



Guidelines for the Preparation of Transportation Impact Studies



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This harmonized edition of the “Guidelines for the Preparation of Transportation Impact Studies” updates the September 1996 document produced by the former Metropolitan Toronto. The harmonized Guidelines are a result of Phase I of the Review Process.

Readers should be aware that this harmonized edition will undergo further technical review during Phase II of the Review Process, with the objective of producing an updated version. Prior to using this document, readers are advised to check with City of Toronto staff with respect to its applicability.

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Forward

A transportation impact study is a valuable source of information for municipal staff and others reviewing development applications. Not only does such a study evaluate the effects of a proposed development on transportation systems, but it also suggests any transportation improvements necessary to accommodate travel generated by the development.

These guidelines outline the steps to produce a comprehensive transportation impact study. However, depending upon individual circumstances, not all of these requirements will have to be met. To determine if a transportation impact study is necessary and to confirm the required elements of that study, it is important for applicants requesting planning approvals to contact City of Toronto staff when preparing a development application. By doing this and, if required, having a transportation impact study available early in the process, the review of the transportation aspects of the application by City staff can proceed with minimum delay.

In areas designated as priorities for reurbanization or intensification, such as Centres and Corridors, City staff will develop transportation plans in conjunction with relevant land-use plans and/or policies. The scope of transportation impact studies for development proposals in reurbanization areas where these plans are in place can often be significantly reduced. In many cases, regional transportation issues would be covered by these plans and would not have to be addressed in detail in the transportation impact study. In addition, there are other elements of the transportation review where development in designated reurbanization areas is viewed favourably relative to other locations. Most notably, there is greater flexibility in assessing the need for and timing of transportation system improvements and development within these designated areas and may be accorded priority when allocating transportation system capacity.

These guidelines have been developed in the context of extensive experience with transportation impact studies and in consultation with individuals and agencies that prepare such studies or review them. Any objectives, policies, or standards referred to were current at the time of preparation. The guidelines will be reviewed and updated as necessary to reflect changes in policy and practice.

1.0 Introduction

Transportation, Development and the Official Plan

1.0.1 Central to the development of the City's position on development applications is consideration of the extent to which these proposals are consistent with the objectives and policies of the applicable Official Plan(s). Transportation is one of a number of policy areas that must be considered, including those related to the development of a liveable and sustainable urban area, economic development, environmental health, and social well-being.

1.0.2 In addition to objectives that promote the concentration of population and employment in areas well served by transit, such as Centres and Corridors, the Official Plan(s) include specific policy themes related to transportation and development that are relevant to the preparation and review of transportation impact studies:

- The manner in which transportation needs are to be met. In keeping with broader environmental, economic, and social goals, a balanced range of travel options should be provided while encouraging walking, cycling and the use of transit and other high-occupancy vehicles and making efficient use of existing and future transportation infrastructure.
- Effective integration of development with the City's transportation system with respect to vehicular and pedestrian access and connections to the transit system.
- The provision in development plans for future transportation system improvements identified in the Official Plan(s), that may be the subject to an application under the Planning Act or the Environmental Assessment Act.
- The inclusion in development proposals of transportation system and service improvements and travel demand management initiatives to ensure that travel demand and transportation supply are kept in balance over time, although flexibility is provided in the case of City Centres and Corridors to allow development to proceed in advance of infrastructure improvements.
- Maximizing of the efficiency of the road network in moving people and goods.

1.0.3 In the context of the objectives and policies of the Official Plan(s) and of the development review process, the purpose of a Transportation Impact Study (TIS) is to provide information needed by staff and Council in reviewing the transportation aspects of a development proposal by:

- assessing the transportation impacts of a proposed development ;
- identifying physical infrastructure or service improvements or other measures which should be considered to keep transportation demand and supply in balance and maintain safe and otherwise acceptable operating conditions on roads and at intersections and access points with the proposed development in place;
- identifying an appropriate travel demand management strategy; and
- evaluating consistency with other transportation objectives and policies of the Official Plan(s).

The TIS is intended to assist staff and Council in their review of development applications. It is not by itself a basis for approval or non-approval.

1.0.4 It is highly recommended that the proponent and/or their transportation/planning/architectural consultants contact appropriate City of Toronto staff early in the preliminary stages of the development planning process. This early contact can yield several benefits:

- **transportation issues which might affect the land use or density, site plan, building placement, etc. can be identified, particularly issues specific to the area which might not otherwise be recognized;**
- **the need for a TIS can be discussed;**
- **the scope of the issues to be addressed in the TIS and the level of detail to be applied can be established and the appropriateness of study assumptions and methods can be confirmed; and**
- **the need for specialized studies, such as noise or air quality, can be identified.**

Early contact with staff and, when required, the preparation of a complete and competent TIS are two steps that a proponent can take to maximize the efficiency of the review process. Staff can also arrange a meeting(s) with the relevant planning and/or transportation agencies as appropriate.

It is useful to integrate preparation of the TIS with the preparation of a development application, as transportation issues are best addressed through proposal modifications and vice versa.

