

When any new development or the proposed land use will generate a peak hour traffic volume of the adjacent street or of generator of 60 trips or more, or when considered necessary by the City, the applicant shall provide a traffic impact study. The study shall be completed and sealed by a Colorado registered professional engineer with adequate experience in Transportation Engineering.

### **Responsibility for Traffic Studies**

The traffic study shall provide the necessary data and analysis to adequately assess the impacts of a development proposal on the existing and/or planned street system. The primary responsibility for assessing the traffic impacts associated with a proposed development will rest with the developer, with the City serving in a review capacity.

Typically, staff will review any first submittal traffic study within 10 working days of the date of submittal to the City's Traffic Division office. If study revisions are needed, staff will normally review these within 5 working days of the date of re-submittal. Longer time periods will be necessary if the Colorado Department of Transportation is involved in the review process. No building permits shall be issued until the traffic impact study is reviewed and approved by the City as part of the civil plans package.

All previous traffic studies relating to the development that are more than two years old will have to be updated, unless the City determines that conditions have not changed significantly.

Where access points are not defined, or a site plan is not available at the time the traffic study is prepared, additional traffic work may be required when a site plan becomes available or the access points are defined.

The applicant will be notified at the pre-planning stage if a traffic study will be required, provided sufficient information is available for the City to determine whether the trip generation criterion has been met. If sufficient information is unavailable but the property appears to involve sufficiently intense land use, the applicant will be informed that a traffic study is required.

The contents and extent of a traffic impact study will depend on the location and size of the proposed development and the conditions prevailing in the surrounding area. Larger developments proposed in congested areas obviously require more extensive traffic analysis, whereas smaller sites may only require minimal analysis of traffic on site and at immediate adjacent intersections. Transportation consultants are required to discuss projects with the City prior to starting the study. As a minimum, topics for possible discussion will include trip generation, directional distribution of traffic, trip assignment, definition of the study area, intersections requiring critical lane analysis, and methods for projecting build-out or horizon year volumes. This will provide a firm base of coordination and communication between the City, the owner or developer, and the project's consultants in forecasting future traffic characteristics that realistically define traffic movements associated with the proposed development. Specific requirements will vary depending on the site location.

## TRAFFIC STUDY FORMAT

In order to provide consistency and to facilitate staff review of traffic studies, the following format shall be followed in the preparation of such studies by transportation consultants. A summary outline is provided (as an attachment). Selected items from the following list may be excluded if not applicable to the situation and exclusion is specifically authorized by the City.

1. **Introduction-** The following portion of the report must contain the following:
  - a. **Land Use, Site and Study Area Boundaries-** A brief description of the size of the land parcel, general terrain features, the location within the jurisdiction and the region must be included in this section. In addition, the roadways adjacent to the site must be identified, along with a description of the roadway's characteristics. The exact limits of the study area should be based on engineering judgment, and an understanding of existing traffic conditions surrounding the site. In all instances, however, the study area limits must be mutually agreed upon by the developer, his engineer, and the City. These limits will usually result from initial discussions with staff. A vicinity map that shows the site and the study area boundaries, in relation to the surrounding transportation system, must be included.
  - b. **Existing and Proposed Site Uses-** The existing and proposed uses of the site must be identified in terms of the various zoning categories of the City. In addition, the specific use for which the request is being made must be identified if known, since a number of uses may be permitted under the existing ordinances. It will be the intent of the traffic study to evaluate the reasonable worst-case traffic impacts for the proposed development allowed by the zoning. If several different uses are permitted by the zoning, the highest trip generation uses must be assumed for the study.
  - c. **Existing and Proposed Uses in Vicinity of Site-** A complete description (including a map) of the existing land uses in the study area as well as their current zoning and use must be included. In addition, all vacant land within the study area and its assumed future uses must be identified. This latter item is especially important where large tracts of undeveloped land are in the vicinity of the site, and within the prescribed study area. Generally much of this information can be obtained from the City's Planning and Development Department staff or from the neighboring jurisdiction if the study area extends beyond the Wheat Ridge city boundary.
  - d. **Existing and Proposed Roadways and Intersections-** Within the study area, the applicant must describe and provide volumes for existing roadways and intersections including geometrics and traffic signal control as well as improvements contemplated by government agencies. This would include the nature of the improvement project, its extent, implementation schedule, and the agency or funding source responsible. A map must be provided showing the location of such facilities.
2. **Trip Generation and Design Hour Volumes-** A summary table listing each type of land use, the size involved, the average trip generation rates used (total daily traffic and A.M./P.M. peaks of generator or adjacent street traffic), and the resultant total trips generated must be provided. Trip generation must be calculated for the maximum uses allowed under the existing and proposed zoning based on the data contained within the most current edition of Institute of Transportation Engineers (ITE) Trip Generation Manual. In the event data is not available for the proposed land use, the City must approve estimated rates prior to acceptance. The calculation of design hour volumes used to determine study area impacts must be based on:
  - a. Peak hour trip generation rates as published in the most current edition of ITE Trip Generation Manual.

