pennsylvania
DEPARTMENT OF TRANSPORTATION

494-13-13

DATE: December 2, 2013

SUBJECT: Updates to PennDOT's *Policies and Procedures for Transportation Impact Studies Related to Highway Occupancy Permits*

TO: District Executives

FROM: Brian G. Thompson, P.E., Acting Director *Brian Thompson /s/*
Bureau of Maintenance and Operations

In order to assist Districts with the review of Transportation Impact Studies (TIS's) and Transportation Impact Assessments (TIA's), PennDOT's *Policies and Procedures for Transportation Impact Studies Related to Highway Occupancy* Permits is being updated to include.

1) A standard TIS/TIA review checklist,
2) Procedures for completing studies for convenience markets with gasoline pumps, and
3) Updated publication references for roundabout guidelines and peak hour factors.

This Strike-off Letter (SOL) is intended to update SOL 470-09-4, issued February 12, 2009. This SOL is time and cost neutral.

This update is effective immediately. Along with the *Policies and Procedures for Transportation Impact Studies Related to Highway Occupancy Permits* revised pages, the attached review checklist and procedures for completing studies for convenience markets with gasoline pumps will be incorporated into the next revision to the *HOP Guidelines* (Publication 282.) Two (2) new appendicies are being added to the *Policies and Procedures for Transportation Impact Studies Related to Highway Occupancy Permits* to include the aforementioned items. In addition, the Transportation Impact Study/Transportation Impact Assessment standard review comments will be updated in the ePermitting system to correspond with the items found in the review checklist.

The revised pages are to replace the old pages and the new pages are to be added to the *Policies and Procedures for Transportation Impact Studies Related to Highway Occupancy Permits* as Appendix F and Appendix G.

Should you have any questions, please contact, Glenn Rowe, P.E., Chief, Traffic Engineering and Permits Section, at 717-783-6479.

Attachments

4940/MJD/hmq

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HOP Read File

January 28, 2009
Rev. November 25, 2013

POLICIES AND PROCEDURES FOR TRANSPORTATION IMPACT STUDIES

Related to Highway Occupancy Permits

Pennsylvania Department of Transportation
Bureau of Maintenance and Operations

Prepared for:

Bureau of Maintenance and Operations
PO Box 2047
Harrisburg, PA 17105

pennsylvania
DEPARTMENT OF TRANSPORTATION

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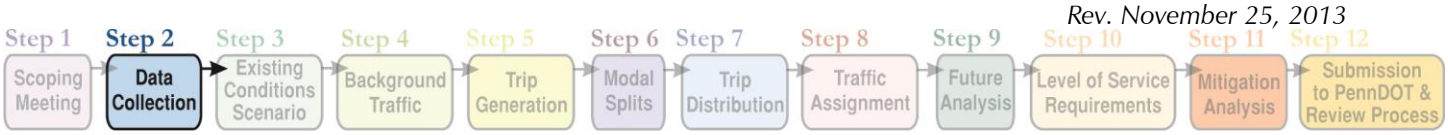


STEP 2: DATA COLLECTION

Preparation of the Transportation Impact Study (TIS) 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 the Department provided:

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

Volume Counts/Data

Traffic volumes shall be obtained through data collection efforts at locations and times agreed upon during the scoping meeting.

It is required that new data obtained from 24-hour automatic traffic recorder counts include classification and speed data unless modified at the scoping meeting.

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.

Based on the turning movement volumes, peak hour factors should be calculated and used for analyses. Applicants should refer to Publication 46, Chapter 10 for additional information related to peak hour factors. As directed by the District at the scoping meeting, 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.

Photo 2: Pedestrian Activity

Roadway data shall be collected including speed limits, grades by approach, lane geometry (widths/shoulders). 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.

the crash data should include review of causation factors and patterns. The Department will provide:

- a Crash Summary Report,
- a Crash Resume Report,
- a Crash grouped by Segment Report, and
- the current Statewide Homogeneous Report.

To request this information, contact the District Safety Engineer within the appropriate District Traffic Unit. Include the analysis of the crash data and copies of the crash reports in a separately bound Appendix.

Additional information on the analysis of crash rates can be found in the *Appendix of Publication 212, Item 2(1)* and *Publication 46, Chapters 11.1 and 11.3*.

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 will 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.

