AN ORDINANCE AMENDING THE ZONING ORDINANCE

OF THE CITY OF CONCORD, NORTH CAROLINA

WHEREAS, the City of Concord, North Carolina pursuant to the authority conferred by the North Carolina General Statute §160A-364 enacted an Official Zoning Ordinance for the City of Concord, North Carolina and the Area of Extraterritorial Jurisdiction on July 28, 1977; and

WHEREAS, the City of Concord, North Carolina pursuant to the authority conferred by North Carolina General Statute §§160D-601 through §§160D-605 and 160D-701 through 160D-706, 160D-801 through 160D-808 and 160D-901 through 160D-951 may from time to time as necessary amend, supplement, change, modify or repeal certain of its zoning regulations and restrictions and zone boundaries; and

WHEREAS, the City of Concord, North Carolina pursuant to the authority conferred by North Carolina General Statute §§ 160D-601 through §§ 160D-605, 160D-701 through 160D-706, 160D-801 through 160D-808 and 160D-901 through 160D-951 does hereby recognize a need to amend the text of certain articles of the City of Concord zoning Ordinance.

NOW, THEREFORE, BE IT ORDAINED by the City Council of the City of Concord, North Carolina:

SECTION 1. That the "Technical Standards Manual" of the CDO, be amended to add Article VIII, "Traffic Impact Analysis (TIA)" to read as follows.

City of Concord
Technical Standards Manual

Article VIII
Traffic Impact Analysis (TIA)

TABLE OF CONTENTS

Article VIII

APPENDICES

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1.0 PURPOSE

A Traffic Impact Analysis (TIA) evaluates the adequacy of the existing and planned transportation system to serve future traffic growth and new development. A TIA should address all elements of the transportation system as it relates to pedestrians, bicyclists, transit, vehicular traffic, and adjacent land development. Throughout the TIA process, cooperation between City staff and the applicant is encouraged to provide safe and efficient conditions for public travel. This Article of the City of Concord's Technical Standards Manual identifies study analysis requirements, format, and transportation operation requirements.

All TIAs for future developments shall begin with initial communication between the Applicant, City Transportation staff, and NCDOT staff as necessary. This communication should be initiated by the Applicant as soon as a project concept is under consideration. The Applicant should not wait until the project has undergone a detailed design before discussing the potential project with City and NCDOT staff. Failure to do so could result in changes to site access locations and site circulation based upon initial City review comments. The purpose of this communication is to provide Applicants with information on City and State site design, access, and traffic study analysis requirements. Site plans should be of a conceptual nature for this meeting to minimize Applicant efforts in the preparation of final plans for submittal to the City approval processes. The City's Development Review Committee, which is administered by the Planning Department and includes City Transportation staff, holds pre-submittal meetings on a weekly basis and the Applicant is encouraged to schedule a time slot to discuss the potential project in one of these meetings.

2.0 QUALIFICATIONS

The TIA *should* be conducted by a licensed professional engineer with experience in traffic engineering studies and is pre-qualified by the NCDOT Congestion Management Section to produce TIAs. The TIA **shall** be prepared by, or under the supervision of, a professional engineer (PE) who has a valid North Carolina PE license/registration and experience in traffic engineering operations. The responsible PE **shall** include their signature, PE seal, and the following statement of certification at the beginning of the TIA:

> *"I certify that this Traffic Impact Analysis has been prepared by me or under my immediate supervision and that I have experience and training in the field of traffic and transportation engineering."*
> (Signature)
> John Q. Smith, P.E.
> North Carolina Registration #12345
> Consulting Firm, Inc.

Preparation by a Professional Traffic Operations Engineer (PTOE) is preferred for Level 3 and Level 4 TIAs.

The Transportation Director or their Designee may grant an exception to the requirement for a Type 1 TIA to be prepared by a licensed Professional Engineer (PE), except where NCDOT may dictate otherwise. Where it is determined certain requirements of the Type 1 TIA are applicable to a specific development and require preparation by a PE, as noted in Section 4.1, those portions **shall** be prepared by, or under the supervision of, a PE and included as part of the complete Type 1 TIA. If exception is granted, the portions of the Type 1 TIA which have been exempted from the PE requirement **shall** be prepared by, or under the supervision of, a qualified professional with experience in site plan preparations and ability to complete the requirements of the remaining aspects of a Type 1 TIA.

3.0 APPLICABILITY

All proposed non-residential and mixed-use developments, all multi-family and single-family attached residential developments, and all other residential developments with 6 or more total dwelling units will be required to prepare a TIA. The scope and TIA requirements for schools will be determined on a case-by-case basis.

All Applicants are encouraged to begin the TIA process as soon as a project concept is under consideration; however, TIAs should be submitted per the following:

3.1 **Rezoning** - The TIA process shall begin once an application is received. An approved TIA Report and subsequent Transportation Mitigation Agreement (TMA) is required prior to the approval of Rezoning applications.

3.2 **Special Use Permits** – The TIA process shall begin once an application is received. An approved TIA Report and subsequent TMA is required prior to the approval of Special Use Permit applications.

3.3 **Subdivision Development** – If not completed as part of a previous application process, the TIA process shall begin once a Preliminary Plat is submitted. An approved TIA Report and subsequent TMA is required prior to the approval of a Preliminary Plat.

3.4 **Driveway Permit** – If not completed as part of a previous application process, an approved TIA and subsequent TMA is required prior to the approval of Driveway Permits for all proposed non-residential and mixed-use developments, all multi-family and single-family attached residential developments, and all other residential developments with 6 or more total dwelling units.

4.0 STUDY ANALYSIS TYPES

The content and level of analysis for each of the study types will increase as the potential impact of the development increases. The following trip generation warrants (prior to any potential trip reductions are assigned) shall be used to determine the level of analysis required for a TIA.

Study Type	Peak-Hour Trips	Daily Trips
1. Access Location and Design Review	<50	< 1000
2. Small Development	50 to 99	1000 to 1999
3. Medium Development	100 to 499	2000 to 9999
4. Large Development	>/= 500	> 9999

(Subsection f. specifies the basis for these estimates.)

