

29.08 TRANSPORTATION IMPACT STUDIES

29.08.010 Transportation Impact Study

The Transportation Impact Study (TIS) will assess the impacts of proposed development on the existing and planned street system. Comprehensive and coordinated transportation planning is critical to providing a balanced transportation system. The application of sound design principles for new streets, preserving street capacities in existing areas, ensuring smooth traffic flow, accommodating all transportation modes, and preserving or increasing safety are part of the TIS. To evaluate the impacts of development proposals on the transportation system, a professionally prepared TIS shall be required. This chapter provides standards for the preparation of a TIS. In addition, the following documents shall be referenced for more detailed information:

- (a) Street Classification Map, figure 3 in the [Grand Junction Circulation Plan](#), or on the Grand Junction Circulation Plan and the Street Classifications layers on the [Grand Junction GIS Transportation Map](#).
- (b) [Mesa County Functional Classification Map](#)
- (c) [City of Grand Junction Standard Contract Documents for Capital Improvements Construction](#)
- (d) [Pedestrian & Bicycle Plan](#)
- (e) Mesa County Transit Design Standards and Guidelines
- (f) [Corridor Guidelines](#)

For Projects with direct or indirect access onto a state highway.

- (a) [CDOT State Highway Access Code](#)
- (b) [CDOT Roadway Design Manual](#)

The primary responsibility for assessing the transportation impacts associated with a proposed development rests with the developer, and including but not limited to the City, County, Colorado Department of Transportation (CDOT) or Regional Transportation Planning Office (RTPO) which operates Grand Valley Transit (GVT) serving in a review capacity.

29.08.020 Procedure

The following required steps describe the procedures required for the preparation and submittal of a TIS. This process can be altered slightly depending on the complexity of the project:

- (a) General Meeting or Pre-Application Meeting
- (b) Determination of Base Assumptions
- (c) Submittal
- (d) Review Agency Comments and Recommendations

29.08.030 General Meeting or Pre-Application Meeting

As a general rule, a TIS shall be required for all land use applications for new development in the City and as required by **Mesa County** Land Development Code. The requirement to prepare a TIS - or portions of a TIS - may be waived by the Transportation Engineer if the peak hour vehicle trip generation of the proposed project is less than 100 trips.

If the peak hour vehicle trip generation is estimated to be between 10 trips and 99 trips and the TIS requirement is waived by the Transportation Engineer, the applicant may still be required to complete a Traffic Assessment to determine if turn lanes are needed and if the proposed circulation serves pedestrians, bicyclists, and access to transit. A Traffic Assessment may include the following portions of a TIS: 1) Project Description, 2) Trip Generation, 3) Site Design and Circulation Evaluation, 4) Turn Lane Warrant Analysis, 5) Sight Distance Evaluation, and 6) Pedestrian and Bicycle Analysis.

If the applicant can demonstrate to the satisfaction of the Transportation Engineer that no other concerns exist with the transportation aspects of the proposed project, then a memo shall be prepared by the engineering consultant documenting the trip generation and safety improvements of the project and conclusions of the TIS.

The peak hour trip threshold of 100 is consistent with the Colorado Department of Transportation (CDOT) thresholds for requiring impact studies on state highways. The peak hour trip threshold of 10 – 99 for completing a Traffic Assessment is also consistent with CDOT thresholds on state highways. The methodology documented in the current edition of the [*Institute of Transportation Engineers' \(ITE\) Trip Generation Manual*](#) should be used to identify the peak hour vehicle trip generation rates for a project. The current edition of *ITE Trip Generation Manual* is adopted and incorporated by this reference.

The applicant shall provide, to the Development Engineer and the Transportation Engineer, information regarding:

- (a) The project including type of land use (single family, townhomes, multi-family, office, retail, etc.) and size (number of dwelling units, square footage, etc.).
- (b) The project site plan showing all proposed access locations and proposed land uses in relation to the accesses.
- (c) Anticipated project completion date and project phasing.
- (d) Any other information necessary or required to evaluate the project.

