MISCELLANEOUS TRAFFIC ITEMS

Table of Contents

CHAPTER 14 - MISCELLANEOUS TRAFFIC ITEMS

14-1.00 INTRODUCTION

14-1.01 Purpose

The purpose of this chapter is to present traffic engineering functions which do not fall within material covered in other chapters.

14-1.02 Scope

This chapter includes review procedures and permits and guidelines for conducting specific studies and investigations. Other specialized subjects are also discussed.

14-1.03 Chapter Organization

This chapter has five major sections:

1. School Crossing Protection,
2. Review and Permits,
3. Route Numbering and Reference Point System,
4. Special Investigations and Studies, and
5. Engineering and Traffic Investigation Requirements to Establish or Change Regulatory Speed Limits.

14-2.00 GLOSSARY

Ball Bank Indicator

An instrument used to determine the safe speed that a passenger vehicle can comfortably travel around a curved section of roadway. This instrument typically consists of a steel ball in a sealed curved glass tube filled with an alcohol solution. New style ball bank indicators utilize technology and accelerometers to replicate the inclinometer of a traditional ball bank indicator.

Commissioner

Unless stated otherwise, “commissioner” means the commissioner of transportation of this state. Regardless of the commissioner referred to, however, the commissioner is to be considered as acting directly or through the commissioner’s duly authorized officers and agents. Minn. Stat. Sec. 169.011, Subd. 17.

County Highway Engineer

A registered professional engineer employed as the County Highway Engineer or the Director of Public Works/County Highway Engineer of each county.

County State-Aid Highway

A highway which:

1. Is projected to carry a relatively heavy traffic volume or is functionally classified as collector or arterial as identified on the county’s functional plans as approved by the county board;
2. Connects towns, communities, shipping points, and markets within a county or in adjacent counties; or provides access to rural churches, schools, community meeting halls, industrial areas, state institutions, and recreational areas; or serves as a principal rural mail route and school bus route;

3. Occurs at reasonable intervals consistent with the density of population, provides an integrated and coordinated highway system affording, within practical limits, a state-aid highway network consistent with projected traffic demands.

Department

Unless stated otherwise, "department" means the Department of Transportation of this state. Regardless of the department referred to, however, it is to be considered as acting directly or through its duly authorized officers and agents. Minn. Stat. Sec. 169.011, Subd. 23.

District Engineer

A District Engineer of any of the eight districts of the Minnesota Department of Transportation.

District State-Aid Engineer

A registered professional engineer employed as the District State-Aid Engineer.

Eighty-Fifth Percentile Speed

The speed at or below which 85 percent of vehicles travel. This metric aids in the establishment of speed limits.

Experimental Traffic Control Device

Any device which varies from the specifications set forth in the Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD).

Municipal State-Aid Streets

"Municipal state-aid streets" includes all streets within the cities having a population of 5,000 or more, established in accordance with law as municipal state-aid streets. Minn. Stat. Sec. 160.02, Subd 21.

Pace

The 10 mph speed range representing the speeds of the largest percentage of vehicles in the traffic stream.. The pace can usually be determined by visual inspection of the vehicle speed data sheet. In general, a normal speed distribution will contain approximately 70 percent of the sample within the pace with 15 percent above and 15 percent below the pace.

Railroad

"Railroad" means a carrier of persons or property upon cars, other than streetcars, operated upon stationary rails. Minn. Stat. Sec. 169.011, Subd. 58.

Roadway

"Roadway" means that portion of a highway improved, designed, or ordinarily used for vehicular travel, exclusive of the sidewalk or shoulder. During periods when the commissioner allows the use of dynamic shoulder lanes as defined in Minn. Stat. Sec. 169.011, Subd. 25, roadway includes that shoulder. In the event a highway includes two or more separate roadways, the term "roadway" as used herein shall refer to any such roadway separately but not to all such roadways collectively. Minn. Stat. Sec. 169.011, Subd. 68.

Rumble Stripes

"Rumble Stripes" are defined as a rumble strip that contains a pavement marking stripe. These are referred to as either edgeline rumble stripes or centerline rumble stripes. MnDOT Technical Memorandom No. 14-07-T-01.

Rumble Strips

A series of intermittent, narrow, transverse areas of rough-textured, slightly raised, or depressed road surface. Transverse rumble strips extend across the travel lane to alert road users to unusual traffic conditions. Edgeline or centerline rumble strips are located along the shoulder, along the roadway center line, or within islands formed by pavement markings to alert road users that they are leaving the travel lanes.

Rural Residential District

(a) "Rural residential district" means the territory contiguous to and including any city street or town road that is built up with visible dwelling houses situated at intervals averaging 300 feet or less for a distance of a quarter of a mile or more.

(b) For purposes of this subdivision, "interval" means the distance, measured along the centerline of the roadway, between the primary access points for adjacent dwelling houses, regardless of whether the dwelling houses are located on the same side of the road. Minn. Stat. Sec. 169.011, Subd. 69a.

Rural Section

A section of highway that has wide rights-of-way, open ditches for drainage, and a clear zone of usually 30 feet from the edge of the outside lane.

Shoulder

The part of the roadway which is contiguous to the regularly traveled portion of the roadway and is on the same level as the roadway. The shoulder may be pavement, gravel, or earth. Minn. Stat. Sec. 169.011, Subd. 74.

Sidewalk

That portion of a street between the curb lines or the lateral lines of a roadway, and the adjacent property lines intended for the use of pedestrians. Minn. Stat. Sec. 169.011, Subd. 75.

State-Aid Engineer

A registered engineer employed as the State-Aid Engineer of the Minnesota Department of Transportation.

State Traffic Engineer

A registered professional engineer employed as the Director of the Office of Traffic, Safety, and Technology (OTST) in the Operations Division of the Minnesota Department of Transportation.

Street or Highway

The entire width between the boundary lines of any way or place when any part thereof is open to the use of the public, as a matter of right, for the purposes of vehicular traffic. Minn. Stat. Sec. 169.011, Subd. 81.

Through Highway

Every highway or portion thereof at the entrances to which vehicular traffic from intersecting highways is required by law to stop before entering or crossing the same and when stop signs are erected. Minn. Stat. Sec. 169.011, Subd. 82.

Trunk Highway

As defined in Minn. Stat. Sec. 160.02, Subd. 29, "Trunk highways" includes all roads established or to be established under the provisions of Article 14, Section 2 of the Constitution of the State of Minnesota.

