pennsylvania
DEPARTMENT OF TRANSPORTATION

494-25-07

DATE: 6/4/2025

SUBJECT: Policies and Procedures for Transportation Impact Studies and Assessments

TO: District Executives

FROM: Daniel P. Farley, P.E., Director
Bureau of Operations

for Doug Tomlinson, P.E.

This time reducing and resource neutral Strike-off Letter (SOL) revises PennDOT's Transportation Impact Studies (TIS) and Transportation Assessment (TIA) Procedure as described in Publication 282, the Highway Occupancy Permit Operations Manual.

Pub 282 Appendix A has been updated to provide clarification and reduce redundancy. Changes include:

- Nomenclature alterations and a restructuring of the phases and steps.
- Events that trigger a TIS are now called "conditions" (formerly called warrants). While most conditions remain the same, a TIS is now required if hourly volume exceeds 150 entering or exiting trips.
- The TIS requirement for opening year analyses has been eliminated.
- The study scope for a TIA has been limited to the site accesses and an immediately adjacent intersection.
- The Department will now "accept the recommendations/mitigation" as presented in the study. The applicant will no longer have to revise the TIS/TIA beyond this point for "clean-up" type comments.
- Scoping meetings will now only be held on an as-needed basis.
- Revisions now align with recent changes to the Scoping Application Process.
- Clarification regarding site access requirements in relation to the functional area of adjacent intersections and required driveway movement restrictions.
- Incorporated SOL 494-24-02 relating to warehouse facilities trip generation.

The revised content is effective immediately and will be incorporated into the next update to PennDOT's Publication 282. A copy of Pub 282 Appendix A is attached.

Should you have any questions, please contact Michael J. Dzurko, Manager, HOP Program at (717) 783-6080 or mdzurko@pa.gov.

Enclosure

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APPENDIX A– POLICIES AND PROCEDURES FOR TRANSPORTATION IMPACT STUDIES RELATED TO HIGHWAY OCCUPANCY PERMITS

The following pages are considered a stand-alone document for the development of Transportation Impact Studies but are implemented as part of this policy by incorporation into the Appendices.

POLICIES and PROCEDURES For

TRANSPORTATION IMPACT STUDIES AND ASSESSMENTS

Related to Highway Occupancy Permits

Pennsylvania Department of Transportation
Bureau of Operations

June 2025

pennsylvania
DEPARTMENT OF TRANSPORTATION

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INTRODUCTION

State Highway Law and PennDOT regulations support mobility needs of the traveling public, which are balanced with the needs of property owners accessing the State highway right-of-way.

PennDOT regulation, Title 67 PA Code Chapter 441, *Access to and Occupancy of Highways by Driveways and Local Roads*, provides PennDOT with authority to ensure the location and design of driveways and local roads within State highway right-of-way preserve safe and reasonable access.

PennDOT has established a Highway Occupancy Permit (HOP) Program to control design, construction, location, maintenance, and drainage of driveways for the safety and welfare of the traveling public.[1] PennDOT has regulatory authority to make such investigations and require such additional information as it deems necessary from property owners requesting access to the state highway system.[2]

As part of the process to obtain an HOP, applicants may be tasked with identifying impacts of the proposed access on the transportation system in the surrounding area and identifying mitigations to offset that impact through development of a Transportation Impact Study (TIS) or a Transportation Impact Assessment (TIA).

Once a TIS or TIA is determined to be necessary in the HOP process, PennDOT will review it in accordance with these guidelines, PennDOT regulations governing access to and occupancy of highways by driveways and local roads, and the requirements of the Municipalities Planning Code (MPC). In accordance with the established time period, the MPC requires PennDOT to approve, reject, or return the study for additional information.[3] The regulations allow PennDOT to reject any study submitted for review if it is not satisfied with its genuineness, regularity, or legality.[4]

PennDOT reviews the TIS or TIA to assure safe and reasonable access as well as safe and convenient passage of traffic on the State highway. PennDOT is also responsible for ensuring that driveways safely and efficiently function as an integral component of the highway system based on the amount and type of traffic expected to be served and the type and character of roadway being accessed.[5] PennDOT will use the TIS or TIA to provide direction to the applicant on needed improvements.

The purpose of these Guidelines is to provide direction to the applicant on the requirements of the TIS or TIA, and how it will be used by PennDOT and other levels of government involved in the development review process. The ultimate goal of the process is a safe and efficient transportation system.

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[1] 67 Pa. Code §441.2(a).

[2] 67 Pa. Code §441.3(k)

[3] 53 P.S. §10508(6)

[4] 67 Pa. Code §441.3(k)

[5] 67 Pa. Code§ 441.2(a) and 67 Pa. Code 441.8(a)(1)

Roles and Authority

The roles of the participants in the HOP Process are described below:

PennDOT

PennDOT is the approving agency for all permits to access the state highway system or occupy state-controlled highway right-of-way.

PennDOT is divided into 11 Engineering Districts. The District Permit Office manages the HOP application submission and issuance of the HOP within its respective region. Each District has a sole point of contact for applicants and can provide assistance as needed. They will be responsible for providing Department and Federal Highway Administration (FHWA) review and comment coordination. HOP contacts can be found on the PennDOT website.

PennDOT makes the final determination on design parameters for the TIS or TIA and concept plans. The ePermitting system will send email correspondence to other stakeholders identified by the applicant, which should include the municipality, the county planning office, and the Metropolitan Planning Organization (MPO) or Rural Planning Organization (RPO) in certain instances.

PennDOT coordinates communications and reviews with FHWA if HOP applications involve interstate highway access or improvements within an interstate highway right-of-way.

Municipalities

As described in these guidelines, municipalities are invited and encouraged to participate in the Scoping Application process, TIS or TIA review process, and HOP application review process within their jurisdictions. Municipalities will have the opportunity to provide input on the TIS or TIA scoping limits, TIS or TIA mitigation strategies, as well as concurrence on Alternative Transportation Plans through the HOP process. Applicants must include a record of all correspondence with the municipalities with every submission.

Municipalities are asked to coordinate subdivision and land development approvals with the District Permit Office.

Applicants

As the owner, the applicant determines the type, size, and layout of development that will occur on the property they control, subject to municipal zoning requirements. Applicants should design their site plan consistent with local and regional transportation planning efforts, applying sound land use and congestion management practices.

The applicant is responsible for preparing an HOP application and, when required, a TIS or TIA consistent with these guidelines. The TIS or TIA must be conducted under the supervision of a person who possesses a current Professional Engineer's (PE) license issued by the Pennsylvania Department of State and preferably possessing a Professional Traffic Operations Engineer (PTOE) certification. Each submission of the TIS or TIA must be signed and sealed by a PE licensed in Pennsylvania.

Changes to the proposed use, site layout or other planned elements of the project should be communicated to PennDOT and updates to the HOP application or TIS/TIA will be required when necessary.

Applicants are responsible for notifying the municipality, local transit authorities, county planning, and MPO or RPO of the status of the HOP application as well as inviting them to PennDOT meetings and ensuring they are copied on any correspondence to PennDOT. PennDOT may request evidence that the location and type of highway access has been reviewed by the municipality.[1]

Metropolitan and Rural Planning Organizations

MPO/RPO are responsible for promoting federal, state, and local transportation objectives and have a role in providing information to the applicant and Department regarding planned projects, visioning, and future growth. MPOs or RPOs will typically be involved in projects that have multi-municipal impacts.

Public Transit Authorities

Local transit authorities operate public transportation systems across the Commonwealth. They will be involved in the review process should PennDOT, municipality or MPO/RPO, determine that the applicant's project impacts the operation of the transit system; that the applicant's project could be designed to accommodate public transit; or the mitigation of site impacts involves the improvement to the public transit system.

FHWA

FHWA has approval authority on permanent occupancy and access HOP applications that involve interstate highway access or improvements within an interstate highway right-of-way. All correspondence and communication shall be coordinated through PennDOT. Individual applicants shall not contact FHWA directly.

Review Process

The TIS or TIA is an integral element of the HOP process, and the procedures are typically as outlined below. This publication covers phases 1 through 3 of the process. **Figure 1** illustrates the HOP process. All submissions are to be submitted through the PennDOT ePermitting System (EPS).

Phase 1: The applicant prepares and submits a Scoping Application and attends a TIS Scoping Meeting (if requested). PennDOT reviews the application and agrees to the scope of the study.

Phase 2: The applicant prepares and submits the TIS or TIA to PennDOT.

Phase 3: PennDOT reviews the TIS or TIA. The applicant coordinates with PennDOT and municipalities to address concerns and comments. PennDOT agrees to the

[1] 67 Pa. Code §441.3(j)(3)

proposed mitigation after the applicant has addressed PennDOT and municipal comments.

Phase 4: The applicant prepares and submits the Engineering Plans with the HOP application.

Phase 5: PennDOT reviews the Engineering Plans depicting the mitigation measures and issues the Highway Occupancy Permit when all other requirements have been satisfied.

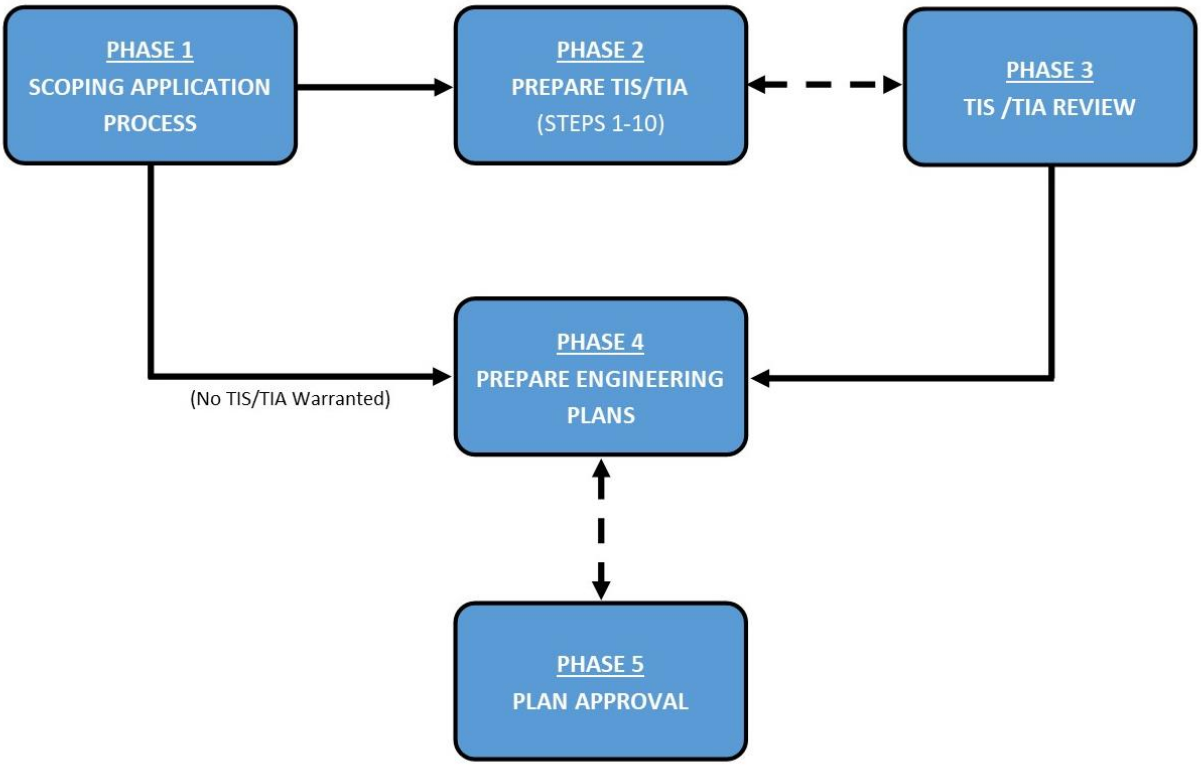


Figure 1: PennDOT HOP Process

Land Development Process Status

Many HOP applications requiring a TIS or TIA involve subdivision or land development activities which are reviewed and approved at the municipal level. Since the project requires approval by both PennDOT and the municipality (and potentially FHWA), it is important to coordinate the PennDOT HOP process with the municipal land development process to avoid delays.

A Scoping Application should be submitted to PennDOT early in the land development process and, ideally, during the sketch plan phase of the municipality's land development process, if one exists, or in advance of the preliminary land development submission.

Figure 2 illustrates the relationship between the HOP process and the land development process. PennDOT is not responsible for project delays or redesign if the Scoping Application is not submitted early in the land development process as shown in **Figure 2**.

The goal is to ensure that the land development approval and HOP approval are timely and consistent with the development review times specified in the PA Municipalities Planning Code.

In addition, PennDOT recommends that applicants submit a TIS or TIA to PennDOT simultaneous with the submission of the same TIS or TIA to the municipality. Submitting studies simultaneously helps with stakeholder coordination and reduces conflicting comments and unnecessary delay. Additionally, applicants should coordinate with the municipality as additional municipal ordinance requirements for a TIS/TIA may also apply.

Figure 2: HOP & Land Development Process

Study Determination

Transportation Impact Study

In determining the need for a TIS, the applicant is to assume only one access point. If the development has multiple stages or phases, the warrant for a TIS shall be based on new trips generated at full build out of the development.

PennDOT requires a TIS for all HOP applications meeting any one of the following conditions:

- Condition 1 – Daily Volume: The site is expected to generate 3,000 or more trips per day (1,500 vehicles per day).
- Condition 2 – Hourly Volume: During any one-hour time period of any day of the week, the development is expected to generate 150 or more trips entering the development or 150 or more trips exiting the development. For existing sites being redeveloped, trip credits may be applied to the TIS conditions on a case-by-case basis as described in STEP 4, Trip Generation.
- Condition 3 – Engineering Judgment: In the opinion of PennDOT, the development or redevelopment is expected to have a significant impact on highway safety or traffic flow on the state transportation network or interstate highway system, even if conditions 1 or 2 above are not met.

Transportation Impact Assessment

If a TIS is not required, a Transportation Impact Assessment (TIA) may be requested by PennDOT to evaluate the site access operations. The District Permit Manager or Traffic Engineer may waive the requirement for a TIA if, in the opinion of PennDOT, the application is anticipated to have a negligible impact on highway safety or traffic flow.

The purpose of a TIA is to evaluate the traffic operations and safety of the site access points to ensure the site access does not impact adjacent intersections or elements of the state transportation system. For example, a TIA would be conducted to determine the best access plan for a corner property that is not projected to generate traffic sufficient to warrant a TIS but where queueing patterns at the adjacent intersection could impact site access. Refer to **PHASE 1**, Study Area, for additional information.

A TIA should be prepared at the same point in the application process as a TIS and in the same manner as a TIS, as applicable. Steps 1-8 of **PHASE 2** outline which requirements are applicable to a TIA.

Table 1: TIS & TIA Criteria Summary

	TIS	TIA
Daily Volume	3,000 trips/day or more	Less than 3,000 trips/day
Hourly Volume	150 or more entering or exiting hourly trips	Less than 150 entering or exiting hourly trips
Study Area	See **Table 2**	Site driveways and immediately adjacent intersection (if applicable)
Applicable Steps (**PHASE 2**)	1 – 10	1 - 8

Site Access Requirements

In addition to the design requirements in 67 Pa. Code Chapter 441, the TIS or TIA evaluates the traffic operations and safety at the site access. This section contains site access requirements from a traffic operations perspective which are considered by PennDOT to determine the number of driveway locations, whether each driveway location is acceptable, and whether any movement restrictions are necessary.

As a general rule, driveways shall be located, designed, constructed, and maintained in such a manner as not to interfere or be inconsistent with the design, maintenance, and drainage of the highway.[2]

Access driveways shall be permitted at locations in which[3]:

- Sight distance is adequate to safely allow each permitted movement to be made into or out of the access driveway. Refer to **STEP 1**, Sight Distance and Sight Access, for details.
- The free movement of normal highway traffic is not impaired.
- The driveway will not create a hazard.
- The driveway will not create an area of undue traffic congestion on the highway.

Specific location restrictions shall include the following:

1. Access driveways may not be located at interchanges, ramp areas, or locations that would interfere with the placement and proper functioning of highway signs, signals, detectors, lighting, or other devices that affect traffic control.[4]
2. The location of a driveway near a signalized intersection may include a requirement that the permittee provide, in cooperation with the municipality, new or relocated detectors, signal heads, controller and the like, for the control of traffic movements from the driveway.[5]

[2] 67 Pa. Code §441.7(a)
[3] 67 Pa. Code §441.7(b)
[4] 67 Pa. Code §441.7(c)(1)
[5] 67 Pa. Code §441.7(c)(2)

3. Access to a property which abuts two or more intersecting streets or highways should only be to the roadway which can more safely accommodate its traffic, which is typically the roadway with the lower functional classification. For example, if the intersection is an arterial with a collector, the driveway access should be to the collector and no driveway access should be provided directly to the arterial. If an applicant desires access to the roadway with higher functional classification, justification for how the proposed access provides safer and more efficient access and does not degrade safety or mobility on the higher classification roadway shall be provided by the applicant.[6]
4. Driveways should be located as far from the intersection as practicable. Typically, this would be adjacent to the property line located farthest from the intersection while meeting design criteria in 67 Pa. Code 441 and Pub 282.
    a. 67 Pa. Code §441.8(d) requires that no portion of the access be located outside the property frontage boundary line.
    b. 67 Pa. Code Chapter 441 and Pub 282 contain radius requirements for various driveway configurations.
5. Low, Medium and High-Volume Driveway access should not be within the functional area of an intersection. The Transportation Research Board (TRB), *Access Management Manual, Second Edition* states "the functional intersection area includes any area upstream or downstream of an intersection where intersection operation and conflicts significantly influence driver behavior, vehicle operations, or traffic conditions" (see **Figure 3**). The functional area for a controlled approach should be assumed to be a minimum of 150-feet from the near corner of the intersection measured from where the near radius return meets the shoulder/curb line. Refer to TRB's *Access Management Manual, Second Edition,* Chapter 14, for guidance.

[6] 67 Pa. Code §441.7(c)(3)

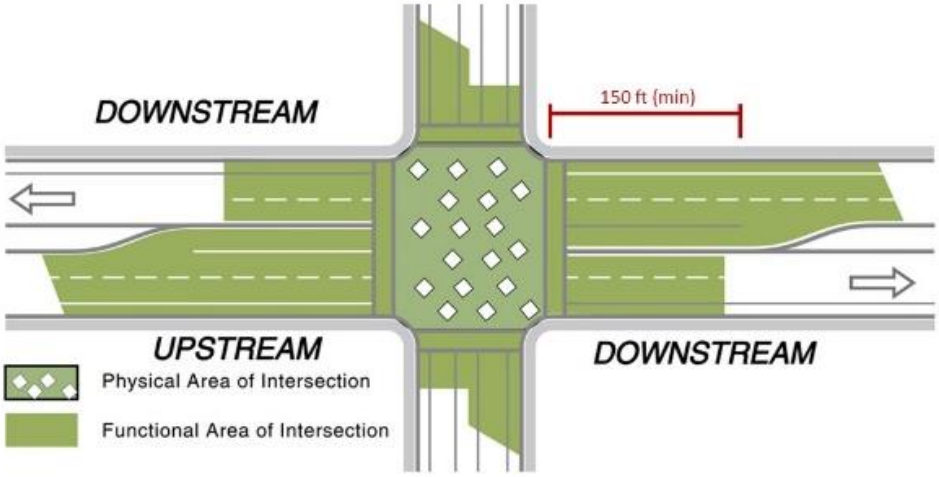


Figure 3: Physical and Functional Area of Intersection (FHWA-SA-10-002)

If a driveway cannot be located outside of the functional area of an intersection, PennDOT may consider allowing the driveway to be located within the functional area for certain circumstances including but not limited to:

a. An uncorrectable sight distance obstruction exists if the driveway would be located outside of the functional area of the intersection.

b. A turn lane is required for the driveway and there are right-of-way (unobtainable), historic property or other geometric constraints which require locating the driveway closer to an intersection to allow space for the turn lane. For example, a railroad overpass prevents the widening for a right turn lane outside the property frontage. Therefore, the driveway must be located closer to the nearby intersection to accommodate the widening of the roadway for the turn lane.

c. Placing the driveway within the functional area of an intersection allows the driveway to be aligned with a driveway or roadway intersecting on the opposite side of the roadway and would eliminate two closely spaced offset intersections.

d. The entire property frontage is within the functional area of the intersection.

