

# Roadway Signing Final Report

By



**Illinois Department of Transportation**



**Federal Highway Administration- Illinois Division**



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## **2005 IDOT/FHWA Joint Process Review Program Roadway Signing Final Report**

### **Purpose of Review:**

The purpose of this review was to examine the current state-of-the-practice in the area of sign maintenance on the rural local road system.

### **Scope of Review:**

The review consisted of an evaluation of current procedures being followed for sign maintenance of township roads, rural county roads, and local streets in communities with populations under 5,000. The team used the threshold of under 5,000 population for three basic reasons: 1) State Transportation Program - Urban funds are available to municipalities over 5,000 in population; 2) Municipalities over 5,000 are considered urban areas; and 3) Municipalities with less than 5,000 don't generally have public works departments.

Issues the team reviewed included the use of signing inventories, evaluation of the condition of existing signs, and replacement procedures by the local agencies. Field reviews were conducted at each local agency to determine the condition and legibility of traffic signs. The field reviews mainly consisted of daytime reviews and one nighttime review. The team was able to borrow a retroreflector for a short time period to test the reflectivity for a sampling of signs in the field.

The review included interviews in three districts with nine County Engineers, eight Road Commissioners, and five municipal representatives. A few of the agencies had more than one representative. The total number of interviews was 19 rather than 22 because some agencies were interviewed at the same time and their responses were combined as appropriate. A questionnaire was used in conducting the interviews (see Appendix A). Procedures for sign maintenance and inventory control, crash problems, funding resources, and general perceived needs at the local level were discussed. The review team did discuss the proposed rulemaking on sign retroreflectivity at each interview and provided a copy of the Federal Register Notice that was published for review and comments (see Appendix B). The Traffic Safety Sign Upgrade Grant Program status was also discussed with each agency. The review team informed the local agencies that the intent of the review was to gain a statewide perspective or state-of-practice on the local needs in the area of traffic sign maintenance and was not intended to be a compliance review. Everyone was informed that when all reviews in Districts 4, 5, & 6 were completed a final report would be prepared and presented to the Illinois Department of Transportation (IDOT)/Federal Highway Administration (FHWA) management with a statewide perspective on local needs in the area of traffic sign maintenance based upon review observations and recommendations.

### **Review Team Members:**

Gary Galecki, Review Co-Coordinator  
J.P. Varma, Review Co-Coordinator  
Kelly Morse  
Larry Gregg

IDOT, Bureau of Local Roads  
FHWA, Transportation Engineer  
IDOT, Bureau of Materials & Physical Research  
IDOT, Bureau of Operations

Ron Rybolt  
 Mike Staggs  
 Arlene Kocher  
 Robin Helmerichs

IDOT, Local Roads Field Engineer, District 6  
 FHWA, Mobility & Safety Team Leader  
 FHWA, Quality Improvement Programs Engineer  
 FHWA, Transportation Engineer

### Best Practices:

The team noted the following best practices used by the local agencies for sign inventory and maintenance.

- Placing stickers on the back of signs indicating when the sign was installed
  - Several of the local agencies used stickers on the back of signs to indicate when the signs were installed. This practice can be a valuable part of a sign replacement and maintenance program.
- Upgrading sign sheeting to high intensity or prismatic
  - Some of the agencies were already upgrading their sheeting to high intensity or prismatic from engineering grade. Most agencies were upgrading the sheeting on their stop signs; however, other agencies had switched a majority of their sign sheeting because the cost difference was minimal.
- Regular schedule for sign inspections
  - One of the counties conducted sign inspections on a weekly basis. Regular inspections are an important part of a sign replacement and maintenance program.
- Making signs a priority
  - The agencies that had signing as a high priority have developed an inventory of their signs and keep it current. They also perform and document their inspections and replacements. These agencies are well on their way to meeting the proposed Manual on Uniform Traffic Control Devices (MUTCD) sign inventory, replacement, and maintenance requirements.

The closeout meeting was held Friday May 20, 2005. The following people were in attendance:

Priscilla Tobias	IDOT, Bureau Chief of Safety Engineering
Eric Harm	IDOT, Deputy Director
Charles Ingersoll	IDOT, Bureau Chief, Bureau Local Roads & Streets
David Lippert	IDOT, Research Engineer, Bureau of Materials & Physical Research
Roy Williamson	IDOT, Training Development Tech., Bureau of Local Roads & Streets
Jon-Paul Kohler	FHWA, Planning and Program Development Manager
Glenn Fulkerson	FHWA, Assistant Division Administrator
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Larry Gregg	IDOT, Review Team member
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Robin Helmerichs	FHWA, Review Team member
Mike Staggs	FHWA, Review Team member
Arlene Kocher	FHWA, Review Team member

## **Observations and Recommendations:**

### **Observation #1**

Condition of the local agency signs was highly dependent on available funding and the priority the agency placed on the importance of sign legibility and retroreflectivity.

### **Discussion**

The agencies that had available funding and placed a high priority on sign legibility and retroreflectivity had significantly better signs in place as observed during field visits. All but one of the local agencies believed sign legibility and retroreflectivity was important; however, the agencies with limited funding found it difficult to make it a higher priority when competing with infrastructure needs such as pavements and culverts. A few of the agencies had knowledge of signing needs and had a prioritized replacement list so that when funds were available they could use them effectively.

Of the signs we tested with the retroreflectometer in the field, 37 percent (23 of 63) of the signs would not meet the proposed retroreflectivity and contrast requirements (see Appendix C).

### **Recommendation**

Include a summary and reference to the final rulemaking for sign retroreflectivity in the Local Roads Manual. The IDOT will summarize the major items in the rulemaking and encourage the local agencies to develop, implement, and maintain a sign inventory and maintenance system in the circular letter announcing the final rule.

### **Resolution**

Concur.

### **Observation #2**

Knowledge of the proposed rulemaking on the MUTCD was limited.

### **Discussion**

Nine of the nineteen agencies were aware of the proposed rulemaking on retroreflectivity requirements. The current procedure to disseminate information on proposed rulemaking is for the Headquarters Bureau of Local Roads to send the information to the County Engineer policy committee and let them forward it to the various local agencies. The information for the retroreflectivity requirements was also published in the Technology Transfer newsletter (see Appendix D). The newsletter is sent hardcopy to all local agencies as well as being available via the Internet.

### **Recommendation**

- a. The distribution for notification on proposed rulemaking should be added to the circular letter system for sending other types of information to the local agencies. Circular letters go to all counties, municipalities, and consultants.

- b. Include the retroreflectivity requirements in the update of the “Signing of Road District and Township Highways” publication. The townships do not directly receive the circular letters from IDOT, but they do receive the “Signing of Road District and Township and Highways” publication.
- c. The IDOT/FHWA should provide training and education on the proposed retroreflectivity MUTCD requirements and increase distribution of proposed rulemaking beyond the County Engineer policy committee and the Technology Transfer newsletter.

Training should be developed or added to the existing T<sup>2</sup> signing class to cover the proposed rulemaking requirements. The training should include:

- A copy and explanation of the final retroreflectivity and contrast requirements
- A copy of the updated “Signing of Road District and Township Highways” for each participant
- Samples of paper and computer inventories
- Procedures for documenting and conducting inspections

### **Resolution**

- a. Concur – The Bureau of Local Roads and Streets will begin distributing proposed rulemaking through the circular letter system.
- b. Concur – The Bureau of Local Roads and Streets will update the “Signing of Road District and Township and Highways” publication to include the 2003 MUTCD updates and a summary of the final rulemaking on sign retroreflectivity.

An additional task accepted by the team is to develop/update a version of the above publication for small cities along with input from the Bureau Chief of Local Roads.

- c. Concur – The Bureau of Local Roads Technology Transfer Center is currently developing training for “train-the-trainers” on the MUTCD and retroreflectivity requirements.

### **Observation #3**

Many agencies are interested in a sign inventory system to track signs in the field.

### **Discussion**

Eighteen of the nineteen agencies interviewed were interested in a sign inventory program. Twelve of the agencies were interested in a computer-based inventory, and six were interested in a paper or map type inventory.

Many local agencies are concerned that the proposed rulemaking will result in increased tort claim lawsuits. The April 2004 edition of Public Works and Management stated, “To address this potential threat, and to reduce the risk of liability, States must develop viable approaches, such as a sign management plan or formal employee training, to ensure proper implementation. More important is the need to keep adequate records to show that the duties are being performed and to establish a quality control program or periodic review to ensure they are being done correctly.”

Several Local Agency representatives indicated that having an inspection and sign inventory program, both current and properly documented, reduced their chances of being found negligent in the event of a lawsuit.

### **Recommendation**

Provide examples to local agencies for inventories and inspections. The team has put together a packet containing examples of ~~and computer~~ inventories (see Appendix E) as well as guidance on performing inspections (see Appendix F).

### **Resolution**

Concur – The team will make the information in Appendices E and F available to the Technology Transfer Center to use in their training.

### **Observation #4**

High intensity sheeting is more effective than engineering grade.

### **Discussion**

The service life of high intensity sheeting is approximately one third longer than engineering grade (12 versus 8 years respectively). Service life includes factors such as retroreflectivity retention, color, and gloss retention, and signs shall show no appreciable physical deterioration such as streaking, crazing, cracking, hazing, blistering, and dimensional changes. The service life data is substantiated through state specifications, manufacturers warranties, and the Indiana Department of Transportation service life study.

The following table is a summary of cost data comparing engineering grade sheeting with high intensity sheeting. Based on the information, there is approximately a \$7 difference per sign for high intensity versus engineering grade. The cost savings for buying in bulk (more than 30 signs per order) varied from as small as \$2 to as much as \$5 per sign.

<b>Sign Company</b>	<b>Type of Sign</b>	<b>Sheeting Grade</b>	<b>1-10</b>	<b>11-49</b>	<b>50+</b>	
<b>Company A</b>	Stop Sign 30" x 30"	Engineering Grade	\$41.00	\$31.00	\$25.50	
<b>Company B</b>	Stop Sign 30" x 30"	High Intensity	\$54.75	\$46.75	\$43.75	
	Right Curve 30" x 30"	Engineering Grade	\$44.00	\$32.75	\$28.00	
	Right Curve 30" x 30"	High Intensity	\$60.75	\$51.75	\$44.75	
<b>Company C</b>	Stop Sign 30" x 30"	Engineering Grade	\$24.65	\$22.38	\$21.26	
<b>Company D</b>	Stop Sign 30" x 30"	High Intensity	\$35.23	\$33.47	\$24.89	
	Right Curve 30" x 30"	Engineering Grade	\$24.84	\$22.55	\$21.42	
	Right Curve 30" x 30"	High Intensity	\$35.54	\$33.76	\$25.75	
			<b>1-30</b>	<b>30+</b>		
<b>Company E</b>	Stop Sign 30" x 30"	Engineering Grade	\$21.00	\$18.85		
	Stop Sign 30" x 30"	High Intensity	\$28.25	\$25.75		
	Right Curve 30" x 30"	Engineering Grade	\$21.00	\$18.85		
	Right Curve 30" x 30"	High Intensity	\$28.25	\$25.75		
			<b>1</b>	<b>5-9</b>	<b>10-25</b>	<b>26-50</b>
<b>Company F</b>	Stop Sign 30" x 30"	High Intensity	\$90.00	\$80.00	\$68.00	\$60.00

High intensity sheeting will exceed the proposed minimum retroreflectivity requirements for all types of signs and improves the visibility of the signs. Based on cost, service life, ability to meet proposed retroreflectivity requirements, and the enhanced safety provided by high intensity sheeting, it is more effective than engineering grade sheeting.

### **Recommendation**

The local agency should purchase all signs with a minimum of high intensity sheeting. If a state or federally funded program for sign upgrades is developed in the future, a minimum of high intensity sheeting should be required to receive funding.

Some of the counties have upgraded to prismatic sheeting and should continue this practice as prismatic sheeting meets or exceeds the characteristics of high intensity sheeting.

### **Resolution**

Concur – The cost information on Engineering vs. High Intensity sheeting should be disseminated to local agencies by the Bureau of Local Roads. The information will also be included in the Technology Transfer Center training on the MUTCD and final rulemaking.

## Observation #5

Cost of compliance with the proposed retroreflectivity rulemaking requirements was a concern for most of the local agencies.

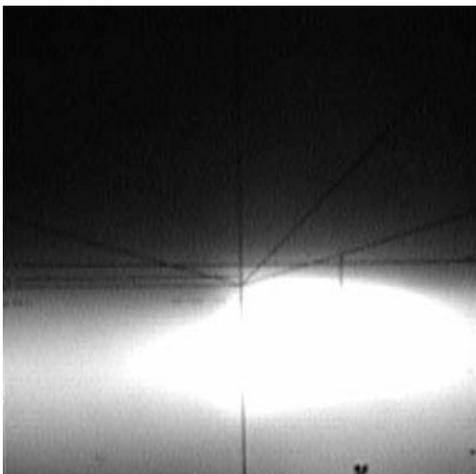
## Discussion

Many of the agencies are concerned about the cost of upgrading signs, the increased liability, and a lack of manpower to meet the requirements of the proposed rulemaking. Many were concerned about paying overtime for nighttime inspections.

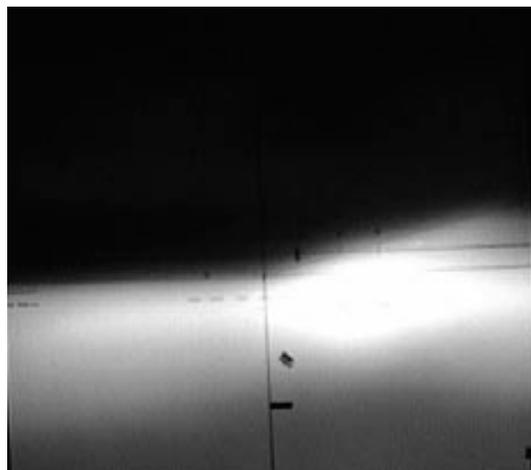
The Division of Traffic Safety developed a sign upgrade grant program in the 1970's using Division of Traffic Safety funding. This program has not been funded over the last few years and thus is not available to the local agencies for sign upgrades. One of the limitations of the previous program was the local agencies weren't educated on the benefits and methods of maintaining and updating a sign inventory once it is developed.

The proposed rulemaking requires the state and local agencies to maintain minimum retroreflectivity and contrast values. According to the Texas Transportation Institute, the rate of fatalities for nighttime crashes versus daytime crashes is 2.86 versus 1.18 fatalities per million vehicle miles traveled. Fatalities occur nearly three times as often during the night. Increased retroreflectivity provides greater visibility of signs both during the day and at night. As a driver ages, the amount of light needed to see in the dark gradually increases, eventually doubling every 13 years. The older driver needs a brighter roadway environment including signs and markings than the younger driver. Newer headlamp designs have a sharp "cut off"; a very noticeable difference in the area where the light shines and where it does not shine. Thus the trends for drivers and headlamps are making signs less visible, leaving it up to the sign materials to make the difference.

The following pictures depict the difference between the old headlamp design and the new "cutoff" design.



Old headlamp



"Cutoff" headlamp

With the old headlamp, the light is broad and tall. The "cutoff" headlamp projects less light on the sign, making it appear dimmer to the driver than it would appear with the older style headlamps.

Sign upgrade or replacement programs have been identified as an effective low cost safety improvement. Studies have shown a reduction in crashes of 20 to 40 percent after a sign replacement/upgrade program was initiated. Studies were conducted in California, New York, Minnesota, Iowa, and British Columbia. The placement of regulatory and warning signs has been identified as one of the best low cost safety improvements for rural roadways, but for the existing signing to be effective, the signs must be legible and visible.

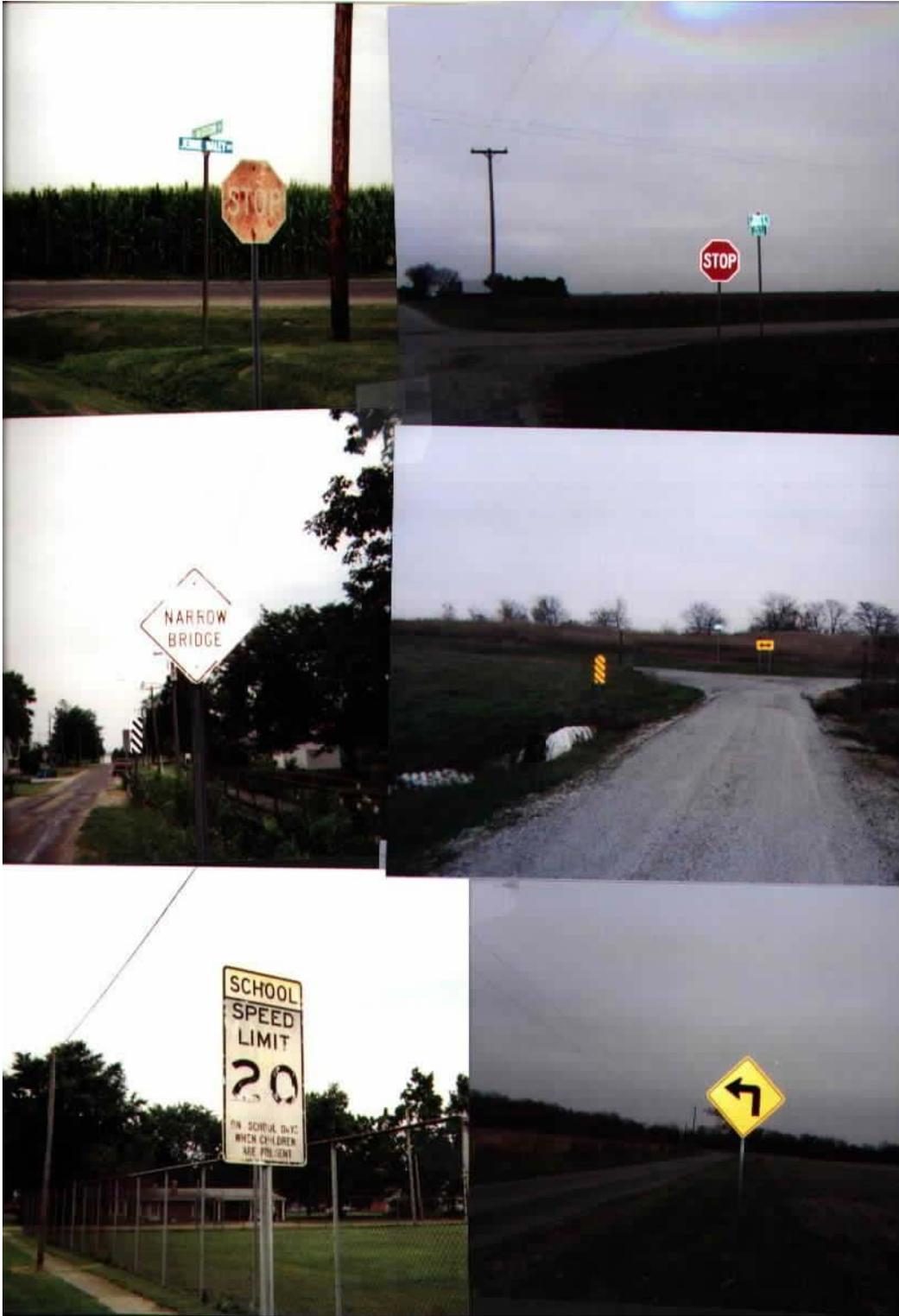
The proposed rulemaking requires minimum retroreflectivity and contrast values on all streets and highways. This can be accomplished within a sign maintenance program. Not only is this a future requirement, the review team believes this will enhance roadway safety at the local level.

### **Recommendation**

Develop a sign replacement program of \$500,000 for local agencies. The sign replacement program should build on the former program (see Appendix G) and incorporate the following changes:

- Funding (possible sources Federal Hazard Elimination, STP, State, Local Match)
- Administered by the Bureau of Safety Engineering and the Bureau of Local Roads
- Program eligibility should be based on prioritized need (may consider both local agency funds available and sign condition)
- Modified specifications to reflect the proposed changes in rulemaking
- A requirement for a documented sign maintenance and inspection program
- District Local Road Engineers should perform final inspections on installations and their inventory and inspection program and forward the documentation to the administering bureau
- Minimum of high intensity sheeting

The following photographs are of a local agency's signs before and after the former upgrade sign program. The signs are not necessarily at the same locations, but they illustrate the improvement in legibility and visibility of signs after the sheeting has been upgraded.



**Resolution**

Concur – The team will develop a new sign upgrade program for IDOT using the Division of Traffic Safety Program as a guide.



