Traffic Sign Retroreflectivity

Basics of Sign Retroreflectivity

&

New Sign Maintenance Requirements

Safe Roads for a Safer Future
Investment in roadway safety saves lives

U.S. Department of Transportation
Federal Highway Administration

Ground Rules

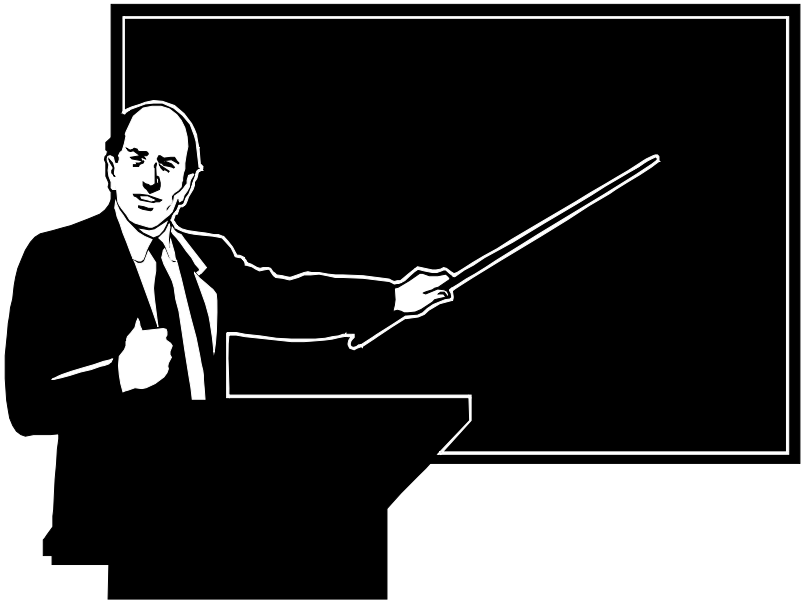
- Facilities
  - Restrooms, drinks, snacks, phones
  - Other considerations
- Cell phones and pagers on silent
- Ask questions and make comments to the group as they occur to you
- Be considerate of others

Welcome

- **Retroreflectivity is important!**
- Importance has increased
- Not a part of any educational curriculum
  - “OTJ” training
- Your agency now responsible

Course Instructor(s)

- Names
  - Short bio



Participant Introductions

- Name
- Agency
- Position/duties

Purpose of Course

Intended for Managers and Decision-makers

- Describe sign retroreflectivity concepts
- Understand nighttime visibility issues
- Summarize new requirements
- Describe retroreflectivity maintenance methods

An inspector training course is also available through your LTAP centers

Content & Schedule

TOPIC	EST. TIME (min)
Welcome	15
Background	25
Retroreflectivity	30
Visibility	20
New MUTCD material	20
Maintenance methods	45
Life cycle cost	15
Implementation & FAQs	10

Questions

Background Information

Safe Roads for a Safer Future
Investment in roadway safety saves lives

Why Do We Install Signs?

Required by MUTCD?

NO

Engineering Decision?

YES!

Why?

To help drivers

(including older)

Key Issue: Older Drivers

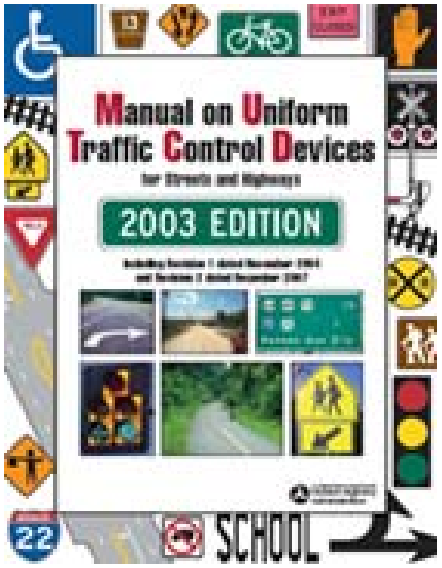
- 18.9 million drivers age 70+ in 2000
- 20.6 million drivers age 70+ in 2006
  - 48% increase from 1990 to 2006
    - 1990 — 8% of drivers were 70+
    - 2006 — 10.2% of drivers were 70+

- "Older" driver population will continue to grow as baby-boomers age

MUTCD

Manual on Uniform Traffic Control Devices

- MUTCD applies to all roads .. “open to public travel”
  - includes toll roads and roads within shopping centers, parking lots, airports, sports arenas, and other similar business and recreation facilities that are privately owned but where the public is allowed to travel without access restrictions. *pending rulemaking process*



MUTCD – Existing Reqs.

- Manual on Uniform Traffic Control Devices
- Section 2A.06 – Design of Signs
  - The basic requirements of a highway sign are that it be legible to those for whom it is intended and that it be understandable in time to permit a proper response. Desirable attributes include:
    - High visibility by day and night; and
    - High legibility (adequately sized letters or symbols, and a short legend for quick comprehension by a road user approaching a sign).
- Section 2A.08 – Retroreflectivity or Illumination
  - …signs shall be retroreflective or illuminated to show the same shape and similar color by both day and night, unless specifically stated otherwise...
  - The requirements for sign illumination shall not be considered to be satisfied by street or highway lighting.
- The responsibility for the design, placement, operation, maintenance, and uniformity of traffic control devices shall rest with the public agency or the official having jurisdiction.

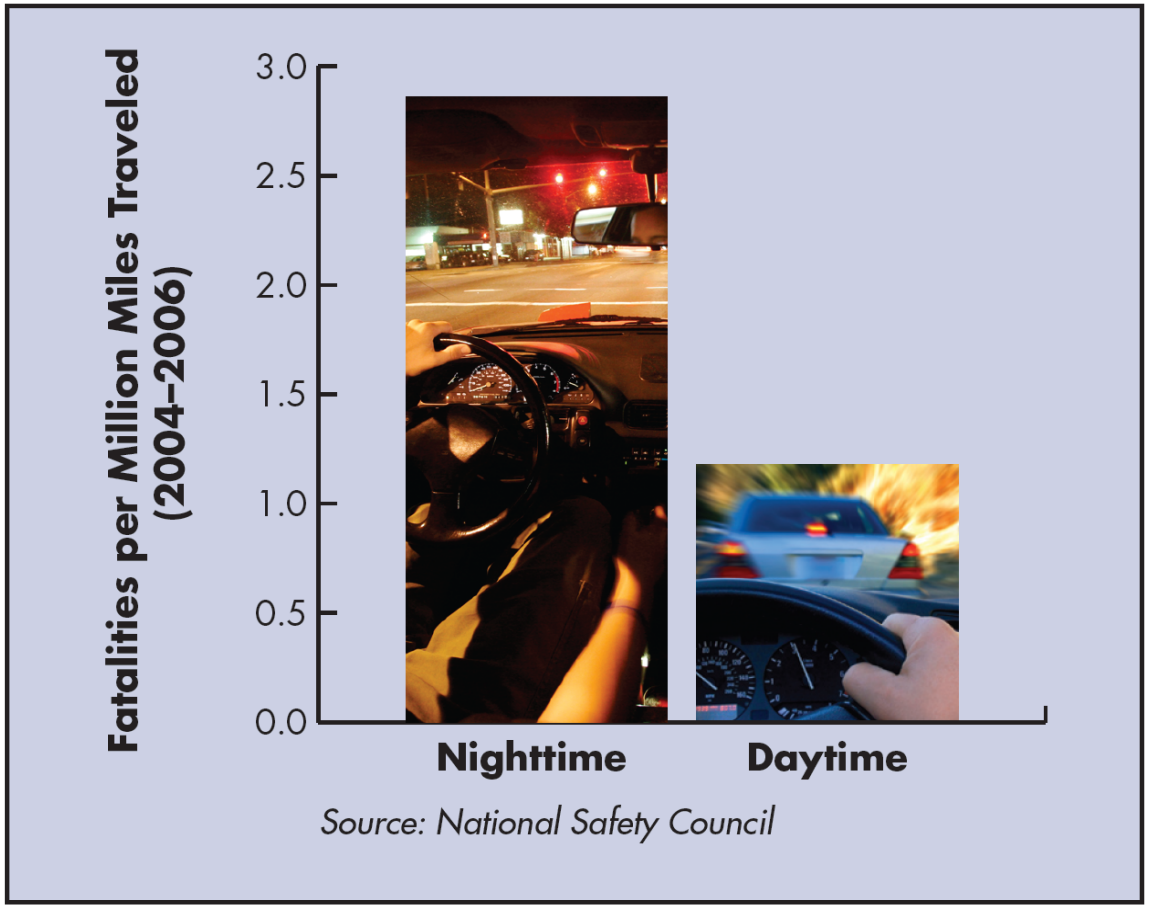
Sign Purpose:
Promote Highway Safety

Reasonably safe for day or night travel?

MUTCD Principles:

- Fulfill a need;
- Command attention;
- Convey a clear, simple meaning;
- Command respect from road users; and
- Give adequate time for proper response.

Night Travel and Crashes



Nighttime Driving

Daytime

Many cues available

Driver task relatively easy

Nighttime

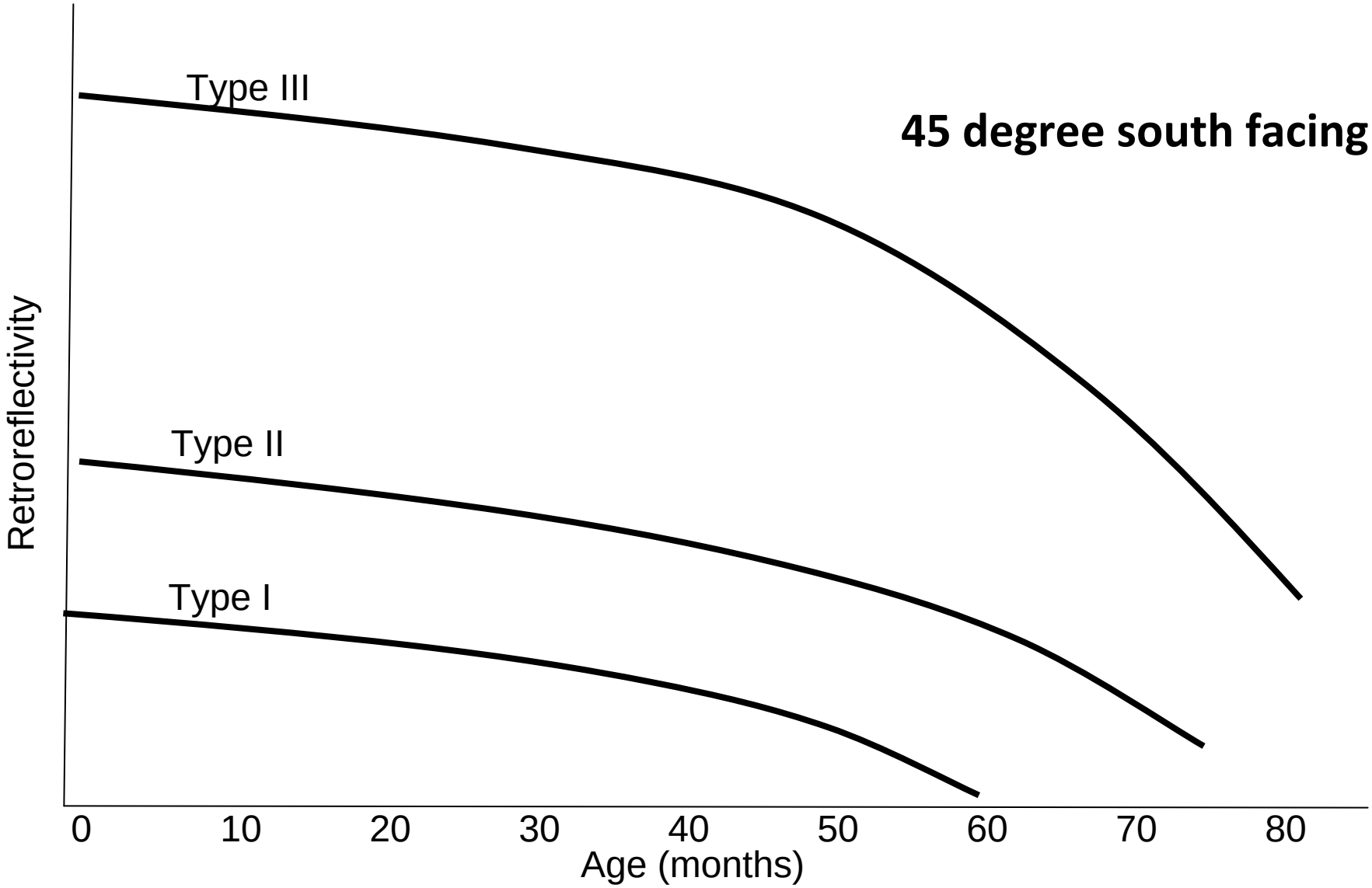
Few cues remain

Task more difficult

Retroreflectivity provides nighttime guidance

Retroreflective Signs

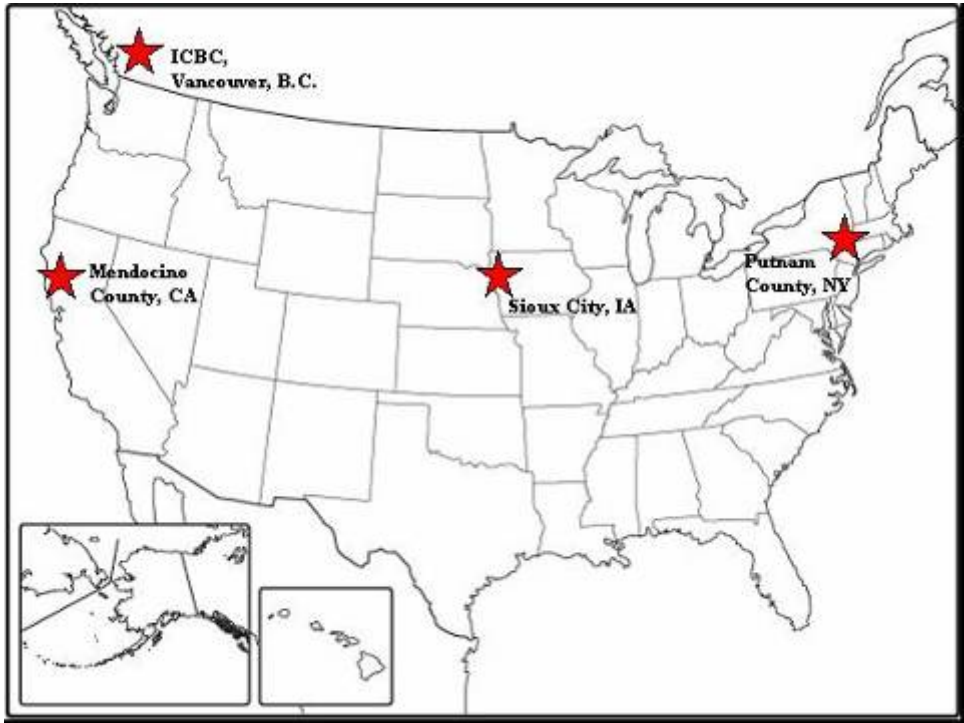
Typical Outdoor Durability Testing



Degraded Stop Sign ..

