# INSULATION BETWEEN STEEL AND ALUMINUM FOR EXTRUDED TRAFFIC SIGN MOUNTINGS

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In a memorandum dated June 5, 1961, R. L. Greenman, Assistant Testing and Research Engineer, authorized the Research Laboratory Division to investigate corrosion of traffic sign mountings in service, from the standpoint of deterioration which might affect mechanical strength. The request for this study had come from the Traffic Division, with the eventual goal being preparation of new specifications.

Several overhead and cantilever type signs were inspected and photographed. Special attention was given to current Departmental practice in assembling signs at the Lansing sign shop, particularly with reference to insulation between steel and aluminum as a means of reducing localized corrosion by galvanic action.

Due to their relative positions in the electrochemical series of metals, galvanic corrosion between steel and aluminum works very much more against the aluminum than against the steel. A fundamental factor of electrochemical corrosion which should be considered in coupling aluminum and steel is the ratio of steel area to aluminum area. The greater this ratio, the more serious is the corrosion problem on aluminum rather than on steel. Aluminum would deteriorate most at areas adjacent to the steel. This situation could become worse on cold or snowy days, during which water condensation would occur on the cold aluminum surface.

If any structural design requires direct contact between these two metals, the best practice to minimize galvanic action is protecting the steel area by coating it, or keeping the exposed aluminum area large relative to the steel, or better, doing both simultaneously. Otherwise, the best method is to break the metallic circuit of the couple by interposing an electrical insulating material between them.

Current Departmental design practice is illustrated in Fig. 1, which shows that electrical contact is made between the steel plate and the aluminum bolt and washer. In this design, the steel surface is protected with paint, so that until the paint film is perforated or worn, the aluminum may not be seriously affected. However, as time passes, the galvanic action may become quite intense, resulting in pitting of the aluminum and eventual perforation failure.

In Fig. 2, a possible improvement in design is shown, which would prevent or minimize galvanic action by the use of plastic sleeves or washers.

In selecting the non-metallic insulator, the following properties should be kept in mind:

1. High dielectric strength.

2. Ability to withstand different weather conditions without deteriorating either chemically or mechanically.

3. Nonreactivity when in contact with aluminum or steel (the metals or the plastic material must not be affected).

4. Adequate mechanical strength, withstanding normal compression, tension, and fatigue or rough handling.

Masonite strips are being used currently as electrical insulation between these two metals. Figs. 3 and 4 show traffic signs in assembly and ready for installation at the Lansing sign shop. Figs. 5 through 8 show signs in roadside and overhead field installations. In addition, for comparison purposes, Figs. 9 and 10 show oxidation corrosion of sign support and base areas.

From the pictorial inspection it appears reasonable to conclude that corrosion of traffic sign mountings is not critical at present, even in cases where steel members are in direct contact with aluminum. The inspected signs show slight corrosion on some steel areas, but serious pitting of the aluminum, or perforation failures, have not occurred.

On the other hand, the current method of installing Masonite strips, shown in Fig. 1, permits eventual conduction of electric current between the aluminum sign and the steel framework through the aluminum bolt. Since these spots are potential sites where galvanic corrosion may be expected to develop over the years, it is recommended that this electrical circuit be broken by the use of an insulating material as illustrated in Fig. 2. Otherwise the advantages of using the Masonite strip currently inserted will be largely negated.

