection of Cedar Creek Road and the southbound Delaware Route 1 Ramp. The agreement should include signal heads, crosswalks and interconnection at DelDOT's discretion. The developer will be required to perform a Signal Justification Study including a peak hour and a four-hour signal warrant analysis at DelDOT's discretion. The developer should coordinate with DelDOT on the implementation and equitable cost sharing of the traffic signal.

4. The developer should enter into a traffic signal agreement with DelDOT for the intersection of Wilkins Road and Site Entrance A. The agreement should include signal heads, pedestrian signals, crosswalks and interconnection at DelDOT's discretion. The developer will be required to perform a Signal Justification Study including a peak hour and a four-hour signal warrant analysis at DelDOT's discretion. The developer should coordinate with DelDOT on the implementation and equitable cost sharing of the traffic signal.

**Transit, Pedestrian, and Bicycle Facilities**

**Existing transit service**: Existing DART Route 303 currently travels within the Milford area. Route 303 operates between Dover and Georgetown, Monday through Friday from 5:00 a.m. to 8:47 p.m and serves Milford with 10 round trips. Within the project limits, this bus route runs along Walnut Street, Johnson Road and US Route 113. This route traverses through three of the project's study intersections (the Walnut Street intersection with McCoy Avenue, the Johnson Road intersection with North Old State Road, and the US Route 113 intersection with Johnson Road). A bus stop is present along westbound Johnson Road, approximately 400 feet west of its intersection with North Old State Road and along northbound Walnut Street, approximately 200 feet north of its intersection with McCoy Avenue.

**Planned transit service**: C. David Jamison, PE contacted Lisa Collins, Service Development Planner of DTC. In an email from June 2012, it was noted that the DTC anticipates ridership growth in Milford and believes there will be a need for a local service in the future. The current six-year business plan does not include a local bus route through Milford but the DTC recommends the addition of a bus pull-off area along the site frontage. JMT contacted Wayne Henderson from the DTC on December 14, 2012 and it was recommended that the bus pull-off area be installed on-site within the main access roadway that connects to Site Entrance A.

**Existing bicycle and pedestrian facilities**: According to DelDOT's *Delaware Bicycle Facility Master Plan* (October 2005), Statewide Bicycle Route 1 exists within the study area. Within the area, Statewide Bicycle Route 1 runs along Fitzgeralds Road, Johnson Road, and Cedar Creek Road. This route traverses through six of the project's study intersections (the US Route 113 intersection with Fitzgeralds Road/Johnson Road, the Johnson Road intersection with North Old State Road, the Johnson Road intersection with Marshall Street, the Johnson Road intersection with Wilkins Road, the Johnson Road intersection with Elks Lodge Road, and the Johnson Road intersection with Cedar Creek Road).

Per the *Sussex County Bicycle Map,* the following other bicycle routes exist in the vicinity of the site:

- A Regional Bicycle Route runs along Delaware Route 14 and continues onto Delaware Route 36. This route traverses through one of the project's study intersections (the Front Street intersection with Delaware Business Route 1).
- A Statewide Bicycle Route runs along Walnut Street and continues onto North Old State Road. This route traverses through two of the project's study intersections (the Walnut Street intersection with McCoy Avenue and the Johnson Road intersection with North Old State Road).
- A Connector Bicycle Route runs along Marshall Street, Wilkins Road, and a portion of Cedar Creek Road. This route traverses through six of the project's study intersections (the Marshall Street intersection with Elks Lodge Road, the Johnson Road intersection with Marshall Street, the Johnson Road intersection with Wilkins Road, the Wilkins Road intersection with Elks Lodge Road, the Wilkins Road intersection with Cedar Creek Road, and the Johnson Road intersection with Cedar Creek Road).

**Planned bicycle and pedestrian facilities**: JMT and C. David Jamison, PE contacted Mr. Marco Boyce, DelDOT's Bicycle and Pedestrian Coordinator. During a December 4, 2012 conversation between JMT and Mr. Boyce, Mr. Boyce recommended that bike lanes be provided along all site entrances and sidewalks be added along both sides of each frontage roadway. Additionally, a buffer should be provided between the sidewalk and back of curb, and if possible, street trees be added within the buffer area outside of any sight lines.

**Bicycle Level of Service and Bicycle Compatibility Index**: According to the League of Illinois Bicyclists (LIB), Bicycle Level of Service (BLOS) is an emerging national standard for quantifying the bike-friendliness of a roadway by measuring on-road bicyclist comfort levels for specific roadway geometries and traffic conditions. Utilizing the 10-year projected AADT along the site frontages, the BLOS with the construction of the proposed development and the provision of 5' bike lanes are summarized below. The BLOS was determined utilizing the calculators published on the LIB website: http://www.bikelib.org/roads/blos/blosform.htm

- Wilkins Road – BLOS: C
- Cedar Creek Road – BLOS: C
- Elks Lodge Road – BLOS: C

**Previous Comments**
None.

**General HCS Analysis Comments**
*(See table footnotes on the following pages for specific comments)*

1. C. David Jamison, PE performed analyses using HCS2000 Version 4.1f. JMT used HCS+T7F, Version 5.5. As such, some of the results are different between the two analyses.

2. For future conditions, the TIS sometimes used peak hour factors inconsistent with the guidelines provided in the ***DelDOT Standards and Regulations for Subdivision Streets and State Highway Access***. However, JMT applied the appropriate peak hour factors in accordance to the DelDOT standards (0.80, 0.88, or 0.92 based on the total intersection volumes).

3. The TIS did not utilize the peak hour factors and heavy vehicle percentages from the Saturday traffic count data. However, JMT utilized them in the analysis consistent with DelDOT standards.

4. For all the unsignalized intersections where saturation flow rates could be modified except the intersection of Johnson Road and Cedar Creek Road, the TIS modified the rate to 1,750 pcphgpl. However, JMT maintained the default saturation flow rate of 1,700 pcphgpl consistent with DelDOT standards for unsignalized intersections.