“Safety” of Sign Upgrades

- Mendocino County, CA – Steve Ford
- City of Sioux City, IA – Scott Carlson
- ICBC, Vancouver, B.C. – John Pump
- Putnam County, NY – Mike Druckreier



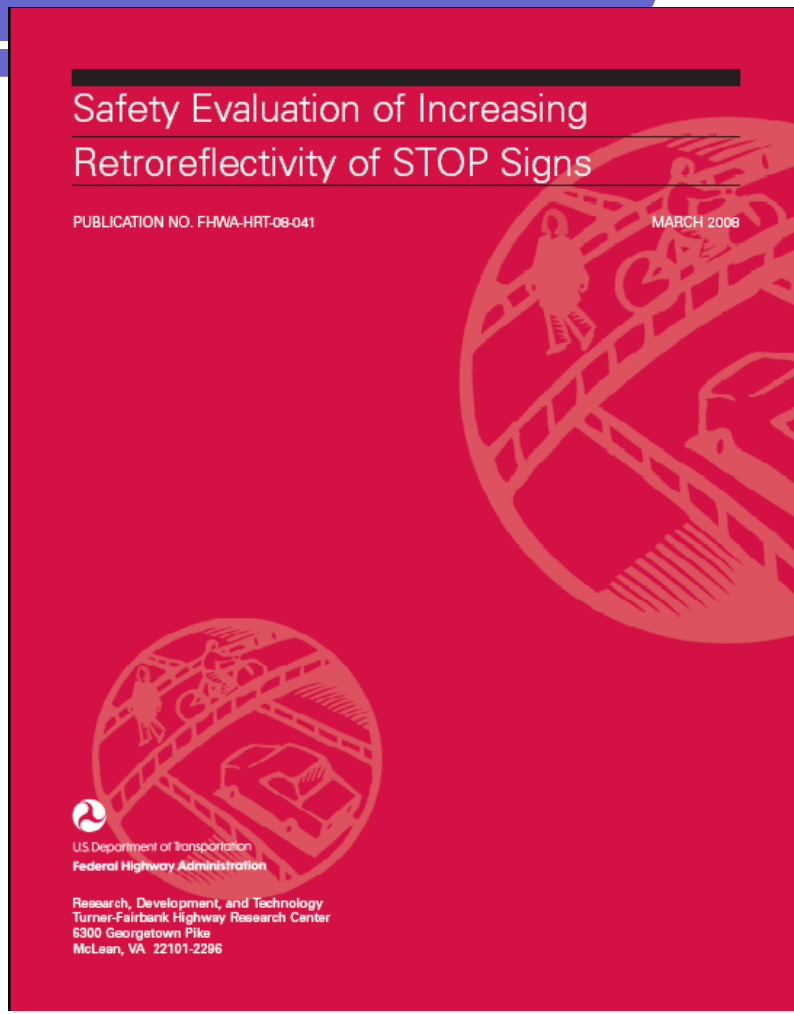
Source:
Douglas A. Ripley
2005 TRB Annual Meeting
Howard R. Green Company

Summary of "Safety" Studies

- Sioux City –
  - City-wide Application
  - Reported crash reductions
  - Day/Night Ratio
  - 34:1 B/C
  - Program continued
- Putnam County
  - Spot Locations
  - 25% reduction in crashes
  - 50% reduction in nighttime
  - Crash Types
  - Program continued
- Mendocino County
  - Spot Locations
  - 42% reduction in crashes
  - Program continued
- ICBC
  - Each Crash prevented has positive cost-benefit ratio
  - Program expanded

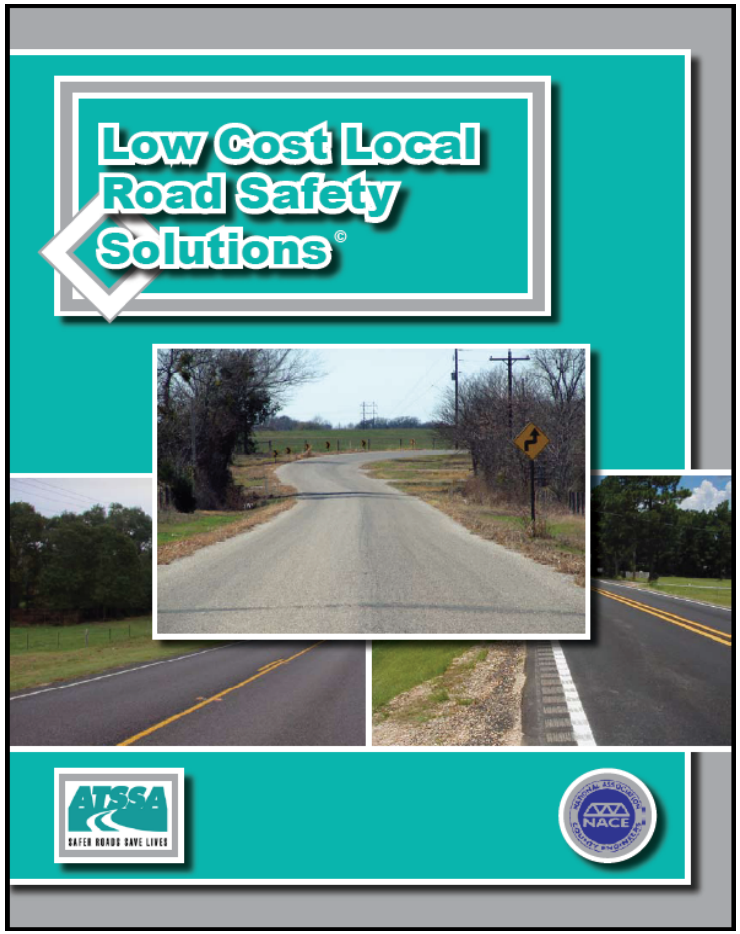
Safety of Stop Sign Upgrades

- Stop signs upgraded in South Carolina and Connecticut
- Before-and-after study conducted
- Mixed findings but cost effective at lower-volume intersections
- FHWA-HRT-08-041



U.S. Department of Transportation
Federal Highway Administration

Sign Upgrade – Low Cost Solution



Volume 1 No. 1

LOW COST LOCAL ROAD SAFETY SOLUTIONS

Sign and pavement marking improvements result in a 42% reduction in crashes, yielding benefit-cost ratios of 159:1 to 299:1.

Sign and Pavement Marking Improvements Reduce Crashes

According to the National Highway Traffic Safety Administration, in 2004 rural roads accounted for approximately 57 percent of all fatal crashes. Contributing factors on secondary roads include sharp curves, no shoulders, no pavement markings, and inconsistent signing. Mendocino County in the county roads (approximately 220 miles), identifying potential signing and marking deficiencies, recommending changes based on the current California Department of Transportation (Caltrans) signing and marking guidelines, and implementing the results. During recurring three-year cycles, all arterials,

MCDOT

http://www.atssa.com/galleries/default-file/LowCostLocalRoads.pdf

Congressional Legislation

1993 DOT Appropriations Act

"The Secretary of Transportation shall revise the MUTCD to include a standard for a minimum level of retroreflectivity that must be maintained for traffic signs and pavement markings which apply to all roads open to public travel."

Why Create Minimums?

Daytime

Nighttime

Retroreflectivity Concepts

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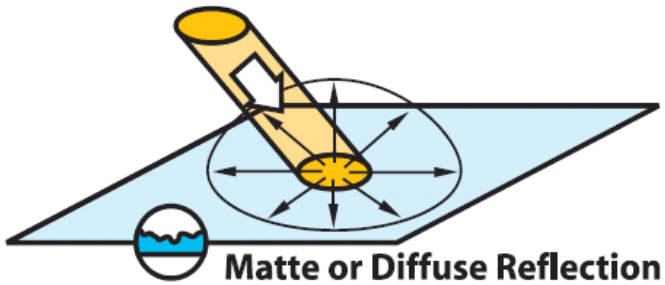
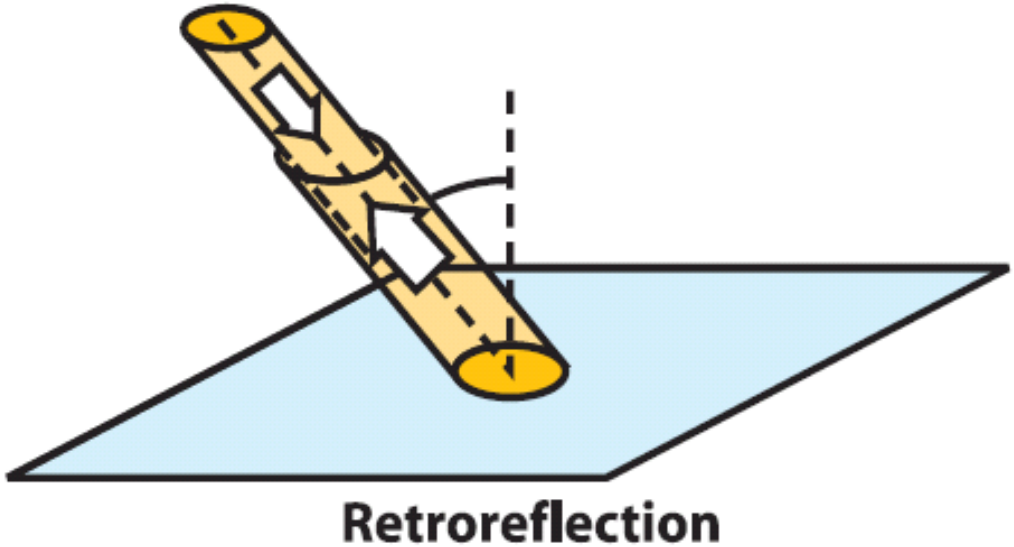
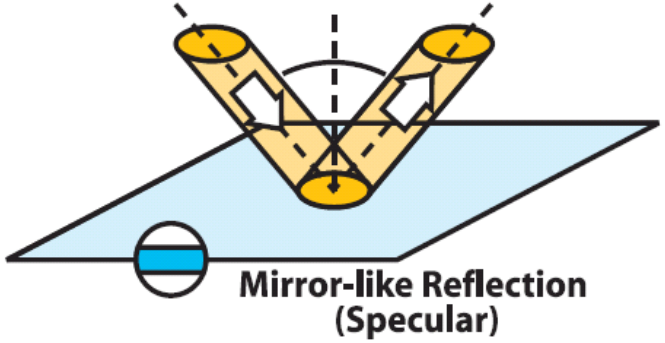
Investment in roadway safety saves lives

RETROreflection



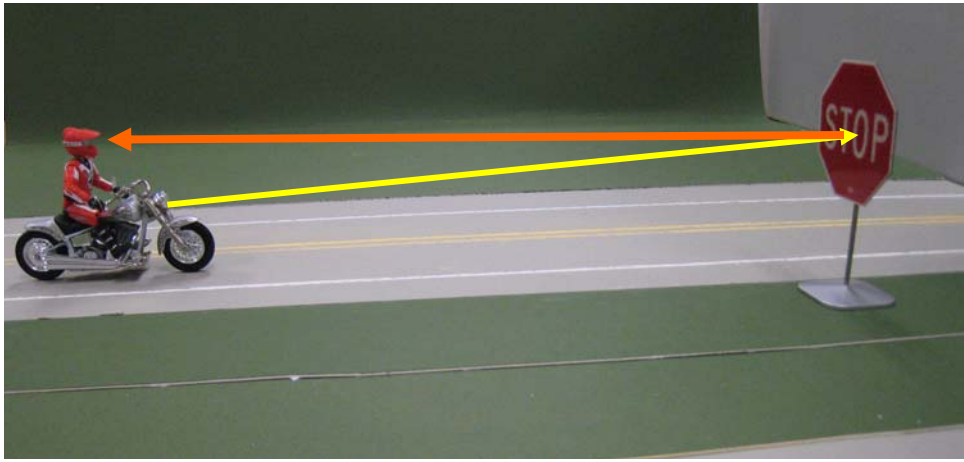




Retroreflection

Informal Definition

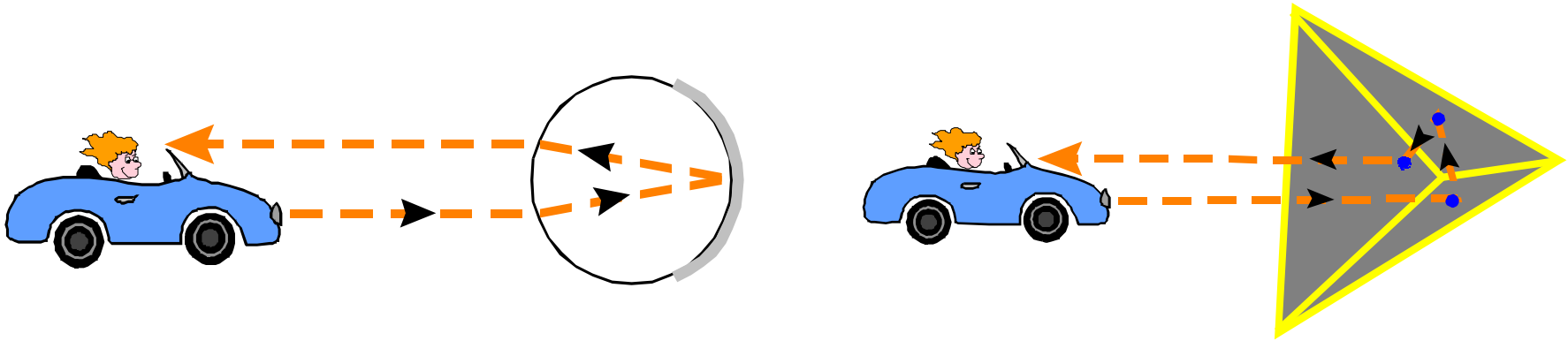
- A ratio of the amount of light returned from a sign versus the amount hitting the sign
- A way to measure the efficiency of a material



$$\frac{\text{Light } \textbf{OUT} \text{ of sign}}{\text{Light } \textbf{INTO} \text{ sign}} = \textbf{Retroreflectivity}$$

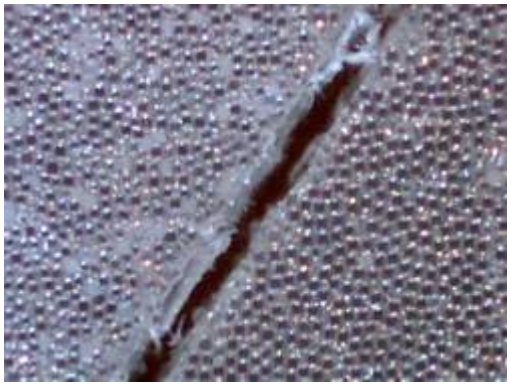
Retroreflective Elements

- Glass spheres and microsized prisms are the current technologies used to make sign materials retroreflective



