



TRANSPORTATION IMPACT ASSESSMENT STUDY

TERMS OF REFERENCE
FEBRUARY 2023



INTRODUCTION

WHEN IS THIS REQUIRED?

A TIA is typically required in most application types, including the following:

- Official Plan Amendment
- Rezoning
- Secondary Plan
- Plan of Subdivision
- Site Plan Control
- Combination of the above

The need or requirement for a TIA is typically established during the pre-consultation process when proponents of land developments formally present their proposals to City staff. This process allows staff and consultants to communicate/collaborate and get clarity on the scale and details expected of the TIA prior to any undertaking of substantial work.

WHO PREPARES THIS ?

A Transportation Impact Assessment (TIA) is a study that involves the application of traffic and transportation engineering principles and practices to assess transportation-related issues and solutions arising from development applications; and must be undertaken by a qualified Transportation Engineering/Planning professional.



WHY DO WE NEED THIS ?

The purpose of a Transportation Impact Assessment (TIA) report is to document the transportation impact assessment of proposed development applications, and to identify, recommend and demonstrate the transportation infrastructure, mobility plans and programs required to support the subject development; and that the development proposals are in conformance to City’s Official Plan policies, applicable secondary plans, and applicable design standards. A TIA Study serves to inform City staff and in turn decision makers in reviewing the development application and/or for establishing approval conditions.

STRUCTURE AND FORMAT

WHAT SHOULD BE INCLUDED?

Submission Requirements

Developments vary in scale and characteristics. In instances where the proposed development is reasonably expected to have no or marginal transportation impacts, City staff may ask for a traffic reliance letter (i.e. transportation impact statement) in lieu of a TIA whereby the review will be more focused.

However, for the majority of development applications, the TIA report is a documentation of the transportation analysis and findings, and typically encompasses the following components (each further expanded and described in the corresponding subsections in the Appendix):



Title/Cover Page	Ref. Section 2.1
Cover Letter	Ref. Section 2.2
Table of Contents	Ref. Section 2.3
Table of Conetns	
List of Tables	
List of Exhibits / Figures	
List of Appendices	
Executive Summary	Ref. Section 2.4
Introduction	Ref. Section 2.5
Study Assumptions	Ref. Section 2.6
Existing Conditions	Ref. Section 2.7
Future Background Conditions	Ref. Section 2.8
Proposed Development	Ref. Section 2.9
Future Total Conditions	Ref. Section 2.10
Site Circulation Review	Ref. Section 2.11
Functional Traffic Design	Ref. Section 2.12
Parking Justification Study	Ref. Section 2.13
Transportation Demand Management	Ref. Section 2.14
Recommendations	Ref. Section 2.15
Conclusions	Ref. Section 2.16

The processes are generally congruent with industry standards/practices and follow closely the York Region Transportation Mobility Plan Guidelines, but may also include requirements specific to the local Markham context.

WHAT ELSE SHOULD WE KNOW?

Note that the following studies may also be requested along with a TIA, in which the study can be consolidated as one submission, or it may be requested as a standalone document.

- Functional Traffic Design Study..... Ref. Section 2.12
- Parking Justification Study..... Ref. Section 2.13
- Transportation Demand Management Ref. Section 2.14.

WHAT OTHER RESOURCES ARE THERE?

York Region’s Transportation Mobility Plan Guidelines for Development Application, November 2016:

- https://www.york.ca/wps/wcm/connect/yorkpublic/71d2f725-b82e-4c96-b181-132ff43f1fda/16214_Mobility_Plan_Guidelines_Accessible.pdf?MOD=AJPERES&CVID=mul36i8
- Institute of Transportation Engineers
- Transportation Association of Canada

NOTES

See also in the Appendix, document titled Preparation of a Transportation Impact Assessment (TIA), for a more detailed guideline. This document is intended as a “living document” that could be updated regularly.





City of Markham

**Guidelines for the Preparation of a
Transportation Impact Assessment (TIA)**

For additional information, please contact:

Transportation Engineering Department

Development Services Commission

101 Town Centre Boulevard

Markham, Ontario

L3R 9W3

Telephone: 905 477 7000

Table of Contents

1.	Transportation Impact Assessment Overview	3
➤ 1.1.	Introduction.....	3
➤ 1.2.	Why do we need this?	3
➤ 1.3.	When is a Transportation Impact Assessment required?	3
2.	Technical Guideline for TIA Submission	5
➤ 2.1.	Title Page/Cover Page.....	6
➤ 2.2.	Cover Letter	6
➤ 2.3.	Table of Contents	7
➤ 2.4.	Executive Summary	7
➤ 2.5.	Introduction.....	7
➤ 2.6.	Scope of Work and Study Assumptions	8
➤ 2.7.	Existing Conditions.....	10
➤ 2.8.	Future Background Conditions	14
➤ 2.9.	Proposed Development	18
➤ 2.10.	Future Total Conditions	22
➤ 2.11.	Site Circulation Review	24
➤ 2.12.	Functional Traffic Design Study.....	24
➤ 2.13.	Parking Justification Study	25
➤ 2.14.	Transportation Demand Management.....	26
➤ 2.15.	Recommendations.....	26
➤ 2.16.	Conclusions.....	26

1. TRANSPORTATION IMPACT ASSESSEMENT OVERVIEW

1.1. Introduction

A Transportation Impact Assessment (TIA) is a study that involves the application of traffic and transportation engineering principles and practices to assess transportation-related issues and solutions arising from development applications; and must be undertaken by a qualified Transportation Engineering/Planning professional.

