Minnesota Department of Transportation

RESEARCH SERVICES

Office of Policy Analysis, Research & Innovation

Sign Retroreflectivity A Minnesota Toolkit - Updated

Renae Kuehl, Primary Author
SRF Consulting Group, Inc.

September 2014

Research Project
Final Report #2014RIC22

LRRB
LOCAL ROAD RESEARCH BOARD

Your Destination...Our Priority

Technical Report Documentation Page

1. Report No.	2.	3. Recipients Accession No.
MN/RC – 2014RIC22		

4. Title and Subtitle	5. Report Date
Sign Retroreflectivity: A Minnesota Toolkit - Updated	September 2014
	6.

7. Author(s)	8. Performing Organization Report No.
Michael Marti, Renae Kuehl	

9. Performing Organization Name and Address	10. Project/Task/Work Unit No.
SRF Consulting Group, Inc. One Carlson Parkway North, Suite 150 Minneapolis, MN 55477-4443	11. Contract (C) or Grant (G) No.

12. Sponsoring Organization Name and Address	13. Type of Report and Period Covered
Minnesota Department of Transportation Research Services Section 395 John Ireland Boulevard Mail Stop 330 St. Paul, Minnesota 55155	Final Report
	14. Sponsoring Agency Code

15. Supplementary Notes

http://www.lrrb.org/pdf/2014RIC22.pdf

16. Abstract (Limit: 200 words)

The Minnesota LRRB has developed this Sign Retroreflectivity Toolkit, designed to provide local governments, especially small cities and townships, with guidance on FHWA's sign retroreflectivity requirement as well as resources they can use to meet this requirement. (This toolkit was originally published in 2010 (2010RIC10 and updated in 2014.)

Current federal requirement: By June 13th, 2014 - Public agencies or officials having jurisdiction shall use an assessment or management method that is designed to maintain sign retroreflectivity at or above the minimum levels in Table 2A-3.

The toolkit includes a variety of resources:

- Know Your Retro – Maintaining Traffic Sign Retroreflectivity (FHWA-SA-07-020)
- 2014 Traffic Sign Retroreflective Sheeting Identification Guide (FHWA-SA-14-022)
- MN MUTCD Requirements – Official Minimum Retroreflectivity Requirements in Minnesota.
- Sign Assessment and Management Methods fact sheets

Appendix A: Examples of Sign Inventory/Inspection Forms
Appendix B: Examples of Sign Policies
Appendix C: Examples of Sign Management Agreements

17. Document Analysis/Descriptors		18.Availability Statement
Sign retroreflectivity Sign maintenance Sign management Sign inventory Retroreflectivity Retroreflectivity assessment Retroreflectivity management Retroreflectivity compliance	Retroreflectivity requirements Retroreflectivity standards Retroreflectivity measurements Visual inspection method Blanket replacement Expected sign life Control signs	No restrictions. Document available from: National Technical Information Services, Springfield, Virginia 22161

19. Security Class (this report)	20. Security Class (this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	116	

Sign Retroreflectivity
A Minnesota Toolkit

Final Report

Prepared by

Renae Kuehl

SRF Consulting Group, Inc.
One Carlson Parkway North, Suite 150
Minneapolis, Minnesota 55447

September 2014

Published by:

Minnesota Department of Transportation
Minnesota Local Road Research Board
Research Services Section
395 John Ireland Boulevard, MS 330
St. Paul, Minnesota 55155-1899

Acknowledgements

We wish to thank the Minnesota Local Road Research Board (LRRB) and its Research Implementation Committee (RIC) for the financial support to make this important toolkit a reality. The Technical Advisory Panel that steered this project was extremely helpful in identifying key issues and concerns related to sign retroreflectivity and the resources needed at the local level. They also were very generous with their time in attending meetings, reviewing and providing oversight for this final document.

The authors would like to thank the following individuals and organizations for their contributions to this document:

Technical Advisory Panel

Kristin Atkins, CH2M Hill

Lon Aune, Marshall County

Mindy Carlson, MN LTAP

Joe Gustafson, Washington County

Kyle Hartnett, MN Township Association

Jeff Holstein, City of Brooklyn Park

Sulmaan Khan, MnDOT

Renae Kuehl, SRF Consulting Group

Heather Lott, MnDOT

Victor Lund, St. Louis County

Tim Plath, City of Eagan

Howard Preston, CH2M Hill

Brent Roshell, Anderson Passe

Rich Sanders, Polk County

Kristi Sebastian, Dakota County

Shirlee Sherkow, MnDOT

Edward Terhaar,Wenck and Associates

Mark Vizecky, MnDOT

Table of Contents

Introduction

The Minnesota LRRB has developed this document, Sign Retroreflectivity – A Minnesota Toolkit, to provide local governments, especially small cities and townships, with guidance on the Federal Highway Administration's (FHWA) current sign retroreflectivity requirements (updated in 2013) as well as resources they can use to meet the compliance deadlines. This toolkit focuses primarily on FHWA's now passed June 13th, 2014 deadline requiring all agencies to establish a sign assessment or management method (see current federal requirement below). While not required, it is strongly recommended that all agencies create a sign inventory as part of this process to increase maintenance efficiency in the future. In addition, each agency is encouraged to create a written plan to document their selected sign assessment or management method for liability purposes. A few examples of existing policies are included in Appendix B of this report.

Federal Requirements

The Manual on Uniform Traffic Control Devices (MUTCD) requires agencies to establish and implement a sign assessment or management method that will maintain minimum levels of sign retroreflectivity.

Current Federal Requirement: FHWA's current sign retroreflectivity requirement and deadline are as follows:

STANDARD:

Public agencies or officials having jurisdiction shall use an assessment or management method that is designed to maintain sign retroreflectivity at or above the minimum levels in Table 2A-3

Compliance Date: June 13, 2014

Previous Federal Requirement: FHWA's previous sign retroreflectivity requirements were as follows:

> *Agencies must establish and implement a sign assessment or management method to maintain minimum levels of sign retro reflectivity.*
>
> *Agencies must replace regulatory, warning, and ground-mounted guide signs (except street name) that are identified using the assessment or management methods as failing to meet the established minimum levels;*
>
> *Agencies must replace street name signs and overhead guide signs that are identified using the assessment or management methods as failing to meet the established minimum levels.*

What does this mean for local agencies? The previous federal requirements pertaining to sign replacement had deadlines associated with each of them, stating when specific signs needed to be replaced. FHWA has changed the requirement to remove the deadlines for replacing specific signs and is only requiring agencies to have an assessment or management method identified in order to maintain signs to meet the established minimum levels. However, local agencies are expected to use their identified sign assessment or management method to assess their signs and are still required to replace any signs that do not meet the established minimum levels. It is important that each agency have a defensible plan that documents what signs will be updated and when.

Resources

A number of resources are available to assist in meeting the current federal requirement of establishing and implementing a sign assessment or management method to maintain minimum levels of sign retroreflectivity:

Federal Resources:

- *Know Your Retro – Maintaining Traffic Sign Retroreflectivity* (FHWA-SA-07-020)
  This four page document provides a concise explanation of the current federal requirements and the various management methods available. (Included on page 5 of this document.)
  http://safety.fhwa.dot.gov/roadway_dept/night_visib/sign_retro_4page.pdf
- *Methods for Maintaining Traffic Sign Retroreflectivity* (FHWA-HRT-08-026)
  This report outlines several possible methods an agency can employ to maintain a minimum level of traffic sign retroreflectivity and details information about various sign management plans that agencies can use to:
  - Systematically identify those signs that do not meet the minimum level of retroreflectivity.
  - Initiate activities that will upgrade signs that fall below the minimum required levels.
  - Monitor the retroreflectivity of in-place signs.
  - Create procedures that will assess the need to change practices and policies to enhance the nighttime visibility of signs.

  http://safety.fhwa.dot.gov/roadway_dept/night_visib/policy_guide/fhwahrt08026/fhwahrt08026.pdf
- *2014 Traffic Sign Retroreflective Sheeting Identification Guide* (FHWA-SA-14-022) Helps identify sign sheeting materials for rigid signs and their common specification designations. (Included on page 10 of this document.)
  http://safety.fhwa.dot.gov/roadway_dept/night_visib/sign_visib/sheetguide/

Minnesota Resources:

- *Minimum Retroreflectivity Levels for Traffic Signs* – training on Retroreflectivity compliance has been available in the past, but no current training is offered. Contact the Mn/DOT Traffic Standards Specialist to see if trainings will be available in the future.
- Mn/DOT State Aid Traffic Safety Website –
  Includes information on federal requirements, retroreflectivity implementation, the MN township sign program and sample traffic sign polices. This website will be updated periodically. For more information, contact Mark Vizecky, State Aid Program Support Engineer at Mark.Vizecky@state.mn.us or 651-366-3839.
  http://www.dot.state.mn.us/stateaid/trafficsafety.html
- *Minnesota's Best Practices for Traffic Sign Maintenance and Management Handbook* –
  (updated in 2014)
  This handbook provides information to assist local agencies in their effort to better maintain the traffic signs on the system. It specifically addresses:
  - Background information on retroreflectivity
  - Maintenances Methods
  - Financial Budgeting
  - Policy Development
  - Implementation
  - Effectiveness of Traffic Signs

  http://www.lrrb.org/pdf/2014ric20.pdf

Federal Resources

Know Your Retro – Maintaining Traffic Sign Retroreflectivity (FHWA-SA-07-020)

KNOW YOUR RETRO 2007*

U.S. Department of Transportation
Federal Highway Administration

Maintaining Traffic Sign Retroreflectivity

**updated in 2013 to reflect current MUTCD compliance dates*

FHWA-SA-07-020 *(Revised 2013)*

This document is referenced in **Section 2A.08** of the *Manual on Uniform Traffic Control Devices* (MUTCD). Please be sure to review the methods discussed on pages two and three, along with the related procedures that make each method reliable and meaningful in its use to maintain signs above the minimum retroreflectivity levels. A full report on these methods can be found at www.fhwa.dot.gov/retro.

SCHEDULE

Method:

Agencies have until June 14, 2014 to implement and continue to use an assessment or management method that is designed to maintain regulatory and warning sign retroreflectivity at or above the minimum levels in Table 2A–3 of the 2009 MUTCD.

Although guide signs are included in the minimum retroreflectivity levels table, there is not a specified compliance date for guide signs (including street name signs) to be addressed by an agency's method. Guide signs are to be added to an agency's management or assessment method as resources allow.

Sign Replacement:

Agencies need to replace any sign they identify as not meeting the established minimum retroreflectivity levels. Agencies' schedules for replacing signs are based on resources and relative priorities rather than specific compliance dates.

Traffic signs provide important information to road users. To be effective, traffic sign visibility must be maintained during daytime and nighttime conditions. In addition to Section 2A.08, the MUTCD addresses sign visibility in several other places, including Sections 1A.03, 1A.04, 1A.05, 2A.06, 2A.07, and 2A.22. These sections address factors such as uniformity, design, placement, operation, and maintenance.

The Standard in Section 2A.08 requires agencies to use a maintenance method that is designed to maintain traffic signs at or above minimum levels of retroreflectivity in Table 2A-3. Including Table 2A-3 in the MUTCD does not imply that an agency must measure the retroreflectivity of every sign. Rather, the MUTCD summarizes five methods that agencies can use to maintain traffic sign retroreflectivity at or above the minimum levels. These methods are listed in Section 2A.08 and are discussed on pages two and three of this document. The Standard promotes safety while providing sufficient flexibility for agencies to choose one or more maintenance methods that best match their specific conditions.

This Standard does NOT imply all signs need to be replaced. The intent is to identify and replace signs that no longer meet the needs of nighttime drivers.

The MUTCD language recognizes that there may be some individual signs that do not meet the minimum retroreflectivity levels at a particular point in time. Reasons for this include vandalism, weather, or damage due to a crash. As long as the agency is using one of the methods (with appropriate procedures) to maintain their signs, they are considered to be in compliance with this Standard.

The methods recommended in the MUTCD are broken into two categories: management methods and assessment methods. Assessment methods involve sending personnel out to examine and assess the retroreflective performance of signs. Some agencies may find this approach to be more labor intensive and turn to management methods as an alternative. Management methods may require less field work (or none at all in some cases) but may also result in replacing some signs that still have useful life left in terms of retroreflectivity. These recommended methods are discussed on pages two and three of this document and are described in detail in a full report entitled "Methods for Maintaining Traffic Sign Retroreflectivity," available at www.fhwa.dot.gov/retro.

ASSESSMENT METHODS

Assessment methods involve evaluating individual signs within an agency's jurisdiction. There are two basic assessment methods identified in the 2009 MUTCD: visual nighttime inspection and measured sign retroreflectivity.

1. VISUAL NIGHTTIME INSPECTION METHOD

In the visual nighttime inspection method, on-the-fly assessments of retroreflectivity are made by an inspector during nighttime conditions. The following are keys to successfully implementing the visual nighttime inspection method:

A. Develop guidelines and procedures for inspectors to use in conducting the nighttime inspections and train inspectors in the use of these procedures.

B. Conduct inspections at normal speed from the travel lane(s).

C. Conduct inspections using low-beam headlights while minimizing interior vehicle lighting.

D. Evaluate signs at typical viewing distances so that adequate time is available for an appropriate driving response.

One or more of the following procedures should be used to properly implement this method:

Calibration Signs Procedure (for Visual Nighttime Inspection Method)

Calibration signs have known retroreflectivity levels at or above minimum levels. These calibration signs are set up so the inspector views the calibration signs in a manner similar to nighttime field inspections. A trained inspector views calibration signs prior to conducting the nighttime inspection described in 1 A-D above. The inspector uses the visual appearance of the calibration signs to establish the evaluation threshold for that night's inspection. During the nighttime drive-through inspection of in-service signs, if the inspector believes a sign appears to be less bright than the calibration signs viewed earlier, the in-service sign should be replaced. The following factors provide additional information on the use of this procedure:

- Calibration signs are needed for each color of sign in Table 2A-3 of the 2009 MUTCD.
- Calibration signs are viewed at typical viewing distances using the inspection vehicle.
- Calibration signs need to be properly stored between inspections so that their retroreflectivity does not deteriorate over time.

Comparison Panels Procedure (for Visual Nighttime Inspection Method)

Comparison panels are fabricated with retroreflectivity levels at or above the minimum levels. The trained inspector makes an initial nighttime visual inspection described in 1 A-D above to identify signs that are obviously above or below the minimum retroreflectivity values as well as those the inspector considers to be marginal. Those signs designated as obviously below the minimum retroreflectivity values are scheduled for replacement. For signs considered marginal, a supplementary nighttime inspection is conducted by attaching a comparison panel to the in-service sign. With a flashlight, the inspector views the in-service sign along with the comparison panel to determine whether the in-service sign appears brighter or less bright than the comparison panel. If the in-service sign appears less bright than the comparison panel, the in-service sign should be replaced.

Consistent Parameters Procedure (for Visual Nighttime Inspection Method)

For this procedure, nighttime inspections described in 1 A-D above are conducted by a trained inspector under similar factors that were used in the research to develop the minimum retroreflectivity levels. These traits include:

- Using an inspector who is at least 60 years old.
- Using a sport utility vehicle or pick-up truck from which to make the observations.
- Using a model year 2000 or newer vehicle.

The trained inspector makes a judgment call as to whether an in-service sign meets their nighttime driving needs. Those signs judged not to meet the visual driving needs should be replaced. Note, the three factors listed here are specific to this procedure and are not required for visual nighttime inspections using the calibration signs procedure or the comparison panels procedure.

2. MEASURED SIGN RETROREFLECTIVITY METHOD

In this method the retroreflectivity of a sign is measured with a handheld or mobile retroreflectometer and directly compared to the minimum level appropriate for that sign. ASTM E1709, Standard Test Method for Measurement of Retroreflective Signs Using a Portable Retroreflectometer, provides the standard method for measuring sign retroreflectivity with handheld instruments. If the measured sign retroreflectivity value is less than the appropriate level in Table 2A-3, the sign should be replaced.

MANAGEMENT METHODS

Management methods provide an agency with the ability to maintain sign retroreflectivity without having to physically inspect each individual sign. While it is not required by the MUTCD, some agencies have chosen to determine the sheeting type and age or retroreflectivity levels of existing signs before using a management method. This is done by those agencies to prevent signs currently near or below minimum levels from being left in place several additional years. The 2009 MUTCD identifies three management methods:

1. EXPECTED SIGN LIFE METHOD

In this method, the agency monitors the age of individual signs and replaces them before they are expected to degrade below the minimum levels in Table 2A-3 of the 2009 MUTCD. The retroreflectivity life of a sign may vary by such factors as type of sheeting, geographic location, color, and direction the sign faces. This method depends on knowing the age and type of sheeting used for the signs. Agencies may choose to consider weathering deck results, measurements of field signs, sign sheeting warranties, or other criteria as the basis for the expected sign life. A common approach for identifying the age of individual signs uses a label on the sign to mark the year of fabrication or installation. Agencies can also use sign management systems to track the age of individual signs.

2. BLANKET REPLACEMENT METHOD

In this method, an agency manages signs in groups rather than as individual signs. An agency may choose to group signs by geographic area, roadway corridor, type of sheeting, or sign category (e.g., warning signs). The sign replacement interval is based on the expected sign life for the sign sheeting in the group with the shortest expected life. This method typically obligates an agency to replace all of the designated signs within a group, even if a sign was recently replaced due to issues such as vandalism or damage.

3. CONTROL SIGNS METHOD

In this method, agencies monitor the performance of a control sample of signs that represent a larger group of signs. Agencies track the retroreflectivity of the control signs to determine when replacement of the larger group is necessary based on the performance of the control signs.

- Agencies should develop a sampling plan to determine the appropriate number and type of control signs needed to represent the larger group of signs. Samples should represent the entire group, including such factors as sign sheeting type and color.
- Control signs may be actual signs in the field or signs in a maintenance yard (for convenience).
- Agencies should monitor the retroreflectivity of the control signs using an assessment method.

OTHER METHODS

Other assessment or management methods that are developed based on engineering studies can be used as long as they are designed to maintain minimum levels in Table 2A-3 of the 2009 MUTCD, as stated in the MUTCD Standard statement in Section 2A.08.

Excerpt from Part 2 of the 2009 MUTCD

Section 2A.08 Maintaining Minimum Retroreflectivity

Support:

01 Retroreflectivity is one of several factors associated with maintaining nighttime sign visibility (see Section 2A.22).