If it is determined placing a driveway within the functional area of an intersection is necessary, the operation and safety of the driveway shall be evaluated within the TIS/TIA. The evaluation of the driveway should include the following:

- The volume of traffic using the driveway,
- The type of turning maneuvers that will be most prominent,
- The type of median present,
- Potential conflicts with and proximity to other driveways,

- The volume of traffic on the major street, and
- For existing sites, the crash history of the driveway.

When placing the driveway within the functional area of an intersection, the driveway shall be placed as far from the intersection as possible. Additionally, movement restrictions should be evaluated and may be required by PennDOT.

6. PennDOT may require the permittee to locate an access driveway directly across from a highway, local road, or access driveway on the opposite side of the roadway if it is judged that offset driveways will not permit left turns to be made safely or that access across the roadway from one access to the other will create a safety hazard.[7]

The number and location of entrances which may be granted will be based on usage, interior and exterior traffic patterns, and current design policy of PennDOT.[8]

- Normally, only one driveway will be permitted for a residential property and not more than two driveways will be permitted for a nonresidential property.
- If the property frontage exceeds 600 feet, the permit may authorize an additional driveway.
- Regardless of frontage, a development may be restricted to a single entrance/exit driveway, served by an internal collector road separated from the traveled way.

If conditions at the site access are found to be unfavorable for the safety or operation of the roadway, it might be necessary to restrict movements at the access. Driveway movements should be restricted if one or more of the following conditions would exist:

- The driveway is located within the functional area of a nearby intersection.
- The driveway is located within a turning bay intended for use by traffic approaching a nearby intersection.
- An existing median on the state highway at the driveway location prevents left-turn access.
- A queue from a nearby intersection is expected to extend across the proposed driveway location. The methodology for queue evaluation should be discussed in the Scoping Application and Scoping Meeting.
- A queue from a nearby intersection doesn't block the driveway directly, but queued vehicles limit available sight distance for vehicles entering and/or exiting the driveway. The methodology for queue evaluation should be discussed in the Scoping Application and Scoping Meeting.

[7] 67 Pa. Code §441.7(c)(4)
[8] 67 Pa. Code §441.7(e)

- One or more movements entering or exiting the driveway would be expected to operate at Level of Service (LOS) E or LOS F if a movement or movements were not restricted.

When restricting driveway movements, provisions should be considered which will enhance motorists' compliance such as raised medians, islands, and flexible delineators.

PHASE 1: PREPARE A TIS/TIA SCOPING APPLICATION

The purpose of the Scoping Application is to establish if a TIS or TIA is required by PennDOT, determine the elements to be included in the TIS or TIA, and establish the parameters for the applicant's engineer to perform the analysis and complete the study. The study area shall be identified, including all intersections and roadways to be evaluated. A Scoping Application is required for HOP applications that will generate 25 or more vehicles (50 trips) per day. The Scoping Application is prepared and submitted electronically via PennDOT's Electronic Permitting System (EPS or ePermitting System).

At a minimum, the Scoping Application should include the following information:

- *Location and description of the proposed development.*
- *Limits of the study area including all intersections (existing and proposed).*
- *Trip Generation.*
- *Proposed Driveway Classification.*
- *Level of study required (no study, TIA, or TIS).*
- *Data Collection efforts.*
- *All planned analyses (sight distance analysis, crash analysis, traffic signal warrants, turn lane warrants, etc.).*
- *Clear and legible site plan with proposed access points labeled.*

During the Scoping Application process, concurrence should be reached on the scope of the study, trip generation, methodology for trip distribution, analysis years, and growth factors. The applicant will also receive information from PennDOT regarding any known and/or foreseeable issues associated with the project location or proposed improvements. It is expected that the applicant will submit a TIS or TIA to PennDOT within a reasonable time after all stakeholders agree to the parameters outlined in the Scoping Application. If, in PennDOT's opinion, it is no longer feasible for the development to be constructed and operational by the opening year indicated on the Scoping Application, the applicant may be required to resubmit the Scoping Application with a revised opening and design year or modify the study period within the TIS/TIA.

Most items in the Scoping Application should be familiar to transportation professionals or can be found in the ITE *Multimodal Transportation Impact Analysis for Site Development* (MTIA).

Applicants may submit preliminary analysis with the Scoping Application. PennDOT may encourage the submission of preliminary analysis for complex or unique developments or transportation systems.

Location Information

Provide details on the location of the proposed development including the PennDOT District, County (RPO/MPO), and local municipality(ies) and email address for all respective stakeholders. Include details of all existing and proposed driveways such as location (including intersection roadway information, SR/SEG/OFF information, street name, etc.), classification, and proposed access level (full access, right-in/right out, etc.).

Development Schedule and Staging

Provide the development's anticipated opening date, and information on development staging if applicable.

Trip Generation

Provide trip generation for the development as outlined in **STEP 4**.

Level of Study Required

Identify the level of study required for the development as per the **Study Determination** section above.

Study Area

Determining the extent of the study area for a TIS is a critical task. It requires a working knowledge of the area surrounding the development; the type and intensity of the development; an understanding of the current transportation conditions (vehicular, pedestrian, bicycle, etc.) and functionality of the existing roadways in the vicinity of the development.

The limits of the site property under control of the developer and proposed site access locations shall be indicated on a map (aerial image) as well as the applicant's proposed study intersections and roadways. This map shall be used to reach concurrence on the proposed study area scope for a TIS. The applicant shall prepare a list of intersections proposed for study to be included in the Scoping Application. If a signalized study intersection is part of a coordinated system, then the entire system may need to be evaluated.

Guidance on the selection of study intersections is provided in **Table 2**. PennDOT may require additional site intersections be added to the study area if the development is anticipated to direct trips to the intersections. As a general rule, any intersection with 100 or more added trips should be included in the study area or in cases where an increase in truck trips are anticipated, such as to the nearest interchange. The study area may also extend to include interchange ramps or freeway mainline analysis if the development is anticipated to significantly increase trips onto a limited access facility.

Table 2: Suggested Study Area Limits for Transportation Impact Studies (*ITE, Multimodal Transportation Impact Analysis for Site Development*, Chapter 2, Table 3)

Development	Minimum TIS Study Area
• Fast-food restaurant • Service station, with or without fast-food counter • Mini-mart or convenience grocery with or without gas pumps • Other development with fewer than 200 total trips during any peak hour	• Adjacent intersection if corner location • Adjacent intersection if corner location 660 ft. from access drive • 1,000 ft. from access drive
• Shopping center less than 70,000 sq. ft. • Development with total peak-hour trips between 200 and 500 during peak hour	• All signalized intersections and access drives within 0.5 mile from a property line of the site and all major unsignalized intersections and access drives within 0.25 mile
• Shopping center between 70,000 and 100,000 sq. ft. Gross Leasable Area (GLA) • Office or industrial park with between 300 and 500 employees • Well-balanced, mixed-use development with more than 500 total peak-hour trips	• All signalized and major unsignalized intersections and freeway ramps within 1 mile of a property line of the site
• Shopping center greater than 100,000 sq. ft. GLA • Office or industrial park with more than 500 employees • All other developments with more than 500 total peak-hour trips	• All signalized intersections and freeway ramps within 2 miles of a property line and all major unsignalized access (streets and driveways) within 1 mile of a property line of the site

For a TIA, the study area should include all proposed site access intersections with public roadways and any abutting public roadway intersections with other public roadways, such as the intersection adjacent to a corner property. See **Figure 4** illustrating the TIA study area for a corner parcel property.

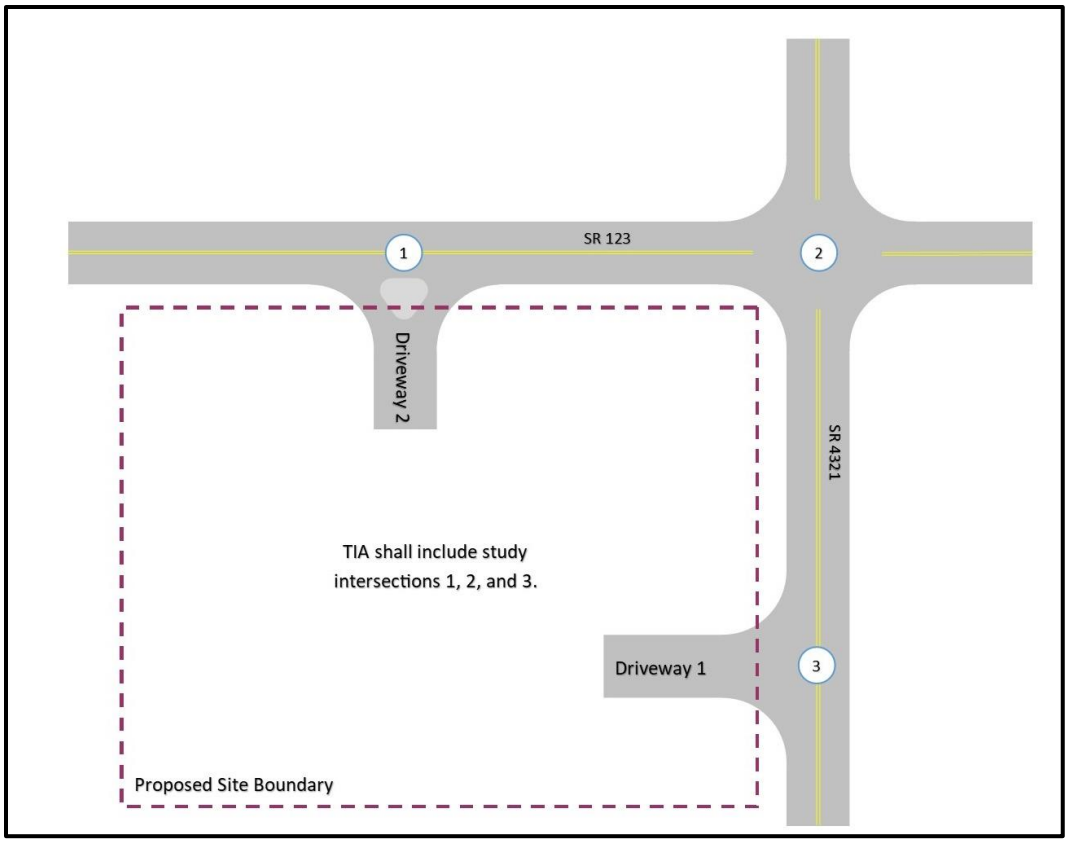


Figure 4: TIA Study Area, Corner Property

PennDOT reserves the right to require additional intersections be included within the study area for a TIS or TIA based on safety and mobility concerns or input from the municipality, local transit authorities, MPO/RPO, or FHWA. The applicant should review the local municipal ordinances to ensure all requirements are met, which may differ from the criteria included in these guidelines.

Context

The applicant must evaluate the existing context(s) of the study area surrounding the subject property, and whether the proposed land use will alter the context.

Context is important in determining the ideal roadway design. It provides guidance on aspects such as roadway design, travel lane width, on-street parking, bicycle and pedestrian facilities, and on the types of landscaping and lighting provided. It also plays a role in suggesting the desired operating speed.

Context is a unique combination of different land uses, building density, and other features. There are five contexts, in order of intensity: rural, rural town, suburban, urban, and urban core. For more information on context, see PennDOT Publication 13, Design Manual Part 2, Contextual Roadway Design.

The scoping application shall identify any known areas of congestion, safety concerns, or environmental constraints. The application shall also provide a brief overview of the pedestrian

and bicycle facilities and concerns and the available transit options in the study area. Review any existing roadway/safety studies recently conducted in the study area to help identify existing concerns.

Study Area Type

The application shall identify whether the study area is designated as rural or urban. Urban boundaries can be found on the corresponding County Functional Classification Maps.

TIS/TIA Analysis Periods and Times

Level of Service (LOS) and Queue Analysis shall be provided for all study intersections and driveways. Analysis years for conducting the LOS and Queue Analysis in the TIS/TIA shall be defined in the Scoping Application. PennDOT will require two analysis years in the TIS or TIA:

1. Existing Year Analysis.
2. Design Year Analysis.
    a. For a TIA, the Design Year shall be the development's Opening Year.
    b. For a TIS, the Design Year shall be 5 years after the development's Opening Year.

For projects involving FHWA review (i.e., projects involving the interstate), a determination of the design year shall be based on input from FHWA and will generally be longer than 5 years.

The Opening Year is when the last phase of construction is completed and the proposed development is fully occupied and operational (full build-out). The determination of the Opening Year should include appropriate timelines for pre-construction activities, including all governmental approvals. If the development timeline changes prior to issuance of the HOP, PennDOT may require the TIS or TIA to be updated to revise the Opening Year.

Projects involving multi-phased development may require additional analysis, and the analysis of opening years after each major phase should be considered (**Figure 5**). Additionally, additional analysis scenarios may be necessary and requested for special cases such as for determining whether a traffic signal is warranted in the opening year vs. the design year.

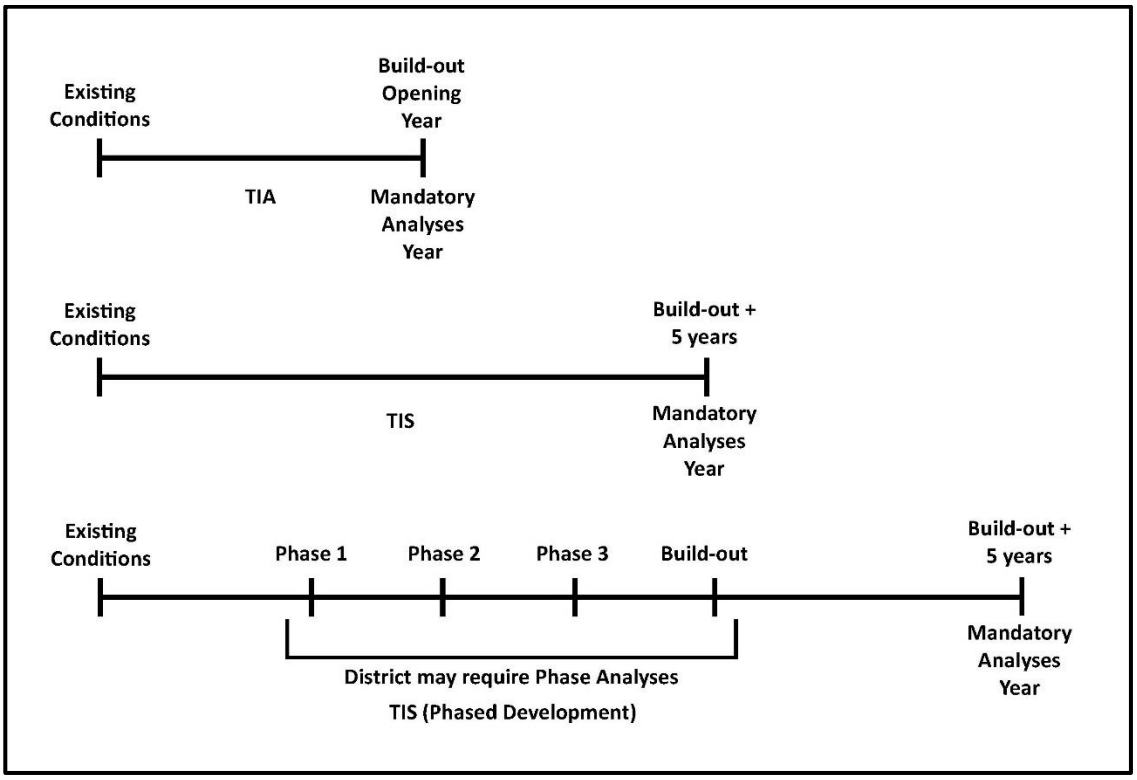


Figure 5: Mandatory Analysis Periods

Traffic Adjustment Factors

Growth factor assumptions shall be defined in the Scoping Application. The background growth factor should be obtained from one of the following sources:

1. PennDOT Growth Factors posted in the PennDOT's ECMS Website.
2. The Metropolitan Planning Organization (MPO) or the Rural Planning Organization (RPO) covering the study area.
3. Other Department approved method.

Growth factors obtained from PennDOT shall be applied as an annually compounded growth rate to reflect the proposed traffic conditions in the Design Year. Growth factors obtained from MPO or RPO's shall be applied in a compounded or linear fashion as directed by the MPO or RPO and concurred by PennDOT. Refer to **STEP 3** for additional information.

Additionally, the application shall identify other trip adjustments proposed in the study including seasonal adjustments, internal capture trips, pass-by trips, or modal split reductions. Refer to **STEP 4** and **STEP 5** for additional information.

Future Land Use and Infrastructure Changes

In addition to background growth, planned and permitted developments in the area that will impact the transportation study area should be evaluated, and appropriate traffic added to the Design Year analysis scenarios.

- Coordinate input with municipal officials and identify all significant study area developments in the region that have potential to impact conditions within the study area. Projects that shall be considered include permitted developments for which HOPs have been issued. The applicant and/or municipality may recommend the TIS include planned development projects which have submitted scoping applications and are in the study phase, even if an HOP has not been issued. PennDOT will approve the planned developments to be included in the TIS or TIA during the Scoping Application Process.
- Identify transportation system improvements that are programmed, committed, or highly likely during the study period. Coordinate with those project teams and the municipality(ies) to determine responsibilities and schedules for final improvements along with needs for interim mitigation and/or access during construction of the transportation system improvements.

Document all changes to be evaluated in the TIS/TIA in the Scoping Application. Coordination between other HOP's and highway improvement projects will require a timeline of improvements that needs to be agreed upon between stakeholders and PennDOT.

Trip Distribution and Trip Assignment

Provide a description of the proposed method for developing the trip distribution and trip assignment for the development. The Trip Distribution for new trips may be based on a combination of a gravity model, existing traffic patterns, and engineering judgement.

For business land uses, applicants should analyze the place of residence for employees using employee zip code data.

For retail goods and services, applicants should consider the prospective market area (e.g., where the anticipated customers live).

Once the available data has been collected, the applicant should select the appropriate trip distribution model. Include all assumptions and justifications in the Scoping Application.

PennDOT encourages the applicant to submit the trip distribution and trip assignment prior to finalizing the scoping application. The trip distribution and trip assignment should be completed according to **STEP 6** and **STEP 7**.

Data Collection and Capacity Analysis Methodologies

The scoping application shall include a list of all proposed data collection efforts including the location, time period, and data collection methods (i.e., turning movement counts, automated traffic recorders (ATR), etc.). Refer to **STEP 1** for additional details. Additionally, the application shall identify the proposed capacity analysis method (i.e., Synchro 11th Edition, HCM 7th Edition, etc.). Refer to **STEP 2** for additional information.

Roadway Improvements/Modifications by Others

The scoping application shall identify any roadway projects or nearby developments which will impact the study area intersections prior to, or during, construction of the study development.

Guideline Compliance and Required Analyses

In addition to the items and discussion points above, the Scoping Application contains a section to certify that the TIS/TIA will conform to these Guidelines. That section also contains an area for the applicant to propose any modifications from the Guidelines where appropriate, and to obtain concurrence from PennDOT on the methodologies to be used for the TIS/TIA.

