

2.5 Design Values

The sum of the distance

traversed during the brake reaction time and the distance to stop the vehicle is the minimum stopping sight distance. For a vehicle travelling at the design speed v (*fps*), the distance d_1 (*ft*) traveled during the reaction time t (*sec*) is given by:

$$d_1 = t v$$

The distance d_2 traveled during the braking from the design speed v to a stopped condition is given by:

$$d_2 = v^2 / 2a$$

where a is the rate of deceleration (*in fps²*). But

$$F = Wa / g \quad \text{and} \quad F/W = f$$

where F = braking force

W = the weight of the vehicle

f = the coefficient of friction between the vehicle tires and the road surface

g = gravity constant

$a = fg$

and hence

$$d_2 = v^2 / 2fg$$

Now the stopping sight distance $d_s = d_1 + d_2 = t v + (v^2 / 2fg)$

If t is taken 2.5 seconds and if v (*fps*) is converted to V (*mph*), the resulting equation for stopping sight distance becomes:

$$d_s = 3.7 V + (V^2 / 30f)$$

At any given speed, the braking distance increases on down-grades, and reduces on up-grades. If grade is allowed for, the equation for stopping sight distance becomes:

$$d_s = 0.7 V + \frac{V^2}{254(f \pm G)} \quad (\text{metric system}) \quad d_s = 3.7 V + \frac{V^2}{30(f \pm G)} \quad (\text{U.S. Units})$$

(A-2)

where G is the per cent grade, being (+) for an up-grade, and (-) for a down-grade.

2.6 Decision Sight Distance

Stopping sight distances are usually sufficient to allow reasonably competent and alert drivers to come to a rush stop under normal circumstances. However, these distances are often are not long enough when drivers must take complex or instant decisions, when information is difficult to perceive, or when unexpected or unusual maneuvers are required. Limiting sight distance to those provided for stopping may also preclude drivers from performing evasive maneuvers, which are often less hazardous and otherwise

preferable to stopping. Even with an appropriate complement of standard traffic control devices, stopping sight distances may not provide sufficient visibility distances for drivers to corroborate advance warnings and to perform the necessary maneuvers. It is evident that there are many locations where it would be prudent to provide longer sight distances. In these circumstances, decision sight distances provides the greater length that drivers need.

Decision sight distance is the distance required for a driver to detect an unexpected or otherwise difficult-to-perceive information source or hazard in a roadway environment that may be visually cluttered, recognize the hazard or its threat potential, select an appropriate speed and path, and initiate and complete the required safety maneuver. Because decision sight distance gives drivers additional margin for error and affords them sufficient length to maneuver their vehicles at the same or reduces speed rather than to just stop, its values are substantially greater than stopping sight distance.

Drivers need decision sight distances whenever there is likelihood for error in either information reception, decision-making, or control actions. The following are examples of critical locations where these kinds of errors are likely to occur, and where it is desirable to provide decision sight distance: interchanges and intersections; location where unusual or unexpected maneuvers are required; changes in cross section such as toll plazas and lane drops; and areas of concentrated demand where there is likely to be “visual noise” whenever sources of information compete, as those from roadway elements, traffic, traffic control devices, and advertising signs.

2.6.1 Criteria

A range of decision sight distance values that will be applicable to most situations has been developed. The range has been provided in recognition of the variation in complexity that may exist at various sites. These values were analytically derived from a summation of premaneuver times converted into distance and empirically validated at a number of locations. Table-A.4 shows these values, rounded for design, along with the factors used to compute the distances. In computing and measuring decision sight distances, the 3.5-ft. eye height and 6-in. object height criteria used for stopping sight distance have been adopted. Although drivers may have to be able to see the entire roadway situation, including roadway surface, the rationale for the 6-in. object height is as applicable for decision sight distance as it is for stopping sight distance.