2.0 General TIS Requirements

In this section, the considerations determining the need for a TIS, as well as the scope and level of detail of the TIS, are outlined.

- 2.0.1 These guidelines outline the elements that should generally be included in a TIS to provide the information required by Council and staff to evaluate the development in the context of the objectives and policies outlined in Section 1.0.2 above. Guidance is also provided on the scope of the TIS, issues to be addressed and analytical approaches. Figure 1 summarizes the various elements of a generalized TIS. Each of these elements is discussed in more detail in the sections that follow.

FIGURE 1: ELEMENTS OF A TYPICAL TRANSPORTATION IMPACT STUDY (TIS)

Describe the development proposal and the study area (Section 3)
Establish a context for the TIS: (Section 4) <ul style="list-style-type: none"> • Horizon year • Time periods for analysis • Existing traffic/transit conditions • Background traffic/transit conditions
Estimate travel that will be generated by the development proposal: (Section 5) <ul style="list-style-type: none"> • Estimate basic travel demand by mode • Apply adjustments as appropriate • Estimate demand adjustments resulting from a proposed Travel Demand Management (TDM) plan
Evaluate transportation impacts of site-generated traffic/transit demand (Section 6) <ul style="list-style-type: none"> • Intersection level of service • Road operations • Transit service levels • Transit operations • Implications for pedestrians and cyclists
Identify transportation system improvements required to mitigate impacts of the proposed development: (Section 6) <ul style="list-style-type: none"> • Identify improvements • Evaluate effectiveness of mitigation • Identify outstanding issues • Functional plans and feasibility assessment
Address parking and access issues: (Section 7) <ul style="list-style-type: none"> • Suitability of parking and loading provisions • Accessibility for all modes
Document and report (Section 8)

2.0.2 It is not possible to provide generic criteria governing the need for a TIS. However, a TIS is generally required if the proposed development adds more than **100 peak-hour, peak-direction vehicle trips** to the transportation system. Other factors which may indicate the need for a TIS, even if fewer than 100 peak-hour, peak-direction vehicle trips are projected, include:

- the development proposal incorporates direct vehicular access to either a major or minor arterial road;
- the vehicular traffic generated by the development results in volume/capacity ratios at a signalized intersection becoming **critical** (i.e. greater than 0.85 overall or for a shared through/turning movement, or greater than 1.0 for an exclusive turning movement);
- the development proposal is in an area with significant traffic congestion and/or a high expected rate of population or employment growth;
- the development proposal is not envisaged by local land-use/transportation plans; and,
- the development proposal requires amendment of the applicable Official Plan(s).

Consult with City staff to determine the need for a TIS and to establish a suitable scope and level of detail for the TIS. The checklist attached as Appendix A to these guidelines is designed to serve as a basis for these discussions.

2.0.3 In some cases, depending upon the location, scale, and type of development proposed, not all of the TIS elements described in these guidelines may be required. For example, for development proposals in areas where an integrated land-use and transportation strategy or plan is in place, a limited TIS focusing on local access and circulation issues and on travel demand management (TDM) may be sufficient.

2.0.4 Provincial staff may require additional information or analyses beyond the City's requirements outlined in these guidelines. Provincial transportation facilities and services should generally be considered as well as City facilities and services.

2.0.5 In some cases, the information indicated for inclusion in the TIS may seem superfluous since it might normally be assumed that the reviewing agencies would have this information on hand. However, its inclusion confirms that the proponent/consultant was aware of all relevant aspects of the transportation context for the analysis, and facilitates review by compiling all relevant information in one place.

Supplementary information on analytical techniques, travel demand parameters, design standards, travel demand management strategies and other topics is available from City staff.

3.0 Description of the Development Proposal and the Study Area

In this section, those elements of the TIS that describe the development proposal and the TIS study area are outlined.

3.1 Description of the Development Proposal

3.1.1 Identify the application number, the type of application (official plan amendment, zoning by-law amendment, etc.), and the applicant.

3.1.2 Identify the site by municipal address and through a map(s) showing the site in the context of the surrounding area. Show identifiable landmarks on the map(s) to facilitate site inspections. A survey plan should normally be included with the application.

3.1.3 Compare the application with existing development on-site and with current 'as-of-right' provisions in the Official Plan(s) and Zoning By-law(s) must be made with respect to land use, density and floor space, parking supply, and other provisions that have transportation implications.

3.1.4 Describe the proposed development in terms of:

- floor space of each proposed use, paying particular attention to gross versus net definitions and ensure that these are defined consistently throughout the TIS and remain consistent with other information including trip generation parameters;
- number of parking stalls, identifying stalls designed for exclusive use by the physically disabled and by high-occupancy vehicles; comparing the proposed parking supply with minimum/maximum zoning standards; and location of parking and access arrangements and bicycle storage areas;
- number, location and type of loading areas; comparison of proposed arrangements with zoning standards; and location and operation of loading area access;
- location and design of access points and identification of available sight distances;
- nearby intersections;
- other access points adjacent to or opposite the site;
- on-site circulation for vehicles (including bicycles) and pedestrians;
- pedestrian access routes, nearby transit station/stop locations, and walking distance to transit services;

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- building sizes and locations; and
 - expected date of occupancy.

