

Chapter 8

MAINTENANCE OF SAFETY AND TRAFFIC CONTROL DEVICES

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8-1.0 INTRODUCTION

8-1.01 DEFINITION

Traffic control devices discussed in this section are traffic signs, signals, lighting, guardrails, barriers, guide posts, attenuation devices (crash cushions), rumble strips, rumble strips, delineators, object markers, barricades, and pavement markings.

8-1.02 PURPOSE

MnDOT field maintenance personnel are responsible for the installation and maintenance of traffic control devices on State Trunk highways. Information contained in this chapter is intended to provide guidance on proper installation and maintenance techniques, the proper use of associated materials and equipment and safety requirements for these activities.

8-1.03 SCOPE

Guidance contained in this chapter only applies to the proper installation and maintenance of traffic control devices noted in Section 8-1.01 above. This chapter is NOT intended to provide guidance for the selection, evaluation and design of traffic control devices.

8-2.0 ROLES AND RESPONSIBILITIES

The roles and responsibilities of the individuals involved in the maintenance of safety and traffic control devices are detailed in the following subsections.

8-2.01 MAINTENANCE OPERATIONS

The Area Maintenance Engineer (AME) is responsible for the maintenance and installation of signs as called for in work orders and layouts provided by the District Traffic Engineer. District Maintenance is also responsible for the maintenance of all signs after they have been installed.

Field Maintenance personnel should ensure that all routine maintenance work is planned so that traffic will be inconvenienced as little as possible and safety will still be afforded to both traffic and workers. It should be noted that higher costs are associated with maintenance of these system components during off-peak hours.

Maintenance work should be restricted to a minimum whenever a large volume of traffic is expected on highways. Such times include peak hours, holiday weekends, opening of fishing or hunting season, and days of football games, fairs, etc.

Maintenance operations require workers and equipment to work on the traveled roadway under all weather and traffic conditions. If it is necessary that materials and equipment be left on the Right-of-Way, storage should not interfere with traffic or block sight distance. It is imperative that when materials and equipment are stored within the clear zone, reasonable precautions are taken to protect employees and the public against crashes and to prevent damage to or theft of state property.

All maintenance employees are responsible for their own safety and for the property and equipment directly under their care. This responsibility is part of the job.

Each maintenance operation should be performed in a way that will provide for the reasonable safety of MnDOT employees and the traveling public.

Prior to driving posts in new locations, digging, trenching, etc., each maintenance personnel will examine available project site records and the site itself for possible utilities. Underground utilities such as power and telephone lines or surveillance, lighting and signal cables are likely to be situated near the ground surface and must be located to avoid damage. Individuals are also responsible for noting overhead utilities. Utility locations can be provided by contacting [Gopher State One Call](#).

Statewide recommendations and instructions for the installation of signs, highway lighting, pavement markings and other traffic control devices will be issued by the [Office of Traffic Safety and Technology](#) or the [Office of Research Services](#).

The District Traffic Engineer has the responsibility to determine whether signs should be replaced. The District Traffic Engineer will coordinate with the Area Maintenance Engineer to decide whether signs should be replaced by maintenance personnel or by contract.

8-2.02 OFFICE OF TRAFFIC, SAFETY AND TECHNOLOGY

The Office of Traffic, Safety and Technology is responsible for providing guidance on the design, selection and location of all traffic control devices. Detailed information on standards and practices can be found in the following publications:

- The [Minnesota Manual on Uniform Traffic Control Devices \(MnMUTCD\)](#) provides full information on the design, location and use of all approved signs. There should be no departure from the provision in the MnMUTCD unless approved by the District Traffic Engineer.
- The [Traffic Engineering Manual](#) establishes uniform guidelines and procedures for use by Department personnel.
- [Chapter 6K of the Minnesota Manual on Uniform Traffic Control Devices \(MnMUTCD\): Temporary Traffic Control Zone Layouts Field Manual](#) shall be used as a reference for signs and devices used in temporary lane closures for short-term maintenance operations. For unique traffic-control setups or high-volume traffic, contact the local District Traffic Engineer.

- The Minnesota Department of Transportation's [Employee Safety Handbook](#) provides information on practices which protect the employee and the public.