- The light is returned to the source in a cone shaped pattern

Sign Sheeting Materials

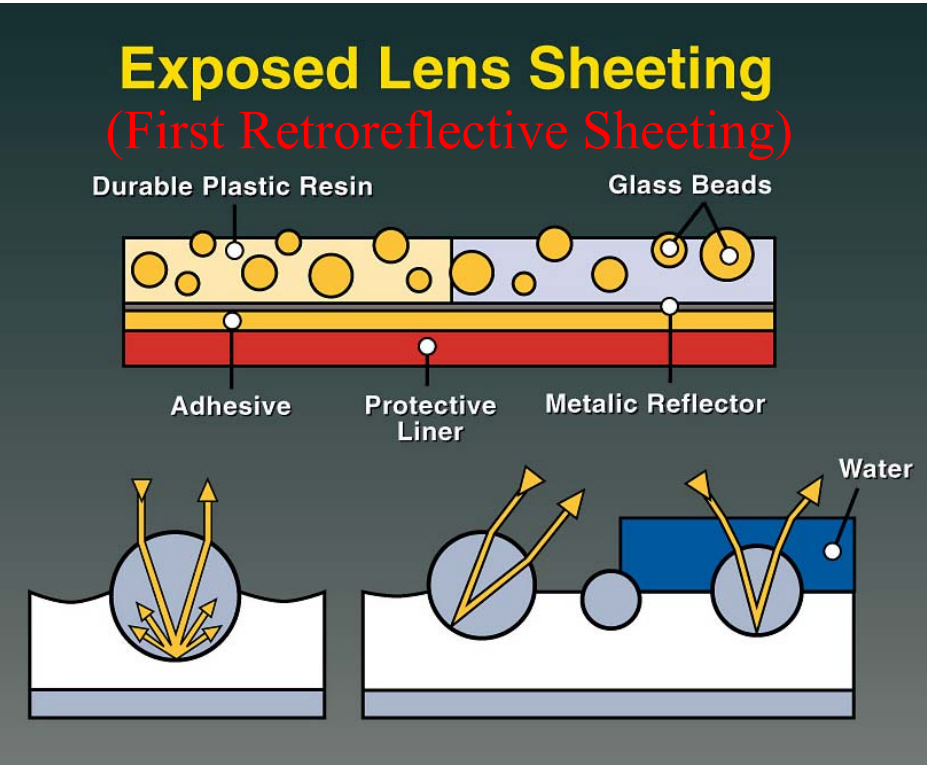


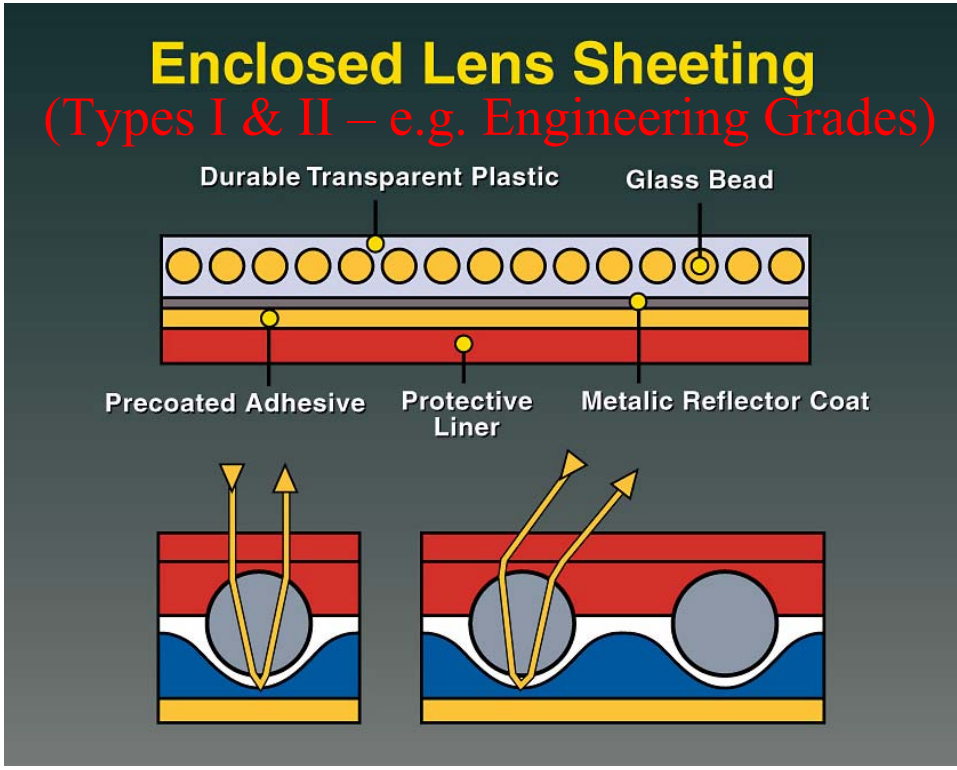
Engineering Grade

Hi-Intensity Beaded

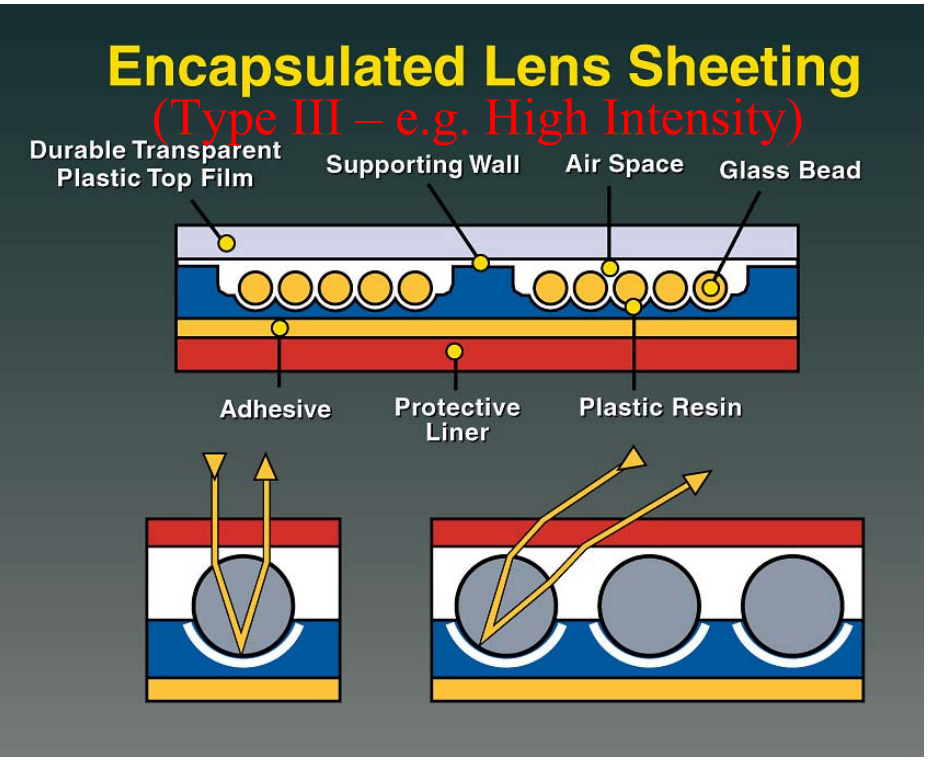
Microprismatic

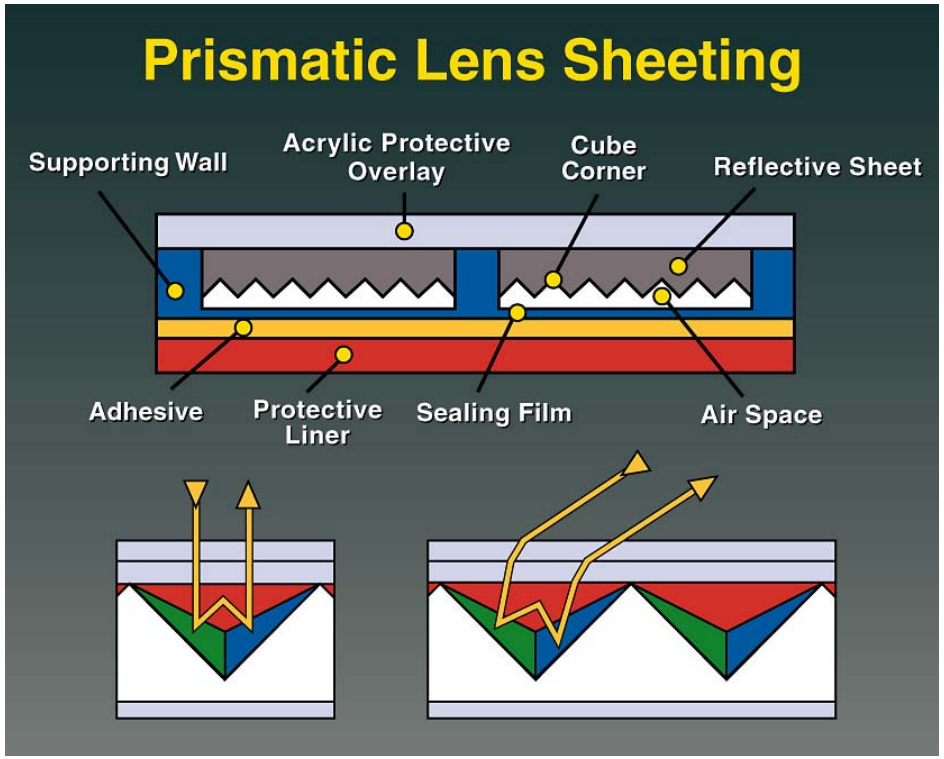
Sign Sheeting





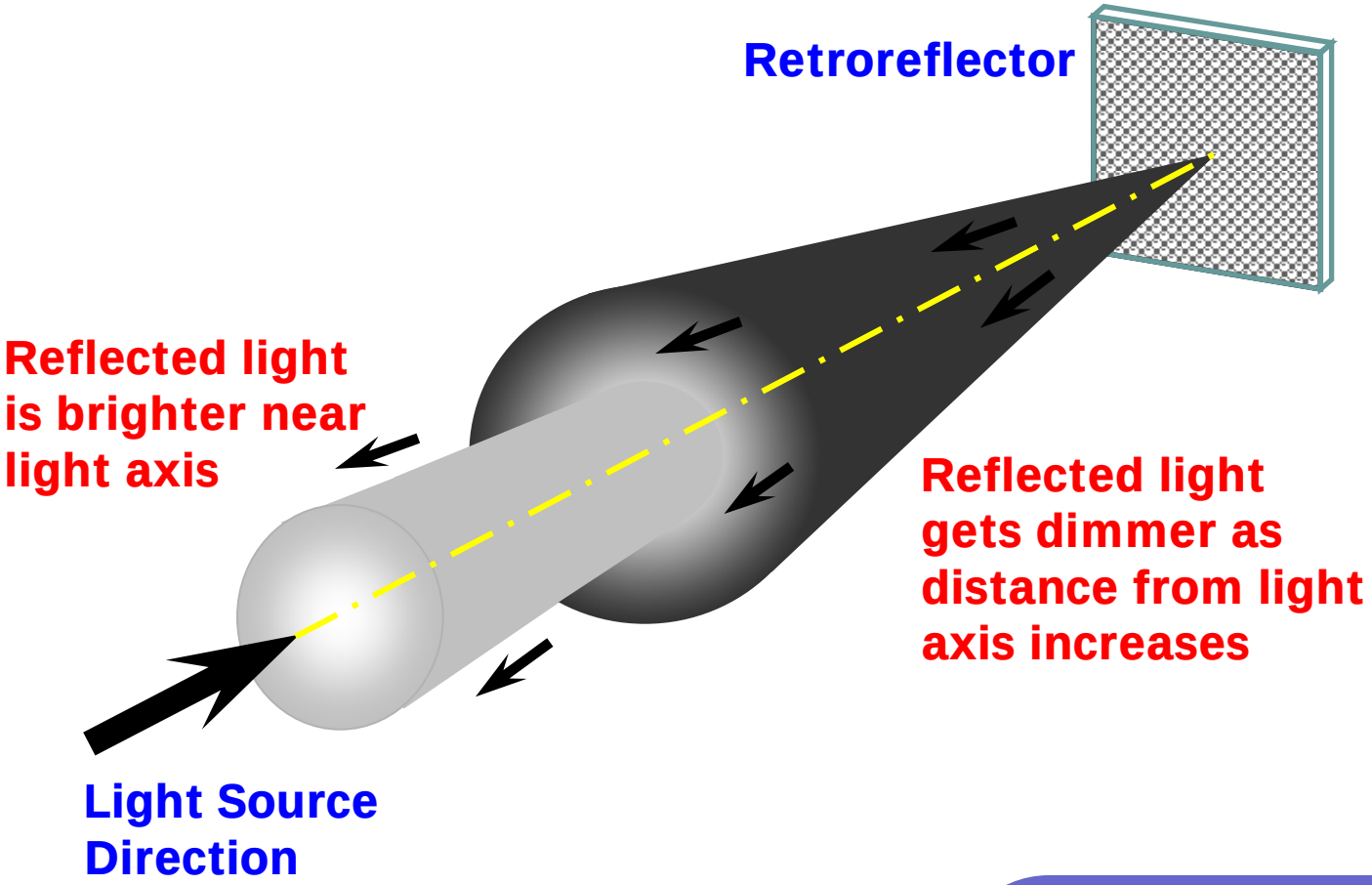
Sheeting Types





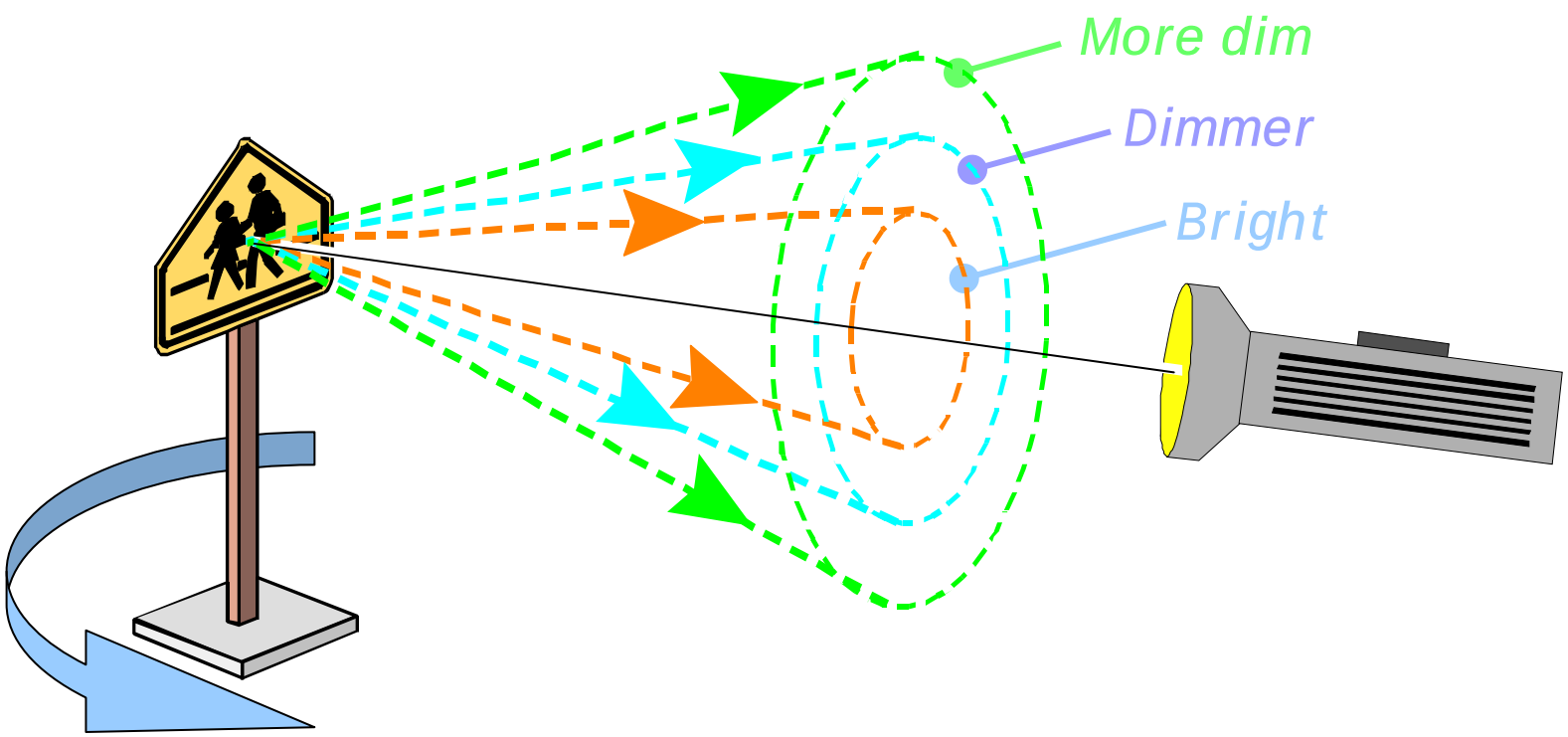
Video Demonstration

Retroreflectivity Cone



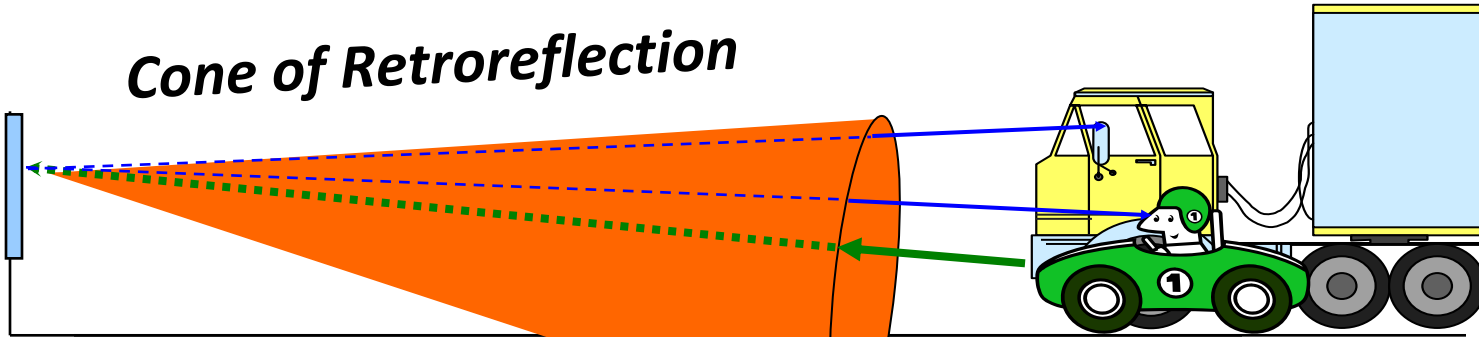
Flashlight Demonstration - Con

Demo



Greg will get sample materials

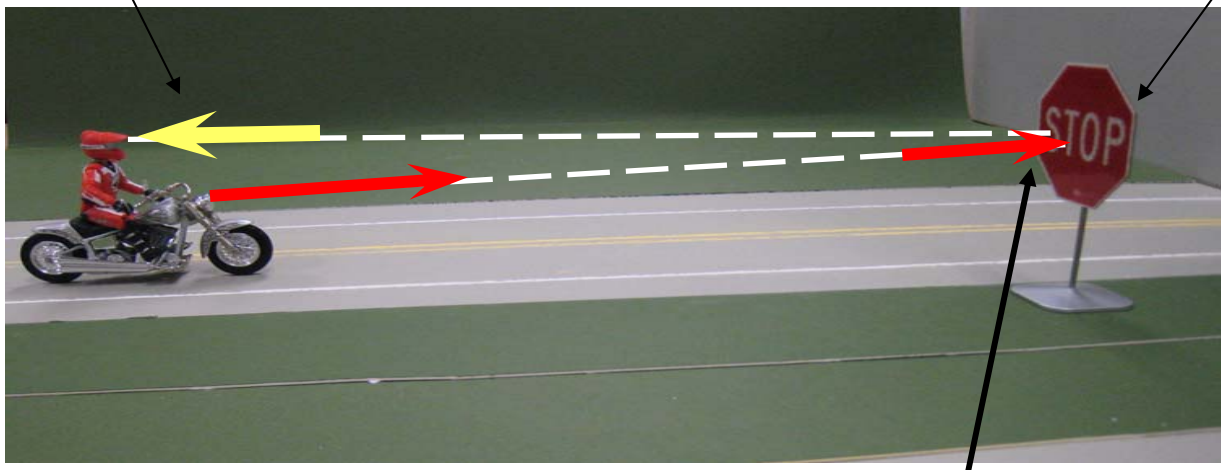
Cone Size is Important



Technical Terms

Luminance
(*cd/m²*)

Retroreflective Sign
(R_A cd/lx/m²)



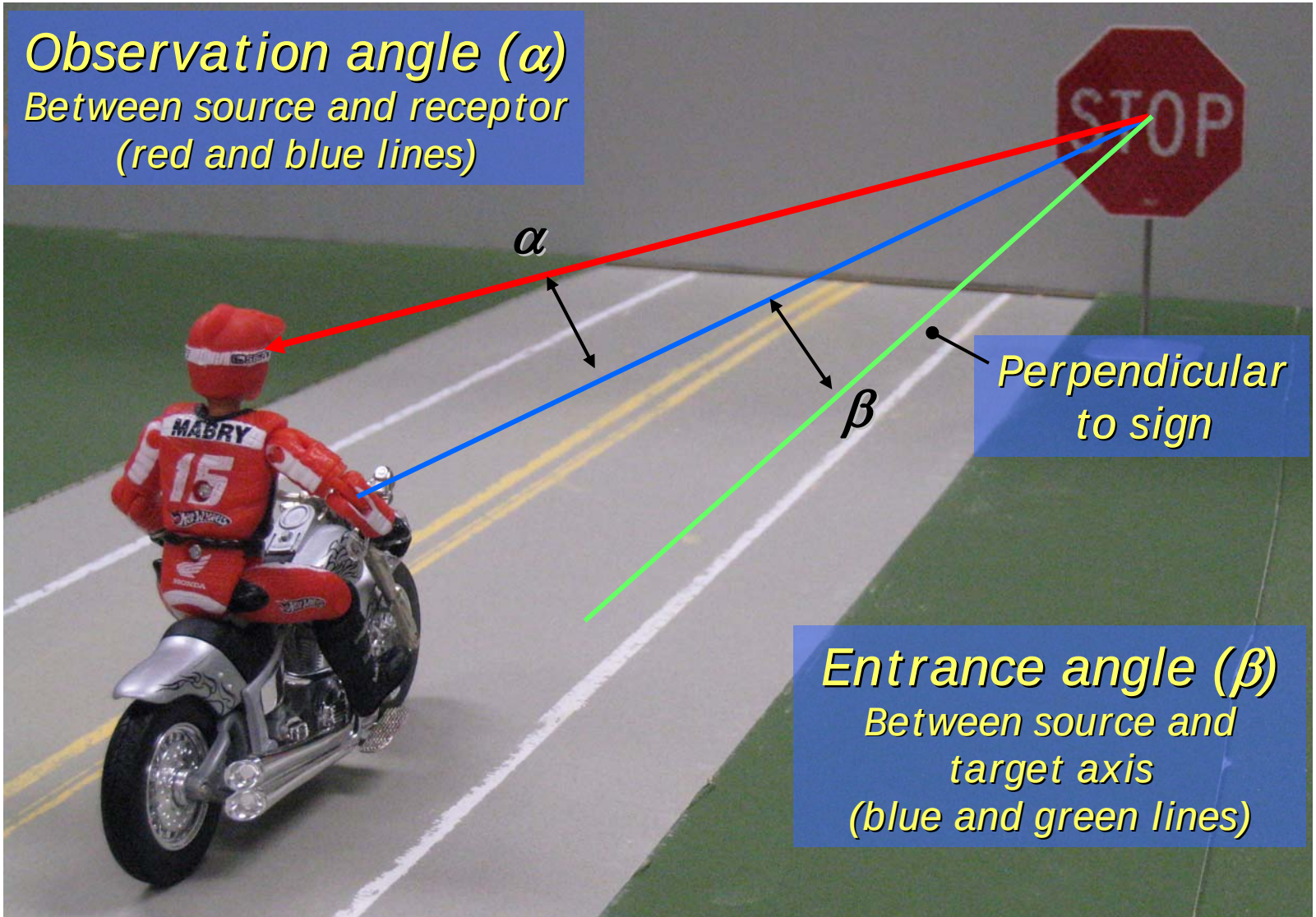
Illuminance (*lx*)

Basic Angles of Retroreflectivity

- Observation Angle – Where in the cone is the measurement made (from the light source).

- Entrance Angle – What is the orientation of the sign or pavement marking (is from the light source)

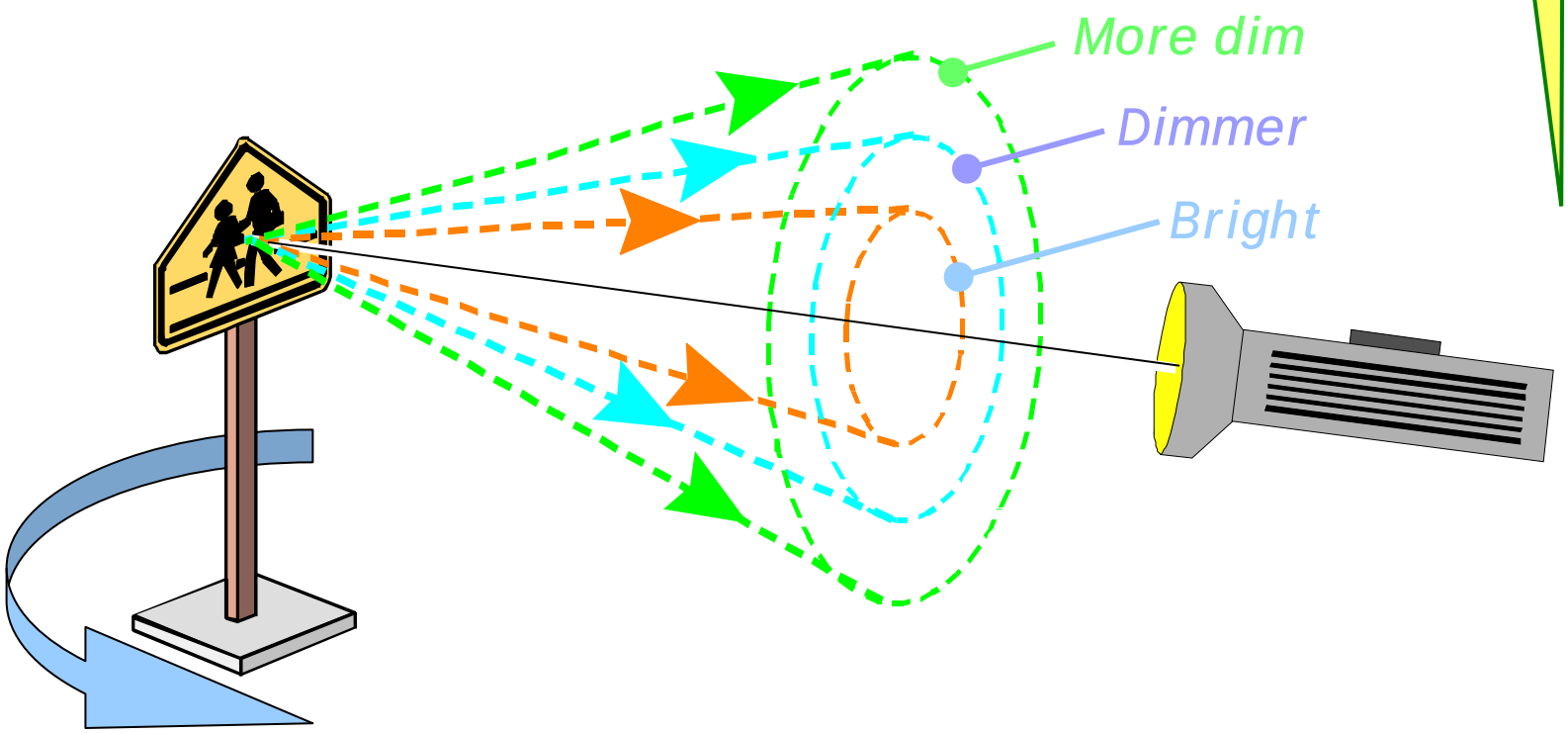
Key Geometry Angles



Penlight Demonstration

Demo

Photo of demo signs



Sheeting Specification Geometry

- Example: ASTM D4956

TABLE 8 Type III Sheeting[A]

