



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

JENNIFER COHAN
SECRETARY

October 6, 2015

Mr. Dev Sitaram
Karins and Associates, Inc.
17 Polly Drummond Center
Newark, DE 19711

Dear Mr. Sitaram:

The enclosed Traffic Impact Study (TIS) review letter for the **Connection Community Church** (Tax Parcel 13-012.00-53.00) has been completed under the responsible charge of a registered professional engineer whose firm is authorized to work in the State of Delaware. They have found the TIS to conform to DelDOT's Development Coordination Manual and other accepted practices and procedures for such studies. DelDOT accepts this review letter and concurs with the recommendations. If you have any questions concerning this letter or the enclosed review letter, please contact me at (302) 760-2167.

Sincerely,



Troy Brestel
Project Engineer

TEB:km

Enclosures

cc with enclosures: Mr. Scott Hoffman, CABA Associates
Ms. Constance C. Holland, Office of State Planning Coordination
Mr. George Haggerty, New Castle County Department of Land Use
Mr. Owen Robatino, New Castle County Department of Land Use
Mr. Marco Boyce, New Castle County Department of Land Use
Mr. Mir Wahed, Johnson, Mirmiran & Thompson, Inc.
Mr. Richard Mishura, Johnson, Mirmiran & Thompson, Inc.
DelDOT Distribution

DelDOT Distribution

Ann Cordo, Deputy Attorney General
Robert McCleary, Director, Transportation Solutions (DOTS)
Drew Boyce, Director, Planning
Mark Luszczyk, Chief Traffic Engineer, Traffic, DOTS
Mark Tudor, Assistant Director, Project Development North, DOTS
J. Marc Coté, Assistant Director, Development Coordination
T. William Brockenbrough, Jr., County Coordinator, Development Coordination
Thomas E. Meyer, Traffic Studies Manager, Traffic, DOTS
Kevin Canning, Canal District Engineer, Canal District
Matthew Lichtenstein, Canal District Public Works Engineer, Canal District
David Dooley, Service Development Planner, Delaware Transit Corporation
Jeff Van Horn, New Castle Subdivision Coordinator, Development Coordination
Ahmed Abdelmoteleb, New Castle Traffic Engineer, Traffic, DOTS
Anthony Aglio, Planning Supervisor, Statewide & Regional Planning
Claudy Joinville, Project Engineer, Development Coordination
Diane Gunn, Project Manager, Project Development North, DOTS



October 1, 2015

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

RE: Agreement No. 1654
Project Number T201469011
Traffic Impact Study Services
Task 7A-Connection Community Church

Dear Mr. Brestel:

Johnson, Mirmiran and Thompson (JMT) has completed the review of the Traffic Impact Study (TIS) for Connection Community Church, prepared by Karins and Associates. This review was assigned Task Number 7A. Karins and Associates prepared the report in a manner generally consistent with DeIDOT's *Development Coordination Manual*.

The TIS evaluates the impacts of the proposed 544-seat Connection Community Church on the west side of US Route 301 (New Castle Road 39), just south of Old School House Road (New Castle Road 431) in New Castle County, Delaware. The subject property is on a 27.23-acre parcel that is zoned as S (Suburban). No rezoning is needed to permit the proposed use. One full movement access point is proposed on US Route 301. Construction is anticipated to be completed in 2016.

DeIDOT currently has two relevant capital projects, a Transportation Improvement District (TID), a Hazard Elimination Project (HEP), and a Pavement Rehabilitation Project within the study area: the *US 301, Maryland State Line to SR 1* project (Contract #T200511301) and the *N427, Cedar Lane Road, Marl Pit Road, to Boyds Corner Road* project (Contract #T200712005).

The *US 301, Maryland State Line to SR 1* project is divided into several sections and contains improvements that will reduce traffic congestion in the project area and improve highway safety by removing through traffic, especially heavy vehicle truck traffic, from local roads. The Selected Alternative (Green North + Spur Road) provides a four-lane limited access toll road, US Route 301, on a new alignment. The new US Route 301 mainline section would extend from the Maryland State Line, west of Middletown, to the vicinity of Armstrong Corner Road where it would continue northeast, crossing the existing US Route 301 and Boyds Corner Road before curving east and tying into Delaware Route 1 south of the Chesapeake and Delaware (C&D) Canal. Access to the new US Route 301 would be provided via interchanges south of Middletown (Levels Road), in the vicinity of Armstrong Corner Road, and at Jamison Corner Road. Additional information can be found on the DeIDOT project website at <http://deldot.gov/information/projects/us301/index.shtml>



As part of the proposed US Route 301 project, improvements are proposed at the US Route 301 intersection with Armstrong Corner Road and Marl Pit Road. Specifically, the northbound and southbound US Route 301 approaches will be widened to provide one left turn lane, two through lanes, and one right turn lane, and the eastbound Armstrong Corner Road and westbound Marl Pit Road approaches will be widened to provide one left turn lane, one through lane, and one right turn lane. Bike lanes will be added along each approach to the intersection as well. DelDOT is working with the US DOT on funding opportunities for construction. Construction could start as early as 2016 and be complete by 2019.

Additionally, as part of the US Route 301 project, improvements are proposed at the Choptank Road intersections with Armstrong Corner Road and Bohemia Mill Road. The two intersections (Armstrong Corner Road with Choptank Road and Bohemia Mill Road with Choptank Road) are approximately ¼ mile apart from each other. Armstrong Corner Road will be realigned to be directly across Bohemia Mill Road to form a four-legged intersection with Choptank Road. The current Armstrong Corner Road intersection with Choptank Road would remain but only serve one existing residence along Armstrong Corner Road, and terminate east of the residence. There is no funding currently allocated in the Capital Transportation Program (CTP) to complete design, right-of-way, and construction of this section of the project.

The *N427, Cedar Lane Road, Marl Pit Road, to Boyds Corner Road* project will be widened to provide 12-foot travel lanes, 8-foot shoulders, and a 10-foot multi-use path. The intersection of Cedar Lane Road and Marl Pit Road will be reconstructed to provide a single lane roundabout. Design is partially funded in the current CTP, however there is no funding allocated to complete design, right-of-way, and construction. Additional information can be found on the DelDOT project website at http://deldot.gov/information/projects/cedar_lane/index.shtml

Some of the TIS study intersections (the US Route 301 intersection with Boyds Corner Road and Churchtown Road, the Boyds Corner Road intersection with Ratledge Road, and the Marl Pit Road intersection with Cedar Lane Road) are located within the Southern New Castle County TID. The study area is bounded by Lorewood Grove Road and the C&D Canal to the north, Marl Pit Road to the south, Delaware Route 1 and US Route 13 to the east, and US Route 301/Delaware Route 71 and Delaware Route 896 to the west. JMT completed a Technical Report in 2013 to update the original TID study performed in 2004.

Based on the 2030 analysis the TID Technical Report recommended improvements at the intersection of Boyds Corner Road/Ratledge Road and Marl Pit Road/Cedar Lane Road. At the intersection of Boyds Corner Road and Ratledge Road, a traffic signal is recommended in the TID Technical Report. The study also recommended southbound Ratledge Road be modified to provide a separate left turn and right turn lane and eastbound Boyds Corner Road be modified to provide a separate left turn lane. At the intersection of Marl Pit Road and Cedar Lane Road, either a traffic signal or a roundabout is recommended in the TID Technical Report.

DelDOT's 2011 HEP identified Site DD which is within the project area. Site DD is a 0.49-mile corridor located along US Route 301 from 0.21-mile north of Springmill Drive to 0.25-mile north



of Armstrong Corner Road/Marl Pit Road. The Site DD Task I report included a crash summary as well as a review of the US Route 301 intersection with Armstrong Corner Road and Marl Pit Road. Suggested Task I remedial improvements at the US Route 301 intersection with Armstrong Corner Road and Marl Pit Road included the installation of Signal Ahead signage along southbound US Route 301, restriping the stop line along eastbound Armstrong Corner Road, and changing the yellow clearance interval along Armstrong Corner Road and Marl Pit Road from 4 seconds to 5 seconds. Based on field observations, the signage and striping improvements have been completed.

DelDOT has one ongoing pavement rehabilitation and resurfacing project within the project area. This project is along Cedar Lane Road, from Marl Pit Road to the bridge at Spring Mill Branch (Contract #T201506102) and involves milling, patching, and overlays. Construction is estimated to be completed in Winter of 2015.

The TIS provided a crash summary that indicates a total of 79 crashes along US Route 301 from Marl Pit Road to Boyds Corner Road from January 2012 to December 2014. A majority of the crashes were rear-end (51 incidents) and two of the crashes involved a fatality. None of the two fatal crashes were results from the operations of the traffic signal at US Route 301 and Marl Pit Road.

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

The proposed development will meet the New Castle County Level of Service (LOS) Standards as stated in Section 40.11.210 of the Unified Development Code (UDC) for all signalized intersections analyzed in this study.

