

MAINTENANCE OF SMALL TRAFFIC SIGNS

A Guide for
Street and Highway Maintenance Personnel



U. S. Department
of Transportation

Federal Highway
Administration
Office of Highway Safety

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TABLE OF CONTENTS

| | page |
|--|-----------|
| I. Importance of Maintaining Small Traffic Signs | 1 |
| Regulatory signs | 1 |
| Warning signs | 1 |
| Guide signs | 1 |
| General | 2 |
| II. Repair and Replacement of Sign Panels | 3 |
| Bent signs | 3 |
| Vandalized signs | 5 |
| Repairing vandalized signs | 7 |
| Replacing old signs | 14 |
| III. Repair and Replacement of Sign Supports | 17 |
| Mounting height and location of signs | 17 |
| Safe support systems | 18 |
| Unsafe practices | 23 |
| IV. Materials and Equipment to Maintain Small Traffic Signs | 25 |
| V. Traffic Control | 31 |
| VI. Sign Maintenance Records | 34 |
| VII. Maintenance Tips | 36 |

I. IMPORTANCE OF MAINTAINING SMALL TRAFFIC SIGNS

This handbook is intended to help maintenance workers do a good job of maintaining small traffic signs. Maintaining small signs is important for driver safety. Three kinds of signs help direct traffic flow safely and efficiently.

- **Regulatory signs**

Regulatory signs are the most important signs. They require the driver to take some specific action. Failure to respond to a regulatory action may result in a severe accident. Regulatory signs include STOP, YIELD, SPEED LIMIT, DO NOT PASS, DO NOT ENTER and ROAD CLOSED. **Damaged or destroyed regulatory signs (especially STOP, YIELD, DO NOT ENTER, ONE WAY, and WRONG WAY signs) should be replaced or repaired as soon as possible. Generally, you should replace or repair a regulatory sign on the same day you discover a problem.**

- **Warning signs**

Warning signs are the next most important type of signs. Warning signs include STOP AHEAD, YIELD AHEAD, TURN, CURVE, Railroad Advance Warning, and similar signs. Most of them are diamond shaped. Most permanent warning signs have black letters or symbols on a yellow background. Warning signs alert the driver to conditions that may require an important driving decision or action. **Maintaining warning signs is important and should be done as soon as possible, but not if it delays maintenance of regulatory signs. Generally you should try to repair or replace warning signs within three calendar days of finding the problem.**

- **Guide signs**

Guide signs usually provide directions to drivers and may not be critical to safety. These signs provide directions to parks, nearby towns, airports, hospitals, and similar kinds of information. **Occasionally, missing or damaged guide signs in a critical area can cause delayed or bad decisions that can lead to accidents. Maintenance of guide signs requires your judgement. If you think an accident could result, you must make every effort to fix the sign. If you think the sign is not critical, you should repair or replace it as soon as practical, generally within two weeks.**

- **General**

Remember, doing a good job of maintaining regulatory and warning signs makes the road safer for all drivers. You should keep in mind that an accident could occur because of missing or unreadable signs. Good sign maintenance will increase traffic safety and reduce the chance of lawsuits. Traffic signs must:

- Fulfill a need
- Command attention
- Command respect
- Convey a clear, readable message
- Give enough time for for the driver to respond correctly

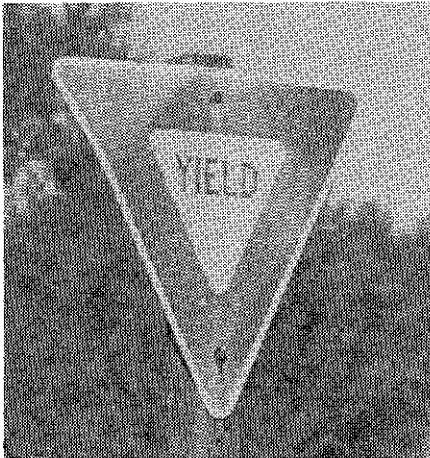
High-quality, well-maintained signs meet these requirements.

II. Repair and Replacement of Sign Panels

You must determine if a sign should be repaired, replaced, or left as is. This is usually a field judgement. More often than not, it is cheaper to replace a badly damaged or unreadable sign than to attempt many repairs. Compare repair costs (and likely sign life) with new sign cost and service life when you decide whether to repair or replace a sign. The policy of many agencies is to replace rather than repair signs that maintenance workers judge to be worn or damaged a lot. **Don't take down a sign and leave nothing.** Take extra signs when you leave the garage. If you decide to make a field repair, consider the following points.

Bent Signs

- Replacement



This YIELD sign is bent in one corner. Even minor bending of a sign is important because it will not permit headlights to light up the sign at night. Minor bending like this should be repaired by removing the sign from the post and straightening the sign.



This NO PASSING ZONE warning sign is badly bent. Panel material of badly bent signs will probably break while you are flattening it. This sign should be replaced as soon as possible with a new one.



This **HANDICAPPED RESERVED PARKING** sign is badly bent. However, since the sign is still readable and is still attached to the parking space post, replacement is not urgent. This is not a traffic safety danger.

● Repair

A bent sign can often be fixed simply by straightening, if the retroreflective background or legend has not been scraped or severely damaged. Remember, if a sign is so badly bent that it will take several hours to fix, it is often cheaper to replace the sign and leave any repair or salvage to a shop operation. To fix a damaged sign you should

1. Straighten the sign. If possible, bend the sign back in place on the post by hand pressure (wear leather gloves). Otherwise, remove the sign from the post, place it on a flat surface such as a truck bed, trailer bed, or fender dolly and pound it flat with a rubber mallet. (A rubber mallet will minimize further damage to the reflective sheeting.)
2. If you carry replacement sign faces, follow the manufacturer's instructions and apply a new sheeting sign face. If you do field patches of the sign face damage, cut the background sheeting from an area slightly larger than the damaged area with a retractable blade knife.
3. Clean exposed surface with Xylol; then varnish maker's and painter's (VM&P) naphtha.
4. Apply matching pressure-sensitive reflective background sheeting, extending it at least 1/2 inch beyond the damaged area.

5. Replace damaged legend with die-cut, pressure-sensitive, prespaced letters, borders, and symbols, and firmly squeegee in place.
6. Edge seal new background sheeting and legend with 3M Co. No. 700 edge sealer or equal. If the sign is subjected to snow burial and replacement sheeting extends to the top edge of sign, place 3M Co. transparent film (No. 639) along top edge.

Vandalized Signs

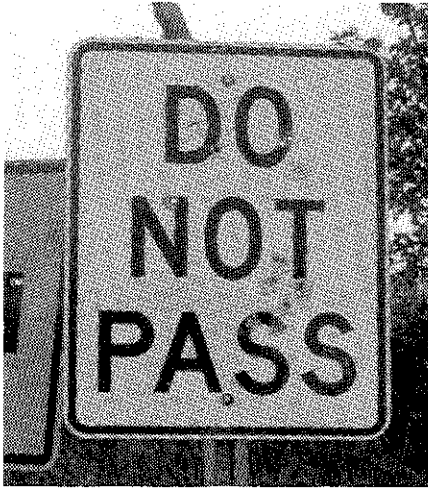
The problem of vandalism must be considered in a sign maintenance program. Defacing and destroying signs happens on all roads and streets. The following signs are examples of common vandalism.

Spray paint on signs



This STOP sign has been sprayed with a light colored paint. Everyone who looks at the sign notices it. Safety effectiveness of the sign is reduced. Either remove the paint or replace the sign face.