The TIA guidelines herein (Section 2) are to provide proponents of land development in the City of Markham, and their transportation consultants, with a framework for the preparation and documentation of a TIA Study that is consistent to baseline expectations of City staff for review. The guidelines are generally in congruence to industry standards and follow closely the York Region Mobility Plan Guidelines, but may also include requirements specific to Markham context.

The technical guideline follows the format of a typical TIA report and is presented as such. To facilitate the efficient review of the TIA report, consultants must strive to satisfy key elements as outlined in the guideline and are encouraged to follow the format as presented to minimize delays and avoid unnecessary re-submissions resulting from incomplete reports.

1.2. Why do we need this?

The purpose of a Transportation Impact Assessment (TIA) report is to document the transportation impact assessment of proposed development applications, and to identify, recommend and demonstrate the transportation infrastructure, mobility plans and programs required to support the subject development; and that the development proposals are in conformance to City's Official Plan policies, applicable secondary plans, and applicable design standards. A TIA Study serves to inform City staff and in turn decision makers in reviewing the development application and/or for establishing approval conditions.

1.3. When is a Transportation Impact Assessment required?

A TIA is typically required in most application types, including the following:

- Official Plan Amendment
- Rezoning
- Secondary Plan
- Plan of Subdivision
- Site Plan Control
- Combination of the above

The need or requirement for a TIA is typically established during the pre-consultation process when proponents of land developments formally present their proposals to City staff. This process allows staff and consultants to communicate/collaborate and get clarity on the scale and details expected of the TIA prior to any undertaking of substantial work.

1.3.1. Consultation

It is highly recommended that the consultant retained to undertake the TIA contact the City to discuss the Terms of Reference in order to determine the appropriate level of detail to consider in the TIA. A formal Terms of Reference shall be submitted to the City prior to commencing the TIA.

2. TECHNICAL GUIDELINE FOR TIA SUBMISSION

Developments vary in scale and characteristics. In instances where the proposed development is reasonably expected to have no or marginal transportation impacts, City staff may ask for a traffic reliance letter (i.e. transportation impact statement) in lieu of a TIA whereby the review will be more focused.

However, for the majority of development applications, the TIA report is a documentation of the transportation analysis and findings, and typically encompasses the following components (each further expanded and described in the corresponding subsections):

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➤ Introduction	Ref. Section 2.5
➤ Scope of Work and Study Assumptions	Ref. Section 2.6
➤ Existing Conditions	Ref. Section 2.7
➤ Future Background Conditions	Ref. Section 2.8
➤ Proposed Development	Ref. Section 2.9
➤ Future Total Conditions	Ref. Section 2.10
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➤ Conclusions	Ref. Section 2.16

2.1. Title Page/Cover Page

The Title Page/Cover Page, while self-explanatory in its purpose, shall include the following reference information:

- Study/Project Name (consistent to the name of overall application submission)
- Location denoted by Municipal Address
- Type of Study Report (Transportation Impact Assessment, and/or Parking Assessment, and/or TDM)
- Owner/Applicant's Name
- Transportation Consultant's Name
- Date

The information on the Title Page/Cover Page must be as precise and concise as possible as it is often referenced when preparing conditions of approval or agreements. Inconsistent or inaccurate project names and dates will introduce confusion.

2.2. Cover Letter

The Cover Letter serves to inform the Reviewer of the basic context of the TIA submission, and the status of the submission in the overall application process. All TIA Reports must include a Cover Letter for administrative and tracking purposes.

The Cover Letter shall include the following information:

- Brief description and purpose of Study Report
- Report revision status (if applicable): E.g. first submission, second submission, etc.
- Overall study conclusions/recommendations
- Contact information of Transportation Consultant
- Signatures of Authors' and Reviewers' representing the Transportation Consultant's work
- Summary of comments and responses

The Cover Letter shall also track any standing issues. For example, if the revised report submission is provided to address previous City and/or Region comments, the letter shall include each of the City's/Region's previous comments and corresponding response.

2.3. Table of Contents

The content page generally provides the Reviewer an overview of the TIA report structure, mapping of information, and shall include the following:

- Table of Contents
- List of Tables
- List of Exhibits/Figures
- List of Appendices

The content page in the electronic versions of the TIA report must include a hyperlink to each section for ease of review.

