CITY OF GASTONIA TRANSPORTATION IMPACT ANALYSIS POLICY MANUAL

Table of Contents

CITY OF GASTONIA
TRANSPORTATION IMPACT
ANALYSIS POLICY MANUAL

INTRODUCTION

The City of Gastonia is committed to establishing an interconnected, multimodal transportation system that increases mobility, safety, connectivity, health, and quality-of-life for its citizens and business owners. A Transportation Impact Analysis (TIA) is one important tool for evaluating the incremental impacts that new development may have on the surrounding public transportation system and it helps local decision-makers evaluate whether a development is appropriate for a site or identify mitigation measures that are necessary to maintain the integrity of the public transportation system.

A TIA may vary in detail and complexity depending on various factors such as project size, type, location, scope, recent development in the area, and other project-specific considerations. Upon initial submittal of any of the applications specified in Section 5.19 of the City of Gastonia Unified Development Ordinance, the Planning Director or his/her designee will determine the need for a TIA. If warranted, the transportation consultant assigned by the City shall prepare the TIA to the requirements set forth herein and any other policies adopted by the City Council for fostering a sustainable public transportation system. At the discretion of the North Carolina Department of Transportation (NCDOT) and the City, a technical memorandum, in lieu of a full TIA report, may be allowed for some developments.

Payment for completing the TIA is solely the responsibility of the applicant.

The intent of this policy manual is to provide a consistent basis by which the City, in coordination with the NCDOT, evaluate transportation impacts within the City of Gastonia. Included in this manual are minimum development thresholds that require a TIA, procedures for completing the TIA process, and requirements for data collection, analysis methodology, and report format. A TIA submitted in conformance with this policy manual shall satisfy the City's requirements for identifying on-site and off-site mitigation; however, the NCDOT reserves the right to request additional information and/or subsequent analyses to satisfy their review requirements independent of the City of Gastonia.

This policy manual moves from the general to the specific for completing a TIA in the City of Gastonia. This policy manual is organized into two main sections: 1) general information for the applicant within the development application review process and 2) expected content and methodologies to be used in the TIA. All users are expected to be generally familiar with the information presented herein; however, the applicant for the development and the assigned transportation consultant are required to consult in detail those sections of this Policy Manual most applicable to their roles in preparing the TIA.

SECTION 1- GENERAL INFORMATION FOR THE APPLICANT

The following information provides the general framework for the TIA process within the City of Gastonia.

Responsibility for Studies

Development Services staff shall determine whether a TIA is required as a part of any development application review and approval process. When required, the TIA must be prepared for the applicant by a duly qualified and registered professional engineer in the State of North Carolina chosen from the City of Gastonia's list of transportation consultants under contract. The list was created through a qualifications based solicitation by the City for professional traffic engineers qualified to perform this service. The applicant has input in the selection of an approved consultant when a TIA is required; however, the final decision on selection is made by Development Services staff. The transportation consultant shall not have had any involvement with the specific development within the 12 months prior to the TIA scoping meeting. The TIA must be approved by Development Services and NCDOT before the development application can move past the concept plan step in the land development process. The TIA and Mitigation Measures Development Agreement described below must be completed and submitted with any application for rezoning before the rezoning may be presented to the Planning Commission or City Council. In those situations where no rezoning is involved the TIA and Mitigation Measures Development Agreement must be completed and approved prior to approval of any initial plan submittal.

Minimum Thresholds for TIAs

A TIA shall be required for any development or redevelopment expected to generate traffic volumes that will significantly impact the capacity and/or safety of the public transportation system. For the purposes of this policy manual, significant impacts are defined for various levels of development activity (rezoning, preliminary and final plats, conditional use permit, or site plan) using expected gross trip generation defined and calculated using data published in the most recent edition of the *ITE Trip Generation Manual.*

A TIA shall be required to accompany any site specific concept plan or application for development approval when expected gross trip generation is **1000 trips or more (entering/exiting combined) in a 24-hour period or 100 trips or more (entering/exiting combined) during either the adjacent road's peak hour(s) or the development's peak hour(s).** This threshold for a TIA is an industry accepted standard from the *Institute of Transportation Engineers' (ITE) Transportation Impact Analyses for Site Development.*

Due to the variety of special circumstances associated with redevelopment, expansion, up fits, and/or change of use applications, Development Services staff will determine the appropriate TIA trip generation threshold calculation method for each case. In general, trip generation shall be measured as the net new base trips generated by the proposed use as compared to trips generated by the current, active use(s) on the site within the most recent six months. Other

development approvals within the most recent five-year period, if not already built and occupied, will be included in the trip generation for the current application unless a separate TIA was performed for the previously approved development.

Notwithstanding the threshold values above, a TIA or Transportation Technical Memorandum shall be required for a site specific concept plan or application for development approval if Development Services staff determines that one or more of the following conditions exist:

- Traffic generated from a non-residential development will significantly impact adjacent residential neighborhoods.
- Traffic operation problems for current and/or future years on nearby streets are expected to be substantially aggravated by traffic generated by the proposed new development.
- Affected major thoroughfares and minor thoroughfares identified in the City of Gastonia Comprehensive Transportation Plan are experiencing noticeable delay.
- Traffic generated from the development is in proximity of a corridor study, area study, or a City project.
- Traffic safety issues exist at intersections or streets that would serve the proposed new development.
- The proposed land use differs significantly from that contemplated in the adopted Comprehensive Land Use Plan.
- The internal street or access system is not anticipated to accommodate the expected traffic generation.
- The proposed site plan includes a building with a fast-food drive-through window. Other drive-through window uses (e.g. pharmacy or bank) shall be determined by Development Services staff based on the overall development plan application.
- The amount or character of traffic is significantly different from an earlier approved study or more than 24 months have passed since completion of the previous transportation study.