A preliminary site plan to a suitable scale (not schematic), combined with maps, drawings, schematics, tables and/or text as appropriate, would provide the most useful information. If the proposed development is to be constructed in phases, describe each phase and the proposed timing of implementation.

- 3.1.5 Describe the provisions incorporated in the development proposal and site plan for future transportation system improvements identified in the Official Plans(s) or those that would result from current applications under the Environmental Assessment Act or applications for Official Plan amendments.

3.2 Definition and Description of the Study Area

- 3.2.1 Define the study area. In general, the study area should extend far enough, within reason, to contain all major and minor arterial roads and expressways, Provincial highways, interchanges, intersections, transit services, and transit stations/terminals which will be **noticeably affected** by the travel generated by the proposed development:

- traffic volumes or transit ridership increased by 5 percent or more,
- volume/capacity ratios for overall intersections or through or shared through/turning movements increased to 0.85 or more, or
- volume/capacity ratios for exclusive turning movements increased to 1.0 or greater.

Where a more limited TIS is appropriate (see 2.0.3 above), the extent of the study area could potentially be reduced as well.

Consult with City staff in establishing a suitable study area for the TIS.

In general, the size of the study area will vary with the size and nature of the development proposal.

3.2.2 Describe the existing transportation system in the study area, using an appropriate combination of maps and text. The following information is relevant:

- streets, indicating the road classification, number of lanes, posted speed limits, lane designations (bicycle routes, HOV, etc.) and expressway interchanges;
- expressway interchanges, indicating available turning movements;
- signalized intersections, including expressway ramp terminals, indicating lane configurations, lane widths, existing signal timing and turning movement restrictions;
- unsignalized intersections, indicating lane configuration, lane widths, type of control, and turning movement restrictions;
- key pedestrian and bicycle routes;
- pedestrian crossovers in the vicinity of the development;
- on-street parking spaces and parking/standing/stopping restrictions in the vicinity of the development site and those which would affect the operation of key intersections being analyzed;
- heavy vehicle restrictions;
- transit routes serving the proposed development;
- transit stations and station entrances, streetcar and bus-stops or platforms, and bus-bays; and
- other transportation facilities or services as appropriate.

Less detailed information may be appropriate for transportation facilities and services that will not be **noticeably affected** by the travel generated by the proposed development or those more distant from the development site.

3.2.3 Identify any potential future transportation improvements that are shown in applicable Official Plan(s) or that are the subject to Official Plan amendment applications or applications under the Environmental Assessment Act, and that may benefit or otherwise affect travel to/from the development. Describe these improvements to a level of detail sufficient to assess their implications for travel to/from the development. In each case, identify the status and anticipated date of implementation and the source of the information.

4.0 Establish a Transportation Context for the Analysis

In this section, the elements useful in developing a suitable transportation context for the TIS are outlined. The projected transportation impacts of the proposed development will later be compared with this summary of baseline conditions.

The objective here is to create a picture of transportation conditions before the development is completed and occupied to compare with expected conditions after occupation.

4.1 Horizon Year and Time Periods for Analysis

- 4.1.1 Identify the horizon year for the impact analysis. In general, this will be five years from the date of the TIS unless an earlier date for occupancy of the development can be supported. Where development is to be phased, or where future major transportation improvements will affect travel to/from the development, analysis of scenarios for additional horizon year(s) may be appropriate.
- 4.1.2 Consider both the morning and afternoon peak hours, these being established on the basis of the worst-case combination of site-generated trips and non-site-related travel. In some cases, such as Saturday afternoons for retail developments, other peak hours should be analyzed if they represent a worst-case situation with respect to either site-generated or non-site-related travel.

Consult with City staff to determine an appropriate horizon year and time periods for analysis.

4.2 Existing Traffic Conditions

- 4.2.1 A map or maps showing existing traffic volumes for streets and intersections in the study area, including the proportion of large trucks and buses for consideration in the level-of-service analysis.

The most recent traffic counts available should be used. Traffic count data is often available from City staff. It may also be possible to use count data from other recent TIS reports conducted for development proposals in the same area. Generally, traffic counts more than two years old should be updated. Where the available traffic count data is not representative of current conditions or appears to be inconsistent, perhaps due to weather, construction activity, seasonal variations or other factors, additional traffic counts will be required.

Where the traffic volumes through an intersection do not appear to reflect actual demand, for example, where the intersection throughput is constrained by downstream congestion, level-of-service analyses may indicate low volume/capacity ratios which mask actual problems. Field observations may be necessary in these situations to determine the necessary adjustments to level-of-service calculations so that actual conditions are fairly represented.

4.2.2 A summary of pedestrian volumes at key intersections should be provided.

The objective here is to provide a representative picture of existing traffic conditions.

4.3 Existing Transit Conditions

4.3.1 A map or maps showing existing transit service frequencies and ridership levels for routes serving the proposed development should be provided.

