



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

JENNIFER COHAN
SECRETARY

February 22, 2016

Mr. Michael Kaszyski
Duffield Associates, Inc.
5400 Limestone Road
Wilmington, DE 19808-1232

Dear Mr. Kaszyski:

The enclosed Traffic Impact Study (TIS) review letter for the **3601 Wrangle Hill Road** commercial development (Tax Parcels 12-012.00-59.00, 159.00 & 160.00) 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,

A handwritten signature in blue ink, appearing to read "Troy Brestel".

Troy Brestel
Project Engineer

TEB:km

Enclosures

cc with enclosures:

Mr. Shawn Tucker, Drinker, Biddle & Reath, L.L.P.
Mr. Jeff Bross, Duffield Associates, Inc.
Ms. Constance C. Holland, Office of State Planning Coordination
Mr. George Haggerty, New Castle County Department of Land Use
Mr. Owen Robatino, New Castle County Department of Land Use
Mr. Marco Boyce, New Castle County Department of Land Use
Mr. Andrew Parker, McCormick Taylor, Inc.
DelDOT Distribution

DelDOT Distribution

Ms. Annie Cordo, Deputy Attorney General
Mr. Robert McCleary, Director, Transportation Solutions (DOTS)
Mr. Drew Boyce, Director, Planning
Mr. Mark Luszcz, Chief Traffic Engineer, Traffic, DOTS
Mr. Mark Tudor, Assistant Director, Project Development North, DOTS
Mr. J. Marc Coté, Assistant Director, Development Coordination
Mr. T. William Brockenbrough, Jr., County Coordinator, Development Coordination
Mr. Peter Haag, Traffic Studies Manager, Traffic, DOTS
Mr. Adam Weiser, Safety Engineer, Traffic, DOTS
Mr. Thomas Felice, Program Manager, Development Coordination
Mr. David Dooley, Service Development Planner, Delaware Transit Corporation
Mr. Anthony Aglio, Planning Supervisor, Statewide & Regional Planning
Ms. Donna Robinson, Administrative Assistant, Statewide & Regional Planning
Mr. Todd Sammons, Subdivision Engineer, Development Coordination
Mr. Jeffrey Van Horn, New Castle County Subdivision Coordinator, Development Coordination
Mr. Ahmed Abdelmoteleb, New Castle County Traffic Engineer, Traffic, DOTS
Mr. Claudy Joinville, Project Engineer, Development Coordination



February 19, 2016

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

RE: Agreement No. 1655
Traffic Impact Study Services
Task No. 1 Subtask 13A – 3601 Wrangle Hill Road

Dear Mr. Brestel:

McCormick Taylor has completed its review of the Traffic Impact Study (TIS) for the 3601 Wrangle Hill Road commercial development prepared by Duffield Associates, Inc., dated June 2015. This review was assigned as Task Number 1 (Subtask 13A). Duffield prepared the report in a manner generally consistent with DelDOT's *Development Coordination Manual* [formerly *Standards and Regulations for Subdivision Streets*, incorporated by reference into the New Castle County Unified Development Code 40.11.130].

The TIS evaluates the impacts of the 3601 Wrangle Hill Road commercial development, proposed to be located on the southeast corner of Wrangle Hill Road (Delaware Route 72 / New Castle Road 356) and Red Lion Road (Delaware Route 71 / New Castle Road 35) in New Castle County, Delaware. The proposed commercial development would include a 4,685 square-foot convenience store with gas pumps and a 4,800 square foot building with a drive-in branch bank and retail tenants. Two access points are proposed: one "3/4" access point along Wrangle Hill Road providing rights in, lefts in and rights-out only; and one full access point along Old Kirkwood Road (New Castle Road 304) which connects to nearby Red Lion Road. Construction is anticipated to be complete by 2017.

The land is currently zoned NC-21 (Neighborhood Conservation) in New Castle County and the developer proposes to rezone the property to CN (Neighborhood Commercial).

DelDOT currently has one project in the study area, *SR 72, McCoy Road to SR 71*, which is currently in design. This project would dualize Wrangle Hill Road, adding a second through lane in each direction, along with a center two-way left-turn lane. The project includes improvements to a number of intersections, one of which is Red Lion Road and Wrangle Hill Road. At that intersection, the project will include concrete medians on all four approaches; on the eastern leg the median was planned to extend beyond the proposed site access on Wrangle Hill Road, meaning that left turns in and out of the site would be restricted. Bike lanes and sidewalks will be constructed along both directions of Wrangle Hill Road for the length of the project, pedestrian facilities will be improved at intersections, and drainage will be improved along the Wrangle Hill Road corridor.



DelDOT is currently in the design and real estate acquisition phases and expects to begin construction in 2018 with completion by 2020. The site access of the proposed commercial development, along with all proposed pedestrian and bicycle facilities, must be compatible with this DelDOT project since it involves the widening of Wrangle Hill Road.

Regarding DelDOT's Hazard Elimination Program (HEP), both Red Lion Road and Wrangle Hill Road in the project area were selected as 2009 Sites. Red Lion Road from 0.07 miles south of Old Kirkwood Rd to 0.19 miles north of Wrangle Hill Road was designated as Site E. Wrangle Hill Road from 0.28 miles east of Red Lion Road to 0.19 miles east of Willamette Drive was designated as Site S. Since the two sites intersect, a combined HEP report was developed for both sites. The focus of this HEP site was to address eastbound and westbound rear end crashes along with capacity deficiencies. As such, the HEP report recommended implementing signal timing improvements including protected-only left-turn phasing on all four approaches, and installing a concrete median on the west leg of Wrangle Hill Road to prohibit left-turns to and from the gas station/convenience store located on the northwest corner. The HEP report also mentioned that the Red Lion Chase developer is responsible for intersection improvements that would convert the Wrangle Hill Road westbound right-turn lane to a shared through/right-turn lane, which would require an additional westbound receiving lane west of the intersection. Finally, the HEP report recommended restriping the southbound Red Lion Road right-turn lane to remove the painted island and install a stop line, thereby converting the southbound right turn from a yield-controlled movement to a signal-controlled movement.

At the time of this TIS review, the minor signing and striping recommendations identified in the HEP report have been implemented, but most of the large recommendation items have not been addressed. The left-turn phasing still remains protected-permitted on all approaches, the Red Lion Road southbound right-turn lane is still yield-controlled with a painted channelizing island, the concrete median on the west leg of Wrangle Hill Road has not been constructed, and a second westbound receiving lane has not been added. Subsequent to the completion of the HEP report and as design of DelDOT's *SR 72, McCoy Road to SR 71* project progressed, DelDOT's Traffic Section re-evaluated the recommendation items in the HEP report and determined that the existing protected-permitted left-turn phasing should remain in place until Wrangle Hill Road is widened as part of the DelDOT project. Additionally, DelDOT's Project Development – North Section has recently modified the *SR 72, McCoy Road to SR 71* project to provide a left-turn lane on westbound Wrangle Hill Road heading into the site as needed to maintain adequate access to the property.



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

The following intersections exhibit level of service (LOS) deficiencies which would not meet the New Castle County LOS Standards as stated in Section 40.11.210 of the Unified Development Code (UDC), unless physical roadway and/or traffic control improvements are implemented:

<i>Intersection</i>	<i>Existing Traffic Control</i>	<i>Situations for which deficiencies occur</i>
Red Lion Road & Wrangle Hill Road	Signalized	2017 AM and PM without development and no SR 72 improvements (Case 2A); 2017 AM and PM with development and no SR 72 improvements (Cases 3A/4A)

In addition, based on DelDOT's evaluation criteria, the stop-controlled minor street approaches at the following intersections exhibit LOS deficiencies without the implementation of physical roadway and/or traffic control improvements:

<i>Intersection</i>	<i>Existing Traffic Control</i>	<i>Situations for which deficiencies occur</i>
Site Access & Wrangle Hill Road	Unsignalized	2017 AM with development and no SR 72 improvements (Cases 3A/4A)
Red Lion Road & North Old Kirkwood Road / Jester Street	Unsignalized	2017 AM with development (Cases 3/4); 2017 PM with development and RIRO SR 72 site access (Case 4)
Wrangle Hill Road & Willamette Drive	Unsignalized	2015 Existing AM and PM (Case 1); 2017 AM and PM without development (Case 2); 2017 AM and PM with development and no SR 72 improvements (Case 3A)
Wrangle Hill Road & Red Lion Drive	Unsignalized	2015 Existing AM & PM (Case 1); 2017 AM & PM without and with development (Cases 2 & 3)
Wrangle Hill Road & Connell Drive	Unsignalized	2015 Existing AM & PM (Case 1); 2017 AM & PM without development (Case 2); 2017 AM & PM with development and no SR 72 improvements (Case 3A)
Wrangle Hill Road & Sunnyside Lane	Unsignalized	2015 Existing AM & PM (Case 1); 2017 AM & PM without development (Case 2); 2017 AM & PM with development and no SR 72 improvements (Case 3A)
Wrangle Hill Road & Fieldstone Crossing Drive	Unsignalized	2015 Existing AM & PM (Case 1); 2017 AM & PM without development (Case 2); 2017 AM & PM with development and no SR 72 improvements (Case 3A)

Once DelDOT's *SR 72, McCoy Road to SR 71* project is constructed, all of the LOS deficiencies above will be improved to meet New Castle County standards (pursuant to UDC 40.11.130), and



all DeIDOT standards will be met with the exceptions of Red Lion Road & North Old Kirkwood Road/Jester Street and Wrangle Hill Road & Red Lion Drive.