2.4. Executive Summary

An Executive Summary is required for all TIA reports, and should include the following:

- A summary of proposed development describing the overall context: proposed use, location, magnitude, phasing, access, etc.
- Proposed transportation infrastructure, mobility and programs
- Key findings and recommendations of the study
- Summary of Implementation Plan

The Executive Summary should be written with the intent for a wide range of audiences.

2.5. Introduction

The Introduction shall provide all relevant information and statistics about the subject development, and shall include:

- The applicant's name, application number, site municipal address, application type (OP amendment, zoning by-law amendment, etc.)
- Project description – a summary of proposed development describing the overall context: existing and proposed use, magnitude, phasing, access, etc.

The Project Description will include information pertaining to the size of the individual land use components expressed in units related to transportation analysis (e.g. floor area, number of residential units, population, employment, number of parking spaces, etc.). The Project Description will also identify any phasing schemes and schedule of implementation with their associated land use statistics and expected dates of completion and full occupancy of the interim phases and ultimate development.

The Introduction should be supplemented with maps, plans and figures to further illustrate the development. This may include (but not limited to) figures for:

- Site Location
- Development Concept Plan (Layout)
- Development Phasing Plan

2.6. Scope of Work and Study Assumptions

The intent of this section is to outline the adopted Scope of Work (or Terms of Reference) and Study Assumptions of the TIA. In most cases, this is a confirmation of the agreed upon Scope of Work and Study Assumptions as established through early consultation at the outset of the project. In essence, the “where”, “when”, and “how” are defined.

2.6.1. Study Area

The *Study Area* defines the geographical limit of the TIA, the area of focus, which is dependant on the type of development application, and the magnitude of development. Specific “study intersections” within the study area are also typically identified as key locations in the transportation network for review.

Include Figure: Study Area

2.6.2. Horizon year(s)

The horizon years of study or the study horizons, represents a timeline, whether existing or a time in the future, for which the transportation conditions will be assessed as part of the TIA. For any given TIA, there could be multiple timelines, which may be based on a number of factors. In general, the horizon years are based on following considerations:

- For applications within established areas: at least five years from the date of the study or the year of full occupancy (whichever is longer);
- For applications within developing areas: at least ten years from the date of the study or year of full occupancy (whichever is longer);
- Any interim phases of development and corresponding year of completion;
- Anticipated year for full build out of the surrounding community; and,
- Anticipated year of future road improvement projects that will affect travel to/from the development.

2.6.3. Peak Periods for Analysis

The peak hours are typically determined by the “worst case” time period where a combination of existing, site generated trips, and background traffic/transit volumes are at their highest. Depending on the type of development, the peak periods for analysis may differ and should be selected with consideration of all these factors.

Table 1.1 outlines the typical peak periods based on a few common development types.

Table 1.1: Development Peak Periods

Development Type	AM peak	PM Peak	Saturday Peak
Residential (eg. Single family, townhouse, condominium, apartment, senior home)	X	X	
Employment (eg. Business park, industrial park, office, warehouse)	X	X	
Retail Commercial (eg. Shopping centre, restaurant, specialty store, supermarket)		X	X
Institutional (eg. School, church, banquet hall entertainment centre, community centre)	Site Specific		

The outlined time periods should be confirmed with City staff before the commencement of the study.

2.6.4. *Level of Service Analysis*

Please refer to York Region's Mobility Plan Guideline for accepted methods for multimodal level of services analysis. The City's accepted methods are generally consistent to York Region's methods.

Notes on Input Parameters and Assumptions

All assumptions concerning saturation flows, peak hour factors, lost times, traffic signal cycle lengths, signal phasing, and signal timings should be documented. Please note the following parameters that are more specific to City of Markham:

- Saturation flow: 1900 vehicles/hour/lane (vphpl) (saturation flow above the ideal 1900 vphpl will not be accepted unless it has been approved by the City or justified through surveys of existing conditions);
- Peak hour factors (PHF) should be based on existing traffic counts for overall intersections;
- For intersections under the City's jurisdiction, traffic signal cycle lengths, signal phasing, and timing plans should be obtained from the City; and
- Lost time adjustment default is zero, which assumes that the start-up lost time is the same as the effective green extension time.

Any deviation from the default parameters should be based on existing conditions confirmed through field observations/surveys and discussed with City Staff.

As existing conditions constantly change, any previously approved changes to analysis parameters must be reapproved by City staff for the current TIA.

2.6.5. Related Transportation Planning Policies

A summary of the key local and Regional transportation related policies in Official Plans and/or Secondary Plans specific to the development site or area should be provided. These policies will provide a better understanding of the context for the proposed development relative to a corridor, urban growth centre, or other planning areas

2.7. Existing Conditions

This section intends to present an understanding of the latest transportation condition within the study area of the subject site. This understanding establishes a baseline for which to assess incremental changes in future conditions.

2.7.1. Site and Area Description

The Existing Condition shall provide a synopsis of the subject site location including its existing land uses and accesses as well as a description of surrounding land uses within the study area.