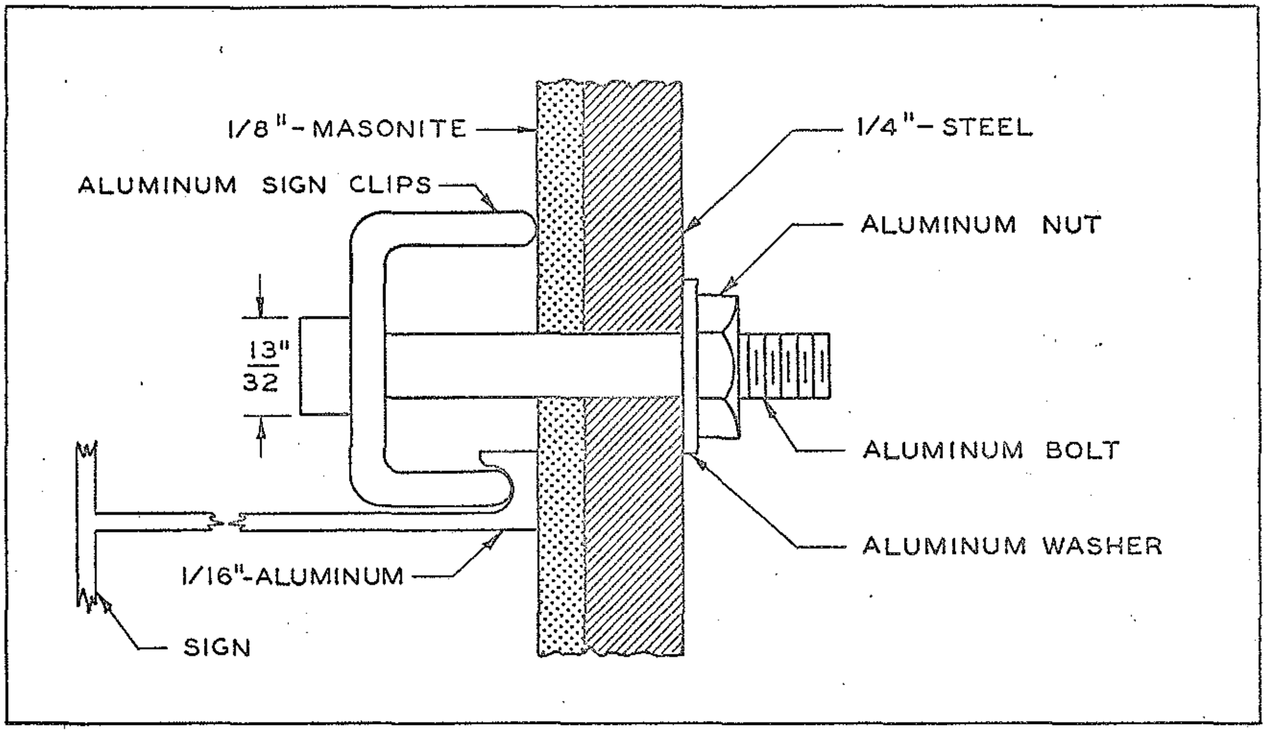


Figure 1. Current Departmental sign fastening practice.

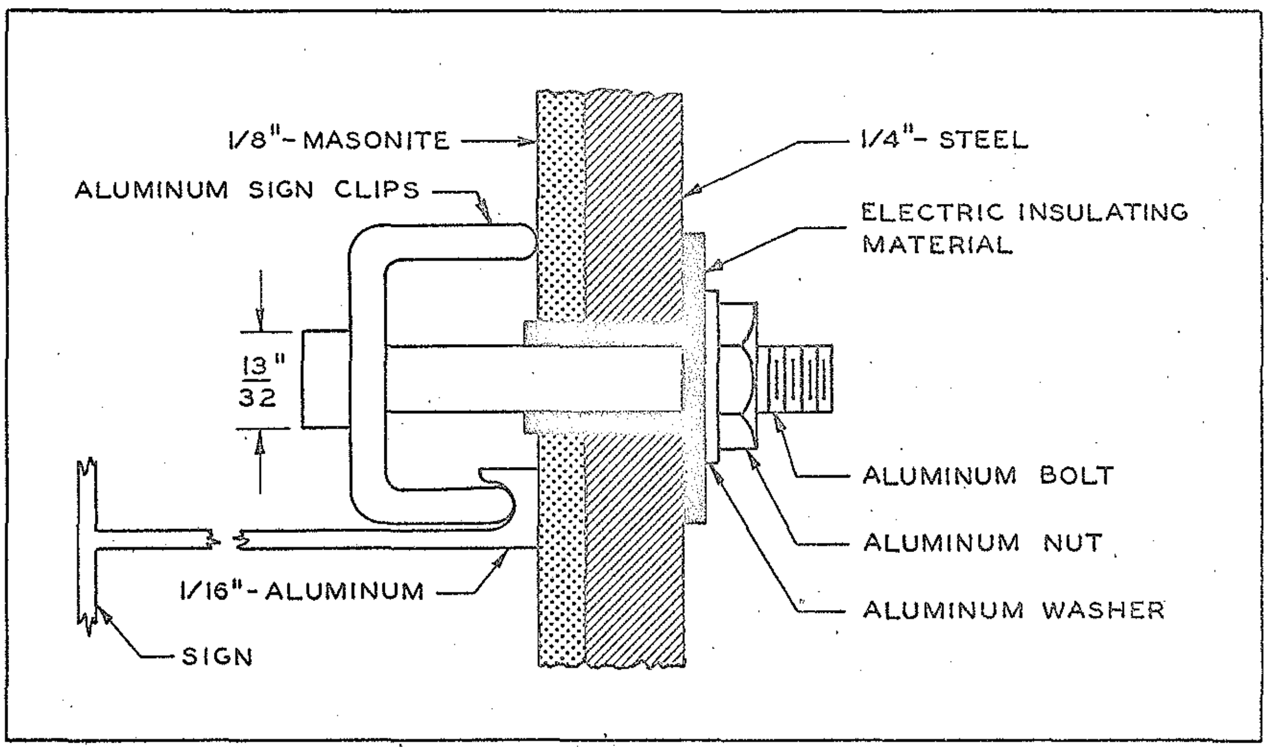


Figure 2. Suggested improved practice using a plastic sleeve and washer.