Table 2
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[1] Two-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Wilkins Road/ Site Entrance A[2]** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2012 Existing (Case 1) | | | | | | |
| Eastbound Wilkins Road - Through/Left | A (7.3) | A (7.5) | A (7.4) | A (7.3) | A (7.5) | A (7.4) |
| Southbound Homestead Boulevard | A (9.8) | A (9.3) | A (9.1) | A (9.8) | A (9.3) | A (9.1) |
| | | | | | | |
| 2020 without The Centre at Hearthstone Manor (Case 2) | | | | | | |
| Eastbound Wilkins Road - Through/Left | A (7.6) | A (7.8) | A (7.4) | A (7.6) | A (7.8) | A (7.4) |
| Southbound Homestead Boulevard | B (11.5) | B (10.4) | C (9.7) | B (11.6) | B (10.5) | A (9.7) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 3) | | | | | | |
| Eastbound Wilkins Road – Through/Left | A (7.5) | A (7.7) | A (7.4) | A (7.6) | A (7.7) | A (7.4) |
| Westbound Wilkins Road – Through/Left | A (7.9) | A (8.1) | A (8.3) | A (7.9) | A (8.1) | A (8.3) |
| Northbound Site Entrance A | B (10.9) | C (15.0+) | B (14.9) | B (11.0) | C (15.0+) | B (14.9) |
| Southbound Homestead Boulevard | C (15.0+) | C (18.9) | C (22.2) | C (15.0+) | C (19.1) | C (22.4) |

[1]For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.
[2]For future conditions, the TIS applied a 3% heavy vehicle percentage to some movements at the intersection. However, due to the projected growth at the intersection JMT applied a 3% heavy vehicle percentage to all movements at the intersection consistent with DelDOT standards.

Table 2 (Continued)
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[1] Two-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Wilkins Road/ Site Entrance A[2]** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2020 with The Centre at Hearthstone Manor (Case 3) *with Improvements*[3] | | | | | | |
| Eastbound Wilkins Road – Left | - | - | - | A (7.6) | A (7.7) | A (7.4) |
| Westbound Wilkins Road - Left | - | - | - | A (7.9) | A (8.1) | A (8.3) |
| Northbound Site Entrance A | - | - | - | B (11.0) | B (14.9) | B (14.8) |
| Southbound Homestead Boulevard | - | - | - | B (15.0-) | C (18.9) | C (22.3) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 3) *with Improvements and Modified Access*[3,4] | | | | | | |
| Eastbound Wilkins Road – Left | - | - | - | A (7.6) | A (7.7) | A (7.4) |
| Westbound Wilkins Road - Left | - | - | - | A (8.0) | A (8.6) | A (9.0) |
| Northbound Site Entrance A | - | - | - | B (11.1) | C (23.2) | D (29.8) |
| Southbound Homestead Boulevard | - | - | - | C (24.1) | F (143.6) | F (568.1) |

[3]The improvements incorporate the provision of an exclusive left turn lane along the eastbound and westbound Wilkins Road approaches to the intersection.
[4]The modified access scenario incorporates the relocation of the Site Entrance E driveway to be south of the southbound Delaware Route 1 Ramp intersection with Cedar Creek Road. Additionally, the Site Entrance E driveway would be configured to only provide right in and right out movements along Cedar Creek Road. As a result, site traffic that previously executed left turn or through movements onto or out of Cedar Creek Road would be rerouted to utilize the Site Entrance A along Wilkins Road.

Table 2 (Continued)
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Signalized Intersection**[1] | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Wilkins Road/ Site Entrance A** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2020 with The Centre at Hearthstone Manor (Case 3) *with Modified Access*[4,5] | - | - | - | B (19.6) | C (25.1) | C (25.5) |

[5]This scenario incorporates the installation of a 120 second cycle length four-phase actuated traffic signal at the Site Entrance A intersection with Wilkins Road. Additionally, the scenario incorporates the provision of separate left turn, through and right turn lanes along the eastbound Wilkins Road, westbound Wilkins Road, and northbound Site Entrance A approaches.

Table 3
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[6] Two-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Cedar Creek Road/Southbound Delaware Route 1 Ramp/ Site Entrance E** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2020 without The Centre at Hearthstone Manor (Case 2) | | | | | | |
| Westbound Delaware Route 1 Ramp | B (12.1) | B (12.6) | B (13.9) | B (12.1) | B (12.6) | B (13.9) |
| Southbound Cedar Creek Road - Left | A (8.1) | A (7.9) | A (8.2) | A (8.1) | A (7.9) | A (8.2) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 3) | | | | | | |
| Eastbound Site Entrance E | E (36.1) | F (*) | F (*) | E (36.1) | F (*) | F (*) |
| Westbound Delaware Route 1 Ramp | D (27.0) | F (612.9) | F(1487.0) | D (27.0) | F (612.9) | F (1487.0) |
| Northbound Cedar Creek Road - Left | A (7.9) | A (9.0) | A (8.8) | A (7.9) | A (9.0) | A (8.8) |
| Southbound Cedar Creek Road - Left | A (8.1) | A (7.8) | A (8.1) | A (8.1) | A (7.8) | A (8.1) |

*HCS did not generate a result due to excessive delay.

[6]For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

Table 3 (Continued)
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Signalized Intersection**[6] | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Cedar Creek Road/Southbound Delaware Route 1 Ramp/ Site Entrance E**[7] | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2020 with The Centre at Hearthstone Manor (Case 3) *with Signal*[8,9] | D (37.7) | E (63.3) | F (103.8) | C (27.3) | D (44.7) | D (53.3) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 3) *with Improvements*[10] | - | - | - | C (23.1) | C (30.5) | D (35.4) |

[7]The TIS used arbitrary right-turn-on-red volumes. However, since right-turn-on-red count data was not available, JMT did not use right-turn-on-red volumes and instead modeled the right turn movements as permissive within the signal phasing where separate right turn lanes are provided.
[8] The TIS utilized variable cycle lengths during the peak hour analyses. However, JMT utilized a 120 second cycle length during all peak hours.
[9]The TIS analyzed the left turn movements along Cedar Creek Road as a protected phase however, based on the conflict factor analysis JMT analyzed the left turn movements along Cedar Creek Road as a protective/permissive phase.
[10]Under this scenario, a 120 second cycle length traffic signal would be installed and the southbound Delaware Route 1 Ramp approach would be modified to provide one left turn lane, one through lane, and one right turn lane.