Required Analyses to be conducted in the TIS/TIA unless otherwise specified and agreed upon by the District Permit Manager include:

1. Capacity Analysis – Capacity Analysis shall be conducted to determine LOS at all study area intersections and site access driveways. Refer to **STEP 2** and PennDOT Publication 46, Chapter 12.2 for additional details. Additionally, PennDOT may require the applicant's engineer to prepare a micro-simulation of the traffic signal system. In requesting the micro-simulation, PennDOT may specify the software package to be used.
2. Queue Analysis –Queue analysis shall be conducted for all study area intersections and site access driveways. Refer to **STEP 2** and **ATTACHMENT E**
3. Sight Distance Analysis –Sight distance analysis is required for all existing or proposed site access driveways. For low/medium/high volume driveways, refer to Chapter 3 of *PennDOT Publication 282*. For site access designated as a local road, use Intersection Sight Distance Criteria (AASHTO Green Book, Chapter 9.5). Refer to **STEP 1**, for additional details.
4. Signal Warrant Analysis – Perform at all unsignalized study area intersections operating at (currently or in the future) a failing level of service. Perform all applicable signal warrants including 8-hour and 4-hour volume warrants per PennDOT Publication 46. Refer to **STEP 10**, for additional details.
5. Turn Lane Warrant Analysis–Turn lane warrant analysis shall be performed at all site driveway locations and proposed intersections and in accordance with the methodology described in **STEP 10**. Provide a list of any additional turn lane warrant locations in the scoping application.
6. Intersection Control Evaluation (ICE) – Complete ICE when required as described in **STEP 9**. Additional information, tools, and forms can be found on the PennDOT Traffic Signal Portal.
7. Crash Analysis – Obtain and analyze crash data in accordance with **STEP 1**.
8. Gap Studies – Conduct gap studies where required and using the methodology described in **STEP 9**.
9. Other – Identify any additional studies or analysis to be included in the TIS or TIA. Provide a list of locations, methods, and applicable criteria.

ADA Compliance

Applicants must adhere to a core principle of ADA; if pedestrian facilities are provided, these must be accessible to persons with disabilities. This may include the Applicant upgrading substandard facilities to current standards if changes will impact the facilities. The applicant must comply with all pertinent federal and state legislation and regulations on accommodating pedestrians with disabilities. These laws and regulations are summarized in Chapter 6 of PennDOT Publication 13M "Design Manual, Part 2", and include the Americans with Disabilities Act of 1990; the ADA Accessibility Guidelines for Buildings and Facilities (ADAAG); and the Public Right of Way Accessibility Guidelines (PROWAG).

For additional information related to ADA requirements, refer to Publication 72M Roadway Construction Standards and Publication 149, Traffic Signal Design Handbook.

Scoping Meeting

At the discretion of the District Permit Manager, a scoping meeting may be held to discuss details of the Scoping Application and to resolve any remaining issues with the content of the application. The applicant or municipality may also request a scoping meeting if desired even if not requested by PennDOT.

After reviewing the Scoping Application, PennDOT will notify the applicant if a scoping meeting is required.

It is the applicant's responsibility to invite all stakeholders of the development including the developer, its engineer, municipal representatives, as well as other agencies such as local transit authorities, county planning and MPOs or RPOs within the proposed study area limits to the scoping meeting, and obtain all information required at the meeting.

The applicant is required to notify PennDOT if it intends to bring legal counsel to the scoping meeting so that PennDOT may have appropriate legal representation. If the applicant has legal counsel in attendance at the meeting and has not provided PennDOT advance notification, the meeting may be rescheduled or cancelled.

The applicant is responsible for developing meeting minutes and distributing them to attendees within 7 business days of the meeting.

The District Permit Manager will be responsible for inviting the appropriate District personnel (i.e., Traffic Unit, Design Unit, Bridge Unit, Right-of-Way Unit, etc.) as well as Office of Chief Counsel (OCC), and/or FHWA or other agencies depending on the scope of the project.

Refer to **ATTACHMENT B** for a sample scoping meeting agenda.

Several aspects of the permit process can be time-consuming and, if not started early in the process, can delay issuing the Highway Occupancy Permit. These items should be discussed during the scoping meeting:

- Right-of-Way (R/W) Acquisition
- Utility Impacts
- Drainage Requirements
- Adjacent Property Owner Impacts

- Traffic Signals
- Letter-of-Credit (LOC)/Security
- Access Covenant

PHASE 2: PREPARE THE TIS/TIA

General Formatting

To facilitate Department review, the TIS or TIA report shall contain a cover page, table of contents, body of report, and appendices containing data collection and analyses. A sample TIS format is contained in **ATTACHMENT C** and a sample TIA is contained in **ATTACHMENT D**.

PennDOT may reject the TIS or TIA if it does not conform to the format provided in **ATTACHMENT C** and **ATTACHMENT D**.

TIS/TIA Review Checklist

To help ensure that the TIS or TIA is in conformance with these policies and procedures, applicants must complete the review checklist provided in **ATTACHMENT G** and submit it with the TIS/TIA.

STEP 1: Data Collection

Preparation of the TIS or TIA will involve data collection, which is the sole responsibility of the applicant. Review of previous studies and inclusion of data gathered for other studies may be acceptable to PennDOT provided:

- The data is not greater than 3 years old when the TIS or TIA is submitted to PennDOT and
- Traffic volumes or patterns have not significantly changed.

PennDOT reserves the right to request for new or additional data should the issuance of the HOP extend beyond the three year limit.

Volume Counts/Data

Traffic volumes shall be obtained through data collection efforts at locations and times agreed upon during the Scoping Application process.

It is required that new data obtained from 24-hour automatic traffic recorder counts include classification and speed data unless modified during the Scoping Application process.

New data obtained from turning movement counts shall incorporate heavy vehicles, pedestrian, and bicycle data. Transit vehicles shall also be reflected in traffic counts if present. Walking school children and school bus stops shall also be noted. At study area intersections where a traffic signal warrant analysis is anticipated, a minimum of 12 hours of data is recommended.

For information related to peak hour factors and multi-period analyses, applicants should refer to Publication 46, Chapter 10. Traffic volumes along corridors should be balanced between intersections when appropriate.

At intersections, pedestrian activity as well as pedestrian accommodations should be recorded and reflected in the TIS. If regular pedestrian activity surpassing 15 pedestrians per hour is observed at midblock crossings in the study area these locations should be counted as well.

A high number of bicyclists riding on the sidewalk should be documented, as this may indicate the need for additional facilities.

Roadway data shall be collected including speed limits, grades by approach, and lane geometry (widths/shoulders/turn bay storage lengths). Information should be included in the TIS in the form of field sketches, existing signal permit plans, or tabular format.

The method of data collection as well as seasonal adjustments if required and balancing shall be summarized in the TIS report.

PennDOT may require updated traffic counts if the count data is more than five years old before the HOP is issued.

Context

As discussed in **PHASE 1**, the applicant must document the context of the subject property, and along key area roadways.

Using the written description of contexts in PennDOT Design Manual, Part 2, Contextual Roadway Design the applicant should first conduct a "windshield screen" field view along roadways in the study area and identify the different contexts present prior to submitting the Scoping Application. If the context is not obvious from initial field views, the applicant can use aerial photographs and municipal zoning ordinances.

Certain areas may have characteristics common to more than one context, and other areas will be hard to identify. The applicant should identify the context that seems most representative of a roadway segment as whole. Contexts should not be defined in too fine a manner; avoid segments of less than 600-feet in length.

Roadway Functional Classification and Typology

The applicant must document and provide data for determination of the functional classification and typology of all roadways adjacent to the subject property in the TIS. PennDOT will approve this information during the review of the Scoping Application.

The functional classification (Interstates/freeways/expressways, principal arterial, minor arterial, collectors, and locals) can typically be determined by checking PennDOT's Functional Class Maps. These maps identify the functional classification for all state roadways and occasionally important local or county owned roadways.

As defined in PennDOT Publication 13, Design Manual Part 2, Contextual Roadway Design, Chapter 3.6, roadway typologies exist within the framework of functional classifications, but they are more varied in recognition of subtle differences in settings (example: rural versus rural town, and urban versus urban core) to better fit actual project-specific conditions.

After documenting the existing roadway functional classification and typology, the applicant should evaluate whether any planned transportation projects, or major land use developments, have the potential to change the roadway type in the future.

Sight Distance and Site Access

Adequate sight distance at existing and proposed site access driveways is critical to safe traffic operations. The applicant shall conduct sight distance measurements at all site access driveway locations and any other locations agreed upon during the Scoping Application process. For low/medium/high volume driveways, refer to Chapter 3 of *PennDOT Publication 282*. For site access designated as a local road, use Intersection Sight Distance Criteria (AASHTO Green Book, Chapter 9.5). PennDOT may require a separate truck sight distance analysis when the site is anticipated to generate a substantial number of truck trips such as industrial and warehousing land uses.

Speeds used for the sight distance analysis shall be the posted speed limit at a minimum, even if the operating speeds are lower. Operating speeds should be used for sight distance analysis if the 85th percentile speed is 10 MPH or more above the posted speed limit.

Photographs

Photographs should be obtained at all study intersections and proposed access driveways and labeled appropriately. The photographs should represent the existing conditions as reflected in the TIS or TIA. It is recommended that two views be taken of each approach for intersections:

1. Approximately 200-feet from the intersection to provide an overview of the approach including pavement markings, shoulders, trees, and overall study area context and
2. Approximately 50-feet from the intersection and show the opposite approach.

Photographs should take into consideration elements such as horizontal/vertical alignment of roadways, trees, buildings or other roadside objects, pavement markings, drainage, signal heads & placement. Images obtained from web-based sources such as PennDOT video log or Google Street View are not acceptable.

Crash Data

Crash data for the study area including all intersections and roadway segments shall be obtained for the most recently available five years, unless otherwise agreed upon during the Scoping Application process.

Authorized users can obtain crash data from the Pennsylvania Crash Information Tool (PCIT). Crash data can also be requested from PennDOT by contacting the District Safety Engineer within the appropriate District Traffic Unit. The crash data should include a crash summary report and crash resume report. The applicant should also contact the municipality for input regarding non-reportable crashes.

The applicant shall analyze the crash data to determine if there are any crash patterns within the study area. Analysis of the crash data should include review of causation factors and patterns.

If any trends or patterns are identified, the applicant shall describe how the proposed development will impact the conditions. If it is anticipated that the development will exacerbate these conditions, the applicant will be required to provide mitigation.

All crash data and analysis shall be provided in an Appendix submitted under separate cover and sealed with a statement of confidentiality. Crash data is not for public consumption and is exempt from the Right to Know Law requests.

Pedestrian/ Bike/ Transit Facilities

Utilizing the checklist located in Publication 10X, Design Manual Part 1X, the applicant shall identify any existing or proposed pedestrian or bicycle facility that would be affected by the proposed development.

Pedestrian facilities include sidewalks, intersection treatments, and off-road paths or trails. Bicycle facilities include on-street bike lanes, paved shoulders, and off-road paths or trails.

The applicant shall note any impact on pedestrian and bicycle facilities and shall also note any impact on the ability of pedestrians to cross roadways within the study area, both at intersections and at identified common mid-block crossings.

The applicant shall identify any existing transit facility that could be affected by the proposed development. At a minimum, this shall include any bus routes within ¼ mile of the development, and any rail centers within ½ mile of the development.

The applicant shall also describe how the proposed development was designed to accommodate pedestrians, bicycles, and transit operations.

Traffic Signals

If existing traffic signals are present within the study area, provide a copy of the current traffic signal permit plans, timings, and system permit plan in an appendix to the TIS or TIA (if applicable). These documents can be obtained by contacting the District Traffic Unit. The applicant shall observe the signal operation to determine if the operation is generally in accordance with the approved traffic signal permit, such as gapping out when there is no traffic on an approach.

STEP 2: Existing Conditions Scenario

The applicant shall document existing transportation conditions within the study area, including, but not limited to volumes, capacity and level of service analysis, queue analysis, and crash analysis. In addition, the existing conditions shall discuss shared-use transportation such as bicycles, pedestrians, and transit and describe existing facilities or lack thereof. If discrepancies between the traffic signal permit and field observations exist, the operation should be reviewed with the District and Municipality to determine the appropriate analysis parameters for the TIS or TIA.

Any schools, colleges or other seasonal/off peak traffic generators shall be identified. If pedestrian facilities are provided, a discussion of ADA compliance is appropriate.

Level of Service data shall be presented in the format as shown in **Table 3**. Some TIS/TIA may require gap studies and/or travel time studies which are further detailed in **ATTACHMENT E**.

Table 3: Sample Level of Service Table

AM Peak Hour				Existing	Design Year-With Out Development	Design Year-With Development	Design Year-With Development with Mitigation
Intersection		Direction	Movement				
1	SR 12 and SR 234	Eastbound	Left Turn	C(29.6)	F(94.2)	F(148.5)	D(49.1)
			Through				D(38.3)
			Right Turn				
			Approach	C(29.6)	F(94.2)	F(148.5)	D(39.2)
		Westbound	Left Turn	C(23.0)	E(78.7)	F(93.1)	C(34.2)
			Through				C(21.5)
			Right Turn				
			Approach	C(23.0)	E(78.7)	F(93.1)	C(22.5)
		Northbound	Left Turn	C(22.3)	C(24.6)	C(26.7)	C(26.7)
			Through				
			Right Turn				
			Approach	C(22.3)	C(24.6)	C(26.7)	C(26.7)
		Southbound	Left Turn	B(18.3)	B(18.7)	B(19.4)	B(19.4)
			Through				
			Right Turn				
			Approach	B(18.3)	B(18.7)	B(19.4)	B(19.4)
			OVERALL	**C(25.6)**	**E(77.2)**	**F(106.8)**	**C(30.2)**

Capacity analysis shall be conducted utilizing appropriate traffic engineering software approved by PennDOT in Publication 46, Chapter 12.2 and agreed to during the Scoping Application process. The applicant shall provide copies of the capacity analysis files to PennDOT with each submission.

95th percentile queuing results shall be reported for all study area intersections in a tabular format for each lane. The tables shall include both existing and proposed storage lengths. Include 50th percentile queue results in the capacity analysis outputs. Refer to **ATTACHMENT E** for details.

STEP 3: Background Traffic

Growth Factor Traffic

Analysis years for the TIS/TIA shall be as agreed upon during the Scoping Application process. Any additional analyses as requested during the Scoping Application process shall be included.

Future traffic volumes in the Design Year shall be projected by applying growth factors as determined during the Scoping Application process to existing base traffic volumes. Design year volume can be calculated utilizing the standard future value equation as shown below:

$$\boldsymbol{V_f = V_p * (1 + GF)^n}$$

$$V_f = Future\ Value$$

$$V_p = Present\ Value$$

$$GF = Growth\ Factor$$

$$n = Number\ of\ Years$$

Planned and Permitted Development

Include the site traffic generated by planned developments to the design year background traffic as agreed upon during the Scoping Application process.

Provide a summary of the planned/permitted developments including development name, location, and description, estimated opening year, trip generation and distribution, and proposed improvements. Include excerpts of the background development traffic studies in the appendix of the report. Background and planned/permitted development traffic growth shall be documented and presented in the TIS/TIA Appendix as noted in **ATTACHMENT C & D**.

If a new development not included in the TIS/TIA is likely to proceed ahead of the subject development, PennDOT may require an updated TIS which includes the new development's traffic as background traffic.

STEP 4: Trip Generation

Trip generation is defined as the total number of trips going to and from a particular land use on a specific site during a specific time period. For sites in suburban and rural contexts, and for many sites in urban contexts, vehicular trips will typically account for the large majority of trips. Trips by public transit, bicycles, or by foot may be important components of trip generation in urban contexts, sites that have regular access to transit routes or other multi-modal facilities, or for special traffic generators.

The traffic characteristics of a proposed development are estimates of the following transportation attributes:

- *Trip Generation: How much traffic the site will add to the surrounding transportation network.*
- *Trip Distribution: Where the trips arriving at the site originate from.*
- *Modal Split: What mode(s) of transportation is used to reach/depart the site.*
- *Trip Assignment: What route(s) are used to reach/depart the site?*

PennDOT has accepted the most current ITE "Trip Generation Manual" and its updates for the development of trip generation. Instructions on the use of the data and step by step methodologies for estimating vehicular trips are described in the publication. The Trip Generation Handbook also provides guidance for the conversion of vehicular trips to person trips so that internal capture, walking trips, bicycle trips, and transit trips can all be accounted for before reaching a vehicular trip generation if the situation dictates.

The applicant must determine the appropriate time period for the trip generation estimate. Typically, the peak hour of adjacent street traffic should be used. However, there may be instances where the peak hour of generator is more appropriate. Refer to ITE's "Trip Generation Handbook" section 3.4.2 for additional guidance related to selecting time periods.

As part of the Scoping Application process, applicants are required to receive Department concurrence and approval on the land use codes and trip generation methodology used for the proposed site. Applicants should be prepared to describe the site's characteristics (urban, infill, etc.), identify transit and multi-modal accommodations or deficiencies, and justify the reason for selection of the analysis approach.

Refer to **ATTACHMENT H** for additional trip generation considerations and guidance regarding Convenience Markets with Gasoline Pumps (H1) and on Warehouse Facilities (H2).

Figure 3.1 from ITE's "Trip Generation Handbook", 3rd Edition is recreated below (**Figure 6**) for reference. This analysis approach determines if traditional trip generation methodology simply using ITE's generation rates or equations is acceptable, or if the more in-depth methodology converting to person trips is required. The following items may trigger the need for the enhanced methodology:

- The site is located in an urban area or classified as infill
- The site has access to frequently used and regularly arriving/departing transit
- Shared-use paths or accommodations are present in the area

- Significant pedestrian activity is present
- The site has multiple uses that will require the evaluation of internal capture

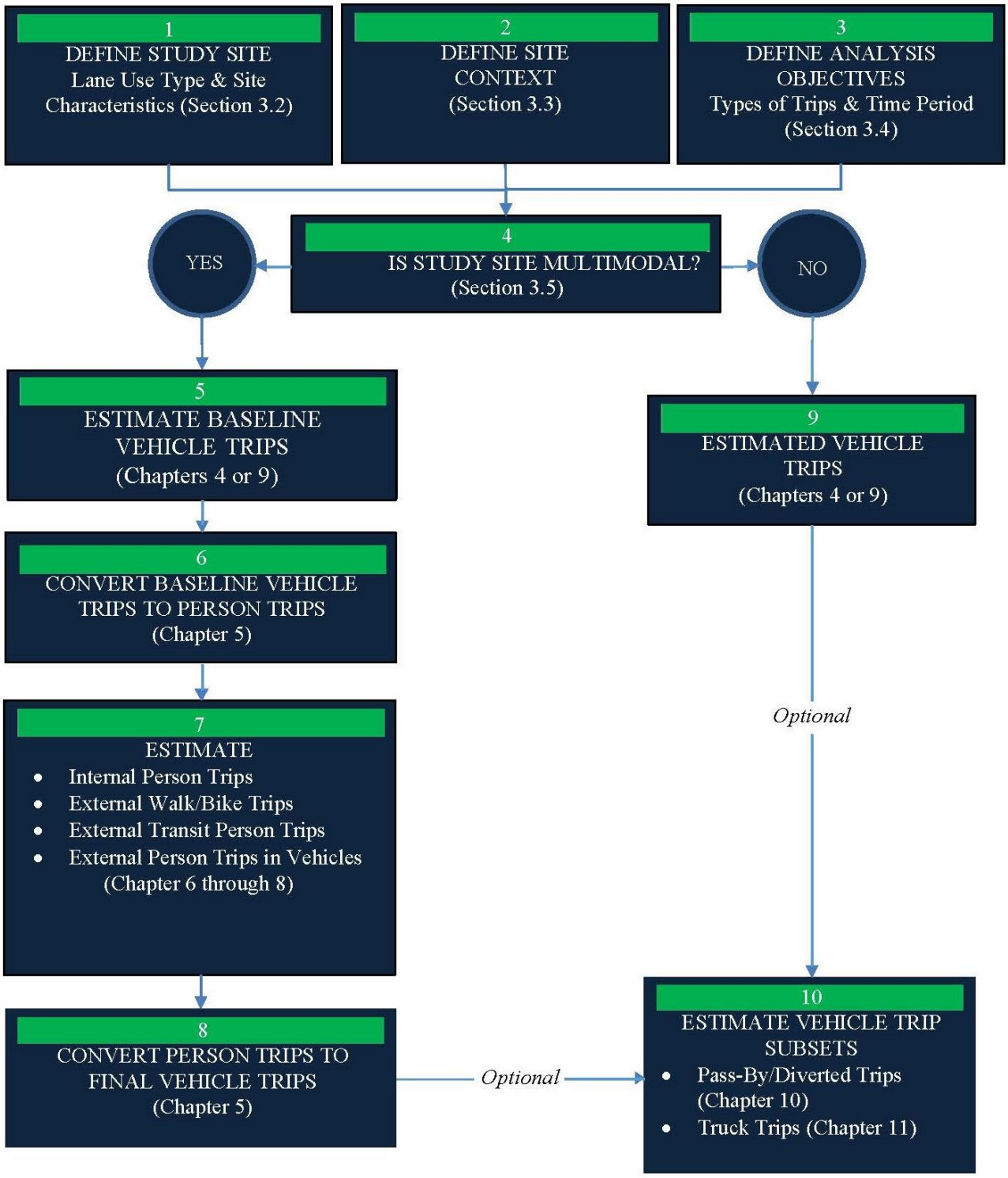


Figure 6: Analysis Approach for Estimating Site Trip Generation (Figure 3.1 – Trip Generation Handbook)
All Chapter and Section references are intended for ITE's Trip Generation Handbook

Local Trip Generation Study

Localized trip generation may be requested by the applicant, municipality, or PennDOT.

