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## **CHAPTER 2      TRAFFIC ANALYSIS AND IMPROVEMENTS**

### **2.1      PURPOSE**

The purpose of this Chapter is to provide a clear process for determining transportation impacts associated with new development so that the impacts can be mitigated and system capacity can be preserved.

In order to accommodate a proposed development access, traffic must operate safely and at satisfactory Levels of Service (LOS).

### **2.2      TRAFFIC IMPACT STUDIES**

A Traffic Impact Study (TIS) can be required by DelDOT, by a local government, or by both. As state and local governments have different responsibilities, their specific reasons for requiring a TIS and the things they need from it differ. DelDOT has responsibility for most of the state's transportation system and therefore utilizes the TIS to identify impacts to that system and to determine appropriate mitigation for those impacts. DelDOT then seeks to obtain that mitigation through its advisory role in the local government's land use approval process, including the issuance of a Letter of No Objection to Recordation. Direct requirements by DelDOT, meaning conditions for the issuance of a permit or for acceptance of a street, as opposed to conditions for a Letter of No Objection or No Contention, typically are limited to the location and design of the development access.

While some local governments have responsibility for municipal streets and in that regard have interests parallel to DelDOT's, most local governments that require a TIS do so in the context of regulating land use. They require that area transportation facilities be demonstrated to operate adequately as a condition for land use approvals.

A TIS may be initiated by DelDOT, the applicable land use agency, or by the Applicant in anticipation of submission of a subdivision or land development proposal for review.

For the purposes of Chapter 2, an intersection shall be defined as a place where two publicly maintained roads or streets intersect; an access drive shall mean where a privately maintained road, street, driveway or other entrance intersects a publicly maintained road or street, and a "major" intersection shall be

defined as one where the side street likely carries more than 500 vehicle trips per day or more than 50 vehicle trips for any hour.

## **2.2.1 Traffic Impact Studies - Authority and Responsibility**

Whenever the DelDOT Division of Planning, Development Coordination Section (DelDOT) determines that a development proposal exceeds the analysis warrants as defined in Section 2.2.2, a TIS shall be completed for such proposed development if in the opinion of DelDOT a TIS is necessary. The scope of the TIS shall be based on the type and intensity of the proposed land use change or development.

Independent of the TIS report, the DelDOT Subdivision Section may require a Traffic Operational Analysis (TOA) during its review of site access issues as outlined in Section 2.3.

### **2.2.1.1 Use of TIS Findings**

If a TIS is required for a proposed development, DelDOT will direct its preparation for use in determination of impacts to the transportation network. Using the findings of the TIS, DelDOT may require transportation network improvements and modifications to be built or funded by the Applicant, as appropriate. DelDOT may also use the TIS to make recommendations to the local land use agency having land use jurisdiction over the property, or for any other purpose that DelDOT deems appropriate.

### **2.2.1.2 Area-Wide Study**

At DelDOT's option, the Department may require the Applicant to provide a monetary contribution to conduct an Area-Wide Study in lieu of a TIS, the results of which will be used to determine transportation impacts and necessary transportation network improvements associated with multiple development proposals or sites. The Applicant shall not be required to pay more than its fair share of the cost of such an Area-Wide Study (See Section 2.2.2.2). The development of a Land Use and Transportation Plan (See Section 2.4.2.1) is one example of an Area-Wide Study.

### **2.2.1.3 Study Costs**

If the Applicant desires to proceed with a development for which a TIS is required, the Applicant shall assume full responsibility for all costs incurred in its preparation, as calculated per the Area-Wide Study fee.

### **2.2.1.4 Qualifications to Perform a Traffic Impact Study**

All TIS document submittals shall be signed and sealed by a professional engineer licensed in the State of Delaware.

### **2.2.1.5 Requirement of a New TIS**

If a TIS is prepared for a proposed development and DelDOT finds that existing or projected future conditions in the study area have changed significantly after the completion of the TIS, DelDOT may require a new, revised, or updated TIS or a TOA at its sole discretion before issuing a Letter of No Objection to Recordation. DelDOT will take reasonable measures in scoping the study to avoid the need for additional work once the study is complete. However, it is the Applicant's responsibility to submit plans for approval in a timely manner. If DelDOT questions the continued validity of the TIS, due to the

passage of time, it is the Applicant's responsibility to demonstrate that it is still valid or to revise it as necessary.

Once DelDOT has issued a Letter of No Objection to Recordation, DelDOT may require a new, revised or updated TIS if the development changes in a way that necessitates a new or amended record plan. In the review of the entrance plans for that development, DelDOT may require a TOA, which may result in new or different requirements for improvement of the entrances and adjacent intersections. In jurisdictions that do not require a DelDOT Letter of No Objection to Recordation, DelDOT approval of entrance plans shall be considered a defacto Letter of No Objection in this context.

The above paragraph notwithstanding, DelDOT shall consider requiring a new or updated TIS in the following situations:

- A. If a Letter of No Objection to Recordation is not issued within five years of the traffic counts
- B. If a Letter of No Objection to Recordation expires before the subject plan is recorded
- C. If the subject plan expires before recordation or is sunset by the land use authority after recordation
- D. If a TIS was not done previously and a change to the subject plan increases its trip generation such that the warrants in Section 2.2.2 are now met

#### **2.2.1.6 Types of Analysis that May Be Included**

A TIS scope may include, but is not limited to, the following types of analyses:

- A. Highway Capacity Manual (HCM)/LOS Analysis – All TIS shall include HCM/LOS analysis to determine whether the approaches at the site entrance(s) and approaches of nearby intersections and road segments operate within acceptable LOS. See Section 2.2.8.12 for DelDOT's LOS Standards. See this section and Section 2.2.4.2.2 regarding the intersections that must be included.
- B. Queuing Analysis – This analysis may be required to determine whether existing and proposed left-turn storage at the site entrance(s) and nearby intersections is adequate, to assess U-turn lane storage adequacy, or to determine that lane queuing does not block access to turn lanes or spill back into upstream intersections.
- C. Safety Analysis – This analysis may consist of a number of factors including review of adequacy of sight distance, crash data, compliance with the Delaware Manual on Uniform Traffic Devices (DE MUTCD) and adherence to applicable guidelines and design standards, such as: the American Association of State Highway and Transportation Officials (AASHTO) *A Policy on Geometric Design of Highways and Streets (the Green Book)*, DelDOT's Road Design Manual (RDM) or other **Nationally Accepted Standards (NAS)**. More specifically:
  - 1. A sight distance evaluation may be required at the entrance driveway(s), at intersections within the study area, and at proposed intersections within the subdivision to be constructed.
  - 2. A crash analysis shall be required if locations within the proposed study area are known to DelDOT as high accident locations as determined through DelDOT's risk assessment programs such as: Hazard Elimination Program, High Risk Rural Roads Program or Rail-Highway Grade Crossing Safety Program. Independent crash analysis may be waived by DelDOT if DelDOT determines that sufficient analysis has already been completed or is planned to be completed as a requirement of the relevant Program. The analysis will be used to determine whether a problem exists, and if so, how the proposed project relates to the problem, and what modifications or

improvements need to be made to ensure safe access on the State-maintained roadway system and safe operation on adjacent roadways and intersections.

3. An analysis to provide for an evaluation of roads near the site relative to DE MUTCD and applicable guidelines and design standards such as: AASHTO's *Roadside Design Guide* (RDG), the Green Book, DelDOT's Road Design Manual (RDM) or **NAS**. This analysis would be required to identify deficiencies in signing, striping, cross-section or geometry that represent or would represent an unsafe condition.
- D. Bicycle, Pedestrian and Transit Facility Analysis - The analysis shall be required to identify and evaluate related impacts and the need for enhancements to bicycle, pedestrian, and transit access, circulation, and facilities within the study area.

## **2.2.2 Traffic Impact Studies - Warrants**

### **2.2.2.1 Basis for Requirement**

This section primarily addresses the criteria that DelDOT uses to determine whether to require a TIS. Where DelDOT finds that a local government's process has not otherwise afforded adequate consideration of transportation impacts and it must decide whether to require a TIS directly in the review of a land development plan or entrance plan, DelDOT shall apply the same criteria.

When evaluating rezoning proposals in the absence of a subdivision or land development plan, DelDOT shall distinguish between residential and non-residential districts. Rezoning for residential use shall be evaluated based on the site's highest and best use while recognizing the limitations, such as mapped wetlands. For rezoning for non-residential use, DelDOT shall recommend that the rezoning be considered without a TIS and that the need for a TIS be evaluated when a subdivision or land development plan is proposed.

Subject to the above paragraph and Sections 2.2.2.2, 2.2.2.3 and 2.2.2.4, DelDOT shall require a TIS if any of the following conditions apply:

- A. A proposed land use change or development will generate 500 vehicles per day (vpd) or more in average weekday or weekend trips, or will generate 50 vehicles per hour (vph) or more during any one hour time period during any day of the week, be it weekday or weekend, that DelDOT finds to be critical with regard to traffic impact. Most commonly, the time period will be the weekday a.m. or p.m. peak hour of traffic on the adjacent street but DelDOT may consider other peak hours depending on the nature of the proposed development and the area in which it would be located.
  1. If an applicant provides information regarding internal capture and/or pass-by trips, DelDOT shall evaluate the information submitted and determine what, if any, reductions in site traffic beyond the site entrance are appropriate. If so, warrants shall be based on the reduced traffic.
  2. Daily traffic volumes shall be the highest of the weekday, Saturday or Sunday volumes as determined in accordance with Section 2.2.8.6.
- B. A new access for an existing land use is proposed for a state-maintained roadway, and the total trips generated by the site would be increased by 500 vpd or 50 vph in the peak hour.
- C. The local land use agency has more stringent TIS warrant requirements than those provided in this section, and requires a TIS using those more stringent requirements.

### **2.2.2.2 Area-Wide Study Fee**

Provisions of Sections 2.2.2.1.A and 2.2.2.1.B notwithstanding, if a development will generate a net increase of fewer than 2,000 vpd and fewer than 200 vehicles in any hour of any day, and the Applicant has not been required to conduct a TIS under the provisions of Section 2.2.2.1.C, the Applicant, may be permitted, in lieu of conducting a TIS, to contribute funds equal to ten (\$10.00) per net daily trip to be generated by the development (Area-Wide Study Fee). Daily trips should be based on the day that generates the highest ADT for the land use proposed. For redevelopment projects, trips should be calculated using the *ITE Trip Generation Manual* for both the former use and the proposed use to calculate the net increase in trips. “Re-development” status will only apply to sites on which the business or other use has been operational within the past 3 years. Sites which have been out of operation for longer than 3 years will be considered new development.

The Area-Wide Study Fee shall be paid in conjunction with the Initial Stage discussed in Section P.4. DelDOT shall apply the collected fee to complete an Area-Wide Study that includes the development or transportation improvements that benefit the development. Payment of an Area-wide Study Fee in lieu of a TIS will not preclude the Applicant’s responsibility for funding and/or construction of its share of off-site improvements. Those improvements may be determined to be needed by the Area-Wide Study or other studies, e.g. TIS for other nearby developments.

THE TABLE BELOW IS INTENDED AS A QUICK REFERENCE. IT IS NOT A SUBSTITUTE FOR THE WARRANTS IN SECTION 2.2.2.1.

**Figure 2.2.2.2-a Volume Warrants for Traffic Impact Studies (TIS)**

Land Use Code (Per ITE Trip Gen. Manual, 9 <sup>th</sup> Ed.)	Land Use	TIS Not Warranted (Fewer than 500 vpd and 50 vph)	Eligible To Pay Area-Wide Study Fee (Fewer than 2,000 vpd and 200 vph)
210	Single Family Detached Houses	1-42 units	43-201 units
220	Apartments	1-57 units	58-287 units
230	Townhouses or Condominiums	1-23 units	24-368 units
240	Mobile Homes	1-60 units	61-340 units
251	Age-Restricted Single Family Detached Houses	1-36 units	37-505 units
320	Motel	1-42 rooms	43-226 rooms
710	General Office Building	1-18,000 square feet	18,001-82,000 square feet
720	Medical/Dental Office Building	1-11,000 square feet	11,001-46,000 square feet
826	Specialty Retail Center (Excludes convenience stores, pharmacies, banks, restaurants and gas stations)	N/A	1-17,000 square feet
851	Convenience Store (no fuel pumps)	N/A	1-2,300 square feet
881	Pharmacy with Drive-Through Window	1-5,000 square feet	5,001-20,000 square feet
912	Drive-in Bank	1-1,800 square feet	1,801-7,400 square feet
934	Fast Food Restaurant with Drive-Through Window	N/A	1-2,700 square feet
945	Gasoline/Service Station with Convenience Market	N/A	1-12 vehicle fueling positions

This table was compiled using the 9<sup>th</sup> edition of the ITE Trip Generation Manual.

