As early as 1939, Forbes and Holmes proposed that sign effectiveness could be measured via four general criteria:

- **Priority value** - Qualities that cause a sign to be seen and read first.
- **Target value** - Characteristics which distinguish a sign from other objects and signs in its surrounding.
- **Pure legibility** - The distance at which a sign can be read, with an extensive viewing time provided.
- **Glance legibility** - The distance at which a sign can be read, with a short viewing time provided, e.g., less than 1 second.

The first two criteria, acting in combination, are today referred to as “conspicuity.” This chapter will look in more detail at the factors that result in conspicuity.

### Visual Conspicuity

Generally, a driver’s view of the roadway environment is characterized by a perceptual continuum ranging from initial detection to final recognition. A conspicuous sign, by definition, stands out from its visual surroundings, and therefore, has a high probability of being detected.

One way to think of conspicuity, as opposed to visibility, legibility or readability, is that the term relates to a sign in its surroundings. A sign in isolation, mounted within a driver’s cone of vision, may meet all the criteria for visibility (or detectability at some distance), legibility (letters and/or graphics can be easily differentiated), and readability (the legend in totality conveys a meaningful or understandable message to the viewer). However, if the same sign is placed among many visible objects along the roadway, such as other signs, utility poles, traffic control devices, bus shelters, and right-of-way landscaping, the sign may blend into the background to the point that it becomes essentially invisible. Principal factors affecting conspicuity are the extent of one’s “cone-of-vision,” brightness, figure-ground complexity, status of peripheral vision (visual and other cues).

---


---

An inconspicuous sign, such as this Applebees sign (which is subject to regulations that strictly limit sign height), cannot do the job it was intended to do because it cannot be easily seen far enough in advance for a driver to safely maneuver through traffic.
Conspicuity and Readability Issues

Conspicuity means the noticeable contrast between a sign and its background, attributed to an exogenous (unplanned) or endogenous (planned) mindset, with the display having features that attract attention to the sign. In highway literature, this is described as “search conspicuity” and “attention conspicuity.”

Search conspicuity is defined as a measure of a sign’s detectability when the driver is looking for it or the information it contains. This would be the case if a driver is looking for a particular destination, such as a place to eat. Attention conspicuity is the sign’s ability to attract attention when it is not expected by the driver, such as construction or warning signs.

Laboratory studies of sign detection have found that if signs are similar, those which are being sought (which have search conspicuity) are three times more likely to be seen than those which are unexpected (attention conspicuity). Both task demand and background visual complexity strongly influence the likelihood that a sign will be detected, but attention conspicuity is more heavily influenced by task difficulty.²

Terminology Clarification: Visibility, Conspicuity, Legibility, and Readability

Visibility and legibility are primarily considered as objective stimuli, while conspicuity and readability may be considered as the respective subjective outcomes.

Assume a motorist is driving down a street and approaching a restaurant whose sign lacks visibility. Whether the visibility is due to atmospheric conditions (darkness, fog, rain, sunlight glare, etc.) or properties of the sign itself (size deficiency, poor illumination, lack of contrast, etc.), in such a case the sign is not conspicuous – therefore, it is not seen. As a result, legibility and readability do not even enter the picture.

Assume, however, that no visibility problem exists, but the sign in question is outside of the motorist’s “cone-of-vision” so that it is not noticed – again, it is not seen. This could be the case even if the motorist had an endogenous mindset (i.e. he was actually looking for that particular restaurant).

On the other hand, assume the motorist had no thought of looking for the restaurant, but its sign was within the “cone-of-vision” and thus in view. Furthermore, assume the sign was legible and readable, allowing the motorist to comprehend the message of the sign. The motorist can now make a decision to stop at the restaurant at that time or at some time in the future to eat something. This is an example of exogenous (unplanned) conspicuity.

In short, the sequence of events for comprehending the meaning of a sign’s message follows the necessary criteria:

1. Visibility
2. Conspicuity
3. Legibility
4. Readability

Terminology usage frequently varies among authorities concerned with signage. Such

² Richard Schwab, Past Chairman of the National Academy of Sciences’ Transportation Research Board’s Visibility Committee.

When a sign fades into its background due to lack of contrast, it fails to communicate for either advertising or wayfinding.
inconsistency often leads to confusion. The Glossary contains definitions of these and other principal terms used in this document, as well as in the real world of motorists’ vision pertaining to signage.

Commercial signs compete in a complex environment. Passing motorists must be able to differentiate a business’s sign from everything else. Most people view a sign from a car through the windshield. They must be able to see, read and react to the sign in a matter of seconds.

Assuming the status of central and peripheral vision is good (i.e., at least 20/40 acuity and full visual fields), Figure 6 shows the progression involved in the typical “see, read, and react” response to a sign.