Table 3 (Continued)
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[6] Two-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Cedar Creek Road/Southbound Delaware Route 1 Ramp** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2020 with The Centre at Hearthstone Manor (Case 3) *with Modified Access*[11] | | | | | | |
| Westbound Delaware Route 1 Ramp | - | - | - | C (20.1) | F (108.9) | F (686.0) |
| Southbound Cedar Creek Road - Left | - | - | - | A (8.3) | A (8.1) | A (9.0) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 4)[12] | | | | | | |
| Westbound Delaware Route 1 Ramp | - | - | - | B (13.7) | C (19.9) | D (27.0) |
| Southbound Cedar Creek Road - Left | - | - | - | A (8.4) | A (8.6) | A (9.3) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 4) *with Hall Property*[12,13] | | | | | | |
| Westbound Delaware Route 1 Ramp | - | - | - | C (21.0) | F (54.6) | F (345.5) |
| Southbound Cedar Creek Road - Left | - | - | - | A (9.0) | A (9.5) | B (12.4) |

[11]The modified access scenario incorporates the relocation of the Site Entrance E site driveway to be south of the southbound Delaware Route 1 ramp intersection with Cedar Creek Road. Additionally, the Site Entrance E driveway would be configured to only provide right in and right out movements along Cedar Creek Road. As a result, site traffic that previously executed left turn or through movements onto or out of Cedar Creek Road would be rerouted to utilize the Site Entrance A along Wilkins Road.
[12]Case 4 scenario incorporates the relocation of the Site Entrance E site driveway to be approximately 850 feet north of the southbound Delaware Route 1 Ramp intersection with Cedar Creek Road.
[13]This scenario incorporates the Hall Property development which is proposed at the northeast corner of the Cedar Creek Road intersection with the southbound Delaware Route 1 Ramp. The entrance for the Hall Property would be located directly across Site Entrance E. Additionally, the northbound and southbound Cedar Creek Road approaches would be configured to provide two left turn lanes, one through lane, and one right turn lane and the eastbound and westbound entrance approaches would provide one left turn lane, one through lane, and one right turn lane.

Table 3 (Continued)
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[6] Two-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Cedar Creek Road/Southbound Delaware Route 1 Ramp** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2020 with The Centre at Hearthstone Manor (Case 4) *with Hall Property*[12,14] | | | | | | |
| Westbound Delaware Route 1 Ramp | - | - | - | C (17.2) | E (43.9) | F (208.8) |
| Southbound Cedar Creek Road - Left | - | - | - | A (9.0) | A (9.5) | B (12.4) |

| **Signalized Intersection[6]** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Cedar Creek Road/Southbound Delaware Route 1 Ramp** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2020 with The Centre at Hearthstone Manor (Case 3) *with Modified Access*[11] | - | - | - | B (19.1) | C (21.7) | C (25.2) |
| 2020 with The Centre at Hearthstone Manor (Case 4)[12] | - | - | - | B (16.4) | B (16.4) | B (18.6) |
| 2020 with The Centre at Hearthstone Manor (Case 4) *with Hall Property*[12,13] | - | - | - | B (16.7) | B (17.2) | B (19.2) |
| 2020 with The Centre at Hearthstone Manor (Case 4) *with Hall Property*[12,14] | - | - | - | B (15.6) | B (17.5) | B (19.6) |

[14]This scenario incorporates the Hall Property development which is proposed at the northeast corner of the Cedar Creek Road intersection with the southbound Delaware Route 1 Ramp. The entrance for the Hall Property would be located directly across Site Entrance E. Additionally, the northbound and southbound Cedar Creek Road approaches would be configured to provide two left turn lanes, one through lane, and one right turn lane and the eastbound and westbound entrance approaches would provide one left turn lane, one through lane, and one right turn lane. This scenario also incorporates the provision of a right in only driveway along the southbound Delaware Route 1 Ramp for the Hall Property.

Table 3 (Continued)
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[6] Two-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Cedar Creek Road/ Site Entrance E** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2020 with The Centre at Hearthstone Manor (Case 3) *with Modified Access*[11] | | | | | | |
| Eastbound Site Entrance E | - | - | - | A (9.7) | B (12.2) | B (10.9) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 4)[12] | | | | | | |
| Eastbound Site Entrance E | - | - | - | C (16.3) | F (458.2) | F (976.8) |
| Northbound Cedar Creek Road - Left | - | - | - | A (8.3) | B (10.9) | B (11.5) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 4) *with Hall Property*[12,13] | | | | | | |
| Eastbound Site Entrance E | - | - | - | F (*) | F (*) | F (*) |
| Westbound Hall Property Entrance | - | - | - | F (*) | F (*) | F (*) |
| Northbound Cedar Creek Road - Left | - | - | - | A (8.2) | B (10.9) | B (11.5) |
| Southbound Cedar Creek Road - Left | - | - | - | B (10.6) | B (10.1) | C (18.9) |

*HCS did not generate a result due to excessive delay.

Table 3 (Continued)
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[6] Two-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Cedar Creek Road/ Site Entrance E** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2020 with The Centre at Hearthstone Manor (Case 4) *with Hall Property*[12,14] | | | | | | |
| Eastbound Site Entrance E | - | - | - | F (*) | F (*) | F (*) |
| Westbound Hall Property Entrance | - | - | - | F (609.4) | F (*) | F (*) |
| Northbound Cedar Creek Road - Left | - | - | - | A (8.2) | B (10.9) | B (11.5) |
| Southbound Cedar Creek Road - Left | - | - | - | A (9.3) | A (9.0) | B (11.2) |

*HCS did not generate a result due to excessive delay.

| **Signalized Intersection[6]** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Cedar Creek Road/ Site Entrance E** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2020 with The Centre at Hearthstone Manor (Case 4)[12] | - | - | - | B (16.3) | C (26.2) | C (27.7) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 4) *with Two NB Left Turn Lanes*[12] | - | - | - | C (21.4) | C (31.5) | C (30.3) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 4) *with Hall Property*[12,13] | - | - | - | C (29.9) | C (32.5) | D (36.2) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 4) *with Hall Property*[12,14] | - | - | - | C (31.1) | C (33.7) | D (36.7) |

Table 4
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[15] Two-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Elks Lodge Road/ Entrance F** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2020 with The Centre at Hearthstone Manor (Case 3) | | | | | | |
| Westbound Entrance F | A (9.6) | B (10.4) | B (11.0) | A (9.6) | B (10.4) | B (11.0) |
| Southbound Elks Lodge Road – Through/Left | A (7.6) | A (7.8) | A (7.9) | A (7.6) | A (7.8) | A (7.9) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 3) *with Improvements*[16] | | | | | | |
| Westbound Entrance F | - | - | - | A (9.6) | A (10.4) | B (11.0) |
| Southbound Elks Lodge Road - Left | - | - | - | A (7.6) | A (7.8) | A (7.9) |

[15]For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.
[16]The improvements incorporate the provision of an exclusive left turn lane (as required by the DelDOT Subdivision Manual) along the southbound Elks Lodge Road approach to the intersection.

