TRANSPORATION IMPACT STUDY

GUIDELINES

April 2018

CITY OF VAUGHAN

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1. INTRODUCTION

1.1 General

A transportation impact study (TIS) provides valuable information and analysis for governing agencies and others reviewing development and redevelopment proposals and applications. The *City of Vaughan's Transportation Impact Study Guidelines* have been compiled to outline the process and structure required to produce a comprehensive TIS for the City. A transportation impact study includes all modes of movement including automobiles, trucks, transit vehicles, cyclists and pedestrians. Transportation impact studies forecast future transportation demands, assess impacts of changes in demand and recommend ways of mitigating any adverse effects of changes in land use.

1.2 Purpose

The main purpose of a Transportation Impact Study (TIS), also referred to as Transportation Impact Assessment (TIA) is to analyze the traffic generated by proposed developments with new accesses or increased use of existing ones. A TIS generally includes a description of the scope and intensity of the proposed project, a summary of the projected impacts and any required mitigation measures to ensure that the surrounding road network can safely accommodate the proposed development. A well-prepared transportation impact assessment helps the developer and permitting agency accomplish the following:

- Quantitatively forecast the traffic impacts created by the proposed development based on accepted practices, not perceptions;
- Determine improvements needed to accommodate the proposed development;
- Allocate funds more efficiently;
- Relate land use decisions with traffic conditions;
- Evaluate the number, location, and design of access points;
- Update traffic data (projections)
- Identify needed roadway improvements; and
- Provide a basis for determining the developer's responsibility for specific off-site improvements (1).

The following guideline is intended to assist developers and consultants in better understanding the department's requirements and expectations regarding TIS. This document is not intended to provide technical engineering guidelines, but rather to provide a framework for the documentation of such reports. A qualified transportation engineer should complete the TIS.

1.3 City of Vaughan Transportation Goals and Objectives

Vaughan Vision is the "umbrella" document that guides the City of Vaughan's planning for the future. Part of the Vaughan Vision is to have Vaughan recognized as a well-planned, growing, innovative city. Outlined in **Table 1.1** are several transportation-related excerpts from the Vaughan Vision document and how they relate to these guidelines and the transportation planning process.

Table 1.1 Fulfillment of the Vaughan Vision	
Specific Strategy	**Application**
Goal 3.4 To establish a long-term transportation system.	
3.4.1 Establish a transportation master plan/strategy.	Ensure that the development proposal and associated transportation activities conform to City transportation plans and strategies.
3.4.3 Co-ordinate land use and transportation planning.	Provide the transportation infrastructure to support the planned land use.
3.4.4 Promote the use of transit services throughout the community.	Ensure that suitable transit services are provided for, through the development process.
3.4.5 Maintain and operate the transportation system in an efficient manner.	Provide transportation related improvements to accommodate present and future demands.
Goal 3.5 To establish healthy communities.	
3.5.1 Establish an urban design and transportation strategy which integrates streets as part of our living environment.	Support transportation networks and strategies which are "livable" and integrate into our existing and future neighbourhoods.
3.5.6 Provide for pedestrian friendly, transit supportive land use pattern. 3.5.7 Establish a multi-use pedestrian and bicycle system throughout the City.	Ensure that future transportation network plans and strategies incorporate pedestrian, bicycle and transit needs and demands in a safe environment.
Goal 3.7 To identify, support and maintain municipal infrastructure and information technology for the present.	
3.7.1 Identify both the present and future infrastructure requirements. 3.7.4 Develop strategic alliances with both the public and private sector for the provision of future infrastructure.	Make provisions for the staging and construction/ reconstruction of required transportation infrastructure elements.

The key issues need to be addressed are to ensure the;

- Long term sustainability
- City's integration of land use and transportation;
- Minimize impacts of transportation improvements on the natural environment; and
- Reduce dependence on the automobile, through minimizing the growth in travel demand and through providing a greater menu of travel choices.

In addition to the above goals, the Transportation Engineering Division is dedicated to the timely review of development related study work undertaken by others. This document is one step towards the efficient and consistent approach for the review of transportation impact studies.

1.4 Need and Justification for TIS Guidelines

The City of Vaughan has experienced record growth in the past few years. Likewise, the number of transportation impact studies submitted for consideration by the City's Transportation Engineering Division has increased dramatically. In an attempt to streamline the approval process, the City's Transportation Engineering Division has prepared a set of guidelines which form the framework for all transportation impact studies submitted to the City for review. Compliance with these guidelines will reduce the time necessary for review and the need for further revisions or submissions.

1.5 Applicability

It is important to recognize that the policies, guidelines and requirements outlined in this document are relevant at the time of printing. The guidelines will be reviewed and updated as necessary to reflect current policy, practice and accepted standards. The proponent or consultant should contact the City of Vaughan Transportation Engineering Division to identify any major modifications to this document since its compilation date.

