TECH NEWS
TECHNOLOGY NEWS

January-February 2005

Providing drivers with a clear, adequate line of sight

The ultimate goal of a "sight distance study" is to ensure that, in any given situation, a driver's actual sight distance is equal to or greater than the minimum recommended sight distance.

Sight distance is the length of roadway visible to a driver. Drivers need adequate sight distance to anticipate and avoid potential collisions with objects in the roadway (stopping sight distance) or with other vehicles at intersections (intersection sight distance). Sight distance can be obstructed by roadway geometry, traffic control devices, buildings, fences, trees and shrubs, and other obstructions.

Sight distance studies may be appropriate at a high-crash intersection, at locations where a change in speed limit is being considered, or in areas experiencing development along a roadway.

Editor's note

This article is the third of five summaries of traffic studies described in the Handbook of Simplified Practice for Traffic Studies: (1) spot speeds, (2) traffic volumes, (3) sight distances, (4) crash analyses, and (5) school zone programs. The handbook was developed by CTRE and funded by the Iowa Highway Research Board (TR-455).

The handbook describes straightforward traffic study procedures to help local agencies "get their arms" around specific traffic-related questions or potential problems. Data collected from these studies can be critical to decision making and can help agencies communicate more effectively with community members and local officials.

All procedures outlined in the handbook and described below follow national standards.

General study information

For any sight distance study, workers will conduct the following activities:

1. Obtain or construct sighting and target rods.
2. Use the rods to measure current sight distance; record the distance.
3. Compare measured sight distance to recommended or minimum sight distance.
4. If the measured sight distance is less than recommended, implement mitigation measures.

The rods can be constructed of 2-inch by .75-inch wood. See Figure 1.

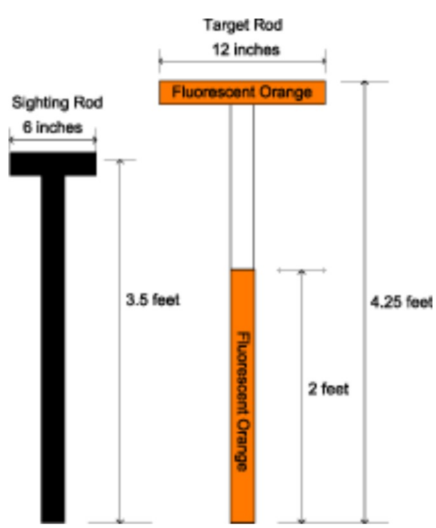


Figure 1. Configurations for a sighting rod and target rod

A target rod should be 4.25 feet tall to represent vehicle height. The top and the bottom 2 feet of the rod should be painted fluorescent orange. (The bottom 2 feet represents an object in the road.)

A sighting rod should be 3.5 feet tall to represent the driver's eye height.

AASHTO has determined minimum "stopping sight distances" and "intersection sight distances"; see Tables 1, 2, and 3. (AASHTO's computations for minimum sight distances are related to vehicle speeds and the distances vehicles travel during the time it takes drivers to perceive and react to an object or vehicle in the roadway.)

Stopping sight distance studies

When considering stopping sight distance, drivers need a clear line of sight along a straight line from the vehicle (driver's height) to a potential object in the road ahead.

An important consideration is the vertical curvature of the roadway. On straight roadways, a vertical curve may obstruct the line of sight. See Figure 2.

Figure 2. Sight rod (right) and target rod in use

To determine actual sight distance, an observer standing at a predetermined location on the roadway sights from the top of the sighting rod. An assistant holding the target rod moves away in the direction of travel. When the bottom 2 feet of the target rod is no longer visible to the observer, the assistant stops. The distance between the observation point and the disappearing point is measured and recorded.

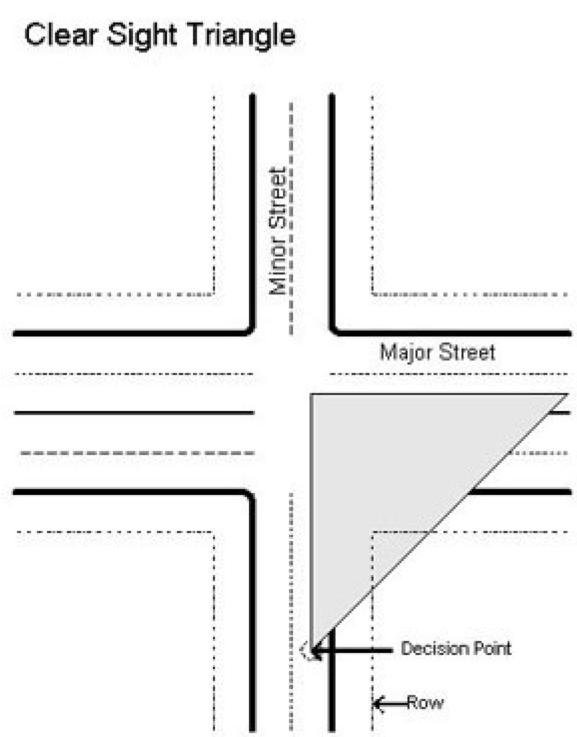
If the measured sight distance is less than the minimum stopping sight distance (see Table 1), the agency should consider mitigation procedures. Strategies might include the following:

- Install traffic control device(s).
- Establish no passing zones.
- Conduct public awareness campaigns.

Intersection sight distance studies

Drivers approaching an uncontrolled intersection or departing from a stop sign or traffic signal at a controlled intersection should have an unobstructed view in either direction. The view should include sufficient lengths in either direction along the intersecting highway to permit the driver to anticipate and avoid potential collisions.