Mandatory Scoping Meeting

A mandatory scoping meeting is required, prior to beginning the TIA, to discuss the requirements and strategies for a TIA specific to the site and the proposed development program. Development Services and NCDOT staff, the transportation consultant assigned by the City, and the applicant are required to attend the mandatory scoping meeting. The applicant may invite members of his development team as needed. The mandatory scoping meeting has an upfront cost based on current market values for a TIA and is subject to change. This cost is to be paid in full in order to begin work.

Prior to the meeting, the applicant shall provide a copy of any previous transportation studies prepared for the site and a sketch plan showing the site location and land use(s) and densities, proposed internal circulation, and access point(s) in relation to adjacent properties and public roads. Approximate timelines for project phasing should also be communicated. The information provided will be the basis for discussion during the scoping meeting.

During the scoping meeting, discussion will include confirmation of land use and densities, project phasing, internal circulation, and site access; general distribution of project traffic to the site; proposed internal capture or pass-by capture rates; proposed multi-modal split (if appropriate); determination of the study intersections and the base condition assumptions for the future year, including committed development and transportation projects; and available traffic data and studies.

A memorandum of understanding (MOU) shall be prepared by the transportation consultant assigned by the City documenting the understood scope of the project. The MOU shall be signed by the applicant, Development Services staff, and the NCDOT District Engineer, or his designee, before the assigned transportation consultant can begin work on the TIA. Failure by the applicant to provide accurate information or failure by the assigned transportation consultant to follow the MOU shall result in disapproval of the TIA or a request for additional information.

Study Fee

After the mandatory scoping meeting, the transportation consultant assigned by the City shall submit an estimate of consultant fees for preparing the TIA to Development Services staff who will then forward the cost proposal to the applicant. Upon the applicant' s agreement and payment in full to the City for the projected cost estimate, the City shall release the work to the consultant. Any additional services incurred by the transportation consultant in addition to the MOU must be approved by Development Services staff, and agreed to and paid for by the applicant, prior to performance of the additional work.

Mitigation Measures Development Agreement

Upon completion of the TIA by the transportation consultant, if mitigation is part of an approved TIA, Development Services Staff will prepare the Mitigation Measure Development Agreement to summarize the development plan, phasing, and site access and the improvements required to adequately mitigate the site-specific impacts to the public transportation system. Any ongoing or additional considerations for the development as it moves forward shall be described in this document. The agreement shall be signed by the applicant, Development Services staff, and the NCDOT District Engineer, or their designee. The agreement must be submitted to and approved by the Gastonia City Council in accordance with the provisions of Chapter 160D, Article 10 of the North Carolina General Statutes governing development agreements. Once adopted by the City Council the Applicant will record the Agreement in the Register of Deeds as provided in NCGS 160D-1011.

Final mitigation measures shall be the sole responsibility of the applicant. Provided, however, in those situations where additional public street right of way must be acquired from third party property owners, the City may agree to include provisions in the Mitigation Measures Development Agreement setting forth the conditions under which the City will acquire such public street right of way through negotiation or the use of Eminent Domain, all at the costs of the applicant. The applicant is only required to mitigate transportation deficiencies for their development and not unacceptable background conditions or other deficiencies caused by offsite development within the defined study area. Any deviation from the development features as described in the final TIA, including

but not limited to land uses and site access, must be submitted to the Development Services Staff in writing who will then determine if a TIA revision will be required. All mitigation measures included in the executed Mitigation Measure Development Agreement must be implemented prior to receipt of any certification of occupancy or final plat approval, whichever is appropriate, unless otherwise provided for in a phasing plan that is included in the approved TIA and Mitigation Measures Development Agreement.

SECTION 2 - CONTENTS AND METHODOLOGIES FOR A TIA

1.0 General TIA and Project Information

The following outline shall be used for all TIA reports submitted to the City of Gastonia. All of the required data and information must be clearly identified in the appropriate sections of the report. Text contained in the required chapters shall be comprehensive and complete. A detailed summary of the expected content and methodologies to be used in the TIA are discussed below. The MOU shall be included in the appendix of the TIA report.

1.1 Signature Page

The Signature Page summarizes the name of the project, project 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.

1.2 Table of Contents

The Table of Contents includes a list of all section headings, figures, tables, and appendices included in the TIA report. Page numbers are to specify the location of all information in the report.

1.3 Executive Summary

The Executive Summary of the report provides a clear, concise description of the study findings. It should include a general description of the project scope, study horizon years, study locations, and mitigation measure recommendations. A figure summarizing recommended mitigation measures shall be included. Exclude all technical publications, calculations, documentation, data reporting, and detailed design in this section of the report.