Standard:

02 **Public agencies or officials having jurisdiction shall use an assessment or management method that is designed to maintain sign retroreflectivity at or above the minimum levels in Table 2A-3.**

Support:

03 Compliance with the Standard in Paragraph 2 is achieved by having a method in place and using the method to maintain the minimum levels established in Table 2A-3. Provided that an assessment or management method is being used, an agency or official having jurisdiction would be in compliance with the Standard in Paragraph 2 even if there are some individual signs that do not meet the minimum retroreflectivity levels at a particular point in time.

Guidance:

04 *Except for those signs specifically identified in Paragraph 6, one or more of the following assessment or management methods should be used to maintain sign retroreflectivity:*

A. Visual Nighttime Inspection—The retroreflectivity of an existing sign is assessed by a trained sign inspector conducting a visual inspection from a moving vehicle during nighttime conditions. Signs that are visually identified by the inspector to have retroreflectivity below the minimum levels should be replaced.

B. Measured Sign Retroreflectivity—Sign retroreflectivity is measured using a retroreflectometer. Signs with retroreflectivity below the minimum levels should be replaced.

C. Expected Sign Life—When signs are installed, the installation date is labeled or recorded so that the age of a sign is known. The age of the sign is compared to the expected sign life. The expected sign life is based on the experience of sign retroreflectivity degradation in a geographic area compared to the minimum levels. Signs older than the expected life should be replaced.

D. Blanket Replacement—All signs in an area/corridor, or of a given type, should be replaced at specified intervals. This eliminates the need to assess retroreflectivity or track the life of individual signs. The replacement interval is based on the expected sign life, compared to the minimum levels, for the shortest-life material used on the affected signs.

E. Control Signs—Replacement of signs in the field is based on the performance of a sample of control signs. The control signs might be a small sample located in a maintenance yard or a sample of signs in the field. The control signs are monitored to determine the end of retroreflective life for the associated signs. All field signs represented by the control sample should be replaced before the retroreflectivity levels of the control sample reach the minimum levels.

F. Other Methods—Other methods developed based on engineering studies can be used.

Support:

05 Additional information about these methods is contained in the 2007 Edition of FHWA's "Maintaining Traffic Sign Retroreflectivity" (see Section 1A.11).

Option:

06 Highway agencies may exclude the following signs from the retroreflectivity maintenance guidelines described in this Section:

A. Parking, Standing, and Stopping signs (R7 and R8 series)
B. Walking/Hitchhiking/Crossing signs (R9 series, R10-1 through R10-4b)
C. Acknowledgment signs
D. All signs with blue or brown backgrounds
E. Bikeway signs that are intended for exclusive use by bicyclists or pedestrians

Note: The referenced document is actually this four-page brochure you are reading.

Table 2A-3. Minimum Maintained Retroreflectivity Levels[1]

Sign Color	Sheeting Type (ASTM D4956-04)				Additional Criteria
	Beaded Sheeting			Prismatic Sheeting	
	I	II	III	III, IV, VI, VII, VIII, IX, X	
White on Green	W*; G ≥ 7	W*; G ≥ 15	W*; G ≥ 25	W ≥ 250; G ≥ 25	Overhead
	W*; G ≥ 7	W ≥ 120; G ≥ 15			Post-mounted
Black on Yellow or Black on Orange	Y*; O*	Y ≥ 50; O ≥ 50			[2]
	Y*; O*	Y ≥ 75; O ≥ 75			[3]
White on Red	W ≥ 35; R ≥ 7				[4]
Black on White	W ≥ 50				–

[1] The minimum maintained retroreflectivity levels shown in this table are in units of cd/lx/m² measured at an observation angle of 0.2° and an entrance angle of -4.0°.
[2] For text and fine symbol signs measuring at least 48 inches and for all sizes of bold symbol signs
[3] For text and fine symbol signs measuring less than 48 inches
[4] Minimum sign contrast ratio ≥ 3:1 (white retroreflectivity ÷ red retroreflectivity)
* This sheeting type shall not be used for this color for this application.

2009 MUTCD Section Number(s)	2009 MUTCD Section Title	Specific Provision	Compliance Date
2A.08	Maintaining Minimum Retroreflectivity	Implementation and continued use of an assessment or management method that is designed to maintain regulatory and warning sign retroreflectivity at or above the established minimum levels (see Paragraph 2)	**June 14, 2014** (date established in Revision 2 to 2009 MUTCD)*

** Types of signs other than regulatory or warning are to be added to an agency's management or assessment method as resources allow.*

Federal Resources

2014 Traffic Sign Retroreflective Sheeting Identification Guide (FHWA-SA-14-022)

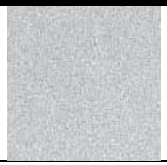
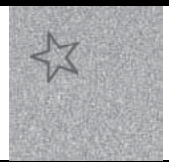
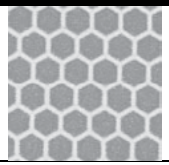
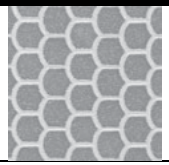
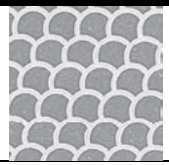
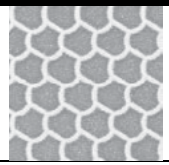
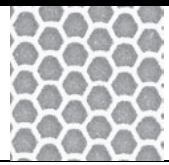
2014 Traffic Sign Retroreflective Sheeting Identification Guide

U.S. Department of Transportation
Federal Highway Administration

This document is intended to help identify sign sheeting materials for rigid signs and their common specification designations. It is not a qualified product list. FHWA does not endorse or approve sign sheeting materials. Many other sheeting materials not listed here are available for delineation and construction/work zone uses.

Many sign sheeting materials have watermarks and/or patterns that are used to identify the material type and manufacturer. The watermarks shown in this guide have been enhanced. The watermarks will be less visible in practice and may not be present on smaller pieces of sheeting due to the spacing.

Retroreflective Sheeting Materials Made with Glass Beads

Example of Sheeting (Shown to scale)								
ASTM D4956-04	I	II	II	III	III	III	III	III
ASTM D4956-13	I	II	II	III	III	III	III	III
AASHTO M268-13	(1)	(1)	(1)	A	A	A	A	A
Manufacturer	Several companies	Avery Dennison®	Nippon Carbide	3M™	ATSM, Inc.	Avery Dennison®	Nippon Carbide	ORAFOL Americas Inc
Brand Name	Engineer Grade	Super Engr Grade	Super Engr Grade	High Intensity	High Intensity	High Intensity	High Intensity	ORALITE® High Intensity
Series	Several	T-2000	15000	2800 3800	ATSM HI	T-5500	N500	5800
NOTES:	(2) (8)	(3) (4) (9)	(4)	(3) (4) (9)	(4)	(4)	(4)	(4)

1) Sheeting material does not meet minimum AASHTO classification criteria.
2) Glass Bead Engineer Grade sheeting is uniform without any patterns or identifying marks.
3) Material no longer sold in the United States as of the date of this publication.
4) Section 2A.08 of the 2009 MUTCD (http://mutcd.fhwa.dot.gov) does not allow this sheeting type to be used for new legends on green signs.

- ASTM D4956-04 is referenced in Table 2A-3 of the 2009 MUTCD.
- ASTM D4956-13 is the most current ASTM sign sheeting specification (the 2013 version is designated by "-13").
- AASHTO M268-13 is the most current AASHTO specification (the 2013 version is designated by "-13").

Manufacturer Contact Information

3M - http://www.3M.com/roadwaysafety
ATSM, Inc. - http://www.atsminc.com
Avery Dennison - http://www.reflectives.averydennison.com
Nippon Carbide - http://www.nikkalite.com
ORAFOL Americas Inc. – http://www.orafolamericas.com

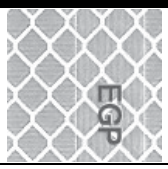
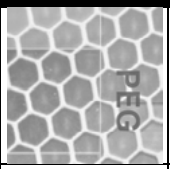
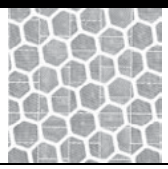
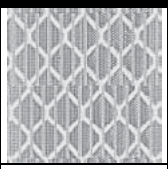
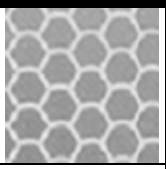
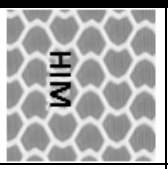
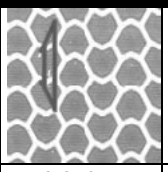
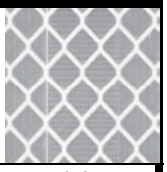
FHWA Publication Number: FHWA-SA-14-022. You may download and print the electronic version of this document, available at www.fhwa.dot.gov/retro

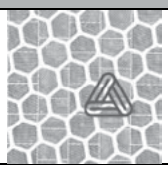
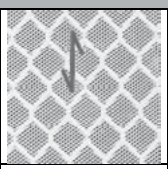
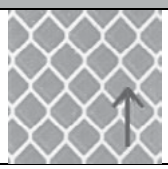
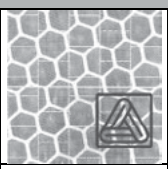
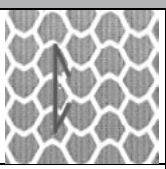
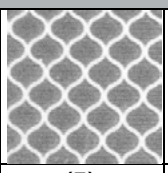
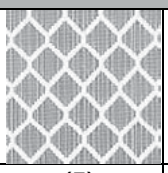
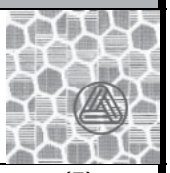
2014 Traffic Sign Retroreflective Sheeting Identification Guide

U.S. Department of Transportation
Federal Highway Administration

This document is intended to help identify sign sheeting materials for rigid signs and their common specification designations. It is not a qualified product list. FHWA does not endorse or approve sign sheeting materials. Many other sheeting materials not listed here are available for delineation and construction/work zone uses.
Many sign sheeting materials have watermarks and/or patterns that are used to identify the material type and manufacturer. The watermarks shown in this guide have been enhanced. The watermarks will be less visible in practice and may not be present on smaller pieces of sheeting due to the spacing.

Retroreflective Sheeting Materials Made with Micro-Prisms

Example of Sheeting (Shown to scale)								
D4956-04	(5)	(5)	III, IV	III, IV, X	(5)	(5)	(5) / X	(5)
D4956-13	I	I	III, IV	III, IV	III, IV	III, IV	VIII	VIII
M268-13	(6)	(6)	B	B	B	B	B	B
Manufacturer	3M™	Avery Dennison®	Avery Dennison®	3M™	ORAFOL Americas Inc	Nippon Carbide	Nippon Carbide	3M™
Brand Name	EGP	PEG	HIP	HIP	ORALITE® HIP	HIM	Crystal Grade	Reflective Sheeting
Series	3430	T-2500	T-6500	3930	5900/5930	CRG 94000	CRG 92000	3940
NOTES:	(8)	(8)						

Example of Sheeting (Shown to scale)								
D4956-04	VIII	VII, VIII, X	IX	IX	(5)	(5)	(5)	(5)
D4956-13	VIII	VIII	IX	IX	IX	IX	XI	XI
M268-13	B	(7)	B	B	B	B	D	D
Manufacturer	Avery Dennison®	3M™	3M™	Avery Dennison®	Nippon Carbide	ORAFOL Americas Inc	3M™	Avery Dennison®
Brand Name	MVP Prismatic	Diamond Grade™ LDP	Diamond Grade™ VIP	OmniView™	Crystal Grade	ORALITE®	Diamond Grade™ DG3	OmniCube™
Series	T-7500	3970	3990	T-9500	95000	7900	4000	T-11500
NOTES:		(9)			(9)			

5) Material was either unavailable in 2005 (previous version of this Guide) or unassigned in the 2004 version of ASTM D4956.
6) Sheeting material does not meet minimum AASHTO classification criteria.
7) Material has been discontinued prior to AASHTO M268-10.
8) Section 2A.08 of the 2009 MUTCD (http://mutcd.fhwa.dot.gov) does not allow this sheeting type to be used for new yellow or orange signs, or new legends on green signs.
9) Material no longer sold in the United States as of the date of this publication.

Resources

Federal Highway Administration – http://www.fhwa.dot.gov/retro
Manual on Uniform Traffic Control Devices (MUTCD) – http://mutcd.fhwa.dot.gov
Texas A&M Transportation Institute – http://tti.tamu.edu/visibility
ASTM – http://www.astm.org AASHTO – http://www.transportation.org

Minnesota Resources

MN MUTCD Requirements – Official Minimum Retroreflectivity Requirements in Minnesota

2A.8 Maintaining Minimum Retroreflectivity

SUPPORT:

Retroreflectivity is one of several factors associated with maintaining nighttime sign visibility (see Section 2A.22).

STANDARD:

Public agencies or officials having jurisdiction shall use an assessment or management method that is designed to maintain sign retroreflectivity at or above the minimum levels in Table 2A-3.

Compliance Date: June 13, 2014

MN Rev. 1

SUPPORT:

Compliance with the above Standard is achieved by having a method in place and using the method to maintain the minimum levels established in Table 2A-3. Provided that an assessment or management method is being used, an agency or official having jurisdiction would be in compliance with the above Standard even if there are some individual signs that do not meet the minimum retroreflectivity levels at a particular point in time.

GUIDANCE:

Except for those signs specifically identified in the following Option, one or more of the following assessment or management methods should be used to maintain sign retroreflectivity:

A. Visual Nighttime Inspection – The retroreflectivity of an existing sign is assessed by a trained sign inspector conducting a visual inspection from a moving vehicle during nighttime conditions. Signs that are visually identified by the inspector to have retroreflectivity below the minimum levels should be replaced.

B. Measured Sign Retroreflectivity – Sign retroreflectivity is measured using a retroreflectometer. Signs with retroreflectivity below the minimum levels should be replaced.

C. Expected Sign Life – When signs are installed, the installation date is labeled or recorded so that the age of a sign is known. The age of the sign is compared to the expected sign life. The expected sign life is based on the experience of sign retroreflectivity degradation in a geographic area compared to the minimum levels. Signs older than the expected life should be replaced.

D. Blanket Replacement – All signs in an area/corridor, or of a given type, should be replaced at specified intervals. This eliminates the need to assess retroreflectivity or track the life of individual signs. The replacement interval is based on the expected sign life, compared to the minimum levels, for the shortest life material used on the affected signs.

E. Control Signs – Replacement of signs in the field is based on the performance of a sample of control signs. The control signs might be a small sample located in a maintenance yard or a sample of signs in the field. The control signs are monitored to determine the end of retroreflective life for the associated signs. All field signs represented by the control sample should be replaced before the retroreflectivity levels of the control sample reach the minimum levels.

F. Other Methods – Other methods developed based on engineering studies can be used.

SUPPORT:

Additional information about these methods is contained in the 2007 Edition of FHWA's "Maintaining Traffic Sign Retroreflectivity" (see Section 1A.11).

OPTION:

Highway agencies may exclude the following signs from the retroreflectivity maintenance guidelines described in this Section:

A. Parking, Standing, and Stopping signs (R7 and R8 series)

B. Walking/Hitchhiking/Crossing signs (R9 series, R10-1 through R10-4b)

C. Acknowledgment signs, including Memorial signs

D. All signs with blue or brown backgrounds

E. Bikeway signs that are intended for exclusive use by bicyclists or pedestrians

2A.9 Shapes

STANDARD:

Particular shapes, as shown in Table 2A-4, shall be used exclusively for specific signs or series of signs, unless otherwise provided in the text discussion in this Manual for a particular sign or class of signs.

2A.10 Sign Colors

STANDARD:

The colors to be used on standard signs and their specific use on these signs shall be as provided in the applicable Sections of this Manual. The color coordinates and values shall be as described in 23 CFR, Part 655, Subpart F, Appendix..

Sign Color	Sheeting Type (ASTM D4956-04)				Additional Criteria
	Beaded Sheeting			Prismatic Sheeting	
	I	II	III	III, IV, VI, VII, VIII, IX, X	
White on Green	W*; G≥7	W*;G≥15	W*;G≥25	W≥250; G≥25	Overhead
	W*; G≥7	W≥120; G≥15			Post-Mounted
Black on Yellow or Black on Orange	Y*; O*	Y≥50; O≥50			②
	Y*; O*	Y≥75; O≥75			③
White on Red	W≥35; R≥7				④
Black on White	W≥50				--

① The minimum maintained retroreflectivity levels shown in this table are in units of cd/lx/m^2 measured at an observation angle of 0.2° and an entrance angle of -4.0°.
② For text and fine symbol signs measuring at least 48 inches and for all sizes of bold symbol signs.
③ For text and fine symbol signs measuring less than 48 inches.
④ Minimum Sign Contrast ratio ≥ 3:1 (white retroreflectivity ÷ red retroreflectivity).
* This sheeting type shall not be used for this color for this application except as noted in 2A.8.

Bold Symbol Signs

- W1-1, -2 -- Turn and Curve
- W1-3, -4 -- Reverse Turn and Curve
- W1-5 -- Winding Road
- W1-6, -7 -- Large Arrow
- W1-8 -- Chevron
- W1-10 -- Intersection in Curve
- W1-11 -- Hairpin Curve
- W1-15 -- 270 Degree Loop
- W2-1 -- Cross Road
- W2-2, -3 -- Side Road
- W2-4, -5 -- T and Y Intersection
- W2-6 -- Circular Intersection
- W2-7, -8 -- Double Side Roads
- W3-1 -- Stop ahead
- W3-2 -- Yield Ahead
- W3-3 -- Signal Ahead
- W4-1 -- Merge
- W4-2 -- Lane Ends
- W4-3 -- Added Lane
  W4-5 -- Entering Roadway Merge
- W4-6 -- Entering Roadway Added Lane
- W6-1, -2 -- Divided Highway Begins and Ends
- W6-3 -- Two-Way Traffic
- W10-1, -2, -3 -4, -11, -12 -- Grade Crossing Advance Warning
- W11-2 -- Pedestrian Crossing
- W11-3, -4, 16 thru 22 -- Large Animals
- W11-5 -- Farm Equipment
- W11-6 -- Snowmobile Crossing
- W11-7 -- Equestrian Crossing
- W11-8 -- Fire Station
- W11-10 -- Truck Crossing
- W12-1 -- Double Arrow
- W16-5p, -6p, -7p -- Pointing Arrow Plaques
- W20-7 -- Flagger
- W21-1 -- Worker

Fine Symbol Signs - Symbol signs not listed as Bold Symbol Signs.