However, based on the LOS evaluation criteria as stated in DelDOT's *Development Coordination Manual*, movements at the following stop-controlled intersections exhibit LOS deficiencies without the implementation of physical roadway and/or traffic control improvements:

<i>Intersection</i>	<i>Situations for which deficiencies occur</i>
Site Access / US Route 301	2016 Sunday with the development of Connection Community Church (Case 3)
US Route 301 / Old School House Road	2016 Sunday without the development of Connection Community Church (Case 2) 2016 Sunday with the development of Connection Community Church (Case 3)
Marl Pit Road / Cedar Lane Road	2016 Sunday with the development of Connection Community Church (Case 3)

The unsignalized site entrance to US Route 301 exhibits LOS deficiencies during the Sunday future peak period once development of the Connection Community Church is accounted for. However, deficiencies take place only at the eastbound site entrance approach. The projected maximum 95th percentile queue length under Case 3 conditions is approximately 190 feet for the



left turn vehicles and 30 feet for the right turn vehicles. From the preliminary site plan, it appears there will be sufficient storage for the turn lanes on the eastbound approach site driveway to accommodate the projected queue lengths. As such, we do not recommend any additional improvements along the site entrance.

The unsignalized intersection of US Route 301 and Old School House Road exhibits LOS deficiencies during the Sunday peak periods with or without the development of the Connection Community Church (Case 2 and Case 3). The LOS deficiencies take place along the eastbound Old School House Road approach. The projected 95th percentile queue length under Case 3 condition is approximately 60 feet along the eastbound Old School House Road approach. Installation of a traffic signal at this intersection would mitigate any LOS deficiencies. However, it would be unreasonable for the developer to install a traffic signal at this location, as the proposed use only impacts the Sunday peak period. As such, we do not recommend any additional improvements at this intersection.

The unsignalized all-way stop controlled intersection of Marl Pit Road and Cedar Lane Road exhibits LOS deficiencies during the Sunday future peak period (Case 3 only). The LOS deficiencies take place along the northbound and southbound Cedar Lane Road approaches. The addition of a separate right turn lane along both northbound and southbound Cedar Lane Road approaches would achieve acceptable LOS. However, per the *N427, Cedar Lane Road, Marl Pit Road, to Boyds Corner Road* project, this intersection is expected to be reconstructed by the installation of a single lane roundabout. With this improvement, acceptable LOS can be achieved in the Sunday future peak period (Case 3).

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

1. The developer should provide a bituminous concrete overlay to the US Route 301 existing travel lanes along the site frontage 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 construct a full movement site entrance for the proposed Connection Community Church development on US Route 301 along the eastern side of the property limits, approximately 2,800 feet south of the US Route 301 intersection with Old School House Road, to be consistent with the proposed lane configurations as shown in the table below:



Approach	Current Configuration	Proposed Configuration
Eastbound Site Entrance	Approach does not exist	One left turn lane and one right turn lane
Northbound US Route 301	One through lane	One left turn lane and one through lane
Southbound US Route 301	One through lane	One through lane and one right turn lane

Based on DelDOT’s *Development Coordination Manual*, the recommended minimum storage length (excluding taper) is 235 feet for the northbound US Route 301 left turn lane and 290 feet for the southbound US Route 301 right turn lane.

3. The developer should enter into an agreement with DelDOT to fund an equitable portion (not to exceed \$4,800) of the geometric improvements planned as part of the *N427, Cedar Lane Road, Marl Pit Road, to Boyds Corner Road* project (Contract #T200712005) at the Marl Pit Road and Cedar Lane Road intersection. Improvements include installing a single lane roundabout at this location. The proposed configuration is shown in the table below:

Approach	Current Configuration	Proposed Configuration [^]
Eastbound Marl Pit Road	One shared through/left turn/right turn lane	One shared through/left turn lane and one bypass right turn lane (yield controlled)
Westbound Marl Pit Road	One shared through/left turn/right turn lane	No change
Northbound Cedar Lane Road	One shared through/left turn/right turn lane	No change
Southbound Cedar Lane Road	One shared through/left turn/right turn lane	One shared through/left turn lane and one bypass right turn lane (yield controlled)

[^] As design of the DelDOT project has not been completed, the proposed configuration is based on the recommended improvements from the Southern New Castle County TID study.

4. The following bicycle and pedestrian improvements should be included:
 - a. A five-foot wide ADA compliant sidewalk with a five-foot setback from the roadway should be constructed along the site frontage. The sidewalk should be within a 15 feet-wide dedicated permanent easement to DelDOT and/or State right-of-way. If feasible, the sidewalk should be placed behind utility poles and street trees should be provided within the buffer area. As the Connection Community Church is located within an Investment Level 3 area (Strategies for State Policies and Spending Map of Delaware), the proposed sidewalk is at the discretion of the DelDOT Subdivision Engineer. Therefore, the developer should coordinate with DelDOT’s Subdivision Section during the plan review process.



- b. 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.
- c. When a right turn lane is added along southbound US Route 301, the five-foot wide bicycle lane should be maintained through the right turn lane in order to facilitate safe and unimpeded bicycle travel. A RIGHT TURN YIELD TO BIKES sign (MUTCD R4-4) should be added before the start of each right turn lane.
- d. ADA compliant curb ramps and marked crosswalks should be provided at the site entrances. The use of Type 3 curb ramps is discouraged.
- e. Utility covers should be moved outside of any designated bicycle lanes or should be flush with the pavement.

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

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

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 Wahed, P.E., PTOE

cc: Richard Mishura
Joanne Maulit, P.E., PTOE

Enclosure

General Information

Report date: June 2015

Prepared by: Karins and Associates

Prepared for: Connection Community Church

Tax Parcels: 13-012.00-53.00

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

Project Description and Background

Description: 544-seat church.

Location: The subject site is along the west side of US Route 301 (New Castle Road 39), south of Old School House Road (New Castle Road 431).

Amount of Land to be developed: 27.23-acre parcel of land.

Land Use approval(s) needed: Site Plan approval.

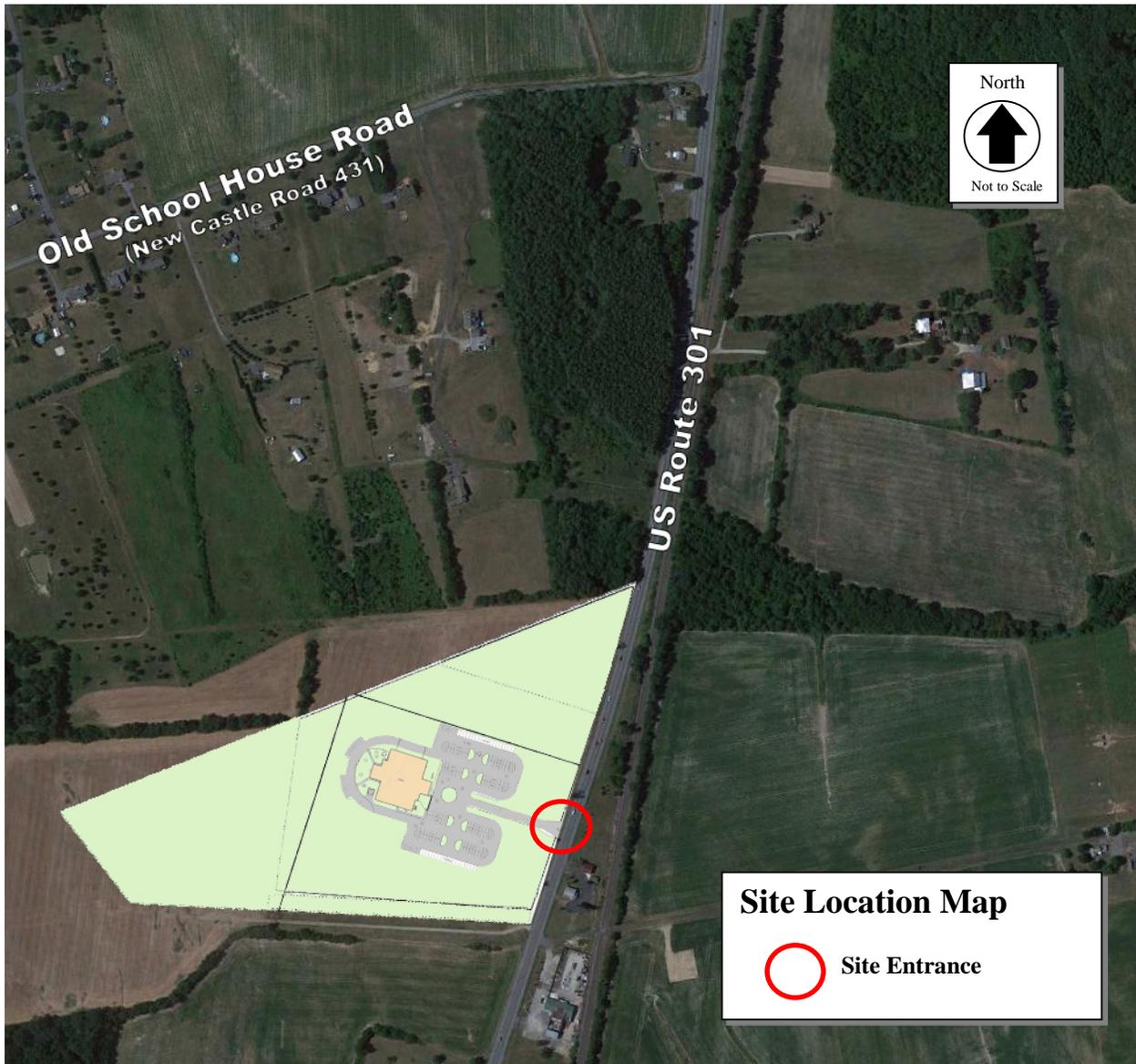
Proposed completion date: 2016.