2.7.2. Existing Transportation System

The Existing Transportation System shall include a complete inventory of physical elements of the transportation system, including but not limited to:

Existing Road Network
• Road jurisdiction (e.g. City of Markham, York Region, MTO) • Road designation/classification (Local, minor collector, major collector, arterial) • Travel lanes • Posted speeds • Parking facilities (parking bay, on-street parking) • Parking restrictions • Vehicular restrictions (e.g. buses only) • Movement restrictions (e.g. no left-turns) • Intersection configurations and traffic control type • Site accesses

Active Transportation Network
• On-road and/or off-road cycling network • Pedestrian network • Crossing locations
Transit Network
• Existing transit routes and frequency • Nearby transit stops / stations • Railway crossings • Higher order transit including High Occupancy Vehicle (HOV) lanes, and Bus Rapid Transit (BRT) networks, GO Stations.

Include Figure: Existing Transportation Network

2.7.3. Existing Traffic Data / Volumes

Review of existing condition shall be informed by traffic data/volume reflective of the existing traffic pattern. This shall include a summary of traffic data/volumes collected for the TIA (vehicles, pedestrians, cycling), and must include sources, dates, and time periods of the data/counts. Type of traffic data may include but not limited to:

- Annual average daily traffic
- Annual average weekday traffic
- Intersection turning movements
- Pedestrian and cyclist counts
- Speed surveys

Backup copy of the detail data / traffic counts must also be provided in the appendix of the report for cross references.

The volume data should be based on the most recent traffic data/counts available. In general, the City will require new or additional traffic counts under the following conditions:

- Existing count data that is more than two years old
- Changes having occurred to the physical traffic control devices at the subject intersection
- Changes having occurred to the traffic control at any adjacent intersections
- Existing data appears to be anomalous or is insufficient
- Major changes in land use within the last two years

- The proposed land use has a peak period of operation outside of the above noted time periods
- Changes to the road network have occurred
- New links have been constructed
- Construction activity which may have impacted typical conditions/validity of the traffic data
- Special events have occurred
- The occurrence of adverse weather conditions
- Existing count data does not include truck, cyclist, or pedestrian volumes

Traffic counts must be conducted during peak periods coinciding with the peak period of analysis (as discussed in Section 2.6.3) on a “typical” day in the week or weekend. Some general guiding principles include (but not limited to) the following:

- The day of traffic count shall coincide with the peak period of subject development
- A typical weekday is any one day from Tuesday to Thursday of a regular work week (without statutory holidays, and outside of summer or holiday periods)
- Peak periods may also include Friday evenings or Saturday afternoons for retail commercial uses
- Many other land uses will have site-specific peak periods such as schools, and places of worship

New surveys should be undertaken where possible as it provides the most up-to-date information; it also presents opportunity for oversight of traffic conditions during data collection

Particular care should be taken in conducting or reviewing traffic counts in congested situations to identify or account for distortions caused by any capacity constraints. Traffic counts should reflect demand rather than capacity where possible

Include Figure: Existing (insert year XXXX) Traffic Volumes: showing peak hour traffic volumes by turning movements.

Include Table: Existing (insert year XXXX) Traffic Counts: showing summary of traffic counts (see example below).

Intersection	Date Counted	Time Counted	Source of Data
Bullock Drive & McCowan Road	Thurs. April 7, 2022	Weekday: 7 am – 9 am	York Region

2.7.4. Existing Level of Service Analysis

Existing operation analysis should be based on the following requirements for **all four travel modes** (vehicle, pedestrian, bicycle, transit) as applicable:

- Assessment of existing conditions. A separate table should be provided to summarize the performance results for the four travel modes;
- Identify any substandard or undesirable conditions, problematic operations, gaps, and missing links in the transportation system; and,
- Identify solutions or mitigation measures.

For Automobile Level of Service:

The table summarizing the performance results for vehicular traffic should include as minimum control delay, volume/capacity ratios (overall and by critical movements), and 95th percentile queue lengths.

Intersection	Overall Intersection/ Critical Movement	LOS	Delay (s)	V/C Ratio		95 th Percentile Queue (m)		Storage Length (m)
				AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	
Bullock Drive & McCowan Road	Intersection	C	60	0.73	0.85	-	-	-
	EB R	D	50	0.90	0.89	57.7	16.6	60

Discussion of the level of service results shall include observable insights of the analytics combined with field observations to identify any operational or design issues, and potential solutions or mitigation measures to address the issues.

Include Appendix: Existing Condition: Intersection Capacity Analysis: program outputs of the intersection shall be included in the appendix and provided electronically. The order of the outputs shall be consistent with the table. The appendix shall be page numbered as “Appendix letter – Page Number”, e.g. “A-1”.

Note

Depending on site context, other forms of analysis may also need to be included, such as traffic simulation, signal warrant analysis, turn lane warrant analysis, gap analysis, etc.