For additional information or for clarification of any of the material contained in this document, please contact the following departments at the City of Vaughan, as applicable:

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The following document outlines general guidelines for the preparation of transportation impact studies in the City of Vaughan. The City recognizes that some of the following guidelines and assumptions may not be applicable to certain locations or projects. The purpose of this document is to provide a general framework for the preparation of transportation impact studies, and it should be complemented with good engineering judgement.

2. GENERAL REQUIREMENTS

2.1 Need for Study

There are several considerations in determining the need and level of detail for a transportation impact study. Block plans will generally require a planning analysis approach to assess demand and capacity on the adjacent transportation network. Subdivision and site plans usually necessitate a more detailed analysis of operational and design issues. Generally, TIS is required when one or more of the following criteria are anticipated or present:

- If the development/redevelopment will add 100 trips or more during the peak hour to the surrounding road network.
- If in the opinion of the Transportation Engineering Division, the site has the potential to generate five (5) percent increase in motor vehicle traffic volumes on the Vaughan road network or on critical intersection turning movements, resulting in unacceptable or adverse operational and safety impacts.
- The proposed site is located in an area of high roadway congestion.
- Site is not envisioned by local land use or transportation plans, or requires a change or exception to a City planning or by-law policy, strategy or plan.

In all cases, the City will determine the need for and scope of a transportation impact study. The level of detail and the required components will be a function of the location, size and operation of the development/ redevelopment proposal. In some instances, the proposal may lie within an area for which a transportation strategy or plan has been undertaken or prepared. In this case the City shall determine if certain elements of the TIS can be omitted. It is important that the proponent contact the City of Vaughan Transportation Engineering Division to obtain an exemption from all or any TIS requirements.

2.2 Study Timing

Transportation needs are a major consideration for new or expanding development. In general, stages in the development process whereby transportation impact studies are potentially appropriate are:

- Zoning and rezoning applications
- Land subdivision applications
- Site plan approval
- Secondary plans, Block Plans or phases thereof
- Amendments to the Official Plan.

A transportation impact study will usually have a “shelf life” of three years. Major changes within the study area may reduce the life of the document if they were not considered in the impact assessment.

ELEMENTS OF A TYPICAL TRANSPORTATION IMPACT STUDY (TIS)

Describe the development proposal and the study area (Section 3.1 and 3.2)

Establish a context for the TIS: (Section 3.3 & 3.4)

- Horizon year
- Time periods for analysis
- Existing traffic/transit conditions
- Background traffic/transit conditions
- surrounding destinations (i.e. school/park/community centre, etc.)

Estimate travel that will be generated by the development proposal: (Section 5)

- 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 4.3)

- 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 7)

- Identify improvements
- Evaluate effectiveness of mitigation
- Identify outstanding issues
- Functional plans and feasibility assessment

Address parking and access issues: (Section 8.2)

- Suitability of parking and loading provisions
- Accessibility for all modes

Transportation Demand Management Plan (Section 9)

Conclusion and Recommendations (Section 10)

2.3 Funding Development-Related Works

The City of Vaughan funds transportation growth related infrastructure from tax levies and City-wide development charges as per the City's DC By-law and Ontario Regulation 82/98. Transportation infrastructure required to mitigate the impact of the development related transportation impacts are funded in one or more of the following ways:

- Where the work is identified and included in the City-wide development charge capital forecast, the proponent will not be required to fund the work above the development charge levies.
- If the work is identified in the development charge capital forecast, but the timing and cost does not coincide with the proposed schedule, the proponent may be asked to "front-end" its cost.
- If the work is not identified in the development charge capital forecast, the proponent will be expected to finance 100 percent of its cost.

The City of Vaughan will assess the need for transportation related infrastructure based on information provided in the TIS, as well as with technical warrants and sound judgment.

3. ANALYSIS ELEMENTS

A description of the development/redevelopment proposal, its location, and the proposed study area are required to permit City Staff to identify its anticipated operation and area of potential impact. Also required is the establishment of an appropriate horizon year and time periods for analysis. Provided below is a summary of the required elements of a development/redevelopment proposal.

3.1 Description of the Development Proposal

Components of a project that shall be described at the beginning of the transportation impact study report, if available, are:

- Existing land uses, "as-of-right" provisions in Official Plans, Official Plan Amendments, Zoning By-laws, etc.
- Municipal addresses
- Total building size and building locations
- Floor space, including a summary of each type of use
- Date of occupancy and approximate hours of operation
- Planned phasing of the development
- Existing road and transit network, including nearby intersections and type of control
- Opposite or adjacent site access driveways
- Proposed vehicle access points and type and number of access(es) (full turns, right-in/right-out, turning movement restrictions, etc.)
- Number and type of loading areas and parking spaces
- Proposed pedestrian access

- Nearby transit facilities or stops
- Traffic calming measures
- Proposed cycling and pedestrian facility (connection to destinations e.g. school and park, pedestrian crossover)
- Parking – change in street context impacting parking (best practices for parking strategy, parking prohibition around school zones)
- Heavy vehicle prohibitions and restrictions

It is required, as applicable, to provide a preliminary site plan of a suitable scale (as indicated in the Site Plan Criteria Guide), for consideration in the evaluation of a transportation impact study.