Depending upon circumstances, the most useful evaluation may focus on the peak point of the route, although evaluation of other points on the route, such as in the vicinity of the development, may be more useful where the ridership added by the proposed development would not add to peak point volumes.

The most recent transit counts available should be used. Where the available ridership data does not appear to be representative of current conditions, additional counts may be necessary.

As with traffic, a representative picture of existing transit operations is the objective.

4.4 Changes in Background Traffic and Transit Conditions

4.4.1 A summary of adjustments to existing traffic and transit volumes to account for developments which were under construction, or constructed but not fully occupied, when the traffic counts were undertaken or which have since been abandoned or demolished.

4.4.2 Assess the cumulative traffic and transit ridership changes associated with other approved, under construction or proposed development within the study area

Consult with City staff to identify other development proposals that should be accounted for in the TIS. In general, the objective should be to attempt to reflect the expected conditions at the time the development will be completed and occupied.

- 4.4.3 Assess traffic and transit ridership changes resulting from development beyond the study area, the ongoing growth of travel across the region and through the study area. In general, observed growth trends or future projections based on area transportation studies or modelling can be used. In some situations, alternative assumptions or methods, such as the application of development absorption rates, may be appropriate.
- 4.4.4 Where a land use or transportation plan is in place establishing a transportation context for the area, it may be possible to streamline or simplify dealing with such issues as background traffic and transit ridership changes. In some cases, development supportive of Official Plan(s) policies may be accorded a higher priority than other development or 'background' traffic growth in the allocation of transportation capacity.

5.0 Estimation of Travel that will be Generated by the Development Proposal and Development of a Travel Demand Management Plan (TDM)

In this section, those elements of the TIS useful 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 travel demand management strategies to be implemented. Adjustments may be required to accurately assess travel generated by existing development to be replaced, 'pass-by' trips, or 'on-site' synergy. Where the development proposal is to be implemented in phases, or where significant future changes to the transportation system or to overall travel patterns may affect site traffic patterns, additional travel demand scenarios should be developed and evaluated.

5.1 Estimation of Basic Travel Demand

- 5.1.1 Estimate travel demand generated by the proposed development, through the application of a four-step process (trip generation, trip distribution, modal split, and trip assignment) for the relevant trip types (work trips, visitor trips, shopping trips, courier/delivery vehicle trips, etc).
- 5.1.2 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. Sources should be documented. Departures from standard or accepted parameters or from survey results should be explained and justified. Where there is uncertainty or a range of possible values, indicate a need for sensitivity analysis unless a most reasonable case can be readily identified.

Consult with City staff when deciding on appropriate trip generation, trip distribution, modal split, auto occupancy, and peaking factors.

- 5.1.3 Available trip generation methodologies include, from most to least preferred:
- local surveys or data, provided that conditions are similar to those for the proposed development or that differences are accounted for;
 - first principles calculations (i.e. converting number of employees into trips through application of parameters such as vacancy rates, peaking factors, etc.);
 - default parameters provided by City staff; and
 - ITE trip generation rates provided that transferability issues are addressed.

Where more than one methodology is available, trip generation estimates should be confirmed across the various methods.

5.1.4 It may be appropriate, depending on the situation, 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, and unless otherwise accounted for, these trips will normally be subtracted from trip generation estimates;
- ‘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 trip generation estimates; and
- ‘pass-by’ trips (ie. retail trips that actually represent intermediate stops on a trip already on the transportation system) are generally included in site access movements but may not be added to volumes already on the road network.

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

5.1.5 Techniques used in determining the distribution of trips include survey results (origin-destination surveys, market surveys, comprehensive travel surveys, etc.), the output from transportation planning models, and gravity model or Fratar techniques.

5.1.6 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.

5.1.7 Assign traffic and transit trips by using a transportation planning model or manual assignment based on knowledge of the transportation system in the area.

5.1.8 Estimate auto occupancy using survey results and adjusted, where appropriate, to account for the availability of high-occupancy vehicle lanes and complementary measures such as a ridesharing strategy. The consideration of auto occupancy objectives may be appropriate in some situations.

City staff can assist in determining if modal split or auto

occupancy objectives should be considered.

5.1.9 Alternative travel demand scenarios may be required, that differentiate between the with and without situations, where there are changes in overall population and employment distribution, or improvements to transportation infrastructure and services, or other factors that significantly alter the volume or pattern of travel demand (background or site generated) or the scope or the impacts of the proposed development to the transportation system.

5.1.10 Evaluate additional scenarios for each phase, if the development is to be phased, or if it is determined later in the TIS that phasing in conjunction with improvements to transportation capacity will be necessary.

5.2 Estimation of Adjustments to Travel Demand Resulting From TDM Initiatives

Depending upon the type and scale of the development proposal, City policies may indicate a need to prepare a Travel Demand Management (TDM) Plan to reduce single-occupant vehicle use.

City staff will determine the need for a TDM Plan and establishing suitable objectives and an appropriate scope for the Plan.

5.2.1 Describe the TDM Plan to be implemented in conjunction with the proposed development. 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.