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
0.1°[B]	−4°	300	200	120	54	54	24	14
0.1°[B]	+ 30°	180	120	72	32	32	14	10
0.2°	− 4°	250	170	100	45	45	20	12
0.2°	+ 30°	150	100	60	25	25	11	8.5
0.5°	−4°	95	62	30	15	15	7.5	5.0
0.5°	+ 30°	65	45	25	10	10	5.0	3.5

[A] Minimum Coefficient of Retroreflection (R_A) cd/fc/ft^2(cd·lx^{-1}·m^{-2}).
[B] Values for 0.1° observation angle are supplementary requirements that shall apply only when specified by the purchaser in the contract or order.

Questions

Summary

- Does retroreflectivity by itself describe how bright a sign will look?

- Everything else equal, how will a driver in a sports car see a nighttime sign versus a driver in a big truck?

How Retroreflection = Nighttime Visibility

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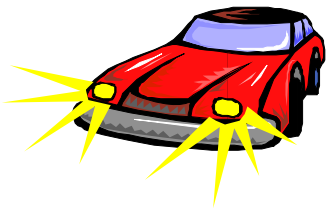
Key Elements of Visibility

Headlamp Illuminance



X

Sign Material Retroreflectivity

=

Luminance

...but that's not all !!

The “Older Driver” Factor

Luminance

X

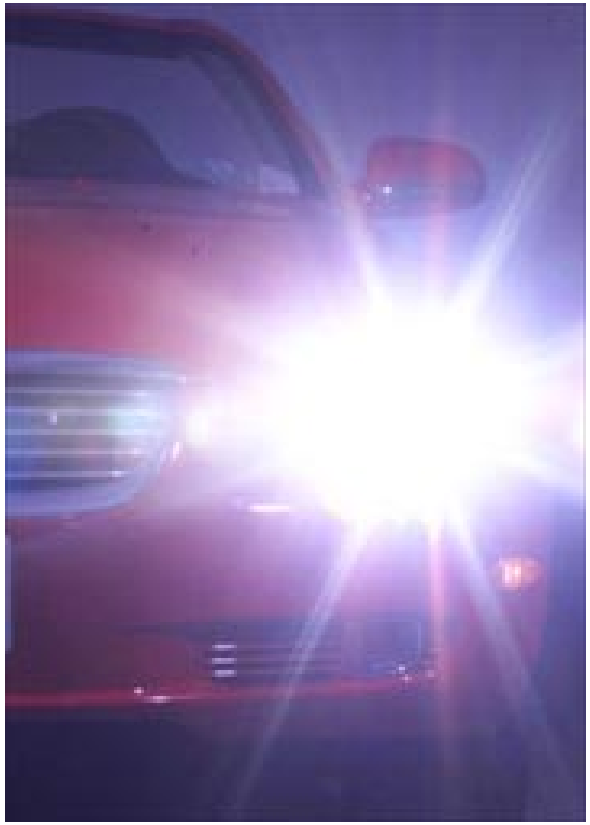
Driver Vision

=

Perceived Brightness

Key Nighttime Visibility Issues

- Sign
  - Location
  - Sheeting materials
- Headlamps
  - Amount of light for signs
- Driver
  - Visual capabilities
  - Comfort level
- Vehicle
  - Size

