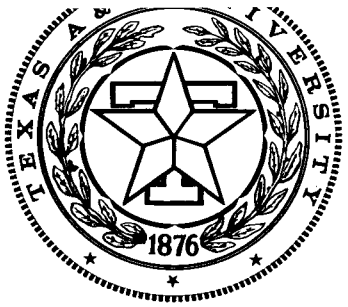

TEXAS TRANSPORTATION INSTITUTE

TEXAS HIGHWAY DEPARTMENT

COOPERATIVE RESEARCH

SIGNS AND SIGN SUPPORTS
2-8-54-1

in cooperation with the
Department of Commerce
Bureau of Public Roads

BIBLIOGRAPHY (63-19)
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SIGNS AND SIGN SUPPORTS

compiled by
Texas Transportation Institute
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1. Angelini, I., " International principles and directions for road sign mark ing. " Roads and Road Construction 34: n 397, Jan 1956, p 17-20.

   Special characteristics of modern road signs; materials for signs; principles of putting signs into operation.

2. Bauch, Willlam F. Jr, " Expressway Signs in the Chicago metropolitan area.

   Nat'l Research Council--Highway Research Board Abstracts 24: n 5, May 1954, p 33.

   The expressway system in the Chicago Metropolitan Area is being designed and constructed by three independent governmental agencies: the State of Illinois, Cook County, and the City of Chicago, with the cooperation of the U.S. Bureau of Public Roads.

   In order to establish standards and policies, and coordinate and unify design details, a working committee composed of representatives of the active construction agencies and a representative from the Bureau of Public Roads was formed in December 1944.

   To assist this committee in its work, various subcommittees were formed to investigate and advise on problems in their special fields. The Traffic Subcommittee was formed in April of 1949. The appointed membership consisted of representatives of the Illinois Division of Highways, Cook County Highway Department, the Bureau of Engineering of the City of Chicago, and the Bureau of Public Roads. To assist the subcommittee in its assigned projects, the Bureau of Street Traffic of the City of Chica go, the Chicago Park District, and the Chicago Transit Authority were invited to designate representatives to act in this capacity. In addition to the above, the Chicago Plan Commission and the Chicago Regional Planning Association were invited to send representatives when the topics under consideration pertained to their particular interests.

   Late in the year 1949, the Traffic Subcommittee was assigned the broad task of developing a system of signing for the expressway system in the Chicago Metropolitan Area. The assignment covered the entire field of sign design from letter size, color combination, reflectorization, and illumination to placemnet and sign erection.

3. Bauch, W.F., G.M. Webb, and W.n. Volk, "Sign supports--characteristics, materials, design, criteria and costs, Institute of Traffic Engineers, 1959 Proceedings, 29 Annual Meeting. p. 273.

Structural requirements for supports for overhead signs are discussed. Consideration is given to the cost of placing signs at clover-leaf interchanges, and charts are givenshowing the cost of various types of overhead sign.

4. Bergendoff, R.N., Research Studies in Connection with design features of the Florida Turnpike: Proc. Higw. Res. Bd, Wash. 1958, 37, 194-200.

...Wind tests on supports for highway signs were undertaken because the turnpike is in a hurricane area; a 4-in H-Beam proved to be satisfactory and stronger than a 4-in I beam, which failed under a wind velocity of 40 to 50 mph. Double standards of two I beams were better than a single H-beam as there was less flutter of the sign itself. Service stations are provided on the central reserve and extra lanes are provided on the carriageway to reduce risk of accident, large roadside signs being erected 2, 1, 3/4 mile ahead of each service area with internally lighted signs on a sign bridge to indicate the lanes for through traffic and the one leading to the service station.

5. Bullock, J.C. Jr, "Overhead signs and markings." Roads and Streets 100: n 9, Sept. 1957, p 110-13, 116.

Several types described and evaluated on basis of experience of Virginia Department of Highways.

6. Cast aluminum street signs. Modern Metals 11, n 3, Apr 1955, p 72

New sign frames to replace old, rusted iron signs in New York City are cast in Tenzaloy which is now tarnish proof aluminum alloy: new signs cost same as steel signs and are guaranteed maintenance free for 15 yrs.

