Transportation Impact Study Guidelines

City of Guelph

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Engineering and Transportation Services

Infrastructure, Development & Enterprise

Contents

1.0 Introduction

As a single-tier municipality, the City of Guelph has jurisdiction over the entire public road system from arterial roads to local roads and laneways. The Hanlon Expressway (Highway 6 North) is the only exception; this highway is property of the Ontario Ministry of Transportation (MTO).

Guelph's public transit needs are provided by Guelph Transit. Provincial "connecting links" through Guelph include Highway 6 North (along Woodlawn Road), and Highway 7 (using Wellington Street, Wyndham Street, and York Road).

The City's Official Plan, Transportation Master Plan (2022), Cycling Master Plan (2012), Active Transportation Network Study (2017) and Transit Future Ready Action Plan (2021) provide outlines of desired development patterns and the anticipated future public road network.

When specifics of a proposed development become available, it is necessary for the applicant to examine its impacts on the surrounding road network. When required, a Transportation Impact Study (TIS) addresses how these impacts can be mitigated and whether proposed mitigation measures meet City design standards and align with City requirements and policy. The purpose of this document is to provide clear guidelines for the preparation of a TIS.

2.0 General Requirements

A TIS generally includes a description of the scope, a summary of the projected impacts and identification of mitigation measures to ensure that the surrounding road network can adequately and safely accommodate the proposed development.

This TIS Guidelines document is established to meet the following objectives:

- Support a complete application as per the City of Guelph's development application process;
- Provide a standard approach and help expedite the review and approval process;
- Ensure consistency in methodologies and assumptions; and
- Enable applicants, reviewers and elected officials to understand the process of preparing a TIS.

2.1 Need for a Traffic Impact Study

Proposed development that is expected to generate at least 100 additional net new trips (inbound and outbound) during the adjacent roadways' peak hours or the proposed development's peak hours generally triggers a TIS.

A TIS (or scoped transportation study) may also be required even if there are less than 100 additional auto trips during peak hours when one or more of the following conditions are present or anticipated:

- The proposed development is in an area of high roadway congestion with traffic volumes near capacity and/or a high expected rate of population or employment growth;
- The proposed development is not envisaged by local land use plans or transportation plans;
- As part of the proposed development, a new traffic signal, roundabout, controlled pedestrian crossing or turning lane is anticipated;
- Existing transportation problem areas, such as traffic collision prone locations, complex intersection geometrics, and/or heavy traffic corridors with traffic volume near capacity;
- The proposed development has the potential to create unacceptable adverse operational and safety impacts on the road network such as:
    - Inadequate horizontal or vertical sight distance at access;
    - Close proximity of the proposed access to other existing driveways or intersections; and
    - The traffic generated by the proposed development may result in volume-capacity (v/c) ratios at a signalized intersection becoming critical (i.e., greater than 0.90 overall or for a shared through/turning movement, or greater than 0.95 for an exclusive turning movement).

TIS studies vary in scope relative to context, scale, and complexity of a proposed development or its surroundings. The City reserves the right to require an update to an existing TIS if the assumptions (and related impacts) have changed substantially in land use type, development size, or traffic conditions in the surrounding area.

2.2 References

The following references in the latest edition should be used in the completion of a TIS:

- City of Guelph Official Plan
- Guelph Transportation Master Plan (2022)
- Active Transportation Network Study (2017)
- Transit Future Ready Action Plan (2021)

- Bicycle-friendly Guelph Cycling Master Plan (2012)
- Development Engineering Manual
- Institute of Transportation Engineers' (ITE) Trip Generation Manual
- Transportation Association of Canada's (TAC) Geometric Design Guide for Canadian Roads
- Transportation Research Board's (TRB) Highway Capacity Manual
- Ontario Traffic Manual (OTM) Books
- Linear Infrastructure Standards

2.3 Terms of Reference

Prior to commencing a TIS for a proposed development, the applicant must submit a Terms of Reference to the City's Manager of Transportation Planning to confirm the scope of the study, determine data requirements and availability, and verify assumptions to be used.