**2.2.2.3 Development Generating Fewer Than 500 VPD and 50 VPH**

Developments generating fewer than 50 vph in any hour and 500 vpd shall be subject to the provisions of this chapter only if a TIS is required under the provisions of Section 2.2.2.1.C.

**2.2.2.4 Development Within a Transportation Improvement District (TID)**

The land use and transportation planning process involved in the creation of a TID is necessarily more comprehensive than that involved in a TIS for a specific development. See Section 2.4 regarding required and recommended elements of a TID.

If a development is proposed within a TID and is consistent with the current Land Use and Transportation Plan (LUTP) for that TID, DelDOT may require participation in the TID in lieu of conducting a TIS and making improvements based on the TIS if all of the following conditions apply:

- A. The TID has been created:
  - 1. By virtue of:
    - i. An act of the General Assembly; or
    - ii. An action of the Council of a Metropolitan Planning Organization; or
    - iii. A Memorandum of Agreement between DelDOT and the relevant local government(s)
  - 2. For purposes that include the implementation of transportation improvements that are based on forecast traffic volumes calculated from adopted demographic data
  - 3. In conformance with the circulation element of a comprehensive plan or a related master plan
- B. All of the development entrances are located within the boundaries of the TID.
- C. The completion date of the subject development is before the year for which traffic was forecast in the current LUTP for the TID, as determined under Section 2.2.8.10 and one of two conditions apply:
  - 1. The subject development (or another land use of equivalent or higher peak hour trip generation) was explicitly accounted for in the traffic forecasts used in the current LUTP for the TID.
  - 2. The traffic entering and exiting the subject development would not result in an increase of more than five percent in the forecast traffic volume on the adjacent road at any of the development entrances.
- D. A specific set of transportation system improvements has been identified as necessary within the TID based on forecast traffic and other relevant factors, such as safety or structural adequacy.
- E. The Applicant has agreed in writing to contribute toward the cost of the identified transportation improvements and that contribution is based on a formula defined in the TID agreement or, if no formula is defined, on the subject development's percentage contribution to the peak hour traffic passing through the facility to be improved in the forecast year.

DelDOT reserves the right to require a bond or similar security as a means of guaranteeing that the pledged funds will be available when needed and/or that any required work will be completed on time and to the satisfaction of DelDOT.

One premise of this section is that sufficient Level of Service (LOS) analysis was done in developing the LUTP for the TID, such that additional analysis is unnecessary. Where DelDOT or local government regulations require the determination of LOS at the development entrance(s) or immediately adjacent facilities, this work may be done through the preparation of a Traffic Operational Analysis, in accordance with Section 2.3. Where more extensive LOS information, not available from the LUTP, is needed, a TIS shall be required.

### **2.2.3 Traffic Impact Studies - Process**

#### **2.2.3.1 TIS Prepared By Applicant's Engineer (Option A)**

To conduct a TIS, the Applicant shall complete the following steps:

- A. A request shall be made to DeIDOT to schedule a mandatory Scoping Meeting in accordance with Section 2.2.4.1. The Applicant shall provide a copy of this letter to the applicable local land development agency concurrent with its submission to DeIDOT.
- B. A Scoping Meeting shall be held with DeIDOT, and at DeIDOT's discretion with representatives of the local land use agency, to discuss the proposed development and the scope of work for the project TIS.
- C. DeIDOT shall provide a memorandum, which will serve as the meeting minutes and scope of work for the study.
- D. If the Applicant wishes to proceed with this option, they shall provide a check in accordance with Section 2.2.4.3.
- E. Count and Trip Distribution Data. After the Applicant receives the Scope of Work Memorandum, the Applicant's engineer will complete traffic counts and the proposed trip distributions for the developments to be addressed in the TIS. The count data and proposed distribution shall be submitted to DeIDOT prior to completion of any additional analysis. Once submitted, DeIDOT will review the count and trip distribution information and will approve the data or, in the alternative will provide requirements for revisions to the data, which could include provision of future base volumes, the provision of growth factors to be used in calculating such volumes, or modifications to distribution percentages.
- F. Preliminary Traffic Impact Study Report. After acceptance of the traffic count data, the Applicant's engineer will complete the elements of the report indicated in Sections 2.2.5, 2.2.6, and 2.2.7, and shall submit a copy of the information to DeIDOT as the "Preliminary Traffic Impact Study" (PTIS). This information allows DeIDOT to review the base data prior to completion of the full analysis by the Applicant's engineer, saving the Applicant's engineer from potential resubmissions of more detailed analyses if a correction is required by DeIDOT to the base data or assumptions. DeIDOT shall respond by approving the PTIS either as submitted or with required amendments or additions. If significant problems are found, e.g., changes are needed to volumes in several report figures; further submissions at this stage will be required.
- G. Traffic Impact Study Report. After acceptance of the PTIS by DeIDOT, the Applicant's Engineer shall complete the TIS in accordance with the analysis provisions of Section 2.2.8 and submit an electronic copy in PDF format of the full report (including the Preliminary TIS sections) to DeIDOT for review. The final TIS report may be rejected by DeIDOT if the report deviates from the approved PTIS, either through failure to make revisions or the inclusion of new, un-reviewed volumes.
- H. Department Recommendations and Requirements for Access. When DeIDOT finds that the TIS is satisfactory and agrees with its conclusions, DeIDOT shall establish conditions for approval of construction of subdivision streets and for approval of access to state-maintained roadways, and shall provide a letter detailing the conditions to the Applicant. Either prior to or at the same time that the Applicant is provided with the conditions letter, DeIDOT may also provide copies of its requirements, recommendations and conditions to other relevant agencies, including the local land use agency. The Applicant shall still be subject to the plan review and entrance plan requirements of Development Coordination Section.

### **2.2.3.2 Traffic Impact Study Prepared By DeIDOT's Traffic Engineer (Option B)**

- A. A request shall be made to DeIDOT to schedule a mandatory Scoping Meeting in accordance with Section 2.2.4.1. The Applicant shall provide a copy of this letter to the applicable local land development agency concurrent with its submission to DeIDOT. A Scoping Meeting shall be held

with DelDOT and, at DelDOT's discretion with representatives of the local land use agency, to discuss the proposed development and the scope of work for the project TIS.

- B. DelDOT shall provide a memorandum, which will serve as the meeting minutes and scope of work for the study. DelDOT shall also provide a cost estimate from their traffic engineer to prepare the TIS in its entirety.
- C. If the Applicant wishes to proceed with this option, they shall provide an electronic payment to DelDOT in accordance with DelDOT's current procedures, in the full amount of the cost estimate. On receipt of that payment, DelDOT will work to issue a notice to proceed to their traffic engineer. Because the notice will be subject to DelDOT's procedures for work by consultants, issuance of the notice to proceed will not be immediate.
- D. DelDOT's traffic engineer will complete the draft final TIS in approximately 40 business days. Upon completion of the draft final TIS, DelDOT will schedule a meeting to discuss the results with the Applicant.
- E. Department Recommendations and Requirements for Access. When DelDOT finds that the TIS is satisfactory and agrees with its conclusions, DelDOT shall establish conditions for approval of construction of subdivision streets and for approval of access to state-maintained roadways, and shall provide a letter detailing the conditions to the Applicant. Either prior to or at the same time that the Applicant is provided with the conditions letter, DelDOT may also provide copies of its requirements, recommendations, and conditions to other relevant agencies, including the local land use agency. The Applicant shall still be subject to the plan review and entrance plan requirements of Development Coordination Section.
- F. DelDOT will provide a copy of the completed TIS to the applicant.

## **2.2.4 Traffic Impact Studies – Scope of Work Determination and Confirmation**

### **2.2.4.1 Letter to Request Scoping Meeting**

An Applicant considering submission of a subdivision or site plan development application shall request in writing, using the Scoping Meeting Request Form found online (for more information go to <http://devcoord.deldot.gov> > Forms), a Scoping Meeting with DelDOT to discuss elements of the project and project analysis assumptions.

The Scoping Meeting Request Form will be used to gather information such as:

- A. Project name
- B. Name and address of the applicant
- C. Contact information for scheduling meeting
- D. Location of project
- E. Copy of tax map showing block number, lot number, parcel number and lot lines
- F. Total acreage of the project site
- G. Current and proposed zoning of the project site
- H. Proposed land use
- I. Proposed number and location of site access points

- J. Proposed build-out year, or if project is to be phased, phase-in dates
- K. Indication as to whether a land use application has been submitted to the local government land use department for review
- L. Indication as to whether a subdivision or land development plan has been submitted to DelDOT's Subdivision Section for review, and, if one has been submitted, a copy of the plan
- M. Indication as to whether a site plan for the project has been prepared, and, if one has been prepared, a copy of the plan
- N. Any other analysis assumptions the Applicant proposes using for the study
- O. Evidence that the Applicant and the current property owner were notified of the request for the meeting
- P. Names and titles of people anticipated to attend the Scoping Meeting

One copy of the request for Scoping Meeting letter shall be sent to the applicable local land use agency concurrent with the submission to DelDOT. The Applicant shall be requested to demonstrate to DelDOT that it has provided a copy of the letter to the land use agency. Failure to provide a concurrent copy of the request for Scoping Meeting letter to the local agency may result in the delay or postponement of the Scoping Meeting.

#### **2.2.4.2 Scoping Meeting**

##### **2.2.4.2.1 General**

DelDOT will schedule the Scoping Meeting. At the Scoping Meeting, the following TIS topics shall be discussed:

- A. Intersections and roadway segments to be studied. See Section 2.2.4.2.2
- B. The impact of any significant committed developments within a two-mile radius of the exterior boundaries of the project on the project study area
- C. The availability of crash data within the proposed study area and the requirements for analysis based on that data
- D. Method to be used to project traffic growth
- E. Traffic count locations and proposed schedule for manual and Automatic Traffic Recorder (ATR) counts
- F. Times and days of analysis
- G. Any anticipated seasonal variations of use
- H. Methods to be used to generate, distribute and assign trips
- I. When appropriate for use in the TIS analysis, pass-by and internal trip capture assumptions
- J. Signalized intersections known to become saturated during peak periods
- K. Other information and assumptions to be used in the analysis for the report

Within 20 business days DelDOT will supply a Memorandum of the Scoping Meeting Minutes and, if requested by the Applicant, an estimate for Option B. The cost estimate for Option B proposal will expire after 40 business days.

#### **2.2.4.2.2 Intersections and Roadway Segments to be Studied**

In considering the study area limits, DelDOT shall consider the area of influence of the proposed development on the surrounding roadway network. The area of influence shall be defined as the area beyond a development site entrance including any intersection or roadway segment that would carry projected site traffic of at least 50 vehicles per hour (during any peak hour) as determined by DelDOT using an adopted regional travel demand model, up to and including the third State-maintained road having a three-digit maintenance number (local roads and higher as defined on DelDOT's Functional Classification Maps). Within that area, the intersections to be analyzed shall also include any signalized access drives and any Type II and Type III subdivision streets. In this context, both State-maintained and privately-maintained subdivision streets shall be included. Municipally-maintained subdivision streets shall be included only at the request of the municipality.

DelDOT will also consider local requirements for area of influence when determining the study area limits. Further, to the extent that a local government receives requests from the public through their land use approval process that an intersection or other transportation facility be included in a TIS and asks that DelDOT include that facility in the study, it shall be included, provided that: 1) a recognized procedure exists for determining the Level of Service on such facilities; and 2) the local government specifies what, if any, requirement they have with regard to the Level of Service on that facility.

The above-described area of influence notwithstanding, the following study area limits shall also apply:

- A. The study area shall include all development site entrances for which a Level of Service can be determined, e.g. an unsignalized right-turn-in-only will generally be excluded, but the development site entrances shall not count toward determination of the third intersection mentioned above.
- B. Where the development would access a local or collector road, the study area should extend to follow any assignment of at least 50 vehicles per hour to the nearest arterial road.
- C. Where the development would have access on two intersecting roads, their intersection shall be included.
- D. Where two roads intersect in a grade such that through traffic movements do not intersect and some or all turning movements are made by means of ramps, DelDOT shall specify in the scoping meeting what elements need to be studied.
- E. Where one of the roads in the area of influence is an expressway, the study area may extend beyond the intersection with that road but it shall not extend along the expressway.
- F. Intersections of roads with State maintenance numbers ending in letters are excluded from the count of three intersections except where site traffic of 50 or more vehicles per hour is expected to use that road. If they are within the third-intersection limit, they may be included if the intersection is signalized or the local government requests their inclusion.

DelDOT may consider a smaller study area for developments located in any of the following situations:

- A. Central business districts and similar urban locations. Factors to consider in reducing the study area on this basis include the existence of a grid street pattern, physical constraints on road widening such as buildings adjoining the right-of-way, and posted speed limits of 30 miles per hour or less.
- B. Rural areas. Factors to consider in reducing the study area on this basis include location of the development in a Level 4 Investment Area relative to the Strategies for State Policies and Spending, Annual Average Daily Traffic volumes on most roads less than 1,000 vehicles per day, and little development other than farms and single-family detached houses (isolated or in strip developments).