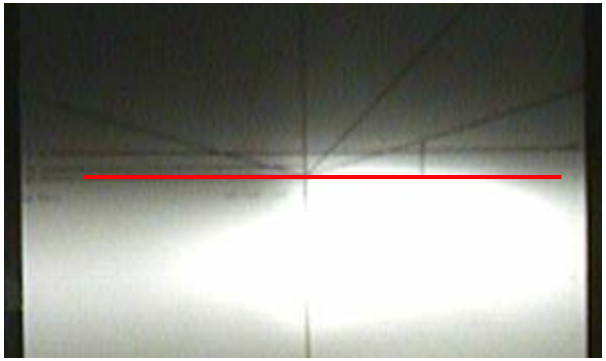


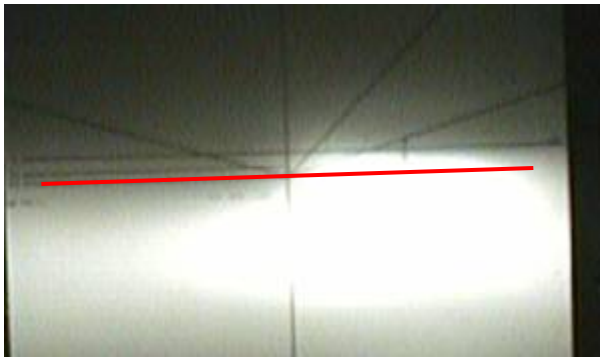
Key Issue: Headlamps

- Out of control of traffic engineers
- Evolving considerably in last decades

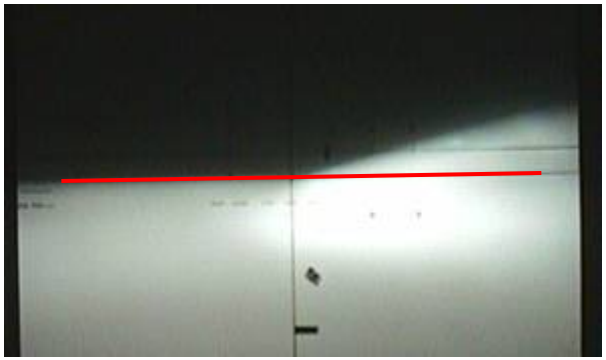
Headlamps

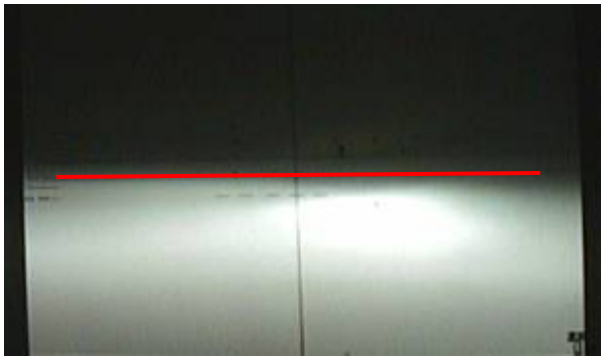
- Sealed Beam Pattern



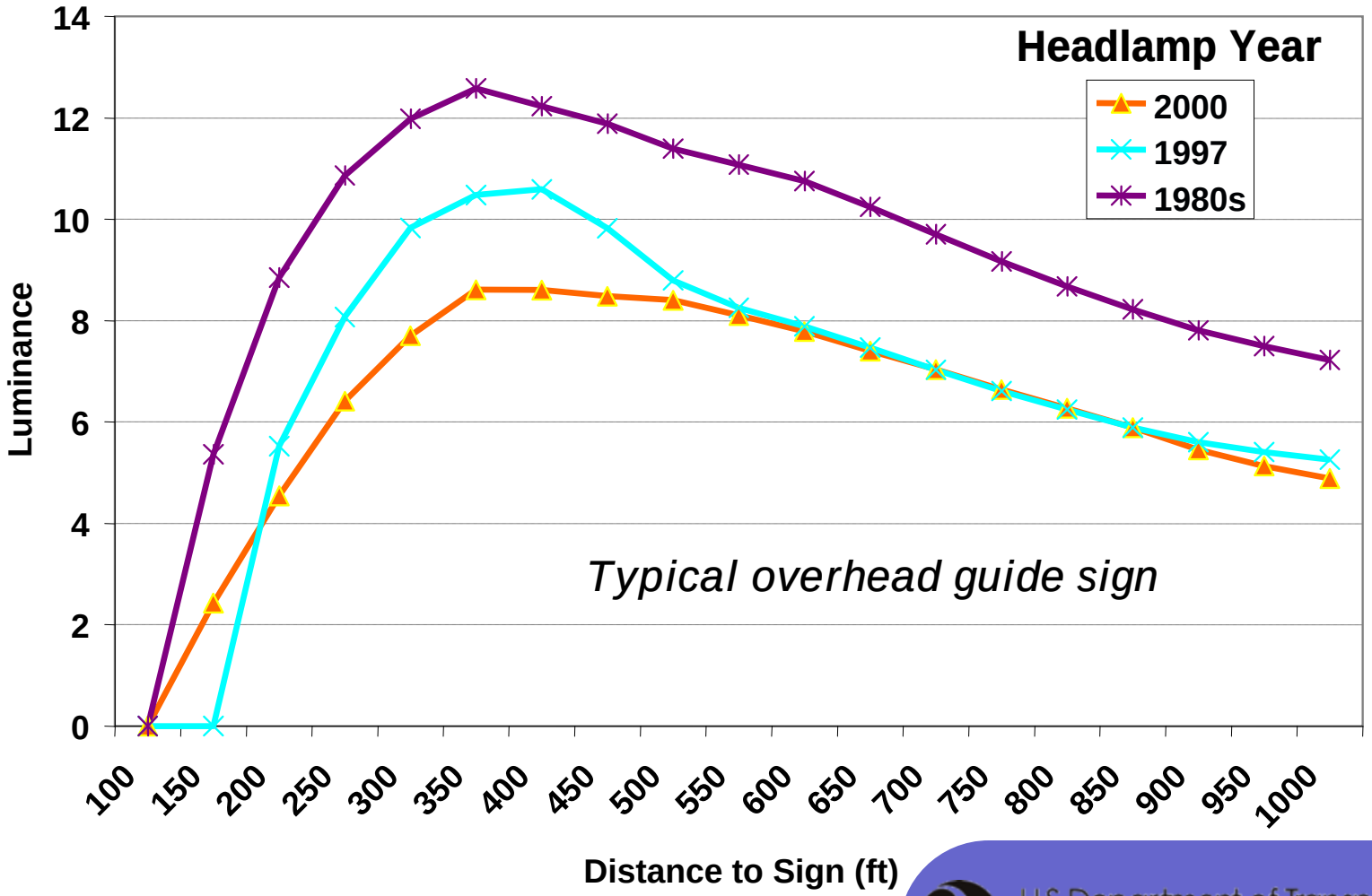


- Modern Cutoff Pattern

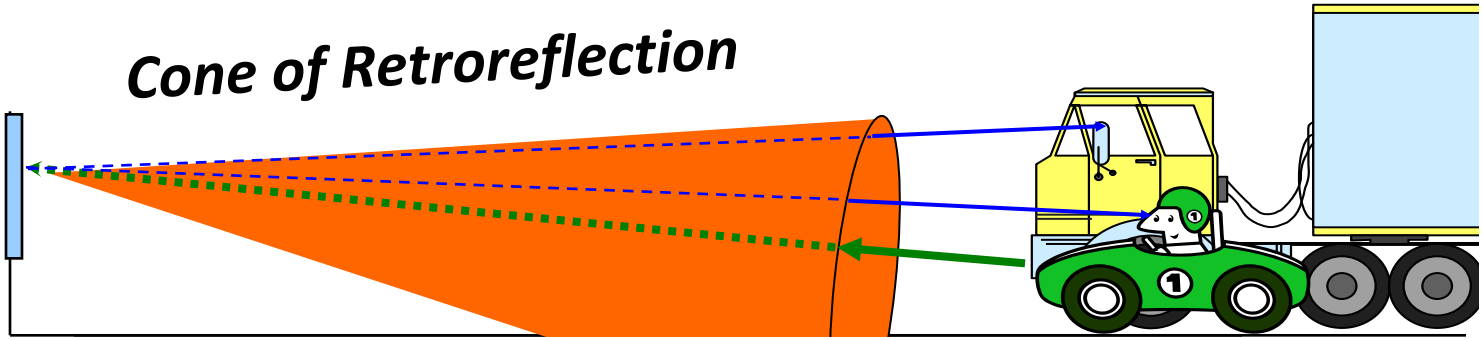




Impacts of Headlamps



Cone Size is Important



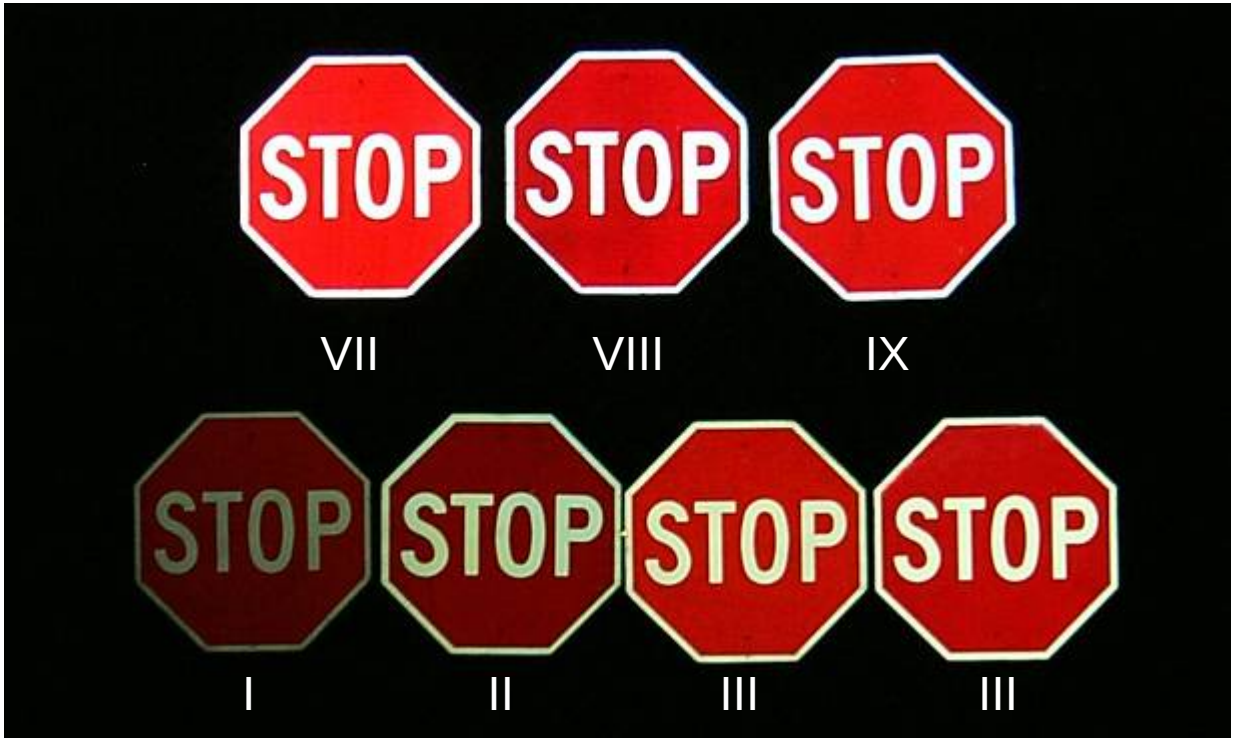
Key Issue: Drivers

- 20.6 million drivers age 70+ in 2006
  - 48% increase from 1990 to 2006
    - 1990 — 8% of drivers were 70+
    - 2006 — 10.2% of drivers were 70+

Example 1

6 different types of material used on these Stop signs

Example 2



7 different types of material used on these Stop signs

Can you see the sign?

New Requirements

MUTCD Sign Retroreflectivity Maintenance Requirements

Safe Roads for a Safer Future
Investment in roadway safety saves lives

Final Rule

Federal Register

- Published on Dec 21, 2007
  - Vol 72, No. 245
- Revision #2 of the 2003 Edition of the MUTCD
- Effective Jan 22, 2008

MUTCD Changes

- Portions of the MUTCD revised:
- Introduction
  - Compliance dates
- Part 1
  - 1A.11 - relation to other publications
- Chapter 2A
  - **2A.09 - minimum sign retroreflectivity**
  - 2A.22 - sign maintenance
- Minor editorial changes to cross-references
  - 2A, 2B, and 6F

New MUTCD Language

Section 2A.09 Maintaining Minimum Retroreflectivity

- "Standard:

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

New MUTCD Language

Section 2A.09 Maintaining Minimum Retroreflectivity

- "Support:

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

New MUTCD Language

"…One or more of the following assessment or management methods should be used…"

- Visual Nighttime Inspection
  - Calibration Signs
  - Comparison Panels
  - Consistent Parameters
- Measured Sign Retro
- Expected Sign Life
- Blanket Replacement
- Control Signs
- Future Method Based On Engr. Study
- Combination Of Any

New MUTCD Table 2A.3
Minimum Maintained Retroreflectivity Levels

Sign Color	Sheeting Type (ASTM D4956-04) ①				Additional Criteria
	Beaded Sheeting			Prismatic Sheeting	
	I	II	III	III, IV, VI, VII, VIII, IX, X	
White on Green	W* G ≥ 7	W* G ≥ 15	W* G ≥ 25	W ≥ 250; G ≥ 25	Overhead
	W* G ≥ 7	W ≥ 120; G ≥ 15			Ground-mounted
Black on Yellow or Black on Orange	Y*; O*	Y ≥ 50; O ≥ 50			②
	Y*; O*	Y ≥ 75; O ≥ 75			③
White on Red	W ≥ 35; R ≥ 7				④
Black on White	W ≥ 50				—

① The minimum maintained retroreflectivity levels shown in this table are in units of cd/lx/m^2 measured at an observation angle of 0.2° and an entrance angle of -4.0°.
②For text and fine symbol signs measuring at least 1200 mm (48 in) and for all sizes of bold symbol signs
③For text and fine symbol signs measuring less than 1200 mm (48 in)
④Minimum Sign Contrast Ratio ≥ 3:1 (white retroreflectivity ÷ red retroreflectivity)
* This sheeting type should not be used for this color for this application.

What do the numbers look like?

Pictures do not represent retroreflectivity well

Quiz

- Which of these signs:
  - Needs to be replaced?
  - Is near the minimum retroreflectivity level?
  - Is adequate and good for a few more years?

A

B

C

Quiz Answers

- Pictures of retro are sensitive to light and position of camera/flash
  - More light = brighter sign
- Example:
  - Same: sign, camera, and camera/flash position
  - Different: flash intensity (amount of light)

Exempt Signs

- Parking/Standing/Stopping
- Walking/Hitchhiking
- Adopt-A-Highway
- Blue or Brown Backgrounds
- Exclusive Use of Bikes or Peds

Note: Must still meet other requirements in MUTCD (inspections, retroreflective, etc,)

Clarification

- Fluorescent colors
  - fluorescent yellow -- > yellow
  - fluorescent yellow-green -- > yellow
  - fluorescent orange -- > orange

Funding … What is eligible

- **Sign Management Programs**: SPR funds and Community Safety Grants. HSIP also, if data supported with link to State's Strategic Highway Safety Plan

- **Sign Replacement: Eligible Federal Aid Programs**: NHS, STP, IM, and HSIP. Also High Risk Rural Roads

- **IMPORTANT**: *Specific eligibility requirements are determined locally. Please coordinate with partnering agencies: local MPO, State DOT, FHWA Highway Safety Office, and the local FHWA Division Office*

Compliance Periods

From "Effective" Date of Final Rule (January 22, 2008):

- **Establish and implement method(s)**
  - 4 yrs (January, 2012)
- **Replace identified regulatory, warning, ground-mounted guide signs (except street-name)**
  - 7 yrs (January, 2015)
- **Replace identified street name & overhead guide signs**
  - 10 yrs (January, 2018)

Summary of New Language

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

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

What Should I Do Next?

