Guidelines for the Preparation of Transportation Impact Studies | 2013

TORONTO

Guidelines for the Preparation of Transportation Impact Studies 2013

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toronto.ca/transportation/pdf/transportation-impact-study-guidelines.pdf

CONTENTS

PREFACE

The *GUIDELINES FOR THE PREPARATION OF TRANSPORTATION IMPACT STUDIES 2013 (GUIDELINES)* is a reference document describing the City of Toronto (City) requirements and methodologies for assessing and mitigating the transportation impacts associated with applications for property development in the City. It is intentionally structured for ease of understanding and application serving both the development industry and City staff.

The *GUIDELINES* supersede the *Guidelines for the Preparation of Transportation Impact Studies - July, 2003.* It reflects current City Official Plan transportation policy direction and incorporates the latest methodologies, practices and tools to analyse transportation impacts at City intersections and within its corridors. The *GUIDELINES* will be reviewed and updated from time-to-time to reflect changes in City policy and development review approval practice. A copy of the most recent version of the *GUIDELINES* can be obtained online at: toronto.ca/transportation/pdf/transportation-impact-study-guidelines.pdf

The *GUIDELINES* have been developed primarily by a City inter-departmental working group comprised of staff with extensive experience in preparing and reviewing TISs, and who have specialized knowledge in one or more areas of multi-modal operations of the City's transportation network. Assisting this group with its effort, amongst a number of other City staff, were seven transportation engineering consultants all with significant experience in preparing TISs for a variety of developments throughout the City. Their contribution has reinforced a well-founded and thorough document that meets the needs of all partners in the TIS review process. A complete listing of all participants in the *GUIDELINES* development process can be found on the following *Acknowledgements* page.

Submitting a Transportation Impact Study (TIS) is just one of a number of studies that form a complete Development Approval Application as described in the latest *Building Toronto Together - A Development Guide.* Prior to undertaking a formal TIS, applicants are encouraged to communicate with City or TTC staff to determine not only the scope of the analysis required, but to confirm if any reference documents, policies, or practices have been amended or adopted since the *GUIDELINES* were released.

ACKNOWLEDGEMENTS

The following individuals are current or former members of the Transportation Impact Study Guidelines Working Group (WG) responsible for the *GUIDELINES*. They have spent countless hours in and out of meetings diligently discussing issues, and reviewing and commenting on numerous drafts throughout the *GUIDELINES'* development process, and should be commended for their effort.

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The City appreciates the effort of the following transportation engineering consultants who freely gave of their time and expertise to review our previous version of the *GUIDELINES* and contribute to our discussion seeking ways to improve upon them.

David Argue
HDR|iTRANS
Jim Bacchus
Sernas Transtech
Yannis Stogios
Delcan Corporation
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Tim Arnott
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LEA Consulting

A special thanks is given to numerous City departmental staff who have contributed time and effort during consultations on the *GUIDELINES* and the review of draft material.

P. A. Sabo
Chair, Transportation Impact Study Guidelines Working Group
July, 2013

CHAPTER 1
INTRODUCTION

A Transportation Impact Study (TIS) is a valuable source of information for officials responsible for reviewing development applications. Not only does a TIS determine and evaluate the effects of a proposed development on the surrounding transportation system, it suggests infrastructure improvements and other mitigating measures necessary to accommodate travel generated by the development.

The *City of Toronto Official Plan* (OP) policy statements pertaining to transportation and development (*see* OP *s2.4*) provide significant additional overarching guidance to those parties responsible for preparing and reviewing a TIS, as follows:

> "***Introduce appropriate TDM measures"***
>
> Travel demand management policies, strategies and tools can be introduced to provide options to reduce private automobile use and make transit, cycling, and walking increasingly attractive alternatives. Efficiently moving people instead of vehicles in support of enhanced system capacity, improved environmental outcomes, and enhanced public health, will lead to a sustainable transportation system and a more liveable city.
>
> ***"Weigh traffic needs against the broader objectives of this Plan"***
>
> Whether the impact is local or regional, or the area is targeted for growth, a balanced range of travel options should be provided that encourages walking, cycling, and the use of transit and other high-occupancy vehicles.
>
> ***"Make provision for future transportation improvements identified in this Plan"***
>
> It is important to develop and protect for the OP's future transportation infrastructure which may be subject to an application under the Planning or Environmental Assessment Acts.
>
> ***"Integrate development into the surrounding public access system of roads, walkways, bikeways and transit facilities"***
>
> There are efficiency gains to be made with the seamless integration of a development into the City's existing transportation system, especially when the focus is on promoting pedestrian, cycling and vehicle access integration with public transit.

While transportation objectives and policies are the primary focus of a TIS, other broader OP policy goals integral to the creation of a strong City should be kept in mind. These include developing a livable and sustainable urban area, promoting economic development, having regard for environmental health, and generally enhancing social well-being.

The *GUIDELINES* outline the steps necessary to meet the City requirements for a TIS. In Chapter 2, an overview of the TIS process is provided outlining its purpose, when it is required, the importance of pre-TIS study staff consultation, with its key elements described in a flow chart.

Chapter 3 is the heart of the document, addressing TIS report requirements. It begins with the requirements for describing the development proposal, establishing a transportation context for the development, and introducing the development's site traffic. After this, how transportation impact is determined and identifying improvements to mitigate impacts, is defined. The final section of the Chapter addresses the documentation and reporting needed to ensure a proper submission. The Appendices provide contact information and links to TIS resources to aid TIS preparation.