1.4 Introduction

The Introduction to the report identifies the applicant' s request. A scalable, 11" x 17" site plan illustrating the project as proposed at full build-out shall be included with the report. Information presented in the TIA report shall be identical in every respect to the site plan submitted for development approval.

1.5 Project Description

The Project Description is a detailed description of the development, including the size of the parcel, development size, land use of the site, existing and proposed zoning for the site, existing and proposed right-of-way limits, study boundary, and anticipated completion dates (including phasing). This information should include the square footage of each use or the number and size of dwelling units proposed. A study map shall be included that depicts the study area boundaries.

1.6 Site Access

A complete description of the ingress/egress of the site should be explained and depicted. It should include number of driveways, their locations, distances between driveways and

intersections, types of driveways (two-way, one-way, etc.), traffic controls, etc. Internal streets, parking lots, sidewalks and bicycle lanes, and designated loading/unloading areas should also be described. Similar information for adjacent properties should 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 should be kept to a minimum and designed to be consistent with the type of roadway facility. Driveways serving the site should be designed in accordance with the most current NCDOT *Policy on Street and Driveway Access to North Carolina Highways* and/or City of Gastonia Specifications. Photographs documenting the locations of the driveways or roadways could be required by City of Gastonia Staff. Anticipated and required sight distances for the proposed ingress and ingresses shall conform to requirements in Section 6.7 Sight Distance Analysis.

1.7 Adjacent Sites

The site proposed driveways shall be aligned as close as possible with adjacent driveways on the opposite side of the street to create an intersection. Driveway spacing is described in the City of Gastonia Unified Development Ordinance. Driveways to adjacent properties or on the opposite side of the road shall also be shown in the site plan.

2.0 Area Conditions

Describe the roadway networks within the study area. Include descriptions of intersections including the lanes and tum lanes, significant roadways within the study area, sight distance deficiencies, geometric deficiencies, existing prohibitions, speed limits, type of roadway, and other information required by City of Gastonia Staff at the scoping meeting. Also include a description of the roadway network in the TIA including the roadway classification. The NCDOT and FHWA Roadway Classifications are Interstate, Other Freeway or Expressway, Major Arterial, Minor Arterial, Major Collector, Minor Collector, and Local.

2.1 Study Area Limits

Intersections, streets, and the study area limits shall be determined in the scoping meeting and described in the TIA.

3.0 Trip Generation

Trip generation of a development is the total number of trips originating from and destined to the development via all modes of transportation. The most current edition of the Institute of Transportation Engineers' (ITE) *Trip Generation Handbook* should be used to determine the total trip generation for the development. Data limitations, data age, choice of peak hour of adjacent street traffic, choice of independent variable, and choice of average rate versus equation shall be discussed at the mandatory scoping meeting. Local trip generation rates may be acceptable if appropriate validation is provided by the applicant to support them. Other circumstances may include

- ITE land use codes do not accurately describe the development.
- The independent variable falls outside the range of ITE data.
- The ITE land use code has fewer than five data points.
- There is reason to believe that ITE rates do not accurately reflect site-specific trip generation characteristics.

Local trip generation data should be collected at a minimum of three comparable sites. Any deviation from ITE trip generation rates shall be discussed in the mandatory scoping meeting and documented in the MOU if approved by the City and NCDOT.

The appropriate setting/location shall be determined at the Scoping Meeting and used to determine the trip generation. The data is to be provided in a table which summarizes the trip generation by land use for each peak hour analyzed and the associated calculations shall be included in the Appendix. The current NCDOT Municipal School Transportation Assistance (MSTA) calculator shall be used to calculate projected trip generations for school sites.

3.1 Internal Trip Capture

When a development consists of two or more complimentary land uses which provide internal connectivity, internal capture trips are expected to occur within the development and to not enter the external roadway network. ITE internal capture methodology using the most current Trip Generation Handbook published by the Institute of Transportation Engineers should be used to determine the expected internal capture trips for a development. Reductions greater than I0% in any peak hour require consultation and acceptance by City of Gastonia Staff and NCDOT. The internal capture reduction should be applied before pass-by trips are calculated.

3.2 Pass-By Trips

Vehicle trips should be divided into primary and pass-by trips where applicable. Primary trips are trips which originate from and are destined to the proposed development and where the proposed development is the primary destination. Pass-by trips are trips which were already on the roadway network, but stop at the development on route to a primary destination. Upon leaving the development, pass-by trips continue in the same direction from which they entered the development. Pass-by trips should be determined using ITE pass-by trip methodology using the most current Trip Generation Handbook published by the Institute of Transportation Engineers. Pass-by trips associated with the development program may not exceed I 0% of the Future No-Build volume reported for the adjacent public street network. This network shall include the streets that provide primary access to/from the site. A trip generation table shall summarize all trip generation calculations for the project and be located in the Appendix.

3.3 Trip Distribution

External trip distribution shall be determined on a project-by-project basis using one of several sources of information available to transportation professionals. Potential sources for determining project trip distribution may include the regional travel demand model, market analysis, existing traffic patterns, or professional judgment. Regardless of methodology, the procedures followed and logic for estimating trip distribution percentages must be well-documented in the TIA. Trip distribution percentages proposed for the surrounding transportation network should be discussed during the scoping meeting and shall be approved by City of Gastonia Staff and NCDOT before proceeding with the TIA. A map showing the percentage of site traffic on each street included in the study area should be included in the TIA.