7. Chevrier, A.,"Le procede Screenpot de gravure photographique sur alumirium. " Revue de l" Aluminium 32: n 222, June 1955, p 603-5.

Screenphot direct process for photography on aluminum developed in France in 1949 by H. Caen makes it possible to obtain on rigid basereproductions in relief of great sharpness which are resistant to moisture, difference of temperature abrasion and shock; signs may be cut, drilled polished and even pressed.

8. "Construction of road traffic signs and internally illuminated bollards." Brit Standards Instn--Brit Standard n 873, 1959, 43 p.

Standard deals with material, quality and finish of road traffic signs and material, quality, dimensions and finish of posts, fittings, lanterns and internally illuminated bollards; optical properties of and methods of test for reflex reflectors and reflecting surfaces are specified, together with tests for other properties of complete signs.

9. Crosby, J.R., " Case for overhead signing." Traffic Eng 29 n 11, Aug 1959, p 14-15, 40.

To overcome traffic flow problems, resultant plaza widening at toll booths on George Washington Bridge Interchange, New York City, uses 110 ft. long, 4 ft. 6 in. square cross section, aluminum truss structure to support two destinational signs; signs were frabicated of porcelain on aluminum with white message copy and dark green background color, and are 5 ft 8 inches high and 17 ft. 6 in and 21 ft. wide, respectfully; illumination, and maintenance techniques.

10. Crosby, J.R."Sign highway materials and maintenances. Pub Works 91: n 1, Jam 1960, p 107-9.

Eight years of experience on New Jersey Turnpike with various fabricating materials from standpoint of durability, appearance structural adequacy and ease and cost of maintenance; methods of maintenance.

11. Domke, K., "Aluminium in road construction." Strassen-Asphalt u. Tiefbau-Technik, 1958, 11 (10), 328-31 (In German).

Details and illustrations are given of the use of aluminium for guard rails, signs, lamp standards and cat"s eyes. A description is given of the Walt Whitman Bridge, Philadelphia, which incorporates about 500 tons of aluminium in the form of signal bridges, signs, lamp standards, rails and footway grids. The steel structure is coated with aluminium paint.

12 "Durasigns are new ideas," Traffic Engineering. Vol 24, No. 3, p 105 Dec. 1953.

A new and revolutinary sign panel, of rustproof, fiber-glass reinforced material is now in production by the Nu-Bone Company, Inc., Erie, Pennsylvania. Trademarked Durasign these panels are strong as steel but weigh only one third as much. They never require painting, as the color goes all the way through. They are ideal for any sign application where strength and weather resistance are important, since they are rustproof and corrosion proof, they are particularlyapplicable for oceanside installations where salt spray quickly ruins conventional metal signs. Cost is competive with comparable metal signs, but lighter weight results in lower net cost, due to transportation savings.

13. Eliot, W.G.3rd, Sign Standards for Interstate Highway Systems. Traffic Engineering 29: n 8, May 1959, p 13-16

Discussion of problems, such as lettering, colors reflectorization ans panel size, relative to design and application of guide signs to create uniform standard of traffic control devices.

14. Garcia, J.Jr., "Up-tp-date traffic-signing program is worth cost." Better Roads 28: n 2, Feb 1958, p 31-2, 48 50.

New signing system installed in Tulare County, Calif has resulted in decline in county's traffic-accident rate; county adopted uniform specification calling for either porcelain enamel or aluminum and reflective sheeting for all signs.

15. Hermann, E., W. Huebner, E. Zurbruegg, "Herstellung von Aluminiumschildern." Metalloberflaeche 8: n 12, Dec 1954, p B177-82.

Production of aluminum signs from anodically oxidized aluminum sheet; pretreatment; printing and photographic methods.

16. "Laminated panels for Interstate road signs." Better Roads 33: n 12, December 1963, p 40.

Can be installed without hoists and expensive erection equipment.

17. Lang, C.H."Overhead signs guide drivers at expressway interchange." Better Roads 27: n 3, Mar 1957, p 38-40; see also unsigned article in Modern Plastics 34: n 10, June 1957, p 126-9.