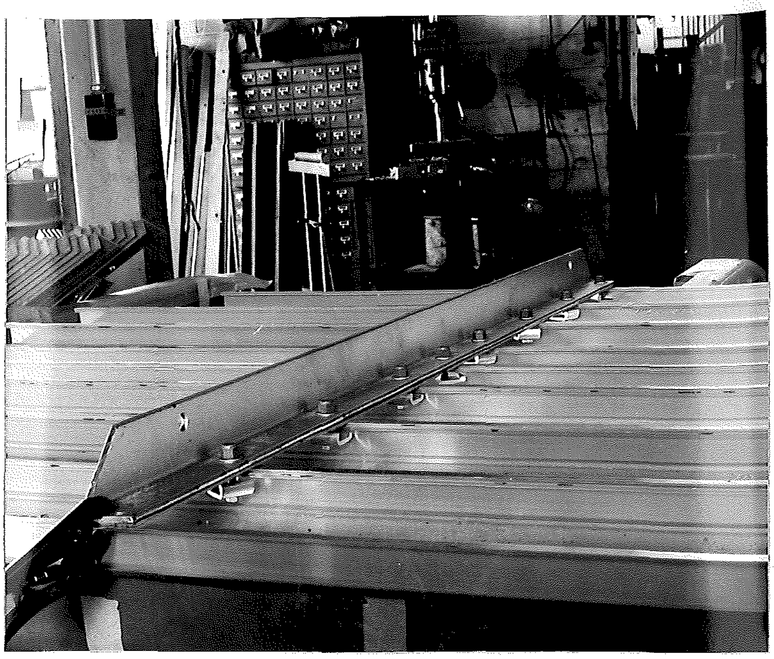

Figure 3. Steel angle assembly clamped in position prior to being bolted in place. Note Masonite strip held in place by clamps.

Figure 4. Finished sign ready for installation. Note how steel angle is separated from interlocking aluminum panels by strip of Masonite, but electrical contact is still maintained between steel and aluminum through bolt and washer. Aluminum paint and primer have not covered steel angle completely.

Figure 5. Three-post sign support assembly on eastbound I 96 (legend: "Detroit 39"). Steel members are in direct contact with aluminum, and corrosion has begun. Age: 3 months.

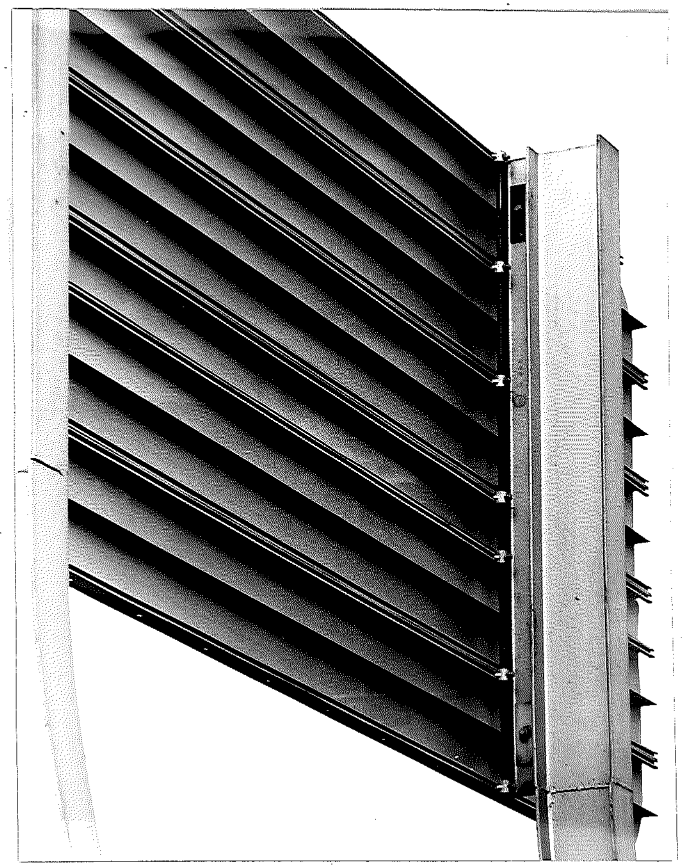

Figure 6. Roadside sign support assembly on eastbound I 96 (legend: "Farmington 5, Detroit 24"). Vertical steel angle is separated from aluminum panels by Masonite strip, but some corrosion is evident. Age: 2 1/2 years.