Chapter 2
TIS Overview

2.1 Purpose

A TIS is intended to provide the information necessary to guide City staff in reviewing the transportation aspects of a development proposal by:

- Assessing the extent of transportation impacts;
- Identifying physical infrastructure, balancing transportation demand with supply, and introducing level-of-service improvements or other measures that should be considered on the 'build-out' of a development to ensure network safety and acceptable operating conditions on roads, sidewalks, intersections and access points;
- Identifying an appropriate travel demand management (TDM) strategy to reduce private motor vehicle use and encourage pedestrian and cycling activity; and
- Maintaining consistency with other City transportation objectives and OP policies.

The *Guidelines* instruct TIS scope determination, issues to address and analytical approaches while a proposed development's location, scale, and land use influence the actual TIS elements required. For development in areas where an environmental assessment, integrated land-use or other transportation strategy is in place, a traffic operations assessment focusing on limited issues such as access design and location may be all that is necessary.

2.2 When Required

In most cases, a TIS will be required if the proposed development adds more than 100 peak-hour, peak-direction vehicle trips to the transportation system. However, there will be situations when the 100 trip threshold is not reached and a TIS is still required, such as:

- The vehicle traffic generated by the development is expected to trigger a critical capacity or level-of-service condition at one or more of the surrounding signalized intersections (i.e., volume-to-capacity ratios are greater than 1.0 or level-of-service exceeds 'E' for either through movements or shared/exclusive turning lanes on intersection approaches);
- The development proposal is in an area with significant levels of existing vehicle or pedestrian traffic congestion, and/or a high expected rate of population or employment growth;
- The development proposal incorporates direct vehicle access to either a major or minor arterial road;
- The development proposal is not captured in local land-use/transportation plans; and
- The development proposal requires an amendment to the OP.

When less than 100 peak-hour, peak-direction trips are anticipated, the Applicant should consult with staff to determine if an analysis of traffic impact is required.

2.3 Staff Consultation

Developers who are required to complete a TIS are strongly encouraged to consult with the appropriate staff from the City of Toronto, TTC, and other external agencies (e.g., Ministry of Transportation of Ontario), early in the application process. Benefits of this pre-consultation include:

- **Identifying transportation issues** that may affect the land use, density, site plan, building placement, or other area-specific issues;
- **Confirming the TIS scope** with issues to address and the detail necessary to form a complete submission; and
- **Assessing the need for additional meetings** with City Planning staff and/or other agencies for information gathering and/or sharing.

2.4 Key TIS Elements

The following flow chart in the figure below entitled *Key Elements of Transportation Impact Study Process,* summarizes the various components of a City TIS. Each of these components is addressed in detail in the referenced sections of the *GUIDELINES*.
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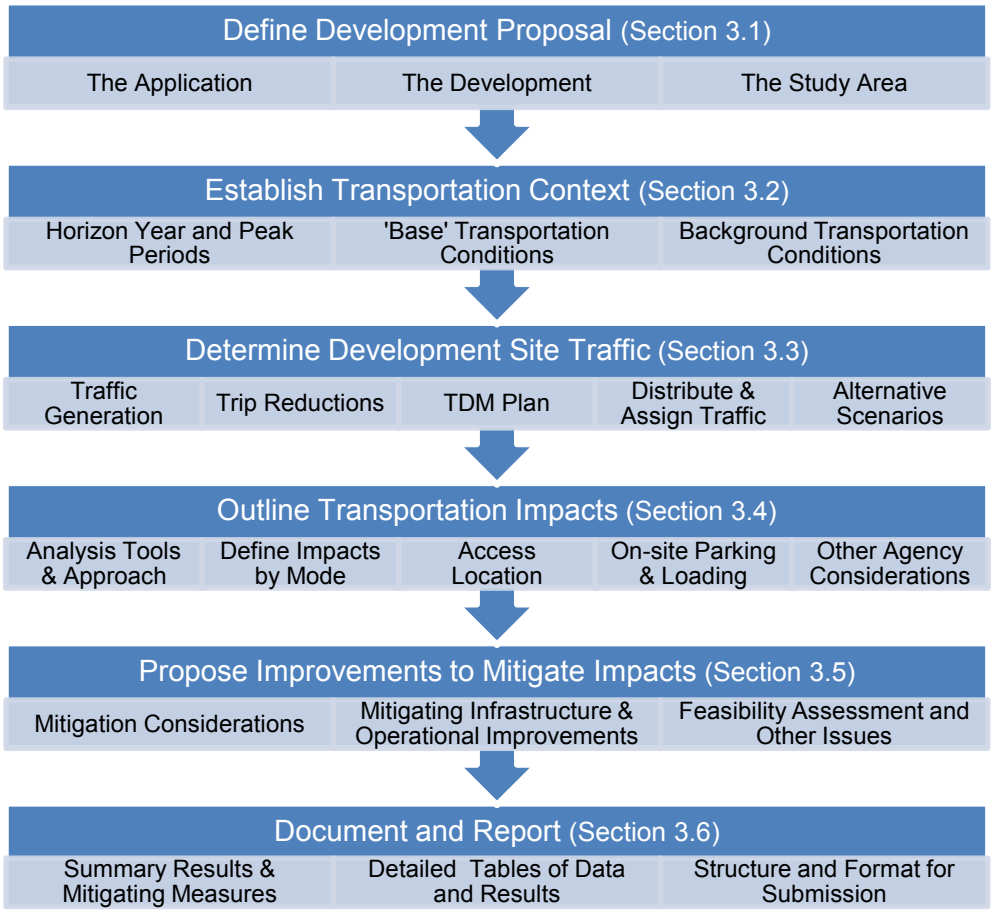
Key Elements of Transportation Impact Study Process



CHAPTER 3
TIS REPORT REQUIREMENTS

The following sections outline the minimum report content requirements constituting a complete City-approved TIS.

