Improve intersection sight distances

Stop signs improve safety at an intersection with obscured view.

Follow these procedures to determine recommended intersection sight distances, measure distances in the field and identify actions for improving sight lines.

GOOD VISIBILITY at highway intersections is an important element of roadway safety. Obstructed views where two roads meet increase the chance for vehicle crashes. Local road officials need to maintain sight triangles at these intersections that meet safety standards.

The method described here for determining minimum sight distances at stop-controlled and uncontrolled intersections comes from guidelines in *Geometric Design of Streets and Highways 2004* published by the America Association of State Highway and Transportation Officials (AASHTO). Often called "The Green Book," the guidelines refer to new construction. Local policies related to sight distance requirements might justify lesser minimums for cost/ benefit reasons. But the Green Book likely will be used as a defacto standard in a court case if no local policy exists.

Follow the procedures in this article to determine the recommended intersection sight distance for an intersection, measure the distances in the field, and identify maintenance actions and low cost improvements to address poor intersection sight distance.

These procedures are based on a passenger car approaching an intersection with approach grades of 3 percent or less and an angle near 90 degrees. See the Green Book to adjust for grades greater than 3 percent, angled intersections or significant truck traffic.

Uncontrolled intersection sight triangles

Highway workers and engineers determine sight triangles by calculating an intersection sight distance (ISD) for each leg of an intersection at intersecting roads. The ISD depends on the configuration of the road and existing traffic control at the intersection.

For uncontrolled intersections—those without stop signs, yield signs or other traffic controls—calculate the minimum ISD along two legs of the intersection to establish an "approach sight triangle." (Fig. A) This is the area to keep clear of visual obstructions so approaching drivers have adequate time to identify hazards and respond safely. Determine the distance of each leg of an *approach* sight triangle from Table 1 using the design speed for each intersecting road.

Stop-controlled intersection sight triangles

Stop-controlled legs of intersections use a "departure sight triangle" (Fig. B) to establish the area with unobstructed views so stopped drivers can judge when to enter or cross the intersection.

The length of the short leg of a ***departure*** sight triangle (along the stop-controlled leg of the intersection) is 14.5 feet plus the distance from the edge of pavement to the center of the lane traveled by a vehicle approaching on the uncontrolled leg of the intersection. Determine the length of the long leg of the sight triangle (along the uncontrolled leg) from Table 2 using the design speed of the uncontrolled street.

ISD for yield-controlled intersections is a more complex case. It requires taking measurements of the approach and departure sight triangles, with lengths different from those presented here. Consult the Green Book for details.

Estimating design speed

It helps to know the design speed of a road when establishing sight triangles. Different from the speed limit, design speed is related primarily to the road's horizontal and vertical curve geometry.

Keith Knapp, Director of Transportation Safety Engineering at the Center for Excellence in Rural Safety at the University of Minnesota, suggests that when information on design speed is not available, local agencies use a design speed 5-to-10 mph above the posted speed limit to determine the minimum sight distance required.

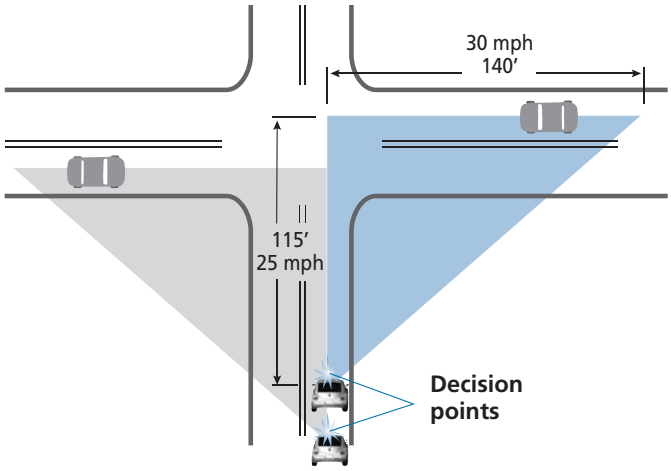


FIG A – Left and right approach triangles at an uncontrolled intersection. Examples show distances taken from Table 1 based on design speeds of intersecting roads.

TABLE 1 – Intersection sight distances: UNCONTROLLED INTERSECTION

Design speed (mph)	20	25	30	35	40	45	50	55	60
Intersection sight distance (ft)	90	115	140	165	195	220	245	285	325

Actions to improve sight lines

Where sight distances do not meet the minimum ISD requirements, the next step is to identify and reduce the obstructions that interfere with sight lines or compensate by changing traffic controls.

Generally, objects that stand higher than 3.5 feet or hang lower than 7.6 feet are considered obstructions in the sight triangle. Some agencies use 2.5 or 3 feet as the lower number and 8.5 feet for the higher number, basing these expanded vertical zones on variations in vehicle height. The expanded vertical zone also helps compensate for vegetation that fills in again after being cut back.