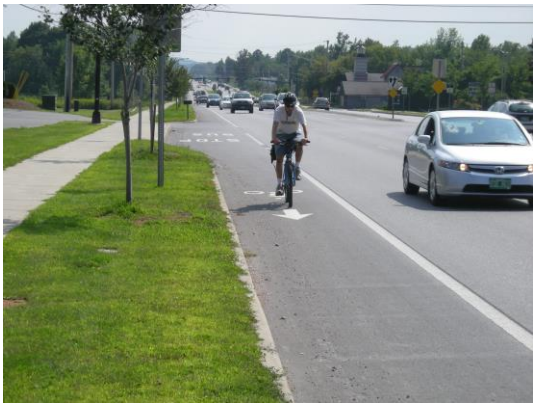


Photo 3: Multi-modal Facilities

STEP 5: TRIP GENERATION

Trip Generation

Trip generation is defined as the amount of traffic arriving and departing the site. 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 or by foot may be important components of trip generation in urban contexts 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 roadway 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?*

The Department has accepted the most current *ITE Trip Generation Manual* and its updates for the development of trip generation. Applicants are cautioned to review Volume 1 of 3 of the publication for instructions on the use of the data. Step by step methodologies for estimating vehicular trips are described in the publication, *Trip Generation Handbook, Second Edition: An ITE Recommended Practice.*

As part of the scoping meeting, applicants are required to receive Department concurrence and approval on the land use codes and trip generation methodology used for the proposed site. When completing studies for Convenience Markets with Gasoline Pumps, applicants should refer to Appendix G for additional guidance.

Local Trip Generation Study

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

It is recommended that the applicant submit Trip Generation Study Approval requests in advance of the TIS scoping meeting. If a plan of study has not been established at that time, the applicant may make the request at the scoping meeting or as part of the formal TIS.

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

- The study site is not compatible with or does not relate to an ITE land use code definition.
- If only one or two data points exist in Trip Generation, local data must be collected. Local data should be collected when five or fewer data points are contained in the plot.
- The independent variable does not fall within the range of data in Trip Generation.
- Neither the weighted average rate line nor the fitted curve fall 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*.

required. Following is additional information for consideration of signals and roundabouts as mitigation measures:

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.

Traffic Signals

Signal Warrant analysis should be performed for unsignalized intersections that operate at poor levels of service in accordance with the MUTCD.

If the impact analysis indicates a need for reconstructing existing intersections, or for constructing new intersections, roundabouts shall be evaluated by the applicant along with other unsignalized or signalized traffic controls.

Note that the Department expects applicants to evaluate all eight MUTCD 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.

In the event that a signal is warranted in the Horizon Year, but not in the Opening Year analysis, a separate analysis shall be provided to project when the warrant is met.

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:

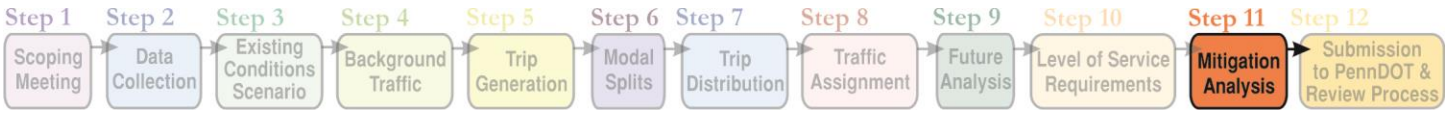
1. Evaluation of the use of a roundabout in lieu of a signal
2. The limits of the traffic signal system to be analyzed
3. Performance requirements
4. The method of analysis
5. Technology and maintenance issues
6. Installation and maintenance agreement with municipality and the Department

Method of Analysis

It should be noted that roundabouts shall be considered at all locations under signalization consideration and applicants shall refer to Department Publication 13M, Chapter 3 and Department Publication 10X, Design Manual Part 1X for more information.

Based on roadway type and land use context established at the TIS Scoping Meeting, 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 shall be submitted.

The Department may require the applicant's engineer to prepare a micro-simulation of the traffic signal system. In requesting the micro-simulation, the Department may specify the software package to be used.



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 available 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 the Department Publication 13M, Chapter 3 and Department Publication 10X, Design Manual Part 1X for more information.

STEP 12: SUBMISSION TO THE DEPARTMENT AND REVIEW PROCESS

General Formatting

To facilitate Department review, the TIS report shall contain a cover page, table of contents, body of report, and appendices containing data collection and analyses. As mentioned in Step 2, a sample TIS format is contained in Appendix C (Figure 7).