3.2 Study Area

3.2.1 Definition of Study Area

Generally, the size of the study area will be a function of the size and nature of the development/ redevelopment proposal and the existing and future operations of the surrounding road network. The study area should encompass all City, Regional and Provincial rights-of-way and transit facilities which could be affected by the transportation impacts of the project. Typically, this will include areas that may be impacted when:

- All roadway or intersections where the vehicular traffic or transit usage increases by 5 percent as a result of the proposal
- Volume to capacity (V/C) ratios for overall intersection operations, through movements, or shared through/turning movements increase to 0.9 or above
- V/C ratios for exclusive movements increase to 0.95 or above
- Intersection control and design for all intersections on a walking and cycling route within 600m (10min walk) of the site.

It is recommended that City of Vaughan Transportation Staff be consulted in establishing a mutually acceptable study area for the TIS.

3.2.2 Description of Study Area

A description or illustration of the existing transportation system within the study area should be provided and should include, but not be limited to, the following:

- Existing or approved land uses in the study area.
- Municipal rights-of-way indicating number and configuration of travel lanes, jurisdiction, posted speed, transit stops or bays and sidewalks.
- Signalized/unsignalized intersections and interchange ramp terminals indicating, as relevant:
  - Lane configurations
  - Available permitted movements

- Type of vehicular and pedestrian control
- Turn restrictions
- Medians and channelization
- Bicycle lane designations
- Sidewalks and pedestrian crossing locations
- Transit stop locations.

- Planned roadway, transit and pedestrian projects which could impact on transportation operations within the study area.

- Location of on-street parking, parking or stopping restrictions near the proposal, or those which would affect the operation of the study area roadways and intersections. The time periods for which the restrictions are in effect shall be provided.

- Truck routes or heavy vehicle restrictions, by time of day or day of week, as applicable.

- Transit facilities and routes which serve or will be expected to serve the development/ redevelopment proposal.

3.3 Horizon Year

It is recommended that City of Vaughan Transportation Staff be consulted when determining an appropriate horizon year for the TIS. The horizon year is generally the time of full build-out and occupancy of a project, or the horizon year of the planning study such as a Block Plan. The horizon year will be a function of the size and nature of the project, but is typically five (5) years. However, for larger developments generating more than 1,000 peak hour trips, a 10-year horizon should be considered. Interim horizon years may need to be evaluated to account for phasing of developments, interim site access arrangements or planned transportation system modifications.

3.4 Analysis Time Periods

Considerations for the identification of appropriate time periods for analysis include:

- Type and size of development
- Potential peak period trip generation
- Hours of operation
- Recurring special events
- Seasonal fluctuations.

Typically, the weekday AM and PM peak periods will constitute the “worst case” combination of site related and background person trips. In the case of retail, entertainment, religious, institutional and sports facility uses, the Saturday, Sunday or site peak may require analysis. For example, noon peak hour should be considered for developments containing eating establishments near business parks or schools. Consultation with City Transportation Staff may aid in determining the appropriate time periods for analysis.

4. TRAFFIC CONDITIONS

4.1 Existing Traffic

To provide a representative picture of existing traffic conditions, the following should be included in a transportation impact study, as applicable:

- Exhibit(s) showing the existing traffic volumes for the roadways and intersections in the study area, including pedestrian volumes and heavy vehicle percentages. Traffic volumes may be acquired from the City's Traffic Engineering Division (traffic.services@vaughan.ca), York Region's Transportation Department (traffic.data@york.ca) or from previous transportation planning, traffic operation or transportation impact studies undertaken in the vicinity of the proposed development. Counts more than two years old or counts that do not appear to reflect existing conditions should be updated to ensure that they reflect current traffic conditions.

- Summary of field observations of the existing conditions (posted speed limits, access sightlines, traffic signage inventory, etc.). This may include a collision history at key points in the study area.

- Intersection analysis of the existing conditions for all peak periods. The analysis should be undertaken with the methodologies and assumptions summarized in **Section 5.2**. Calibration of the analysis to actual conditions must be undertaken and the modifications to the analysis parameters must be documented.

- Summary of levels-of-service including volume to capacity (V/C) ratios for all intersections and individual turning movements. Full documentation of the results of all level of service analyses should be provided in an appendix.

4.2 Background Traffic

Background traffic generally consists of two components: growth and other area development. Traffic growth arises from increases in motor vehicle traffic volumes from outside the study area (i.e. commuter based trips from neighbouring municipalities) that act to raise through volumes on major arterial roads in the study area.

4.2.1 Traffic Growth

Acceptable methods of forecasting traffic growth are:

- The estimation of future volumes from a calibrated traffic forecast model (i.e. EMME/2, System 2, etc.) or by consultation with City staff
- Regression analysis of historical traffic growth
- Representative growth rate(s) considered acceptable to the City of Vaughan and York Region.

Engineering judgment should be used to determine the most applicable of these methodologies for each application.