Trunk Highway Turnback

A former trunk highway or portion of it that has reverted to a county or municipality in accordance with law.

Urban District

The territory contiguous to and including any street which is built up with structures devoted to business, industry, or dwelling houses situated at intervals of less than 100 feet for a distance of one quarter mile or more. Minn. Stat. Sec. 169.011, Subd. 90.

Urban Section

A roadway design used in urban districts where the right-of-way width is restricted. Because of the restricted right-of-way, there is not enough room for ditches, thus necessitating curbs and gutters.

14-3.00 SCHOOL CROSSING PROTECTION

14-3.01 Responsibility

The safety of school crossings is the joint responsibility of parents, school administrators, other public officials, and the general public. On trunk highways, the Department will install appropriate signs and markings at designated school crossings and may authorize local authorities to install additional devices conforming to approved standards in situations that meet reasonable warrants.

14-3.02 Laws and Guidelines

Minn. Stat. Sec. 169.14, Subd, 5a sets forth the legal requirements of speed zoning in a school zone.

Information on traffic controls and speeds for school areas can be found in the MN MUTCD, Part 7.

More information can be found regarding speed limits at MnDOT's Speed Limits in Minnesota website.

14-3.03 School Safety Patrols and Crossing Guards

School Safety Patrols and/or Crossing Guards are strongly recommended at all crossings used by grade school students. No other means of protection has been as effective at facilitating crossings used by the younger students at grade schools. However, these patrols have not proven effective for high school or junior high school students. Where a School Safety Patrol or Crossing Guard is functioning as recommended, normally the only necessary controls are the standard school crossing warning signs and markings.

14-3.04 School Speed Limits

Each road authority may establish school zone speed limits on roads under their jurisdiction. In order to provide an objective, uniform, and safe environment for walking and biking students, Minnesota law (Minn. Stat. Sec. 169.14, Subd. 5a) requires an engineering and traffic investigation as prescribed by the Commissioner of Transportation prior to establishing a school speed limit. A Guide to Establishing Speed Limits in School Zones can be found in the MN MUTCD, Part 7.

14-3.05 School Site Plan Review

It is the responsibility of the School District, when planning to build a new school facility or make major changes to an in-place facility, to obtain all the necessary permits and approvals. The Minnesota Department of Education Planning Guide requires that the School District contact the District Traffic Engineer for guidance in planning for pedestrian and vehicle movements when trunk highways are involved. Other road authorities are to be contacted when their roadway is involved. MnDOT will also assist school districts in planning student, vehicle, and community user access to a school site based on available resources. In some cases an engineering consultant may need to be retained by the school district to work in conjunction with MnDOT staff.

14-4.00 REVIEW AND PERMITS

14-4.01 Geometric Reviews

Geometric design is concerned with the visible features of a highway such as pavement width, horizontal and vertical alignment, slopes, channelization, interchanges, etc. The design of these features can significantly affect traffic operation, safety, and capacity. In fact, some of the traffic problems existing today are the result of geometric design features that could have been corrected during the design stages if the design had been reviewed from a traffic engineering perspective. It is essential to maintain regular and cooperative communication between traffic and design personnel. Each group needs and benefits from the knowledge, expertise, and experience of the other.

14-4.02 Preliminary Layouts

The District Traffic Engineers should review all preliminary layouts to provide early input into the design process.

14-4.03 Evaluation of New Facilities

All newly constructed facilities should be evaluated on a systematic operating basis by District Traffic Engineers to assess their effectiveness in moving traffic safely and efficiently. If the improvement is not working as expected, it is imperative that an evaluation of the reasons be made. Positive and negative feedback based on traffic engineering evaluations can be an important contribution toward upgrading design standards and criteria to meet changing conditions. A copy of comments should be sent to the State Traffic Engineer.

14-4.04 Entrance Permits

No entrance or driveway from a trunk highway to private property may be constructed without permission of the Department. Under normal conditions any necessary entrance facilities are provided by the Department when the highway is constructed or reconstructed. In the event of a change in land use or major change in the traffic pattern of an existing facility, existing access often must be revised. After a highway has been constructed, no additional entrances shall be constructed, nor shall an existing entrance be changed without the approval of the District Engineer. It is the responsibility of the Area Maintenance Engineer to investigate all requests for such permits and to recommend proper action to the District Engineer. Traffic engineering principles should be applied in the investigation, and the District Traffic Engineer should have direct input. Entrance permit application forms and instructions can be found on the MnDOT Land Management website.

A variance from the standards set forth in Minnesota Rules, Chapter 8810 parts 4100-5600 may be allowed by the Department when the variance will facilitate the safe, efficient use of the property for a lawful purpose and will not interfere with the construction, maintenance, or safe and efficient use of the highway and its appurtenances by the public.

14-4.05 Transportation Permits

Permits for the movement of over-size or over-weight loads are issued by MnDOT's Office of Freight and Commercial Vehicle Operations. Permit guidelines and forms can be found at www.dot.state.mn.us/cvo/oversize/oversize.html.

14-4.06 Use of Trunk Highway Right-of-Way for Special Events

Use of trunk highway right-of-way for special events and activities will not be allowed unless a legitimate public interest is to be served. Use of trunk highway right-of-way not related to construction or maintenance requires that the requester contact the MnDOT District Office. MnDOT authorization will be granted, through the district permitting process, if all pertinent criteria covered in the following guidelines are satisfied.

1. The permit shall identify that the sponsor agrees to assume the entire responsibility and liability for all damages or injury to all persons, whether employees or otherwise, and to all property, arising out of, resulting from, or in any manner connected with the operation of the special event.
2. The sponsor shall agree to defend and indemnify MnDOT, its agents and employees from all such claims including, without limiting the generality of the foregoing, claims for which MnDOT may be claimed to be liable and legal fees and disbursements paid or incurred to enforce the provisions of this paragraph, and the sponsor shall further agree and pay for such general liability coverage which protects the state as an additional named insured.
3. The permit shall also identify that the sponsor shall be responsible for any damage done to trunk highway property as a result of the special event. Damages are payable upon receipt of invoice.

If MnDOT provides assistance in the form of traffic control devices, signs and/or labor, the requester should be billed for the actual costs incurred by MnDOT.