Accepted methods for intersection analysis include: Highway Capacity Software or Synchro software based on Highway Capacity Manual, InterCalc based on Canadian Capacity Guide for Signalized Intersections, Microsimulation software such as Vissim, Paramics and SimTraffic, and various roundabout analysis software (Rodel, Sidra, etc.)

Pedestrian Mode Performance

A pedestrian mode performance analysis is required in most instances. The existing pedestrian mode performance analysis should be based on York Region's Transportation Mobility Plan Guidelines. This generally includes the following:

- Pedestrian counts at all study area intersections
- Assessment of existing facilities and connectivity
- Identify substandard designs, substandard operations, and gaps and missing links
- Identify potential mitigation measures for the existing conditions, if applicable

Bicycle Mode Performance

Similar to the pedestrian mode, when a new development is proposed, opportunities to connect to existing cycling facilities should be taken into consideration. The existing bicycle mode performance analysis should be based on York Region's Transportation Mobility Plan Guidelines and include the following:

- Bicycle counts at all study intersections
- Assessment and identification of existing bicycle facilities and connectivity
- Identify substandard design, substandard operations, and gaps and missing links
- Assessment of accessibility to cycling facilities
- Identify potential mitigation measures for the existing conditions, if applicable

Transit Mode Performance

The existing performance analysis should be based on York Region's Transit Mobility Plan. This generally includes the following:

- Assessment of existing routes, ridership, connections to transit facilities and the designs of the facilities
- Assessment of the existing transit modal split
- Identify substandard designs, substandard operations, gaps and missing links to the transit facilities under the existing conditions
- Transit service frequency and boarding volumes
- Relative transit speed – average transit speed/average traffic speed (mixed traffic, HOV, dedicated transit lane)
- Rapid transit connectivity

2.8. Future Background Conditions

The section represents the transportation assessment of a future baseline condition for a given horizon year established at the outset of the TIA (as discussed in Section 2.6.2). Overall, the assessment (level of service analysis) of background conditions are based on the following:

- Planned transportation infrastructure improvements and programs

- Background traffic forecasting (not including subject development) for the study horizon(s)

The findings establish an understanding of the baseline condition for which to measure the incremental impacts of proposed development.

2.8.1. Planned Transportation Improvements

Each study horizon, would have assumed planned and/or scheduled transportation improvements in its model. These improvements must be documented, including the nature (e.g. road widening or extension, new transit lane/route), status, anticipated implementation date (year), and the information source.

Information source for planned transportation improvements may include (but not limited to):

- Municipality's Capital Program (York Region 10-year Construction Program, Markham 10-year Capital Plan)
- Official Plans and Secondary Plans
- City of Markham Active Transportation Master Plan
- York Region's Transportation Master Plan
- York Region Transit (YRT) - 5 Year Service Plan
- Road and Rapid Transit Project Environmental Assessment Studies
- Metrolinx Regional Transportation Plan
- MTO's Greater Golden Horseshoe Transportation Plan

Any assumptions on planned transportation improvements should be confirmed with City staff at the outset of the TIA.

Include Figure: XXXX (year) Planned Future Road Network; showing future transportation network including number of lanes along segments, lane configuration at intersections, and traffic controls. Ensure that the exhibit presents the current capital works program. Note. This figure is only required if the future road network is different from the existing road network. The figure shall differentiate between existing lanes versus planned road improvements using different line types.

2.8.2. Background Traffic Forecast

For each study horizon, future background traffic volumes are generally estimated based on the addition of the following layers:

- Existing volumes
- Background growth rate volumes
- Background development volumes

Background Traffic Growth

Existing traffic volumes should be factored to account for growth related to population increase and developments occurring between the date of the counts used and the horizon year(s).

Growth factors can be estimated using the following methodologies:

- **Historical Counts:** A minimum of three (3) years of AADT data or Cordon Counts;
- **Modelling:** Transportation demand forecasting models (strategic planning model or sub-area model); and,
- **Background studies:** Recent background transportation studies (Class Environmental Assessment, Secondary Plan, or other transportation studies).

Although each of the methodologies noted above are generally applicable to the auto mode, historical counts can be applied to walking and cycling, and modelling can be applied to transit mode. The City will accept any combination of the methodologies noted for all four modes of transportation considered. However, all assumptions and calculations must be clearly documented, explained, and included in the appendix of the report for reference purposes.

The percentage growth per year shall be applied as compounded growth.

Include Figure: XXXX (year) Background Growth Traffic Volumes; supported by calculation sheets in the Appendix.

Background Development Volumes

Background development refers to other developments under construction, approved, or in the approval process, within the study area. Background development volumes are generally not captured in the background traffic growth and thus an added layer of traffic to be included.

Transportation consultants shall coordinate with City staff on identifying specific background developments to be included.

