Chapter Forty-one
TRAFFIC IMPACT STUDIES

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Chapter Forty-one
TRAFFIC IMPACT STUDIES

Chapter Forty-one documents the Department's procedures for evaluating the access proposals that may affect State transportation facilities and provides guidelines for determining the need, scope and format of traffic impact studies. Employing these guidelines will facilitate coordination and consistency during the evaluation process. Chapter Forty-one does not, however, address the policies, procedures or study requirements of local government agencies nor does it present the technical procedures or analyses found elsewhere in the traffic engineering literature.

41.1 GENERAL GUIDELINES

41.1.1 Reference Documents

For additional information on traffic impact studies, site planning and design, on-site circulation and parking, and other technical details not covered in this Chapter, the reader is referred to the following documents:

1. Traffic Access and Impact Studies for Site Development, ITE;
2. Transportation and Land Development, ITE;
3. Traffic Engineering Handbook, ITE;
4. Manual of Transportation Engineering Studies, ITE;
5. Site Impact Traffic Evaluation (S.I.T.E.) Handbook, FHWA;
6. Development and Application of Trip Generation Rates, FHWA;
7. Trip Generation, ITE;
8. Highway Capacity Manual, TRB;
9. Approach Standards for Montana Highways, MDT;
10. Guidelines for Driveway Location and Design, ITE;
11. A Policy on Geometric Design of Highways and Streets, AASHTO;
12. Parking Generation, ITE; and
13. Manual of Uniform Traffic Control Devices, FHWA, ATSSA, AASHTO and ITE.

41.1.2 Definition of Terms

Section 41.1.2 documents the technical terminology that is typically associated with the Department's approach permit application and traffic impact study procedures. The reader is referred to the following definitions to clarify such terminology:

1. Approach. That section of highway right-of-way between the outside edge of shoulder and the right-of-way line which is designed as a roadway for the movement of vehicles between the highway and abutting property. The width of the approach, excluding flares or radii, is measured at right angles to the approach centerline at the right-of-way limit.

2. Capacity. The maximum hourly rate at which vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time period under prevailing roadway, traffic and control conditions.

3. Department. The Montana Department of Transportation.

4. Developer. The landowner or otherwise bona-fide applicant of an approach permit or development proposal.

5. Distance Between Approaches. The distance measured along the curb line or outside edge of shoulder between the extensions of the near edges of adjacent approaches, excluding flares or radii.

6. Frontage. The distance a property is contiguous to the highway right-of-way.

7. Frontage Boundary Line. A line perpendicular to the highway centerline that passes through the point of intersection of the property line and the highway right-of-way line.

8. Horizon Year. The target year or years of analysis.

9. Influence Area. The geographic area surrounding the site from which the development is likely to draw a high percentage of the total site traffic.

10. Level of Service (LOS). A set of criteria that describes the degree to which an intersection, roadway, weaving section or ramp can effectively serve peak-hour and/or daily traffic. Level-of-service definitions are provided in the Highway Capacity Manual.

11. MDT. The Montana Department of Transportation.

12. On-Site Circulation. Vehicular network which primarily accommodates site-generated traffic within the site boundary and includes roadways, parking lots, loading docks, parking garages and parking deck travelways.

13. Pass-By Trips. Those trips that are diverted from traffic already on the roadway system.

14. Planned Development. New land-use projects for which site plans are being or have been developed, but no firm date has been established for construction. Completion, however, is expected within the study horizon.

15. Planned Transportation System Improvements. New roadway or traffic operation improvements for which plans are being or have been developed but no firm date has been set for construction. Completion, however, is expected within the study horizon.

16. Plot Plan. A plan to show the proposed location of the approach. It should show the distance from the nearest reference point or station marker. In urban areas, ties should be made to street centerlines. The sketch should show the highway right-of-way, property lines, approach location, other approaches in the vicinity of the development and other pertinent information.

17. Private Approach. Connections to and/or from a commercial, industrial, residential or otherwise private property.

18. Programmed Development. New land-use projects for which site location, type and density are firmly established for construction.

19. Programmed Transportation System Improvements. New roadway or traffic operational improvements for which planning is established and funding is identified.

20. Public Approach. An entrance to and/or from a highway, street, road or alley that is on dedicated public right-of-way.

21. Site Access Plan. A scaled drawing that explicitly illustrates the location, configuration and geometrics of all site approaches in relation to the local highway system and other approaches. The site access plan should also illustrate the supporting internal circulation, parking and loading facilities of the development, the footprints of key building structures and any out-parcel locations, and the type and location of any required off-site improvements.

22. Study Area. The road network and land-use area that encompasses the principal intersections, road links, etc., and the land-use developments of primary concern in the traffic impact study.

23. System Impact Action Process. An internal MDT process for the review and assessment of development projects that significantly and permanently impact the State transportation system.

24. Traffic Generation. The estimated number of origins from and destinations to a site resulting from the land-use activity on that site.

25. Traffic Generator. A designated land use (e.g., residential, commercial, office, industrial) that generates vehicular and/or pedestrian traffic to and from the site.

26. Traffic Impact. The effect of site traffic on highway operations and safety.

27. Traffic Impact Analysis. An engineering and traffic study that determines the potential traffic impacts of a proposed traffic generator. A complete analysis includes an estimation of future traffic with and without the proposed generator, analyses of the traffic impacts and recommended roadway improvements that are necessary to accommodate the additional site traffic.

28. Traffic Impact Mitigation. The reduction of traffic impacts on roadways and/or intersections to an acceptable level of service.

29. Vehicular Trip. A single or one-way vehicular trip with its origin (i.e., outbound), destination (i.e., inbound) or both trip ends made inside the study area.

41.1.3 Purpose of Traffic Impact Studies

A traffic impact study can be prepared for any type of new or expanding land development (e.g., residential, commercial, office, industrial, mixed-use project, mining facility). Such studies describe how a particular project will affect the surrounding transportation system. The purpose of a traffic impact study is to:

1. identify the traffic loads (i.e., traffic impacts) that a new development project will contribute to the roadway system;

2. provide a credible basis for estimating site access requirements and off-site roadway improvements that are attributable to a new project;

3. assess whether or not on-site functions will compromise off-site operations; and

4. assess compatibility with State and local transportation plans.