At Red Lion Road and North Old Kirkwood Road/Jester Street, we do not recommend that any further improvements be implemented by the developer at this intersection beyond those described below in Item No. 4. At Wrangle Hill Road and Red Lion Drive, we do not recommend that any improvements be implemented by the developer at this intersection.

The anticipated LOS deficiencies at the two intersections noted immediately above would only occur for the low-volume eastbound Jester Street approach and the low-volume northbound Red Lion Drive approach, respectively, which serve no more than ten vehicles and have projected 95th percentile queue lengths of less than one vehicle during each peak hour. In accordance with DeIDOT's *Development Coordination Manual* Section 2.2.8.12.5 (incorporated into the UDC pursuant to 40.11.130), "where the FWP (future with project) volume on a stop-controlled approach would be 10 vph (vehicles per hour) or less, any LOS problem that might exist is considered to be negligible and its mitigation is not required."

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

1. Along the Red Lion Road site frontage, the developer should provide a bituminous concrete overlay to the existing travel lanes, at DeIDOT's discretion. DeIDOT should analyze the existing lanes' pavement section and recommend an overlay thickness to the developer's engineer if necessary. This overlay may extend beyond the site frontage as necessary to address changes in striping associated with entrance construction.
2. The developer should construct the site entrance on Wrangle Hill Road as close to the east end of the site frontage as possible. The proposed configuration is shown in the table below.

Approach	Current Configuration	Final Configuration (with DeIDOT SR 72 Project)
Northbound Site Access	Approach does not exist	One right-turn only lane
Eastbound Wrangle Hill Road	One through lane	Two through lanes and one right-turn lane
Westbound Wrangle Hill Road	One through lane	One left-turn lane and two through lanes

Initial recommended minimum turn-lane lengths (excluding tapers) of the separate turn lanes are listed below. The developer should coordinate with DeIDOT's Subdivision Section to determine final design details, including final turn-lane lengths, during the site plan review process. This coordination should consider DeIDOT's *SR 72, McCoy*



Road to SR 71 project, so that potential impacts of each project on the design of the other are known and addressed.

Approach	Left-Turn Lane	Right-Turn Lane
Northbound Site Access	N/A	N/A
Eastbound Wrangle Hill Road	N/A	350 feet *
Westbound Wrangle Hill Road	235 feet *	N/A

* Proposed turn-lane length based on DeIDOT's *Auxiliary Lane Worksheet*.

At the proposed Site Access on Wrangle Hill Road, the developer should include a concrete channelization island on the site driveway to separate entering and exiting traffic. This island should be designed to limit exiting traffic to right turns only. Appropriate signage should be installed along the northbound Site Access to reinforce the prohibition of left turns out of the site.

The developer should coordinate with DeIDOT's Subdivision Section and Project Development North regarding the design details of the site access for the interim and final condition. This should be done to provide appropriate design for the interim condition while minimizing the need for access-related modifications when DeIDOT's SR 72 project is constructed. Interim design elements to be determined include but are not limited to the following: possible widening of Wrangle Hill Road along the site frontage, layout of the eastbound right-turn lane, layout of the access driveway and channelization island, signing and striping/pavement markings, and pedestrian, bicycle and transit facilities.

3. The developer should construct the site entrance on Old Kirkwood Road, with the site entrance driveway intersecting Old Kirkwood Road in the approximate location of the outside edge of the existing curve just east of Red Lion Road (see Site Location Map on Page 11). Old Kirkwood Road should be realigned such that the northern portion of Old Kirkwood Road leading into the site entrance driveway would be aligned parallel to Red Lion Road. The east-west portion of Old Kirkwood Road closest to Red Lion Road would intersect with realigned Old Kirkwood Road / Proposed Site Entrance at a perpendicular angle (approximate). The proposed configuration of the site entrance intersection is shown in the table below.



Approach	Current Configuration	Proposed Configuration
Northbound Old Kirkwood Road	One through lane (curving to west)	One shared through/left-turn lane (stop-controlled)
Eastbound Old Kirkwood Road	One through lane (curving to south)	One shared left/right-turn lane (free-flow)
Southbound Site Access	Approach does not exist	One shared through/right-turn lane (stop-controlled)

The developer should coordinate with DeIDOT's Subdivision Section to determine final design details of the proposed site entrance at Old Kirkwood Road.

- The developer should improve the intersection of Red Lion Road and North Old Kirkwood Road / Jester Street. The proposed configuration is shown in the table below.

Approach	Current Configuration	Proposed Configuration
Northbound Red Lion Road	One shared through/left-turn lane and one right-turn lane	One left-turn lane, one through lane and one right-turn lane
Southbound Red Lion Road	One shared through/left-turn lane and one right-turn lane	One left-turn lane, one through lane and one right-turn lane
Eastbound Jester Street	One shared left/through/right-turn lane	One shared left/through/right-turn lane
Westbound North Old Kirkwood Road	One shared left/through/right-turn lane	One shared left/through/right-turn lane

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

Approach	Left-Turn Lane	Right-Turn Lane
Northbound Red Lion Road	170 feet *	240 feet **
Southbound Red Lion Road	260 feet **	190 feet **
Eastbound Jester Street	N/A	N/A
Westbound North Old Kirkwood Road	N/A	N/A

* Per DeIDOT's *Auxiliary Lane Worksheet*, northbound left-turn lane not required based on volume. If built, length shown is minimum acceptable turn-lane length based on posted speed of 50 mph.

** Proposed turn-lane length based on DeIDOT's *Auxiliary Lane Worksheet*.

5. The developer should coordinate with DelDOT regarding an equitable share contribution toward DelDOT's *SR 72, McCoy Road to SR 71* project. The developer should also dedicate to DelDOT the necessary right-of-way along the Wrangle Hill Road site frontage to accommodate the future widening. The amount of the contribution toward the project and the details of the right-of-way dedication should be determined through coordination with DelDOT's Subdivision Section and Right of Way Section.

As noted above in Item No. 2, because DelDOT's SR 72 widening project is still in the design phase and development of the site could occur prior to completion of DelDOT's project, the developer should coordinate with DelDOT regarding design details of interim and final conditions that will affect the Wrangle Hill Road site frontage and site access.

6. The developer should enter into a railroad grade crossing agreement with DelDOT to fund an equitable portion of any needed improvements for the at-grade crossing on Wrangle Hill Road between Willamette Drive and Red Lion Drive. This is an active crossing used by Norfolk Southern. Should improvements be necessary, they may be identified by the Rail-Highway Grade Crossing Safety Program. Other developers may enter into an agreement for this railroad crossing as well. The developer should coordinate with DelDOT on the implementation and equitable cost sharing of needed improvements. This railroad grade crossing agreement should expire seven years from the date of execution.
7. The following bicycle, pedestrian, and transit improvements should be included. As noted previously, the developer should coordinate with DelDOT regarding design details of interim and final conditions on Wrangle Hill Road as they relate to bicycle and pedestrian improvements and DelDOT's *SR 72, McCoy Road to SR 71* project.
 - a. A right-turn yield to bikes sign (MUTCD R4-4) should be added at the start of the right-turn lanes on northbound Red Lion Road at North Old Kirkwood Road, on southbound Red Lion Road at Jester Street, and on eastbound Wrangle Hill Road at the proposed site entrance.
 - b. Adjacent to the right-turn lanes along northbound Red Lion Road at North Old Kirkwood Road and along eastbound Wrangle Hill Road at the proposed site entrance, a minimum of a five foot bicycle lane should be dedicated and striped with appropriate markings for bicyclists through the turn lane in order to facilitate safe and unimpeded bicycle travel.
 - c. Appropriate bicycle symbols, directional arrows, striping (including stop bars), and signing should be included along bicycle facilities and right-turn lanes within the project limits.
 - d. Utility covers should be made flush with the pavement.
 - e. Bike parking should be provided near the building entrances within this development. If the building architecture provides for an awning or other overhang, the bike parking should be covered.
 - f. An easement within the site frontage along Wrangle Hill Road for DelDOT's *SR 72, McCoy Road to SR 71* project should be coordinated with DelDOT's Right of Way