- Select maintenance method(s)
- Budget to implement method
- Train inspectors
- Implement maintenance method(s)
- Decide on sheeting types
  - Consider initial and life cycle costs
- Budget for future sign replacement

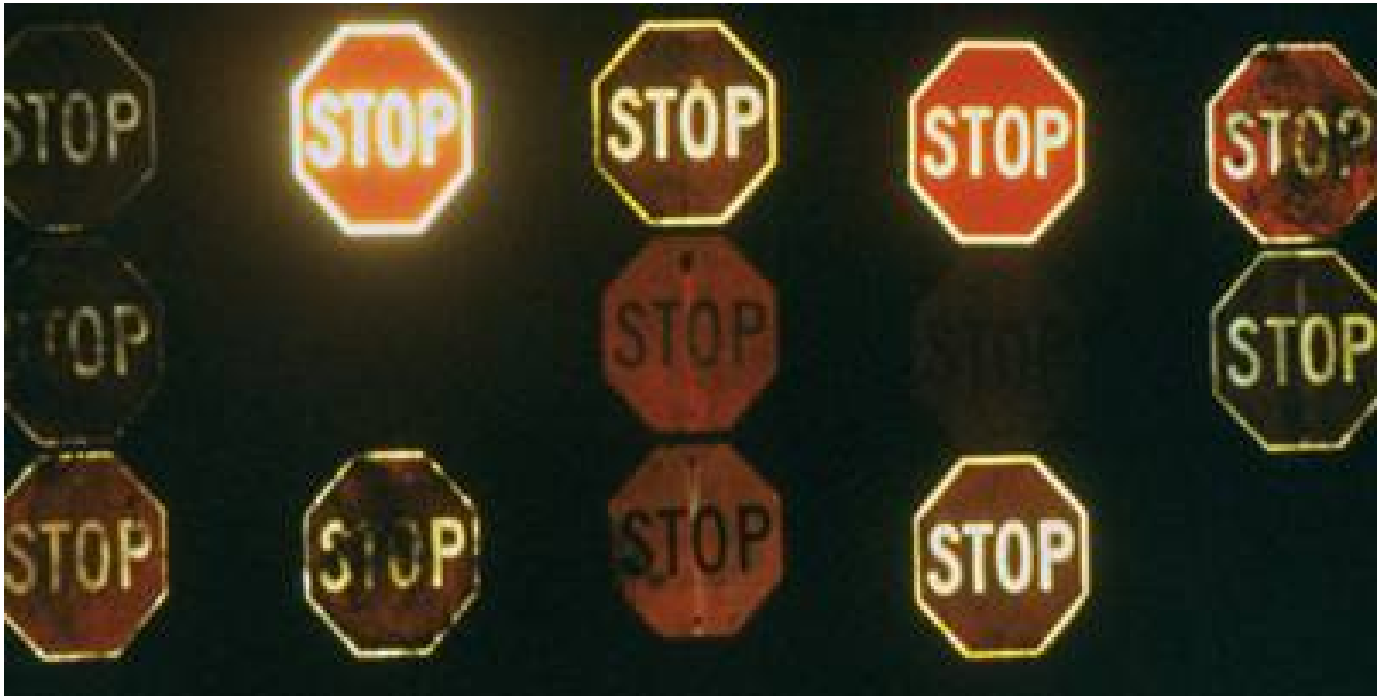
MUTCD Sign Maintenance Methods

How to be in Compliance with new Retroreflectivity Maintenance Requirements

Safe Roads for a Safer Future

Investment in roadway safety saves lives

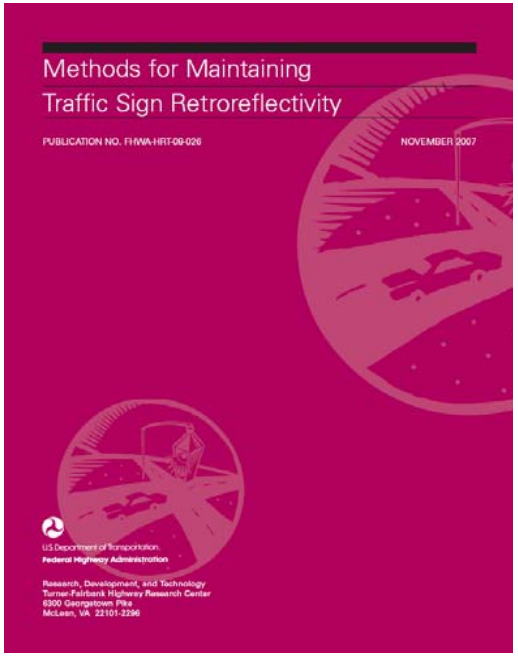
Can we decide to replace signs based on daytime inspections?



U.S.Department of Transportation
Federal Highway Administration

MUTCD Methods

- Visual assessment
- Measured retroreflectivity
- Expected sign life
- Blanket replacement
- Control signs
- Future methods
- Combination of methods



www.fhwa.dot.gov/retro

Method 1: Visual Assessment

- Trained inspector
- Visual inspection at night
- Need to tie to minimum values by using
  - Calibration signs procedure, or
  - Comparison panels procedure, or
  - Consistent parameters

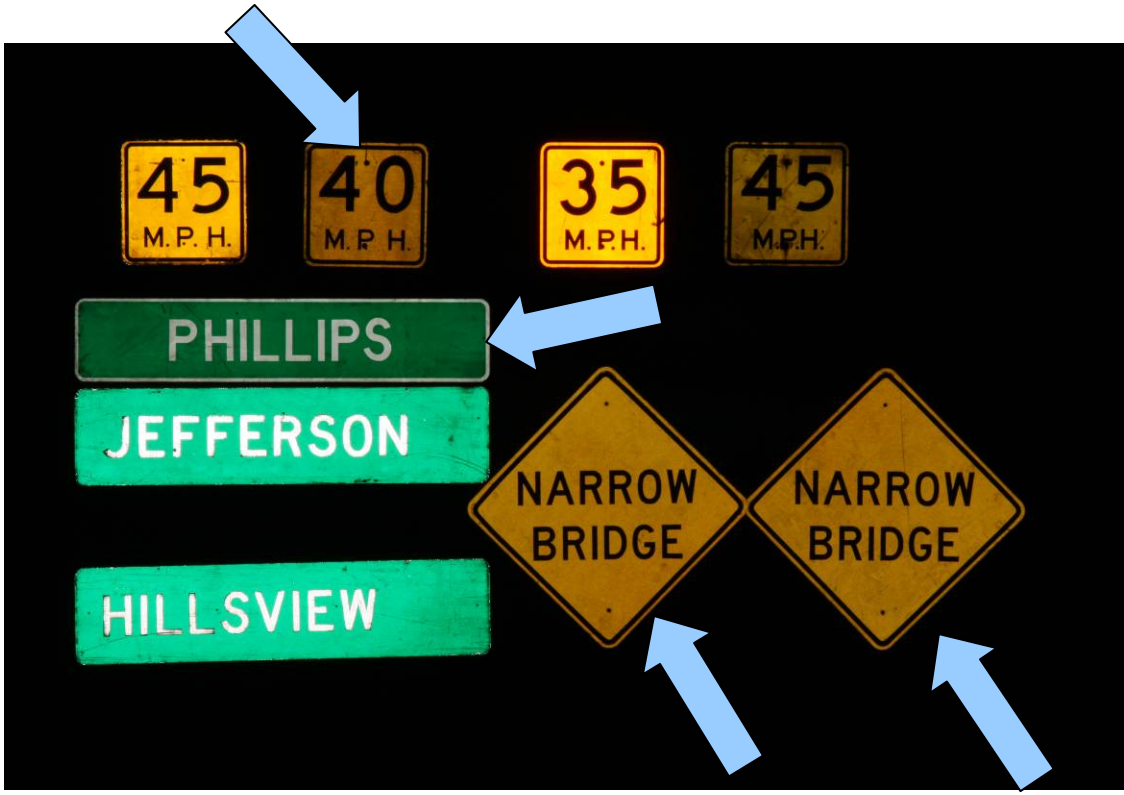
Method 1: Visual Assessment

- Common elements of all visual assessment techniques
  - Aim inspection vehicle headlamps
  - Two-person crew works best
  - Having an inventory is ideal
  - Use low-beam headlamps
  - Have evaluation form and criteria
  - Conduct evaluations at roadway speed

Method 1: Visual Assessment

- "Calibrate" eyes with calibration signs

- Calibration signs are near minimum retro
- Evaluate signs compared to calibration signs



Method 1: Visual Assessment

- Tie to minimum values with comparison panels
  - Panels are near desired retro
  - Clipped to sign - viewed from distance
  - Evaluate signs compared to panels

Method 1: Visual Assessment

- Tie to minimum values by using consistent parameters as used to develop the minimum levels
  - Inspector – older driver (60+)
  - SUV type vehicle
  - Cutoff headlamps
    (properly aimed)

Advantages / Disadvantages

- Advantages:
  - Low administrative and fiscal burden
  - signs are viewed in their natural surroundings
  - Low level of sign replacement and sign waste.
- Disadvantages:
  - Subjective but research has shown that trained observers can reasonably and repeatedly detect signs with marginal retroreflectivity.
  - Exposure of conducting nighttime inspections
  - Paying overtime

MUTCD Methods

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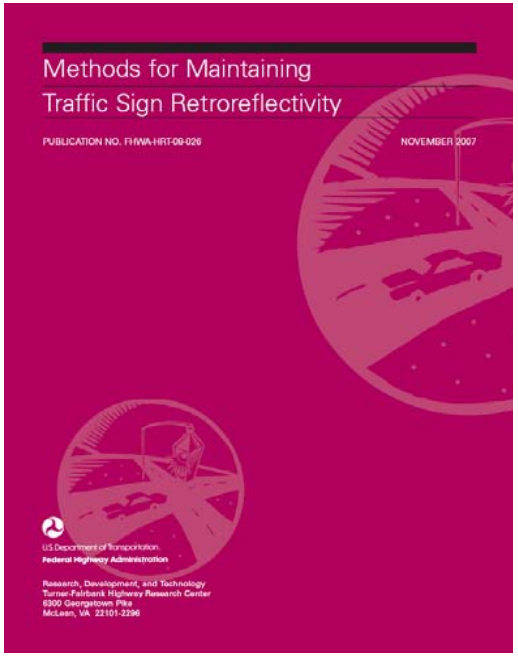

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Method 2: Measure Sign Retro

- Use a portable instrument
- Receive proper training
- Have a protocol for consistency
- Compare readings to minimum values

Examples of Sign Retroreflectometers

Contact Devices:

Model 922
(Gamma Scientific)

Model GR3
(Delta)

Non-Contact Devices:

SMARTS Van

Experimental concept, but NOT yet available.

Handheld Devices as of April 2008

- **RoadVista Model 922**
  - **Annular Device** (one measurement on prismatics)
  - Measurement Point: 1 inch in Diameter
  - Aperture reducer (for measuring narrow text)
  - GPS
  - Data storage (4,500 readings) & Download Software
  - Removable / Rechargeable Battery
  - Entrance Angle -4.0 degrees
  - Measures 2 observation angles at the same time (0.2 & 0.5)
  - Bar code reader
  - ASTM E1709 compliant
  - Extension Pole Kit is Available & Adjustable Entrance Angle Attachment
  - Built in USA

- **Delta RetroSign 4500 now replaced by the New Model GR3**
  - **Point Device** (two measurements on prismatics 0 / 90 degrees)
  - Measurement Point: 1.2 inches
  - Aperture reducer (for measuring narrow text, .625 +/-)
  - GPS
  - Data storage (250,000 readings) & Download Software
  - Removable / Rechargeable Battery
  - Entrance Angle -4.0 degrees
  - 4500 Measures 1 observation angle (0.2)
  - GR3 Measures 3 observation angles at the same time (0.2 0.5 & 1)
  - RFID reader (field tag reading device)
  - ASTM E1709 compliant
  - Extension Pole Kit is Available

Information on Hand-Held Devices

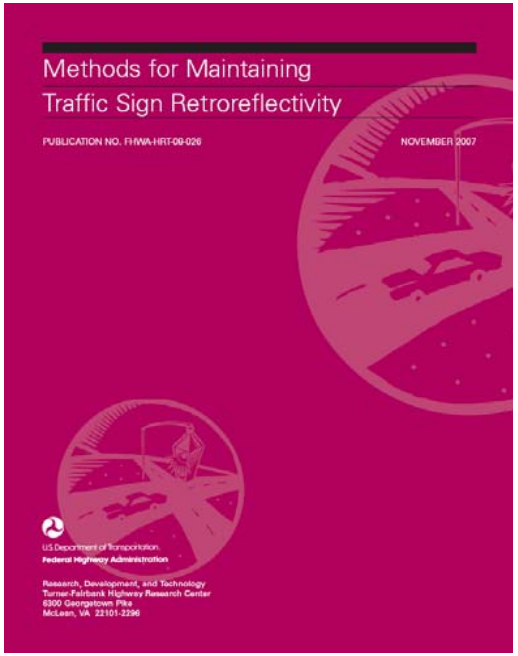
- Delta Retrosign GR3
  - http://www.flinttrading.com
- RoadVista 922
  - http://www.roadvista.com
- Zehntner ZRS (Available in Europe)
  - http://www.zehntner.com/html/download/prospekt_zrs5060_d_e.pdf
- Mechatronic RC200 (Available in Europe)
  - http://www.mechatronic.de/04traffic/en/01/rc2000.html
- As of May 2008

Advantages / Disadvantages

- Advantages:
  - Provides the most direct means of monitoring the maintained retroreflectivity levels
  - Removes subjectivity
- Disadvantages:
  - Cost of instruments (approx $10,000 to $12,000)
  - Measuring all signs in a jurisdiction can be time consuming
  - Using retroreflectivity as the only indicator of whether or not a sign should be replaced may end up neglecting other attributes of the sign's overall appearance.

MUTCD Methods

- Visual assessment
- Measured retroreflectivity
- Expected sign life
- Blanket replacement
- Control signs
- Future methods
- Combination of methods



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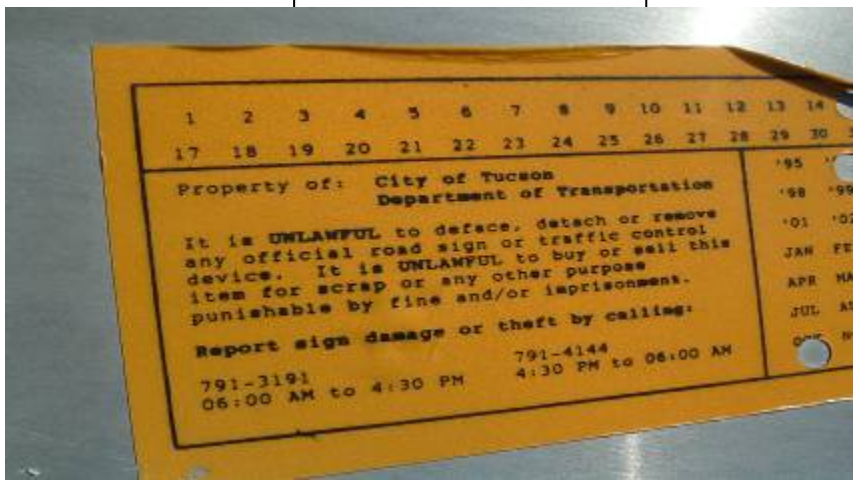
Method 3: Expected Sign Life

- Find the life of the sheeting type in your area
- Replacement based on expected life for individual signs

Indicating Sign Age

- Stickers on front or back of sign to show when fabricated or installed



Determining Sign Life

- ***Build and use a weathering rack like the one shown***
- ***Use AASHTO-NTPEP data***
- ***Use warranty information from sheeting company***
- ***Specify sign life***
- ***Measure existing signs with know install date and compare to min level***
- ***Use weathering data or nearby jurisdiction's weathering data***

Using Warranty Information

- Predicted sign age could be provided in a warranty by sheeting manufacturers.
- Typical warranties not typically based on minimum retroreflectivity levels
- Agencies could develop specifications with warranties based on minimum retroreflectivity levels
  - Example: Warranty Type III sheeting for 15 years in accordance to Table 2A-3 of the MUTCD

Advantages / Disadvantages

- Advantages:
  - This method requires that agencies track the installation date of their signs.
  - Can use a date sticker, bar code, or computerized sign management system
  - Agencies can develop or copy local service life levels
- Disadvantages:
  - It may be time consuming to inspect date stickers if the stickers are not easily viewable or identifiable on the sign.
  - Another possible difficulty relates to marking signs that need to be replaced.