The appropriate agencies shall review the project information and provide comments regarding transportation issues including, but not necessarily limited to, accesses (locations/type), impacts on adjacent neighborhoods, the size of the study area and the study methodology.

29.08.040 Determination of Base Assumptions

The consultant preparing the TIS shall complete the Base Assumptions form (see Appendix). The Transportation Engineer will evaluate the TIS. The assumptions, once approved, shall confirm the base parameters and assumptions to be utilized by the traffic consultant in preparation of the TIS.

A Base Assumptions Form shall specify:

- (a) Study Area Boundaries
- (b) Study Years
- (c) Future Traffic Growth Rates
- (d) Study Intersections
- (e) Time Period for Study
- (f) Trip Generation Rates
- (g) Trip Adjustment Factors
- (h) Overall Trip Distribution
- (i) Mode Split Assumptions
- (j) Committed Roadway Improvements by other projects, CDOT, Grand Junction and Mesa County
- (k) Other Relevant Transportation Impact Studies

(I) Areas Requiring Special Study

29.08.050 Pedestrian & Bicycle Analysis

As part of the Pedestrian and Bicycle Analysis the Applicant shall complete the Pedestrian & Bicycle Analysis Worksheet (see Appendix) and document the existing conditions of adjacent pedestrian and bicycle infrastructure. The Pedestrian and Bicycle Analysis Worksheet is intended to identify impacts (if any) and potential mitigations (if needed) to existing or planned pedestrian and bicycle infrastructure by the proposed development. A transportation engineer is not required to complete the Pedestrian and Bicycle Analysis Worksheet.

Documentation of the existing pedestrian and bicycle infrastructure should include the following areas near the development:

- (a)** Pedestrian and bicycle infrastructure adjacent to the proposed development.
- (b)** Pedestrian and bicycle infrastructure between the proposed development and the nearest adequate facilities if there are no or substandard pedestrian or bicycle facilities adjacent to the development.
- (c)** Pedestrian and bicycle infrastructure to destinations within a quarter mile of the development that will likely generate pedestrian or bicycle trips (such as grocery stores, transit stops, housing, employment centers, recreational facilities, services, and schools).

As part of this analysis the Applicant shall identify missing or substandard pedestrian and bicycle infrastructure by specifically noting the following conditions for each.

For pedestrian infrastructure:

- (a)** Pavement width
- (b)** Pavement condition
- (c)** Pavement material
- (d)** Whether the walkway is attached (directly adjacent to the street), detached (separated by a landscaped or hardscaped buffer), part of a multiuse trail independent of a street, or missing.
- (e)** Width of the buffer (between the sidewalk and the street) as applicable.
- (f)** Presence of obstructions in the walkway (such as street poles, etc.).

- (g) Presence of pedestrian crossings and whether they are marked or unmarked, controlled (by a stop sign or signal) or uncontrolled.
- (h) ADA compliance of pedestrian ramps at crossings.
- (i) Number of conflicting driveways and lengths.

For bicycle infrastructure:

- (a) Presence of a bicycle facility and type of facility (Bicycle facilities are defined by the Pedestrian and Bicycle Plan and described in section 29.48 Transit, Bicycle, and Pedestrian Facilities of the TEDS Manual.)
- (b) Width of the bicycle facility and width of the buffer if applicable

Pedestrian and bicycle standard widths and buffers by street type or context can be found in Chapter 29.20 for Local, Industrial, and Commercial Streets, and 29.28 for Collector and Arterial Streets, and Trails.

The analysis shall also discuss how pedestrians and bicyclists would access the proposed project to/from the adjacent neighborhood(s), and the need for special facilities to enhance pedestrian and bicycle connectivity.

The Pedestrian & Bicycle Analysis Worksheet (which can be found in the Appendix) will also identify existing pedestrian and bicycle facilities that may be impacted by the development and the extent of the impact, such as whether those facilities will result in an improvement, degradation, or no change to pedestrian and bicycle facilities. The form will also identify whether there is a proposed bicycle facility identified in the Pedestrian & Bicycle Plan on or adjacent to the proposed development and whether the development will impact the planned bicycle facility.