Each of the study types should include the following details:

4.1 **Type 1 - Access Location and Design Review** (for developments that generate less than 50 peak-hour trips and less than 1000 daily trips)

a. **Existing Roadway Geometrics, Traffic Controls, and Traffic Volumes**

The TIA should provide a sketch that shows the roadway and intersection geometry of all roadways and intersections that are adjacent to the development. This sketch should also note the existing traffic controls (stop signs, signals, etc.) for the intersections being depicted. The Applicant should also provide a schematic of the roadway system that lies directly adjacent to the development along with the estimated daily volumes on those roadways. The daily volumes for many area roadways are available on the following NCDOT web site:
https://connect.ncdot.gov/resources/State-Mapping/Pages/Traffic-Volume-Maps.aspx
If volumes are not available, the Applicant will need to provide them.

b. **Sight Distance Evaluation (PE Required)**

The TIA should contain an evaluation of the sight distance available for the development entrance/exit using the methodology described in AASHTO's *A Policy on Geometric Design of Highways and Streets*. The stop-controlled Type B1 and B2 situations should be used. A summary of this methodology is shown in Appendix E. The evaluation should be performed for proposed street connections with the existing street system. The evaluation should also be performed for internal street intersections if they exist.

c. **Access Evaluation: Number and Spacing**

The TIA shall show the proposed driveway location(s) and its relationship to other adjacent driveways. Driveways on both sides of the roadway should be shown. This shall be in graphic form and show distances and widths of driveways.

d. **Access LOS Analysis (PE Required)**

Where a new public street is proposed, the TIA should provide a LOS analysis for all individual movements where the proposed street(s) intersects an existing street.

e. **Trip Generation**

The TIA should provide trip generation estimates for the weekday morning and evening peak hours in addition to daily trip generation totals. This trip generation should be based on the most recent edition of the Institute of Transportation Engineers (ITE) *Trip Generation Manual*. Please note that depending on the type and use of the proposed development, trip generation estimates may be required for other than normal weekday peak hours.

f. **Site Circulation Evaluation**

The TIA shall contain a site circulation map with arrows that clearly defines how entering and exiting traffic and service/delivery vehicles will travel through the site.

g. **Turn Lane Determinations**

Left and right turn lanes and storage lengths shall be provided in accordance with the requirements and warrants outlined in Appendix C, Turn Lane Warrants, as well as using guidance provided in the NCDOT's *Policy on Street and Driveway Access to North Carolina Highways*. NCDOT Nomograph for determining storage length, along with NCDOTs recommended treatments for turn lanes are provided in Appendix C as a reference, however, NCDOT's *Policy on Street and Driveway Access to North Carolina Highways* should be consulted for further guidance.

h. **Traffic Signal and/or Multi-Way Stop Analysis (PE Required)**

The TIA shall contain a Traffic Signal and/or Multi-Way Stop analysis for all locations where a Traffic Signal or Multi-Way stop is proposed or is to be analyzed as a potential mitigation measure.

4.2 **Type 2 - Small Development** (for developments that generate from 50 to 99 peak-hour trips or between 1,000 and 1,999 daily trips)

a. **All required elements of a Type 1 TIA**

b. **Planning Level Capacity Analysis**

The TIA should contain an estimated Level of Service (LOS) analysis of the roadways within the Impact Analysis Area. The Cabarrus-Rowan Metropolitan Planning Organization (CRMPO) Comprehensive Transportation Plan (CTP) includes the determined existing capacity and the future proposed capacity of many area roadways. These numbers should be used to determine the LOS based on a volume to capacity ratio (V/C). Both existing and build-out conditions should be included in the analysis.

c. **Ped/Bike LOS Analysis**

The TIA shall determine the Ped/Bike Level of Service at signalized intersections within the Impact Analysis Area. For bicycles and pedestrians, the Impact Analysis Area for Ped/Bike analysis is generally, but not limited to, 600 feet from the development. The methodology for this analysis is described in Appendix G.

d. **Crash History and Analysis**

If the development is adjacent to a roadway or intersection with a high frequency of crashes, as identified by City staff, the TIA shall contain a crash history and analysis. The need for this shall be discussed during the scoping phase. If a crash analysis is needed, City Transportation will provide a list of crash reports for the study area, where available, upon request. The TIA shall diagram the crashes and list possible causes for the crashes. The TIA shall then discuss how the proposed development access may affect and address the crash potential at this location.

e. **Trip Distribution and Assignment**

The TIA shall schematically show how trips from the development were distributed throughout the Impact Analysis Area network. (This is typically shown with arrows and percentages.) The TIA shall also have a diagram that shows the resulting trip assignments (actual trip numbers).

f. **Intersection Operation Analysis**

The TIA shall perform an operations analysis for both the development entrance(s)/exit(s) as well as all intersections within the Impact Analysis Area. The operations analysis shall include delay values for all movements, as well as 95 percentile queues. Highway Capacity Software, Synchro/SimTraffic, Signal2000, Sidra, or other software approved by the City, shall be used. Two operations analysis shall be performed:

1. Build-Out year without development (base network condition)
2. Build-Out year with development

The two operations analyses shall then be compared to determine the effect of development on traffic operations.

g. **Mitigation Analysis**

A mitigation analysis will need to be performed if at least one of the following conditions exist when comparing the base network conditions to project conditions:

1. The total average delay at an intersection or individual approach increases by 25% or greater while maintaining the same level of service:

   Movements experiencing LOS C or better. The TIA shall identify and investigate, at a minimum, mitigation measures for all traffic movements with a LOS C or better that experience an increase in delay by more than 25% without a change in LOS as a result of the development. The analysis shall be performed using traffic operations software.

2. The Level of service degrades by at least one level:

   The TIA shall identify and investigate, at a minimum, mitigation measures for all traffic movements with a LOS C or better that experience a lower LOS as a result of the development. The analysis shall be performed using traffic operations software

3. Level of Service is "D" or lower:

   Movements experiencing LOS D or below. The TIA shall identify and investigate, at a minimum, mitigation measures for all traffic movements that currently, or will in the build-out year, experience a LOS D or below. The analysis shall be performed using traffic operations software. For movements that experience LOS D prior to the addition of development traffic, the TIA shall investigate mitigation measures that maintain or improve traffic operation levels.

4. *Pedestrian and Bicycle LOS*. The TIA shall investigate mitigation measures for all pedestrian and bicycle movements with a LOS lower than those listed in tables 4-1 and 4-2.