In general, local data should be collected in the following circumstances:

Before using local data or a source for trip generation data other than the data contained in the most recent ITE "Trip Generation Manual", concurrence of the District Traffic Engineer and approval of the Central Permit Office Manager are required.

- The study site is not compatible with or does not relate to an ITE land use code definition.
- Local data must be collected when five or fewer data points are contained in the plot.
- The weighted standard deviation for the average rate is greater than 55% of the weighted average rate.
- The independent variable does not fall within the range of data in trip generation.
- Neither the weighted average rate line nor the fitted curve falls within the data cluster for the size of the development.

If local data is to be used, the applicant should submit a Trip Generation Study request, documenting the reason that local data is needed, and a plan of study developed in accordance with the ITE "Trip Generation Handbook".

The following guidelines, as applicable, should be followed when seeking approval to conduct a Trip Generation Study:

- Trip Generation Study requests shall be made directly to the District Permit Office.
- The District Permit Office will review and forward the request with recommendation to the Central Permit Office for consideration.
- Trip Generation Study requests must be made prior to conducting the actual study.
- The request should be made by the industry representing the land use type, (i.e., if the trip generation study is being requested for a bank, a representative from a bank or banking group shall apply for the study request).
- If determined necessary, the requesting party will meet with the Central Permit Office (CPO), the District Permit Office, and District Traffic Engineer to discuss the following:
    - Selection of land use to study
    - Scope of the study
    - Site selection
    - Sample size determination
    - Independent variable selection

  - Development data requirements
  - Survey periods

- The study must be conducted and documented as per the methodology outlined in the ITE "Trip Generation Handbook".
- The applicant understands that PennDOT may forward the study data to ITE.
- Statewide approval, if granted, will be limited in duration, generally until a new edition to the ITE "Trip Generation Manual" is published.
- The requesting entity/analyst understands that the approved trip rates may be made available for use to other interested parties for a similar land use development.
- Although a proposed development might correspond to an ITE land use code with adequate data points in the ITE "Trip Generation Manual", if PennDOT has reason to believe that site trip generation will vary from ITE rates, it may allow the applicant to collect data at comparable sites.

Internally Captured Trips at Multi-Use Developments

A multi-use development is a single development project that consists of two or more land use classifications and contains an internal roadway network such that trips can be made between the different land uses without leaving the site. Trips between land uses within the development are considered internally captured trips.

For multi-use developments, PennDOT requires use of the methodology contained in the ITE "Trip Generation Handbook" and using the *NCHRP 684 Internal Trip Capture Estimation Tool* spreadsheet as provided by ITE (select "read full description" to view the download link). If the ITE data set is not sufficiently large, PennDOT may request the applicant to conduct observations at a similar site in the region, in accordance with the cautions contained in the Handbook. The applicant must submit all worksheets used to calculate internally captured trips.

It is important to note that any site that will have internal capture characteristics must use the left side of Figure 3.1 from the ITE "Trip Generation Handbook" (Steps 5-8) (**Figure 6**). This requires the conversion of baseline vehicular trips to person trips before removing the internally captured trips and converting back to vehicle trips.

Pass-by Trips

Pass-by trips include vehicles already on the roadway that pass by the commercial site as an intermediate stop on a primary trip. They exit the site and continue to travel in the same direction from which they entered. As such, they are driveway trips but not new trips generated by the proposed development. Pass-by trips should not result in an unrealistic reduction in the adjacent street volumes and should be applied with engineering judgement. Pass-by trips are estimated using the methodology in the ITE "Trip Generation Handbook" and are applied in Step 10 of Figure 3.1 (**Figure 6**).

Diverted Link Trips

Diverted Link Trips are trips already on the larger roadway network that are diverted from their primary route to the proposed development via other roadways leading to the site. They are considered new trips on the roadways immediately adjacent to the site. Diverted Link Trips are estimated using the methodology in the ITE "Trip Generation Handbook" and are applied in Step 10 of Figure 3.1 (**Figure 6**).

Existing Sites Being Redeveloped

PennDOT encourages redevelopment of existing sites in order to discourage sprawl. In cases in which an existing site is being redeveloped, PennDOT may consider permitting trips being generated by the existing development be applied to the proposed redeveloped site as a "trip credit".

The number of "trip credits" to be applied will be determined on a case-by-case basis during the Scoping Application process. Trip credits shall only apply to existing permitted driveways. PennDOT waives none of its powers or rights to require the future change in operation, removal, relocation, or proper maintenance of any access within the State highway right-of-way.

Business Transportation Demand Management

Vehicular trips may be reduced for businesses up to 2% of trips if they have committed to a Transportation Demand Management (TDM) program, provided that the business enters into a legally enforceable agreement, such as a developers' agreement with the local municipality, with a guarantee that the mitigation measures will be implemented. The credit for the TDM program depends upon the number of TDM strategies that the business is willing to implement. This trip reduction, if used, should be applied in either Step 5 or Step 9 of Figure 3.1 from the Trip Generation Handbook (**Figure 6**).

The options are:

- Parking pricing (employees must pay share of parking expense)
- Telecommuting
- Compressed/ Flexible Work Schedule
- Guaranteed Ride Home
- Locker and showers, and place to store bikes
- Car-sharing or car-matching services
- Free transit pass

The business may reduce trips by 2.0% if at least four of the elements listed above are part of the TDM program and may reduce trips by 1.0% if three elements are part of the TDM program.

STEP 5: Modal Splits

This section recognizes the potential for non-vehicular trips and offers "standard assumptions" for the modal split of alternative trips provided that pedestrian, bike, and transit-friendly characteristics are present.

Factors that lend themselves to a greater number of non-vehicular trips include presence of pedestrian, bike, and transit facilities; high density; mix of land uses in close proximity; good roadway connectivity; promotion of alternative trips (through work trip demand management programs); price of parking; and other factors.

If applicants can provide documentation indicating that the percentage of trips conducted via alternative modes will be even greater than shown below, such documentation may be considered by Department. Cities such as Pittsburgh and Philadelphia have transit studies that may be used and considered by the Department.

Applicants shall discuss the use of modal splits during the Scoping Meeting and obtain concurrence from the Department.

The methodology presented in ITE's "Trip Generation Handbook" should be utilized for modal splits. This process utilizes the left side of Figure 3.1 (**Figure 6**) of the Handbook and converts vehicular trips to person trips before applying reductions for walking, biking, or transit riding. Sites that are located in urban areas, are infill developments, or some suburban corridors may require the analysis of modal splits.

Baseline Mode Share Assumptions

In Section 5.5.2 of the ITE "Trip Generation Handbook", it states that most situations have at most 5% of person trips accessing a site doing so by walking, biking, or transit. This percentage is the maximum that can be used for most of the state. Locations in Pittsburgh and Philadelphia may be an exception to this allowance and exceed this mode share percentage.

All mode share reductions, even if less than or equal to the 5% allowance in the Handbook, should be documented and justified in the TIS. Refer to Section 5.5.2 of the Handbook for more guidance with mode sharing.

STEP 6: Trip Distribution

Estimating the arrival and departure pattern of traffic to a site requires knowledge of:

- Transportation system (e.g., location of the major roadways, parking facilities and the traffic patterns of those roadways);
- Turning movement data at adjacent driveways or streets with similar traffic characteristics to the proposed site (e.g., if analyzing a proposed residential development, study the driveway of an adjacent residential development);
- Travel times in and around the proposed development; and

- Availability of public transportation and pedestrian accommodations.

All supporting assumptions and calculations shall be included in the TIS or TIA to ensure that the trip distribution calculations can be verified by PennDOT.

The trip distribution for pass-by trips would only apply at the site driveway locations and should be based on the directional distribution of traffic on the adjacent roadway.

Figures for trip distribution shall be provided as outlined in **ATTACHMENT C & D**.

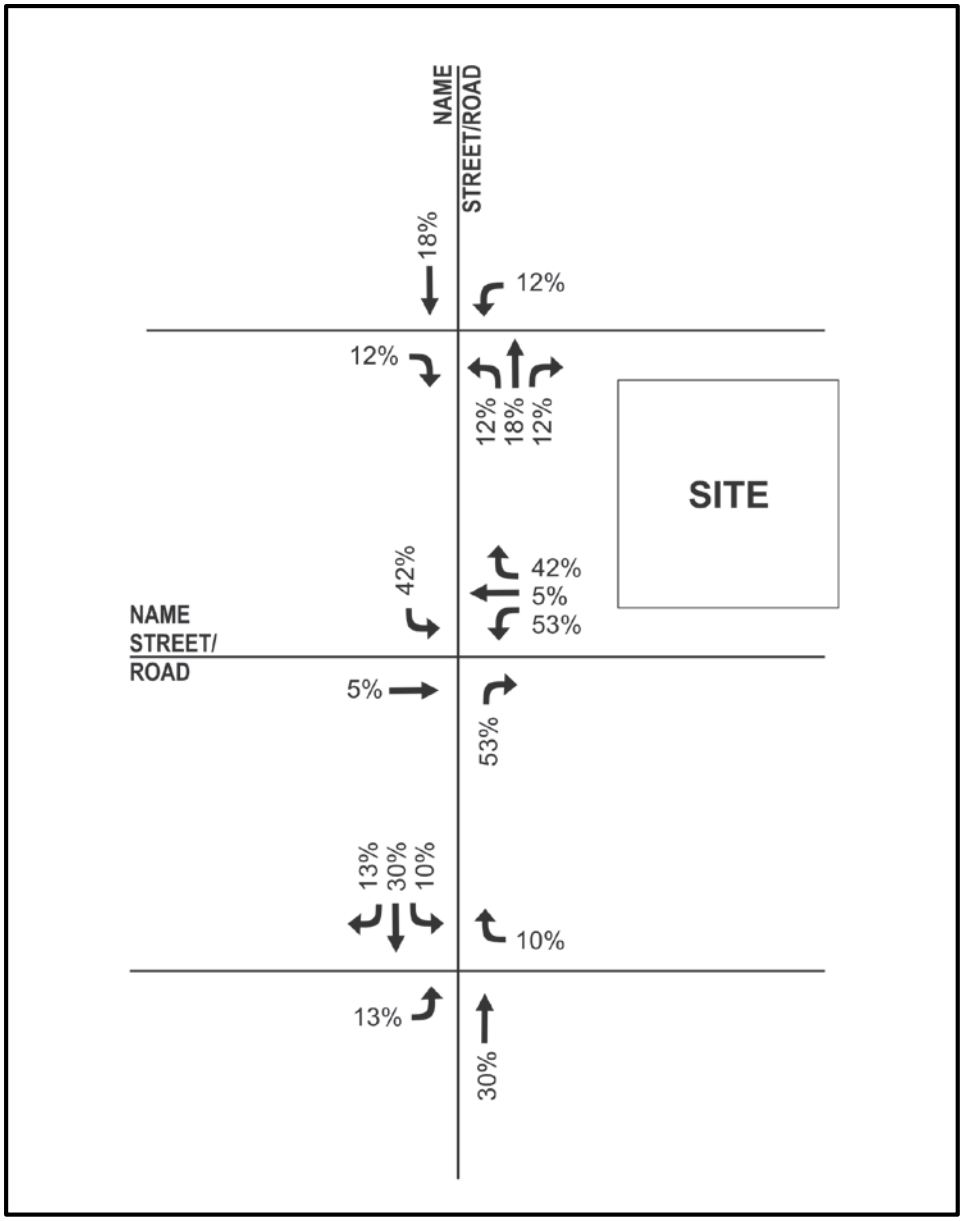
The Department typically prefers the following distribution models to be used with these certain land uses:

- *Residential – gravity model based upon place of employment (US Census data);*
- *Commercial – gravity model based upon a market sector study prepared by a professional marketing firm retained by the developer;*
- *Employment center – gravity model based upon place of residence (US Census data);*
- *Existing institution (hospital, school) to be relocated or expanded – use existing employee zip code data for employees, and use US Census place of residence data for clients or students.*
- *MPO/RPO or local municipal model.*

STEP 7: Traffic Assignment

The applicant must provide a brief description of the proposed project including access with proposed permissible movements, and distance to nearby intersections. This information, combined with the site related trips, is used to assign and distribute trips onto the roadway, pedestrian and transit networks as well as driveway access point(s). PennDOT requires the assignment of vehicular traffic to be based upon travel time (quickest route), reflecting left turn and signal delays.

Trip assignment diagrams indicating the trip assignment percentages and volumes are required to be included in the TIS (**Figure 7**).



STEP 8: Design Year Analysis

Design Year traffic volumes shall be generated for the study area, along with a spreadsheet clearly indicating the baseline traffic growth volumes and traffic generated by planned or approved projects in the study area. A traffic volume figure depicting the Design Year Volumes and roadway conditions shall be provided as indicated in **ATTACHMENT C & D**.

Without Development Design Year (TIS Only)

The applicant shall conduct an analysis of the Without Development Design Year scenarios. Without Development Design Year analyses shall be calculated using the same methodology as the Existing Conditions Scenario.

An analysis of the Without Development Design Year shall be conducted for the future time frame(s) as agreed upon during the Scoping Application process.

Capacity and delay for the intersections in the study area shall be presented in the LOS Table format as indicated in **ATTACHMENT C**. Queue and turn lane analysis shall be conducted for the Design Year and provided for the site driveway intersections. Refer to Publication 46, Chapter 11.16.

Analysis of traffic signals should assume optimized signal timing for the without development and with development conditions. In the event that existing uncoordinated signals are recommended for coordination that involves signals outside the study area, the external signals may need to be analyzed to ensure efficient operation of the entire system. Signals within a coordinated system may require analysis of the entire system. This should be discussed with the District Traffic Engineer as appropriate.

With Development Design Year (TIS & TIA)

An analysis of the With Development Design Year shall be conducted as agreed upon during the Scoping Application process.

With Development Design Year analyses are required for peak travel periods for study area intersections and for a corridor or roadway analysis. Queue and turn lane analysis should also be conducted as specified during the Scoping Application process.

No Improvement Scenario (TIS & TIA)

No Improvement Scenario analysis shall be conducted to determine the impacts of the proposed development. The capacity and delay results shall be included in the LOS Table indicated in **ATTACHMENT C & D**.

With Improvement Scenario (TIS & TIA)

With Improvement Scenario analysis shall be conducted to indicate the improvements that are required to mitigate any LOS drops or queuing concerns (TIS only) and site access improvements such as turn lanes or movement restrictions (TIS & TIA). The analysis should also account for any safety mitigation measures, as necessary. This information will allow the municipality and PennDOT to understand the level of improvements that would be required to fully mitigate the LOS drops and provide a comparison basis for alternative mitigation measures.

Concept plans are required for the With Improvement Scenario in the TIS as applicable. Concept plans of full mitigation shall be prepared with sufficient detail to describe their feasibility. The plans must also show right-of-way lines. Acceptable base plans are aerial photographs or as-built plans. The applicant may provide a plan on a new survey base if the

applicant believes it is needed at this stage. The plan scale should be in 50-scale unless otherwise agreed to at the scoping meeting.

STEP 9: Mitigation Requirements (TIS Only)

The TIS shall compare the operating LOS, delay, and queuing for the design year both with and without the development. Evaluation of the Without Development and With Development Design Year scenarios determine the impacts the proposed development has on the study area transportation system.

Mitigation Analysis must be conducted to determine the level of improvements necessary to address LOS drops, queuing impacts, and safety concerns. It should be noted that the analysis of critical lane movements and approaches shall also evaluate available storage lengths and queues. If typical intersection improvements are not an option to address LOS drops, **STEP 10** describes alternative mitigation strategies available for consideration.

The Department may request the applicant to mitigate critical movements or approaches and perform additional analysis. This may include queue length analysis, auxiliary lane analysis or gap study analysis as outlined in **ATTACHMENT E.** Turn Lane guidelines can be found in Publication 46, Chapter 11.16 as discussed as in **STEP 10.**

Application of 10-Second Variance

The intent of the application of a 10-second delay variance is to provide the option to apply a reasonable capacity and delay contingency to overall LOS drops for both signalized and unsignalized intersections.

If evaluation of the With Development Design Year Scenario to the Without Development Design Year Scenario indicates that the overall intersection LOS has dropped, the applicant will be required to mitigate the LOS if the increase in overall intersection delay is greater than 10-seconds. If the overall intersection delay increase is less than or equal to 10-seconds, mitigation of the intersection will not be required. If the intersection LOS meets the level of service requirements, applicants may still be required to provide mitigation to address critical lanes or approaches. For locations where the level of service of the design year without the development is LOS F and with development, the delay increases more than 10 seconds, the remedies shall provide an estimated delay which will be no worse than the delay for the design year without the development. **Table 4** provides examples of the application of the 10-second variance at various intersections.

Table 4: 10 Second Variance Example

Intersection Number	Intersection	Design Year without Development	Design Year with Development	10 Second Variance Calculation	Meets LOS Requirements
1	East St & Tally Ho Dr	C (21)	C (34)	N/A	Yes
2	East St & King Dr	D (40)	E (56)	56-40=16s	No
3	East St & Seabiscuit Ln	D (47)	E (56)	56-47=9s	Yes
4	East St & Queen Dr	F (82)	F (92)	92-82=10s	Yes
5	East St & Main St	F (82)	F (100)	100-82=18s	No

As shown in **Table 4**, Intersection 1 indicates no LOS drop, therefore it meets the LOS Requirements.

Intersection 2 shows an overall intersection drop, but the delay difference is 16-seconds, which is greater than the 10-second variance. Therefore, Intersection 2 does not meet the overall intersection LOS requirements and mitigation is needed.

Intersection 3 indicates that the LOS has dropped, however the delay difference is 9-seconds which is less than the 10-second variance. Therefore, Intersection 3 meets the overall intersection LOS requirements.