Table 5
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Signalized Intersection**[17] | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Wilkins Road/ Cedar Creek Road**[18,19,20] | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2020 without The Centre at Hearthstone Manor (Case 2)[21] | D (35.9) | D (36.1) | C (35.0) | C (24.8) | C (24.5) | C (25.2) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 3)[21] | C (34.3) | D (36.4) | D (38.1) | C (25.0) | C (25.4) | C (25.6) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 3) *with Modified Access*[22] | - | - | - | C (24.2) | C (29.0) | C (28.0) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 4)[23] | - | - | - | C (25.0) | C (25.4) | C (25.6) |

[17]For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.
[18]This intersection was only analyzed under Case 2 and Case 3 scenarios since the existing conditions at the intersection will significantly change due to the installation of a traffic signal as part of the DelDOT SR 1, SR 30 Grade Separated Intersection project.
[19]The TIS utilized a pretimed four-phase signal operation whereas JMT utilized an actuated four-phase signal operation.
[20]The TIS analyzed the left turn movements along each approach as a protected phase however, based on the conflict factor analysis JMT analyzed the left turn movements along each approach as a protective/permissive phase.
[21]The TIS utilized variable cycle lengths during the peak hour analyses. However, JMT utilized a 120 second cycle length during all peak hours.
[22]The modified access scenario incorporates the relocation of the Site Entrance E driveway to be south of the southbound Delaware Route 1 Ramp intersection with Cedar Creek Road. Additionally, the Site Entrance E driveway would be configured to only provide right in and right out movements along Cedar Creek Road. As a result, site traffic that previously executed left turn or through movements onto or out of Cedar Creek Road would be rerouted to utilize the Site Entrance A along Wilkins Road.
[23]Case 4 incorporates the relocation of the Site Entrance E driveway to be approximately 850 feet north of the southbound Delaware Route 1 Ramp intersection with Cedar Creek Road.

Table 5 (Continued)
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Signalized Intersection**[17] | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Wilkins Road/ Cedar Creek Road** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2020 with The Centre at Hearthstone Manor (Case 4) *with Hall Property*[23,24] | - | - | - | C (27.0) | C (27.2) | C (28.1) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 4) *with Hall Property*[23,25] | - | - | - | C (27.0) | C (27.2) | C (28.1) |

[24]This scenario incorporates the Hall Property development which is proposed at the northeast corner of the Cedar Creek Road intersection with the southbound Delaware Route 1 Ramp. The entrance for the Hall Property would be located directly across Site Entrance E.
[25]This scenario incorporates the Hall Property development which is proposed at the northeast corner of the Cedar Creek Road intersection with the southbound Delaware Route 1 Ramp. The entrance for the Hall Property would be located directly across Site Entrance E. Additionally, this scenario incorporates the provision of a right in only driveway along the southbound Delaware Route 1 Ramp for the Hall Property.

Table 6
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[26] Two-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Johnson Road/ Delaware Route 1** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2012 Existing (Case 1) | | | | | | |
| Eastbound Johnson Road | B (11.1) | B (11.5) | C (18.5) | B (11.1) | B (11.5) | C (18.5) |
| Northbound Delaware Route 1 - Left | A (9.2) | B (10.2) | C (17.4) | A (9.2) | B (10.2) | C (17.4) |
| | | | | | | |
| 2020 without The Centre at Hearthstone Manor (Case 2) | | | | | | |
| Eastbound Johnson Road | B (13.2) | B (14.8) | D (26.7) | B (13.2) | B (14.8) | D (26.7) |
| Northbound Delaware Route 1 - Left | B (10.9) | B (13.4) | D (25.7) | B (10.9) | B (13.4) | D (25.7) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 3) | | | | | | |
| Eastbound Johnson Road | B (13.6) | C (17.8) | E (40.5) | B (13.6) | C (17.8) | E (40.5) |
| Northbound Delaware Route 1 - Left | B (11.3) | C (15.8) | E (45.5) | B (11.3) | C (15.8) | E (45.5) |

[26]For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

Table 6 (Continued)
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[26] Two-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Johnson Road/ Delaware Route 1** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2020 with The Centre at Hearthstone Manor (Case 3) *with Modified Access*[27] | | | | | | |
| Eastbound Johnson Road | - | - | - | B (13.6) | C (17.8) | E (40.5) |
| Northbound Delaware Route 1 - Left | - | - | - | B (11.1) | B (14.4) | D (28.5) |

[27]The modified access scenario incorporates the relocation of the Site Entrance E driveway to be south of the southbound Delaware Route 1 Ramp intersection with Cedar Creek Road. Additionally, the Site Entrance E driveway would be configured to only provide right in and right out movements along Cedar Creek Road. As a result, site traffic that previously executed left turn or through movements onto or out of Cedar Creek Road would be rerouted to utilize the Site Entrance A along Wilkins Road.

Table 7
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[28] Two-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Johnson Road/ Cedar Creek Road[29]** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2012 Existing (Case 1) | | | | | | |
| Eastbound Johnson Road | B (13.0) | B (12.1) | B (13.4) | B (13.1) | B (12.2) | B (13.5) |
| Westbound Johnson Road | B (14.6) | B (14.9) | B (14.8) | B (14.7) | B (15.0) | B (14.9) |
| Northbound Cedar Creek Road | A (7.6) | A (7.9) | A (7.7) | A (7.6) | A (7.9) | A (7.7) |
| Southbound Cedar Creek Road | A (7.8) | A (7.7) | A (8.0) | A (7.8) | A (7.7) | A (8.0) |
| | | | | | | |
| 2020 without The Centre at Hearthstone Manor (Case 2) | | | | | | |
| Eastbound Johnson Road | C (17.4) | C (15.8) | C (18.7) | C (17.5) | C (16.0) | C (18.9) |
| Westbound Johnson Road | C (20.3) | C (22.7) | C (21.0) | C (20.5) | C (22.9) | C (21.2) |
| Northbound Cedar Creek Road | A (7.8) | A (8.2) | A (7.9) | A (7.8) | A (8.2) | A (7.9) |
| Southbound Cedar Creek Road | A (8.0) | A (7.9) | A (8.4) | A (8.0) | A (7.9) | A (8.4) |

[28]For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.
[29]Along the eastbound and westbound Johnson Road approaches, the TIS applied a 3% heavy vehicle percentage to only the left turn movements. However, JMT applied a 3% heavy vehicle percentage to all movements along each approach consistent with DelDOT standards.

