



Guidelines for the Preparation of Transportation Impact Studies

8th Revision



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Halifax Regional Municipality Guidelines for the Preparation of Transportation Impact Studies

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FOREWORD

A transportation impact study is a valuable source of information for Halifax Regional Municipality staff and others reviewing development and redevelopment applications. Not only does such a study contain an evaluation of the effects of a new development or redevelopment on the transportation system, 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. It is important for applicants for planning approvals to contact Halifax Regional Municipality staff, as early as possible in the preparation of a development or redevelopment application, to determine if a transportation impact study is necessary and to confirm the required elements of that study. 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 Halifax Regional Municipality staff can proceed with minimum delay.

These guidelines have been developed in the context of experience with transportation impact studies and with the assistance of other municipalities. 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.

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1.0 Introduction: Transportation, Development, and Municipal Plans

1.0.1 Central to the development of a Halifax Regional Municipality position on development and redevelopment applications is consideration of the extent to which these proposals are consistent with the objectives and policies of the Municipal Planning Strategies/Municipal Development Plans and the Regional Plan. 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. Amalgamation of the four former municipal units included a service exchange which involved Halifax Regional Municipality becoming the approving authority for transportation aspects of development in areas of the former County where development activity is concentrated. Therefore, some of the policies that were applied to development by the Nova Scotia Department of Transportation and Public Works have been or are being replaced by policies more appropriate for Halifax Regional Municipality.

1.0.2 The objective in the former City of Halifax Municipal Development Plan provides guidance generally how development applications will be reviewed. The objective is:

“The provision of a transportation network with special emphasis on public transportation and pedestrian safety and convenience which minimizes detrimental effects on residential and business neighbourhoods, and which maximizes accessibility from home to work and to business and community facilities.”

The various Municipal Planning Strategies and Plans have similar language. The details of how these principles are applied to development applications will naturally have to vary depending on the context. Developments in very low density unserved residential areas located well away from concentrations of population and activity centres will require different transportation systems than more intense settlements.

From a transportation perspective, Halifax Regional Municipality review of development and redevelopment applications attempts to strike an appropriate balance between facilitating development, encouraging walking, cycling and the use of transit and other high-occupancy vehicles, integrating development with the transportation system, protecting for future transportation system changes and balancing transportation supply and demand. In turn, consistency of a development or redevelopment proposal with Council's transportation policies is often weighed against consistency with other objectives and policies.

1.0.3 In the context of the objectives and policies of Halifax Regional Municipality 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 or redevelopment proposal by:

- assessing the transportation impacts of a proposed development or redevelopment;
- identifying physical infrastructure or service changes 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 or redevelopment in place;
- identifying an appropriate travel demand management strategy; and
- evaluating consistency with other transportation objectives and policies of Halifax Regional Municipality.

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 Halifax Regional Municipality and Provincial staff as appropriate early in the development planning process, preferably in the early stages of site plan development and before a TIS has been initiated. 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, 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 generally useful to integrate preparation of the TIS with preparation of a development or redevelopment application, as transportation issues might be 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 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. The section numbers in Figure 1 refer to following sections of this guide.

Figure 1: Elements of a typical transportation impact study (TIS)

Describe the development/redevelopment 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 	<ul style="list-style-type: none"> • existing traffic/transit conditions • background traffic/transit conditions
Estimate travel that will be generated by the development / redevelopment proposal (Section 5):	
<ul style="list-style-type: none"> • estimate basic travel demand by mode • apply adjustments as appropriate 	<ul style="list-style-type: none"> • estimate demand adjustments resulting from any proposed Travel Demand Management 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 	<ul style="list-style-type: none"> • transit operations • implications for pedestrians and cyclists
Identify changes required to mitigate effects of the proposed development / redevelopment (Section 6):	
<ul style="list-style-type: none"> • identify changes • evaluate effectiveness of mitigation 	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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, as a rough guide, a TIS will generally be required if the proposed development or redevelopment will add more than 100 peak-hour, peak-direction **person** trips to the transportation system. Other factors which may indicate the need for a TIS, even if fewer than 100 peak-hour, peak-direction person trips are projected, include:

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

Consultation with Halifax Regional Municipality and Provincial staff will be useful in determining the need for a TIS and in establishing 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.