For purposes of these guidelines, the use of trunk highway right-of-way is split into four categories:

1. Use of Right-of-Way Involving Road Closure,
2. Use of Right-of-Way Involving Traffic Restrictions,
3. Use of Right-of-Way Not Involving Traffic Restrictions, and
4. Signs, Banners, and Decorations.

Within each of these, the categories are subdivided as follows:

Freeways - includes interchange areas on expressways.

Expressways - does not include interchange areas.

High Speed, Two-Lane, Two-Way Highways - speed limit of 45 miles per hour or greater (includes segments that may have additional lanes for passing, turning or bypassing and/or short segments of four or more lanes).

Low Speed Roads - speed limit of 40 miles per hour or less (generally includes those segments of trunk highways that pass through a city and/or serve a city street-type function and all frontage roads).

14-4.06.01 Use of Right-of-Way Involving Road Closure

Examples of road closures include parades, races, filming, etc.

1. Freeways, Expressways and High Speed Two-Lane Two-Way Highways
   Closures should not be allowed.
2. Low Speed Roads
   Closures may be allowed at the discretion of the District Office subject to the following criteria:
   a. Closures shall not be allowed during peak traffic periods unless authorized by the District Traffic Engineer.
   b. If the right-of-way is located within a city, requests shall be made through the offices of or by the city.
   c. A plan for traffic control and documentation of the means to implement it should be submitted. An adequate detour route shall be provided. Motorists shall be guided through the detour by signs, traffic control personnel, law enforcement personnel or a combination of the three.
   d. Signs, if used, shall be in accordance with the MN MUTCD.
   e. Detour signing, advance notices, and publications are the responsibility of the requester. MnDOT should review, comment on, and approve the plan. Upon request, MnDOT may provide assistance in the form of traffic control devices, signs, and/or labor. The requester should be billed for the actual costs incurred by MnDOT.
   f. All road closures should be coordinated with the State Patrol and the local law enforcement agency.
   g. Adequate traffic control and law enforcement personnel shall be arranged by the requester.
   h. Festivals with a long history of occurrence and no traffic mobility or safety problems in the past should be allowed to continue. If a new traffic mobility or safety problem arises, it should immediately be brought to the attention of the event sponsor, local municipality, and enforcement agencies to be addressed. If no solution can be found, the organizations shall jointly agree to revise the location of the festival.
   i. Denials of permits for road closures may be appealed to the Commissioner of Transportation by the requester.

14-4.06.02 Use of Right-of-Way Involving Traffic Restrictions

Examples of this category include races, filming, etc.

1. Freeways

   Use of the freeway mainline and the adjacent right-of-way should not be allowed. However, use of a local road overpass or underpass area may be allowed in those cases where there is no significant impact on freeway traffic, subject to the criteria covered under “High Speed Two-Lane Two-Way Highways and Low Speed Roads,” below.

2. Expressways

   Use of right-of-way should not be allowed. However, use may be allowed in those cases where there is a limited impact on traffic, subject to the criteria covered under “High Speed Two-Lane Two-Way Highways and Low Speed Roads,” below.

3. High Speed Two-Lane Two-Way Highways and Low Speed Roads

   Use of right-of-way should not be allowed during peak traffic periods. Limited use is allowed subject to the following criteria:

   a. The period of time for which a road is restricted for partial use should not exceed four hours.

   b. If the right-of-way is located within a city, requests shall be made through the offices of or by the city.

   c. The use of the right-of-way shall not interfere with motorists’ safe operation of their vehicles.

   d. The use of the right-of-way shall not obstruct sight distance and shall not detract from motorists’ view of traffic control devices.

   e. A plan for traffic control and documentation of the means to implement it should be submitted.

   f. Adequate traffic control and law enforcement personnel shall be arranged by the requester.

   g. All traffic restrictions should be coordinated with the State Patrol and the local law enforcement agency.

14-4.06.03 Use of Right-of-way Not Involving Traffic Restrictions

Examples in this category are parking, booths, sales, etc.

1. Freeways

   Use of the freeway mainline and the adjacent right-of-way should not be allowed. However, use of a local road overpass or underpass area may be allowed in those cases where there is no significant impact on freeway traffic, subject to the criteria covered under “Low Speed Roads” below.

2. Expressways and High Speed Two-Lane Two-Way Highways

   Use of right-of-way should not be allowed. However, use may be allowed in those cases where there is a limited impact on traffic, subject to the criteria covered under “Low Speed Roads” below.

3. Low Speed Roads

   Use of right-of-way may be allowed subject to the following criteria:

   a. If the right-of-way is located within a city, requests should be made through the offices of or by the city.

   b. No advertisements should be permitted on the right-of-way.

c. The use of the right-of-way shall not interfere with motorists' safe operation of their vehicles.

d. The use of the right-of-way shall not obstruct sight distance and shall not detract from motorists' view of traffic control devices.

e. Adequate law enforcement personnel protection shall be arranged by the requester, as necessary.

f. Use of the right-of-way shall not exceed 30 days and similar use should not recur within ten months.

14-4.06.04 Signs, Banners, and Decorations

1. Freeways

   Signs, banners, and decorations should not be allowed on the right-of-way.

2. Expressways, High Speed Two-Lane Two-Way Highways, and Low Speed Roads

   Directional signs may be allowed at the intersection of the local road leading to the event. Non-directional signs, banners, and overhead decorations will be allowed only on low speed roads subject to the following criteria:

   a. If the signs, banners, or decorations are to be located within a city, the requests should be made through the offices of or by the city.

   b. Signs, banners, or decorations shall not be attached to any MnDOT structure (sign, signal, bridge, etc.).

   c. Directional and non-directional signing are the responsibility of the requester. If, upon request, MnDOT provides assistance in the form of signs and labor, the requester should be billed for the actual costs to the Department.

   d. The requester for directional signing will be advised that signing must conform to the MN MUTCD or as directed by the District Office.

   e. Directional signing shall contain only directional information for the event.

   f. Non-directional signs or banners shall not appear to represent or conflict with an official traffic control device in shape, form, color, or legend. They should be of a neutral color.

   g. Non-directional signs or banners should display only the name of the event and the scheduled time.

   h. Signs, banners, and decorations shall not obstruct sight distance or detract from motorists' view of traffic control devices.

   i. No changeable message signs of the type used for temporary or permanent traffic control shall be permitted for event advertising purposes.

   j. The minimum clearance for all signs, banners, and decorations spanning a highway should be 22 feet above the roadway and shoulder.

   k. Letter height displayed on city banners is not to exceed two inches.

   l. Stroke width displayed on city banners is not to exceed width of B Series Highway Gothic lettering.

   m. No logos or product advertising is allowed.

   n. Adequate traffic control shall be provided when overhead signs, banners, and decorations are being installed and removed.

o. Non-directional signs, banners, and decorations pertaining to an event shall not be in place longer than two weeks prior to the event and shall be removed within three days after the last day of the event.