41.1.4 Traffic Impact Studies

41.1.4.1 MDT Requirements

A developer is required to submit an approach permit application and development proposal to the Department if the site requires an approach to a State highway. Upon

review, the Department may require the developer to submit a traffic impact study of the contributory impacts of the project and to develop a site access plan that meets MDT approach criteria. The traffic impact documents must be signed by a Professional Engineer registered in the State of Montana. The developer may need to develop off-site improvement plans to accommodate the additional traffic. The developer needs to maintain safe public facilities and acceptable operational levels of service. A traffic impact study may be required by the Department under any of the following conditions:

1. the proposed development is eligible for the MDT System Action Process as discussed in Section 41.1.4.2;

2. the review of existing roadway features and traffic conditions indicate to MDT staff that off-site improvements may be necessary and the developer disagrees (the developer's traffic impact study will document the expected operational parameters and recommendations on access needs);

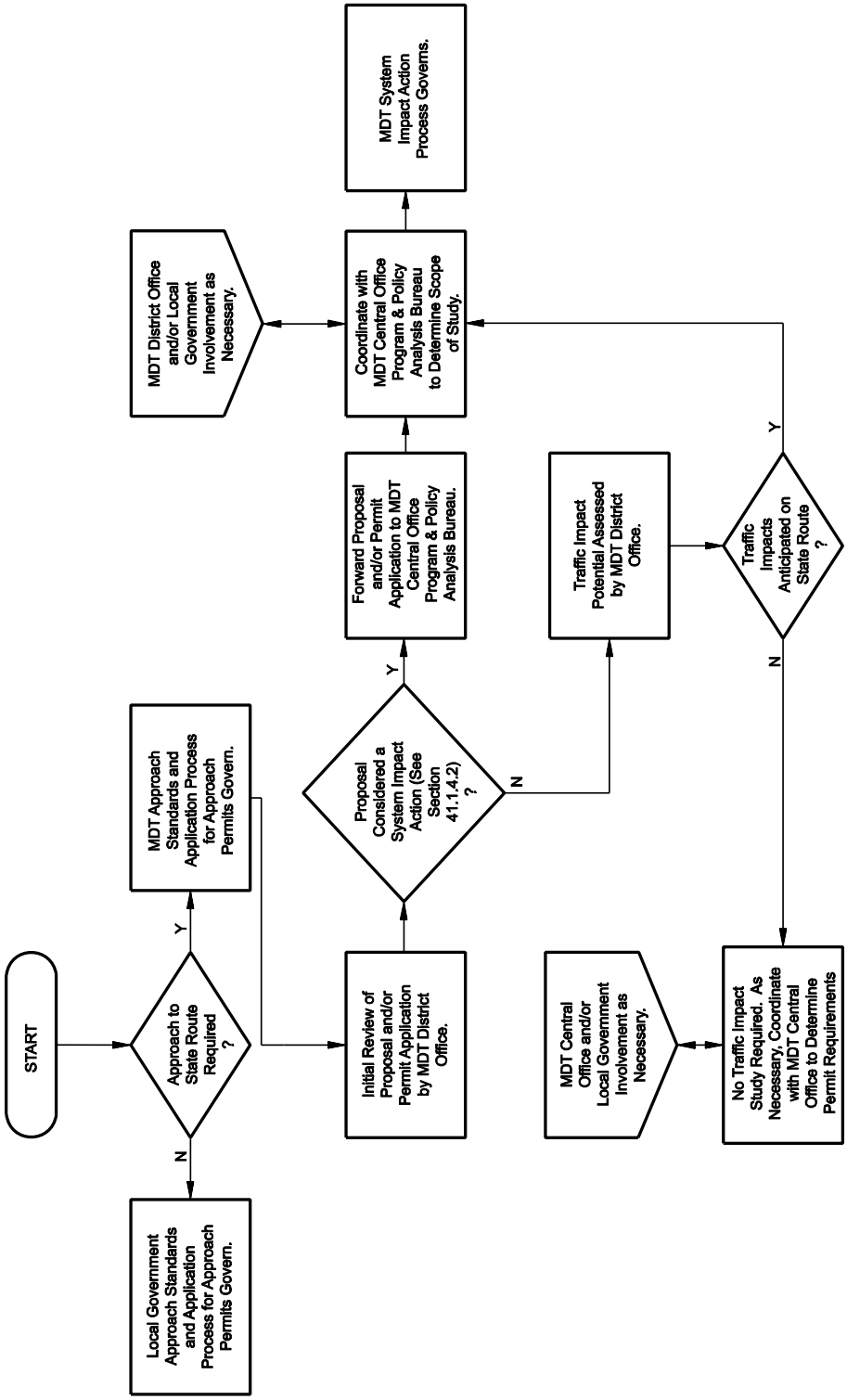
3. the location is already experiencing traffic congestion and operational problems (in this case, the traffic impact study will show how the reasonable access can be designed and located to prevent exasperating the congestion and operational problem); or

4. if conditions at the site fall below existing design standards (e.g., sight distance, grade), then the developer should provide a study that identifies both the issues and the method selected to mitigate the problems.

Figure 41.1A presents a flowchart that illustrates the traffic impact study needs assessment process. The flowchart also depicts when specific MDT requirements govern and when MDT Central and District Office involvement will most likely occur.

41.1.4.2 MDT System Impact Action Process

The MDT System Impact Action Process is an internal coordination process for the review and continuous assessment of land development projects that may significantly and permanently impact the State transportation system. As impacts from such actions are typically the result of private development proposals, an effort is made to minimize costs to the State by identifying mitigation measures that will be included in the project's permits. This process is coordinated by the Program and Policy Analysis Bureau of the MDT Central Office.



TRAFFIC IMPACT STUDY NEEDS ASSESSMENT PROCESS

Figure 41.1A

If the proposed development is eligible for the MDT System Impact Action Process, the Department may require the developer to submit a traffic impact study and related plans. Proposals that are eligible for the System Impact Action Process are as follows:

1. any new land development requiring off-site improvements or any land development (e.g., commercial, residential, industrial, institutional, office, mixed-use) that generates 150 or more vehicular trips (both directions combined) during the peak generating hour of the development;

2. projects which must comply with NEPA, MEPA or the Major Facility Siting Act;

3. projects for which Questions 6 through 8 of the MDT Environmental Checklist for Utility and Encroachment Permits have been answered yes;

4. developments requiring a new access roadway that would be dedicated public right-of-way with the potential of opening up existing undeveloped land;

5. new developments having a proposed access that breaches an existing access resolution;

6. projects having anticipated safety issues that may require an engineering solution (i.e., turn lanes, signals);

7. project proposals that consist of mixed-use land developments (e.g., commercial/ residential, light industrial/commercials) that cumulatively generate 150 or more vehicular trips (both directions combined) during the peak generating hour of the mixed-use development;

8. proposals that include at-grade or above-grade railroad crossings;

9. development projects having a proposed access serving a major mine greater than 5 acres (2 hectares); or

10. any development with unique operational characteristics (e.g., trucking facilities, distribution centers, grain elevators, arenas, convention centers, schools adjacent to State highways).

In cases where the above criteria are not met, the District is responsible for confirming that other State and/or Federal permits and environmental analyses are completed. The Department will not issue permits in advance of other permitting. If, after initial evaluation, the Department determines that the development proposal is not eligible for the System Impact Action Process, then project review and coordination can continue through the appropriate MDT District Office. On a case-by-case basis, the District may contact the Rail, Transit and Planning Division to clarify any uncertainties as to whether

or not a proposed development will require the coordinated review procedures of the System Impact Action Process.