Bullet hole damage



This DO NOT PASS sign has been hit by several gun shots. Even with the holes, this sign can be read and will function as intended. But leaving a sign up in this condition looks sloppy and may encourage more gun shots. This sign should be repaired or replaced as soon as practical.

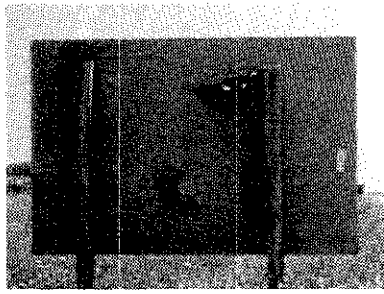
Shotgun blast damage



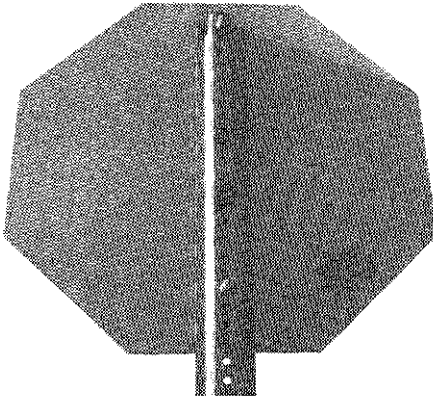
This NO PARKING sign has been struck by a shotgun blast. The retroreflective material can be damaged beyond the hit, and the night visibility may be lost. Check this sign at night, or use the retroreflectivity test described later in this handbook. Then decide if you need to replace it.

To reduce vandalism, consider including these steps in your sign maintenance program:

- Use materials that continue to perform the sign's functions, even though marred. Plywood panels reduce the effect of bullet damage as shown in the two photographs below.
- Use anti-vandal, theft-resistant hardware to prevent the sign from being easily loosened and carried away.



- Place your agency identification on the back of the sign panel. This sticker should have a unique number for each sign in the sign inventory and a warning about vandalizing signs. This will assist law enforcement officials in prosecuting persons stealing or vandalizing signs. Also install a date marking the date of sign installation.



The agency identification marker shown on the back of this STOP sign includes the agency name, who to contact if this sign is found, the sign location code, and a warning about the legal consequences of stealing or damaging this sign.

Repairing Vandalized Signs

- Removing spray paint

Spray paint can be removed without damage to a sign face.

First, assume the paint sprayed on is an enamel-based paint. Wipe the sprayed area lightly with a soft cloth moistened with mineral spirits (for example, toluene). Continue wiping lightly until the spray paint is removed. If this does not work, go to the second step.

Second, assume the paint sprayed on the sign is a laquer-based paint. Wipe the sprayed area lightly with soft cloth moistened with laquer thinner. Continue wiping lightly until the spray paint is removed.

Both steps are not supposed to damage the sign face material, but it is a good idea to make a nighttime reflectivity check or a nighttime visual inspection of all signs from which you have removed spray paint.

● Patching holes and punctures

Many times it is not necessary to repair each hole in a sign. When a hole does not damage the message or symbol and does not create the impression of a sloppy sign, you need to ask whether repair is really needed. If you decide to make a field repair on the sign, it is suggested that you follow these steps:

Retroreflective aluminum sign panels

1. Remove all damaged background sheeting and legend. Usually this means about one inch from the edge of the hole. A retractable blade knife is a useful tool for this.
2. Straighten the sign (flatten out the hole puncture nipple area) using a ball peen hammer and a flat surface (truck bed, trailer bed or a fender dolly if you have one).
3. Remove any additional sheeting damaged during straightening.
4. Clean the entire area with Xylol; then apply varnish maker's and painter's (VM&P) naphtha.
5. Patch the hole or puncture on both sides of the sign backing material using 3M Co. No. 425 UAL aluminum foil tape or equal. Use a squeegee to apply firm pressure on both sides of the sign. On large holes, start placing the foil at the bottom of the hole, overlapping each strip about 1/4 inch in shingle fashion as you move up and cover the hole area.
- *6. Apply retroreflective background sheeting, extending it at least 1/2 inch beyond the foil tape strips.
- *7. Replace damaged legend with die-cut, pressure-sensitive, prespaced letters, borders, or symbols and firmly squeegee them into place.

8. Seal edge of new background sheeting and legend with 3M Co. No. 700 edge sealer or equal. If the sign is subject to snow burial and replacement sheeting extends to the top edge of sign, place 3M Co. transparent film (No. 639 or equal) along that top edge.

* NOTE: (Alternate to Steps 6 & 7) If your agency does not want you to make small patches to signs with holes, you may be furnished a portable double-roller unit for applying a full-sized sign face to a sign blank in the field. In that case you will carry with you standard sign faces with pressure-sensitive adhesive backing. After you have completed Step 5, remove the paper material protecting the adhesive backing. Carefully align the new sign face sheet with one edge of the sign blank and spread the new sign face over the sign blank as smoothly as you can by hand. Then crank the sign blank with new sign face through the portable roller unit to properly pressure seat the new sign face. Continue with Step 8 if necessary.

Retroreflective plywood panel signs

1. Remove all loose wood on both sides of the sign and all damaged sheeting.
2. Fill holes with wood filler, let the surface set, and sand smooth if you think the holes need to be filled for a field repair. Allow filler to harden. Small holes can be covered by foil tape without filling.
3. Wipe areas with clean cloth.
4. Cover holes on both sides of the plywood sign back with 3M Co. No. 425 UAL aluminum foil tape or equal. Apply firm pressure to the tape on both sides of the plywood sign back using a squeegee. On large holes, start placing the foil at the bottom of the hole, overlapping each strip about 1/4 inch in shingle fashion as you move up and cover the hole area.
5. Apply retroreflective background sheeting, extending it at least 1/2 inch beyond the foil tape strips on the face of the sign.
6. In the area covered by the patching, replace any damaged legend with die-cut, pressure-sensitive, prespaced letters, borders, or symbols and firmly squeegee them in place.

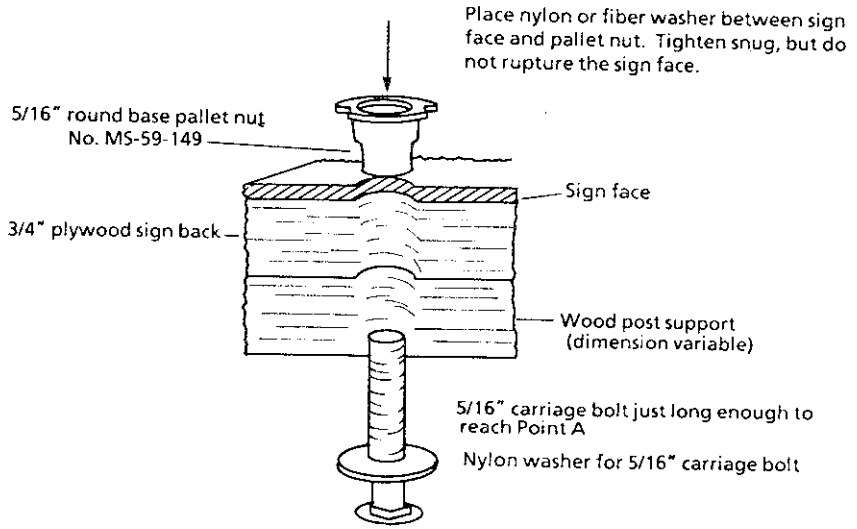
7. Seal edge of new background sheeting and legend with 3M Co. No. 700 edge sealer or equal. If the sign is subject to snow burial and replacement sheeting extends to the top edge of the sign, place 3M Co. transparent film (No. 639 or equal) along the top edge.
8. Lightly spray a sealing film of flat black enamel paint (use an aerosol can) over the aluminum foil tape covering the holes on the back of the sign panel. Be careful to keep paint off the front sign face because paint will destroy the night retroreflection. If your agency paints plywood sign backs some color other than black, use an appropriate color if possible.