- b. Traffic volume counts for similar existing uses, if no published rates are available.
  - c. Additional sources from other jurisdictions if acceptable to the City.
3. **Trip Distribution-** The estimates of percentage distribution of trips from the proposed development to destinations in the metro region must be clearly stated in the report using the north, south, east, and west compass points. Market studies and/or information concerning origin of trip attractions to the proposed development may be used to support these assumptions where available. A map showing the percentage of site traffic on each street must be provided as part of the traffic study graphic material.
4. **Trip Assignment-** The direction of approach of site-generated traffic via the area's street system will be presented in this section. The technical analysis steps, basic methods, and assumptions used in this work must be clearly stated and agreed to by the City. The assumed trip distribution and assignments must represent the most logically traveled routes for drivers accessing the proposed development. These routes can be determined by observation of travel patterns to existing land uses in the study area.
5. **Existing and Projected Traffic Volumes-** Graphics must be provided which show the following traffic impacts for private access points, intersections and streets:
  - a. A.M. peak hour site traffic (in and out) including turning movements.
  - b. P.M. peak hour site traffic (in and out) including turning movements.
  - c. A.M. peak hour total traffic including site generated traffic (in and out). These volumes must include through and turning movement volumes for current conditions and a separate set of numbers that also includes 20-year projections or build-out (whichever is specified by the City).
  - d. P.M. peak hour traffic total including site generated traffic (in and out). These volumes must include through and turning movement volumes for current conditions and a separate set of numbers that also includes 20-year projections or build-out (whichever is specified by the City).
  - e. Any other peak hour which may be critical to site traffic and the street system in the study area should be included in the graphics and show the same information as is provided for the A.M./P.M. peak hours.
  - f. Actual counts of existing total daily traffic for the street system in the study area at the time the study is being prepared.
  - g. Projected total daily traffic for the street system in the study area based on traffic from the proposed development and counts of existing daily traffic obtained in item f. The component of the existing daily traffic attributable to the existing uses must be identified and the increase to total daily traffic from the proposed uses.
  - h. Projected total daily traffic for the street system in the study area on traffic from the proposed development, counts of existing daily traffic obtained in item f above, and traffic projections based on build-out of land use within the study area or a 20-year projection (whichever is specified by the City).
6. All raw traffic count data (including average daily volumes and peak hour turning movements) and analysis worksheets must be provided in the appendices of the report. Computer techniques, and the associated printouts may be used as part of the report.
7. Volume projections for background traffic growth will be provided by the City, or alternatively a method for determining these volumes will be recommended by the City.
8. All total daily traffic counts must be actual machine counts and not based on factored peak hour sampling. Latest available machine counts from Colorado Department of Transportation, the City, and other agencies may be acceptable if not more than two years old.

## Level of Service

Level of service “C” will be the design objective for all movements and under no circumstances will be less than the level of service “D” be accepted for site and non-site traffic including existing traffic at build-out of the study area. The design year will be approximately 20 years following construction and include volumes generated by build-out of the study area or a 20-year projection in background traffic (whichever is specified by the City). The interpretations of “Level of Service” shall be based on the definition specified in the TRB Highway Capacity Manual Special Report 209.

9. **Capacity Analysis-** A capacity analysis will be conducted for all public street intersections impacted by the proposed development and for all private property access points to streets adjacent to the proposed development as specified in the traffic study requirements form and within the limits of the previously defined study area. The A.M., P.M., and any other possible peak period will be tested to determine which peak hours need to be analyzed. Capacity calculations should also include an analysis for 20<sup>th</sup> year projections or study area build-out conditions. The capacity analysis calculations should be based on the analysis techniques contained in the TRB Highway Capacity Manual Special Report 209. All capacity analysis work sheets must be included in the appendices of the report.
10. **Traffic Signals-** The need for new traffic signals will be based on warrants contained in the latest edition of Manual on Uniform Traffic Control Devices. In determining the location of a new signal, traffic progression is of paramount importance. Generally a spacing of one-half mile for all signalized intersections should be maintained. This spacing is usually desirable to achieve good speed, capacity, and optimum signal progression. Pedestrian movements must be considered in the evaluation and adequate pedestrian clearance provided in the signal cycle split assumptions.

To provide flexibility for existing conditions and ensure optimum two-way signal progression, an approved traffic engineering analysis must be made to properly locate all proposed accesses that may require signalization. The section of roadway to be analyzed for signal progression will be determined by the City and will include all existing and possible future signalized intersections.