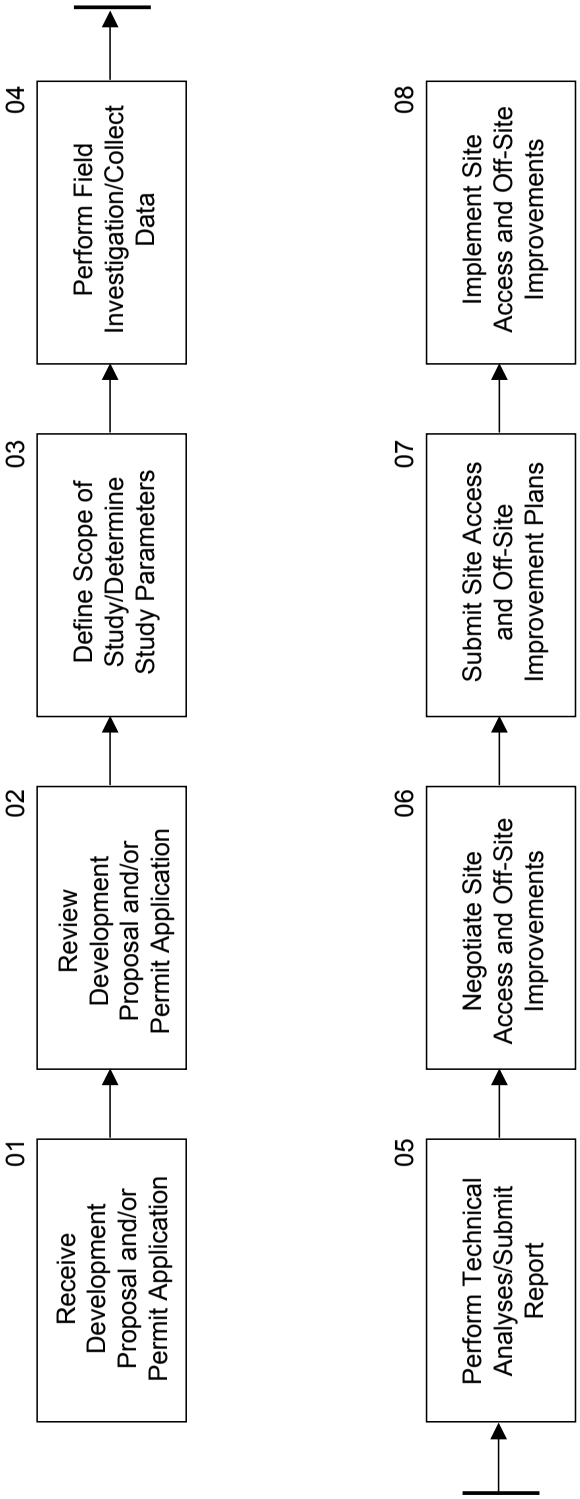
41.1.4.3 Local Government Coordination

Upon review of a development proposal or permit application, the Department may waive the requirement for a traffic impact study. However, local governments may require a developer to submit such a study before zoning variances, subdivision maps, site plans or new driveways are approved. They may also require that these studies be conducted for comprehensive plan amendments, annexations or other actions that may ultimately have local traffic or transportation impacts.

Land development policies, procedures, study requirements and approach criteria vary among local government agencies and are usually different from those required by the Department; however, it is very important that the developer coordinate with the local governing jurisdiction during the preliminary site planning phase. The flowchart presented in Figure 41.1A depicts when the requirements of a local jurisdiction govern and when local government involvement will most likely occur.

41.1.5 Traffic Impact Study Procedures

To facilitate coordination and consistency, Figure 41.1B presents a flowchart illustrating the proper steps that should be followed during a traffic impact study. Presented after Figure 41.1B are brief descriptions of each activity within the flowchart. Adhering to these procedures will reduce confusion and provide for a consistent study approach.



TRAFFIC IMPACT STUDY PROCEDURES

Figure 41.1B

TRAFFIC IMPACT STUDY ACTIVITY

Activity Title:	Receive Development Proposal and/or Permit Application
Activity No.:	01
Responsible Unit:	MDT District Office or MDT Helena Headquarters

Activity Description:

A land development proposal or an application for an approach permit can be initiated by any number of sources including:

1. private land owner or developer,
2. contract land purchaser,
3. owner of long-term land lease of greater than five years,
4. authorized legal representative of land development team,
5. local government agency or jurisdiction,
6. State governmental agency or jurisdiction,
7. Federal government office or agency, and/or
8. by the Department itself.

Intradepartmental action typically arises from MDT office and maintenance building construction and from State highway construction and reconstruction projects. The developer or applicant is responsible for obtaining and submitting the materials required by MDT and local officials.

State route approach permits should be processed according to MDT's Approach Standards for Montana Highways. If the site requires a State route approach or if the new or expanding development is expected to either locally or regionally affect the operations of a State highway, the development proposal, permit application and plot plan are submitted to the District Office for initial review. As illustrated in Figure 41.1A, the Department will process the request to determine if there is a need for a traffic impact study.

The developer(s) and consultant(s) are encouraged to consult with MDT staff during the early planning phases of the development project.

TRAFFIC IMPACT STUDY ACTIVITY

Activity Title:	Review Development Proposal and/or Permit Application
Activity No.:	02
Responsible Unit:	MDT Helena Headquarters and/or District Administrator

Activity Description:

The Department may require the developer to submit a traffic impact study and site access and off-site improvement plan before permits are approved. Upon receipt of the proposal and/or application, the District Administrator identifies the level of system impacts and either:

1. directs a District coordinated application review and issues the approach permits (i.e., if the development falls below System Impact Action criteria);
2. requests substantiation by a traffic impact study and site access and off-site improvement plan before issuing approach permits (i.e., if the development falls below System Impact Action criteria); or
3. forwards the proposal under cover letter to the Program and Policy Analysis Bureau for processing (i.e., if the development falls within System Impact Action criteria).

The District Administrator, or designee, is responsible for approving approach permits. Frequently, the District Office receives the initial request. The District evaluates the proposal and, based on the potential level of system impacts, directs the request to either District or MDT Helena Headquarters staff. At the District Coordinator's discretion, project review and coordination may also involve MDT Helena Headquarters engineering staff. Engineering Division staff will review and approve proposed improvements designed for State facilities. If the project is deemed eligible for the System Impact Action Process (see Section 41.1.4), the Program and Policy Analysis Section becomes the lead coordinator. This Section will coordinate appropriate District and Headquarters staff (e.g., Traffic Engineering Section, Hydraulics Section), local agencies and other parties, as necessary, to determine study and plan requirements. If the project is deemed not to be a System Impact Action, then review and coordination continue through the District. In either case, the approach permit is signed by the District Administrator or the Administrator's designee.