Internally lighted signs with faces and lettering made of translucent acrylic plastic selected for complex directional signs for interchange of New York State Thruway at Suffern; all of signs are 4 ft. high, 11 in. deep, and vary in length from 15 to 37 ft.; molded in colors make repainting unnecessary.

18. Menking, V.H."Big extruded signs guide superhighway traffic." Modern Metals 12: n 11, Dec 1956, p 50, 52, 54-5.

Fast growing acceptance of extruded aluminum sign panels which were first used on Ohio Turnpike; advantages over other materials; systems of interlocking extrusions for superhighways signs; properties required in extruded panel; finishing factors; erection methods.

19. "New look in signs." Modern Plastics 38: n 8, Apr 1961, p 90-2, 146-6, 171.

Among newest fabricated methods to enter display field are expandable styrene molding and blow molding; plastics used by sign manufacturers include cast acrylic and newer extruded sheets, cellulose acetate butyrate for vacuum formed signs, background panels, and molded or formed letters, reinforced plastics, rotationally molded vinyl plastisols and ,Mylar polyster film.

20. O"Keefe, J.F. and E.D. Gardner: "Wind loading tests on aluminum sign supports." Civ. Engng, Easton, Pa, 1958, 28 (6), 437-8

Aluminium road signs (4 by 4 ft.) have been subject to wind loading tests at the Hurricane Test Station of the University of Miami to investigate calculated loadings and mechanical design of various types of support. It is concluded that a single aluminium 4-in. H-beam is a satisfactory support at a wind velocity of 105 mile/h. with single 4-in. I-beams, a resonant vibration started in the assembly and caused severe oscillations leading to support failure at 50 mile/h. Double supports of 3-in. or 4-in. I beams showed lower stress concentrations than single 4-in H beams and reduced flutter at sign edges.

21. Pepper, A.R., "Traffic control and facilitation." Am City 68: n 10, Oct 1953, p 141, 143.

Of first importance for high speed traffic are highway symbols and messages defining proper use of roadway; examples given of Denver Boulder Turnpike where simplified route diagrams

bearing reflectorized arrows and route designations on 4x6-ft. plywood panels, are erected at all junction points; speed restriction of 65 mph is posted every 2½ mi; road delineation markers consisting of reflector units mounted in guard posts are provided along shoulder edge.

22. Plywood signs cut replacement costs." The American City, Vol. 69, No. 4,p 193, April 1954.

Because traffic signs of resin-overlaid fir plywood can't be wrapped around the post by vandals and won't chip or rust when struck by rocks and bullets,Tacoma, Washington, is replacing all its existing signs with plywood units. According to R.E. Schmidt, Tacoma traffic engineer, some 4,000 of the new signs have been placed in service, two thirds of them reflectorized. Replacement has moved forward most rapidly in areas where vandalism has been prevalent and monthly sign requirements are dropping rapidly.

The blanks are 5/8 inch panels which are rounded off at the edges to quicken runoff. The resin-overlaid service, permanently fused with the plywood when laid up in the hot press, is the base for either enamel of reflectorized surfaces.

23. "Sign supports--foundation design." Nat Research Council - Highway Research Board Bul n 247, 1960, 35 p.

Papers at 38th Annual Meeting, Jan 5-9, 1959, Washington,DC as follows: Foundations to Resist Tilting Moments Imposed on Upright Cantilevers Supporting Highway Signs, W.C. Anderson, 1-13, Tests of Tilting Moment Resistance of Cylindrical Reinforced Concrete Foundations for Overhead Sign Supports, F.E. Behn, 14-33; Device for Evaluating Horizontal Soil Resistance for Overhead Sign Supports, W.C. Anderson, 34-5.

24. "Signs that stick." Modern Plastics 29: n 3, Nov 1951, p 86-7

Use of cast vinyl plastisol sheeting by Ad-Stik Co., Pittsburg, Pa., to provide point of sale advertising surface; surface of vinyl sheet can be pressed against smooth surface, and sign will adhere indefinitely without glue or other adhesive; sign is readily removed by peeling; product is about same price as decals.