Proposed access locations: One full movement access along US Route 301.

Daily Traffic Volumes:

- 2014 Average Annual Daily Traffic on US Route 301: 25,112 vehicles per day.

Site Map



**Graphic is an approximation based on the Site Plan prepared by CABA Associates, Inc.*

Relevant and On-going Projects

DelDOT currently has two relevant capital projects, a Transportation Improvement District (TID), a Hazard Elimination Project (HEP), and a Pavement Rehabilitation Project within the study area: the *US 301, Maryland State Line to SR 1* project (Contract #T200511301) and the *N427, Cedar Lane Road, Marl Pit Road, to Boyds Corner Road* project (Contract #T200712005).

The *US 301, Maryland State Line to SR 1* project is divided into several sections and contains improvements that will reduce traffic congestion in the project area and improve highway safety by removing through traffic, especially heavy vehicle truck traffic, from local roads. The Selected

Alternative (Green North + Spur Road) provides a four-lane limited access toll road, US Route 301, on a new alignment. The new US Route 301 mainline section would extend from the Maryland State Line, west of Middletown, to the vicinity of Armstrong Corner Road where it would continue northeast, crossing the existing US Route 301 and Boyds Corner Road before curving east and tying into Delaware Route 1 south of the Chesapeake and Delaware (C&D) Canal. Access to the new US Route 301 would be provided via interchanges south of Middletown (Levels Road), in the vicinity of Armstrong Corner Road, and at Jamison Corner Road. Additional information can be found on the DelDOT project website at <http://deldot.gov/information/projects/us301/index.shtml>

As part of the proposed US Route 301 project, improvements are proposed at the US Route 301 intersection with Armstrong Corner Road and Marl Pit Road. Specifically, the northbound and southbound US Route 301 approaches will be widened to provide one left turn lane, two through lanes, and one right turn lane, and the eastbound Armstrong Corner Road and westbound Marl Pit Road approaches will be widened to provide one left turn lane, one through lane, and one right turn lane. Bike lanes will be added along each approach to the intersection as well. DelDOT is working with the US DOT on funding opportunities for construction. Construction could start as early as 2016 and be complete by 2019.

Additionally, as part of the US Route 301 project, improvements are proposed at the Choptank Road intersections with Armstrong Corner Road and Bohemia Mill Road. The two intersections (Armstrong Corner Road with Choptank Road and Bohemia Mill Road with Choptank Road) are approximately ¼ mile apart from each other. Armstrong Corner Road will be realigned to be directly across Bohemia Mill Road to form a four-legged intersection with Choptank Road. The current Armstrong Corner Road intersection with Choptank Road would remain but only serve one existing residence along Armstrong Corner Road, and terminate east of the residence. There is no funding currently allocated in the Capital Transportation Program (CTP) to complete design, right-of-way, and construction of this section of the project.

The *N427, Cedar Lane Road, Marl Pit Road, to Boyds Corner Road* project will be widened to provide 12-foot travel lanes, 8-foot shoulders, and a 10-foot multi-use path. The intersection of Cedar Lane Road and Marl Pit Road will be reconstructed to provide a single lane roundabout. Design is partially funded in the current CTP, however there is no funding allocated to complete design, right-of-way, and construction. Additional information can be found on the DelDOT project website at http://deldot.gov/information/projects/cedar_lane/index.shtml

Some of the TIS study intersections (the US Route 301 intersection with Boyds Corner Road and Churchtown Road, the Boyds Corner Road intersection with Ratledge Road, and the Marl Pit Road intersection with Cedar Lane Road) are located within the Southern New Castle County TID. The study area is bounded by Lorewood Grove Road and the C&D Canal to the north, Marl Pit Road to the south, Delaware Route 1 and US Route 13 to the east, and US Route 301/Delaware Route 71 and Delaware Route 896 to the west. JMT completed a Technical Report in 2013 to update the original TID study performed in 2004.

Based on the 2030 analysis the TID Technical Report recommended improvements at the intersection of Boyds Corner Road/Ratledge Road and Marl Pit Road/Cedar Lane Road. At the intersection of Boyds Corner Road and Ratledge Road, a traffic signal is recommended in the TID

Technical Report. The study also recommended southbound Ratledge Road be modified to provide a separate left turn and right turn lane and eastbound Boyds Corner Road be modified to provide a separate left turn lane. At the intersection of Marl Pit Road and Cedar Lane Road, either a traffic signal or a roundabout is recommended in the TID Technical Report.

DelDOT's 2011 HEP identified Site DD which is within the project area. Site DD is a 0.49-mile corridor located along US Route 301 from 0.21-mile north of Springmill Drive to 0.25-mile north of Armstrong Corner Road/Marl Pit Road. The Site DD Task I report included a crash summary as well as a review of the US Route 301 intersection with Armstrong Corner Road and Marl Pit Road. Suggested Task I remedial improvements at the US Route 301 intersection with Armstrong Corner Road and Marl Pit Road included the installation of Signal Ahead signage along southbound US Route 301, restriping the stop line along eastbound Armstrong Corner Road, and changing the yellow clearance interval along Armstrong Corner Road and Marl Pit Road from 4 seconds to 5 seconds. Based on field observations, the signage and striping improvements have been completed.

DelDOT has one ongoing pavement rehabilitation and resurfacing project within the project area. This project is along Cedar Lane Road, from Marl Pit Road to the bridge at Spring Mill Branch (Contract #T201506102) and involves milling, patching, and overlays. Construction is estimated to be completed in Winter of 2015.

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 Connection Community Church is located within the Investment Level 3 area.

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:

The proposed development would promote visitors to the area with the provision of a specific church service. According to Livable Delaware, appropriate uses in Level 3 areas may contain visitor-industry development, such as heritage, ethnic festivals and events and similar operations. 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: New Castle County, 2012 Comprehensive Plan)

New Castle County Comprehensive Plan:

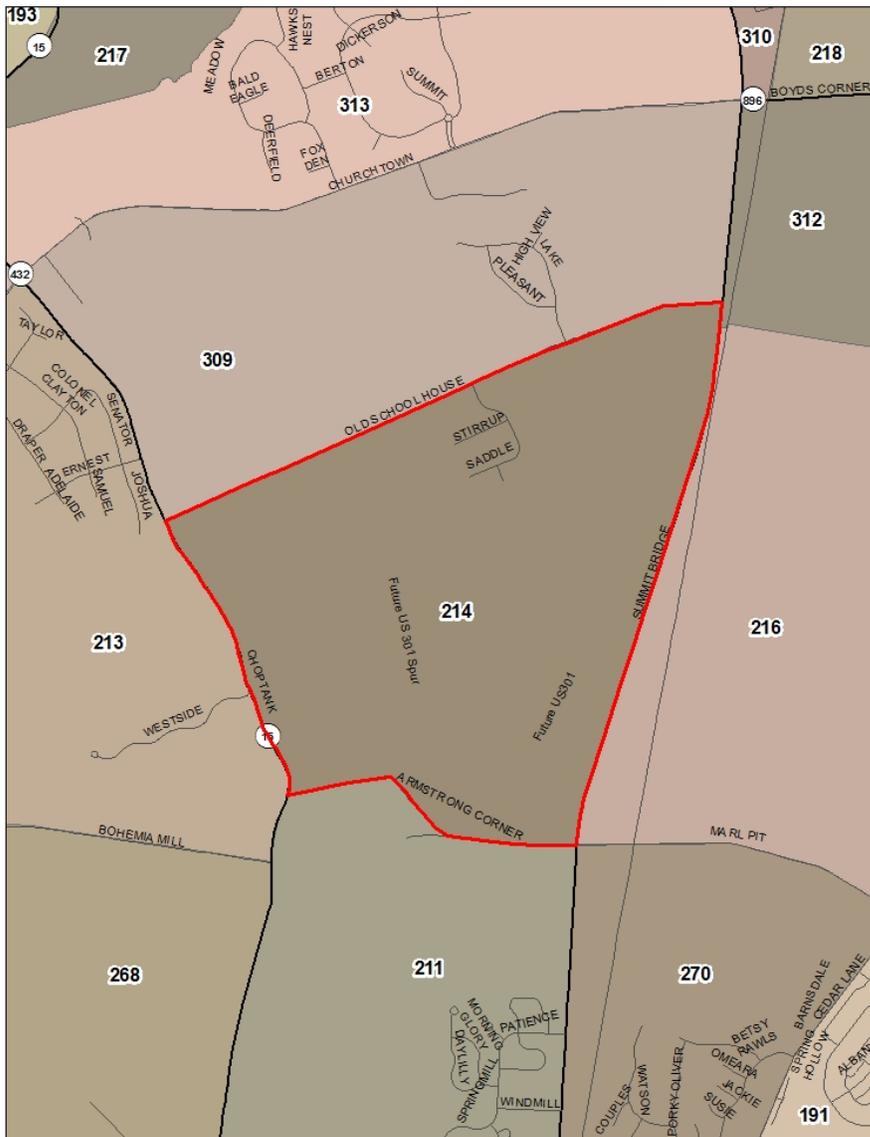
The lands of the subject property are situated within New Castle County and zoned as S (Suburban). The developer proposes to maintain the existing zoning. According to the New Castle County Comprehensive Plan, the future land use of the property would be within the Low Density Residential (1-3 units per acre) areas.