- C. Arterial highways through developed areas. Factors to consider in reducing the study area on this basis include the number and density of signalized intersections at which the intersecting streets or driveways are not State-maintained, e.g. municipal streets, subdivision streets and commercial entrances.

**Example 1:** 250 single-family houses on the Judge Morris Estate, located on Polly Drummond Hill Road (N328)

1. Begin with the site entrance on Polly Drummond Hill Road.
2. To the north, follow the extent of 50 p.m. peak hour site trips to Old Coach Road (N316). Include that intersection but stop there as less than 50 p.m. peak hour site trips are on either road beyond there.
3. To the south, follow the extent of 50 p.m. peak hour site trips to Kirkwood Highway (N011). Include that intersection but do not continue south on Red Mill Road (N352) as less than 50 p.m. peak hour site trips are on that road.
4. Looking east on Kirkwood Highway, follow the extent of 50 p.m. peak hour site trips to Harmony Road (N355). Include that intersection. East of there, there are less than 50 p.m. peak hour site trips so look no further on Kirkwood Highway.
5. Continue following the extent of 50 p.m. peak hour site trips along Harmony Road to Ruthar Drive (N065). Stop there as it is the third intersection from the site.
6. Returning to the intersection of Kirkwood Highway and Polly Drummond Hill Road, follow the extent of 50 p.m. peak hour site trips west to Old Possum Park Road (N303). Include this intersection do not continue north on Old Possum Park Road as less than 50 p.m. peak hour site trips are on that road.
7. Continue following the extent of 50 p.m. peak hour site trips along Kirkwood Highway to Possum Park Road (N314). Stop there as it is the third intersection from the site.
8. Add in intervening Type II and Type III subdivision streets and signalized access drives.

Resulting list of intersections to be analyzed:

- Site Entrance / Polly Drummond Hill Road
- Polly Drummond Hill Road / Old Coach Road
- Polly Drummond Hill Road / Chestnut Avenue
- Kirkwood Highway / Polly Drummond Hill Road
- Kirkwood Highway / Brewster Drive
- Kirkwood Highway / Darwin Drive
- Kirkwood Highway / Harmony Road
- Harmony Road / Greenridge Road
- Harmony Road / Ruthar Drive
- Kirkwood Highway / Delaplane Avenue / Melrose Place Drive
- Kirkwood Highway / Old Possum Park Road
- Kirkwood Highway / Possum Park Road

**Example 2:** 100,000 square foot shopping center on the Judge Morris Estate, located on Polly Drummond Hill Road (N328)

1. Begin with the site entrance on Polly Drummond Hill Road.

2. To the north, follow the extent of 50 p.m. peak hour site trips to Old Coach Road (N316).
3. From Old Coach Road, continue following extent of 50 p.m. peak hour site trips east to North Upper Pike Creek Road (N295). Stop there as it is the third intersection from the site.
4. Returning to the intersection of Polly Drummond Hill Road / Old Coach Road, continue following extent of 50 p.m. peak hour site trips north to New Linden Hill Road (N321). Include that intersection but stop there as there are less than 50 p.m. peak hour site trips north along Polly Drummond Hill Road.
5. From Polly Drummond Hill Road, continue following extent of 50 p.m. peak hour site trips east along New Linden Hill Road to North Upper Pike Creek Road (N295). Stop there as it is the third intersection from the site.
6. Returning to the site entrance on Polly Drummond Hill Road, follow the extent of 50 p.m. peak hour site trips south to Kirkwood Highway (N011).
7. From Kirkwood Highway, continue following extent of 50 p.m. peak hour site trips south to Ruthar Drive (N065). Include that intersection but stop there as less than 50 p.m. peak hour site trips are on either road beyond there.
8. Returning to the intersection of Kirkwood Highway / Polly Drummond Hill Road, continue following extent of 50 p.m. peak hour site trips east along Kirkwood Highway to Harmony Road (N355).
9. From Harmony Road, continue following extent of 50 p.m. peak hour site trips east to South Upper Pike Creek Road. Stop there as it is the third intersection from the site.
10. Returning to the intersection of Kirkwood Highway / Harmony Road, continue following extent of 50 p.m. peak hour site trips south to Ruthar Drive. Stop there as it is the third intersection from the site.
11. Returning to the intersection of Kirkwood Highway and Polly Drummond Hill Road, follow the extent of 50 p.m. peak hour site trips west to Old Possum Park Road (N303). Include this intersection do not continue north on Old Possum Park Road as less than 50 p.m. peak hour site trips are on that road.
12. Continue following the extent of 50 p.m. peak hour site trips along Kirkwood Highway to Possum Park Road (N314). Stop there as it is the third intersection from the site.
13. Add in intervening Type II and Type III subdivision streets and signalized access drives.

Resulting list of intersections to be analyzed:

- Site Entrance / Polly Drummond Hill Road
- Polly Drummond Hill Road / Old Coach Road
- Old Coach Road / Dewalt Road
- Old Coach Road / Henderson Hill Road
- Old Coach Road / North Upper Pike Creek Road
- Old Coach Road / South Upper Pike Creek Road
- Polly Drummond Hill Road / Forge Road
- Polly Drummond Hill Road / New Linden Hill Road
- New Linden Hill Road / Chadd Road
- New Linden Hill Road / Quarry Lane
- New Linden Hill Road / Boyds Valley Drive / Henderson Hill Road
- New Linden Hill Road / North Upper Pike Creek Road

- Kirkwood Highway / Polly Drummond Hill Road
- Red Mill Road / Andries Road
- Red Mill Road / Darwin Drive
- Red Mill Road / Old Manor Road
- Red Mill Road / Ruthar Drive
- Kirkwood Highway / Brewster Drive
- Kirkwood Highway / Darwin Drive
- Kirkwood Highway / Harmony Road
- Kirkwood Highway / South Upper Pike Creek Road
- Harmony Road / Greenridge Road
- Harmony Road / Ruthar Drive
- Kirkwood Highway / Delaplane Avenue / Melrose Place Drive
- Kirkwood Highway / Old Possum Park Road
- Kirkwood Highway / Possum Park Road

#### **2.2.4.3 Confirmation of Scope of Work for the TIS**

If after the receipt of the Scoping Meeting Memorandum the Applicant decides to proceed with the project, the Applicant's engineer shall provide DelDOT with confirmation that they agree with the Scoping Meeting Memorandum or with any changes they find necessary. At this time they shall also identify if they want to proceed with Option A or Option B.

If the Applicant chooses Option A, their confirmation of the Scoping Meeting Memorandum shall be accompanied by a fee in the amount of \$5000 (pending review and approval of the General Assembly), in the form of a check made payable to the Department of Transportation. An estimated time for review of a TIS under Option A after the Applicant's engineer has submitted the Final TIS is 20 business days. Completion of a draft TIS review letter in a form suitable for discussion with the Applicant can be expected approximately 20 business days after that date, for a total of 40 business days.

If the Applicant chooses Option B, their confirmation of the Scoping Meeting Memorandum shall be accompanied by a check made payable to the Department of Transportation in the full amount of the estimate for Option B. After receipt of payment, DelDOT will issue its Traffic Engineer a Notice to Proceed (NTP) with the Final TIS preparation. An estimated time for a draft Final TIS and comment letter in a form suitable for discussion with the Applicant is approximately 40 business days with final TIS and comment letter completion approximately 20 business days after that date.

DelDOT may revise a scope of work if the TIS is not submitted within a 12-month period from the date of the Scope Confirmation Letter, or within a time period earlier than 12 months should conditions in the study area change. A revised scope of work may require a restart of the TIS process, including a requirement for a new processing fee.

#### **2.2.5 Traffic Impact Studies - Report Format**

All TIS submittals shall be signed and sealed on the first page by a licensed Delaware Professional Engineer.

The pages of the TIS shall be numbered and the topics shall be addressed in the same sequence as they appear in this subsection.

The following outline details the Topic Sections to be contained in a TIS:

- A. Table of Contents
- B. List of Figures
- C. List of Tables
- D. Executive Summary
- E. Project Description
- F. Study Area
- G. Existing Traffic and Transportation Conditions
- H. Trip Generation
- I. Pass-by and Internal Capture Trips (if appropriate)
- J. Trip Distribution
- K. Trip Assignment
- L. Future Traffic:
  - 1. Traffic Analysis
  - 2. Analysis Years
  - 3. Peak Hour Factors
- M. Safety Evaluation and Adequacy of Sight Distance
- N. Capacity Analyses
- O. Geometric Design Operational and Circulation Improvements
- P. Impacts on Bicycles, Pedestrians, and Transit
- Q. Mitigation Identification
- R. Recommendations
- S. Conclusions
- T. Appendices:
  - 1. Traffic Count Summary Sheets
  - 2. Collision Diagrams
  - 3. List of Committed Developments
  - 4. Trip Generation, Distribution and Assignment Calculations for the subject development and all committed developments
  - 5. Capacity Analysis Worksheets
  - 6. Critical Movement Summation Forms and Signal Timing Sheets
  - 7. DelDOT and Applicant Correspondence, including original scope of work
  - 8. Support for Recommendations

### **2.2.6 Traffic Impact Studies - Content of Traffic Count and Trip Distribution Submission (Option A only)**

To avoid repetition of work in preparation of the Preliminary TIS and expedite the review process, traffic count data and proposed trip distributions for all committed developments shall be submitted for review as follows:

- A. Prior to beginning preparation of the Preliminary Traffic Impact Study, described in Section 2.2.7, the Applicant shall submit to DeIDOT a copy of the data from the tasks completed in accordance with the work outlined in Sections 2.2.8.5.A and 2.2.8.5.C, and the proposed trip distributions for all committed developments.
- B. DeIDOT shall review the items listed in paragraph 1 above and respond by approving them for use in the Preliminary TIS either as submitted or with required amendments or additions. If significant problems are found, e.g. unacceptable traffic counts, a resubmission at this stage will be required. At this time, DeIDOT will also provide any additional data needed for the Applicant's engineer to project future traffic in accordance with Section 2.2.8.10.
- C. All content shall be submitted electronically.

### **2.2.7 Traffic Impact Studies - Preliminary Traffic Impact Study Report Content submission (Option A only)**

To avoid repetition of analyses and expedite the review process, a Preliminary TIS report shall be completed as follows:

- A. Prior to beginning the analysis work outlined in Section 2.2.8.11, the Applicant shall submit to DeIDOT a copy of the data from the tasks completed in accordance with the work outlined in Sections 2.2.8.2 through 2.2.8.10 and corresponding to report topics E through L and T.1 and T.4 in Section 2.2.5. Furthermore, diagrams of future peak hour traffic both with and without site traffic added shall be included in the report.
- B. DeIDOT shall review the Preliminary TIS and respond by approving the Preliminary TIS either as submitted or with required amendments or additions. If significant problems are found, e.g., extensive errors in calculating future traffic, a resubmission at this stage will be required.
- C. All content shall be submitted electronically.

### **2.2.8 Traffic Impact Studies - Content**

The TIS shall evaluate the intersection and roadway sections detailed in the Scoping Meeting Memorandum for the proposed development. The following sections list the information that shall be included in the submission.

#### **2.2.8.1 Executive Summary**

An Executive Summary shall be included at the beginning of the TIS report. The Executive Summary shall discuss the analysis and conclusions and identify recommended transportation improvements. If the project has changed between the scoping meeting and final TIS, list how it has changed.

### **2.2.8.2 Site Information**

The following information shall be included in site information:

- A. Name(s) and address(es) of the site owner and Applicant
- B. Lot location noting tax parcel numbers, municipality (if incorporated), county
- C. Routes of access, with their direction and milepoint
- D. Size and type and zoning of all existing and proposed land use on the site
- E. A topographic site map (if available) and aerial photos
- F. Sketch plan of site (24" x 36") that includes the right-of-way (throughout), curb lines, entrances and lane striping of both sides of roadways adjacent to the site

### **2.2.8.3 Project Description**

The TIS shall provide a comprehensive project description including, but not limited to, the following:

- A. Site plan showing block number, lot number, lot lines, proposed site access (including existing to remain), and proposed transportation improvements
- B. Project phasing and schedule: development staging identifying the year of development activities per phase and proposed access plans
- C. Narrative on the intended use of the site, including the range of uses allowed without additional land-use approvals and the ITE land use code(s) used to generate trips:
  - 1. Residential developments should be described in terms of number and type of dwelling units, e.g., 32 single-family homes
  - 2. Non-residential uses should be described in terms of use and gross leasable floor area or another relevant descriptor, e.g., industrial type of warehousing, or general or medical office
- D. Frequency of use:
  - 1. Anticipated peak days and hours of operation should be described
  - 2. Any anticipated seasonal variations of use should be discussed
- E. Intensity of use:
  - 1. At a minimum, the proposed use and buildable area (in square feet) of the site must be specified.
  - 2. For residential uses the buildable area (i.e., density) shall be described as the number of dwelling units per acre.
  - 3. For non-residential uses the buildable area shall be described in terms of floor area ratio and gross square footage by use which should be specific (e.g. medical office vs. office).
- F. Digital photographs of the site shall be provided showing sufficient detail of relevant features impacting traffic, including but not limited to, existing and proposed access entrances, adjacent entrances on both sides of the street, and features and intersections within the influence area.