Section. Within the easement along Wrangle Hill Road, a minimum of a five-foot wide sidewalk that meets current AASHTO and ADA standards should be constructed along the site frontage. The sidewalk should have a minimum of a five-foot buffer from the roadway. At its western end, the sidewalk should connect to the sidewalk being constructed along the Red Lion Road site frontage. At the eastern property boundary, the sidewalk should connect to the shoulder of Wrangle Hill Road (for the interim condition) in accordance with DelDOT's *Shared Use Path and/or Sidewalk Termination Policy* dated June 19, 2014, and it should be constructed to easily tie into the future sidewalk proposed farther to the east as part of DelDOT's *SR 72, McCoy Road to SR 71* project.

- g. The developer should coordinate with DelDOT regarding the potential dedication of an easement to DelDOT along the Red Lion Road site frontage, along with the details of such a dedication. Along Red Lion Road, a minimum of a five-foot wide sidewalk that meets current AASHTO and ADA standards should be constructed along the site frontage. The sidewalk should have a minimum of a five-foot buffer from the roadway. At its northern end, the sidewalk should connect to the sidewalk being constructed along the Wrangle Hill Road site frontage. At its southern end, the sidewalk should continue to the south side of the North Old Kirkwood Road intersection. The developer should coordinate with DelDOT regarding a suitable method for terminating the sidewalk at this point or connecting it to either the shoulder of Red Lion Road or to a future crosswalk leading across Red Lion Road.
- h. The developer should coordinate with DelDOT regarding the potential dedication of a minimum 15-foot wide easement within the site frontage along Old Kirkwood Road. Along Old Kirkwood Road, a minimum of a five-foot wide sidewalk that meets current AASHTO and ADA standards should be constructed along the site frontage. The sidewalk should have a minimum of a five-foot buffer from the roadway. At its western end, the sidewalk should connect to the sidewalk being constructed along the Red Lion Road site frontage. At the southern property boundary, the sidewalk should be terminated in accordance with DelDOT's *Shared Use Path and/or Sidewalk Termination Policy* dated June 19, 2014.
- i. ADA compliant curb ramps and crosswalks should be provided at all pedestrian crossings, including all site entrances. Type 3 curb ramps are discouraged.
- j. The developer should coordinate with DelDOT regarding the possibility of including a pedestrian refuge island on the North Old Kirkwood Road approach to Red Lion Road. A crosswalk will be constructed across this approach, and a pedestrian refuge island may be desired due to the long crossing distance.
- k. In addition to the site frontage sidewalks described above, internal sidewalks for pedestrian safety and to promote walking as a viable transportation alternative should be constructed within the development. These sidewalks should meet current UDC, DelDOT, AASHTO and ADA standards. These internal sidewalks should connect the building entrances to the proposed frontage sidewalks.
- l. Where internal sidewalks are located alongside of parking spaces, a buffer should be added to eliminate vehicular overhang onto the sidewalk.



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

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

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

Sincerely,

McCormick Taylor, Inc.

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

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

Enclosure

General Information

Report date: June 2015

Prepared by: Duffield Associates, Inc.

Prepared for: WF Development, LLC

Tax parcel: 12-012.00-59.00, 159.00, & 160.00

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

Project Description and Background

Description: The proposed commercial development would include a 4,685 square-foot convenience store with gas pumps and a 4,800 square foot building with a drive-in branch bank and retail tenants.

Location: The 3601 Wrangle Hill Road commercial development is proposed to be located on the southeast corner of Wrangle Hill Road (Delaware Route 72 / New Castle Road 356) and Red Lion Road (Delaware Route 71 / New Castle Road 35) in New Castle County, Delaware. A site location map is included on Page 11.

Amount of land to be developed: approximately 10.6 acres

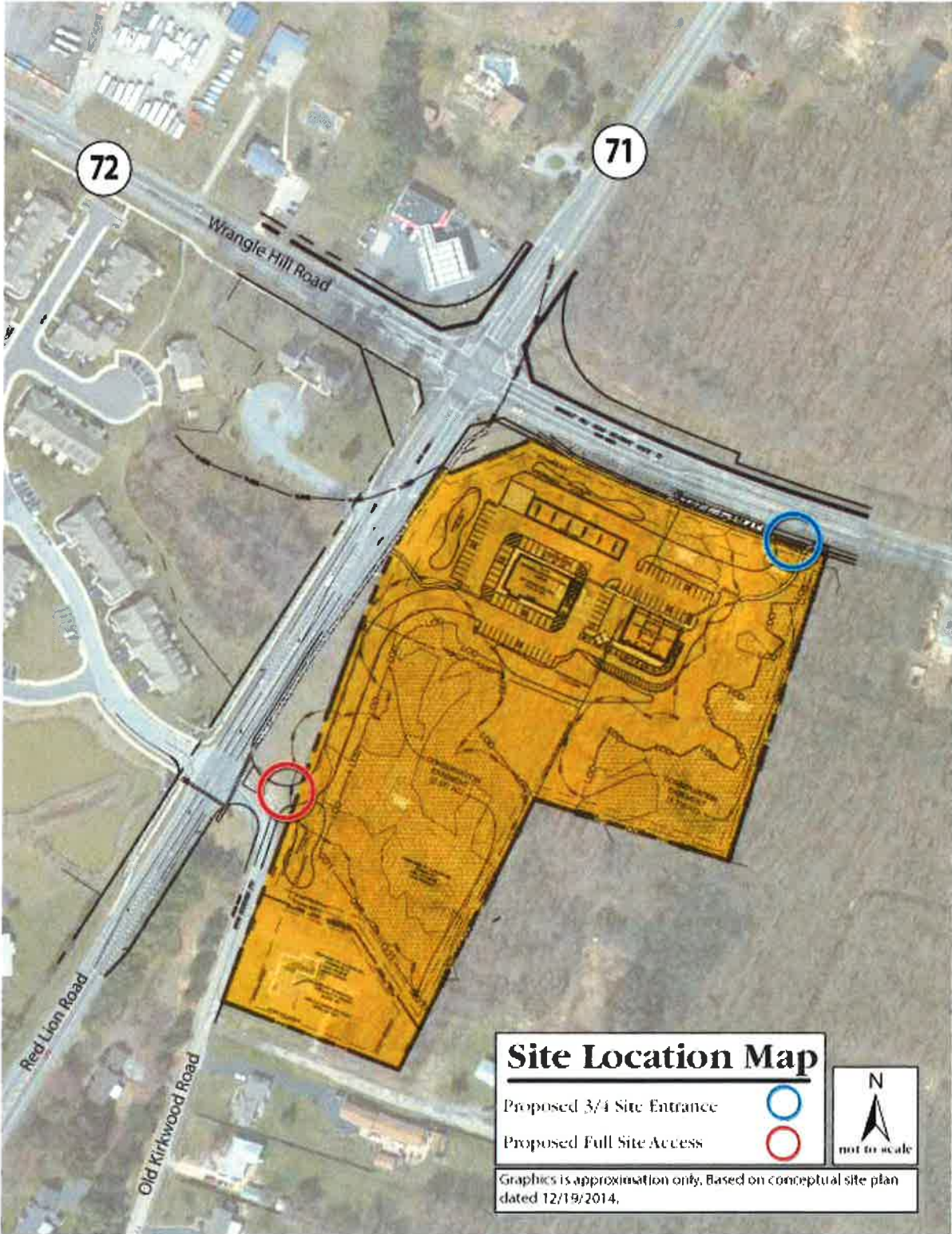
Land use approval(s) needed: Rezoning and Subdivision approval. The land is currently zoned NC-21 (Neighborhood Conservation) in New Castle County and the developer proposes to rezone the property to CN (Neighborhood Commercial).

Proposed completion date: 2017

Proposed access locations: Two access points are proposed: one "3/4" access point along Wrangle Hill Road providing rights in, lefts in and rights-out only; and one full access point along Old Kirkwood Road (New Castle Road 304) which connects to nearby Red Lion Road.