14-5.00 ROUTE NUMBERING AND REFERENCE POINT SYSTEM

14-5.01 General

Each highway in Minnesota is part of a dual system of numbering. The first part of the system is a Constitutional or Legislative route number and the second part is a route signing number (i.e., U.S. route number, Interstate route number, or a Minnesota Trunk Highway number). The total numbering system must be kept in logical order and great care must be exercised in changing or revising any portion of the system. There are certain rules which must be followed and certain committees, both locally and nationally, that must be involved to make the system workable.

14-5.02 Constitutional Routes

The Constitutional amendment adopted in 1920 establishing the Minnesota highway system listed 70 routes that by their very description connected various cities and areas in the state into a highway system. These first 70 routes are known as Constitutional Routes and are numbered 1-70. These routes are described in Minn. Stat. Sec. 161.114 and, because of the constitutional nature of their establishment, should be considered unchangeable.

14-5.03 Legislative Routes

Since the original 70 routes were established, many additional routes have been added to the trunk highway system by the State Legislature. These routes, currently numbering over three hundred, are known as Legislative Routes. These routes are modified, revised, changed, and added to from time to time by the Legislature, usually on the recommendation of the Department. These routes are described in Minn. Stat. Sec. 161.115. Any changes proposed by the district to these routes should be coordinated through the Department's Control Section and Route Numbering Committee.

14-5.04 Names and Designation of Certain Highways

At various times the Legislature has named and designated portions of certain constitutional and legislative routes. Examples include "Capitol Highway," "Floyd B. Olson Memorial Highway," "Yellowstone Trail," etc. Named routes are listed in Minn. Stat. Sec. 161.14 where the route itself is described and the special conditions for signing each route are set forth. Refer to MnDOT Policy, Names and Designation of Highway and Bridge Memorials located on the MnDOT Policies - Operations and Engineering website for more information.

14-5.05 Interstate Routes

The National System of Interstate Highways was established in 1957 with a numbering system and distinctive markers designed by the American Association of State Highway and Transportation Officials (AASHTO). East-west routes have even numbers and north-south routes have odd numbers with the lowest number routes in the west and south. Major routes have one or two digit numbers, and the most important routes have numbers ending with 0 or 5. Special, related three-digit numbers are used to designate spurs and circumferential routes in urban areas. Any proposed revisions to this numbering system must be coordinated through the Route Numbering and Control Section Committee (RNCS) since approval by a national committee is required prior to any change in the system.

14-5.06 U.S. Highways

The system of United States Numbered Highways was adopted in 1926 in order to provide a uniform system of numbered highways extending across the nation for the benefit of the interstate traveler. The numbering system

and the distinctive markers were developed by AASHTO at the request of the Federal Highway Administration with advice from several states. This system is kept current through the coordination of AASHTO and the cooperation of the states. Even numbered routes generally follow an east-west alignment, while odd numbered routes are generally north-south. Any proposed changes to this system must be coordinated through the Route Numbering Committee since the approval of the Executive Board of AASHTO is necessary. The U.S. route system is only a route numbering signing system and is not related to federal funding.

14-5.07 Trunk Highway Routes

All routes not designated as part of the Interstate or U.S. Route numbering systems are given a "Minnesota" route number. These numbers are assigned by the Route Numbering and Control Section Committee (RNCS) and all requests for new numbers or changes must be coordinated through that committee.

14-5.08 Turnbacks

As roads are rebuilt or new roads are constructed, certain old routes are turned back to the counties and municipalities. The route is deleted from the trunk highway system and is normally assigned a route number by the involved jurisdiction. Funds are available for restoration of the roads that have reverted to county and municipal jurisdiction. See Minn. Stat. Sec. 161.082 and 161.083.

Rules and regulations for implementing a "turnback" are set forth in the current MnDOT Right of Way Manual. Upon completion of a "turnback" all responsibility for providing traffic control devices rests totally with the local jurisdiction. The Project Manager should review any existing signal agreements to assure that any responsibilities of MnDOT identified within any existing signal agreement are met.

14-5.09 Reference Point System

Reference posting is a continuous distance reference system which indicates the distance from a known starting point. The purpose of a reference point system on freeways and highways is to provide uniform and accurate reference points for all highway-oriented activities. Actual physical reference points consist of reference location signs, installed at approximately one mile intervals along the roadside, showing the continuous distance along the route.

Distance numbering is continuous for each route within the state, except where overlaps occur. Distances are computed from the west state line or the westerly terminus for highways running in a general west-east direction (increasing going east) and from the south state line or the southerly terminus for highways running in a general south-north direction (increasing going north).

The Trunk Highway Log Point Listing specifies the locations of side roads, bridges, crossroads, culverts and other identifiable physical features to the nearest thousandth of a mile. The Log Point Listing was developed for the purpose of providing more precise and specific reference to locations between the reference location signs. Log Point systems are available for both county and municipal road systems. More information can be found on the Roadway Data website.

The Reference Point System and Trunk Highway Log Point Listing are used to aid offices and organizations directly associated with highway-oriented activities. Included in the practical uses of the system are the following:

1. Precise identification of crash locations.
2. Reference points for the location of emergency incidents.
3. Reference points for roadway maintenance servicing.
4. Reference points for use in road inventory records.
5. Aid to motorists in estimating their progress.
6. Transportation planning purposes.

14-5.09.01 Overlapping Routes

Mileage numbering should be continuous for each route within the state. On overlapping routes, continuity should be established for only one of the routes in accordance with the Control Section Record. On the route without reference location sign continuity, the first reference location sign beyond the overlap should indicate the approximate distance traveled from the beginning of the route.

14-5.09.02 Divided Highways

For divided highways, mileage measurements shall be made on northbound and eastbound roadways. The reference location signs for southbound and westbound roadways shall be set at directly opposite locations.