5.2.2 Evaluate the impacts of the proposed TDM Plan. These measures may act to reduce trip generation, reduce the proportion of trips in the peak hour, reduce vehicle modal share, and/or increase auto occupancy. The impacts should be calculated as adjustments to the basic travel demand estimates discussed in 5.1.

5.2.3 Identify the steps taken with respect to the proposed development to support walking, cycling and the use of transit and high-occupancy vehicles.

Consult with City staff concerning ways to make a development site supporting transit, HOV riders, cyclists and pedestrians.

5.3 Summary of Travel Demand Estimates

5.3.1 Provide a map or maps, consistent with those summarizing existing conditions as discussed in 4.2 and 4.3, to show:

- existing traffic and transit volumes (see 4.2 and 4.3);
- background changes to traffic and transit volumes over the study period (see 4.4);
- site-generated traffic and transit volumes (see 5.1);
- changes to traffic and transit volumes which are anticipated to result from TDM measures (see 5.2); and
- total traffic and transit volumes.

A map or maps should be prepared for each time period (identified in 4.1.1 and 4.1.2) and for each scenario (see 5.1.9 and 5.1.10) being evaluated. Where practical, present all the information for a given time period or scenario on two maps, one for traffic volumes and one for transit volumes, using parentheses or other devices to identify the different volumes and adjustments.

6.0 Evaluation of Transportation Impacts and Identification of Transportation System Improvements Needed to Mitigate these Impacts

Sections 6.1 and 6.2 outline the elements of the TIS useful in identifying and evaluating the impacts of site-generated traffic and transit demand on road and transit levels-of-service. Transportation system and service improvements and other measures required to ensure acceptable operation of the transportation system are also identified.

6.1 Evaluation of Impacts of Site Generated Traffic Demand

6.1.1 Analyze signalized and unsignalized intersections that will be **noticeably affected** (see 3.2.1) by site-generated traffic volumes for all relevant time periods and development scenarios. The analysis should include projected levels-of-service; i.e., control delay per vehicle and volume/capacity ratios for:

- existing traffic;
- existing traffic adjusted to account for changes in background traffic; and
- existing traffic adjusted for background changes, and including site-generated traffic demand after adjustment for proposed TDM Plan.

Confirm with City staff the scope of the analysis, the suitability of alternative methods and assumptions for level-of-service and queuing analyses and the potential need for supplementary surveys or analyses.

6.1.2 Document in an appendix to the TIS all assumptions used in the level-of-service analysis concerning lane configuration, pedestrian activity, pedestrian signal timing, saturation flow rates, traffic signal progression, traffic signal cycle length, phasing and timing, signalized intersection lost time, and other relevant parameters. **Existing signal timings must be used in the level-of-service analysis.** Signal timing modifications may be considered to address capacity or level-of-service deficiencies; however proposed signal timing parameters must adhere to existing City of Toronto practices.

6.1.3 Evaluate future pedestrian activity associated with the development and related implications for signal warrant calculations and signal timing requirements to provide pedestrian road-crossing opportunities. Of particular interest are pedestrian connections to transit services, including streetcar platforms.

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- 6.1.4 Supplementary surveys or analyses will be needed to assess saturation flow rates, gap availability, and vehicle queuing. At congested intersections, particularly where the intersection volume/capacity ratio is greater than 1.0, and where average vehicle delays appear excessive, it is advisable to conduct further field observations of intersection operations, saturation flow rates, queuing, progression and vehicle delays to confirm the results of the level-of-service analysis (see also 4.2.1). Surveys of saturation flow rates are recommended at signalized intersections with shared turn and through lanes; surveys of saturation flow rates at signalized intersections with shared streetcar and through/turn lanes are required. Unless supported by actual survey data, saturation flow rates for signalized intersections shall not exceed the values described in the City of Toronto's Saturation Flow Rates for the City of Toronto (December 31, 2001).
- 6.1.5 Intersection capacity analysis should be submitted using the most recent versions of either the US Highway Capacity Manual or the Canadian Capacity Guide for Signalized Intersections. Unless permission is obtained to use another method, all capacity analysis must reflect the US HCM methodology when a network analysis is requested using programs such as Transyt 7-F or Synchro/SimTraffic. Avoid switching between methodologies: e.g., analyzing signalized intersection capacity using the CCG, but estimating unsignalized intersection capacity using the US HCM (which requires the calculation of capacity and progression at upstream and downstream signalized intersection). Intersection capacity analysis using HCM-based software should conform to the City of Toronto's "Input Parameters for HCM-based Software" (November 29, 2000). Intersection capacity analysis using CCG-based software should conform to the City of Toronto's "Guidelines for Capacity Analysis Using CCG-based Software" (May 30, 2003).
- 6.1.6 Identify in the main body of the report under existing, future background and total future traffic conditions:
- the delay per vehicle and volume/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/capacity ratios for all signalized and unsignalized intersections within the study area;
 - vehicle queuing that exceeds the available storage; and
 - the measure of effectiveness (MOE's) for the network – stops, fuel consumption, average speed and delay.

The information above should be summarized in a table for the various time periods and scenarios being evaluated.