MUTCD Methods

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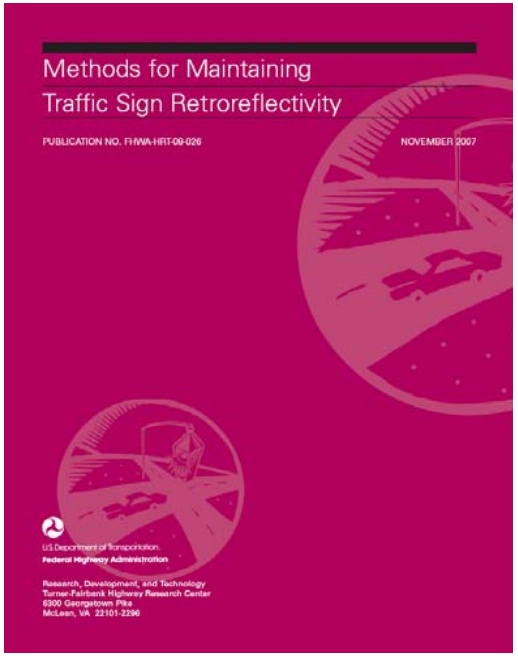


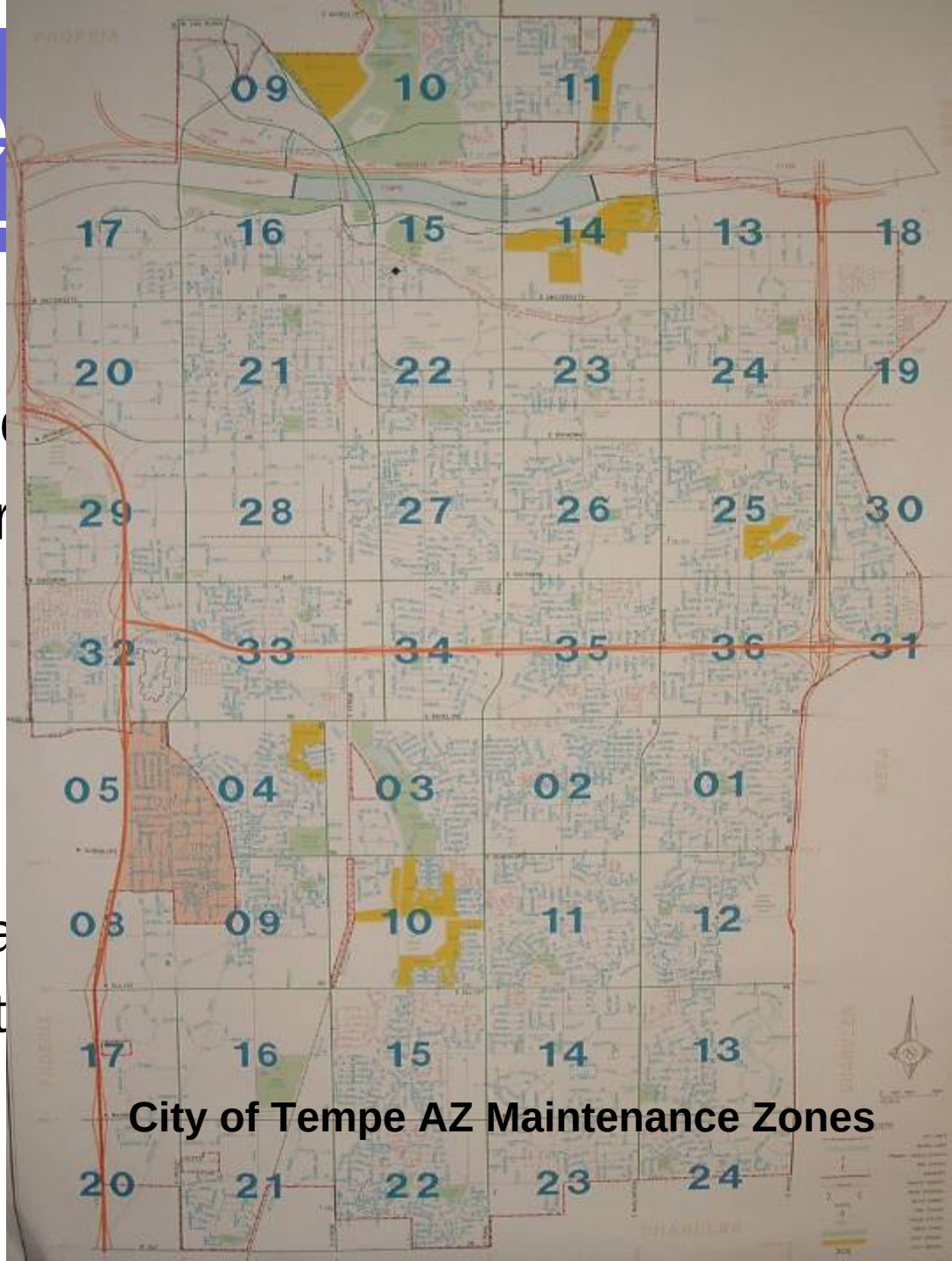
www.fhwa.dot.gov/retro

Method 4: Blanket Replacement

- All signs in an area/corridor are replaced at the same time at specified intervals
- Specified intervals could be set based on expected sign life
- Some existing blanket sign replacement policies exist using 10-12 years for Beaded High-Intensity sheeting signs

Blanket Replace

- Divide agency into areas/corridors or z
- Relate number of ar replacement cycle
- Replace all signs in area/ corridor each replacement cycle
  - 10 yr life, ➔ 10 area
  - Annual replacement area



City of Tempe AZ Maintenance Zones

Advantages / Disadvantages

- Advantages:
  - The major benefit of using this method is that all signs are replaced; there is a low likelihood of a given sign being skipped over or not being replaced. This ensures that all replaced signs are visible and meet minimum retroreflectivity levels.
- Disadvantages:
  - The major drawback to this method is the potential amount of waste than can be generated if signs that are relatively new are removed during a normal replacement cycle.

MUTCD Methods

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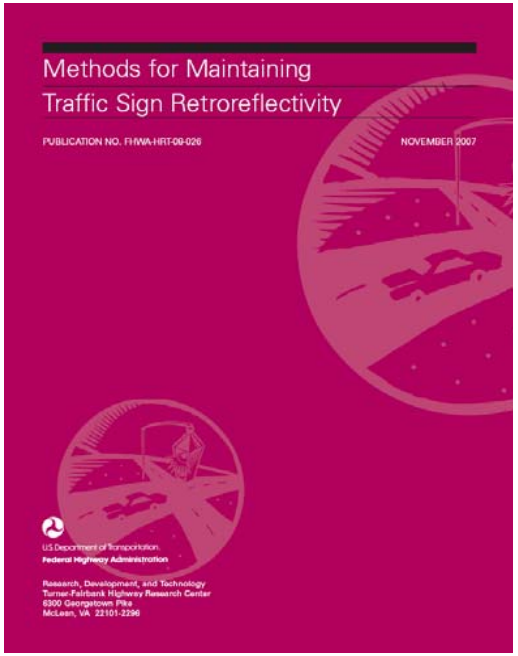
- Combination of methods



www.fhwa.dot.gov/retro

Method 5: Control Signs

- Sign life is estimated using a subset of signs representing an agency's inventory.
  - Subset of signs is the "control signs"
- Control signs can be in-service signs or signs in a maintenance yard.
- Agency monitors control signs to estimate condition of all their signs.
- Periodically measure retroreflectivity of control signs.

Example of Control Signs

Advantages / Disadvantages

- Advantages:
  - Not very labor intensive
  - Low cost option
- Disadvantages:
  - Need to have an adequate sampling of signs
  - Need to have signs selected from in-service signs or have a place in the designated area like a maintenance yard

MUTCD Methods

- Visual assessment
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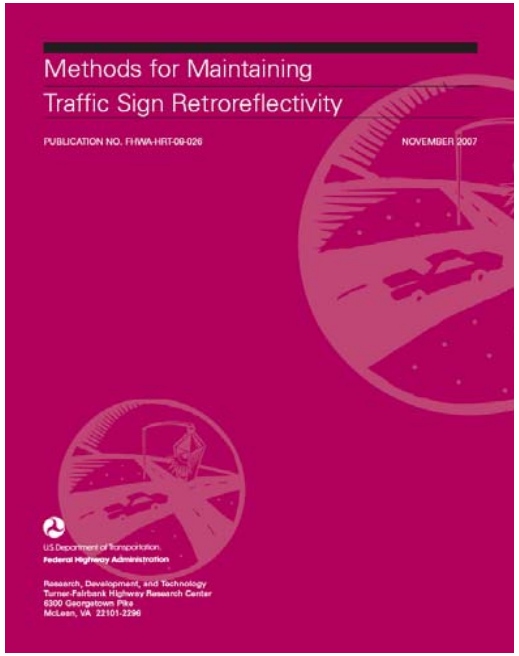

www.fhwa.dot.gov/retro

Method 6: Other Options

- Flexibility is provided for future advancements in technology and methods that have not been fully developed
- Must be based on an engineering study

MUTCD Methods

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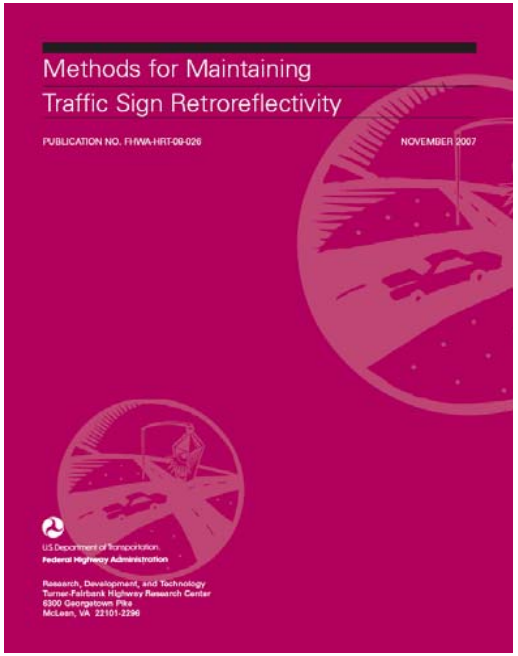


www.fhwa.dot.gov/retro

Combining Methods

- Use one or more of the methods together
  - Support and reinforce each other
  - Use one as quality control of another
- Possibilities
  - Visual inspection to identify signs to be measured
  - Measured retro of control signs

Summary: Methods Allowed

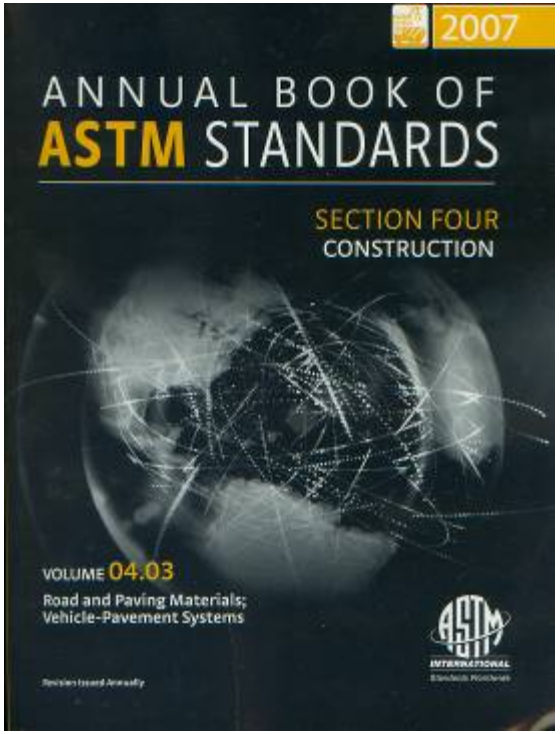
- Visual Nighttime Inspection
  - Calibration Signs
  - Comparison Panels
  - Consistent Parameters
- Measured Sign Retro
- Expected Sign Life
- Blanket Replacement
- Control Signs
- Future Method Based On Engr. Study
- Combination Of Any

What Should I Do Next?

- Select maintenance method(s)
- Budget to implement method
- Train inspectors (ask LTAP for slides)
- Implement maintenance method(s)
- Decide on sheeting types
  - Consider initial and life cycle costs
- Budget for future sign replacement

Decide on Sheeting Types

- Engineering grade (EG)
  - ASTM Type I
- Super engineer grade (SEG)
  - ASTM Type II
- High intensity (HI)
  - ASTM Type III
- Microprismatic (MP)
  - ASTM Types III, IV, VII, VIII, IX, X
- Delineators
  - ASTM Type V
- Roll-up
  - ASTM Type VI



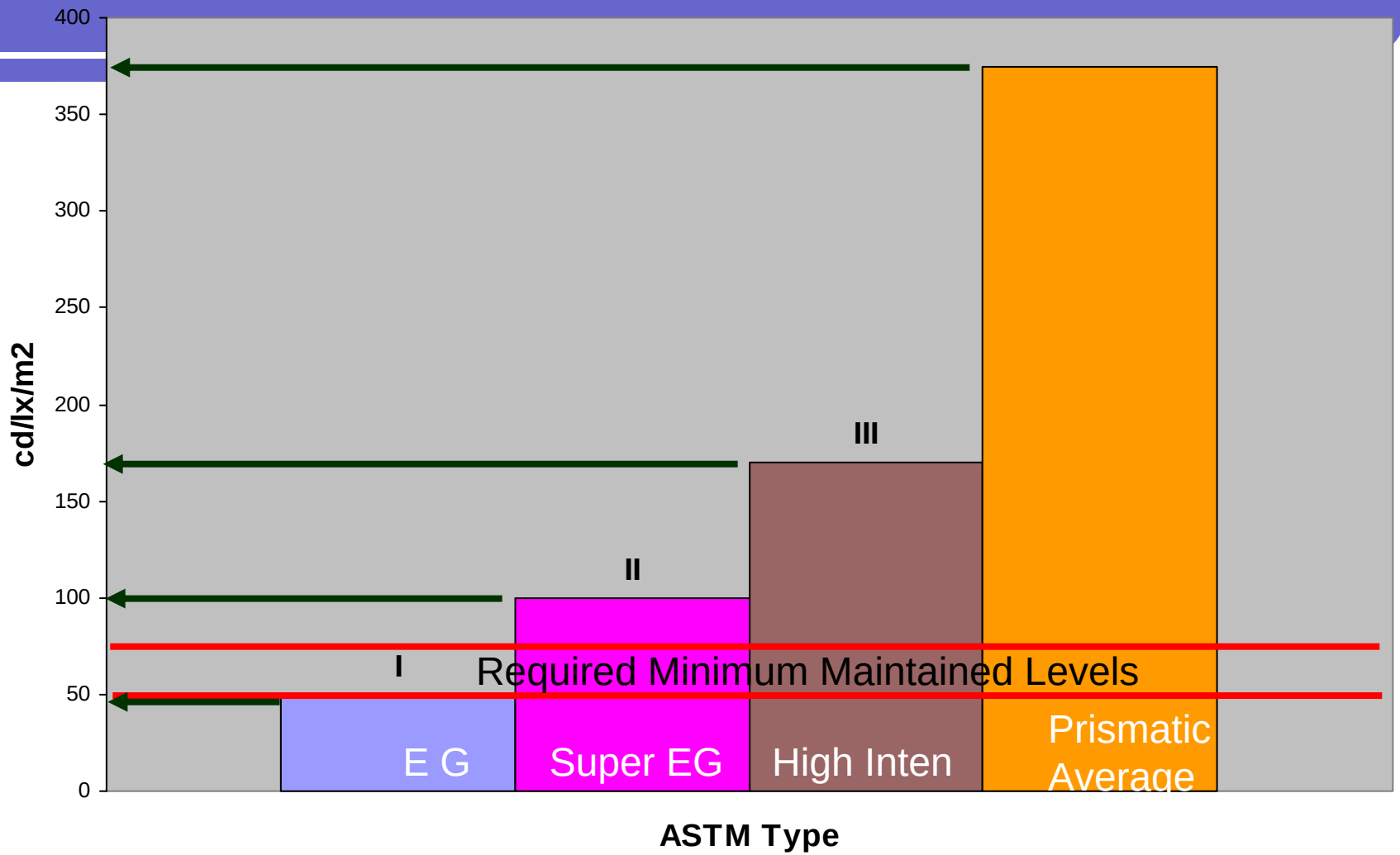
Web link

New MUTCD Table 2A.3
Minimum Maintained Retroreflectivity Levels

Sign Color	Sheeting Type (ASTM D4956-04) ①				Additional Criteria
	Beaded Sheeting			Prismatic Sheeting	
	I	II	III	III, IV, VI, VII, VIII, IX, X	
White on Green	W* G ≥ 7	W* G ≥ 15	W* G ≥ 25	W ≥ 250; G ≥ 25	Overhead
	W* G ≥ 7	W ≥ 120; G ≥ 15			Ground-mounted
Black on Yellow or Black on Orange	Y*; O*	Y ≥ 50; O ≥ 50			②
	Y*; O*	Y ≥ 75; O ≥ 75			③
White on Red	W ≥ 35; R ≥ 7				④
Black on White	W ≥ 50				—