Desired Signalized Intersection LOS for Pedestrians

Land Use	Level of Service
Residential	A
Neighborhood Commercial	A
Business/Office	B
Other	C

Table 4-1

Desired Signalized Intersection LOS for Bicycles

Land Use	Level of Service
Residential	A
Neighborhood Commercial	A
Bike Route	B
Business/Office	B
Other	C

Table 4-2

4.3 **Type 3 - Medium Development** (for developments that generate from 100 to 499 peak-hour trips or between 2,000 and 9,999 daily trips)

a. **All required elements of Type 2 TIA**

b. **Future Road Improvements**

The TIA shall identify all improvements planned by the City, county, or state for roadways within the Impact Analysis Area. The nature of the improvements should be described and considered in the horizon year analyses.

c. **Trip Generation of Adjacent Developments**

Trip generation of nearby developments that have been approved or are currently proposed should be accounted for in the operations analysis. The TIA must consider trips from other adjacent planned development. These trips shall be added to the background traffic growth. Inclusion of adjacent developments should be discussed during the scoping process.

d. **Background Traffic Growth**

For the horizon year analysis, the TIA shall account for normal traffic growth on study area roadways. The background growth increase shall be discussed with City and NCDOT staff. A linear regression of historic traffic growth can be used as a basis for the increase; however, area development potential may justify a higher or lower growth increase than what has been observed historically.

e. **Future Conditions Operation Analysis of Intersections**

In addition to the two Build-Out year analyses (with and without development), the TIA shall consider traffic operations in the future horizon year. Unless otherwise dictated by City Transportation or NCDOT Staff, the horizon year will be Build-Out year plus 5. Two horizon year analyses shall be performed:

1. Horizon year ***without*** development, with background and adjacent anticipated development. (base network condition)
2. Horizon year ***with*** development, with background and adjacent anticipated development.

The two operations analyses shall then be compared to determine the effect of development on traffic operations. As with the previous TIA level, a mitigation analysis will then need to be performed if at least one of the following conditions exist when comparing the base network conditions to project conditions:

1. The total average delay at an intersection or individual approach increases by 25% or greater while maintaining the same level of service,
2. The Level of service degrades by at least one level, or
3. Level of Service is “D” or lower.

f. **Effect on Signal Progression**

When the Impact Analysis Area contains multiple signals that are coordinated, the operations

analysis shall use software capable of analyzing progression between the signals. Examples of software include Synchro/Simtraffic, Transyt7f, and Passer.

4.4 **Type 4 - Large Development** (for developments that generate more than 500 peak-hour trips and/or 10,000 or more daily trips)

a. **All required elements of Type 3 TIA**

b. **Transportation System Management/Transportation Demand Management Mitigation Measures**

The TIA shall contain a section that describes Transportation System Management and/or Transportation Demand Management (TDM) measures that the development will implement, including enforcement measures, to reduce its effect on the transportation system. Examples of TDM measures include staggered work hours, transit subsidies, and carpooling initiatives.

4.5 **Other Considerations**. In addition to projected peak-hour and daily trips, other considerations may require a study to be conducted or increase the level of detail required. These considerations will be based on recommendations of City Transportation or NCDOT staff and may include:

a. Crash rates: Locations identified by the City staff as being high crash intersections or locations.

b. Neighborhood sensitivity to traffic impacts: Areas where the potential exists to increase average daily traffic volumes on neighborhood streets by 15 percent or more.

c. Congestion: Areas of high traffic congestion that are currently operating with peak- period LOS D or lower conditions.

d. Planning and Zoning Commission and/or City Council recommendations.

These considerations will be identified by the City or NCDOT staff.

5.0 TRAFFIC IMPACT ANALYSIS PROCESS

5.1 Initial Scoping Communication

Prior to the commencement of a TIA, scoping communication with City Transportation staff is required. This communication will provide the City an understanding of the proposed development concept and needs and discuss the TIA requirements for the project. It is noted that the North Carolina Department of Transportation (NCDOT) has TIA requirements that must be followed if a development project affects or has direct access to the State Highway System. In such cases, appropriate NCDOT staff should be included in the communication.

Background information shall be submitted by the Applicant five or more business days prior to an in-person scoping meeting and shall include a conceptual site plan showing proposed access points, proposed land use(s) and densities, structure and parking envelopes, proposed trip generation and distribution, and other pertinent information. Email correspondence may be sufficient to substitute for an in-person meeting for many cases, however in-person meetings may be needed depending on the proposed development. A checklist to be used by the Applicant for the initial project communication is located in Appendix A of this Article.

5.2 Impact Analysis Area

The analysis area for each study type varies to reflect the potential geographic area affected by the volume of traffic generated by a development. Smaller developments generally draw local trips, potentially affecting adjacent intersections. Conversely, larger size developments generally draw from regional areas, potentially affecting major arterials, freeway interchanges, and most minor roadways. Study areas for each study type for motor vehicle analysis can generally be defined as, but not limited to, the following:

a. **Type 1 - Access Location and Design Review**

Adjacent street intersections within 600 feet of site driveway(s) (access points).

b. **Type 2 - Small Development**

All major signalized and unsignalized intersections within 2,500 feet of site driveway(s). All intersections where traffic estimated for build-out of the proposed new development will constitute 10% or more of any signalized intersection approach during the peak hour should also be included.

c. **Type 3 - Medium Development**

All signalized intersections and freeway ramps within 1 mile and major unsignalized street intersections within 2,500 feet of site driveway(s). All intersections where traffic estimated for build-out of the proposed new development will constitute 10% or more of any signalized intersection approach during the peak hour should also be included.

d. **Type 4 - Large Development**

All signalized intersections and freeway ramps, all unsignalized streets within 1 mile of site driveways, and all intersections where traffic estimated for build-out of the proposed new

development will constitute 10% or more of any signalized intersection approach during the peak hour. The analysis shall also include signalized intersections greater than one mile from the development if the signal is in a coordinated system with other signals in the study area.

e. **Pedestrian & Bicycle**

The study area/Impact Analysis Area for pedestrian/bicycle analyses is smaller and is generally, but not limited to 600 feet from the development.

5.3 TIA Horizons

Based on the level of detail required for each TIA study type, it is necessary to define future traffic analysis horizon years. Please note that NCDOT may have different horizon years. The following horizon years are required for the different study types:

a. **Type 1 - Access Location and Design Review**

No detailed operations analysis required.

b. **Type 2 - Small Development**

Opening year with full buildout/occupancy.

c. **Type 3 - Medium Development**

1. Same as Small Development, plus:
2. Five years after full buildout/occupancy, or five years after each identified buildout year for phased developments.

d. **Type 4 - Large Development**

1. Same as Medium Development, plus:
2. Cabarrus Rowan Area MPO traffic forecast long-range plan year.

5.4 Trip Generation

The major factors determining the amount of traffic that will be generated by a development are its size and land uses. In particular, the type of land use (residential, retail, industrial, office, etc.) will have a significant effect on the amount of new traffic that will be added to the area roadway network and the time(s) of day when it will occur.