Daily Traffic Volumes (per DelDOT Traffic Summary 2014):

- 2014 Average Annual Daily Traffic on Wrangle Hill Road: 22,238 vpd
- 2014 Average Annual Daily Traffic on Red Lion Road: 12,834 vpd



Delaware Strategies for State Policies and Spending – 2010 Update

Location with respect to the Strategies for State Policies and Spending Map of Delaware:
The proposed 3601 Wrangle Hill Road commercial development is located within an Investment Level 2 area.

Investment Level 2

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

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

The proposed 3601 Wrangle Hill Road commercial development is located within an Investment Level 2 area, and is to be developed as a 4,685 square-foot convenience store with gas pumps along with a 4,800 square-foot building to be utilized as a bank with a drive-through window and additional retail. This type of development is consistent with the character of Investment Level 2 areas. The *Strategies* document generally encourages a wide range of development in Investment Level 2 areas, including a broad mix of housing types and commercial sites to promote compact, mixed-use development where applicable. The land use in the surrounding area is predominately comprised of single family homes and industrial use, so the addition of the proposed commercial development is consistent with the mixed land use that Investment Level 2 areas encourage. It is therefore concluded that the proposed development generally complies with the policies stated in the 2010 update of the "Strategies for State Policies and Spending."

Comprehensive Plan

New Castle County Comprehensive Plan:

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

The New Castle County Comprehensive Plan Future Land Use Map indicates that the proposed 3601 Wrangle Hill Road commercial development is located in an area with future land use designated as Low Density Residential (1-3 dwelling units per acre).

The land is currently zoned NC-21 (Neighborhood Conservation) in New Castle County and the developer proposes to rezone the property to CN (Neighborhood Commercial). According to Section 40.02.232 of the New Castle County Unified Development Code (UDC), characteristics of CN zoning are as follows

- This district has a suburban character.
- The scale and intensity of the development is regulated to ensure that uses primarily serve the surrounding residential neighborhoods. Roof design and landscaping are intended to reinforce the compatibility of these uses with the neighborhoods.

- Size and spacing of this district is regulated to ensure this district does not promote strip commercial development that serves highway traffic or regional uses.

Proposed Development's Compatibility with Comprehensive Plan: The proposed 3601 Wrangle Hill Road commercial development is planned as a 4,685 square-foot convenience store with gas pumps along with a 4,800 square-foot building to be utilized as a bank with a drive-through window and additional retail. Given that the site's future land use designation and current NC-21 zoning are both residential in nature but the proposed land use is commercial, this development raises questions regarding consistency with the New Castle County Comprehensive Plan, and thus requires additional discussion.

Transportation Analysis Zones (TAZ)

Transportation Analysis Zones (TAZ) where development would be located: 256

TAZ Boundaries:



Current employment estimate for TAZ: 34 jobs in 2010
Future employment estimate for TAZ: 37 jobs in 2040
Current population estimate for TAZ: 2,753 people in 2010
Future population estimate for TAZ: 2,960 people in 2040
Current household estimate for TAZ: 879 houses in 2010
Future household estimate for TAZ: 1,101 houses in 2040
Relevant committed developments in 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 for employment, no for households and population

Relevant Projects in the DelDOT Capital Transportation Program

DelDOT currently has one project in the study area, *SR 72, McCoy Road to SR 71*, which is currently in design. This project would dualize Wrangle Hill Road, adding a second through lane in each direction, along with a center two-way left-turn lane. The project includes improvements to a number of intersections, one of which is Red Lion Road and Wrangle Hill Road. At that intersection, the project will include concrete medians on all four approaches; on the eastern leg the median was planned to extend beyond the proposed site access on Wrangle Hill Road, meaning that left turns in and out of the site would be restricted. Bike lanes and sidewalks will be constructed along both directions of Wrangle Hill Road for the length of the project, pedestrian facilities will be improved at intersections, and drainage will be improved along the Wrangle Hill Road corridor.

DelDOT is currently in the design and real estate acquisition phases and expects to begin construction in 2018 with completion by 2020. The site access of the proposed commercial development, along with all proposed pedestrian and bicycle facilities, must be compatible with this DelDOT project since it involves the widening of Wrangle Hill Road.

Regarding DelDOT's Hazard Elimination Program (HEP), both Red Lion Road and Wrangle Hill Road in the project area were selected as 2009 Sites. Red Lion Road from 0.07 miles south of Old Kirkwood Rd to 0.19 miles north of Wrangle Hill Road was designated as Site E. Wrangle Hill Road from 0.28 miles east of Red Lion Road to 0.19 miles east of Willamette Drive was designated as Site S. Since the two sites intersect, a combined HEP report was developed for both sites. The focus of this HEP site was to address eastbound and westbound rear end crashes along with capacity deficiencies. As such, the HEP report recommended implementing signal timing improvements including protected-only left-turn phasing on all four approaches, and installing a concrete median on the west leg of Wrangle Hill Road to prohibit left-turns to and from the gas station/convenience store located on the northwest corner. The HEP report also mentioned that the Red Lion Chase developer is responsible for intersection improvements that would convert the Wrangle Hill Road westbound right-turn lane to a shared through/right-turn lane, which would require an additional westbound receiving lane west of the intersection. Finally, the HEP report recommended restriping the southbound Red Lion Road right-turn lane to remove the painted island and install a stop line, thereby converting the southbound right turn from a yield-controlled movement to a signal-controlled movement.

At the time of this TIS review, the minor signing and striping recommendations identified in the HEP report have been implemented, but most of the large recommendation items have not been addressed. The left-turn phasing still remains protected-permitted on all approaches, the Red Lion Road southbound right-turn lane is still yield-controlled with a painted channelizing island, the concrete median on the west leg of Wrangle Hill Road has not been constructed, and a second westbound receiving lane has not been added. Subsequent to the completion of the HEP

report and as design of DelDOT's SR 72, McCoy Road to SR 71 project progressed, DelDOT's Traffic Section re-evaluated the recommendation items in the HEP report and determined that the existing protected-permitted left-turn phasing should remain in place until Wrangle Hill Road is widened as part of the DelDOT project. Additionally, DelDOT's Project Development – North Section has recently modified the SR 72, McCoy Road to SR 71 project to provide a left-turn lane on westbound Wrangle Hill Road heading into the site as needed to maintain adequate access to the property.

Trip Generation

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

- Convenience Market with Gasoline Pumps (ITE Land Use Code 853)
- Drive-In Bank (ITE Land Use Code 912)
- Specialty Retail Center (ITE Land Use Code 826)

Table 1
3601 WRANGLE HILL ROAD PEAK HOUR TRIP GENERATION

Land Use	Weekday AM Peak Hour			Weekday PM Peak Hour		
	In	Out	Total	In	Out	Total
4,685 SF Convenience Market w/ Gas Pumps	96	96	192	114	114	228
Pass-by Trips (AM 63%, PM 66%)	-60	-61	-121	-75	-75	-150
Net Conv. Market w/ Gas Pumps Trips	36	35	71	39	39	78
1,800 SF Drive-In Bank	13	9	22	22	22	44
Pass-by Trips (AM 0%, PM 47%)	0	0	0	-10	-10	-20
Net Drive-In Bank Trips	13	9	22	12	12	24
3,000 SF Specialty Retail	0	0	0	4	4	8
Pass-by Trips (AM 0%, PM 0%)	0	0	0	0	0	0
Net Specialty Retail Trips	0	0	0	4	4	8
Total Pass-by Trips	60	61	121	85	85	170
TOTAL NEW TRIPS	49	44	93	55	55	110

Table 2
3601 WRANGLE HILL ROAD DAILY TRIP GENERATION

Land Use	Weekday ADT		
	In	Out	Total
4,685 SF Convenience Market w/ Gas Pumps	3256	3256	6512
1,800 SF Drive-In Bank	134	133	267
3,000 SF Specialty Retail	66	67	133
TOTAL TRIPS	3456	3456	6912

Overview of TIS

Intersections examined:

- 1) Site Access & Wrangle Hill Road
- 2) Site Access & North Old Kirkwood Road
- 3) Red Lion Road & North Old Kirkwood Road / Jester Street
- 4) Red Lion Road & South Old Kirkwood Road
- 5) Red Lion Road & Rice Street
- 6) Red Lion Road & Wrangle Hill Road
- 7) Red Lion Road & Willow Oak Boulevard
- 8) Red Lion Road & County Road (New Castle Road 384)
- 9) Wrangle Hill Road & Willamette Drive
- 10) Wrangle Hill Road & Red Lion Drive
- 11) Wrangle Hill Road & Connell Drive
- 12) Wrangle Hill Road & Sunnyside Lane
- 13) Wrangle Hill Road & Fieldstone Crossing Drive