- **Special considerations for reducing vandalism**

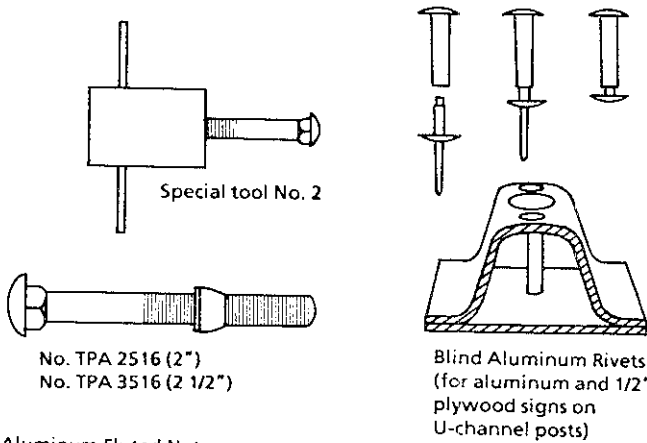
Sign theft is a special concern. Special fasteners can be used to attach signs to support posts which make it far more difficult for vandals to remove signs. Among those are Teenut pallet fasteners, aluminum fluted nuts, blind aluminum rivets, Tufnuts, and Vandlgard Nuts. Use of these are illustrated on the following pages (see drawings). Vandalism is sometimes a problem only in certain locations within a county or district. Sign inventory and maintenance records can help identify areas in which it is a good idea to consider using some of these special fasteners.

Theft-resistant sign fasteners.

Use 5/16" Allen wrench.

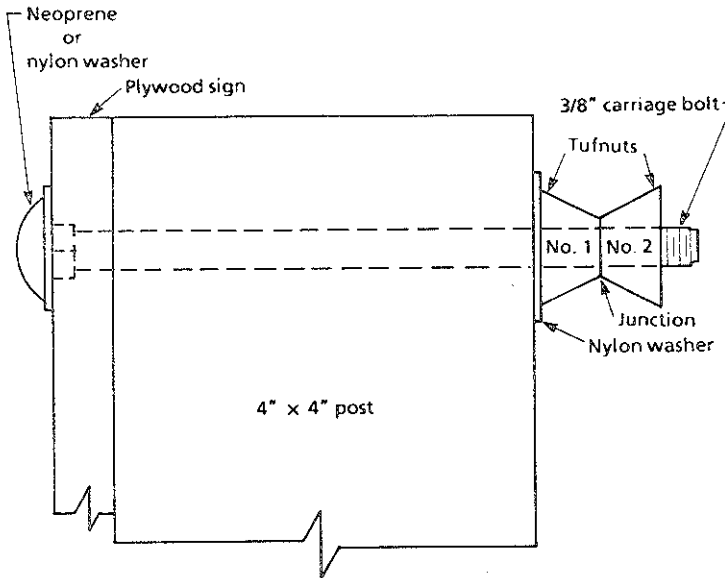


Teenut Pallet Fastener
(for 4" x 4" wood post supports)



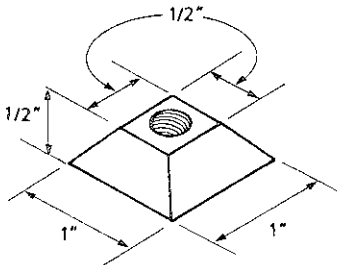
Aluminum Fluted Nuts
(for aluminum delineators and signs on U-channel posts)

Sign-installation hardware for Tufnut (pyramidal nuts) antitheft, antivandal fasteners.



Typical installation procedure

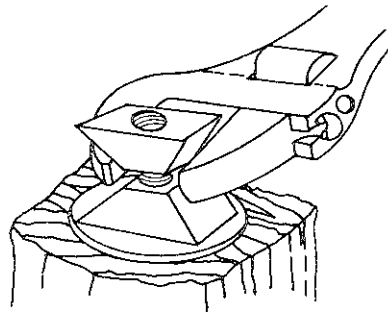
- Step 1: Install first Tufnut (No. 1) finger tight as shown.
- Step 2: Install second Tufnut (No. 2) finger tight as shown.
- Step 3: insert wrench at junction to tighten (or loosen) as necessary.
- Step 4: Remove Tufnut No. 2; then installation is complete.



Typical Tufnut
(for 3/8" carriage bolt)
Item S-29(7)
Minimum order - 100

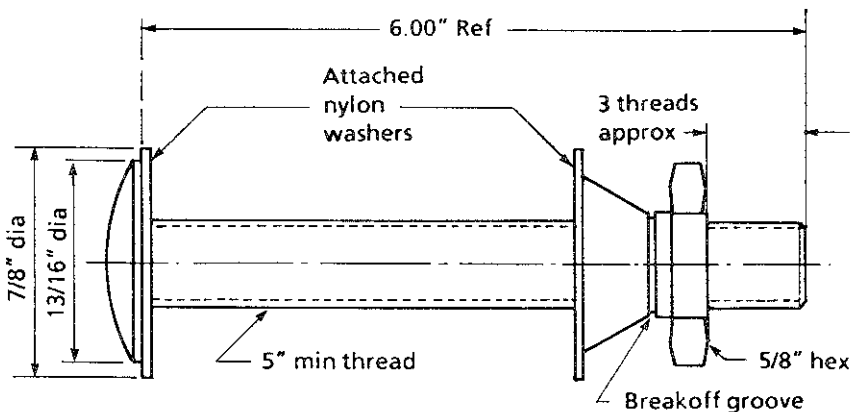
(Not to Scale)

Single Tufnut is difficult to remove because of its shape.
Always use four Tufnuts for each sign installation.



Typical Tufnut
(for 3/8" carriage bolt)

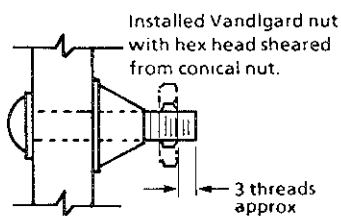
Vandlgard nut assembly.



Hardware assembly.

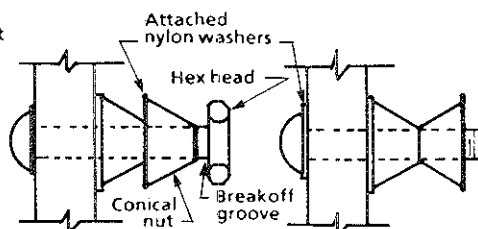
Vandlgard-nut-installation and removal.

Installation

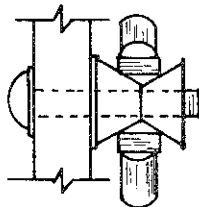


1. Install Vandlgard nut by tightening hex until it shears.

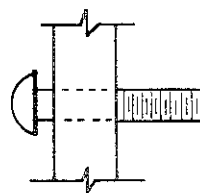
Removal



1. Thread on second Vandlgard nut and twist off hex. Remove the remaining conical nut.
2. Install this conical nut in the inverted position.