a. The Applicant should use the latest edition of the Institute of Transportation Engineers (ITE) *Trip Generation Manual to* estimate trip generation unless individual special studies have been conducted specific to the proposed development or individual company data exists. All sources used shall be referenced. If the source is not from the ITE *Trip Generation Manual*, evidence shall be provided as to their suitability for this particular application. Use of non-ITE rates must be reasonable, defensible and approved by City and/or NCDOT staff. The NCDOT Municipal School Transportation Assistance (MSTA) calculator should be used to calculate projected trip generations for school sites.

b. Trip generation for individual outparcels should be calculated separately from the remainder of

the development. If a development includes multiple buildings of the same land use, trip generation should be calculated separately for each building unless otherwise specified in the ITE *Trip Generation Manual*.

c. Developments involving multiple parcels, or those proposed to subdivide larger parcels to be partially developed, shall include the potential for development on all existing parcels which contribute to the proposed development site as well as all parcels resulting from subdivision/recombination. The trip generation associated with a conceptual master plan should be included in the analysis. In the absence of an appropriate master plan, the potential traffic generation of all existing parcels which contribute to the proposed development site and those resulting from subdivision/recombination shall be estimated using the ITE Trip Generation land use code(s), allowed by the current or proposed City land use and zoning, that produces the maximum number of potential trips.

d. The trip generation table should be organized in a manner that will be clearly understandable by the author of the report and its readers. Table 5-1 is provided as a typical example. The table should identify the following minimum information:

- Land use(s)
- ITE code(s), including the appropriate units attributed to each land use and ITE code
- Size of development
- Trip rates (in, out, total for peak hours) (two-way–daily)
- Number of vehicle trips generated (in, out, total for peak hours) (two-way–daily)
- Data Source - ITE Rate, ITE Equation, Other Data (must be explained and accepted)

Typical Trip Generation Table

ITE Land Use Code	Prop. Land Use	Size	Unit	Daily Trips	AM Peak Hour Trips			PM Peak Hour Trips			Data Source
					Enter	Exit	Total	Enter	Exit	Total	
Total											

Table 5-1

5.5 Trip Reductions

Trip reductions should be calculated and applied in accordance with *NCDOT Congestion Management Capacity Analysis Guidelines*.

a. ***Internal Capture*** **-** Base trip generation may be reduced by rate of internal capture when two or more land uses are proposed using methodology recommended in the most current *Trip Generation Handbook* published by the ITE, or research published by the National Cooperative Highway Research Program (NCHRP) Transportation Research Board. Reductions for internal capture shall be applied to multi- or mixed-use sites only. The internal capture reduction shall be applied before pass-by trips are calculated.

b. ***Pass-by Trips*** - Pass-by trips are those made as intermediate trips between an origin and primary destination (i.e., home to work, home to shopping, etc.). However, pass-by trips are not diverted from another roadway. Base trip generation may be reduced by rate of pass-by capture using methodology recommended in the most current *Trip Generation Handbook* published by the ITE. Pass-by trips associated with the proposed new development may not exceed 10% of the peak-hour volume reported for the adjacent public street network. This network shall include the streets that provide primary access to/from the proposed new development. For example, if a site access drive that connects to a low-volume local street, which its primary access is to a major collector road, the traffic on the major collector shall be used as the adjacent street for pass-by calculation purposes. Evaluation of diverted trips may apply depending on the specifics of each site. A trip generation table shall summarize all trip generation calculations for the proposed new development.

c. ***Existing Use Credit*** – Trip generation reductions may be allowable in the event a development will be replacing or altering an existing site which currently generates traffic. The Applicant is responsible for verifying with NCDOT that any reductions which may be allowed by the City are acceptable to be included in the trip generation calculations. No credit/reductions will be allowed for any portion of an existing site which was not active and currently occupied at the time traffic counts were performed. Trip generation reductions for existing uses will be based solely on actual traffic generated by the existing site. If the existing site was active when traffic counts were performed then sufficient documentation (i.e. certificate of occupancy, lease agreements, utility bills, etc.) should be provided along with additional traffic counts taken at all existing access points in order to determine the allowable trip generation credit. No reductions shall be applied to the trip generation of the proposed development prior to determining the level of TIA required.

5.6 Trip Distribution & Assignment

The developer should discuss proposed trip distribution and assignment with City and/or NCDOT Staff during the scoping process. Reasons for the proposed trip distribution should also be discussed with staff. Proposed Trip Distribution should be approved by the City and/or NCDOT prior to commencement of the TIA. Within the TIA report, site traffic distributions should be depicted graphically as percentages for each direction of travel. Displaying this information on a map provides the best method of showing the directional distribution of traffic for the development. Procedures followed and logic for estimating trip distribution percentages and trip assignment must be well documented in the TIA.

5.7 Scoping Document

Following the initial scoping process, determination of the required study type, Impact Analysis Area, analysis horizon years, trip generation and trip distribution, a Scoping Document shall be prepared by the Applicant or their TIA consultant for review and approval by City and NCDOT staff (as applicable). The Scoping Document shall be signed by the applicant, the City, and appropriate NCDOT staff (as applicable) before work should begin on the TIA.

a. The City of Concord TIA Scoping document is available in Appendix B. If a TIA involves NCDOT streets, the NCDOT *Traffic Impact Analysis Need Screening / Scoping Request* form should be prepared and submitted to NCDOT as well as the City. In the Additional Comments section of the NCDOT *Traffic Impact Analysis Need Screening / Scoping Request* form, the appropriate City TIA Study Type should be annotated. Both documents should be prepared and submitted to the City.

b. Following approval of the Scoping Document the Applicant and/or their TIA consultant may begin preparation of the TIA. Failure by the Applicant or their TIA consultant to provide accurate information or to follow the Scoping Document shall result in disapproval of the TIA until such failures are corrected. If changes are made to the parameters outlined in the Scoping Document, a revised Scoping Document may be required and agreed to by City and NCDOT Staff as well as the applicant.

c. An approved Scoping Document is valid for nine (9) months from the date of final approval. If a TIA is not received prior to the expiration of the nine (9) month period, the Scoping Document may need to be revised or renewed.

5.8 Operating Requirements - System operation is defined to include motor vehicles, pedestrians, and bicycles. Typically, operation is cited in Levels of Service (LOS) that range from A to F. A LOS A represents excellent operating conditions while a LOS F represents very poor operating conditions. In order for the City transportation system to continue to operate safely and efficiently, it is the responsibility of Applicants to minimize and adequately mitigate the traffic impacts of new developments on the system. The City goal is to have its transportation system operate at a minimum Level of Service (LOS) C. However, the City recognizes that at some locations throughout the transportation system, it may only be economically feasible to achieve LOS D.

a. The desirable intersection operation for the City's transportation system is LOS C and the minimum is LOS D. For analysis purposes, this LOS requirement includes each intersection movement, not just the overall average intersection operation.