TRAFFIC IMPACT STUDY ACTIVITY

Activity Title:	Define Scope of Study/Determine Study Parameters
Activity No.:	03
Responsible Unit:	MDT Helena Headquarters and/or District Administrator, Developer, Study Preparer and Local Officials

Activity Description:

If the Department has determined in Activity 02 that a traffic impact study is needed, then the lead coordinator (i.e., District Administrator or Program and Policy Analysis Bureau) will organize an initial meeting between the developer, study preparer, local government and appropriate MDT personnel. The purpose of the meeting is to define the scope and parameters of the study. Topics that may be discussed during the meeting include:

1. permit requirements (e.g., type of access control);
2. other governmental agency requirements and applicability of codes;
3. adherence of design criteria to MDT criteria (e.g., NHS, STP);
4. site location, access potential and any neighborhood sensitivities;
5. development type, density, influence area and construction phasing;
6. study approach and methodology necessary to address issues;
7. study area boundary, horizon years and analysis time periods;
8. locations in study area with congestion or crash problems;
9. roadway sections, intersections and roadways to be analyzed;
10. accuracy of existing and background land-use and transportation data;
11. data sources and supplemental data collection requirements;
12. temporary anomalies in the study area that would influence the study;
13. trip generation, distribution and assignment methodology;
14. adjacent land development projects to be included in the study;
15. timing of planned/programmed transportation improvements to be analyzed;
16. capacity, queuing, signal, speed and crash analysis needs;
17. methodology to evaluate acceptability of mitigation countermeasures;
18. final plan requirements for off-site improvements, site access and parking;
19. environmental, right-of-way and drainage considerations; and
20. impact fee assessment, bonding and funding requirements.

These topics are not all inclusive and will vary on a case-by-case basis by site conditions, development size and complexity. Only those study elements needed to address the issues of developing the particular site will be considered. Section 41.2 provides additional information on scoping and initiating the impact study.

TRAFFIC IMPACT STUDY ACTIVITY

Activity Title: Perform Field Investigation/Collect Data

Activity No.: 04

Responsible Unit: Developer and Study Preparer

Activity Description:

Upon completion of Activity 03, the scope of the investigation and its study parameters are established. The developer and study preparer are responsible for the field investigation and the collection of any required supplemental data for the technical analyses of the study. This may include any of the following data:

1. turning movement counts (8-hour minimum), machine counts (24-hour minimum) and pedestrian counts. Traffic data should identify am, noon and pm peak hours;
2. data relative to traffic control devices;
3. roadway configurations, geometric and lane-use data;
4. parking regulations and availability;
5. location and configuration of all driveways with the study area likely to be impacted by this development and/or by the proposed improvements;
6. location, type and availability of transit service;
7. data relative to vehicular speeds and travel times;
8. hazardous locations, clearance and sight distance data;
9. data relative to land use and right-of-way; and
10. any other data specific to the needs of the study's scope.

Supplemental data should be obtained in surveys consistent with the procedures in the latest editions of the ITE publications Traffic Engineering Handbook and Manual of Transportation Engineering Studies. Section 41.2 provides additional information on the typical data requirements of traffic impact studies.

TRAFFIC IMPACT STUDY ACTIVITY

Activity Title: Perform Technical Analyses/Submit Report

Activity No.: 05

Responsible Unit: Developer, Study Preparer and Designer

Activity Description:

The developer and study preparer are responsible for performing the technical engineering and traffic analyses of the study. This may include any of the following technical analyses:

1. non-site traffic forecasts,
2. site traffic forecasts,
3. capacity analyses,
4. queuing analyses,
5. traffic safety and crash analyses,
6. pedestrian studies,
7. speed studies,
8. traffic control and signal needs analyses,
9. site access and off-site improvements analyses and recommendations, and/or
10. design, engineering and preliminary plan preparation for improvements.

During this Activity, interim meetings with the Department may be necessary to resolve data or analytical issues not previously addressed. Section 42.3 provides additional information on the technical analyses that may be applicable to the study.

Upon completion of the technical phase of the study, the developer, study preparer and designer are responsible for preparing and submitting the Traffic Impact Study Report and preliminary site access and roadway improvement plans to the lead coordinator of the Department (i.e., either the District Administrator or the Program and Policy Analysis Bureau). Section 42.4 provides information on report and plan preparation.

TRAFFIC IMPACT STUDY ACTIVITY

Activity Title:	Negotiate Site Access and Off-Site Improvements
Activity No.:	06
Responsible Unit:	MDT Helena Headquarters and/or District Administrator, Developer, Study Preparer and/or Local Officials

Activity Description:

Either the District Administrator or the Program and Policy Analysis Bureau, whichever is the lead, will coordinate the appropriate Departmental personnel to review the developer's Report and preliminary plan submission. If the Traffic Engineering Section is involved, it is responsible for reviewing the acceptability of the study's plans and recommendations and preparing a memo from the Traffic Engineer to the District Administrator or the Program and Policy Analysis Bureau summarizing the results of the review. The Traffic Engineering Section will be available to assist in the negotiation process. Section 2.1 of the Traffic Engineering Manual provides the Department's procedures for the plan-in-hand review process, and Section 41.4 provides additional information on study correspondence and plan preparation.

The lead coordinator will then organize one or more meetings with the developer, study preparer, appropriate Departmental personnel and, as necessary, the local government agency to negotiate site access and off-site improvements and to discuss final plan preparation requirements. At that time, the developer will be informed if plan changes or additional analyses are required.

TRAFFIC IMPACT STUDY ACTIVITY

Activity Title:	Submit Site Access and Off-Site Improvement Plans
Activity No.:	07
Responsible Unit:	Developer's Consultant

Activity Description:

The developer's consultant is responsible for preparing and submitting the final site access and off-site improvement plans. Section 41.4 provides additional information on plan preparation.

Upon receipt of the final plans, either the District Administrator or the Program and Policy Analysis Section, whichever is the lead, will coordinate with the appropriate Departmental personnel to have the final plans reviewed and approved. The Traffic and Safety Engineer will concur with the engineering design elements of the off-site improvements and approve any design exceptions. The Department's procedures for final plan review are documented in Section 2.1 of the Traffic Engineering Manual.

Once agreement has been reached, the District Administrator will attach any relevant conditions to the approved permit and/or Memorandum of Understanding, notify the developer of approval and forward a copy to the Traffic and Safety Engineer.

TRAFFIC IMPACT STUDY ACTIVITY

Activity Title: Implement Site Access and Off-Site Improvement

Activity No.: 08

Responsible Unit: Developer and MDT

Activity Description:

The developer is responsible for implementation and the District is responsible for oversight. The implementation of traffic signals will be coordinated with the Traffic Engineering Section. The developer is responsible for providing a complete set of as-built plans and an electronic copy of the as-built plans on CD-ROM format to the following areas:

- the District;
- Traffic Engineering Section – Engineering Analysis Design Unit; and/or
- Traffic Engineering Section – Electrical Design Unit, if applicable.