14-5.09.03 Transportation Information System (TIS)

TIS is an integrated database system that stores roadway related traffic information such as Average Annual Daily Traffic (AADT), Heavy Commercial Average Annual Daily Traffic (HCAADT), and select roadway physical characteristics such as bridge, crash, traffic, and pavement data.

Reference location signs play a critical role in TIS as all road features, inventory items, or crash locations are directly or indirectly referenced to the field reference location sign. It is imperative that the sign be in place. If replacement is required, it must be done in accordance with location instructions found in Chapter 6 of this Manual.

When construction projects or turnbacks affect reference posting on any trunk highway, the Transportation Data and Analysis office should be contacted as to placement of the required posts. Do not invent a new method, as the True Mileage System of TIS has established adjustment rules and procedures to follow.

14-5.10 Exit Numbering

Exits from freeway and expressway interchanges in Minnesota are numbered in accordance with Federal Highway Administration requirements which specify a reference post format. Exit numbers are displayed at the top of major guide signs located in advance of an interchange at the exit. The exit number normally utilizes the last reference post number in a decreasing reference post direction from the interchange. When there are multiple exits at an interchange (cloverleaf, for example), or more than one interchange for a given reference post, the first exit number in the increasing reference post direction is given the letter “A” and the second the letter “B”. Occasionally, a third exit may occur within the same reference post number assigned to an interchange. In that case, the exit would carry the reference post number followed by the letter “C”.

14-6.00 SPECIAL INVESTIGATIONS AND STUDIES

14-6.01 Rumble Strips and Rumble Stripes

Rumble Strips

Rumble strips are grooves or rows of indents in the pavement designed to alert inattentive drivers through noise and vibration to reduce crashes. There are two general types of rumbles, longitudinal and transverse. Technical Memo 14-07-T-01 Rumble Strips and Stripes on Rural Trunk Highways contains details of MnDOT requirements, exceptions, and typical dimensions of longitudinal rumbles.

Shoulder rumble strips are longitudinal rumble strips installed outside of the edgeline. The intent of shoulder rumbles is to notify inattentive drivers that they are leaving the roadway with the goal of reducing run-off-the-road crashes. They are also useful during snowy conditions to help the driver keep the vehicle on the road. The edgeline may also be installed on top of the rumble. These are typically called edgeline rumbles or edgeline rumble stripes.

Centerline rumble stripes (or simply centerline rumbles) are longitudinal rumbles installed along the centerline of undivided roads with the goal of reducing head-on, opposite direction side-swipe, and run-off-the-road-left crashes. The centerline is installed on top of the rumble.

Transverse rumble strips may be used when unusual alertness is required of drivers of an upcoming hazard and standard traffic control devices such as signs and/or flashers have not proven to give adequate warning. Several strips are placed laterally across the pavement to cause a rumble or bumpy motion that, when traversed by a vehicle, will alert the driver. Typical locations for use of transverse rumble strips are approaches to toll gates and to stop signs hidden by horizontal or vertical curves. Proximity of the rumble strip to the hazard is important. If the rumble strip is located too close to the hazard, sufficient driver reaction time is not given. If they are located too far away, the driver may not relate the rumble strip to the hazard. MnDOT has developed a formal rumble strip layout, see the MnDOT Road Design Manual.

14-6.02 Experimental Traffic Control Devices

14-6.02.01 Legal Authority

Minnesota Statutes 169.06, Subdivision 2, states, "The Commissioner may authorize variations from the manual and specifications for the purpose of investigation and research into the use and development of traffic-control devices. When such authorized variation pertains to the regulation of traffic, notice of the intended regulatory purpose shall be published in a qualified newspaper of general circulation in the area where the research is being conducted."

14-6.02.02 Procedures

The following procedures shall be followed to obtain approval to use experimental traffic control devices:

1. The District Traffic Engineer or other MnDOT representative shall originate the procedure by making a thorough investigation relative to the needs for the experimental device, reasons for choosing it, description of device, and expected results. See MN MUTCD Chapter 1A.10.2 "Request to Experiment".
2. The originator shall submit the Request to Experiment to the Traffic Standards Engineer, Office of Traffic, Safety, and Technology (OTST) for review with a request for approval.
3. The OTST Traffic Standards Engineer, shall draft a letter to the FHWA requesting approval of the experimental device(s).The District Traffic Engineer or other MnDOT representative shall review the site upon installation of the device and shall monitor it periodically to assure safe and efficient operation of the device and to recommend any necessary alterations to the OTST Traffic Standards Engineer.
4. Upon termination of the operation or experiment, the originator shall submit a report to the OTST Traffic Standards Engineer and the FHWA, outlining all aspects of the experiment and evaluating the device, recounting both positive and negative aspects, and including comments and suggestions.

14-6.03 Speed Trend Studies

Minnesota Department of Transportation Districts typically conduct speed trend studies. The data collection procedure may require staff hours in the field to set up portable data collection machines. These machines may require in-road placement of road tubes, in-pavement loop detectors, or portable magnetic sensing devices.

Speed trend studies measure motorist's travel speed at a particular site or on a roadway type. The study is a compilation of speed monitoring sessions (sometimes called speed surveys). Analyses of these data determine one or more roadway speed metrics. The results from a speed trend study may identify changes in speeds due to changes in the roadway environment, i.e. road construction, changes to the roadway geometric, etc.

14-6.03.01 Minnesota Speed Monitoring Program

Detailed information regarding the Minnesota Speed Monitoring Program can be found at www.dot.state.mn.us/trafficeng/speed_monitoring/index.html.

Previously, the Federal Highway Administration required states to submit speed trend studies of highways with posted speed limits of 55 to 65 miles per hour. This program established a consistent statistical method to measuring vehicle roadway speeds. Annual reports of vehicle roadway speeds determined Minnesota's public compliance with the National Maximum Speed Limit Law (NMSL), a provision of the 1974 Emergency Highway Energy Conservation Act. In 1995, Congress passed the National Highway System Designation Act which repealed the NMSL and all federal speed limit controls.

The Minnesota Department of Transportation, Office of Traffic, Safety, and Technology continues to provide annual speed reports. The reports are found at http://www.dot.state.mn.us/trafficeng/speed_monitoring/speed_reports.html. The annual speed report shows the 85th percentile speed for urban freeways, rural freeways, rural two-lane two-way highways, rural divided highways, and urban divided highways.