Common sight obstructions include: trees, bushes and crops, fences, signs, buildings, parked vehicles, and roadway pavement or embankment. Although property owners may object, trim or remove vegetation within the right-of-way. For obstructions outside the right-of-way but inside the sight triangle, find out if private property owners must remove them by ordinance. If not, communicate the safety issues and work with property owners to gain voluntary compliance.

When removing an obstruction is impossible or cost prohibitive, local governments can address the sight distance issue with other actions. Installing a stop sign at an uncontrolled intersection (when MUTCD stop sign warrants are met) can reduce the size of the sight triangle. In some cases the way to improve sight lines is to make changes to grades, curves and embankments adjacent to the intersection.

If it is not possible to improve sight distance by removing obstructions, changing intersection control or making geometric changes, consider posting advance warning signs and advisory speed limits to make drivers more aware of the intersection.

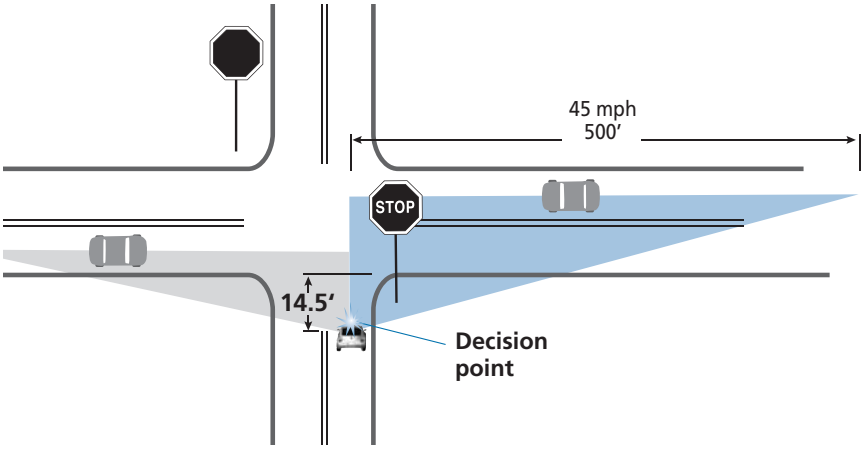


FIG B – Left and right departure sight triangles at stop-controlled intersection. Example shows required sight distance taken from Table 2 based on the design speed of uncontrolled leg of intersection.

TABLE 2 – Intersection sight distances: STOP-CONTROLLED INTERSECTION

Design speed (mph)	20	25	30	35	40	45	50	55	60
Required sight distance (ft)	225	280	335	390	445	500	555	610	665

Safety in season

Summer is a good time to check intersections for adequate and safe sight distances while vegetation is thick and full. The fieldwork to check intersection sight distance is not costly or complicated, and many of the remedies for inadequate sight distance can be done at low cost. Improving sight distances at intersections goes a long way toward reducing crashes and keeping local roadways safe. ■

Resource

http://www.transportation.org/
Link to American Association of State Highway Transportation Officials site and the organization's bookstore, a source for the AASHTO Green Book.

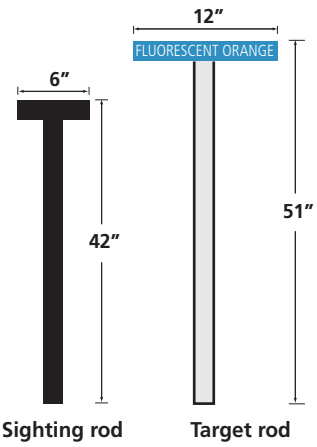
Check ISD in the field

Checking ISD in the field takes a crew of two people with other personnel providing work zone traffic control as necessary.

Tools for the job include sighting and target rods. Construct both from 1x2 lumber. The T-shaped target rod is 51 inches tall with a 12-inch piece of wood fastened horizontally across the top painted fluorescent orange. The sighting rod is a 42-inch-tall version of the same design painted flat black.

Determine sight distances for uncontrolled intersections by placing the sighting and target rods at recommended sight distances taken from Table 1. Sight 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 along the line that describes the limits of the sight triangle. Check sight distances at other locations within the triangle by moving the sighting rod and the target rod toward the intersection, checking visibility at different locations along each leg of the intersection.

Check sight lines at a stop-controlled intersection by first placing the sighting rod at the decision point on the stop-controlled leg. Sight along the top of the rod as the other person, holding the target rod, moves away along the intersecting road. Measure the distance along the intersecting road between the two rods at the point where the target goes out of view. This is the sight distance. If the measured distance is less than the minimum distance, plan to improve visibility by removing obstacles.



Use both sighting and target rods for field measurements.