### **2.2.8.4 TIS Study Area Description**

The TIS shall provide a complete evaluation of existing conditions and include maps and tables displaying the following information for the study area identified in the Scoping Meeting Memorandum:

- A. Study Area/Vicinity Map. A map showing the street system including street names, functional classifications and entrance locations as specified in Chapter 3
- B. A description of the study area limits including intersections, roadway weaving sections and ramps to be studied
- C. Schematic diagram(s) of existing and future roadways and intersections including traffic control, geometric features (pavement, lane and shoulder widths, channelization, etc.) sidewalks, bikeways and roadway striping
- D. Any functional, operational or programmatic activities, including public and private operators or carriers, which affect trip making activity such as ridesharing participation, park and rides, transit services, or other travel demand management methods
- E. Intersection lane configurations in the study area
- F. Traffic signal information including traffic signal locations, type and capabilities of existing signal hardware.
- G. Existence of any privately owned shared access agreements or cross access easements
- H. Description, location and schedule of proposed transportation improvements and/or public or private mitigation, within the study area
- I. Digital photographs of each approach of each intersection included within the study area, as well as other locations as may be requested by DelDOT in the Scoping Meeting Memorandum, sufficient to determine relevant features including, but not limited to, traffic controls, striping and signing locations

#### **2.2.8.5 Existing Traffic and Transportation Conditions**

The report shall provide an inventory of the following traffic and transportation existing conditions for the Study Area identified in the Scoping Meeting Memorandum:

- A. Narrative and flow diagrams of seasonally adjusted peak hour traffic through the study area and identification of peak hours. **N.B.:** Flow diagrams must be continuous. Separate diagrams of each intersection are not acceptable
- B. Narrative describing existing pedestrian, bicycle and transit conditions within the study area. Transit information shall include routes, stop and shelter locations, route numbers, headways, frequency, passenger boardings, pull outs, and times of service
- C. Existing Condition Traffic Data:
  - 1. Unless explicitly eliminated from the Scope of Work by DelDOT, the Applicant shall provide traffic count data generally taken on a Tuesday, Wednesday, or Thursday, within 12 months of the application date.
  - 2. Classified peak hour manual turning-movement counts for one day shall be supported by one week of machine counts.
  - 3. To be acceptable, manual count volumes must be within 10 percent of the machine count volumes for the same time periods on each approach that day.
  - 4. For weekday a.m. and p.m. peak hours, manual counts shall be factored to agree with the highest of the weekday machine counts for the highest a.m. and p.m. peak hours respectively.

5. For Saturday peak hours, manual counts do not need to be factored if they are within 10 percent of machine counts. To be acceptable the manual count must include the peak hour identified from the machine counts.
6. Two-way (i.e., showing separate counts for each travel direction), all lane, ATRs shall be placed in the locations required in the Scoping Meeting Memorandum. If an ATR malfunctions, the counter should be restarted on the nearest whole day to make up the week (e.g. if a count starts on a Monday morning and the ATR breaks down on Wednesday afternoon, the Monday and Tuesday data will be useable but the count will need to be started again on a Wednesday morning to complete the week).
7. All counts shall be included in the traffic impact study as an appendix. The Engineer shall provide evidence of proper calibration of automatic traffic recorder (ATR) equipment.
8. Traffic counts shall be shown by 15-minute intervals over a period long enough to establish relevant peak hour(s). The manual peak hour count period is generally two hours.
9. Traffic counts shall not be taken on, or the day before or after, holidays or other special events when traffic may not be representative of average daily traffic.
10. Days and times of manual turning movement peak hour counts shall be subject to review and approval by DelDOT and should normally be conducted on a Tuesday, Wednesday, or Thursday from 7 a.m. to 9 a.m. and from 4 p.m. to 6 p.m. However, these days and times may differ depending on the type and location of the development proposed.
11. Counts also shall be provided for weekends if weekends are the peak traffic period for either the existing street or the proposed development.
12. Counts to be made on streets near a school shall be done when the school is in session;
13. If another TIS has been done in the area (provided that counts used in the TIS were taken within the past year) and DelDOT believes that it is relevant to the proposed project, DelDOT may, in its sole discretion, provide copies and the traffic counts from such a TIS may be used. Other traffic counts may be available from the Traffic Section, but must be deemed acceptable by DelDOT prior to their use in a TIS analysis for the project. If DelDOT allows the use of previous count data, it may also require actual sample counts at locations of its choosing to use as a verification of prior counts, and may require adjustments to the prior counts based on sample count verifications.
14. Vehicle classification must be sufficient to address the needs of the TIS, in most cases simply determining a percentage of heavy vehicles. However, where large percentages (i.e., 5 percent or higher) of multi-axle vehicles are present it may be necessary to more finely stratify the classification in order to conform to the machine count. Also, if a turning movement volume is less than 100 vph, 5 percent heavy vehicles shall be assumed and vehicle classification is unnecessary (See Section 2.2.8.11.6.H).
15. Seasonal variations in traffic volumes shall be considered. A seasonal adjustment factor may be provided by DelDOT to be applied to the volumes, and/or DelDOT may require traffic counts during summer periods in eastern Sussex County or along routes containing a high percentage of resort-oriented traffic.
16. During the counting period, the counter shall record the basic weather conditions, and any features or events particular to the count location such as detours, construction, or accidents. These conditions and events shall be included within the traffic count information provided to DelDOT by the Engineer when submitting the counts. An event occurring during the manual count will not necessarily disqualify the count from use in the analysis if the event has not materially impacted traffic flow conditions. However, events such as steady rain, snow-covered

surfaces, accidents or detours which block or substantially lower the rate of traffic flow through an intersection shall automatically require that the intersection volumes be recounted during a period of normal traffic flow conditions. DeIDOT in its sole discretion shall determine the validity and usability of count data supplied by the Engineer.

17. Any new traffic counts should be submitted to DeIDOT both electronically as Excel or pdf files and as draft report figures showing peak hour volumes posted on continuous flow diagrams of the road network. Individual location diagrams are not acceptable. Peak hour time period, day and date of count shall be shown on the forms.
18. At or after the Scope of Work meeting, DeIDOT may approve alternative proposals for counting programs as long as they conform to the intent of the program as outlined above.
19. If an intersection becomes saturated during the count period, such that the queue of arriving vehicles does not clear, the Engineer shall record arrival volumes (arriving at the back of queue) as well as departure volumes (departing the stop line) and conduct their analyses using the arrival volumes. DeIDOT will advise the Engineer of times and locations where saturation is expected, but it is the Engineer’s responsibility to identify such locations and to record data appropriately. Where queues exceed turning lane lengths, the total queue shall be recorded and turning movements for arrival volumes shall be obtained by assuming that arrivals follow the same distribution of left, through and right volumes as departures. Where queues extend through the next intersection, such that arrival volumes cannot properly be determined, the length of the queue back to that intersection shall be recorded and the situation noted. Figure 2.2.8.5-a, Example of Estimating Arrival Volumes from Departure Counts, shows an acceptable procedure for estimating arrival volumes based on aggregation of the counts into 15-minute periods and one queue length measurement each period. Ideally, volumes and queues should be recorded continually (every cycle where there is a signal) and a similar calculation done each time the queue discharges (for each cycle where there is a signal) to obtain actual arrival volumes.

D. Crash Data:

1. If an intersection in the study area or a location along the site frontage has been addressed in current or past Highway Safety Improvement Programs (HSIPs) the Engineer shall report on the status or results of its inclusion in the program.
2. For all other intersections in the study area and locations along the site frontage, the Engineer shall provide collision diagrams showing crash data for the most recent three-year period for which data is available.

E. Signal Timing:

1. The Engineer shall coordinate with the DeIDOT Traffic Management Center to collect signal timing charts, time of day charts, split charts and signal progressions and utilize the acquired information for signalized intersection analysis.

***Figure 2.2.8.5.a Example of Estimating Arrival Volumes from Departure Counts***

Time Period	Total Departure Count (Vehicles)	Queue Length (Vehicles)	Arrival Volume (Vehicles)
7:00 – 7:15 AM	165	0	165
7:15 – 7:30 AM	135	0	135
7:30 – 7:45 AM	196	0	196
7:45 – 8:00 AM	170	10	170 + 10 = 180

8:00 – 8:15 AM	201	12	$201 - 10 + 12 = 203$
8:15 – 8:30 AM	201	14	$201 - 12 + 14 = 203$
8:30 – 8:45 AM	173	0	$173 - 14 = 159$
8:45 – 9:00 AM	194	0	194
TOTAL	1,435		1,435

### **2.2.8.6 Trip Generation**

The trip generation section of the TIS shall include a narrative describing the methodology used to generate site trips.

Estimates of the proposed development’s trip generation shall be made for peak period traffic. Selection of the peak period used in the analysis shall be justified and shall consider, at a minimum, the peak period for the proposed development, and the peak period for surrounding streets. DelDOT may, in the Scoping Meeting Memorandum, require other time periods based on known or anticipated marginal or substandard traffic capacity or traffic safety. Except as directed and approved by DelDOT, trip generation estimates shall be based on ITE’s *Trip Generation Manual* using the procedures of ITE’s *Trip Generation Handbook*. DelDOT may approve different trip generation rates when trip generation data is not available in ITE’s *Trip Generation Manual* or if different methods are justified.

The ninth edition of ITE’s *Trip Generation Manual* does not specifically address duplex dwellings, defined as single structures, each containing exactly two distinct dwellings. For the purposes of this chapter treatment of duplex dwellings shall be consistent with their architectural characteristics, (i.e., structures in which two dwellings resembling single-family detached houses share a common wall shall be treated as two single-family detached houses; structures in which two dwellings resembling townhouses share a common wall shall be treated as two townhouses; and structures, in which the dwellings are stacked, one above the other, shall be treated as apartments or condominiums, depending on their form of ownership. DelDOT shall provide the final determination on how a building is to be classified based on its characteristics.

Previous traffic counts at similar sites for the same use may be used with the approval of DelDOT. If new counts are to be done to determine a trip generation rate, the sites to be counted shall be subject to DelDOT review and approval and DelDOT shall be given sufficient notice of the counts that they may be observed to ensure accuracy. Secondary measures of traffic, such as receipt counts or parking lot traffic may be accepted in some cases. In all cases, the method of trip generation must meet with the approval of DelDOT.

A tabular summary indicating the entering, exiting and total trips for a.m., p.m., and weekend peak hours and the weekday and weekend daily trips shall be provided.

### **2.2.8.7 Trip Distribution**

Prior to the scoping meeting, DelDOT shall develop a trip distribution for the p.m. peak hour traffic. DelDOT shall provide that distribution to the consultant at the scoping meeting.

The TIS shall provide:

- A. Trip distribution documentation in the form of a narrative of rationale and procedures, possibly including use of a travel demand model or a site specific survey. Traffic generated by the proposed

development shall be distributed within the study area using engineering judgment based on knowledge of surrounding traffic characteristics.

- B. Proposed trip distributions for the developments to be addressed in the TIS shall be submitted for review with the traffic counts.
- C. Road network diagram(s) of percentage distributions to and from the site shall be included in the TIS report.
- D. Trip distribution shall be done by assigning percentages of the traffic entering and leaving the site to the principal directions of travel. This shall be done separately for different types of land use within the site. Generally, inbound and outbound percentage distributions in the a.m. peak hour should be the reverse of the p.m. peak hour. Where a different distribution is used, it must be justified.
- E. The source of the distribution assumptions shall be noted in this section if it is not original to the report.

#### **2.2.8.8 Traffic Assignment**

Prior to the scoping meeting, DelDOT shall develop a trip assignment for the p.m. peak hour traffic. DelDOT shall provide that distribution to the consultant at the scoping meeting.

Road network diagrams of traffic assignment shall be included in the report.

The traffic assignment shall follow logically from the trip distribution. Any special conditions must be explained.

Peak-hour traffic volumes covering the analysis area shall be depicted graphically. They must identify site generated, background, pass-by, and total traffic.

Entering and exiting traffic shall be routed on public roadways and the Applicant's site unless Applicant can demonstrate that there is or will be a cross-access easement. Routing on any other site shall be permitted only with the expressed approval of DelDOT.

The source of the assignment shall be noted in this section if it is not original to the report.