**Appendix A**  
(Local Agency and IDOT staff, Questionnaire)

| **-LOCAL AGENCY STAFF:**

Star Rheynard, Mercer County Engineer  
 Dennis Bedford, Mercer Township Road Commissioner, Mercer County  
 Jewel Bucy, City of Aledo Public Works Director, Mercer County  
 Norm Johansen, Tazewell County Engineer  
 Robert Cremeens, Village of Minier Supt. of Public Works, Tazewell County  
 Thomas McFarland, Peoria County Engineer  
 Roger French, Limestone Township Commissioner, Peoria County  
 Rick Myers, Village of Atwood Street Superintendent, Douglas County  
 Jerry Schauf, Piatt County Engineer  
 John Carlson, City Administrator for West Peoria, Peoria County  
 Henry Strube, Street Department Manager for West Peoria, Peoria County  
 Ronnie Creys, City of Virden Street Superintendent, Macoupin County  
 George Buerk, Locust Township Commissioner, Christian County  
 John Vancil, Woodstock Township Commissioner, Schuyler County  
 Cliff Frye, Christian County Engineer  
 Dave Schneider, Schuyler County Engineer  
 Dave Weaver, Washington Township Commissioner, Tazewell County  
 Tom Casson, Menard County Engineer  
 Brian Anderson, Ashgrove Township Commissioner, Shelby County  
 Brian Bell, Road District 2 Commissioner, Menard County  
 Alan Spesard, Shelby County Engineer  
 Dave Speicher, Local Roads Bureau Chief, IDOT – D5

| **IDOT STAFF:**

Martin Augspurger, Local Roads Technician, IDOT – D4 - schedule coordinator  
 George Merkle, Field Engineer, IDOT – D4  
 Ken Park, Field Engineer, IDOT – D4  
 Bill Schweickert, Field Engineer, IDOT – D4

Review Questions

1. How long have you been in your position?
2. Do you have a sign inventory for signs under your jurisdiction?
  - a) If yes, how is it administered?
  - b) If no, are you interested in a sign inventory?
  - c) What type of inventory would be appropriate for your needs?  
(i.e., paper, computer program, other)
  - d) Are new signs dated for sign inventory tracking?
  - e) Do you have signs on hand?
3. Do you perform daytime/nighttime reviews of your signs?
4. Do you have a sign replacement schedule?
  - a) If yes, what is the schedule based on?
  - b) How do you pay for sign replacement?
  - c) Do you replace signs with your own forces?
  - d) What are your procedures for replacing signs knocked down or damaged?
5. When replacing signs, do you replace to current Manual on Uniform Traffic Control Devices (MUTCD) minimum sign size requirements?
6. What type of sign supports do you use? Replacement system?
7. What guidelines do you use for selecting sign sheeting?
8. In your opinion, what is the general condition of your signs (legibility/reflectivity)?

9. Are you aware of the proposed Federal Highway Administration requirements for retro-reflectivity?
- What impacts do you see on your agency, and on how you manage your sign program?
10. In your opinion, how important are adequate sign legibility and retro-reflectivity in preventing roadway crashes?
11. If a sign replacement program were available, would you be interested in participating? Why or why not?
- What suggestions would you offer if a new sign upgrade program were to be developed?
12. Do you have any other comments regarding signs or sign inventories that have not been discussed?

**Appendix B**  
(Federal Register notice of proposed rulemaking)

## DEPARTMENT OF TRANSPORTATION

## Federal Highway Administration

## 23 CFR Part 655

[FHWA Docket No. FHWA-2003-15149]

RIN 2125-AE98

**National Standards for Traffic Control Devices; the Manual on Uniform Traffic Control Devices for Streets and Highways; Maintaining Traffic Sign Retroreflectivity****AGENCY:** Federal Highway Administration (FHWA), (DOT).**ACTION:** Notice of proposed amendments (NPA) to the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD); request for comments.

**SUMMARY:** The MUTCD, approved by the Federal Highway Administration, is incorporated by reference at 23 CFR part 655, subpart F. The FHWA proposes to amend the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) to include methods to maintain traffic sign retroreflectivity. The proposed maintenance methods would establish a basis for improving nighttime visibility of traffic signs to promote safety, enhance traffic operations, and facilitate comfort and convenience for all drivers. The proposed changes would be designated as Revision No. 2 to the 2003 Edition of the MUTCD.

**DATES:** Comments must be received on or before October 28, 2004.

**ADDRESSES:** Mail or hand deliver comments to the U.S. Department of Transportation, Dockets Management Facility, Room PL-401, 400 Seventh Street, SW., Washington, DC 20590, or submit electronically at <http://dmses.dot.gov/submit>. All comments should include the docket number that appears in the heading of this document or fax comments to (202) 493-2251. Alternatively, comments may be submitted via the Federal eRulemaking Portal at <http://www.regulations.gov> (follow the on-line instructions for submitted comments). All comments received will be available for examination and copying at the above address from 9 a.m. to 5 p.m., e.t., Monday through Friday, except Federal holidays. Those desiring notification of receipt of comments must include a self-addressed, stamped postcard or may print the acknowledgment page that appears after submitting comments electronically. Anyone is able to search the electronic form of all comments received into any of our dockets by the

name of the individual submitting the comment (or signing the comment, if submitted on behalf of an association, business, labor union, etc.). Persons making comments may review DOT's complete Privacy Act Statement in the Federal Register published on April 11, 2000 (volume 65, number 70, pages 19477-78), or may visit <http://dms.dot.gov>.

**FOR FURTHER INFORMATION CONTACT:** Mr. Peter J. Hatzl, Office of Safety Design (HSA-10), (202) 366-8036, or Raymond Cuprill, Office of the Chief Counsel (202) 366-0791, Federal Highway Administration, 400 Seventh Street, SW., Washington, DC 20590-0001. Office hours are from 7:45 a.m. to 4:15 p.m., e.t., Monday through Friday, except Federal holidays.

**SUPPLEMENTARY INFORMATION:****Electronic Access and Filing**

Interested parties may submit or retrieve comments online through the Document Management System (DMS) at: <http://dmses.dot.gov/submit>. Acceptable formats include: MS Word (versions 95 to 97), MS Word for Mac (versions 6 to 8), Rich Text File (RTF), American Standard Code Information Interchange (ASCII)(TXT), Portable Document Format (PDF), and WordPerfect (versions 7 to 8). The DMS is available 24 hours each day, 365 days each year. Electronic submission, retrieval help and guidelines are available under the help section of the Web site. An electronic copy of this document may be downloaded using a computer, modem and suitable communications software from the Government Printing Office's Electronic Bulletin Board Service at (202) 512-1661. Internet users may reach the Office of the Federal Register's home page at <http://www.archives.gov> and the Government Printing Office's Web page at: <http://www.access.gpo.gov/nara>.

**Background**

The MUTCD is available for inspection and copying as prescribed in 49 CFR part 7 and on the FHWA's Web site at <http://mutcd.fhwa.dot.gov>. This notice is being issued to provide an opportunity for public comment on the desirability of proposed amendments to Section 1A.11 Relation to Other Documents, Section 2A.09 Minimum Retroreflectivity, and Section 2A.22 Maintenance concerning sign retroreflectivity. Based on the comments received and its own experience, the FHWA may issue a final rule concerning the proposed changes included in this notice and would be incorporated by reference into 23 CFR part 655, subpart

F. The 2003 Edition of the MUTCD with Revision No. 2 changes incorporated as proposed in this amendment is also available on the Web site.

One of the FHWA's primary goals is to improve safety on the nation's roads.<sup>1</sup> Approximately 42,000 people have been killed on U.S. roads each year for the last eight years.<sup>2</sup> While nearly a quarter of travel occurs at night,<sup>3</sup> about one-half of traffic fatalities occur during nighttime hours.<sup>4</sup> There are many reasons for this disparity. However, the FHWA expects that improvements to the nighttime visibility of traffic signs will help drivers better navigate the roads at night and thus promote safety and mobility.

The purpose of traffic control devices, as well as the principles for their use, is to promote highway safety and efficiency by providing for the orderly movement of all road users. Those devices notify road users of regulations and provide warning and guidance needed for the safe, uniform, and efficient operation of traffic.

The MUTCD requires that traffic signs be illuminated or retroreflective to enhance nighttime visibility.<sup>5</sup> Most sign faces are made with retroreflective sheeting material to enhance the visibility of signs and their messages at night. Retroreflectivity, one factor associated with night visibility, is the property of a material to redirect light back towards its source. In the case of a traffic sign, light is redirected back from the sign face toward the vehicle's headlights, making the sign visible to the driver. Available sign sheeting materials offer different degrees of retroreflectivity, making some signs

<sup>1</sup> Fiscal Year 2003 Performance Plan. This document can be viewed at the Internet Web site: <http://www.fhwa.dot.gov/reports/2003plan/index.htm>.

<sup>2</sup> "Traffic Safety Facts 2001: A Compilation of Motor Vehicle Crash Data from the Fatality Analysis Reporting System and the General Estimates System." Publication NO. DOT HS 809484 December 2002. This document can be viewed at the Internet Web site: <http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/ncsa/tsfann/tsf2001.pdf>.

<sup>3</sup> Federal Highway Administration and The Bureau of Transportation Statistics, 2001 National Household Travel Survey, (23.3% of vehicle miles traveled occur between 7 p.m. and 6 a.m.). This document can be viewed at the Internet Web site: <http://nhts.ornl.gov>.

<sup>4</sup> "Traffic Safety Facts 2001: A Compilation of Motor Vehicle Crash Data from the Fatality Analysis Reporting System and the General Estimates System." Publication NO. DOT HS 809484 December 2002. This document can be viewed at Internet Web site: <http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/ncsa/tsfann/tsf2001.pdf>.

<sup>5</sup> "Manual on Uniform Traffic Control Devices, 2003 Edition." U.S. Department of Transportation, Federal Highway Administration, Washington, DC, November 2003. This document can be viewed at the Internet Web site: <http://mutcd.fhwa.dot.gov>.

appear brighter than others. The brightness of the sign is also a function of the age of the sign face material, as well as the size of vehicle, type of headlamps, the driver's visual capabilities, and the environmental conditions. In general, the higher the retroreflectivity level the brighter the sign will appear to a driver.

The retroreflectivity of signs gradually deteriorates over time making signs progressively less visible (*i.e.*, bright) at night. As signs lose their retroreflective properties, their effectiveness in communicating regulatory, warning, and guidance messages to road users diminishes to the point where they cannot be seen or read. Thus to maintain effectiveness, signs must be replaced before they reach the end of their useful retroreflective life. Until recently, little information was available about the levels of retroreflectivity necessary to meet the needs of drivers and thereby define the useful life of signs. FHWA research has led to the development of minimum maintained levels of traffic sign retroreflectivity for regulatory, warning, and guide signs for currently available materials, vehicle fleet characteristics, and capabilities of the driving population. Further, new methods have evolved for assessing and managing the retroreflectivity of existing signs on the road network. Sign assessment methods involve the evaluation of a sign's retroreflectivity by nighttime visual inspection or measurement of retroreflectivity using an appropriate instrument. Visual and numeric criteria based upon the minimum retroreflectivity needs of drivers are used to judge whether the sign has adequate night visibility. Sign management methods involve tracking or predicting the retroreflective life of individual signs, and scheduling for replacement those approaching the minimum levels.

Darkness significantly hides many of the visual cues used by drivers to interpret roadway alignment (including objects such as signs, pavement markings, and roadside barriers). Retroreflective treatments or illumination increases the visibility of these objects to provide information directly or restore the visual cues needed by the driver to safely navigate the road at night.

Maintaining minimum levels of traffic sign retroreflectivity on the nation's roads is becoming increasingly important as the driving population ages. Older drivers have diminished visual capabilities that are most

apparent under dark conditions.<sup>6</sup> Currently, 26.2 million drivers are 65 or older and by 2010 an estimated 33.7 million drivers will be 65 or older.<sup>7</sup> Traffic signs that are easier to see and read can help all drivers (not just the elderly) at night.

The MUTCD, approved by the Federal Highway Administration, is incorporated by reference in 23 CFR part 655, subpart F, and is recognized as the national standard for traffic control devices used on all public roads. The Secretary of Transportation's authority to establish these standards was established in 23 U.S.C. 109, and the Secretary has delegated that authority to the Federal Highway Administration, as stated in 49 CFR 1.48(b)(8). The FHWA is proposing changes to the MUTCD to improve night visibility for drivers by establishing a benchmark for adequacy of traffic signs that are currently in place and those that will be installed in the future. Improved night visibility of traffic signs is expected to promote safety and mobility on the nation's roads.

#### History of Sign Retroreflectivity

Requirements for nighttime sign visibility have been included in every version of the MUTCD, since the first edition in 1935. The 2003 Edition of the MUTCD continues to address the visibility of signs.<sup>8</sup> Some of the pertinent MUTCD sections include: Sections 1A.03 through 1A.05, dealing with design, placement, operation, and maintenance of traffic control devices, and Section 2A.22 Maintenance. Sign retroreflectivity is specifically addressed in Section 2A.08 Retroreflectivity and Illumination, which states, "[r]egulatory, warning, and guide signs shall be retroreflective or illuminated to show the same shape and similar color by both day and night, unless specifically stated otherwise in the text discussion in this Manual of a particular sign or group of signs." This language has essentially remained unchanged

<sup>6</sup> Information about this research is summarized on page 206 of the "Highway Design Handbook for Older Drivers and Pedestrians," Report number FHWA-RD-01-103, published by the FHWA Office of Safety Research and Development, 2001. It is available for purchase from the Technical Information Service, Springfield, Virginia 22161, (703) 605-6000. Internet Web site address at <http://www.ntis.gov>.

<sup>7</sup> Federal Highway Administration and the Bureau of Transportation Statistics, 2001 National Household Travel Survey. This document can be viewed at the Internet Web site: <http://nhts.ornl.gov>.

<sup>8</sup> "Manual on Uniform Traffic Control Devices, 2003 Edition," U.S. Department of Transportation, Federal Highway Administration, Washington, DC, October 2003. This document can be viewed at the Internet Web site: <http://mutcd.fhwa.dot.gov>.

since 1971. The FHWA also added Section 2A.09 Minimum Retroreflectivity Levels in the MUTCD Millennium Edition. Section 2A.09 serves as a placeholder for the results of the rulemaking addressed herein.

In 1993, the Congress directed the Secretary of Transportation to revise the MUTCD to include a standard for minimum levels of retroreflectivity that must be maintained for traffic signs and pavement markings, which apply to all roads open to public travel.<sup>9</sup> The FHWA already had an active research program investigating the nighttime visibility of traffic control devices to meet driver needs. In 1993, the FHWA responded to the congressional mandate by publishing a set of research recommendations for minimum maintained sign retroreflectivity levels.<sup>10</sup> A series of tables was presented in the research report to establish minimum maintained retroreflectivity levels for regulatory, warning, and side-mounted and overhead guide signs. These tables set minimum levels for various factors including sign size, roadway speed limit, type of sign face material, and nature of the sign legend.

In 1995, three national workshops were conducted to educate State and local highway agency personnel and solicit their input regarding the initial set of minimum maintained sign retroreflectivity levels. The findings from these workshops, combined with an increased knowledge of both driver needs and the performance of retroreflective materials and their durability, were used to revise the initial set of minimum maintained retroreflectivity levels. The revised minimum levels were published in 1998 in a report entitled "An Implementation Guide for Minimum Retroreflectivity Requirements for Traffic Signs."<sup>11</sup> One of the most evident changes was the removal of minimum levels of retroreflectivity for overhead signs because of unresolved issues with vehicle headlamp performance specifications and the difficulty of measuring overhead sign retroreflectivity.

<sup>9</sup> United States Department of Transportation and Related Agencies Appropriations Act of 1993, Public Law 102-388, 106 Stat. 1520, Section 406.

<sup>10</sup> Paniati, J.F. and Mace, D.J., "Minimum Retroreflectivity Requirements for Traffic Signs," FHWA-RD-93-077, U.S. Department of Transportation, Federal Highway Administration, Washington, DC, October 1993.

<sup>11</sup> McGee, H.W. and Paniati, J. F., "An Implementation Guide for Minimum Retroreflectivity Requirements for Traffic Signs," FHWA-RD-97-052, U.S. Department of Transportation, Federal Highway Administration, Washington, DC, 1998.

Also in 1998, a report entitled "Impacts on State and Local Agencies for Maintaining Traffic Signs Within Minimum Retroreflectivity Guidelines" presented the findings of a survey and analyses related to the expected impacts of the proposed minimum maintained retroreflectivity levels.<sup>12</sup> The report estimated that about five percent of the signs under State jurisdiction and eight percent of the signs under local jurisdiction would not meet the proposed minimum levels and would have to be replaced. The report concluded that the one-time replacement costs would be \$32 million for State agencies, and \$144 million for local agencies. It also stated that the cost impacts to agencies would be small if the minimum maintained retroreflectivity levels were phased in over a sufficiently long period of time.

Near completion of the 1998 work on the revised minimum levels, the National Highway Traffic Safety Administration (NHTSA) revised the Federal Motor Vehicle Safety Standard Number 108, Lamps, Reflective Devices, and Associated Equipment (FMVSS 108), so that vehicle owners could easily aim and adjust their headlamps and therefore reduce the variability associated with headlamp aim. FMVSS 108 is the document that sets the minimum and maximum luminous intensities for headlamps, headlamp mounting heights, and standardization of headlamps on new vehicles sold in the U.S. after 1968. Since that time, there have been several changes. Because of these changes, the FHWA conducted additional research to develop minimum maintained retroreflectivity levels for overhead guide signs and street name signs, which were not included in the minimum levels published in 1998. The research for overhead guide signs and street name signs was completed in early 2001.<sup>13</sup>

One of the significant findings of the research was the need to update some of the fundamental inputs on headlights, vehicle type (and hence headlight height), and driver capabilities to reflect the current vehicle fleet and older driver population in the development of minimum maintained retroreflectivity levels for traffic signs.

<sup>12</sup> McGee, H.W. and Taori, S., "Impacts on State and Local Agencies for Maintaining Traffic Signs Within Retroreflectivity Guidelines," FHWA-RD-97-053, U.S. Department of Transportation, Federal Highway Administration, Washington, DC 1998.

<sup>13</sup> Carlson, P.J. and Hawkins, H.G., "Minimum Retroreflectivity Levels for Overhead Guide Signs and Street Name Signs," FHWA-RD-03-082, U.S. Department of Transportation, Federal Highway Administration, Washington, DC, 2003. A copy of this report is available on the docket.

Consequently, additional research was sponsored by the FHWA to update the inputs and develop an updated set of minimum maintained retroreflectivity levels for traffic signs in the U.S. This work was completed in 2003 and has become the basis for this rulemaking.<sup>14</sup>

At least two significant events happened during the development of the proposed minimum maintained retroreflectivity levels. The first was the formation of the Special Task Force on Retroreflectivity by the AASHTO Standing Committee on Highways. The objective of the Task Force was to review the proposed minimum maintained levels for retroreflectivity (both traffic signs and pavement markings) and provide implementation recommendations to the FHWA. In 2000, the AASHTO's Board of Directors approved the Task Force's resolution that included several recommendations.<sup>15</sup> One of the key recommendations was that the minimum maintained retroreflectivity levels for traffic signs not be included in the MUTCD. Another key recommendation was that the proposed minimum maintained retroreflectivity levels for traffic signs should be revised to be clear and unambiguous and consolidated so they can be easily and properly applied. The AASHTO also recommended a six year phase-in compliance period.

The second significant activity occurred during the summer of 2002. The FHWA conducted a second round of national workshops to solicit input from transportation agency personnel concerning the implications of the revised minimum maintained retroreflectivity levels for traffic signs and the proposed changes to the MUTCD to adopt the minimum levels.<sup>16</sup> Feedback from these workshops led to refinement of the consolidated table of minimum maintained retroreflectivity levels, definition of methods for assessing and managing the retroreflectivity of in-place signs, formulation of language for the MUTCD,

<sup>14</sup> Carlson, P.J. and Hawkins, H.G., "Updated Minimum Retroreflectivity Levels for Traffic Signs," FHWA-RD-03-081, U.S. Department of Transportation, Federal Highway Administration, Washington, DC, 2003. A copy of this report is available on the docket.

<sup>15</sup> AASHTO Policy Resolution, "Minimum Retroreflectivity of Signs and Pavement Markings," December 2000. A copy of this AASHTO resolution is available at the following Web site: <http://safety.fhwa.dot.gov/fourthlevel/retroct.htm>.

<sup>16</sup> Hawkins, H.G., Carlson, P.J., Schertz, G.F., and Opiela, K.S., "Workshops on Nighttime Visibility of Traffic Signs: Summary of Workshop Findings," FHWA-SA-03-002, U.S. Department of Transportation, Federal Highway Administration, Washington, DC, 2003.

and development of implementation recommendations.

#### Proposed Amendment

The purpose of this notice of proposed amendments (NPA) is to obtain public comment on proposed amendments to the Manual on Uniform Traffic Control Devices (MUTCD) to include methods to maintain traffic sign retroreflectivity. The FHWA seeks comment on the proposed changes to the Introduction, Section 1A.11 Relation to Other Publications, Section 2A.09 Minimum Retroreflectivity, and 2A.22 Maintenance. Minimum maintained retroreflectivity levels associated with the above-mentioned methods are contained in the FHWA document "Maintaining Traffic Sign Retroreflectivity."<sup>17</sup> "Maintaining Traffic Sign Retroreflectivity" is included as an appendix to the preamble.

The American Society of Testing Materials (ASTM) definition of the term "standard" is "a concept established by authority, custom, or agreement to serve as a model or rule in a measurement of quality or the establishment of a practice or procedure."<sup>18</sup> This proposed amendment to the MUTCD is intended to meet that definition. In addition, feedback received during FHWA sponsored workshops reinforced the importance of not only sign retroreflectivity, but also nighttime visibility of signs. This feedback led to the emphasis in this proposal on actual methods to assess and maintain sign retroreflectivity, and not just establishment of minimum thresholds for retroreflectivity.

The proposed changes to the MUTCD by sections are as follows:

#### Discussion of Proposed Amendments to the Introduction

1. In the Introduction, the FHWA proposes to add to the STANDARD statement a seven-year target compliance date for Section 2A.09 Minimum Retroreflectivity. The FHWA proposes a phase-in target compliance period for implementation of seven years for ground mounted signs and ten years for overhead signs from the effective date of the final rule for Revision No. 2 of the 2003 MUTCD to

<sup>17</sup> A copy of the FHWA report "Maintaining Traffic Sign Retroreflectivity," Publication No. FHWA-SA-03-027, October 2003 is available as an appendix to the preamble.