2.0.4 Provincial staff may require additional information or analyses beyond Halifax Regional Municipality requirements outlined in these guidelines. Provincial transportation facilities and services should generally be considered as well as Halifax Regional Municipality 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 Halifax Regional Municipality planning and transportation staff.

3.0 Description of the Development Proposal and the Study Area

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

3.1 Description of the Development or Redevelopment Proposal

3.1.1 Identify the application (municipal file number), the type of application (MPS 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 itself.

3.1.3 Compare the application with existing development on-site and with current "as-of-right" provisions in the MPS and zoning by-law 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 type of use. Pay particular attention to gross vs. net definitions and ensure these are defined consistently throughout the TIS and are consistent with other information including trip generation parameters;
- number of parking spaces, identifying those designated for exclusive use by persons with handicaps and by high-occupancy vehicles, comparison of proposed parking supply with minimum and 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 sight-lines;
- 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 stop locations, and walking distance to transit services;
- building sizes and locations;
- expected date of occupancy.

A preliminary plan or 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 provisions incorporated in the development proposal and site plan for future transportation system improvements identified in the MPSs or those that would result from current applications under the Environmental Assessment Act or applications for MPS amendments.

3.2 Definition and Description of the Study Area

- 3.2.1 In general, the study area should extend far enough, within reason, to contain all Halifax Regional Municipality roads, Provincial highways, interchanges, intersections, transit services, and transit terminals which will be noticeably affected by the travel generated by the proposed development: (ie. traffic volumes or transit ridership increased by 5 per cent or more, volume/capacity ratios for overall intersections or through or shared through/turning movements increased to 0.85 or above, or volume/capacity ratios for exclusive turning movements increased to 1.0 or above). Where a more limited TIS is appropriate (see 2.0.3 above), the extent of the study area could potentially be reduced as well.

It would be helpful to consult with Halifax Regional Municipality 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 or redevelopment proposal.

- 3.2.2 Describe the existing transportation system in the study area using a combination of maps and text as appropriate. The following information is relevant:
- streets, indicating the number of lanes and posted speed, and highways;
 - highway interchanges, indicating the available movements;
 - signalized intersections, including highway ramp terminals, indicating the lane configurations, lane widths, and any turning or similar restrictions;
 - unsignalized intersections, indicating the lane configuration, lane widths, type of control, and any turning or similar restrictions;
 - key pedestrian and bicycle routes;
 - marked pedestrian crosswalks in the vicinity of the development site;

- on-street parking spaces and parking or 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 or redevelopment;
- transit terminal entrances, bus-stops or platforms, and bus-bays;
- 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 changes that are shown in the Municipal Planning Strategies or that are the subject of MPS amendment applications or applications under the Environmental Assessment Act, which may benefit or otherwise affect travel to/from the development. Describe these changes to a level of detail sufficient only to assess their implications for travel to/from the development. In each case, identify the status and anticipated date of implementation.

4.0 Establishing a Transportation Context for the Analysis

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

The objective here is to create a picture of transportation conditions before the development or redevelopment 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 changes 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.

Consultation with Halifax Regional Municipality staff may be useful in determining the appropriate horizon year and time periods for analysis.

4.2 Existing Traffic Conditions

- 4.2.1 Show on a map or maps existing traffic volumes for streets and intersections in the study area, including the proportion of large trucks and buses for consideration in the street and intersection performance analysis.

The most recent traffic counts available should generally be used. It may also be possible to use count or forecast data from other recent TIS reports conducted for development proposals in the same area. Usually, 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 or other factors, additional traffic counts may 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, performance analyses may indicate low (good) volume/capacity ratios which mask actual problems. Field observations may be necessary in these situations to determine the necessary adjustments to performance calculations so that actual conditions are fairly represented.

4.2.2 Show a summary of pedestrian volumes crossing key intersections.

The objective here is to provide a representative picture of existing traffic conditions. Traffic count data is generally available from Halifax Regional Municipality staff.