41.2 TRAFFIC IMPACT STUDY INITIATION AND SCOPE CONSIDERATIONS

41.2.1 Initial Study Meeting

A traffic impact study should not be conducted before an initial meeting between the developer, study preparer, local government and appropriate MDT personnel has occurred. This meeting should occur as early as practical to best serve the requirements and objectives of the Department, local government and developer. The purpose of the meeting is to define the study's scope and study parameters and to establish a mutual understanding of the level of detail and the assumptions appropriate for the study. Topics that may be covered during this meeting include the following:

1. permit requirements (e.g., type of access control);
2. other governmental agency requirements and applicability of codes;
3. adherence of design criteria to MDT criteria (e.g., NHS, STP);
4. site location, access potential and any neighborhood sensitivities;
5. development type, density, influence area and construction phasing;
6. study approach and methodology necessary to address issues;
7. study area boundary, horizon years and analysis time periods;
8. locations in study area with congestion or crash problems;
9. roadway sections, intersections and roadways to be analyzed;
10. accuracy of existing and background land-use and transportation data;
11. data sources and supplemental data collection requirements;
12. temporary anomalies in the study area that would influence the study;
13. trip generation, distribution and assignment methodology;
14. adjacent land development projects to be included in the study;
15. timing of planned/programmed transportation improvements to be analyzed;
16. capacity, queuing, signal, speed and crash analysis needs;
17. methodology to evaluate acceptability of mitigation countermeasures;
18. final plan requirements for off-site improvements, site access and parking;
19. environmental, right-of-way and drainage considerations; and
20. impact fee assessment, bonding and funding requirements.

Because projects vary on a case-by-case basis by site conditions, development size and complexity, only those study elements needed to address the particular issues of the site and its development should be considered.

41.2.2 Study Area

The study area will vary based on the location, size and complexity of the proposed development and the prevailing traffic conditions around the site. The minimum study area should include all site access points and major intersections adjacent to the site

and, within a practical distance from the site, the first signalized intersection or intersection with a principal arterial on each roadway that will serve the development. However, the Department may require a more extensive area be analyzed for large or complex development proposals, for sites in congested or poorly accessible areas or for developments that will have regional impacts on the transportation system.

41.2.3 Study Horizon Years

The study horizon defines one or more target years that land-use and transportation conditions are forecast and analyzed. The selection of an appropriate study horizon is greatly dependent on the timing of land utilization and transportation improvements. For example, large multi-phase developments may require several study horizon years each coinciding with a major phase of planned development or major stage of transportation system improvements. The following factors should be considered when establishing the study's horizon years:

1. year the proposed development or major development phase is fully occupied;
2. occupancy timing of non-site developments and major development phases;
3. affect of market absorption rates on development construction and occupancy;
4. phasing of State and local transportation system improvements;
5. capital improvement, bond and funding program schedules; and
6. the inherent difficulties in accurately and reliably forecasting distant years.

An analysis of long-term conditions for the continued operation of both the site and the highway facility should be performed. When analyzing the operational potential of full build-out conditions, particular attention should be placed on reserve capacity, especially along the highway. It is very important to determine the extent to which access demand will influence the highway's ability to absorb additional traffic growth and to define any capital improvements that may be required. Geometric design alternatives should be analyzed and configurations drawn that reflect those improvements that will mitigate the anticipated problems. Care should be taken to not compromise the functional life of the public facility.

41.2.4 Analysis Time Period(s)

The impacts on the adjacent roadway system generated by site traffic during the analysis time periods will define the roadway configurations and traffic control measures required. The selection of the analysis time periods is primarily based on the following factors:

1. the peaking characteristics of the estimated site traffic resulting from the projected trip making characteristics of the land uses within the proposed project; and

2. the peaking characteristics of traffic on the adjacent street and highway system.

The morning, noon and afternoon weekday commuter peak hours of the adjacent roadway system are typical periods of analysis. If the site will generate little or no traffic activity during these peaks, the Department may waive this requirement. AM vs. PM directionality and seasonal traffic volume variations should also be considered.

Some land-use types (e.g., retail, special events, recreational facilities, convention centers) generate evening or weekend peaks and are relatively inactive during weekday commuter peak hours. If the peak site activity will differ from that of the adjacent street and highway system (e.g., midday, weekend) or will exhibit unusual peaking characteristics, the Department may require the analysis of the evening and weekend peaks.

As determined on a case-by-case basis, the Department may require analyzing the peak periods of both the adjacent roadway system and the site's peak activity period to ensure sufficient driveway, turn lane and queuing capacity and adequate roadway operation.

41.2.5 Consideration and Review of Background Data

During the initial meeting with the Department, the available background data should be reviewed for applicability to the study. Existing and forecasted land development, traffic and transportation data and their sources should be discussed to determine if they are acceptable to MDT and local officials for use in analyses. A joint agreement should be established for any data adjustments to maintain consistency in analytical assumptions and applications. The following items should be considered when reviewing the applicability and acceptability of background data:

1. Traffic Volumes. The following background traffic volume data should be reviewed during the meeting:

    a. current and historic daily and hourly volume counts;
    b. recent intersection turning movement counts;
    c. hourly, daily and seasonal variations in traffic;
    d. projected volumes from previous studies or regional plans; and
    e. relationship of count day to both average and design days.

2. Land Use. Discussion on the applicability and acceptability of background land-use data may include the following topics:

   a. current land uses, densities and occupancy in the vicinity of the site;

   b. type and density of approved developments and planned completion dates;

   c. anticipated development on other undeveloped parcels;

   d. land-use master plan and zoning in the vicinity of the site;

   e. absorption rates by type of development; and

   f. access control restrictions (e.g., deeded full-access control, limited-access control or no access strip on plat).

3. Demographics. Current and future population and employment within the study area by census tract or traffic zone should be considered, as needed, for use in site traffic distribution.

4. Transportation System. The following background transportation system data should be reviewed with the Department for applicability:

   a. current roadway operation including flow direction and lane designations;

   b. right-of-way, access control and traffic control including signal timings;

   c. roadway functional classification;

   d. governmental jurisdictions of routes;

   e. traffic signal locations, coordination and timing;

   f. adopted State and local plans;

   g. planned thoroughfares and streets in study area, including improvements;

   h. transit mode, frequency, schedule, routes, stops and patronage;

   i. pedestrian and bicycle links and usage;

   j. available curb and off-site parking facilities;

   k. obstacles to the implementation of planned projects;

l. implementation timing and certainty of funding for study area improvements;

m. origin-destination or trip distribution data;

n. crash history in study area and near major intersections;

o. adjacent railroads; and

p. design vehicles including inventory delivery, school buses, emergency vehicles, etc.

