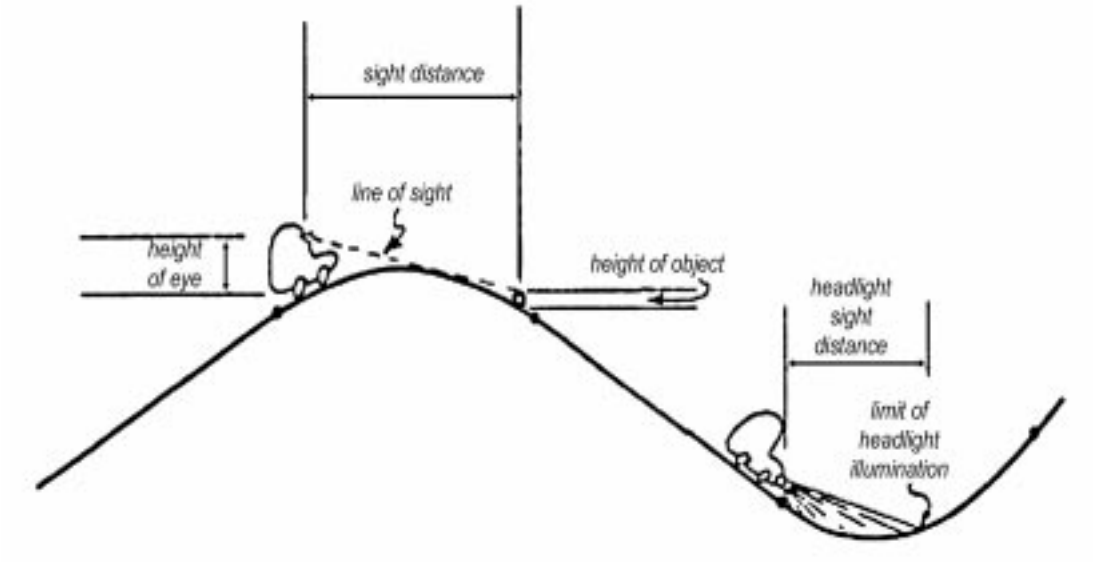
Baystate Roads Program
Local Technical Assistance Program (LTAP)
Tech Notes

Tech Note #35 -- 2004

Stopping-Sight Distance

"Sight distance is the length of the roadway ahead that is visible to the driver. The available sight distance on a roadway should be sufficiently long to enable a vehicle traveling at or near the design speed to stop before reaching a stationary object in its path. Although greater lengths of visible roadway are desirable, the sight distance at every point along a roadway should be at least that needed for a below-average driver or vehicle to stop." *(1)*



Stopping sight distance combines the brake reaction distance and the braking distance. That is, the distance a vehicle travels: (1) from the time an object is sighted to the time that the brakes are applied and (2) from the time the brakes are applied to the time that the vehicle comes to a stop.

The general equation for brake reaction distance is the following:

$$d = 1.47\ V\ t$$

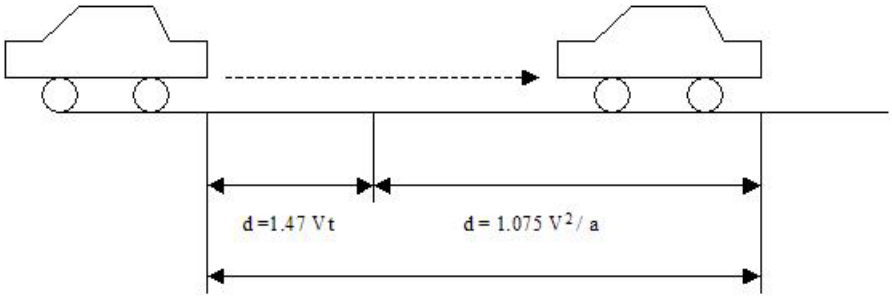
where:
d = brake reaction distance, ft
V = design speed, mph
t = brake reaction time, sec

It has been shown through research that a brake reaction time of 2.5 seconds is adequate for the majority of conditions, excluding the most complex, encountered when driving. This applies to all drivers, including inexperienced and elderly.

The braking distance takes into account vehicle deceleration rate and road design speed. These are combined into the following equation:

$$d = 1.075\ V^2/a$$

where:
d = braking distance, ft
V = design speed, mph
a = deceleration rate, 11.2 ft/s^2



$$SSD = 1.47\ Vt + 1.075\ V^2 / a$$

Combining the brake reaction distance and the braking distance as illustrated in the illustration to the right provides the following formula:

$$SSD = 1.47\ V\ t + 1.075\ V^2 / a$$

where:
SSD = stopping sight distance, ft
t = brake reaction time, 2.5 sec
V = design speed, mph
a = deceleration rate, 11.2 ft/s^2

This equation can be simplified greatly by simply substituting accepted values for brake reaction time and deceleration rate. As mentioned earlier, 2.5 seconds will be used for the brake reaction time. A deceleration rate of 11.2 ft/s^2 has been adopted by AASHTO for all drivers on dry roadways. The equation above includes two constants (1.47 & 1.075), as well. These constants take into account unit conversion rates and driver eye height and object height. "In computing and measuring stopping sight distances, the height of the driver's eye is estimated to be 3.5 feet and the height of the object to be seen by the driver is 2.0 feet, equivalent to the tailgate height of a passenger car." *(1)*

With these substitutions, the formula can be cut down to:

$$SSD = 3.675\ V + .0960\ V^2$$

All that is required now is the vehicle speed! Take a roadway with a 30 mph design speed, for example. Plugging 30 mph into the above equation reveals:

$$SSD = 3.675 * (30) + .0960 * (30^2)$$
$$= 196.7 \text{ feet} = 200 \text{ feet}$$

In this example, 200 feet is the stopping sight distance that should be available at all points on the roadway. In the case of a vehicle traveling 30 mph, it would take 200 feet for the vehicle to come to a complete stop after the driver has detected an object in the travel path. This has all been broken down in the table below, showing the relationship between the reaction, braking, and stopping sight distance.

Reference:

(1) From *A Policy on Geometric Design of Highways and Streets 2001*, 2001, American Association of State Highway and Transportation Officials, Washington, DC. Used by permission. Documents may be purchased from the AASHTO bookstore at 1-800-231-3475 or online at http://bookstore.transportation.org

Vehicle Speed (mph)	Reaction Distance (feet)	Braking Distance (feet)	Summed Distance (feet)	Stopping Sight Distance (feet)
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

Exhibit 3-1. Stopping Sight Distance (1)
Distances are for dry conditions and may change in future versions.