4.2.2 Other Area Development

The consultant should contact the City of Vaughan Community Planning Department to establish the extent of approved or active development/redevelopment proposals within the study area. The consultant should include anticipated traffic growth on the area road network from developments which are expected to proceed prior to or within the study horizons determined in **Section 3.3**. Other area development should consider:

- Projects that are approved or under construction
- The occupancy levels of adjacent projects (i.e. buildings which are constructed but not fully occupied)
- Projects which are planned to be closed or activities suspended which will noticeably impact the transportation system in the study area.

Traffic volumes associated with other area development may already be accounted for through the use of a traffic forecast model.

4.3 Site Generated Traffic

4.3.1 Trip Generation

Consultation with City of Vaughan Transportation Staff is recommended to ensure that appropriate and agreed upon trip generation rates are being employed in the TIS. Available trip generation methods, in order of preference, include:

- Trip generation surveys from similar developments in the GTA which have similar operating characteristics as the proposed development
- Latest Institute of Transportation Engineers (ITE) *Trip Generation* rates, if differences in the nature and size of the site are accounted for
- "First principles" calculations of anticipated trips to and from the site

Where appropriate, it may be justified to adjust the trip generation of the proposed development to account for the following:

- Captive market effects or internalization B trips which are shared between two or more uses on the same site (i.e. a motorist visiting a retail store and a grocery store on the same development).

- Pass-by trips B trips which represent intermediate stops on a trip already on the road network (i.e. a motorist stopping into a retail store on the way home from work). It should be recognized that pass-by trips must be accounted for in the turning movements at the site.

- Transit mode split. Travel surveys are the most reliable sources of transit modal splits. Transportation planning projections or goals should be considered, but they should not replace good engineering judgement and actual modal split data. The number of trips estimated with this assumption should be reflected in **Section 6.3**.

    - Consistent with the York Region Official Plan, the City of Vaughan's new Official Plan set a transit modal split target of 30% during peak periods for the City as a whole and a transit modal splits of 40% and 50% are targeted for the Regional Intensification Corridors and Vaughan Metropolitan Centre, respectively by 2031. However appropriate methodologies must be adopted or sufficient sources should be provided to support and justify the targeted trip rate reductions.
    - The report should also include the existing Modal Split.
    - The report should determine the change from existing modal split to the proposed Modal to determine estimated shifts to sustainable modes.
    - To achieve the proposed transit modal splits, the site requires to have a TDM Plan along with sufficient pedestrian/cycling connections which should be aligned with City's Pedestrian and Bicycle Master Plan. (Please see Sustainable Transportation Section Comments for more details)

- Transportation Demand Management (TDM) strategies that act to reduce trip generation, reduce the number of peak hour trips, or increase transit modal split.

The effects of these adjustments, as well as all trip generation assumptions, should be clearly supported and documented. Sensitivity analyses should be undertaken where trip generation parameters have the potential to vary considerably and most probable values cannot be readily identified.

4.3.2 Trip Distribution

Site generated traffic must be distributed using an established means of trip distribution. Available methods, in order of preference, include:

- Transportation Tomorrow Survey (TTS) data, if applicable
- Origin-destination surveys
- Comprehensive travel surveys
- Existing or anticipated travel patterns
- Output from transportation planning models
- Market studies.

4.3.3 Trip Assignment

Trip assignment assumptions should reflect the most probable travel patterns expected. Traffic assignments may be estimated using a transportation planning model or "hand assignment" based on knowledge of the proposed or future transportation network in the study area. The effects of any traffic

control devices or traffic calming measures planned for the area should be accounted for in the trip assignment.

4.4 Summary of Traffic Conditions

A summary of the existing and future traffic demands should be provided in the form of exhibits which show traffic volumes for all intersections within the study area for:

- Existing traffic
- Future background traffic B existing plus background (other area development and growth) traffic
- Site generated traffic (if pass-by traffic has been assumed, an exhibit must be provided which summarizes the reassignment of pass-by traffic)
- Future total traffic B future background plus site generated traffic.

Summary exhibits must be provided for each analysis period and analysis horizon. In some cases, interim traffic conditions may need to be assessed to reflect phasing of developments, temporary site access arrangements or planned transportation system modifications. It is preferred that the exhibits be included in the body of the report where they are referenced, as opposed to an appendix, to aid in the review of the TIS.

5. EVALUATION OF SITE TRAFFIC IMPACTS

5.1 General Provisions

The level of detail required in the evaluation of a development/redevelopment proposal will depend on whether the proposal is a block plan or a subdivision or site plan. The following are steps which shall be undertaken to evaluate the impacts on the area transportation network:

- Provision of a summary of computed level of service or volume to capacity (V/C) ratios for overall road intersection operations and individual movements, for all analysis periods and time horizons. Full documentation of the results of all intersection performance measures should be provided in an appendix.

- Identification of signalized intersections where:
  - Volume to capacity (V/C) ratios for overall intersection operations, through movements, or shared through/turning movements increase to 0.9 or above
  - V/C ratios for exclusive movements increase to 0.95 or above
  - Queues for an individual movement are projected to exceed available turning lane storage.