41.2.6 Supplemental Data Requirements and Collection

A field reconnaissance should be conducted to collect the data needed to supplement the background data approved for use in the study and to observe existing traffic conditions at the site and on the study area roadways. Only that data necessary to address the particular issues of the study need be collected. This may include some or all of the following data:

1. minimum 8-hour turning movement counts during analysis time periods at study intersections;

2. minimum 24-hour machine counts to verify peaking characteristics of traffic;

3. adjustment factors to relate count data to design period;

4. pedestrian and bicycle data as needed for the study;

5. data relative to primary traffic control devices within the study area;

6. data on traffic signal phasing, timing and coordination;

7. roadway configurations, geometric and lane-use data;

8. parking regulations and availability;

9. location and configuration of all driveways likely to be impacted by the development. Include existing access impacted by the proposed turning lane development, medians, etc.;

10. location, type and availability of transit service;

11. data relative to route availability, usage and travel times;

12. posted speed limits and prevailing operating speeds as needed;

13. hazardous locations, vertical and lateral clearances and sight distance data;

14. data relative to land use and right-of-way; and

15. any other data specific to the needs of the study's scope.

Supplemental data should be obtained in surveys consistent with the procedures in the latest editions of the ITE publications Traffic Engineering Handbook and Manual of Transportation Engineering Studies. Any adjustments made to traffic counts (e.g., seasonal variations) or other survey data should be documented and based on data taken under similar study conditions.

41.3 ENGINEERING AND TRAFFIC ANALYSES

41.3.1 Trip Generation

Land-use type (e.g., residential, retail, industrial, office, mining facility) and size are the primary factors used in trip generation. These factors have a significant impact on the amount of traffic generated and the time-of-day it will occur. The trip generation rates or equations published in the latest edition of ITE's Trip Generation should be employed to estimate the traffic generated by the development types considered in the study. Any adjustments made to these rates (e.g., for pass-by or internal trips) must be documented. Other rates may be employed with the approval of the Department; however, the basis for selection or method of determination must be justified and documented.

41.3.2 Traffic Forecasts

41.3.2.1 Non-Site Traffic Forecast

The non-site traffic forecast is a key element of the traffic impact study because it characterizes and establishes the base traffic conditions on the future roadway system (i.e., with planned and programmed improvements) before site traffic is added and its contributory impacts assessed.

It is important to establish a credible base traffic condition before site traffic is added to the study's roadway system. The assumptions and methodology used to forecast non-site traffic vary on a project-by-project basis and are largely dependent on the scope of the study. Consideration should be given to selecting the most reliable forecasting method that is in balance with the study's scope. Before the study is initiated, alternative data sources and forecast methods should be discussed with the Department to determine an applicable and mutually acceptable procedure.

41.3.2.2 Site Traffic Forecast

Site traffic is typically estimated using trip generation rates that are published in the latest edition of ITE's Trip Generation; however, the Department may approve use of other methods; see Section 41.3.1. The resulting site traffic is distributed within the study area, assigned to the future roadway system (i.e., with planned and programmed improvements) and added to the non-site traffic forecast to establish the basis for assessing contributory project impacts and any needed improvements. The assumptions and methodology used for distribution and assignment must be documented as they vary on a case-by-case basis.

41.3.2.3 Total Traffic Forecast

The total traffic forecast is the sum of all non-site and site traffic components that are estimated to use the future roadway system in each horizon year of the study. The existing traffic volumes, the site traffic and the non-site traffic growth must be identified. Engineering and traffic analyses are performed at key study locations for each analysis time period to determine the operational and safety impacts of the proposed development. Site access needs and off-site improvement requirements are predicated on this analysis.

41.3.3 Site Access Considerations

All approaches to Montana highways should be designed and located according to the criteria presented in MDT Approach Standards for Montana Highways and Part IV of the MDT Traffic Engineering Manual. Each proposed site access should be fully analyzed with respect to capacity, traffic operations and safety. The following guidelines should also be considered:

1. Approach and Roadway Capacity. The study analyses should document impacts to the life and reserve capacity of adjacent arterials, intersections and other public roadways (e.g., design life of intersections, availability for growth, before and after level-of-service calculations). Sufficient capacity should be provided at site access points to ensure that approach operations do not interfere with the safe and efficient flow of future traffic.

2. Access Spacing. Adequate spacing should be maintained between driveways and other intersections. Site access should be located so that driveways are not blocked by queued vehicles at other intersections. Required median openings should conform to the Department's design criteria.

3. Signal Progression. Where signalization is warranted and justified, site access should be planned and designed to facilitate an existing signal progression. Section 41.3.11 provides information on traffic signal needs analyses.

4. Joint Access. Joint access of adjacent properties should be considered where adjacent property frontages are relatively short.

5. Angle of Intersection. Access drives, especially those with two-way operation, should intersect roadways at an angle as close to perpendicular as practical.

6. Safety Considerations. All approaches should be designed to maintain an efficient and safe flow of both through and site traffic. Proposed approach plans

should be reviewed to ensure adequate sight distance. Section 41.3.7 provides additional information on traffic safety issues.

7. Number of Driveways. The number of driveways should be limited to minimize traffic conflicts along the intersecting roadway.

8. Auxiliary Lanes. The adequacy and need for acceleration and deceleration lanes at proposed approaches should be evaluated.

9. Access Alignment. Where practical, site approaches should be aligned with driveways, alleys, median openings and intersections. Staggered or offset alignment is undesirable.

10. Storage Capacity. Adequate storage capacity for turn lanes should be provided at the site access intersection. Internal circulation, delivery operations and parking should be designed to minimize ingress impedance and vehicular queuing onto the adjacent roadway.

11. Access Width and Radii. The width and radii of all approaches should be designed to accommodate entering and exiting design vehicles efficiently and safely. The study should document all design vehicles used to develop access designs. The study should clearly document the primary truck route(s) used for deliveries by school buses, delivery trucks, etc.

12. Sight Distance. Sight distance at all approaches should be checked for adequacy.

13. Impacts to Other Transportation Modes. The impacts to and conflicts with other modes of transportation (e.g., pedestrians, bicycles, buses, railroads) should be addressed during the study.

14. Impact to Existing Access. Impacts and conflicts with existing access should be addressed in the study. In general, no proposed access or improvements should degrade movements (to or from), operations and safety of an existing access.

41.3.4 Capacity Analysis

For each study horizon year and analysis time period, the level of service should be computed at key study locations (e.g., signalized and unsignalized intersections, ramps, weaving sections, street and highway sections) in accordance with the procedures presented in the latest edition of the Highway Capacity Manual. Where signalization is warranted and justified, operational analyses should be conducted for study horizons having reliable turning movement forecasts; otherwise, the planning method will be

acceptable. Chapter Thirty of the Traffic Engineering Manual provides additional guidance.

41.3.5 Queuing Analysis

For larger, more complex development proposals, queuing analyses of drive-through facilities, intersection turn lanes and ramp termini that are under stop or signal control may be required. The primary purpose is to estimate vehicular queue lengths at the site planning stage to minimize traffic conflicts and flow interference. The following factors should be considered for queuing analyses:

1. Turn Lanes. Off-site intersection left- and right-turn lanes should be checked to ensure that there is sufficient storage capacity to prevent turning vehicles from queuing into through lanes.