The Office of Traffic Forecasting and Analysis coordinates, collects, and manages the roadway speed data. Automatic Traffic Recorders (ATR), Weigh-in-motion (WIM), and Wavetronix (SmartSensor HD) devices, located throughout the state, provide continuous data collection.

- The Automatic Traffic Recorder is a permanent data collection device in the pavement surface. ATRs offer continuous automatic data collection throughout the year. These devices collect roadway volume, vehicle classification, and travel speed.
- Weigh-in-motion is similar to the ATR, but also provides axle loadings, vehicle and axle configuration, and truck volume characteristics.
- The Wavetronix SmartSensor HD operates off radar technology to measure volume, individual vehicle speed, average speed, 85th percentile speed, average headway, average gap, lane occupancy, and length based vehicle classification.

More information regarding traffic data collection methods can be found at http://www.dot.state.mn.us/traffic/data/coll-methods.html.

Speed Monitoring Session Location Requirements

When conducting short-term speed surveys or installing long-term data collection devices, the following roadway conditions should be avoided.

1. Locations near or at a sharp horizontal curve with a speed advisory plate less than the posted speed limit.
2. Locations with steep grades (i.e. greater than 4 percent).
3. Locations within 100 feet of a significant at-grade intersection.
4. Locations within 1000 feet of an interchange exit or entrance ramp.
5. Locations within the interchange (defined as the distance from the beginning of a deceleration lane through the end of an acceleration lane).
6. Locations with other features that may influence vehicle speeds (e.g. a narrow bridge or railroad crossing).

14-6.04 Sight Distances at Crossroads

A major safety aspect is the sight obstruction caused by noise barriers, plantings, poles, signs, fences, bridge rails, etc., at or near the intersections of ramps, frontage roads, and crossroads. When evaluating sight distance at intersections, two different procedures must be followed in order to determine if it is adequate-, 1) perceptual and 2) driver acceptance of a minimum 10 second vehicle interval. It is very desirable that both of these be met at all intersections.

14-6.04.01 Perceptual

When approaching an at-grade intersection, the operator of a vehicle should have an unobstructed view of the whole intersection and enough of the intersecting highway such that the driver can perceive a hazard in sufficient time to alter the speed of his vehicle as necessary before reaching the intersection. Minimum distances along the intersection road (setback distance) which should be unobstructed are determined by the approach speed and the distance traveled by the vehicle in three seconds. This does not provide enough distance to stop the vehicle; however, the three seconds gives the driver two seconds for perception and reaction plus one additional second to actuate braking or accelerating his vehicle to avoid a collision. For additional information see Chapter 5 of the MnDOT Road Design Manual.

14-6.04.02 Driver Acceptance of a 10-Second Vehicle Interval

Once a vehicle has stopped at the intersection, the driver must be provided adequate sight distance to safely enter the intersection. This distance is based on the acceptance of a 10-second vehicle interval. This may or may not be provided using the perceptual sight triangle method. Telephone and power poles, fences, and bridge rails do not obstruct vision when approaching an intersection (i.e., perceptual sight) but can block the entire view when stopped at the intersection. Figure 5-2.01A of the Road Design Manual provides the necessary information to determine the lengths needed for this sight distance.

14-6.05 Railroad Crossing Review

Information regarding Railroad Crossings can be found on MnDOT's Rail Safety website and also in the MN MUTCD, Part 8.

14-6.06 Advisory Curve Study

The need for installation of Horizontal Alignment signs can be found in the MN MUTCD, Part 2C. Advisory speeds will be determined by the established engineering practice using a ball bank indicator as stated in Chapter 6 of this manual (6-6.05 Advisory Speed Plaques and 6-6.21 Truck Rollover Warning Signs). Field ball bank readings may be measured by making several trial runs through the curves in a test vehicle equipped with a slope meter or an electronic meter. The ball bank reading is a measure of the overturning force (side friction) measured in degrees, on a vehicle negotiating a horizontal curve.

Slope Meter

The slope meter is an instrument used to help determine the speed that a passenger vehicle can comfortably travel around a curved roadway section. This instrument consists of a steel ball within a sealed, curved glass tube filled with an alcohol solution. The tube, bent on the arc of a circle, is graduated from 0 to 20 degrees, both to the left and right of the zero point. The tube is enclosed in a metal case. When mounting the ball-bank indicator, the vehicle should be in a stationary level position. The speedometer of the test vehicle must be accurately calibrated and the tires uniformly inflated. The indicator should be mounted vertically, with the steel ball at the zero point. All occupants who are to be in the vehicle when the observations are made should be in the same position when mounting or checking the instrument as when making the test drive. This is necessary because changing the position of a passenger or the load in the test vehicle may cause the vehicle body to tilt to the right or left. This tilting action or body roll will cause a change in the slope meter readings.

Procedures for Testing a Curve

The use of the slope meter or electronic meter to measure the comfortable speed on curves involves the efforts of two people - one to drive and the other to observe the meter. The following procedures should be followed for each test:

1. The curve under observation should first be appraised by the driver to determine the approximate safe speed that can be maintained.
2. The driver should then conduct the first test at a speed 10 mph below the appraised speed.

3. Each succeeding test should be made at a speed 5 mph greater than the preceding test, until the meter has reached the degree of ball bank as shown in "Chart 6.5: Ball Bank Angles for Safe Turn or Curve Speeds" found in Chapter 6 of this manual.
4. On each test, the driver should attain the trial run speed at a distance of at least 1/4 mile from the beginning of the curve.
5. The course throughout the curve should be maintained precisely in the center of the lane and at uniform speed. Using a vehicle with cruise control aids in this process.
6. The observer shall note carefully the position of the ball on the slope meter or the display on an electronic meter at the approximate center of the curve and shall record the reading.

Curve Study Sheet

It is important that all information be recorded as indicated on a curve study sheet. As provided on the curve study sheet, trial runs should be made in each direction. The ball bank angles in Chart 6.5 shall be used to establish the safe speed on curves. As an example, for the speed range 35 mph and above, the comfortable speed for the curve is the exact speed which swings the ball 12 degrees off center on a slope meter or displays 12 degrees on an electronic meter. Any speed which causes the ball to move more than 12 degrees away from the zero position is considered uncomfortable to the driver and possibly unsafe at higher speeds.