At any moment, a driver is in the act of committing his/her vision to a subportion of a fan-shaped visual awareness zone or “cone of vision.” The important information that guides the driver comes from visual inputs within that cone. The cone of vision pertains primarily to location for conspicuity, rather than for readability. Vision decreases rapidly from the central fixation point (center of the fovea) to the peripheral vision. For example, at just 4 degrees from the central fixation point, a driver with 20/40 central visual acuity (the minimum for legal driving) will have peripheral vision of approximately 20/100.3

Some factors the driver must consider are highway design, road surface, traffic volume, the speed and spacing of vehicles in his vicinity, his speed, weather (particularly its affect on visibility), and time of day. All of these factors must be considered when determining whether a particular sign is well placed in relation to the driver’s cone of vision so that it will be seen.

At night, the cone of vision is greatly reduced, often to only the area illuminated by the vehicle’s headlights. Unless a sign otherwise optimally visible is either internally lighted or lighted by exterior flood lamps, it is essentially invisible at night. Furthermore, signs containing retroreflective materials cannot be seen unless they can be illuminated by vehicle headlights.

For retroreflective signs to perform their function safely and effectively under nighttime or inclement weather conditions, they must be capable of reflecting light from vehicle headlamps back toward the driver. Low-beam headlamps are used by most drivers except where traffic volume is very high.
Conspicuity and Readability Issues

light. Low-beam aim favors retroreflective signs mounted near the right shoulder of the roadway. As signs are moved away from the shoulder, the amount of headlamp light available for illumination decreases rapidly.

A conclusion by many researchers is that signs should be placed close to the line of sight, because signs are rarely seen at eccentricities greater than 8 degrees, or beyond a cone-of-vision diameter of 16 degrees. When no visual search is possible, either because of complex driving tasks or a test is undertaken to determine the minimum standard required by most states to obtain a driver’s license.

Legibility and Minimum Sight Distance

In most research minimum sight distance is referenced as the MRLD, or “the Minimum Required Legibility Distance at which the sign should become detectable and readable.” Figure 7 sets out setback measurements based on a 20-degree cone of vision. The viewing angle and setback should be measured at the end of the read and react distance, where the angle is greater, rather than at the farther distance at which the sign first becomes legible.

TABLE 1
The Standard Relationship Between Vehicle Speed and Legibility Distance
In Feet and Meters

<table>
<thead>
<tr>
<th>Vehicle Speed</th>
<th>MRLD</th>
</tr>
</thead>
<tbody>
<tr>
<td>55 mph (88 kph)</td>
<td>81' /sec (25 m/sec)</td>
</tr>
<tr>
<td>50 mph (90 kph)</td>
<td>73' /sec (22.25 m/sec)</td>
</tr>
<tr>
<td>45 mph (72 kph)</td>
<td>66' /sec (20 m/sec)</td>
</tr>
<tr>
<td>40 mph (64 kph)</td>
<td>59'/sec (18 m/sec)</td>
</tr>
<tr>
<td>35 mph (56 kph)</td>
<td>51' /sec (15.5 m/sec)</td>
</tr>
<tr>
<td>30 mph (48 kph)</td>
<td>44' /sec (13.4 m/sec)</td>
</tr>
<tr>
<td>25 mph (40 kph)</td>
<td>37' /sec (11.3 m/sec)</td>
</tr>
</tbody>
</table>


Environmental degradation, distractions, or visual obstructions. It further assumes that the visual acuity of the observer is 20/40 – the minimum standard required by most states to obtain a driver’s license.

Viewing Angle

Older research has clearly established that the greatest likelihood of seeing a sign (visibility and conspicuity) and reading the words on it (legibility and readability) is when the sign face is mounted perpendicular to traffic flow, and within the viewer’s cone of vision, at an angle 2-3 degrees of perpendicular (the angle helps eliminate daytime or headlight glare). According to Schwab, a general assumption is that at angles greater than 2-3 degrees, the sign’s legend or copy is foreshortened, thereby decreasing legibility and readability.

A study by Griffin and Bailey was undertaken to determine the legibility of signs that were not mounted perpendicular to traffic flow.

The illustrations below show a motorist’s view of signs with different degrees of obliquity.

The freestanding sign with a face perpendicular to the roadway is the most readable.

According to Griffin and Bailey, for an approaching pedestrian viewing the above signs, the wall sign, while visible, is not readable but the “V” sign, at a 30-degree angle, is both legible and readable, although the sign is 60 degrees oblique to the pedestrian’s line of sight (angle 60 degrees from a direction perpendicular to the sign). For a motorist approaching on the same side of the street as the “V” sign, the obliquity of the sign would be less than for a pedestrian, because the setback from the street is greater than from the sidewalk. Less obliquity would also hold true for motorists approaching from the opposite direction.