4.3 Existing Transit Conditions

4.3.1 Provide a map or maps showing existing transit service frequencies and ridership levels for routes serving the proposed development or redevelopment.

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 Background Changes in Traffic and Transit Conditions

- 4.4.1 Provide 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 Provide an assessment of cumulative traffic and transit ridership changes associated with other development proposals in the study area which have been approved or which, in the judgement of HRM planning staff, will likely be approved before the development proposal in question.

Consultation with Halifax Regional Municipality staff will be useful in identifying other development or redevelopment 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 An assessment of traffic and transit ridership changes resulting from development beyond the study area and the ongoing growth of travel across the region and through the study area is needed. 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 that establishes a transportation context for the area, it should be possible to streamline or simplify dealing with such issues as background traffic and transit ridership changes.

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

Those elements of the TIS useful in estimating the travel demand that will be generated by the proposed development or redevelopment are outlined in this section. The basic travel demand estimates will, optionally, be modified to account for travel demand management strategies to be implemented. Adjustments may also be appropriate to account for travel generated by existing development to be replaced, pass-by trips, and on-site synergies. Where the development or redevelopment 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 Provide an estimate of travel demand that will be generated by the proposed development or redevelopment proposal, generally through application of the '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 Provide a summary of travel demand assumptions and methodologies used in trip generation, trip distribution, modal split, and trip assignment analyses. 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. "Soft" parameters, 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.

Consultation with Halifax Regional Municipality staff may be useful 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 (eg. converting number of employees into trips through application of parameters such as vacancy rates, peaking factors, etc.);
- Default parameters provided by Halifax Regional Municipality staff;
- 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 land use activities to be replaced by the proposed development. Unless otherwise accounted for, these trips will normally be subtracted from the trip generation estimates;
- "on-site synergy" (eg. internal shopping trips by workers in a combined office/retail building). Where appropriate, these trips may be subtracted from trip generation estimates;
- "pass-by" trips (eg. retail trips which actually represent intermediate stops on a trip already on the transportation system). These trips 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 useful 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 Traffic and transit assignments may be accomplished using a transportation planning model or 'hand' assignment based on knowledge of the transportation system in the area.

5.1.8 Auto occupancy may be estimated using survey results adjusted, where appropriate, to account for measures such as a ridesharing strategy. The consideration of auto occupancy objectives may be appropriate in some situations.

Halifax Regional Municipality staff will be able to assist in determining if modal split or auto occupancy objectives should be considered.

5.1.9 Alternative travel demand scenarios may be necessary, differentiating between the "with" and "without" situations, if any of the following are applicable:

- there are changes in overall population and employment distribution,
- changes to transportation infrastructure and services,

- other factors that may be expected to significantly alter the volume or the pattern of travel demand (background or site-generated) or the scope or significance of the transportation impacts of the proposed development.

In the case of less significant changes, these may be evaluated "at the margin".

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

5.2 Estimation of Adjustments to Travel Demand Resulting From TDM Initiatives

Depending upon the type and scale of the development or redevelopment proposal, applicants may chose to prepare and implement a Travel Demand Management (TDM) Plan to reduce single-occupant auto use.

Halifax Regional Municipality staff will be able to assist in determining the need for a TDM plan and in establishing suitable objectives and an appropriate scope for the TDM Plan.

5.2.1 Provide a description of the TDM Plan to be implemented in conjunction with the proposed development or redevelopment. 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 auto.

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

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

It may be useful to consult with Halifax Regional Municipality staff concerning ways to make a development site 'friendly' to transit and other 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);
- net 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 Changes 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 performance. Transportation system and service changes 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 Evaluate those signalized and unsignalized intersections which will be noticeably affected (see 3.2.1) by site-generated traffic volumes for all relevant time periods and scenarios. The analysis should include volume/capacity ratios, average and 95th percentile queue lengths, and average delay for:

- existing traffic;
- existing traffic adjusted to account for background changes; and
- existing traffic adjusted for background changes plus forecast site-generated traffic demand after accounting for the effects of the proposed TDM plan and other adjustments.

Provide a table or tables showing volume/capacity ratios, average and 95th percentile queue lengths, and average delay for all movements at all study intersections.