The Department may reject the TIS if it does not conform to the format provided in Appendix C.

To help ensure that the TIS is in conformance with these policies and procedures, applicants are encouraged to complete the review checklist provided in Appendix F and submit it with the TIS.

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.

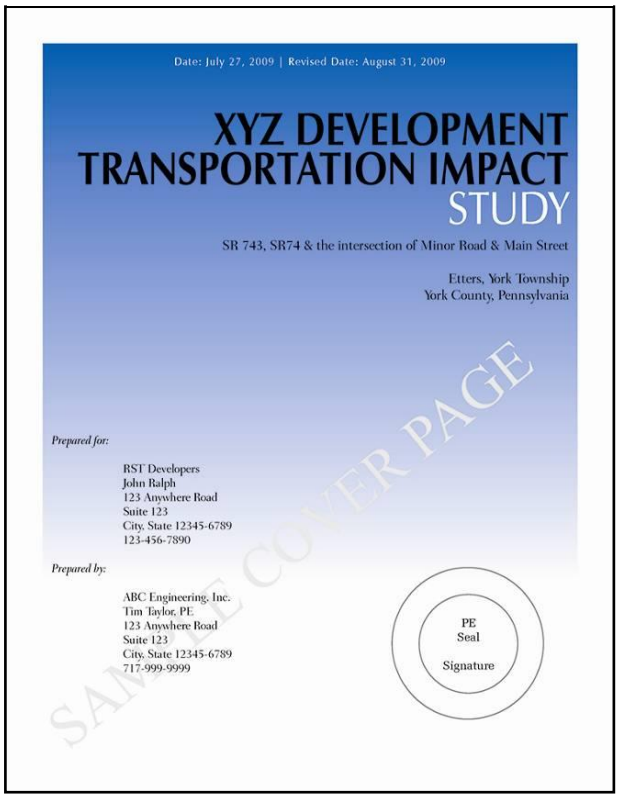
TIS reports that utilize Alternative Transportation Plans as a mitigation strategy shall not be approved by the District Permit Office prior to obtaining review and approval by the Central Permit Office.

As mentioned in Step 2, applicants may request to submit to the Department a Preliminary TIS for larger projects in which the project's data collection and trip forecasting elements are provided prior to addressing operations and mitigation options.

The Department Review Process

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

Figure 7: Sample Cover Page



TIS and TIA documents prepared in accordance with these guidelines shall be submitted to the Department with an appropriate HOP application (M945A). The Department will review and return comments, if necessary, pertaining to the TIS within 45-60 days of the submission. The District Office

will issue an approval letter for the TIS when all Department concerns are addressed.

If the applicant pursues Condition 1 or Condition 2 under Step 11: Mitigation Analysis, 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 the Department 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 stand-alone document.

If approved by the Department, the Design Waiver - LOS request as well as the approval shall be included in the appendix of the final TIS along with all documentation of applicant's attempts to comply with Condition 1 or 2.

The TIS and associated mitigation(s), if any, must be identified and agreed to by the Department before the applicant submits final HOP engineering plans for review.

F. APPENDIX F: TRANSPORTATION IMPACT STUDY (TIS) / TRANSPORTATION IMPACT ASSESSMENT (TIA) REVIEW CHECKLIST

TIS / TIA Review Checklist

General

- ☐ Study signed and sealed by PA P.E.
- ☐ Scoping meeting application completed, signed, and attached
- ☐ Meeting minutes for all previous correspondence with the Department
- ☐ Municipal review/approval of TIS/TIS
- ☐ Review/approval of TIS/TIA from adjacent municipality required/provided
- ☐ FHWA review required/provided for interstate projects
- ☐ Report contains a cover page, table of contents, and body
- ☐ Report contains all applicable sections
- ☐ Report appendices marked and tabbed
- ☐ Central Office and/or FHWA approval required/provided for median break/POA studies
- ☐ Municipal and Central Office approval of ATP
- ☐ Municipal Waste Facilities adhere to Pub. 46, Ch. 11 guidance and criteria