Intersection 4 is already operating at LOS F, but the increase in delay is only 10-seconds in comparing the With Development Design Year to the Without Development scenario. Therefore, Intersection 4 meets the overall intersection LOS requirements.

Intersection 5 is also already operating at LOS F, but the increase in delay is 18-seconds in comparing the With Development Design Year to the Without Development scenario. Therefore, Intersection 5 does not meet the overall intersection LOS requirements because the delay exceeds the 10-second variance.

For mitigation scenarios, applicants are expected to mitigate the overall intersection LOS to the original Without Development LOS; the 10-second delay variance is not applied to mitigation scenarios. Applicants may be required to address available storage and queue lengths at critical movements or approaches even if the overall LOS requirements are met.

Table 5: LOS Mitigation Example

Intersection Number	Intersection	Design Year without Development	Design Year with Development	Design Year with Dev and Improvements	LOS Mitigated?
1	East St & Tally Ho Dr	C (21)	C (34)	C (34)	N/A
2	East St & King Dr	D (40)	E (56)	D (42)	Yes
3	East St & Seabiscuit Ln	D (47)	E (56)	E (56)	N/A
4	East St & Queen Dr	F (82)	F (92)	F (92)	N/A
5	East St & Main St	F (82)	F (100)	F (87)	No

For intersections 1, 3, and 4, no mitigation was required therefore no improvements are proposed and the design year with development with improvement scenario is unchanged.

Intersection 2 required mitigation and improvements are proposed. The improvements satisfy the mitigation criteria as the capacity analysis shows a return to a LOS D for the intersection. The total delay of the intersection does not need to be less than or equal to the without development scenario to meet the mitigation requirements.

Intersection 5 required mitigation and improvements are proposed. The improvements do not satisfy the mitigation criteria as a failing LOS in both the without development and with development scenarios must be returned to the without development scenario delay or better.

Queue Analysis

If the queuing analysis indicates the site generated traffic causes queues to exceed the existing storage bays (by at least 25 feet, representing one car length), spills back into major intersections, or blocks a proposed site driveway, mitigation shall be provided. For turn bays, the queue length with the mitigation improvements must be either accommodated within the turn bay or be no longer than the "without development" queue length. Refer to **ATTACHMENT E** for details.

Existing Signalized Intersections

With Development Design Year overall intersection LOS should be no worse than Without Development Design Year overall intersection LOS, except as noted previously.

All movements and approaches shall be evaluated, and queues shall be evaluated to ensure that available storage exists.

Existing Unsignalized Intersections

The evaluation of the performance of unsignalized/stop-controlled intersections should include more than just the LOS and delay. Measures of effectiveness such as v/c ratios for individual movements and queue length shall be considered by applicants and presented in the TIS regardless of whether the following LOS requirements are met.

Intersection analysis software does not provide overall LOS for 2-way stop controlled unsignalized intersections but provides LOS for approaches. The applicant should develop an overall LOS for unsignalized intersections by using a weighted average of approach delays to calculate the overall intersection delay as shown in **Figure 8.**

Safety issues should be identified, and sight distance studies and gaps should be evaluated as well. Focusing on a single measure of effectiveness may result in making a less effective traffic control decision.

Following are LOS requirements for unsignalized intersections:

- Overall intersection LOS for With Development Design Year scenarios should be no worse than Without Development Design Year scenarios. If lane movement LOS drops occur, the toolbox for unsignalized evaluation should be considered.
- If signalization is the preferred alternative for mitigation, overall intersection LOS C in rural areas and LOS D in urban areas is acceptable.
- If a drop in LOS occurs but the intersection does NOT meet warrants for a traffic signal, other options should be explored to mitigate as discussed in **STEP 10**.
- If other mitigation measures are not applicable, municipal input is required to seek Department approval for an unsignalized intersection Design (LOS) Waiver.

Toolbox for Unsignalized Intersection Evaluation

- *Alternative Routes and Connectivity*
- *Queuing, Gap Evaluation*
- *Turn Restriction Evaluation*
- *Median Barrier Evaluation*
- *Roundabout Evaluation*
- *Traffic Signal Evaluation in accordance with Publication 212*

Gap studies shall be conducted for two-way stop-controlled intersections where a stop-controlled approach is projected to operate at LOS E or worse and other mitigation such as a traffic signal or roundabout are not warranted or feasible. Refer to **ATTACHMENT E**.

New Intersections / Driveways

New signalized or unsignalized intersection established to serve as access to the development shall be designed to operate at minimum LOS C for rural areas, and minimum LOS D for urban areas.

The applicant shall identify and confirm that the proposed driveways/intersections are the best access plan. Plans should be evaluated based on the operations of each driveway, impact on adjacent roadways, safety, and acceptability to the community. The applicant shall identify the different access options available to the subject property.

Gap studies, sight distance studies and queue length/auxiliary lane analysis should be conducted as part of the new intersection or driveway analysis.

PennDOT, on a case-by-case basis, will consider evaluation of new intersections to be designed to an overall intersection LOS E, with input from the municipality. An example would be designing an intersection to LOS E to maintain context with other intersections in the area, and to encourage pedestrian mobility through smaller intersection design.

In all cases, the applicant must coordinate with the District to determine the applicable context and acceptable levels of service for the site location, as outlined in **PHASE 1**.

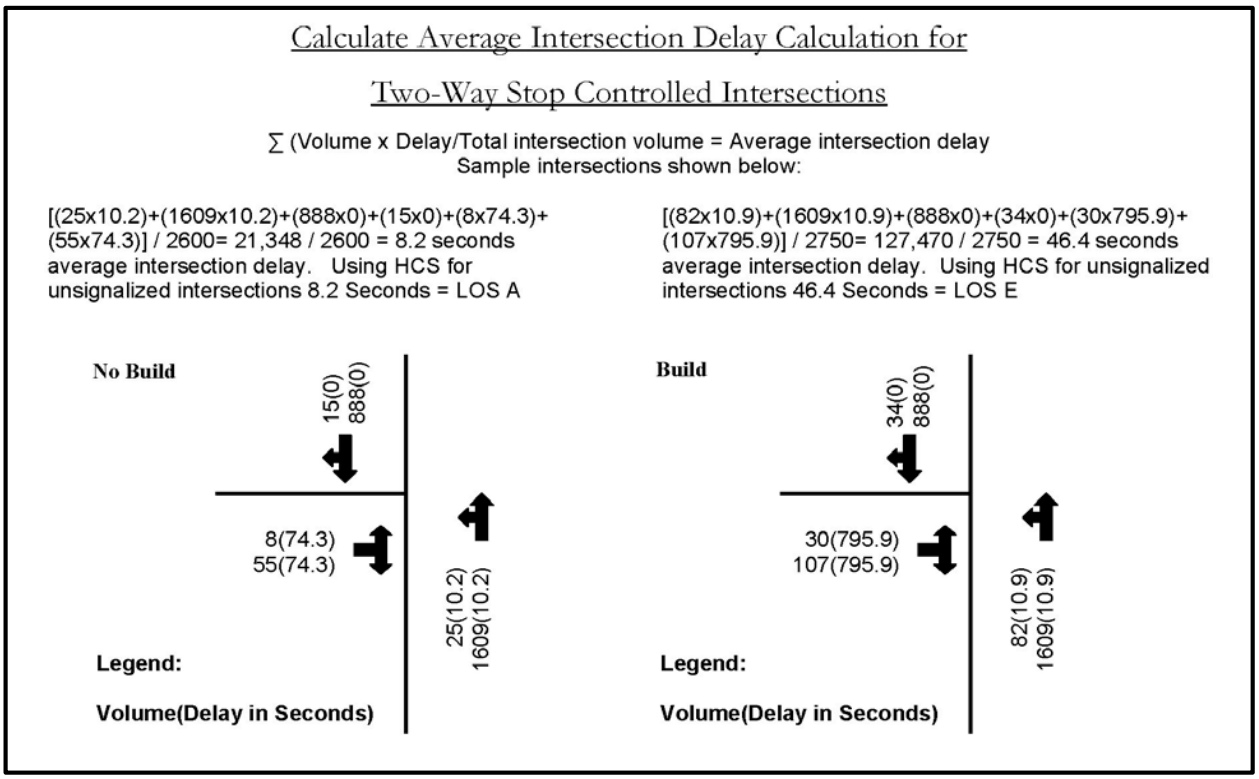


Figure 8: Intersection Delay Calculation - TWSC Intersection

Intersection Control Evaluation (ICE)

An ICE shall be completed and included when the site development includes any of the following:

- Creation of a new intersection
- Creation of a medium volume or high-volume driveway
- Adding a leg to an existing intersection that is not a minimal use driveway
- Adding a through lane or turning lane at an existing intersection, or changing the lane configuration at an existing intersection
- Changing control at an existing intersection (such as installing a new traffic signal)
- Lane configuration or control changes at ramp terminal intersections

The initial Stage 1: Screening can be conducted first to determine if further stages of analysis are required. Refer to PennDOT Publication 10-X, DM1 Appendix, Appendix AI, for more information. Additional information, tools, and forms can be found on the PennDOT Traffic Signal Portal.

STEP 10: Mitigation Analysis (TIS Only)

If it is determined mitigation is required, the applicant is responsible to construct improvements that will satisfy the requirements identified in **STEP 9**. Common strategies of traffic impact mitigation may involve changes to physical geometry, striping, and traffic controls. PennDOT also encourages innovative transportation solutions and consideration of unconventional intersection treatments.

In cases where nearby development(s) are proposed concurrently, improvements proposed by another development may also be required to mitigate the applicant's impact. If the other development implementing the mitigation falls through or is delayed, but the improvements are still needed to mitigate the applicant's impact, the applicant shall be responsible for providing the necessary mitigation. If the nearby development falls through prior to acceptance of the proposed mitigation, the applicant may revise the TIS to remove the background development trips and reassess the need for mitigation.

When designing improvements for mitigation, an applicant should consider the ability for future expansion, such as the placement of signal poles or design of a roundabout to accommodate future lanes.

Turn Lanes

Turn lane warrants shall be performed at all site driveway intersections and newly created intersections. The need for turning lanes shall be determined based on the criteria in PennDOT Publication 46, Chapter 11, unless otherwise agreed upon during the Scoping Application process. Turn lane lengths shall be determined based on the 95th percentile queue length or Pub 46 criteria, whichever is greater. The lower of the two values may be considered acceptable

by the District Permit Manager where circumstances limit the available storage lengths such as closely spaced intersections, complex transportation systems, and right-of-way constraints, if supported by the operational analysis.

Traffic Signals

Signal Warrant analysis should be performed for unsignalized intersections that operate at failing levels of service in accordance with Publication 212.

Signal warrants shall be conducted with the developments opening year volumes to determine if a signal is warranted in the opening year. In the event that a signal is warranted in the Design Year, but not in the Opening Year, a separate analysis shall be provided to project when the warrant is met. Additional volume development might be required to project the necessary volumes for the signal warrant analysis.

In the event that a traffic signal is required as part of mitigation, the applicant/permittee for the signal will be the municipality. It is recommended that the municipality execute an agreement with the HOP applicant that requires the HOP applicant be responsible for the costs associated with the signal installation as well as maintenance of the signal for up to at least one year after initial operation.

Note: PennDOT expects applicants to evaluate all applicable signal warrants. The peak hour warrant shall only be applied in unusual cases, including but not limited to, office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.

As soon as the applicant determines that a traffic signal is a mitigation option, coordination should be initiated with the municipality and Department. The scope of the coordination shall include:

1. Evaluation of the use of a roundabout in lieu of a signal
2. The limits of the traffic signal system to be analyzed
3. Performance requirements
4. The method of analysis
5. Technology and maintenance issues
6. Installation and maintenance agreement with municipality and PennDOT

Method of Analysis

It should be noted that roundabouts shall be considered at all locations under signalization consideration and applicants shall refer to PennDOT "Design Manual, Part 2", Chapter 3, and NCHRP Report 1043 – Guide for Roundabouts for more information.

Based on roadway type and context established during the Scoping Application process, the applicant shall ascertain if either minimizing stops (such as along a major corridor) or minimizing delay (such as in a grid network) is the primary purpose of the traffic signal system.

Based upon this, the applicant shall prepare an analysis using an acceptable software package to develop appropriate signal timing plans. Time space diagrams documenting the results may be requested by PennDOT.

Technology and Maintenance Issues

A traffic signal system shall be sufficient to mitigate the impact of the applicant's development, but capable of being operated and maintained by the municipality. The applicant may be required to participate in and/or fund a portion of a Traffic Signal Assets Management Plan. Municipal concurrence is required for operating and maintaining the traffic signal system in accordance with the Traffic Signal Assets Management Plan. The municipality may require that the applicant retain the services of a traffic engineer to address and respond to complaints regarding signals for up to 1-year after the development opens.

Roundabouts

A roundabout is a circular intersection consisting of a central island, a circulatory roadway, and splitter islands on each approach. Studies have shown that relative to other traffic controls at intersections, roundabouts are often better able to reduce conflict points; reduce crash incidence and the severity of crashes; and reduce delay. Roundabouts shall receive particular consideration for existing study area intersections with high crash histories.

The feasibility of installing a roundabout shall include consideration of site constraints such as unobtainable ROW, environmental factors, and other design factors. Roundabouts may not be suitable when the intersection is within a well-coordinated signal system with acceptable crash histories; where a signal exists to serve emergency vehicle pre-emption; or where the intersection has functioned well for all users under existing traffic controls. If a roundabout is determined to be feasible and is anticipated to be superior to other traffic controls in addressing the needs of all users at an intersection, it should be considered the preferred alternative.

Applicants are encouraged to refer to PennDOT "Design Manual, Part 2", Chapter 3, and NCHRP Report 1043 – Guide for Roundabouts for more information.

Due to the complexity and evolving criteria associated with roundabouts and Diverging Diamond Interchanges (DDI), all roundabout and DDI alternatives will require coordination with the Bureau of Design and Delivery (BODD), Highway Design and Technology Division (HDTD). The District Permit Manager shall remain the point of contact for the applicant and will coordinate with the District Roundabout Coordinator and BODD HDTD as required.

Impractical or Infeasible Improvements

If the LOS or queue requirements are not met, and the improvements are determined to be impractical or infeasible, there are three opportunities available for the applicant to pursue.

1. Local Land Use Transportation Plan with Marginal LOS Degradation
2. Alternative Transportation Plan with Significant LOS Degradation
3. Design Waiver - LOS

If the applicant documents that construction of improvements to mitigate the LOS drops is impractical or infeasible, the applicant may evaluate Conditions 1 and 2 as mitigation scenarios as shown in **Figure 9**.

If after evaluation of Conditions 1 and 2 it is determined that mitigation is not feasible, a LOS Waiver can be requested as the third and final option.

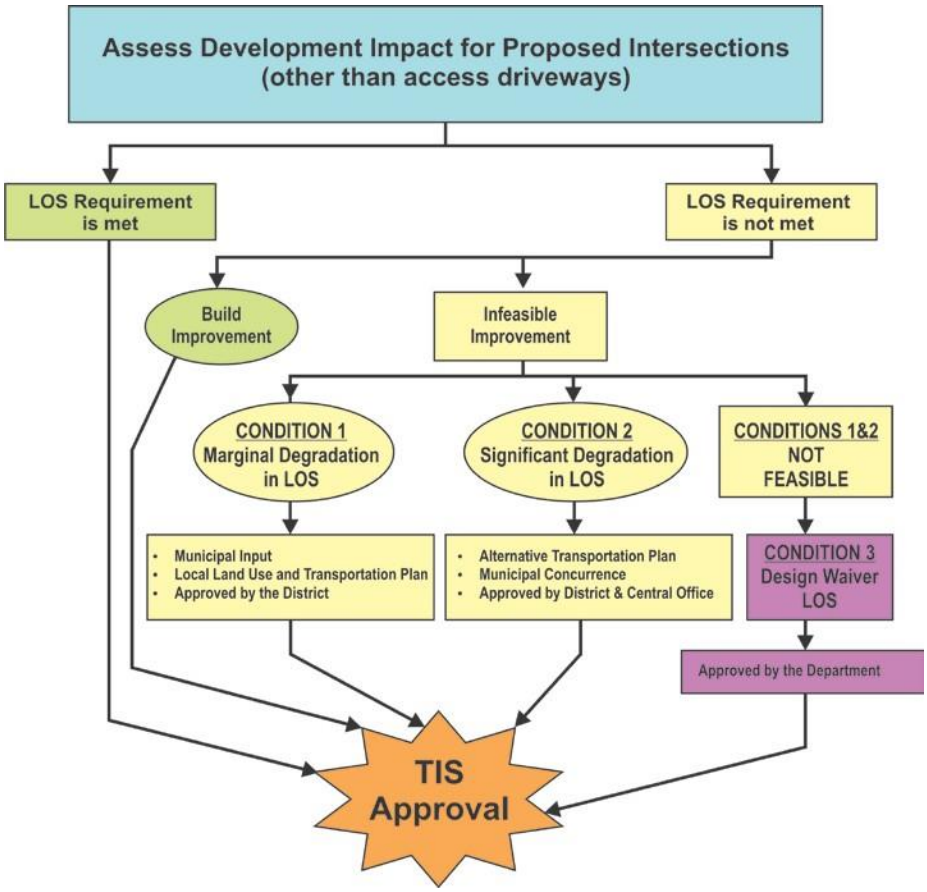


Figure 9: Mitigation Procedure

Condition 1: Marginal LOS Degradation, Local Land Use and Transportation Plan

If the LOS requirements are not met and improvements required to mitigate the impacts are impractical or infeasible, the applicant may evaluate the use of the Marginal LOS Degradation condition. Marginal Degradation is defined as a drop in the overall intersection LOS within LOS range of LOS B to LOS C for rural areas, and LOS B to LOS D for urban areas.

PennDOT will consider accepting the Marginal LOS Degradation based on municipal input and review of the Municipal Land Use and Transportation Plan to ensure congestion and delay are managed in the study area. The Municipal Land Use and Transportation Plan and correspondence from the municipality should be provided as part of the TIS submission.

Condition 2: Significant LOS Degradation, Alternative Transportation Plan

If the LOS requirements are not met and improvements required to mitigate the impacts are impractical or infeasible, the applicant may evaluate the use of the Significant LOS

Degradation condition. Significant Degradation is defined as a drop in the overall intersection LOS below LOS range of C in rural areas and D in urban areas. A significant degradation may be acceptable if:

1. PennDOT concurs that improvements are demonstrated to be infeasible AND
2. PennDOT concurs that foregoing the improvements will jeopardize neither public safety nor the highway/bridge infrastructure; AND
3. The degradation to overall intersection is acceptable to the municipality; AND
4. The applicant prepares an Alternative Transportation Plan to address improvements to the transportation network which are accepted by the municipality and PennDOT. The implementation of the Alternative Transportation Plan may not always completely mitigate LOS drops, as its purpose is to improve congestion and delay in the transportation network by promoting other transportation strategies.

Alternative Transportation Plan

An Alternative Transportation Plan (ATP) should encompass a wide range of strategies that will enable the future improvement of conditions for motorists, pedestrians, bicyclists, and transit users within the study area. It extends beyond mitigation strategies that can be implemented by the applicant directly, to encompass strategies that should be implemented by public agencies.

Once approved by the host municipality(ies), PennDOT will review the ATP and evaluate the feasibility of implementation of strategies. PennDOT may request input from the County planning office, MPO/ RPO, and local transit authorities as well. PennDOT and applicant must agree upon the role of the applicant in implementing the strategies.

ATTACHMENT F contains a variety of strategies that may be used for the ATP.