3.1 The Development Proposal

A TIS report begins with an outline of the development proposal thoroughly describing the application, the development itself, and the development context or its study area. These elements are described as follows:

3.1.1 The Application

Identifying the application includes the following:

- Application number;
- Application type (i.e., OP amendment, zoning by-law amendment, etc.);
- Applicant name; and
- Site municipal address. (Include a map showing the site in the context of the surrounding area. Show identifiable landmarks on the map(s) to facilitate site inspections. A survey plan must be included with the application.)

3.1.2 The Development

Describing the proposed development includes:

- Building size(s), driveway locations and on-site circulation for all motorists, including cyclists, and pedestrians. A site plan in 1:250 or 1:500 scale (metric), combined with maps, drawings, tables and/or text as appropriate, must accompany the TIS. If the proposed development is to be constructed in phases, each phase must be described along with the construction phasing schedule and construction management plans;
- Projected 'build-out' date and phasing plans;
- Floor space of each proposed use. Use of gross, net, or commercial floor space must be applied consistently throughout the document;
- Pedestrian accommodation. Pedestrian access points and walking routes, including those for pedestrians with disabilities, must be identified along with nearby transit station/stop locations and associated walking distances to these locations;
- Access point location and design. Development driveways, as well as those access points adjacent and/or directly opposing the site, must be shown along with an analysis of existing and projected turning sight distances;
- Location of existing upstream and downstream signalized intersections;

- Number of parking stalls. Considerations include comparing the proposed parking supply with applicable zoning standards, the location of vehicle parking areas, accessible parking stalls, bicycle parking, and pedestrian crossing areas; and
- Loading areas. The number, location, design and operation of loading and service areas and their compliance with zoning or other applicable technical standards, must be identified.

If applicable, it will be necessary to describe the provisions incorporated in the development proposal and site plan for future transportation system improvements identified in the OP, or those that will result from current applications under the Environmental Assessment Act, or applications for OP amendments.

3.1.3 Study Area

The study area should encompass all major and minor arterial roads and expressways, Provincial highways, interchanges, intersections, transit services, and transit stations/terminals that are expected to be affected by vehicle and pedestrian traffic generated by the proposed development. The extent of the study area is driven by technical parameters such as: vehicle traffic volumes or transit ridership exceeding five percent; volume-to-capacity ratios exceeding 1.0 or level-of-service exceeding 'E' for either through movements, or shared/exclusive turning lanes on intersection approaches; or, vehicle queuing negatively affecting upstream or downstream intersections.

The size of the study area can be reduced in those situations when staff determine that a more limited TIS is considered appropriate.

3.2 Transportation Context for Analysis

Elements to be considered in developing a suitable transportation context for the TIS, are outlined as follows.

3.2.1 Horizon Year and Peak Periods for Analysis

Typically, a TIS horizon year is five years from the date the study is commissioned, unless an earlier development 'build-out' date is set. Analysis for additional horizon years is required when a phased development and associated transportation improvements are proposed, or where future major transportation improvements will affect travel to/from the development.

For most developments, the time periods of the greatest 'worst case' traffic impact is the weekday morning and afternoon peak hours when the combination of site-generated trips and non-site related travel on the adjacent road network is greatest. As a result and with rare exception, these time periods should be examined at a minimum. In cases when a development is predominantly retail, an analysis of the Saturday afternoon peak hour or some other time period associated with the peak hour of the generator should be conducted. Also, for industrial use developments relying on staggered shifts, a trip generation analysis focused on time periods associated with the peak travel generated during shift changes is recommended.

3.2.2 'Base' Transportation Conditions

'Base' transportation conditions should be defined to demonstrate an understanding of the existing transportation system and its associated traffic operational characteristics. These conditions are described in detail below.

Existing Transportation Network

The following existing network information is relevant if it is in the study area and is expected to serve or be impacted by the development directly:

- **Street network,** including its road classification, number of lanes, lane designations (bicycle, HOV, etc.), expressway interchanges, posted speed limits and heavy vehicle restrictions;
- **Expressway interchanges,** indicating available turning movements;
- **Signalized intersections** including expressway ramp terminals, indicating lane configurations, turning movement restrictions, curb radii, existing signal timing and lane widths;
- **Unsignalized intersections,** indicating type of control, lane configuration, turning movement restrictions, curb radii and lane widths;
- **Transit routes;**
- **Transit stations and stops,** including the location of station entrances, all light rail vehicle, streetcar and bus-stops or platforms, and bus bays;
- **Pedestrian routes,** including existing sidewalks, walkways, pedestrian crossings and walkway/sidewalk widths;
- **Cycling routes,** including on- and off-road bicycle facilities;
- **On-street parking,** including current limits, parking fees, and availability with parking/standing/stopping restrictions in the vicinity of the development site;
- **Parking facilities,** including neighbourhood parking lots (e.g., Toronto Parking Authority) or bicycle parking (e.g., BIXI stations); and
- **Other transportation facilities or services,** as appropriate.

The level of detail required for each of the elements described above will vary depending on both the magnitude of the traffic being generated and distance from the development site.

A description of the existing transportation system in the study area should be presented using a combination of maps and text.

Existing Traffic Conditions

The following existing traffic condition information is relevant if it forms part of the existing transportation network as defined above:

- **Road link volumes** (i.e., Average Annual Daily Traffic (AADT));
- **Intersection turning movement volumes** through the a.m. and p.m. peak periods, including cycling movements;

- **Pedestrian volumes** at intersections, adjacent to the site and at other mid-block locations, where appropriate;
- **Transit service frequencies and ridership levels** for routes serving the proposed development;
- **Proportion of large vehicles** (i.e., trucks and buses) on key streets and at intersections for consideration in the level-of-service analysis;
- **Storage lane lengths** for exclusive left and right turn auxiliary lanes;
- **Collision history,** at existing intersections and road links. (Staff should be consulted to determine the need for and extent of review or analysis required); and
- **Road gradients and turning sight distance** at signalized and unsignalized intersections. (Staff should be consulted to determine the need for and extent of review or analysis required).

