

91.350

MAINTENANCE OF SAFETY AND TRAFFIC CONTROL DEVICES

5-791.350 DEFINITION

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

5-791.354 GENERAL DISCUSSION

- A. All routine maintenance work should be planned so that traffic will be inconvenienced as little as possible and safety will still be afforded to both traffic and workers.
- B. Maintenance work should be restricted to a minimum whenever a large volume of traffic is expected on highways. Such times are peak hours, holiday weekends, football games, fairs, opening of fishing or hunting season, etc.
- C. 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 accidents and to prevent damage to or theft of state property.
- D. Every maintenance employee is responsible for their own safety and for the property and equipment directly under their care. Such responsibility is part of the job.
- E. Every maintenance operation should be performed in such a way as to provide for the reasonable safety of Mn/DOT employees and the traveling public.
- F. Prior to driving posts in new locations, digging, trenching, etc., underground utilities likely to be located near the ground surface, such as power and telephone lines or surveillance, lighting and signal cables, should be located to avoid damage. Contact Gopher State One-Call for utility locations.
- G. 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 Engineering or Office of Materials and Research.
- H. Detailed information on standards and practice is found in the following publications:
 - 1. 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 provisions in the Mn MUTCD unless approved by the District Traffic Engineer.
 - 2. The Minnesota Traffic Engineering Manual establishes uniform guidelines and

procedures for use by Department personnel.

3. Appendix B of the Minnesota Manual of Uniform Traffic Control Devices should be used as a reference for signing temporary lane closures for maintenance operations.
4. The Minnesota Department of Transportation's Employee Safety Handbook provides information on practices which protect the employee and the public.

5-791.356 TRAFFIC SIGNS

- A. Highway signs are erected to convey specific messages to the traveling public. They are classified as follows:
 1. Regulatory - advise the highway user of traffic laws or regulations that apply at a given place or to a given highway.
 2. Warning - call attention to conditions or locations which are potentially hazardous to traffic operations.
 3. Guide - give direction and information such as route numbers, destinations and distances.
 4. Changeable message signs and blank-out" signs are used to provide motorists with information on traffic regulations, current traffic conditions, maintenance operations and weather and roadway surface conditions.
- B. Highway signing should be executed jointly under the direction of the traffic and maintenance engineers. 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. The Area Maintenance Engineer is responsible for the installation of signs as called for in these orders and layouts provided by the District Traffic Engineer. He is also responsible for the maintenance of all signs after they have been installed.
- C. Key advance warning signs may be supplemented by flashing yellow lights to attract drivers attention.
- D. Sign Installation.
 1. Signs should be installed as called for in traffic control orders work orders and signing layouts furnished by the District Traffic Engineer.
 2. Signs should be positioned as nearly as practicable in compliance with the location and height called for in the Minnesota Manual on Uniform Traffic Control Devices and the Mn/DOT Traffic Engineering Manual.

NOTE: To avoid glare, signs should be turned away from traffic approximately 30 (offset 50 millimeters in 1 meter) from a plane perpendicular to the traffic lane.

3. Any temporary sign that is used for protection of maintenance operations must be firmly set on a standard or other suitable device, possibly a post or posts driven into the ground.

E. Maintenance of Signs.

1. Signs should be kept legible and in proper position.
2. 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 replacement of signs which warn or regulate the movement of traffic or assign right-of-way to a particular movement. Signs for which response time is not as critical include orientation-type guide signs, confirmatory speed limit signs, routine information signs, etc. Each 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, Mn/DOT maintenance forces should replace the necessary signs and inform the local authority, as soon as possible, of the action that was taken.