The form will also identify whether the proposed development is within an existing or planned shared micromobility zone as identified by the city. If so, the applicant should identify how the proposed development will include or accommodate storage space for shared micromobility devices. Similarly, the form will identify if the proposed development is within an overlay zone and whether the site plan is within compliance of the pedestrian and bicycle elements of the overlay zone.

29.08.060 Submittal

Copies of the TIS shall be submitted to the City Community Development or **County Planning Department**, as part of the required planning information. Revisions to the TIS shall be made as required if:

- (a) Necessary to have a complete TIS; or
- (b) When changes to the development necessitate additional revisions to the study. Electronic files of capacity analyses must be submitted with the TIS.

29.08.070 Review Agency Comments and Recommendations

The review agency or designee shall analyze, evaluate and/or review the TIS according to the adopted standards. Evaluative comments concerning the TIS shall be forwarded to the Project Planner. The Project Planner shall provide all review agency comments to the applicant. As a result of the engineering review the applicant may be required to:

- (a) Perform and submit supplemental analyses and/or address specific transportation issues or;
- (b) Prepare, perform, and submit a new study. Engineering review, shall to the extent practicable, cite references to this Manual, the Code, laws, rules, or regulation deficiencies in the TIS.

Review and evaluation of TISs are, and shall be, initially and principally based on local conditions and community expectations as articulated by local government and its officials. An example of such a local expectation is that eliminating existing left-turn phasing of a traffic signal at a nearby impacted intersection would not be a satisfactory solution to improving traffic level of service at that intersection.

If the TIS is based on assumptions that conflict with local conditions, and/or community expectations which may affect the usefulness or predictions proven by the TIS, the TIS will be rejected.

29.08.080 Transportation Impact Study Report Contents

A Colorado licensed professional engineer shall prepare the TIS. The engineer shall have experience in traffic and transportation engineering. A statement of qualifications must be included in the submitted study. Certification as a Professional Traffic Operations Engineer by the [*Institute of Transportation Engineers*](#) is preferred. Each TIS shall address:

- (a) Project Description
- (b) Existing Conditions
- (c) Future Background Traffic Projections

- (d) Project Traffic
- (e) Total Traffic Projections
- (f) Future Total Traffic Projections
- (g) Site Circulation and Design Evaluation
- (h) Transportation Impact Analysis
- (i) Mitigation Measures
- (j) Neighborhood Transportation Impact Analysis
- (k) Conclusions
- (l) Recommendations
- (m) Any other information necessary or required to evaluate the project

29.08.090 Project Description

A description of the proposed project shall be prepared and include the type of land use and size of the proposed project, generally known as density and intensity. Intensity may be described in terms of floor area ratio or square footage of proposed development. Phasing plans shall be proposed, including the anticipated completion date. The proposed site plan shall be included; the site plan shall include a description of all proposed vehicular access locations, dimensions, and movements. The project description shall include how pedestrian and bicycle travel shall be accommodated. This shall include a discussion of types of sidewalks (attached/detached), pathways, trails, and connections to local and perimeter destinations.

29.08.100 Existing Conditions

The TIS shall identify the existing transportation system conditions. Existing conditions shall include a description of the surrounding roadway network, bicycle facilities, and pedestrian facilities; an evaluation of the peak hour capacity and level of service at the study intersections and traffic crash history.

29.08.110 Description of Existing Transportation System

The study description of the existing roadway network shall include, but not necessarily be limited to, the number of travel lanes, presence or lack of pedestrian and bicycle facilities, posted speed limits, and adjacent land use(s). Traffic and intersection data compiled by the City and/or County Engineering Departments may be available. All

recent (within two years) average daily traffic data that is available for the roadway network shall be shown on a figure in the study. Intersection peak hour traffic data shall be no older than one year; if new counts are necessary this is the sole responsibility of the applicant. The applicant may, at the direction of the Transportation Engineer, be required to collect data at a shorter interval. All traffic count data shall be included in an appendix to the TIS.