Proposed Development's Compatibility with the New Castle County Comprehensive Plan:

As part of the development proposal, the property would remain as S since rezoning is not needed to permit the proposed use. The proposed site would not be consistent with the future land use of the property within the County Comprehensive Plan of providing a low density residential area for this part of the county. However, the proposed use is expected to only generate traffic on a Sunday and therefore low usage is expected at the site during all other days of the week. As such, the proposed use is generally compatible with the New Castle County Comprehensive Plan.

Transportation Analysis Zones (TAZ)

Transportation Analysis Zones (TAZ) where development would be located: 214



Current employment estimate for TAZ: 23 in 2010

Future employment estimate for TAZ: 27 in 2040

Current Population estimate for TAZ: 221 in 2010

Future Population estimate for TAZ: 239 in 2040

Current household estimate for TAZ: 69 in 2010

Future household estimate for TAZ: 79 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: No.

Trip Generation

As per the TIS, the trip generation for the proposed site modifications was determined by using the comparable land use and rates/equations contained in the *Trip Generation, 9th Edition: An ITE Informational Report*, published by the Institute of Transportation Engineers (ITE) for ITE Land Use Code 560 (Church).

The peak period trip generation for the Connection Community Church is included in Table 1.

Table 1
CONNECTION COMMUNITY CHURCH

Land Use	ADT	SUN Peak Hour		
		In	Out	Total
544 Seat Church	1007	166	166	332

Overview of TIS

Intersections examined:

1. Site Access / US Route 301 (New Castle Road 39)
2. US Route 301 / Old School House Road (New Castle Road 431)
3. Old School House Road / Lake Drive
4. Old School House Road / Saddle Drive
5. US Route 301 / Boyds Corner Road (Delaware Route 896) / Churchtown Road (New Castle Road 432)
6. Churchtown Road / Dickerson Lane
7. Boyds Corner Road / Ratledge Road (New Castle Road 414)
8. US Route 301 / Signalized Entrance to Valero Gas Station
9. US Route 301 / Armstrong Corner Road / Marl Pit Road (New Castle Road 429)
10. Armstrong Corner Road / Entrance to Middletown Baptist Church
11. Choptank Road (Delaware Route 15) / Armstrong Corner Road
12. Marl Pit Road / Cedar Lane Road (New Castle Road 427)
13. Cedar Lane Road / Chestnut Way
14. Cedar Lane Road / West Middlepark Drive
15. Marl Pit Road / West Middlepark Drive
16. US Route 301 / Springmill Drive
17. US Route 301 / Windmill Lane

Conditions examined:

1. Case 1 - 2014 Existing conditions
2. Case 2 – 2016 No Build conditions without Connection Community Church
3. Case 3 – 2016 Build conditions with Connection Community Church

Peak hours evaluated: Sunday morning peak hour

Committed Developments considered:

1. Rothwell Village (150 single-family detached houses)
2. Country Club Estates (115 single-family detached houses)
3. Carter Farm (321 single-family detached houses and 257 townhouses)
4. Parkside (492 single-family detached houses; 307 unbuilt)
5. Bayberry-North (557 single-family detached houses (438 unbuilt) and 392 single-family attached houses (277 unbuilt)
6. Bayberry-South (580 single-family detached houses, 100 townhouses, 389 age-restricted single-family detached houses, 120 age-restricted apartments)
7. Bayberry Town Center (318,594 square feet of retail, a 61, 650 square-foot athletic club, a 3,960 square-foot bank with drive-through window)
8. Winchelsea (181 single-family detached houses, 178 townhouses, 154 apartments)
9. Cedar Lane Housing (77 single-family detached houses)

Note: Contrary to the October 25, 2014 DelDOT Scoping Meeting Minutes, the number of units listed for Bayberry-North are consistent with the TIS.

Intersection Descriptions

1. Site Access / US Route 301 (New Castle Road 39)

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

Eastbound Approach: (Site Access) proposed one left turn lane and one right turn lane, stop controlled

Northbound Approach: (US Route 301) existing one through lane; proposed one left turn lane and one through lane

Southbound Approach: (US Route 301) existing one through lane; proposed one through lane and one right turn lane

2. US Route 301 / Old School House Road (New Castle Road 431)

Type of Control: existing stop controlled intersection (T-intersection)

Eastbound Approach: (Old School House Road) existing one shared left turn/right turn lane, stop controlled

Northbound Approach: (US Route 301) existing one shared through/left turn lane and one bypass lane

Southbound Approach: (US Route 301) existing one through lane and one right turn lane

3. Old School House Road / Lake Drive

Type of Control: existing stop controlled intersection (T-intersection)

Eastbound Approach: (Old School House Road) existing one shared through/left turn lane

Westbound Approach: (Old School House Road) existing one shared through/right turn lane

Southbound Approach: (Lake Drive) existing one shared left turn/right turn lane, stop controlled

4. Old School House Road / Saddle Drive

Type of Control: existing stop controlled intersection (T-intersection)

Eastbound Approach: (Old School House Road) existing one shared through/right turn lane

Westbound Approach: (Old School House Road) existing one shared through/left turn lane

Northbound Approach: (Saddle Drive) existing one shared left turn/right turn lane, stop controlled

5. US Route 301 / Boyds Corner Road (Delaware Route 896) / Churchtown Road (New Castle Road 432)

Type of Control: existing signal controlled intersection

Eastbound Approach: (Churchtown Road) existing one left turn lane and one shared through/right turn lane

Westbound Approach: (Boyds Corner Road) existing two left turn lanes, one through lane, and one channelized free-flow right turn lane

Northbound Approach: (US Route 301) existing one left turn lane, two through lanes, and one right turn lane

Southbound Approach: (US Route 301) existing two left turn lanes, two through lanes, and one right turn lane

6. Churchtown Road / Dickerson Lane

Type of Control: existing stop controlled intersection (T-intersection)

Eastbound Approach: (Churchtown Road) existing one shared through/left turn lane and one bypass lane

Westbound Approach: (Churchtown Road) existing one through lane and one right turn lane

Southbound Approach: (Dickerson Lane) existing one shared left turn/right turn lane, stop controlled

7. Boyds Corner Road / Ratledge Road (New Castle Road 414)

Type of Control: existing stop controlled intersection (T-intersection)

Eastbound Approach: (Boyds Corner Road) existing one shared through/left turn lane and one bypass lane

Westbound Approach: (Boyds Corner Road) existing one through lane and one right turn lane

Southbound Approach: (Ratledge Road) existing one shared left turn/right turn lane, stop controlled

8. US Route 301 / Signalized Entrance to Valero Gas Station

Type of Control: existing signal controlled intersection

Eastbound Approach: (Entrance to Valero Gas Station) existing one shared through/left turn lane and one right turn lane

Westbound Approach: (Entrance to Walgreens Shopping Center) existing one shared through/left turn lane and one right turn lane

Northbound Approach: (US Route 301) existing one left turn lane, two through lanes, and one right turn lane

Southbound Approach: (US Route 301) existing one left turn lane, two through lanes, and one right turn lane

9. US Route 301 / Armstrong Corner Road / Marl Pit Road (New Castle Road 429)

Type of Control: existing signal controlled intersection

Eastbound Approach: (Armstrong Corner Road) existing one shared through/left turn/right turn lane

Westbound Approach: (Marl Pit Road) existing one shared through/left turn/right turn lane

Northbound Approach: (US Route 301) existing one left turn lane, one through lane, and one right turn lane

Southbound Approach: (US Route 301) existing one left turn lane, one through lane, and one right turn lane

10. Armstrong Corner Road / Entrance to Middletown Baptist Church

Type of Control: existing stop controlled intersection (T-intersection)

Eastbound Approach: (Armstrong Corner Road) existing one shared through/left turn lane

Westbound Approach: (Armstrong Corner Road) existing one shared through/right turn lane

Southbound Approach: (Entrance to Middletown Baptist Church) existing one left turn lane and one right turn lane, stop controlled

Note: The entering and exiting movements for the Middletown Baptist Church are two separate driveways approximately 140 feet apart. For the purpose of the analysis, both the TIS and JMT modeled the two driveways as only one driveway with entering and exiting movements.