Table 7 (Continued)
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[28] Two-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Johnson Road/ Cedar Creek Road[29]** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2020 with The Centre at Hearthstone Manor (Case 3) | | | | | | |
| Eastbound Johnson Road | C (20.3) | D (25.5) | E (43.2) | C (20.4) | C (23.4) | E (36.6) |
| Westbound Johnson Road | C (23.1) | E (48.7) | F (50.8) | C (23.4) | E (40.1) | E (39.9) |
| Northbound Cedar Creek Road | A (7.9) | A (8.6) | A (8.3) | A (7.9) | A (8.5) | A (8.2) |
| Southbound Cedar Creek Road | A (8.2) | A (8.3) | A (9.1) | A (8.2) | A (8.2) | A (8.9) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 3) *with Improvements*[30] | | | | | | |
| Eastbound Johnson Road | - | - | - | C (18.9) | C (19.3) | D (31.0) |
| Westbound Johnson Road | - | - | - | C (21.5) | D (32.2) | D (27.2) |
| Northbound Cedar Creek Road | - | - | - | A (7.9) | A (8.5) | A (8.2) |
| Southbound Cedar Creek Road | - | - | - | A (8.2) | A (8.2) | A (8.9) |

[30]Improvements scenario includes the provision of channelized right turn lanes along the eastbound and westbound Johnson Road approaches to the intersection.

Table 7 (Continued)
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[28] Two-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Johnson Road/ Cedar Creek Road** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2020 with The Centre at Hearthstone Manor (Case 3) *with Modified Access*[31] | | | | | | |
| Eastbound Johnson Road | - | - | - | C (20.4) | C (23.0) | E (35.4) |
| Westbound Johnson Road | - | - | - | C (24.6) | E (44.8) | E (41.9) |
| Northbound Cedar Creek Road | - | - | - | A (7.9) | A (8.5) | A (8.2) |
| Southbound Cedar Creek Road | - | - | - | A (8.2) | A (8.2) | A (8.9) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 3) *with Modified Access and Improvements*[31,32] | | | | | | |
| Eastbound Johnson Road | - | - | - | C (18.8) | C (19.1) | D (28.9) |
| Westbound Johnson Road | - | - | - | C (23.8) | E (42.8) | C (21.5) |
| Northbound Cedar Creek Road | - | - | - | A (7.9) | A (8.5) | A (8.2) |
| Southbound Cedar Creek Road | - | - | - | A (8.2) | A (8.2) | A (8.9) |

[31]The modified access scenario incorporates the relocation of the Site Entrance E driveway to be south of the southbound Delaware Route 1 Ramp intersection with Cedar Creek Road. Additionally, the Site Entrance E driveway would be configured to only provide right in and right out movements along Cedar Creek Road. As a result, site traffic that previously executed left turn or through movements onto or out of Cedar Creek Road would be rerouted to utilize the Site Entrance A along Wilkins Road.
[32]Improvements scenario includes the provision of channelized right turn lanes along the eastbound and westbound Johnson Road approaches to the intersection.

Table 8
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[33] Two-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Johnson Road/ Elks Lodge Road** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2012 Existing (Case 1) | | | | | | |
| Eastbound Johnson Road | A (7.6) | A (7.5) | A (7.4) | A (7.6) | A (7.5) | A (7.3) |
| Southbound Elks Lodge Road | A (9.9) | A (9.7) | A (9.4) | A (9.9) | A (9.7) | A (9.2) |
| | | | | | | |
| 2020 without The Centre at Hearthstone Manor (Case 2) | | | | | | |
| Eastbound Johnson Road | A (7.7) | A (7.6) | A (7.4) | A (7.7) | A (7.6) | A (7.4) |
| Southbound Elks Lodge Road | B (10.7) | B (10.7) | A (9.8) | B (10.7) | B (10.7) | A (9.5) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 3) | | | | | | |
| Eastbound Johnson Road | A (7.8) | A (7.7) | A (7.6) | A (7.8) | A (7.7) | A (7.5) |
| Southbound Elks Lodge Road | B (11.0) | B (11.7) | B (10.6) | B (11.0) | B (11.7) | B (10.1) |

[33]For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

Table 9
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[34] All-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Wilkins Road/ Elks Lodge Road** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2012 Existing (Case 1) | | | | | | |
| Eastbound Wilkins Road | A (7.94) | A (8.12) | A (7.63) | A (7.94) | A (8.12) | A (7.56) |
| Westbound Wilkins Road | A (7.79) | A (8.08) | A (7.53) | A (7.79) | A (8.08) | A (7.47) |
| Northbound Elks Lodge Road | A (7.88) | A (7.83) | A (7.59) | A (7.88) | A (7.83) | A (7.51) |
| Southbound Elks Lodge Road | A (8.30) | A (8.85) | A (7.97) | A (8.30) | A (8.85) | A (7.90) |
| Overall Intersection | A (8.02) | A (8.41) | A (7.72) | A (8.02) | A (8.41) | A (7.65) |
| | | | | | | |
| 2020 without The Centre at Hearthstone Manor (Case 2) | | | | | | |
| Eastbound Wilkins Road | A (9.02) | A (8.96) | A (8.31) | A (9.02) | A (8.96) | A (8.30) |
| Westbound Wilkins Road | A (8.88) | A (9.16) | A (8.87) | A (8.88) | A (9.16) | A (8.84) |
| Northbound Elks Lodge Road | A (8.73) | A (8.46) | A (8.20) | A (8.73) | A (8.46) | A (8.18) |
| Southbound Elks Lodge Road | A (9.78) | A (9.78) | A (9.10) | A (9.78) | A (9.78) | A (9.07) |
| Overall Intersection | A (9.21) | A (9.27) | A (8.76) | A (9.21) | A (9.27) | A (8.74) |