25. "Sprayed-on masks." Modern Plastics 31: n 1, Sept 1953, p 98-9

How strip type vinyl coating sprayed on surface in liquid form and air dried to form abrasion resistant film covering, has been successfully adapted as masking material for painting formed acrylite signs; coating, Spraylat A, was originally developed by Spraylat Corp., New York, N.Y. as means of protecting formed acrylite parts during fabrication, etc. method of coating signs.

26. "Traffic Control Needs in Iowa." Traffic and Highway Planning Department, Iowa State Highway Commission, October 1, 1961, 154 p.

The Highway Commission retained the services of the Automative Safety Foundation to assist in the development of techniques, analysis of data and the preparation of the final report.

The study was planned and carried out in four fairly distinct phases. First was a study of all existing signs and signals to compare them with the new standards and determine needed replacements.

Second was a study of need for signs and signals to determine those which be removed and those which should be added.

Third was a study of route numbers, both U.S. and State, to determine changes which could be made to reduce duplications and improve signing.

Fourth was a study of city names used for destination purposes on the Primary System to develope a consistent System of destination.signing.

The cost of the modernization program, together with the projected costs of current and proposed programs, will require an increase of $ 1 million per year over the next five years. Normal increases in maintenance costs account for part of this increase. The major part is related to traffic signal modernization, required new signal installations and continued maintenance. In the past, these costs have been born by the municipalities.

Figures and tables will be used to supplement the discussion of each part of this report. They may or not be referred to directly, depending on the importance of aiding and clarifying the text.

27. "Two cities' experience with plywood traffic signs." Street Engineering (22 W Maple St., Chicago 10, Ill.), Vol. 6, No. 2 pp 24-25, 34, Feb 1961.

High-density overlaid plywood as a material for traffic signs which first gained national acceptance with the Interstate highway program, is following the highroads into the cities. While this type of signconstruction is still new in many cities its use in others is as old as the yellow stop sign.

As reported by the Douglas Fir Plywood Association, the cities of Tacoma and Seattle, Washington, both have used plywood signs for many years and use them today for every conceivable application, including the smaller restrictive type signs. Some of these regulative signs in Tacoma have been in continuous service for more than 7 years. Seattle has plywood signs which have been in use 15 years.

Two major developments in plywood manufacture have made softwood plywood panels useful as traffic signs. The first was the development of exterior glue which forms a highly permanent bond between the plys. Phenolformaldehyde adhesive creates a bond so strong that no exposure to water, weather, heat or cold can weaken it.

Plywood in a few areas has been used since as far back as the 1930's for traffic signs. However, the standard exterior panel has a disadvantage in sign applications because of face checking or grain raise that tends to cause flaking of the sign surface.

This problem was eliminated with the more recent development of high-density overlaid fir plywood. The panels are overlaid with a resin-impregnated fiber surface that is permanently fused to the plywood. This surface gives a smooth, plastic-like covering well suited for sign uses. A special panel with a green overlay (Kimpreg 8000 green) was developed for use in the Interstate highway program.

One of the earlier users of the high-density overlay panels for signs wasthe Wisconsin State Highway Commission. Other early users include the Port of New York Authority which uses high-density panels for regulatory and directional signs on bridge, tunnel, highway and airport approches; also the Texas Highway Department (Gulf Freeway at Houston) and the Washington State Highway Department. After suceess in these areas, plywood became one of the standard sign materials along the Interstate highway system.

Tacoma's traffic engineer, Yoshio Kasai, reports that the advantages of plywood signs for city applications are much the same as those shown in rural highway signs: low initial cost, resistance to vandalism, durability and low maintenance.

28. Wallace, R.W. "Overhead signs for better traffic control." Pub Works 88: n 3, Mar 1957, p 128-9.

To be most effective advance destination sign should be placed distance of 300 to 500 ft. from intersection; for multi-lane highways it is desirable to use separate sign for each lane; letters should be not less than 12 in. in height and preferably 15 or 18 in; sign should be at heightof not less than 17 ft above road.

29. Watson, W. "Signing New Jersey roads." Civ Eng (NY) 31: n 6, June 1961, p 36-8

Policy in selecting names of cimmittees which will appear on signs, for designation at intersections; advance signaling of intersections, construction, material, and application of signs; pole supports and bridge supports; signs for George Washington Bridge approaches.