#### **2.2.8.9 Pass-By and Internal Capture Trips**

The source for determining pass-by and internal capture trips, such as the *ITE Trip Generation Handbook*, must be used as directed and approved by DelDOT. DelDOT, at its sole discretion may provide guidance to apply pass-by percentages where no information is provided in the *ITE Trip Generation Handbook*.

Justification shall be provided for any credits or reductions for pass-by trips or mixed-use developments. Included shall be an explanation of how these trips are being captured and a demonstration that the existing traffic volume is high enough to support the pass-by rates used. Assumed internalization must be supported by a sketch plan showing a balanced and interconnected site circulation system.

It is important to discuss procedures for estimating pass-by trips and internal capture trips at the Scoping Meeting. An agreement on the rates or an agreement on the approach must be reached at the meeting and included in the Scoping Meeting Memorandum.

### **2.2.8.10 Future Traffic**

Road network diagrams of future peak hour traffic, both with and without site traffic added, shall be included in the report.

There are three acceptable ways of projecting future peak hour traffic:

- A. Through growth factors by which existing volumes should be multiplied
- B. Through assumptions made, in conjunction with, and subject to the approval of, DeIDOT and the local zoning/land development agency, as to types and levels of development for the undeveloped land in the study area which are then used to generate and distribute trips for these developments
- C. Through use of forecast volumes from a DeIDOT travel demand model

DeIDOT shall determine which method, or combination of methods, is appropriate and will consider local requirements in making its determination.

DeIDOT shall provide applicable growth factors and/or, if the land development agency requests, a list of committed development to address.

Future peak hour traffic should be calculated for conditions in the project's year of completion (build out year) and, if specified by DeIDOT, at other significant conditions such as before or after highway projects are completed:

For residential developments, calculation of the project's year of completion shall assume a total of two years from the Scoping Meeting date for design and plan approvals and a minimum of one year per 50 dwelling units, provided that for a development containing two or more dwelling types (detached houses, townhouses, and apartments) the calculation may be based on the dwelling type that predominates; for developments consisting of apartments only, DeIDOT may approve an earlier year of completion provided that it is at least three years from the Scoping Meeting date.

For non-residential developments, calculation of the project's year of completion shall assume a total of two years from the scoping meeting date for design and plan approvals and a minimum of one year of construction.

An exception to the assumption of two years from the scoping meeting date for design and plan approvals may be permitted at DeIDOT's sole discretion if the applicant provides a letter from the local land use agency advising that plan approvals can be expected sooner.

When projecting future traffic for locations that are presently saturated, the projections shall be based on counts of the arrival (demand) volumes. Analysis of saturated conditions is further addressed in Section 2.2.8.11.6.J.

Peak hour factors for use in the analysis of future conditions shall be determined when the future volumes are calculated. Future peak hour factors shall be subject to DeIDOT review and approval as part of the Preliminary TIS. Calculation of peak hour factors is further addressed in Section 2.2.8.11.6.F.

Heavy vehicle percentages for use in the analysis of future conditions shall be determined when the future volumes are calculated. Future heavy vehicle percentages shall be subject to DeIDOT review and approval as part of the Preliminary TIS. Heavy vehicle percentages are further addressed in Section 2.2.8.11.6.H.

### **2.2.8.11 Analysis**

#### **2.2.8.11.1 General Criteria**

The impact analysis section shall include a narrative of the standards and methodology used for each element of the analysis.

The TIS shall evaluate access, safety, operation, capacity, circulation, level of service, and performance of the transportation system within the proposed development's Study Area as outlined in this section.

The TIS shall include analysis results in tabular format wherever possible. Tables shall show evaluation criteria, including level of service and delay, for all intersections and roadway segments identified in the Scoping Meeting Memorandum for analysis for each of the following applicable conditions:

- A. Existing
- B. Future without Project
- C. Future with Project and proper entrance
- D. Future with Project, proper entrance, and off-site improvements

#### **2.2.8.11.2 Safety Evaluation**

Existing and potential safety problems resulting from conflicting turning movements between and among entrances, intersections, and internal traffic shall be corrected or improved as required.

Entrances on both sides of the streets fronting the site, in both directions, shall be shown on the site plan at lengths as indicated in Figure 3.4.2-a in Chapter 3. The safety evaluation shall include a discussion and, where necessary, calculations demonstrating that movements to and from the entrance will not conflict with the turning movements from adjacent entrances.

On-site entrance stacking and queuing impacts, the on-site roadway network for the project, and the potential for shared access with adjacent development also shall be assessed.

#### **2.2.8.11.3 Geometric Design, Operational and Circulation Improvements**

- A. Geometric design, operational and circulation improvements including, but not limited to, acceleration lanes, deceleration lanes, turning lanes, traffic signals, roundabouts, creation of one-way streets, and channelization shall be considered, evaluated, and required when determined necessary.
- B. No operational analysis completed under the TIS process shall be construed to relieve the Applicant of any operational analysis required during the access review for the development.
- C. The need for auxiliary lane analysis should be examined at all intersections itemized and included within the study area outlined in the Scoping Meeting Memorandum.
- D. Auxiliary lanes at entrances shall be examined in accordance with Section 5.2.9, Auxiliary Lanes.
- E. For auxiliary lanes at intersections beyond the site entrances, the following rules apply:
  - 1. Where auxiliary lanes exist at signalized intersections, or a need for them is identified through the Level of Service Analysis discussed in Section 2.2.8.11.6, their storage length should be evaluated or determined in accordance with Section 2.2.8.12.3.D. Deceleration lengths and tapers should be evaluated or determined in accordance with current DelDOT guidance and resources.

See Section 5.2.9, Auxiliary Lanes and the derived Auxiliary Lane Worksheet (<http://devcoord.deldot.gov> > Forms) for more info.

2. At intersections with two-way stop control (includes tee intersections), if auxiliary lanes do not exist and the Level of Service Analysis does not identify a need, the need for major street left turn lanes shall be further evaluated in accordance with applicable guidelines and design standards such as: HCM, *the Green Book*, Section 7.5 of DelDOT's RDM or **NAS**. If, at a specific intersection, the subject development will not add traffic to a major street left turn, this evaluation shall not be required.
3. At intersections with all-way stop, roundabout or signal control, if auxiliary lanes do not exist and the level of service analysis does not identify a need, no further analysis shall be required.
4. The volumes analyzed should be for the future year(s) identified in the Scoping Meeting Memorandum.
5. Average Daily Traffic (ADT) volumes shall be calculated as 10 times the weekday p.m. peak hour volumes for the Future With Project (FWP) condition unless otherwise specified by DelDOT in the Scoping Meeting Memorandum or the review of the Preliminary TIS.

#### **2.2.8.11.4 Adequacy of Sight Distance**

Entrance and intersection sight distance requirements shall meet DelDOT standards.

Adequacy of sight distance shall be demonstrated at:

- A. Identified locations within the scope of work area
- B. The proposed road access point(s) for both the existing road configuration and for the ultimate road configuration based on improvements planned for the development and improvements identified in the transportation element of the local government's Comprehensive Plan.

#### **2.2.8.11.5 Impacts and Opportunities for Bicycles, Pedestrians and Transit**

- A. The analysis shall identify and evaluate related impacts on bicycle, pedestrian, and transit access, circulation, and facilities.
- B. Opportunities to provide for improved bicycle, pedestrian and transit access and circulation shall be noted in the analysis.

#### **2.2.8.11.6 LOS Analysis**

- A. A Level of Service analysis will be used to determine the impacts and required improvements, if any, that a proposed site will have on the roadway network within the study area.
- B. Capacity analyses shall be completed for all intersections, roundabouts, roadway sections, weaving sections and ramps itemized and included within the study area outlined in the Scoping Meeting Memorandum.
- C. The TIS shall include a LOS analysis for each of the following conditions:
  1. Existing
  2. Future without project (FWOP)
  3. Future with project and proper entrance (FWP)
  4. Future with project, proper entrance and off-site improvements (if needed) (FWP and improvements)

Results of the LOS analysis for each condition shall be provided in a tabular format that includes the LOS and delay for each approach analyzed at each analysis location.

- D. Analysis Criteria and Assumptions – Unless expressly authorized by DelDOT, all analyses shall be done in accordance with TRB’s *Highway Capacity Manual* (HCM).
- E. Analysis Software – In general, the analysis should be completed using the Highway Capacity Software (HCS) that implements the HCM, and include completed input worksheets from the HCM software analysis, as well as any printed output from the software. If a detailed output format is submitted, then input worksheets are unnecessary. In addition to, or in place of, analyses using HCS, DelDOT may require corridor analysis, using Synchro or similar software, and simulation analysis, using SimTraffic or similar software. Exceptions to the use of HCS should be identified in the Scoping Meeting if possible.
- F. Peak Hour Calculations – The Applicant’s engineer shall calculate the peak hour factors for existing conditions. Except where saturated conditions exist (see Item J. below) or where directed otherwise by DelDOT to account for an unusual condition, the Applicant’s engineer shall use the total entering volume to determine the peak 15-minute interval and the peak hour and then compute an overall intersection peak hour factor (PHF). Generally existing PHFs shall be applied to future conditions as well. DelDOT may, on review of the existing and projected traffic volumes, authorize use of one of the following three PHFs to be selected according to the total intersection volume in the future conditions. For a total intersection volume of 500 vph or less, use 0.80. For a total intersection volume of 500 vph to 1,000 vph, use 0.88. For a total intersection volume over 1,000 vph, use 0.92.
- G. Lane Utilization Factors – Except as directed by DelDOT, all signalized intersection analyses shall use the HCM default lane utilization factors.
- H. Percentage of Heavy Vehicles – The Applicant’s Engineer shall calculate the percentage of heavy vehicles from traffic counts. For unsignalized intersections, the percentage of heavy vehicles shall be calculated separately for each turning movement. For signalized intersections, the percentage of heavy vehicles shall be calculated separately for each lane group. Where DelDOT finds the traffic counts to be a poor indicator of future heavy vehicle percentages, e.g. where the counts are very low and significant growth is expected, DelDOT may authorize the use of the following default values: 7% and 9% for two-lane highways and multi-lane highways, respectively, in rural areas; 6% and 8% for two-lane highways and multi-lane highways, respectively, in all other areas; and 3% for intersections. To account for traffic from specific uses that generate high heavy vehicle volumes, e.g. industrial facilities, or low heavy vehicle volumes, e.g. residential developments, DelDOT may specify higher or lower percentages.
- I. Base Saturation Flow Rates – North of the Chesapeake and Delaware (C&D) Canal, base saturation flow rates for signalized intersections shall be maintained at the HCS default value of 1,900 pcphgpl. South of the C&D Canal, base saturation flow rates for signalized intersections shall be reduced to 1,750 pcphgpl unless data is available or provided to indicate that a higher value is appropriate. Procedures for collecting such data are provided in Chapter 16, Appendix H of the 2000 HCM and Chapter 31 of the 2010 HCM. The Applicant’s engineer is encouraged to collect data where little or none is available.
- J. Saturated Conditions – Where a road segment, or one or more approaches of an intersection, is observed to be saturated for existing conditions (See Section 2.2.8.5, item 19) the Applicant’s engineer shall use demand volumes and a PHF of 1.00 and shall analyze a minimum of the highest four consecutive 15-minute periods. The number of 15-minute periods analyzed generally shall be expanded to capture the entire peak period. Where saturated conditions exist for several hours at a time, DelDOT may, on review of the traffic counts, authorize analysis of as few as the highest four consecutive 15-minute periods.

For analysis of future conditions, where the existing condition is saturated and saturation is expected to continue, the demand volumes for each of the highest four consecutive 15-minute periods shall be increased equally to project future volumes (unless there is a known reason to weight the increase to one or more specific periods), a PHF of 1.00 shall be used and multi-period analysis shall be performed for the highest four consecutive 15-minute periods.

### **2.2.8.12 LOS Standards**

#### **2.2.8.12.1 General**

LOS standards shall be applied based on the location of the proposed development.

##### **A. Development in Developed, Developing or Planned Development Areas:**

If a proposed development is located within a developed, developing or planned development area, all intersections, roundabouts, roadway sections, weaving sections and ramps analyzed will be subject to the LOS standards for those areas even if the intersection, roundabout, roadway section, weaving section or ramp is in a rural area.

##### **B. Development in Rural Areas:**

If a proposed development is located in a rural area, all intersections, roundabouts, roadway sections, weaving sections and ramps shall be subject to the LOS standards for such areas even if the intersection, roundabout, roadway section, weaving section or ramp is inside a developed, developing or planned development area.

##### **C. Local Government Standards:**

DelDOT recognizes that the standards in this manual will not be appropriate to all areas. A local government, as part of its adopted comprehensive plan, may determine that acceptance of a lower LOS (D, E or F) for some portion of the day is necessary and appropriate for the pattern of development they seek to create. If a proposed development is located in, or affects, such an area, DelDOT will consider the local government's standards to the extent that adherence to them does not result in substandard LOS or an unacceptable operational condition outside that area.