The background development volumes may be:

- Extracted from corresponding TIA studies for the background development applications
- Extracted based on assumptions in other area-wide transportation studies (such as secondary plans or master plans)
- Developed following the transportation planning four-step process (trip generation, modal split, trip distribution, and trip assignment)

When information are extracted from other TIA studies, consultants are required to independently review and confirm the accuracy of the information.

For documentation, please include the following:

- The type, size and location of each development.
- Trip generation summary of each development (applied trip generation rates, total trips generated, and trip reductions for each of the study time periods shall be provided).
- Supporting calculations to be provided in the Appendix.

Include Figure: Other Area Developments: A map shall be provided that illustrates the location of the background developments in relation to the proposed development.

Include Figure: Background Development Traffic: A figure illustrating the estimated traffic volumes for each individual background development is required, along with a figure illustrating the total background development traffic volumes.

2.8.3. Future Total Background Traffic Volumes

Future background volumes should be estimated based on the addition of the following layers:

- Existing volumes
- Background growth rate volumes
- Background development volumes

Note Regarding Traffic Diversion

Adjustments maybe necessary to reflect planned transportation improvements which may result in changes to traffic pattern from the existing condition (e.g. a new link, or road widening).

Include Figure: XXXX (year) Background Traffic Volumes: showing traffic volume by turning movements.

2.8.4. Future Total Background Level of Service Analysis

Future total background operation analysis should be based on the following requirements for each horizon year considered for **all four travel modes** as applicable:

- Assessment of future background conditions. A separate table should be provided to summarize the performance results for the four travel modes;
- Identify any substandard designs, problematic operations, gaps, and missing links on the roadway network; and,
- Identify potential mitigation measures such as new bus routes, expansion of the facilities, route realignment, and frequency.

Any planned roadway improvements (as discussed in **Section 2.8.1**) shall be incorporated into the level of service analysis.

Documentation of the level of service analysis shall be consistent to the method as described in **Section 2.7.4**.

Discussion of the level of service results shall include observable insights of the analytics combined with understanding of existing conditions, to identify any operational or design issues, and potential solutions or mitigation measures to address the issues.

Include Appendix: XXXX (year) Future Background Condition: Level of service analysis output; electronic copy of analysis files.

Note

Capacity analysis inputs (lane configuration, traffic volumes) shall be consistent with the Figures (described in section **2.8.1** - Future Road Network and section **2.8.3** – Future Background Traffic Volumes) provided in the main text.

2.9. Proposed Development

This section details projection of development traffic as it relates to the subject development application.

2.9.1. Proposed Development

The section shall provide relevant information and statistics about the subject development, and shall include:

- Individual land use statistics and expected dates of completion and full occupancy (including phasing if applicable)
- Description of associated transportation infrastructures, including:
 - Proposed road network and traffic control
 - Proposed active transportation network
 - Site Accesses and traffic control

- Parking accommodation (vehicles, bicycle)
- Transit

The Project Description will also identify any phasing schemes and schedule of implementation with their associated land use statistics and expected dates of completion and full occupancy of the interim phases and ultimate development.

2.9.2. Auto Site Trip Generation

Describe the methodology used to determine the trips generated for the site. This may be based on a number of different methods, subject to confirmation and acceptance by Markham staff and other reviewing agencies:

- Institute of Transportation Engineers (ITE) Trip Generation Manual
- Database of site trip generation surveys
- Local and recent proxy surveys or data, provided that conditions are similar to those for the proposed site development or that differences are accounted for
- First principles calculations
- Other transportation studies in the area
- Default parameters provided by City staff

While the ITE Trip Generation Manual is commonly used as reference, analytics based on ITE Trip Generation Manual will require professional judgment. Moreover in the event that a proposed land use is not typical or has limited sample size in the Manual, proxy surveys may be required.

Proxy site surveys that are based in Markham or York Region and/or the GTA will generally provide information more reflective of local context. However, *prior to undertaking any proxy site surveys, City staff should be consulted to ensure suitability of the proxy sites.*

Include Table: Trip Generation Summary.

2.9.3. Auto Trip Adjustments

Adjustments to auto trip generation may be required to reflect:

- Projected transit, pedestrian, cycling modal splits.
- Pass-by and diverted trips.
- On-site interactions (internal capture) between different uses.

2.9.4. Site Transit Trip Generation

Site transit trip generation can be estimated by using the projected transit modal split for the proposed development. Typically, transit modal split can be obtained through various data sources and estimation methodologies such as the Transportation

Tomorrow Survey (TTS) data, existing and surrogate site surveys, York Region's transportation model and first principles. Refer to York Region Transportation Mobility Plan Guidelines for more information.

It is important to note that local Official Plans, Secondary Plans, and development area plans may identify site specific transit modal split objectives that are more prescriptive than overall Regional and Municipal targets. Should there be a need for Site Transit Trip Generation, please ensure that the above mentioned documents are considered.