2. Through Lanes. Off-site through lanes should be checked to prevent queuing into upstream intersections.

3. Site Access. Site access ingress lanes should be analyzed to ensure traffic will not queue into the intersecting highway.

4. Drive-Through Facilities. Drive-through facilities (e.g., banks, fast-food restaurants) should be analyzed to ensure that vehicular queues do not interfere with normal highway operations. Verify service times per customer.

Various manual and computer simulation methods are available to perform queue length analyses. Prior to initiating the study, the need to conduct such analyses and the acceptability of analysis procedures should be discussed with the Department.

41.3.6 Roadway Improvements Analysis

Roadway improvements vary widely among projects. Engineering and traffic analyses should be performed at the study's key roadway locations. The proposed project's contributory impacts to traffic operations, safety and impacts on adjacent land owners will be determined. The need for improvements will also be assessed. At locations where capacity or safety problems are anticipated, the Department may require the consideration of one or more of the following engineering solutions:

1. adding or lengthening left- or right-turn lanes at intersections,
2. providing additional through lanes at intersection approaches,
3. adding additional highway through lanes,
4. installing a new traffic signal,

5. re-phasing or re-timing an existing signal,
6. redesigning or relocating transit stops,
7. providing a grade-separated structure,
8. restricting intersection turning movements,
9. providing right-in and right-out access points,
10. closing or relocating approach(es), and
11. other mitigating countermeasures as deemed appropriate.

The design of any off-site improvements must conform to the MDT design criteria for that specific roadway.

41.3.7 Traffic Safety Consideration and Analysis

Site access driveways and off-site improvement recommendations should be reviewed to ensure that the design is consistent with vehicular, pedestrian and bicycle safety practices. Analysis needs are determined on a project-by-project basis and usually require three years of crash data, if available. A review of the number, rate and severity of crashes that have occurred within the study area is a typical requirement. If site traffic is expected to exacerbate an existing crash pattern (e.g., addition of heavy left-turn volumes), improvements may be justified. Mitigation countermeasures vary and may include:

1. changing traffic control,
2. adjusting signal phasing,
3. adding left- or right-turn lanes,
4. providing additional roadway and shoulder widths,
5. realigning horizontal and vertical curvature,
6. improving sight distance, and
7. realigning opposing driveways and access points.

41.3.8 Pedestrian Consideration and Analysis

The need to perform pedestrian studies varies on a project-by-project basis. The site plan and improvement recommendations should ensure that pedestrian traffic is safely and effectively accommodated. Locations where there is low pedestrian traffic will typically not require special pedestrian studies. However, other locations (e.g., large development areas, locations near schools) may require that site access or street intersections be designed to accommodate pedestrians. At these locations, the following countermeasures should be considered:

1. adding marked pedestrian crosswalks and ramps for the disabled as justified,
2. adjusting traffic signals for pedestrian actuation,
3. providing a raised median island for use as a pedestrian refuge,
4. implementing a grade-separated pedestrian structure, and
5. prohibiting pedestrian access.

Chapter Forty-two provides additional information on pedestrian considerations and school crossing studies.

41.3.9 Speed Consideration and Analysis

Vehicular speed is a primary factor that is used in determining stopping and intersection sight distance requirements. For approach intersections with high-speed facilities, it may be necessary to perform speed studies to determine the appropriate speed to use. Chapter Forty provides the Department's criteria for conducting speed studies.

41.3.10 Traffic Control Needs Analysis

The study should identify the type and location of traffic control devices required for site approaches and off-site improvements. The implementation of off-site traffic control (e.g., highway signing, pavement marking) will be consistent with the criteria presented in the Manual of Uniform Traffic Control Devices. Traffic control devices that are internal to the site should also meet these criteria. Chapter Eighteen and Chapter Nineteen of the Traffic Engineering Manual, respectively, provide additional information on the Department's criteria for highway signing and pavement markings.

41.3.11 Traffic Signal Needs Analysis

A traffic signal needs study should be conducted for all proposed traffic signals that are necessary to accommodate site generated traffic. New traffic signals must meet the minimum warrants for signalization as specified in the Manual of Uniform Traffic Control Devices and must be justified. Chapter Twelve of the Traffic Engineering Manual provides the Department's criteria for traffic signal design. The following additional factors should be considered for both proposed and existing traffic signals:

1. integration with existing signal progression,
2. need for coordination,
3. need for traffic signal actuation,
4. need for pedestrian signal heads and actuation, and
5. signal phasing adjustments such as left-turn phasing.

41.3.12 On-Site Planning and Parking Considerations

On-site planning and parking design should be fully integrated with the external roadway system and off-site improvements. The internal site design has a direct bearing on the adequacy of site access points to accommodate site traffic without impeding the safe and efficient flow of non-site traffic. The following factors should be considered during site planning:

1. location of access points in relation to off-site intersections and interchanges,
2. vehicular queue storage at intersections and drive-through facilities,
3. circulation of traffic within the site,
4. provisions for service and delivery vehicles,
5. internal and out-parcel building service drives,
6. design and implementation consistency of signs and pavement markings,
7. parking circulation, orientation and access for surface and structure parking, and
8. pedestrian, transit, bicycle and provisions for the disabled.

41.3.13 Transportation Demand Management

Large urban areas and large developments may require the application of Transportation Demand Management techniques to reduce the level of vehicular traffic. Transportation Demand Management techniques may include:

1. transit service,
2. carpools and vanpools,
3. modified work schedules,
4. internal bus shuttles for large developments, and
5. pedestrian systems within mixed-use developments.

The effectiveness of Transportation Demand Management techniques is difficult to assess. Sufficient documentation must be provided for peak-hour traffic volume reductions that are attributed to this countermeasure.

41.4 STUDY CORRESPONDENCE, REPORT AND PLAN PREPARATION

41.4.1 Study Correspondence

Section 2.2 of the Traffic Engineering Manual provides the Department's criteria for preparing general correspondence to individuals, groups or units inside and outside of the Department. The type of correspondence presented in Section 2.2 should be employed during the study.

41.4.2 Traffic Impact Study Report

41.4.2.1 Report Purpose and Objectives

The purpose of the Traffic Impact Study Report is to document the purpose, procedures, assumptions, findings, conclusions and recommendations of the study. The Report serves to assist the Department, local government agency and other interested parties in reviewing the attributes of the proposed development in conjunction with the requests that have an impact on the transportation facilities adjacent to the site (e.g., approach and building permits, zoning changes). The Report also serves as a credible basis to establish and negotiate mitigation requirements where off-site improvements are necessary.

41.4.2.2 Report Presentation

The Traffic Impact Study Report should present an objective technical analysis in a straightforward and logical manner that leads the reader through the analytical process to the resulting conclusions and recommendations. At a minimum, the Report should include the following information:

1. the study's purpose and objectives,
2. a description of the site and the study area,
3. a description of the existing conditions in the area of the site,
4. the anticipated nearby land developments and transportation improvements,
5. analysis and discussion of trip generation, distribution and modal split,
6. the traffic assignment resulting from the proposed development,
7. the projection and assignment of future traffic volumes,
8. an assessment of the traffic impacts attributable to the development, and
9. recommendations for site access and transportation improvements.