Discussions with Halifax Regional Municipality staff would be useful in confirming the scope of the analysis, the suitability of alternative methods and assumptions for performance and queuing analyses, and the potential need for supplementary surveys or analyses.

6.1.2 Provide documentation in an appendix to the TIS of all assumptions used in the performance analysis concerning lane configuration/use, pedestrian activity, saturation flows, traffic signal cycle length, phasing and timing, use of the inter-green phase, and other relevant parameters. Existing signal timings should be assumed in the performance analysis. Signal timing modifications may be considered as a measure to address capacity or performance deficiencies.

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.

6.1.4 Supplementary surveys or analyses may be needed to assess saturation flows, gap availability, projected queue lengths and possible blocking queues. In the case of congested intersections, particularly where the existing volume/capacity ratio is greater than 1.0, it is advisable to conduct further field observations of intersection operations, saturation flows, queues, and delays to confirm and/or rationalize the results of the performance analysis (see also 4.2.1).

6.1.5 Identify intersections and individual traffic movements where:

- the overall volume/capacity ratio of an intersection exceeds 0.85;
- the volume/capacity ratio of an individual through movement or shared through/turning movement exceeds 0.85;
- the volume/capacity ratio of an exclusive turning movement exceeds 1.0;
- an exclusive turning movement generates queues which exceed the available turning lane storage space, or,
- average delay for any particular movement exceeds what is typically acceptable.¹

Intersections/movements meeting one or more of the above criteria and the associated performance results for the various time periods and scenarios being evaluated should be summarized in a table.

6.1.6 Identify other safety or operational issues, such as those associated with merging, weaving, sight-distance, etc.

6.1.7 Document, in an appendix to the TIS, the results of all performance analyses, volume/capacity ratios for each intersection and for individual traffic movements.

6.2 Evaluation of Impacts of Site Generated Transit Demand

6.2.1 Prepare an evaluation of the impacts of site-generated transit demand for the relevant time periods and scenarios on all transit services and transit stops and terminals where

¹What is an acceptable amount of delay to drivers or pedestrians varies according to the situation being examined. Drivers waiting on private driveways will accept longer delays than the same drivers waiting on side streets, and drivers waiting on major streets expect lower delays than on side streets. The more urbanized and/or congested an area the longer drivers will wait. What is needed is consideration of what drivers might accept before starting to take more dangerous actions, such as turning out into shorter-than-usual inter-vehicle gaps. HRM does not explicitly consider the calculated “level-of-service” results because any one particular delay range is not representative of various situations. Another aspect is the analysis/calculation procedure allows an analyst to manipulate the inputs to achieve so-called “good level-of-service” on a problem movement at the expense of overall excessively poor performance.

ridership/usage will be increased 5 per cent 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 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 Provide an assessment of the potential for effects on transit operations caused by site-generated traffic movements or queues.

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

The elements of the TIS associated with identifying transportation system changes required to mitigate the impacts of traffic or transit demand generated by the development or redevelopment proposal are outlined in this section.

In assessing the need for transportation changes to be provided, in conjunction with the development or redevelopment proposal, all reasonable attempts should be made to identify transportation or other changes that mitigate the transportation impacts of the development or redevelopment proposal such that:

- site generated traffic does not cause any intersections or individual traffic movements to meet or exceed the criteria in 6.1.5;
- intersections or individual traffic movements where the performance met or exceeded the criteria in 6.1.5 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 will not have an unmanageable adverse effect on transit operations.

Transportation system changes proposed in conjunction with the development or redevelopment 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 or

redevelopment proposal is financially responsible for transportation system changes reasonably required to accommodate the proposal or to mitigate adverse impacts of the proposal. Normally such changes will be included as conditions of development approval. In cases where the need for a change is attributable to several developments, a cost-sharing arrangement is possible. In cases where needed transportation changes 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 changes to advance the implementation schedule for these improvements to match that of the proposed development.