Special Cases

- W3-1 -- Stop Ahead: Red retroreflectivity ≥ 7
- W3-2 -- Yield Ahead: Red retroreflectivity ≥ 7; White retroreflectivity ≥ 35
- W3-3 -- Signal Ahead: Red retroreflectivity ≥ 7; Green retroreflectivity ≥ 7
- W3-5 -- Speed Reduction: White retroreflectivity ≥ 50
- For non-diamond shaped signs such as W14-3 (No Passing Zone), W4-4p (Cross Traffic Does Not Stop), or W13-1P, -2, -3, -6, -7 (Speed Advisory Plaques, use the largest sign dimension to determine proper minimum retroreflectivity level.

Table 2A-3 Minimum Maintained Retroreflectivity Levels ①

Sign Assessment and Management Methods fact sheets:

There are multiple methods for local agencies to use to maintain sign retroreflectivity that meet FHWA's requirements. The following is a brief overview of each FHWA approved method, including what the method is, how it is administered and the advantages/disadvantages of each:

- Summary Table of all Methods
- Visual Nighttime Inspection
  - calibration signs
  - comparison panels
  - consistent parameters
- Measured Sign Retroreflectivity
- Expected Sign Life
- Blanket Replacement
- Control Signs

Summary of Sign Retroreflectivity Maintenance Methods

for regulatory and warning signs

A method must be implemented and in use by ~~January 2012~~ June 2014

			EQUIPMENT NEEDS				INSPECTOR REQMTS		TIME DEMANDS	
			Retrore-flectometer	Inspection Vehicle	Must Know Sheet Type	Inventory	Trained	Age	At Night	Must Stop At Signs
ASSESSMENT METHODS	Select Any 1 of These 3 Visual Procedures	Calibration Signs			Any		(1)	✔	Any	✔	
		Comparison Panels			Any		(1)	✔	Any	✔	Only ✔ Marginal Signs
		Consistent Parameters			PU or SUV		(1)	✔	60+	✔	
	Measured Retro			✔		✔	(1)	(2)	Any		✔ Every Sign
MANAGEMENT METHODS	Expected Sign Life					✔	(1)				
	Blanket Replacement					✔	(1)				
	Control Signs			To Check Control Signs		✔	(1)	(2)			Only ✔ Control Signs

(1) Not required in MUTCD, but might be beneficial

(2) Need training on operation of retroreflectometer

✔ Means "required"

VISUAL NIGHTTIME INSPECTION

Method Description: The retroreflectivity of existing signs are assessed by a trained sign inspector from a moving vehicle during nighttime conditions. There are three procedures to choose from:

- Calibration Signs Procedure
- Comparison Panels Procedure
- Consistent Parameters Procedure

Background: This is the most common type of sign maintenance program used. While there are some concerns about the reliability of this method, research has shown that trained inspectors can do a reasonable job of determining which signs need to be replaced.

Procedure:

- Preferably conducted by a two person crew (driver and inspector), in a vehicle driving in the travel lane (not the shoulder) with low-beam lights at or near the speed limit of the roadway during nighttime conditions.
- **The key to this method is having a trained inspector.** There is no nationally-recognized training course for sign inspectors. To reduce subjectivity, agencies should develop guidelines and procedures for inspectors to use and train them on how to use them.
- Each agency should have a defined rating system for signs (e.g. adequate, marginal and fail) and properly document the ratings as this is important to know which signs to replace as well as to provide tort protection.
- **Three different methods are available (must select one):**
    - **Calibration Signs Procedure**
        - Have inspector view calibration signs with retroreflectivity levels at or above the minimum level prior to inspection. Agency must have access to calibration signs for each color of sign. Calibration sign kits (like the one shown in the picture) can be purchased from a commercial vendor such as Avery Dennison®.

        - Requires a retroreflectometer to measure calibration signs periodically.
        - The calibration signs are viewed at typical viewing distances and from the same vehicle that will be used for conducting the inspections.
        - During inspection, evaluate signs compared to calibrations signs viewed earlier.
        - Procedure Checklist:
            - ☐ Be well rested
            - ☐ Select inspection vehicle and have headlamps aimed
            - ☐ Select inspection routes (both directions)
            - ☐ Prepare inspection forms (example shown later)
            - ☐ Have sign list if available (for each inspection route, a list of signs you expect to see, in order of the direction of travel)
            - ☐ Clip board, pen lights, dash cam, tape recorder, laptop
            - ☐ Cannot start in earnest until complete darkness
            - ☐ View calibration signs before starting your inspection routes

VISUAL NIGHTTIME INSPECTION (CONT.)

- **Comparison Panels Procedure**
  - Requires developing a set of comparison panels that are at or above minimum levels that can be compared to individual signs during the inspection.
  - Comparison panels are clipped to signs in questions and viewed by inspector. Comparison panel sign kits (like the one shown in the picture) can be purchased from a commercial vendor such as Avery Dennison®.

  - Procedure Checklist
    - ☐ Be well rested
    - ☐ Select inspection vehicle and have headlamps aimed
    - ☐ Select inspection routes (both directions)
    - ☐ Prepare inspection forms
    - ☐ Have sign list if available (for each inspection route, a list of signs you expect to see, in order of the direction of travel)
    - ☐ Clip board, pen lights, dash cam, tape recorder, laptop
    - ☐ Cannot start in earnest until complete darkness
    - ☐ View calibration signs before starting your inspection routes

- **Consistent Parameters Procedure**
  - Retroreflectivity of signs is evaluated based on brightness and readability of the sign.
  - This method requires the inspections to follow these consistent parameters:
    - Inspections must be conducted during nighttime conditions.
    - Inspections must be conducted using an SUV or pick-up truck model year 2000 or newer
    - Inspector must be at least 60 years old.
    - Signs are viewed at the typical viewing distance for that sign.
    - Signs need to be replaced if they are not legible to the inspector.
  - Procedure Checklist
    - ☐ Inspector and driver need to be well rested
    - ☐ Have SUV/ Truck vehicle with VOA headlamps aimed properly
    - ☐ Have routes selected
    - ☐ Prepare enough inspection forms
    - ☐ Have sign list if available
    - ☐ Clip board, pen lights, dash cam, tape recorder, laptop
    - ☐ Be fueled up
    - ☐ Cannot start in earnest until complete darkness
    - ☐ Remember to evaluate both colors of signs with two retroreflective colors (white on green, white on red, etc.)

Current Practices: Visual nighttime inspections are typically used in conjunction with a sign replacement schedule to make sure that the signs are legible and to find signs that may have been passed over or accidentally skipped during the last replacement schedule. Inspections are usually performed every one to two years and rotate between predefined sections of roads under the agency's jurisdiction.

Advantages:

- Possible to assess more than just the retroreflectivity of a sign. Damage, obstructions, poor placement, and other factors can be observed.
- A sign inventory can be established, if none currently exists.
- Has the least administrative and fiscal burden of all the methods
- Has the lowest level of sign replacement and sign waste, implying that it maximizes sign life.

Disadvantages:

- Most subjective of all the methods.
- Funding overtime pay to conduct the inspections during late evening or early-morning hours.
- Inspectors need to be properly trained.

MEASURED SIGN RETROREFLECTIVITY

Method Description: Sign retroreflectivity is measured using a retroreflectometer. Handheld contact reflectometers (shown to the right) or non-contact reflectometers held at a distance can be used.

Background: Contact instruments (shown here – measurements read while in contact with the sign) are believed to provide relatively low levels of uncertainty for a given measurement. Non-contact instruments (measurements read from a distance) have a higher level of uncertainty which has not been well evaluated. ASTM procedures (see below) for the measurement of sign retroreflectivity require the averaging of multiple measurements on the face and legend (text/boarder) of the sign. The selection of the measurement points and the calibration of the device can lead to different results, even when measuring the same sign. This can create an issue if there are small differences between measured values and the required minimum levels.

Procedure: Measuring retroreflectivity using a contact instrument should be performed as specified in ASTM Standard Test Method E1709-00e1, which requires a minimum of four retroreflectivity measurements to be taken of the sign background and legend (text/border), if applicable. The four measurements for each color are averaged to obtain an overall measurement of the retroreflectivity for each color on the sign. Two types on hand-held contact reflectometers exist: point and annular (internal reading device is different), which measure differently and produce differing results. Be sure the inspector knows which type of instrument they are using and understand the readings.
A video showing how to use a retrrefletometer is available here: http://youtu.be/Efj8iyECquw

Current Practices: Few agencies solely use the measurement method, rather, most use this method to supplement other inspection methods. Some also use measured retroreflectivity values from a sample set of signs as an assessment of their total sign inventory.

Advantages:

- Provides the most direct means of monitoring the maintained retroreflectivity levels of deployed traffic signs and removes all subjectivity that exists in other methods.
- Provides the most direct comparison of the sign's in-service retroreflectivity relative to the minimum maintained retroreflectivity levels
- Non-contact reflectometers offer flexibility and speed-up the measurement process

Disadvantages:

- Reflectometers can be expensive for an agency to purchase (approximately $10,000)
- The use of a handheld contact reflectometer tends to be time consuming and may be cost prohibitive
- **Readings from a reflectometer can differ and vary significantly because the instrument is rotationally sensitive when reading prismatic sheeting.**
- Retroreflectivity only accounts for one aspect of a sign's appearance. Other factors should be considered when determining whether or not a sign is adequate including ambient light levels, presence of glare, location relative to the road, and the complexity of the visual background.

EXPECTED SIGN LIFE

Method Description: The date a sign is installed is usually marked on the sign or recorded so that the age of any given sign is known. The age of the sign is compared to the expected sign life.

Example of sticker indicating year "95" on front of sign

Background: The expected service life of a sign can be based on sign sheeting warranties, test deck measurements, measurement of signs in the field (control signs), measurement of signs taken out of service, or information from other agencies. The key to this method is being able to identify the age of individual signs. This is often accomplished by placing a sticker or other label on the sign (usually on the back) that identifies the year of fabrication, installation, or planned replacement or by recording the date of installation in a sign management system.

Procedure: The basic idea is that the installation date of every sign in an agency's jurisdiction is known, along with the type of retroreflective sheeting material used on the sign face. It is also necessary to define an expected sign life for each type of retroreflective sheeting material. This can be done for individual signs or as a general parameter for the types of material used by the agency. Common tracking methods used are:

- Computerized sign management system
- Installation or replacement date stickers
- Spreadsheets
- Mapping

Example sticker that Mn/DOT places on the back of signs

Current Practices: The use of expected sign life as a maintenance method is widely used because of its ease of implementation. Most agencies use the warranty period provided by the manufacturer to determine when a sign should be replaced. However, some agencies are beginning to extend their expected sign life levels beyond the warranted sign life as a result of research documenting the durability of sign materials in their area. A recent study conduceted by MnDOT and the LRRB investigated the true expected life of a sign. Research findings and more details about the study can be found here: http://www.dot.state.mn.us/materials/signretroreflectivity.html

Advantages:

- Can easily identify when signs need to be replaced.
- Can measure sign retroreflectivity at the end of the expected sign life to confirm if the sign life estimate for that type of sign is accurate or not. Adjusting expected sign life based on these reading could create a cost savings if it is found that signs can remain in service longer.

Disadvantages:

- The actual retroreflectivity of a sign is not assessed—only the age of the sign is monitored.
- Little data exists on how different types of sheeting deteriorate over time in a given climate.
- There are no definitive results relating orientation of the sign face (sun angle) to its deterioration rate. Many studies have been conducted and do not come to the same conclusions.
- Basing replacement on the manufacturer's warranty period may result in removing signs before their service life is complete.
- Identifying signs to replace based on stickers placed on a sign can be time consuming if signs along a roadway vary significantly in age.
- Stickers placed on the back of a sign make it more difficult for maintenance staff to identify as they drive by, particularly on wide roads.

BLANKET REPLACEMENT

Method Description: All signs in an area/corridor or of a given type are replaced at specified intervals eliminating the need to assess retroreflectivity or track the life of individual signs.

Background: The replacement interval is based on the expected sign life for the shortest-life material used in the area/corridor or on a given sign type.

Procedure: At set time periods, a sign maintenance crew will go to a specific area or corridor and replace all the designated traffic signs under its jurisdiction (no judgment of sign condition used). There are two typical approaches for blanket replacement:

- Spatial basis - all the signs in a specific area or corridor are replaced at the same time, when the effective service life is reached.
- Strategic basis - all the signs of a specific type (e.g. regulatory signs, warning signs, guide signs, etc.) are replaced at the same time.

The time interval between replacements for both approaches is usually based on the expected sign life.
Under this method, all signs are replaced regardless of the amount of time they have been in the field or the condition at the time of replacement.

Current Practices: This maintenance method is popular with State DOTs. Of the agencies that use a blanket replacement method, most replace their Type I signs every 7 to 10 years; Type III signs every 10 to 15 years; and Types VI, VIII, and IX signs every 15 years. The vast majority of the agencies use Type III sheeting for the majority of their traffic signs. (See Page 11 for more details on sheeting types)

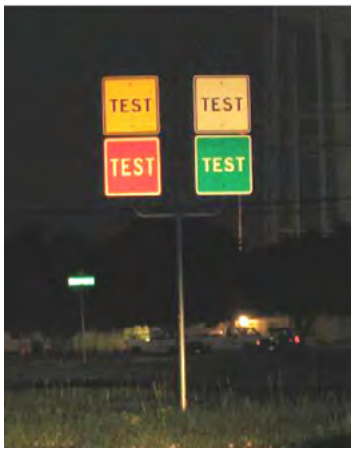
Advantages:

- This is the simplest of the management methods since it is not necessary to track the age of individual signs or measure the signs retroreflectivity. It is only necessary to maintain a record of when the blanket actions were undertaken and when they need to be repeated.
- The major benefit of using this method is that all signs are replaced, reducing the likelihood of a given sign being skipped over or not being replaced, ensuring that all replaced signs are visible and meet minimum retroreflectivity levels.

Disadvantages:

- Replacement times can vary depending on the region of the country in which the agency is located, or even across a jurisdiction for large agencies.
- Replacement time depends on the type of sign sheeting used.
- Risk wasting resources by removing signs before their useful life has been reached. This is particularly true where signs have been added or replaced in an area after the last replacement cycle.
- Under this method, retroreflectivity levels of signs are not measured, and opportunities are limited for capturing data that may be useful in adjusting service lives, trigger points, or sign maintenance strategies.

CONTROL SIGNS



Method Description: Replacement of signs in the field is based on the performance of a sample set of signs that represent an agencies inventory.

Background: The control signs might be a small sample located in a maintenance yard or a selection of signs in the field. The control signs are monitored to determine the end of retroreflective life for the associated signs.

Procedure: The control signs represent a population of signs made with the same material for which the retroreflectivity performance is monitored over time by actual measurements. As the retroreflectivity levels of the control signs approach the minimum levels, it triggers action to begin replacement of the entire associated population. The control signs can be located at one or more of the agency's maintenance yards or can be traffic signs that are deployed at various locations in the jurisdiction. The control signs are measured periodically to monitor actual degradation of retroreflectivity. This method requires only the management of the control sign information and the retroreflectivity measurements of those signs over time. The effectiveness of this method is dependent upon the size of the control sign sample (e.g. a larger sample provides better estimation of the retroreflectivity levels)

Current Practices: Few agencies solely use this method to maintain their traffic signs. Some agencies do take retroreflectivity readings on a sample set of signs to estimate how the overall sign population is performing. This is used primarily as a verification method for agency sign management policies and practices.

Advantages:

- It is not nearly as labor intensive as taking retroreflectivity readings on every sign in an agency's jurisdiction
- Signs that do meet the required minimum retroreflectivity levels are not removed prematurely (like with the blanket replacement method), allowing for an efficient use of the signs and their material. This may be particularly advantageous when the life of a new sign material exceeds the warranties provided by the manufacturer.

Disadvantages:

- There is no specific guidance on the number or percentage of the population the sample represents. However, a minimum of three signs per type of sheeting and color should be monitored.
- There is no guidance on how often a new set of control signs should be established. Possible scenarios include when a new sign material or a new sign fabrication process is used or when a major change in the sign management process occurs.
- There is no guidance on how often the control signs should be checked for their retroreflectivity levels and appearance.

Appendix A:
Examples of Sign Inventories

The following are examples sign inventories and maps currently used by local agencies as well as a computer software program that can be used to inventory signs within your agency.