11. Choptank Road (Delaware Route 15) / Armstrong Corner Road

Type of Control: existing stop controlled intersection (T-intersection)

Westbound Approach: (Armstrong Corner Road) existing one shared left turn/right turn lane, stop controlled

Northbound Approach: (Choptank Road) existing one through lane and one right turn lane

Southbound Approach: (Choptank Road) existing one shared through/left turn lane

12. Marl Pit Road / Cedar Lane Road (New Castle Road 427)

Type of Control: existing all-way stop controlled intersection; proposed roundabout

Eastbound Approach: (Marl Pit Road) existing one shared left turn/through/right turn lane, stop controlled; proposed one shared through/left turn lane and one right turn bypass lane, yield controlled

Westbound Approach: (Marl Pit Road) existing one shared left turn/through/right turn lane, stop controlled; proposed one shared left turn/through/right turn lane, yield controlled

Northbound Approach: (Cedar Lane Road) existing one shared left turn/through/right turn lane, stop controlled; proposed one shared left turn/through/right turn lane, yield controlled

Southbound Approach: (Cedar Lane Road) existing one shared left turn/through/right turn lane, stop controlled; proposed one shared through/left turn lane and one right turn bypass lane, yield controlled

13. Cedar Lane Road / Chestnut Way

Type of Control: existing stop controlled intersection (T-intersection)

Westbound Approach: (Chestnut Way) existing one shared left turn/right turn lane, stop controlled

Northbound Approach: (Cedar Lane Road) existing one shared through/right turn lane

Southbound Approach: (Cedar Lane Road) existing one shared through/left turn lane

14. Cedar Lane Road / West Middlepark Drive

Type of Control: existing stop controlled intersection (T-intersection)

Westbound Approach: (West Middlepark Road) existing one shared left turn/right turn lane, stop controlled

Northbound Approach: (Cedar Lane Road) existing one through lane and one right turn lane

Southbound Approach: (Cedar Lane Road) existing one left turn lane and one through lane

15. Marl Pit Road / West Middlepark Drive

Type of Control: existing stop controlled intersection (T-intersection)

Eastbound Approach: (Marl Pit Road) existing one shared through/right turn lane

Westbound Approach: (Marl Pit Road) existing one shared through/left turn lane

Northbound Approach: (West Middlepark Drive) existing one shared left turn/right turn lane, stop controlled

Note: The West Middlepark Drive receiving lane was closed for construction during the field visit. Both the TIS and JMT modeled West Middlepark Drive as fully operational.

16. US Route 301 / Springmill Drive

Type of Control: existing signal controlled intersection

Eastbound Approach: (Springmill Drive) existing one left turn lane and one right turn lane

Northbound Approach: (US Route 301) existing one left turn lane and one through lane

Southbound Approach: (US Route 301) existing one through lane and one right turn lane

17. Us Route 301 / Windmill Lane

Type of Control: existing stop controlled intersection (T-intersection)

Eastbound Approach: (Windmill Lane) existing one right turn lane

Northbound Approach: (US Route 301) existing one left turn lane and one through lane

Southbound Approach: (US Route 301) existing one through lane and one right turn lane

Transit, Pedestrian, and Bicycle Facilities

Existing transit service: Delaware Transit Corporation (DTC) currently does not provide any service in the study area. The closest DART facility is a Park & Ride located approximately 4 miles to the east of the site, adjacent to the Delaware Route 1 intersection with Pole Bridge Road/Boys Corner Road. The Park & Ride provides service to DART Routes 45 and 301.

Planned transit service: JMT contacted Mr. Wayne Henderson, Service Development Planner at the DTC. In a July 7, 2015 email, Mr. Henderson stated that the proposed site is outside of the DTC's existing and immediately planned service area.

Existing bicycle and pedestrian facilities: According to DelDOT's *New Castle County Bicycle Map*, Statewide Bicycle Route 1 traverses through the study intersection of Choptank Road with Armstrong Corner Road. Connector bicycle routes traverse US Route 301, Churchtown Road, Boys Corner Road, Armstrong Corner Road, and Marl Pit Road through each of the study intersections.

Planned bicycle and pedestrian facilities: JMT contacted Mr. Anthony Aglio, DelDOT's Bicycle and Pedestrian Coordinator. In a July 30, 2015 email, Mr. Aglio recommended a five-foot wide ADA compliant sidewalk with a five-foot setback from the roadway should be constructed along

the site frontage. In addition, when a right turn lane is added along southbound US Route 301, the five-foot wide bicycle lane should be maintained through the right turn lane in order to facilitate safe and unimpeded bicycle travel.

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-foot 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>

- US Route 301 – BLOS: C

Previous Comments

None.

General HCS Analysis Comments

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

1. For future conditions, the TIS sometimes used peak hour factors inconsistent with the guidelines provided in the *DelDOT Development Coordination Manual*. 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, or the peak hour factor based on existing turning movement counts, when greater).
2. For future conditions, JMT utilized a minimum of 3% heavy vehicle along all movements whereas the TIS sometimes used existing truck percentages based on traffic counts.
3. JMT analyzed the signalized intersections from US Route 301 and the signalized entrance to the Valero Gas Station to US Route 301 and Springmill Drive as corridors which allowed the input of offset data. The TIS did not input offset data as they individually analyzed each intersection. This analysis difference could cause discrepancies between the TIS and JMT's level of service results.
4. JMT utilized right-turn-on-red volumes within the signalized intersection analyses and proportionally increased them for the future cases. Instead of utilizing the right-turn-on-red volumes, the TIS modeled right turn movements as permissive within the signal phasing where separate right turn lanes are provided.
5. For unsignalized intersections, JMT utilized a saturation flow rate of 1,700 vph whereas the TIS utilized a saturation flow rate of 1,750 vph.

Table 2
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Traffic Impact Study for Connection Community Church
Report Dated June 2015
Prepared by Karins and Associates

Unsignalized Intersection¹ Two-Way Stop Control (T-Intersection)	LOS per TIS	LOS per JMT
Site Access/US Route 301	Sunday AM	Sunday AM
2016 with development of Connection Community Church (Case 3)		
Eastbound Connection Community Church Entrance Left	F (453.2)	F (453.2)
Eastbound Connection Community Church Entrance Right	C (19.9)	C (19.9)
Eastbound Connection Community Church Approach	F (216.0)	F (216.0)
Northbound US Route 301 Left	B (10.9)	B (10.9)

Signalized Intersection¹ (T-Intersection)	LOS per TIS	LOS per JMT
Site Access/US Route 301	Sunday AM	Sunday AM
2016 with development of Connection Community Church (Case 3) <i>with Signal</i> ^{2,3}	-	B (16.5)

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

² This scenario includes the installation of a 120 second cycle length traffic signal.

³ Although through movements are not provided along the eastbound Site Access approach, JMT modeled this approach with a through movement since side street approaches with only left and/or right movements must be coded with a through movement having a zero volume to be computed properly per McTrans HCS 2010 technical support.

Table 3
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Traffic Impact Study for Connection Community Church
Report Dated June 2015
Prepared by Karins and Associates

Unsignalized Intersection⁴ Two-Way Stop Control (T-Intersection)	LOS per TIS	LOS per JMT
US Route 301/Old School House Road (New Castle Road 431)⁵	Sunday AM	Sunday AM
2014 Existing (Case 1)		
Eastbound Old School House Road	C (21.1)	D (29.5)
Northbound US Route 301 Through/Left	A (9.1)	-
Northbound US Route 301 Left	-	A (9.1)
2016 without development of Connection Community Church (Case 2)		
Eastbound Old School House Road	E (36.9)	F (72.5)
Northbound US Route 301 Through/Left	A (9.9)	-
Northbound US Route 301 Left	-	A (9.9)
2016 without development of Connection Community Church (Case 2) <i>with Improvements⁶</i>		
Eastbound Old School House Road Left	-	F (81.6)
Eastbound Old School House Road Right	-	C (15.7)
Eastbound Old School House Road Approach	-	F (68.4)
Northbound US Route 301 Left	-	A (9.9)

⁴ For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

⁵ Based on field observations, the northbound US Route 301 approach is configured with one shared through/left turn lane and one bypass lane. As such, the TIS modeled the northbound approach with one shared through/left turn lane and one through lane. However, JMT modeled the northbound approach with one left turn lane and one through lane.