Executive Summary/Recommendations

- ☐ Project description
- ☐ Impacts of proposed development
- ☐ Proposed methods of mitigation
- ☐ Design waivers requested
- ☐ Parties responsible for improvements identified
- ☐ Details on the location, nature and extent of the proposed improvements
- ☐ Turn lane storage lengths, shifting taper lengths, and bay taper lengths identified
- ☐ All improvements to be ADA-compliant noted
- ☐ Driveway classification identified for each driveway serving the development
- ☐ Studies / construction projects which may affect the design are identified, if applicable

Introduction/Project Summary

- ☐ Description of analysis and assumptions
- ☐ Legible study area map
- ☐ Description of study area (indicate roadway intersections) and boundaries
- ☐ Legible site plan (1:50 scale min.) with lot size, building size(s) and types provided
- ☐ Discussion and/or illustration of the site layout
- ☐ Site plan reflects all of the latest findings of the study
- ☐ Description of project phasing

Data Collection

- ☐ Data collection methodology described
- ☐ Data collection consistent with Pub. 46, Ch. 10 parameters
- ☐ Raw count data provided in Appendix
- ☐ Count data less than 3 years old
- ☐ Recent construction project that may have impacted count data
- ☐ Counts conducted on an avg. weekday, on a non-holiday week, while school was in session
- ☐ RTOR volumes included in right-turn volumes
- ☐ Additional peak hour counts (AM, Midday, PM, Sat, Sun) required
- ☐ 24-hour ATR counts include volume, class, and speed
- ☐ Counts include heavy vehicles, pedestrians, bicycles and transit vehicles (if present)
- ☐ Counts include walking school children and school bus stops where applicable
- ☐ Peak hour factors calculated consistent with Pub. 46, Ch. 10
- ☐ Volume balancing necessary
- ☐ Pedestrian activity/accommodations recorded and reflected in the study
- ☐ Midblock pedestrian crossing data required/provided
- ☐ Bicyclists riding on sidewalk documented/addressed

- ☐ Inventory of roadway data (signal permits, sketches, or table)
- ☐ Land use contexts documented
- ☐ Sight distance – calculations / tabular summary / narrative
- ☐ Sight distance – Safe sight distance criteria met
- ☐ Sight distance – For safe sight distance, posted speeds used unless operating speeds vary by > 10 MPH
- ☐ Sight distance – PennDOT Form M-950S (Driveway Sight Distance Measurements)
- ☐ Sight distance – Improvements necessary to achieve acceptable sight distance
- ☐ Photos – at all study intersections (including proposed driveways)
- ☐ Photos – include 2 views of each approach (50-feet and 200-feet)
- ☐ Crash data – extracts provided separately for most recent 5 years / excluded from report
- ☐ Crash data – analysis provided in separately bound Appendix / excluded from report
- ☐ Crash data – proper confidentiality statement included on crash data
- ☐ Crash data – non-reportable data required/provided per scoping meeting
- ☐ Crash data – crash trend mitigation needed/provided
- ☐ Bicycle and Pedestrian Checklist (Publication 10A, Design Manual Part 1X) provided
- ☐ Impacts to ped/bike facilities noted
- ☐ Existing transit facilities identified (bus routes within 1/4 mile and rail centers within 1/2 mile)
- ☐ Description of proposed pedestrian, bicycle, and transit accommodations

Existing Conditions Scenario

- ☐ Study area/roadway network described
- ☐ Functional classifications/roadway types documented
- ☐ Rural/urban setting justified
- ☐ Existing conditions documented
- ☐ Multimodal transportation discussion
- ☐ ADA compliance discussion
- ☐ Permits plans included in Appendix
- ☐ Capacity analyses software/version indicated
- ☐ Latest version of capacity analyses software used
- ☐ HCM reports provided
- ☐ Synchro Lane, Volume, and Timings reports provided
- ☐ Multi-period analysis used at signalized intersections in accordance with Pub. 46, Ch. 10 and HCM 2010 where high v/c ratio exists
- ☐ If simulation software is used, 10 min. seeding and 60 min. durations are used / results based on 5-10 runs
- ☐ Traffic volumes consistent between the count data, tables, figures, spreadsheets, and analyses
- ☐ System peak hour required per scoping meeting
- ☐ Peak hour factors used in analyses match count data
- ☐ HV percentages used in analyses match count data
- ☐ Lane configurations, widths and grades match field data/signal permit
- ☐ Capacity analyses inputs match signal permits
- ☐ C-Max recall mode used for coordinated phases unless noted otherwise on signal permit
- ☐ Calibration parameters consistent with Pub 46, Ch. 10
- ☐ Base saturation flow rate consistent with Pub 46, Ch. 10
- ☐ Travel time study needed
- ☐ Gap study needed