Generic Sign Inventory and Inspection Forms

- Small City Sign Inventory/Inspection Form
  - Example form
  - Blank form
  - Form guide
  - Map
- Township Traffic Sign Field Inventory Report
  - Example form
  - Blank form
  - Form guide
- Township Annual Sign Maintenance and Inspection Form
  - Example form
  - Blank form
  - Form guide

Computer Programs (free)

- Utah LTAP"Safety Software Suite"

Small City Sign Inventory/Inspection Form

Small City Sign Inventory/Inspection Form

SMALL CITY SIGN INVENTORY/INSPECTION FORM

CITY: Middle River
DATE: 2/18/2014
BY: MEV

SIGN ID	MN MUTCD CODE	SEQ	DESCRIPTION	SIZE	SHEETING MATERIAL	VISUAL DAYTIME CONDITION	NIGHTTIME CONDITION	SUPPORT			ROUTE	ROUTE ID	ROUTE AHEAD	DISTANCE AHEAD FT	ROUTE BACK	OFFSET	YEAR INSTALLED	PICTURE	COMMENT
								Type	No. Post	Condition									
011357R581	R1-1	1	STOP	30 x 30	XI	A	A	U	1	F	HILL ST (M-11)	011	3RD ST (M-6)	357	CR 60	R	58	N	
011357R581A	R1-3P	1A	ALL-WAY	18 x 6	XI	A	A	U	1	F	HILL ST (M-11)	011	3RD ST (M-6)	357	CR60	R	58	Y	
011038R582	R2-1	2	SPEED LIMIT 20MPH	18 x 24	VIII	B	B	U	1	F	HILL ST (M-11)	011	5TH ST (M-22)	038	3RD ST (M-6)	R	58	Y	SPRAY PAINTED, SPEED AUTHORIZATION ON FILE?
011100R583	W11-1	3	BICYCLE	24 x 24	III	A	A	U	1	P	HILL ST (M-11)	011	5TH ST (M-22)	100	3RD ST (M-6)	R	58	Y	
011153R584	NA	4	WATCH FOR CHILDERN	24 x 24	III	C	C	U	1	F	HILL ST (M-11)	011	5TH ST (M-22)	153	3RD ST (M-6)	R	58	Y	CONSIDER FOR REMOVAL
011530R585	NA	5	WATCH FOR CHILDERN	24 x 24	III	B	B	U	1	F	HILL ST (M-11)	011	5TH ST (M-22)	530	3RD ST (M-6)	R	58	Y	CONSIDER FOR REMOVAL
011589R586	W11-1	6	BICYCLE	24 x 24	III	A	A	U	1	P	HILL ST (M-11)	011	5TH ST (M-22)	589	3RD ST (M-6)	R	58	Y	
011620L587	R2-1	7	SPEED LIMIT 20MPH	18 x 24	III	A	B	U	1	F	HILL ST (M-11)	011	5TH ST (M-22)	620	3RD ST (M-6)	L	58	Y	SPEED AUTHORIZATION ON FILE?
011682L588	D3-X1	8	HILL ST	36 x 8	III	C	C	U	1	F	HILL ST (M-11)	011	5TH ST (M-22)	682	3RD ST (M-6)	L	58	Y	NOT PLUMB, UNDER SIZED AND UPPER LOWER CASE
011038L589	D3-X1	9	5TH AVE	36 x 8	III	C	C	U	1	F	HILL ST (M-11)	011	5TH ST (M-22)	038	3RD ST (M-6)	L	58	Y	NOT PLUMB, UNDER SIZED AND UPPER LOWER CASE
011038L5810	R1-1	10	STOP	30 x 30	XI	A	A	U	1	F	HILL ST (M-11)	011	5TH ST (M-22)	038	3RD ST (M-6)	L	58	Y	BLOCKED AND DAMAGED BY TREE
011038L5810A	R1-3P	10A	ALL-WAY	18 x 6	XI	B	A	U	1	F	HILL ST (M-11)	011	5TH ST (M-22)	038	3RD ST (M-6)	L	58	Y	
011345L5811	NA	11	CHILDREN AT PLAY	24 x 24	III	C	B	U	1	F	HILL ST (M-11)	011	6TH ST (M-24)	345	5TH ST (M-22)	L	58	N	PLACEMENT ISSUES
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B												
				x		A B C	A B												
				x		A B C	A B												
				x		A B C	A B												
				x		A B C	A B												
				x		A B C	A B												
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									
				x		A B C	A B C	W U C	1P 2P A	P F									

XXX - Route ID
XXX - Distance Ahead (FT)
X - Offset
XX- Year Installed
XXX - Sequence

Type I, II, III, IV, V, VI, VII, VIII, IX, X or XI
A = Adequate
B = Marginal
C = Fail

W = Wood
U = U Channel
S= Square Tube
1P = One Post
2P = Two Post
A= Support Post
P = Pass
F=Fail

Small City Sign Inventory/Inspection Form

SMALL CITY SIGN INVENTORY/INSPECTION FORM

CITY:
DATE:
BY:

SIGN ID	MN MUTCD CODE	SEQ	DESCRIPTION	SIZE	SHEETING MATERIAL	VISUAL DAYTIME CONDITION	NIGHTTIME CONDITION	SUPPORT			ROUTE	ROUTE ID	ROUTE AHEAD	DISTANCE AHEAD FT	ROUTE BACK	OFFSET	YEAR INSTALLED	PICTURE	COMMENT
								Type	No. Post	Condition									
				x		A B C	A B C	W U C	1P 2P A	P F									

XXX - Route ID
XXX - Distance Ahead (FT)
X - Offset
XX- Year Installed
XXX - Sequence

Type I, II, III, IV, V, VI, VII, VIII, IX, X or XI
A = Adequate
B = Marginal
C = Fail

W = Wood
U = U Channel
S= Square Tube

1P = One Post
2P = Two Post
A= Support Post

P = Pass
F=Fail

Small City Sign Inventory/Inspection Form Guide

Purpose of this Form: To document details about all signs within a local agency's jurisdiction.

Link to the Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD): http://www.dot.state.mn.us/trafficeng/publ/mutcd/index.html

---

TABLE COLUMN HEADING DESCRIPTIONS

SIGN ID – The unique combination of letters and/or numbers your agency uses to identify roads. In the given example (as noted in key at the bottom of the spreadsheet), the first three numbers reference the "Route ID" or the municipal code for the road that the sign is on. The next three number show the "Distance Ahead (FT)", or the distance in feet to the next road. The next character, which is the first letter, gives the side of the road the sign is on (the "Offset"): L (left) or R (right), when facing north or east. The fourth set of characters is a two digit representation of the year the sign was installed, "58" for 1958. The last set of characters is called the "sequence" and represents the order the sign was placed on its sign post, see description below (SEQ).

MN MUTCD CODE – The MN MUTCD official code for the type of sign. For example, all stop signs have the MN MUTCD code of R1-1. "R" refers to regulatory, the first "1" refers to the type of regulatory and the second "1" refers to stop signs being the first and most noteworthy sign of this type. See Part 2 of the MN MUTCD for a table of all traffic sign codes.

SEQ – A number and letter combination which shows first the order of the sign along the route with a number, and then the order of the sign within the sign post with a letter. For example, the first sign along a route is a yield, this has a SEQ of 1. Next there is a 4-way stop sign. The stop sign has sequence number "2" and its corresponding "4-Way" stop placard has sequence number of "2A".

DESCRIPTION – List text of sign as well as purpose of sign, if necessary.

SIZE – Dimensions of sign. For example, 36'' x 36''.

SHEETING MATERIAL – Sheeting material used on the sign, usually identified by the ASTM number. Reference Table 2A-3 in Part 2 of the MN MUTCD. For more specific information, reference the 2014 Traffic Sign Retroreflective Sheeting Identification Guide. http://safety.fhwa.dot.gov/roadway_dept/night_visib/sign_visib/sheetguide/

VISUAL DAYTIME CONDITION – Give grade, A, B, or C of sign condition. A = Adequate, B= Marginal, C = Fail. (See key at bottom of spreadsheet)

NIGHTTIME CONDITION – Give grade, A, B, or C of sign condition. A = Adequate, B= Marginal, C = Fail. (See key at bottom of spreadsheet)

SUPPORT (Type, No. Post, Condition) –

TYPE - list “W” (Wood), “U” (U Channel), or “S” (Square Tube).

NO. POST - list the number of posts the sign uses, usually 1 or 2.

CONDITION - list “P” (Pass) or “F” (Fail). A support could fail for many reasons, generally based on a lack of crashworthiness. Examples of reasons for failure are: bent support, not true, or not plumb. (See key at bottom of spreadsheet)

ROUTE – Municipal and/or local name of the road the sign is on.

ROUTE ID – Unique number identification of the road the sign is on.

ROUTE AHEAD – Name of the next cross street along the route.

DISTANCE AHEAD FT – The distance, in feet, until the route ahead.

ROUTE BACK – The previous cross street along the route.

OFFSET – Which side, “L” (left) or “R” (right), the sign is on. Assume worker is facing to the north or east.

YEAR INSTALLED – Year that the sign was installed, for example: “1958” or “58”.

PICTURE – Y or N (Yes or No), is there a picture on file for this sign? Pictures can be particularly helpful to answer questions about the sign without making addition trips into the field. Additionally, they are helpful for daytime to nighttime comparisons, which can make levels of retroreflectivity more obvious. See example pictures below.

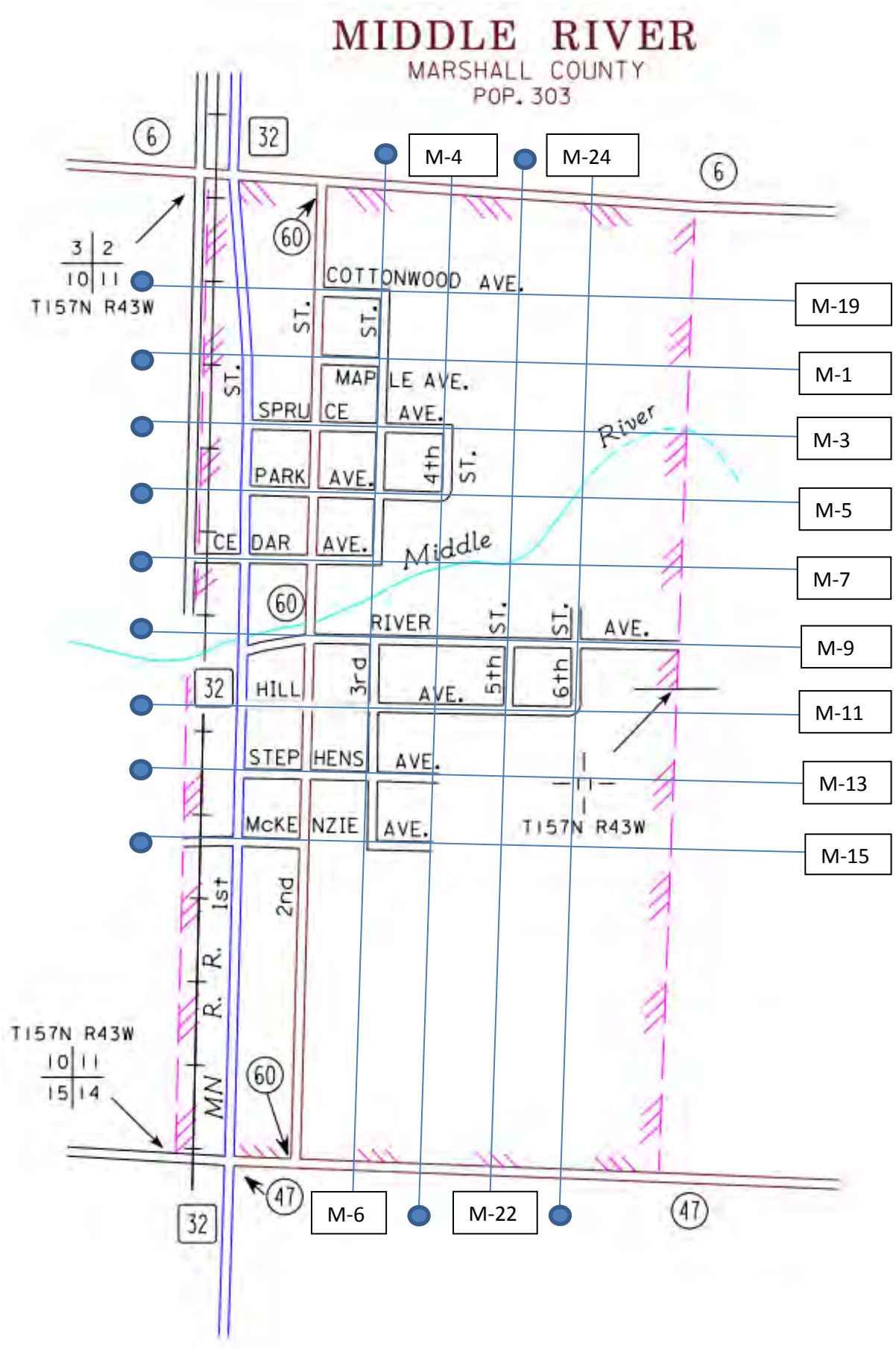
COMMENT – Any additional information that should be recorded, such as (but not limited to) damage to the sign, sightline issues, or further questions that should be followed up on.

Notes:

- Unneeded signs have a cost associated with them. Consider removing unnecessary signs or signs that have been proven ineffective in order to reduce traffic sign maintenance costs. See the *Minnesota's Best Practices for Traffic Sign Maintenance and Management Handbook* – (updated in 2014) for more information about sign removal. http://www.lrrb.org/pdf/2014RIC20.pdf
- Examples of sign during the day and at night are shown below to emphasis the importance of checking your sign retroreflectivity.

Daytime view - Notice many of the signs are visible during daytime

Nighttime view - Notice the difference in visibility per sign during nighttime



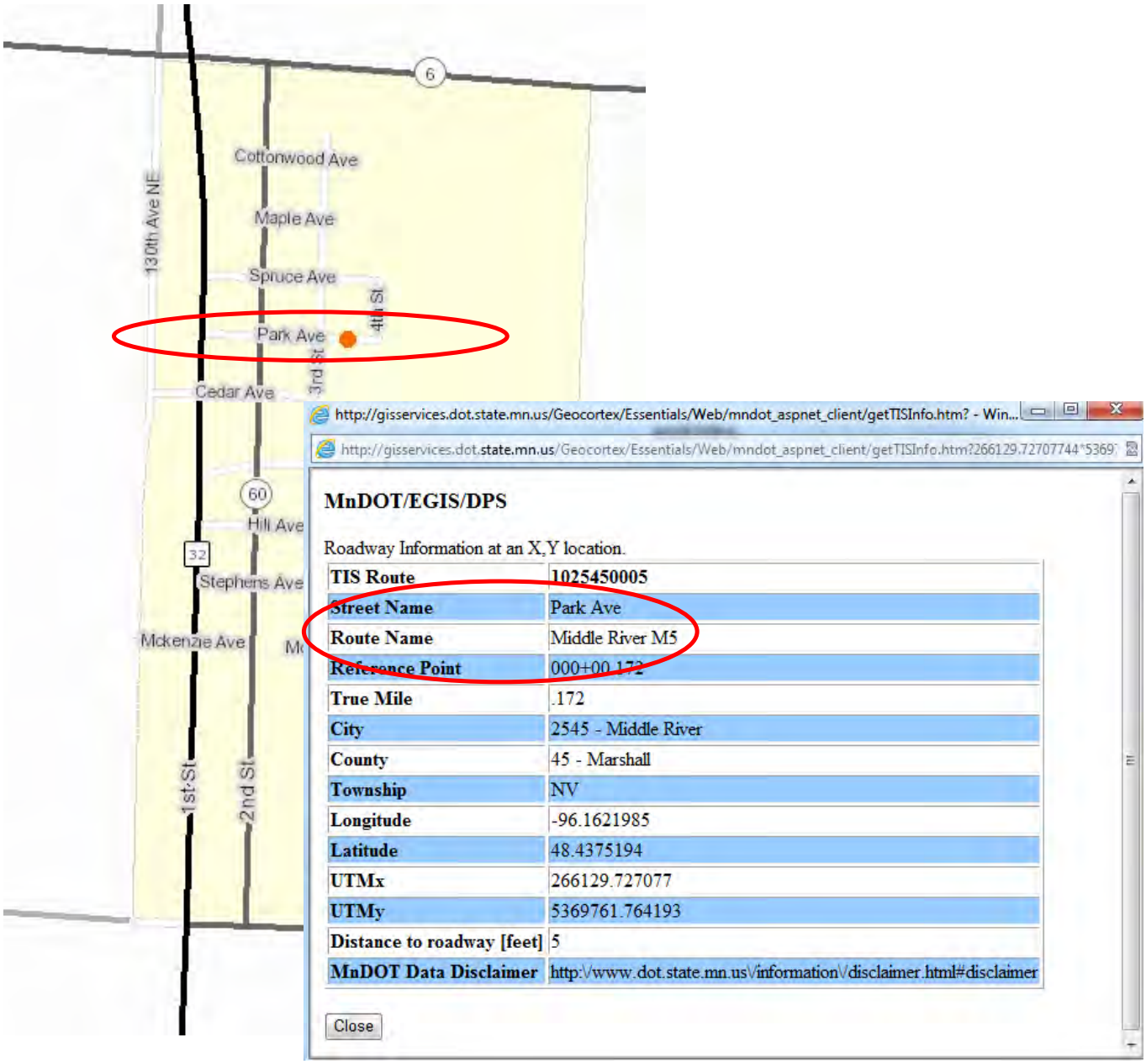
Minnesota City Maps: http://www.dot.state.mn.us/maps/gdma/maps-muni-alpha.html

MnDOT Basemap:
http://gisservices.dot.state.mn.us/geocortex/essentials/web/viewer.aspx?site=mndot_basemap

The “M” name classification was developed by MnDOT many years ago for municipal streets. The number of a M road can be found by clicking on the MnDOT Basemap link and zooming to the desired city.

Using the tool bar at the top of screen, select the icon of the roadway with the orange dot and the arrow.

Then click on the roadway segment in question. An orange dot will appear along with the following pop window. As shown in the pop up window the Route Name is “Middle River M5” or M5. This process was repeated on each of the streets to populate the map of Middle River provided on the previous page.



Township Traffic Sign Field Inventory Report

Township Traffic Sign
Field Inventory Report

Sign ID No.	620	**Township Name**	WINSTED	**Sign Owner**	WINSTED
Sign Code	W1-1(L)	**Sign Width (inches)**	30	**County Name**	MCLEOD
Sign Legend	Turn - LEFT	**Sign Height (inches)**	30	**Installation Date**	JUNE 2009
Route	EAGLE AVE	**Direction Sign is Facing**	W		
Reference Point	HWY 7	**Substrate**	ALUMINUM	**Sign Manufacturer**	M&R
Reference Pt. Dist. (FT)	17,160	**Sheeting Material**	DG3 - TYPE XI		
GPS Latitude	44.9534715	**Sign Condition**	A	**Comments**	
GPS Longitude	-94.1140081	**Mounting Height (FT)**	7		
		Offset (FT)	5		
Inspected By	JB				
Date Inspected	10/1/2009	**Sign Structure Type**	2U		
Reason Inspected	CONSTRUCTION COMPLETE	**Structure Condition**	P		

Sign Maintenance History

Date	Inspector Name	Action Required	Comments
2009	JB	YEARLY INSPECTION	NO ACTION REQUIRED
2010	DF	YEARLY INSPECTION	POST DAMAGED IN CRASH, REPLACED
2011	RK	YEARLY INSPECTION	NO ACTION REQUIRED
2012	PL	YEARLY INSPECTION	SNOW PLOW DAMAGE TO POST, STRAIGHTEN
2013	PS	YEARLY INSPECTION	NO ACTION REQUIRED
2014	MV	YEARLY INSPECTION	NO ACTION REQUIRED

EXAMPLE

Township Traffic Sign
Field Inventory Report

Sign ID No.		**Township Name**		**Sign Owner**	
Sign Code		**Sign Width (inches)**		**County Name**	
Sign Legend		**Sign Height (inches)**		**Installation Date**	
Route		**Direction Sign is Facing**			
Reference Point		**Substrate**		**Sign Manufacturer**	
Reference Pt. Dist. (FT)		**Sheeting Material**			
GPS Latitude		**Sign Condition**		**Comments**	
GPS Longitude		**Mounting Height (FT)**			
		Offset (FT)			
Inspected By					
Date Inspected		**Sign Structure Type**			
Reason Inspected		**Structure Condition**			

Sign Maintenance History

Date	Inspector Name	Action Required	Comments

Township Traffic Sign Field Inventory Report Guide

Purpose of this Form: To document all maintenance activities for a particular sign throughout its life.