<sup>18</sup> "Compilation of ASTM [American Society of Testing Materials] Standard Definitions", Eighth Edition, ASTM Publication Code Number 03-001094-42, 1994. A copy of this document is available from the ASTM at 1916 Race St., Philadelphia, PA 19103. Internet at the following URL: <http://www.astm.org>.

minimize any impact on State or local governments. The FHWA believes a target compliance period of seven years would allow State and local agencies to replace their engineering grade sign sheeting within a normal replacement period of a commonly-accepted seven year service life. The FHWA proposes a ten year compliance period for overhead signs to allow an extended period of time due to the longer service life typically used for those signs.

#### Discussion of Proposed Amendments to Part 1—General

2. In Section 1A.11 Relation to Other Publications, the FHWA proposes to add the publication "Maintaining Traffic Sign Retroreflectivity" to the list of other publications that are useful sources. "Maintaining Traffic Sign Retroreflectivity" is included as an appendix to the preamble.

#### Discussion of Proposed Amendments to Part 2—Signs

3. In Section 2A.09 Minimum Retroreflectivity Levels, the FHWA proposes changing the title of the section by deleting the word "levels" from the title to better describe the content of the section. The FHWA proposes to replace the SUPPORT statement with new SUPPORT, GUIDANCE, and OPTION statements that refer to minimum sign retroreflectivity.

In the SUPPORT statement, the FHWA proposes to provide a reference to Section 2A.22 Maintenance, stating that retroreflectivity is one of several factors associated with maintaining nighttime sign visibility.

In the GUIDANCE statement, the FHWA proposes to indicate that except for those signs specifically identified in the OPTION statement, one or more of the assessment or management methods described in this section should be used to maintain sign retroreflectivity above the minimum levels identified in the FHWA document "Maintaining Traffic Sign Retroreflectivity."<sup>19</sup> The methods are visual nighttime inspection (including three procedures: calibration signs, consistent parameters, and comparison panels), measured sign retroreflectivity, expected sign life, blanket replacement, and control signs. The GUIDANCE statement includes a brief description of each method and the following SUPPORT statement includes a reference to "Maintaining Traffic Sign Retroreflectivity" that provides more information about these methods and

their association to minimum maintained retroreflectivity levels for traffic signs. As part of the descriptions of the various methods in the GUIDANCE, the FHWA proposes to include a statement that signs that have retroreflectivity below the minimum levels should be replaced.

In the OPTION statement, the FHWA proposes to list several sign series that agencies may exclude from the proposed assessment methods and minimum maintained sign retroreflectivity levels. The FHWA proposes to exclude these sign series, because additional research is needed to support establishment of minimum retroreflectivity levels for these signs. The sign series that the FHWA proposes to exclude are: (1) Parking, Standing, and Stopping signs (R7 and R8 series), (2) Walking, Hitchhiking, and Crossing signs (R9 series, R10-1 through R10-4b), (3) Adopt-A-Highway series, (4) All signs with blue or brown backgrounds, and (5) Bikeway signs that are intended for exclusive use by bicyclists and/or pedestrians. This list will not exclude those signs from existing MUTCD retroreflectivity and maintenance requirements and guidance.

4. In Section 2A.22 Maintenance, the FHWA proposes changing the first paragraph of the GUIDANCE statement by replacing the phrase "adequate retroreflectivity" with "retroreflectivity levels as indicated in Section 2A.09." The reference to Section 2A.09 Minimum Retroreflectivity, enables readers to access information specific to retroreflectivity more easily. The FHWA proposes a new sentence that reads, "Maintenance activities should consider proper position, cleanliness, legibility, and daytime and nighttime visibility of a sign."

#### Appendix to the Preamble— Maintaining Traffic Sign Retroreflectivity

Traffic signs provide an important means of communicating information to road users and they need to be visible to be effective. The 2003 Manual on Uniform Traffic Control Devices (MUTCD) addresses sign visibility in several sections, including 1A.03, 1A.04, 1A.05, 2A.08, and 2A.22. Visibility is addressed in portions of these sections through factors such as design, placement, operation, maintenance, and uniformity.

The concept of visibility encompasses many different considerations and is difficult to quantify as an overall measure. Specific metrics such as conspicuity, legibility, or retroreflectivity are used to represent the various elements that contribute to

visibility. Conspicuity is the ability to identify a target (such as a sign) from its surroundings. It is what helps the user to first see a sign. Legibility is the ability to identify the message (content) of the target. It is what helps the user to read the sign.

The nighttime environment presents many sign visibility challenges. At night, road users cannot see as many visual cues as they can in the day. This places greater reliance on signs and other traffic control devices. To provide nighttime sign visibility, most signs are made from retroreflective sheeting. Retroreflectivity is the property of a material to redirect light back toward the originating source. It is what helps make a sign conspicuous and legible.

Existing procedures and technologies for measuring sign retroreflectivity provide one, but not the only, metric for quantifying nighttime sign visibility. The Federal Highway Administration (FHWA) has focused significant attention on retroreflectivity in recent years, including developing research recommendations for minimum maintained levels of sign retroreflectivity.

Sign location and orientation also impact sign visibility. Signs placed outside of the driver's cone of vision may not be seen by the driver even though they meet other visibility criteria. Likewise, signs behind obstructions (such as a structure or vegetation) may meet some visibility criteria, but can't be seen by drivers. To provide maximum effectiveness, signs should be designed, placed, and maintained in a manner that is consistent with MUTCD guidelines.

This document provides recommendations and general information about minimum maintained retroreflectivity levels and the methods that can be used to maintain sign retroreflectivity. Information contained in this document is intended for policy-makers and managers.

#### Retroreflectivity Maintenance

There are several methods that agencies can use to maintain sign retroreflectivity above the minimum maintained retroreflectivity levels that FHWA has developed through research. These minimum retroreflectivity levels were developed to provide transportation agencies with a general target for maintaining sign retroreflectivity. The existence of minimum retroreflectivity levels is not intended to imply that agencies need to measure the retroreflectivity of every sign in their jurisdictions. Instead, these methods provide agencies with options

<sup>19</sup> A copy of the FHWA report "Maintaining Traffic Sign Retroreflectivity," Publication No. FHWA-SA-03-027, October 2003 is available as an appendix to the preamble.

that will help to improve nighttime sign visibility.

Sign maintenance methods can be divided into two groups—assessment methods and management methods. Assessment methods involve the actual evaluation of individual signs, while management methods involve tracking and/or predicting the retroreflectivity of signs. The FHWA has identified several assessment and management methods for maintaining sign retroreflectivity in a manner that is consistent with the minimum retroreflectivity levels. Agencies also have the flexibility to develop their own methods for maintaining sign retroreflectivity.

#### Assessment Methods

The assessment methods require evaluation of individual signs within an agency's jurisdiction. There are two basic assessment methods—visual assessment and retroreflectivity measurement.

##### *Visual Nighttime Inspection Method*

In the visual nighttime inspection method, agency personnel assess the nighttime visibility of their signs. The visual inspection method is probably the most consistent with current practices at many agencies. Visual inspections are also recommended in Section 2A.22 of the MUTCD.

In the visual inspection method, the inspector assesses the visibility and retroreflectivity of the traffic signs as he/she approaches the signs. Signs need to be replaced if they do not meet the comparison defined in the appropriate procedure. The following recommendations provide general guidance on how to conduct the inspections:

- Agencies develop guidelines and procedures for inspectors to use in conducting the nighttime inspections. Inspectors are trained on the use of these procedures.
- The inspection is conducted at normal roadway operating speeds. If it is necessary to slow or stop the vehicle to read the sign, the sign typically needs to be replaced. Signs are normally inspected from the travel lane.
- The inspection is conducted using the low beam headlights. It is better not to use the bright beams for inspections as they create higher illuminance levels at the sign and make it appear brighter than it would to a driver using low beams.
- Signs are normally evaluated at a typical viewing distance for each sign, one that provides a driver with adequate time for an appropriate response.

In addition to the above recommendations, one or more of the

following procedures are used in conducting visual nighttime inspections.

#### Calibration Signs Procedure

Calibration signs are viewed prior to conducting the nighttime inspection. The calibration signs have retroreflectivity levels at or above the minimum levels. These signs are set up where the inspectors can view the calibration signs in a manner similar to how they will conduct the nighttime inspection. The inspector uses the visual appearance of the calibration sign to establish the evaluation threshold for that night's inspection activities. The following factors provide additional information on the use of this procedure:

- Calibration signs are needed for each color of sign for which there are minimum levels.
- The calibration signs are viewed at typical viewing distances and from the same vehicle that will be used for conducting the inspections.
- The calibration signs need to be properly stored between inspections so that the retroreflectivity of the calibration signs does not deteriorate over time. Calibration sign retroreflectivity is checked at periodic intervals to ensure that the calibration panels have the appropriate retroreflectivity levels.
- Field signs need to be replaced if the inspector judges a sign to be less bright than the appropriate calibration sign.

#### Consistent Parameters Procedure

The same factors that were used to develop the minimum levels are used in conducting the inspections. These factors include:

- Using a full-size sport utility vehicle or pick-up to conduct the inspection.
- Using a model year 2000 or newer vehicle for the inspection.
- Using an inspector age 60 or older.
- Signs are viewed at the typical viewing distance for that sign.
- Signs need to be replaced if they are not legible to the inspector.

#### Comparison Panels Procedure

Small comparison panels are used to assess the retroreflectivity of questionable signs. The comparison panels are fabricated at retroreflectivity levels that are at or above the minimum levels. When the retroreflectivity of a sign is considered to be questionable, a comparison panel is attached to the sign and the sign/panel combination is viewed by the inspector. If the comparison panel appears brighter than the sign, the sign needs to be replaced.

#### *Measured Retroreflectivity Method*

In this method, the retroreflectivity of a sign is measured and directly compared to the minimum level appropriate to that sign. If the sign retroreflectivity is lower than the minimum levels, the sign needs to be replaced. The following factors provide additional information about measuring sign retroreflectivity:

- ASTM E1709, Standard Test Method for Measurement of Retroreflective Signs Using a Portable Retroreflectometer, provides a standard method for measuring sign retroreflectivity using a handheld retroreflectometer.
- A sign needs to be replaced if the average retroreflectivity value is less than the appropriate minimum level.

#### Management Methods

The management methods provide an agency with the ability to maintain sign retroreflectivity without having to devote significant effort into assessing individual signs. There are three basic types of management methods—replacing signs based on age, blanket replacement of large numbers of signs at appropriate intervals, and using a sample of control signs to determine when to replace equivalent signs.

#### *Expected Sign Life Method*

In this method, individual 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 following factors provide additional information about using this method:

- The expected service life of a sign can be based on several different sources of information, such as:

—Sign sheeting warranties.  
—Sign test deck measurements.  
—Measurements of actual signs.

- An agency will need a method of identifying the age of individual signs. Potential methods include:

—A sticker or other label attached to the sign that identifies the year of fabrication, installation, or replacement.  
—A sign management system that can identify the age of individual signs.

#### *Blanket Replacement Method*

In this method, an agency replaces all the signs in an area/corridor, or of a given type, at specified intervals. An agency that uses this method does not need to track the age or assess the retroreflectivity of individual signs. The following factors provide additional

information about the use of this procedure:

- Replacement zones can be based on an area, corridor, or sign type.
- The replacement interval for the area/corridor, or sign type, is based on the expected sign life for the affected signs.
- All signs within a replacement area/corridor/type are typically replaced, even if the sign was recently installed.

*Control Sign Method*

In this method, a control sample of signs is used to represent the total population of an agency's signs. The retroreflectivity of the control signs is monitored at appropriate intervals and sign replacement is based on the performance of the control signs. The following factors provide additional information about using this method:

- An agency develops a sampling plan to determine the appropriate number of control signs needed to represent the agency's sign population.
- Control signs may be actual signs in the field or signs installed in a maintenance yard to serve specifically as control signs.
- The retroreflectivity of the control signs should be monitored following the procedures outlined for one of the assessment methods.
- All field signs represented by the control sample need to be replaced before the retroreflectivity levels of the control sample reach the minimum levels.

**Sign Replacement**

All of the sign retroreflectivity maintenance methods indicate that signs need to be replaced when they do

not meet the threshold criteria for the individual method. In maintaining sign retroreflectivity, an agency may want to consider the interval before the next assessment or management event as part of the sign evaluation and replacement process. In some cases, it may be appropriate to replace a sign even though it is above the threshold criteria because it could be expected to drop below the threshold criteria before the next assessment/management event.

**Sign Exclusions**

The following signs may be excluded from the various methods of maintaining sign retroreflectivity:

- 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 or brown backgrounds.
- Bikeways which are not immediately adjacent to a roadway and that are intended for exclusive use by bicyclists and/or pedestrians.

**Minimum Retroreflectivity Levels**

Since the early 1990s, the FHWA has sponsored several different efforts to develop research recommendations for minimum retroreflectivity levels for traffic signs. These efforts represent various attempts to define and refine the concept of minimum maintained sign retroreflectivity. Initial minimum retroreflectivity levels were developed through research in 1993 (1). These levels were revised in 1998 through further research (2). Updated minimum levels were developed in 2003 (3) and

are the ones that FHWA proposes for use. A paper describes the evolution of the research to develop minimum levels of sign retroreflectivity (4).

The updated minimum levels of sign retroreflectivity are generally similar in magnitude to levels published previously, but represent several refinements and updates. The following improvements were incorporated into the 2003 updated levels:

- An improved computer model was used to develop the minimum levels.
- Additional sheeting types were incorporated into the minimum levels.
- Headlamp (headlight) performance was updated to represent the model year 2000 vehicle fleet.
- Vehicle size was increased to represent the greater prevalence of sport utility vehicles and pick-up trucks.
- The luminance level needed for legibility was increased to better accommodate older drivers.
- Minimum retroreflectivity levels were consolidated across more sheeting types to reduce the number of minimum levels.

The updated minimum maintained retroreflectivity levels are shown in the following table. They represent the most current research recommendations, and are recommended by FHWA, but are limited to the current knowledge of the nighttime luminance requirements of traffic signs. The assumptions and limitations associated with the development of these levels are described in the research report (3). It should be noted that there may be situations where, based on engineering judgment, an agency may want to provide greater retroreflectivity.

**MINIMUM MAINTAINED RETROREFLECTIVITY LEVELS**

Sign color	Criteria	Sheeting type (ASTM D4956-01a)					
		I	II	III	VII	VIII	IX
White on Red	See Note 1	35//7					
Black on Orange or Yellow	See Note 2	*					
	See Note 3	75					
Black on White		50					
White on Green	Overhead	*//7	*//15	*//25	250//25		
	Shoulder	*//7					

**Notes:**

Levels in cells represent legend retroreflectivity // background retroreflectivity (for positive contrast signs). Units are cd/lx/m<sup>2</sup> measured at an observation angle of 0.2° and an entrance angle of -4.0°.

1 Minimum Contrast Ratio ≥ 3:1 (white retroreflectivity + red retroreflectivity).

2 For text signs measuring 48 inches or more and all bold symbol signs.

3 For text signs measuring less than 48 inches and all fine symbol signs.

\* Sheeting type should not be used.

MINIMUM MAINTAINED RETROREFLECTIVITY LEVELS—Continued

<p><b>Bold Symbol Signs</b> .....</p>	<ul style="list-style-type: none"> <li>• W1-1—Turn.</li> <li>• W1-2—Curve.</li> <li>• W1-3—Reverse Turn.</li> <li>• W1-4—Reverse Curve.</li> <li>• W1-5—Winding Road.</li> <li>• W1-6—Large Single Arrow.</li> <li>• W1-7—Large Double Arrow.</li> <li>• W1-8—Chevron.</li> <li>• W1-9—Turn &amp; Advisory Speed.</li> <li>• W1-10—Horizontal Alignment &amp; Intersection.</li> <li>• W2-1—Cross Road.</li> <li>• W2-2, W2-3—Side Road.</li> <li>• W2-4—T Intersection.</li> <li>• W2-5—Y Intersection.</li> <li>• W2-6—Circular Intersection.</li> <li>• W3-1a—Stop Ahead.</li> <li>• W3-2a—Yield Ahead.</li> <li>• W3-3—Signal Ahead.</li> <li>• W4-3—Added Lane.</li> <li>• W6-1—Divided Highway Begins.</li> <li>• W6-2—Divided Highway Ends.</li> <li>• W6-3—Two-Way Traffic.</li> <li>• W10-1, -2, -3, -4—Highway-Railroad Intersection Advance Warning.</li> <li>• W11-2—Pedestrian Crossing.</li> <li>• W11-3—Deer Crossing.</li> <li>• W11-4—Cattle Crossing.</li> <li>• W11-5—Farm Equipment.</li> <li>• W11-5p, -6p, -7p—Pointing Arrow Plaques.</li> <li>• W11-8—Fire Station.</li> <li>• W11-10—Truck Crossing.</li> <li>• W12-1—Double Arrow.</li> </ul>
<p><b>Fine Symbol Signs</b> .....</p> <p><b>Special Case Signs</b> (for requirements in addition to yellow color addressed in above table).</p>	<p>All symbol signs not listed in the bold category are considered fine symbol signs.</p> <ul style="list-style-type: none"> <li>• W3-1a—Stop Ahead.</li> <li>• Red retroreflectivity <math>\geq 7</math>.</li> <li>• W3-2a—Yield Ahead.</li> <li>• Red retroreflectivity <math>\geq 7</math>, White retroreflectivity <math>\geq 35</math>.</li> <li>• W3-3—Signal Ahead.</li> <li>• Red retroreflectivity <math>\geq 7</math>, Green retroreflectivity <math>\geq 7</math>.</li> <li>• W14-3—No Passing Zone, W4-4p—Cross Traffic Does Not Stop, or W13-2, -3, -1, -5—Ramp &amp; Curve Speed Advisory Plaques.</li> <li>• Use largest sign dimension to find proper category in above table.</li> </ul>

References

1. Paniati, J.F. and Mace, D.J., Minimum Retroreflectivity Requirements for Traffic Signs, Technical Report. FHWA-RD-93-077, Federal Highway Administration, Washington, DC, October 1993.
2. McGee, H.W. and Paniati, J.F., An Implementation Guide for Minimum Retroreflectivity Requirements for Traffic Signs. FHWA-RD-97-052, Federal Highway Administration, Washington, DC, 1998.
3. Carlson, P.J. and Hawkins, H.G., Updated Minimum Retroreflectivity Levels for Traffic Signs. FHWA-RD-03-081, Federal Highway Administration, Washington, DC, 2003.
4. Carlson, P.J., Hawkins, H.G., Schertz, G.F., Opiela, K.S., and Mace, D.J., Developing Updated Minimum In-Service Retroreflectivity Levels for Traffic Signs, accepted for publication in the Transportation Research Record, Transportation Research Board, Washington, DC, 2003.

Rulemaking Analyses and Notices

All comments received before the close of business on the comment closing date indicated above will be considered and will be available for examination using the docket number appearing at the top of this document in the docket room at the above address. The FHWA will file comments received after the comment closing date and will consider late comments to the extent practicable. In addition to late comments, the FHWA will also continue to file in the docket relevant information becoming available after the comment closing date, and interested persons should continue to examine the docket for new material. A final rule may be published at any time after the close of the comment period.

Executive Order 12866 (Regulatory Planning and Review) and U.S. DOT Regulatory Policies and Procedures

The FHWA has determined that this action is a significant regulatory action

within the meaning of Executive Order 12866 and under the regulatory policies and procedures of the U.S. Department of Transportation, because of the substantial public interest in the retroreflectivity of traffic signs. This rulemaking addresses comments received in response to the Office of Management and Budget's (OMB) request for regulatory reform nominations from the public. The OMB is required to submit an annual report to Congress on the costs and benefits of Federal regulations. The 2002 report included recommendations for regulatory reform that OMB requested from the public.<sup>20</sup> One recommendation was that the FHWA should establish standards for minimum levels of

<sup>20</sup> A copy of the OMB report "Stimulating Smarter Regulation: 2002 Report to Congress on the Costs and Benefits of Regulation and Unfunded Mandates on State, Local, and Tribal Entities" is available at the following Web address: [http://www.whitehouse.gov/omb/inforeg/summaries\\_nominations\\_final.pdf](http://www.whitehouse.gov/omb/inforeg/summaries_nominations_final.pdf).

brightness of traffic signs.<sup>21</sup> The FHWA has identified this rulemaking as responsive to that recommendation.

It is anticipated that the economic impact of this rulemaking would cause minimal additional expense to public agencies. In 2003, the FHWA updated its analysis of the cost impacts to State and local agencies to reflect higher material costs due to inflation, an increase in the proportion of signs that would be replaced with higher-level sign sheeting material, and changes in the overall mileage of State and local roads. The findings of the 2003 analysis show that the costs of the proposed action to State and local agencies would be less than \$100 million per year. The proposed seven-year regulation implementation period for ground mounted signs would allow State and local agencies to delay replacement of recently-placed Type I signs until they have reached their commonly-accepted seven-year service life. The proposed ten-year compliance period for overhead signs would allow an extended period of time due to the longer service life typically used for those signs.

The FHWA has considered the costs and benefits associated with this rulemaking and believes that the benefits outweigh the costs. Currently, the MUTCD requires that traffic signs be illuminated or retroreflective to enhance nighttime visibility. The changes proposed in this notice provide additional guidance, clarification, and flexibility in maintaining traffic sign retroreflectivity that is already required by the MUTCD. The proposed maintenance methods consider changes in the composition of the vehicle population, vehicle headlamp design, and the demographics of drivers. The FHWA expects that the proposed maintenance methods will help to promote safety and mobility on the nation's roads and will result in minimum additional expense to public agencies or the motoring public.

#### Regulatory Flexibility Act

In compliance with the Regulatory Flexibility Act (Pub. L. 96-354, 5 U.S.C. 601-612), the FHWA has evaluated the effects of this proposed action on small entities, including small governments. The FHWA certifies that this proposed action would not have a significant economic impact on a substantial number of small entities.