Sufficient detail should be provided so that the reviewer is able to follow the path and methodology of the study. All assumptions should be documented and published

sources referenced as necessary. Special situations (e.g., development of new trip generation rates or equations) should be sufficiently described to ensure application validity.

41.4.2.3 Sample Report Outline

The contents of a Traffic Impact Study Report vary with the size and complexity of the development proposal and are customized on a case-by-case basis to meet the specific needs of the study. The following sample outline is offered to the study preparer as a guide in preparing the Report:

I. INTRODUCTION AND SUMMARY
- A. Purpose of Report and Study Objectives
- B. Executive Summary
  1. Site Location and Study Area
  2. Development Description
  3. Principal Findings
  4. Conclusions
  5. Recommendations

II. PROPOSED SITE AND NEARBY DEVELOPMENTS
- A. Off-Site Developments
- B. Description of On-Site Development
  1. Location
  2. Land Use and Intensity
  3. Site Plan and Access Geometrics
  4. Applicable Zoning Criteria
  5. Development Phasing and Timing

III. STUDY AREA CONDITIONS
- A. Study Area
  1. Area of Influence
  2. Area of Significant Traffic Impact
- B. Study Area Land Use
  1. Existing Land Uses
  2. Existing Zoning Criteria
  3. Anticipated Future Developments
- C. Site Accessibility
  1. Existing and Future Area Roadway System
  2. Traffic Volumes and Conditions
  3. Transit Service

4. Existing Relevant Transportation System Management Programs
5. Other

D. Environmental Issues/Considerations
1. Other Required Agency Approvals/Permits
2. Wetlands, Noise, Air Quality and Aesthetics
3. Affects on Adjacent Landowners

IV. PROJECTED TRAFFIC

A. Site Traffic for Each Horizon Year
1. Trip Generation
2. Trip Distribution
3. Modal Split (if needed)
4. Pass-By and Capture Traffic
5. Trip Assignment

B. Non-Site Traffic Forecast for Each Horizon Year
1. Method of Projection
2. Traffic for Anticipated Developments In Study Area
   a. method of projection
   b. trip generation
   c. trip distribution
   d. modal split (if needed)
   e. trip assignment
3. Through Traffic
4. Estimated Volumes

C. Total Traffic for Each Horizon Year

V. TRAFFIC ANALYSIS

A. Site Access
B. Capacity and Level of Service
1. Without Site Including Programmed Improvements
2. With Site Including Programmed Improvements

C. Traffic Safety
1. Sight Distance
2. Acceleration/Deceleration, Left-Turn and Right-Turn Lanes
3. Adequacy of Location and Design of Driveway Access

D. Pedestrian Considerations
E. Speed Considerations
F. Traffic Control Needs
G. Traffic Signal Needs
H. Site Circulation and Parking

VI. IMPROVEMENT ANALYSIS
- A. Improvements to Accommodate Base Traffic
- B. Additional Improvements to Accommodate Site Traffic
- C. Alternative Improvements
- D. Status of Improvements Already Funded, Programmed or Planned
- E. Evaluation

VII. FINDINGS
- A. Site Accessibility
- B. Traffic Impacts
- C. Need for Improvements
- D. Compliance with Applicable Codes

VIII. CONCLUSIONS AND RECOMMENDATIONS
- A. Site Access and Circulation Plan
- B. Roadway Improvements
  1. On-Site Improvements
  2. Off-Site Improvements
  3. Construction and Operational Phasing
- C. Applicable Transportation System Management Actions
- D. Other

IX. APPENDICES
- A. Traffic Counts
  1. Daily Traffic Counts
  2. Peak-Hour Turning Movement Counts
  3. Pedestrian and Bicycle Counts
- B. Capacity Analyses Worksheets
  1. Signalized Intersection Operational Analyses
  2. Signalized Intersection Planning Analyses
  3. Unsignalized Intersection Analyses
  4. Two-lane and Multilane Analyses
  5. Ramp and Weaving Section Analyses
- C. Traffic Control Needs Studies
- D. Traffic Signal Needs Studies
- E. Crash Summaries

41.4.2.4 Report Figures and Tables

For larger, multi-phased or otherwise complex development proposals, study data should be presented in tables, graphs, maps and diagrams rather than in narrative text

for clarity and ease of review. Design drawings of roadway improvements (e.g., intersection reconfiguration) should also be considered when appropriate. The following list of study data and analyses are practical candidates for figure and table presentation:

1. Site Location;
2. Site Plan;
3. Existing Transportation System;
4. Existing and Anticipated Area Development;
5. Current Daily Traffic Volumes;
6. Existing Peak-Hour Turning Movement Volumes;
7. Anticipated Transportation System;
8. Directional Distribution of Site Traffic;
9. Estimated Site Traffic Generation;
10. Site Traffic;
11. Estimated Trip Generation for Non-Site Developments;
12. Estimated Non-Site Traffic;
13. Estimated Total Future Traffic (i.e., existing, site and growth traffic);
14. Signalized Intersection Operational Capacity Analyses;
15. Signalized Intersection Planning Capacity Analyses;
16. Unsignalized Intersection Capacity Analyses;
17. Two-Lane and Multilane Capacity Analyses;
18. Ramp and Weaving Section Capacity Analyses;
19. Projected Levels of Service;
20. Recommended Intersection Improvements;
21. Driveway Design Details; and
22. Traffic Signal Needs Analyses.

Additional figures and tables may be needed for studies with additional complexities, issues or study years. However, for smaller, less complicated developments, many items in the above list may be documented in narrative form within the Report.

41.4.2.5 Report Certification

The Traffic Impact Study Report should be prepared by or under the supervision of a professional civil engineer registered in the State of Montana who specializes in the area of traffic and transportation engineering. For studies conducted by individuals external to MDT, the Report must be signed by the professional engineer.

41.4.3 Preparation of Site Access and Off-Site Improvement Plans

All site access and off-site improvement plans should be prepared (i.e., design criteria and drafting quality) according to the applicable criteria and guidelines presented in the MDT Road Design Manual, MDT CADD Standards Manual and the following Chapters of the Traffic Engineering Manual:

1. Chapter Three, Part I - General;
2. Chapter Ten, Part II - Electrical (e.g., traffic signals);
3. Chapter Seventeen, Part III - Signs/Pavement Markings;
4. Chapter Twenty-three, Part IV - Geometrics; and
5. Chapter Thirty-Five, Part V - Safety Projects.

Preliminary plans (i.e., three full-size sets and one half-size set) should be submitted as soon as practical during the site planning phase. Final plan submission is required before permits are approved. The computer CADD-drawing files of the plans, in a digital format suitable for use by the Department, should be submitted with the final plans.