The most recent available traffic counts should be used. These counts are often available from City staff or from other TIS reports conducted for development proposals in the same area. In situations where traffic counts are more than two years old, or where the available traffic count data is not representative of typical conditions or appears to be inconsistent (i.e., due to weather, construction activity, seasonal variations, or other factors), additional traffic counts will have to be conducted. All traffic counts included in the TIS report must be referenced in a separate technical Appendix.

In situations where the traffic volumes through an intersection do not appear to reflect actual demand (i.e., where an intersection's throughput appears constrained by upstream or downstream congestion or vehicle queuing and the level-of-service analyses suggests a low volume-to-capacity ratio that appears 'optimistic' in light of existing conditions), additional field observations are necessary to properly calibrates level-of-service calculations to actual operating conditions.

With respect to transit, the most recent peak ridership information in the vicinity of the routes directly impacted by the development should be obtained. Where the available ridership data does not appear to be representative of current conditions, additional counts may be necessary.

Where traffic counts along a transportation corridor have been conducted at different times of year or in different years, the Proponent will need to adjust and 'balance' upstream and downstream traffic volumes entering and exiting the intersections within the study area. The rationale for not making adjustments in this circumstance should be stated or otherwise documented when adjustments are made.

In areas experiencing high levels of pedestrian and cycling activity, and where the proposed development is expected to substantially add to those levels, data collection and analysis must include these travel modes.

As with the existing transportation network above, existing traffic conditions for all modes of transport should be presented using a combination of maps and text.

3.2.3 Background Transportation Conditions Adjusted for Time Horizons

Defining the transportation context at the location and the timing of the development 'build-out', is key to an effective analysis. These background transportation conditions must include all planned and/or potential future transportation improvements, and anticipated changes in background vehicle, bicycle, and pedestrian traffic along key routes and intersections.

Future Transportation Improvements

The analysis must include all planned or potential future transportation improvements contained in the OP and related Secondary/Community improvement/Streetscape Plans, subject to OP amendment applications, or any applications under the Environmental Assessment Act that may benefit or otherwise impact travel to/from the development within its study horizon. Other planned improvements, such as the installation of pedestrian facilities, bicycle lanes or bicycle lanes identified in the Toronto Bike Plan, may need to be included as part of future background transportation conditions. (Staff should be consulted to determine the current state of these Plans.) In each case, the status and the anticipated date of implementation and the source of the information, should be identified.

Future Background Traffic Conditions

When considering background traffic including cycling, transit ridership and pedestrian volumes, adjustments must be made to account for new development within the study area that is approved and/or under construction.

Volume and ridership changes resulting from developments beyond the study area and the ongoing growth of travel across the region and through the study area must be considered. In general, observed growth trends or future projections based on area transportation studies or modeling must be considered, if available. In some situations, alternative assumptions or methods, such as the application of development absorption rates, may be appropriate.

3.3 Development Site Traffic

In this section, the elements of the TIS used in estimating the travel demand that will be generated by the proposed development are outlined. The basic travel demand estimates will, in some cases, be modified to account for proposed travel demand management strategies. Adjustments may be required to accurately assess 'pass-by' trips, 'on-site' synergy, as well as traffic generated by the existing development that will be replaced by traffic from the new development. Where the development proposal is to be implemented in phases, or where significant future changes to the transportation system or to overall travel patterns might affect site travel patterns, additional travel demand scenarios should be developed and evaluated.

3.3.1 Determine Unadjusted Traffic Generation

Traffic demand generated by the proposed development must be estimated through the application of a four-step process (i.e., trip generation, modal split, trip distribution, and trip assignment) for the relevant trip types (work trips, visitor trips, shopping trips, courier/delivery vehicle trips, etc.).

A summary of travel demand assumptions and methodologies used in trip generation, trip distribution, modal split, and trip assignment analyses, must be provided. These should be consistent with standard or accepted parameters and techniques, or based on surveys or other local knowledge with sources documented. Departures from standard or accepted parameters or from survey results should be explained and justified. Should trip generation values from previous studies be utilized, an explanation or qualification should be provided with regard for the community context, transportation context, or age of the data. Where there is uncertainty, or a range of possible values exists, a need for sensitivity analysis should be indicated unless a more reasonable explanation is provided.

Available trip generation methodologies, listed from most to least preferred, include:

- **Local surveys or data**, provided that conditions are comparable to those for the proposed development;
- **First principles calculations** (e.g., converting number of employees into trips through the application of parameters such as occupancy rates, peaking factors, or floor space per employee);
- **Default parameters provided by City staff**; and
- **Institute of Transportation Engineers (ITE) trip generation rates** provided that comparability issues are addressed.

Where more than one methodology is available, trip generation estimates should be confirmed across the various methods. Also, it may be prudent to confirm trip generation assumptions with City staff prior to completing a TIS analysis.

In cases of land uses characterized by high volumes of pedestrian or cycling activity (e.g., intensification areas, mobility hubs/transportation terminals/transit stations, or sporting and special event venues), it may be necessary to analyse peak pedestrian/cycling trip generation.

The Applicant must compare the traffic generated by their proposed development with traffic generated by 'building-out' the site to the maximum existing 'as-of-right' zoning permission.

3.3.2 Trip Reductions Resulting from Pass-by and/or Internal Trips

Depending on the situation and the proposed mitigation measures, it may be appropriate to adjust the calculated trip generation to account for the following:

- **Trips generated by existing land use activities to be replaced by the proposed development.** Unless otherwise accounted for, these trips will normally be subtracted from final trip generation estimate;
- **'On-site synergy'**, (e.g. internal shopping trips by workers in a combined office/ retail building). Where appropriate, these trips can be subtracted from the final trip generation estimates; and
- **'Pass-by' trips**, (i.e. retail trips that actually represent intermediate stops on a trip already on the adjoining roads). These are generally included in site access movements but may not be added to volumes already on the road network.