For developments, there are two basic conditions typically encountered that affect transportation operation.

b. The first condition affects intersections that currently, or which will in the future horizon year, operate without development traffic at LOS C or better. Under this condition, new developments are expected to prevent degradation of LOS to a lower level and/or prevent an increase in delay by more than 25% while maintaining the same LOS at an intersection or an individual approach. City Transportation and/or NCDOT staff will determine if LOS C is a feasible goal to maintain or if LOS D is a more appropriate operational goal. The City Transportation Director shall then make a recommendation to the Development Review Committee (DRC) for consideration. These conditions shall be treated on a case by case basis.

c. The second condition affects intersections that currently, or which will in the horizon year, operate without development traffic at or below LOS D. Under this condition, new developments are expected to prevent any increase in delay and to at least maintain the base condition LOS for an intersection or individual approach.

d. Where a new public street is proposed, the TIA should provide a LOS analysis for all individual movements where the proposed street(s) intersects an existing street. Proposed public streets indicated by the TIA to have an individual movement onto an existing street with a LOS D or lower may not be eligible for public street acceptance.

e. The operation of the Transportation System beyond intersections should also be considered. The calculated existing capacity for many streets throughout Concord is provided in the Cabarrus Rowan Metropolitan Planning Organization's (CRMPO) Comprehensive Transportation Plan (CTP). The level of service based on capacity should be calculated for both

the existing conditions and the build-out and horizon year conditions using Highway Capacity Manual methodologies. The same LOS thresholds apply to street segments as they do to intersections. Applicants are expected to ensure that the streets serving the development have enough capacity to adequately serve the additional traffic added by the development.

The Applicant is responsible for ensuring street segments, intersections and site access control maintain the stated LOS operation for all motor vehicle movements. Driveway permits for developments where transportation impacts are greater than permitted and LOS thresholds are not met may be denied due to inadequate infrastructure.

6.0 TIA REVIEW

6.1 Submittals - The TIA Consultant shall provide at least one (1) electronic and one (1) hard copy of draft and final TIA Reports to the City Transportation Director at PO Box 308, Concord, NC 28026. An electronic copy shall also be uploaded to the respective development application case along with site plans, storm water reports, etc. If a TIA is identified for review by a pre-selected consultant, the Applicant shall also provide the number of hard and electronic copies as required by the review consultant. The TIA Consultant is responsible for providing required copies of TIAs to the NCDOT as applicable. Submittals to the City should include the TIA Submittal Checklist in Appendix H.

6.2 TIA Review - Review of TIAs submitted to the City will be undertaken by City Transportation staff and may be reviewed jointly with, or solely by, a pre-selected consulting firm on behalf of the City. TIAs identified to be reviewed by a consultant will be reviewed by a PE at a consulting firm to be selected by the City. A list of consulting firms pre-qualified by the City for TIA reviews will be identified by City staff following periodic Requests for Qualifications. TIA review consultants may not have a current contract or other agreement related to site design/development or transportation related consulting with the Applicant of the development for which they are conducting the review. All TIAs requiring NCDOT review will also be reviewed by appropriate NCDOT Staff.

a. ***Fees*** – The costs for TIA reviews will be based on review proposal costs requested by City staff of qualified engineering firms. After the scoping process and approval of a scoping document, the City will determine if a TIA will be reviewed by a review consultant, choose a consultant from the pre-qualified list and request a statement of fees for the review of the subsequent TIA. If a TIA is identified to be reviewed by a consultant, a TIA will not be considered submitted and the review will not begin until such time as the Applicant provides payment in full to the TIA review consultant. If, in the review process, additional study revision reviews or meetings are required, supplemental fees may be required by the City/TIA review consultant.

6.3 Review Timelines - The City follows NC GS, Chp. 136, Transportation, § 136-93.1A to align with NCDOT timelines for TIAs.

6.4 Final Approval - The development of the TIA requirements for a specific development request is an iterative process starting with the initial staff communication through the final review. City, and NCDOT staff as appropriate, must give final approval before recommendations will be made to the Planning and Zoning Commission and/or City Council. Once the City and NCDOT have determined the TIA is acceptable the Applicant will be notified by letter that the TIA has been approved.

7.0 STUDY FORMAT

Each TIA needs to be prepared in a consistent manner to assure that all study requirements are addressed and that elected officials and City staff are familiar with study assumptions, procedures, and conclusions. The content of each TIA will vary based on which study type is being required for the development.

7.1 The following general TIA format should be followed. For TIA study types that do not require a certain analysis, such as Future Traffic analysis for Type 1 TIA, that portion of the outline should be omitted.

A. Cover/Signature Page
B. TIA Submittal Checklist
C. Table of Contents
D. Introduction and Executive Summary
E. Proposed Development Description and Site Plan
F. Existing Area Conditions
    1. Roadway and Transportation System
    2. Area Land Uses
    3. Site Access
G. Development Traffic
    1. Trip Generation
    2. Trip Reductions
    3. Distribution
    4. Assignment
H. Future Traffic
    1. Background Traffic Growth
    2. Proposed Off-site Development Traffic
    3. Total Traffic
I. Operation Analysis (without proposed roadway improvements)
    1. Existing Conditions
    2. Build-Out Year Traffic Conditions without Development
    3. Build-Out Year Traffic Conditions with Development
    4. Future Horizon Year Traffic Conditions without Development
    5. Future Horizon Year Traffic Conditions with Development
J. Improvement Analysis (with proposed roadway improvements)
    1. Existing Conditions
    2. Build-Out Year Traffic Conditions without Development
    3. Build-Out Year Traffic Conditions with Development
    4. Future Horizon Year Traffic Conditions without Development
    5. Future Horizon Year Traffic Conditions with Development
K. Crash History and Analysis
L. Turn Lane Determinations
M. Findings
    1. Motor Vehicle
    2. Bicycle/Pedestrian
N. Recommendations
O. Proposed Transportation Mitigation Agreement
P. Technical Appendix
    1. Approved Scoping Document(s) (NCDOT and City)

2. Traffic Count Data
3. Trip Generation/Assignment Calculations
4. Existing Signal Timing Plans
5. Traffic Signal and/or Multi-Way Stop Warrant Analysis
6. Transportation System Management/Transportation Demand Management Mitigation
7. Crash History Analysis
8. Printouts of Operational Level of Service Analysis
9. Pedestrian and Bicycle Level of Service Analysis
10. Other Pertinent Information

For a development where NCDOT requires a TIA, the NCDOT TIA format may be substituted for the outline listed above; however, the TIA should satisfy all requirements of both the NCDOT and the City.