##### **D. Development in Areas Designated for Re-Development:**

If a proposed development is located in an area, or on a land parcel or parcels of land, designated as a "re-development" site by either state or local government, with local government concurrence DelDOT may accept the existing Level of Service provided that the proposed development makes sufficient improvements, to DelDOT's satisfaction, to retain the existing measured Level of Service.

#### **2.2.8.12.2 Uninterrupted-Flow Standards**

LOS for uninterrupted-flow locations will be measured by density and volume to capacity ratio (V/C) and conform to the values shown in the appropriate exhibits in the HCM (Exhibits 15-3, 14-4 and 11-5 of the 2010 HCM).

When a development is in a developed, developing, or planned development area, an increase in the uninterrupted-flow V/C ratio to the low point of LOS D (approaching LOS E) will be allowed.

When a development is in a rural area, an increase in the uninterrupted-flow V/C ratio to the low point of LOS C (approaching LOS D) will be allowed in the FWP condition.

In analyzing facilities for which HCS does not calculate V/C ratios, e.g. multi-lane highways and freeways, separate calculation is required as determined by DelDOT.

### **2.2.8.12.3 Signalized Intersection Standards**

All signalized intersections shall be analyzed using the following criteria for evaluating impacts and needed improvements:

- A. Sites in developed, developing or planned development areas: For each intersection, deterioration up to 55 seconds (the bottom of LOS D) will be allowed for the FWP Condition.
- B. Sites in rural areas: For each intersection, deterioration up to the 35 seconds (bottom of LOS C) will be allowed for the FWP condition.
- C. For saturated conditions, multi-period analysis shall be required and overall intersection delay for the peak period shall be calculated as the mean overall intersection delay for the four peak 15-minute periods.
- D. Regardless of LOS, for unsaturated conditions, DelDOT shall require turning lane improvements to accommodate 95th percentile queue lengths. For saturated conditions, DelDOT shall require turning lane improvements to accommodate 80<sup>th</sup> percentile queue lengths for fourth of the four peak 15-minute periods.
- E. The analysis shall document that the impacts of queuing from adjacent intersections or traffic restrictions have been addressed.
- F. The analysis shall document the interaction of conflicting movements at adjacent entrances.
- G. The analysis shall note changes made in signal timing and phasing (i.e. protected, permitted, etc). The Applicant shall obtain approval from DelDOT prior to incorporating phasing changes in its analysis.
- H. Minimum green times must be equal to or greater than minimum pedestrian crossing times on each approach unless specifically authorized by DelDOT.
- I. If there is a traffic signal within 2,640 feet of the site, an arterial analysis as in the HCM Chapter 15 may be required.
- J. In determining the signal timing for FWOP it shall be assumed that the existing traffic signal hardware will still be in use. Any recommendations for timing modification must be supported by the hardware and appropriate for the future year no-build traffic volumes. The build analysis may use traffic signal timing changes that are possible with new traffic signal hardware, provided the hardware is a recommendation for mitigation, and should comply with the standards for progression.

In addition to the HCM analysis, the TIS shall include Critical Movement Summation forms in an Appendix to the TIS for all existing or proposed signals. CMS calculations shall be done using the standard form shown in Figure CMS-4 in DelDOT's *Critical Movement Summation (CMS) How-To Guide* which can be found online (for more information go to <http://devcoord.deldot.gov> > Guidance).

### **2.2.8.12.4 Roundabouts**

References to the HCM and HCS notwithstanding, the 2010 HCM shall be used for the analysis of roundabouts. For developments in developed, developing or planned development areas, the minimum acceptable LOS shall be D. For developments in rural areas, the minimum acceptable LOS shall be C.

### **2.2.8.12.5 Unsignalized Intersection Standards**

For unsignalized intersections LOS will be measured by control delay per the appropriate exhibits in the HCM (Exhibits 17-2 and 17-22 of the 2000 HCM, or Exhibits 19-1 and 20-2 of the 2010 HCM).

Turns may not cause excessive disruption to through traffic and may not be allowed when acceptance of substandard gaps is promoted. In some cases, elimination of the movement and diversion of the demand to a nearby location is the preferred treatment. Comments on the interaction of conflicting movements at adjacent access points may be required.

For developments in developed, developing or planned development areas, the maximum allowable delay for each movement shall be 35 seconds (bottom of LOS D) in the FWP condition.

For developments in rural areas, the maximum allowable delay for each movement shall be 25 seconds (bottom of LOS C) in the FWP condition.

Unacceptable delay during a peak hour at a site entrance is not necessarily a justification for the installation of a traffic signal. While the installation of a signal may be appropriate at some point, in which case an agreement to fund that signal shall be required, DelDOT determines whether to install signals on the basis of 12-hour warrant studies.

Where the FWP volume on a stop-controlled approach would be 10 vph or less, any LOS problem that might exist is considered to be negligible and its mitigation is not required.

#### **2.2.8.12.6 Weaving Area Standards**

For the weave area, LOS will be measured by weaving speed and non-weaving speed and conform to the values shown in the appropriate exhibits in the HCM (Exhibit 12-10 of the 2010 HCM).

For non-freeways, the potential for site traffic to cause deterioration of the weaving area traffic flow and the methods to quantify such deterioration shall be discussed at the scoping meeting. Although weaving and non-weaving speeds are independent, it is desirable that these speeds be balanced. The addition of FWP traffic shall maintain the balance.

#### **2.2.8.12.7 Ramp Standards**

Ramp standards are based on density, the primary measure of effectiveness, and the level of service criteria shown in the appropriate exhibits in the HCM (Exhibit 13-2 of the 2010 HCM).

- A. For a study location applicable to a site in a developed, developing or planned development area, with a merge or diverge influence area, the maximum allowable density shall be to 35 pc/mi/ln (bottom of LOS D) in the FWP condition.
- B. For a study location applicable to a site in a rural area, with a merge or diverge influence area, the maximum allowable density shall be 28 pc/mi/ln (bottom of LOS C) in the FWP condition.

### **2.2.9 Traffic Impact Studies - Mitigation Identification**

In order to protect the Delaware transportation system from potentially adverse impacts of the proposed development, to fulfill an identified need for public services within the impacted area related to the development, or both, mitigation measures will be required when deficiencies have been identified or LOS results do not meet the standards set forth in Section 2.2.8.12.

The TIS shall identify methods of mitigating on-site and off-site deficiencies for present and proposed phases of the development. The report shall indicate the level of improvement to the deficiency, including the capacity deficiencies identified in Section 2.2.8.12, provided by the mitigation.

[Guidance] The focus of the traffic analysis or mitigation should not be limited to the specific location where an unacceptable deterioration of the LOS standards has been identified. In many cases it is preferable to direct site-generated traffic to other roadways. In other cases, improvements apart from the deficient location may divert enough background traffic to make room for the site generated traffic and thus mitigate the impacts. Most capacity analyses assume that each intersection is acting independently; therefore, the analysis must account for the presence and operational characteristics of adjacent entrances.

The TIS shall list any factors that have been modified during analysis and the reasons for the modification.

Build out year and project phasing impacts shall be considered in the mitigation section of the report.

Mitigation shall be consistent with improvements identified in the transportation element of the relevant local government's Comprehensive Plan. At a minimum, the TIS shall consider ultimate rights-of-way and additional streets, bicycle, transit, and pedestrian connections and extensions and intersection improvements that are identified in the Transportation Element of the relevant local government's Comprehensive Plan. Mitigation measures may also include, but are not limited to, additional street connections and street extensions, turn lanes and turn lane extensions, signalization, signal modifications, installation of medians, shared access and other access management strategies, geometric improvements such as lane geometry improvements, and intersection realignments, structure widenings, frontage roads, local or collector roads, and alternative access.

Where stop-controlled intersections do not meet the minimum performance standard, an additional street connection or a street extension to distribute traffic from the site to another access point, preferably on a different road, shall be considered as a potential mitigation measure.

Mitigation measures must be evaluated with regard to their operational safety and effectiveness before being recommended. A measure that provides adequate capacity but creates an operational problem is not acceptable.

Mitigation measures must also be evaluated with regard to their context. As mentioned above, mitigation shall be consistent with improvements identified in the transportation element of the relevant local government's Comprehensive Plan. The transportation element of such a Plan should include any designated Delaware Byways, but regardless, any proposal to widen or otherwise improve a designated byways must be consistent with the Management Plan for that byway if such a plan exists.

[Guidance] Mitigation measures with regard to transit (See Section 2.2.8.11.5) may include waiting pads, sidewalk, benches, shelters, crosswalks and financial contributions toward such facilities, bus service or the maintenance or expansion of Park and Ride Facilities. It is important to recognize that most of the mileage on most bus routes is two-way: buses follow the same set of roads first in one direction and then in the other. Therefore, bus stops and their associated facilities ordinarily should be installed in pairs on opposite sides of the road. Where this has not occurred previously, an important mitigation measure may be to install the missing stop and facilities on the opposite side of the road.

Mitigation measures that involve changes in the number or usage of lanes at an intersection or the phasing at a signalized intersection will require conceptual approval from DelDOT prior to submission of the TIS. If the Applicant's engineer or DelDOT's engineer proposes mitigation that involves such measures, then they shall meet with representatives of DelDOT's Traffic and Development Coordination Sections, preferably at the same time, to discuss those changes and seek approval before submitting the TIS for review. If a measure is not approved, the engineer is responsible for finding an acceptable alternative. The engineer shall document the meeting(s) in the TIS, including the date(s) of the meeting(s), the names

of those attending, the measures discussed, and the results of the meeting(s). Failure to obtain approval for mitigation measures that require it shall be cause for DeIDOT to return the TIS for revisions.

[Guidance] The mitigation section of the TIS may include a travel demand management plan in accordance with DeIDOT and local requirements. This is an optional plan. The trip reduction anticipated in an approved travel demand management plan shall be deemed to reduce the site trips, thereby also reducing site traffic impacts and associated fair share financial obligations.

### **2.2.10 Traffic Impact Studies - Recommendations**

If safety or capacity analyses using the existing or anticipated highway system and full development show that unsatisfactory levels of service will result, or that pedestrian, bicycle and transit accessibility, safety or compatibility is compromised, recommendations should be made as to how this may be prevented.

Recommendation Narrative – A narrative discussing the recommendations, including a development phasing plan, if needed, to maintain Levels of Service in accordance with Section 2.2.8.12 shall be included in the recommendations.

Access Driveway/Entrance – In all cases, a site entrance that meets the requirements of access in accordance with DeIDOT's *Development Coordination Manual* shall be required.

All proposed improvements shall be supported by, and consistent with the analyses performed.

The following types of recommendations are anticipated:

- A. Phasing development to the completion of programmed highway projects
- B. Reducing the proposed density of development (where appropriate), or construction of off-site improvements by the Applicant
- C. Improvements necessary for safe and efficient flow of vehicle, bicycle, pedestrian, and transit movements and access
- D. Operational improvements to the roadway network
- E. Travel Demand Management Strategies

#### **2.2.10.1 Depiction and Inclusion of Recommendation Support**

All proposed recommended mitigation improvements that involve signing, striping or construction, including needed off-site improvements, as well as all site entrance(s) shall be illustrated at a scale of no more than 1" = 100', with 1" = 50' or 1" = 30' preferred. The drawing(s) shall show both existing and the recommended improvement conditions. In cases where improvement conditions repetitively extend, the improvements may be shown with line extensions between the end points of the improvement if there are no significant changes to the proposed features within the extensions.

If the recommended improvements include the installation of a traffic signal or the re-timing of an existing signal, the proposed timing shall be appended to the TIS. Proposed signals that would be needed the day a development opens, such as at a shopping center entrance, shall be supported by 12-hour MUTCD warrant investigations. Copies of those investigations shall be appended.

### **2.2.11 Traffic Impact Studies - Required TIS Appendices**

Appendices shall include the following:

- A. Traffic count summary sheets
- B. Collision diagrams
- C. List of committed developments
- D. Trip generation, distribution and assignment calculations for the subject development and all committed developments
- E. Capacity analysis worksheets or reports
- F. Critical movement summation forms and signal timing sheets for all signalized intersections in the study area
- G. DelDOT and Applicant correspondence
- H. Support for recommendations

## **2.3 TRAFFIC OPERATIONAL ANALYSIS**

A Traffic Operational Analysis (TOA) is an evaluation or series of evaluations conducted during the review of subdivision, land development and entrance plans primarily intended to determine site entrance location and movements to be allowed at the site entrance. These evaluations may include Queuing Analysis, Highway Capacity Manual (HCM) Analysis, and Crash Analysis. A TOA is usually, but not always, more limited in scope than a TIS.