Conditions examined:

- 1) 2015 existing conditions (Case 1)
- 2) 2017 without proposed development (Case 2)
- 3) 2017 with proposed development and 3/4 Site Access (no lefts out) on Wrangle Hill Road (Case 3)
- 4) 2017 with proposed development and rights-in/rights-out (RIRO) Site Access on Wrangle Hill Road (Case 4)

Peak hours evaluated: Weekday morning and evening peak hours

Committed developments considered:

- 1) Peoples Industrial Park (9 industrial park parcels on approximately 116 acres)
- 2) Highpointe at St. Georges, fka Linden Hill Farm (175 single-family detached houses)
- 3) Vistas at Red Lion (290 single-family detached houses, 279 age-restricted townhouses)

Intersection Descriptions

1) **Site Access & Wrangle Hill Road**

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

Northbound approach: (Site Access) proposed one right-turn lane, stop-controlled

Eastbound approach: (Wrangle Hill Road) existing one through lane; proposed one through lane and one right-turn lane in the interim condition; proposed two through lanes and one right-turn lane in ultimate condition after SR 72 improvements project is complete

Westbound approach: (Wrangle Hill Road) existing one through lane; proposed one through lane and one left-turn lane in the interim condition; proposed two through lanes and one left-turn lane (center two-way left-turn lane) in ultimate condition after SR 72 improvements project is complete

2) **Site Access & North Old Kirkwood Road**

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

Northbound approach: (North Old Kirkwood Road) existing one through lane; proposed one shared through/left-turn lane, stop-controlled

Southbound approach: (Site Access) proposed one through/right-turn lane, stop-controlled

Eastbound approach: (North Old Kirkwood Road) existing one through lane; one shared left/right-turn lane (free-flow)

3) **Red Lion Road & North Old Kirkwood Road / Jester Street**

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

Northbound approach: (Red Lion Road) existing one shared through/left-turn lane and one right-turn lane; proposed one left-turn lane, one through lane and one right-turn lane

Southbound approach: (Red Lion Road) existing one shared through/left-turn lane and one right-turn lane; proposed one left-turn lane, one through lane and one right-turn lane

Eastbound approach: (Jester Street) existing and proposed one shared left/through/right-turn lane with wide throat, stop-controlled

Westbound approach: (North Old Kirkwood Road) existing and proposed one shared left/through/right-turn lane with wide throat, stop-controlled

4) **Red Lion Road & South Old Kirkwood Road**

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

Northbound approach: (Red Lion Road) one through lane and one right-turn lane

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

Westbound approach: (South Old Kirkwood Road) one shared left/right-turn lane, stop-controlled

5) **Red Lion Road & Rice Street**

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

Northbound approach: (Red Lion Road) one left-turn lane and one through lane

Southbound approach: (Red Lion Road) one through lane and one right-turn lane

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

- 6) **Red Lion Road & Wrangle Hill Road**
Type of Control: four-way signalized intersection
Northbound approach: (Red Lion Road) one left-turn lane, one through lane, and one right-turn lane
Southbound approach: (Red Lion Road) one left-turn lane, one through lane, and one right-turn lane
Eastbound approach: (Wrangle Hill Road) one left-turn lane, one through lane, and one right-turn lane
Westbound approach: (Wrangle Hill Road) one left-turn lane, one through lane, and one right-turn lane

- 7) **Red Lion Road & Willow Oak Boulevard**
Type of Control: two-way stop-controlled (three-leg intersection)
Northbound approach: (Red Lion Road) one shared through/left-turn lane
Southbound approach: (Red Lion Road) one shared through/right-turn lane
Eastbound approach: (Willow Oak Boulevard) one shared left/right-turn lane, stop-controlled

- 8) **Red Lion Road & County Road**
Type of Control: two-way stop-controlled (three-leg intersection)
Northbound approach: (Red Lion Road) one shared through/left-turn lane
Southbound approach: (Red Lion Road) one shared through/right-turn lane
Eastbound approach: (County Road) one shared left/right-turn lane, stop-controlled

- 9) **Wrangle Hill Road & Willamette Drive**
Type of Control: two-way stop-controlled (three-leg intersection)
Southbound approach: (Willamette Drive) one shared left/right-turn lane, stop-controlled
Eastbound approach: (Wrangle Hill Road) one left-turn lane and one through lane
Westbound approach: (Wrangle Hill Road) one through lane and one right-turn lane

- 10) **Wrangle Hill Road & Red Lion Drive**
Type of Control: two-way stop-controlled (three-leg intersection)
Northbound approach: (Red Lion Drive) one shared left/right-turn lane, stop-controlled
Eastbound approach: (Wrangle Hill Road) one through lane and one right-turn lane
Westbound approach: (Wrangle Hill Road) one left-turn lane and one through lane

- 11) **Wrangle Hill Road & Connell Drive**
Type of Control: two-way stop-controlled (three-leg intersection)
Northbound approach: (Connell Drive) one shared left/right-turn lane, stop-controlled
Eastbound approach: (Wrangle Hill Road) one shared through/right-turn lane
Westbound approach: (Wrangle Hill Road) one shared through/left-turn lane

- 12) **Wrangle Hill Road & Sunnyside Lane**
Type of Control: two-way stop-controlled (three-leg intersection)
Northbound approach: (Sunnyside Lane) one shared left/right-turn lane, stop-controlled
Eastbound approach: (Wrangle Hill Road) one through lane and one right-turn lane
Westbound approach: (Wrangle Hill Road) one shared through/left-turn lane with bypass lane
- 13) **Wrangle Hill Road & Fieldstone Crossing Drive**
Type of Control: two-way stop-controlled (three-leg intersection)
Southbound approach: (Fieldstone Crossing Drive) one shared left/right-turn lane, stop-controlled
Eastbound approach: (Wrangle Hill Road) one shared through/left-turn lane with bypass lane
Westbound approach: (Wrangle Hill Road) one through lane and one right-turn lane

Safety Evaluation

Crash Data: Crash data was obtained within a half mile radius of the intersection of Red Lion Road and Wrangle Hill Road, covering the three-year period from January 15, 2012 to January 15, 2015. During the study period, a total of 82 crashes were reported, including 15 personal injury crashes, two crashes that involved pedestrians and one alcohol-related crash. The data indicates that the most common types of crashes were rear-end crashes (50%) and angle crashes (28%). Most of the crashes occurred during daylight hours (62%), or dark-lit conditions (15%) and with dry surface conditions (74%). The highest occurrence of crashes was during the hour of 5:00 PM to 6:00 PM (20% of all crashes). Most crashes were a result of driver inattention, distraction and fatigue (35%), failure to yield right-of-way (18%), or following too close (17%). Of the 82 reported crashes, 43 were associated with the Red Lion Road and Wrangle Hill Road intersection, which included 18 rear-end crashes, 17 angle crashes and 3 head-on crashes. There were no fatal crashes within the study area during this time period.

Sight Distance: With generally straight and flat roadways, and few potential visual obstructions, sight distance is largely adequate throughout the study area. One potential sight distance issue was observed in the field at the southbound Red Lion Road right-turn to westbound Wrangle Hill Road, due to the horizontal curvature of Wrangle Hill Road east of the intersection combined with roadside vegetation. This sight distance issue was also mentioned in the 2009 HEP report and it was recommended that the channelized, yield-controlled southbound right turn be restriped to remove the painted channelizing island and convert it to a signal-controlled movement. This recommendation has not yet been implemented. Otherwise, no additional problematic sight distance issues have been reported or indicated by crash data, and no major problems were observed during field observations in the area.

Transit, Pedestrian, and Bicycle Facilities

Existing transit service: The Delaware Transit Corporation (DTC) does not currently operate bus routes or other public transit in the project area. Several bus routes run along the Delaware Route 1 / US Route 13 corridor to the east and several other routes run along the US Route 40

corridor to the west, but there is no transit service along Wrangle Hill Road or Red Lion Road near the project area.

Planned transit service: As part of DelDOT's *SR 72, McCoy Road to SR 71* project, DelDOT plans to install ADA-compliant bus stop waiting pads along Wrangle Hill Road approximately 600 feet east and west of the intersection with Red Lion Road for potential future transit service. The TIS did not include correspondence regarding future planned transit service in the area. McCormick Taylor contacted DTC for information on existing and planned transit service but did not receive a response to date.