Link to the Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD): http://www.dot.state.mn.us/trafficeng/publ/mutcd/index.html

---

TABLE COLUMN HEADING DESCRIPTIONS

SIGN ID No. – The unique combination of letters and/or numbers your agency uses to identify roads. In the given example (as noted in key at the bottom of the spreadsheet), the first three numbers reference the "Route ID" or the municipal code for the road that the sign is on. The next three number show the "Distance Ahead (FT)", or the distance in feet to the next road. The next character, which is the first letter, gives the side of the road the sign is on (the "Offset"): L (left) or R (right) when facing north or east. The fourth set of characters is a two digit representation of the year the sign was installed, like "58" for 1958. The last set of characters is called the "sequence" and represents the order the sign was placed on its sign post, see description below (SEQ).

MN MUTCD CODE – The MN MUTCD official code for the type of sign. For example, all stop signs have the MN MUTCD code of R1-1. "R" refers to regulatory, the first "1" refers to the type of regulatory and the second "1" refers to stop signs being the first and most noteworthy sign of this type. See Part 2 of the MN MUTCD for a table of all traffic sign codes.

SIGN LEGEND – List text of sign as well as purpose of sign, if necessary.

ROUTE – Municipal and/or local name of the road the sign is on.

REFERENCE POINT – A nearby landmark, such as an intersection or easily identified building's driveway.

REFERENCE PT. DIST. (FT) – The distance, in feet, from the sign to the reference point.

GPS LATITUDE – The east-west GPS measurement from -90 to 90 degrees, typically shown to six decimal places.

GPS LONGITUDE – The north-south GPS measurement from -180 to 180 degrees, typically shown to six decimal places.

INSPECTED BY – Name of the worker to inspect the sign.

DATE INSPECTED – Date the worker was in the field inspecting the sign.

REASON INSPECTED – The purpose or prompt to inspect this sign. For example, regular inspection or citizen complaint of damage.

TOWNSHIP NAME – Name of the township who has jurisdiction for this sign.

SIGN WIDTH (INCHES) – The horizontal measurement of the sign face (example – 18" for a 18" x 30" speed limit sign)

SIGN HEIGHT (INCHES) – The vertical measurement of the sign face (example – 30" for a 18" x 30" speed limit sign)

DIRECTION SIGN IS FACING – Direction the sign message points: N, NE, E, SE, S, SW, W or NW. If a sign is facing north, then cars driving south bound will see it.

SUBSTRATE – Material the sign blank (not post) is made of. "Sign blank" refers to the object the sheeting of the sign is applied to.

SHEETING MATERIAL – Sheeting material used on the sign, usually identified by the ASTM number. Reference Table 2A-3 in Part 2 of the MN MUTCD. For more specific information, reference the 2014 Traffic Sign Retroreflective Sheeting Identification Guide. http://safety.fhwa.dot.gov/roadway_dept/night_visib/sign_visib/sheetguide/

SIGN CONDITION – This is a judgment of the sign face condition. A = Adequate, B = Marginal or C = Fail. See Structure Condition for a judgment of the sign post and general crashworthiness. A sign could fail for many reasons, generally based on defacement or illegibility.

MOUNTING HEIGHT (FT) – Distance, in feet, to the bottom of the sign.

OFFSET – Which side, "L" (left) or "R" (right), the sign is on when facing north or east.

SIGN STRUCTURE TYPE – The type of sign post used, for example: Wood, U Channel, or Square Tube.

STRUCTURE CONDITION – Pass or Fail. A support could fail for many reasons, generally based on a lack of crashworthiness. Examples of reasons for failure are: bent support, not true, or not plumb. See Sign Condition for failures based on defacement or illegibility.

SIGN OWNER – local agency that owns the sign.

COUNTY NAME – Name of county that the sign resides in.

INSTALLATION DATE – Date the sign was installed.

SIGN MANUFACTURER – Name of company who created the sign. Useful to check factory specifications.

COMMENTS – Any additional information that should be recorded, such as (but not limited to) damage to the sign, sightline issues, or further questions that should be followed up on.

SIGN MAINTENANCE HISTORY TABLE

DATE – Date the inspection was performed in the field.

INSPECTOR NAME – Name of the worker that conducted the inspection.

ACTION REQUIRED – Work to be completed on the sign.

COMMENTS – Any additional information about the action required, such as (but not limited to) damage to the sign, sightline issues, further questions that should be followed up on or when the action will take place. For example, if a sign needs to be replaced but a replacement sign is not immediately available, note here when a new sign was ordered and when it is expected to be replaced.

Note: Unneeded signs have a cost associated with them. Consider removing unnecessary signs or signs that have been proven ineffective in order to reduce traffic sign maintenance costs. See the *Minnesota's Best Practices for Traffic Sign Maintenance and Management Handbook* – (updated in 2014) for more information about sign removal. http://www.lrrb.org/pdf/2014RIC20.pdf

Township Annual Sign Maintenance and Inspection Form

Township Annual Sign Maintenance and Inspection Form

Township: Oak Grove
County: Watonwan
Year: 2009

Sign ID	Sign Code	Sign Panel Legend	Size	GPS Lat.	GPS Long.	Action	Reason	Comments	Date
1245	R2-1	SPEED LIMIT 30	24" x 30"			Trim Bushes	Sign not visible		4/9/2009
73	W1-2R	Curve Right	30" x 30"			Replace	Hit by vehicle	New sign panel and post	5/20/2009
8080	R1-1	STOP	30" x 30"	44.862092	-94.0890116			New sign-needed GPS for records	6/13/2009
1500	W2-1	Crossroad	30" x 30"			Replaced Panel	Graffiti		6/13/2009
120	W1-8	Chevron	18" x 24"			Replaced Panel	Retroreflectivity	Does not meet minimums	6/14/2009
216	W21-X8	MINIMUM MAINT ROAD	36" x 30"			Replaced Posts	Bent		6/14/2009
772	R1-2	YIELD	36" x 36"			Replaced Panel	Bullet Holes	Legend becoming unreadable	6/14/2009
829	W13-1	30 MPH	18" x 18"			Replace	Hit by vehicle	New sign panel and post	8/1/2009
224	W20-100p	500 FEET	24" x 18"			Replaced Panel	Stolen	Post still in ground	9/27/2009

EXAMPLE

Date of Annual Inspection: 6/13/2009 to 6/14/2009

General Comments:
Utilized the assessment method of a Visual Nighttime Inspection to measure sign retroreflectivity.

The Town of Oak Grove **certifies that the inventory of all township road signs have been inspected and maintained for inspaction year** 2009 **pursuant to the retroreflectivity requirements set forth by the Federal Highway Administration (FHWA) and sign requirements set forth by the current Minnesota Manual on Uniform Traffic Control Devices (MMUTCD).**

SIGNATURE- TOWNSHIP CHAIRPERSON **DATE**

Township Annual Sign Maintenance and Inspection Form

Township: _____

County: _____

Year: _____

Sign ID	Sign Code	Sign Panel Legend	Size	GPS Lat.	GPS Long.	Action	Reason	Comments	Date

Date of Annual Inspection: _____

General Comments:

The Town of _____ certifies that the road signs described in this form have been inspected and maintained for inspaction year _____ pursuant to the retroreflectivity requirements set forth by the Federal Highway Administration (FHWA) and sign requirements set forth by the current Minnesota Manual on Uniform Traffic Control Devices (MMUTCD).

Township Annual Sign Maintenance and Inspection Form Guide

Purpose of this Form: To document sign conditions during an annual inspection.

Link to the Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD): http://www.dot.state.mn.us/trafficeng/publ/mutcd/index.html

---

TABLE COLUMN HEADING DESCRIPTIONS

TOWNSHIP – Name of the township who has jurisdiction for this sign.

COUNTY – Name of county that the sign resides in.

YEAR – Year of the annual inspection that this form is recording.

SIGN ID No. – The unique combination of letters and/or numbers your agency uses to identify roads.

SIGN CODE – The MN MUTCD official code for the type of sign. For example, all stop signs have the MN MUTCD code of R1-1. "R" refers to regulatory, the first "1" refers to the type of regulatory and the second "1" refers to stop signs being the first and most noteworthy sign of this type. See Part 2 of the MN MUTCD for a table of all traffic sign codes.

SIGN PANEL LEGEND – List text of sign as well as purpose of sign, if necessary.

SIZE – Dimensions of sign. For example, 36'' x 36''.

GPS LATITUDE – The east-west GPS measurement from -90 to 90 degrees, typically shown to six decimal places.

GPS LONGITUDE – The north-south GPS measurement from -180 to 180 degrees, typically shown to six decimal places.

ACTION – Work to be completed on the sign**.**

REASON – Cause or purpose for the action.

COMMENTS – Any additional information about the action required, such as (but not limited to) damage to the sign, sightline issues, further questions that should be followed up on or when the action will take place. For example, if a sign needs to be replaced but a replacement sign is not immediately available, note here when a new sign was ordered and when it is expected to be replaced.

DATE – Date action was completed

DATE OF ANNUAL INSPECTION – List the range of dates in which the inspection took place

GENERAL COMMENTS – Document any additional comments here, such as the inspection method used (i.e. visual nighttime inspection, comparison panels, etc)

OFFICIAL STATEMENT OF INSPECTION COMPLETION – Fill in the name of the town, the year the inspection took place and a signature of the township chairperson to certify the inspection was complete. It is recommended that this form be filed with the township board for historical record.

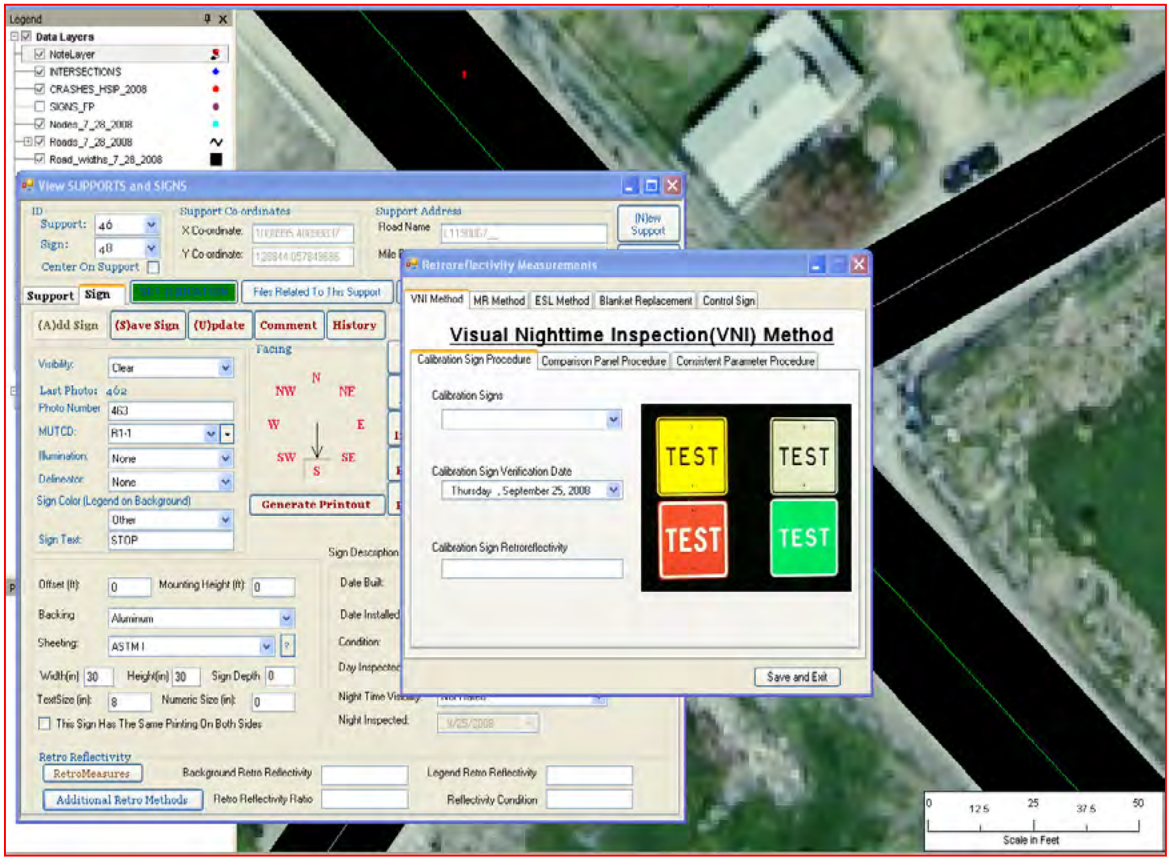
Note: Unneeded signs have a cost associated with them. Consider removing unnecessary signs or signs that have been proven ineffective in order to reduce traffic sign maintenance costs. See the *Minnesota's Best Practices for Traffic Sign Maintenance and Management Handbook* – (updated in 2014) for more information about sign removal. http://www.lrrb.org/pdf/2014RIC20.pdf

Computer Programs

Utah's Local Technical Assistance Program (LTAP) – *Safety Software Suite*

Safety Software Suite **-** FREE geographic information system with plug-in's for Crash analysis, Signs Management and Inventory, Intersection Analysis, Road Safety Audits, ADA Ramp Management, and more

Available for FREE download at: http://www.utahltap.org/software/sss.php



Program Summary: The Signs Plug-in is a complete package for signs management. It allows you to inventory the locations/conditions and other important attributes for Signs and Supports On the map. The tool allows you to keep a history of all changes made to a sign or support. It allows you to keep photos, and files stored with the sign they belong to. It has a book-keeping tool that lets you keep track of how many signs/supports of a specific type you have on hand in your shop inventory. It has reporting tools that allow you to print out a list of the signs inspected by an inspector and any extra work done on the sign. There is a Warrant Life tool that allows you to figure out how many signs will be expiring in a given date range and how much it will cost to fix them. There are Merging tools that allow you to merge two signs projects together.

Appendix B:
Examples of Sign Policies

- League of Minnesota Cities Insurance Trust (LMCIT) Sign Retroreflectivity Memo and Model Policy
- Minnesota Association of Townships (MAT) Sample Road Sign Policy
- Generic County Policy

League of Minnesota Cities Insurance Trust (LMCIT) Sign Retroreflectivity Memo and Model Policy

LEAGUE OF MINNESOTA CITIES

CONNECTING & INNOVATING
SINCE 1913

RISK MANAGEMENT INFORMATION

LMCIT SIGN RETROREFLECTIFITY MEMO AND MODEL POLICY

(3rd Edition, Revised January 2014)

145 UNIVERSITY AVE. WEST
ST. PAUL. MN 55103-2044

PHONE: (651) 281-1200 FAX: (651) 281-1299
TOLL FREE: (800) 925-1122 WEB: WWW.LMC.ORG

Introduction
This memo and model policy has been developed and revised by the League of Minnesota Cities to help our members meet the latest federal and state requirements related to sign retroreflectivity.

By June 13, 2014, all agencies, including cities, who maintain roadways open to public travel must adopt a sign maintenance program designed to maintain traffic sign retroreflectivity at or above specific levels.

"Retroreflectivity" describes how light is reflected from a surface and returned to its original source. Traffic signs are made with retroreflective sign sheeting material that redirects headlamp illumination back toward the vehicle, thereby making the sign visible at nighttime to the vehicle driver. Improvements to nighttime visibility of traffic signs will help drivers better navigate roads at night and thus promote safety and mobility. Improvements in sign visibility will also help older drivers whose visual capabilities may be declining.

The retroreflective properties of all sign sheeting materials degrade over time making signs progressively less visible at night. As signs degrade and become less retroreflective, their effectiveness in communicating regulatory, warning, and guidance messages to road users at nighttime diminishes to the point that they cannot be seen or read in time for the driver to react properly. Thus, to maintain nighttime effectiveness, signs should be replaced before they reach the end of their useful retroreflective life.

Manual of Uniform Traffic Control Devices
The *Manual of Uniform Traffic Control Devices* (MUTCD), published by the U.S. Department of Transportation, Federal Highway Administration (FHWA), sets forth basic principles of traffic signs in order to promote safety on public roads. The MUTCD establishes uniform standards for traffic signs.

The Minnesota Department of Transportation (MN/DOT) has adopted the MUTCD and certain MN/DOT appendices as the *Minnesota Manual on Uniform Traffic Control Devices* (MN MUTCD). See http://www.dot.state.mn.us/trafficeng/publ/mutcd/index.html. The Minnesota Commissioner of Transportation has ordered that the MN MUTCD shall be implemented and applied to all traffic control devices.

The MN MUTCD requires the city to establish an assessment or management method that is designed to maintain sign retroreflectivity at or above minimum levels specified in MN MUTCD Table 2A-3, which can be seen on page 2A-6 of the following document: http://www.dot.state.mn.us/trafficeng/publ/mutcd/mnmutcd2009/mn%20mutcd-2A%202009.pdf.

The 2015 and 2018 compliance dates for replacement of signs that fail to meet minimum standards have been eliminated. However, cities still need to adopt a policy to replace traffic signs when they are worn out. Adopting a sign retroreflectivity policy will significantly reduce tort liability lawsuits involving traffic signs.

Applicable Signs
The sign retroreflectivity requirements apply to all signs in the city except the following:

Parking, Standing, and Stopping signs (R7 and R8 series). Signs governing the parking, stopping, and standing of vehicles cover a wide variety of regulations, and only general guidance can be provided here. The word "standing" when used on the R7 and R8 series of signs refers to the practice of a driver keeping the vehicle in a stationary position while continuing to occupy the vehicle. Typical examples of parking, stopping, and standing signs are as follows:

- NO PARKING ANY TIME
- NO PARKING 8:30 AM TO 5:30 PM
- NO PARKING EXCEPT SUNDAYS AND HOLIDAYS
- ONE HOUR PARKING
- NO PARKING LOADING ZONE
- NO PARKING BUS STOP
- NO PARKING ON PAVEMENT
- NO PARKING EXCEPT ON SHOULDER
- NO STOPPING ON PAVEMENT

Walking/Hitchhiking/Crossing signs (R9 series, R10-1 through R10-4b).