⁶ This scenario includes the modification of the eastbound Old School House Road approach to provide one left turn lane and one right turn lane.

Table 3 (Continued)
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Traffic Impact Study for Connection Community Church
Report Dated June 2015
Prepared by Karins and Associates

Unsignalized Intersection⁴ Two-Way Stop Control (T-Intersection)	LOS per TIS	LOS per JMT
US Route 301/Old School House Road (New Castle Road 431)⁵	Sunday AM	Sunday AM
2016 with development of Connection Community Church (Case 3)		
Eastbound Old School House Road	E (45.4)	F (102.0)
Northbound US Route 301 Through/Left	B (10.3)	-
Northbound US Route 301 Left	-	B (10.3)
2016 with development of Connection Community Church (Case 3) <i>with Improvements⁶</i>		
Eastbound Old School House Road Left	-	F (116.3)
Eastbound Old School House Road Right	-	C (17.1)
Eastbound Old School House Road Approach	-	F (92.7)
Northbound US Route 301 Left	-	B (10.3)
Signalized Intersection⁴ (T-Intersection)	LOS per TIS	LOS per JMT
US Route 301/Old School House Road (New Castle Road 431)	Sunday AM	Sunday AM
2016 without development of Connection Community Church (Case 2) <i>with Signal^{7,8}</i>	-	A (9.9)
2016 with development of Connection Community Church (Case 3) <i>with Signal^{7,8}</i>	-	B (11.7)

⁷ Although through movements are not provided along the eastbound Old School House Road approach, JMT modeled this approach with a through movement since side street approaches with only left and/or right movements must be coded with a through movement having a zero volume to be computed properly per McTrans HCS 2010 technical support.

⁸ This scenario includes the installation of a 120 second cycle length traffic signal.

Table 4
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Traffic Impact Study for Connection Community Church
Report Dated June 2015
Prepared by Karins and Associates

Unsignalized Intersection⁹ Two-Way Stop Control (T-Intersection)	LOS per TIS	LOS per JMT
Old School House Road/Lake Drive	Sunday AM	Sunday AM
2014 Existing (Case 1)		
Eastbound Old School House Road Through/Left	A (7.3)	A (7.3)
Southbound Lake Drive	A (8.8)	A (8.8)
2016 without development of Connection Community Church (Case 2)		
Eastbound Old School House Road Through/Left	A (7.3)	A (7.3)
Southbound Lake Drive	A (9.0)	A (8.9)
2016 with development of Connection Community Church (Case 3)		
Eastbound Old School House Road Through/Left	A (7.3)	A (7.3)
Southbound Lake Drive	A (9.0)	A (9.0)

⁹ For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

Table 5
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Traffic Impact Study for Connection Community Church
Report Dated June 2015
Prepared by Karins and Associates

Unsignalized Intersection¹⁰ Two-Way Stop Control (T-Intersection)	LOS per TIS	LOS per JMT
Old School House Road/Saddle Drive¹¹	Sunday AM	Sunday AM
2014 Existing (Case 1)		
Westbound Old School House Road Through/Left	A (7.2)	A (7.2)
Northbound Saddle Drive	A (8.5)	A (8.5)
2016 without development of Connection Community Church (Case 2)		
Westbound Old School House Road Through/Left	A (7.3)	A (7.3)
Northbound Saddle Drive	A (8.6)	A (8.6)
2016 with development of Connection Community Church (Case 3)		
Westbound Old School House Road Through/Left	A (7.3)	A (7.3)
Northbound Saddle Drive	A (8.6)	A (8.6)

¹⁰ For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

¹¹ Based on field observations, the northbound Saddle Drive approach is configured with one shared left turn/right turn lane. As such, the TIS modeled the northbound approach with one left turn lane and one right turn lane. However, JMT modeled this approach with one shared left turn/right turn lane.

Table 6
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Traffic Impact Study for Connection Community Church
Report Dated June 2015
Prepared by Karins and Associates

Signalized Intersection ¹²	LOS per TIS	LOS per JMT
US Route 301/ Boyd's Corner Road (Delaware Route 896)/ Churchtown Road (New Castle Road 432) ^{13,14,15,16,17,18,19,20}	Sunday AM	Sunday AM
2014 Existing (Case 1)	C (22.1)	C (26.4)
2016 without development of Connection Community Church (Case 2)	D (45.8)	D (41.0)
2016 with development of Connection Community Church (Case 3)	D (48.3)	D (45.4)

¹² For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

¹³ The TIS included the westbound Boyd's Corner Road right turn movement in the analysis. However, JMT omitted the right turn as this movement operates as free-flow per field observations.

¹⁴ For the northbound and southbound approaches of US Route 301, the TIS utilized a 4 second yellow time whereas JMT utilized a 5 second yellow time consistent with the DeIDOT Timing Plan.

¹⁵ For the northbound and southbound approaches of US Route 301, the TIS utilized a 2 second all red time whereas JMT utilized a 3 second all red time consistent with the DeIDOT Timing Plan.

¹⁶ For the eastbound Churchtown Road approach, the TIS utilized a 3 second yellow time whereas JMT utilized a 5 second yellow time consistent with the DeIDOT Timing Plan.

¹⁷ For the westbound Boyd's Corner Road approach, the TIS utilized a 3 second yellow time whereas JMT utilized a 4 second yellow time consistent with the DeIDOT Timing Plan.

¹⁸ For the eastbound Churchtown Road and westbound Boyd's Corner Road approaches, the TIS modeled these approaches as concurrent phasing whereas JMT modeled these approaches as split phase operation consistent with field observations and the DeIDOT Timing Plan.

¹⁹ The TIS utilized a 70 second cycle length during Case 1 and a 125 second cycle length during Cases 2 and 3. However, JMT utilized a 90 second cycle length for every case consistent with field observations and the DeIDOT Timing Plan.

²⁰ The TIS utilized arbitrary heavy vehicle percentages whereas JMT utilized heavy vehicle percentages based on the existing traffic count data.

Table 7
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Traffic Impact Study for Connection Community Church
Report Dated June 2015
Prepared by Karins and Associates

Unsignalized Intersection²¹ Two-Way Stop Control (T-Intersection)	LOS per TIS	LOS per JMT
Churchtown Road/Dickerson Lane^{22,23,24}	Sunday AM	Sunday AM
2014 Existing (Case 1)		
Eastbound Churchtown Road Through/Left	A (7.4)	-
Eastbound Churchtown Road Left	-	A (7.4)
Southbound Dickerson Lane	A (9.3)	A (9.6)
2016 without development of Connection Community Church (Case 2)		
Eastbound Churchtown Road Through/Left	A (7.6)	-
Eastbound Churchtown Road Left	-	A (7.6)
Southbound Dickerson Lane	B (10.2)	B (10.8)
2016 with development of Connection Community Church (Case 3)		
Eastbound Churchtown Road Through/Left	A (7.6)	-
Eastbound Churchtown Road Left	-	A (7.7)
Southbound Dickerson Lane	B (10.3)	B (10.9)

²¹ For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

²² Based on field observations, the southbound Dickerson Lane approach is configured with one shared left turn/right turn lane. As such, the TIS modeled the approach with one left turn lane and one right turn lane. However, JMT modeled the approach with one shared left turn/right turn lane.

²³ Based on field observations, the eastbound Churchtown Road approach is configured with one shared through/left turn lane and one bypass lane. As such, the TIS modeled the approach with one shared through/left turn lane and one through lane. However, JMT modeled the approach with one left turn lane and one through lane.

²⁴ The TIS did not account for heavy vehicle percentages at this intersection whereas JMT utilized heavy vehicle percentages based on the existing traffic count data.

Table 8
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Traffic Impact Study for Connection Community Church
Report Dated June 2015
Prepared by Karins and Associates

Unsignalized Intersection²⁵ Two-Way Stop Control (T-Intersection)	LOS per TIS	LOS per JMT
Boyd's Corner Road/Ratlidge Road (New Castle Road 414)²⁶	Sunday AM	Sunday AM
2014 Existing (Case 1)		
Eastbound Boyd's Corner Road Through/Left	A (8.3)	-
Eastbound Boyd's Corner Road Left	-	A (8.3)
Southbound Ratledge Road	B (12.0)	B (12.3)
2016 without development of Connection Community Church (Case 2)		
Eastbound Boyd's Corner Road Through/Left	B (10.1)	-
Eastbound Boyd's Corner Road Left	-	B (10.2)
Southbound Ratledge Road	C (22.3)	D (26.4)
2016 with development of Connection Community Church (Case 3)		
Eastbound Boyd's Corner Road Through/Left	B (10.2)	-
Eastbound Boyd's Corner Road Left	-	B (10.3)
Southbound Ratledge Road	C (23.6)	D (28.7)

²⁵ For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

²⁶ Based on field observations, the eastbound Boyd's Corner Road approach is configured with one shared through/left turn lane and one bypass lane. As such, the TIS modeled the eastbound approach with one shared through/left turn lane and one through lane. However, JMT modeled the eastbound approach with one left turn lane and one through lane.