<sup>21</sup> A complete compilation of comments received by OMB is available at the following Web address: [http://www.whitehouse.gov/omb/info/reg/key\\_comments.html](http://www.whitehouse.gov/omb/info/reg/key_comments.html). Comment number 93 includes the recommendation concerning the retroreflectivity of traffic signs.

#### Executive Order 13132 (Federalism)

The FHWA analyzed this proposed amendment in accordance with the principles and criteria contained in Executive Order 13132, dated August 4, 1999, and the FHWA has determined that this proposed action would not have a substantial direct effect or sufficient federalism implications on States and local governments that would limit the policy making discretion of the States and local governments. Nothing in the MUTCD directly preempts any State law or regulation.

The MUTCD is incorporated by reference in 23 CFR part 655, subpart F. These proposed amendments are in keeping with the Secretary of Transportation's authority under 23 U.S.C. 109(d), 315, and 402(a) to promulgate uniform guidelines to promote the safe and efficient use of the highway.

#### Executive Order 12372 (Intergovernmental Review)

Catalog of Federal Domestic Assistance Program Number 20.205, Highway Planning and Construction. The regulations implementing Executive Order 12372 regarding intergovernmental consultation on Federal programs and activities apply to this program.

#### Unfunded Mandates Reform Act

This notice of proposed amendments would not impose unfunded mandates as defined by the Unfunded Mandates Reform Act of 1995 (Pub. L. 104-4, 109 Stat. 48, March 22, 1995). The findings of the impacts analysis indicate that this proposed action will not result in the expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of \$120.7 million or more in any one year. In addition, sign replacement is eligible for up to 100 percent Federal-aid funding—this applies to local jurisdictions and tribal governments, pursuant to 23 U.S.C. 120(c).

#### Paperwork Reduction Act

Under the Paperwork Reduction Act of 1995 (PRA) (44 U.S.C. 3501, *et seq.*), Federal agencies must obtain approval from the Office of Management and Budget (OMB) for each collection of information they conduct, sponsor, or require through regulations. The FHWA has determined that this proposed action does not contain a collection of information requirement for the purposes of the PRA.

#### Executive Order 12988 (Civil Justice Reform)

This proposed action meets applicable standards in Sections 3(a) and 3(b)(2) of Executive Order 12988, Civil Justice Reform, to minimize litigation, to eliminate ambiguity, and to reduce burden.

#### Executive Order 13045 (Protection of Children)

The FHWA has analyzed this proposed action under Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks. This is not an economically significant proposed action and does not concern an environmental risk to health or safety that may disproportionately affect children.

#### Executive Order 12630 (Taking of Private Property)

This proposed action would not affect a taking of private property or otherwise have taking implications under Executive Order 12630, Governmental Actions and Interference with Constitutionally Protected Property Rights.

#### Executive Order 13211 (Energy Effects)

The FHWA has analyzed this proposed action under Executive Order 13211, Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use. We have determined that this is not a significant energy action under that order because it is not a significant regulatory action under Executive Order 12866 and is not likely to have a significant adverse effect on the supply, distribution, or use of energy. Therefore, a Statement of Energy Effects under Executive Order 13211 is not required.

#### Executive Order 13175 (Tribal Consultation)

The FHWA has analyzed this proposed action under Executive Order 13175, dated November 6, 2000, and believes that it will not have substantial direct effects on one or more Indian tribes; will not impose substantial direct compliance costs on Indian tribal governments; and will not preempt tribal law. Therefore, a tribal summary impact statement is not required.

#### National Environmental Policy Act

The agency has analyzed this proposed action for the purpose of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq.*) and has determined that it would not have any effect on the quality of the environment.

**Regulation Identification Number**

A regulation identification number (RIN) is assigned to each regulatory action listed in the Unified Agenda of Federal Regulations. The Regulatory Information Service Center publishes the Unified Agenda in April and October of each year. The RIN contained in the heading of this document can be used to cross-reference this action with the Unified Agenda.

**List of Subjects in 23 CFR 655**

Design standards, Grant programs—Transportation, Highways and roads, Incorporation by reference, Signs, Traffic regulations.

**Authority:** (23 U.S.C. 101(a), 104, 105, 109(d), 114(a), 135, 217, 307, 315, and 402(a); sec. 406(a), Pub. L. 102-388, 106 Stat. 1520, 1564; 23 CFR 1.32; and 49 CFR 1.48(b).)

Issued on: July 26, 2004.

Mary E. Peters,

*Federal Highway Administrator.*

[FR Doc. 04-17409 Filed 7-29-04; 8:45 am]

**BILLING CODE 4910-22-P**

**DEPARTMENT OF THE TREASURY****Internal Revenue Service****26 CFR Part 48**

[REG-120616-03]

RIN 1545-BC08

**Entry of Taxable Fuel**

**AGENCY:** Internal Revenue Service (IRS), Treasury.

**ACTION:** Notice of proposed rulemaking by cross-reference to temporary regulations.

**SUMMARY:** In the Rules and Regulations section of this issue of the Federal Register, the IRS is issuing temporary regulations relating to the tax on the entry of taxable fuel into the United States. The text of those regulations also serves as the text of these proposed regulations. The regulations affect enterers of taxable fuel, certain other importers, and certain sureties.

**DATES:** Written and electronic comments and requests for a public hearing must be received by October 28, 2004.

**ADDRESSES:** Send submissions to: CC:PA:LPD:PR (REG-120616-03), room 5203, Internal Revenue Service, POB 7604, Ben Franklin Station, Washington, DC 20044. Alternatively, submissions may be hand delivered Monday through Friday between the hours of 8 a.m. and 4 p.m. to: CC:PA:LPD:PR (REG-120616-03), Courier's Desk, Internal Revenue Service, 1111 Constitution Avenue,

NW., Washington, DC, or sent electronically, via the IRS Internet site at <http://www.irs.gov/regs> or via the Federal eRulemaking portal at <http://www.regulations.gov> (IRS and REG-120616-03).

**FOR FURTHER INFORMATION CONTACT:**

Concerning submissions, LaNita VanDyke (202) 622-7180; concerning the regulations, Celia Gabrysh (202) 622-3130 (not toll-free numbers).

**SUPPLEMENTARY INFORMATION:****Paperwork Reduction Act**

The collection of information contained in this notice of proposed rulemaking has been submitted to the Office of Management and Budget for review in accordance with the Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)). Comments on the collection of information should be sent to the Office of Management and Budget, Attn: Desk Officer for the Department of the Treasury, Office of Information and Regulatory Affairs, Washington, DC 20503, with copies to the Internal Revenue Service, Attn: IRS Reports Clearance Officer, SE:W:CAR:MP:T:T:SP, Washington, DC 20224. Comments on the collection of information should be received by September 28, 2004. Comments are specifically requested concerning:

Whether the proposed collection of information is necessary for the proper performance of the functions of the IRS, including whether the information will have practical utility;

The accuracy of the estimated burden associated with the proposed collection of information (see below);

How the quality, utility, and clarity of the information to be collected may be enhanced;

How the burden of complying with the proposed collection of information may be minimized, including through the application of automated collection techniques or other forms of information technology; and

Estimates of capital or start-up costs and costs of operation, maintenance, and purchase of services to provide information.

The collections of information in this proposed regulation are in § 48.4081-3T(c)(2)(iii) and (iv). Section 48.4081-3T(c)(2)(iii) generally provides that an importer of record may avoid tax liability if the importer of record obtains from the enterer a notification certificate, described in 48.4081-5, which contains the enterer's registration number. Section 48.4081-3T(c)(2)(iv) generally provides that a surety bond will not be charged for the tax imposed on the entry of the fuel covered by the

bond, if at the time of entry, the surety has a notification certificate, described in 48.4081-5, which contains the enterer's registration number. These collections of information are required to obtain a tax benefit. The likely respondents are businesses.

*Estimated total annual reporting and/or recordkeeping burden:* 281 hours.

*Estimated average annual burden hours per respondent and/or recordkeeper varies from .25 hour to 2.25 hours, depending on individual circumstances, with an estimated average of 1.25 hours.*

*Estimated number respondents and/or recordkeepers:* 225.

An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a valid control number assigned by the Office of Management and Budget.

Books or records relating to a collection of information must be retained as long as their contents may become material in the administration of any internal revenue law. Generally, tax returns and tax return information are confidential, as required by 26 U.S.C. 6103.

**Background**

Temporary regulations in the Rules and Regulations section of this issue of the Federal Register amend the Manufacturers and Retailers Excise Taxes Regulations (26 CFR part 48) relating to the tax on the entry of taxable fuel imposed by section 4081. The text of those regulations also serves as the text of these proposed regulations. The preamble to the temporary regulations explains the amendments.

**Special Analyses**

It has been determined that this notice of proposed rulemaking is not a significant regulatory action as defined in Executive Order 12866. Therefore, a regulatory flexibility assessment is not required. It also has been determined that section 553(b) of the Administrative Procedure Act (5 U.S.C. chapter 5) does not apply to these regulations. It is hereby certified that the collection of information in these regulations will not have a significant economic impact on a substantial number of small entities. This certification is based on the fact that the time required to request and to furnish a notification certificate is minimal and will not have a significant impact on those small entities. Therefore, a Regulatory Flexibility Analysis under the Regulatory Flexibility Act (5 U.S.C. chapter 6) is not required. Pursuant to section 7805(f) of the Internal Revenue Code, this

**Appendix C**

(Excel tables of retroreflectometer readings and pictures)

Results of field measurements with retroreflectometer:

Type of Sign	Yellow Retro.	Red Retro.	White Retro.	Green Retro.	Contrast Ratio
4-Way Stop		274	?		?
4-Way Stop		15	200		13.33
4-Way Stop		2	75		37.50
4-Way Stop		40	140		3.50
Chevron	59				
Children Playing	72				
City Sign			1	15	
Curve	11				
Curve	49				
Curve	22				
Curve	75				
Library			80		
Narrow Bridge	1				
Right Turn	0				
Road Marking	7				
School Crossing	275				
School Crossing	24				
School Crossing	80				
School Speed			35		
School Speed			85		
School Xing	0				
School Zone	71		80		
Speed Limit			22		
Speed Limit			112		
Speed Limit			210		
Speed Limit			0		
Speed Limit			98		
Speed Limit			1		
Speed Limit			21		
Speed Limit			65		
Speed Zone			275		

Type of Sign	Yellow Retro.	Red Retro.	White Retro.	Green Retro.	Contrast Ratio
Stop		27	290		10.74
Stop		33	90		2.73
Stop		53	73		1.38
Stop		24	60		2.50
Stop		53	60		1.13
Stop		18	36		2.00
Stop		28	10		0.36
Stop		65	280		4.31
Stop		27	90		3.33
Stop		14	64		4.57
Stop		20	330		16.50
Stop		70	280		4.00
Stop		57	300		5.26
Stop		25	95		3.80
Stop		165	78		0.47
Stop		25	70		2.80
Stop		12	83		6.92
Stop		35	310		8.86
Stop Ahead	385				
Stop Ahead	77				
Stop Ahead	215				
Stop Ahead	76				
T-Intersection	68				
T-Intersection	220				
T-Intersection	65				
Weight Limit			88		
X-Traffic		23	100		4.35
Yield		17	96		5.65
Yield		14	70		5.00
Yield		23	82		3.57
Yield		12	51		4.25
Yield		0	1		#DIV/0!
		0.37	37%	Failures	
		40.00			
		0.63	63%	Passing	

### Proposed Minimums

Sign Color	Sheeting Type	Sign Size	Contrast Criteria	Retroreflectivity Minimum
White on Red	All Types	Any Size	$\geq 3:1$ White Retro $\div$ Red Retro	35 W    7 R
Black on Orange or Yellow	All Types Except Type I	48 inches or more and Bold Symbols		50
Black on Orange or Yellow	All Types Except Type I	48 inches or less and Fine Symbols		75
Black on White	All Types	Any Size		50
White on Green	Type I	Any Size	Overhead	7 G
White on Green	Type II	Any Size	Overhead	15 G
White on Green	Type III	Any Size	Overhead	25 G
White on Green	Type VII, VIII, IX	Any Size	Overhead	250 W    25 G
White on Green	Type I	Any Size	Shoulder	7 G
White on Green	Type I, II, III, VII, VIII, IX	Any Size	Shoulder	120 W    15 G

Following is a sample of signs inspected or measured in the field.











**Appendix D**  
(Technology Transfer Newsletter Fall/Winter 2004)

# Proposed Minimum Requirements for Maintaining Traffic Sign Retroreflectivity

by Kelly Morse, Bureau of Materials and Physical Research, Analytical Chemistry Laboratory Supervisor

The following article is a summary of the Federal Register/Vol. 69, No. 146/Friday, July 30, 2004, Proposed Rules, regarding minimum levels of retroreflectivity. The comment period for the rulemaking ended October 28, 2004 and some of the following details may be changed and or modified based on the comments received. The Federal Highway Administration (FHWA) has proposed an amendment to the Manual of Uniform Traffic Control Devices (MUTCD) to add methods of maintaining traffic sign retroreflectivity. The proposed methods would establish means for improving the nighttime visibility of traffic signs to promote safety; enhance traffic operations; and facilitate comfort and convenience for all drivers of all ages and abilities.

The MUTCD already requires that traffic signs be illuminated or retroreflective to enhance nighttime visibility. Most signs in Illinois are manufactured with retroreflective sign sheeting. Retroreflective sign sheeting redirects light from the driver's headlights back to the driver allowing the sign to be visible and legible at night. There are several types of retroreflective sign sheeting available which vary in their degree of retroreflectivity as well as color and durability. Therefore, some types of retroreflective sheeting will make signs appear brighter than others. As

signs age, they lose some of their retroreflectivity and will typically fade and lose gloss. This degradation makes signs less visible over time and diminishes the effectiveness of the sign to communicate regulatory, warning, and guidance messages to the driver. Therefore, to maintain effectiveness the signs must be replaced before they reach the end of their useful retroreflective life.

**Retroreflective sign sheeting redirects light from the driver's headlights back to the driver allowing the sign to be visible and legible at night.**

FHWA research led to the development of minimum retroreflective values for regulatory, warning, and guide signs based upon currently available materials, vehicle characteristics, and capabilities of the driving population. In addition, new methods for assessing and managing the retroreflectivity of existing signs have been developed. The assessment methods entail the evaluation of the

sign's retroreflectivity by nighttime visual inspection or measurement of retroreflectivity using an appropriate instrument. Visual and numeric criteria based upon the minimum retroreflectivity needs of the drivers are used to judge whether the sign has adequate nighttime visibility. Sign management methods involve tracking or predicting the retroreflective life of individual signs and scheduling for the replacement of those signs that are approaching the minimum levels.

A breakdown of the assessment methods are as follows: Visual Nighttime Inspection Method, Calibration Signs Procedure, Consistent Parameters Procedure, Comparison Panels Procedure and the Measured Retroreflectivity Method.

Visual nighttime inspection involves the assessment of the visibility and retroreflectivity of the traffic signs as the inspector approaches the signs. For consistency the FHWA has provided guidelines that should be adhered to when developing and performing nighttime inspections. First, the agency should develop guidelines and procedures for inspectors to use in conducting the inspections. Second, the inspections should be performed at normal roadway operating speeds from the travel lane. Third, the inspection shall be done using low beam headlights. Lastly, the signs shall be inspected at the typical

*(continued on page 11)*

### Traffic Sign Retroreflectivity

(continued from page 5)

viewing distance for the sign, the distance which provides the driver adequate time for an appropriate response. In addition to the above, one or more of the following procedures should be used with the nighttime inspection to ensure that the inspector has a good indication of how signs at the minimum level will appear.

- The calibration signs procedure utilizes a set of signs known to meet or exceed the minimum retroreflectivity requirements. These signs are viewed prior to conducting the nighttime inspection. Calibration signs are needed in each color of sign for which there are minimum levels. The calibration signs are viewed at the typical viewing distances and from the same vehicle that will perform the nighttime inspections. The calibration signs shall be properly stored between inspections and the retroreflectivity checked periodically to verify they meet or exceed minimum values. Signs in the field that are viewed to be less bright than the appropriate calibration sign shall be replaced.
- The consistent parameters procedure requires the inspections to utilize the same factors that were used to develop the minimum levels. Those factors utilized are, a full sized SUV or pickup truck, model year 2000 or newer, inspector age 60 or over, and the signs shall be viewed at the typical viewing distances used for the particular sign being evaluated. If the inspector using these factors

views the sign to be illegible, the sign shall be replaced.

- The comparison panel procedure utilizes a small panel that has been fabricated to meet or exceed the minimum retroreflectivity values of each type of sign to be evaluated. The appropriate panel is then temporarily attached to the sign being inspected. If the comparison panel is viewed to be brighter than the sign, the sign shall be replaced.

The measured retroreflectivity method involves the use of a retroreflectometer to measure the retroreflectivity of the sign in accordance with ASTM E1709 and comparing the measured values directly with the minimum levels for the sign being inspected. If the measurement is lower than the minimums the sign shall be replaced.



A breakdown of the management methods are as follows: Expected Sign Life Method, Blanket Replacement Method and the Control Sign Method. These techniques provide an option to the agencies that does not involve significant individual sign inspection effort.

The expected sign life method requires the replacement of signs

before they reach the end of their expected service life. The expected service life can be determined by, sign sheeting warranties, sign test deck measurements, and the measurement of retroreflectivity of a population of the signs to represent the whole. In order to utilize the expected sign life method, the age of the sign must be known. This can be accomplished by labeling the signs with the dates of fabrication, installation or replacement. An alternative would be a sign management system with an inventory that tracks the age of individual signs.

The blanket replacement method provides for an agency to replace all the signs in an area or corridor, or of a given sign type, at specific intervals. The replacement interval for the area or corridor, or of a given sign type, is based on the expected sign life for the affected signs. All signs within a replacement area or corridor, or of a given sign type are typically replaced even if the sign was recently installed.

The control sign method utilizes a control sample of signs which is used to represent the total population of an agency's signs. The retroreflectivity of the control signs is monitored at appropriate intervals and sign replacement is based upon the performance of the control signs. First, an agency develops a sampling plan that determines the appropriate number of control needed to represent the agency's sign population. Second, the control signs may be actual signs in the field or installed in a maintenance yard to serve specifically as control signs. Third, the retroreflectivity of the control signs should be monitored following one of the assessment methods previously described. Lastly, the field signs represented by the

(continued on page 12)

**Traffic Sign Retroreflectivity**  
*(continued from page 11)*

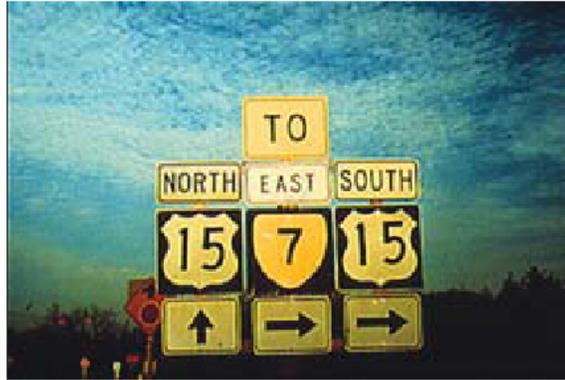
control signs need to be replaced before the retroreflectivity levels of the control signs reach the minimum levels. An inventory with date, sheeting type service life, etc. is essential in ensuring that the control signs represent the total population.

The minimum retroreflectivity values were formulated through years of research and represent several improvements in the area of retroreflectivity. The minimum retroreflectivity levels are summarized in the chart on page 13.

There are signs that are currently excluded from the minimum requirements. The following signs have been excluded at this time due to the lack of research in order to establish appropriate minimum levels. 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 or brown backgrounds and

bikeways which are not immediately adjacent to a roadway and that are intended for exclusive use by bicyclists and or pedestrians.

The greatest impacts anticipated after field reviews are, the minimum values for 36 inch yellow warning signs and the contrast ratio of  $\geq 3:1$  (white retroreflectivity  $\div$  red retroreflectivity) for stop signs. The minimum retroreflectivity value, 75cd/lx/m<sup>2</sup>, for the black on yellow signs is higher than can be expected from new, yellow, engineering grade sheeting, 60cd/lx/m<sup>2</sup>. Many local agencies are still using engineering grade sheeting for many of the signs in their jurisdiction.



Daytime Appearance



Nighttime Appearance

This policy will have to be modified as part of the compliance with minimum retroreflectivity values. Also, many stop signs that were evaluated failed to meet the 3:1 requirement despite meeting the minimum

retroreflectivity values.

Because of the anticipated impacts on the State and Local Agencies, a seven year phase in for ground mounted signs and a ten year phase in for overhead signs were proposed. These time frames would be effective from the date of the final rule. These replacement windows were chosen due to their coincidence with the typical replacement windows for the types of sheeting typically used for each application.

The proposed rulemaking has provided guidelines for attaining minimum standards for retroreflectivity but has also maintained flexibility for the agencies to create and select their own methods and techniques. Education and training efforts will be vital for the success of the program. Both IDOT and the FHWA are dedicated to those efforts.

For more information on the proposed wording, see the MUTCD website at <http://mutcd.fhwa.dot.gov/>

*(continued on page 13)*

### Traffic Sign Retroreflectivity

(continued from page 12)

MINIMUM MAINTAINED RETROREFLECTIVITY LEVELS		
Sign Color	Criteria	Sheeting Type (ASTM D4956-01a)
		I II III VII VIII IX
White on Red	See Note 1	35/7
Black on Orange or Yellow	See Note 2	* 50
	See Note 3	* 75
Black on White		50
White on Green	Overhead	*//7 *//15 *//25 250//25
	Shoulder	*//7 120//15
Notes Levels in cells represent retroreflectivity // background retroreflectivity (for positive contrast signs). Units are cd/lx/m <sup>2</sup> measured at an observation angle of 0.2° and an entrance angle of -4.0°.		
1Minimum Contrast Ratio > 3:1 (white retroreflectivity - red retroreflectivity).		
2For text signs measuring 48 inches or more and all bold symbol signs.		
3For text signs measuring less than 48 inches and all fine symbol signs.		
*Sheeting type should not be used.		