Adopt-A-Highway signs.

All signs with blue (motor services) or brown (recreational) backgrounds.

Bikeway signs that are intended for exclusive use by bicyclists or pedestrians.

Evaluation Methods
The establishment of minimum maintained traffic sign retroreflectivity levels in the MN MUTCD requires the city adopt one or more acceptable methods to assure adequate nighttime visibility of traffic signs. The MN MUTCD describes various evaluation methods that cities can chose from to provide reasonable nighttime sign visibility. It does not dictate which method to use. Rather, the city has several options to choose from based on the city's resources, needs, and current practices.

Evaluation methods can be divided into one of two categories—*assessment* or *management* methods. Assessment methods involve some type of assessment of the nighttime visibility of individual signs (e.g., visual inspection or retroreflectivity measurement). Management methods are based on the expected retroreflective life of the overall sign inventory, based on factors such as warranties, demonstrated performance, or control sign assessments.

The following is a description of the evaluation methods and some of the concerns, advantages, and disadvantages of each method. The descriptions are taken from *Methods for Maintaining Traffic Sign Retroreflectivity* (Publication No. FHWA-HRT-08-026, November 2007), published by the U.S. Department of Transportation, Federal Highway Administration.

A. Assessment Methods.

The basic concept of an assessment method is that the condition of each individual sign in the city is assessed or evaluated on a periodic basis. The MN MUTCD does not set specific intervals. The two assessment methods are:

- Nighttime Visual Inspection
- Measured Sign Retroreflectivity

Nighttime Visual Inspection
Visual inspections are perceived to be the most likely means to find nighttime visibility problems with signs. Using this approach, it is possible to assess more than just the retroreflectivity of a sign. Damage, obstructions, poor placement, and other factors that might detract from the nighttime visibility of the sign can be observed. The MN MUTCD currently includes language that encourages cities to undertake periodic daytime and nighttime visual inspections.

This method requires a minimal investment of resources on the part of the city, although there is a need for a record-keeping system for inspection data and the potential for higher labor costs where overtime pay is required. While visual inspections will reveal night visibility problems not discernable under any other method, they are subjective and hence more difficult to tie to a benchmark value of retroreflectivity.

Cities using visual inspections must establish procedures to provide consistency in inspections. This implies the need for training programs and certification of inspectors to assure consistency of inspections. Inspection procedures should address the type of vehicle used, type of headlamps on the inspection vehicle, headlamp aiming, and age and visual acuity of the inspector(s). While there are some concerns about the reliability of the visual nighttime inspection, research has shown that trained inspectors can do a reasonable job of determining which signs need to be replaced because of inadequate retroreflectivity.

The visual inspection technique uses trained personnel to observe traffic signs during the nighttime to assess the overall appearance of a sign and determine if it meets the required minimum retroreflectivity level. The observation is typically done through the windshield of the vehicle at or near the speed limit of the roadway. The key to this method is having trained inspectors. While there is no nationally-recognized training course or certification for sign inspectors, cities should provide some form of training before sign inspections are performed.

One way to perform the training is to have the inspectors observe sample signs at a variety of known retroreflectivity levels before conducting the inspections. Training helps facilitate an inspector's ability to discern sign retroreflectivity levels that are at the minimum levels prior to conducting inspections. Preferably, there should be sample signs that are at or near the minimum retroreflectivity levels associated with each sign type and color. The inspector should view the sample signs under similar conditions to those under which inspections will be performed. This includes using the appropriate vehicle and placing the sample signs at typical positions that will be encountered during an inspection. For this method to be effective, the training must prepare the

inspector in advance, using correct sample signs that represent retroreflectivity levels at or near the MN MUTCD minimum retroreflectivity levels.

The usual method of inspecting signs at night is to use a two-person crew. While the driver focuses on the driving task, the passenger evaluates the signs and records the appropriate information. If an inventory is available, signs that have been knocked down or missing for some other reason can be identified during the nighttime inspection. If no inventory exists, an inventory of existing signs can be created while conducting the nighttime inspection, but it may not account for missing signs. A nighttime inspection procedure can be performed without a sign inventory.

The nighttime visual inspection method should only use the low-beam headlamps of the vehicle as the source of illumination for the signs. The interior light of the vehicle should remain off to the extent feasible. The inspection should be performed at highway speeds and from the travel lanes and not the shoulder. As the vehicle approaches the sign, the sign's overall appearance in terms of brightness and legibility is assessed. Usually the sign is given a rating defined by the city. At a minimum, the scale should include three designations: good, fair, and poor. The inspector records the information for each sign and the rating that it is given. Signs rated as poor should be scheduled for replacement as soon as possible. Depending on the inspection schedule, signs rated as fair can be noted as requiring attention during the next set of scheduled inspections or can be identified for additional assessment, such as measurement at a later date using a handheld retroreflectometer.

The vehicle and inspector combination should be selected to provide a conservative estimate of sign retroreflectivity. The increased sales of pickup trucks and sport utility vehicles, which result in larger observation angles, make these types of vehicles appropriate for use. Relatively new vehicles, with visually/optically aimable (VOA) headlamps, should be considered. Ideally, the inspector should be older, with nighttime visual capabilities similar to older drivers. The vision of the inspector should be tested to ensure that it is within the legal limits of the State of Minnesota. It is important that a city develop consistent guidelines to decrease the subjectivity of inspections. For instance, some items to consider are procedures to clean the headlamps and windshield before each night of inspections and to periodically check the headlamp aiming.

Probably the most important element of nighttime inspection is documenting the process and results. This can be done with a voice or video recorder, or even with paper and pencil. Whichever method is selected, it is important that inspections are properly documented and preserved to provide tort protection.

Concerns

One concern associated with nighttime visual inspections is that it is the most subjective of all the methods. Another concern is funding overtime pay to conduct the inspections during late evening or early-morning hours. It is also important that inspectors are properly trained.

Linking Nighttime Visual Inspections to Minimum Retroreflectivity Levels

Minimum retroreflectivity levels are incorporated into this method by training the inspectors and using procedures that allow them to correlate their observations through the use of sample signs. A good practice is for inspectors to observe the sample signs prior to each inspection run. The use of

appropriate sample signs at or near minimum retroreflectivity levels is a key element to training that links the nighttime visual inspection method to the minimum retroreflectivity levels.

Advantages and Disadvantages
One of the major benefits of using the visual inspection method is that it has the least administrative and fiscal burden of all the methods. This method also has a unique feature in that the signs are viewed in their natural surroundings. Thus, the overall appearance of the sign and the ability of the sign to provide information to the driving public can be assessed.

Another advantage of the visual inspection method is that it has the lowest level of sign replacement and sign waste. Only those signs identified as needing to be replaced because of low retroreflectivity levels are replaced, assuming that the inspection frequency is appropriate. With management methods, it is probable that some signs will be replaced before their full life is achieved. This may imply that the visual inspection method (as compared to the measured retroreflectivity method) maximizes sign life.

While this method may be more subjective than other methods, research has shown that trained observers can reasonably and repeatedly detect signs with marginal retroreflectivity. There is some risk involved while doing these inspections, particularly if the driver is also the evaluator and recorder. Ideally, nighttime inspections should be conducted with two people for safety reasons.

Measured Sign Retroreflectivity
In general, there are two ways that sign retroreflectivity can be measured in the field: with handheld contact instruments or with non-contact instruments. Contact instruments require the measurement device to be in physical contact with the sign surface. Non-contact instruments, which measure the retroreflectivity from a distance, include both a hand-held device and vehicle based systems. The use of the measurement method as an exclusive process to maintain sign retroreflectivity has not historically appealed to cities. However, when combined with another method, the measured sign retroreflectivity method adds an element of accuracy to the overall program. This combination of methods may maximize maintenance budgets and provide additional protection from tort claims.

There are several commercially available hand-held retroreflectometers that can be used to measure sign retroreflectivity. While the contact instruments are believed to provide relatively low levels of uncertainty for a given measurement, using contact instruments can be time consuming. Non-contact devices offer flexibility and speed-up the measurement process, but the trade-off is a higher level of uncertainty. The uncertainty associated with field measurement of sign retroreflectivity has not been well established. The FHWA does not endorse the use of any specific instrument.

Concerns
The main concern with the measured sign retroreflectivity method is that retroreflectivity only accounts for one aspect of a sign's appearance. Other factors should be considered when determining whether or not a sign is adequate for continued use at a particular location. These factors include ambient light levels, presence of glare, location relative to the road, and the complexity of the visual background. A sign that is acceptable in a rural environment may not be acceptable in a complex urban environment.

Another concern with this method is the amount of time it takes to measure the retroreflectivity of a traffic sign using hand-held devices. Given the current methods and technology available to obtain a sign's retroreflectivity, the time commitment required to take retroreflectivity readings of all signs within a city's jurisdiction may be labor intensive and cost prohibitive.

Linking Measurements to Minimum Retroreflectivity Levels
This method uses measured retroreflectivity as the basis for the decision of whether or not a sign meets the required minimum level of retroreflectivity. The measured retroreflectivity values are compared to the minimum retroreflectivity levels specified in the MN MUTCD. A sign should be scheduled for replacement if the measured retroreflectivity is at or very close to the minimum required level. This method provides the most direct comparison of the sign's in-service retroreflectivity relative to the minimum maintained retroreflectivity levels.

Advantages and Disadvantages
Measured retroreflectivity provides the most direct means of monitoring the maintained retroreflectivity levels of traffic signs. This removes all subjectivity that exists in other methods.

The main disadvantage of using this method is that measuring all of the signs in a jurisdiction is time consuming. In addition the cost of the equipment to measure signs can be very expensive. Most retroreflectometers are in excess of $12,000. Measured sign retroreflectivity may be best used to support one of the other methods or as a means of evaluating marginal signs. Another disadvantage is that using the retroreflectivity of the sign as the only indicator of whether or not a sign should be replaced may end up neglecting other attributes of the sign's overall appearance. Other factors should be considered, including the overall appearance and legibility of the sign, as well as environmental concerns, such as areas with high levels of visual clutter or glare, that may require a brighter sign. Cities need access to instruments and trained personnel to use this method.

B. <u>Management Methods</u>.

Management methods are based on the expected retroreflective life of the overall sign inventory. The three management methods are:

- Expected Sign Life Method.
- Blanket Replacement Method.
- Control Sign Method.

Expected Sign Life
In this method, signs are replaced before they reach the end of their expected service life. The expected service life is based on the time required for the retroreflective material to degrade to the minimum retroreflectivity levels. The expected service life of a sign can be based on sign sheeting warranties, test deck measurements, measurement of signs in the field (control signs) and measurement of signs taken out of service, or information from other municipalities. The key to this method is being able to identify the age of individual signs. This is often accomplished by placing a

sticker or other label on the sign that identifies the year of fabrication, installation, or planned replacement or by recording the date of installation in a sign management system.

Although there are variations to this method, the basic idea is that the installation date of every sign in a city's jurisdiction is known, along with the type of retroreflective sheeting material used on the sign face. It is also necessary to define an expected sign life for each type of retroreflective sheeting material. This can be done for individual signs or as a general parameter for the types of material used by the city. Other information may also be of interest to the city such as sign color, direction the sign is facing, and sign construction. This information is used in a systematic manner to "flag" signs that need to be replaced before their sign life expires.

One way to use this method is through a computerized sign management system to keep track of a city's sign inventory and periodically extract information on signs that are reaching the age at which they need to be replaced. The degree of sophistication of the sign management system will dictate the options available to the city. For example, most systems can generate lists of signs needing replacement, but some allow specific categories of sign type, size, or color to be focused upon. These systems may be able to generate individual work orders for each sign that needs to be replaced or can group replacements in a manner that provides an effective work schedule for sign crews.

If a city has a computerized sign management system, it should be possible to query the sign database at regular intervals for a list of signs that are nearing the end of service life. Actual readings of sign retroreflectivity can be taken to determine if the degradation is occurring as expected. If the degradation is not occurring as fast as expected, then signs of that type could be left in the field longer (and an update to the planned replacement date subsequently made in the database). Conversely, if the deterioration is occurring faster than expected, the signs can be scheduled for replacement sooner. Monitoring changes in degradation can help ensure better nighttime visibility and increase the overall life cycle of a city's signs, resulting in cost savings.

Another way this method can be used is by placing an installation or replacement date sticker on each sign to allow field crews to know when specific signs reach their replacement age. If a sign is found to be older than indicated by the maximum life noted on the sticker, then the sign should be replaced. This method can be time consuming if signs along a roadway vary significantly in age, but it can be executed during the day and requires no inspection or measurement of the sign.

A complication of this method is related to the placement of the date stickers. When placed on the front of the sign, field crews can more readily view the date information. However, the information must be limited so as not to distract from the message on the sign. More information can be included on stickers placed on the back of the sign, but it is harder for field crews to see this information as they drive by, particularly on wide roadways.

Concerns

The main concern with this method is that there are little data on how different types of sheeting deteriorate over time in a given climate. It can be a complex process to determine how long signs of a certain sheeting type and color will last in a given region of the country. Also, there are no

definitive results on the role that the orientation of the sign face plays in the deterioration of the sign and whether or not signs facing different directions deteriorate at significantly different rates. While there have been many studies, these studies do not come to the same conclusions about the relationship between sign face orientation and deterioration rates.

One of the easiest ways to assign expected sign life to retroreflective sheeting materials is to use the manufacturer's warranty. However, these warranties obviously include a certain factor of risk on the part of the manufacturer and therefore are often conservative. They may also vary depending on the region of the country.

Linking Expected Sign Life to Minimum Retroreflectivity Levels
The minimum retroreflectivity levels provide the initial basis for the expected life criteria, but an understanding of the actual degradation rates of in-service signs is required to set appropriate triggers as retroreflectivity levels approach the minimum requirements. Degradation rates differ by region of the country, type and color of material, and orientation. Furthermore, under this method, the actual retroreflectivity of a sign is not assessed—only the age of the sign is monitored.

There is a potential need to gather sample data on the true service life of signs to adjust the expected life measures. Some cities accomplish this by the measurement of a sample of the removed signs; some monitor the performance of a small number of signs; and others measure the retroreflectivity of in-service signs with known installation dates.

Advantages and Disadvantages
This method requires that cities track the installation date of their signs. For the field replacement approach to this method, there is the benefit of associating the condition of a sign to its age. The use of a computerized sign management system may eliminate the need for a date sticker, but it also limits the means that may be used to analyze actual service lives because of the need for bar-code reading equipment or other technology-dependent equipment that might be used to code information on a sign.

The expected sign life method allows cities to help develop local service life requirements based on actual end-of-service-life retroreflectivity measurements and comparisons to minimum required levels. These comparisons can provide useful information on service life under local conditions, product performance, sign fabrication processes, and analysis of replacement strategies. This method requires that the type of sheeting used to fabricate a sign be known.

One drawback to this method is that it can be fairly time consuming to check date stickers if the stickers are not easily viewable or identifiable on the sign. Another possible difficulty relates to marking signs that need to be replaced, although immediate replacement is possible for some sign types. If a city uses a sign management system and functions with the use of portable computers in the field, the inspectors can easily note the signs that need to be replaced, and even generate work orders.

Blanket Replacement
The blanket replacement method is essentially the expected sign life method executed on a spatial or strategic basis. On a spatial basis, all the signs in a specific area or corridor get slated for

replacement at the same time, when the effective service life is reached. On a strategic basis, all the signs of a specific type get slated for replacement at the same time. Depending on the size of the jurisdiction, it may be possible to plan sign replacements that consider both geographic and strategic criteria.

This method is probably the simplest of the management methods in that tracking the age of individual signs, either by physical labeling or in a database, is not necessary. It is only necessary to maintain a record of when the blanket actions were undertaken and when they need to be repeated. Usually this method is repeated after a set number of years, depending on the expected life of the signs.

At set time periods, a sign maintenance crew will go to a specific area or corridor and replace all the designated traffic signs under its jurisdiction. This might be done such that regulatory signs are replaced in one cycle, warning signs in another cycle, and guide signs in a third cycle. The time interval between replacements is usually based on the expected sign life as discussed in the previous section. Under this method, all signs are replaced regardless of the amount of time they have been in the field or the condition at the time of replacement. Blanket replacements can be scheduled to coincide with major roadwork or repaving, resulting in the least impact on traffic. This is especially beneficial on routes with high traffic volumes.

Concerns

One of the issues with this method is that the replacement times can vary depending on the region of the country in which the city, or even across a jurisdiction for large cities. The replacement time also depends on the types of sheeting that are used to make the city's traffic signs. Therefore, a city needs to have relevant data on the in-service life of all the sheeting materials it has in the field. Another concern is that this method potentially wastes resources by removing signs before their useful life has been reached. This is particularly true where signs have been added or replaced in an area after the last replacement cycle. When the replacement cycle comes around, these signs will be replaced regardless of their age.

Linking Blanket Replacement to Minimum Retroreflectivity Levels

The minimum retroreflectivity levels provide the initial basis for the expected life criteria, but an understanding of the actual degradation rates of in-service signs is required to set appropriate triggers as retroreflectivity levels approach the minimum requirements. Under this method, retroreflectivity levels of signs are not measured, and opportunities are limited for capturing data that may be useful in adjusting service lives, trigger points, or sign maintenance strategies.

Advantages and Disadvantages

The major benefit of using this method is that all signs are replaced; there is a low likelihood of a given sign being skipped over or not being replaced. This ensures that all replaced signs are visible and meet minimum retroreflectivity levels.

The major drawback to this method is the potential amount of waste than can be generated if signs that are relatively new are removed during a normal replacement cycle. This can be particularly expensive when a blanket replacement method is first implemented. Follow-up replacement cycles

can also be wasteful if signs are replaced between the expected service life periods because of knockdowns, graffiti, etc.

Control Signs

The control sign method is based on measurements made of a subset of signs that represent the city's inventory. The subset of signs represents a population of signs made with the same material for which the retroreflectivity performance over time is monitored by actual measurements. As the retroreflectivity levels of the control signs approach the minimum levels, it triggers action to begin replacement of the entire associated population of city signs. The control signs can be located at one or more of the city's maintenance yards or can be traffic signs that are deployed at various locations in the city. The control signs are measured periodically to monitor actual degradation of retroreflectivity. This method requires only the management of the control sign information and the retroreflectivity measurements of those signs over time.