- 6.3.1 Identify transportation infrastructure or service changes 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 or redevelopment.
- 6.3.2 Evaluate the effectiveness of the identified transportation changes or TDM measures towards meeting the above criteria. The details of any additional performance 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 changes or supplementary TDM measures identified in 6.3.1 or in conjunction with other proposed, committed, or under-construction transportation changes as identified in 3.2.3.
- 6.3.4 Identify those situations for which the criteria listed above cannot be satisfied, even with the identified transportation changes and/or additional TDM initiatives, and the extent to which these criteria have not been satisfied.
- 6.3.5 Provide functional plans for road and intersection changes, identified as necessary in 6.3.1 above, sufficient to demonstrate their feasibility and identify additional road right-of-way required.

Consultation with appropriate Halifax Regional Municipality and/or Provincial staff would be useful in assessing the feasibility of the proposed changes. Further information is available on road and intersection design guidelines.

- 6.3.6 Do a signal warrant analysis for all proposed or required new traffic signals using the method in the Canadian Traffic Signal Warrant Matrix Procedure (Transportation Association of Canada, edition current with study preparation). Analysts should note and apply the provisions regarding intersection spacing. Supplementary analysis of traffic signal “system” operations may be required to assess effects on traffic signal coordination. Evaluate proposed adjustments to existing traffic signal cycle length, phasing, and timing

to assess effects on pedestrian crossing time availability, queue lengths, and adequacy of queue storage.

- 6.3.7 Provide functional plans as appropriate for proposed transit improvements such as bus-stop relocations, bus-bay provision or relocation, and new or revised transit terminal access points. These plans should be sufficient to demonstrate feasibility and identify space requirements and additional road right-of-way required.

Consultation with Metro Transit staff will be useful in assessing necessary transit changes and their feasibility. Where the development or redevelopment is adjacent to an existing or proposed transit terminal, consultation with Metro Transit staff is suggested to identify any need to consider incorporation in the development site plan of transit stations or terminals, terminal access facilities or commuter drop-off or parking facilities. Although the design of major transit facilities is outside the TIS process, the identification of any space requirements would be of value in developing a site plan. Also to be considered is the relationship of proposed buildings to transit-related structures.

7.0 Parking and Access

The question of parking supply is addressed in this section. Access to the site for pedestrians, cyclists, transit users, vehicles and persons with mobility constraints is also discussed.

The parking supply to be provided for the development or redevelopment 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 Municipal Planning Strategies or other policies of Halifax Regional Municipality.

In general, direct access to arterial roads should be minimized to maintain the ability of the arterial road system to efficiently move people and goods. All reasonable access alternatives should be considered and evaluated before proposing direct access to an arterial or major collector road.

7.0.1 Provide a description of the parking and loading facilities proposed in conjunction with the proposed development or redevelopment. 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 Municipal Planning Strategies and other policies. The provision of bicycle parking or storage and parking for high-occupancy vehicles and for vehicles operated by or for persons with mobility limitations should also be addressed.

7.0.2 Describe and evaluate the design, operation and performance of all proposed access points to public streets, with particular emphasis on access points to collector or higher classification roads or those where operations may affect collector or higher classification roads, and signalized intersections. The need to restrict certain movements to avoid unmanageable conflicts should be assessed. Direct access to arterial roads should be justified in the context of available alternative access opportunities. Adverse effects of site access on road and transit operations should 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 cyclist movements.

Additional information on access design is available from the Halifax Regional Municipality Traffic and Right of Way Section.

7.0.3 Evaluate proposed access points with respect to possible mutual interference with other adjacent or opposed access points.

7.0.4 Evaluate sight-lines to ensure safe conditions in accordance with accepted standards.

- 7.0.5 Evaluate the potential for access and circulation movements associated with on-site parking or other activity (such as drive-through service windows) to result in queues extending onto public streets, or vehicles backing onto public streets.
- 7.0.6 Evaluate delivery vehicle/courier loading/unloading facilities and access to these facilities with respect to location, size, and design. Convenient access should be provided to off-street loading facilities to minimize the possibility that pick-up/delivery operations will occur on-street. If the proposed site is adjacent a truck route, the design should allow for access and egress via the truck route street only and not rely on using a non-truck-route side street.
- 7.0.7 Describe and evaluate site access provisions 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 or redevelopment, including on-site transit facilities where appropriate, accessible to persons with personal mobility limitations.