If a proposed development falls within the Ministry of Transportation's (MTO) Controlled Area such as those in close proximity to Hanlon Expressway, the applicant must contact MTO's Highway Corridor Management office to obtain the Ministry's approval of the TIS and development plans.

At a minimum, the Terms of Reference must include:

- A map of the study area that indicates the locations of data collection and intersections to be analyzed within the study area
- Description of the project
- Peak hour periods
- Study horizons
- Growth rate assumptions
- Indicate whether a parking justification report is required (these are reviewed by Planning staff)
- Transportation Demand Management recommendations to support long term growth of transit and active transportation trips, and reduction of single-occupant auto trips.
- Traffic Geometric Plans to demonstrate vehicle turning manoeuvres.
- The Terms of Reference may be expanded to also include the following, if applicable:
- Sight line analysis
- Daylight triangle assessments
- Functional design of public right-of-way
- Gap analysis
- Traffic signal warrant analysis
- Turning lane warrant analysis
- Other analyses as scoped with City of Guelph staff.

3. Traffic Impact Study outline

The TIS should contain typical sections outlined below.

3.1 Description of the Proposed Development

The TIS must provide a full description of the project using a combination of maps and figures. This includes but is not limited to the following elements:

- Existing land uses or permitted land use provisions in City's Official Plan (i.e., residential, commercial, industrial, etc.)
- Number of residential units and dwelling types
- Gross Floor Area including a summary of each type of land use (if applicable)
- Access control type and lane configuration
- A preliminary site plan or draft plan in a suitable scale
- Planned phasing (if applicable) of the proposed development
- Anticipated year of completion
- Surrounding road network and traffic regulations (i.e., speed limit, parking restriction and turning prohibition, etc.)
- Intersection lane configuration and type of control
- Transit stops and services
- Bicycle and pedestrian connections and facilities
- Adjacent developments and their access points
- Proposed internal layout including parking, loading and waste pick-up arrangements and circulation

A preliminary site plan or draft plan should be submitted with the following details shown:

- Number and location of accesses including access width, access radius and clear throat length
- Building placement
- Adjacent accesses on both sides of a fronting street
- Adjacent intersection control types and turning restrictions
- Traffic calming measures
- Existing and proposed walking and cycling facilities (i.e., sidewalks, bike lanes and trails, bike parking)
- Internal circulation (i.e., drive aisles for passenger cars, delivery trucks, waste collection trucks, emergency trucks and service vehicles; and walkways, stairs and ramps for pedestrians)

3.2 Study Area

In general, the study area should extend to cover all public roadways that will be affected by the site traffic. Typically, this will include the following impacts:

- An increase of 5% or more traffic volumes on adjacent roads;
- volume-capacity (v/c) ratios for overall intersection operations, through movements or shared through/turning movements increase to 0.90 or greater; or
- v/c ratios for exclusive turning movements increase to 0.95 or greater.

The TIS should contain a figure (or table) that illustrates the following relevant information:

- All adjacent roads including the road classifications, number of lanes, posted speeds, transit routes and stops, sidewalks and bike facilities
- All adjacent and affected intersections including type of control, lane configurations, lane widths, and any turning restrictions
- On-street parking arrangement in the vicinity of the proposed development site
- Heavy vehicle prohibitions and restrictions
- Other transportation facilities such as trails and walkways, etc.

The TIS must identify any future transportation improvements that are currently being considered in existing master plans, Environmental Assessments or Provincial Policy including status and implementation, where available. These improvements should be described to a level of detail sufficient to assess their relevant impact on accessing a proposed development site.

3.3 Horizon Years and Peak Periods

In the Terms of Reference, the applicant must consult with City staff prior to determining appropriate horizon years and peak periods for the completion of the TIS.

3.3.1 Horizon Years

The TIS should include analyses for several horizon years:

- Current year
- The year of completion of the proposed development
- Five to ten years after completion of the proposed development, depending on the size of the development, phasing, adjacent developments and/or surrounding roadway improvements (to be confirmed by City staff at the Terms of Reference stage)

- Ten (10) years after the completion of the proposed development, typically for large sized developments
- If the proposed development is to be carried out in phases, traffic impact analysis for each phase must be provided as part of the TIS. Any changes to the subsequent phases that result in a change in land use, development size or other factors that the City deems significant relative to transportation impacts will require an addendum to the TIS.