- Identification of unsignalized intersections where:
  - Levels of service (LOS), based on average delay per vehicle, on individual movements exceed LOS E.

- The estimated 95th percentile queue length for an individual movement exceeds the lesser of 5 vehicles or the available queue storage.

- Identification of potential safety or operational issues associated with:
  - Weaving and merging
  - Corner clearances and sight distances
  - Vehicle-pedestrian conflicts
  - Access conflicts
  - Traffic infiltration
  - Cyclist movements
  - Emergency vehicle response
  - Heavy truck movement conflicts, etc.

- Identification of transit priority measures where the generated traffic will negatively impact transit operations.

- Provision of supplementary analysis to address additional operational or safety issues (i.e. vehicle queuing or blockage, merging, weaving, gap availability or acceptance, sight distance availability, travel time surveys, etc.).

5.2 Accepted Capacity Analysis Methodologies and Assumptions

Provided below are a few analysis methodologies and assumptions accepted by the City of Vaughan. These assumptions represent base values and should be utilized in the absence of specific data. These assumptions should not be used in place of engineering judgement and common sense. The analysis assumptions must be documented in a section or appendix to the TIS. Any confirmation of agreement to analysis assumptions by the City should also be included.

5.2.1 Intersection Capacity Analysis Methodologies

The City of Vaughan currently accepts only the *Canadian Capacity Guide* (CCG) and *Highway Capacity Manual* (HCM) methodologies of intersection analysis. Any computer software packages used must be based on these methodologies or otherwise justified. The City reserves the right to request that certain intersection analyses be undertaken using specific software packages should the verification of results be required.

5.2.2 Truck Percentages and Passenger Car Equivalents

The majority of analysis techniques, methodologies and computer applications require the utilization of a vehicle flow expressed in a homogeneous unit, or passenger car unit (pcu). Commercial and other heavy vehicles generally have different operating characteristics than passenger vehicles. The pcu for trucks can range from 1.2 to 6.0 due to variations in truck length, type and power-to-weight ratio. For planning purposes, an average of 2.0 pcu can be assumed for trucks, buses and recreational vehicles. In situations where a high percentage of multi-unit or heavily loaded vehicles can be reasonably expected, the use of a higher pcu may be warranted.

The percentage of heavy vehicle traffic in a vehicle stream will vary by location and development. Actual truck percentages should be incorporated into the analysis of existing conditions. For future traffic scenarios, a minimum of 5 percent trucks and heavies shall be assumed on industrial roads during the peak analysis periods.

5.2.3 Saturation Flow Rate

The saturation flow rate is a measure of the rate which vehicles may enter a signalized intersection on a green phase under *ideal* conditions. The maximum base through saturation flow rate for City of Vaughan intersections is considered to be 1900 pcuphplg (passenger car units per hour per lane green). The TIS shall incorporate a base rate higher than this value only if justified through a documented saturation flow rate survey.

Base saturation flow rates may need to be reduced to reflect actual geometric, traffic or control conditions, and to account for heavy pedestrian volumes or multiple lanes. Field observations or surveys should be undertaken to determine appropriate assumptions under these circumstances. In the case of dual left turn lanes, the base saturation flow rate must be reduced, or a lane utilization factor used, to account for its lower capacity compared to two individual left turn lanes.

5.2.4 Peak Hour Factor

When the HCM methodology is used for the analysis of signalized or unsignalized intersections, a suitable peak hour factor (PHF) must be employed to account for the peak 15-minute traffic volume within the one-hour analysis period. Actual PHFs should be assumed for all existing intersection analyses. A PHF of 0.90 should be assumed for proposed or future intersections. Higher PHFs may be used if supported by documented field surveys.

5.2.5 Pedestrian Walking Speeds

Generally, a pedestrian walking speed of 1.0 m/s is accepted as design criteria for pedestrian crossing times. Pedestrian walking speed assumptions should consider such factors as school children and seniors utilizing the area intersections. Walking speeds may be reduced in these areas down to 0.9 m/s. Pedestrian crossing times must be accommodated in the intersection signal timing where it is reasonable to expect pedestrian movements at the intersection.

5.2.6 Cycle Length and Signal Phasing

Cycle lengths for the City=s signalized intersections vary from 60 seconds to 120 seconds. Cycle lengths in the order of 100 to 120 seconds are in effect at major intersections which are generally under the jurisdiction of York Region. Signal phasing and cycle length assumptions incorporated into the analysis of existing conditions must reflect actual timings. Analysis of future conditions may utilize modified phasing to:

- Minimize overall delay at the intersection
- Minimize the degree of saturation for critical movements or major traffic flows
- Implement queue management
- Balance flow ratios
- Better accommodate pedestrians.

Modifications to the cycle length and existing signal phasing employed by the City must be explicitly identified and justified. Typically, the City will accept cycle lengths in the range of 60 to 90 seconds. All revised (existing intersection) and proposed (future intersection) signal timings must be approved by the Transportation Engineering Division. If the signal is part of a coordinated system, then the system cycle length must be used in the analysis.