3. Squeeze both nuts firmly with Vise-grips and remove both nuts together.

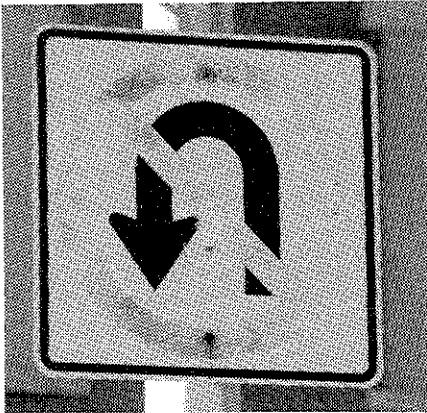


4. Original bolt is undamaged and ready for reuse

Replacing Old Signs

When a sign face becomes so worn or faded that the message is not legible during daytime or nighttime, the sign should be replaced. A sign needs to be readable in ordinary sunlight and still reflect enough light at night to be a useful sign.

- Daylight contrast



On this NO U-TURN sign the U-turn arrow is still bright and clear, but the red circle and red slash are almost completely faded out. If a driver glances at this sign, it may seem to indicate that U-turns are permitted. This sign should be replaced as soon as possible.



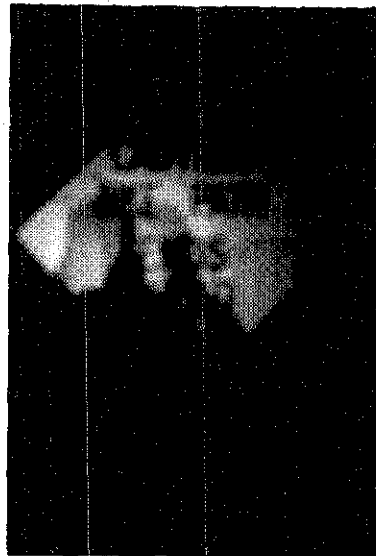
This DO NOT ENTER sign has faded so badly that it is not easily and quickly read. A driver may not notice this sign. It should be replaced.



This NO PARKING sign is starting to fade badly. The red circle and red slash banning parking is still visible in daylight but has lost much of its attention value. This sign should be replaced as soon as possible.

- **Nighttime visibility**

This sign appears bright and clear during the day. This next picture is the same sign with vehicle headlights shining on it at night. A person has to be very close to the sign to read it at night. It should be replaced.

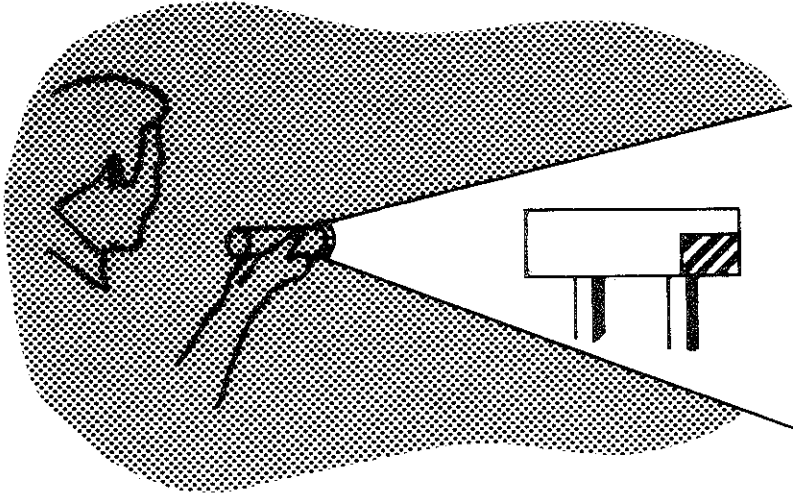


Nighttime retroreflection can be inspected by using an inspection go-no go kit available from 3M Co., Reflective Products Division, St. Paul, Minnesota.

- Use masking tape to tape an 8" × 10" sign inspection guide panel to a clean area of the sign face.
- Stand back about 30 feet from the sign.
- Hold a flashlight about 2 inches from your eyes and shine it on the sign. (Do not use vehicle headlights.)

- If the inspection guide panel is brighter than the sign face, the sign should be programmed to be replaced.
- If the sign appears to be much brighter than the inspection guide panel, the sign should not have to be replaced for several years.
- If the sign face and the inspection guide seem to be about equal brightness, the sign should be considered acceptable for at least one year, maybe as long as two years.

Nighttime retroreflection can also be checked during the day by using a high-intensity spotlight. The spotlight can be flashed on the sign face from inside a maintenance vehicle. If the sign flashes back, its retroreflection is good. If there is no flashback, the sign's sheeting is dead and the sign should be replaced. The spotlight should have a 200,000 to 400,000 candlepower bulb. It can be plugged into the vehicle's cigarette lighter. The light and the observer should be 100 to 200 feet from the sign.



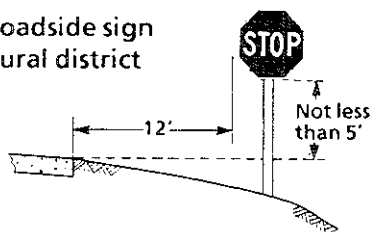
III. Repair and Replacement of Sign Supports

Mounting Height and Location

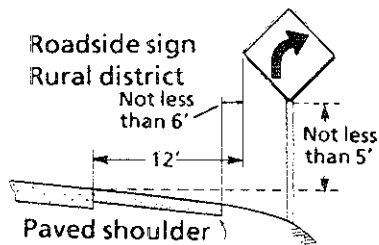
Sometimes you will be replacing a small sign on an existing post. Other times the sign and post are damaged so badly you will replace both. It is important to check the location of the post and the height of the sign above the roadway for proper location. You do not want to replace a sign in its original position and find you have followed someone who put it up wrong before. The figure below is from the Manual on Uniform Traffic Control Devices. That, or your state manual, is the guide to proper sign mounting and location.

Crash tests have shown that a 7-foot minimum height to the bottom of a sign panel improves safety. The MUTCD shows 5-foot minimum height for a rural section. You might use the higher mounting height. Check with your supervisor for local or state DOT standards.

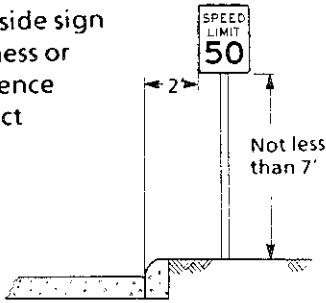
Roadside sign
Rural district



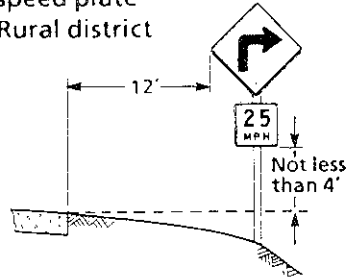
Roadside sign
Rural district



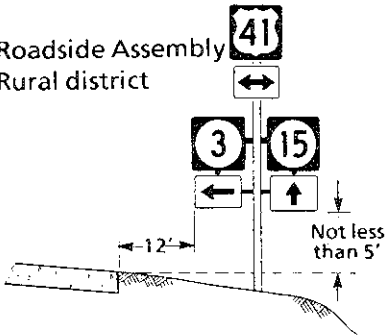
Roadside sign
Business or
residence
district



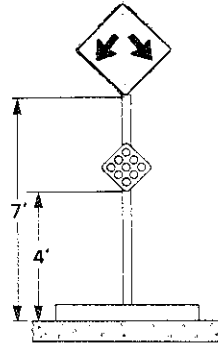
Warning sign
with advisory
speed plate
Rural district