3.3.2 Peak Periods

The analysis period is determined to coincide with the traffic peaks on the surrounding roadways and/or the site traffic peaks. Typically, the weekday AM and PM peak periods represent the design periods that capture peak commuter, work/delivery, and retail activity.

However, in the case of some retail, entertainment, religious, school, and sport facility uses, the Saturday, Sunday or site peak may represent the highest impact scenarios.

3.4 Existing Traffic Analysis

The TIS should provide exhibits showing the existing traffic volumes and turning movements for roadways and intersections in the study area including pedestrian and cyclist volumes, and heavy truck movements.

3.4.1 Traffic Counts

Existing traffic data should be requested from the City through traffic@guelph.ca. Data less than three (3) years old may be considered as base year data. If these data are not available, the applicant should collect new traffic data. The new data should be included in the appendices of the report with the following information: date, time, road surface and weather conditions.

The new traffic counts should be collected for a minimum of two (2) hours during the AM period (7:00 AM to 9:00 AM), and four (4) hours during PM peak period (3:00 PM to 7:00 PM) at each intersection within the study area. The data collection schedule should avoid any factors that could affect the results obtained in the field such as road construction or low activity periods when primary and secondary schools and post-secondary institutions are closed, or a public holiday is observed. The City's website contains an up-to-date list of planned roadway closures, available at https://guelph.ca/living/construction-projects/.

Large trucks, buses, and recreational vehicles, with an average factor of 2.0 Passenger Car Units (PCUs) should be used to establish the heavy vehicle percentage.

3.4.2 Data Balancing

New data usually needs to be balanced to the upstream and downstream intersections that are considered to have more reliable counts such as those at major intersections. Through movements should be adjusted first before turning movements. Sometimes volume balancing cannot be achieved due to various factors (i.e., land uses, access locations and other midpoint road connections). In this case, the imbalance has to be justified and approved by City staff.

3.4.3 Active Transportation and Transit

Staff will provide available count and/or ridership data at the time of reviewing the Terms of Reference. Data less than three (3) years old may be considered as base year data. If these data are not available, the applicant should collect new data. The count data should be included in the appendices of the report with the following information: date, time, road surface and weather conditions.

3.4.4 Capacity Analysis for Existing Traffic

Assessment of existing traffic conditions should follow the capacity analysis methodology described in Section 8.0.

3.5 Background Traffic Analysis

Background traffic generally consists of background growth and other developments in the surrounding area.

3.5.1 Background Growth

An annual growth rate will be established in consultation with City staff. In general, staff recommend a 2% growth rate for the five years after the full buildout, and a 1% growth rate thereafter. Site-specific considerations may require for the growth rate to be determined through one of the following methods:

- Application of growth rate based on regression analysis of historical data
- Estimation of traffic growth from the City's travel demand forecasting model
- A growth rate based on previously completed area transportation studies

3.5.2 Other Area Developments

The TIS must recognize all developments that are under construction, approved, or in the approval process in the study area. Some developments are listed at https://guelph.ca/city-hall/planning-and-development/current-development-applications/. The applicant must consult with City staff for a complete list of developments.

The land-use type and size of these future developments should be identified in consultation with City staff. The trips that are expected to be generated by these developments, as indicated in their TIS, should be included as part of the future background traffic. Please contact City staff for electronic copies of TIS for these developments.

3.5.3 Planned Roadway Improvements

Changes to the existing or planned road networks and their realistic timing is to be confirmed in consultation with City staff. The impacts of the road network changes must be identified, including the traffic diversion from other facilities to new or improved facilities.

3.5.4 Active Transportation and Transit Improvements

The City's target modal split for the area relevant to a development site should be established from reviewing the Transportation Tomorrow Survey for existing mode split and reviewing the Transportation Master Plan policy for future targets.

The TIS must include a description of future active transportation facilities that will service the study area, such as sidewalks, crossings, bike lanes/cycle tracks, trails and bike parking, as well as enhanced connections to existing trails, parks, schools and transit.