Any adjustments must be documented and justified, preferably using previous research or surveys.

3.3.3 Travel Demand Management Plan

All development proposals should take steps to promote non-automobile modes of transportation. Depending on the type and scale of the development, City policies may indicate a need to prepare a Travel Demand Management (TDM) Plan to reduce single-occupant vehicle use. The TDM Plan should include a description of the TDM initiatives proposed and any complementary measures required to provide or enhance alternatives to the single-occupant vehicle. Steps taken to support walking, cycling and the use of transit and high-occupancy vehicles, should be identified.

TDM measures may include improvements to facilities/infrastructure (i.e., walkways or new pedestrian connections, bicycle parking/bike stations, and/or dedicated parking for car-sharing vehicles), to encourage alternative travel options. Also, additional measures and their application can be found in the *Toronto Green Standard*.

Once prepared, the impacts of the proposed TDM Plan must be evaluated. These measures may reduce trip generation, reduce the proportion of trips in the peak hour, reduce vehicle modal share, or increase vehicle occupancy. The impacts should be calculated as adjustments to the basic travel demand estimates discussed in Section 3.3.1.

3.3.4 Distribution and Assignment of Traffic to the Network

Techniques used to determine the distribution and assignment of traffic, transit, pedestrian and cycling trips onto the area transportation network include survey results (e.g., origin-destination/market studies and comprehensive travel surveys), transportation planning models, gravity models or Fratar techniques.

Typically, travel survey results are the most appropriate source for modal split assumptions. The consideration of modal split objectives may be relevant in some situations. Vehicle occupancy must be estimated using survey results and adjusted, where appropriate, to account for the availability of high-occupancy vehicle lanes and complementary measures such as ridesharing. The consideration of vehicle occupancy objectives may be appropriate in some situations.

3.3.5 Alternative Travel Demand Scenarios

Alternative travel demand scenarios for each development phase should be evaluated for transportation improvements linked to the phase or other related site development milestones.

3.4 Determining Transportation Impacts

The projected transportation impacts of the proposed development should be compared to the summary baseline conditions developed earlier.

3.4.1 Approved Travel Analysis Tools, Methods and Parameters

Intersection Capacity Analysis Considerations

All intersection capacity analysis should be submitted using the most recent versions of:

- *Canadian Capacity Guide for Signalized Intersections* (CCG) - Institute of Transportation Engineers District 7, Canada; and
- *Highway Capacity Manual* (HCM) - Transportation Research Board, The National Academies, U.S..

The use of the above methodologies for the same development application should be avoided (e.g., analyzing signalized intersection capacity using CCG, but estimating unsignalized intersection capacity using the HCM). When network signal coordination issues are to be considered, the HCM method should be used.

At congested intersections, particularly where the intersection volume-to-capacity ratio is greater than 1.0 or Level-of-Service 'E', it is advisable to conduct further field observations of intersection operations, saturation flow rates, vehicle queuing, signal coordination and vehicle delays, to validate initial analysis results.

Intersection analysis must also compare the adequacy of existing auxiliary storage lane lengths to observed or calculated peak period vehicle queuing. Queuing that routinely exceeds the storage lane length suggests that the intersection operation is worse than calculated in the analysis and thus warrants further investigation.

For pedestrian analysis, localized existing and forecast conditions should be reflected with an explanation provided for all assumptions or revised parameters that differ from the 'default' values used in the standard HCM or CCG analysis procedures for pedestrians.

Pedestrian signal timing for existing and future conditions must conform to the City's *Pedestrian Timing at Signalised Intersections Guideline* with emphasis on adequate crossing times for pedestrians that account for existing and forecast pedestrian volumes and the presence of the elderly, children and persons with disabilities.

Saturation Flow Rate Considerations

Surveys of saturation flow rates at intersections are required:

- Where streetcars/light rail transit vehicles share lane use with private/commercial motor vehicles; and
- For shared through/turn lanes, or where queue spillback from turn lanes routinely blocks the adjoining through lane.

Saturation flow rates shall not exceed the values stipulated in the latest version of *Saturation Flow Rates for the City of Toronto* unless supported by supplementary data collection.

3.4.2 Summary of Transportation Impacts

Once traffic generated by the proposed development is applied to the future transportation network, a summary of the transportation impacts resulting from the development can be reviewed and summarized. This summary must include an evaluation of the impacts of site-generated travel demand on road (including transit and cycling), and pedestrian level-of-service.

Traffic Operations

All signalized and unsignalized intersections significantly impacted by site-generated traffic volumes, for all relevant time periods and development phasing, must be evaluated. This evaluation should include forecast operating conditions (control delay per vehicle, volume-to-capacity ratios and level-of-service) for:

- **Existing traffic**;
- **Existing and background traffic**, (i.e., existing traffic adjusted to account for changes in background traffic); and
- **Total traffic**, (i.e., existing traffic adjusted for background changes and site-generated traffic demand after adjustment for trip reductions, such as pass-by trips, internal trips, or a proposed TDM Plan).

Cyclists and pedestrians should be accounted for in the consideration of future operating conditions.

Transit Operations

The impacts on transit operations caused by site-generated traffic movements or queuing needs to be evaluated.

Also, all developments generating significant increases in transit ridership, and/or are in areas where transit operations are considered to be particularity sensitive to increases in demand, the impacts of site-generated transit demand must be evaluated. City and/or TTC staff should be consulted to establish the need for this analysis and determine the analysis' scope and approach.