### The Value of Training

(continued from page 3)

training outweigh the investment?

### Training Return on Investment (ROI)

When calculated using sound methodology, training has been shown to provide significant return on investment: on the order of 5 to 200 percent. The problem is that methods used to quantify training ROI can often be suspect or even outright self-promotion. Furthermore, it is often very difficult to quantify the effects of training. For instance, one effect of training can be increased job satisfaction, which is difficult if not impossible to quantify. Intuitively we know this is important in retaining good employees; however, it will not show up on an ROI calculation.

In 2000, Bartel provided one of

the best objective looks at the value of training to the employer. She looked at 10 large data set surveys and 16 individual case studies in an attempt to determine the employer's return on investment for employee training. She found the following:

- Methods using large data sets to compare many different organizations estimated training ROI from 7 to 50 percent.
- Individual case studies estimated training ROI from 100 to 5900 percent. Bartel believes the high ROIs in this category are based on faulty methodology. Her in-depth analysis of two well-constructed internal case studies revealed a 100 to 200 percent ROI.

Therefore, even the most conservative estimate puts training's ROI at 7 percent – an acceptable rate of return

by most standards. Additionally, although it is not appropriate to generalize based on the results of two case studies, it can be said that based on Bartel's in-depth analysis of two well-constructed internal case studies, training's ROI can be much higher: approaching 100 to 200 percent.

### Summary

Training is a valuable commodity that, if viewed as an investment rather than an expense, can produce high returns. While it is true that training costs money and uses valuable employee time and resources, studies tend to show training provides a positive return on investment – sometimes in the neighborhood of several hundred percent. Therefore, although training might seem like a luxury expense in tight financial times, it is, in fact, one of the most sure and sound investments available.



**Appendix E**  
(Sign Inventories and Work order /Inspection forms)

This is a sample of a straight-line diagram used for sign inventory in Christian County.

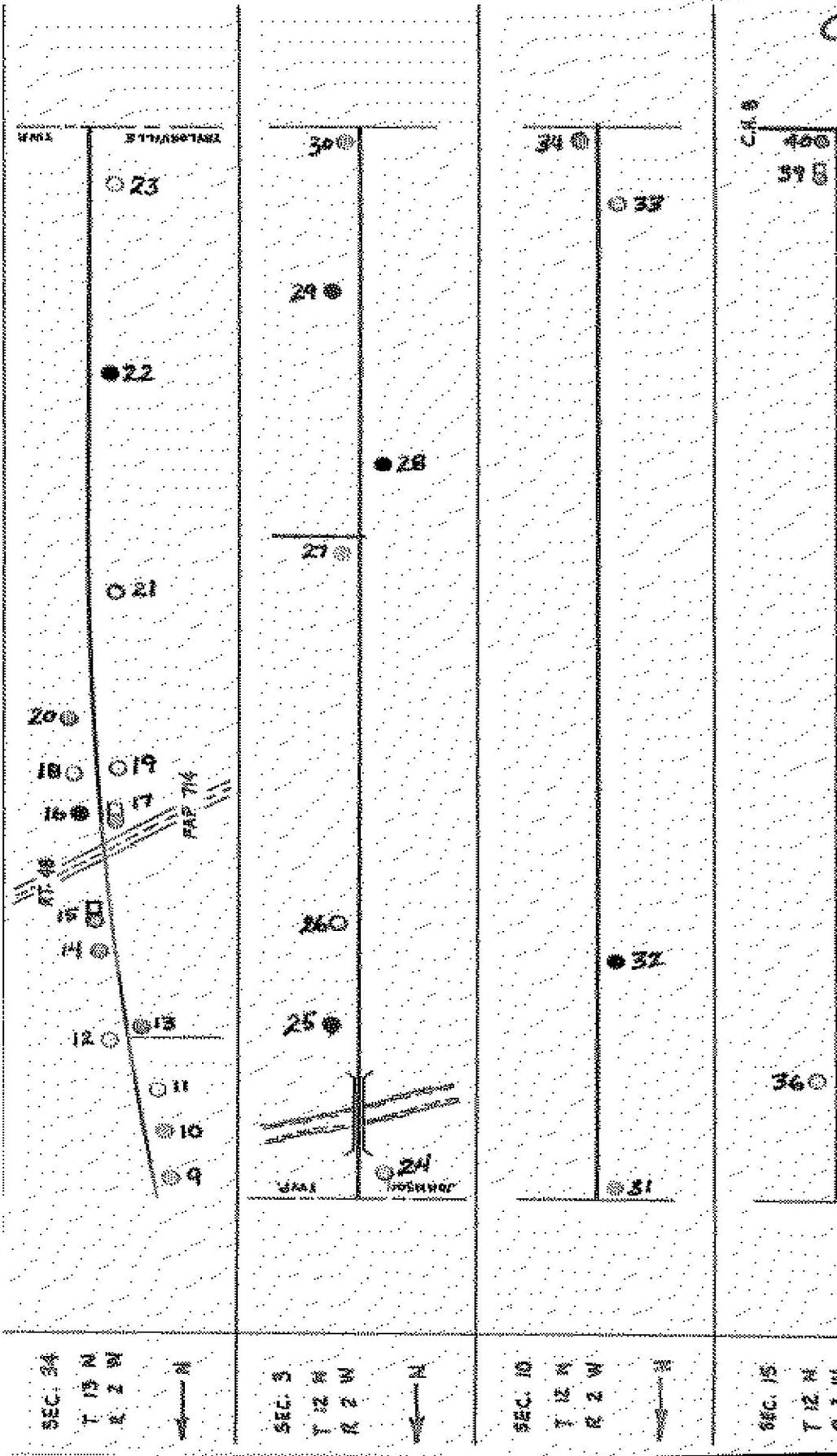
## Christian County Department of Highways

### Color Code for Signs

- Stop
- Stop Ahead
- Unlawful to Pass Stopped School Bus
- County Highway Marker
- Directional Signs
- Warning Signs
- ⊗ R.R. Crossings
- ⊙ Speed Indicators
- ⊙ Bridge Weight Limits
- No Passing
- ⊘ No Parking
- Other

## County Highway 1

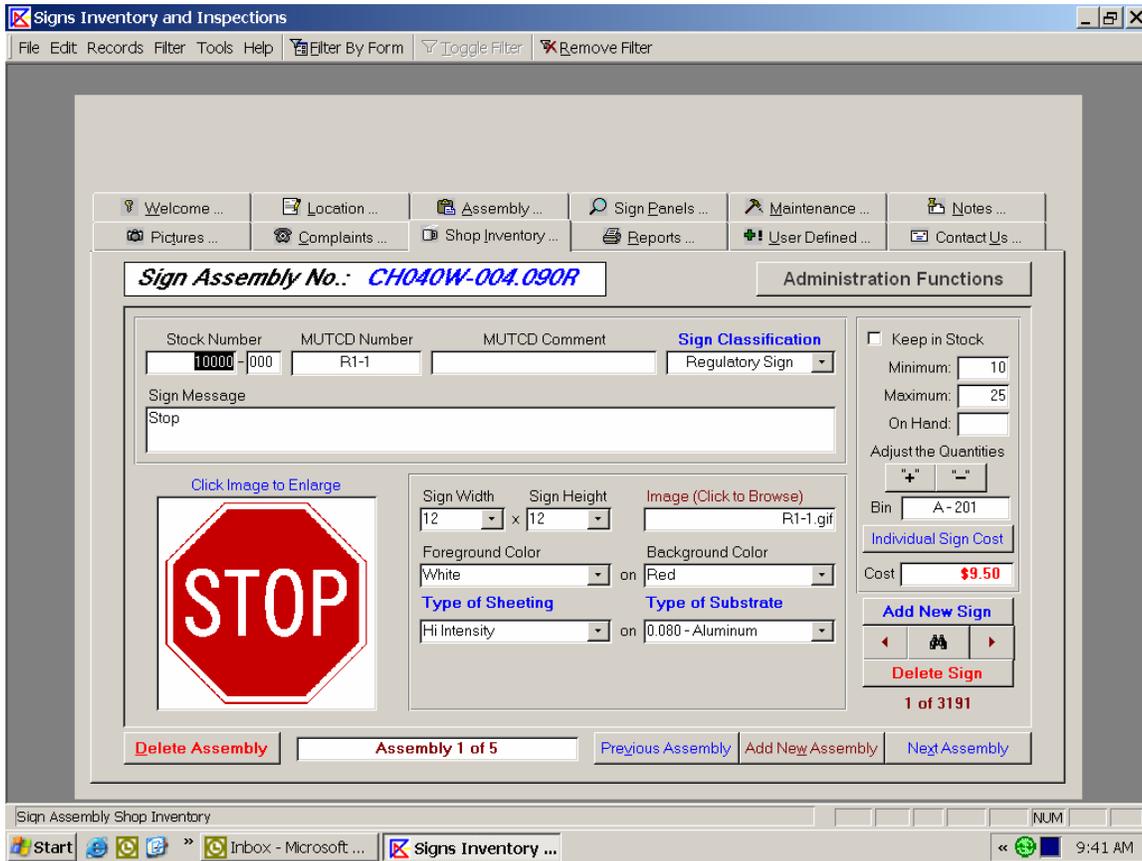
1. No Parking
2. No Parking
3. R.R. Crossing
4. C.H. 1 & Unlawful to Pass Stopped School Bus
5. No Parking
6. Stop
7. Stop
8. R.R. Crossing
9. Lakeshore Golf Course
10. Stop Ahead
11. Center Curb Ahead
12. Double Arrow
13. Stop
14. Speed Limit 30 M.P.H.
15. C.H. 1 & Unlawful to Pass Stopped School Bus
16. No Passing
17. C.H. 1 & Unlawful to Pass Stopped School Bus
18. Center Curb Ahead
19. Pavement Narrows
20. Stop Ahead
21. Begin Class III Truck Route
22. No Passing
23. Watch for Ice on Bridge
24. Lakeshore Golf Course
25. No Passing
26. Watch for Ice on Bridge
27. Stop
28. No Passing
29. No Passing
30. Stop
31. Stop
32. No Passing
33. Lakeshore Golf Course
34. Stop
35. Stop
36. Lakeshore Golf Course
37. Crossroad
38. Owaneco-Clarksdale-Johnson Twsp Building
39. C.H. 1 & Unlawful to Pass Stopped School Bus
40. Stop



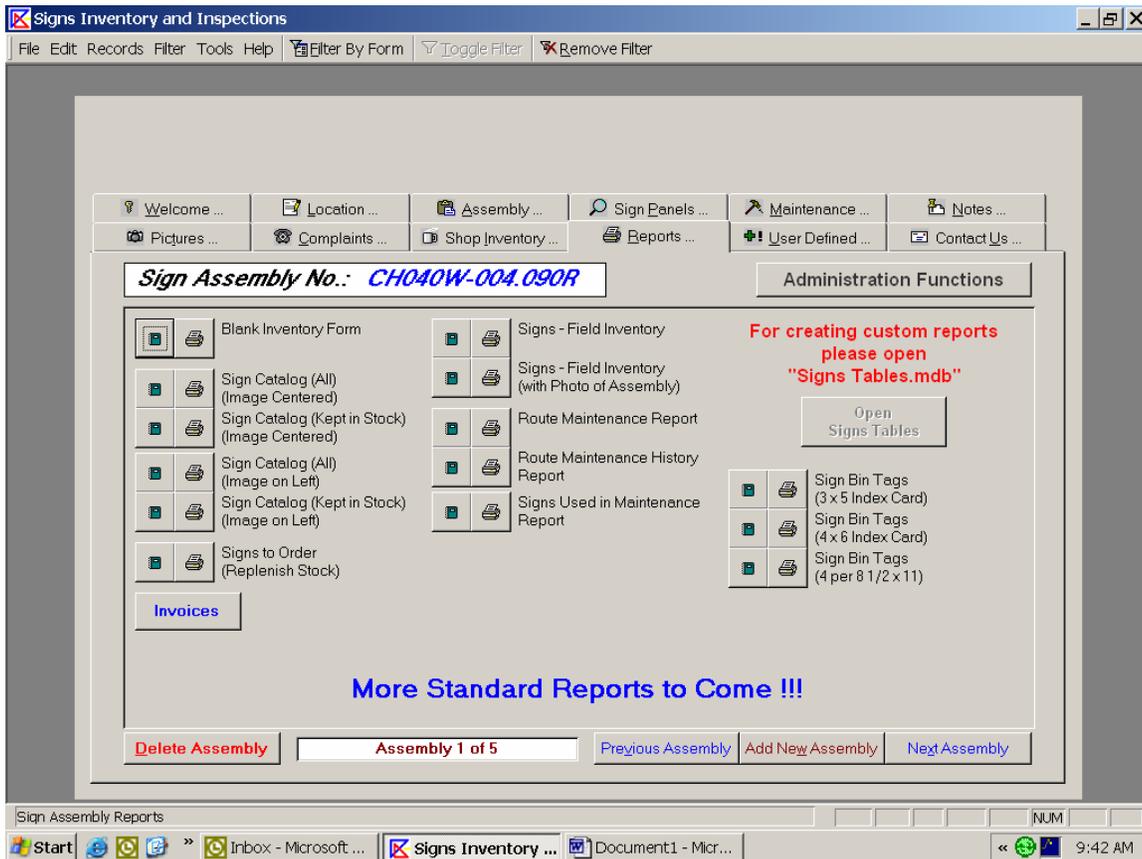
# Sample Computer Program

Following are some screen shots from one computer-based program for tracking and maintaining sign inventories.

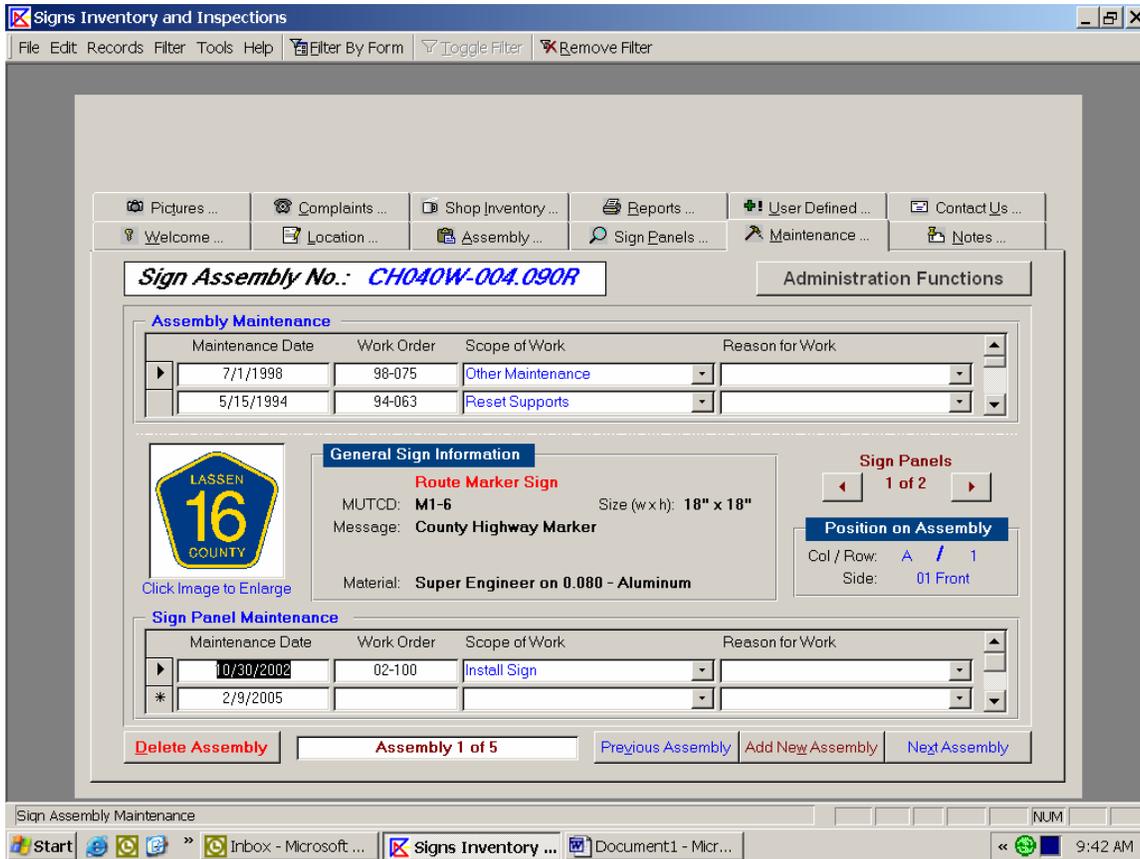
On this screen, you can track what inventory of signs you have on hand in your shop.



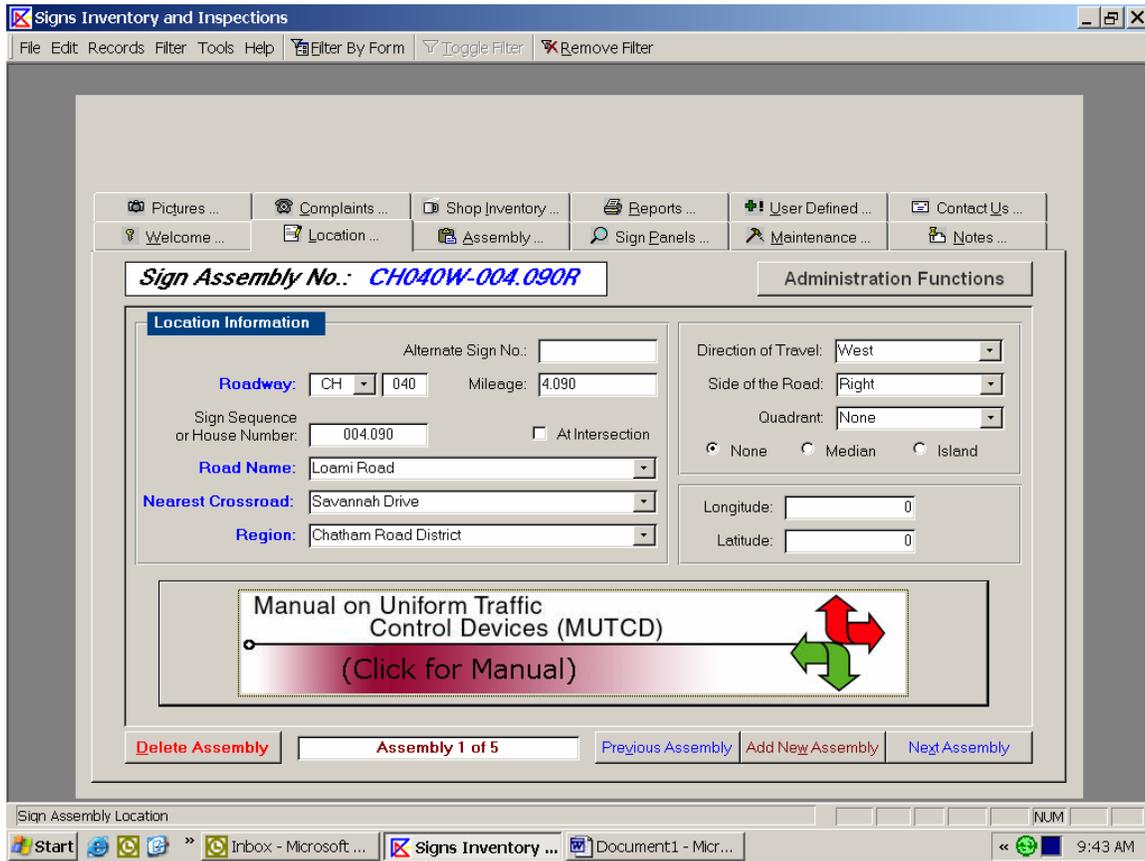
This screen shows the various reports that can be printed based on the information the local agency has input into the program. You can print blank inventory forms as well as route maintenance forms. The program also allows you to print out what signs you need to order based on inventory needs established by the local agency.



This screen creates a record of sign maintenance. Local agencies can enter the type of work performed and the date it was completed.



This screen is where the location information can be entered and then later recalled.



This screen contains information regarding the sign assembly including type of post and whether there is a light accompanying the sign. This screen also shows the original installation date, date of last inspection, the inspection interval, and when the next inspection is due.

Signs Inventory and Inspections

File Edit Records Filter Tools Help Filter By Form Toggle Filter Remove Filter

Pictures ... Complaints ... Shop Inventory ... Reports ... User Defined ... Contact Us ...  
 Welcome ... Location ... Assembly ... Sign Panels ... Maintenance ... Notes ...