3. Signs with bullet holes should be replaced only if the message is distorted or it is felt that the sign will not provide the service for which it was intended.
4. Signs defaced with paint should be reported to traffic services as soon as possible. These can occasionally be restored with paint remover.
5. 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.
6. Signs should be checked for damage and legibility as soon as reasonably possible after high winds, snow storms or other inclement weather. Signs should be cleaned and repaired as necessary.
7. Large ground mounted Type A signs should be periodically inspected for deterioration of the post clip locknuts on the extruded panels and to check the condition of the breakaway sign mounting.
8. Overhead sign supports and signs should be periodically checked for structural integrity and for post clip locknut deterioration.
9. Vegetation that interferes with the visibility of signs should be removed.
10. Sign lighting outages or malfunctions should be reported to the district traffic office and maintenance office for payment adjustments.
11. Changeable message and "blank-out signs with malfunctions should be reported to the district traffic office.

F. Sign Fabrication.

1. Sign blanks should be cleaned with a non-oil base cleaner or thinner before sheeting is

applied.

2. Sheeting applied to the sign blanks should provide a wrinkle-free and bubble-free sign surface. The joints of the sign sheeting on the sign face should be carefully lapped or butted to eliminate the possibility of an open joint or an area of weakness. Sign sheeting should be selected to provide a sign of uniform color.
3. The sign face should be cleaned to provide a clean and dry surface, and the legend should be cut to form a neat and uniform message in accordance with layouts in the Standard Signs Manual.

G. Sign Replacement.

It shall be the Area Maintenance Engineer's responsibility to decide whether signs should be replaced by maintenance personnel or by contract. Generally, overhead signs and large Type A signs are replaced by contract. The contract is initiated by the District and programmed based on available funding.

The following guidelines apply to signs replaced by maintenance personnel, generally the ground mounted Type C and Type D signs:

1. The periodic sign replacement program is based on a sign life expectancy of approximately ten years for high intensity reflective sheeting.

Each maintenance area should be divided into ten sign replacement sub-divisions. The boundaries should be selected so that there is approximately the same number of signs in each sub-division. Depending upon the geographic layout of the maintenance area, the division may be controlled either by area or by route. By establishing a rotation program all highway signing would be reviewed for replacement approximately every ten years.

2. Prior to each year's replacement program, the district traffic office should review each roadway scheduled for sign replacement that year. This should include both a daytime and a nighttime review. Additional signing, relocation of signing or removal of signing may be incorporated into the program at this time.
3. The replacement program includes the use of the latest standards for sign design, dimensioning, mounting and roadway location.
4. As each new sign is installed, the mounting should be checked for deterioration. Bent or excessively rusted posts should be replaced. A warning sticker, color coded for year of installation, is affixed to the back of each new sign. Old standard "four-pound" posts should be removed. New mounting should be furnished in accordance with the Traffic Engineering Manual, Figures 6.5A, 6.5B, 6.6A, 6.6B and 6.6C.
5. Signs that have recently been replaced on the roads scheduled for sign replacement may be left as is, provided that they are still in a like-new condition and conform to 3. and 4. above.

5-791.358 SIGNALS

- A. Highway traffic signals include power-operated devices using light to warn or direct traffic. These devices include:
 - 1. Traffic control signals.
 - 2. Ramp meters.
 - 3. Beacons and flashers.
 - 4. Lane use control signals.
 - 5. Drawbridge signals.
 - 6. Emergency traffic signals.
 - 7. Railroad crossing signals and gates.

- B. 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 by the Area Maintenance Office.

- C. State participating funds are involved in most installations of traffic signals. Routine maintenance and operation responsibilities of signals are defined by maintenance agreements and may fall under the jurisdiction of city or other local agencies. 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, 6000 Minnehaha Avenue South in Minneapolis, under the direction of the Office of Traffic Engineering.

5-791.360 LIGHTING

- A. For detailed information on the preferred practice in Minnesota for the lighting of traffic facilities consult the Minnesota Traffic Engineering Manual, Chapter 10.

- B. The maintenance and repair of lighting fixtures is covered in maintenance agreements. These should be checked to determine maintenance responsibility before performing any repairs. The District Traffic Engineer should provide for the monitoring of all lighting units. The responsibilities of the area maintenance personnel are as follows:
 - 1. To notify the Area Maintenance Office, who will then notify the District Traffic Office as soon as possible after a knockdown occurs.