Proposed signal timings at City intersections should not incorporate split phasing or extended/lagging fully protected phasing unless agreed upon, in advance, by the City.

5.2.7 Green Intervals

Signal timings must satisfy motorist and pedestrian expectations, as both expect and require a reasonable length of green time. The expectation varies depending on the movements to be accommodated and local operating conditions. Provided in **Table 5.1** are the minimum green times to be provided at City of Vaughan intersections.

TABLE 5.1
Minimum Green Intervals

Signal Indication	Min. Major Street Duration (s)	Min. Minor Street Duration (s)	Exceptional Min. Duration (s)
Green (steady green)	20	12	7 (minor street) 15 (major street)
Left or Right Turn Advance (arrow)	7	7	5
Note: Minimum pedestrian crossing times must be accommodated where it is reasonable to expect pedestrian movements.			

These minimum green times outlined above may need to be increased in areas where intersections accommodate significant volumes of multi-unit or heavily loaded commercial vehicles.

5.2.8 Intergreen Periods

At signalized intersections, intergreen (amber plus all-red) periods are based on a number of factors including operating speeds, approach grades, and local driving habits. The intergreen periods used in the analysis of existing conditions should reflect actual signal timings. For planning purposes, current

intergreen periods should be utilized at existing intersections. In the case of future or proposed intersections, a minimum intergreen period of 6.0 seconds should be assumed.

5.2.9 Lost Time

Provisions must be made in the analysis to account for lost or start up time. Unless otherwise agreed upon or supported by documented field surveys, the lost time should be:

- 5.0 seconds for main phases
- 1.0 seconds for advance phases.

5.2.10 Left Turns on Intergreen

The number of left turns on intergreen ("sneakers") can vary considerably from one signalized intersection to the next. For design purposes, a maximum of 2.0 left turns on intergreen/cycle may be assumed at typical intersections, and 2.5 left turns on intergreen/cycle may be assumed at congested intersections. Note that in shared lanes with permissive left turns, the number of left turns on intergreen is assumed to be zero unless otherwise supported by documented surveys at the subject location(s).

5.2.11 Right Turns on Red

The number of right turns on red (RTOR) at signalized intersections is generally a function of conflicting vehicular and pedestrian volumes on the cross street. The RTOR volume is assumed to be zero in shared right turn lanes, unless the right turn volumes are high enough to expect that the lane functions as an exclusive right turn lane. Channelized right turns that are not under signal control may be removed from the analysis. Right turn on red volumes assumed in the existing intersection analysis should reflect those observed in the field. Intersection analysis for future scenarios should include reasonable assumptions relating to RTOR volumes.

5.2.12 Critical Gaps

Used in unsignalized intersection analyses, a critical gap represents the time interval a motorist is willing to accept when proceeding across or turning into a higher-order traffic flow. Critical gap assumptions should reflect the most recent research provided in the *Highway Capacity Manual*. Deviations from these values must be justified. The City of Vaughan will consider alternative gap data based on representative documented field surveys.

6. TRANSIT OPERATIONS

Provided below is a summary of the steps that are required to complete a thorough assessment of the transit impacts of a development/redevelopment proposal. The need for some of the components of the transit analysis will be dependant on the anticipated transit demands of the specific site. Transit analysis is typically required where 20 or more transit passengers could be generated or attracted by the

proposed development in the peak hour. York Region Transit, Vaughan Operations should be contacted early in the preparation of the TIS to determine the level of detail that is required for the transit analysis.

6.1 Existing Transit Operations

To provide a representative picture of the existing transit conditions within the study area, the TIS should include, as applicable:

- Exhibit(s) illustrating the existing transit routes, stops and facility locations
- Approximate walking distance to the transit services, or where appropriate, walking distance contours
- Transit vehicle headways or frequency for routes that service or may be anticipated to service the development/redevelopment proposal
- Current ridership and residual capacity on each route, by bus and average peak passenger hour.

Recent transit counts may be available from York Region Transit, Vaughan Operations. Where ridership data does not reflect existing conditions or is not available, additional surveys may be necessary.

6.2 Background Growth in Transit Demand or Service

An assessment of transit ridership changes resulting from travel growth and other area development must be incorporated into the analysis. The proponent should contact York Region Transit, Vaughan Operations to establish suitable assumptions for changes in transit demand.

The background growth in transit demand must recognize:

- The transit travel aspirations of the City of Vaughan
- Transit modal split assumptions based on current local data for short-term forecasts, and targets as established by the City for mid- to long-term forecasts
- Projects that are approved or under construction, or planned to be closed or suspended, prior to the proposed development.

6.3 Site Generated Transit Demand

It is recommended that York Region Transit, Vaughan Operations be contacted early in the impact review process to establish mutually acceptable assumptions for transit usage for the development/redevelopment proposal. The site generated transit demand must reflect the assumptions outlined in **Section 4.3**. In order of preference, transit demand for the subject development may be established by:

- Transit surveys or data provided by the City of Vaughan
- Transit surveys or data obtained from a similar development with proper adjustments for dissimilarities between the proposed and surveyed site
- “First principles” calculations of anticipated transit trips to and from the site

- Published trip generation rates for transit, if available, provided that differences in the site nature and size are accounted for.