The planned future transit services for a development site must be identified to assess the potential impacts on modal split, road capacity and geometries. Future transit services are described in the Guelph Transit Future Ready Action Plan, available at: https://guelph.ca/living/getting-around/bus/guelph-transit-future-ready-action-plan/

3.5.5 Capacity Analysis for Background Traffic

Assessment of background traffic conditions should follow the capacity analysis methodology described in Section 8.0.

3.6 Estimate of Travel Demand

All trip generation, trip distribution, trip assignment and modal split assumptions will be completed in accordance with industry standards and

acceptable practices. Assumptions should be clearly identified, and sources should be well documented.

3.6.1 Trip Generation

The number of site trips entering and exiting the proposed development during peak periods will be estimated using one of the following methods:

- Trip generation surveys at proxy site(s) from similar developments in the City of Guelph or comparable municipalities. The proxy site(s) and data collection methodology will be approved by City staff during review of the Terms of Reference;
- ITE's Trip Generation Manual rates or equations, provided that the quality of ITE data such as number of data points and R^2 value are all considered; and
- "First principles" calculations of anticipated trips to/from the site.
- Where appropriate, trip reduction may be justified to account for the following:
    - Synergy/Internal Trips that are shared between two or more land uses on the same site;
    - Pass-by trips that enter the site as an intermediate stop on the way from their primary origin to their primary destination. Pass-by trips should account for turning movements at the access intersections. Pass-by trips are considered for applicable land uses;
    - Diverted link trips that divert from a nearby intersection on their way from their primary destination; and
    - Travel Mode Share adjustment applicable to a proposed development that will increase non-auto mode share (reduce single occupancy vehicle trips and vehicle ownership)such as contributions to active transportation infrastructure (bike parking, cycling lanes, bus pad, enhanced infrastructure, etc. where appropriate), TDM Initiatives promoting active transportation and public transit, unbundled parking, carsharing, and carpooling, and alignment with existing or proposed transit and active transportation improvements (i.e. increased bus frequency, bike lanes) that may already be underway by the City or others.

Sensitivity analysis may be required to support the analysis where trip generation parameters have the potential to vary considerably.

The TIS must include a table identifying the categories and quantities for each land use, along with the corresponding trip generation rates or equations and the resulting number of trips.

3.6.2 Trip Distribution

Trip distribution assumptions will be supported by one or more of the following methods:

- Existing or anticipated travel patterns
- Transportation Tomorrow Survey (TTS) data
- Origin-destination surveys
- Comprehensive travel surveys
- Output from the City's travel demand forecasting model

Engineering judgement should be used to determine the most applicable of the above methodologies.

3.6.3 Trip Assignment

Traffic assignments will consider logical routings, projected roadway capacities, road network restrictions, and travel time. Traffic assignments may be estimated using a transportation planning model or "hand assignment" based on knowledge of the future road network in the study area.

3.7 Future Total Traffic Analysis

3.7.1 Capacity Analysis for Future Total Traffic

Assessment of future total traffic conditions should follow the capacity analysis methodology described in Section 8.0. A summary of future traffic demands should be provided in the form of exhibits that summarize the following:

- Future background traffic (corridor growth plus growth from other area developments)
- Future total traffic (future background plus net site traffic)

3.8 Traffic Operation Evaluation

The objective of a traffic operation evaluation is to assess the impact of area growth and development traffic on existing and planned infrastructure and recommend improvements, where practical and appropriate, to maintain acceptable levels of service or to mitigate impacts. The traffic operation evaluation should focus on assessing signalized and major unsignalized intersections within the study area that will be affected by the site-generated traffic as well as the ability of the proposed development's access(es) to accommodate the forecast site traffic.

3.8.1 Capacity Analysis Methodology

Analysis will be performed using the software Synchro for signalized and unsignalized intersection, Highway Capacity Software+ for unsignalized intersection, and ARCADY for roundabout. The simulation results should be summarized and displayed in a tabular format. The summary must include Level of Service, average vehicle delay in seconds and volume-capacity (v/c) ratios for overall intersection and individual movements. Individual movements must include 95th percentile queue length and available storage length. If any warning footnote (~, # and m) is present in Synchro outputs, it should be flagged beside the corresponding value in the summary tables.