8.0 Documentation and Reporting

This final section provides some guidelines for the organization and format of the TIS itself.

- 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. Place maps, graphs, and tables grouped together 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 The TIS report shall be signed, dated, and stamped by a professional engineer.
- 8.0.4 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 Utilities Review Board evidence.
- 8.0.5 Five (5) copies of the final (consolidated) TIS and two (2) copies of any supporting or supplementary documentation should be submitted to Halifax Regional Municipality staff for review.
- 8.0.6 In most cases, it will be beneficial for the proponent/consultant to submit the data and results of computerized analyses in computer disk form to expedite review.
- 8.0.7 All information submitted to Halifax Regional Municipality in connection with any TIS will be considered to be in the public domain.

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 Halifax Regional Municipality and Provincial 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.

Where indicated, information should be entered in the appropriate box on page A-3

A. DESCRIPTION OF THE DEVELOPMENT PROPOSAL AND THE STUDY AREA

- 3.1.1 (a) identification of application, type of application, and applicant
- 3.1.2 (b) identification of site location
- 3.1.3 (c) comparison of application with existing development and as-of-right provisions
- 3.1.4 (d) description of application:
 - land use
 - parking provisions
 - loading provisions
 - site access
 - nearby intersections
 - other nearby access
 - on-site circulation
 - pedestrian access and nearby transit terminals/stops
 - building sizes and locations
 - expected date of occupancy
 - description and timing of development phases
- 3.1.5 (e) provisions for planned transportation system changes (List in Box A-1)
- 3.2.1 (f) definition of study area (Describe boundaries in Box A-2)
- 3.2.2 (g) description of study area transportation system
 - streets and highways
 - interchanges
 - signalized intersections
 - unsignalized intersections
 - pedestrian and bicycle routes
 - pedestrian crosswalks
 - on-street parking and parking and stopping restrictions
 - heavy vehicle restrictions
 - transit routes
 - transit terminals, stops and bus-bays
- 3.2.3 (h) potential future transportation changes (List in Box A-3)

B. ESTABLISHING A TRANSPORTATION CONTEXT FOR THE ANALYSIS HORIZON YEAR AND TIME PERIODS FOR ANALYSIS

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

Existing Traffic Conditions

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

Existing Conditions

- 4.3.1 (e) transit frequencies and ridership

Background Changes in Traffic and Transit Conditions

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

C. ESTIMATION OF TRAVEL THAT WILL BE GENERATED BY THE DEVELOPMENT PROPOSAL AND DEVELOPMENT OF A TDM PLAN

Estimation of Basic Travel Demand

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

Estimation of Adjustments to Travel Demand Resulting from TDM Initiatives

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

Summary of Travel Demand Estimates

- 5.3.1 (i) summary maps

D. EVALUATION OF TRANSPORTATION IMPACTS AND IDENTIFICATION OF TRANSPORTATION SYSTEM CHANGES NEEDED TO MITIGATE THESE IMPACTS

Evaluation of Impacts of Site-Generated Traffic Demand

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

Evaluation of Impacts of Site-Generated Transit Demand

- 6.2.1 (f) evaluation of transit services and stops/terminals (List of routes to be assessed in Box D-3)
- 6.2.2 (g) assessment of traffic impacts on transit operations

Identification of Transportation System Changes Required to Mitigate the Impacts of the Proposed Development

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

E. PARKING AND ACCESS

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

F. DOCUMENTATION AND REPORTING

- 8.0.5 (a) submission of analysis on disk

Supplementary Information for the Transportation Impact Studies Checklist

A-1: Planned transportation changes to be provided for:

A-2: Boundaries of study area:

A-3: Future transportation changes 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:

Appendix B: Guidelines for Analysis and Design of Intersection Capacity using Computer Software

Introduction

As a requirement for many development proposals, Halifax Regional Municipality (HRM) requires the production of a Traffic Impact Analysis. The analysis focuses on the effects a development will have on the existing street network. Such a study usually encompasses the analysis of the capacity of signalized intersections. The typical way to perform this type of analysis is to enter related data into a software package which is capable of calculating intersection capacity. Due to the complexity of this software and in order to provide a standard set of operating parameters, HRM. has developed the following base requirements:

Software

The following software packages are capable of performing the required analysis and are approved for Halifax Regional Municipality sanctioned traffic impact studies:

HCS+ v5.21 or newer
TRANSYT- 7F v.8.1
Synchro/SimTraffic version 6
CCG/CALC 2
TSIS 4.32

Other packages are available which can calculate capacity, but HRM. does not support them at the this time. However, we will accept data/output from other programs that have been converted into a format that can be read by one of the above programs. The analysis must be based on the Highway Capacity Manual 2000 or the Canadian Capacity Guide for Signalized Intersections (1995).

Data

The data required to perform an intersection analysis covers a broad range of attributes. This section will provide guidance on where the required data can be found and, if not available, what is considered acceptable as an input.

Please remember to provide copies of all data used as an appendices to your report. Failure to do so may cause delays in the review of the traffic study, which in turn may delay the issuing of permits by other HRM departments.

Existing Traffic:

Halifax Regional Municipality performs a number of manual and automated traffic counts throughout the region every year. These counts are available for the inclusion in a traffic study if requested. For information on what counts are available, please call 490-4866. Where counts are not available or are not appropriate for the study the consultant will have to conduct their own traffic counts.

All existing traffic should be taken from a traffic count performed within one year of the study's completion date. In some case where this data is not available, previous years data may be factored by background growth to estimate the current years data. The consultant should contact Traffic and Transportation to determine if factoring is appropriate in their case. Otherwise the consultant is responsible for conducting their own traffic counts.

Average Annual Daily Traffic (AADT) volumes should be determined from a machine count made over a minimum 24 hour period. A 12 hour manual count, appropriately factored, may be substituted. A peak hour count must be based on a continuous count of a minimum 90 minute duration with 15 minute increments. Although HRM does not factor peak hour counts to a design hour, counts must be performed at a time of high demand or factored accordingly.

Background Growth:

To determine background growth the consultant should base this figure on available data from the past 5-10 years. For most major locations HRM has enough data for a consultant to determine background growth. Where this information is not available from HRM the consultant should base background growth on existing traffic volumes and approved but unbuilt developments in the area. Any assumptions should be clearly stated when determining background growth.

Trip Generation:

Trip generation is the process of estimating the amount of traffic to be generated by a subject development. This is usually done through the use of rates or equations expressed in terms of units of development (i.e., per dwelling unit or per thousand feet of building floor area).

Acceptable Data Sources

Several data sources and methods for estimating trips generated by a development are available:

1. Institute of Transportation Engineers (ITE) Trip Generation report (latest edition) containing data from observations around North America for over 20 years.
2. Prior local (HRM) studies which have been made for various reasons, but which are applicable for the purpose of estimating trip generation for site development. These studies should be approved by HRM Traffic and Transportation prior to being used.

3. Prior studies made outside the Halifax Regional Municipality for a similar land use. These studies should only be used if they are approved in advance by HRM Traffic and Transportation.
4. Special studies conducted specifically for the study at hand. Developments surveyed should be representative of the development for which the trip generation estimate is to be made. These should be local if similar developments exist and can be isolated for proper surveys. They may be made out of town if no adequate local examples can be surveyed. Proper procedures should be used. Study sites should be approved in advance by HRM Traffic and Transportation.
5. A combination of the above, adding local data to the I.T.E. data, or combining local or special study data. Additions to I.T.E. data should be plotted on the scatter diagram provided in the latest edition of Trip Generation, if available, to check for consistency. Combination of data from different sources should be approved in advance by HRM Traffic and Transportation.

Geometric and Traffic Characteristics Input

Geometric Data such as the number of lanes, lane widths, adjacent parking lanes and grade may be available from HRM. Where not available the consultant will have to perform an on-site survey to determine the required information. For proposed intersections or modifications to existing intersections the analysis should differentiate what is existing and what is proposed.

Traffic Characteristics - Peak Hour Factors (PHF) should be left at the default of 0.90 unless supporting data for a change is provided.