The TIS shall describe the existing bicycle and pedestrian facilities as defined in Section 29.48 and shall include any facilities described in Section 29.08.050.

Special attention shall be given to the bicycle and pedestrian connections to specific uses including but not limited to: schools, parks, employment centers, commercial areas, shopping, and adjacent land uses.

29.08.120 Capacity Analysis and Level of Service

The procedures set forth in the current edition of the [*Highway Capacity Manual*](#) (HCM) shall be used in analyzing the capacity and operational characteristics of vehicular, pedestrian and bicycle facilities.

HCM delay and queuing reports (such as Synchro or Sidra reports) shall be included in the appendices to the TIS report.

Roundabout analyses shall use SIDRA software or approved methodology. All worksheets shall be included in the appendices of the TIS report.

29.08.130 Future Traffic Projections

The future traffic projections shall be determined for each of the study years identified earlier as part of the base assumptions. Future traffic projections for the TIS analysis shall include:

- (a) Planned System Improvements – Capital Projects
- (b) Planned or in Process Development Projects
- (c) Background Traffic Growth

A description of project-specific planned transportation system improvements identified in City, County or CDOT capital improvement plans shall be provided. This shall include, but not be limited to: signalization, intersection improvements, roadway

widening, bicycle/pedestrian projects, and transit capital and operating/service improvements.

The future traffic analysis shall include known development projects that are within the study area and would impact the study intersections. Projects outside the study area currently being developed shall also be considered. Every project(s) and the cumulative effect shall be listed in the TIS and include location, size, and proposed land use.

The background traffic growth within the study area shall also be accounted for when determining future traffic projections. Background traffic growth is defined as the expected growth in traffic from regional changes to land use and the transportation network exclusive of the project. Growth factors suggested by the consultant in the Base Assumptions form will be reviewed by the appropriate agency prior to use in the TIS.

The resulting future peak hour traffic projections at the study intersections shall be depicted on a figure in the TIS.

29.08.140 Project Traffic

(a) The transportation impacts of the project shall be generally determined based upon the following three-step process:

- (1) Determination of Trip Generation
- (2) Determination of Trip Distribution
- (3) Assignment of Project Traffic

(b) Trip Generation.

The trips generated by the project shall be determined and provided in tabular form. The trip generation shall be determined for total build-out conditions and for any development phases. The trip generation table shall indicate the number of average daily trips and AM and PM peak hour trips and any other peak hour periods relevant to the development type.

The development of trip generation estimates for the project shall be based upon data from the current edition of the [*Institute of Transportation Engineers' - Trip Generation Manual*](#). This includes using the selection process identified in the *Trip Generation Manual* to identify the appropriate land use code and trip generate rate. However, other data sources or trip generation rate studies may be utilized if the manual does not contain data for the type of project or other reliable data exists which better reflects the trip generation characteristics of the project. The use of other trip generation sources shall be discussed with the Transportation Engineer

before being used, and if agreed, shall be memorialized in writing signed by the Transportation Engineer.

Adjustments to the standard trip generation of the proposed project may be made to account for internal site trips, pass-by trips, or other site specific/project specific characteristics of the proposed project. Adjustments for these characteristics shall be discussed with the City or **County** Transportation Engineer before use; in most cases the TIS shall follow guidelines set forth in documents such as the ITE *Trip Generation Manual*. The adjusted trip generation for the proposed project shall be provided in tabular form or illustrated on figures.

Pass-by trip percentages represent the percent of expected trips generated from the site that would have traveled along the adjacent roadway network even if the land use did not exist. The percent of pass-by trips may be deducted from the expected trip generation from a proposed development of the corresponding land use. The *ITE Trip Generation Manual* should be used to identify any applicable pass-by trip percentages.

(c) Trip Distribution.

The trip distribution for the proposed project shall be identified in the TIS. The distribution pattern shall be based upon: the project's location within the urban area, the traffic model maintained by the MPO, existing traffic volume data, project marketing data, and engineering judgment. A figure showing the percentage of site traffic on each street shall be provided as part of the traffic study graphic material.