8-2.03 DISTRICT TRAFFIC ENGINEER

The District Traffic Engineer will provide traffic control orders, work orders and layouts for all new sign installations and make any revisions which may be required.

8-3.0 TRAFFIC SIGNS

Highway signs are erected to convey specific messages to the traveling public. Sign classifications are described in the remaining portion of this section.

8-3.01 REGULATORY SIGNS

Regulatory signs shall be used to inform the road users of selected traffic laws or regulations and indicate the applicability of the legal requirements. More information can be found at the [Minnesota Manual on Uniform Traffic Control Devices \(MnMUTCD\)](#) website.

8-3.02 WARNING SIGNS

Warning signs shall be used to call attention to unexpected conditions on or adjacent to a highway, street or private road open to public travel and to situations that might not be readily apparent to road users. They also alert road users to conditions that might call for reduced speeds or an action in the interest of safety and traffic operations. Key advance warning signs may be supplemented by flashing yellow lights to attract drivers' attention to hazardous traffic operations.

8-3.03 GUIDE SIGNS

Guide signs shall be used to direct road users along streets or highways, to inform them of intersecting routes, and to direct them to cities, towns, villages or other important destinations. They also identify nearby rivers, streams, parks, forests and historic sites and generally give information that will help the road users along the highway in the most simple and direct manner.

8-3.04 CHANGEABLE MESSAGE SIGNS

Changeable Message Signs (CMS's) are traffic control devices that are capable of displaying one or more alternative messages. Some CMS's have a "blank mode" when no message is displayed while others display multiple messages with only one of the messages being displayed at a time (such as OPEN/CLOSED signs at weigh stations).

CMS's shall be used to provide information on traffic regulations, current traffic conditions, maintenance operations, and weather and road surface conditions. Additional information and e-learning training modules regarding changeable message signs can be found in the [MnDOT 2012 CMS Manual of Practice](#).

8-3.05 SIGN INSTALLATION

Signs should be installed as specified in work orders and signing layouts furnished by the District Traffic Engineer.

All sign installs are ordered by the District Traffic Engineer Office through either a construction process or maintenance work orders. The District Maintenance Office is responsible for these installations and the maintenance thereafter.

8-3.06 MAINTENANCE OF SIGNS

Signs that are damaged to such an extent that their use is impaired or signs that are missing must be replaced. Priority should be given to the critical sign replacements (i.e. stop and yield) as defined by the local district.

Each Maintenance Area must develop a procedure for dealing with damaged or missing sign reports that assures the prompt replacement of critical signs. When a local authority is responsible for replacement of a critical sign that has been reported to the Area Maintenance Office, the local authority should be contacted immediately to arrange for prompt replacement. If the appropriate authority cannot be contacted, MnDOT maintenance forces should replace the necessary signs and inform the local authority, as soon as possible, of the action that was taken.

Signs with bullet holes should be replaced only if the message is not legible or it is felt that the sign will not provide the service for which it was intended.

Signs defaced with paint should be reported to the District Maintenance Office as soon as possible.

Signs should be checked for missing or loose bolts. Splices should be checked for the proper size bolt for breakaway performance, and bolts should be replaced or tightened as necessary. Old sign posts no longer used shall be removed or marked to prevent damage to maintenance equipment operating on the roadside.

Signs should be checked for damage and legibility as soon as reasonably possible after high winds, snow storms or other inclement weather, and reported to the Area Supervisor.

Large ground-mounted Type A signs should be inspected for structural deficiency.

Overhead sign supports and signs should be periodically checked for structural integrity and for post clip locknut deterioration.

Vegetation that interferes with the visibility of signs must be removed in such a way that will still be aesthetically pleasing. Additional guidance can be found in [Chapter 5: Roadsides](#).

Sign lighting outages or malfunctions should be reported to the District Traffic Office or Dispatch.

Changeable Message Signs with malfunctions shall be reported to the District Traffic Office.

8-3.07 SIGN FABRICATION

Sign panels are provided by the [State Sign Shop](#). The MnDOT State Sign Shop located in Oakdale designs, fabricates, and furnishes standard and non-standard signs for MnDOT's statewide needs. This includes both maintenance operations needs and supplying signs for district construction contracts. The State Sign Shop will provide quotes in response to District requests and then fabricate or order signs based upon a work order received from a district. Delivery method or pickup should be addressed when ordering. The email address for the State Sign Shop is: metsignshop.dot@state.mn.us The Sign Shop can provide information on sign panels. More information can be found in the [Standard Signs Manual](#) and the [Standard Signs Summary](#).