Such an evaluation would typically examine peak-point in-the-route ridership and ridership in the vicinity of the development proposal for the relevant time periods and development phasing, on affected transit routes. Further, the evaluation would consider the need for changes to existing service frequencies, implementation of new or revised transit routes, or upgrades to existing transit stations/terminals for:

- **Existing transit ridership**;
- **Existing and background transit ridership**, (i.e., existing ridership adjusted to account for changes in background traffic); and
- **Total ridership**, (i.e., existing ridership adjusted for background changes and site-generated transit demand after adjustments, if any).

Pedestrian Movements

An evaluation of pedestrian activity generated by the development must be included in signal warrant calculations to determine signal timing requirements, and for safe and convenient pedestrian connections along main streets and to transit facilities (i.e., Light Rail Vehicle and streetcar platforms, and bus stops) and other key destinations.

In those instances where land use is expected to generate high levels of pedestrian activity, pedestrian flow conditions during peak periods should be analysed (e.g., using the methodology described in the HCM). City staff should be consulted to establish the need for this analysis and determine the analysis' scope and approach. Consultants are advised that this type of analysis will require detailed pedestrian count data, particularly directional flows along sidewalks as well as across roads and intersections, and that the City does not actively collect this type of data.

Also, staff should be consulted to guide the evaluation of other qualitative pedestrian factors.

Cycling Movements

Where warranted by existing or forecast cycling volumes, all applications should address level-of-service for cyclists using the methodology described in the HCM.

3.4.3 Access Location Analysis

The following elements should be examined when evaluating existing and proposed access points:

- Adequacy with respect to design operation and level-of-service, including turning sight distances that conform with accepted guidelines;
- Potential conflicts between modes, particularly vehicle conflicts with pedestrians and cyclists, localized hazards for pedestrians, and any requirements to restrict certain turning movements to address sight restrictions or pedestrian/cyclist safety;
- Site access opportunities for cyclists and pedestrians, including those with disabilities, with particular emphasis on convenient and safe access to transit services;
- Prohibiting or restricting direct access to arterial roads where access to collector or local roads is available;
- Adverse impacts on road and transit operations with appropriate remedial measures, if required;
- Possible interference with other adjacent or opposing driveways;
- The need to mitigate potential on-street queuing and weaving problems;
- The need for auxiliary turning lanes; and
- Collision history and safety analysis.

3.4.4 Site Parking, Loading, and Circulation

When evaluating site parking, loading and circulation issues, the following should be considered:

- All development parking must be consistent with the modal split assumptions used in the travel demand analysis and account for OP modal split objectives, all within the context of local policies, standards and by-laws (i.e., Zoning);
- The provision of bicycle parking, parking for high-occupancy vehicles, car-share and vehicles operated by or for persons with disabilities, must be examined where necessary;
- Vehicle queuing as a result of on-site vehicle circulation patterns must be evaluated to ensure that queuing vehicles do not interfere with on-street traffic operations;
- Delivery vehicle/courier loading facilities must be evaluated in regards to access (i.e., location, size, and design) and convenience (i.e., maximize the opportunity that pick-up/delivery operations will occur on-site and not on-street);
- A loading vehicle maneuvering assessment should be undertaken to assess adequacy of access into and out from the loading area and its associated driveway; and
- Any impacts to on-street parking that would be necessary for delivery vehicle/courier vehicles to access the site, should also be identified.

Reference must be made to any measures taken to make the proposed development accessible to persons with disabilities, including transit facilities. The City's *Accessibility Design Guidelines* and the Province of Ontario's *Accessibility for Ontarians with Disabilities Act*, as amended, must be complied with.

3.4.5 Other Jurisdiction and Agency Considerations

In situations where Provincial and Federal facilities and services may be impacted, staff at the Ministry of Transportation of Ontario, Transport Canada or other Provincial/Federal departments/agencies must be consulted to ensure that their requirements are identified and addressed.

3.5 Transportation System Improvements Required to Mitigate Impacts

Transportation system service improvements and other measures required to ensure acceptable transportation systems operation, must be identified in the TIS report. Mitigating measures must not hinder or preclude the realization of pre-planned City initiatives envisioned to be implemented within the study horizon.

3.5.1 Mitigation Considerations

Development-related transportation improvements that mitigate the impacts of the site on transportation infrastructure should be made such that:

- Generated traffic does not cause any intersections or individual traffic movements to meet or exceed the criteria in Section 2.2;

- Intersections or individual traffic movements where the level-of-service meet or exceed the criteria in Section 2.2 before the addition of site-generated traffic, are not worsened by this addition;
- Adequate storage is provided in exclusive turning lanes to accommodate projected traffic, including site-generated traffic;
- Traffic operations are not significantly impacted nor have an unmanageable adverse impact on transit operations, and safety is maintained or improved;
- The capacity of transit services or facilities is sufficient to accommodate site-generated transit demand; and
- Pedestrian and cycling needs are safely accommodated and, where applicable, the required capacity of pedestrian infrastructure is demonstrated and other needs accounted for following further assessment. Staff should be consulted to determine requirements here.

Note that mitigating measures identified should give due consideration to improve conditions for and avoid adverse impacts upon the more sensitive road users (i.e., pedestrians, cyclists, or those persons with disabilities).

3.5.2 Proposed Infrastructure and Operational Improvements to Mitigate Impacts

Proposed transportation improvements must support the objectives of the OP, acknowledge other City initiatives and planned improvements and reflect the remaining elements of the City's transportation system while contributing to the effective and efficient movement of people and goods.