Roadside Assembly
Rural district



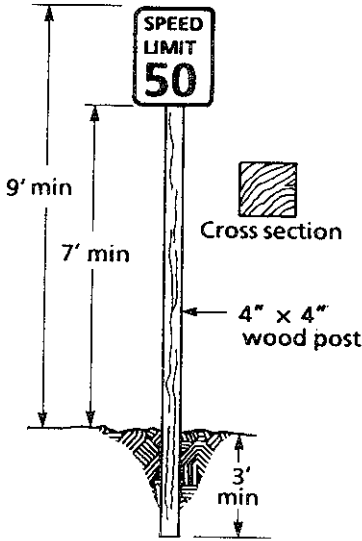
Warning sign
on island
in the line
of traffic



Safe Sign Support Systems

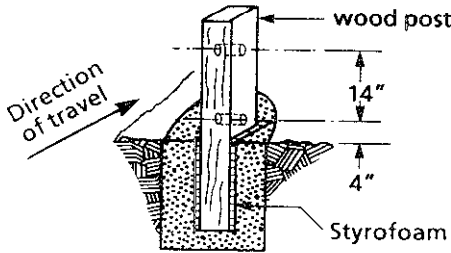
- Wood post

Wood posts are the most common sign support. Posts of the proper size and installation will break off when hit by a vehicle. They should be southern yellow pine, grade 2 or equivalent, and pressure treated.



Small supports. Cross section is 16 sq. inches. Posts should be buried in firm ground. Minimum recommended depth is three feet. You may need to bury deeper to reduce vandalism. Do not encase post in concrete. One or two posts may be used.

Large Supports should be drilled. A 6" x 8" wood post can be used if the cross section is weakened by drilling two 3-inch holes as shown in the lower drawing (drill perpendicular to roadway). A 4" x 4" is the largest undrilled wood post recommended to act as a breakaway support.



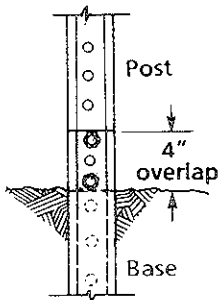
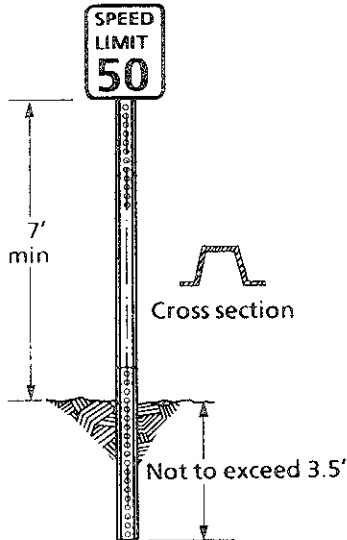
Maximum Post Sizes

| Max. Sign Panel | Post Size |
|-----------------|----------------------------|
| 18" x 24" | 4" x 4" nom. |
| 30" x 30" | 4" x 6" nom. (2" holes) |
| 36" x 48" | 6" x 6" nom. (2" holes) |

Sign Panels. Sign panels should be bolted to the post with oversized washers. This will prevent the panel from separating from the post on impact and then penetrating a windshield. Set the bottom of the sign panel a minimum of 7 feet above the pavement or ground. This will limit the chance of the sign and post rotating hitting the car's windshield.

● U-Channel Steel Post

The U-channel rolled steel post is the second most common small sign support. It is considered breakaway since it will bend, break or pull out of the ground when it is hit.



Post Support. The post should be driven into the ground and not encased in concrete. Drive posts into the ground no more than 3.5 feet to make it easier to pull out damaged posts.

Breakaway Devices. Splices can be purchased commercially to install at ground level (see lower drawing). They allow the post to break off on impact. These devices improve safety when the post is hit, will make repair easier, and will make it possible to use a U-channel post when it has to be placed in a concrete area.

An alternate installation is to set a stub post in the concrete with a 4-inch length available to bolt to the sign post as a base connection.

Maximum Post Size

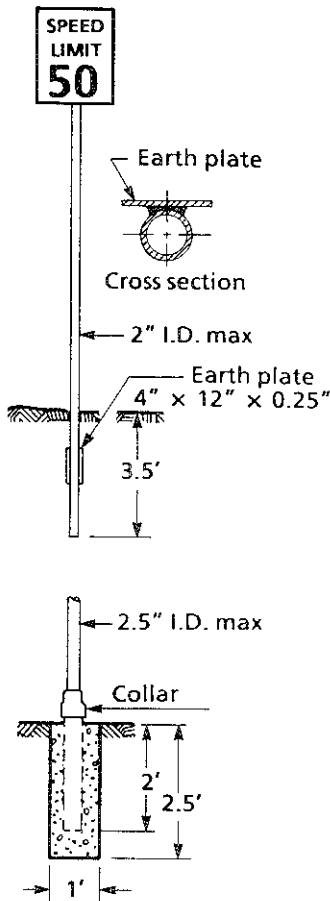
| Max. Size Panel | Post Size |
|-----------------|--------------|
| 18" × 24" | 2 lb/ft |
| 30" × 30" | 3 lb/ft |
| 36" × 48" | 2 @ 2 lb/ft* |

Sign Panels. Sign panels should be securely bolted to the post with oversized washers. This will prevent the panel from separating from the post on impact and then penetrating a windshield. Set the bottom of the sign panel a minimum of 7 feet above the pavement or ground. This limits the chance of the sign hitting a car's windshield.

* One post at each end of sign; not a single post made of two rails bolted together

● Steel Pipe Post

Steel pipe posts are used less frequently than wood or U-channel posts, but are often used in cities to support small signs. Standard steel pipe, schedule 40, galvanized, should be used.



Post Support. Steel pipe posts can be driven directly into the ground to a depth of at least 3.5 feet. A steel plate (earth plate) measuring 4" × 12" × 0.25" should be welded or bolted to the pipe (see figure) to keep the sign from rotating in the wind and to help in driving the post.

Breakaway Devices. A collar assembly (see example in the lower drawing) is recommended if the sign is likely to be hit. A collar assembly consists of a concrete footing (usually 2.5' deep × 1' diameter), a two-foot pipe base (usually one pipe size larger than the post), and a pipe reduction collar. When the pipe post is hit, the post usually shears off just above the collar. This speeds repair and replacement by installing a new collar. Often the pipe post can be reused.

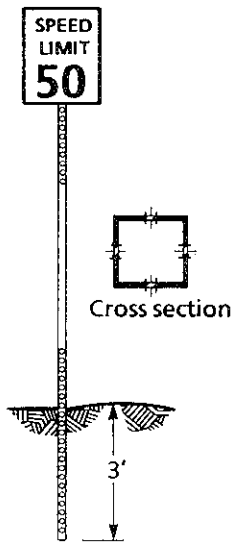
Maximum Post Size

| Max. Sign Panel | Pipe Size |
|-----------------|--------------|
| 30" × 30" | 2.0 in. I.D. |
| 36" × 48" | 2.5 in. I.D. |

Sign Panels. Sign panels should be securely attached to the pipe post using pipe clamps to prevent the sign panel from rotating or slipping loose from the post if it is hit. Tight fasteners will limit the danger of penetrating a windshield when a vehicle hits the sign. Sign panels should be mounted a minimum of 7 feet above the ground or pavement.

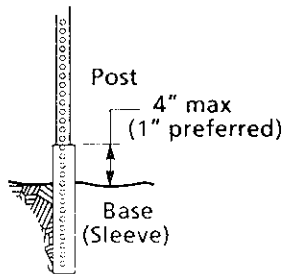
● **Square Steel Tube (Perforated)**

Another sign post is the square steel tube design. It is used in many localities.