3.4 Trip Assignment

Project traffic shall be distributed to the surrounding transportation system based on the site ' s trip generation estimates and trip distribution percentages. Future year build out traffic forecasts (i.e., future year background traffic plus project traffic) shall be presented in both tabular and graphic formats for AM and PM peak hour conditions at all intersections included in the study area. If the

project will be built in phases, traffic assignments shall be reported for each phase. Pass-by traffic shall be included at the driveways and access points for evaluating driveway volumes. Multiple assignment analyses may be required if the traffic control at the access drives varies (i.e., right-in/right-out vs. stop controlled vs. signalized).

3.6 Modal Split

If alternative modes are available and there is enough past documentation to support that alternative modes of transportation are utilized within the study area, document any modal splits for the trip generation calculations. Alternative modes may include transit, taxis, carpooling, light-rail, greenway, bicycles, and pedestrians.

3.7 Trip Reduction Factors

The City of Gastonia reserves the right to determine trip reduction factors for developments that provide infrastructure to promote trips to stay within the boundaries of the site or specific neighborhoods where multi-modal trips are encouraged.

4.0 Traffic Analysis Scenarios

The traffic scenarios to be analyzed in the report are existing conditions, background conditions, and future conditions.

4.1 Background Conditions

The TIA shall include conditions for background or existing conditions in the TIA. The background traffic analysis should include the background growth of the roadway network, trips from approved or nearly approved significant developments within 5 miles of the project site, any upcoming projects on the STIP (State Transportation Improvement Program), existing traffic conditions, existing traffic volumes, traffic signal phasing and timing, on-street parking as applicable, pedestrian accommodations, and multi-modal accommodations.

4.1.1 Study Area Growth Rate

Provide the historic growth of all major roadways within the Study area. Utilize the most current edition of NCDOT's *Policy on Street and Driveway Access to North Carolina Highways* to determine the historic growth rate and its application in the report.

4.1.2 Approved Nearby Site Developments

The City of Gastonia will determine at the scoping meeting about approved developments near the study area to be included in the analysis. All approved developments and their approved mitigations shall be included in the background analysis and evaluated in the report. The City of Gastonia Staff may also require that unapproved significant developments be described with a general impact within the study area, but not quantitatively studied in the report.

4.1.3 Roadway Network Changes

Any recent changes to the roadway network within or near the study area shall be described, and the study should explain any anticipated effects the proposed lane development will have on the recent roadway network changes. These changes could include traffic signal improvements, lane additions or subtractions, road diets, bike lanes, sidewalk, greenways, bus routes, etc.

4.2 Existing Conditions Scenario

The report shall include an existing conditions scenario with the appropriate existing and background information for the analysis.

4.2.1 Peak Hours

The TIA will analyze the Peak Hour (s) as follows in Table 1 below:

Peak Hour Guidelines		
Day of Week	Peak Hour Times	Districts
Tuesday to Thursday	7 AM to 9 AM	All
Tuesday to Thursday	11 AM to 2 PM	CBD Medical District Franklin Commercial District
Tuesday to Thursday	2 PM to 4 PM	School District
Tuesday to Thursday	4 PM to 6 PM	All
Saturday	9AM to4 PM	Franklin Commercial District

(Table 4.2.1)

City of Gastonia Staff may adjust peak hours in Table 1 according to current traffic patterns within the study area. Discuss the findings of the Peak Hours in the report.

4.2.2 Data Collection

Traffic volumes data shall be collected in 15-minute intervals with turning movement counts (Tuesday through Thursday). The traffic volumes and turning movement data shall be no more than twelve months old at the time of the scoping meeting. Traffic volumes will not be accepted if counted outside of the current public school year, on or during weeks of local, state, and federal holidays, extreme or disruptive weather, local emergencies that affect traffic conditions, major incidents that cause significant congestion during the study period, or during a week with a major event. The City of Gastonia Staff may not permit traffic counts to be used in the study if provided from Thanksgiving to New Year's Day. The traffic volume s shall be counted from Tuesday thru Thursday and other days specified by City of Gastonia Staff. Traffic Counts shall be no older than 12 months unless otherwise specified. The Appendix shall include traffic count summary sheets including turning movements, truck and bus counts, bicycle counts, and pedestrian counts. City of Gastonia Staff may require 13-hour traffic counts in the report. The traffic counts will be completed by method of video based vehicle counting systems or as otherwise directed by the City of Gastonia Staff.

Traffic volume s along corridors should be balanced to account for variations in the counts. Balancing should be balanced with no loss of volume between intersections which have no driveways between them and within 5 percent where a sufficient number/type of driveways exist between the study intersections.

4.3 Future Conditions

The report for future conditions shall include a no build scenario, a build scenario, a build scenario with mitigations, and a build scenario five years after completion of the site. All analysis scenarios shall include existing traffic volumes, traffic signal phasing and timing, background growth, and all approved development s. The analysis shall take into consideration any improvements to the roadway network that will be in place by the build-out year, five years after build-out as applicable or staged build-out indevelopment, as necessary. Transportation improvements assumed in the future-year background conditions analysis may include those with an expected completion date concurrent with that of the development and funded through either by the City of Gastonia, the NCDOT Transportation Improvement Program, and/ or indicated as a required condition of approval from another nearby development application. Only projects approved by the City at the scoping meeting may be included in the analysis as future existing infrastructure. Historic growth rates shall be applied to the existing traffic counts as applicable. A narrative and map shall be prepared that presents turning movement volumes for each peak hour for all intersections identified within the study area.