The use of this method requires the installation of signs in a maintenance yard or the definition of specific control signs from the population of deployed signs. Periodic measurements of control signs are made following ASTM E1709 or other accepted procedures. Measurements or other observations are tracked over time to monitor changes in retroreflectivity and nighttime visibility. Once these signs, as a whole, start to approach the minimum retroreflectivity levels, all the traffic signs in the field that these control signs represent are replaced.

Concerns

The effectiveness of this method is dependent upon the size of the control sign sample. The larger the sample, the better the estimation of the retroreflectivity levels of the sign populations it represents. There is no specific guidance on the number or percentage of the population the sample represents. However, a minimum of three signs per type of sheeting and color should be monitored.

Another question relates to how often a set of control signs is needed. Each new sign material or deployment of a major product order would warrant a set of control signs, as there are likely to be differences in retroreflectivity performance. It may be appropriate to install controls when new sign fabrication processes are implemented or other major changes in the sign management process occur. It may also be appropriate for a large city that deploys signs continually to set up control signs as materials age on the shelf and personnel change. Too short a time period between adding control signs may cause the city to have a large number of control signs to monitor, which negates the simplicity of this method. Too much time between control signs could result in errors estimating the service life of signs installed in the time interval between the control signs.

Another consideration is how often the control signs should be checked for their retroreflectivity levels and appearance. If the time interval between measurements is too short, then this may needlessly waste time and personnel resources. On the other hand, if the time interval is too long, signs may be left in the field that are not adequate for continued use and may pose a possible safety risk. An annual inspection of the signs, including retroreflectivity measurements, may be appropriate.

Linking Control Signs to Minimum Retroreflectivity Levels
The control signs must be measured at given intervals with a retroreflectometer to determine how they are performing. These values are then compared to the minimum retroreflectivity levels in order to trigger sign replacement actions. The precise retroreflectivity levels of the majority of deployed signs are not known using this method.

Advantages and Disadvantages
The main benefit of this method is that it is not nearly as labor intensive as taking retroreflectivity readings on every sign in a city's jurisdiction. Because a sample set of signs is used to monitor the retroreflectivity levels, it is easier and less labor intensive to get an estimate on how the traffic signs, represented by the control signs, are performing in the field.

Another benefit of using this method is that signs that do meet the required minimum retroreflectivity levels are not removed prematurely, allowing for an efficient use of the signs and their material. This may be particularly advantageous when the life of a new sign material exceeds the warranties provided by the manufacturer.

This method requires cities to have the capability to measure the retroreflectivity of the control signs. Without an appropriate sampling process, the control signs may not be representative of the larger sign population they are intended to represent. This could lead to replacing signs that do not need replacement or not replacing signs that do need replacement. Therefore, cities must evaluate the number of signs of each type within their jurisdiction and establish guidelines on the number of control signs that are needed to appropriately represent signs in the field.

C. Combination of Evaluation Methods or New Methods.

Combinations of two or more methods will be viable for many cities. In addition, cities are not limited to the proposed evaluation methods. Cities may develop their own methods using documented engineering studies that demonstrate that deviations are appropriate.

Cities may combine different methods or parts of different methods to achieve sign retroreflectivity maintenance practices that best fit the city's needs and budget. For example, a combination method might include a management method complemented with an assessment method used to provide supplemental data. This method provides a means to track individual signs but without the need to inspect or measure every sign. Any number of combinations can be implemented to logically integrate with other aspects of the sign management process and best fit a city's limited resources. Also note that the proposed methods can be used exclusively with effective results.

One possible combination is the use of a management method with both daytime and nighttime visual inspections. The expected life of a sign is a management method and is based on the age and degradation of the sheeting types used. This management method in combination with daytime visual inspections may allow a city to track how many signs they have, how old they are, and where they are located. It also provides field crews with a list or summary of deployed signs that can be easily used to note the need for sign replacements or repairs when conducting nighttime visual inspections. The information may be downloaded to laptop computers to further facilitate field

inspections and documentation of sign conditions and replacement needs. Combining the expected sign life management method with both daytime and nighttime visual inspections is one example of adapting methods that meet a city's needs.

Another possibility is to combine expected sign life with measured retroreflectivity. Under this method, a city is not required to measure the retroreflectivity of all signs. Measurement of a small sample from across a region allows the city to compare the expected and measured retroreflectivity. The measurements allow the city to validate, and revise if necessary, the service life of each sign sheeting material and color used by the city.

In summary, these methods can be used in different ways but will provide a consistent evaluation of the nighttime visibility of in-place traffic signs.

Which method should cities use?
Selecting a method, or combination of methods, is one of the first decisions a city needs to make in order to comply with the new retroreflectivity requirements.

It is not appropriate to prescribe a single method for all cities to follow. The most cost effective and efficient method to maintain sign retroreflectivity will vary by city. However, many engineers and city officials have suggested that that some variation of the Blanket Replacement Method combined with the Expected Sign Life Method would likely be the best methods for most cities. Once the age of a sign is known, using the Expected Sign Life Method is likely to be the easiest approach to replacing signs.

Documentation
Regardless of which method is adopted by the city, it is important for the city to document the process. Good records provide documentation that an appropriate method was used and also allows the city to assess and revise, if necessary, the method used to meet the sign retroreflectivity requirements. As long as the city has a reasonable method in place to manage or assess it signs and establishes a reasonable schedule for sign replacement, the city will be in conformance with the new sign retroreflectivity requirements.

Sign reduction
As cities contemplate how to comply with the new sign retroreflectivity requirements, it is likely that part of the discussion will involve considering a reduction in the size of the city's sign inventory. If a city has fewer signs, the cost of complying with the new requirements will be less. Only certain signs are required by the MN MUTCD. Thus, the city may consider getting rid of signs that are not required.

Implementation plan
No one implementation plan will work for every city. However, below is a suggested plan of action to assist cities in meeting the new sign retroreflectivity requirements.

- Create a traffic sign inventory for the city
- Remove excess and unnecessary signs

- Adopt one or more methods to manage or assess the retroreflectivity of the city's signs
- Develop a budget for replacing signs
- Use the selected method to evaluate the retroreflectivity of the city's traffic signs
- Identify signs that do not meet the minimum retroreflectivity requirements
- Prioritize and schedule replacement of signs that do not meet the minimum retroreflectivity requirements
- Plan for long-term compliance to better manage your city's signs
- Document the city's actions

Chris Smith (January 2014)

City of _____, Minnesota
Sign Retroreflectivity Policy

Article I. Purpose and Goal.

The purpose of this policy is to establish how the city will implement an assessment or management method, or combination of methods, to meet the minimum sign retroreflectivity requirements in the Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD).

Substantial conformance with the MN MUTCD is achieved by having a method in place to maintain minimum retroreflectivity levels. Conformance does not require or guarantee that every individual sign in the city will meet or exceed the minimum retroreflective levels at every point in time.

The goal of this policy is to improve public safety on the city's streets and roads and prioritize the city's limited resources to replace signs.

Article II. Applicable Signs.

This policy applies to all traffic sign in the city except the following:

- Parking, Standing, and Stopping signs (R7 and R8 series)
- Walking/Hitchhiking/Crossing signs (R9 series, R10-1 through R10-4b)
- Adopt-A-Highway signs
- All signs with blue (motor services) or brown (recreational) backgrounds
- Bikeway signs that are intended for exclusive use by bicyclists or pedestrians

Article III. Resource Materials

The city has reviewed and relied on numerous resources in adopting this policy. These resource materials include, but are not limited to the following:

- *Methods for Maintaining Traffic Sign Retroreflectivity*, Publication No. FHWA-HRT-08-026, U.S. Department of Transportation, Federal Highway Administration (November 2007).

- *Sign Retroreflectivity Guidebook*, Publication No. FHWA-CFL/TD-09-005, U.S. Department of Transportation, Federal Highway Administration (September 2009).

- *Sign Retroreflectivity: A Minnesota Toolkit*, Minnesota Department of Transportation, Local Road Research Board (June 2010).

- Traffic Sign Maintenance/Management Handbook, Report No. 2010RIC10, Version 1.1, Minnesota Department of Transportation (October 2010).

- *LMCIT Sign Retroreflectivity Memo and Model Policy*, League of Minnesota Cities (3rd Edition, January 2014).

Article IV. Sign Inventory

To meet the city's goal of maintaining sign retroreflectivity above certain levels, the city will maintain a sign inventory of all new or replacement signs installed after the effective date of this policy. The inventory shall indicate the type of sign, the location of the sign, the date of installation or replacement, the type of sheeting material used on the sign face, the expected life of the sign, and any maintenance performed on the sign.

As to existing signs, the city will perform an inventory of all signs covered by this policy. The city recognizes this process will occur over time subject to the city's monetary and human resources. The city expects to complete its sign inventory by _____. The city shall record the above information related to new signs to the extent that such information is known and shall also include a statement on the general condition of the sign.

Article V. Removal of Signs

In recognition of the fact that excess road signs have been shown to reduce the effectiveness of signage, as well as impose an unnecessary financial burden on road authorities, it is the city's policy to remove signs determined to be unnecessary for safety purposes and which are not required to comply with an applicable state or federal statute or regulation. The removal of signs shall be based on an engineering study and the MN MUTCD. Particular attention shall be paid to recommendations on signage for roads considered to be "low-volume" under the MN MUTCD. The city shall document the date a sign is removed and the reason for the removal.

Article VI. Approved Sign Evaluation Method.

[NOTE: Each city needs to customize this section of the policy to select the method or combination of methods it will use to meet the sign retroreflectivity requirements. Below is a non-exhaustive list of suggestions that a city might use to comply with the requirements. You can check one or more boxes tto match the city's selected method(s).

If the city chooses an assessment method (nighttime visual inspection or measured sign retroreflectivity), the city needs to select a reoccurring time frame, e.g., annual, every other year, etc., to assure continued compliance.

LMCIT suggests that you consult with your city's engineer in determining which method is most appropriate for your city.]

After reviewing the various methods proposed for sign maintenance, the City adopts one or more of the following methods to meet the minimum sign retroreflectivity requirements in the MN MUTCD: [Check one or more of the boxes that apply; for example, a city might choose Nighttime Visual Inspection and Expected Sign Life]

☐ **Nighttime Visual Inspection.** The retroreflectivity of the City's signs is assessed by a trained sign inspector following a formal visual inspection procedure from a moving vehicle during nighttime conditions. Signs that are visually identified by the inspector to have retroreflectivity below the minimum levels will be replaced. The City will visually inspect its signs based on the following schedule: _____ _____.

> [Describe how often the city will visually inspect signs. For example, the City might visually inspect all signs covered by this policy once each year; visually inspect one-half of all sign covered by this policy in even-numbered years and visually inspect the other one-half of its signs in odd-numbered years; visually inspect all signs on high volume roads once per year and visually inspect signs on all other roads once every three years.]

☐ **Measured Sign Retroreflectivity.** Sign retroreflectivity is measured using a retroreflectometer. Signs with retroreflectivity below the minimum levels will be replaced. The City will measure sign retroreflectivity based on the following schedule: _____ _____.

> [Describe how often the city will measure signs. For example, the City might measure the retroreflectivity of all signs covered by this policy once every two years; measure the retroreflectivity of all signs covered by this policy once every four years dividing the City into quadrants and measuring all the signs in one quadrant each year; measure the retroreflectivity of all signs on principal arterial roads once each year, measure the retroreflectivity of minor arterial roads once every two years and measure the retroreflectivity of all other roads once every three years.]

☐ **Expected Sign Life.** The installation date is labeled or recorded when a sign is installed, so that the age of any given sign is known. The age of the sign is compared to the expected sign life. The expected sign life is based on the experience of sign retroreflectivity degradation in the City. Signs older than the expected life will be replaced.

☐ **Blanket Replacement.** All signs in the City of a given type are replaced at specified intervals. This eliminates the need to assess retroreflectivity or track the life of individual signs. The replacement interval is based on the expected sign life for the shortest-life material used in the City or a given sign type. The current replacement interval is ____ years.

☐ **Control Signs.** Replacement of signs in the City is based on the performance of a sample set of signs. The control signs will be a small sample located in the City's maintenance yard or a selection of signs in the field. The control signs will be monitored to determine the end of retroreflective life for the associated signs. All signs represented by a specific set of control signs will be replaced before the retroreflectivity levels of the control signs reach the minimum retroreflectivity levels.

Article VII. Sign Replacement.

The City hereby establishes the following priority order in which road signs will be replaced:

- First priority shall be given to replacing all signs determined not to meet applicable retroreflectivity standards. Top priority shall also be given to replacing missing or damaged signs determined to be of a priority for safety purposes.
- Second priority shall be given to signs determined to be marginal in their retroreflectivity evaluation.
- Third priority shall be given to all remaining signs as they come to the end of their anticipated service life, become damaged, etc.

In addition, within each category above, further priority shall be given to warning and regulatory signs on roads with higher vehicle usage.

After the initial replacement of signs as provided for in this Article or the installation of new signs, the City shall, for the purpose of complying with the requirements of the MN MUTCD, maintain minimum retroreflectivity standards, as budgetary factors allow, by replacing signs as they reach the end of the latter of their (a) warranty period; (b) expected life expectancy for the sheeting material used on the sign; or (c) expected life as determined by an authorized engineering study.

Damaged, stolen, or missing signs may be replaced as needed.

Article VIII. Modification and Deviation from Policy.

The City reserves the right to modify this Sign Retroreflectivity Policy at any time if deemed to be in the best interests of the City based on safety, political and economic considerations.

The Director of Public Works, or his or her designee, may authorize a deviation from the implementation of this policy in regard to a particular sign when deemed to be in the best interests of the City based on safety, political and economic considerations. Such deviation shall be documented including the reason for the deviation and other information supporting the deviation.

Adopted by the City Council of the City of _____ on this _____ day of _____, 2014.

_____
City Clerk or Administrator

_____
Mayor

This Model Policy is for guideline purposes only. Each city has unique and specific circumstances that may dictate a different approach than is recommended here. Please consult your engineer and city attorney when developing a policy for your city. The responsibility for complying with the MN MUTCD rests with each city.

To obtain a Word© copy of this document, contact Helene Tetz at (651) 215-4095 or htetz@lmc.org.

Minnesota Association of Townships (MAT) Sample Road Sign Policy

MAT SAMPLE ROAD SIGN POLICY (April 2014)

The following is intended to serve as a general guide for towns in Minnesota to use in developing and adopting a plan to comply with the new guidelines regarding road signs imposed by the Federal Highway Administration. This sample policy is not intended to serve as formal legal or engineering advice. Towns are encouraged to adopt a policy comparable to the one below, or one developed for the town by a qualified consultant, prior to June 13, 2014, as required by Federal rules.

Township Road Sign Inventory, Retroreflectivity Compliance Evaluation, and Replacement Policy

It is the stated objective of _____ Township, _____ County, MN (the Township) to maintain its town roads in a safe but cost effective manner. As part of its maintenance efforts, The Township recognizes that regulatory, warning, and directional road signs (commonly referred to collectively as safety signs), including but not limited to stop signs, yield signs and other similar traffic control devices, need to be properly inventoried, assessed for compliance with applicable retroreflectivity standards, maintained, and replaced from time to time. The Township further recognizes that when signs are installed within town road rights-of-way they must comply with state and federal regulations as primarily outlined in the Manual on Uniform Traffic Control Devices. As part of its efforts to comply with applicable regulations, the Township Board shall be guided by the following plan adopted in accordance with Section 2A.08 of the Manual on Uniform Traffic Control Devices:

1. **Inventory.** In recognition of the importance of knowing the number, type, and location of road signs situated in township road rights-of-way, it is the intent of the Town Board to have any inventory of all town road signs completed by _____ (insert reasonable date for town conducting inventory) The completed inventory shall be maintained using _____(choose either paper records or a computer program) and shall be updated each time a sign is installed, replaced, or removed but not less than on an annual basis. The inventory shall indicate the type of sign, the number of each type of sign, the location of each sign including the direction the sign faces, the date of

installation (when known for pre-existing signs), type of material used on sign face (when known), a general statement on the condition of the sign, a record of any maintenance performed on the sign, and the date of sign removal if applicable.

2. **Removal of Excess Signs.** In recognition of the fact that excess road signs have been shown to reduce the effectiveness of signage, as well as impose an unnecessary financial burden on the road authority, it shall be the policy of the Township to remove signs determined to be unnecessary for safety purposes and which are not otherwise required to comply with an applicable state or federal statute or regulation. The removal of signs shall be based on an engineering study and the Manual on Uniform Traffic Control Devices. Particular attention shall be paid to recommendations on signage for roads considered to be "low-volume" under the Manual on Uniform Traffic Control Devices as adopted by the State.

3. **Retroreflectivity Assessment.** In recognition of the new retroreflectivity standards adopted into the Manual on Uniform Traffic Control Devices by the Federal Highway Administration, the town board shall arrange to have all town road signs not removed under section 2 above evaluated for compliance with the applicable retroreflectivity standards. It shall be the intent of the township to conduct this assessment using the following method as authorized by the Manual on Uniform Traffic Control Devices rules: (Choose one)

    a. Visual Nighttime Inspection Method
        i. Utilizing Calibration Sign Procedure
            or
        ii. Utilizing Comparison Panel Procedure
            or
        iii. Utilizing Consistent Parameters Procedure

    b. Measured Sign Retroreflectivity Method

    It shall be the intent of the town board to have this evaluation completed by (insert reasonable completion date, recommended no later than June 13, 2014.) The board reserves the right to change which evaluation method will be utilized as expressly found necessary by the board due to budgetary constraints or other practical difficulties in completing this process.

4. **Sign Replacement.** After completion of the inventory, removal of unnecessary signs, and proper retroreflectivity evaluation, the town board hereby establishes the following priority order in which road signs will be replaced:
    a. First priority shall be given to replacing all signs determined not to meet applicable retroreflectivity standards. Top priority shall also be given to replacing missing or damaged signs determined to be of a priority for safety purposes.

b. Second priority shall be given to signs determined to be marginal in their retro-reflectivity evaluation.
c. Third priority shall be given to all remaining signs as they come to the end of their anticipated service life, become damaged, etc.

In addition, within each category above, further priority shall be given to warning and regulatory signs on roads with higher vehicle usage.