ATP Mitigation Strategy Toolbox (See **ATTACHMENT F***)*

1. *Alternative Routes*
2. *Access Management Plans*
3. *Traffic Signal Asset Management Plan*
4. *Multi-modal Plans*
5. *Pedestrian Facilities*
6. *Transit Facilities*
7. *Bicycle Facilities*
8. *Park and Ride Facilities*
9. *Intelligent Transportation Systems*
10. *Act 209 Plan*

To be accepted as fulfilling part of the development's mitigation obligations, the ATP must be legally binding and have received approval of the municipality's(ies') governing body. As a condition of approval, PennDOT will review the plan for certainty of funding and implementation schedule such that the public benefits of the ATP beginning at opening of the development.

An Act 209 Plan prepared by a municipality may also qualify as an ATP, but the Plan should also include a Traffic Signal Assets Management Plan, and a summary of projects on the MPO's Transportation Improvement Plan (TIP) and Long-Range Plan that have the potential to address congestion in the study area.

Another plan that may qualify as an ATP is a TIP arising from a Land Use and Transportation Study for a municipality, a group of municipalities, or for a corridor in which PennDOT is part of the Steering Committee. Municipalities that have Official Maps indicating areas for improvements may also qualify as an ATP. To qualify as an ATP, the plan must be funded and have a feasible implementation schedule. Also, the costs associated with the implementation of the ATP should be comparable to the costs associated with the impractical or infeasible improvements the applicant is requesting to forego.

The applicant may fully or partially fund the ATP in order to guarantee implementation and schedule. PennDOT will make the ATP a condition of the HOP. It is recommended that the municipality make the ATP a condition of the municipal land use approval.

Condition 3: Design Waiver – LOS

In the event that Conditions 1 or 2 are unachievable, a Design Waiver - LOS may be applied for as outlined in Chapter 2 of this publication (Pub 282). Due to the variety of alternative mitigation options available to applicants, a very small percentage of waivers are anticipated to be granted by PennDOT.

PHASE 3: SUBMISSION TO PENNDOT AND REVIEW PROCESS

PennDOT Review Process

The District Permit Manager will be the point of contact for the entire permit process and related submissions. Upon receipt of a TIS or TIA, PennDOT will review the applicant's assessment of the need for capacity, safety, or other enhancements to mitigate transportation impacts.

TIS and TIA documents prepared in accordance with these guidelines shall be submitted to PennDOT with an appropriate HOP application. PennDOT will typically review and return comments, if necessary, pertaining to the TIS or TIA within 30 calendar days of the submission but no longer than 60 days. For a TIS, when all PennDOT concerns impacting the necessary mitigation are addressed, the District Permit Office will inform the applicant the mitigation is accepted, and the applicant may proceed with preparation of design plans (Phase 4). For a TIA, when all PennDOT concerns impacting the site access design have been addressed, the District Permit Office will inform the applicant the site access design is accepted, and the applicant may proceed with preparation of the design plans (Phase 4).

If the applicant pursues Condition 1 or Condition 2 under **STEP 10**, the documentation from the municipality(ies) with respect to Marginal and Significant Degradation as well as the proposed ATP shall be submitted separate from the TIS.

If PennDOT approves the Marginal or Significant Degradation, related correspondence and the ATP shall be included in the appendix of the final TIS document. If the applicant pursues a Design (LOS) Waiver, the waiver request shall also be submitted as a standalone document.

If approved by PennDOT, the Design Waiver - LOS request and the approval will be attached in ePermitting by the PennDOT District Permit Office.

Approval of mitigation does not waive any of PennDOT's rights to require updates to the TIS or TIA due to changed conditions, such as but not limited to, other developments in the vicinity changing the volume of traffic and/or making highway improvements.

Special Review

Median break studies or Point of Access Studies required or requested as part of the TIS shall not be approved prior to obtaining all necessary Department and/or FHWA approvals.

TIS reports that utilize Alternative Transportation Plans as a mitigation strategy shall not be approved by the District Permit Office prior to obtaining review and approval by the Central Permit Office.

As mentioned in **PHASE 1**, applicants may request to submit to PennDOT a Preliminary TIS for projects in which the project's data collection and trip forecasting elements are provided prior to addressing operations and mitigation options.

REFERENCES

A Policy on Geometric Design of Highways and Streets, 7th Edition, 2018, AASHTO. Also known as the "Green Book."

Access to and Occupancy of Highway by Driveways and Local Roads, 67 Pa. Code, Chapter 441

PennDOT Design Manual Part 1X, PennDOT Publication 10X

PennDOT Design Manual Part 2, Contextual Roadway Design, PennDOT Publication 13

PennDOT Design Manual, Part 2, Highway Design, PennDOT Publication 13M

Roadway Construction Standards, PennDOT Publication 72M

Traffic Engineering Manual, PennDOT Publication 46

Traffic Signal Design Handbook, PennDOT Publication 149

Traffic Signal Standards, PennDOT Publication 148

Official Traffic Control Devices, PennDOT Publication 212

Highway Safety Program Guide, PennDOT Publication 638

Multimodal Transportation Impact Analysis for Site Development, ITE (2023)

Highway Capacity Manual, 7th Edition

TRB Access Management Manual, Second Edition

NCHRP Report 1043 – Guide for Roundabouts

ATTACHMENT A – GLOSSARY

AVERAGE TRIP RATE – is the weighted average of the number of vehicle trip or trip ends per unit of independent variable.

ACCESS – is the ability to enter or leave a public street or highway from an abutting private property or other public street.

ACCESS MANAGEMENT – is the control and regulation of the spacing and design of driveways, ramps, medians, median openings, traffic signals, and intersections on arterial roads to improve safe and efficient traffic flow on the road system.

AVERAGE DAILY TRAFFIC – is the average number of vehicles crossing a specific point on a roadway on any given day.

AVERAGE TRAVEL SPEED – means the average speed of a traffic stream computed as the length of a highway segment divided by the average travel time of vehicles traversing the segment, in miles per hour.

ALTERNATIVE TRANSPORTATION PLAN – is a plan prepared by the applicant to address significant degradation of LOS. It encompasses a variety of multi-modal and congestion management strategies for improving the study area and transportation network.

BACKGROUND TRAFFIC – refers to an estimate of future traffic within the vicinity of the proposed development, without the site development traffic, but with existing traffic adjusted for expected growth, and addition of traffic from major vested projects.

CAPACITY – means the maximum rate of flow at which persons or vehicles can be reasonably expected to traverse a point or uniform segment of a lane or roadway during a specific time period under prevailing roadway, traffic, and control conditions; usually expressed as vehicles per hour (VPH) or persons per hours.

CONTEXT – a land area comprising a unique combination of different land uses, architectural types, urban form, building density, roadways, and topography and other natural features. See PennDOT *Publication 13, Design Manual Part 2, Contextual Roadway Design* for the five contexts; two are rural, and the remaining three (3) are considered urban in this document.

CRASH RATE – number of crashes per million vehicle miles traveled in a given segment of roadway.

DEPARTMENT – The Pennsylvania Department of Transportation.

DESIRED OPERATING SPEED - the speed of traffic that best reflects the function of the roadway and surrounding context/typology.

DESIGN SPEED – is the speed used to determine the design features of the roadway.

DESIGN YEAR – is the year for which the roadway is designed.

FHWA – The Federal Highway Administration is the division of the United States Department of Transportation that administers the federally funded transportation program and is responsible for disbursing federal highway funds to the states.

GRAVITY MODEL – is a mathematical model used to estimate the number of trips that will be drawn to a development based on population and travel time. In the case of a proposed retail development project, it is the attraction of the population of a segment of market to the site. In the case of a residential project, it is the attraction of the location of employment opportunities, and in the case of an employment center; it is the residential locations of potential employees. Typically, a gravity model is represented by the following equation:

$$= \frac{Segment\ Population}{(Travel\ Time\ to\ Site)^2}$$

INFILL DEVELOPMENT – a development site located in a fully developed urbanized area, often with different interactive land uses and with good pedestrian and vehicular connectivity and served by convenient/frequent transit and/or designated bicycle facilities.

INTERNAL CAPTURE RATE – is the percentage of the total number of trips from a site that are contained within on-site circulation systems only.

ITE TRIP GENERATION – is the most widely used reference source, published by the Institute of Transportation Engineers (ITE) since 1976, for trip generation data, by traffic engineers, and transportation planners for site level planning and analysis.

LAND DEVELOPMENT PROCESS – the process by which municipalities review, approve, or reject land development proposals. The land development process is governed by the Municipalities Planning Code.

LEVEL OF SERVICE (LOS) – a qualitative measure describing the operational conditions within a section of roadway or at an intersection that includes factors such as speed, travel time, ability to maneuver, traffic interruptions, delay, and driver comfort. Level of service is described as a letter grade system (similar to a school grading system) where delay (in seconds) is equivalent to a certain letter grade from A through F.

LIMITED-ACCESS FACILITY – means a street or highway especially designed for through traffic that owners or occupants of abutting land or other persons have no right or easement of access.

LOS DROP – represents a change in letter grade. Generally, all LOS drops must be mitigated to the no- development scenario LOS.

MARGINAL DEGRADATION – is a degradation in level of service that is within the ranges of LOS A to LOS C in rural areas and LOS A to LOS D in urban areas.

MITIGATION – is that collective process whereby a developer of land makes adequate provisions for the public transportation facilities needed to accommodate the impacts of the proposed development.

MULTI-USE DEVELOPMENT – (as defined by the Urban Land Institute) means land development that includes two or more different types of land uses; for example, residential, commercial, and industrial.

MUTCD – (Manual on Uniform Traffic Control Devices) This federal publication established the methodology to study, design, install, and operate signs, signals, and pavement markings

on a uniform basis across the United States. While PennDOT regulations follow the MUTCD, there are differences, and the traffic engineering community is cautioned to refer to PennDOT Publications. PennDOT publications take precedence where there are differences.

NEW DEVELOPMENT – any commercial, industrial, residential, or other project which involves new construction, enlargement, reconstruction, redevelopment, relocation, or structural alteration and which is expected to generate additional vehicular traffic.

OFF-SITE IMPROVEMENTS – those capital improvements which are not on-site improvements.

ON-SITE IMPROVEMENTS – all improvements constructed on the applicant's property, or the improvements constructed on the property abutting the applicant's property necessary for the ingress or egress to the applicant's property, and required to be constructed by the applicant pursuant to any municipal ordinance, including, but not limited to, the municipal building code, subdivision and land development ordinance, Planned Residential Development (PRD) regulations, and zoning ordinance.

OPERATING SPEED – the rate of travel at which vehicles are observed traveling during free-flow conditions.

PASS-BY TRIPS – trips that are attracted to a site from existing traffic passing the site on the adjacent street or roadway that provides direct access to the site.

PEAK-HOUR FACTOR (PHF) – is the ratio of the hourly volume to four times the peak 15-minutes volume.

RIGHT-OF-WAY (ROW) – an area of land that is used by the public for travel and for the location of utilities.

RURAL AREAS – are areas not included in an urbanized area, a transitioning urbanized area, an urban area, or a community.

SIGNIFICANT DEGRADATION – is a degradation in level of service below LOS C in rural areas and LOS D in urban areas.

SUBURBAN AREAS – areas of low density and almost fully residential except for commercial that usually occurs at major intersections, schools, and other occasional isolated uses.

TRAFFIC VOLUME – is the number of vehicles passing a point on a highway during a specific time period.

TRANSPORTATION IMPACT ASSESSMENT – a limited analysis and evaluation of the impact of development of sites not warranting a Transportation Impact Study conducted under the supervision of a Pennsylvania Registered Professional Engineer. The purpose of the Transportation Impact Assessment is to assess the impact of the site access points and adjacent intersections or elements of the state transportation system.

TRANSPORTATION IMPACT STUDY – analyses of the impact of development conducted under the supervision of a Pennsylvania registered Professional Engineer to determine the full impact of proposed development on the transportation system.

TRIP – is a single- or one-way directional movement. Transportation engineers & planners refer to trips as "internal," "external," or "through." Internal trips have both origin and destination within a particular projects area. External trips have only one end within the project area. Through trips neither originate nor end within the analysis area but pass through it.

TRIP DISTRIBUTION – is the arrival and departure patterns for trips to and from the site by geographic area.

TRIP END – is a term denoting the origin or the destination end of the trip in question.

TRIP GENERATION RATE – are average rates of vehicular travel to and from a development, usually cited per square foot, per housing units or per acre.

TRIP GENERATION – is the total number of vehicular trips going to and from a particular land use on a specific site during a specific time period.

URBAN AREAS – areas just outside of a Central Business District as indicated on PennDOT's Type 10 maps.

ATTACHMENT B – SCOPING MEETING AGENDA

Scoping Meeting Agenda

1) Background of Proposed Project
   a) Location and Type of Project
   b) Status in Land Development Process
   c) Site Plan Discussion
      i) Proposed site access
      ii) Proposed land uses
      iii) Community linkages (access to neighboring properties, cross easements, pedestrian accommodations (sidewalks, crosswalks, etc.), bicycle and transit accommodations)
      iv) Adjacent properties
2) Review of Study Area
   a) Context (Refer to PennDOT Publication 13, Design Manual, Part 2)
   b) Known Congestion Areas and Safety Concerns
   c) Known Historical or Environmental Constraints
   d) Pedestrian/Bike Review: Community Centers, Parks, Schools, etc.
   e) Transit Review (current routes/stops)
   f) 102" wide combinations (w/ trailer lengths greater than 28') permitted on SR (Refer to 75 PA. C.S. §4908)
3) Existing Planning Information
   a) Comprehensive Plans
   b) Act 209 Plans
   c) Access Management Ordinances/Plans
   d) Zoning/Land Use in the Study Area
   e) Known projects/developments with HOP approval or approved TIS
4) Study Area
   a) Proposed Project Location/Best Access Plan
   b) Proposed Study Roadways
      i) Roadway Type (Present/Future)
      ii) Location of Structures
      iii) Current Speed, Desired Operating Speed
      iv) Existing Right-Of-Way
   c) Proposed Study Intersections
      i) Type of Control (Stop/Signals/etc.)
      ii) Coordinated Signals; Is expansion of study area required/needed?
5) Trip Generation
   a) Methodology Used
   b) Anticipated number of trips
   c) Modal Split Reductions
6) Approval of Data Collection Elements and Methodologies to be used for evaluation
   a) Turning Movement and 24-Hour Count Parameters
   b) Balancing of Traffic Volumes / Seasonal Adjustment Factors
   c) Gap, Queue Length, Turn Lane, and Sight Distance Studies
   d) Analysis Software

7) Approval of Analysis Years, Growth Rates
   a) Design Year
8) Design Criteria
   a) Lane/Roadway Widths, Design Speeds and LOS Criteria
9) Miscellaneous Department Discussions
   a) Funding/Funded Projects
   b) Right-of-Way, Utility and Drainage Impacts
   c) Impacts to Access of Neighboring Owners
   d) Recording of Permit
   e) Condition Statements
   f) Critical Milestones
   g) Letter of Credit
   h) Traffic Signals
   i) Access Covenant
   j) Continuous Inspection

ATTACHMENT C – SAMPLE TIS

Date: July 27, 2009 | Revised Date: August 31, 2009

XYZ DEVELOPMENT TRANSPORTATION IMPACT STUDY

SR 743, SR74 & the intersection of Minor Road & Main Street

Etters, York Township
York County, Pennsylvania

Prepared for:

RST Developers
John Ralph
123 Anywhere Road
Suite 123
City, State 12345-6789
123-456-7890

Prepared by:

ABC Engineering, Inc.
Tim Taylor, PE
123 Anywhere Road
Suite 123
City, State 12345-6789
717-999-9999

PE
Seal

Signature

Transportation Impact Study (TIS) Format Guidelines

The purpose of the TIS will be to demonstrate the overall impact of traffic generated by the proposed development on the transportation study area. The report structure should follow the Table of Contents provided in the Attachment. The following are elements that need to be addressed in each section of the report. These elements should be presented as discussed and agreed upon during the Scoping Application process.

It should be noted that all Figures, concept plans, calculations, etc. are to be contained in the Appendix of the report but should be discussed and referenced in the appropriate sections as shown.

Executive Summary

The executive summary should be 2 or 3 pages long and concisely cover the project description (location, land use code(s)/trip generation variables, phasing (if applicable), etc.), impact of the proposed development, driveway design recommendations, proposed methods of mitigation, design waivers requested, and financial responsibilities.

A final executive summary can be greater than 3 pages and include any and all memorandum of understandings, agreements including obligation dates, major milestones, and approved or denied design waivers. The final summary should list any and all traffic impacts identified and mitigation options.

Introduction/Project Summary

A brief, descriptive summary of the analysis undertaken in the study must be included; any assumptions used in the traffic analysis must be identified. The following items should also be addressed:

- Study Area, Transportation Facilities
- Figure 1: Study Area Map included in the Appendix, and description of the study area and boundaries defined verbally.
- Figure 2: A site plan (1:50 scale minimum). Lot size, building size(s) and types (retail etc.) and location shall be clearly defined on the map/plans.
- Discussion and/or illustration of the site layout identifying the internal traffic circulation patterns, location of existing and proposed access points. Pedestrian crossings or paths should be identified, as well as locations for drive-through facilities and fuel pumps. Project phasing (if applicable) and schedules should be provided identifying the anticipated opening date, anticipated completion years for each phase of development and the anticipated full build out completion date.

Data Collection

Raw data collected as part of the study in accordance with the scoping meeting shall be contained in the Appendix, however a brief summary of the data collected as well as methodology used to obtain the data must be included in this section.

Existing Study Area Conditions

This section of the report should cover the existing traffic conditions, context, roadway classification and typology, traffic controls in the study area, functional area of the intersection, etc. The study area should also be described, including the roadway network. Figures for existing traffic volumes (AM, PM, Site Peak, and Saturday (as applicable)) as well as the existing level of service (LOS) and queues shall be referenced in this section and contained in the appendix. Document the software used for conducting the capacity analysis including all version/build numbers as applicable. Reference any traffic volume data and photographs included in the appendices.

Turning lane analysis, merge/diverge/weave analysis, gap analysis, and travel time studies should be included for discussion in this section as applicable.

Discuss the results of the crash analysis in this section with reference to the full crash analysis and crash data submitted under separate cover. Do not include any confidential information.

Discussion of the need for sidewalks and crosswalk, and other pedestrian facilities shall be evaluated as part of the project. Evaluation of transit facilities, bus routes/service should also be included in this section.

Reference any existing traffic signals and signal systems within the study area in this section and include permit plans in the appendix.

Design Year Traffic Conditions without Development

This section shall contain the traffic volumes that have been projected to the design year utilizing background growth factors, as well as appropriate background traffic from permitted developments. Reference to the volume development calculations contained in the appendix.

Committed transportation improvements in place prior to the design year shall be described and included in the analysis.

Capacity analysis shall be conducted. Signalized intersections shall be optimized for either corridor prioritization if signals are coordinated. Single intersections shall be optimized for the best overall intersection LOS. Changes to signal timings should be limited to optimized split times. No changes to cycle lengths or phasing should be conducted unless proposed as part of improvements by planned and permitted developments or other roadway improvement projects.

Development Description

The description of the proposed development should be presented in this section. Information that should be discussed and included in the appendix should include but not be limited to:

- Proposed site access including distance from adjacent intersections/relation to the functional area of the intersections and proposed control/movements. Discussion should be provided regarding how access relates to internal circulation and design.
- Sight Distance Analysis (Intersection, Stopping Sight Distance and Existing/Measured Sight Distance)
- Trip Generation (include any modal reductions)
- Internal Capture Trips
- Pass-By and Diverted Link Trips
- Trip Distribution/Assignment. Methods of assumption shall be provided in this section, as well as back up information for verification of calculations included in the appendix.
- If a post development study is necessary, it should be discussed here, including what financial security will be provided in the form and amount for the study and required mitigation.