### **2.3.1 Traffic Operational Analysis - Introduction**

To ensure safe access to all proposed land development plans, the developer may be required to prepare an operational analysis for review by DelDOT. This operational analysis shall consist of but is not limited to one or more of the following evaluations:

- A. Queuing Analysis – This analysis is required to determine whether existing and proposed left-turn lane at the site entrance and nearby intersections is adequate. The 95th percentile maximum queue shall be used for the purpose of this analysis.
- B. Highway Capacity Manual (HCM) Analysis – This analysis is required to determine whether the operation of the site entrance and nearby intersections is adequate. HCM analysis should follow the requirements as described in Section 2.2.2.
- C. Crash Analysis – This analysis is required if the entrance is proposed at a known or alleged high crash location to determine whether a problem exists, and if so, how the entrance might relate to the problem, and what remedies might be possible.

This information shall be used to determine what modifications or improvements need to be made to ensure safe access to the State-maintained roadway system.

### **2.3.2 Traffic Operational Analysis - Rules for a Requirement of a TOA**

DelDOT may require a TOA for any development project that is expected to generate 200 or more vehicle trips per day and for which a TIS was not completed. DelDOT shall require a TOA for such a project if:

- A. As part of a plan review process, DelDOT identifies a potential problem in the operation of the site access, such that information obtainable through a TOA is needed to properly review the plan and determine what access to permit.
- B. In considering whether a development should be required to participate in a TID or instead perform a TIS (See Section 2.2.2.4.) DelDOT or the County determines that additional LOS information is needed at the site access or an adjoining intersection. For example, information may be needed to determine whether a local concurrency requirement is met.

If a development project's scope changes after DelDOT and the Applicant have agreed upon the initial scope of study, DelDOT may revisit the scope of a TOA that is being prepared, or require a new TOA or a Traffic Impact Study (TIS).

If the TOA is not needed with respect to Section 2.2.2.4 and the project developer agrees to make traffic improvements determined by both the Subdivision Engineer and the Chief Traffic Engineer, or designee, to adequately address the concerns that prompted the initial requirement of a TOA, DelDOT may waive the requirement for the TOA.

Projects that do not generate 200 or more vehicle trips per day will not be required to complete a TOA.

The TOA, if required, must be reviewed and accepted by DelDOT prior to the issuance of a Letter of No Objection to Recordation.

Other traffic analyses that may be required in addition to a TIS or TOA in the review of land development plans may include traffic signal justification analysis, and/or the development of a Transportation Management Plan (TMP). A traffic signal justification analysis will likely be required to be performed by the developer if it is desired or expected that a new traffic signal will need to be installed concurrent with or soon after the opening of a new development. A TMP may be required for large projects, or projects that impact roadways on the National Highway System (NHS).

### **2.3.3 Requirements of a New TOA**

If a TOA is prepared for a proposed development and DelDOT finds that existing or projected future conditions in the study area have changed significantly after the completion of the TOA, DelDOT may require a new, revised, or updated TOA at its sole discretion before issuing a Letter of No Objection to Recordation or, where a DelDOT Letter of No Objection to Recordation is not required, before approving entrance plans. DelDOT will take reasonable measures in scoping the study to avoid the need for additional work once the study is complete. However, it is the Applicant's responsibility to obtain plan approvals while their TOA is still valid and to demonstrate that validity as necessary.

## **2.4 TRANSPORTATION IMPROVEMENT DISTRICTS**

### **2.4.1 Transportation Improvement Districts - Introduction**

A Transportation Improvement District is a geographic area defined for the purpose of securing required improvements to transportation facilities in that area.

Essential to the creation of a Transportation Improvement District (TID) is the development of a comprehensive and specific plan for land use and transportation within the geographic area of the District. The existence of such a plan allows DelDOT and the local land use agency(ies) to assess developers building in accordance with the plan for the cost of needed transportation improvements in a more comprehensive way than a TIS specific to one development affords. See also Section 2.2.2.4 regarding the relationship between TIDs and TIS.

It is to be expected that there will be significant differences between TIDs in the terms of their land use and transportation characteristics. Because DelDOT creates TIDs in partnership with local governments there will necessarily be differences in their administration as well. The purpose of Section 2.4 is to set forth DelDOT's requirements and recommendations for the elements of a TID.

A TID may include lands under the jurisdiction of more than one local government. Particularly near municipal boundaries, this condition is to be expected.

### **2.4.2 Transportation Improvement Districts - Required Elements**

#### **2.4.2.1 Land Use and Transportation Plan (LUTP)**

An LUTP should be completed for the TID based upon the forecast described in Section 2.4.2.5 below, identifying the improvements needed to bring all roads and other transportation facilities in the TID up to applicable State or local standards, including the service standards described in Section 2.4.2.6 below.

#### **2.4.2.2 TID Agreement**

DelDOT and the local government(s) in whose jurisdiction(s) the TID is located should enter a written agreement regarding it and addressing the following subjects:

- A. The initial boundaries and target horizon year for the TID and procedures for amending them
- B. Roles and responsibilities with regard to creation of the LUTP
- C. Service standards to be used in developing the LUTP (See also Section 2.4.2.6)
- D. Implementation of the improvements identified in the LUTP (See also Section 2.4.2.8)

#### **2.4.2.3 Boundaries**

A TID must have distinct boundaries such that one can determine what parcels are in the TID and what parcels are not. Where possible those boundaries should follow geographic features that are easily identified, are rarely altered and generally do not cross parcel lines, such as railroad lines and major drainage courses. An exception to this rule is that roads are not desirable boundaries. Absent a good reason to the contrary, TID boundaries should follow Traffic Analysis Zone (TAZ) boundaries for ease in working with population and employment projections (See Section 2.4.2.5 below).

#### **2.4.2.4 Target Horizon Year**

A TID must have a target horizon year for which population and employment is forecast in creating the TID. Usually, but not always, this year should be 20 years from the creation of the TID. As the LUTP for the TID is revised (See Section 2.4.2.7 below) the target horizon year may be adjusted.

#### **2.4.2.5 Land Use Forecast**

The LUTP for the TID must include a quantitative, parcel-specific forecast of land use in the TID. The forecast can be either in terms of population and jobs (classified by employment type) or in terms of numbers of dwelling units and floor areas of non-residential uses, such that DeIDOT can calculate population and jobs. The forecast must have the following components:

- A. Existing land use as of a specific date
- B. Development approved and/or recorded but not yet built as of that date
- C. Development expected or in the land development process but not approved as of that date
- D. Development not yet proposed but projected by the target horizon year, based on population and employment forecasts, and the current Comprehensive Plan(s) and zoning map(s)

#### **2.4.2.6 Service Standards**

Service standards must be established for the TID, in the creation of the LUTP, to specify what is considered adequate transportation infrastructure. Service standards may include Levels of Service but shall also include desired typical sections for local, collector and arterial streets, and standards for the presence and frequency of transit service. Typically one standard will apply throughout the TID but there may be locations where a different standard is specified. The standards should be set collaboratively by DeIDOT and the local governments involved, with some measure of public involvement. Review and approval of the standards by a local government committee at a public meeting constitutes public involvement.

#### **2.4.2.7 Adoption in the Local Governments' Comprehensive Plan(s)**

The Comprehensive Plan(s) should list and map any TIDs, and incorporate by reference any completed LUTPs and TID agreements. When a local government updates their Comprehensive Plan, they should also initiate an update of the LUTPs and TID agreements for those TIDs.

#### **2.4.2.8 Infrastructure Fee Program**

Where possible the TID Agreement shall estimate the costs of the improvements contemplated in the LUTP and apportion the cost of those improvements such that developers seeking plan approvals must either make improvements identified in the LUTP or contribute toward improvements to be made by others, and developers doing more than their share of improvements can be compensated. The program will allow developer contributions to take the form of cash payments, construction, land needed for rights-of-way (in excess of those needed for the development streets and dedications addressed in Section 3.2.5) or a combination of the three. Administration of the program should be specific to the TID with which it is associated. For each TID the funds received from developers should be held by DeIDOT, or a participating local government, in a fund dedicated to transportation improvements within that TID alone.

#### **2.4.2.9 Transitional Rules for Certain Pre-existing TIDs**

The terms of the Memorandum of Agreement or other mechanism used to create and implement TIDs or their functional equivalent in existence as of May 10, 2013 may conflict with the Required Elements described in Section 2.4.2 hereof. In such cases, the adoption of these Required Elements in lieu of existing provisions may be negotiated and agreed as between the Department and the participating local governments. Otherwise, the existing terms will continue in force and effect.

#### **2.4.3 Transportation Improvement Districts - Recommended Elements**

##### **2.4.3.1 Master Plan**

Where possible, creation of a TID should be part of the development of a master plan for the area encompassed by the TID. A broad and holistic approach, such as outlined in the *Guide for Master Planning in Delaware* will necessarily yield a better land use forecast and an LUTP with greater public acceptance and support than will a planning effort conducted solely by local land use agency and DelDOT staff.

##### **2.4.3.2 Monitoring Program**

It may be appropriate to make transportation improvements gradually over time. In such situations the TID Agreement should include a program for monitoring conditions in the TID to determine when design and construction of the next level of improvements should be started. Such a program will involve tracking land development, transportation improvements and the need for transportation improvements in the TID and will provide information necessary for updates of the LUTP. Administration of the program should be specific to the TID with which it is associated. A surcharge may be added to the infrastructure fee described in Section 2.14.2.8 to fund the monitoring program.

##### **2.4.3.3 MPO Participation**

[Guidance] Where one exists, a Metropolitan Planning Organization (MPO) can provide assistance in the development and monitoring of an LUTP. An MPO can be of particular value in coordinating land use information where multiple local governments are involved. It may be appropriate to include the local MPO as a party to a TID agreement.

##### **2.4.3.4 Build-out Analysis**

[Guidance] While it is possible to create a TID considering only a target horizon year (See Section 2.4.2.4), examination of conditions when all land in the TID is considered to be fully developed can often be useful in the planning process. If build-out analysis is to be done, the TID Agreement should specify what degree of development is considered to be build-out, and what use is to be made of the results of the analysis.

## **2.5 AGREEMENTS**

### **2.5.1 Agreements - Signals**

The need for installation of new traffic signals and/or the modification of existing traffic signals to accommodate traffic from commercial establishments or subdivisions shall be determined by DelDOT.

When DelDOT, in its sole discretion, determines that a traffic signal may be required in the future or that an existing traffic signal requires modification, the developer shall enter into a Traffic Signal Agreement (TSA) with DelDOT prior to obtaining entrance approval. DelDOT shall consider the need for a TSA in the following situations:

- A. A Traffic Impact Study (TIS) or a Traffic Operational Analysis (TOA) has identified a need for a new signal or modifications to an existing signal.
- B. A DelDOT plan review has identified a need for signal modifications, possibly including implementation of safety mitigation measures identified by DelDOT's Hazard Elimination Program (HEP) and/or installation of pedestrian improvements, to provide for safety. Projects that abut an existing signalized intersection (including corner lots and parcels that have frontage on two roads that intersect at an existing signal) will at DelDOT's discretion be required to perform identified safety improvements and/or pedestrian improvements to complete connections to and/or crossings of that intersection. Pedestrian improvements may include but are not limited to: design, pedestrian signals, crosswalks, curb ramps, refuge islands, sections of sidewalk, conduit, junction wells, signing and striping.
- C. Access to a school is proposed.
- D. Access is proposed as an additional leg at an existing signalized intersection.

The TSA shall be kept on file by the DelDOT Traffic Section and used to assess costs when DelDOT finds it necessary to install or modify a signal at the location addressed in the agreement. The assessed costs will include both construction costs and a onetime fee to cover long-term maintenance costs. The Department will not separately track the maintenance funds collected, and may use these funds for any signal maintenance purpose, statewide.

Should a project impact, or reasonably be expected to impact, DelDOT traffic signal or Integrated Transportation Management Systems (ITMS) infrastructure, the developer may be required to relocate the infrastructure, enter into an agreement to fund the relocation of the infrastructure, or some combination thereof at DelDOT's discretion.

The following representative (but not exhaustive) types of information must be supplied to the DelDOT Traffic Section for the preparation of the agreement. See DelDOT's *Sample Traffic Signal Agreement Letters* which can be found online (for more information go to <http://devcoord.deldot.gov> > Forms).

- A. Name and address of the company or developer entering into the agreement
- B. Name and address of the development or subdivision
- C. Name of all intersections and/or streets affected (location of signal)
- D. Name and title of the person who shall be signing the agreement
- E. Phone number for the person who shall be signing the agreement.