 - 2. To provide emergency removal service for damaged or knocked down luminaries. If necessary, the damaged lighting standard and miscellaneous debris should be hauled to a salvage area. Lighting units are designed to electrically disconnect, but maintenance personnel should check before touching anything at the site. If an electrical problem exists, seek assistance from trained personnel.

 - 3. To watch for any lighting defects or damage. Any deficiencies noted should be reported to the District Traffic Office. In most cases, a radioed report is sufficient. If possible, the report should include the pole number of the light or lighted sign.

- a. In some areas, the District Traffic Engineering Office does scheduled maintenance area night patrols to provide monthly surveillance of highway lighting and sign illumination systems. A report on defective lights should be given to the Area Maintenance Office. The report should be in writing and should include pole numbers and the dates any outages were reported.
- b. The District Traffic Office will fill out the Lighting Maintenance Record to ensure prompt repair of the outage. They will notify the appropriate agency to affect repairs and will follow up with a report to the Area Maintenance Office when repairs have been completed.
- c. Repairs by Mn/DOT are performed by the Electrical Services Section located at 6000 Minnehaha Avenue South in Minneapolis.

5-791.362 GUARDRAILS, BARRIERS AND GUIDEPOSTS

- A. Definition: Guardrails, barriers and guide posts shall include all permanent barriers and marking posts normally installed parallel to the roadway for the purpose of accomplishing all or some of the following:
 1. Preventing or reducing the severity of collisions with fixed objects.
 2. Reducing the likelihood of vehicles leaving the roadway at hazardous locations.
 3. Reducing the likelihood of cross-median accidents.
 4. Delineating the edge of the roadway.
 5. Lowering the incidence of vehicles striking bridge end posts or piers.
- B. Policy.

To maintain guardrails, barriers and guide posts in good condition. This includes repairs necessitated by vehicle damage or deterioration. Operations may also include modifications to existing devices as directed by the Area Maintenance Engineer.

- C. Types of Longitudinal Guardrails.
 1. Cable.
 2. Cable fence.
 3. Structural plate beams.
 4. Double-faced structural plate beams.
 5. Box beam barriers.
 6. Concrete barriers.
 - a. Temporary.
 - b. Permanent.

- D. Maintenance of Guardrails, Barriers and Guide Posts.
 - 1. Replace broken or rotted posts.
 - 2. Replace or repair broken cable and fittings, damaged plate beam, box beam or concrete barrier.
 - 3. Check cable tension and post alignment and correct either if required. In general practice, cable guardrail with or without the spring assembly does not need adjustment unless it has been damaged.
 - 4. Replace ineffective delineation material as required.
 - 5. Areas which have a history of frequent hits should be noted, and the information relayed to the maintenance office to be forwarded to the District Traffic Engineer for possible modifications.

- E. Standard Details and Instructions.
 - 1. Construction details for guardrail are shown in the Standard Plates Manual under the 8300 series.
 - 2. Warrants for installation of guardrail are shown in the Road Design Manual in Chapter 10.

5-791.364 ATTENUATION DEVICES (CRASH CUSHIONS)

- A. 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.

- B. 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 the Road Design Manual, Chapter 10.

- C. The District Traffic Engineer 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.

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

- E. Sand barrels should be inspected each fall 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.

5-791.368 RUMBLE STRIPS

- A. Rumble strips may be used when unusual alertness is required of the driver and standard traffic control devices such as signs or flashers apparently do not provide adequate warning. There are two types of rumble strips. The first consists of slightly raised strips of asphalt, plastic or other suitable material across the pavement. The second type consists of transverse grooves cut across the driving surface. Several strips are placed laterally across the pavement to cause a noise and motion that, when traversed by a vehicle, will alert the driver.
- B. Rumble strips shall not be placed without a specific request by the District Traffic Engineer. The District Traffic Engineer will also provide installation details.
- C. Condition of the rumble strips should be reviewed in the spring and defective strips reported to the Area Maintenance Engineer.

5-791.370 DELINEATORS AND OBJECT MARKERS

- A. 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 vertical or 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.
- B. The installation of all delineators and markers should be as prescribed by the Traffic Engineering Manual, Chapter 7.
- C. Maintenance workers should be alert for delineators or markers that are damaged by accidents or vandalism and schedule replacement as soon as practical.