Table 8 (Continued)
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Traffic Impact Study for Connection Community Church
Report Dated June 2015
Prepared by Karins and Associates

Signalized Intersection²⁵ (T-Intersection)	LOS per TIS	LOS per JMT
Boys Corner Road/Ratledge Road (New Castle Road 414)	Sunday AM	Sunday AM
2016 without development of Connection Community Church (Case 2) <i>with Signal</i> ^{27,28}	-	A (7.6)
2016 with development of Connection Community Church (Case 3) <i>with Signal</i> ^{27,28}	-	A (8.0)

²⁷ This scenario includes the installation of a 120 second cycle length traffic signal and the modification of the southbound Ratledge Road approach to provide one left turn lane and one right turn lane.

²⁸ Although through movements are not provided along the southbound Ratledge Road approach, JMT modeled this approach with a through movement since side street approaches with only left and/or right movements must be coded with a through movement having a zero volume to be computed properly per McTrans HCS 2010 technical support.

Table 9
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Traffic Impact Study for Connection Community Church
Report Dated June 2015
Prepared by Karins and Associates

Signalized Intersection ²⁹	LOS per TIS	LOS per JMT
US Route 301/Signalized Entrance to Valero Gas Station^{30,31,32,33}	Sunday AM	Sunday AM
2014 Existing (Case 1)	B (13.4)	A (5.4)
2016 without development of Connection Community Church (Case 2)	B (13.5)	A (6.1)
2016 with development of Connection Community Church (Case 3)	B (13.6)	A (6.2)

²⁹ For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

³⁰ For the northbound and southbound approaches of US Route 301, the TIS utilized a 4 second yellow time whereas JMT utilized a 5 second yellow time consistent with the DelDOT Timing Plan.

³¹ For the northbound and southbound approaches of US Route 301, the TIS utilized protected only left turn phasing whereas JMT utilized protected and permitted left turn phasing consistent with field observations.

³² The TIS utilized a cycle length of 110 seconds whereas JMT utilized a cycle length of 90 seconds consistent with field conditions and the DelDOT Timing Plan.

³³ The TIS analyzed the eastbound Valero Gas Station entrance and westbound Walgreens shopping center entrance with split phase operation. However, JMT analyzed the eastbound and westbound approaches as concurrent phasing consistent with field observations.

Table 10
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Traffic Impact Study for Connection Community Church
Report Dated June 2015
Prepared by Karins and Associates

Signalized Intersection ³⁴	LOS per TIS	LOS per JMT
US Route 301/Armstrong Corner Road/Marl Pit Road (New Castle Road 429) ^{35,36,37,38}	Sunday AM	Sunday AM
2014 Existing (Case 1)	C (34.4)	B (16.5)
2016 without development of Connection Community Church (Case 2)	E (56.1)	C (22.7)
2016 without development of Connection Community Church (Case 2) <i>with Improvements</i> ^{39,40,41}	C (20.7)	B (16.9)
2016 with development of Connection Community Church (Case 3)	E (68.8)	C (24.5)
2016 with development of Connection Community Church (Case 3) <i>with Improvements</i> ^{39,40,41}	C (21.0)	B (17.1)

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

³⁵ For the northbound and southbound approaches of US Route 301, the TIS utilized a 4 second yellow time whereas JMT utilized a 5 second yellow time consistent with the DelDOT Timing Plan.

³⁶ For the northbound and southbound approaches of US Route 301, the TIS utilized protected only left turn phasing whereas JMT utilized protected and permitted left turn phasing consistent with field observations.

³⁷ The TIS utilized a cycle length of 135 seconds whereas JMT utilized a cycle length of 120 seconds consistent with field conditions and the DelDOT Timing Plan.

³⁸ The TIS analyzed the eastbound Armstrong Corner Road and westbound Marl Pit Road with split phase operation. However, JMT analyzed the eastbound and westbound approaches as concurrent phasing consistent with field observations.

³⁹ This scenario includes the improvements proposed as part of the US 301 DelDOT project. The improvements include widening the northbound and southbound US Route 301 approaches to provide one left turn lane, two through lanes, and one right turn lane. Additionally, the eastbound Armstrong Corner Road and westbound Marl Pit Road approaches will be widened to provide one left turn lane, one through lane, and one right turn lane.

⁴⁰ The TIS utilized a cycle length of 90 seconds whereas JMT utilized a cycle length of 120 seconds.

⁴¹ The TIS modeled each approach to the intersection with protected only left turn phasing whereas JMT modeled the each approach with protected and permitted left turn phasing consistent with guidelines contained in the DelDOT *Traffic Design Manual*.

Table 11
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Traffic Impact Study for Connection Community Church
Report Dated June 2015
Prepared by Karins and Associates

Unsignalized Intersection⁴² Two-Way Stop Control (T-Intersection)	LOS per TIS	LOS per JMT
Armstrong Corner Road/Entrance to Middletown Baptist Church⁴³	Sunday AM	Sunday AM
2014 Existing (Case 1)		
Eastbound Armstrong Corner Road Through/Left	A (7.5)	A (7.5)
Southbound Entrance to Middletown Baptist Church	A (9.7)	A (9.7)
2016 without development of Connection Community Church (Case 2)		
Eastbound Armstrong Corner Road Through/Left	A (7.6)	A (7.7)
Southbound Entrance to Middletown Baptist Church	B (10.4)	B (10.5)
2016 with development of Connection Community Church (Case 3)		
Eastbound Armstrong Corner Road Through/Left	A (7.6)	A (7.7)
Southbound Entrance to Middletown Baptist Church	B (10.5)	B (10.5)

⁴² For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

⁴³ JMT utilized pedestrian volumes based on the existing traffic count data.

Table 12
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Traffic Impact Study for Connection Community Church
Report Dated June 2015
Prepared by Karins and Associates

Unsignalized Intersection⁴⁴ Two-Way Stop Control (T-Intersection)	LOS per TIS	LOS per JMT
Choptank Road (Delaware Route 15)/Armstrong Corner Road	Sunday AM	Sunday AM
2014 Existing (Case 1)		
Westbound Armstrong Corner Road	A (9.6)	A (9.6)
Southbound Choptank Road Through/Left	A (7.5)	A (7.5)
2016 without development of Connection Community Church (Case 2)		
Westbound Armstrong Corner Road	B (11.2)	B (11.3)
Southbound Choptank Road Through/Left	A (7.7)	A (7.8)
2016 with development of Connection Community Church (Case 3)		
Westbound Armstrong Corner Road	B (11.3)	B (11.4)
Southbound Choptank Road Through/Left	A (7.8)	A (7.8)

⁴⁴ For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

Table 13
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Traffic Impact Study for Connection Community Church
Report Dated June 2015
Prepared by Karins and Associates

Unsignalized Intersection⁴⁵ All-Way Stop Control	LOS per TIS	LOS per JMT
Marl Pit Road/Cedar Lane Road (New Castle Road 427)	Sunday AM	Sunday AM
2014 Existing (Case 1)		
Eastbound Marl Pit Road	A (9.27)	A (9.27)
Westbound Marl Pit Road	A (9.79)	A (9.79)
Northbound Cedar Lane Road	A (9.49)	A (9.49)
Southbound Cedar Lane Road	A (9.09)	A (9.09)
Overall Intersection	A (9.45)	A (9.45)
2016 without development of Connection Community Church (Case 2)		
Eastbound Marl Pit Road	C (17.46)	C (17.90)
Westbound Marl Pit Road	C (20.25)	C (20.88)
Northbound Cedar Lane Road	D (31.50)	D (33.19)
Southbound Cedar Lane Road	D (31.26)	D (32.92)
Overall Intersection	D (26.75)	D (28.00)
2016 without development of Connection Community Church (Case 2) <i>with Improvements⁴⁶</i>		
Eastbound Marl Pit Road	-	C (16.40)
Westbound Marl Pit Road	-	C (18.78)
Northbound Cedar Lane Road	-	C (23.36)
Southbound Cedar Lane Road	-	C (24.30)
Overall Intersection	-	C (21.54)

⁴⁵ For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

⁴⁶ This scenario includes the modification of the northbound and southbound Cedar Lane Road approaches to provide one shared through/left turn lane and one right turn lane.