Provide documentation of all assumptions used in the analysis such as intersection control type, lane configuration, turning lane storage length, turning movements, bus operation, on-street parking, pedestrian and cyclist activity and other relevant parameters. Full documentation of Synchro outputs must be provided in an appendix. Use Synchro – Lanes, Volumes Timing Report for signalized intersections including options for queues and Splits and Phases diagrams; and use HCM Unsignalized report for TWSC or AWSC for all stop or yield controlled intersections.

In general, the following model parameters and assumptions should be used in Synchro simulation. Other default parameters should be retained. Modifications to these parameters and assumptions should be confirmed with City staff to ensure they are appropriate for use in the study.

Table 1 - Synchro model parameters and assumptions

Speed limit	Posted speed limit
PCU	2.0 for all large vehicles
Heavy vehicle %	Existing traffic counts to reflect existing conditions A minimum of 5.0% trucks on industrial roads for future scenarios
Saturation flow rate	1900 pcuphplg (passenger car units per hour per lane green)
Peak Hour Factor	Actual PHFs for existing scenario. Peak Hour Factor based on intersection location and variability of traffic based on nearby land uses subject to discussion with City staff. 0.92 for scenarios if information is not otherwise available.

Signal timing split diagram	Signal timing split diagrams must be included in the appendices for signalized intersections.
Cycle length	Most intersections: 90s An acceptable range is 70s to 110s Signal Timing Plans can be requested through traffic@guelph.ca
Intersection control type	Semi-actuated Uncoordinated unless coordination is confirmed with City staff
Vehicle green time	Minimum 7s for minor roads Minimum 10s for major roads
Pedestrian walk time	Minimum 7s Pedestrian walk speed 1 m/s
Pedestrian don't Walk time	Minimum 7s
Amber time	4s for through movements 3s for exclusive left-turning movements
All red time	2s
Queue length	The 95th percentile queue length should be determined from Synchro outputs not SimTraffic. Outputs from SimTraffic may be influenced by the input of storage length for turning movements.
Signal optimization	Signal timing optimization may be considered as a measure to address capacity or level of service deficiencies through: • Minimizing overall delay at intersection; • Minimize the degree of saturation for critical movements or major traffic flows; • Improving queue management; and • Better accommodating pedestrians and cyclists.

Synchro's Intersection Reports "Lanes, Volumes Timings" must be provided for signalized intersections including traffic queues, and signal timing splits and phases diagrams. Simulation and detector settings are not required.

HCM Unsignalized reports for Two-way Stop Control (TWSC) or All-way Stop Control (AWSC) must be provided for all stop or yield controlled intersections.

3.8.2 Intersections with Capacity or Level of Service Deficiencies

The analysis should identify signalized intersections where:

- v/c ratios for overall intersection operations, through movements or shared/turning movements increase to 0.90 or above;
- v/c ratios for exclusive movements increase to 0.95 or above; or
- The estimated 95th percentile queue for an individual movement exceeds available turning lane storage.

The analysis should identify unsignalized intersections where:

- Level of Service (LOS) based on average delay per vehicle, or on individual movements exceeds LOS "E"; or
- The estimated 95th percentile queue length for an individual movement exceeds the available queue storage.

3.8.3 Safety Analysis

A safety review may be required to identify and address potential safety or operations issues arising from the following:

- Insufficient sight distance and sight triangle at access or intersections. Sight distance and sight triangle should be determined based on the standards outlined in TAC's Geometric Design Guide for Canadian Roads, or obtained from actual field measurements. Consideration should be given to the presence of horizontal and/or vertical curvatures;
- Vehicle-pedestrian or vehicle-cyclist conflicts;
- Access conflicts;
- Heavy truck movements conflicts;
- Weaving and merging
- Emergency vehicle response;
- Transit operational conflicts;
- Internal circulation, if applicable;
- Cut-through traffic; and
- Critical gap acceptance at unsignalized intersections. The critical gap analysis should reflect the most recent research provided in the TRB's Highway Capacity Manual.