Because intersections involve traffic approaching at right angles, drivers require a clear line of sight across a triangular area. See Figure 3.



A "sight triangle" is the area encompassed by a right triangle made by connecting three points:

- a point at the minimum sight distance from an intersection to an approaching vehicle on one leg of the intersection (point "A"),
- a point at either the measured (actual) sight distance (point "B^1") or minimum sight distance (point "B^2") along the intersecting leg of the intersection, and
- the centerpoint of the intersecting legs in the intersection

"point C").

The line of sight is the hypotenuse of the sight triangle.

The method for measuring actual sight distance differs between uncontrolled and stop-controlled intersections.

Controlled intersection

An observer with a sighting rod stands at the center of the approach lane, aligned with the stop sign or traffic signal, and sights from the top of the sighting rod. An assistant holding the target rod moves away from the observer along the intersecting roadway toward approaching traffic.

When the observer can no longer see the target rod, the assistant stops. The distance between the observation point and the disappearing point is measured and recorded.

Sight distance is adequate if the measured distance is equal to or greater than the minimum sight distance; see Table 2.

Uncontrolled intersection

Both an observer with a sighting rod and an assistant with a target rod position themselves at minimum sight distances (based on speed limits) on intersecting approaches to an intersection; see Table 3.

The observer sights from the top of the sighting rod to the top of the target rod. If the target rod is visible, the sight distance is adequate.

Figure 3. A sight triangle for one intersection quadrant (In this triangle, the actual sight distance B^1C is the same as the minimum sight distance B^2C.)

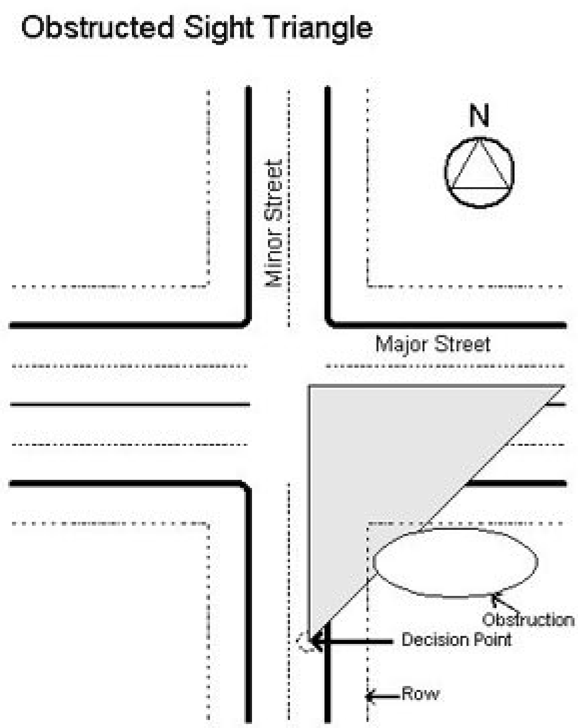


Figure 4. An obstructed line of sight (In this triangle, the actual sight distance B^1C is less than the minimum sight distance B^2C.)

In Figure 4, a tree obstructs the line of sight to the target rod, and the sight distance is not adequate.

At both controlled and uncontrolled intersections, if the sight distance is not adequate, some mitigation may be required. Strategies could include the following:

- Remove or modify obstruction(s).
- Reduce speed limits.
- Install traffic control device(s) if warranted by the MUTCD.

Contracting for a sight distance study

City and county staff are capable of conducting many variations of sight distance studies. However, in some situations it might be helpful to use a consulting firm. (See the article on the following page about situations that may qualify for free consulting services through Iowa's Traffic Engineering Assistance Program.)

Consultants will likely require at least the following information:

- specific need or issue at hand
- existing traffic control devices
- conditions map/photographs
- right-of-way information
- roadway geometry
- crash history

- speed limits
- results of speed studies
- contact person(s)

For more information

This article provides only a general overview of sight distance studies. Contact the Center for Transportation Research at Iowa State University for more information.

Tables

Table 1. Minimum stopping sight distances

Vehicle Speed (mph)	Reaction Distance (ft) +	Braking Distance (ft) =	Summed Distance (ft) =	Stopping Sight Distance (ft)
15	55.1	21.6	76.7	80
20	73.5	38.4	111.9	115
25	91.9	60.0	151.9	155
30	110.3	86.0	196.7	200
35	128.6	117.6	246.2	250
40	147.0	153.6	300.6	305
45	165.4	194.4	359.8	360
50	183.8	240.0	423.8	425
55	202.1	290.3	492.4	495

Note: Distances are from the 2001 AASHTO *Green Book* and are for dry conditions. Distances may change in future versions.

Table 2. Minimum stopping sight distances

Vehicle Speed (mph)	Stopping Sight Distance for Left-Turn Maneuver (ft)	Stopping Sight Distance for Crossover / Right-Turn Maneuver (ft)
15	170	145
20	225	195
25	280	240
30	335	290
35	390	335
40	445	385
45	500	430

50	555	480
55	610	530

Note: Distances are from the 2001 AASHTO *Green Book* and are for two-lane roadways. Distances may change in future versions.

Table 3. Uncontrolled intersection minimum sight distances

Vehicle Speed (mph)	**Stopping Sight Distance (ft)**
15	70
20	90
25	115
30	140
35	165
40	195
45	220
50	245
55	285

Note: Distances are from the 2001 AASHTO *Green Book* and 2001 AASHTO *Little Green Book*. Distances may change in future versions.