**Sign Assembly No.: CHO40W-004.090R** Administration Functions

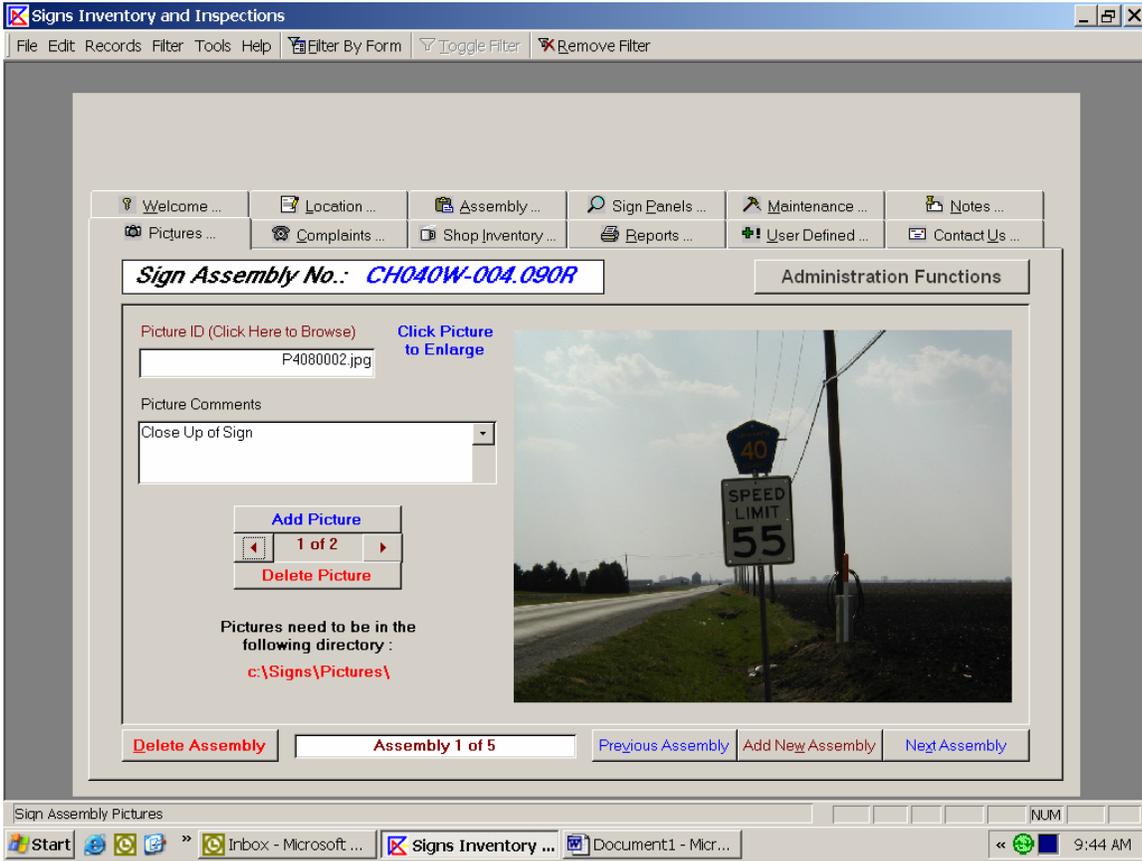
<p><b>Support Information</b></p> <p>No. &amp; Type: 1 Square Tubing (Telspar)        Base: Metal Stub Post</p> <p>Size Length        Support 1: 2-1/4" x 2-1/4" 12' - 00"</p>	<p><b>Maintenance</b></p> <p><input type="radio"/> Assembly OK  <input type="radio"/> Install Assembly  <input type="radio"/> Straighten Supports  <input type="radio"/> Reset Supports</p> <p><input type="radio"/> Replace Supports  <input type="radio"/> Remove Assembly  <input type="radio"/> Trim Foilage  <input checked="" type="radio"/> Other Maintenance</p> <p><input type="checkbox"/> Maintenance Completed  <input type="checkbox"/> Removed in the Field (Keep for History)</p> <p>Add New        1 of 1        Delete Inspection</p>
<p><b>Misc. Information</b></p> <p><input checked="" type="checkbox"/> Illuminated  <input type="checkbox"/> Flasher / Color:        Height above Pavement: 05' - 06"        Offset from Pavement: 12' - 00"</p> <p><b>Status of Inspection</b></p> <p>Current - <span style="color: green;">■</span>        Schedule - <span style="color: yellow;">■</span>        Inspect - <span style="color: red;">■</span></p>	<p><b>Inspection Dates</b></p> <p>Original Installation: 10/26/2002 Night Time Inspection <input checked="" type="checkbox"/>        Last Inspection: 10/27/2002        Next Inspection: 10/27/2003 12 Inspection Interval (Months)        Inspected By: Terry Fountain</p>

Delete Assembly Assembly 1 of 5 Previous Assembly Add New Assembly Next Assembly

Sign Assembly Information

Start Inbox - Microsoft ... Signs Inventory ... Document1 - Micr... 9:43 AM

This screen allows the user to add a picture of the sign or sign assembly.



This screen is where complaints received from law enforcement, the general public, or another source can be entered.

The screenshot displays the 'Signs Inventory and Inspections' application window. The title bar reads 'Signs Inventory and Inspections' with standard window controls. The menu bar includes 'File', 'Edit', 'Records', 'Filter', 'Tools', and 'Help'. Below the menu bar are buttons for 'Filter By Form', 'Toggle Filter', and 'Remove Filter'. A toolbar contains icons for 'Welcome ...', 'Location ...', 'Assembly ...', 'Sign Panels ...', 'Maintenance ...', 'Notes ...', 'Pictures ...', 'Complaints ...', 'Shop Inventory ...', 'Reports ...', 'User Defined ...', and 'Contact Us ...'. The main content area features a header with 'Sign Assembly No.: CH040W-004.090R' and an 'Administration Functions' button. The form fields include:
 

- Date of Complaint: 3/10/2002
- Time of Complaint: 12:48 PM
- Person Calling: John Smith
- Telephone: (217) 555-1234
- Complaint Investigated:
- Complaint: A large text area containing the placeholder text 'Enter information about the complaint'.

 On the left side of the form, there are buttons for 'New Complaint', navigation arrows, '1 of 1', and 'Delete Complaint'. At the bottom of the form, there are buttons for 'Delete Assembly', 'Assembly 1 of 5', 'Previous Assembly', 'Add New Assembly', and 'Next Assembly'. The Windows taskbar at the bottom shows the 'Start' button, several open applications including 'Inbox - Microsoft ...', 'Form - Sign Data...', 'Administrative Func...', and 'Document1 - Micr...', and a system tray with the time '9:45 AM'.

This is just one example of a computer program to track sign inventories and is used for illustrative purposes. We would encourage the local agencies to compare programs, features offered, time required to input existing information, and initial and possible renewal costs.



This is a computer printout of the information in the Peoria County sign database and can be used for inspections.

1008c3e1Lt300R10U

Page No. 1

09/20/2004

BOTH ERECTED AND PROPOSED SIGNS

SIC  
 Yankee Lane  
 Start 0.00 @ Marshall County Line  
 End 1.75 @ Il. 29, 1.5 Miles north of Chillicothe

Sign Loc. No.	Miles From		Sign CODE No.	Size	POSTS	Message on Sign	Date/Reason/Initials (Reset, Replace, Remove, etc.) (Vandalism, Accident, obsolete, etc)
	START	END			N T L U Y E M P N		
1	0.00	1.75	I1-I104	3624	1 W 12	PEORIA COUNTY	
2	0.00	1.75	M3-2	2412	1 W 12	SOUTH	
2a	0.00	1.75	M1-5	2424		PEORIA CO S-10	
2b	0.00	1.75	M4-6B	2115		BEGIN	
3	0.00	1.75	M4-6	2412	1 W 12	END	
3a	0.00	1.75	M1-5	2424		PEORIA CO S-10	
4	0.10	1.65	D2-2	3624	1 W 12	SHEPARD ROAD	1 PROPOSED
4+	0.10	1.65	D2-2			ILLINOIS 29	2 PROPOSED
5	0.15	1.00	W1-4R	30	1 W 12	Right-Left Curve	
6	0.16	1.59	W14-3	364848	1 W 12	NO PASSING ZONE	
7	0.32	1.43	W11-4	30	1 W 12	COW SYMBOL	GAVE TO FARMER
8	0.45	1.30	W14-3	364848	1 W 12	NO PASSING ZONE	
9	0.46	1.29	W1-5L	30	1 W 12	Winding L-R-L-R	
10	0.49	1.26	W14-3	364848	1 W 12	NO PASSING ZONE	
11	0.67	1.06	R1-1	30	1 W 12	STOP	
12	0.67	1.08	M1-53 PC	246		6180	E
12a	0.67	1.08	D3	246		SHEPARD LANE	
13	0.67	1.08	M1-51 PC	240	1 W 14	22500	N
13a	0.67	1.08	D3	246		YANKEE LANE	
14	0.91	0.84	W11-4	30	1 W 12	COW SYMBOL	
15	1.58	0.17	M4-6	2412	1 W 12	END	
15a	1.58	0.17	M1-5	2424		PEORIA CO S-10	

aCH

Sign Ratings - Poor & Replace 09/20/04 09:22:07 - C:\CARTE\COUNTYS\sign

Label	Code	Sheeting	Sign	Route	Distance	Route Back	Sign Direction
	W1-8	Engineering Grade	Poor	Washington			
	R2-1	Engineering Grade	Poor	Townline			East
880	M1-5	Engineering Grade	Poor	Washington Rd	1609		North
881	M6-4	Engineering Grade	Poor	Washington Rd	1609		North
627	M1-10	Home Made	Poor	Springfield Rd	767	Tomm Rd	South
659	M1-10	Home Made	Poor	Springfield Rd	192	Townline Rd	North
651	R2-1	Engineering Grade	Poor	Springfield Rd	245	Peach St	North
646	M1-10	Engineering Grade	Poor	Springfield Rd	6394	Connell Rd	South
426	S1-1	Engineering Grade	Poor	Delavan S	46	11th St	South
713	R2-1101	Engineering Grade	Poor	Armington	3276	Dale Rd	West
760	R12-1	Engineering Grade	Poor	Boston School	7767	Morgan	North
754	Blind Entrance	Engineering Grade	Poor	Boston School	5919	Imig Rd	North
993	W54-56	Engineering Grade	Poor	Manito	2333	Wagonseller	West
992	End Speed Zone	Engineering Grade	Poor	Manito	943	Myrtle	South
1097	W16-8	Engineering Grade	Poor	AllenTown	636	Washington Rd	East

p:\voznstreetz

SIGN INVENTORY SHEET

SHEET 1 OF 13

ATTACHMENT B

City / County: Coles County

Street / Road Name: East Oakland Road District

Direction: N/S

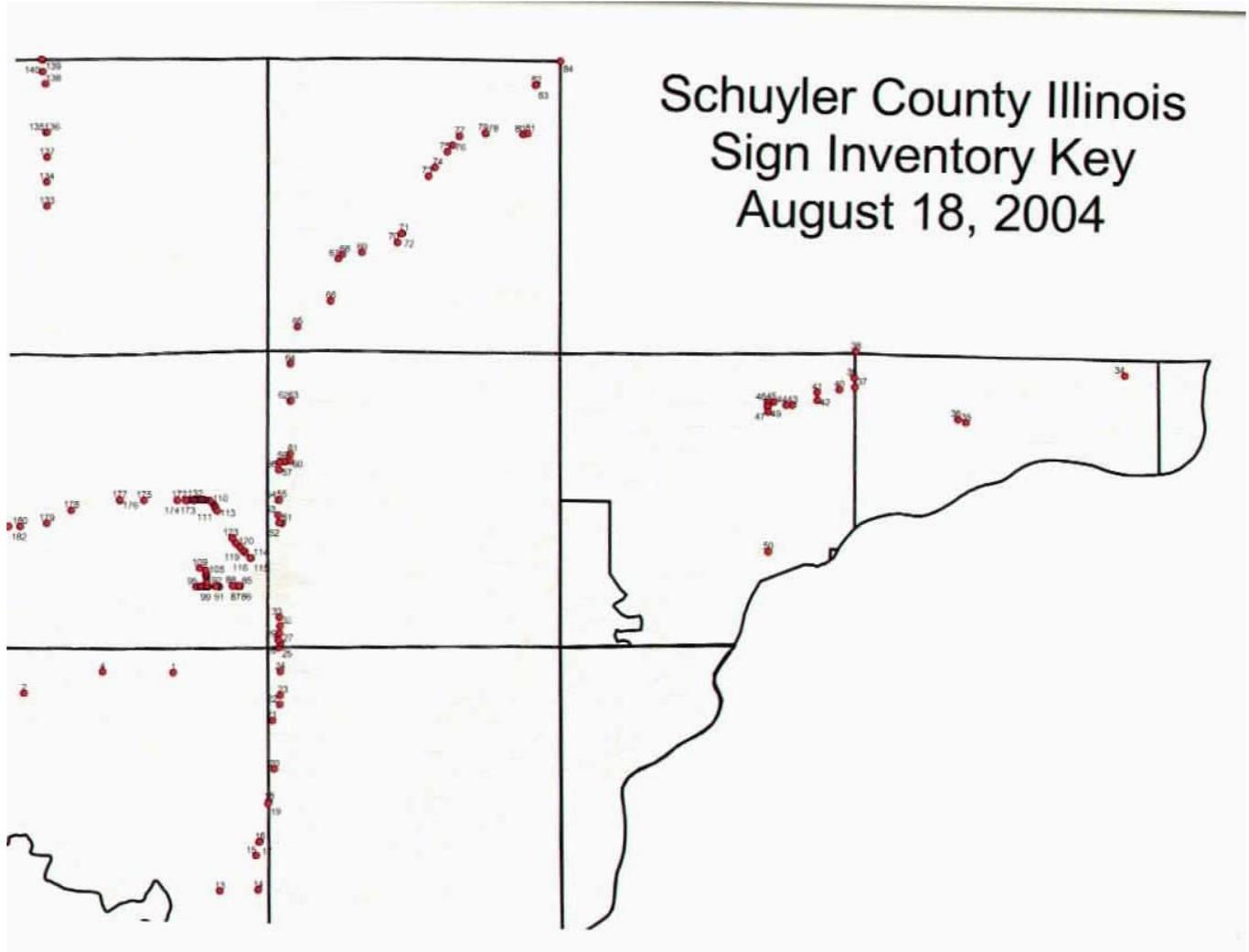
Date: April 2003

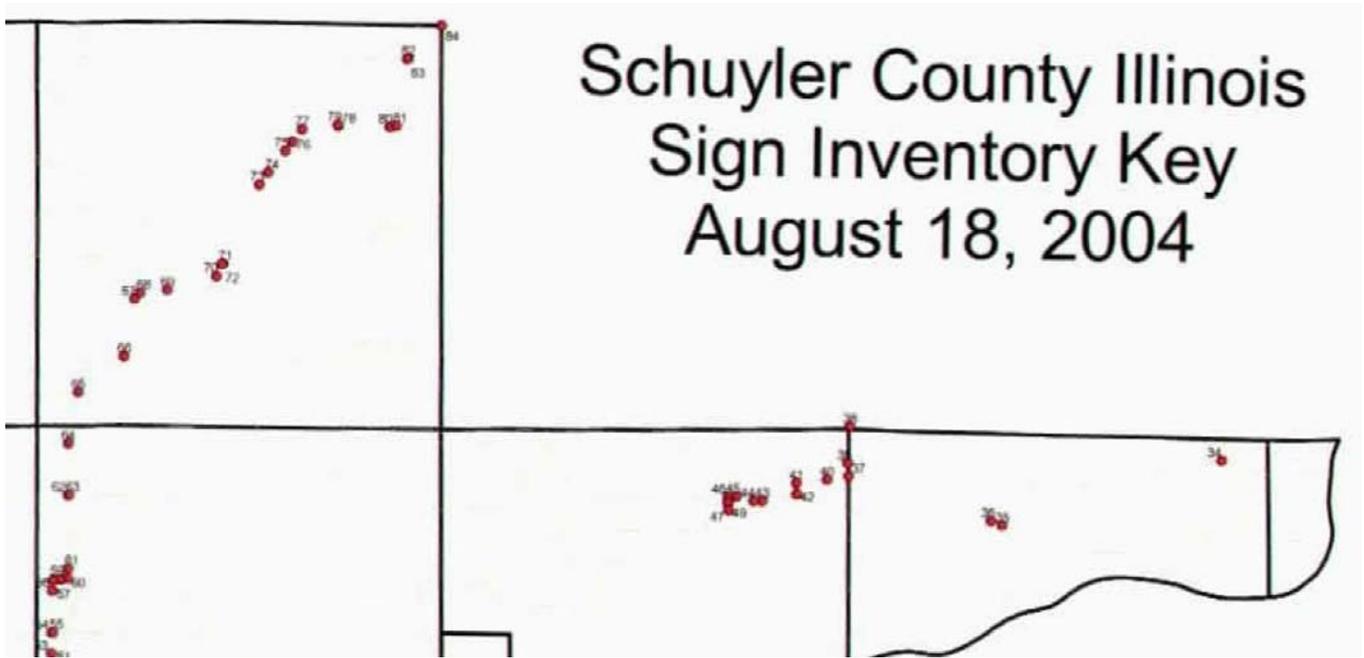
Maintenance Dates:

Maintenance Person:

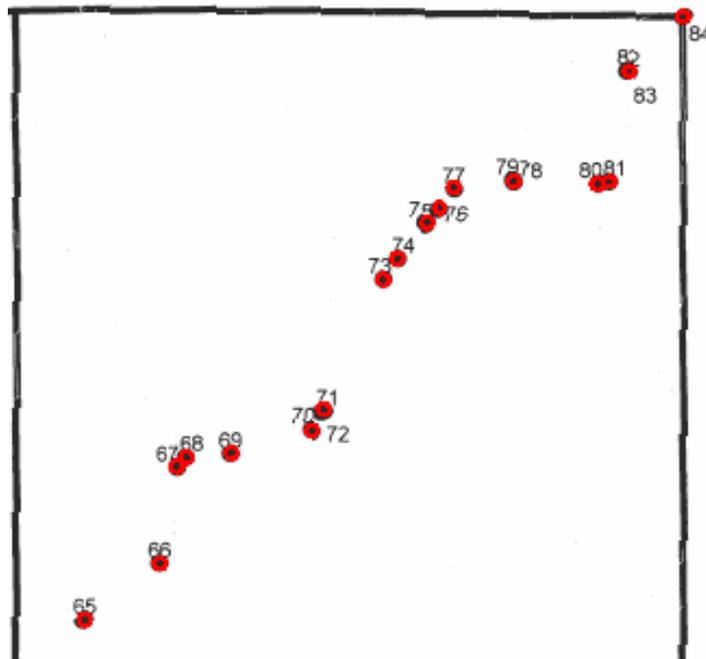
a	b	c	d		e	f	g	h	i	j	k	l	m	n	o	p	
			Width	Height													
Location (odometer, intersecting street/road name, Map #	Side of Street	MUTCD/ IL Supp Sign Number	Width Inches	Height Inches	Number in Assembly	Reflectivity	Visibility	Face Material	Back Material	Condition	Type	Horz. Place	Height	Condition	Adequacy	Maintenance	Remarks
1450N 2500E	S	W1-4L	30	30	1												Add Left Double Curve Arrow sign and post.
1450N 2500E	N	W1-4L	30	30	1												Add Left Double Curve Arrow sign and post.
1450N 2620E	W	R1-2	30	30	1	P	V	B	A	P	U	5'	5'	P			Replace faded Yield sign and bent post.
1450N 2620E	E	R1-2	30	30	1	P	V	B	A	P	U	5'	5'	P			Replace faded Yield sign and short post.
1450N 2760E	S	R12-1(10T)	24	30	1												Good Installation
1450N 2760E	N	R12-1(10T)	24	30	1												Good Installation
1450N 2800E	E	W1-7	48	24	1												Add Large Double Arrow sign and 2 posts.
1500N 2800E	E	R1-2	30	30	1	P	V	B	A	P	U	6'	2'	P			Replace faded Yield sign and short post.
1500N 2800E	N	W1-7	48	24	1												Add Large Double Arrow sign and 2 posts.
1500N 2750E	S	W1-7	48	24	1												Add Large Double Arrow sign and 2 posts.
1500N 2620E	E	R1-2	30	30	1	P	V	B	A	P	U	4'	3'	P			Replace faded Yield sign and short post.

Schuyler County has developed their sign inventory using Global Information Systems (GIS). The map depicts the location of the sign and it's associated number designation.





This is an enlargement of the upper left corner of the Schuyler County GIS inventory.



This is the description in the sign inventory database of sign number 65 through sign 84.

65	phillips ln	vermont	stop	wooden		
66	rabbit run	vermont	stop	metal		
67	boeur branch	vermont	stop	wooden		
68	bouer branch	vermont	stop	wooden		
69	jones ln	vermont	stop	wooden		
70	fisk ln	vermont	stop	metal		
71	richie branch	vermont	stop	wooden		
72	fisk ln	vermont	stop	wooden		
73	oakland center	vermont	stop	metal		
74	meadow lark	vermont	stop	metal		
75	sugar creek	vermont	stop	wooden		
76	sugar creek	vermont	stop	metal		
77	snake den	vermont	stop	metal		
78	south flatwoods	vermont	stop	metal		
79	north flatwoods	vermont	stop	metal		
80	east center	vermont	stop	wooden		
81	kost	vermont	stop	metal		
82	north flatwoods	vermont	stop	metal		
83	north flatwoods	vermont	stop	metal		
84	north flatwoods	vermont	stop	metal		

## Work Order Forms

This is a two-part form developed by Christian County to document phone calls regarding work that needs to be completed. The two-part form allows them to track items that are pending completion and then when they are completed.

**CHRISTIAN COUNTY  
HIGHWAY DEPARTMENT  
Maintenance Record**

Date \_\_\_\_\_ Time \_\_\_\_\_

Location \_\_\_\_\_

Sign Type \_\_\_\_\_

Problem \_\_\_\_\_

\_\_\_\_\_

Received by \_\_\_\_\_

Action Taken \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Repaired by \_\_\_\_\_

Date \_\_\_\_\_ Time \_\_\_\_\_

This is a form developed by Peoria County to document phone calls received regarding work to be completed. The form is returned to the office when the work is completed and filed.