- 6.1.7 Identify collision histories and other safety or operational issues; e.g., transit priority requirements, merging/weaving constraints, driveway blockage, restricted sight distance, etc.
- 6.1.8 Document the results of all level-of-service analyses, including overall delay, control delay per vehicle, vehicle queues, and volume/capacity ratios for each intersection and critical lane group or critical movements, in an appendix to the TIS.

6.2 Evaluation of Site Generated Transit Demand

6.2.1 Evaluate the impacts of site-generated transit demand for the relevant time periods and scenarios on all transit services and transit stops/stations/terminals where ridership/usage will be increased 5 percent or more by site-generated transit demand. As discussed in 4.3.1, the situation will determine whether it is most useful to evaluate peak-point ridership or ridership in the vicinity of the development proposal. The analysis should include an assessment of the need for changes to existing service frequencies, the need for new or revised transit routes, and the adequacy of existing transit stations/terminals for:

- existing transit ridership;
- existing ridership adjusted to account for background changes; and,
- existing ridership adjusted for background changes and including site-generated transit demand after accounting for the impacts of the proposed TDM Plan.

6.2.2 Assess the potential for impacts on transit operations caused by site-generated traffic movements or queues.

6.3 Identification of Required Transportation System Improvements to Mitigate the Impacts of the Proposed Development

In this section, the elements of the TIS associated with identifying transportation improvements required to mitigate the impacts of traffic or transit demand generated by the development proposal are outlined.

In assessing the need for transportation improvements to be provided in conjunction with the development proposal, all reasonable attempts should be made to identify

transportation or other improvements that mitigate the transportation impacts of the development proposal such that:

- site generated traffic does not cause any intersections or individual traffic movements to meet or exceed the criteria in 2.0.2;
- intersections or individual traffic movements where the level of service met or exceeded the criteria in 2.0.2 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;
- pedestrian and cycling needs are safely accommodated;
- traffic operating and safety conditions are maintained or improved;
- the capacity of transit services or facilities is sufficient to accommodate site-generated transit demand; and,
- site-generated traffic does not have an unmanageable adverse impact on transit operations.

Improvements proposed in conjunction with the development proposal must be compatible with other elements of the transportation system and must be warranted, safe, and contribute to more effective and efficient movement of people and goods.

Generally, the proponent of a development proposal is financially responsible for transportation improvements reasonably required to accommodate the proposal or to mitigate adverse impacts of the proposal. Normally, such improvements will be included as conditions of development approval. In cases where the need for an improvement is attributable to several developments, the proponent may wish to negotiate a cost-sharing arrangement. In cases where needed transportation improvements are planned by public agencies, phasing of the development in conjunction with the proposed timing of such improvements, or with the demonstrated success of TDM initiatives, may be indicated. Alternatively, the proponent may wish to investigate the possibility of assuming financial responsibility for such improvements to advance the implementation schedule for these improvements to match that of the proposed development.

- 6.3.1 Identify transportation infrastructure or service improvements or TDM measures which would mitigate the traffic or transit impacts resulting from site-generated travel demand

in accordance with the above criteria or which would improve the safety or convenience of travel to and from the proposed development.

- 6.3.2 Evaluate the effectiveness of the identified transportation improvements or TDM measures towards meeting the above criteria. The details of any additional level-of-service analyses should be documented in an appendix to the TIS.
- 6.3.3 Assess the potential need to phase the development in conjunction with the transportation infrastructure or service improvements or supplementary TDM measures identified in 6.3.1 or in conjunction with other proposed, committed, or under-construction transportation improvements as identified in 3.2.3. In the case of designated City Centres, and other special policy areas, there may be greater flexibility with respect to the timing of transportation improvements. Development can proceed in advance of physical infrastructure improvements, provided it can be demonstrated that transportation demand and supply can be kept in reasonable balance over time.
- 6.3.4 Identify those situations for which the criteria listed above cannot be satisfied, even with the identified transportation improvements and/or additional TDM initiatives, and the extent to which these criteria have not been satisfied.
- 6.3.5 Provide functional plans showing the road and intersection improvements, identified in 6.3.1 above. The plans should sufficiently demonstrate their feasibility and identify additional required road rights-of-way.

Consult with City staff when assessing the feasibility of the proposed improvements. Further information is available on road and intersection design requirements.

- 6.3.6 Provide signal warrant analysis for all proposed and required traffic signals. Supplementary analysis of traffic signal network operations may be required to assess impacts on traffic signal co-ordination. An evaluation of proposed adjustments to existing traffic signal cycle length, phasing, and timing should be undertaken to assess impacts on pedestrian crossing time availability, queue lengths, and adequacy of queue storage.
- 6.3.7 Provision of functional plans as appropriate for proposed transit improvements such as bus-stop relocations, bus-bay provision or relocation, streetcar platform provision, and new or revised subway station access points, including the additional of elevators or escalators. These plans should be sufficient to demonstrate feasibility and identify space requirements and additional road rights-of-way required.