The progression pattern calculations must use a cycle consistent with current signal timing policies of the City. A desirable bandwidth of 50% of the signal cycle must be used where existing conditions allow. Where intersections have no signals presently, but are expected to have signals, typically a 60% mainline, 40% cross street cycle split should be assumed. Cycle split assumptions must relate to the volume assumptions in the capacity analysis of individual intersections, and where computerized progression analysis techniques are used, they must be of the type which utilizes turning movement volume data and pedestrian clearance times in the development of time/space diagrams. The green time allocated to the cross street will be considered no less than the time which is required for a pedestrian to clear the main street using Manual on Uniform Traffic Control Devices standards. Those intersections which would reduce the optimum bandwidth if a traffic signal were installed may be required by the City to remain unsignalized and have turning movements limited by access design or median islands.

11. **Traffic Accidents-** Traffic accident data for affected street corridors may be required for the study. The study period will normally be three years. Such locations will be specified by the City. Where this is necessary, estimates of increased or decreased accident potential must be evaluated for the development, particularly if the proposed development might impact existing traffic safety problems in the study area, and safely improvement recommended where necessary.
12. **Noise Attenuation-** If a residential development is planned adjacent to a freeway or arterial roadway, the need for noise attenuation measures may be required as part of the impact analysis. It is recommended that the need for noise attenuation measures be determined using the methods

outlined in Fundamentals and Abatement of Highway Traffic Noise Textbook, FHWA, September 1980.

13. **Conclusions-** This chapter of the report must be a clear, concise description of the study findings. It is anticipated that this conclusion chapter will serve as an executive summary
14. **Recommendations-** In the event that analysis indicates unsatisfactory levels of service on the study area roadways, a description of proposed improvements to remedy deficiencies must be included. These proposals would include projects by the City or the Colorado Department of Transportation for which funds have been appropriated and obligated. The assumptions regarding all future roads and laneages in an analysis will require approval from the City. In general, the recommendation section should include:
  - a. **Proposed Recommended Improvements-** This section must describe the location, nature, and extent of proposed improvements to assure sufficient roadway capacity. A sketch of each improvement (similar to Figure 1) should be provided showing the length, width and other pertinent geometric features of the proposed improvements.
  - b. **Volume/Capacity Analysis at Critical Points-** Another iteration of the volume/capacity analysis must be described, which demonstrates the anticipated level of service as a result of making these improvements. This level of service must be “D” or better.
  - c. **Traffic Volume Proportions-** Percentage based on the traffic impact analysis may be required by the City to determine the proportion of traffic using various public improvements (both existing and proposed) from several developments with the study.

### **Revisions to the Traffic Study**

Revisions to the traffic study must be provided as required by the City. The need to require revisions will be based on the completeness of the traffic study, the thoroughness of the impact evaluation and the compatibility of the study with the proposed access and development plan. The revised study or report shall be signed and sealed by the Professional Engineer.



## Traffic Study Checklist

Project Name: \_\_\_\_\_

Date: \_\_\_\_\_

Project Location: \_\_\_\_\_

Engineer: \_\_\_\_\_

### Introduction

#### Land Use, Site and Study Area Boundaries

- Size of parcel
- General terrain features
- Location w/in City
- Region of City
- Adjacent roadways w/ characteristics
- Vicinity map w/ transportation system

#### Existing and Proposed Site Uses

- Existing zoning categories
- Proposed zoning categories
- Specific proposed uses

#### Existing and Proposed Uses in Vicinity of Site w/ map

- Existing zoning and uses
- Vacant land w/ future use

#### Existing and Proposed Roadways and Intersections w/ map

- Volumes of streets & intersections
- Geometrics & traffic signal control
- Future improvements w/ schedule, agency, & funding

### Trip Generation and Design Hour Volumes

#### Summary table

- Each type of land use w/ size
- Average trip rates w/ ADT & am & pm peak of site or streets
- Total trips with site and streets

### Trip Distribution

- % distribution in N, S, E, & W
- Map of street distribution

### Trip Assignment

- % distribution at each access & intersection
- Diagram of each access & intersection

### Existing and Projected Traffic Volumes

- Diagrams showing in/out & turning for each access, intersection, & street
  - am peak hour site traffic
  - pm peak hour site traffic
  - am peak hour total traffic for current & 20-yr
  - pm peak hour total traffic for current & 20 yr
  - Other peak hour total traffic for current & 20yr
- Existing total daily traffic for streets
- Projected total daily traffic for streets for current
- Projected total daily traffic for streets for 20-yr

#### Traffic count data and analysis worksheets

#### Volume projections for background traffic growth

#### Existing daily volumes traffic based on counts not estimates