Where the proposed development is in the vicinity of collision prone locations, existing collision data (available from traffic@guelph.ca) should be reviewed. The study should summarize findings using collision diagrams and tables to identify patterns and contributing factors.

3.9 Mitigation Measures

Mitigation measures should be identified to alleviate any potential concerns pertaining to traffic congestion and safety. These measures may include installation or upgrade of traffic control devices, infrastructure improvements, and implementation of active transportation facilities, etc.

3.9.1 Traffic Signal Warrant

A Traffic Signal Warrant should be undertaken for unsignalized intersections that may have the potential to satisfy the warrant justifications outlined in Ontario Traffic Manual (OTM) Book 12. At the mid-block of a street or an unsignalized intersection where full traffic signals are not warranted, if a significant increase in pedestrian crossings is anticipated in particular for vulnerable road users such as students or seniors, controlled pedestrian crossings should be considered to protect pedestrians. Ontario Traffic Manual (OTM) Book 15 provides detailed guidance on how to plan, design and operate various controlled pedestrian crossings.

3.9.2 Exclusive Turning Lane Warrant

Exclusive right-turn or left-turn lanes should be assessed based on the traffic operational analysis and design guidelines from TAC's Geometric Design Guide for Canadian Roads and TRB's Highway Capacity Manual. Where turning lanes are warranted, the length of storage and taper should be documented and illustrated in a functional design plan.

Adequate spacing should be provided between intersections to avoid potential overlaps for turn lanes and tapers. All design standards should be in conformance with TAC's Geometric Design Guide for Canadian Roads.

3.9.3 Transportation Demand Management Strategies

The study must identify appropriate auto trip reduction strategies for a development. These may include:

- Strong pedestrian and cyclist connectivity to surrounding sidewalks, trails and cycling facilities, especially toward nearby transit stops
- Provision of car share membership for occupants (multi-unit residential only
- Promoting public transit by subsidizing a monthly transit pass for occupants for their first six (6) months of occupancy at 1 pass per unit for 6 months (approximately $480/unit in 2023)
- Providing the required parking spaces without exceeding the Zoning Bylaw requirements
- Unbundling vehicular parking from the lease or sale of units

- Meeting or exceeding the zoning requirements for secure long-term bicycle parking
- Providing a bicycle repair station on-site
- Installing wayfinding maps and signage

Parking Justification Reports are separate and distinct requirements for certain development applications as per the Development Application guidelines and are reviewed separately by Planning Department. It is strongly recommended that, where a Parking Justification Report is also required, the TIS recommendations for TDM align with the Parking Justification Report.

3.9.4 Traffic Calming Measures

A traffic calming plan may be required to improve safety for pedestrians, cyclists and motorists in the study aera. The traffic calming plan should generally follow City's Traffic Calming Policy on how to incorporate various traffic control measures.

3.10 Access Management

Access management is a key component in the review of a proposed development proposal.

3.10.1 Number and Location of Accesses

From a safety and operational perspective, the number and location of access must not create a safety concern or have an undue impact to the flow of traffic, including pedestrians and micro-mobility users (cyclists, scooters, skateboarders, etc.), along abutting roads and nearby driveways.

Accesses should generally be located on minor roads and align with any existing intersection or driveway on the opposite side of the street.

Accesses should be adequately spaced from adjacent intersections and driveways as per City's Development Engineering Manual.

The Official Plan and Transportation Master Plan policies discourage direct access onto arterial roadways unless it can be demonstrated that safety is not compromised.

3.10.2 Sight Triangle and Sight Distance

Access points should be provided with adequate sight triangles at the access opening areas, and sufficient sight distances along the fronting streets if significant horizontal and/or vertical curvatures are present. The methodology is defined in TAC's Geometric Design Guide for Canadian Roads.

3.10.3 Access Control

A warrant analysis for traffic signals should be performed for those access intersections that have potential for signalization under the future scenarios. The methodology is presented in Section 9.1.

3.10.4 Fronting Street

When the access is expected to generate heavy turning movements or the traffic flows on fronting streets will be negatively impacted by turning movements to/from the site, a warrant analysis should be undertaken to assess the need for addition of exclusive turning lanes. The methodology is presented in Section 9.2.