The level of detail required by the City will be dependant on the nature of the development and its current or anticipated reliance on transit service.

6.4 Evaluation of Site Transit Impacts

The following steps shall be undertaken to evaluate the impacts of the site generated transit demands on transit level of service:

- Evaluation of the site generated transit demands and impact on the peak point on the route and in the vicinity of the development.

- Identification of situations, locations, time periods and corrective opportunities where:
  - Transit service is not provided in the area and is required
  - The provision of transit service or facilities are desired on site
  - Demand exceeds residual capacity of the existing transit service (in which case times of day, duration and days of week should be specified as applicable)
  - Transit service hours do not coincide with the times when transit will be required
  - It would be beneficial to provide increase transit frequency or service requirements for special events or peak arrival or departure times.

- Identification of pedestrian connections required to access transit services.

- Identification of impacts on transit operations directly associated with the site generated traffic volumes or operations, and corrective measures.

- Preliminary concept of route configuration and integration of new routes into existing network.

- Estimates of expected service frequency, additional vehicle requirements and cost to accommodate site demand.

7. MITIGATIVE MEASURES

The mitigation of traffic and transit related impacts arising from a development/redevelopment proposal should be considered in unison, as modifications to one inherently affect the operations of the other. The physical and operational mitigative measures recommended must address all deficiencies identified through the completion of the tasks outlined in **Sections 5.1** and **6.4** of this document.

7.1 Identification of Required Road Network Modifications

Physical and operational road network modifications identified in the TIS must address and ensure that:

- Site generated traffic does not create conditions in which the capacity criteria summarized in **Section 5.1** is exceeded
- Motorist, pedestrian and cyclist needs are accommodated
- Vehicular, pedestrian and cyclist operations and safety are maintained or improved
- Site generated traffic will not have an adverse impact on existing or proposed residential communities.

Additional analysis shall be provided to demonstrate that the proposed mitigative measures will address the impacts of the site generated traffic. The City may request preliminary design plans for identified physical modifications to ensure their feasibility.

7.2 Identification of Required Transit System Modifications

The physical and operational transit system and service modifications identified in the TIS must address the following:

- The existing capacity of the transit service and facilities, to ensure it can accommodate the anticipated site generated transit demand.
- Site generated traffic, to ensure it will not have an adverse impact on transit operations.
- If required, that there is provision for:
  - Transit service to the area or to the site including potential transit routes
  - An increase in transit frequency or hours of operation
  - Special event service
  - High Occupancy Vehicle (HOV) lanes or transit priority
  - Transit facilities such as terminals, bays or stops.

Additional analysis shall be provided to demonstrate that the proposed mitigative measures will address the impacts of the site generated traffic. The proponent or consultant should consult with York Region Transit, Vaughan Operations to confirm the feasibility of new or expanded transit services and facilities.

8. SITE PLAN, PARKING AND ACCESS REQUIREMENTS

This section addresses site plan criteria, parking and access locations to develop a plan that will be harmonized with the surrounding developments and provide acceptable access and site circulation for pedestrians, cyclists, transit users, motorists and persons with disabilities.

8.1 Site Plan

The site plan should be completed in accordance with the City of Vaughan Site Servicing and Site Plan Criteria Guide, the Zoning By-Law 1-88 and any applicable official plan requirements, policies and/or standards.

8.2 Parking Study

Parking requirements should be in accordance with City of Vaughan Zoning By-law 1-88, and should be consistent with the accepted analysis methodologies and assumptions utilized in the transportation impact study.

If the study is in support of a parking standard reduction for the proposed development from the City of Vaughan Zoning By-Law 1-88 parking requirements, a detailed parking study including analysis of at least two similar facilities shall be submitted. Surveys should be done during the busiest time periods.

8.3 Access Requirement

When determining the location of an access, consideration should be given to how the access will affect the surrounding road network, area residents and area businesses. Approval must be granted from the affected agency for access onto roadways not under the jurisdiction of the City of Vaughan. Some considerations with respect to site plan criteria, parking and access are:

- All commercial and multiple-family dwelling developments access should be provided from collector roads where possible versus local streets
- Provision of a secondary and/or emergency access should be considered when a development is proposed for 40 or more residential units or a commercial/office addition with 2,000m^2
- Minimizing the number of accesses on collector roads and providing justification for all accesses above the secondary access
- The possibility of consolidating or sharing access with adjacent developments
- The possibility of restricting one or more site access to right in/right out only
- The potential for mutual interference with other adjacent or opposed access points, or with operations within municipal rights-of-way
- Provision of aligning accesses with existing intersection and/or private driveways
- The provision of adequate sight lines and recommendation of any mitigation measures (i.e. parking prohibition, removal and/or relocation of shrubs, trees, signage, etc.)
- The location of delivery vehicle loading/unloading facilities to allow for convenient access away from any municipal rights-of-way
- The provision of safe and convenient pedestrian and bicycle routes within the site, particularly to and from transit services
- The provision of facilities for persons with personal mobility limitations.