PEORIA COUNTY HIGHWAY DEPARTMENT

6915 W Plank Road  
Peoria, IL 61604

SERVICE REQUEST

Date	Name
Township	Address
Road	Phone
Received By	Permit Number

*Nature of Service Request:*

Date Repaired	Repaired By
---------------	-------------

*Remarks:*

Final Report By
-----------------

RETURN TO OFFICE WHEN WORK HAS BEEN COMPLETED

This is a form developed by Tazewell County to document repairs as well as inspections.



# SIGN FIELD FORM

TAZEWELL COUNTY PROJECT #

2008 ALIQUOT ROUTE #

TREASURY, L. #100

DATE 03-04-02

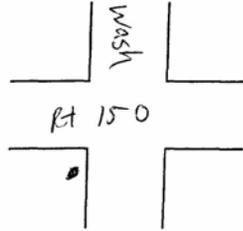
---

**1) SIGN INFO:** ( Please Circle Correct Info or provide other details )

SIGN TYPE:	STOP	STOP AHEAD	OTHER: <i>Weight Limit 25t</i>
SIGN SIZE:	WIDTH: <i>2y</i>	HEIGHT: <i>30</i>	
POLE TYPE:	4" x 6"	QUICK PUNCH	OTHER: <i>4x4</i>
SHEETING TYPE:	HI	VIP	OTHER:
SIGN CONDITION:	POOR		FAIR
			GOOD
LABEL NUMBERS:	NEW NUMBER:		OLD NUMBER:
ACTION TAKEN:	REPLACE SIGN	REPLACE POST	REPAIR/REPLANT
			<u>INSPECT</u>
<i>Att. Randy!!!</i>			

---

**2) SIGN LOCATION:** ( Please Position Sign in Location Box )

ROAD NAME:	<i>Washington Rd</i>	<div style="border: 1px solid black; padding: 10px; margin: 0 auto; width: 80%;"> <p style="text-align: center; margin: 0;"><u>LOCATION BOX</u></p>  <p style="text-align: center; margin: 5px 0;">( Please Mark Location of Sign )</p> </div>
NEAREST SIDEROAD:	<i>553 ft from Jefferson St.</i>	
DISTANCE OFF EDGE OF ROAD:	2 <u>4</u> 6 8 OTHER:	
SIGN HEIGHT:	4 <u>5</u> 6 7 OTHER:	
KNOCK DOWN?	YES <u>NO</u>	
TIME REPORTED:		
TIME REPAIRED:		

---

**3) DATE:** *3-10-04*

---

**4) EMPLOYEE NAME:** *Chris & Roland* BLOOD FINGERPRIN

---

**5) NOTES:** *The sign taken down due to construction but we got the footage for it will take at a later date*

D:\SIGNS\FIELDFORM2.DWG
Form TC007 27NOV

### Inspection Forms

This form was developed by Peoria County to track their sign inspections and the improvements that should be made.

Route	Mile Post	Sign Code	Size		Message On Sign	Type of Post			Time	Date	Reason (Reset, Replaced, Removed, Etc...) (Vandalism, Accident, Obsolete, Etc...)	Initials	
			Horiz.	Vert.		No.	Mat.	Len.					
A-9-B	2.62	w3-1	36		STOP AHEAD	In Out	1	w	12	Pm	7/22/04	Mower	J.S
D-25	10.66	m3-2	24	12	EAST	In Out	1	w	12	Pm	8/2/04	Mower	J.S
D-25	10.66	m1-5	24		D-25	In Out					8/18/04		J.S
✓ D-51	5.94	R12 I100	54	42	BRWT 8-12-14	In Out	2	w	12	Am	8/24/04	Missing	J.S
✓ D-52	6.84	R12 I100	54	42	BRWT 8-12-14	In Out				Am	8/24/04	changed	J.S
✓ D-52	6.85	R12 I100	54	42	BRWT 8-12-14	In Out				Am	8/24/04	changed.	J.S
✓ D-52	7.98	R12 I100	54	42	BRWT 8-12-14	In Out				Am	8/24/04	changed	J.S
✓ R-10	11.16	R1-1	36		Stop	In Out	1	s	10	Pm	5/14/04	Accident	J.S
✓ D-24	2.30	m1-5 pc	24	6	15' x 00'	In Out				Am	7/14/04	Missing	J.S
✓ D-24	2.30	C3	24	6	COX HLC	In Out				Am	7/14/04	Missing	J.S

This is the inspection sheet used by District 9 to identify work that needs to be completed on signs.

Sheet 1 of 3

**SIGN CHANGEOUT WORKSHEET**

Date Surveyed 11/16/04

Route IL. 154 PERRY CO. Date Issued \_\_\_\_\_

From MILE MARKER 14.00 To MILE MARKER 16.00

Mileage	Direction	Manual Number	Sign Size	Sign Message	OK	Remove	Erect	Adj. Height	Replace	On U Steel	On T Steel	On Wood	New Post	Level Post	Remarks
14.000	E/B			PLANT ENTRANCE	✓										
	E/B			14.0	✓										
	W/B			14.0	✓										
14.065	E/B			S.L. 50	✓										5/99
14.065	W/B			S.L. 50	✓										5/99
14.131	S/B		30	STOP				✓				✓			
14.196	W/B		36	PLANT ENTRANCE				✓				✓			
14.283	N/B		30	STOP (HOLTS PRAVLE RD)				✓				✓			
14.452	E/B		24/18	DO NOT PICK UP HITCHHIKERS				✓				✓			
14.452	W/B		24/18	DO NOT PICK UP HITCHHIKERS				✓				✓			
14.501	E/B		36	TRUCK CROSSING SYM				✓				✓			
14.537	E/B		18	14.5	✓										
	W/B		18	14.5	✓										
14.705	E/B			S.L. 50	✓							✓			5/99
14.705	W/B			S.L. 50	✓							✓			5/99
14.732	N/B		30	STOP (SAP RD)			✓								
14.786	S/B		30	STOP (PVILLE CORRECTION CENTER)				✓				✓			
14.792	W/B		30	STOP (PVILLE CORRECTION CENTER)				✓				✓			
15.210	S/B		30	STOP (BLUE BUNTING RD)				✓	✓						
15.210	S/B		36	STOP AHEAD SYM				✓				✓			
15.233	E/B		24/36	SCHOOL SPEED ZONE AHEAD				✓				✓			
	E/B		18	20 M.P.H.				✓				✓			

TRAFFORM 13

P. 04/05 JRM-21-2005 08:51

This is the resulting summary sheet of signs that need to be replaced or repaired as a result of the previous inspection sheet.

WORK ORDER SUMMARY SHEET

WRITTEN BY TOMMY HAMILTON

DATE 11/24/04

SIGN MAN \_\_\_\_\_

DATE COMPLETED \_\_\_\_\_

ROUTE IL. -154 PERRY CO. LOCATION MILE MARKER 14.00 To 16.00

QUANTITY	SHOP CHECK	STANDARD	SIGN SIZE	MESSAGE
11			30	STOP
4			24 X 18	DO NOT PICK UP HITCHHIKERS
2			30	DO NOT ENTER
1			36	PLANT ENTRANCE
2			36	TRUCK CROSS SYM.
1			36	SIDE RD. SYM.
2			64 X 48	N. P. Z.
2			36	STOP AHEAD SYM.
2			24 X 36	SCHOOL SPEED ZONE AHEAD
2			18	20 M. P. H.
2			30	SCHOOL ADV. SYM.
2			24 X 48	S.S. L. 20 WHEN FLASHING
2			18 X 24	ONE WAY ARROW
2			18	16.0

**Appendix F**  
(Inspection procedures)

## **RETROREFLECTIVITY MAINTENANCE**

There are several methods that agencies can use to maintain sign retroreflectivity above the minimum maintained retroreflectivity levels that FHWA has developed through research. These minimum retroreflectivity levels were developed to provide transportation agencies with a general target for maintaining sign retroreflectivity. The existence of minimum retroreflectivity levels is not intended to imply that agencies need to measure the retroreflectivity of every sign in their jurisdictions. Instead, these methods provide agencies with options that will help to improve nighttime sign visibility.

Sign maintenance methods can be divided into two groups – assessment methods and management methods. Assessment methods involve the actual evaluation of individual signs, while management methods involve tracking and/or predicting the retroreflectivity of signs. The FHWA has identified several assessment and management methods for maintaining sign retroreflectivity in a manner that is consistent with the minimum retroreflectivity levels. Agencies also have the flexibility to develop their own methods for maintaining sign retroreflectivity.

### **ASSESSMENT METHODS**

The assessment methods require evaluation of individual signs within an agency's jurisdiction. There are two basic assessment methods – visual assessment and retroreflectivity measurement.

#### **Visual Nighttime Inspection Method**

In the visual nighttime inspection method, agency personnel assess the nighttime visibility of their signs. The visual inspection method is probably the most consistent with current practices at many agencies. Visual inspections are also recommended in Section 2A.22 of MUTCD.

In the visual inspection method, the inspector assesses the visibility and retroreflectivity of the traffic signs as he/she approaches the signs. Signs need to be replaced if they do not meet the comparison defined in the appropriate procedure. The following recommendations provide general guidance on how to conduct the inspections:

- Agencies develop guidelines and procedures for inspectors to use in conducting the nighttime inspections. Inspectors are trained on the use of these procedures.
- The inspection is conducted at normal roadway operating speeds. If it is necessary to slow or stop the vehicle to read the sign, the sign typically needs to be replaced. Signs are normally inspected from the travel lane.
- The inspection is conducted using the low beam headlights. It is better not to use the bright beams for inspections as they create higher illuminance levels at the sign and make it appear brighter than it would to a driver using low beams.
- Signs are normally evaluated at a typical viewing distance for each sign, one that provides a driver with adequate time for an appropriate response.

In addition to the above, one or more of the following procedures are used in conducting visual nighttime inspections.

### ***Calibration Signs Procedure***

Calibration signs are viewed prior to conducting the nighttime inspection. The calibration signs have retroreflectivity levels at or above the minimum levels. These signs are set up where the inspectors can view the calibration signs in a manner similar to how they will conduct the nighttime inspection. The inspector uses the visual appearance of the calibration sign to establish the evaluation threshold for that night's inspection activities. The following factors provide additional information on the use of this procedure:

- Calibration signs are needed for each color of sign for which there are minimum levels.
- The calibration signs are viewed at typical viewing distances and from the same vehicle that will be used for conducting the inspections.
- The calibration signs need to be properly stored between inspections so that the retroreflectivity of the calibration signs does not deteriorate over time. Calibration sign retroreflectivity is checked at periodic intervals to ensure that the calibration panels have the appropriate retroreflectivity levels.
- Field signs need to be replaced if the inspector judges a sign to be less bright than the appropriate calibration sign.

### ***Consistent Parameters Procedure***

The same factors that were used to develop the minimum levels are used in conducting the inspections. These factors include:

- Using a full-size sport utility vehicle or pick-up to conduct the inspection.
- Using a model year 2000 or newer vehicle for the inspection.
- Using an inspector age 60 or older.
- Signs are viewed at the typical viewing distance for that sign.
- Signs need to be replaced if they are not legible to the inspector.

### ***Comparison Panels Procedure***

Small comparison panels are used to assess the retroreflectivity of questionable signs. The comparison panels are fabricated at retroreflectivity levels that are at or above the minimum levels. When the retroreflectivity of a sign is considered to be questionable, a comparison panel is attached to the sign and the sign/panel combination is viewed by the inspector. If the comparison panel appears brighter than the sign, the sign needs to be replaced.

### ***Measured Retroreflectivity Method***

In this method, the retroreflectivity of a sign is measured and directly compared to the minimum level appropriate to that sign. If the sign retroreflectivity is lower than the minimum levels, the sign needs to be replaced. The following factors provide additional information about measuring sign retroreflectivity:

- ASTM E1709, Standard Test Method for Measurement of Retroreflective Signs Using a Portable Retroreflectometer, provides a standard method for measuring sign retroreflectivity using a handheld retroreflectometer.

- A sign needs to be replaced if the average retroreflectivity value is less than the appropriate minimum level.

## **MANAGEMENT METHODS**

The management methods provide an agency with the ability to maintain sign retroreflectivity without having to devote significant effort into assessing individual signs. There are three basic types of management methods – replacing signs based on age, blanket replacement of large numbers of signs at appropriate intervals, and using a sample of control signs to determine when to replace equivalent signs.

### **Expected Sign Life Method**

In this method, individual 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 following factors provide additional information about using this method:

- The expected service life of a sign can be based on several different sources of information, such as:
  - Sign sheeting warranties.
  - Sign test deck measurements.
  - Measurements of actual signs.
- An agency will need a method of identifying the age of individual signs. Potential methods include:
  - A sticker or other label attached to the sign that identifies the year of fabrication, installation, or replacement.
  - A sign management system that can identify the age of individual signs.

### **Blanket Replacement Method**

In this method, an agency replaces all the signs in an area/corridor, or of a given type, at specified intervals. An agency that uses this method does not need to track the age or assess the retroreflectivity of individual signs.

The following factors provide additional information about the use of this procedure:

- Replacement zones can be based on an area, corridor, or sign type.
- The replacement interval for the area/corridor, or sign type, is based on the expected sign life for the affected signs.
- All signs within a replacement area/corridor/type are typically replaced, even if the sign was recently installed.

### **Control Sign Method**

In this method, a control sample of signs is used to represent the total population of an agency's signs. The retroreflectivity of the control signs is monitored at appropriate intervals

and sign replacement is based on the performance of the control signs. The following factors provide additional information about using this method:

- An agency develops a sampling plan to determine the appropriate number of control signs needed to represent the agency's sign population.
- Control signs may be actual signs in the field or signs installed in a maintenance yard to serve specifically as control signs.
- The retroreflectivity of the control signs should be monitored following the procedures outlined for one of the assessment methods.
- All field signs represented by the control sample need to be replaced before the retroreflectivity levels of the control sample reach the minimum levels.

## **SIGN REPLACEMENT**

All of the sign retroreflectivity maintenance methods indicate that signs need to be replaced when they do not meet the threshold criteria for the individual method. In maintaining sign retroreflectivity, an agency may want to consider the interval before the next assessment or management event as part of the sign evaluation and replacement process. In some cases, it may be appropriate to replace a sign even though it is above the threshold criteria because it could be expected to drop below the threshold criteria before the next assessment/management event.

## **SIGN EXCLUSIONS**

The following signs may be excluded from the various methods of maintaining sign retroreflectivity:

- 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 or brown backgrounds.
- Bikeways, which are not immediately adjacent to a roadway and that, are intended for exclusive use by bicyclists and/or pedestrians.

Inspection tools websites:

[http://www.dot.state.al.us/Bureau/Maintenance/traffic/new\\_sign\\_inventory\\_management\\_pi.htm](http://www.dot.state.al.us/Bureau/Maintenance/traffic/new_sign_inventory_management_pi.htm)

Some communities have adopted computerized sign inventory systems. A variety of commercial programs are available. The University of New Hampshire LTAP program offers one for \$25. The Windows-compatible "Sign Inventory Management System—SIMS02" is designed for small to medium-sized county highway agencies.

<http://www.t2.unh.edu/pwms/sims.html>

<http://www.flintrtrading.com/retrosign.htm>

**Appendix G**  
(Former 402 grant program)

**Traffic Sign Upgrade  
Project Specifications**

**Division of Traffic Safety Program**

**Prepared by:**

**Illinois Department of Transportation  
Division of Traffic Safety  
in cooperation with the  
U.S. Department of Transportation  
National Highway Traffic Safety  
Administration**

(Revised 3/01)

## TRAFFIC SIGN UPGRADE PROJECT

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**Attachment A - Highway Safety Project Request (Form TS1986)**

**Attachment B - Sign Inventory Sheet and Instructions**

**Attachment C - Signs Approved for Type A or AP Reflective Sheeting**

**Attachment D - Confirmation of Materials Certification**

**Attachment E - IDOT District Boundaries and Office Locations**

**Attachment F - Claim for Reimbursement**

**Attachment G - MUTCD and Illinois Supplement Order Information**

## TRAFFIC SIGN UPGRADE PROJECT SPECIFICATIONS

### I. INTRODUCTION

All local traffic control devices must conform to the **Manual on Uniform Traffic Control Devices for Streets and Highways** along with **Illinois Supplement to the National Manual on Uniform Traffic Control Devices** (hereafter, referred to as **MUTCD** and the **IL Supplement**) and meet the traffic warrants stated therein. Section 11-305 of the **Illinois Vehicle Code** mandates conformance with the MUTCD and the IL Supplement. To comply with this requirement, a physical inventory and/or engineering study of all traffic control devices must be conducted (see Attachment B). The costs to conduct the inventory and the study are the responsibility of the applicant agency. However, the correction of certain sign (i.e., warning, regulatory, school) and post deficiencies identified in the study is eligible for funding as a local highway safety project. Federal 402 Highway Safety Funds may be used to upgrade appropriate signs that are located off the national highway system; **they may not be used for work on the national highway system.**

The obligation of federal funds for any fiscal year is subject to the availability of federal 402 funds.

### II. APPLICANT AGENCY REQUIREMENTS

#### A. Eligibility

1. Any municipality or county through its Public Works/Highway Department may request a Traffic Sign Upgrade Highway Safety Project. **Police Departments, Townships\*, and Road Districts are not eligible applicant agencies.**

\*(NOTE: For those counties where Township roads have not previously been upgraded, it is acceptable to apply for funding provided that the County Engineer's office sponsors the application.)

2. The applicant agency must have identified a noncompliance problem with existing signs based on their inventory and/or study.
3. The applicant agency must **not** have previously had an approved Traffic Sign Upgrade project funded with 402 Highway Safety Funds.

B. **How to Apply** - Applications **must be submitted** to the Illinois Department of Transportation, Division of Traffic Safety (hereafter referred to as DTS) on a Highway Safety Project Request, (Form TS 1986, Attachment A) **by April 1**. All projects will begin October 1.

The instructions for completing the request are detailed in the following pages. Division of Traffic Safety personnel are available to help in the preparation of a project request.

1. **Applicant Agency** - Enter the name and address of the applicant agency responsible for this request. Enter the Taxpayers Identification Number (TIN) or the Federal Employer Identification Number (FEIN) in the appropriate space.
2. **Governmental Unit** - Enter the name and address of the county or municipality.
3. **Starting Date** - October 1
4. **Expiration Date** - September 30
5. **Project Description** - This description will be reviewed by the DTS to determine the benefit to the applicant agency's traffic safety program and to the Illinois Highway Safety Program. For this reason, it is important that the project description be clearly stated in sufficient detail so that all factors can be properly evaluated. On an attachment entitled "Project Description", please provide the following:

- 5a. **Problem Statement** - The local agency shall indicate the completion of an inventory of the sign installations in the community/county, and the deficiencies found as a result of the inventory. The number of signs and posts found to be deficient shall be included.
- 5b. **Background** - This section must include the number of miles of streets/roads maintained by the applicant agency, and the previous program utilized for sign maintenance.
- 5c. **Project Objectives** - State the primary goal of the project, which is to bring all signs and posts into compliance with the MUTCD and the IL Supplement, thereby reducing potential motor vehicle crashes and related injuries. Indicate the project objectives which are designed to help accomplish the main goal (e.g., **the total number of signs and posts to be purchased and installed, the proposed maintenance schedule for future updating, etc.**). The applicant agency or designee is the responsible party for maintaining the traffic control signs. A schedule indicating how and when the signs will be maintained will accompany the highway safety request.
- 5d. **Methods of Procedure** - This section must include the following information.
- (1) **Inventory form** - Utilize the approved inventory form or a similar format. (Verification that inventory data (i.e., signs and posts) has been collected using approved inventory forms, or a similar format). The inventory form (an example is shown in Attachment B) must include the following information relative to existing signs:

- Location
- Size
- Condition
- Horizontal Clearance
- Adequacy per MUTCD and the IL Supplement Requirements
- MUTCD/IL Supplement Sign Number
- Reflectivity
- Visibility
- Post Condition (Height)

- (2) **Completed inventory forms** - The inventory form which identifies the number and type of signs, the reflective sheeting requested, plus the number and type of posts must accompany the Highway Safety Request.

All signs purchased as part of this grant will, as a minimum, utilize Type BB reflective sheeting; and the thickness of the reflective sheeting without protective liner shall be no more than 0.015 inch.

However, if desired by the local agency, Type A (High Intensity) or AP (Prismatic) reflective sheeting may be purchased for those signs recommended by the Illinois Department of Transportation's Bureau of Operations. The signs approved for Type A or AP reflective sheeting are listed in Attachment C. The applicant agency may further upgrade the reflective sheeting at their own expense. **The program will only reimburse eligible cost established by the program specifications.**

- (3) **Timetable** - A proposed timetable should consist of a schedule for completion of the following tasks:

- (a) Bid preparation.
- (b) Bid letting.

- (c) Bid award.
  - (d) Sign & Post delivery.
  - (e) Sign & Post installation.
- (4) **Statement of Understanding** - A statement of understanding that the sign materials letting must meet Agreement Condition E on competitive procurement procedures. The letting will be conducted by the applicant agency or the consultant representing the agency.
- (5) **Guidelines for the Preparation of Bid Specifications for Sign Materials** are available from the project manager.
- (6) **A letter will be forwarded to DTS providing a list of bidders and bid amounts for the project and indicate the bid(s) selected.** DTS will respond in writing if acceptable.
- (7) **Manufacturer's Certification** - Prior to installation of the signs and posts, the successful bidder will provide the local project director with two (2) copies of the **manufacturer's certification(s)** (Attachment D) confirming that the materials meet or exceed Illinois Department of Transportation Standard Specifications for Road and Bridge Construction.
- (a) The local project director will furnish the DTS with a copy of the aforementioned certification(s).
  - (b) The Illinois Department of Transportation reserves the right to request samples of any commodities or signing materials for testing by the Central Bureau of Materials and Physical Research to verify compliance with the applicable specifications.