7.2 Content

A detailed summary of the expected content and methodologies to be used in the TIA is given below. Certain contents are dependent on the determined TIA Study Type.

a. ***Cover/Signature page*** – Includes the project name, location, name of the Applicant, contact information for the Applicant, and date of the study. The name, contact information, registration number, signature, and seal of a duly qualified and registered professional engineer in the State of North Carolina are also required to appear on this page. The cover sheet shall also include a statement of compliance with plans, programs, and policies adopted by the City of Concord for maintaining a safe and efficient multi-modal transportation system.

b. ***TIA Submittal Checklist*** – Checklist to help ensure all elements of the TIA are included in the submittal.

c. ***Table of Contents*** – Includes a list of all section headings, figures, tables, and appendices included in the TIA report. Page numbers shall denote the location of all information, excluding appendices, in the TIA report.

d. ***Executive Summary*** – Includes a description of the study findings, a general description of the proposed new development scope, study horizon years, expected transportation impacts of the proposed new development, and mitigation measure recommendations. Technical publications, calculations, documentation, data reporting, and detailed design shall not be included in this section.

e. ***Proposed Development Description*** – Includes a detailed description of the proposed development, including the size of the parcel, development size, existing and proposed uses for the site, and anticipated completion dates (including phasing). It shall also include the square footage of each use and/or the number and size of dwelling units proposed, and a map and copy of the site plan provided by the Applicant.

f. ***Approved Scoping Documents*** – Both the approved City and NCDOT (as applicable) Scoping Documents shall be included in the TIA.

g. ***Site Description*** – Includes a description of the project location within the City and region, existing zoning and use (and proposed use if applicable), and key physical characteristics of the site, including general terrain and environmentally sensitive or protected areas.

h. ***Site Access*** – A complete description of the ingress/egress of the proposed new development shall be explained and depicted. It shall include number of driveways, their locations, distances between driveways and intersections, access control (full-movement, leftover, right-in/right-out, etc.) types of driveways (two-way, one-way, etc.), traffic controls, etc. Internal streets (lanes, flow, and queuing), parking lots, sidewalks, bicycle lanes, and designated loading/unloading areas shall also be described. Similar information for adjacent properties, including topographic grade relationship, shall be provided to evaluate opportunities for internal connections. The design, number, and location of access points to collector and arterial roadways immediately adjacent to the site must be fully analyzed. The number of access points shall be kept to a minimum and designed to be consistent with the type of roadway facility. Driveways serving the site from state roads shall be designed in accordance with the NCDOT's Policy on Street and Driveway Access and/or the City standards, as applicable.

i. ***Study Area*** – The limits of the Impact Analysis Area shall be based on the location, size and extent of the proposed new development, and an understanding of existing and future land uses and traffic conditions surrounding the site. The limits of the Impact Analysis Area for the TIA shall be reviewed and approved by the City and NCDOT staff during the scoping process. At a minimum, the study area shall include all streets and signalized intersections as specified for the determined TIA Study type. Unsignalized intersections between the required signalized intersections will be added to the scope as directed by the City. Related impacts or current operational problems may dictate that other intersections be included in the study area as determined by City staff and/or NCDOT staff. A narrative describing the study area shall identify the location of the proposed new development in relation to the existing transportation system and list the specific study intersections and/or segments. Any unique transportation plans or policies applicable to the area (e.g.CK Rider bus service and future plans) shall be mentioned. A site location map shall be provided and shall identify natural features, major and minor roadways within the study area, study intersections, and a boundary of the proposed new development under consideration.

j. ***Existing Conditions*** – The study shall include a narrative and map that represents AM and PM peak-hour turning-movement volumes for all intersections within the study area.

1. Traffic volumes shall represent 15-minute interval weekday turning-movement counts (Tuesday through Thursday), and shall include heavy-vehicle, pedestrian and bicycle counts. The City and/or NCDOT will determine if modified peak hours or weekend analyses shall be included in the TIA.
2. Traffic counts shall be no more than 12 months old (from the date of initial TIA submittal) and collected:
   - During weeks that have no observed federal, state, or local holidays and periods,
   - During the period when local schools are in session, not to include the first and last week of the academic school year (refer to the local school academic calendar),
   - Outside of time periods for major events such as races or large concert events at the speedway,
   - During the minimum timeframes of 6:30-8:30AM and 2:00-7:00PM,
   - During time periods where normal traffic is present and not potentially altered due to circumstances stemming from voluntary or involuntary travel restrictions, stay at home orders, states of emergency, or other unforeseen situations that may impact typical traffic patterns.

3. At a minimum, 16 hour turning movement counts shall be required to complete the analysis at intersections where a multi-way stop, or traffic signal warrant analysis is included as part of the TIA.
4. Counts taken during or interrupted by significant weather events or traffic incidents may need to be retaken.
5. The source of existing traffic volume data shall be explicitly stated (e.g. new counts collected by Applicant, NCDOT counts, etc.) and records of count data, along with summary sheets for existing turning movement counts should be included in an appendix to the TIA report.
6. A separate narrative and map shall be prepared to describe the characteristics of surrounding roadways, including functional classification, number of lanes, posted speed limit, existing average daily traffic volumes, typical cross section, intersection control, and lineal distance between major roadways. Field notes for the existing conditions investigation may be included in the appendix of the TIA report.

k. ***Development Traffic*** – Trip generation, trip reductions, distribution and assignment should be determined as outlined in sections 5.4-5.6 during the scoping process. These determinations shall be included in the TIA in clear tables and graphic diagrams as appropriate.

l. ***Future Year Conditions*** – Unless otherwise approved by the City and/or NCDOT, future year conditions for a single-phase development shall be analyzed for the year the development is expected to be at full occupancy (build-out year) and five years after the build-out year (build-out + 5). For multiple-phased developments, the scenarios shall be completed in order, with any improvements specified for each phase clearly indicated in each scenario, including five years after the full build-out year (build-out + 5).