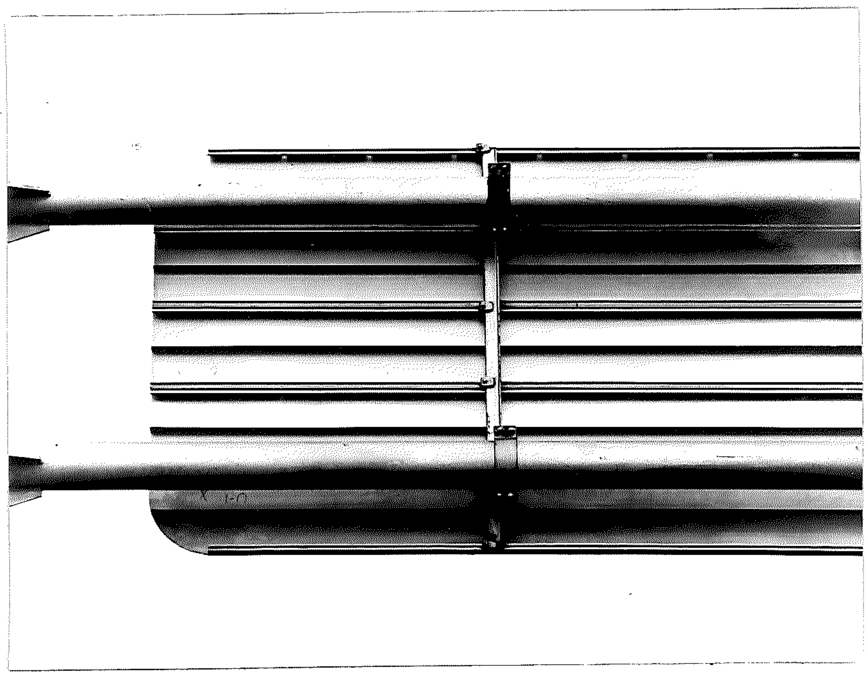

Figure 7. Corrosion of vertical angle and straps on cantilever type sign structure on eastbound I 96 (legend: "Farmington" with arrow). Age: 2 1/2 years.

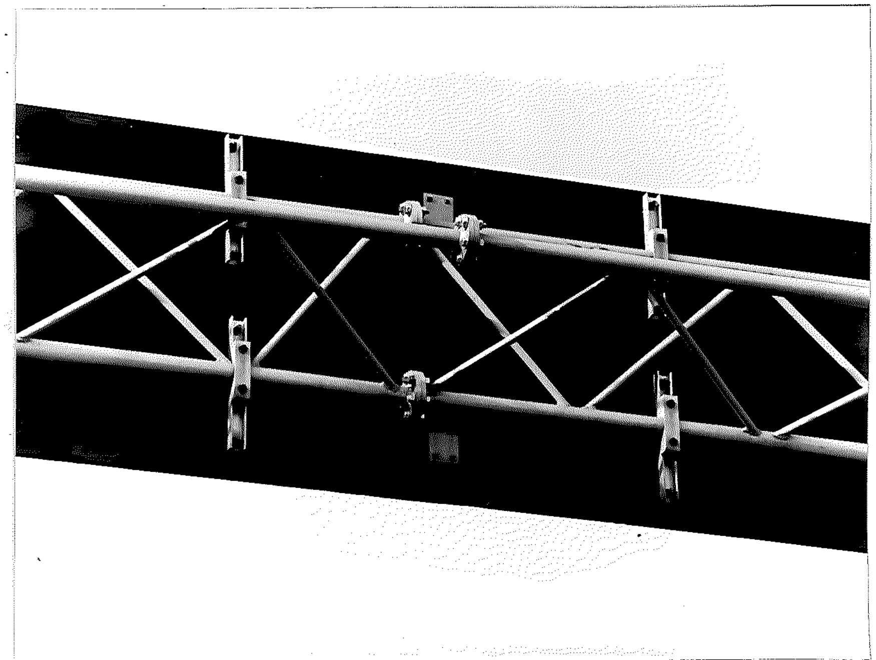

Figure 8. Bolt heads and nuts are corroded on overhead truss support structure on southbound US 127 (legend: "Mason" and "Jackson" with arrows). This is one of two such experimental installations in Michigan. Age: 5 1/2 years.

Figure 9. Relatively pronounced oxidation corrosion of steel supports of roadside signs support assembly on eastbound I 96 (legend: "New Hudson 4, Lansing 56"). Age: 2 1/2 years.

Figure 10. Extensive oxidation corrosion of steel nuts and bolt heads (and base plate staining) on an experimental overhead assembly on Farm Lane, MSU. Tubing, stiffener elements, and base plate are aluminum alloy, and bolts are cadmium-plated (0.2-mil) steel. Age: 5 years.