4.3.1 Future No Build Conditions

The TIA shall include conditions for all study intersections for the year the development is expected to be at full occupancy. The No Build Conditions will analyze the future traffic volume and planned transportation improvements absent the development. This scenario will set the baseline for comparison to determine site impacts and mitigations.

4.3.2 Build-Out Conditions without Mitigation

The TIA shall include conditions for all study intersections for build out conditions without any improvements within the study area related to the site.

4.3.3 Build-Out Conditions with Mitigation

The TIA shall include conditions for all study intersections for build out conditions with the proposed mitigation improvements within the study area related to the site. The mitigations utilized in the study should only include mitigations that the site developer, the City, or NCDOT will construct by the completion of the site as well as requirements stated in Section 4.3 Future Conditions.

4.3.4 Build-Out Conditions with Mitigation in Five Years

The TIA shall include conditions for all study intersections for the build out conditions with the proposed mitigation improvements within the study area related to the site after five years of the opening of the site. Document any adverse effects in the report. No mitigation or improvements are required from site 's impacts on traffic for the five year build-out analysis. See Section 4.3 Future Conditions for the analysis requirements.

4.3.5 Full Build Out in Multiple Phases

For project with multiple phases, the scenarios should be completed in order, with any improvements specified by development included in the subsequent build scenarios, including five years after the full build-out year. Specific analysis periods to include in the study shall depend greatly upon the development program, proposed project phasing plan, and significant improvements programmed for the transportation system. The analysis periods shall be determined at the Scoping Meeting.

4.4 Traffic Signals

The capacity of intersections shall be measured by the Level of Service (LOS), the delay in seconds, queuing of vehicles in feet, and the volume to capacity ratio. The level of service, delay, and volume to capacity ratio are defined in the most current edition of the Highway Capacity Manual. Queuing analysis will depend upon blockages of intersections and notable excessive queue lengths determined acceptable by City of Gastonia Staff.

Unless otherwise specified by City of Gastonia Staff, Synchro LOS, delay, volume to capacity ratios, and 95th queuing analysis shall be reported for proposed and existing signalized intersections and approaches. For unsignalized existing and proposed intersections and approaches, the LOS, delay, and volume to capacity ratio shall be analyzed utilizing methods in the current edition of the Highway Capacity Manual. Traffic signals shall be analyzed under coordinated conditions if the existing traffic signals are coordinated. Other standard practices and default input values for evaluating signalized intersections should be consistent with the most recent guidelines published by the NCDOT, Traffic Engineering and Safety Systems Branch, Congestion Management Unit ("Capacity Analysis Guidelines").

City of Gastonia Staff may also require additional analysis for safety, traffic simulation, gap, or other types of analysis for the site. Synchro Software and VISSIM are expected to analyze traffic signals in the report unless it is necessary to analyze the intersections in another software as specified above or in the current *NCDOT Congestion Management Capacity Analysis Guidelines* and/or the current edition of the *NCDOT Policy on Street and Driveway Access to North Carolina Highways Manual.* The types of analysis, analysis tools, and software will be agreed upon at the project scoping meeting.

All TIAs submitted to the City of Gastonia shall use the following software: Synchro, SimTraffic, VISSIM Software, or Transmodeler Software for signalized and unsignalized intersections, and Sidra Software for roundabouts. The software used in the TIA shall conform to current NCDOT polices specified in the *NCDOT Congestion Management Capacity Analysis Guidelines* and/or the current edition of the *NCDOT Policy on Street and Driveway Access to North Carolina Highways Manual.*

A narrative, table, and map shall be prepared that summarizes the methodology and measured conditions at the intersections reported in level of service (LOS A- F), intersection and approach signal delay for signalized intersections, approach delay for unsignalized intersections, and 95th percentile queue lengths for all movements. Capacity analysis worksheets and auxiliary turn lane warrants for unsignalized intersections should be included in the appendix of the TIA report.

Include an analysis of traffic signals that could be replaced with a two-way or multi-way stop controlled intersection.

4.5 Turn Lane Warrants

Turn lane storage needs shall be identified based on projected turning volumes and AASHTO analytic techniques and by the criteria below:

- Determination of turn lane storage lengths for signalized intersections shall be based on the SimTraffic Maximum Queue or Synchro 95th Percentile Queue, whichever is greater.

- Determination of tum lane storage lengths for unsignalized intersections shall be based on the Warrant for Left and Right-Tum lanes graph published by the most current North Carolina Department of Transportation manuals.
- Recommended storage lengths should be rounded up to the nearest 25 feet with a minimum of 100 feet for a right- or left-turn lane.

Appropriate documentation of the calculations must be provided.