8-3.08 SIGN REPLACEMENT

It shall be the District Traffic Engineer's responsibility, in coordination with the Area Maintenance Engineer, to decide whether signs should be replaced by maintenance personnel or by contract. Generally, type OH and A sign structures are replaced by contract. Further details can be found in the [Traffic Engineering Manual](#).

If reusing the in-place support structure, mounting hardware should be checked for deterioration. Bent or excessively rusted posts should be replaced. A warning sticker—color coded for year of installation—shall be affixed to the back of each new sign panel. Old standard “four-pound” posts should be removed. For type C and D sign structures, new mounting should be furnished in accordance with the [Traffic Engineering Manual](#).

8-4.0 SIGNALS

Highway traffic signals include electrical and electronic devices to light, warn or direct traffic. These devices include:

- Traffic control signals
- Ramp meters
- Beacons and flashers
- Lane use control signals
- Drawbridge signals
- Emergency or temporary traffic signals
- Railroad crossing signals and gates
- Intelligent traffic signals (ITS)

Maintenance crews should immediately report any malfunction of electrically operated automatic signals to the Maintenance Supervisor or the Area Maintenance Office. A request for repairs then will be submitted to those responsible for and qualified to do signal maintenance. If necessary, temporary traffic control shall be arranged in coordination with the responding electrical services technician.

Other installations are under the direct charge of State Maintenance. Before performing any maintenance, the signal maintenance list should be checked for agreements to determine maintenance responsibility. The Department's signal maintenance crews operate out of the [Electrical Services Section \(ESS\)](#).

8-5.0 LIGHTING

Detailed information on the preferred practice in Minnesota for lighting of traffic facilities can be found in the [Traffic Engineering Manual](#).

The maintenance and repair of lighting fixtures is detailed in maintenance agreements. These should be checked to determine maintenance responsibility before any repairs are performed. The District Traffic Engineer should provide for the monitoring of all lighting units.

The responsibilities of the area maintenance personnel are as follows:

- As soon as possible after a knockdown occurs, notify Dispatch or the District Traffic Office who will then notify Electrical Services. If emergency removal is required for damaged or knocked down electrical components it shall be reported to Dispatch and Area Maintenance Supervisor. Electrical components may be energized even if damaged. Don't touch! If an electrical problem exists, seek assistance from trained personnel.
- Any lighting defects or deficiencies shall be reported to the District Traffic Office. In most cases, a report to Dispatch is sufficient. If possible, the report should include the pole number and location of the light or lighted sign.

8-6.0 GUARDRAILS, BARRIERS AND GUIDE POSTS

8-6.01 GUARDRAILS, BARRIERS AND GUIDE POST TYPES

Guardrails, barriers and guide posts shall include all permanent barriers, guide posts and associated end treatments normally installed parallel to the roadway for the purpose of accomplishing all or some of the following:

- Preventing or reducing the severity of collisions with fixed objects, such as bridge end posts, piers and high-mast light towers.
- Reducing the likelihood of vehicles leaving the roadway at hazardous locations.
- Reducing the likelihood of cross median accidents.
- Delineating the edge of the roadway.

8-6.02 MAINTENANCE GUIDELINES

Guardrails, barriers and guide posts shall be maintained in good working condition. This includes repairs necessitated by vehicle damage or deterioration. Operations may also include modifications to existing devices as directed by the District Design Engineer.

8-6.03 TYPES OF LONGITUDINAL GUARDRAILS

- Low-tension cable
- High-tension cable median barrier
- Cable fence
- Thrie beams
- Double faced structural plate beams
- Box beam barriers
- Concrete barriers
 - Temporary
 - Permanent

8-6.04 MAINTENANCE RESPONSIBILITIES FOR GUARDRAILS, BARRIERS AND GUIDE POSTS

The following maintenance activities shall be accomplished as required to maintain guardrails, barriers and posts in good repair:

- Replace damaged posts.
- Replace or repair broken cable and fittings, damaged plate beam, box beam or concrete barrier.
- Check high-tension cable median barriers for tension. Post alignment should also be checked if required. In general, low-tension cable guardrails with or without the spring assembly do not need adjustment unless they have been damaged. The

Area Supervisor can provide additional information on manufacturer's recommendations and [Technical Memorandum No. 13-02-TS-01](#) can provide additional information on high-tension cable median barriers.