Existing bicycle and pedestrian facilities: According to DelDOT's New Castle County Bicycle Map (dated 2011), Wrangle Hill Road along the site frontage is classified as a Regional Bicycle Route with a bikeway that contains high traffic (over 10,000 vehicles daily). Red Lion Road is classified as a Connector Bicycle Route with a bikeway along the proposed site frontage. Currently, both roads have wide shoulders but do not have designated bicycle lanes, signing, or striping. In general, there are no shoulders for bicyclists near intersection approaches with auxiliary lanes, and dedicated bicycle lanes have not been striped between the through and right-turn lanes. According to the bicycle level of service (BLOS) calculator developed by the *League of Illinois Bicyclists*, the Wrangle Hill Road corridor operates at BLOS F and the Red Lion Road corridor operates at BLOS C.

There are currently no sidewalks or pedestrian facilities along the site frontages on Wrangle Hill Road or Red Lion Road. A sidewalk exists along the eastbound Wrangle Hill Road and southbound Red Lion Road frontages of the Village of Jester Crossing, which is located on the southwest corner of the intersection of Red Lion Road and Wrangle Hill Road. There are no sidewalks, pedestrian signals or crosswalks at the signalized intersection of Red Lion Road and Wrangle Hill Road.

Planned bicycle and pedestrian facilities: The TIS did not include any correspondence with DelDOT's Statewide and Regional Planning Section regarding planned or requested bicycle and pedestrian facilities in the area of this proposed development. McCormick Taylor contacted Mr. Anthony Aglio and Ms. Sarah Coakley from DelDOT's Planning Section but did not receive a response. McCormick Taylor spoke with Michael Nauman from DelDOT who is the Project Engineer for DelDOT's *SR 72, McCoy Road to SR 71* project. Mr. Nauman confirmed that sidewalks and bike lanes will be constructed along both directions of Wrangle Hill Road for the length of the DelDOT project. Pedestrian crossing facilities will also be installed at the signalized intersection of Red Lion Road and Wrangle Hill Road. The developer should coordinate with DelDOT to ensure that all pedestrian and bicycle facilities within the site are designed to tie-in with future pedestrian and bicycle facilities that will be constructed as part of DelDOT's *SR 72* project.

Previous Comments

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

- There were no indications that the applicant contacted the Delaware Transit Corporation (DTC) for transit-related comments.
- There were no indications that the applicant contacted DelDOT's Statewide and Regional Planning Section for bicycle and pedestrian-related comments.

General HCS Analysis Comments

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

- 1) For unsignalized intersections the TIS and McCormick Taylor applied heavy vehicle factors (HV) by movement using existing data. For signalized intersections, the TIS and McCormick Taylor applied HV by lane group using existing data. For the two proposed site entrances, McCormick Taylor assumed 3% HV for each movement. The TIS did not analyze the proposed site entrance at Old Kirkwood Road and assumed 0% HV for each movement at the proposed Wrangle Hill Road site entrance.
- 2) For existing conditions, the TIS and McCormick Taylor determined, for each intersection, overall intersection peak hour factors (PHF). For future conditions, the TIS and McCormick Taylor generally assumed existing PHF for all intersections unless otherwise noted. McCormick Taylor assumed a PHF of 0.92 for the proposed site entrance along Wrangle Hill Road and 0.80 for the proposed site entrance along Old Kirkwood Road. The TIS did not analyze the proposed site entrance at Old Kirkwood Road and assumed a PHF of 0.92 for the proposed Wrangle Hill Road site entrance.
- 3) For signalized intersections, McCormick Taylor used a base saturation flow rate of 1,900 pcphpl per DelDOT's *Development Coordination Manual*. The TIS did not note the base saturation flow rates used in their analysis, either in the letter or the capacity analysis appendix.
- 4) McCormick Taylor conservatively input no right-turn-on-red (RTOR) volumes for existing and future conditions analyses at Wrangle Hill Road and Red Lion Road, but did include overlapping right-turn phases since all right-turns are yield-controlled and are not controlled by the signal. The TIS did not note whether RTOR volumes were used in their analysis, either in the letter or the capacity analysis appendix, and the TIS did not include overlapping right-turn phases.
- 5) The HCS analyses included in the TIS did not always reflect the lane widths observed in the field by McCormick Taylor. McCormick Taylor's HCS analyses incorporated our field-measured lane widths.

- 6) The TIS analyzed the signalized intersection of Wrangle Hill Road and Red Lion Road as a pre-timed, non-actuated signal. McCormick Taylor analyzed the signalized intersection with full actuation, as observed in the field.

Table 3
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for 3601 Wrangle Hill Road Commercial Development
Report dated June 2015
Prepared by Duffield Associates, Inc.

Unsignalized Intersection ¹ Two-Way Stop Control	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Site Access & Wrangle Hill Road (SR 72)				
2017 with development and no SR 72 improvements, 3/4 Site Access (Case 3A) ²				
Northbound Site Access – Right	N/A	N/A	E (35.6)	C (23.0)
Westbound SR 72 – Left	N/A	N/A	B (14.1)	B (11.8)
2017 with development and SR 72 improvements, 3/4 Site Access (Case 3B) ³				
Northbound Site Access – Right	B (14.4)	B (12.6)	B (14.6)	B (12.6)
Westbound SR 72 – Left	B (13.9)	B (11.6)	B (14.3)	B (11.8)
2017 with development and no SR 72 improvements, RIRO Site Access (Case 4A)				
Northbound Site Access – Right	N/A	N/A	E (35.6) ⁴	C (23.0)
2017 with development and SR 72 improvements, RIRO Site Access (Case 4B)				
Northbound Site Access – Right	N/A	N/A	B (14.6)	B (12.6)

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

² The TIS did not analyze the future 2017 build scenario without the SR 72 improvements (Case 3). McCormick Taylor assumed an eastbound right-turn lane and westbound left-turn lane will be required in the interim period before the SR 72 improvements project is constructed.

³ The proposed lane configuration with the SR 72 improvements project includes two eastbound through lanes with an eastbound-right turn lane, and two westbound through lanes with a westbound left-turn lane via a center two-way left-turn lane. The TIS analyzed this scenario as if westbound left turns into the site would be allowed, however DelDOT is not going to allow the lefts-in movement and the SR 72 improvements project will extend the concrete median on Wrangle Hill Road beyond the proposed site entrance.

⁴ The 95th percentile queue length for the northbound approach is approximately 1 vehicle during the Case 4A AM peak hour.

Table 4
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for 3601 Wrangle Hill Road Commercial Development
Report dated June 2015
Prepared by Duffield Associates, Inc.

Unsignalized Intersection ⁵ Two-Way Stop Control	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Site Access & Old Kirkwood Road ⁶				
2017 with development and 3/4 SR 72 site access (Case 3) ⁷				
Northbound Old Kirkwood Road	N/A	N/A	B (10.4)	B (11.1)
Southbound Site Access	N/A	N/A	A (8.6)	A (8.8)
2017 with development and RIRO SR 72 site access (Case 4) ⁷				
Northbound Old Kirkwood Road	N/A	N/A	B (11.3)	B (12.4)
Southbound Site Access	N/A	N/A	A (8.7)	A (8.9)
2017 with development and RIRO SR 72 site access (Case 4) With Modified Entrance ⁸				
Southbound Old Kirkwood Road – Left	N/A	N/A	A (7.5)	A (7.5)
Westbound Site Access	N/A	N/A	A (9.1)	A (9.1)

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

⁶ The TIS did not analyze the future two-way stop-controlled intersection of Old Kirkwood Road and the proposed southern site access.

⁷ Per the most recent site plan, McCormick Taylor assumed the eastbound Old Kirkwood Road approach is free, while the southbound site access and northbound Old Kirkwood Road approaches are stop-controlled.

⁸ For the modified entrance, McCormick Taylor assumed both approaches of Old Kirkwood Road would be uncontrolled (free flow), and only the southbound site access approach would be stop-controlled. This entrance would be constructed as far to the south as possible, making the site access approach more of a westbound approach than a southbound approach.

Table 5
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for 3601 Wrangle Hill Road Commercial Development
Report dated June 2015
Prepared by Duffield Associates, Inc.