Design Year Traffic Conditions with Development

Design year traffic volumes and capacity analysis shall be discussed in this section. Figures and worksheets shall be included in the Appendix as noted.

As with previous analyses, analyses should be performed assuming optimized signal timings. Turning lane and queue analysis should be discussed in this section. Auxiliary lanes and proposed lengths should be presented as appropriate. Alternative access locations should be discussed as appropriate.

Signal warrant analysis should be discussed in this section and included in the Appendix as noted.

Mitigation Identification and Recommendations

This section of the report should identify what mitigation measures are needed to meet LOS requirements and to address the traffic impacts of the project. A concept plan of the improvements necessary to mitigate the LOS drops is required to serve as baseline information. Final access design shall address both traffic flow and highway safety considerations, which should be discussed succinctly in this section.

A description of the proposed mitigations, arranged by location and type of mitigation should be included in this section. Concept plans of proposed mitigations shall be prepared and included in the Appendix. The proposed mitigations must be constructible improvements; if right-of-way is a concern, the ability to obtain the necessary right-of-way must be specifically identified. Analysis of Proposed Mitigations shall be discussed, and capacity analyses included in the Appendix as noted.

If post development condition monitoring is requested by PennDOT, it should be discussed in this section. Elements to include in the discussion include what analysis will be provided to

substantiate recommended improvements, optimize signal timings, or to determine if a traffic signal is warranted. If improvements are necessary as a result of the intersection monitoring, the applicant, or their successor, shall be responsible for the full expense of designing and constructing the necessary improvements. PennDOT may require financial security, a condition statement with these terms specifying the duration of the monitoring, as well as the reason for or extent of the monitoring.

If an Alternative Transportation Plan (ATP) is proposed as mitigation, it should be provided as a separate document and referred to in this section. PennDOT will require concurrence from the municipality regarding the ATP which should be included in the final TIS correspondence section of the Appendix as well as the ATP, if approved by PennDOT.

If a Design (LOS) Waiver is pursued, it shall be submitted separate from the TIS and referred to in this section. If approved by PennDOT, the Design (LOS) Waiver request and approval shall be incorporated into the appendix of the final TIS document.

Conclusions

This section shall be a brief, concise description of the study findings, acceptable to PennDOT, and consistent with Publication 282. Proposed development plans shall include the recommended mitigation improvements to address future design year LOS and transportation network needs.

Appendices:

The appendices shall be clearly marked and tabbed appropriately and should include electronic hyperlinks (bookmarks). The following appendices should be included as applicable:

Capacity and Queue Analysis Result Tables:

Table 1: Levels of Service Summary

Table 2: Queue Length Summary

Existing Condition and Volume Figures:

Figure 1: Study Area Map

Figure 2: Site Plan

Figure 3a: Existing Volume

Figure 3b: Existing Level of Service

Design Year Condition Figures:

Figure 4a: Design Year Traffic Volumes without Development (AM, PM, Site Peak)

Figure 4b: Design Year Levels of Service without Development

Figure 5: Trip Distribution Percentage and Trip Assignment Volumes

Figure 6a: Design Year Traffic Volumes with Development

Figure 6b: Design Year Levels of Service with Development

Figure 7: Design Year Levels of Service with Development & Recommended Mitigation

Data Collection

- Turning Movement Counts/24-Hour Volumes
- Existing Conditions (Sketches, Transit Data etc.)
- Site Photographs
- Roadway Functional Classification and Typology documentation
- Existing Traffic Signal Permit Plans
- Pedestrian/Bike/Transit Documentation (Ped/Bike Checklist)

Sight Distance Evaluation

Crash Analysis (under separate cover)

Growth Rate Information

Seasonal Adjustment and Balancing Calculations

List of Committed Developments

- Excerpts from development studies
- Concept plans for roadway improvements

Trip Generation Worksheets

Trips Distribution and Assignment Assumptions and Calculations

Design Year Traffic Volume Calculations

Capacity and Queue Analysis Worksheets

Gap Study

Intersection Control Evaluation

Traffic Signal Warrant Analysis

Turn Lane Analysis

Correspondence (including all meeting minutes)

Approved Scoping Application

Concept Plans

Alternative Transportation Plan

Approved Alternative Transportation Plan

Design (LOS) Waiver Request/Approval

ATTACHMENT D – SAMPLE TIA

Transportation Impact Assessment (TIA) Format Guidelines

The purpose of the TIA will be to demonstrate the overall impact of traffic generated by the proposed development on the immediately adjacent transportation study area surrounding the site access locations. The report structure should follow the Table of Contents provided in the Attachment. The following are elements that need to be addressed in each section of the report. These elements should be presented as discussed and agreed upon during the Scoping Application process.

It should be noted that all Figures, concept plans, calculations, etc. are to be contained in the Appendix of the report but should be discussed and referenced in the appropriate sections as shown.

Executive Summary

The executive summary should be approximately 1 page long and concisely cover the project description (location, land use code(s)/trip generation variables, phasing (if applicable), etc.), impact of the proposed development, driveway design recommendations, design waivers requested, and financial responsibilities.

Introduction/Project Summary

A brief, descriptive summary of the analysis undertaken in the study must be included; any assumptions used in the traffic analysis must be identified. The following items should also be addressed:

- Study Area, Transportation Facilities
- Figure 1: Study Area Map included in the Appendix, and description of the study area and boundaries defined verbally.
- Figure 2: A site plan (1:50 scale minimum). Lot size, building size(s) and types (retail etc.) and location shall be clearly defined on the map/plans.
- Discussion and/or illustration of the site layout identifying the internal traffic circulation patterns, location of existing and proposed access points. Pedestrian crossings or paths should be identified, as well as locations for drive-through facilities and fuel pumps. Project schedule should be provided identifying the anticipated opening date.

Data Collection

Raw data collected as part of the study in accordance with the scoping meeting shall be contained in the Appendix, however a brief summary of the data collected as well as methodology used to obtain the data must be included in this section.

Existing Study Area Conditions

This section of the report should cover the existing traffic conditions, context, roadway classification and typology, traffic controls in the study area, functional area of the intersection,

etc. The study area should also be described, including the roadway network. Figures for existing traffic volumes (AM, PM, Site Peak, and Saturday (as applicable)) as well as existing level of service (LOS) and queues shall be referenced in this section and contained in the appendix. Document the software used for conducting the capacity analysis including all version/build numbers as applicable. Reference any traffic volume data and photographs included in the appendices.

Turning lane warrants, gap analysis, and travel time studies should be included for discussion in this section as applicable.

Discuss the results of the crash analysis in this section with reference to the full crash analysis and crash data submitted under separate cover. Do not include any confidential information.

Discussion of the need for sidewalks and crosswalks, and other pedestrian facilities shall be evaluated as part of the project. Evaluation of transit facilities, bus routes/service should also be included in this section.

Reference any existing traffic signals and signal systems within the study area in this section and include permit plans in the appendix.

Development Description

The description of the proposed development should be presented in this section. Information that should be discussed and included in the appendix should include but not be limited to:

- Proposed site access including distance from adjacent intersections/relation to the functional area of the intersections and proposed control/movements. Discussion should be provided regarding how access relates to internal circulation and design.
- Sight Distance Analysis (Intersection, Stopping Sight Distance and Existing/Measured Sight Distance)
- Trip Generation (include any modal reductions)
- Internal Capture Trips
- Pass-By and Diverted Link Trips
- Trip Distribution/Assignment. Methods of assumption shall be provided in this section, as well as back up information for verification of calculations included in the appendix.
- If a post development study is necessary, it should be discussed here, including what financial security will be provided in the form and amount for the study and required mitigation.

Design Year Traffic Conditions with Development

Design year traffic volumes and capacity analyses shall be discussed in this section. Figures and worksheets shall be included in the Appendix as noted.

As with previous analyses, analyses should be performed assuming optimized signal timings. Turning lane and queue analysis should be discussed in this section. Auxiliary lanes and proposed lengths should be presented as appropriate. Alternative access locations should be discussed as appropriate.

Signal warrant analysis should be discussed in this section and included in the Appendix as noted.

Conclusions

This section shall be a brief, concise description of the study findings, acceptable to PennDOT, and consistent with Publication 282. Include all driveway design recommendations including traffic control, proposed turn lanes, and/or movement restrictions. Proposed development plans shall include the recommended access design.

Appendices:

The appendices shall be clearly marked and tabbed appropriately and should include electronic hyperlinks. The following appendices should be included, as applicable:

Capacity and Queue Analysis Result Tables:

Table 1: Levels of Service Summary

Table 2: Queue Length Summary

Existing Condition and Volume Figures:

Figure 1: Study Area Map

Figure 2: Site Plan

Figure 3a: Existing Volume

Figure 3b: Existing Levels of Service

Design Year Condition Figures:

Figure 4: Trip Distribution Percentage and Trip Assignment Volumes

Figure 5a: Design Year Traffic Volumes with Development

Figure 5b: Design Year Levels of Service with Development

Data Collection

- Turning Movement Counts/24-Hour Volumes
- Existing Conditions (Sketches, Transit Data etc.)
- Site Photographs
- Roadway Functional Classification and Typology documentation
- Existing Traffic Signal Permit Plans
- Pedestrian/Bike/Transit Documentation (Ped/Bike Checklist)

Sight Distance Evaluation

Crash Analysis (under separate cover)

Growth Rate Information

Seasonal Adjustment and Balancing Calculations

List of Committed Developments

- Excerpts from development studies
- Concept plans for roadway improvements

Trip Generation Worksheets

Trips Distribution and Assignment Assumptions and Calculations

Design Year Traffic Volume Calculations

Capacity and Queue Analysis Worksheets

Gap Study

Intersection Control Evaluation

Traffic Signal Warrant Analysis

Turn Lane Analysis

Correspondence (including all meeting minutes)

Approved Scoping Application

Concept Plans

Approved Alternative Transportation Plan

ATTACHMENT E – GAP, QUEUE AND TRAVEL TIME STUDIES

Travel Time Studies

PennDOT may ask the applicant to conduct travel time and delay studies to determine the efficiency of travel along major corridors in the study area, and to identify problem locations. These studies should be discussed during the Scoping Application phase. If they are not initially warranted, they may be requested by PennDOT after review of the traffic analysis and proposed recommendations.

Queue Studies

Queuing results shall be reported for all study area intersections in a tabular format including 95th percentile queue for each lane and the existing/proposed storage lengths. Storage length refers to the maximum length of queue which would not cause traffic operational issues, such as turn bay overflow, spillback to an adjacent intersection, or blocking the proposed site driveway. If Synchro and HCM are used, include both Synchro and HCM results in the report. At the discretion of the district permit unit, traffic micro simulation (such as SimTraffic) may be required for saturated/oversaturated conditions, or complex transportation systems.

The applicant shall refer to PennDOT's policy on queue length located in Publication 46, Chapter 11 – Turn Lane Guidelines. Use the 95th percentile queue when estimating required storage length from traffic engineering software packages, unless otherwise directed by PennDOT.

95th PERCENTILE QUEUE LENGTH (ft)

AM Peak Hour			Storage Length		2024 Existing		2030 Design w/o Development		2030 Design with Development		2030 Design with Mitigation	
Intersection		Movement	Existing	Proposed	HCM	Synchro	HCM	Synchro	HCM	Synchro	HCM	Synchro
1	SR 12 and SR 234	EBL	1000'+	N/A	100'	105'	115'	118'	140'	149'	100'	106'
		EBT										
		EBR										
		WBL	400'	N/A	241'	236'	252'	249'	254'	250'	199'	201'
		WBT										
		WBR										
		NBL	150'	225'	78'	85'	89'	99'	198'	206'	198'	206'
		NBT	800'	800'	249'	255'	261'	273'	341'	339'	341'	339'
		NBR										
		SBL	750'	100'	400'	423'	418'	457'	776'	793'	65'	77'
		SBT		750'							227'	261'
		SBR										

Gap Studies (Critical Headway Studies)

Gap studies are useful in evaluating the capacity and level of service of unsignalized intersections, driveways, and unprotected left turns. Gap studies should be discussed during the Scoping Application phase. If not initially warranted, a gap study may be requested by PennDOT after review of the traffic analysis and proposed recommendations. Refer to *HCM 7th Edition*, Chapter 20, for additional guidance.

ATTACHMENT F – ALTERNATIVE TRANSPORTATION PLAN STRATEGIES

As indicated in **STEP 10**, it will not always be feasible or desirable to modify intersections to mitigate LOS drops. Such modifications could have excessive community or environmental impacts, or they might be less valuable to the community than other strategies which abet more comprehensive transportation improvements.

A variety of mitigation strategies are available for consideration in the development of an Alternative Transportation Plan, while some of the strategies may not mitigate LOS drops, they may still have significant value as congestion management strategies. Developer costs for funding these strategies should be similar to costs that would be assumed by the developer if they had funded physical improvements to roadways and intersections proximate to the development in order to achieve an acceptable LOS. All of the mitigation strategies should involve coordination with local officials and receive approval by the municipal governing body. Following are examples of elements that can be incorporated in the alternative transportation plan.

1. Alternate Routes

   As an alternative to adding capacity to existing intersections on major roads adjacent to the development, or as a supplement to such measures, the applicant should consider the option of improving the connectivity of the area roadway network. A well-connected roadway network can better serve the needs of area motorists, since it provides a greater choice of routes; and better serve pedestrians and bicyclists, by allowing them to travel on streets with lower traffic volumes.

   Typically, this strategy would consist of altering the network such that area residents and workers can make better use of other arterial and collector roadways parallel to the major roadways. The Department will consider this mitigation strategy even if it is physically feasible to add capacity on the state highways adjacent to the development. One consideration will be whether the proposed improvement on the state highway would result in a roadway design out of character with other intersections or segments along the roadway.

   It should be possible in many cases to estimate the traffic volumes that will be diverted to other intersections, thus reducing volumes at intersections on the major roadway. An analysis will reveal whether this strategy would permit the study area intersections to achieve desirable levels of service; even if these levels are not achieved, because of the benefits of a well-connected network, the Department will still consider this as a possible strategy.

   In some cases, installation of a signal at existing unsignalized intersections proximate to the subject property, and providing access to the development, will permit the applicant to avoid constructing a new signalized driveway.

Coordination with local officials will be particularly important for this mitigation strategy. Any proposal for improving the roadway network should avoid significant diversion of traffic to local roads. The municipal transportation plan or official map should be consulted to determine if desired new roadway links in the area of the development are identified.

2. Access Management Plans

An Access Management Plan will recommend comprehensive strategies for controlling access points along arterial roadways within the study area, by identifying opportunities for closing, combining, or moving existing driveways, and by identifying optimal locations for future driveways and opportunities for frontage and mutual access roads on undeveloped properties.

Access management is a tool to improve vehicular flow and safety for motorists, pedestrians, and bicycles through improved control of the location, spacing, design, and operation of driveways along a roadway. Preparing and implementing recommendations for improving access management along arterial roadways in the study area, along and proximate to the subject property, is thus a possible mitigation strategy. This strategy should be primarily considered for existing or planned commercial corridors. As part of this strategy, the applicant should coordinate with adjacent landowners and identify the potential for eliminating and/or combining access points, thus reducing the overall number of driveways along the major roadways and removing them from the influence area of roadway intersections. Ideally, the municipality would pass an ordinance incorporating access management strategies such as minimum driveway spacing, and investigation of shared driveways.

Applicants are encouraged to refer to information from the Department on Access Management Ordinances.

3. Multi-Modal Plans

A Multi-modal Plan will recommend new facilities, programs, and other strategies for accommodating and encouraging pedestrians, bicyclists, and transit users. This should not be limited to the study area, but should prioritize facilities wherever needed in the municipality, and comprehensive strategies for alternative modes.

   a. *Pedestrian Facilities*

      The need for sidewalks and crosswalks, pedestrian signs and signals, and other pedestrian facilities shall be evaluated as part of all development projects. The need for sidewalks is assumed for all projects within urban contexts; the need for sidewalks is assumed as part of any projects within suburban or rural contexts that would generate regular pedestrian activity. In very low-density areas, where the number of existing pedestrians, and pedestrians projected based upon planned development is less than five per day, pedestrians can be accommodated through other means, such as shoulders.

      As a mitigation strategy, in addition to installing sidewalks on the subject property, consideration can be given to the installation of sidewalks along other roadway segments in the study area. The applicant should identify key "missing links" along the roadways adjacent to the development, and along other arterial and collector roadways. Provision of an easement to permit installation of a sidewalk not along a public roadway, enabling pedestrian access between key roads, should also be considered. The focus should be on improving the connections between medium- to high-pedestrian generators, thus enhancing

pedestrian mobility throughout the larger area. The municipal transportation plan or other pedestrian plans should also be consulted.

The applicant should evaluate the need for other pedestrian facilities at intersections and mid-block crossings in the study area, including pedestrian signals, signs, and crosswalks. As mentioned in **PHASE 1**, applicants must adhere to a core principle of ADA: If pedestrian facilities are provided, they must be accessible to persons with disabilities.

b. *Transit Facilities*
The applicant shall evaluate and discuss the potential for increased demand for bus use due to the proposal, addressing whether such increases will increase the number of stops, dwell time, or the frequency of service for existing bus routes in the study area. The applicant shall also evaluate the need for new bus routes. As a mitigation strategy, the applicant could provide funding for planning new transit routes or modification to existing routes, and for the operating costs of such service for the first one to two years of operation.

Improvements to the safety and security of transit stops and low-cost design elements, such as transit shelters and sidewalks in proximity to transit stops, should also be considered.

There are a number of transit agencies in Pennsylvania, and initiatives exist to encourage transit-oriented development. Applicants are encouraged to visit the Pennsylvania Public Transit Association website and the Department page on public transit by county.

c. *Bicycle Facilities*
The applicant should evaluate the need for bicycle facilities on the subject property, whether a bike lane, bicycle-compatible shoulder, or shared-use path. On-road bicycle facilities are of greater priority on arterial and collector roadways. Off-road paths provide the greatest benefit in fairly limited situations – for example, as part of linear recreational or natural areas. This evaluation should consider the opportunity to connect to other bicycle facilities in the study area, and whether there is a comprehensive plan prepared for the municipality, county or regional planning office identifying desirable bicycle facilities within the region. Installed in isolation, bicycle facilities may have minimal value, and the benefit of this mitigation strategy should be viewed accordingly. The applicant may also agree to install bike racks or other bike parking facilities at high bicycle generators in the community, such as parks, schools, and retail centers.

d. *Park and Ride*
Park-and-ride lots have great value in reducing the number of vehicular trips on roadways heading into a regional employment destination. For this mitigation strategy, the applicant may provide park-and-ride parking spaces on the subject property, such as by designating such spaces in a retail center parking lot;

provide these parking spaces on other properties controlled by the applicant in the region; or rent spaces on other properties within the region.

The park-and-ride lot provided by the applicant does not need to be in the study area but should be positioned convenient to regional arterial roadways or transit lines and be located between the study area and regional employment destination, to better capture motorists from this commuter shed.

4. Intelligent Transportation Systems
   A number of ITS strategies may be funded by the applicant to help offset the traffic impacts of the subject property. Along higher order roadways on which closely spaced traffic signals are not coordinated, the applicant could fund the physical interconnection of signals in order to create a coordinated traffic signal system. The applicant should evaluate different signal phasing plans and recommend the most efficient plan for the study area corridor. Another option would be the installation of Changeable Message Signs (CMS) along regional arterial roadways within five miles of the development, focusing on roadways leading to regional employment centers, in order to better inform motorists of travel conditions on those roadways. In conjunction with CMS, or as a separate strategy, the applicant may fund the installation of traffic cameras along regional arterial roadways, in order to monitor traffic flow and incidents on these roadways.
5. Traffic Signal Asset Management Plans
   A Traffic Signal Assets Management Plan will provide recommendations on signal timing for all intersections within an agreed upon area in order to optimize traffic flow and detail a strategy for periodic re-evaluation and re-timing of signals in the future. It will also offer recommendations on a preventive maintenance program that can be adopted by the host municipality and set the funding responsibility by the applicant.