- Replace damaged or missing delineation material as required.
- Note areas which have a history of frequent hits, and relay the information to the maintenance office to be forwarded to the District Traffic Engineer for possible modifications.

8-6.05 STANDARD DETAILS AND INSTRUCTIONS

- Construction details for guardrail or barrier installation can be found in the [Standard Plates Manual](#) under the 8300 series or district design office.
- [Road Design Manual](#) provides detailed design guidance for all features of highway design.
- Information on required guardrail, barrier and high-tension median cable installations can be found in project Technical Memorandums.

8-7.0 ATTENUATION DEVICES (CRASH CUSHIONS)

A number of objects along the highway may be potentially hazardous to an unwary motorist. Many of these objects, such as bridge rails and piers in exit gores, cannot be removed. Crash cushions are installed to reduce the severity of accidents at those locations.

The Department uses many types of crash cushions. Selection of cushion type depends upon three factors: space available, general requirements and accident frequency. The cushions used are designed for the specific obstruction, the expected speed and size of the impacting vehicle and site geometrics. Typical layouts are illustrated in [Chapter 10 of the MnDOT Road Design Manual: Traffic Control Devices and Traffic Barriers](#).

The District Traffic or Design Office is responsible for recommending the placement and type of impact attenuator for retrofit installations and should be contacted for recommendations regarding attenuator use on maintenance projects.

Maintenance of crash cushions consist of replacing damaged sections with in-kind parts. Repair should be scheduled and completed as soon as possible since many of the cushions will have little or no capacity left to sustain a second impact.

Timely maintenance of sand barrels should be performed to ensure that the barrels are properly aligned and that they are not damaged. When replacing barrels, use the appropriate winter sand to prevent freezing.

8-8.0 RUMBLE STRIPS AND STRIPES

Rumble strips and stripes are an effective countermeasure for preventing roadway departure crashes.

Rumble strips are grooves or rows of indents in the pavement designed to alert inattentive drivers through noise and vibration and reduce the number of accidents. Rumble stripes are essentially rumble strips cut into the pavement where the white edge lines are placed. After the rumble strips are ground in, the white line is marked right over the rumble strips. The advantage is that the white line is much more visible in the rain and the rumble strip provides warning to a motorist who strays from the driving lane.

There are two main applications of rumble strips and stripes. The Centerline Rumble placement is designed to prevent head-on collisions and opposite-direction sideswipes often referred to as cross-over centerline crashes. Shoulder Rumble placement is an effective means of preventing run-off-the-road departures or crashes.

Additional information regarding Rumble Strips Stripes can be found in the [Rumble Strips and Stripes](#) section of the [Traffic Engineering Manual](#).

Rumble Strips and Stripes shall not be installed without a specific request by the District Traffic Engineer. Extra effort should be made to remove persistent debris before refreshing Rumble Stripes.

8-9.0 DELINEATORS AND OBJECT MARKERS

Road delineation markers are effective aids for night driving. Delineators are guide markers rather than warning devices. They may be used on long continuous sections of highway or through short stretches where there are changes in horizontal alignment, particularly where the alignment might be confusing, or at pavement width transitions. Object markers identify physical objects located immediately adjacent to the traveled surface. Markers are erected on end posts of narrow bridges and other objects which may present a hazard to traffic.

The installation of all delineators and markers should be as prescribed by the Traffic Engineering Manual.

Maintenance workers should be alert for delineators or markers that are damaged by accidents or vandalism.

8-10.0 HIGHWAY STRIPING AND PAVEMENT MARKINGS

Pavement markings are traffic control devices placed on the pavement or curb. Markings are in the form of lines, words and symbols to regulate, warn, and guide traffic.

Lane lines and messages should be placed in accordance with the current [Minnesota Manual on Uniform Traffic Control Devices \(MnMUTCD\)](#) and the [Traffic Engineering Manual](#). Striping or marking for any condition not specifically detailed in the manual should be placed in a manner as directed by the District Traffic Office.