In the case of development/redevelopment proposals incorporating drive-throughs, service kiosks, automatic gates or similar facilities, a queuing analysis may be required to demonstrate that the maximum probable queue can be accommodated within the proposed site plan without extending onto public streets or blocking access to parking areas.

It may be beneficial for the proponent to discuss access opportunities and constraints with City Staff prior to the preparation of site plans and establishment of building locations.

9. TRANSPORTATION DEMAND MANAGEMENT (TDM) PLAN

In the Vaughan Official Plan (adopted by Council in September 2010), it is policy to require the preparation and implementation of TDM Plans to support sustainable transportation. TDM Plans are required for all Site Plan approval applications for office uses greater than 2,000m^2 or residential apartment or mixed-use buildings with greater than 50 residential units. TDM Plans should be prepared with the aim to encourage/enhance shifts to sustainable modes of transportation through ongoing action before and after occupation. As stated in the Vaughan Official Plan (VOP), the TDM Plan shall:

a) *be integrated with required transportation impact assessments submitted to support the proposed development;*
b) *identify design and/or programmatic means to reduce single occupancy vehicle use;*
c) *identify the roles and responsibilities of the landowner with respect to each recommended program and its implementation; and*
d) *identify the operational and financial roles and responsibilities of the landowner including, but not limited to, program development, implementation and ongoing management and operations of the travel demand management plan and/or program.*

TDM Requirement Summary

Use	**TDM Plan Thresholds**
Office	> 2,000m^2 Gross Floor Area
Residential apartment or mixed-use buildings	> 50 residential units

Based on the above requirements, a TDM Plan shall be included within or attached to the Traffic Impact Study (TIS). The TDM Plan shall identify TDM measures to support the modal split assumptions in the TIS. To meet the requirements of the VOP, the following contents are recommended for the TDM Plan:

a) **Targets** - The TDM Plan should include the modal split assumptions/targets in the TIS. The future modal split assumptions for this development must contribute to a transit modal split of 30/40/50% during peak periods for the City by 2031 (VOP, 2010, Policy 4.1.1.2).

b) **TDM Measures** - The TDM Plan should recommend a mix of hard and soft measures that support and link to the modal split assumptions for this development. The recommended measures should also include both 'education, promotion and outreach' measures, and 'incentive/disincentive' measures (as defined by Transport Canada).

c) **Monitoring** - A five-year monitoring program is recommended for TDM Plans, with a baseline travel survey occurring within one year of occupation. Travel surveys are recommended every 2-3 years as part of the monitoring program. Reporting procedures should also be identified for the City's approval. For example, TDM Plan Updates should be prepared following each travel survey to report on overall progress, evaluation, challenges, new opportunities, and changes to TDM measures.

d) **Budget** - The estimated cost for each recommended TDM measure or task should be provided as part of the TDM Plan, including the cost of monitoring, and the financial roles and responsibilities of the landowner.

e) **Implementation plan** - The TDM Plan should identify roles and responsibilities for all parties, including the landowner, TDM Coordinator (e.g. property management, employer representative), Transportation Management Association (e.g. Smart Commute North Toronto Vaughan), internal and external partners. The TDM Plan should also summarize implementation of TDM measures, program of target dates, phasing of the development, and information about ongoing management of the TDM Plan.

For more information on developing a TDM plan and a checklist of the recommended TDM measures, please see York Region Transportation Mobility Plan Guidelines.

10. CONCLUSIONS AND RECOMMENDATIONS

A summary of the key findings with respect to the transportation impact of the proposed development along with a summary of the recommended improvements shall be presented

11. DOCUMENTATION AND REPORTING

Two (2) copies of the final transportation impact study report and technical appendices should be provided to the City of Vaughan Transportation Engineering Division of the Development Engineering Department for review both in digital and hardcopy formats. Similar requirements are made for addendums and subsequent work submitted in support of the original TIS. Should changes to the original TIS be requested and these changes are deemed substantial by the City of Vaughan, then an update TIS will be requested to replace the original.

The results of the 'Synchro' analysis along with the results of 'SimTraffic' analysis shall be supplemented as part of the TIS submission, both in digital and hardcopy format.

If the study area for the analysis includes transportation facilities under the jurisdiction of agencies other than the City of Vaughan, then copies of the transportation impact study report should be submitted to these agencies for review.

The TIS should consist of a main text document containing key maps, illustrations, summary tables and detailed analysis. A technical appendix included under another cover should be provided in the case were the analysis and other technical material is too substantial to provide in one document. Where possible, key maps, diagrams, graphs, tables and other exhibits should be placed adjacent to the relevant text as opposed to an appendix.

The TIS and all related information submitted to the City of Vaughan will be considered as public domain once approved or addressed in Committee of the Whole or Council, in whole or in part.