

White Paper on Sign-making
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Introduction

Business success requires producing a quality product while maintaining a strong bottom line. Many businesses rely on proven, cost-saving, and waste-reducing practices, and road sign manufacturing is no exception. Standards for “rotationally sensitive” materials or materials whose reflective performance is based upon orientation, established by the American Association of State Highway and Transportation Officials (AASHTO) present a challenge to fabricators’ best practices.

To reduce costs and avoid waste, fabricators typically use material on hand rather than purchasing additional materials for each new job. When using rotationally sensitive materials, manufacturers’ recommendations prohibit this practice. Speed limit signs 36 inches wide by 48 inches tall, for instance, require 36 inch material at 0 degrees or 48 inch material at 90 degrees to retain reflective performance. Rotationally sensitive materials cannot be turned to fit sign shapes. When producing rectangular speed limit signs or diamond-shaped warning signs, the aluminum backings must be in the upright position (the direction the sign will be placed on the road) on the sheeting material, even though it would reduce waste and costs to rotate the backings so they could be placed side by side.

The Manual on Uniform Traffic Control (MUTCD), which sets the national standard for road sign appearance, placement and maintenance, recently updated compliance guidelines for

minimum road sign reflectivity specifications. In response, states are evaluating road sign performance. Is sign luminance consistent? Do discolorations or background lines reduce visibility or distract drivers?

New specifications and state agencies recognition of road sign reflectivity problems mean replacement of unsatisfactory road signs which is a boon for fabricators. Yet, many fabricators struggle to meet the bottom line as the materials many use don't readily allow for best practice implementation.

State-of-the-art rotationally insensitive materials that provide optimal reflective performance regardless of orientation are available. Conforming to all the newest specifications, rotationally insensitive materials save fabricators time and reduce costs. These new materials dramatically improve road sign manufacturing.

From Glass Beads to Prismatic Materials

In the early years of sign production, when glass beading from spherical tubing set the standard for sign sheeting, orientation was not a concern. Providing consistent reflectivity from all angles and directions, glass bead sheeting worked in perfect in harmony with any sign specifications, regardless of the way the sign was manufactured or installed. In the early 1920's, prismatic sheeting introduced a brighter alternative to glass beads. Prismatic materials soon became the new standard in the sign-making industry, essentially eliminating glass bead technology. Commercialization triggered a rush for brighter and brighter versions, yet manufacturers found limitations to the amount they could increase the brightness. They failed to acknowledge that prisms are fundamentally asymmetrical. Manufactured sheets of identical rows ultimately perform best in one direction, 0 degrees, and turning the material or piecing

together materials with different orientations produces inconsistent reflectivity. Manufacturers subsequently began to include usage requirements with their rotationally sensitive materials, a practice which continues today.

Impact of Preferred Prismatic Sheeting Orientation on “Best Practices”

For fabricators, these requirements, though instructional, negate many best practices traditionally utilized to minimize waste and reduce costs. Cutting different shaped signs, (i.e. stop signs and “one-way” signs) simultaneously saves time and materials, as does turning materials to fit odd-shaped signs. In addition, nesting is often used to produce legends (since lining up the letters in order in the word “Missouri” for instance, is more costly than turning the letters every-which-way to fit closer together and save material). Studies show fabricators may use 25 percent less materials when they nest legends. These cost-cutting practices, however, induce rotation when working with rotationally sensitive materials and reduce reflective performance. Although fabricators would prefer to ignore sheeting orientation when bolting separate panels for large guide signs, bolting mismatched orientation panels leaves lines and/or discolored backgrounds at the panel connection points.

Rotational sensitivity makes a difference when cutting the white borders that frame road signs. All components must be cut in the same direction to avoid different luminance between top, bottom and sides. Uniform cutting requires considerably more time and effort. Manufacturing rotationally sensitive sheeting materials demands time-consuming attention to sign orientation.

How Agency Responses to Prismatic Materials Affect Fabricators

AASHTO pioneered the official recognition of prismatic sheeting retroreflectivity problems when it published the M268-10. Used to “identify sign sheeting materials for rigid signs and their common specification designations”, this publication inaugurated the phrase “rotational sensitivity.” The Federal Highway Administration (FHWA) set minimum standards for retroreflectivity in the second edition of the 2003 The Manuals on Uniform Traffic Control Devices (MUTCD), which provides national guidelines for appearance, placement and maintenance of road signs. For fabricators, the MUTCD proved important, since it prompted various state agencies to examine road signs and determine what changes were necessary to comply. Several states made significant changes:

- The Texas Department of Transportation (TxDOT) leads and innovates in concern about inconsistencies in road signs manufactured using rotationally sensitive products. TxDOT developed a Quality Product List (QPL) of acceptable sign-making materials for specific types and locations of signs. In addition, TxDOT inspectors visit fabricators’ businesses with whom they contract to inspect materials and processes and ensure signs meet their standards. Texas Transportation Institute (TTI), a division of Texas A&M University that collaborated on MUTCD and is well-regarded in the research of retroreflectivity, supports TxDOT research and findings.
- The Illinois Department of Transportation (IDOT) revised its road sign specifications to insure rotationally sensitive materials were well-marked: “If material orientation is required for optimum retroreflectivity, permanent

orientation marks shall be incorporated into the face of the sheeting. Neither the overall pattern nor the orientation marks shall interfere with the retroreflectivity of the sheeting.” IDOT replaced several new signs on the Dan-Ryan Expressway, a major highway, due to inconsistencies in legend luminance.

- The Missouri Department of Transportation (MODOT), which began outsourcing sign manufacturing in 2010, has updated road sign specifications. It now states: “Retroreflective sheeting applied as legend and border for specific signing applications, without a datum mark on the surface of the sheeting, shall be evaluated for rotational sensitivity per AASHTO M 268.” MODOT stipulates precise procedures for traffic engineers if products do not meet the rotational sensitivity requirements.
- Utah (UDOT) recently updated specifications for road sign manufacturing to include: “Establish proper orientation of the sheeting for all traffic signs and traffic control devices. Verify cutout legends, symbols, and borders have the same sheeting orientation as background sheeting.”

Problems and Challenges

Many agencies are closely reviewing their sign-making procedures and discovering rotationally insensitive materials work best. However, some fabricators have long-standing, loyal relationships with sign sheeting vendors. Other fabricators lack knowledge about rotationally insensitive materials and may be unclear how to work with and utilize the product. Research and education followed by hands-on experience with the rotationally insensitive materials makes all the difference.

Business growth and success often hinges on new ventures, improving operations and evolving best practices to attract new and serve existing clients.

The Solution: Switching to Rotationally Insensitive Sign-making Material

Switching to rotationally insensitive sign-making materials carries tremendous benefit. Concerns about material orientation no longer hold sway. Regardless of how material comes off the roll, how it's turned to fit a particularly odd-shaped sign or whether it is pieced together from scraps, the reflective performance of rotationally insensitive materials will remain robust and consistent. For fabricators, this equates to saving time and reducing waste, or basically implementing best practices. Speed limit signs and directional arrows can be cut from the same sheet. State names from Alabama to Wyoming, highway legends for overhead guide signs and mounted shoulder signs can be nested for optimal cost and time savings.

In addition, all signs manufactured with rotationally insensitive materials satisfy all local, state and federal compliance specifications. They also meet end-user expectations the first time, creating goodwill and long-lasting business relationships.

Avery Dennison's Omni-Directional Prismatic Retroreflective Films

Avery Dennison has a long successful history of producing prismatic materials. Avery Dennison's omni-directional films are the only truly rotationally insensitive sheeting available in today's market. Durable and robust at any angle, omni-directional sheeting is perfect for any size or shape of sign. It also ensures all signs will have consistent retroreflectivity regardless of installation, driver's angle or height of vehicle on approach. Compliant with all federal and state specifications, omni-directional sets the standard in sign-making and installation. In addition, with no orientation concerns, nearly every piece of sheeting is usable, eliminating most waste.

Because Avery Dennison's products are not proprietary, they can be used in conjunction with or in place of any competitor's products with confidence and ease.

Summary and Conclusion

Like all business owners, sign-makers must focus on the bottom line. Understanding what their customers want is essential. In the sign industry, end users want and expect a durable, visually effective road sign with consistent reflective qualities to enhance driver safety.

Sign-making fabricators using rotationally insensitive sheeting materials have a foolproof product with consistent retroreflectivity performance at any angle, which provides time- and cost-savings. Rotationally insensitive sheeting satisfies compliance specifications and provides the optimal level of reflectivity end users are seeking for increased traffic safety, without compromising the fabricator's bottom line.

Avery Dennison Credentials

Avery Dennison, a recognized industry leader in developing innovative identification and decorative solutions for businesses and consumers worldwide, has been manufacturing components for prismatic signs since 1924. Globally recognized as a supplier to preferred sign shops, Avery Dennison offers the most comprehensive range of reflective sheeting in the industry, providing a full spectrum of products to meet or exceed local specifications.