The required frequency of refreshing pavement lines depends upon traffic volume, type of pavement and pavement marking conditions. The need for refreshing can be determined by visual inspections made after-dark or retro-reflective readings. Either Maintenance or Traffic is responsible for making such inspections.

Pavement markings should generally be applied when the pavement is dry and its temperature is above 50°F and rising. On heavily traveled urban highways, or where new construction is completed late in the fall, it may be necessary to disregard the temperature requirement in the interest of safety to the traveling public. If needed, all roadways should be swept with a single pass of a power broom prior to application or refreshing.

Each Maintenance Area or District should establish priority schedules for pavement markings giving preference to unusual locations and to the more heavily traveled routes. Centerline striping should generally be given priority over edge line striping.

Pavement markings should be coordinated with construction and maintenance operations such as crack filling, joint sealing, seal coating, and shoulder repair.

In general, markings should be refreshed while the design patterns are still legible and the retention of the previous markings is sufficient to provide a guide for the new markings.

Protection for the new markings should be provided. Trucks should be parked off the roadway if possible. It may be necessary to use cones or the lane closure guidelines in [Chapter 6K of the Minnesota Manual on Uniform Traffic Control Devices \(MnMUTCD\): Temporary Traffic Control Zone Layouts Field Manual](#) to direct traffic around the markings when slower drying materials are used.

Pavement markings should be placed on all new constructed surfaces which are open to traffic as soon as the surface has cured. Pavement marking design and installation recommendations can be discovered through consulting with the District Traffic Office. All new constructed roadways or temporary bypasses should be striped and marked before opening to traffic.

Obsolete pavement markings should be removed when they are no longer required. Misleading markings should be removed when a change in geometrics or traffic patterns is made. Removal methods may also leave a visible scar on the pavements. Care must be exercised to minimize the scar so drivers will not be misled

during wet weather or nighttime driving conditions. Guidance on the removal of pavement markings can be provided by the District Traffic Office.

INDEX OF LINKS

Chapter 10 of the MnDOT Road Design Manual: Traffic Control Devices and Traffic Barriers

<http://dotapp7.dot.state.mn.us/edms/download?docId=1062363>

Chapter 5: Roadsides

<http://www.dot.state.mn.us/maintenance/MaintManual/CH5.pdf>

Chapter 6K of the Minnesota manual on Uniform Traffic Control Devices (MnMUTCD): Temporary Traffic Control Zone layouts Field Manual

<http://www.dot.state.mn.us/trafficeng/publ/fieldmanual/index.html>

Electrical Services Section (ESS)

http://www.dot.state.mn.us.metro/trafficeng/electrical_svcs.html

Employee Safety Handbook

<http://ihub/safetyandworkerscomp/documents/safetyemployeeshandbook.pdf>

Gopher State One Call

<http://www.gopherstateonecall.org/>

Minnesota Manual on Uniform Traffic Control Devices (MnMUTCD)

<http://www.dot.state.mn.us/trafficeng/publ/mutcd/>

MnDOT 2012 CMS Manual of Practice

<http://dotapp7.dot.state.mn.us/edms/download?docId=1244587>

Office of Research Services

<http://www.dot.state.mn.us/research/>

Office of Traffic Safety and Technology

<http://www.dot.state.mn.us/trafficeng/safety/>

Road Design Manual

<http://roaddesign.dot.state.mn.us/>

Rumble Strips and Stripes

<http://www.dot.state.mn.us/trafficeng/safety/rumble/index.html>

Standard Plates Manual

<http://standardplates.dot.state.mn.us/StdPlate.aspx>

Standard Signs Manual

<http://www.dot.state.mn.us/trafficeng/publ/signsmanual/standardsigns-2013-complete.pdf>

Standard Signs Summary

<http://www.dot.state.mn.us/trafficeng/publ/signsmanual/standardsignssummary-2013.pdf>

State Sign Shop

<http://www.dot.state.mn.us/maintenance/signshop.html>

Technical Memorandum No. 13-02-TS-01

<http://dotapp7.dot.state.mn.us/edms/download?docId=1249371>

Traffic Engineering Manual

<http://www.dot.state.mn.us/trafficeng/publ/tem/index.html>