   Specific analysis periods to include in the study shall depend greatly upon the proposed new development, proposed project phasing plan, and significant improvements programmed for the surrounding transportation system. Transportation improvements assumed in the future-year background conditions analysis shall be determined during the scoping process and may include those with an expected completion date proximate to that of the proposed new development and funded either by the City, NCDOT, or is the subject of a TMA for another nearby development application. Only projects approved by the City and/or NCDOT during the scoping process may be included in the analysis as future existing infrastructure. Adjacent development traffic information used in the development of the future year background traffic volumes shall be included in the appendix of the TIA report. Unfunded, planned infrastructure projects may be mentioned in the TIA, but the description shall specifically identify that these projects are not included in the background condition. Future year background traffic volumes shall be forecasted using historical growth rate information, regional models, and/or TIA reports for developments approved by the City and/or NCDOT but not yet built. A narrative and map shall be prepared that presents turning movement volumes for each peak hour for all intersections identified within the study area. Future year base traffic volumes, other development volumes, and site traffic volumes shall be indicated and separately identified in the map.

m. ***Operations Analysis (Including Improvement Analysis)*** - The TIA shall include multi-modal operations analyses including vehicular, pedestrian, and bicycle to allow for the safe and efficient travel for all modes. Level-of-Service (LOS) and delay are the primary measures of effectiveness for the transportation system. Operations analyses shall be performed for the existing and all future year scenarios. Impacts from the proposed new development shall be measured by comparing the future year background conditions to the future year build-out conditions, and/or horizon year background conditions to horizon year build-out conditions.

Mitigation measures to address the proposed development's impacts on the transportation system shall be analyzed. Analysis guidelines are generally consistent with NCDOT's *Congestion Management Capacity Analysis Guidelines* which should be used as an additional reference.

1. Analysis Software. Consistent with the NCDOT *Congestion Management Capacity Analysis Guidelines*, for software to be acceptable it must be based on HCM methods. System analysis software should be used for streets and networks of multiple and/or stop/yield-controlled intersections. Simulation Software should be utilized to aid in determining storage lengths, verifying geometry and lane continuity, and to identify overall network operations. Analysis procedures utilizing gap acceptance methodology should be used for roundabout analysis. Turn lane storage lengths and node distances should be appropriately coded into the analysis files. Incorrect storage lengths or node/link distances may impact intersection operations during simulation.

    A. All TIA reports submitted to the City shall use Synchro, SimTraffic, VISSIM and/or Transmodeler analysis software for signalized and unsignalized intersections, or Sidra Software for roundabouts, consistent with NCDOT policies and guidelines.

2. Vehicular Capacity Analysis. Unless additional information, data and/or analyses are indicated in this Article, the vehicular capacity analysis should be consistent with HCM and NCDOT *Congestion Management Capacity Analysis Guidelines*.

    A. Unless otherwise noted, Synchro LOS and delay shall be reported for all signalized intersections and approaches identified in the study area.
    B. Based on HCM, LOS for unsignalized intersections is not defined as a whole; instead, only the individual approaches shall be reported based on the HCM reports determined through the Synchro analysis.
    C. Existing signalized intersections shall be modeled based on existing signal timing plans provided by either the City or NCDOT. Existing signal timing plans shall be included in the appendix of the TIA report.
    D. If a traffic signal is part of a coordinated system, it must be analyzed as such under all conditions.
    E. Other standard practices and default input values for evaluating signalized intersections shall be consistent with the most recent guidelines published by the NCDOT *Congestion Management Capacity Analysis Guidelines*.
    F. The City may also require safety, traffic simulation, gap and/or other analyses appropriate for evaluating a proposed new development. Additional analyses and/or traffic capacity or simulation tools (such as VISSIM or Transmodeler) required for the TIA shall be identified during the scoping meeting.
    G. A narrative, table, and map shall be prepared that summarizes the methodology and measured conditions at the intersections reported in LOS (LOS A – F), the intersection and approach signal delay for signalized intersections, the approach delay for unsignalized intersections, and 95th percentile queue lengths for all movements. Capacity analysis worksheets and auxiliary turn-lane warrants for unsignalized intersections shall be included in the appendix of the TIA report.

3. Queuing Analysis. 95th percentile and simulation analysis of future year queues shall be consistent with NCDOT's Congestion Management Unit current practices and published *Capacity Analysis Guidelines*. Turn lanes and storage lengths at unsignalized intersections shall be identified using volume thresholds published in the NCDOT's Policy on Street and Driveway Access to North Carolina Highways (see Warrant for

Left- and Right-Turn Lanes Nomograph, pg. 80) and/or as warranted in Article III of the City TSM. Recommendations for left and right-turn lanes serving the proposed new development shall be designed to account for both the NCDOT and City warrants described above and to meet future year capacity needs identified through the capacity analyses. For proposed new developments that include drive-through facilities, pick-up/drop-off areas, or entrance gates, a queuing analysis is required to ensure that vehicle stacking will not adversely impact the public transportation system. The queuing analysis must be performed using accepted transportation engineering procedures approved by the City and/or NCDOT. If a TIA is required for a new school site, the internal circulation and ingress/egress of the site shall be modeled using a "dummy signal" in the Synchro software as prescribed by NCDOT Municipal School Transportation Assistance (MSTA) department.

4. Pedestrian and Bicycle LOS Analysis. The TIA should determine the LOS for pedestrians and bicyclists at signalized intersections within the impact analysis area and investigate improvements for intersections which fall below the recommended LOS thresholds in tables 4-1 and 4-2. This analysis should be based on the methodology developed by the City of Charlotte, NC outlined in Appendix G. While this Article does not define LOS calculations or recommendations for mid-block pedestrian crossings, the need for mid-block crossings and any proposed mid-block crossings will be considered on a case by case basis.

5. Planning Level Capacity Analysis. The TIA should include an analysis to determine the LOS for adjacent streets based on current and future capacity. The Cabarrus-Rowan Metropolitan Planning Organization (CRMPO) periodically publishes a Comprehensive Transportation Plan (CTP) Roadway Inventory which identifies the standard capacity, as developed by NCDOT methodology, for streets throughout the planning area. Using these existing capacities along with current ADT traffic volumes the estimated LOS based on a volume to capacity ratio (V/C) should be provided using *Highway Capacity Manual* (HCM) methodology for streets within the impact study area. Daily volumes for many roadways throughout Concord are available at the following NCDOT website: https://connect.ncdot.gov/resources/State-Mapping/Pages/Traffic-Volume-Maps.aspx. If volumes are not available, the Applicant will need to collect them.