Unsignalized Intersection ⁹ Two-Way Stop Control	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Red Lion Road (SR 71) & North Old Kirkwood Road / Jester Street				
2015 Existing (Case 1)				
Northbound SR 71 – Left	A (7.6)	A (9.1)	A (7.6)	A (9.1)
Southbound SR 71 – Left	A (9.4)	A (8.1)	A (9.6)	A (8.1)
Eastbound Jester Street	D (26.1)	C (24.4)	D (26.2)	C (21.0)
Westbound North Old Kirkwood Road	C (15.7)	B (10.5)	C (16.0)	B (10.6)
2017 without development (Case 2)				
Northbound SR 71 – Left	A (7.6)	A (9.3)	A (7.6)	A (9.3)
Southbound SR 71 – Left	A (9.6)	A (8.2)	A (9.9)	A (8.2)
Eastbound Jester Street	D (29.2)	D (27.0)	D (29.3)	D (27.6)
Westbound North Old Kirkwood Road	C (16.8)	B (10.7)	C (17.1)	B (10.8)
2017 with development and 3/4 SR 72 site access (Case 3) ¹⁰				
Northbound SR 71 – Left	A (7.6)	A (9.3)	A (7.6)	A (9.3)
Southbound SR 71 – Left	A (9.8)	A (8.3)	B (10.0)	A (8.3)
Eastbound Jester Street ¹¹	D (35.0-)	D (33.6)	E (41.0) ¹²	D (34.3) ¹²
Westbound North Old Kirkwood Road	C (20.2)	C (15.1)	C (20.6) ¹³	C (17.4) ¹³
2017 with development and RIRO SR 72 site access (Case 4) ¹⁴				
Northbound SR 71 – Left	N/A	N/A	A (7.6)	A (9.3)
Southbound SR 71 – Left	N/A	N/A	B (10.3)	A (8.5)
Eastbound Jester Street	N/A	N/A	E (46.4) ¹²	E (39.0) ¹²
Westbound North Old Kirkwood Road	N/A	N/A	C (20.8) ¹³	C (19.0) ¹³

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

¹⁰ The TIS and McCormick Taylor used the proposed lane configuration (exclusive SR 71 northbound and southbound right and left turn lanes) for Case 3 analysis.

¹¹ The TIS included one (1) eastbound through vehicle in their analysis. McCormick Taylor used the volumes presented in TIS (Exhibit 27 – 2017 Build AM Peak Hour Traffic Volumes), which shows zero (0) eastbound through vehicles.

¹² The 95th percentile queue length for the eastbound approach is less than 1 vehicle during the Case 3 and Case 4 AM and PM peak hours. Peak hour volume on this approach is less than 10 vehicles.

¹³ The 95th percentile queue length for the westbound approach is less than 2 vehicles during the Case 3 and Case 4 AM and PM peak hours.

¹⁴ McCormick Taylor used the proposed lane configuration (exclusive SR 71 northbound and southbound right and left turn lanes) for Case 4 analysis.

Table 6
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for 3601 Wrangle Hill Road Commercial Development
Report dated June 2015
Prepared by Duffield Associates, Inc.

Unsignalized Intersection ¹⁵ Two-Way Stop Control	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Red Lion Road (SR 71) & South Old Kirkwood Road				
2015 Existing (Case 1)				
Southbound SR 71 – Left	A (9.1)	A (8.0)	B (10.2)	A (8.0)
Westbound South Old Kirkwood Road	C (16.6)	C (19.8)	C (16.9)	C (20.4)
2017 without development (Case 2)				
Southbound SR 71 – Left	A (9.3)	A (8.0)	B (10.4)	A (8.0)
Westbound South Old Kirkwood Road	C (17.9)	C (21.7)	C (18.2)	C (22.4)
2017 with development (Cases 3/4)				
Southbound SR 71 – Left	A (9.3)	A (8.0)	B (10.4)	A (8.0)
Westbound South Old Kirkwood Road	C (18.0)	C (21.8)	C (18.3)	C (22.5)

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

Table 7
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for 3601 Wrangle Hill Road Commercial Development
Report dated June 2015
Prepared by Duffield Associates, Inc.

Unsignalized Intersection ¹⁶ Two-Way Stop Control	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Red Lion Road (SR 71) & Rice Street				
2015 Existing (Case 1)				
Northbound SR 71 – Left	A (7.6)	A (9.2)	A (8.2)	A (9.2)
Eastbound Rice Street	C (19.1)	C (20.1)	C (19.7)	C (20.2)
2017 without development (Case 2)				
Northbound SR 71 – Left	A (7.6)	A (9.4)	A (8.2)	A (9.4)
Eastbound Rice Street	C (21.2)	C (22.1)	C (21.8)	C (22.3)
2017 with development (Cases 3/4)				
Northbound SR 71 – Left	A (7.6)	A (9.5)	A (8.2)	A (9.5)
Eastbound Rice Street	C (21.4)	C (22.5)	C (22.0)	C (22.7)

¹⁶ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

Table 8
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for 3601 Wrangle Hill Road Commercial Development
Report dated June 2015
Prepared by Duffield Associates, Inc.

Signalized Intersection ¹⁷	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Red Lion Road (SR 71) & Wrangle Hill Road (SR 72) ¹⁸				
2015 Existing (Case 1)	F (127.1)	F (116.1)	D (53.0)	D (52.6)
2017 without development (Case 2A)	F (146.6)	F (158.0)	F (80.5)	E (71.1)
2017 without development – With SR 72 improvements (Case 2B)	D (41.5)	D (43.8)	D (39.3)	D (40.0)
2017 with development - No SR 72 improvements and 3/4 SR 72 site access (Case 3A)	F (144.2)	F (129.4)	F (80.2)	E (75.1)
2017 with development - With SR 72 improvements and 3/4 SR 72 site access (Case 3B)	D (44.0)	D (40.4)	D (41.7)	D (43.4)
2017 with development - No SR 72 improvements and 3/4 SR 72 site access, No NB RTOR (Case 3C)	N/A	N/A	F (86.4)	E (75.8)
2017 with development - With SR 72 improvements and 3/4 SR 72 site access, No NB RTOR (Case 3D)	N/A	N/A	D (49.2)	D (45.4)
2017 with development and RIRO SR 72 site access, No SR 72 improvements (Case 4A)	N/A	N/A	E (74.7)	E (76.1)
2017 with development and RIRO SR 72 site access, With SR 72 improvements (Case 4B)	N/A	N/A	D (41.8)	D (45.3)
2017 with development and RIRO SR 72 site access, No SR 72 improvements, No NB RTOR (Case 4C)	N/A	N/A	F (89.3)	E (77.3)
2017 with development and RIRO SR 72 site access, With SR 72 improvements, No NB RTOR (Case 4D)	N/A	N/A	D (42.0)	D (46.4)

¹⁷ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

¹⁸ The TIS analyzed the signalized intersection as a pre-timed signal without actuation, and with protected-permitted phasing for all scenarios. McCormick Taylor analyzed the signalized intersection as fully actuated, and switched to protected-prohibited phasing on the eastbound and westbound approaches for scenarios with SR 72 improvements, which include widening SR 72 to two through lanes in each direction.

Table 9
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for 3601 Wrangle Hill Road Commercial Development
Report dated June 2015
Prepared by Duffield Associates, Inc.

Unsignalized Intersection ¹⁹ Two-Way Stop Control	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Red Lion Road (SR 71) & Willow Oak Boulevard				
2015 Existing (Case 1)				
Northbound SR 71 – Left	A (7.9)	A (8.6)	A (8.1)	A (8.7)
Eastbound Willow Oak Boulevard	B (12.6)	B (13.5)	B (14.7)	B (13.8)
2017 without development (Case 2)				
Northbound SR 71 – Left	A (8.2)	A (8.8)	A (8.5)	A (8.9)
Eastbound Willow Oak Boulevard	B (14.4)	B (15.1)	C (17.7)	C (15.4)
2017 with development (Cases 3/4)				
Northbound SR 71 – Left	A (8.2)	A (8.9)	A (8.6)	A (9.0)
Eastbound Willow Oak Boulevard	B (14.9)	C (15.7)	C (18.6)	C (16.1)

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

Table 10
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for 3601 Wrangle Hill Road Commercial Development
Report dated June 2015
Prepared by Duffield Associates, Inc.