Although the “V” sign is a compromise between a perpendicular pole sign and a parallel wall sign, Griffin and Bailey concluded that such a sign angled approximately...
When the Formulas and Calculations Don’t Work – Blockage or Masking

We know about minimum heights, sight distances, and cones of vision, however, fails to address five factors, which block the sign, or otherwise obstruct a viewer’s detection. These factors are:

- Curbside parking and traffic
- Curbside landscaping, shrubs, trees, etc.
- Signs not perpendicular to the roadway
- After-dark driving
- Signs with broken or missing elements
- Driving during inclement weather or foggy conditions

Even signs not masked during daylight hours by parked or passing cars, pedestrians or landscaping, may be masked during nighttime hours. Obviously, night decreases the cone of vision – often limiting it to only that cone which is disclosed or reflected by vehicle headlights. A sign must be either internally lighted or lighted by exterior flood lamps if it is to be visible at night.

The federal standards require a free-standing sign, placed in the right of way and readable from only one direction, to be 5 feet (1.5 meters) in height from sign base to sign face in rural (or non-complex) driving situations, and 7 feet (2.1 meters) in business and commercial (or complex) driving situations. This “complex” standard recognizes that parked cars, and curbside traffic and landscaping may block sign copy or legends if the face height is less than 7 feet (2.1 meters) from the ground. Masking creates traffic hazard, yet many municipalities demand sign heights of less than 5 feet (1.5 meters). Today, even the federal height standard may be inadequate, given the great influx of 4-wheel drive pickups and sports utility vehicles on our roads. Many of these vehicles approach 7 feet (2.1 meters), and more, in height. The result is that drivers cannot see signs between themselves and a parked or passing vehicle.

Garvey, et al, also confirmed that signs oriented perpendicular to the adjacent street were both more detectable and legible than parallel (wall or fascia) signs. Although there was some variation in the number of wall signs that went undetected by test subjects, based on the nature of the commercial site, parallel signs were missed significantly more times than perpendicular signs. Additionally, the research team found that increasing the size of a parallel sign did not improve its visibility. For example, in strip commercial areas, the researchers report that perpendicular signs were almost never missed, while test subjects failed to detect 30% of the parallel signs, even though the parallel signs were 2-3 three times larger. In central business districts (with posted speed limits of 25 mph), between 50-60% of parallel signs were likely to be missed, compared to a 30% “miss rate” for perpendicular signs. And when the subjects were able to find a subject sign, the business district perpendicular signs were read 100% further away than the parallel signs. This differential in detection/legibility distance increased to 400% for the strip development locations.


30 degrees from the wall of a building that is parallel to the roadway is highly readable (criterion of 75% accuracy under normal viewing conditions). Note that 50% accuracy is the visual acuity criterion when using professional eye charts. They found, however, that readability at increasingly oblique angles is greatly reduced when a sign utilizes crowded letters (small spaces between letters); although, larger letters may be used to help offset crowding if wider spacing is not an option. (Refer to the complete report of their research for details of their study on obliquity.)

Garvey, et al, also confirmed that signs oriented perpendicular to the adjacent street were both more detectable and legible than parallel (wall or fascia) signs. Although there was some variation in the number of wall signs that went undetected by test subjects, based on the nature of the commercial site, parallel signs were missed significantly more times than perpendicular signs. Additionally, the research team found that increasing the size of a parallel sign did not improve its visibility. For example, in strip commercial areas, the researchers report that perpendicular signs were almost never missed, while test subjects failed to detect 30% of the parallel signs, even though the parallel signs were 2-3 three times larger. In central business districts (with posted speed limits of 25 mph), between 50-60% of parallel signs were likely to be missed, compared to a 30% “miss rate” for perpendicular signs. And when the subjects were able to find a subject sign, the business district perpendicular signs were read 100% further away than the parallel signs. This differential in detection/legibility distance increased to 400% for the strip development locations.

Garvey, et al, also confirmed that signs oriented perpendicular to the adjacent street were both more detectable and legible than parallel (wall or fascia) signs. Although there was some variation in the number of wall signs that went undetected by test subjects, based on the nature of the commercial site, parallel signs were missed significantly more times than perpendicular signs. Additionally, the research team found that increasing the size of a parallel sign did not improve its visibility. For example, in strip commercial areas, the researchers report that perpendicular signs were almost never missed, while test subjects failed to detect 30% of the parallel signs, even though the parallel signs were 2-3 three times larger. In central business districts (with posted speed limits of 25 mph), between 50-60% of parallel signs were likely to be missed, compared to a 30% “miss rate” for perpendicular signs. And when the subjects were able to find a subject sign, the business district perpendicular signs were read 100% further away than the parallel signs. This differential in detection/legibility distance increased to 400% for the strip development locations.