(d) Trip Assignment.

The project traffic shall be assigned to the roadway system according to the established trip distribution. The resulting project site generated traffic shall be depicted on figures for build-out conditions and any project phases. Daily and peak hour traffic volume information shall specifically be included.

29.08.150 Total Traffic Projections

The total traffic projections shall be determined for each of the study years identified in the base assumptions. The project-related traffic shall be added to the existing peak hour traffic. The resulting total traffic projections shall be depicted on a figure in the TIS. For each of the study years, the total traffic projections shall include the future traffic plus the project-generated traffic. The future total traffic projections shall be depicted on figures for each study year.

29.08.160 Site Design and Circulation Evaluation

The project shall be analyzed to determine if the proposed circulation serves pedestrians, bicyclists and vehicles. The site design shall be evaluated to determine if facilities for vehicles, pedestrians and bicycles are consistent with the location and facility type as shown in the Pedestrian and Bicycle Plan.

The project shall be evaluated to determine if traffic flows are properly designed. Proper design shall minimize areas where motorists would tend to speed, minimize potential conflict areas between vehicles and pedestrians/bicyclists, and to establish circulation patterns that avoid unnecessary traffic congestion, cut-through traffic and conflict points. Adequate throat lengths for on-site stacking at exit points is required (see 29.16.100). At signalized driveways, the HCM 90th percentile worst lane queue model shall determine the necessary storage. Businesses with drive-thrus must conduct a queuing analysis for the drive-thru to demonstrate that the queue will not extend back onto the public street.

29.08.170 Transportation Impact Analysis

The TIS shall determine if the project creates any significant impacts at the study intersections and/or corridors within the study area boundaries. The peak hour capacity and level of service at each of the study intersections and /or corridors shall be evaluated for:

- (a) Future Background Traffic Conditions for each Study Year;
- (b) Total Existing Traffic Conditions; and
- (c) Future Total Traffic Conditions for each Study Year.

The capacity and level of service analysis for each traffic scenario and each study year needs to include mode split assumptions, if any. The findings shall be shown in the TIS in tabular form or illustrated on figures.

29.08.180 Calculations for Capacity and Level of Service

HCM delays and queues shall be calculated for signalized intersections using the current version of the Highway Capacity Manual. Synchro is the preferred software, however additional software that that utilize the current HCM methodologies may be utilized with prior approval from the Transportation Engineer. The HCM delay and queues shall be calculated for the identified peak hours for existing conditions, the projected traffic with build-out of the project, or at completion of phases of larger projects. An appropriate 15-

minute peak hour factor shall be used. The performance evaluation of signalized intersections shall include the following:

- (a) Critical movements shall be identified and must meet or exceed the threshold requirement of 35 seconds of delay or less;
- (b) No movements shall have an adverse effect on the coordinated progression of the street system as determined by an approved coordination model consistent with the methods of HCM;
- (c) HCM 90th percentile worst lane queues shall be calculated and shall not obstruct upstream intersections or major driveways;
- (d) The analysis of a signalized corridor must show a reasonable progression band, identified as a usable (unblocked) band for major traffic movements.

Unsignalized intersections shall be analyzed using the current Highway Capacity Manual methods. In the performance evaluation of stop controlled intersections, measures of effectiveness to consider include the delay, volume/capacity ratios for individual movements, average queue lengths and 95th-percentile queue lengths to make appropriate traffic control recommendations. The Highway Capacity Manual recognizes that the delay equation used in the capacity analysis procedure will predict Level of Service F for many urban intersections that allow minor-street left-turn movements, regardless of the volume of minor-street left-turning traffic. In recognition of this, the TIS should evaluate the results of the intersection capacity analysis in terms of all of the measures of effectiveness.

Roundabouts shall be analyzed using the current version of SIDRA or approved methodology.