[34]For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

Table 9 (Continued)
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[34] All-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Wilkins Road/ Elks Lodge Road** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2020 with The Centre at Hearthstone Manor (Case 3) | | | | | | |
| Eastbound Wilkins Road | B (10.31) | C (15.83) | C (16.04) | B (10.31) | C (15.83) | C (15.62) |
| Westbound Wilkins Road | B (10.10) | C (19.01) | C (20.21) | B (10.10) | C (19.01) | C (19.51) |
| Northbound Elks Lodge Road | A (9.99) | C (16.15) | C (19.49) | A (9.99) | C (16.15) | C (18.79) |
| Southbound Elks Lodge Road | B (11.94) | C (24.14) | D (29.79) | B (11.94) | C (24.14) | D (28.20) |
| Overall Intersection | B (10.79) | C (19.43) | C (22.45) | B (10.79) | C (19.43) | C (21.51) |

Table 10
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[35] Two-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Wilkins Road/ Johnson Road** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2012 Existing (Case 1) | | | | | | |
| Eastbound Johnson Road | A (7.7) | A (7.5) | A (7.5) | A (7.7) | A (7.5) | A (7.4) |
| Southbound Wilkins Road | A (9.7) | A (9.1) | A (9.1) | A (9.7) | A (9.1) | A (9.0) |
| | | | | | | |
| 2020 without The Centre at Hearthstone Manor (Case 2) | | | | | | |
| Eastbound Johnson Road | A (7.9) | A (7.7) | A (7.5) | A (7.9) | A (7.7) | A (7.5) |
| Southbound Wilkins Road | B (11.0) | B (10.3) | B (10.8) | B (11.0) | B (10.3) | B (10.5) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 3) | | | | | | |
| Eastbound Johnson Road | A (8.1) | A (8.2) | A (8.0) | A (8.0) | A (8.0) | A (7.9) |
| Southbound Wilkins Road | B (11.7) | B (12.6) | C (16.9) | B (11.2) | B (11.8) | B (14.8) |

[35]For signalized and unsignalized analyses, 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 Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Signalized Intersection**[36] | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Marshall Street/ Johnson Road**[37,38] | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2012 Existing (Case 1) | B (16.9) | A (9.7) | A (9.1) | B (17.4) | B (13.7) | B (12.2) |
| | | | | | | |
| 2020 without The Centre at Hearthstone Manor (Case 2) | B (16.6) | B (12.4) | A (9.9) | B (18.9) | B (18.8) | B (13.3) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 3) | B (17.9) | B (14.7) | B (11.9) | B (19.5) | B (19.3) | B (13.4) |

[36]For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.
[37]The TIS utilized a variable cycle length and a pretimed signal operation during the peak hour analyses. However, based on field observations, JMT assumed a 90 second cycle length and an actuated signal operation during the peak hour analyses due to the free operation of the signal.
[38]The TIS used arbitrary right-turn-on-red volumes. However, since right-turn-on-red count data was not available, JMT did not use right-turn-on-red volumes.

Table 12
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[39] Two-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **North Old State Road/ Johnson Road** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2012 Existing (Case 1) | | | | | | |
| Eastbound Johnson Road | A (7.7) | A (7.6) | A (7.6) | A (7.7) | A (7.6) | A (7.5) |
| Westbound Johnson Road | A (7.6) | A (7.7) | A (7.6) | A (7.6) | A (7.7) | A (7.5) |
| Northbound North Old State Road | B (12.5) | B (13.1) | B (11.6) | B (12.5) | B (13.1) | B (11.3) |
| Southbound North Old State Road | B (13.4) | B (13.4) | B (12.3) | B (13.4) | B (13.4) | B (11.8) |
| | | | | | | |
| 2020 without The Centre at Hearthstone Manor (Case 2) | | | | | | |
| Eastbound Johnson Road | A (7.9) | A (8.0) | A (7.8) | A (7.9) | A (8.0) | A (7.7) |
| Westbound Johnson Road | A (8.1) | A (7.9) | A (7.7) | A (8.1) | A (7.9) | A (7.7) |
| Northbound North Old State Road | C (18.9) | C (20.4) | B (13.9) | C (18.9) | C (20.4) | B (13.1) |
| Southbound North Old State Road | C (22.6) | C (23.9) | C (16.2) | C (22.6) | C (23.9) | B (14.8) |

[39]For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

Table 12 (Continued)
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[39] Two-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **North Old State Road/ Johnson Road** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2020 with The Centre at Hearthstone Manor (Case 3) | | | | | | |
| Eastbound Johnson Road | A (8.0) | A (8.2) | A (7.9) | A (8.0) | A (8.1) | A (7.9) |
| Westbound Johnson Road | A (8.2) | A (8.1) | A (8.1) | A (8.2) | A (8.1) | A (8.0) |
| Northbound North Old State Road | C (19.9) | D (34.1) | C (17.4) | C (19.9) | D (29.0) | C (15.5) |
| Southbound North Old State Road | D (26.9) | F (57.3) | D (31.7) | D (26.9) | E (44.6) | C (24.8) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 3) *with Improvement Option 1*[40] | | | | | | |
| Eastbound Johnson Road | - | - | - | A (8.0) | A (8.1) | A (7.9) |
| Westbound Johnson Road | - | - | - | A (8.2) | A (8.1) | A (8.0) |
| Northbound North Old State Road | - | - | - | C (19.9) | D (29.0) | C (15.5) |
| Southbound North Old State Road | - | - | - | C (20.8) | D (30.7) | C (20.2) |

[40] Improvement Option 1 includes the modification of the southbound North Old State Road approach to provide a separate left turn lane and a shared through/right turn lane.

Table 12 (Continued)
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[39] All-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **North Old State Road/ Johnson Road** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2020 with The Centre at Hearthstone Manor (Case 3) *with Improvement Option 2*[41] | | | | | | |
| Eastbound Johnson Road | - | - | - | C (15.46) | B (14.74) | B (11.85) |
| Westbound Johnson Road | - | - | - | B (14.09) | C (22.15) | B (13.47) |
| Northbound North Old State Road | - | - | - | B (10.45) | B (12.49) | B (10.10) |
| Southbound North Old State Road | - | - | - | B (10.93) | B (11.69) | B (10.44) |
| Overall Intersection | - | - | - | B (13.83) | C (17.15) | B (12.04) |

[41]Improvement Option 2 includes the modification of the intersection to operate under all-way stop control. The existing lane configurations would be maintained.