Consult City and Toronto Transit Commission staff assess the necessary transit improvements and their feasibility. Where the development is adjacent to an existing or proposed rapid transit line, consult with City and Toronto Transit Commission staff to identify the need to incorporate transit stations or terminals, station access facilities or commuter drop-off or parking facilities in the site plan.

7.0 Parking, Loading and Access

In this section, the question of parking supply is addressed. Access to the site for pedestrians, cyclists, transit users, vehicles and persons with physical disabilities is also discussed. The parking supply to be provided for the development should, within the context of local policies and standards, be consistent with the modal split assumptions used in the travel demand analysis (see 5.1.6) and should take into account modal split objectives for the area as may be expressed in the Official Plan(s).

In general, direct access to major and minor arterial roads should be minimized to maintain the ability of the arterial road system to efficiently move people and goods. Before proposing direct access to an arterial road, all reasonable access alternatives must be evaluated.

- 7.0.1 Describe parking and loading facilities proposed in conjunction with the proposed development. The parking supply should be rationalized with the modal split assumptions used in the calculation of travel demand, with local policies and standards and, where appropriate, with modal split objectives established in conjunction with Official Plan policy. The provision of bicycle parking or storage and parking for high-occupancy vehicles and for vehicles operated by persons with physical disabilities should also be addressed.
- 7.0.2 Describe and evaluate the design operation and level-of-service of all proposed access points to public roads. The need to restrict certain movements to avoid unmanageable conflicts must be assessed. Direct access to arterial roads must be justified in the context of available alternative access opportunities. Adverse impacts of site access on road and transit operations must be identified and appropriate remedial measures identified and evaluated. Also to be considered, where appropriate, are potential on-street weaving problems, the need for acceleration or deceleration lanes, and conflicts with pedestrian and cyclists.

City staff must be consulted for additional information on access

design and location.

- 7.0.3 Evaluate proposed access points with respect to possible interference with other adjacent or opposing access points.
- 7.0.4 Evaluate sight distances to ensure safe operating conditions in conformity with accepted guidelines.

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- 7.0.5 Evaluate vehicle queuing as a result of on-site vehicle circulation patterns is required so that queuing vehicles do not interfere with on-street operations.
 - 7.0.6 Evaluate delivery vehicle/courier loading/unloading facilities and access to these facilities with respect to location, size, and design. Convenient access must be provided to on-site loading facilities to minimize the possibility that pick-up/delivery operations will occur on street.
 - 7.0.7 Describe and evaluate site access opportunities for pedestrians and cyclists with particular emphasis on convenient and safe access to transit services.
 - 7.0.8 Describe the measures taken to make the proposed development, including on-site transit facilities where appropriate, accessible to persons with physical disabilities .

8.0 Documentation and Reporting

This section provides some suggestions for organizing and formatting the final report.

- 8.0.1 It is recommended that a structure and format for the TIS similar to that used for these guidelines be used. The checklist included as Appendix A provides a suitable list of section headings. The use of these headings will facilitate review, discussion, and communication. Wherever practical, place maps, graphs, and tables adjacent to the relevant text rather than grouped at the end of the TIS.
- 8.0.2 The TIS should consist of a main document, containing the text, key maps and drawings, and summary tables, supplemented by technical appendices containing detailed analyses as required.
- 8.0.3 A consolidated final version of the TIS should be submitted, incorporating all revisions and supplementary analyses resulting from the review process. This will facilitate review, both by staff and by the public and, if required, the use of the TIS as Ontario Municipal Board evidence.
- 8.0.4 Five (5) copies of the final (consolidated) TIS and two (2) copies of any supporting or supplementary documentation should be submitted to City staff for review.
- 8.0.5 In some cases, it is beneficial to submit the results of computerized analyses in disk form. Staff will advise if this is necessary.

Appendix A

Transportation Impact Studies Checklist

This checklist can be used to identify the specific elements to be included in a TIS in the context of discussions with City staff. As indicated in the Guidelines for the Preparation of Transportation Impact Studies, not all of the elements identified in the Guidelines may be necessary in each case.

A. Description of the Development Proposal and the Study Area	Section	
(a) Identification of application, type of application, and applicant.....	3.1.1	<input type="checkbox"/>
(b) Identification of site location.....	3.1.2	<input type="checkbox"/>
(c) Comparison of application with existing development and as-of-right provisions.....	3.1.3	<input type="checkbox"/>
(d) Description of application:.....	3.1.4	<input type="checkbox"/>
• land use.....		<input type="checkbox"/>
• parking provisions.....		<input type="checkbox"/>
• loading provisions.....		<input type="checkbox"/>
• site access.....		<input type="checkbox"/>
• nearby intersections.....		<input type="checkbox"/>
• other nearby access.....		<input type="checkbox"/>
• on-site circulation.....		<input type="checkbox"/>
• pedestrian access and nearby transit stations/stops.....		<input type="checkbox"/>
• building sizes and locations.....		<input type="checkbox"/>
• expected date of occupancy.....		<input type="checkbox"/>
• description and timing of development phases.....		<input type="checkbox"/>
(e) Provision for planned transportation system improvements (List in Box A-1).....	3.1.5	<input type="checkbox"/>
(f) Definition of study area (describe boundaries in Box A-2).....	3.2.1	<input type="checkbox"/>
(g) Description of study area transportation system.....	3.2.2	<input type="checkbox"/>
• streets and expressways.....		<input type="checkbox"/>
• interchanges.....		<input type="checkbox"/>
• signalized intersections.....		<input type="checkbox"/>
• unsignalized intersections.....		<input type="checkbox"/>
• pedestrian and bicycle routes.....		<input type="checkbox"/>
• pedestrian cross-overs.....		<input type="checkbox"/>
• on-street parking and parking/standing/stopping restrictions.....		<input type="checkbox"/>
• heavy vehicle restrictions.....		<input type="checkbox"/>
• transit routes.....		<input type="checkbox"/>
• transit stations, stops and bus-bays.....		<input type="checkbox"/>
(h) Potential future transportation improvements (List in Box A-3).....	3.2.3	<input type="checkbox"/>