4.6 Traffic Signal Warrants

Traffic Signals could be one of the mitigation items that is necessary to reduce the impact of the site on existing traffic volumes. Progression of traffic within the roadway network should take precedence over installing a new traffic signal. If a new traffic signal may be needed to mitigate the effects of the site development the 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 current 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 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 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 the transportation consultant assigned by the City; however, final approval of the dollar amount rests with the City.

Conversely, the study should use the current MUTCD Traffic Signal Warrants to evaluate intersections that may not meet the criteria to continue to operate as a signalized intersection within the study area.

4.7 Queuing Analysis

The 95th percentile and simulation analysis of future year (s) queues shall be consistent with NCDOT's Traffic Engineering and Safety Systems Branch, Congestion Management Unit current practices and most current published NCDOT *Capacity Analysis Guidelines.* Tum lanes for unsignalized driveways serving the site shall be identified using volume thresholds published in the current edition of the NCDOT's *Policy on Street and Driveway Access to North Carolina Highways* and from the queuing analysis. Recommendations for left and right tum lanes serving the site shall be designed to meet future year(s) capacity needs identified in the TIA report.

For site developments that include drive-through facilities or entrance gates, a queuing analysis shall be required to ensure that vehicle stacking will not adversely impact the transportation system. The queuing analysis shall be performed using accepted transportation engineering procedures including NCDOT and ITE methods. This analysis shall be required for all fast-food drive-through uses.

When NCDOT requires a TIA for a new school site, the consultant shall model the internal circulation and ingress /egress of the site using a "dummy signal" in the Synchro software as required by NCDOT Municipal School Transportation Assistance (MSTA) department.

Include maps and figures showing the extent of the queues at each major study intersection.

4.8 Other Observed Intersection Deficiencies

Include any geometric and intersection deficiencies that currently exist within the study area that may contribute to existing conditions. Also, if warranted by engineering judgment, determine in the study whether an existing traffic signal could be removed and replaced with a two-way or four-way stop controlled intersection.

4.9 City of Gastonia Applicable Plans

All TIA reports must include a statement of compliance with all plans, programs, and policies adopted by the City of Gastonia, Gaston County, and the GCLMPO (Gaston Cleveland Lincoln Metropolitan Planning Organization) for maintaining a safe and efficient multi-modal transportation system.

5.0 Mitigation

This section of the TIA report shall provide a description of the study' s findings regarding impacts of the proposed project on the existing and future transportation system and describe the location, nature, and extent of all mitigation measures identified to improve and/or maintain the future year background conditions level-of-service (LOS), delays, queuing, and volume to capacity ratios through phasing and ultimate build-out of the project. This mitigation will be based on the build-out year scenario.

5.1 Traffic Signal Conditions

The applicant is required to mitigate transportation deficiencies caused solely by the projected impact of their proposed development, and not unacceptable background conditions or other deficiencies caused by offsite development within the defined study area. The applicant shall be required to identify mitigation improvements to the roadway network if at least one of the following conditions exists when comparing future year no-build conditions to future year build conditions:

- the total average delay at an intersection or individual intersection approach increases by 25% or greater, while maintaining the same LOS,
- the LOS degrades by at least one level,
- the LOS is "D" or worse in no build conditions and the proposed development shows a negative impact on the intersection or approach,
- Or an increase to the Volume to Capacity Ratios are more than the allowable thresholds shown below:

Volume to Capacity Ratio	
Volume to Capacity Ratio	Increase of Volume to Capacity Ratio
0.00 to 0.60	0.1
0.61to 0.70	0.07
0.71to 0.80	0.05
0.81 to 0.90	0.03
0.91 to 1.00+	0.02

(Table 5.1)

If the future year no build LOS (intersection or approach) (i.e., " D," "E," or F"), *V/C* Ratio (i.e. > 0.90), or delays of more than 35 seconds for signalized intersections and more than 25 seconds for stop controlled intersections are inadequate, the applicant will be expected to mitigate only the impact caused by the proposed project. The City of Gastonia generally will not accept optimization of existing traffic signals or phase changes as acceptable mitigation. City of Gastonia Staff and NCDOT will review the recommendations in the final version of the TIA and will have the ultimate determination in the scope of the required mitigation measures.

For multi-phase developments, the capacity analyses scenarios shall address the phasing of improvements for each phase of development. The build-out+ 5 scenario will require the analysis of only five years beyond the full build-out year. The build-out scenario after five years' analysis is not used for mitigation purposes. A narrative and table shall be prepared that summarizes the methodology and measured conditions at the intersections reported in LOS (LOS A-F), average control delay, queuing, and volume to capacity ratios for each intersection and approach.

A narrative and map shall also be prepared that describes and illustrates recommended improvements, by development phase if necessary, for mitigating the projected impact of the proposed development.

5.2 Queuing Conditions

The TIA analyzes queuing according to the conditions described in Section 4.7 Queuing Analysis. Mitigation due to queuing is required for the following conditions:

- Increase of 50' or more in queue length between future year build and no build
- 95u, Percentile Queue or Maximum Queue exceeds storage for tum lanes
- Build-out scenario queues lead to blocked or nearly blocked intersections during Peak Hours
- Left-tum and/or right-tum lane warrants are met or within the taper regions of the warrant analysis per current NCDOT's *Policy on Street and Driveway Manual Access to North Carolina Highways*
- As defined by City of Gastonia Staff

5.3 Mitigation Alternatives

The City and NCDOT may permit the installation of a roundabout as an alternative to a traffic signal. The City of Gastonia may also consider additional innovative alternatives to a traffic signal. Use the most current version of SIDRA Software to analyze the roundabout.