14-7.00 ENGINEERING AND TRAFFIC INVESTIGATION REQUIREMENTS TO ESTABLISH OR CHANGE REGULATORY SPEED LIMITS

14-7.01 Authority

Minnesota Statute Section 169.14 sets forth speed limits to govern all highways and alleys in the state. Any posted speed limit greater or less than the statutory limits (Minn. Stat. Sec.169.14, Subd. 2) must be authorized by the Commissioner of Transportation. Any alteration of statutory speed limits on any public road or street shall be based upon the results of an engineering and traffic investigation. It is MnDOT's standard practice that the entire trunk highway system shall have regulatory speed limits and the speed limits shall be determined by an engineering and traffic investigation. The regulatory speed limit shall be effective when such signs are erected.

The Commissioner delegates authority to the Assistant State Traffic Engineer, OTST, to authorize the establishment of speed limits. The District Traffic Engineer is responsible for performing the engineering and traffic investigation necessary for speed limit determination.

There are exceptions to the Commissioner's authority to establish regulatory speed limits:

1. School zone speed limits on local roadways (see Minn. Stat. Sec. 169.14, Subd. 5a and MN MUTCD, Part 7).
2. Work zone speed limits when workers are present (see Minn. Stat. Sec. 169.14, Subd. 5d and MN MUTCD, Part 6).
3. Manufactured home parks and recreational areas (see Minn. Stat. Sec. 327.27, Subd. 2).
4. Roadways that have a designated bike lane (Minn. Stat. Sec. 160.263 and the MnDOT Bikeways Facility Design Manual).
5. Speed limits within a park (Minn. Stat. Sec. 169.14, Subd. 5e).

14-7.02 Principles of Speed Zoning

The statutory speed limits described in Minn. Stat. Sec. 169.14, Subd. 2 are intended to provide uniformity for typical highways, under ideal conditions, and no apparent hazards. Alteration of the statutory speed limits to fit existing traffic and physical conditions of the highway constitutes the basic principle of speed zoning. The

objective of correct speed zoning is to influence as many drivers as possible to operate at or near the same speed, thus reducing conflicts created by wide speed differentials. Wide differences in speed are statistically proven to contribute to crashes. A speed zone study is conducted to determine the maximum safe speed that should be posted for a particular location in order to provide continuity of traffic flow.

Correct and realistic speed zoning will serve to protect the public and regulate the unreasonable behavior of an individual. Recognizing that careful and competent actions of a reasonable driver should be considered legal, MnDOT has a responsibility to assure this protection. If a speed zone is determined by the actions of the majority of drivers on a highway, it will facilitate the most efficient and orderly movement of traffic by increasing driver compliance of a reasonable and prudent speed. The speed limit should aid the motorist in adjusting speed to the conditions and furnish police officers with an indication of what is excessive and unreasonable speed.

14-7.03 General Administrative Requirements and Procedures

Trunk Highways (Minn. Stat. Sec.169.14, Subd. 4)

All speed limits on trunk highways are under the authority of the Commissioner of Transportation and not local authorities. Alteration of these speed limits is at the discretion of MnDOT. All trunk highways should be investigated at least once every ten years to ensure that every speed zone is appropriate. Any trunk highway that is reconstructed must also be investigated.

The District Traffic Engineer shall compile all supporting documentation along with a completed Trunk Highway Speed Limit Authorization Form. The THSLA shall be written for the entire control section, even if only one portion is under explicit investigation. These documents shall be submitted to the Assistant State Traffic Engineer, OTST, for review and approval. After this review and approval, the authorization will be signed and returned to the district for implementation. When signs are erected, the new authorized speed limit will be enforceable.

Local Streets and Highways (Minn. Stat. Sec.169.14, Subd. 5)

When a local authority deems an existing speed limit is not reasonable or safe on a road under its jurisdiction, and the roadway is not eligible for any other statutory speed described in Minn. Stat. Sec. 169.14, Subd.2, the local road authority may request MnDOT to conduct an engineering and traffic investigation to determine the speed limit.

The procedure is for the local road authority to draw up a formal request for an investigation. The request should describe the road or street fully and indicate the exact termini of each section where an investigation is desired. This request should be submitted to the District Traffic Engineer to initiate the investigation by MnDOT. Before the investigation begins, it is important to discuss the possible impact of this request with the roadway authority. The roadway authority should be informed of any statutory speed limit options it may have overlooked.

The termini should describe a sufficiently long section (at least one quarter mile or more) to provide for a meaningful study. If MnDOT has issued previous authorizations for the requested section of road, the road authority should be notified to expand its request to ensure that there are no gaps or inappropriate overlapping authorizations. If the road authority (or the adjacent road authority) refuses expansion of the study, this should be documented and included with the study report when it is submitted to Central Office.

The District Traffic Engineer shall conduct the field investigation and prepare speed limit recommendations. The local authority should be furnished with a copy of the investigation results. These recommendations should be discussed with the local authority after completion of the investigation.

The District Traffic Engineer shall compile all supporting documentation along with a completed Local Speed Limit Authorization Form (LSLA). The LSLA shall be written for the roadway and extent agreed upon by the local authority and MnDOT. These documents shall be submitted to the Assistant State Traffic Engineer, OTST, for review and approval. After this review and approval, the authorization will be signed and returned to the local authority for implementation. When signs are erected, the new authorized speed limit will be enforceable.

14-7.04 Investigation Procedures

The posted regulatory speed limits should reflect off-peak hour traffic on an average weekday under ideal conditions, so that the road may be driven at the highest safe speed. Hazards such as weather, road surface conditions, or traffic congestion will negatively impact a proper investigation.

Factors to Determine Appropriate Speed Limits

Prevailing speeds, physical features, crash experience and traffic characteristics are the primary factors in determining the appropriate speed limit. The most revealing factor is the 85th percentile speed from a spot speed study. This is the speed that 85 percent of observed traffic is traveling at or below. The 85th percentile speed reflects a safe and reasonable speed for existing conditions. Using the 85th percentile speed recognizes the need for compliance which is necessary to establish an enforceable limit.

Collecting Speed Samples

Using calibrated radar or lidar tools to collect samples, the 85th percentile speed is usually at or near the upper limits of the 10 mile per hour pace speed – the 10 mph window that contains the majority of samples. Posting a speed limit near the 85th percentile speed will result in the highest percentage of drivers being grouped in the pace speed. Speed limits less than the midpoint of the 10 mph pace should be avoided as they tend to increase the relative speed differentials among vehicles.