Post Support. Posts can be driven into the ground. Do not place concrete around the post. A broken or damaged post is easier to remove if it is not driven or set into the ground more than three feet.

Breakaway Devices. Sleeve assemblies like the one shown in the lower drawing will increase the safety of a sign when it is hit and make it easier to repair. After the sign has been hit, the broken stub of the post can be removed from the base sleeve and a new sign post put back in place.



Maximum Post Size

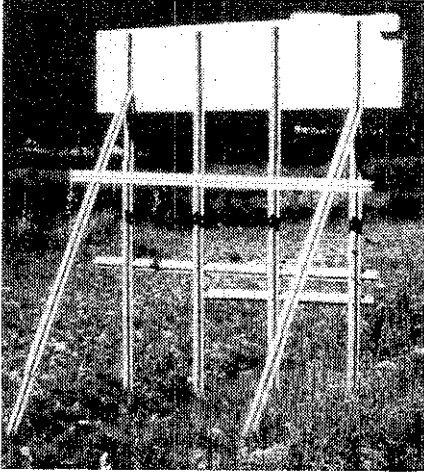
| Max. Sign Panel | Post Size |
|-----------------|---------------------------|
| 30" × 30" | 2.25" × 2.25" × 0.105" |

Sign Panels. Attach the sign panels tightly to the post and use oversized washers to keep the sign from breaking loose from the post when a vehicle hits it. Sign panels should be mounted a minimum of 7 feet above the pavement or ground.

There are many other products available commercially for sign supports. Use depends on local requirements and costs. This publication only shows four of the most common types of small sign supports.

Unsafe Practices

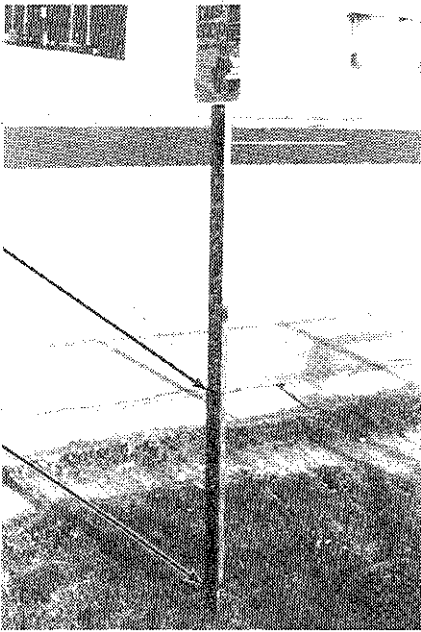
Some practices in sign maintenance can reduce safety. The following examples will give you an idea of the kinds of things to watch for. Look carefully around your own patrol area. Maybe there are some things you can fix differently to increase safety through sign maintenance.



This sign has multiple posts supporting it when two are probably enough. Also, two horizontal braces cross the bottom. These increase the strength of the support greatly, but a small car hitting this is likely to stop suddenly, causing a severe accident. Larger posts with breakaway mechanisms at the ground are better.



This speed limit sign replaced a large sign that had two posts. The second post has been left in place. Remove unneeded posts. They are just objects for a vehicle to hit.



This shows a U-channel that has been spliced well above the ground. Splices more that 24" above the ground can cause the sign and the post to break into pieces when hit. The pieces may cut through a windshield and injure passengers. Do not use more than one splice in a post.

A splice at the ground line (4" overlap) is safe and recommended.



This photograph shows a STOP sign mounted on a standard U-channel post. A small metal drainage pipe has been placed around the U-channel, driven into the ground and filled with concrete. This method adds strength to resist vandalism but also makes the sign post a safety hazard for small cars that may hit it.

You need to be especially careful in an urban area that has buried telephone cable, electric lines, and gas lines along the side of the street or road when you are driving metal posts or digging holes to set posts. If these underground utilities may present a hazard, check with your supervisor or call the utility organization in your area.

IV. Materials and Equipment to Maintain Small Traffic Signs

The materials and equipment you should take with you when you leave the maintenance yard depends on the assignment. If you have a report of a specific sign being damaged, your sign inventory and maintenance records should tell you what is needed. Other materials and equipment you should take with you to fix unreported problems found on your patrol route include:

Signs

For routine patrol, the following replacement signs should be carried if they are found on your route. This will allow you to replace damaged signs immediately.

Carry four of these signs: STOP, YIELD, and Hazard Marker Panels. Carry two of these signs: TEE INTERSECTION, DOUBLE ARROW, STOP AHEAD, and YIELD AHEAD.

Sign Posts

For routine patrol, take several sign posts commonly used in your patrol area. Think about both type (wood, U-channel, steel pipe, or perforated square steel tube, etc.) and length of post. Remember the length includes proper mounting height and depth in the ground. Suggested numbers of posts by types are:

1. Wood post 4" × 4" × 12' - suggest 6
2. Wood post 4" × 6" × 14' - suggest 6
3. Wood post 4" × 6" × 16' - suggest 6
4. U-channel 8' long - suggest 8
5. U-channel 10' long - suggest 8
6. Pipe 2" inside diameter × 12' - suggest 6
7. Pipe 2.5" inside diameter × 12' - suggest 6
8. Square steel tube 2.25" × 2.25" × 10' - suggest 6

Supplies and Sign Hardware Items

You should take enough hardware to replace a minimum of 20 signs. When your hardware supply falls below this level, obtain more before beginning a patrol. You will need these supplies to replace damaged signs:

1. Anti-theft, vandal-resistant fasteners. Carry with you those which your agency has adopted for use, such as Teenuts, Vandlgards, blind aluminum rivets, or aluminum fluted rivets.
2. Oversize neoprene or nylon washers.
3. Pipe collars if pipe posts are used and the collar assemblies have been installed.
4. Pipe clamps if pipe posts are used.
5. Several boxes of bolts with nuts.

If you plan to make field repairs to damaged sign faces (repair the legend or lettering) rather than do this in the shop, you will need additional supplies. The following are suggested:

1. Face masks to protect your lungs from spray paint and dust.
2. One package of assorted capital letters (84 items in each package)
3. One package of assorted arrows and numbers.
4. Two rolls of 3M Co. No. 639 transparent film or equal (one each 2-inch width and 3-inch width).
5. Four one-quart cans of 3M Co. No. 700 clear sealer or equal.
6. Four one-quart cans of 3M Co. No. 711 thinner or equal.
7. One-pint can of 3M Co. A-3 Activator or equal.
8. One-gallon cans of ready-mixed exterior alkyd resin enamel paint if you expect to paint sign supports.
9. One roll of 1.5-inch 3M Co. No. 425 UAL aluminum foil tape.
10. One roll of 3M Co. reflective tape in each color of sign background you may repair (for example, red, yellow, green, white).
11. One container each of Xylol or VM&P naphtha, and wood filler.
12. Assorted paint brushes if painting of supports is expected.
13. Replacement vandal warning markers and sign identification markers.

Handtools

Handtools suggested for sign maintenance patrol:

1. Several sizes of adjustable wrenches and a pair of adjustable (horse-faced) pliers.
2. Weed cutter to clear weeds blocking sign.
3. Loppers to cut any small branches blocking sign face.
4. 3-cu. ft. utility wheelbarrow if there will be a need to mix any concrete, move hole spoil, or move material to tamp a new post hole.
5. Brace and bits to drill holes in wood posts.