5-791.372 BARRICADES

- A. Maintenance of barricades on jobs that are under construction by contract is normally the responsibility of the contractor. Variations in this are covered under the Standard Specifications for Highway Construction and project special provisions.
- B. All barricades must be of standard design and maintained as specified in the Standard Plates Manual, 8000 series and the Road Design Manual, Chapter 10.
- C. It is often desirable or necessary to supplement the reflectorized barricades with lighting devices at night. Most commonly used are floodlights, steady burning lights and flashing lights. Lighting devices shall conform to the standards set forth in the Minnesota Manual of Uniform Traffic Control Devices, Chapter 6-D.
 - 1. When attaching flashers to barricades, always attach them to the vertical supports of the barricade. Use M8 x 1 .25 steel sign bolts with telspar vertical supports. With other support types a minimum of M8 x 1 .25 steel sign bolts should be used.

- C. Permanent barricades should be reviewed periodically to determine if they should be maintained or removed.

5-791.374 DETOUR SIGNS

- A. Detour signs should be erected and maintained in accordance with traffic control orders. If field conditions change, consult with the District Traffic Engineer.

5-791.376 HIGHWAY STRIPING AND PAVEMENT MARKINGS

- A. Pavement markings are traffic control devices placed on the pavement or curb, usually by means of paint, in the form of lines, words and symbols to regulate, warn and guide traffic.
- B. Traffic lines and markings should be placed in accordance with the current Minnesota Manual of Uniform Traffic Control Devices. Striping or marking for any condition not specifically detailed in the manual should be placed in a manner as directed by the District Traffic Engineer.
- C. The required frequency of repainting pavement lines depends upon traffic volume, type of pavement and weather conditions. The need for repainting can be determined by visual inspections made after dark. The Area Maintenance Engineer and his assistants are responsible for making such inspections.
- D. Pavement markings should generally be applied when the pavement is dry and its temperature is above 10⁰C. 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. All roadways should be swept with a single pass of a power broom, if needed, prior to painting.
- E. Each Maintenance Area or District should establish priority schedules for striping giving preference to unusual locations and to the more heavily traveled routes. Centerline striping should generally be given priority over edge striping.

The work program should be planned to avoid striping on routes during periods of high traffic concentration resulting from fairs, athletic events, celebrations or daily peak volumes. Coordination of pavement markings with other maintenance operations such as crack filling, joint sealing, seal coating and shoulder repair and with construction scheduling is also necessary.

- F. Pavement markings subjected to heavy traffic may require renewal several times annually. In general, markings should be repainted while the design patterns are still legible and the retention of the previous paint film is sufficient to provide a foundation coat for the new paint.
- G. Protection for the newly painted markings should be provided. Trucks should be parked off the roadway if possible. The use of cones or the lane closure guidelines in Appendix B of the Mn MUTCD to direct traffic around the markings may be necessary when the

slower drying paints are used.

- H. Pavement stripes and markings should be placed on all newly constructed bituminous surfaces which are open to traffic as soon as the surface has cured. Interim centerline pavement markings generally consist of a strip 0.6 meters long placed at 15 meter nominal centers and should be placed on all bituminous overlays the same day the overlay is placed. Consult the District Traffic Engineer for stripe recommendations.

All newly constructed roadways should be striped and marked before traffic is routed thereon. All surfaced temporary bypasses should be properly striped and marked before traffic is routed thereon.

Pavement markings and stripes which are obsolete should be removed when they are no longer required. Obsolete markings may cause confusion in the mind of motorists and could lead them into opposing lanes of traffic, obstructions, etc. Misleading markings should be removed when a change in geometrics or traffic patterns is made. Sandblasting, grinding, burning, chemical treatment and high pressure water jets have been used to remove markings. However, these methods also leave a visible scar on the pavements so care must be exercised to minimize the scar so drivers will not be misled during wet weather or nighttime driving conditions.