- 5e. **Reports** - This section must include the following information:
- (1) Progress reports addressing the tasks identified in the timetable (Methods of Procedure):
    - (a) Bid preparation.
    - (b) Bid letting announcement and to whom sent.
    - (c) Award recipient and cost.
    - (d) Materials delivery.
    - (e) Materials installation.
  - (2) A **final report** reviewing total project activity and including:
    - (a) **A plan** for the correction and future maintenance of deficiencies (i.e., warning, regulatory, and school signs).
    - (b) **A copy of the ordinance** approving each of the traffic signs installed as a proper traffic control device, and
    - (c) **A copy of the final inspection** report  
(See Section III-D of these specifications).

**The final report must be submitted by November 1.**

- 5f. **Project Description Summary** - Using the above information (5a-5e), summarize in 100 words or less the proposed project in Item 5F on the request form.
- 5g. **Budget Summary** - The local agency must submit an itemized budget that includes an estimate of sign costs for warning, regulatory, or school signs off the national highway system. Federal-aid signs are to be upgraded with federal-aid construction money. Contact your Illinois Department of Transportation District Highway Office for further information (see Attachment E).

A local source of operating funds is required for all projects. Actual funding of the project will be in accordance with the approved Highway Safety Project Agreement. **Only those items included in the approved project budget are reimbursable.**

The budget shall cover the entire period of project operation. On an attachment, please provide the following information which details anticipated project costs.

(1) The costs that are eligible for 100 percent reimbursement are:

**Commodities** - Signs, posts, mounting hardware and shipping costs. The summary of quantities needed for the upgrade project should detail the letter and number designation by sign type from the MUTCD and the IL Supplement, the quantity needed by sign type, and the estimated cost per sign. Identify the reflective sheeting (Type A, Type AP or Type BB).

**Equipment** - A post driver (if required to perform installation of signs and if unavailable to the applicant agency - maximum \$500).

6. **Agreement Conditions**

The conditions attached to the request describe the terms and obligations to which the agency agrees when accepting a grant award. Local agency officials must assure compliance with all conditions.

7A. **Project Director**

The person identified by the local agency to act as a liaison to DTS. Type in name, title, address, and telephone and fax number. The assigned project director must sign the request.

7B. **Authorizing Official**

The person responsible for authorization to expend local funds. Type in name, title, address, and telephone and fax number. The authorizing official must sign the request.

III. **DIVISION OF TRAFFIC SAFETY REQUIREMENTS**

A. **Project Approval**

The Highway Safety Project **Request must be submitted no later than April 1** to allow for its review by DTS. A project manager will be assigned by DTS to assist the applicant agency with any changes during the request review.

If the request is warranted, a Highway Safety Project Agreement will be returned to the applicant agency for signatures. If the agreement is acceptable, the signatures of the project director and authorizing official are required on the agreement. The original agreement, along with all required forms, must be returned to the DTS. Upon receipt the Governor's Representative will sign the agreement and a copy of the executed agreement will be sent to the applicant agency.

B. **Reimbursement**

Highway Safety Projects are funded on a **cost-reimbursement basis**. That is, the applicant agency pays the cost of program operation using local funds. The agency then submits an Illinois Highway Safety Project Claim for Reimbursement (Attachment F) to the DTS. The "federal" costs as detailed in 5g. are eligible for reimbursement.

- (1) Claims for reimbursement must reflect actual project expenditures. The proper supportive documentation for expenditures is explained in the Procedures for Submittal of Claims for Reimbursement which will be provided.

- (2) Claims will be returned if not accompanied by the proper supporting documentation of expenditures.
- (3) Claim form must be signed by the project director and authorizing official. The signatures must be the same as those on the approved agreement.
- (4) **The final claim for reimbursement must be submitted for payment no later than November 1.**
- (5) Allow 6-8 weeks for processing and payment of claims with complete expenditure documentation. (Final claims for reimbursement will be processed for payment after all evaluation requirements of the project have been fulfilled.) All project activity must be completed prior to the expiration date.

C. **Final Inspection**

**Upon completion of all sign installations the project director shall contact the Illinois Department of Transportation Highway District office (Attachment E) and request an inspection of sign installations to ensure compliance with the MUTCD and the IL Supplement.** A copy of the final inspection report shall be forwarded to the DTS prior to submittal of the final claim for reimbursement.

Should the Illinois Department of Transportation Highway District Office indicate it is not able to **conduct a final inspection, the consultant or authorizing official must submit to the DTS a letter of certification indicating that all signs were installed in accordance with the MUTCD and the IL Supplement.**

D. **Reporting Requirements**

The Division of Traffic Safety's overall assessment of the project will be based on the successful and timely completion of the scheduled tasks on the timetable.

- (1) **Progress reports** shall be forwarded to the DTS addressing the individual tasks identified in the timetable within ten (10) days of their completion. Report any problems encountered and necessary modifications to the timetable.
- (2) **Final report** must be submitted within 30 days after project completion. The final report must include a copy of the **ordinance** approving the installed traffic signs as a proper traffic control device, a copy of the **final inspection report** conducted by the IDOT Highway District Office or a **letter of certification** by the consultant or authorizing official, and **maintenance program**.

E. **Project Monitoring**

To ensure that the project is proceeding in accordance with the approved contract and to assist local project staff with any problems that may arise, the DTS staff will conduct at least one on-site visit. Failure to comply with the terms of the contract may result in cancellation of the project in accordance with Section L of the Agreement Conditions.

## **ATTACHMENTS**

**A - Highway Safety Project Request Form TS1986**

**B - Sign Inventory Sheet and Instructions**

**C - Signs Approved for Reflective Sheeting by Type**

**D - Confirmation of Materials Certification**

**E - IDOT District Boundaries and Office Locations**

**F - Claim for Reimbursement**

**G - MUTCD and Illinois Supplement Order Information**

## ATTACHMENT B

### SIGN INVENTORY INSTRUCTIONS

#### 1. Heading Information

- a. City/County - Municipality or county name and quadrant designation if the local agency is so divided for inventory purposes.
- b. Street/Road Name - All signs on the right of way of each street or road must be inventoried.
- c. Direction - The direction traveled while recording data (N, S, E, or W).
- d. Date - Day, month and year the sign data is recorded.
- e. Maintenance Dates - When adequacy or maintenance deficiencies are corrected (see Items O. and P.).
- f. Maintenance Personnel - Initials of who made the corrections.

#### 2. Inventory Data

- a. Location - An odometer reading, intersecting street or road name, house address, or rural reference number that identifies the sign's location along the subject street or road.
- b. Side of Street - N, S, E or W.

- c. MUTCD/IL. Supplement Sign Number - The code number from the 1988 Manual on Uniform Traffic Control Devices and/or the Illinois Supplement which is available through Illinois Department of Transportation District Offices shown in Attachment E. Section 11-304 of the Illinois Vehicle Code requires local authorities to place and maintain traffic control devices that conform to this State manual and are justified by traffic warrants stated in the manual. Signs not in the manual should be coded with a letter series other than R, W, S, C or M (such as X-1, 2 ...) and described in "Remarks".
- d. Size - The width and height of the sign face in inches. Diamond shaped warning signs (W) are measured from the bottom to the side corners for height and width. Triangular signs (yield or R1-2) are also measured from the bottom to side corner for height, but width is the actual dimension of the top edge.
- e. Number in Assembly - Numbered from left to right and from top to bottom, the first sign is coded as 1 the second as 2, and etc.
- f. Reflectivity - Whether the sign face reflects headlights at night, may be coded as G-good, P-poor, or N-no reflectivity.
- g. Visibility - Whether the sign is readily visible, obscured by trees and shrubbery, or completely hidden by buildings, signs, or other objects (V, O, H).
- h. Face Material (optional) -- The type of sign face may be entered, such as reflective sheeting, B-reflectorized beads on paint, P-painted but not reflectorized, etc.
- i. Backing Material (optional) - The type of sign backing may be entered, such as S-embossed steel, F-flat steel, A-aluminum, W-plywood, etc.
- j. Condition - Any change in the sign from its new conditions, such as 1-faded, 2-rusted, 3-bent, 4-peeling, 5-defaced, 6-missing, etc.

- k. Post Type (optional) - The local agency may wish to record types of post to compare lifetimes (such as P-steel pipe, U-steel channel, W-4x4" wood, etc.).
- l. Horizontal Placement - The number of feet between the near edge of the sign and the curb face or pavement edge.
- m. Height - The number of feet between the bottom of the sign and the pavement or roadway edge.
- n. Post Condition - Any change in the post from its new condition such as B-bent, R-rusted, M-missing.
- o. Adequacy - This column will be coded in the office after the field inventory is complete. It should be coded with actions needed to comply with the 1988 Manual on Uniform Traffic Control Devices/IL Supplement, such as 1-remove sign and post, 2-add sign and post, 3-replace sign and post, 4-replace sign, 5-replace post, 6-relocate post, etc.
- p. Maintenance - This column is also coded in the office with the actions needed to bring the device back to its new condition. Sample codes are: 1-wash sign face, 2-straighten sign, 3-straighten post, 4-paint post, 5-replace sign face, 6-remove obscuring shrubbery, etc.

## ATTACHMENT C

### Signs Approved for Reflective Sheeting by Type

1. **Type A or AP** sheeting will be used for critical warning and regulatory signs, those using color combinations exhibiting lower reflective values, and those signs less subject to vehicular damage where a high percentage will be replaced because of age rather than damage. The following signs are approved for Type A or AP sheeting.

- STOP/YIELD
- ALL WAY plate
- DO NOT ENTER/WRONG WAY
- Chevron
- STOP AHEAD/YIELD AHEAD
- Railroad Advance (RxR Only)
- Merge/Added Lane
- Ramp Speed
- NO PASSING ZONE
- All signs on full freeways and ramps
- All white (silver) direct applied legend
- All reversed screened signs
- All signs with blue or brown backgrounds
- All guide sign mounted route shields
- All Interstate and Interstate Business route shields
- All blue/brown/green arrows, direction and other route marker auxiliary plates
- Red Object Markers
- Large Arrow

**ATTACHMENT D**  
**CONFIRMATION OF**  
**MATERIALS CERTIFICATION**

**COMPLETE AND SUBMIT TO THE DIVISION OF TRAFFIC SAFETY PRIOR TO INSTALLATION OF SIGNS.**

**Project Number:** \_\_\_\_\_  
**Project Type:** \_\_\_\_\_  
**County/City** \_\_\_\_\_

This will confirm that a sign materials letting that meets Agreement Condition E on Competitive Procurement Procedures was conducted:

Date: \_\_\_\_\_

Location: \_\_\_\_\_

The successful bidder, \_\_\_\_\_, has provided two copies of the manufacturer's certification confirming that the materials meet or exceed Illinois Department of Transportation Standard Specifications for Road and Bridge Construction. As required in the project agreement we are providing one copy of the certification. (See attachment.)

If the samples of signing materials for testing are required, please advise.

Signed: \_\_\_\_\_

Project Director

2. **Type BB** sheeting will be used for the following signs when not otherwise fabricated with Type A or AP sheeting.
- All warning signs
  - SPEED LIMIT \_\_\_\_
  - SPEED ZONE AHEAD and \_\_\_\_ MPH plate
  - All signs with green backgrounds
  - Yellow Object Markers
3. **Type B** sheeting will be used for all white (silver) signs not otherwise fabricated with Types A, AP or BB sheeting.

Division of Traffic Safety Program

**Applicant agency may choose to upgrade any and all signs.  
However, 402 funds will only reimburse the maximum costs established by the program  
specifications.**

**ATTACHMENT G**

**TO ORDER:** THE **1988** EDITION OF THE NATIONAL MANUAL ON  
UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND  
HIGHWAYS

UNITED STATES GOVERNMENT  
PRINTING OFFICE  
SUPERINTENDENT OF DOCUMENTS  
WASHINGTON, DC 20402

SUBSCRIPTION #050-001-00308-2

PHONE 202-512-1800

PLEASE ALLOW 60 TO 90 DAYS FOR SHIPMENT

**TO ORDER:** THE **ILLINOIS SUPPLEMENT** TO THIS MANUAL MAY BE  
ORDERED for \$5.00 FROM:

ILLINOIS DEPARTMENT OF TRANSPORTATION  
Manual Sales  
2300 SOUTH DIRKSEN PARKWAY, Room 012  
SPRINGFIELD, ILLINOIS 62764

OR CALL 217/785-8971

**Traffic Sign Upgrade**

## **Guidelines for Preparation of Bid Specifications for Sign Materials**

This guideline is presented in order to assist the applicant agency in preparing specifications for the materials bid letting.

### **TRAFFIC SIGNS**

All signs furnished shall be fabricated of new materials. The backs of all sign panels shall be metal stamped, engraved, etched, or otherwise marked in a manner designed to last as long as the sign face material, in letters and numerals at least 90 mm (3/8 inch) in height with the month and year of manufacture, the name of the sign manufacturer, and "(city/village name)".

All standard signs shall be in accordance with the **Illinois Manual on Uniform Traffic Control Devices**. Design drawings for signs designated by letters and numbers such as R2-1, may be found in **Standard Highway Signs** available from:

The Federal Highway Administration (HTO)-30  
400 7th Street, SW  
Washington, DC 20590

Signs where the number following the hyphen is preceded by the letter "I", such as R2-I101, are available from:

The Illinois Department of Transportation  
Bureau of Operations  
2300 South Dirksen Parkway  
Springfield, IL 62564.

Details for all other signs in this order may be obtained from the ordering agency.

#### **A. Sign Faces**

Reflective sheeting shall meet the requirements of **Article T602.01** of the **Illinois Department of Transportation's Standard Specifications for Traffic Control Items**, dated April 1, 1989. Where nonreflective sign faces are specified, the nonreflective sheeting shall meet the requirements of **Article T602.02** of said specifications.

Sign legend shall conform to the requirements of **Articles T603, T603.01, T603.07 and T603.08** as appropriate for the individual sign.

#### **B. Sign Bases**

The base material used for sign panels shall be sheet aluminum meeting the requirements of **Article T601.01**. Aluminum for **signs 9 square feet or less in area shall be at least 0.080 inches thick;** those **over 9 square feet in area shall be at least 0.125 inches thick.**

### C. Field Performance

The sign faces shall be processed and applied to the sign base material in accordance with the sheeting manufacturer's recommendations. The sheeting will be considered unsatisfactory if it has deteriorated due to natural causes to the extent that:

- 1) The sign is ineffective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions;
- or**
- 2) The coefficient of retroreflection is less than the minimum specified for that sheeting during that period listed in the following table.

<b>Table I</b> <b>Minimum Coefficient of Retroreflection</b> <b>Candelas per Foot Candle per Square Foot</b> <b>(.2 obs. and -4 entrance)</b>		
	<b>Type BB</b>	<b>Type A</b>
<b>Sheeting Color</b>	<b>Minimum Coefficient of Retro. (7 years)</b>	<b>Minimum Coefficient of Retro. (10 years)</b>
<b>White</b>	<b>212</b>	<b>200</b>
<b>Yellow</b>	<b>144</b>	<b>136</b>
<b>Red</b>	<b>38</b>	<b>36</b>

#### Notes:

- 1) All measurements shall be made after sign cleaning, according to sheeting manufacturer's recommendations.
- 2) For screen-printed transparent colored areas on white sheeting, the coefficients of retroreflection shall not be less than 50% of the values for the corresponding color in the above table.

### SIGN MANUFACTURER'S REPLACEMENT OBLIGATIONS:

Where it can be shown that retroreflective traffic signs with sheetings supplied and used according to the sheeting manufacturer's recommendations have not met field performance requirements (Table I), the sign manufacturer shall cover restoration costs as follows for sheeting shown to be unsatisfactory during:

- A. **The entire ten years:** The sign manufacturer shall replace the sheeting required to restore the sign surface to its original effectiveness.

- B. **In addition, during the first seven years:** The sign manufacturer shall cover the cost of restoring the sign surface to its original effectiveness at no cost to the City/County for materials or labor.

## **SIGN POSTS**

### **A. Telescoping Steel**

Telescoping steel sign posts shall meet the requirements of **Article T 604.04** of the **Illinois Department of Transportation's Purchase Specifications for Tubular Metal Posts for Highway Signs (T 20-93)**.

### **B. U-Channel**

U-channel posts shall meet the requirements for galvanized steel Type A or Type B posts, as specified, contained in **Article 710.35** of the **Illinois Department of Transportation's Standard Specifications for Road and Bridge Construction** adopted July 1, 1988.

## **SIGN HARDWARE**

All bolts, nuts and metal washers shall be zinc or cadmium-plated steel or stainless steel. Bolts shall be 5/16 inch diameter with hex heads and have National Coarse Threads (UNC).

**State of Illinois**  
**Department of Transportation**  
**T 20-93**  
**SPECIFICATIONS FOR TUBULAR METAL POSTS FOR HIGHWAY SIGNS**

**MATERIAL**

- Posts and anchors shall conform to the Standard Specification for either Cold Rolled Carbon Sheet Steel, commercial quality ASTM Designation A-446 or Hot Rolled Structural quality ASTM Designation A-570-79.

**SHAPE**

- The cross section of both post and anchor shall be carefully formed square tubing, welded in one corner and sized to permit telescoping internally or externally.

**SECTION PROPERTIES**

- **PALL Anchors and posts shall meet the following:**

<b>Anchors</b>			
<b>Size</b>	<b>U.S.S. Gauge</b>	<b>Min. Yield Strength</b>	<b>Weight per Foot, Pounds</b>
2" x 2"	12	40,000 psi	2.42
* 2-1/4" x 2-1/4"	12	40,000 psi	2.77
2-1/4" x 2-1/2"	12	40,000 psi	3.14

<b>Posts</b>			
<b>Size</b>	<b>U.S.S. Gauge</b>	<b>Min. Yield Strength</b>	<b>Weight per Foot, Pounds</b>
1-1/2" x 1-1/2"	12	40,000 psi	1.70
1-3/4" x 1-3/4"	12	40,000 psi	2.06
* 2" x 2"	12	40,000 psi	2.42
1-1/4" x 2-1/4"	12	40,000 psi	2.77
2-1/2" x 2-1/2"	12	40,000 psi	3.14
1-3/4" x 1-3/4"	14	60,000 psi	1.71
* 2" x 2"	14	60,000 psi	1.99
2-1/4" x 2-1/4"	14	60,000 psi	2.27
2-1/2" x 2-1/2"	14	60,000 psi	2.55
*	Recommended		

**HOLES**

- Holes shall be fully perforated 7/16" diameter plus or minus 1/64" on 1" centers, on all four sides of post.
- Holes shall be full length of posts truly aligned to center of a side and exactly opposite each other on opposing sides.
- Holes shall maintain a plus or minus tolerance of 1/8" in 60" of length.

### **LENGTH**

- The length of each post or anchor shall be as specified with a permissible tolerance of plus or minus 1/4" overall.

### **TELESCOPING PROPERTIES**

- The finished anchor and post shall be straight and have a smooth uniform finish.
- It shall be possible to telescope all consecutive sizes of square tubing freely for at least the length of the anchor without having to match any particular face to any opposing face.
- All holes and ends shall be free from burrs, ends shall be cut square and anchors shall always be cut exactly between two holes to ensure bolt alignment when reinforcing anchor sleeves are used.

### **TOLERANCES**

Tolerances on outside sizes:

<b>Nominal Outside Dimensions</b>	<b>Outside Tolerance at all Sides at Corners</b>
1-1/2" x 1-1/2"	plus or minus .006"
1-3/4" x 1-3/4"	plus or minus .008"
2" x 2"	plus or minus .008"
2-1/4" x 2-1/4"	plus or minus .010"
2-1/2" x 2-1/2"	plus or minus .010"

**Note: Measurements for outside dimensions shall be made at least 2" from end of tube**

- **Wall Thickness Tolerance:** Permissible variation in wall thickness is plus .011", minus .008".
- **Convexity and Concavity:** Measured in the center of the flat side tolerance is plus or minus 0.01" applied to the specific size determined at the corner.

- **Squareness of Sides and Twist:**

Nominal Outside Dimensions	Squareness Tolerance	Twist Permissible in 3 feet lengths
1-1/2" x 1-1/2"	plus or minus .009"	.050"
1-3/4" x 1-3/4"	plus or minus .010"	.062"
2" x 2"	plus or minus .012"	.062"
2-1/4" x 2-1/4"	plus or minus .014"	.062"
2-1/2" x 2-1/2"	plus or minus .015"	.075"

**Note: A sample shall be considered to fail if its sides are not 90 degrees to each other by the tolerance listed above.**

- **Straightness Tolerance:** Permissible variation in straightness is 1/16" in three feet.
- **Corner Radii:** Standard outside corner radius shall be 5/32" plus or minus 1/32 of an inch.

### **FINISH**

- The square sign post tubing shall be manufactured from hot-dipped galvanized steel, ASTM A-525 coating, designation G 90, or given triple-coated protection by in-line application of hot-dipped galvanized zinc per AASHTO M-120 followed by a chromate conversion coating and a cross-linked polyurethane acrylic exterior coating.
- The inside surface shall be given corrosion protection by in-line application of a full zinc base organic coating after fabrication, tested in accordance with ASTM B-117.
- If weld process is performed after galvanizing, weld shall be zinc coated after scarfing operation.

### **PACKAGING**

- Posts shall be securely bundled with 4 or more steel straps and shall weigh approximately 2,000 lbs. per bundle.

(Revised 3/99)







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