Background Traffic

- ☐ Correct growth factor used and compounded correctly
- ☐ Planned and permitted development traffic included
- ☐ Study indicates if planned developments are consistent with formal land use plans
- ☐ Improvements proposed as part of planned/permitted development documented
- ☐ Background traffic growth documented in Appendix

Trip Generation

- ☐ Approval of land use codes and methodology obtained
- ☐ Latest edition of ITE *Trip Generation Manual* used
- ☐ Regression equation or average rate used correctly
- ☐ More conservative methodology used, where appropriate and in conjunction with engineering judgment
- ☐ Land use consistent with land use code
- ☐ Local rate needed
- ☐ Local trip generation data approved by District and Central Office
- ☐ Pass-by / diverted link trips estimated according to ITE *Trip Generation Handbook*
- ☐ Internal trips estimated according to ITE *Trip Generation Handbook*
- ☐ Internal capture rates other than ITE rates justified
- ☐ Trip credits consistent with scoping meeting documentation
- ☐ For trip credits, documentation shows existing land use was open during counts

Modal Splits

- ☐ Modal split reductions are in accordance with Step 6 of Policies and Procedures for TIS's

Trip Distribution

- ☐ Based on gravity model / existing volume distributions
- ☐ Engineering justification provided
- ☐ Supporting assumptions and calculations provided
- ☐ Figures provided

Traffic Assignment

- ☐ Brief description of the proposed project / permissible movements / distance to int.
- ☐ Based on travel time (quickest route)
- ☐ For multiple driveways, assignment methodology is clearly explained and considers travel time, most logical path, location of development features such as parking, etc.
- ☐ Figures for percentages and volumes provided
- ☐ Volumes match trip generation

Future Analysis

- ☐ Volume development spreadsheet provided
- ☐ Figures provided
- ☐ Capacity analyses inputs consistent with existing conditions
- ☐ Opening year analysis provided (TIS and TIA)
- ☐ Design Horizon year analysis provided (TIS only or as discussed at scoping meeting)
- ☐ With development analysis provided for 2 scenarios (no improvements and with improvements)
- ☐ Analysis for 5 years after phase opening provided for phased developments
- ☐ Without Development volumes = existing volumes + annual growth + permitted or planned projects
- ☐ With Development volumes = Without Development volumes + proposed site volumes
- ☐ Volumes consistent between analyses, volume development spreadsheets, and figures
- ☐ Committed transportation improvements described/included
- ☐ Signal timings optimized for Without Development and With Development in Opening and Design Horizon year analyses
- ☐ Lead/lag phasing not optimized
- ☐ PHF of 0.90 used for proposed driveway movements
- ☐ Heavy vehicle % for proposed driveway movements based on ITE *Trip Generation Manual* data, if available. Otherwise 2% is used.
- ☐ Left turn signal phasing calculations required/provided
- ☐ Proposed signal timings within Min/Max range shown on existing permit; copy of plan included
- ☐ Opening year signal timings are realistic
- ☐ Cycle lengths consistent with corridor for coordinated systems
- ☐ Signal timing changes required/included in recommendations

- Queue analysis – provided for all movements (Synchro and HCM methodologies)
- Queue analysis – lengths match analysis
- Queue analysis – With Development queues<Without Development queues or storage length
- Queue analysis – Analysis in electronic format needed for further review
- Queue analysis – Study addresses V/C >1 and theoretically infinite queues
- Queue analysis – Distances to adjacent intersections provided in queue table
- Turn lane warrant/length analysis – provided
- Turn lane warrant/length analysis –consistent with Pub. 46, Ch. 11
- Turn lane warrant/length analysis – correct traffic volumes/percentages used
- Turn lane warrant/length analysis – correct type of terrain used
- Turn lane warrant/length analysis – correct speed used
- Turn lane warrant/length analysis – cycle length matches capacity analysis
- Turn lane warrant/length analysis – storage lengths rounded to the next highest 25-foot increment
- Turn lane warrant/length analysis – provided for proposed off-site turn lanes
- Turn lane warrant/length analysis – included in recommendations / lengths match analysis