Sample Alternative Transportation Plan

The alternative transportation plan shall be a bound document submitted to the Department separate from the TIS document. If approved by the Department, the ATP shall be included in the final TIS submitted to the Department. The ATP shall contain the following information:

1. Proposed project overview
   a. Provide a map that encompasses the proposed development site as well as the impacted area.
   b. Provide the development description.
      i. Type of Land use, Size, Trip Generation.
      ii. Trip assignment figure.
      iii. Total traffic volume assignment figure.
      iv. Additional information as needed to describe the extent of the development.

2. LOS Table highlighting the specific impacts.
3. Picture(s) of intersection(s) impacted.
4. Construction cost estimate for highway improvements, including, but not limited to, R/W and utility costs, which will fully mitigate impacts.
5. Conceptual plans at a reasonable scale that depicts the highway improvements which will fully mitigate impacts.
6. Conceptual plans at a reasonable scale that depicts highway improvements the applicant intends to implement which will partially but not completely mitigate impacts (as applicable).
7. Detailed justification as to why all or a portion of the highway improvements are not feasible.
8. Detailed justifications as to why foregoing the particular highway improvements will jeopardize neither public safety nor the highway/bridge infrastructure.
9. Proposed ATP
    a. Description of the ATP.
    b. Description how the ATP addresses mitigation (Is it reasonable?).
    c. Explanation/documentation of how the ATP will be legally enforced.
    d. Cost estimate to implement the ATP.
    e. ATP implementation schedule.
    f. Evidence that all key stakeholders concur.
10. Signature Lines for District Executive and Central Permit Office Approval

ATTACHMENT G – TRANSPORTATION IMPACT STUDY (TIS) / TRANSPORTATION IMPACT ASSESSMENT (TIA) REVIEW CHECKLIST

TIS / TIA Review Checklist

Instructions: Complete all applicable items in the checklist. **Please note that not all items listed are required for TIAs.** Mark items as Completed (C), Not Applicable (N), or See Additional Notes (S). For items marked See Additional Notes, provide necessary additional information on the Additional Notes section on the last page of this checklist. Checklist items with multiple requirements shall be completed as shown. If part of the checklist item is notcompleted, provide reason(s) or justification in the Additional Notes section.

Checklist regulation and publication references can be found in the following documents:

- 67 Pa. Code Chapter 441 – Access to and Occupancy of Highways by Driveways and Local Roads
- Publication 10X – Design Manual Part 1X - Appendices to Design Manuals 1, 1A, 1B, and 1C
- Publication 46 – Traffic Engineering Manual
- Publication 149 – Traffic Signal Design Handbook
- Publication 282 – Highway Occupancy Permit Operations Manual

Section 1 – General Requirements

C	N	S	
☐	☐	☐	(1) Provide signature and seal of licensed PA P.E. on the front cover (Pub. 282, App. A, Introduction)
☐	☐	☐	(2) Follow TIS example format as identified in **Pub. 282, App. A, Att. C**/D or as agreed upon by the PennDOT District
☐	☐	☐	(3) Provide any additional information as required by the PennDOT District (67 Pa. Code §441.3(k))

Section 2 – Executive Summary

C	N	S	
☐	☐	☐	(1) Provide a high level, concise summary of the following: (**Pub. 282, App. A, Att. C/D**)

- Project location and scope
- Proposed development
- Anticipated development impact
- Mitigation strategies and improvements
- Financial responsibilities of improvements
- Design waivers requested (if applicable)

Section 3 – Introduction/Project Summary

C	N	S	
☐	☐	☐	(1) Provide a summary of the scope of the project including description of the following: (**Pub. 282, App. A, Att. C/D**)

- Traffic analyses and assumptions
- Study area/roadway network
- Site layout
- Project phasing

Section 4 – Data Collection

C N S

☐ ☐ ☐ (1) Describe data collection efforts and methodology per Step 1 in the Policies and Procedures for Transportation Impact Studies Related to Highway Occupancy Permits: (**Pub. 282, App. A, Step 1**)

- Volume counts
- Land use context
- Sight distance and site access
- Study area photos
- Crash data (separate cover)
- Multimodal facilities

Section 5 – Existing Study Area Conditions

C N S

☐ ☐ ☐ (1) Discuss the following existing conditions: (**Pub. 282, App. A, Step 2 and Att. C/D**)

- Surrounding land use
- Existing traffic volumes and level of service/delay
- Crash analysis (Provide full crash analysis as separate bound document)
- Pedestrian/bicycle/transit activity and accommodations
- Queue analysis (if applicable)
- Merge/Diverge/Weave analysis (if applicable)
- Gap analysis (if applicable)
- Travel time studies (if applicable)

☐ ☐ ☐ (2) Document traffic engineering software utilized to perform capacity and crash analysis (**Pub. 282, App. A, Step 3**)

Section 6 – Design Year Traffic Conditions without Development (TIS Only)

C N S

☐ ☐ ☐ (1) Discuss background traffic utilized to calculate design year traffic volumes using growth factor and planned and permitted developments (**Pub. 282, App. A, Step 3**)

☐ ☐ ☐ (2) Include design year without development traffic volume and capacity analysis as figures (**Pub. 282, App. A, Step 8**)

☐ ☐ ☐ (3) Include design year without development queue and turn lane analysis (if applicable) (**Pub. 282, App. A, Step 8**)

☐ ☐ ☐ (4) Include merge/diverge/weaving analysis if applicable (**Pub. 282, App. A, Att. C**)

☐ ☐ ☐ (5) Describe and include committed transportation improvements (**Pub. 282, App. A, Att. C**)

Section 7 – Development Description

C N S

☐ ☐ ☐ (1) Provide brief description of proposed site access – permissible movements and distance to intersection (**Pub. 282, App. A, Step 7**)

☐ ☐ ☐ (2) Provide brief description of sight distance analysis (**Pub. 282, App. A, Step 1**)

☐ ☐ ☐ (3) Provide brief description of proposed trip information: (**Pub. 282, App. A, Steps 4 - 7**)

- Total number and peak hour trips generated (include modal reductions if applicable)
- Internally captured trips
- Pass-by and diverted link trips
- Trip distribution/assignment

☐ ☐ ☐ (4) Provide brief description of post development study (if applicable) (**Pub. 282, App. A, Att. C/D**)

Section 8 – Design Year Traffic Conditions with Development

C N S

☐ ☐ ☐ (1) Provide brief description of strategies to manage anticipated demand (**Pub. 282, App. A, Step 10**)

☐ ☐ ☐ (2) Include traffic assignment diagrams with percentages and volumes indicated as figures (**Pub. 282, App. A, Step 7**)

☐ ☐ ☐ (3) Include design year capacity analysis as tables (**Pub. 282, App. A, Step 8**)

☐ ☐ ☐ (4) Include left turn signal phasing analysis if required by Pub 149 (**Pub. 149, Ch. 3.1**)

☐ ☐ ☐ (5) Include queue analyses if required by Pub 46 (**Pub. 46, Ch. 10.2**)

☐ ☐ ☐ (6) Include turn lane warrants/length analysis if required by Pub 46 (**Pub. 46, Ch. 11.16**)

☐ ☐ ☐ (7) Include signal warrant if applicable (**Pub. 282, App. A, Step 9**)

☐ ☐ ☐ (8) Include merge/diverge/weaving analysis if applicable (**Pub. 282, App. A, Att. C/D**)

Section 9 – Mitigation Identification and Recommendations (TIS ONLY)

C N S

☐ ☐ ☐ (1) Provide mitigation analysis and description of proposed mitigation (**Pub. 282, App. A, Att. C**).

☐ ☐ ☐ (2) Provide concept plans of full mitigation at 1:50 scale. (**Pub. 282, App. A, Step 8**).

☐ ☐ ☐ (4) Provide Alternative Transportation Plan (ATP) as separate document (if applicable) (**Pub. 282, App. A, Step 10**)

☐ ☐ ☐ (5) Provide Design (LOS) Waiver as a separate document (if applicable) (**Pub. 282, Ch. 2.6**)

Section 10 – Conclusions

C N S

☐ ☐ ☐ (1) Summarize study findings and recommendations (**Pub. 282, App. A, Att. C/D**)

Section 11 – Appendices

C	N	S	
☐	☐	☐	(1) Include Intersection Control Evaluation (**Design Manual Part 1X, Appendix AI and Step 9**)
☐	☐	☐	(2) Include scoping meeting application and any correspondence with the Department (**Pub. 282, App. A, Att. C/D**)
☐	☐	☐	(3) Include Proposed Site Plan (**Pub. 282, App. A, Att. C/D**)
☐	☐	☐	(5) Include Turning Movement and 24-Hour Volume Counts (**Pub. 282, App. A, Att. C/D**)
☐	☐	☐	(6) Include existing signal plan(s) and permit plan(s) if applicable (**Pub. 282, App. A, Step 1**)
☐	☐	☐	(7) Include roadway data in the form of field sketches if applicable (**Pub. 282, App. A, Att. C/D**)
☐	☐	☐	(8) Include background traffic growth (**Pub. 282, App. A, Step 3**)
☐	☐	☐	(9) Include trip distribution figures, supporting assumptions and calculations, and engineering justification (**Pub. 282, App. A, Step 6**)
☐	☐	☐	(10) Include volume spreadsheet indicating baseline traffic growth volumes and generated traffic (**Pub. 282, App. A, Att. C/D**)
☐	☐	☐	(11) Include capacity and queue analysis worksheets or analysis reports for all analysis scenarios (**Pub. 282, App. A, Att. C/D**)
☐	☐	☐	(12) Include pedestrian/bicycle checklist located in Design Manual Part 1X, Appendix S (**Pub. 282, App. A, Step 1**)
☐	☐	☐	(13) Include crash analysis as a separately bound document (**Pub. 282, App. A, Att. C and Step 1**)
☐	☐	☐	(14) Include gap study (**Pub. 282, App. A, Att. C/D**)
☐	☐	☐	(15) Include traffic signal warrant analysis (**Pub. 282, App. A, Att. C/D**)
☐	☐	☐	(16) Include left turn signal phasing analysis (**Pub 282, App. A, Att. C/D**)
☐	☐	☐	(17) Include turn lane analysis (**Pub. 282, App. A, Att. C/D**)
☐	☐	☐	(18) Include approved Alternative Transportation Plan (ATP) if applicable (**Pub. 282, App. A, Att. C/D**)
☐	☐	☐	(19) Include Design (LOS) Waiver Request/Approval if applicable (**Pub. 282, App. A, Att. C/D**)
☐	☐	☐	(20) Include any additional supporting analysis data as agreed upon during the Scoping Application process. List the additional analyses below. (**Pub. 282, App. A, Step 10**)

Additional Notes

For any items marked See Additional notes (i.e., S), provide necessary additional information. For ease of reference, please refer to the applicable comment by its numerical number (For example, 1.2, 3.5, etc.).

ATTACHMENT H – SPECIAL LAND USE CONSIDERATIONS AND GUIDANCE

CONVENIENCE MARKET WITH GASOLINE PUMPS

The following guidance should be followed when completing studies for various sized convenience markets with gasoline pumps:

Trip Generation

ITE states, "Convenience Market with Gasoline Pumps (Land Use 853), Gasoline/Service Station with Convenience Market (Land Use 945) and Super Convenience Market/Gas Station (Land Use 960) were re-assigned to a single new land use Convenience Store/Gas Station (Land Use 945). Multiple subcategories were added to this land use to allow for multi-variable evaluation with single-variable data plots. Convenience Market with Gasoline Pumps (Land Use 853) and Super Convenience Market/Gas Station (Land Use 960) were removed as land uses."

Existing Facilities: For existing facilities that are being rebuilt or being relocated within the same municipality, traffic counts shall be completed at the existing site driveways and local trip generation rates established for each analysis period. The engineer should then determine whether the local trip generation rates or the ITE rates should be used based on the proposed location, size, and adjacent traffic conditions.

Local Trip Generation: Although a proposed development might correspond to the ITE land use code with adequate data points, the applicant may request or PennDOT may require the use of data collected at comparable sites if there is reason to believe that site trip generation will vary from ITE rates.

Pass-by Trips

1. Weekday A.M. Peak Period and Weekday P.M. Peak Period: Use the pass-by and non-pass-by trip tables in the ITE *Trip Generation Handbook* to determine the appropriate land use pass-by trips.
2. Saturday Midday Peak Period: Use ten percent less than the Weekday P.M. Peak Period average pass-by trip percentage provided in the *ITE Trip Generation Handbook* for applicable land use.
3. According to ITE's *Transportation Impact Analyses for Site Development*, adjustments should be made to the number of pass-by trips if the results do not appear to be logical or reasonable given the characteristics of the road system and trip distribution. For example, ITE's *Transportation Impact Analyses for Site Development* states that pass-by trips diverted from a thoroughfare should be rechecked if they represent more than 15 percent of the traffic volume on that street.

Driveway Design

The study should identify the driveway classification (low volume, medium volume, or high volume), as defined in PA Code Title 67, Chapter 441.1, for each driveway serving the proposed development. If the design standards provided in PA Code Title 67, Chapter 441.9 for the

driveway classification cannot be met (i.e., driveway throat length), justification must be provided. Queue analyses should be completed for the driveway egress to justify driveway throat lengths that are less than those shown in the standards. The site should also be designed to ensure that site traffic circulation (e.g., the location of the gasoline pumps and parking spaces) will not negatively impact the driveway operation. For sites being designed to accommodate trucks, the location of on-site trucking facilities and the impact on site circulation and driveway operation should also be considered.

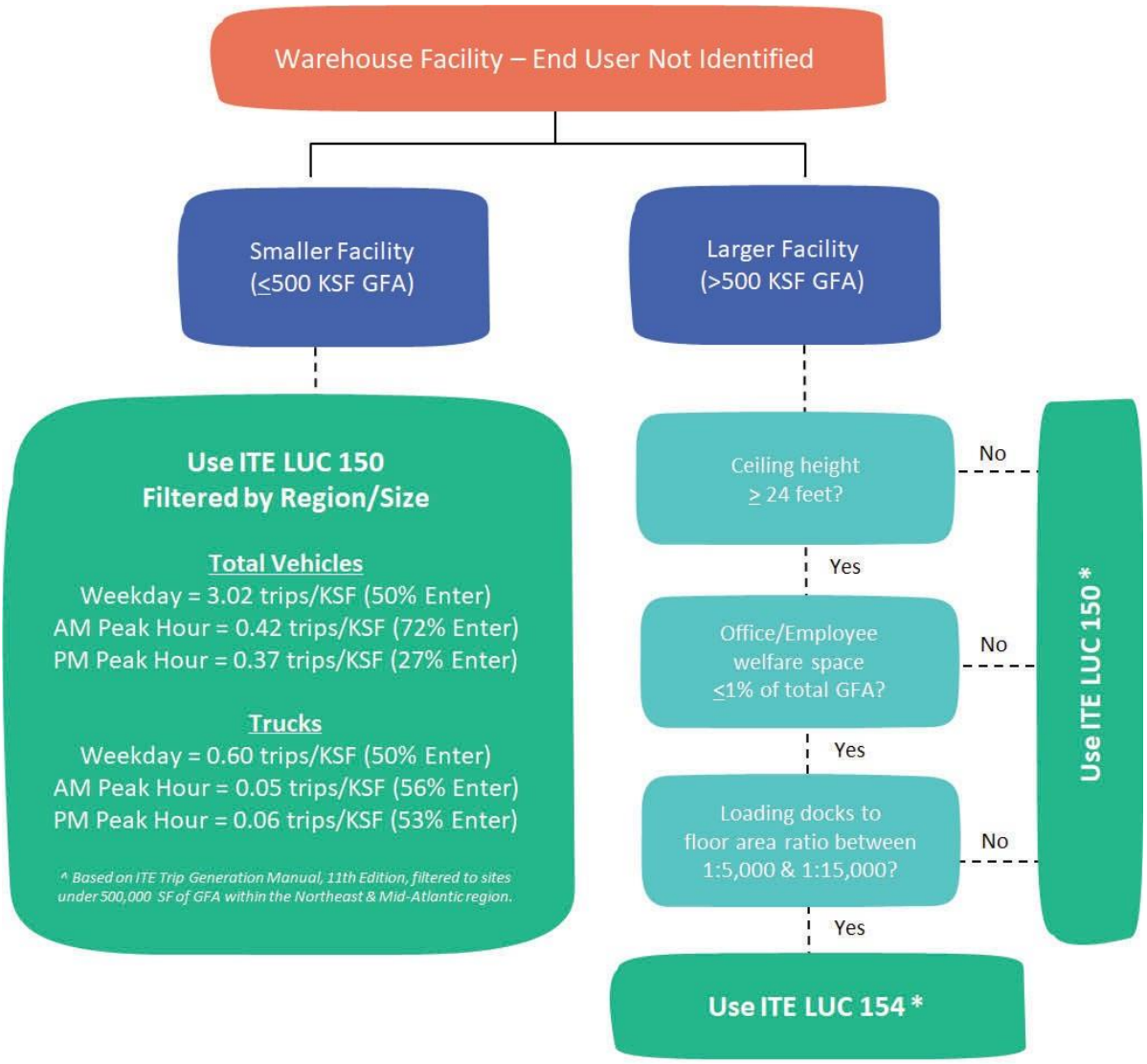
Access Management

The study should evaluate the need to restrict turning movements at the proposed driveway(s). If a driveway is proposed within the functional area or corner clearance of an intersection as described in TRB's Access Management Manual, consideration to restrict turning movements should be analyzed based on but not limited to the site design, the adjacent street lane configurations, traffic volumes, traffic speeds, type of highway being accessed, and alternative access points. Additional restrictions may also be required such as the complete elimination of the proposed access.

WAREHOUSE FACILITIES

Based on the findings from a Department study, the following best practices guidance was developed for Districts to consider when permitting speculative warehouse facilities:

- Understand the use in the land use: The amount of traffic associated with a warehouse facility can vary greatly depending on the function and logistics designation. As part of the scoping meeting, applicants should document the characteristics of the warehouse use.
    - Cross docks may signify major distribution centers or large fulfillment centers.
    - Building height greater than 40 feet may signify cold storage facilities.
    - Large parking fields may signify larger employee count for the facility indicative of fulfillment centers.
    - Parking fields that accommodate various vehicle types may signify a last- mile fulfillment center.
    - Facilities with very high truck parking ratios to dock positions may signify a parcel hub.
- Utilize data subsets in ITE TripGen web app: The ITE digital trip generation database can be filtered to provide a better estimation of trips for smaller facilities. If employed, consider the use of ITE Land Use Code 150 warehouse trip data filtered by size (under 500 KSF) and region (Northeast & Mid-Atlantic) for smaller facilities.
- Specify Land Use Code 150 permits are not inclusive: Understanding trip characteristics vary based on the function and logistics of a warehouse facility, consider clearly specifying that highway occupancy permits classified under Land Use 150 are not inclusive of other warehouse-type facility, including but not limited to cold storage, last-mile fulfillment centers, and parcel hubs. If tenancy changes occur in the future, applicants should be required to supplement the existing permit with additional information so the Department can determine if additional traffic mitigations are warranted.
- A step-by-step procedure (flow chart) is provided below for the Department to consider in determining how best to estimate trip generation for future speculative warehouse facilities until such time that a new version of ITE's Trip Generation Manual is published.



** Follow ITE Trip Generation Handbook guidance for selecting average rate or equation in Trip Generation Manual Data*

Note: The Department's Warehouse Trip Generation Study can be found in the Department's P:\permits shared folder.