6. Set of woodworking chisels if any trimming of wood post or plywood sign back is expected.
7. Set of various sizes of cold chisels to cut bolts or rivets.
8. Crosscut hand saw to cut wood posts.
9. Post hole auger, post hole digger and post hole breaker bar for preparing new post hole and resetting post.
10. Double-handled slip hammer of suitable size to drive posts, most usually for U-channel, pipe or square-tube.
11. 16-lb. or 20-lb. double-faced sledge hammer.
12. 6-lb. double-faced hammer.
13. 16-oz. or 20-oz. curved claw hammer.
14. Long-handled shovel.
15. Heavy-duty tall step ladder or an extension ladder.

Additional handtools suggested for making field repairs to damaged sign faces.

1. Ripcut handsaw for cutting wood sign backing.
2. Paint scraping knife.
3. Heavy-duty step ladders in 4- and 10-foot heights.
4. Sign post step
5. Utility knife
6. Ball peen hammer
7. Fender dolly (if available)

See page 10 on repairing aluminum sign panels.

Commercial Sign Repair Kits

Companies marketing signs and signing materials provide kits with a certain set of items and quantities of each item for agencies which want their field personnel to repair sign faces.

Ojo Caliente Craftsmen, Inc., assembles and markets a sign repair kit intended to specially fit the needs of the U. S. Forest Service. As an example of a special kit it typically contains the following items.

- 2 rolls brown retroreflective sheeting
- 1 roll silver retroreflective sheeting
- 1 roll black opaque material
- 1 roll yellow retroreflective sheeting
- 20 sheets red retroreflective sheeting
(6" × 6" size)
- 26 packages of prespaced, diecut
letters.
- 10 packages of prespaced, diecut
numbers

3 packages of arrows
1 package of border radius corners
1 roll of sign border material
1 roll transparent film No. 639
3 plastic applicator squeegees
1 roll aluminum foil tape
1 can of No. 700 clear sealer
1 pair scissors
1 package of single edged razor
blades
1 small plywood cutting block
1 container of adhesive activator
1 spray can of flat black enamel
paint
1 flat dolly
1 ball peen hammer

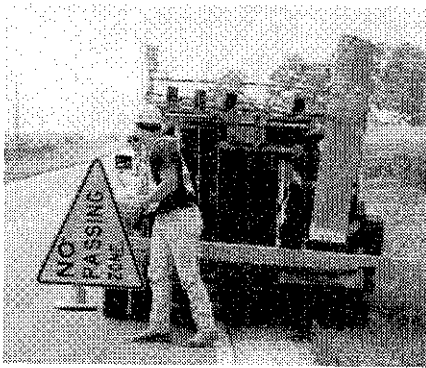
Ojo Caliente Craftsmen, Inc.
P.O. Box 67
Ojo Caliente, N. Mex. 87549

**Your local Technology Transfer Center can assist you in
locating firms which supply kits.**

Other Equipment



Here a small pickup truck is outfitted for one person to maintain small signs in a city. Orange flag mounts have been installed on each side and a large rotating yellow beacon has been installed on top. An acetylene torch is included to cut damaged bolts or metal posts. A metal platform has been fabricated from small angles and metal grating so a person can stand in the back and remove or replace signs mounted high up. An open metal frame rack has been installed to carry replacement signs and posts.



This photograph illustrates a larger, full-size, pickup truck which has been modified for a two-person sign maintenance crew. A 2" x 12" plank has been cut and hinged so that it can be folded up to fit in the truck bed and then unfolded to act as a working platform while removing or replacing signs.



Shown here is a locally fabricated tool to align the sign and post before final tamping. A metal U-shape the size of the wood post (4" x 4" or 4" x 6") has a pipe handle welded to it. After attaching the sign to the post, filling the hole, and lightly tamping the material, one person checks the sign to make certain it is facing the roadway at the proper angle to be seen at night while the other person rotates the post with the tool. Small signs should be mounted at 90° to the road.

V. Traffic Control

Shoulder Closure on Two-Lane Two-Way Traffic Roadways

NOTES:

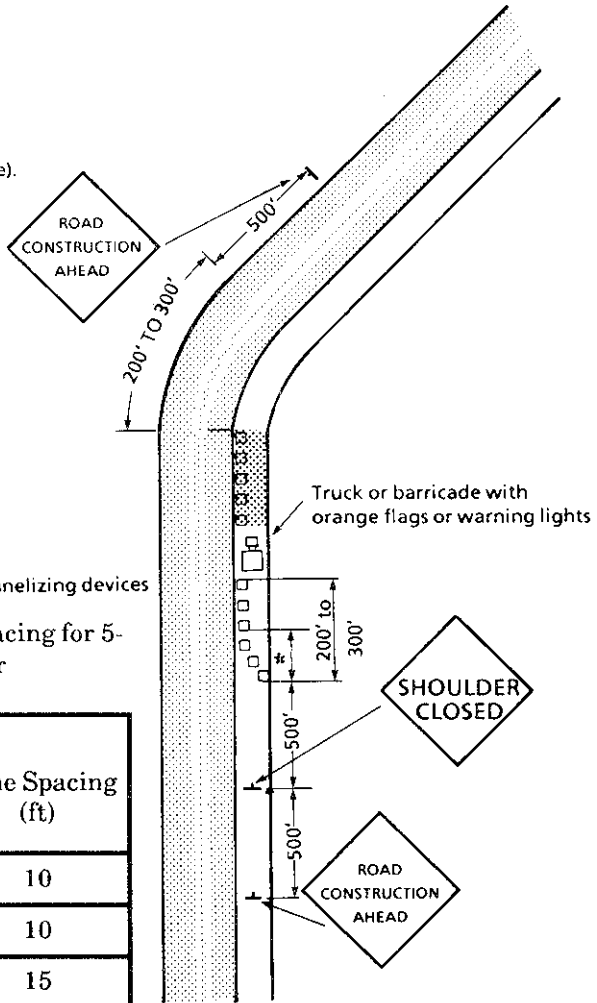
1. Daytime operation and short repair duration.
2. Close the lane if repair work is on or within 2 feet of the travelled way (traffic lane).
3. Flaggers should use STOP/SLOW paddies instead of red flags.
4. Buffer zone may be reduced or extended depending on available sight distance.
5. Keep parked vehicles away from the traffic as much as possible.
6. Keep buffer zone free of obstacles or hazards.

KEY:

□ Channelizing devices

Suggested Taper Spacing for 5-Cone Shoulder Taper

| Road Speed Limit (MPH) | Cone Spacing (ft) |
|------------------------|-------------------|
| 20 | 10 |
| 25 | 10 |
| 30 | 15 |
| 35 | 20 |
| 40 | 30 |
| 45 | 45 |
| 50 | 50 |
| 55 | 55 |