Level of Service Requirements

- LOS/delay presented
- Mitigation provided at int.'s with overall int. LOS drop and increase in delay >10 s
- Mitigation improves int. LOS to original Without Development int. LOS
- Mitigation provided at int.'s with overall int. LOS F and increase in delay >10 s
- If LOS F, mitigation improves int. delay to original Without Development int. delay
- Mitigation provided to address critical lanes or approaches
- MOE's at unsig. int.'s presented
- Toolbox for unsig. intersection evaluation used for lane movement LOS drops
- New signals – acceptable LOS (LOS C in rural areas/LOS D in urban areas)
- Other mitigation explored for LOS drops at int. not meeting warrants for a traffic signal or roundabout
- Municipal input provided seeking Department approval for an unsignalized int. Design (LOS) Waiver.
- New int. – acceptable LOS (LOS C in rural areas/LOS D in urban areas)
- New int. provides best access plan
- New int. – municipal input provided if LOS E
- Number of driveways acceptable
- Proposed driveway aligns w/ driveways/road/lanes across highway
- Proposed driveway located as far as possible from signalized intersection
- LOS/delay results from analyses match figures and tables
- Correct lane configurations shown in figures/tables

Mitigation Analysis

- Analysis provided
- Description of proposed mitigations provided
- Concept plans at 1:50 scale provided; proposed improvements dimensioned
- Design (lane/shoulder widths, tapers, etc.) shown on concept plans consistent with design criteria
- Cost estimates provided for proposed improvements
- Right-of-way issues identified
- Impractical/infeasible improvements – reasons documented
- Impractical/infeasible improvements – Local Land Use Transportation Plan for marginal LOS degradation
- Impractical/infeasible improvements – ATP for significant LOS degradation
- LOS waiver if Local Land Use Transportation Plan or ATP are unachievable
- Alternatives other than signals evaluated for new/reconstructed int.'s
- Signal warrant analysis – needed/provided
- Signal warrant analysis – all applicable MUTCD warrants evaluated
- Signal warrant analysis – warrants other than peak hour warrant met
- Signal warrant analysis – Central Office approval provided if only peak hour warrant is met
- Signal warrant analysis – ADT volume warrant analysis required/provided

- ☐ Signal warrant analysis – separate analysis provided if not met in Opening year
- ☐ Signal warrant analysis – correct number of lanes and volumes used
- ☐ Signal warrant analysis – correct graphs and volume thresholds used
- ☐ Signal warrant analysis – reduction in minor-street right-turning traffic required/applied
- ☐ Signal warrant analysis – acceptable methodology used to project new trips for off-peak hours
- ☐ Signal monitoring agreement with municipality needed/provided
- ☐ Underground conduit needed for future signal installation
- ☐ Roundabout analysis provided
- ☐ Study addresses impacts to coordinated system caused by signal retiming at one of the int.
- ☐ Longer cycle lengths required to help alleviate over-capacity conditions
- ☐ Traffic signal timed to balance capacity / additional capacity is provided to state road
- ☐ Type of proposed coordinated system identified
- ☐ Fair share contributions not acceptable

G. APPENDIX G: CONVENIENCE MARKET WITH GASOLINE PUMPS

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

Trip Generation

1) Weekday: Using the Gasoline/Service Station with Convenience Market land use (ITE *Trip Generation Manual* Land Use Code 945) data, calculate the number of trips utilizing the independent variable of Vehicle Fueling Positions.
2) Weekday Peak Hour of Adjacent Street Traffic One Hour Between 7 and 9 A.M., Weekday Peak Hour of Adjacent Street Traffic One Hour Between 4 and 6 P.M., and Saturday Peak Hour of Generator: Using the Convenience Market with Gasoline Pumps land use (ITE *Trip Generation Manual* Land Use Code 853) data, calculate the number of trips utilizing the independent variable of 1000 Square Feet Gross Floor Area and the independent variable of Vehicle Fueling Positions and use the more conservative trip generation methodology in the study.
3) 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.
4) Local trip generation: Although a proposed development might correspond to the ITE land use code with adequate data points, the applicant may request or the Department 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 average pass-by trip percentage for the Convenience Market with Gasoline Pumps land use (ITE *Trip Generation Manual* Land Use Code 853).
2) Saturday Midday Peak Period: Use ten percent less than the Weekday P.M. Peak Period average pass-by trip percentage for the Convenience Market with Gasoline Pumps land use (ITE *Trip Generation Manual* Land Use Code 853).
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 through-fare 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.