On-going Maintenance. The town shall include a general inspection of road signs in township rights-of-way as part of its annual road inspections. The town shall update it's sign inventory as provided in section 1. After the initial replacement of signs as provided for in Section 4, the town shall, for the purpose of complying with the requirements of the Manual on Uniform Traffic Control Devices to maintain minimum retro-reflectivity standards, shall, as budgetary factors allow, replace signs as they reach the end of the latter of their (a) warranty period; (b) expected life expectancy for the facing material used on the sign; or (c) expected life as determined by an authorized engineering study. Damaged, stolen, or missing signs may be replaced as needed.

Adopted by _____ Township, _____ 20__

_____ _____

Chairperson Clerk

Generic County Policy

_____ County Transportation Traffic Operations Procedures

Adopted by County Board: _____

Purpose

The purpose of the Traffic Operations Procedures is to establish and maintain uniform definitions and practices concerning traffic maintenance operations on _____ County highways. The County will provide such control in a safe and cost-effective manner balancing the needs of safety for highway users and County personnel, budget, social and environmental concerns. It is in the County's best interest to have traffic operation maintenance procedures. Because of variables in the weather, traffic issues, changing driver demographics, road design, standards and other factors, these procedures must remain flexible. The County may use County employees or other entities under contract to provide this service.

I. Procedure

The traffic operations supervisor or designated supervisor/ lead worker will make decisions concerning scheduling and the procedures to be followed for daily traffic operation maintenance needs and subsequent yearly detailed condition inspections. Scheduling and the procedures to be followed will be based upon consideration of the following factors: significance of the traffic device to driver safety, condition and effectiveness of the device, standards compliance, and whether damage or condition creates an immediate safety hazard.

In every instance, the onsite Traffic Technician must assess the conditions of the traffic control device and rely on judgment and experience to determine the appropriate action to correct or maintain the device. Factors that may delay completion of traffic operation maintenance include other repair needs; utility locate needs, fabrication of necessary material, weather conditions including severe cold or significant winds, limited visibility, and other staff and field condition issues.

II. General Practices: Subject to the factors set forth in Section II, Procedures, the County will maintain traffic control devices (signs, traffic signals and pavement markings) to ensure a safe and efficient operation.

Sign Maintenance

A. Sign Installation: Signs will be installed to meet federal standards set forth in the most recent Manual on Uniform Traffic Control Devices (MUTCD), in accordance to _____ County Guidelines and practices.

B. Maintain Signing, Overall Responsibility: County utilizes a geographical information based sign log to identify key information on each sign along the county highway system. The sign retroreflectivity will be maintained consistent with standards per the MUTCD (ref. section 2A.8 Maintain Minimum Retroreflectivity) through use of a "Sign Management Program" based on sign life. *The sign life will be used based on the best known information from LRRB study or warranty length whichever is greater. In addition,* county will conduct a night survey every 2-3 years to supplement the management program and to monitor for sign replacement needs based on

vandalism or unexpected sign degradation.

_____ County Maintains highway signs and street identification signs on all _____ County highways, with the exception of:

1) All signing on approaches to County highways are not installed or maintained by the County other than street name signs and stop signs intersecting the County Highway which are maintained by the county.
2) Stop signs at Minnesota Department of Transportation (MnDOT) controlled intersections and highway ramps with County highways;
3) Specific signs installed by others (Mn/DOT, transit agencies, and Cities permitted to place signs on County highways) as outlined in the advanced signing guideline document.
4) Signs along County Highway within Mn/DOT right of way, unless specific agreement with Mn/DOT stipulates a county maintenance responsibility for signing.
5) Bike path and other pedestrian-control signs not pertaining to vehicle traffic.

C. Response to Incident Report for Sign Repair Needs: Sign maintenance staff will respond after receiving notice of a repair need to determine appropriate action with the following priorities:
   1) Stop sign: as soon as practical, no later than one business day, a temporary stop sign will be placed if required.
   2) Other regulatory signs: no later than three business days.
   3) Warning signs: within one scheduled workday.
   4) Informational/guidance signs: within two scheduled workweeks.

D. Sign Survey: Traffic staff will perform a biannual night time survey as follows:
   1) Acceptable retro reflectivity will be determined by the technicians conducting the survey through following the Comparison Panels Procedure as outlined in the Federal Highway Retro reflectivity requirements (FHWA-SA-07-020).
   2) A comparison of sample signs that are “acceptable” vs. “unacceptable” will be conducted prior to staff starting the survey. These sample signs are categorized as “adequate”, “marginal” and “fail”. This will allow staff to understand what they will be looking for on the survey.
   3) Written documentation of the location, sign type, size and reason for sign replacement will be recorded for each sign that is not in an acceptable condition and needs replacement.
   4) Sign replacement will occur as follows:
      a) Stop signs – within three working days
      b) All other signs – by segment with the entire replacement program for signs identified through the survey being replaced within four months of completion of the review.

F. Guidance Signs: *The _____ County Transportation Department Roadway Guidance Signing* document provides the direction for staff assessment and installation of signs to supplement regulatory and warning signs, providing motorists further guidance along the County highways.

G. Miscellaneous Sign Practices:

1) Sign staff is not directly on-call after normal working hours. After hours phone numbers for traffic operation sign staff is provided to the (911 center) so staff can be contacted in case of an emergency. In addition, a signal maintenance and highway maintenance person is on-call at all times after normal working hours and can respond to emergency situations in case traffic operation staff cannot be contacted.
2) Training is provided to ensure traffic staff can perform sign maintenance duties in an efficient, effective and responsive manner. Such training shall consist of, at a minimum, appropriate signing and traffic control seminars, appropriate available training videos, and yearly training by supervisors.
3) Unauthorized signs will be removed from County right of way consistent with the County Sign Placement Policy xxx.
4) Support staff will be informed and updated regarding sign maintenance operations (e.g., schedules and other priority needs or equipment failures) to ensure accurate information is available to respond to telephone inquiries.
5) Sign staff may park a sign maintenance vehicle against traffic flow in order to perform necessary emergency and routine maintenance duties.
6) Sign staff may drive or park maintenance vehicles on the center medians or boulevards in order to perform necessary emergency and routine maintenance duties.
7) Street name identification signs shall use 6" (4 ½ " lower case) C series letters on 9" aluminum, unless the street name exceeds 46" (the maximum length allowed on a 48" sign blank); then, 6" (4 ½ " lower case) B series or 5" (3 ¾ " lower case) C series can be used. Those street signs not at this standard will be replaced/upgrade through attrition.

Appendix C:

Examples of Sign Management Agreements

The following are examples sign management agreement currently used by local agencies

Lac Qui Parle County/Madison Township Sign Maintenance Agreement

AGREEMENT FOR TRAFFIC SIGN MAINTENANCE SERVICES BETWEEN LAC QUI PARLE COUNTY & MADISON TOWNSHIP

THIS AGREEMENT is made and entered into by and between the Township of Madison ("Township"), and the County of Lac qui Parle ("County"), governmental subdivisions of the State of Minnesota, pursuant to the authority granted to the parties by Minnesota Statutes 161.39 and 471.59.

Minnesota Statute 161.39 allows road authorities to contract with each other for technical and engineering assistance and to perform maintenance on any highway, street, road, or bridge under their jurisdiction, and

The Township requests that the County assist in the installation and maintenance of traffic signs on Township roads.

In consideration of the mutual promises and covenants of each to the other contained in this Agreement and other good and valuable consideration, the parties covenant and agree as follows:

SECTION 1. THE AGREEMENT

1.01. The County shall conduct an initial review and inventory of the Township signs and create a database recording the inventory.

1.02. The Township shall review and approve the database for accuracy and completeness.

1.03. The Township, upon completion, shall inform the County in writing of all signs it replaces, removes or installs during the term of this Agreement so the County can update the database.

1.04. By January 1st of each year the County shall submit to the Township a suggested list of signs that should be installed or replaced during the year based upon the County's Sign Replacement Policy, a copy of which is attached hereto and marked as "Exhibit A." The placement and installation of signs will be in accordance with the Minnesota Manual of Uniform Traffic Control Devices or other federal or state regulations.

1.05. By March 1st of each year the Township shall advise the County in writing as to which suggested signs are to be installed or replaced.

1.06. The coordination, timing, and dispatching of County operators and equipment shall be at the discretion of the County Engineer, County Maintenance Supervisor, or his/her direct representative but all work will be completed by September 1st of each year.

1.07. The Township can request additional sign work during the year that if the County is available will be handled by the County balancing inventory, equipment and staff.

1.08. The Township agrees to reimburse the County for all costs including but not limited to labor, material and equipment arising from the initial sign inventory, development and

maintenance of Township sign data base, inventory and installation and replacement of Township signs.

1.09. The Township shall reimburse the County monthly after receipt of invoice.

1.10. The term of this Agreement shall be for a period commencing on the date hereof and terminating on December 31, 2007, and will automatically renew for additional one year terms thereafter. Either party may terminate this agreement, at any time, upon 60 day written notice.

1.11. Each party shall fully indemnify and hold harmless the other party against all claims, losses, liability, suits, judgments, costs and expenses by reason of the action or inaction of its employees participating in this joint arrangement. This agreement to indemnify and hold harmless does not constitute a waiver by any participant of limitations on liability provided under Minnesota States Statutes, Chapter 466. The parties of this agreement are not liable for the acts or omissions of the other party to this agreement except to the extent to which they have agreed in writing to be responsible for acts or omissions of the other party.

1.12. Each party shall be responsible for injuries or death of its own personnel. Each party will maintain workers' compensation coverage, as required by law, on its personnel when performing work pursuant to this agreement.

SECTION 2. GENERAL PROVISIONS

2.01. **Notices**. All notices or communications required or permitted pursuant to this Agreement shall be either hand delivered or mailed to Township and County, certified mail, return-receipt requested, at the following address:

Township	**County**
Township of Madison	Lac qui Parle County Engineer
C/O _____	Lac qui Parle County Hwy Department 308 6th Avenue South Madison, MN 56256
_____	
_____	

Either Party may change its address or authorized representative by written notice delivered to the other party pursuant to this Section 2.01.

2.02. **Survival of Representations and Covenants**. The representations, covenants, and agreements of the parties under this Agreement, and the remedies of either party for the breach of such representations, covenants, and agreements by the other party shall survive the execution and termination of this Agreement.

2.03. **Alteration**. Any alteration, variation, modification or waiver of the provisions of the Agreement shall be valid only after it has been reduced to writing and duly signed by all parties.

2.04. **Waiver**. The waiver of any of the rights and/or remedies arising under the terms of this Agreement on any one occasion by any party hereto shall not constitute a waiver of any rights and/or remedies in respect to any subsequent breach or default of the terms of this Agreement. The rights and remedies provided or referred to under the terms of this Agreement are cumulative and not mutually exclusive.

2.05. **Interpretation According to Minnesota Law**. This Agreement shall be interpreted and construed according to the laws of the State of Minnesota.

2.06. **Entire Agreement**. This Agreement shall constitute the entire agreement between the parties and shall supersede all prior oral or written negotiations.

2.07. **Further Actions**. The parties agree to execute such further documents and take such further actions as may reasonably be required or expedient to carry out the provisions and intentions of this Agreement, or any agreement or document relating hereto or entered into in connection herewith.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed by their duly authorized representatives as of the day and year first above written.

TOWNSHIP OF MADISON

Attest:

By: _____

Name: _____

Title: _____

Date: _____

By: _____

Name: _____

Title: _____

Date: _____

LAC QUI PARLE COUNTY

By: _____

Name: _____

Title: County Board Chairperson

Date: _____

APPROVED AS TO FORM:

_____
County Attorney

St. Louis County/Town of Greenwood Fire Hall Warning Sign Agreement

ST. LOUIS COUNTY
AGREEMENT
BETWEEN
THE COUNTY OF ST. LOUIS
AND
THE TOWN OF GREENWOOD
TO

Install Remote Activated Solar Flashing Beacons Mounted on Fire Hall Warning Signs on County State Aid Highway No. 77 (Highway 77) in the Town of Greenwood, St. Louis County, Minnesota.

Prepared by the St. Louis County Traffic Engineering Division

THIS AGREEMENT is made and entered into by and between the County of St. Louis, a duly organized county within the State of Minnesota, hereinafter referred to as the "County", and the Town of Greenwood, hereinafter referred to as the "Town", an organized township within St. Louis County, Minnesota.

WHEREAS County State Aid Highway No. 77 is hereinafter referred to as "Highway 77"; and

WHEREAS, the County has authorized the installation of remote activated solar flashing beacons mounted on fire hall warning signs on Highway 77, hereinafter referred to as "Warning Beacons"; and

WHEREAS, the County has approved a plan to install Warning Beacons; and

WHEREAS, the County and the Town shall participate in the cost, maintenance and operation of the Warning Beacons, as hereinafter set forth.

NOW THEREFORE, IT IS MUTUALLY AGREED AND UNDERSTOOD AS FOLLOWS:

1. The Town, at its cost and expense, shall prepare the Plan to furnish the Warning Beacons.
2. The County shall approve the Plan and the Warning Beacons, and all required hardware shall conform to the specifications and requirements of the County.
3. The Town shall pay one-hundred percent (100%) of the cost of materials and any associated costs incurred by the Warning Beacon vendor or manufacturer that is required to furnish fully functional Warning Beacons in accordance with the approved Plan, but not limited to, the cost of the Warning Beacons and all required hardware for a complete installation.

4. The County shall install the Warning Beacons, fire hall warning sign panels (MUTCD Code W11-8) and mounting devices in accordance with the 2005 Edition of the Minnesota Department of Transportation "Standard Specifications for Construction", the Minnesota Manual on Uniform Traffic Control Devices (MUTCD), and the American Association of State Highway and Transportation Officials (AASHTO) Roadside Design Guide at its cost and expense.
5. The County shall perform a final inspection of the completed installation of the Warning Beacons and shall notify the Town of the County's acceptance or rejection of the installation of the Warning Beacons in writing to the Town. If the County rejects the installation including, but not limited to, the workmanship thereof, the Town shall perform whatever modification(s) required to satisfy the County's requirements.
6. If required, the Town shall provide an adequate electrical power supply to the Warning Beacons, and shall provide the necessary electrical power for the operation of the Warning Beacons at its cost and expense.
7. Should the County or the Town determine that any of the Warning Beacons are in need of repair or replacement, it is understood and agreed that the Town shall pay one-hundred (100%) of the cost of materials and any associated costs incurred by the Warning Beacon vendor or manufacturer required to repair or replace said damaged or deteriorated Warning Beacons including, but not limited to, the cost of the Warning Beacons and all required hardware for a complete installation.
8. The County shall maintain the sign panel and mounting devices, and install Warning Beacon replacement components furnished by the Town, at its cost and

expense.

9. Each Party designates an Authorized Representative for the purpose of administering this Agreement. A Party's authorized representative has the authority to give and receive notices, and to make any other decision required or permitted by this Agreement.

    a. For the County:

        Victor Lund
        Acting Traffic Engineer
        4787 Midway Road
        Duluth, MN 55811
        (218) 625-3873
        e-mail: lundv@co.st-louis.mn.us

    b. For the Town:

        Ellen Trancheff
        Town of Greenwood
        3000 County Road 77
        Tower, MN 55790
        (218) 753-2231

10. This Agreement represents the full and complete understanding of the Parties and both Parties represent that neither Party is relying on any prior agreements or understandings, whether oral or written. This Agreement shall be modified, if at all, with the signed, written consent of both Parties.

11. This Agreement may be terminated by any party upon thirty (30) days notice in writing to the other Party's authorized representative. Upon termination of this Agreement, the Warning Beacons shall be immediately removed by County

forces and returned to the Town.

12. Each of the Parties hereto hereby agrees that it shall defend, indemnify and save harmless the other Party and all of their employees and agents from any and all claims, demands actions or causes of action of whatever nature or character arising out of or by reason of their negligent or intentional acts or omissions in the execution or performance of the work provided herein, including, but not limited to, the installation, maintenance or repair of any of the Warning Beacons on Highway 77.

13. Any and all employees of the County, while engaged in the performance of any work or service which the County is specifically required to perform under this Agreement, shall be considered employees of the County, and not the Town, and that any and all claims that may or might arise under the Workers Compensation Act of the State of Minnesota on behalf of said employees while so engaged and any claims made by any third parties as a consequence of any act of said employees, shall be the sole obligation of the County.

14. Any and all employees of the Town, while engaged in the performance of any work or service which the Town is specifically required to perform under this Agreement, shall be considered employees of the Town, and not the County, and that any and all claims that may or might arise under the Workers Compensation Act of the State of Minnesota on behalf of said employees while so engaged and any claims made by any third parties as a consequence of any act of said employees, shall be the sole obligation of the Town.

COUNTY OF ST. LOUIS

RECOMMENDED FOR APPROVAL:

By: _____
Chair of the County Board

Date: _____

By: _____
Public Works Director/Highway Engineer

Date: 11/19/09

APPROVED AS TO FORM AND EXECUTION:

By: Nancy Nilsen
County Auditor - Chief Deputy

Date: 1/4/10

By: _____
County Attorney

Date: 1/11/10

2010 - 5530

TOWN OF GREENWOOD

COUNTERSIGNED:

By: _____
Chair

Date: 11-10-09

By: _____
Clerk

Date: 11-10-09

Resolution
of the
Board of County Commissioners
St. Louis County, Minnesota
Adopted on: December 15, 2009 Resolution No. 558
Offered by Commissioner: Sweeney

RESOLVED, that the St. Louis County Board authorizes the appropriate county officials to execute an agreement with the Town of Greenwood and any amendments approved by the County Attorney, for installing flashing beacons mounted on fire hall warning signs on County State Aid Highway No. 77 in the Town of Greenwood.

RESOLVED FURTHER, that Greenwood Township will pay for materials and other costs including maintenance and St. Louis County will install the beacons and mounting devices in accordance with engineering standards as detailed in the agreement.

Commissioner Sweeney moved the adoption of the Resolution and it was declared adopted upon the following vote:
Yeas – Commissioners O'Neil, Dahlberg, Forsman, Sweeney, Nelson, Raukar and Chair Fink - 7
Nays – None

STATE OF MINNESOTA
Office of County Auditor, ss.
County of St. Louis

I, **DONALD DICKLICH,** Auditor of the County of St. Louis, do hereby certify that I have compared the foregoing with the original resolution filed in my office on the 15th day of December, A.D. 2009, and that this is a true and correct copy.

WITNESS MY HAND AND SEAL OF OFFICE at Duluth, Minnesota, this 15th day of December, A.D., 2009

DONALD DICKLICH, COUNTY AUDITOR

By _____

Deputy Auditor/Clerk of County Board