3.10.5 Access Geometrics

Access configuration should generally follow the standards outlined in TAC's Geometric Design Guide for Canadian Roads, in particular,

- The number of ingress and egress lanes at access will be determined based on the traffic demand to/from the site;
- Access throat length must be sufficient to minimize conflicts with street traffic and internal traffic. TAC's Geometric Design Guide for Canadian Roads suggested minimum clear access throat lengths can be used, subject to queuing analysis;
- Access curb radii must be sufficient to accommodate design vehicles. Traffic Geometric Plans may be required to demonstrate turning manoeuvers by design vehicles. Appropriate speed of 5 km/h to 15 km/h must be applied when using AutoTurn (or equivalent vehicle modelling software) to generate vehicle turning templates. A minimum 0.3m clearance must be retained from curb lines; and
- Where left turning movements are restricted at a right-in/right-out access, the layout must be designed to effectively prohibit these left turning movements. Where feasible, the preference is to consider a concrete centre median on the fronting street. If this centre median is deemed unfeasible due to physical constraints, a channelized island should be considered with acute angles to fronting street, narrow travel lane and large island area. Design elements are described in further detail in City's Development Engineering Manual.

3.11 Internal Traffic Circulation

On-site parking and the circulation system should be evaluated to demonstrate minimum conflicts among all road users. The TIS must demonstrate how the site avoids traffic queuing onto City's roads. On-site

pedestrian connections to the public sidewalk and existing or future bus stops should demonstrate minimal conflict points with vehicles on-site.

Proposed truck loading facilities (such as those for waste collection) and access to these facilities should be evaluated to ensure that they are adequately sized and designed. Refer to City's Waste Collection Guideline for Multi Residential Developments. As per the waste collection guideline, 11.4m waste collection trucks are utilized for waste pick up on site.

Traffic Geometric Plans are usually required to demonstrate turning manoeuvres by delivery trucks, waste collection trucks and emergency trucks. Appropriate speed of 5 km/h to 15 km/h must be applied when using AutoTurn (or equivalent vehicle modelling software) to generate vehicle turning templates. A minimum 0.3m clearance must be retained from curb lines.

3.12 Findings and Recommendations

A summary of key findings and recommendations should be presented in the study report, including the following:

- Impacts of the proposed development on the adjacent road network, and on any transit and active transportation systems
- Mitigation measures to support the future traffic demands
- An implementation strategy that outlines the timing of road improvements
- A preliminary cost estimate for all identified operational and roadway improvements.

3.13 Parking Justification Study

A parking justification study is not part of the TIS. The requirement for a parking justification study will be advised by City's Development Planning staff as part of the pre-consultation process and will be reviewed by Development Planning staff.

3.14 Documentation and Reporting

Where possible, key maps, diagrams, graphs, tables and exhibits should be placed within the body of the TIS report alongside the corresponding text.

3.14.1 Report Contents

The following is a suggested structure of contents for a TIS report:

- Executive summary
- Study purpose and objectives
- Transportation policy review
- Proposed development description

- Study area
- Analysis peak periods
- Existing traffic condition analysis
- Future background traffic analysis
- Site traffic demand including trip generation, distribution, mode split and assignment
- Total traffic analysis
- Active transportation and transit impact
- Mitigation measures
- Traffic analysis with mitigation measures
- Access configuration
- Transportation Demand Management plan
- Conclusions and Recommendations
- Appendices, to include:
    - Traffic counts
    - Synchro reports
    - Signal warrant analysis (if applicable)
    - Turning lane warrant analysis (if applicable)
    - Sight triangle and sight distance analysis (if applicable)
    - Preliminary site plan or draft plan in a suitable scale
    - Functional design for any roadway improvements with pavement marking and signage plan (if applicable)
    - Traffic Geometric Plans

3.14.2 Submission Requirements

Printable electronic copy in pdf format of the final TIS report stamped/signed by a registered Professional Engineer, Planner or C.E.T. and original electronic Synchro and/or SimTraffic files to be submitted to City staff for review.

All information submitted will be posted to the City's "Current development applications" website at: https://guelph.ca/city-hall/planning-and-development/current-development-applications/.