Speed samples should be collected during low-congestion periods in order to minimize the impact of these hazards. Intersections alone do not necessitate a reduction in speed, but the traffic congestion that occurs near intersections does affect speed. The 85th percentile speed will reflect the maximum safe speed for the roadway without measuring the impact of each factor.

Number of Vehicles Sampled

A minimum of 100 free-flowing vehicles should be sampled on roadways with more than 1000 Average Annual Daily Traffic (AADT). On roadways with less than 1000 AADT, a minimum of 30 free-flowing vehicles should be sampled. In both scenarios, the study should be discontinued after two hours. Free-flow vehicles are those drivers choosing their own speed with at least 6 second headway. Only the speed of the first vehicle in a platoon should be sampled. Cars involved in passing maneuvers or slowing to make turns should not be sampled. Speeds of trucks and buses should be sampled separately, to determine if they are over-represented on the roadway.

Sample Locations

Care should be taken to select locations sufficiently removed from any stop signs, traffic signals, or other traffic flow interruptions that significantly affect operating speeds. Mid-block locations generally represent typical flow conditions for accurate sampling in urban areas. In rural areas, the spacing of speed check locations may be at much greater intervals so long as they reflect the general speed pattern and roadway design and roadside features.

In all situations, the roadway section under investigation should be test-driven by experienced MnDOT staff to ensure the uniformity of the recommended speed limit as well as how well it transitions into the speed zones at both termini by driving a minimum of 10 seconds beyond the termini of the investigation area. The test drive is particularly important in locations where traffic flow is too low to provide meaningful samples.

Crash Experience

Crash experience shall be reviewed for the preceding 3-year period. Many requests for speed studies are initiated by the public after a specific crash. It is important to review the crash history of the study area to determine if there is a problem that should be resolved independent of the speed limit. Crashes involving tailgating, illegal passing maneuvers, or other aggressive factors can be associated with a large speed differential.

14-7.05 Conditions Justifying Variations from the 85th Percentile Speed

The approved posted speed should normally be the nearest value below the 85th percentile speed which ends

in 5 or 0. Conditions which justify varying the zone speed from the 85th percentile speed are:

1. Different speed limits may be established for opposing directions if sampled directional speed differences are greater than 10 mph. Enforcement officials should be notified of this decision.
2. Speed limits may be authorized 5 mph under the 85th percentile speed when there is an exceptionally high crash history involving crashes of a type that would be reduced by enforcement of a lower speed limit. A lower speed limit shall only be established only after the commitment of reasonable enforcement is assured and documented.
3. If the study area is of a continuous curvilinear design, the area should be test driven and a ball bank survey done. Radar checks should be made at midpoints of tangents (if available) and used as a guideline for determining reasonable values. The controlling factor of the speed limit will be the average of the safe speeds as determined by the ball bank survey. Individual curves will still have to be checked and advisory speeds posted where necessary.
4. When physical features at spot locations such as limited sight distance, narrow bridges, blind intersections, or potential hazards such as pedestrians or children in unfenced playgrounds occur, the use of warning signs and advisory speeds should be considered.
5. Transition zones may be used to accomplish a gradual reduction from higher speeds to a lower speed. Transition zones on an approach to a city are where speeds fluctuate. The sections of such a zone may be as short as one quarter mile. The change in speed for a transition zone should be 10 or 15 mph, not lower or higher. Speed samples collected at these points will show large differences for opposing directions, but a single speed limit value is appropriate.

14-7.06 Speed Zones on Gravel Roads

Gravel roads have considerable differences from paved roads. Typically, gravel roads are designed with minimal design criteria, are subject to fluctuating surface conditions, have low enforcement priority, and serve low ADT's usually comprised of local repeat traffic. The principles of speed zoning are described in the ITE Traffic Engineering Handbook (6th Edition). In summary they address reduced stopping distance, traffic flow, capacity, safety, and crash severity reduction. It is very difficult to equate these principles with the conditions that usually exist on a gravel road. Due to these principles and the operational characteristics of gravel roads, MnDOT has generally not set speed limits on gravel roads and has relied on the "Basic Rule" described in Minn. Stat. Sec.169.14, Subd.1.

It is the policy of MnDOT to evaluate gravel roads based on the merits of the principles described above and if these principles are not met or there will be no improvement in the operation or safety of the road, then a reduced speed limit will not be authorized. MnDOT will, however, honor all requests to investigate any type of road and perform the traffic investigation.

To aid the investigation teams, the following list of typical qualifications should be used in the first phase of an investigation in order to facilitate the team's prompt judgment of whether or not a speed limit should be established on a gravel road.

1. Speed limits are not necessary on gravel roads that are:
    a. Having dust problems.
    b. DEAD END roads.
    c. Not a connecting road between arterial roads or major traffic generators.
    d. Non-collector roads that serve scattered local residents only.
    e. Prone to other enforcement-related problems.
2. Speed limits may be beneficial on gravel roads that are:
    a. Serving as a connector between two paved roads as one continuous roadway.

b. Densely populated with seasonal homes and cabins.

All gravel road speed limit authorizations will include a contingency that will void the speed limit authorization in the event that the gravel road is paved or reconstructed with new alignment or grade.

14-7.07 Checklist of Items Submitted with a Speed Report

1. Copy of request for initiating a study from the road authority.
2. Cover Letter from the District Traffic Engineer summarizing the investigation, feedback from the road authority (for local roadways), and any other essential findings.
3. Related correspondence from officers, citizens, or political factions (if available).
4. Map(s) of the area investigated at a scale capable of depicting crossing roadway names and jurisdictional boundaries as well as locations of speed samples taken.
5. Roadway Summary Form describing the roadway width, shoulder width, surface type and condition, AADT, test run speeds, and crash summary.
6. Log of buildings, entrances, and general development along the road (map or video footage may be substituted).
7. Log of traffic signals, signs, and markings (map or video footage may be substituted).
8. Log of vertical curves (map or video footage may be substituted).
9. Log of school zones, playgrounds, or other special zones (map or video footage may be substituted).
10. Speed sample form for each location sampled.

14-8.00 REFERENCES

1. 2014 Minnesota Statutes
2. Minnesota Administrative Rules
3. Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD), current edition.
4. MnDOT Right of Way Manual
5. MnDOT Technical Memoranda
6. MnDOT Bikeways Facility Design Manual
7. AASHTO - Geometric Design of Highways and Streets, 2011.
8. ITE Traffic Engineering Handbook (6th Edition).