Table 13 (Continued)
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Traffic Impact Study for Connection Community Church
Report Dated June 2015
Prepared by Karins and Associates

Unsignalized Intersection⁴⁵ All-Way Stop Control	LOS per TIS	LOS per JMT
Marl Pit Road/Cedar Lane Road (New Castle Road 427)	Sunday AM	Sunday AM
2016 with development of Connection Community Church (Case 3)		
Eastbound Marl Pit Road	C (19.17)	C (19.72)
Westbound Marl Pit Road	C (22.59)	C (23.40)
Northbound Cedar Lane Road	E (36.03)	E (38.20)
Southbound Cedar Lane Road	E (35.33)	E (37.41)
Overall Intersection	D (30.03)	D (31.61)
2016 with development of Connection Community Church (Case 3) <i>with Improvements⁴⁶</i>		
Eastbound Marl Pit Road	-	C (17.66)
Westbound Marl Pit Road	-	C (20.45)
Northbound Cedar Lane Road	-	D (25.22)
Southbound Cedar Lane Road	-	D (26.02)
Overall Intersection	-	C (23.14)

Table 13 (Continued)
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Traffic Impact Study for Connection Community Church
Report Dated June 2015
Prepared by Karins and Associates

Roundabout ⁴⁵	LOS per TIS	LOS per JMT
Marl Pit Road/Cedar Lane Road (New Castle Road 427)	Sunday AM	Sunday AM
2016 without development of Connection Community Church (Case 2) <i>with Improvements</i> ⁴⁷		
Eastbound Marl Pit Road	-	A (7.81)
Westbound Marl Pit Road	-	B (10.00)
Northbound Cedar Lane Road	-	B (10.90)
Southbound Cedar Lane Road	-	A (8.44)
Overall Intersection	-	A (9.44)
2016 with development of Connection Community Church (Case 3) <i>with Improvements</i> ⁴⁷		
Eastbound Marl Pit Road	-	A (8.01)
Westbound Marl Pit Road	-	B (10.34)
Northbound Cedar Lane Road	-	B (11.21)
Southbound Cedar Lane Road	-	A (8.62)
Overall Intersection	-	A (9.69)

⁴⁷ This scenario includes the improvements proposed as part of the Southern New Castle County TID. The improvements include the installation of a roundabout. Additionally, the eastbound Marl Pit Road and southbound Cedar Lane Road approaches will have separate right turn bypass lanes (yield controlled).

Table 13 (Continued)
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Traffic Impact Study for Connection Community Church
Report Dated June 2015
Prepared by Karins and Associates

Signalized Intersection⁴⁵	LOS per TIS	LOS per JMT
Marl Pit Road/Cedar Lane Road (New Castle Road 427)	Sunday AM	Sunday AM
2016 without development of Connection Community Church (Case 2) with Improvements ⁴⁸	-	C (25.7)
2016 with development of Connection Community Church (Case 3) with Improvements ⁴⁸	-	C (26.8)

⁴⁸ This scenario includes the improvements proposed as part of the Southern New Castle County TID. The improvements include the installation of a 120 second cycle length traffic signal. Additionally, all approaches to the intersection is proposed to have one left turn lane and one shared through/right turn lane.

Table 14
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Traffic Impact Study for Connection Community Church
Report Dated June 2015
Prepared by Karins and Associates

Unsignalized Intersection⁴⁹ Two-Way Stop Control (T-Intersection)	LOS per TIS	LOS per JMT
Cedar Lane Road/Chestnut Way	Sunday AM	Sunday AM
2014 Existing (Case 1)		
Westbound Chestnut Way	B (10.2)	B (10.2)
Southbound Cedar Lane Road Through/Left	A (7.5)	A (7.5)
2016 without development of Connection Community Church (Case 2)		
Westbound Chestnut Way	C (16.5)	C (16.7)
Southbound Cedar Lane Road Through/Left	A (8.2)	A (8.3)
2016 with development of Connection Community Church (Case 3)		
Westbound Chestnut Way	C (16.5)	C (16.7)
Southbound Cedar Lane Road Through/Left	A (8.2)	A (8.3)

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

Table 15
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Traffic Impact Study for Connection Community Church
Report Dated June 2015
Prepared by Karins and Associates

Unsignalized Intersection⁵⁰ Two-Way Stop Control (T-Intersection)	LOS per TIS	LOS per JMT
Cedar Lane Road/West Middlepark Drive⁵¹	Sunday AM	Sunday AM
2014 Existing (Case 1)		
Westbound West Middlepark Drive	A (9.8)	A (10.0)
Southbound Cedar Lane Road Left	A (7.6)	A (7.6)
2016 without development of Connection Community Church (Case 2)		
Westbound West Middlepark Drive	B (13.2)	B (14.3)
Southbound Cedar Lane Road Left	A(8.2)	A (8.3)
2016 with development of Connection Community Church (Case 3)		
Westbound West Middlepark Drive	B (13.2)	B (14.4)
Southbound Cedar Lane Road Left	A (8.3)	A (8.3)

⁵⁰ For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

⁵¹ Based on field observations, the westbound West Middlepark Drive approach is configured with one shared left turn/right turn lane. As such, the TIS modeled the westbound approach with one left turn lane and one right turn lane. However, JMT modeled the westbound approach with one shared left turn/right turn lane.

Table 16
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Traffic Impact Study for Connection Community Church
Report Dated June 2015
Prepared by Karins and Associates

Unsignalized Intersection⁵² Two-Way Stop Control (T-Intersection)	LOS per TIS	LOS per JMT
Marl Pit Road/West Middlepark Drive	Sunday AM	Sunday AM
2014 Existing (Case 1)		
Westbound Marl Pit Road Through/Left	A (7.6)	A (7.6)
Northbound West Middlepark Drive	A (9.8)	A (9.8)
2016 without development of Connection Community Church (Case 2)		
Westbound Marl Pit Road Through/Left	A (7.8)	A (7.9)
Northbound West Middlepark Drive	B (12.4)	B (12.5)
2016 with development of Connection Community Church (Case 3)		
Westbound Marl Pit Road Through/Left	A (7.9)	A (7.9)
Northbound West Middlepark Drive	B (12.7)	B (12.8)

⁵² 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 Traffic Impact Study for Connection Community Church
Report Dated June 2015
Prepared by Karins and Associates

Signalized Intersection ⁵³	LOS per TIS	LOS per JMT
US Route 301/Springmill Drive ^{54,55,56,57,58,59}	Sunday AM	Sunday AM
2014 Existing (Case 1)	A (7.0)	B (11.4)
2016 without development of Connection Community Church (Case 2)	B (10.6)	B (13.1)
2016 with development of Connection Community Church (Case 3)	B (13.9)	B (14.0)

⁵³ For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

⁵⁴ Although through movements are not provided along the eastbound Springmill Drive approach, JMT modeled this approach with a through movement since side street approaches with only left and/or right movements must be coded with a through movement having a zero volume to be computed properly per McTrans HCS 2010 technical support.

⁵⁵ The TIS utilized arbitrary heavy vehicle percentages whereas JMT utilized heavy vehicle percentages based on the existing traffic count data.

⁵⁶ For the northbound and southbound US Route 301 approaches, the TIS utilized a 4 second yellow time whereas JMT utilized a 5 second yellow time consistent with the DelDOT Timing Plan.

⁵⁷ For the northbound US Route 301 approach, the TIS utilized protected only left turn phasing whereas JMT utilized protected and permitted left turn phasing consistent with field observations.

⁵⁸ For the eastbound Springmill Drive approach, the TIS utilized a 3 second yellow time whereas JMT utilized a 4 second yellow time consistent with the DelDOT Timing Plan.

⁵⁹ The TIS utilized a cycle length of 90 seconds whereas JMT utilized a cycle length of 120 seconds consistent with field conditions and the DelDOT Timing Plan.

Table 18
PEAK HOUR LEVELS OF SERVICE (LOS)
Based on Traffic Impact Study for Connection Community Church
Report Dated June 2015
Prepared by Karins and Associates

Unsignalized Intersection⁶⁰ Two-Way Stop Control (T-Intersection)	LOS per TIS	LOS per JMT
US Route 301/Windmill Lane⁶¹	Sunday AM	Sunday AM
2014 Existing (Case 1)		
Eastbound Windmill Lane Right	B (14.4)	B (14.2)
Northbound US Route 301 Left	A (9.2)	A (9.6)
2016 without development of Connection Community Church (Case 2)		
Eastbound Windmill Lane	C (17.9)	C (18.1)
Northbound US Route 301 Left	B (11.0)	B (11.1)
2016 with development of Connection Community Church (Case 3)		
Eastbound Windmill Lane	C (20.3)	C (20.5)
Northbound US Route 301 Left	B (12.0)	B (12.2)

⁶⁰ For signalized and unsignalized analyses, the numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

⁶¹ The TIS utilized upstream signal information from Springmill Drive based on a 90 second cycle length whereas JMT utilized a 120 second cycle length based on field observations and the DelDOT timing plan.