The development Proponent is financially responsible for transportation improvements identified to support their proposal, or to mitigate adverse impacts of the proposal. Normally, such improvements will be included as conditions of development approval. When the need for an improvement is attributable to several developments, the Proponent may wish to negotiate a cost-sharing arrangement. In cases where required transportation improvements are already scheduled by public agencies, phasing of the development in conjunction with the proposed timing of these improvements, or with the demonstrated success of TDM initiatives should be indicated. Alternatively, to advance the implementation schedule for their development, the Proponent may wish to consider the option of assuming financial responsibility for these improvements.

The Proponent must identify feasible realistic transportation infrastructure, service improvements, or additional TDM measures that can mitigate vehicle traffic and cycling, transit and pedestrian impacts, and improve the safety or convenience of travel to and from the proposed development. To adequately predict road safety impacts resulting from the development site traffic, analytical tools like those of the Highway Safety Manual (www.highwaysafetymanual.org) should be applied.

When signal timing changes are proposed to existing traffic control signals, consultation with the Transportation Services (TS) staff should take place to determine if equipment changes will be required. TS staff should also be consulted if a new traffic control signal is to be installed.

3.5.3 Feasibility Assessment and Unresolved Travel Issues

The Proponent must evaluate the effectiveness of the identified transportation improvements or TDM measures towards meeting the criteria listed in Section 3.5.1. The details of any additional level-of-service analyses conducted should be documented in an Appendix to the TIS.

The Proponent must assess the potential need to phase the development in conjunction with the transportation infrastructure or service improvements, supplementary TDM measures, or in association with other proposed, committed, or under-construction transportation infrastructure. In the case of OP designated City Centres or other special OP policy areas, there may exist greater flexibility with respect to implementation timing of transportation improvements. Development can proceed in advance of physical infrastructure improvements provided it is demonstrated that transportation demand and supply can be kept reasonably balanced over this period.

Should one or more criteria listed in Section 3.5.1 not be satisfied, the TIS should identify both the situations when this occurs and the extent to which it occurs, even with the identified transportation improvements and/or additional TDM initiatives.

3.6 Documentation and Reporting

The following elements are recommended for inclusion in the TIS:

3.6.1 Summary Table of Results and Proposed Mitigating Measures

A summary of **travel demand estimates** for all modes of travel (including cyclists, transit users and pedestrians) using mapping, should be provided showing the following:

- **Existing volumes;**
- **Background changes to existing volumes over the study period;**
- **Site-generated volumes;**
- **Adjustments to site-generated volumes that result from trip reductions** (i.e., TDM measures); and
- **Total volumes.**

Mapping in support of the above should be prepared for each time period and for each scenario being evaluated. Where practical, all the information for a given time period or scenario should be presented on two maps: one map for traffic and transit, and another for cycling and pedestrian volumes. Parentheses or other similar devices should be used to identify the different volumes and/or adjustments.

The TIS must provide a **signal warrant analysis** for all proposed traffic control signals using forecast eight-hour peak-volume conditions. Supplementary analysis of the area traffic control signal network operations may be required to assess impacts on traffic control signal coordination. An evaluation of any proposed adjustments to existing traffic control signal cycle length, phasing, and timing should be undertaken to assess impacts on pedestrian crossing times, queue lengths, and adequacy of auxiliary lane queue storage.

The TIS must also include functional plans, as appropriate, showing proposed:

- **Road and intersection improvements;**
- **Transit improvements** such as bus stop locations, bus bays, streetcar/light rail platforms and new or revised subway station access points, if required, including the addition of elevators and escalators;
- **Pedestrian improvements** such as new sidewalks (i.e., to address missing links in the pedestrian network, to provide direct connections to transit facilities, or to provide safe walkways through parking lots to the pedestrian network), sidewalk widenings, curb and sidewalk re-alignments, new pedestrian crossings, pedestrian refuge islands, pavement markings, raised intersections, and the removal of unnecessary channelizing islands; and
- **Cycling improvements** such as new bike lanes/ bike paths, sharrows, intersection bike boxes, advance bicycle turn signal, or protection for future bike lanes and paths.). If applicable, the merit and design specifics of any identified cycling related infrastructure improvements should be reviewed by Transportation Services staff.

The functional plans must show improvements that are feasible to implement, identify intersection improvements, and show property requirements. In addition, these plans must have regard for both sides of the public street right-of-way as well as those elements located in the municipal boulevard.

3.6.2 Detailed Tables of Data and Results

Identify in the main body of the report under existing, future background and total future traffic conditions, the following:

- The **delay per vehicle, level-of-service, and volume-to-capacity ratios** for all critical movements or critical lane groups at signalized and unsignalized intersections within the study area;
- The **intersection delay and intersection volume-to-capacity ratios** for all signalized and unsignalized intersections within the study area;
- **Vehicle queuing** that exceeds the available auxiliary lane storage;
- **Road safety issues,** including collision statistics, formal safety analysis results (if any), and existing and projected sight distance assessments;
- **Operational Issues,** including transit priority requirements, merging/weaving constraints, driveway blockage, and restricted sight distance; and
- **Sustainable Transportation Measures of Effectiveness for the transportation network**, including the number of stops, fuel consumption, average speeds and delay. (Staff should be consulted to determine the need for and extent of review or analysis required.)

All of the above information should be summarized in a table for the various time periods and scenarios under evaluation.

Level-of-Service Analysis

The Appendix should include the following:

- All **assumptions used in the level-of-service analysis** concerning lane configuration, pedestrian activity, pedestrian signal timing, saturation flow rates, traffic control signal coordination, traffic control signal cycle length/phasing/timing, signalized intersection lost time, and other relevant parameters;
- All **signal timings** used in the level-of-service analysis. Existing traffic control signal cycle length/phasing/timing must be provided along with modifications under consideration to address capacity or level-of-service deficiencies. Proposed traffic control signal timing parameters must adhere to existing City of Toronto guidelines.; and
- The **results of all level-of-service analyses**, including overall delay, control delay per vehicle, vehicle queues, and volume-to-capacity ratios for each intersection and critical lane group or critical movements.