6.0 Supplementary Traffic Analysis

The supplementary traffic analysis may include, but not limited to Crash Data, Site Circulation, Site Parking, Site On-Street Parking, 85[111] Percentile Speeds, Traffic Calming, Sight Distance Analysis, Multi-Modal Analysis and Complete Streets.

6.1. Crash Data

A summary of crash data (type, number, and severity) for the most recent 5-year period at each study location is required. The proposed development shall not contribute to factors involved in collision rates. If contributing factors are identified, recommendations to eliminate these features

shall be included. The City requires standard HISP data from NCDOT in summary form, but reserves the right to require collision diagrams or safety studies of high accident intersections.

6.2 Site Circulation

Include the proper turning template for commercial and/or industrial site developments for trucks, buses, or City of Gastonia essential vehicles that may need to access the site. Also show and describe how vehicles will flow through the site. Identify any conflicts within the site and at existing roadways in the network.

6.3 Site Parking

Analyze the need for parking and use the standard parking rates for the site according to the current ITE Parking Manual and the City of Gastonia Unified Development Ordinance.

6.4 Site On-street Parking

Analyze the parking needs in residential and mixed use developments. Proposed parking spaces shall be only permitted on one side of the street for City standard streets standard defined in the Unified Development Ordinance. On-Street parking on both sides of the street may be permitted by the City of Gastonia depending upon the proposed street widths and application of any Complete Streets guidelines and policies.

6.5 85th Percentile Speeds

Document the 85th percentile speeds on roadways within the study area if directed by the City of Gastonia Staff at the Scoping Meeting. Ensure new public streets are constructed to limit speeds to 25 mph unless otherwise directed by the City of Gastonia Staff.

6.6 Traffic Calming

Propose traffic calming measures for City of Gastonia owned streets that are affected by the development. Also include traffic calming measures on any new public streets that are projected to handle 400 AADT. The traffic calming methods could include, but not limited to speed humps, chicanes, roundabouts, raised intersections, chokers, and center island narrowing.

6.7 Sight Distance Analysis

Include a detailed analysis and include site distance measurements of proposed ingress/egress access points according to the most current AASHTO Publication, *A Policy on Geometric Design of Highways and Streets* and/or NCDOT's *Policy on Street and Driveway Manual Access to North Carolina Highways*. The City reserves to right to require sight distance at additional intersections within the study area.

6.8 Multi-Modal Analysis

The City of Gastonia Staff may require a multi-modal analysis of the site and the roadway network. Some aspects of the multi-modal analysis may include existing or need for bicycle facilities, existing greenways and their potential access to the site, existing transit routes near the site, walkability and pedestrian access near and at the site, and potential trip generation reduction factors and parking reduction factors based upon the modes of transportation accessing the site.

6.9 Complete Streets

When applicable, incorporate complete streets guidelines for the design of the streets within the site. Please see the current edition of the NCDOT's *Complete Streets Policy Guidelines* and NACTO's *Urban Street Design Guide* for additional information on complete street designs.

7.0 Recommendations

This section of the report shall provide a clear, concise description of the study's findings regarding impacts of the proposed project on the existing and proposed transportation system and describe the location, nature, and extent of all mitigation measures recommended to the applicant to improve and/or maintain the future year no build level of service (LOS) conditions through phasing and build-out of the project. The applicant is only required to mitigate transportation deficiencies for their development and not unacceptable background conditions or other deficiencies caused by offsite development within the defined study area.

For multi-phase developments, the capacity analyses scenarios shall address the phasing of improvements required to provide an acceptable level of service with each phase. A narrative and table shall be prepared that summarizes the methodology and measured conditions at the intersections reported in level of service (LOS A- F) and seconds of stop delay. A narrative and map shall also be prepared that describes and illustrates recommended mitigations, by phase if necessary, for maintaining the integrity of the transportation system. Timing, scope, and transportation consultant cost of any deferred analysis should be clearly described. The recommendation should end with a statement by the duly qualified and registered professional engineer in the State of North Carolina responsible for the TIA that indicates whether or not the proposed project will meet minimum standards described herein through build-out of the project. City of Gastonia Staff and NCDOT will review the recommendations in the final version of the TIA and will have the ultimate determination in the scope of the required mitigation measures. The TIA shall be approved if the recommendations from the report will adequately mitigate the site-specific impacts to the public transportation system. Final mitigation measures shall be the responsibility of the applicant unless otherwise determined by City of Gastonia Staff and NCDOT.

8.0 Appendices

The City of Gastonia requires the following documents in the Appendix: Scoping Forms, Site Plan, Growth Rate Calculations, Zoning Maps, Trip Generation Figures, Calculations, and Tables, Traffic Volume Figures, 95^{111} Percentile Queuing Figures, Crash Data (Diagrams and/or Data), Traffic Counts, Queuing, Delay, and LOS Summary Tables, Synchro Analysis Existing Conditions, Synchro Analysis No Build Year, Synchro Analysis Build Out Year and Sight Distance Worksheets.