Right turn on red (RTOR) should be based on field observation. In the absence of this data, the default of zero should be used, unless the right turn is shadowed by a turn from another direction. In this case an estimate of RTOR may be used.

Saturation Flow Rates of 1900 vehicles per hour are the standard used in HRM. Other values are possible, but must be justified.

Heavy Vehicle rates of two percent should be used on arterial roadways, unless otherwise supported by data.

Pedestrian Volumes should be based on counted and projected volumes. For base volumes, in the absence of pedestrian volume counts use 100 persons per hour in core areas, 50 persons per hour in other city areas, and 10 persons per hour in suburban areas.

Bus stops per hour should be based on Metro Transit bus schedules. Route maps and bus schedules are available through Metro Transit (902) 490-4000.

All other inputs should be based on data collected during the traffic study. Where adjustments are made, they should be clearly outlined in the text of the report.

Signal Timing Inputs

Existing Phasing - Phasing plans for all existing signalized intersections are available from HRM Traffic and Right of Way. Call 490-4788 for detailed information. These phasing plans must be used as inputs for base year calculations.

Existing Phasing and Timing - Since traffic signal splits at the majority of intersections within HRM are controlled in response to vehicle demand, the cycle length in peak periods should be set at 120 seconds and splits adjusted to minimize overall delay.

Proposed Phasing and Timing - Where the consultant proposes to change the timing or phasing of an intersection it must be demonstrated that the proposed changes will not negatively affect traffic flow. All changes should meet the following criteria:

- C a) the maximum cycle length used shall be 128 seconds (except for certain areas on Portland Street in Dartmouth and certain locations on Bedford Highway). Cycle lengths should be in multiples of eight seconds.
- C b) the time allocated for a phase shall be equal to or greater than the internally calculated minimum walk time for a movement unless a pushbutton is provided.
- C c) minimum pedestrian walk time is seven seconds.
- C d) minimum pedestrian clearance time is calculated using a walking speed of 1.2 metres per second (or less for locations with significant numbers of senior citizens). The width to be crossed is from curb to curb at the middle of the crosswalk width. If the vehicle phase is longer than the pedestrian minimum time the excess should be made up in the "walk" phase. Vehicle amber phase can be included, but only where absolutely necessary. All-red phase is not to be included.
- C e) standard amber time is 4 seconds, with rare 3 second locations. All-red time is from 1 to 2.5 seconds, with 2 seconds being the most common. Solid advance green should be a minimum of 2 seconds. Amber arrow times are typically 4 seconds, with 4 seconds being the minimum.
- C f) minimum vehicle green ball time is 10 seconds; for a turn arrow or flashing green phase the minimum time is 7 seconds.
- C g) use lane widths in metres. If there are varying widths for groups of lanes then use the average width.
- C h) lagging phases are only permitted when there are opposing protected left turns or where there is no opposing turn movement such as at a "T" Intersection. (Avoid the "left-turn trap.")
- C i) where the intersection(s) in question is a part of a coordinated corridor of traffic signals, the consultant must demonstrate that the proposed changes will not affect progression along the corridor. We suggest using progression analysis programs such as Transyt 7F, or Synchro. If using Highway Capacity Software, set the progression factor to "2."

Checklist

1. Please remember to provide hard copies of all data used as an appendices to your report. Failure to do so may cause delays in the review of the traffic study, which in turn may delay the issuing of permits by other HRM departments.
2. Where standard capacity analysis inputs have been modified, have all the modifications been justified in the text of the report? Modifications without justification can lead to delays in review as we wait for clarification from the consultant.
3. The performance of intersections under existing or proposed conditions should be reported as volume-to-capacity ratios, average and 95th percentile queue lengths, and average delay for each approach movement or combination of movements. As well report the overall or critical volume-to-capacity ratio (called "X" in HCS reports) for the intersection.
4. All software outputs should be clearly labeled indicating the time frame for analysis. All data files for software must be provided on floppy disk or CD as a supplement to the report. Please ensure HRM staff can interrelate data tables in your report, printouts in your appendices, and data files on the disks.