Table 13
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Signalized Intersection**[42] | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **US Route 113/ Johnson Road**[43,44,45] | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2012 Existing (Case 1) | D (35.8) | D (35.4) | D (40.6) | C (29.3) | C (29.7) | C (30.3) |
| | | | | | | |
| 2020 without The Centre at Hearthstone Manor (Case 2) | D (44.8) | D (45.9) | D (46.2) | C (32.5) | C (33.7) | D (35.7) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 3) | D (39.9) | D (41.3) | D (49.9) | C (32.8) | D (35.2) | D (36.7) |

[42]For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.
[43]The TIS utilized a variable cycle length during the peak hour analyses. However, based on field observations, JMT assumed a 120 second cycle length during the peak hour analyses due to the free operation of the signal.
[44]The TIS utilized a pretimed four-phase signal operation whereas JMT utilized an actuated four-phase signal operation with an advanced southbound movement.
[45]The TIS used arbitrary right-turn-on-red volumes. However, since right-turn-on-red count data was not available, JMT did not use right-turn-on-red volumes and instead modeled the right turn movements as permissive within the signal phasing where separate right turn lanes are provided.

Table 14
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[46] All-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Elks Lodge Road/Marshall Street/McCoy Avenue** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2012 Existing (Case 1) | | | | | | |
| Eastbound McCoy Avenue | A (9.02) | B (10.43) | A (8.79) | A (9.02) | A (9.84) | A (8.44) |
| Westbound Elks Lodge Road | A (8.51) | A (9.14) | A (8.60) | A (8.51) | A (8.81) | A (8.30) |
| Northbound Marshall Street | A (9.77) | A (9.34) | A (8.83) | A (9.77) | A (9.02) | A (8.54) |
| Southbound Marshall Street | A (8.82) | A (9.57) | A (8.86) | A (8.82) | A (9.20) | A (8.57) |
| Overall Intersection | A (9.17) | A (9.78) | A (8.76) | A (9.17) | A (9.34) | A (8.45) |
| | | | | | | |
| 2020 without The Centre at Hearthstone Manor (Case 2) | | | | | | |
| Eastbound McCoy Avenue | B (11.83) | B (14.35) | B (10.05) | B (11.83) | B (14.35) | B (10.05) |
| Westbound Elks Lodge Road | B (13.25) | B (11.68) | A (9.66) | B (13.25) | B (11.68) | A (9.66) |
| Northbound Marshall Street | B (13.64) | B (11.60) | A (9.80) | B (13.64) | B (11.60) | A (9.80) |
| Southbound Marshall Street | B (11.35) | B (11.72) | A (9.86) | B (11.35) | B (11.72) | A (9.86) |
| Overall Intersection | B (12.70) | B (12.65) | A (9.85) | B (12.70) | B (12.65) | A (9.85) |

[46]For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

Table 14 (Continued)
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[46] All-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Elks Lodge Road/Marshall Street/McCoy Avenue** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2020 with The Centre at Hearthstone Manor (Case 3) | | | | | | |
| Eastbound McCoy Avenue | B (13.49) | C (22.54) | B (14.03) | B (13.49) | C (22.72) | B (14.03) |
| Westbound Elks Lodge Road | C (16.07) | C (21.33) | C (16.37) | C (16.07) | C (21.50) | C (16.37) |
| Northbound Marshall Street | C (15.25) | B (14.28) | B (12.07) | C (15.25) | B (14.34) | B (12.07) |
| Southbound Marshall Street | B (13.37) | C (18.40) | C (15.36) | B (13.37) | C (18.64) | C (15.36) |
| Overall Intersection | B (14.73) | C (20.04) | B (14.90) | B (14.73) | C (20.21) | B (14.90) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 3) *with Improvements*[47] | | | | | | |
| Eastbound McCoy Avenue | - | - | - | B (13.67) | C (22.02) | B (14.01) |
| Westbound Elks Lodge Road | - | - | - | B (13.51) | B (13.33) | B (11.57) |
| Northbound Marshall Street | - | - | - | C (15.00) | B (13.72) | B (11.76) |
| Southbound Marshall Street | - | - | - | B (13.20) | C (17.53) | B (14.81) |
| Overall Intersection | - | - | - | B (13.88) | C (17.09) | B (13.04) |

[47]Improvements scenario includes the off-site improvement as part of the Hearthstone Manor II and Watergate at Milford developments that would modify the westbound Elks Lodge Road approach to provide a shared through/left turn lane and an exclusive right turn lane.

Table 15
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[48] Two-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **McCoy Avenue/ Walnut Street** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2012 Existing (Case 1) | | | | | | |
| Westbound McCoy Avenue | B (10.5) | B (11.4) | A (9.4) | B (10.5) | B (11.4) | A (9.2) |
| Southbound Walnut Street | A (7.7) | A (7.8) | A (7.6) | A (7.7) | A (7.8) | A (7.5) |
| | | | | | | |
| 2020 without The Centre at Hearthstone Manor (Case 2) | | | | | | |
| Westbound McCoy Avenue | B (12.0) | B (13.1) | B (10.2) | B (12.0) | B (13.1) | A (10.0) |
| Southbound Walnut Street | A (7.9) | A (8.1) | A (7.8) | A (7.9) | A (8.1) | A (7.7) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 3) | | | | | | |
| Westbound McCoy Avenue | B (12.4) | B (14.5) | B (10.5) | B (12.4) | B (14.5) | B (10.5) |
| Southbound Walnut Street | A (8.0) | A (8.2) | A (7.9) | A (8.0) | A (8.2) | A (7.9) |

[48]For signalized and unsignalized analyses, 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 Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[49] Two-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Delaware Route 1 Ramp/ Delaware Route 30** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2012 Existing (Case 1) | | | | | | |
| Southbound Delaware Route 30 - Left | A (8.4) | A (8.0) | A (8.2) | A (8.2) | A (7.9) | A (8.1) |
| | | | | | | |
| 2020 without The Centre at Hearthstone Manor (Case 2) | | | | | | |
| Southbound Delaware Route 30 - Left | A (9.0) | A (8.4) | A (8.7) | A (8.8) | A (8.3) | A (8.6) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 3) | | | | | | |
| Southbound Delaware Route 30 - Left | A (9.0) | A (9.0) | A (9.4) | A (9.0) | A (9.0) | A (9.4) |