Garvey, et al, also confirmed that signs oriented perpendicular to the adjacent street were both more detectable and legible than parallel (wall or fascia) signs. Although there was some variation in the number of wall signs that went undetected by test subjects, based on the nature of the commercial site, parallel signs were missed significantly more times than perpendicular signs. Additionally, the research team found that increasing the size of a parallel sign did not improve its visibility. For example, in strip commercial areas, the researchers report that perpendicular signs were almost never missed, while test subjects failed to detect 30% of the parallel signs, even though the parallel signs were 2-3 three times larger. In central business districts (with posted speed limits of 25 mph), between 50-60% of parallel signs were likely to be missed, compared to a 30% “miss rate” for perpendicular signs. And when the subjects were able to find a subject sign, the business district perpendicular signs were read 100% further away than the parallel signs. This differential in detection/legibility distance increased to 400% for the strip development locations.

Garvey, et al, also confirmed that signs oriented perpendicular to the adjacent street were both more detectable and legible than parallel (wall or fascia) signs. Although there was some variation in the number of wall signs that went undetected by test subjects, based on the nature of the commercial site, parallel signs were missed significantly more times than perpendicular signs. Additionally, the research team found that increasing the size of a parallel sign did not improve its visibility. For example, in strip commercial areas, the researchers report that perpendicular signs were almost never missed, while test subjects failed to detect 30% of the parallel signs, even though the parallel signs were 2-3 three times larger. In central business districts (with posted speed limits of 25 mph), between 50-60% of parallel signs were likely to be missed, compared to a 30% “miss rate” for perpendicular signs. And when the subjects were able to find a subject sign, the business district perpendicular signs were read 100% further away than the parallel signs. This differential in detection/legibility distance increased to 400% for the strip development locations.

Garvey, et al, also confirmed that signs oriented perpendicular to the adjacent street were both more detectable and legible than parallel (wall or fascia) signs. Although there was some variation in the number of wall signs that went undetected by test subjects, based on the nature of the commercial site, parallel signs were missed significantly more times than perpendicular signs. Additionally, the research team found that increasing the size of a parallel sign did not improve its visibility. For example, in strip commercial areas, the researchers report that perpendicular signs were almost never missed, while test subjects failed to detect 30% of the parallel signs, even though the parallel signs were 2-3 three times larger. In central business districts (with posted speed limits of 25 mph), between 50-60% of parallel signs were likely to be missed, compared to a 30% “miss rate” for perpendicular signs. And when the subjects were able to find a subject sign, the business district perpendicular signs were read 100% further away than the parallel signs. This differential in detection/legibility distance increased to 400% for the strip development locations.

Garvey, et al, also confirmed that signs oriented perpendicular to the adjacent street were both more detectable and legible than parallel (wall or fascia) signs. Although there was some variation in the number of wall signs that went undetected by test subjects, based on the nature of the commercial site, parallel signs were missed significantly more times than perpendicular signs. Additionally, the research team found that increasing the size of a parallel sign did not improve its visibility. For example, in strip commercial areas, the researchers report that perpendicular signs were almost never missed, while test subjects failed to detect 30% of the parallel signs, even though the parallel signs were 2-3 three times larger. In central business districts (with posted speed limits of 25 mph), between 50-60% of parallel signs were likely to be missed, compared to a 30% “miss rate” for perpendicular signs. And when the subjects were able to find a subject sign, the business district perpendicular signs were read 100% further away than the parallel signs. This differential in detection/legibility distance increased to 400% for the strip development locations.
blesome as communication devices (although they can be very attractive as “trade dress”) because they may be blocked for a large majority of passing motorists. This is so because they are parallel to the roadway, and unless the driver is approaching from a direction directly or nearly-directly opposite, the sign is outside the cone of vision. To those driving past, it can only be discerned by a sideways glance, and possibly a complete turn of the head. In many cases, neither action provides the driver enough time to safely slow down, brake, or change lanes should the sign prompt a responsive reaction or contain information the driver is looking for.

Color-coded signature buildings, such as BP gasoline stations, have resolved the masking problem with wall signs by carrying recognizable “logo” colors all the way around the building. However, most commercial buildings are not stand-alone and are limited to presenting only one side of their face to the public. And while the wall sign placed or painted on this face may accommodate all minimum site distance and sign area formulas, and meet all minimum height, size and legibility/readability requirements, it still remains fundamentally invisible to a significant proportion of the driver public.

To correct this visibility deficiency and enhance safe driver responses, it may be necessary to install either a building-mounted, double-faced projecting “V”, double-faced roof sign, or double-faced free-standing sign near the right of way and perpendicular to the adjacent road.