29.08.190 Mitigation Measures

The TIS shall include feasible measures that would mitigate the project's vehicular traffic impacts. The mitigation measures shall be in addition to the required improvements necessary to preserve corridor and intersection capacity. The acceptable mitigation measure(s) shall minimize the demand for trips by single occupant vehicles and increase the use of alternative modes. Mitigation listed in order of priority includes:

- (a) Transportation Demand Management Measures
- (b) Traffic Signal Operation Improvements
- (c) Street Widening and Other Physical Improvements

29.08.200 Transportation Demand Management (TDM) Measures

Transportation Demand Management measures are designed to facilitate the use of alternate transportation modes in order to decrease demand on the roadway system by single occupant vehicles. Example of TDM measures include:

- (a) Vehicle trip reduction incentives and services offered by employers to encourage employees to utilize alternative modes of travel such as carpooling, vanpooling, riding public transit, bicycling, walking and telecommuting.
- (b) Provision of a mix of land uses in close proximity, facilitating walking, bicycling or transit trips.

A detailed description of the proposed TDM measures and implementation plan shall be included in the TIS for any project seeking TDM-related trip reductions. If the proposed TDM program is acceptable to the Transportation Engineer, the applicant shall be allowed to reduce total project vehicle trips by an amount commensurate with applicable trip reduction policies.

The intersection capacity and level of service shall be calculated to reflect the application of the proposed mitigation measures; the calculation shall show that the project-related impacts have been reduced to an acceptable delay (see thresholds identified in 29.08.180) for all movements and transportation modes (vehicle, bicycles, pedestrians). The findings shall be shown in tabular form.

29.08.220 Traffic Signal Operational Improvements

Required traffic signal operational improvements may include upgrading signals with additional signal phases and/or signalization of an unsignalized intersection, addition of turn lanes and/or construction of a roundabout.

The need for new traffic signals shall be based on warrants established in the Manual on Uniform Traffic Control Devices, [MUTCD](#). In determining the location of a new signal, traffic progression is of paramount importance. On arterial streets a spacing of one-half mile for all signalized intersections is necessary to achieve reasonable operating speed, capacity and optimum signal progression. Pedestrian movements shall be considered in the evaluation and adequate pedestrian clearance provided in the signal phasing assumptions.

The applicant shall submit an analysis addressing proposed access, proposed signals and capacity and level of service based on the City's operational practices. All assumptions shall be documented in the TIS. An approved traffic engineering analysis must be made

to properly locate all proposed accesses that may require signalization. The roadway to be analyzed for signal progression shall be established by the City or **County** and shall include all existing and proposed signalized intersections.

- (a) The progression pattern calculations must match the existing cycle length on the corridor under analysis.
- (b) Signal phasing assumptions must relate to traffic volumes in the capacity analysis of individual intersections.
- (c) Approved computerized progression analysis techniques must be of the type which utilize turning movement volume data and pedestrian clearance times in the development of timing plans.
- (d) The green time allocated to the cross street shall be considered no less than the time which is required for a pedestrian to clear the main street using [MUTCD](#) standards.
- (e) Existing timing and phasing data for City and/or County signals on the corridor(s) being analyzed will be provided to the consultant on written request.
- (f) Elimination of or substantial changes to existing phases and/or timing will not be allowed without written approval of the Transportation Engineer.
- (g) Existing signal operations shall be presumed to reflect the local conditions and community expectations as determined and directed by the Transportation Engineer.
- (h) If optimum usable bandwidth, as that term is defined by the Transportation Engineer, would be reduced if a traffic signal were installed then the intersection shall remain unsignalized and turning movements shall be limited.

29.08.230 Street Widening and Other Physical Improvements

Mitigation measures that include street widening and other physical improvements must be physically feasible and must meet minimum standards and Code(s) for both on-site and off-site improvements.

29.08.250 Conclusions

The findings of the TIS shall be provided in a summary report.

29.08.260 Recommendations

The TIS should include an executive summary including recommendations. Recommended improvements/mitigation measures to achieve standards and safety improvements shall be stated. The recommendation section of the report shall describe the location, nature, and extent of proposed improvements. A sketch of each improvement shall be provided showing the length, width, and other pertinent geometric features of the proposed improvement.