[49]For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

Table 17
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[50] Two-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Delaware Route 30/ Kirby Road[51]** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2012 Existing (Case 1) | | | | | | |
| Westbound Kirby Road | B (11.6) | B (12.4) | B (13.4) | B (11.7) | B (12.5) | B (13.6) |
| Southbound Delaware Route 30 | A (8.2) | A (7.8) | A (8.2) | A (8.2) | A (7.8) | A (8.2) |
| | | | | | | |
| 2020 without The Centre at Hearthstone Manor (Case 2) | | | | | | |
| Westbound Kirby Road | B (13.1) | C (15.0) | C (17.6) | B (13.4) | C (15.3) | C (18.4) |
| Southbound Delaware Route 30 | A (8.5) | A (8.1) | A (8.6) | A (8.5) | A (8.1) | A (8.6) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 3)[52] | | | | | | |
| Westbound Kirby Road | B (14.4) | C (21.8) | D (27.6) | B (14.8) | C (22.4) | D (32.7) |
| Southbound Delaware Route 30 | A (8.7) | A (8.7) | A (9.2) | A (8.7) | A (8.7) | A (9.4) |

[50]For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.
[51] The TIS modeled the westbound Kirby Road approach with separate left turn and right turn lanes. However, JMT modeled the approach as one shared left turn/right turn lane based on existing conditions.
[52] The TIS used a northbound through volume of 609 vph during the Case 3 Saturday peak period. However, JMT utilized a volume of 669 vph consistent with Figure No. 45 of the TIS.

Table 18
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[53] Two-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Delaware Business Route 1/ 2nd Street[54,55]** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2012 Existing (Case 1) | | | | | | |
| Eastbound 2nd Street | B (14.0) | B (14.0) | B (13.4) | C (16.0) | C (16.6) | B (14.3) |
| Westbound Restaurant Entrance | B (10.1) | C (20.7) | C (21.4) | C (18.4) | C (20.7) | C (19.6) |
| Northbound Delaware Business Route 1 | A (7.9) | A (8.4) | A (8.2) | A (7.9) | A (8.5) | A (8.1) |
| Southbound Delaware Business Route 1 | A (8.0) | A (7.8) | A (7.9) | A (8.0) | A (7.8) | A (7.8) |
| | | | | | | |
| 2020 without The Centre at Hearthstone Manor (Case 2) | | | | | | |
| Eastbound 2nd Street | C (19.4) | C (17.9) | C (16.8) | D (25.8) | C (22.8) | C (19.4) |
| Westbound Restaurant Entrance | B (10.7) | B (10.1) | D (30.5) | C (23.9) | C (23.9) | D (27.4) |
| Northbound Delaware Business Route 1 | A (8.1) | A (8.9) | A (8.6) | A (8.1) | A (8.8) | A (8.5) |
| Southbound Delaware Business Route 1 | A (8.2) | A (8.0) | A (8.0) | A (8.2) | A (7.9) | A (8.0) |

[53]For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.
[54] The TIS modeled the eastbound 2nd Street and westbound restaurant entrance approaches with separate right turn lanes. However, JMT modeled the approaches as one shared through/left turn/right turn lane based on existing conditions.
[55]The TIS applied a 3% heavy vehicle percentage to only the westbound and southbound approaches. However, JMT applied a 3% or existing heavy vehicle percentage to all approaches at the intersection consistent with DelDOT standards.

Table 18 (Continued)
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Unsignalized Intersection[53] Two-Way Stop Control** | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Delaware Business Route 1/ 2nd Street[54,55]** | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2020 with The Centre at Hearthstone Manor (Case 3) | | | | | | |
| Eastbound 2nd Street | C (21.3) | D (29.6) | D (31.3) | D (31.3) | F (80.8) | F (72.2) |
| Westbound Restaurant Entrance | B (10.9) | B (11.3) | F (86.7) | D (27.0) | E (44.6) | F (83.2) |
| Northbound Delaware Business Route 1 | A (8.3) | A (9.7) | A (9.5) | A (8.3) | A (9.7) | A (9.5) |
| Southbound Delaware Business Route 1 | A (8.2) | A (8.4) | A (8.5) | A (8.2) | A (8.4) | A (8.5) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 3) *with Improvements*[56] | | | | | | |
| Eastbound 2nd Street | - | - | - | C (22.9) | D (32.4) | D (31.1) |
| Westbound Restaurant Entrance | - | - | - | D (27.0) | E (44.6) | F (83.2) |
| Northbound Delaware Business Route 1 | - | - | - | A (8.3) | A (9.7) | A (9.5) |
| Southbound Delaware Business Route 1 | - | - | - | A (8.2) | A (8.4) | A (8.5) |

[56]Improvements scenario includes the modification of the eastbound 2nd Street approach to provide one shared through/left turn lane and one exclusive right turn lane due to the available roadway width along 2nd Street.

Table 19
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Final Traffic Impact Study for The Centre at Hearthstone Manor
Prepared by C. David Jamison. PE

| **Signalized Intersection**[57] | **LOS per TIS** | | | **LOS per JMT** | | |
|---|---|---|---|---|---|---|
| **Delaware Business Route 1/ Front Street**[58,59,60,61] | Weekday AM | Weekday PM | Saturday Midday | Weekday AM | Weekday PM | Saturday Midday |
| 2012 Existing (Case 1) | B (16.1) | B (17.0) | B (16.8) | B (17.0) | B (17.3) | B (17.1) |
| | | | | | | |
| 2020 without The Centre at Hearthstone Manor (Case 2) | B (17.9) | B (19.2) | B (18.9) | B (17.4) | B (17.9) | B (17.7) |
| | | | | | | |
| 2020 with The Centre at Hearthstone Manor (Case 3) | B (19.7) | C (23.8) | C (30.1) | B (17.6) | B (18.4) | B (17.9) |

[57]For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.
[58] The TIS utilized a pretimed two-phase signal operation whereas JMT utilized an actuated two-phase signal operation based on field observations.
[59] The TIS utilized a variable cycle length during the peak hour analyses. However, based on field observations, JMT assumed a 120 second cycle length during the peak hour analyses due to the free operation of the signal.
[60] The TIS modeled the eastbound Front Street approach with a shared through/left turn/right turn lane. However, due to the channelized right turn lane along that approach, JMT modeled it with a shared through/left turn lane and a separate right turn lane.
[61]The TIS used arbitrary right-turn-on-red volumes. However, since right-turn-on-red count data was not available, JMT did not use right-turn-on-red volumes and instead modeled the right turn movements as permissive within the signal phasing where separate right turn lanes are provided.