2.9.5. Walking and Cycling Site Trip Generation

Site walking and cycling trip generation can be estimated by using the following methodology or data source:

- York Region/Markham data collection (if available)
- Smart Commute data (if available)
- Transportation Tomorrow Survey (TTS) data
- Proxy site surveys
- First principles calculation
- Other transportation studies in the area

Any assumptions and methodologies used to estimate site walking and cycling trip generation should be clearly documented and included in the appendix of the report for further review and future reference. A summary table that summarizes the estimation of the walking and cycling trip generation is also required.

2.9.6. Trip Generation Summary

The follow table provides an example of trip generation summary:

Land Use			AM Peak Hour			PM Peak Hour		
Type (LUC)	Units/Size		In	Out	Total	In	Out	Total
Shopping Centre	10,000 sf GFA	XXX – Trip Rate	G					
		Volumes (veh/hr)	A					
		Transit Modal Split	B					
		Walking & cycling Modal Split	C					
		Internal capture	D					
		Net New Trips (veh/hr)	E					
		Pass-by (veh/hr)	F					
		Final Trip Rate	H					

Repeat columns for each analysis period.

A = calculated using ITE Trip Generation Hand Book – equations

B = Transit reduction

C = Walking & Cycling reduction

D = Internal trip reduction

E = A less B,C,D (as applicable)

*F = Pass-by volumes = (% pass-by * E)*

G = unadjusted trip rate = A / land use units (e.g. 2.8 trips per 1000 sf)

H = adjusted trip rate = E / land use units (e.g. 2.4 trips per 1000 sf)

2.9.7. Site Trip Distribution and Assignment

The direction of trips to and from the study area can vary depending on the type of development. Different trip distributions shall be identified for different land uses (e.g. residential trip distribution is different from commercial developments).

The distribution of site traffic may be based on one or combination of the following methods:

- Transportation models (e.g. York Region model forecasts)
- Existing traffic patterns
- ITE trip generation manual
- Origin-destination or similar travel surveys
- Transportation Tomorrow Survey data
- Market Studies
- Census data

The assignment of traffic will depend on:

- Mode choice
- Existing and future transportation network – road network, transit infrastructure and services, cycling facilities, sidewalks, etc.
- Access configuration and design

A description of the methodology used for trip distribution and assignment is required. The trip distribution shall be presented in a table or a clearly labeled figure. Relevant

background information shall be provided for reference as part of the report appendix materials (i.e. survey results, calculations, etc.). For ease of review, these calculations should also be provided electronically. The following table provides an example of trip distribution summary:

Direction To/From	Via	AM Peak Hour		PM Peak Hour	
		Inbound	Outbound	Inbound	Outbound
South	Street A	10%			
	Street B	30%			
Subtotal		40%			
North					
Total		100%	100%		

Include Figure: Trip Adjustments related to pass-by trips, traffic diversions and on-site interactions.

Include Figure: Net Site Traffic: showing net site traffic volume by turning movement at all intersections including site accesses.

Separate figures shall be prepared for each proposed land use and included in the Appendix. The Net Site Traffic Figure shall be the sum of the site trips from all land uses.

The total inbound and outbound trips to the site should be consistent with the net trip generated calculated. The site trips shown in the figure shall be balanced on the road network as appropriate.

2.10. Future Total Conditions

The section represents the transportation assessment of a future condition that includes the “total” of all anticipated development for a given horizon year. The findings would establish an understanding of the adequacy of transportation network and programs required to support the development; and an understanding of the incremental impacts of the proposed development relative to baseline conditions.

2.10.1. Future Total Traffic Volumes

Future Total Traffic volumes should be estimated based on the addition of the following layers:

- Total background volumes
- Site trip volumes

Include Figure: XXXX (year) Future Total Traffic Volumes: showing traffic volume by turning movements, including all site accesses.

2.10.2. Future Total Level of Service Analysis

Future total operation analysis should be based on the following requirements for each horizon year considered for **all four travel modes** as applicable:

- Assessment of future total conditions. A separate table should be provided to summarize the performance results for the four travel modes;
- Identify any substandard designs, problematic operations, gaps, and missing links on the roadway network; and,
- Identify potential mitigation measures such as new bus routes, expansion of the facilities, route realignment, and frequency.

Documentation of the level of service analysis shall be consistent to the method as described in Section **2.7.4**.

Include Appendix: XXXX (year) Future Total Condition: Level of service analysis output; electronic copy of analysis files.

Depending on the site context, other forms of analysis may also be required such as:

- Traffic simulation
- Signal warrant analysis

Discussion of the level of service results shall include observable insights of the analytics combined with understanding of existing and background conditions, to identify any operational or design issues, and potential solutions or mitigation measures to address the issues. This may need to be discussed in terms of contribution of the development proposal to the situation, possible remedial measures, a recommended solution, and the effectiveness of the solution towards resolving the situation.