3.6.3 Submission of Transportation Impact Study

It is recommended that the submitted TIS report be similar to the structure and format that the *GUIDELINES* detail in order to facilitate study review, discussion, and communication. Wherever practical, all maps, graphs, and tables should be placed adjacent to the relevant text rather than clustering them on the back pages of the TIS report.

The TIS report should begin with an executive summary with the main document, containing the text, key maps and drawings, and summary tables supplemented by technical appendices containing detailed analyses, where required. In the 'Conclusion', the TIS report must clearly indicated whether the proposal can be accommodated on the existing network, and identify any and all recommended road and right-of-way improvements.

A TIS submission is considered 'complete' when all revisions and supplementary analyses resulting from the review process, have been incorporated into the final document. A complete document will facilitate review by both staff and the public and, if required, enable its use and usefulness as Ontario Municipal Board evidence.

Five (5) copies of the final TIS report and two (2) copies of any supporting or supplementary documentation must be submitted. In some cases, the Proponent will need to provide additional copies of the TIS report, or be required to submit the results of computerized analyses in an electronic format.

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APPENDIX A
CONTACT INFORMATION FOR TIS PREPARATION

1. City of Toronto (www.toronto.ca)

Transportation Services
Transportation Infrastructure Management Section
Operational Planning & Policy Unit
22nd floor East Tower, City Hall
100 Queen Street
Toronto, Ontario M5H 2N2
Telephone: 416-392-5230
Fax: 416-392-4808

City Planning Division
Transportation Planning Section
Toronto and East York District
22nd floor, Metro Hall
55 John Street
Toronto, Ontario M5V 3C6
Telephone: 416-392-0070
Fax: 416-392-3821

2. Toronto Transit Commission (www.ttc.ca)

Strategy and Service Planning Department
5160 Yonge Street, 9th Floor
Toronto, Ontario M2N 6L9
Telephone: 416-393-4467
Fax: 416-338-0400

APPENDIX B
LINKS TO TIS RESOURCES

1. City of Toronto (www.toronto.ca)

GENERAL

- Building Toronto Together - A Development Guide
  www.toronto.ca/developing-toronto/pdf/guide_main.pdf
- City of Toronto Official Plan
  www.toronto.ca/planning/official_plan/introduction.htm
- City of Toronto Construction Information
  www.toronto.ca/improvements
- Toronto Green Standard
  www.toronto.ca/planning/environment/index.htm
- Design Guidelines for 'Greening' Surface Parking Lots
  www.toronto.ca/planning/urbdesign/greening_parking_lots.htm
- Saturation Flow Rates for the City of Toronto
  (Contact Transportation Services staff for a copy)
- Selected Traffic and Safety Data
  - 2011 Personal Injury and Fatal Collision Summary Leaflet
    www.toronto.ca/transportation/publications/brochures/2011_fatal.pdf
  - 24 hour volume map
    www.toronto.ca/transportation/publications/brochures/24hourvolumemap.pdf
  - AM peak hour volume map
    www.toronto.ca/transportation/publications/brochures/volmapam.pdf
  - PM peak hour volume map
    www.toronto.ca/transportation/publications/brochures/volmappm.pdf
  - Signalized Intersection Traffic and Pedestrian Volumes - Open Data
    www1.toronto.ca/wps/portal/open_data/open_data_item_details?vgnextoid=417aed3c99cc7310VgnVCM1000003dd60f89RCRD&vgnextchannel=6e886aa8cc819210VgnVCM10000067d60f89RCRD

CYCLING

- Guidelines for Design and Management of Bicycle Parking Facilities
  www.toronto.ca/planning/pdf/bicycle_parking_guidelines_final_may08.pdf
- Toronto Bike Plan
  www.toronto.ca/cycling/bikeplan/
- Toronto Cycling Map
  www.toronto.ca/cycling/map/index.htm
- 2011 Cyclist Collision Summary Leaflet
  www.toronto.ca/transportation/publications/brochures/2011_bike.pdf

PEDESTRIANS

- Toronto Walking Strategy
  www.toronto.ca/transportation/walking/walking_strategy.htm
- Design Guidelines for PATH and Other Climate-Controlled Pedestrian Networks
  http://www.toronto.ca/planning/pdf/path_designguideline16feb12.pdf
- Accessibility Design Guidelines
  www1.toronto.ca/static_files/equity_diversity_and_human_rights_office/pdf/accessibility_design_guidelines.pdf
- 2011 Pedestrian Collision Summary Leaflet
  www.toronto.ca/transportation/publications/brochures/2011_ped.pdf
- Pedestrian Timing at Signalised Intersections
  (Contact Transportation Services staff for a copy)

2. Toronto Transit Commission (www.ttc.ca)

- TTC Map of Existing Operations
  www.ttc.ca/Routes/General_Information/Maps/index.jsp
- Current Projects
  www3.ttc.ca/About_the_TTC/Projects_and_initiatives/Transit_city/Current_Projects/index.jsp

3. Province of Ontario (www.ontario.ca)

- Land Use Planning - Provincial Policy Statement , 2005
  www.mah.gov.on.ca/Asset1421.aspx
- Selected Reulations
  (www.e-laws.gov.on.ca)
  - Accessibility for Ontarians with Disabilities Act, 2005
  - City of Toronto Act, 2006
  - Municipal Act, 2001
  - Places to Grow Act, 2005
  - Planning Act, 1990
- Metrolinx - GTA Regional Transit Authority
  www.metrolinx.com
  - GO Transit
    www.gotransit.com
  - Toronto Light Rail Transit Projects
    www.metrolinx.com/en/projectsandprograms/transitexpansionprojects/CrosstownProject.aspx