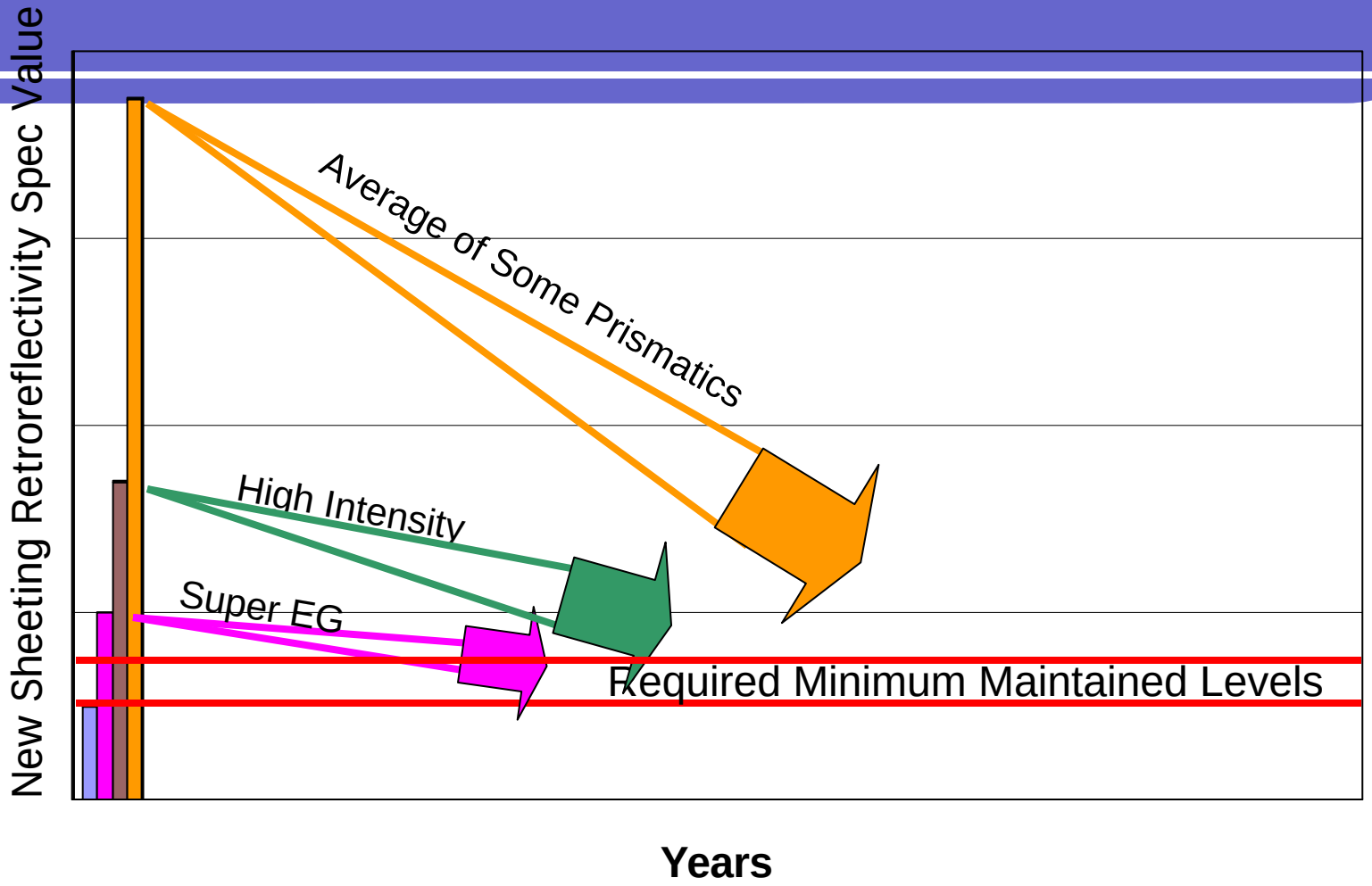
① The minimum maintained retroreflectivity levels shown in this table are in units of cd/lx/m^2 measured at an observation angle of 0.2° and an entrance angle of -4.0°.
②For text and fine symbol signs measuring at least 1200 mm (48 in) and for all sizes of bold symbol signs
③For text and fine symbol signs measuring less than 1200 mm (48 in)
④Minimum Sign Contrast Ratio ≥ 3:1 (white retroreflectivity ÷ red retroreflectivity)
* This sheeting type should not be used for this color for this application.

Yellow - ASTM Specification (new matl, 0.2, -4.0)



Generalized Life of Yellow Sheeting

(no data)



Sign Sheeting Material Costs

- What are reasonable costs you can expect for these materials:
- Assume per sq. ft
  - Engineering Grade ____
  - Super Engineer Grade ____
  - High Intensity Beaded ____
  - High Intensity Prismatic ____
  - Other Prismatic (Avery, NCI, or DG3) ____

Life Costs of Warning Signs with Different Sheetings

- Warning sign
  - Engineering Grade = ____ ÷ 7 = ____$/yr
  - Super Engineer Grade = ____ ÷ 10 = ____$/yr
  - High Intensity Beaded = ____ ÷ 12 = ____$/yr
  - High Intensity Prismatic = ____ ÷ 12 = ____$/yr
  - Other Prismatic = ____ ÷ 16 = ____$/yr

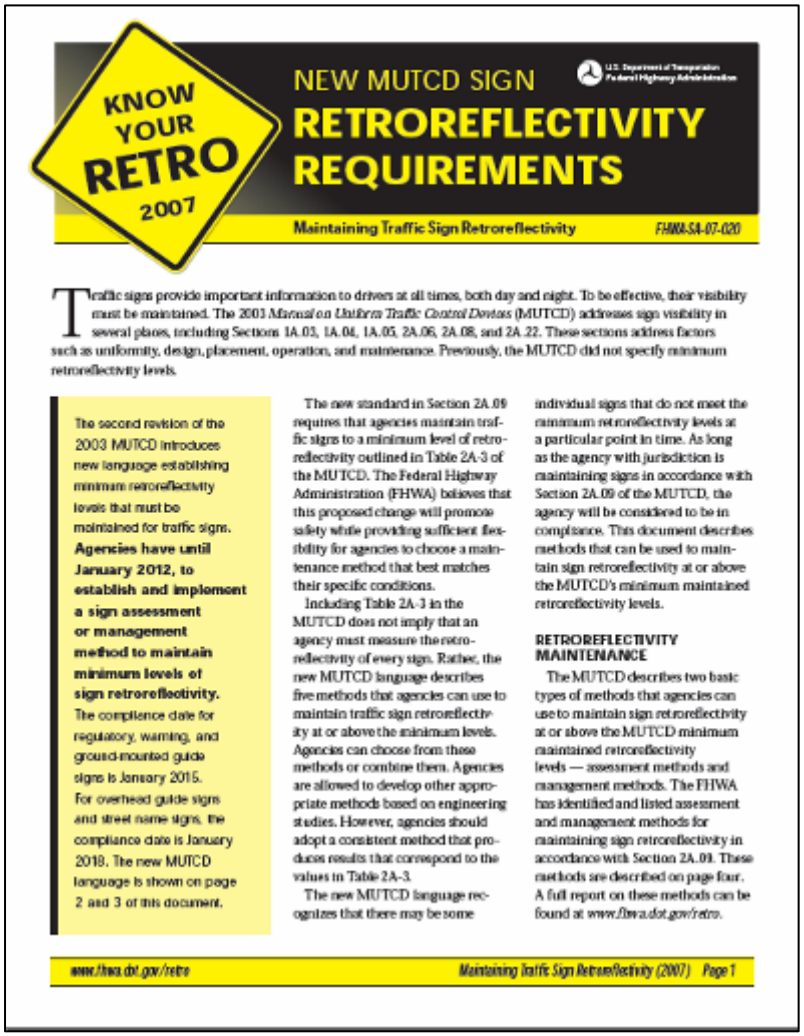
Expected sign life (in years)

Now what if you have 2000 warning signs?

More Information

- ATSSA www.retroreflectivity.net
  - Primer on retroreflectivity
  - Common questions
- FHWA fhwa.dot.gov/retro
  - Summary Brochure
  - Final Rule
  - Power Point Presentations
  - Newsletter Articles
  - Frequently Asked Questions

FHWA Supporting Material



KNOW YOUR RETRO 2007

NEW MUTCD SIGN

RETROREFLECTIVITY REQUIREMENTS

U.S. Department of Transportation Federal Highway Administration

Maintaining Traffic Sign Retroreflectivity FHWA-SA-07-020

Traffic signs provide important information to drivers at all times, both day and night. To be effective, their visibility must be maintained. The 2003 *Manual on Uniform Traffic Control Devices* (MUTCD) addresses sign visibility in several places, including Sections 1A.03, 1A.04, 1A.05, 2A.06, 2A.08, and 2A.22. These sections address factors such as uniformity, design, placement, operation, and maintenance. Previously, the MUTCD did not specify minimum retroreflectivity levels.

The second revision of the 2003 MUTCD introduces new language establishing minimum retroreflectivity levels that must be maintained for traffic signs. **Agencies have until January 2012, to establish and implement a sign assessment or management method to maintain minimum levels of sign retroreflectivity.** The compliance date for regulatory, warning, and ground-mounted guide signs is January 2015. For overhead guide signs and street name signs, the compliance date is January 2018. The new MUTCD language is shown on page 2 and 3 of this document.

The new standard in Section 2A.09 requires that agencies maintain traffic signs to a minimum level of retroreflectivity outlined in Table 2A-3 of the MUTCD. The Federal Highway Administration (FHWA) believes that this proposed change will promote safety while providing sufficient flexibility for agencies to choose a maintenance method that best matches their specific conditions.

Including Table 2A-3 in the MUTCD does not imply that an agency must measure the retroreflectivity of every sign. Rather, the new MUTCD language describes five methods that agencies can use to maintain traffic sign retroreflectivity at or above the minimum levels. Agencies can choose from these methods or combine them. Agencies are allowed to develop other appropriate methods based on engineering studies. However, agencies should adopt a consistent method that produces results that correspond to the values in Table 2A-3.

The new MUTCD language recognizes that there may be some individual signs that do not meet the minimum retroreflectivity levels at a particular point in time. As long as the agency with jurisdiction is maintaining signs in accordance with Section 2A.09 of the MUTCD, the agency will be considered to be in compliance. This document describes methods that can be used to maintain sign retroreflectivity at or above the MUTCD's minimum maintained retroreflectivity levels.

RETROREFLECTIVITY MAINTENANCE

The MUTCD describes two basic types of methods that agencies can use to maintain sign retroreflectivity at or above the MUTCD minimum maintained retroreflectivity levels — assessment methods and management methods. The FHWA has identified and listed assessment and management methods for maintaining sign retroreflectivity in accordance with Section 2A.09. These methods are described on page four. A full report on these methods can be found at *www.fhwa.dot.gov/retro*.

www.fhwa.dot.gov/retro Maintaining Traffic Sign Retroreflectivity (2007) Page 1

- FHWA Retro Web Site

  www.fhwa.dot.gov/retro

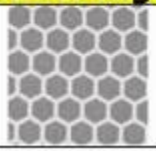
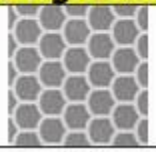
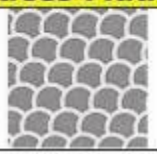
- 4-page summary
- FAQs
- Research Reports

U.S. Department of Transportation
Federal Highway Administration

FHWA Retroreflective Sheeting Identification Guide – September 2005

Notes: ASTM Types are shown as stated by the manufacturers using ASTM D4956-04 "type" designations.
Agencies should verify that the sheeting they use complies with their specifications or ASTM D4956.
FHWA does not endorse or approve any material nor does it determine type category(s) for materials.
This side of the Sheeting ID Guide is for rigid surfaces only. The other side is for flexible surfaces and non-signing applications.

Retroreflective Sheeting Materials for Rigid Sign Surfaces Made with Glass Beads

Example of Sheeting (Shown to scale)									
ASTM Type	I	II	II	III	III	III	III	III	III
Manufacturer	See note A	Avery Dennison®	Nippon Carbide	3M™	ATSM, Inc.	Avery Dennison®	Kiwalite®	LG Lite	Nippon Carbide
Brand Name	Engineer Grade	Super Engineer Grade	Super Engineer Grade	High Intensity	High Intensity	High Intensity	High Intensity	High Intensity	High Intensity
Series Number	Several	T-2000	15000 17000 18000	2800 3800	ASTM HI	T-5500	22000	LH8000 LH8100	N500 N800
NOTES:	A								

Retroreflective Sheeting Materials for Rigid Sign Surfaces Made with Prisms

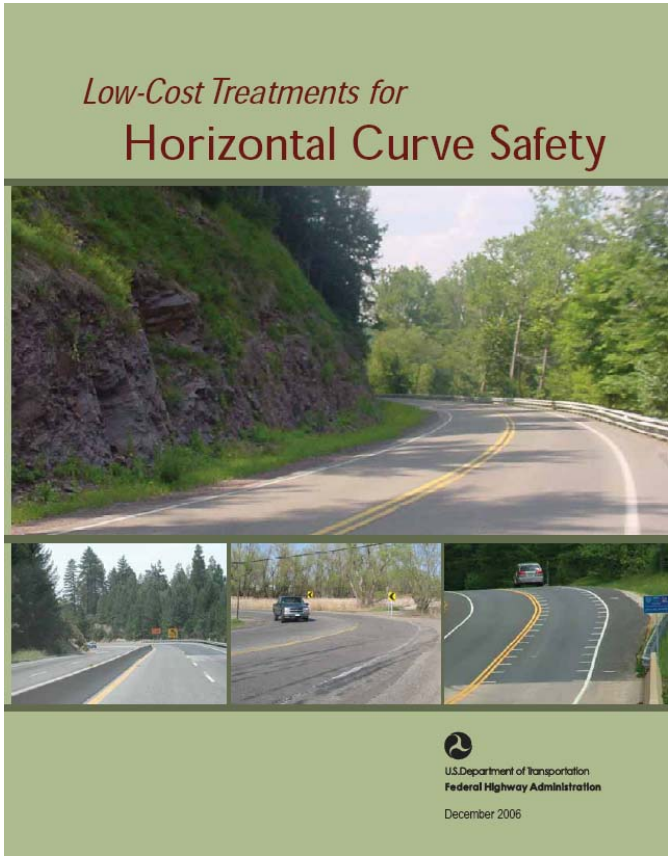
Example of Sheeting (Shown to scale)									
ASTM Type	III, IV	III, IV, X	VII, VIII, X	VIII	IV, VIII	IX	IX	X	Unassigned
Manufacturer	Avery Dennison®	3M™	3M™	Avery Dennison®	Nippon Carbide	3M™	Avery Dennison®	Nippon Carbide	3M™
Brand Name	High Intensity Prismatic	High Intensity Prismatic	Diamond Grade™ LDP	MVP Prismatic	Crystal Grade	Diamond Grade™ VIP	Omni-View™	Crystal Grade	Diamond Grade™ DG3
Series Number	T-6500	3930	3970	T-7500	94000 (IV) 92000 (VIII)	3990	T-9500	93000	4000
NOTES:	B	B	B,D		B,C			C	

A – All the manufacturers listed on the other side of this guide (except Reflexite) provide Engineer Grade sheeting. Engineer Grade sheeting is uniform without any patterns or identifying marks. Visually, it is indistinguishable from lower quality grades (i.e., utility and commercial grades).
B – These materials can be classified as different ASTM Types.
C – These materials are visually indistinguishable from one another.
D – The arrow or "water mark" on this product is no longer included with new productions.

http://safety.fhwa.dot.gov/roadway_dept/safersigns.pdf

Federal Highway Administration

Recent FHWA Related Reports



http://safety.fhwa.dot.gov/roadway_dept/index.htm

U.S.Department of Transportation
Federal Highway Administration

For Further Information

- LTAP contact
- State DOT
- FHWA Division Office

What Should My Agency Do Now?

Act casual, say nothing and hope no one notices, or be proactive and help drivers?