2.10.3. Recommended Improvements

This section should summarize based on the level of service analysis the transportation improvements required to support the proposed development and to mitigate the associated traffic impacts. This may include but not limited to the following:

- New roads, active transportation links, driveways, intersections, and traffic controls
- Geometric improvements to existing roads, active transportation links, intersections and traffic controls
- Transit infrastructure and services
- Phasing plan (as applicable)

2.11. Site Circulation Review

For any site plan application, the TIS may also include the review of internal site circulation, including (but not limited to):

- Demonstration that the design vehicles, service vehicles, and emergency vehicles can be accommodated
- Adequate site access design
- Provisions for movements of cyclists and pedestrians
- Accessibility

An AutoTURN analysis shall be provided to demonstrate the manoeuvrability of a typical passenger vehicle in and out of the site accesses, parking lot, and parking spaces. An AutoTURN analysis should be included to demonstrate the on-site circulation and loading manoeuvrability of delivery, courier, and garbage trucks in and out of the proposed loading areas. When applicable, an AutoTURN analysis to demonstrate on-site circulation of emergency vehicles shall be provided.

Include Figure(s): AutoTURN analysis – Passenger Vehicle, garbage trucks, fire trucks.

When evaluating existing and proposed site accesses, there should be consistency with the site access design principles – access alignment, access spacing, and connectivity, etc. The following should be examined as applicable to the proposed development:

- adequacy of design operation and level of service, including available sight distance and adequacy of queue storage capacity;
- potential conflicts between vehicles, pedestrians, and cyclists;
- any requirements to restrict certain turning movements to address sight restrictions or pedestrian/cyclist safety;
- site access opportunities for pedestrians and cyclists (e.g. convenient and safe access to transit services);
- prohibiting or restricting direct access to arterial roads where access to collector or local roads is available;
- possible interference with other adjacent or opposing driveways;
- the need to mitigate potential on-street queuing and weaving problems,
- the need for auxiliary turning lanes; and,
- collision history and safety analysis.

2.12. Functional Traffic Design Study

A functional traffic design study is typically required as part of an application for Draft Plan of Subdivision but may also be required as part of a site plan application. Overall, this is a geometric design review of any proposed road network and the purpose of the

review is to outline and confirm that the design criteria are in conformance to the applicable geometric design standards by Markham, Transportation Association of Canada and/or other agencies.

Key elements of the review typically include (but not limited to):

- Horizontal and vertical alignments
- Right-of-way widths
- Daylight triangles and rounding
- Cross-section elements
- Turn lane and storage requirements
- Intersection spacing
- Protected walking and cycling links
- Pedestrian and cycling crossings to access amenities
- Traffic controls
- Sight distance review

The review must also include a “functional design” of the proposed network, which would serve to inform future detailed design work.

A Functional Traffic Design Study may be consolidated as part of a TIS, or it may be submitted separately as a standalone document.

2.13. Parking Justification Study

The TIA shall confirm that parking provisions in the subject development will meet the City of Markham’s zoning requirements. If the parking supply in the proposed development does not meet the City of Markham’s zoning requirements, a parking justification study is required. This may be consolidated as part of a TIA report or submitted as a standalone document.

A parking justification study may be based on the review of any or combination of the following methods:

- Proxy parking surveys – City staff typically requires a minimum of three comparable sites for survey and the surveys must not be older than two years
- First principles approach – Based on known design parameters of the subject development, such as staffing, scheduling, sales data, etc.
- References to other published research and studies

City staff should be consulted prior to undertaking any parking justification study to confirm the method and source of information are acceptable.

2.14. Transportation Demand Management

All development proposals must include a Transportation Demand Management (TDM) Plan to outline the steps that will be taken to promote a reduction of single occupant vehicles. TDM strategies include the following, but are not limited to:

- Improvements to existing facilities/infrastructure (i.e. pedestrian connections, bicycle parking, cycling infrastructure, and/or dedicated parking for car-sharing vehicles, bus stops);
- Creation of new facilities/infrastructure (i.e. new pedestrian connections, cycling infrastructure, secure bicycle storage and parking, change-room and shower facilities, bus stops, etc.);
- Car-sharing incentives (i.e. dedicated car-share parking spaces);
- Transit incentives (i.e. pre-loaded Presto cards, discount transit passes);
- Information package to promote existing transit options in the area and provide links to TDM initiative supported by the City, such as Smart Commute, Markham Cycling Maps, etc.); and,
- Telecommuting programs and flexible work hours.

These TDM strategies may be applied to trip generation reductions. Any reductions in trip generation based on TDM strategies must be documented and reference materials must be provided in order to support the reduction. A cost summary table should also be included in the TDM Plan.

Include Figure: TDM Plan: Show the location of existing and proposed pedestrian walkways and connections, protected bicycle facilities, secure bicycle parking/storage, pavement markings for car-share parking spaces, bus stops, etc.)

The City of Markham's TDM Coordinator should be consulted for more information regarding the TDM plan.

2.15. Recommendations

Provide a summary of key findings and recommended improvements.

2.16. Conclusions

Provide an overall conclusion of the findings, recommendations, implementation plans and next steps.