The following items are to be included in the Appendix per direction of City of Gastonia Staff: Parking Analysis Tables, Synchro Full Build Out, Traffic Signal Warrants, Multi-way Stop Controlled Intersection Warrants, Right and Left Turn Warrants, Site Truck Turning Templates, and Multi-modal Infrastructure near the site (Greenways, Bus Routes, etc.).

9.0 Glossary of Terms

AASHTO - American Associate of State Highway and Transportation Officials

AADT-Average Annual Daily Traffic

Arterial - A roadway for through traffic linking major traffic generators and communities to regional highway facilities

Chicane - is a series of horizontal deflections (usually three in a row) installed on an otherwise straight road to create an "S" shaped traffic lane

Choker - an isolated narrowing of one or several traffic lanes created by the installation of horizontal deflections in the center or on the sides of the road.

Complete Streets - streets designed and operated to enable safe use and support mobility for all users. Those include people of all ages and abilities, regardless of whether they are travelling as drivers, pedestrians, bicyclists, or public transportation riders. Manuals are published by professional organizations, states, and the Federal Highway Administration.

Egress - driveway for traffic exiting the site

Franklin Boulevard Commercial District - Area of Shopping Centers located on Franklin Boulevard between New Hope Road and Red Bud Drive

Freeway - A divided highway for through traffic with full control of access using grade-separated interchanges exclusively for access

Ingress - driveway for traffic entering the site

ITE - Institute of Transportation Engineers

Level of Service (LOS) - A qualitative measure using a sequence of letters from A through F to describe the quality of operational conditions within an intersection, roadway link or corridor.

Major Arterial - A principal roadway that carries a high volume of traffic for long distances and distributes traffic to minor arterials and collector streets

Major Collector - A street that links local streets to arterial roadways which carries residential and some commercial traffic between local streets and arterials which contain between 3 and 5 lanes of traffic.

Minor Arterial - A principal roadway that is shorter in length and carries fewer cars than the major arterial. The roadway carries more short distance trips.

Minor Collector - A street that links local streets to arterial roadways which carries more residential traffic and is generally contains two lanes of traffic

Medical District - Area of Medical Offices and the Caromont Hospital located on Court Drive between New Hope Road and Cox Road

Mitigation - required improvements that will offset the negative effects on the roadway network from the development

Modal Split - The percentage of people using a particular means of transport, such as auto, transit, bicycle or walk, to make a trip

MOU - Memorandum of Understanding

Multi-Modal- available transportation infrastructure that considers various modes (walking, cycling, automobile, public transit, etc.) and connections among modes

NACTO - National Association of City Transportation Officials

NCDOT - North Carolina Department of Transportation

No-Build Traffic - In a TIA, existing traffic in accordance with recent traffic counts+ traffic generated by pipeline development + growth in through traffic on the current road network, all assigned to the existing and proposed roadway network

Pass-by Trip - trips already on the roadways immediately adjacent to the site, but altering their path at the driveway to visit the site

Peak Hour - Highest volume of traffic in a continuous 60 minute period. May be referred to as AM or PM peak hour, which represents the highest volume hour for both the morning and evening periods, or Saturday or afternoon peak (for schools).

Primary Trip - trips where the motorist's only goal in getting the vehicle was to come to the development and then return to where they came from.

Raised Crosswalk - facility designed to make crossing the road easier for pedestrians and which typically raises the pavement to the level of the sidewalks

Raised Intersection - an intersection where the pavement has been raised relative to the level of the roads leading to it

Schoo l District - An area defined as within a radius l.0 mile of a public or private K-12 school

Sight Distance - This is the area that establishes a clear line of sight for a waiting vehicle to see oncoming traffic and make turning movements into or out of a street or driveway connection safely or for traffic to see entering or waiting vehicles

Storage Area - Space used by queuing vehicles while being served or until service begins.

Traffic Calming- uses physical design and other measures to improve safety for motorists, pedestrians and cyclists. It aims to encourage safer, more responsible driving and potentially reduce traffic flow

Traffic Impact Analysis (TIA) - The assessment of site traffic impacts and mitigation alternatives based on traffic forecasts and analysis techniques described in these Guidelines

Trip - A single or one direction vehicle movement with either the origin or destination inside the site

Trip Assignment - The process of allocating vehicle travel generated by a land use to/from each link of the roadway network

Trip Distribution - a model of the number of trips that occur between each origin zone and each destination zone. It uses the predicted number of trips originating in each origin zone (trip production model) and the predicted number of trips ending in each destination zone (trip attraction model)

Trip Generation - The process of estimating the number of vehicle trips originating from or destined for the uses on a land parcel

Video Based Vehicle Counting System - traffic counting method that uses video cameras in the field to record traffic and analyzed later by viewing the footage from the cameras

Volume-to-Capacity Ratio (V/C) - A performance measure computed using the ratio of an actual roadway volume to the capacity of a roadway link

85th Percentile Speed - the speed at or below which 85 percent of all vehicles are observed to travel under free-flowing conditions past a monitored point

95th Percentile Queue - queue length (in vehicles) that has only a 5-percent probability of being exceeded during the analysis time period. It is a useful parameter for determining the appropriate length of tum pockets, but it is not typical of what an average driver would experience.