Low-Volume City Streets or Low-Volume Times

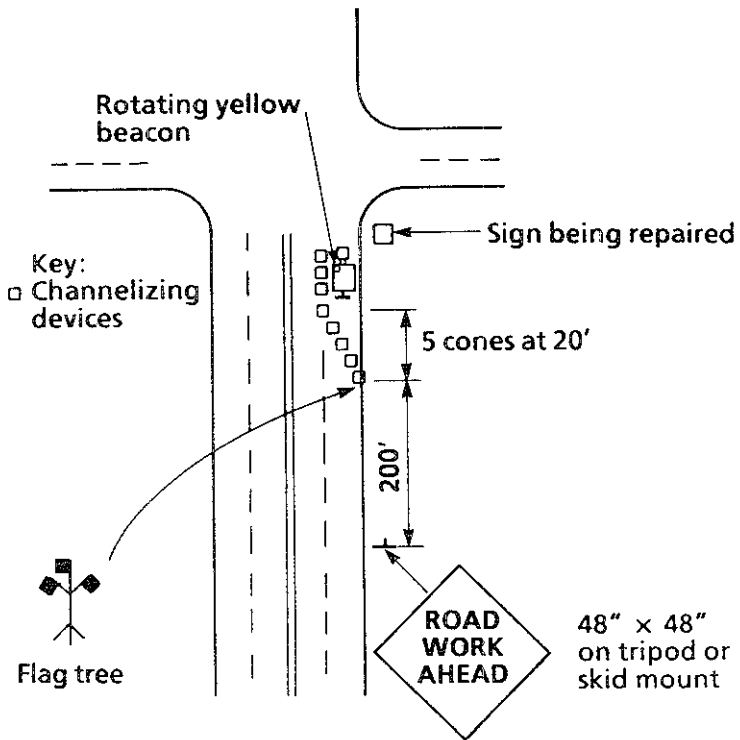
Small sign maintenance takes a short period of time at each location. A large yellow rotating beacon and orange warning flags are enough advance warning to safely divert traffic around the sign repair if it is in residential areas, industrial parks, on low-speed streets (35 MPH or slower speed limit), at low-volume times (not in the morning or evening rush),



This photograph shows a sign being replaced with only a yellow rotating beacon and orange flags to warn traffic. In this case, the worker could park his vehicle off the traveled lane onto a bicycle path.

Major Street or Intersection with Major Street

When you repair or replace a small sign at a major street carrying significant traffic or at an intersection of a minor street with a major street, drivers may be confused by your maintenance activity. In those cases, more warning and guidance is required than for lower classes of streets. The drawing below is a suggested layout for traffic control in maintaining small signs on major streets.



Maintenance traffic control at major street intersections.

VI. Small Sign Maintenance Records

Records of maintenance and inspection of small signs is important. Keeping good records will help you

- make good decisions about when old signs should be replaced
- respond more quickly to reports of damaged signs with the correct repairs
- determine what materials give you the most wear for the least money
- defend any lawsuit arising from a collision near one of your signs

Incident reports

Your agency should keep a log of reports of signs that are damaged or knocked down or vandalized. These reports may come from citizens, other workers in public agencies, or law enforcement officers. Incident report records can be as simple as a ledger in which the incident report is noted and a notation is made of any action taken. The record system should include:

- Date and time of the report.
- Who made the report and who received the report.
- Brief description of the problem.
- What action was taken, when it was taken, and who was responsible for it. This might indicate the sign was checked by J. Smith on January 16, straightened, and scheduled to be replaced on January 18.

Sign Inventory

It is very important to develop and maintain a sign inventory. Without a record of what signs are where, it is easy to miss some signs in regular maintenance inspection. A sign inventory will help you quickly and correctly respond to incident reports of a damaged sign at a particular location. It will help you find areas where you have repeated vandalism problems. An inventory can be a microcomputer program, a main frame computer program, a card file, or a ledger book. As long as the people using it know how it works, it can be effective. Information that should be in the inventory includes these items.

- Sign location including street or highway, milepost or block location, and traffic direction it faces.
- Sign type or name (STOP, NO PASSING, etc.)
- Sign size (18" × 18", 30" × 30", etc.)

- Date initially installed.
- Date of any changes and a brief note of what the change was (raised it 2 feet, changed from pipe post to 4" × 4" wood post, etc.)
- Date of most recent inspection or repair.

Maintenance Records

You should have some maintenance record of each repair or replacement job done on small signs. This will help decide if changes in your maintenance will increase safety or reduce costs. A maintenance record should include at least these items of information.

- Date of maintenance and person who completed it.
- Sign location by street or highway and traffic direction it is facing.
- Type of sign and size used if replaced.
- Type of post and size if replaced.
- If the following were checked were they correct?
 - * Height of bottom of sign
 - * Color of sign
 - * Size of sign
 - * Any breakaway features of the post
 - * Orientation of sign for night traffic
 - * Wear or fading of sign face
 - * Location with respect to edge of pavement

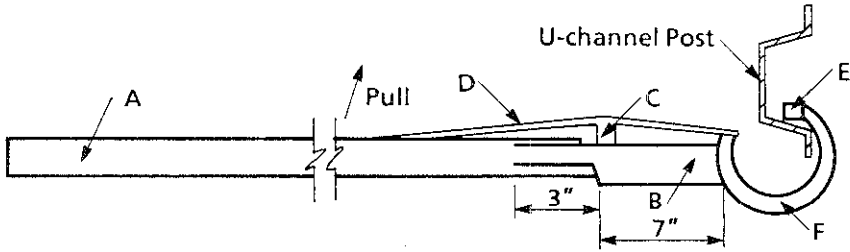
Sign Inspection

Most sign inspection can be recorded as a part of regular sign maintenance. Some agencies try to inspect every sign once each month while some agencies inspect every sign at least once each year during daytime and at night. It is important that your agency decide upon a sign inspection cycle that is reasonable (considering the number of signs and the number of available personnel), and that the inspection is recorded (date, who did it, and general condition of the sign).

VII. Maintenance Tips

1. Check signs at night. Too many agencies have signs that look good in daylight but have lost too much retroreflectivity to be effective at night. Too many signs are slightly off line for approaching night traffic to see the sign. Check signs for sight blockage by brush, other signs, etc.
2. Store signs in vertical racks to prevent the signs from rubbing against one another. The same is true for transporting signs to a repair site. When sign faces are rubbed or scratched, they lose retroreflectivity.
3. Keep all fuels, oils, cleaners, and similar liquids away from signs being stored or handled. These materials may dissolve some of the sign face and reduce its visibility.
4. Protect stored signs from sun exposure. Sunlight deteriorates the sign face material and fades the color. Sunlight on a sign face for 6 or 8 months before using it means reduced sign life along the road.
5. Tell people you know how important good signs are for traffic safety. This will spread public support in attitudes and may have a small but important effect in reducing sign vandalism and damage.
6. Oregon Department of Transportation has developed a hydraulic guidepost driver and puller which can be mounted on a truck or removed in less than five minutes. Its use has tripled productivity over hand or loader driving and pulling. Total cost of the unit including commercial components was less than \$5,000. Contact John W. Sheldrake, P.E., Field Operations Engineer, Oregon Department of Transportation, Highway Division, Office of Operations - Maintenance & Construction, P. O. Box 14030, Salem, Oregon 97310; telephone (503) 378-6528, for details on fabrication and use.
7. Dickinson County, Kansas, Highway Department has developed a steel post straightner which greatly reduces the number of small sign posts that have to be pulled and replaced. The sketch below shows the device arrangement. Contact James A. Hague, Highway Administrator, Dickinson County Court

House, Abilene, Kansas, 67410; telephone (913) 263-3093, for details on fabrication and use.



- A. 1Pc. - 1 1/2" Black pipe - 50" long
- B. 1Pc. - 5/8" x 3" x 10" long
- C. 1 Pc. - 3/4" x 3/4" x 5/8" long
- D. 1 Pc. - 1/4" x 3/4" x 20" long
- E. 1 Pc. - 3/8" x 3/8" x 3" long
- F. 1 - Clevis slip hook (remove eye)

8. Your local RTAP Technology Transfer Center can assist you with implementing or improving a small traffic sign maintenance program. Use them as a resource to assist you.
9. Microcomputer software is available to assist in organizing traffic sign maintenance records and inventories. A suggested contact source is McTrans Center for Microcomputers in Transportation, 512 Weil Hall, University of Florida, Gainesville, Florida 32611-9988; telephone (904) 392-0378; FAX (904) 392-9673; electronic bulletin board (305) 554-2145.

NOTES