## **2.5.2 Agreements - Off-Site Improvement Agreement**

During the land development process, DelDOT may refer to a previously identified need, or determine the need for road improvements beyond the entrance to the site. These improvements shall be required as part of the entrance approval. The developer shall enter into an Off-Site Improvement Agreement (agreement) with DelDOT outlining the implementation of the improvements. The agreement may include the design, right-of-way acquisition, construction, and inspection of the improvements, or any part thereof, as determined by DelDOT. Alternatively, where there is another party, e.g. DelDOT or another developer, already preparing to make the improvements, the agreement may be for a monetary contribution toward the construction of the improvements. This agreement shall be executed prior to entrance plan approval. See Section 2308 of the Delaware Administrative Code “*2308 Development Related Improvements Requiring New Rights-of-way*” which is available online, (for more information go to <http://regulations.delaware.gov/AdminCode/title2/2000/2300/>) for guidance regarding improvements requiring new rights-of-way and refer to DelDOT’s online content for sample public road construction applications, forms and agreements (for more information go to <http://devcoord.deldot.gov> > Forms ).

## **2.5.3 Agreements - Traffic Mitigation Agreements (TMAs)**

Land use agencies may have adopted specific level of service or adequate facilities requirements. If these requirements cannot be met, the applicant may, through the local land use agency’s process, seek a waiver from such level of service requirements. As a condition of such a waiver, a Traffic Mitigation Agreement between the applicant and DelDOT shall be executed. DelDOT’s participation in such agreements shall not be unreasonably withheld.

## **2.5.4 Traffic Signal Revolving Fund**

Under certain circumstances, described below, a developer has the option of voluntarily contributing to a Traffic Signal Revolving Fund (TSRF) in lieu of entering into a signal agreement. Advantages for the developer include knowing at the outset the amount they will need to pay and when that amount will be due. Advantages for DelDOT include the certainty that the payment will in fact be made and there will be funds available that are derived from a dedicated source of revenue.

DelDOT reserves the right to determine the appropriate location, configuration and implementation of all new and modified traffic signals paid for through use of this TSRF.

### **2.5.4.1 Improvements Qualifying for Use of the TSRF**

The TSRF may be used to plan, design, construct, upgrade and maintain a traffic signal. Appropriate uses include signal equipment, pedestrian signals, crosswalks, curb ramps, refuge islands, sections of sidewalk, conduit, junction wells, cameras, interconnection, signing, striping, engineering and right-of-way needed for the signal installation.

### **2.5.4.2 Improvements Not Qualifying for Use of the TSRF**

- A. If a development directly impacts existing signal equipment, e.g. development of a corner property, the developer must relocate DelDOT’s equipment or pay immediately for the repair, relocation or upgrade of the equipment, or some combination thereof, at DelDOT’s discretion. Use of the TSRF is not applicable or intended for this purpose.

- B. The TSRF shall not be used for turning lanes, realignments, or other geometric improvements.
- C. If Physical improvements are required as per the approved construction plans which require traffic signal modifications or installation, the developer must enter into a Traffic Signal Agreement.

#### **2.5.4.3 Payments into the TSRF**

- A. Any development that is qualified with respect to the criteria described in 2.5.4.1 and 2.5.4.2 and has been determined to be contributing to the future need to modify or install a traffic signal, will be given the option to contribute to the TSRF in lieu of executing a signal agreement that will require future payment. However, if the development has been determined to create the need for a current modification or installation of a traffic signal, then a TSA shall be required, and the TSRF shall not be an available option to pursue.
- B. The Development Coordination Section shall be responsible for informing developers of their option to pay into the TSRF, for determining the amount of their contribution in accordance with Section 2.5.4.5 below, and for ensuring that the funds are received prior to issuing entrance approval.
- C. Concurrent with payment into the TSRF, the developer will enter into a Traffic Signal Revolving Fund Agreement (TSRFA) which will memorialize the fact that they have no further financial obligations associated with a particular development to fund existing or future traffic signals at the intersection or intersections in question. They will also be informed that there is no guarantee a signal will be installed when and where they may want it.

#### **2.5.4.4 TSRF Administration**

- A. DelDOT will pool the funding that is collected from various developers related to various intersections into two separate funds: one for new traffic signals/major upgrades, and the other for regular maintenance. The construction fund may be used by DelDOT to fund a new traffic signal or modify an existing traffic signal related to any land development project. The maintenance fund may be used for any legitimate traffic signal/ITMS maintenance purposes, statewide.
- B. As traffic signal projects become justified, funding from the developer contributions to the Traffic Signal Revolving Fund will first be used. If this fund runs out, then state funding would be used to support the project.

#### **2.5.4.5 Costs and Cost Allocation**

- A. The current construction cost of installing a new signal, for purposes of contribution to the TSRF, is estimated to be \$200,000. This estimated cost will be updated periodically in the future, as costs change. An update of this cost will be documented via a memorandum from the Chief Traffic Engineer to the Assistant Director of Planning, Development Coordination, and will be posted on DelDOT's web site. If a design for a signal has proceeded such that the actual cost is available, this actual cost will be substituted for the estimated cost.
- B. The cost of maintaining a signal is highly variable. For purposes of contribution to the TSRF, the amount is five percent of the amount contributed. This five percent represents an anticipated expense of \$1,000 per year for ten years for a new signal costing \$200,000. The Department will assume maintenance costs that exceed the five percent. Once collected, these funds will be transferred to the signal maintenance operating budget. The Department will not separately track these maintenance funds, and may use these funds for any signal maintenance purpose, statewide.

- C. If a developer must modify an existing signal, the Traffic Section shall prepare a cost estimate specific to the work to be done. An additional five percent of the construction cost will be added for maintenance costs.
- D. A developer seeking access on a State-maintained road with no access opposite them shall pay into the TSRF at 105 percent of the current established signal construction cost (includes five percent for signal maintenance).
- E. If costs are to be allocated based upon proportional share, traffic on all existing movements should be counted. Where possible, existing counts should be used rather than obtaining new ones. Counts done for studies associated with the subject development shall generally be considered sufficiently recent. The Development Coordination Section shall determine whether previous counts can be used.  
  
If costs are to be allocated based upon proportional share, the calculations shall be done using weekday evening peak hour volumes unless the Development Coordination Section determines that another analysis period is more appropriate to the specific situation.  
  
If costs are to be allocated based upon proportional share, and it is necessary to project volumes to and from committed and proposed developments, the projected volumes shall be calculated using ITE's Trip Generation Manual where applicable. The Development Coordination Section shall determine applicability and will rule on any alternative methods of trip generation. The Development Coordination Section shall also develop or review and approve all trip distribution calculations and network assignments.
- F. For intersections beyond the site access, where the need for a future signal or a modification of an existing signal, has been identified, the developer must enter a signal agreement or pay into the TSRF. Payment into the TSRF shall be based on the developer's share of the existing background traffic plus committed and proposed development traffic.

Example:

Approach	Movement	Existing Traffic (vehicles per hour)	Committed Development Traffic (vehicles/hour)	Existing + Committed vehicles per hour)	Proposed Development Traffic (vehicles per hour)
Northbound	Left	50		50	56
	Through	25	25	50	6
	Right	75		75	38
Southbound	Left	50	28	78	
	Through	25	3	28	50
	Right	75	19	94	
Eastbound	Left	50	175	225	
	Through	1,500		1,500	
	Right	75		75	350
Westbound	Left	75		75	500
	Through	1,500		1,500	
	Right	50	250	300	
Total		3,550	500	4,050	1,000

For a new signal, the developer would pay \$41,580 into the TSRF, i.e. 20.79 percent ( $1.05 \times (1,000/(1,000+4,050))$ ) of the cost (\$200,000) of a signal. For a modification of an existing signal, the percentage would be the same but the base cost would be reduced to reflect the smaller construction cost.

Note: The term “committed” shall be interpreted as defined in the Preface, Section P.5 Definitions. The Development Coordination Section shall determine which developments to include as committed in the calculations for a specific intersection and proposed development.

- G. Where a development depends on a nearby intersection for access, e.g. a corner parcel, (including parcels that have frontage on two roads that intersect at an existing signal), that has full access on a minor road and limited or no access on a major road, that intersection shall be treated, for purposes of cost allocation, as a site access, i.e., through movements on the major road shall be excluded from the calculation shown in part F.

## **2.6 SIGNALIZED ACCESS STUDY REQUIREMENTS**

When properly designed and located, traffic signals can safely and efficiently control motor vehicle, pedestrian, and bicycle traffic by assigning the right-of-way at intersections. However, poor placement and design of the traffic signal and associated intersection can lead to excessive delay and increased crash rates. The decision to install a new traffic signal is at the sole discretion of DelDOT. New traffic signals will not be considered for commercial marketing purposes. The following studies will be required to be prepared by the applicant and approved by DelDOT, prior to approval being granted for a new traffic signal:

### **2.6.1 Traffic Signal Justification Report**

If a Traffic Impact Study or Traffic Operational Analysis indicates that a traffic signal may be justified when the development opens to traffic, then the developer will be required to complete a Traffic Signal Justification Report. The report should be completed by a Delaware registered professional engineer and should include the following:

- A. Analysis of existing conditions
  - 1. Approach lane widths
  - 2. Approach lane configurations
  - 3. Location and lengths of exclusive turn lanes (storage and taper length should be noted separately)
  - 4. Other geometric features
  - 5. Horizontal and vertical geometry (description)
  - 6. Roadside features
  - 7. Adjacent land use
- B. Collection and analysis of turning movement count data
  - 1. 12 hours' worth of data is ideal, but 8 hours may be acceptable (include surrounding peak periods)
  - 2. Separate cars from heavy vehicles

3. Separate counts of bicycles and pedestrians

C. Collision data

1. Obtain at least three (3) years of data to be used for the Traffic signal warrant analysis
2. This requirement may be waived at DelDOT's discretion for new intersections

D. Traffic signal warrant analysis

1. Three scenarios are typically analyzed when considering signalization related to developments:
  - i. Existing conditions (Is a signal warranted now?)
  - ii. Build out of proposed site to determine when a traffic signal would be warranted. For example, if the site was commercial, how many operational parcels would warrant a signal? For a residential site, how many lots would warrant a signal? (Multiple scenarios may be required based on the construction schedule. The analysis should reflect the construction schedule, keeping in mind the Plan Review approval process, of the site.
2. Complete build out of the site (Is a signal warranted only when the entire site is built out?)
3. All nine (9) warrants provided in the Delaware Manual on Uniform Traffic Control Devices (DE MUTCD) should be evaluated if they are applicable. Some may not be applicable to the specific location being studied.

E. Intersection Capacity Analysis

1. Evaluate the operation of the intersection based on the outcome of the traffic signal warrant analysis. If a signal is warranted, how will it operate? If not, how will it operate?
2. Evaluate queue lengths at impacted intersection and effected intersections in the surrounding area.
3. Conduct capacity analysis, typically using HCS or Synchro. If the proposed signal is in a corridor and will be coordinated with other signals, now or in the foreseeable future, cycle lengths in the analysis should match existing signal's cycle lengths.
4. Conduct a Critical Movement analysis at the impacted intersection.
5. If applicable, evaluate the impact a pedestrian crosswalk may have at the impacted intersection. A recommended location for the crosswalk(s) should be provided, considering both pedestrian path desire lines and the impact to vehicular traffic.
6. Proposed signal phasing should be noted.

### **2.6.2 Bandwidth Analysis**

If a new signal is being proposed within an existing signalized corridor, then a Bandwidth Analysis may be required. This analysis will ensure that the proposed traffic signal does not negatively impact the progression along a corridor. The analysis may result in a recommendation as to the best location to situate a new signalized intersection along the corridor. Alternately, if the locations cannot be easily adjusted, the analysis may indicate that the intersection should in fact not be signalized, or that the number of lanes required may be more than indicated by a capacity analysis alone (to ensure adequate green time for the mainline corridor).

- A. When a study is required, the study shall be completed and signed by a Delaware registered professional engineer using the following standards:

1. Highway signal progression bandwidth and efficiency analysis including current and anticipated future signalized intersections. The number of signals to be included in the study shall be at DelDOT's discretion.
  2. An optimum signal cycle as determined by DelDOT
  3. Actual speeds as determined by a spot speed study
  4. The goal is to achieve a coordinated, signalized corridor with an optimized highway bandwidth. The requirement is that the bandwidth with the proposed traffic signal be no less than the optimized existing bandwidth without the proposed traffic signal.
  5. The green time allowed for the cross street shall be no less than the time necessary to accommodate pedestrian movements.
- B. The study shall also provide the following information:
1. Notation of all existing access, possible future access locations within the scope of work defined by DelDOT, and all potential roadway and signal improvements
  2. Current and future arterial travel speed, travel time, and delay time
  3. Traffic generation rate estimates
  4. Information, data and reference sources
  5. An evaluation of the level of service for all geometric elements
  6. Accurate and understandable diagrams
  7. All assumptions and adjustment factors
  8. An analysis of all reasonable alternatives including a no build alternative
  9. A conceptual design showing all geometric elements and approximate dimensions with detailed analysis of any elements below code standards

Additional information and additional analysis based upon other factors and standards may be required if determined to be necessary for a complete evaluation.