B. Establishing a Transportation Context for the Analysis Horizon Year and Time Periods for Analysis

- (a) horizon year (identify: _____).....4.1.1
- (b) time periods (identify: _____).....4.1.2

Existing Traffic Conditions

- (c) existing traffic volumes.....4.2.1
- (d) pedestrian volumes.....4.2.2

Existing Conditions

- (e) transit frequencies and ridership.....4.3.1

Background Changes in Traffic and Transit Conditions

- (f) adjustments for existing development not included in counts (Listed in Box B-1).....4.4.1
- (g) adjustments for approved development or development likely to be approved (Listed in Box B-2).....4.4.2
- (h) adjustments for growth beyond study area.4.4.3
- (i) transportation context (Identify study or plan: _____).....4.4.4

C. Estimation of Travel that will be Generated by the Development proposal and development of a TDM Plan

Estimation of Basic Travel Demand

- (a) summary of travel demand assumptions and methodologies.....5.1.2
- (b) trip generation.....5.1.3
- (c) adjustments to trip generation (Details in Box C-1).....5.1.4
- (d) trip distribution, modal split, auto occupancy, route assignment.....5.1.5-5.1.8
- (e) development of scenarios (Details in Box C-2).....5.1.9-5.1.10

Estimation of Adjustments to Travel Demand Resulting from TDM Initiatives

- (f) description of TDM plan.....5.2.1
- (g) evaluation of effects of TDM plan.....5.2.2
- (h) steps to support walking, cycling and transit/HOV's.....5.2.3

Summary of Travel Demand Estimates

- (i) summary maps.....5.3.1

D. Evaluation of Transportation Impacts and Identification of Transportation System Improvements Needed to Mitigate these Impacts

Evaluation of Impacts of Site-Generated Traffic Demand

- (a) evaluation of signalized and unsignalized intersections.....6.1.1
(List of intersections to be analyzed in Box D-1)
- (b) summary of assumptions for level-of-service analysis (Include in appendix to TIS)...6.1.2
- (c) supplementary surveys or analyses (Listed in Box D-2).....6.1.4
- (d) identification of critical intersections.....6.1.5
- (e) documentation of results of level-of-service analysis (Include in appendix to TIS)...6.1.7

Evaluation of Impacts of Site-Generated Transit Demand

- (f) evaluation of transit services and stops/stations.....6.2.1
(List if routes to be assessed in Box D-3)
- (g) Assessment of traffic impacts on transit operations

Identification of Transportation System Improvements Required to Mitigate the impacts of the proposed Development

- (h) transportation infrastructure or service improvements or TDM measures.....6.3.1
- (i) effectiveness of transportation improvements or TDM measures.....6.3.2
- (j) assessment of need to phase development.....6.3.3
- (k) identification of residual critical situations.....6.3.4
- (l) functional plans for road and intersection improvements.....6.3.5
- (m) traffic signal warrant analysis for new signals.....6.3.6
- (n) traffic signal co-ordination analysis for new signals.....6.3.6
- (o) evaluation of adjustments to existing traffic signals.....6.3.6
- (p) functional plans for transit improvements.....6.3.7

E. Parking and Access

- (a) parking and loading facilities.....7.0.1, 7.0.6
- (b) parking for bicycles, HOV's, and handicapped.....7.0.1
- (c) rationalization of parking supply.....7.0.1
- (d) design and operation of access points.....7.0.2-7.0.5
- (e) access for pedestrians and cyclists.....7.0.7
- (f) accessibility provisions.....7.0.8

F. Documentation and Reporting

- (a) submission of analysis on disk.....

Supplementary Information for the Transportation Impact Studies Checklist

A-1: Planned transportation improvements to be provided for

A-2: Boundaries of study area

A-3: Future transportation improvements to be accounted for in analysis

B-1: Existing developments to be accounted for

B-2: Developments approved or likely to be approved to be accounted for

C-1: Adjustments to trip generation

C-2: Scenarios to be evaluated

D-1: Intersections to be analyzed

D-2: Supplementary surveys and analyses

D-3: Transit routes to be assessed