Unsignalized Intersection ²⁰ Two-Way Stop Control	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Red Lion Road (SR 71) & County Road				
2015 Existing (Case 1)				
Northbound SR 71 – Left	A (7.9)	A (8.5)	A (8.0)	A (8.5)
Eastbound County Road	B (14.1)	B (13.1)	C (16.6)	B (13.5)
2017 without development (Case 2)				
Northbound SR 71 – Left	A (8.2)	A (8.7)	A (8.4)	A (8.7)
Eastbound County Road	C (16.3)	B (14.7)	C (20.6)	C (15.3)
2017 with development (Cases 3/4)				
Northbound SR 71 – Left	A (8.2)	A (8.8)	A (8.5)	A (8.8)
Eastbound County Road	C (15.8)	B (14.9)	C (20.4)	C (15.7)

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

Table 11
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for 3601 Wrangle Hill Road Commercial Development
Report dated June 2015
Prepared by Duffield Associates, Inc.

Unsignalized Intersection ²¹ Two-Way Stop Control	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Wrangle Hill Road (SR 72) & Willamette Drive				
2015 Existing (Case 1)				
Southbound Willamette Drive	F (84.7)	F (59.7)	F (97.9)	F (59.7)
Eastbound SR 72 – Left	B (11.2)	B (10.7)	B (12.9)	B (10.7)
2017 without development (Case 2)				
Southbound Willamette Drive	F (134.7)	F (92.3)	F (152.9)	F (92.3)
Eastbound SR 72 – Left	B (11.7)	B (11.5)	B (13.5)	B (11.5)
2017 with development – No SR 72 Improvements (Case 3A/4A)				
Southbound Willamette Drive	F (146.6)	F (105.0)	F (167.1)	F (104.9)
Eastbound SR 72 – Left	B (11.8)	B (11.6)	B (13.6)	B (11.6)
2017 with development – With SR 72 Improvements (Case 3B/4B) ²²				
Southbound Willamette Drive	D (31.0)	D (28.3)	D (32.7)	D (28.3)
Eastbound SR 72 – Left	B (11.8)	B (11.6)	B (13.6)	B (11.6)

²¹ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

²² The SR 72 improvements include two eastbound through lanes, two westbound through lanes and a center two-way left-turn lane along SR 72, in addition to the westbound right-turn lane that currently exists.

Table 12
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for 3601 Wrangle Hill Road Commercial Development
Report dated June 2015
Prepared by Duffield Associates, Inc.

Unsignalized Intersection ²³ Two-Way Stop Control	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Wrangle Hill Road (SR 72) & Red Lion Drive				
2015 Existing (Case 1)				
Northbound Red Lion Drive	F (55.6)	E (46.4)	F (55.6)	E (48.3)
Westbound SR 72 – Left	B (10.2)	B (10.7)	B (10.2)	B (10.8)
2017 without development (Case 2)				
Northbound Red Lion Drive	F (76.6)	F (54.9)	F (76.6)	F (64.9)
Westbound SR 72 – Left	B (10.9)	B (11.1)	B (10.9)	B (11.2)
2017 with development (Cases 3/4) ²⁴				
Northbound Red Lion Drive	F (79.6)	F (62.9)	F (82.8) ²⁵	F (69.1) ²⁵
Westbound SR 72 – Left	B (11.0)	B (11.2)	B (11.0)	B (11.3)

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

²⁴ The future SR 72 improvements project terminates east of the intersection of SR 72 and Red Lion Drive; therefore the configuration at this intersection is the same without or with the SR 72 improvements project.

²⁵ The 95th percentile queue length for the northbound approach is less than 1 vehicle during the Case 3/4 AM and PM peak hours. Peak hour volume on this approach is no more than 10 vehicles.

Table 13
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for 3601 Wrangle Hill Road Commercial Development
Report dated June 2015
Prepared by Duffield Associates, Inc.

Unsignalized Intersection ²⁶ Two-Way Stop Control	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Wrangle Hill Road (SR 72) & Connell Drive				
2015 Existing (Case 1)				
Northbound Connell Drive	F (67.1)	E (41.4)	F (60.4)	E (37.7)
Westbound SR 72 – Left	B (11.9)	B (10.8)	B (11.7)	B (10.5)
2017 without development (Case 2)				
Northbound Connell Drive	F (129.0)	F (84.9)	F (110.8)	F (74.2)
Westbound SR 72 – Left	B (12.9)	B (13.1)	B (12.6)	B (12.6)
2017 with development – No SR 72 Improvements (Case 3A/4A)				
Northbound Connell Drive	F (129.0)	F (90.6)	F (117.4)	F (74.2)
Westbound SR 72 – Left	B (12.9)	B (13.1)	B (12.6)	B (12.7)
2017 with development – With SR 72 Improvements (Case 3B/4B) ²⁷				
Northbound Connell Drive	C (23.6)	C (19.0)	C (22.6)	C (17.9)
Westbound SR 72 – Left	B (13.0)	B (13.1)	B (12.6)	B (12.6)

²⁶ The numbers in parentheses following levels of service are average delay per vehicle, measured in seconds.

²⁷ The SR 72 improvements include two eastbound through lanes, an eastbound right-turn lane, two westbound through lanes and a center two-way left-turn lane along SR 72. The concept plans for DelDOT's SR 72, McCoy Road to SR 71 project show a future fourth leg opposite Connell Drive. That fourth leg is named American Boulevard on the concept plans, and it would serve the proposed Peoples Industrial Park. That leg was not included at this intersection in the capacity analysis provided in the TIS. The TIS assumed the Peoples Industrial Park Entrance on the north side of SR 72 would be located west of Connell Drive and east of the proposed 3601 Wrangle Hill Road site entrance, and the volumes generated by Peoples Industrial Park were included in background traffic for all future cases.

Table 14
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for 3601 Wrangle Hill Road Commercial Development
Report dated June 2015
Prepared by Duffield Associates, Inc.

Unsignalized Intersection ²⁸ Two-Way Stop Control	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Wrangle Hill Road (SR 72) & Sunnyside Lane				
2015 Existing (Case 1)				
Northbound Sunnyside Lane	F (76.4)	F (59.5)	F (76.4)	F (59.5)
Westbound SR 72 – Left	B (11.8)	B (10.4)	B (11.8)	B (10.4)
2017 without development (Case 2)				
Northbound Sunnyside Lane	F (172.5)	F (128.5)	F (172.5)	F (128.6)
Westbound SR 72 – Left	B (12.8)	B (12.4)	B (12.8)	B (12.4)
2017 with development – No SR 72 Improvements (Case 3A/4A)				
Northbound Sunnyside Lane	F (187.9)	F (128.6)	F (187.9)	F (128.6)
Westbound SR 72 – Left	B (12.8)	B (12.5)	B (12.8)	B (12.5)
2017 with development – With SR 72 Improvements (Case 3B/4B) ²⁹				
Northbound Sunnyside Lane	C (23.6)	C (22.5)	C (23.6)	C (22.5)
Westbound SR 72 – Left	B (12.8)	B (12.5)	B (12.8)	B (12.5)

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

²⁹ The SR 72 improvements include two eastbound through lanes, two westbound through lanes and a center two-way left-turn lane along SR 72, in addition to the eastbound right-turn lane that currently exists.

Table 15
PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for 3601 Wrangle Hill Road Commercial Development
Report dated June 2015
Prepared by Duffield Associates, Inc.

Unsignalized Intersection ³⁰ Two-Way Stop Control	LOS per TIS		LOS per McCormick Taylor	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Wrangle Hill Road (SR 72) & Fieldstone Crossing Drive				
2015 Existing (Case 1)				
Southbound Fieldstone Crossing Drive	F (80.9)	F (52.9)	F (80.9)	F (52.9)
Eastbound SR 72 – Left	B (10.7)	B (11.8)	B (12.5)	B (11.8)
2017 without development (Case 2)				
Southbound Fieldstone Crossing Drive	F (206.1)	F (106.7)	F (206.1)	F (106.7)
Eastbound SR 72 – Left	B (12.7)	B (12.9)	C (15.6)	B (12.9)
2017 with development – No SR 72 Improvements (Case 3A/4A)				
Southbound Fieldstone Crossing Drive	F (206.1)	F (112.7)	F (206.1)	F (112.7)
Eastbound SR 72 – Left	B (12.8)	B (13.0)	C (15.7)	B (13.0)
2017 with development – With SR 72 Improvements (Case 3B/4B) ³¹				
Southbound Fieldstone Crossing Drive	C (24.9)	C (20.5)	C (24.9)	C (20.5)
Eastbound SR 72 – Left	B (12.8)	B (13.0)	C (18.3)	B (13.0)

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

³¹ The SR 72 improvements include two eastbound through lanes, two westbound through lanes and a center two-way left-turn lane along SR 72, in addition to the westbound right-turn lane that currently exists.