6. Improvement Analysis. The TIA should include additional operation analyses which include all identified mitigation measures, transportation improvements, and pedestrian and bicycle improvements for all intersections and individual traffic movements which are determined to not meet the operating requirements and recommendations outlined in the sections 4.2f and 5.8 of this Article. The improvement analyses should also include all recommended traffic signals, multi-way stops, turn lanes, and other identified improvements.

n. ***Crash History and Analysis*** - A summary of crash data (type, number, and severity) for the most recent 3-year period at each study location is required. City and/or NCDOT staff will determine if Collision Diagrams should be included in the TIA during the scoping process. Where available and allowable, Traffic Engineering Accident Analysis System (TEAAS) reports and/or police reports will be provided by the City and/or NCDOT and shall be included in the appendix of the TIA report. For locations with prevalent crash types and/or frequency, a discussion shall be included describing factors that may be contributing to the incidents. At a minimum, the proposed new development shall not contribute to factors potentially involved in the existing crash rates. If contributing factors are identified, recommendations to eliminate or

mitigate these factors shall be included.

o. ***Traffic Signal Warrant Analysis*** - City staff and/or NCDOT may consider potential signal locations during the scoping phase. However, traffic flow progression is of paramount importance when considering a new traffic signal location. A new traffic signal shall not cause an undesirable delay to the surrounding transportation system. Installation of a traffic signal at a new location shall be based on the application of warrants criteria contained in the most current edition of the Manual on Uniform Traffic Control Devices (MUTCD) and engineering judgment. Traffic signal warrants shall be included in the appendix of the TIA report. Additionally, spacing of traffic signals within the City must adhere to NCDOT requirements. Pedestrian movements must be considered in the evaluation and adequate pedestrian clearance provided in the signal cycle split assumptions. If a signal warrant analysis is recommended in the TIA, the City and/or NCDOT may decide to defer a signal warrant analysis until after the proposed new development has opened to allow use of actual turning movement counts at an intersection. The TIA recommendations must clearly state that this analysis shall occur at a specified date following the opening of the proposed new development. The applicant must issue a bond or letter of credit in the name of the City for the estimated cost of the signal warrant analysis and resulting signal prior to final approval of the TIA. The cost shall be established based on an engineer's estimate provided by the engineer of record for the applicant or by the consultant identified by the City; however, final approval of the dollar amount rests with the City.

p. ***Turn Lane Determinations*** – Left and Right turn lanes and storage lengths shall be provided in accordance with the requirements and warrants outlined in Appendix C, Turn Lane Warrants. The NCDOT's *Policy on Street and Driveway Access to North Carolina Highways* should also be used to determine the need for turn lanes and for design guidelines. A summary of turn lane warrants for each intersection should be included in the appendix of the TIA.

q. ***Transportation System Management/Transportation Demand Management*** – The TIA shall contain a section that describes Transportation System Management and/or Transportation Demand Management (TDM) measures that the development will implement to reduce its effect on the transportation system. Examples of TDM measures include staggered work hours, transit subsidies, and carpooling initiatives. The TIA should include supporting materials sufficient to justify the proposed reductions along with measures to be implemented which will ensure the TDM measures are actively practiced once the development is built out. City and/or NCDOT staff will make a determination whether or not any proposed traffic impact reductions resulting from proposed TDM measures will be acceptable based on the provided supporting materials.

r. ***Findings*** – The TIA should include a summary clearly identifying all instances where mitigations are triggered, are to be identified, or are otherwise required or recommended by the City or NCDOT. This includes all intersection approaches and/or turning movements which fall below the indicated acceptable LOS thresholds, all turn lanes, all traffic signals, all multi-way stops, and all other mitigation measures or transportation improvements identified throughout the TIA Process.

s. ***Recommendations*** – The TIA should include a summary indicating recommended mitigation measures and/or transportation improvements for each instance identified in the Findings.

t. ***Proposed Transportation Mitigation Agreement*** – The TIA should include a proposed Transportation Mitigation Agreement identifying all mitigation measures and transportation

improvements the Applicant agrees to provide as a condition of the applicable application approval. All mitigation measures agreed to in the approved TMA must be constructed or implemented prior to approval of the Certificate of Compliance (COC) for a non-phased development. If the proposed development is planned to be completed in multiple phases all mitigation measures agreed to in the approved TMA must be constructed or implemented prior to approval of the Certificate of Compliance (COC) of the second phase, regardless of the total number of proposed phases unless otherwise agreed to in the TMA.

u. ***Technical Appendices*** – The Technical Appendices should include copies of the Approved Scoping Document(s), Traffic Count Data, Trip Generation Data, Printouts of Operational Level of Service analysis, Pedestrian and Bicycle Level of Service analysis reports, Existing Signal Timing Plans, and supporting documentation for Traffic Signal and/or Multi-Way stop analyses and Transportation System Management/Transportation Demand Management mitigation. The appendices should also include any other pertinent documentation or supporting documents along with any other information noted throughout this Article to be provided.

8.0 GLOSSARY

8.1 Definitions

Applicant – Any person, firm, partnership, joint venture, association, corporation, group or organization applying for an applicable development approval.

Access Management–The control and spacing of access points and median openings to minimize traffic conflicts and reduce crashes.

Background Traffic Growth Rate–The annual rate of change in through traffic on principal off-site streets as determined from historical 24-hour average daily traffic volumes or from MPO transportation/land use projection models.

Crash Analysis–A summary of the three-year crash history at street intersections and along roadway segments. Such analysis typically includes measures to mitigate the impact of site traffic based on safety and crash history.

ITE–Institute of Transportation Engineers.

Level of Service (Motor Vehicles)–A quantitative measure of motor vehicle operating conditions based on such factors as delay, speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety.

Level of Service (Pedestrians–Bicyclist)–A qualitative measure of perceived comfort and safety based on such factors as traffic conflicts and intersection enhancements.

MPO–Metropolitan planning organization responsible for regional planning functions as it relates to transportation and land use.

Mode Split–The percentage of site-generated trips that utilize various modes of travel to access a site, such as auto, bus, walk, and bike.

Off-Site Development–Development proposals that have been submitted for the City approval process that are within the TIA study area that may increase traffic volumes on the study area roadway network.

Peak Hour–The single hour of a representative day when the traffic volume on a highway represents the most critical period for operation and the highest typical capacity requirements. Usually considered as the hour with the highest volumes of adjacent street traffic or site-generated traffic.

Planning Capacity–General daily capacity of a street segment based on the typical relationship of daily volume to average system peak-hour volume and traffic composition characteristics.

PTOE–Professional Traffic Operations Engineer as certified by ITE.

Queuing Analysis–An analysis of vehicle stacking and required lane storage lengths.

Study Area–The street network and land use area that encompasses the principal intersections, street segments, and new developments of primary concern in traffic impact analysis.
Traffic Control Device–Any sign, signal, marking, or other device placed or erected for the purpose of regulating, warning, or guiding traffic, pedestrians and/or bicyclists.

TIA–Traffic Impact Analysis

Trip Assignment–The assignment of site plus non-site traffic to specific streets and highways.

Trip Distribution–The allocation of site-generated traffic among all possible arrival and departure routes.

Trip Generation–The number of one-way traffic movements associated with land uses. Factors determining trip generation include use, building size, type of dwelling unit, employees, and land area.

Vehicle Trip–A one-way movement of a vehicle between two points.