ATTACHMENT A

Sight Distance Standards and Deviations

PURPOSE

The information in this document is intended to provide information and guidance on the key factors involved in sight distance evaluation in accordance with OAR 734-051-4020(2)(c). Information is provided on sight distance measurement procedures and evaluation of deviation requests, "moving in the direction of" criteria and optimizing approach locations for landlocked properties.

DEFINITIONS

"85th Percentile Speed" refers to the speed at which 85 percent of the vehicular traffic is traveling at or below during free-flow conditions. An engineering study is typically required to determine the 85th percentile speed.

"Intersection Sight Distance" refers to the sight distance required for a motorist entering the highway from an approach to anticipate and avoid potential collisions.

"Landlocked" refers to property that has a right of access and no alternate access other than the proposed approach.

"Stopping Sight Distance" refers to the minimum distance required for a vehicle traveling at a particular design speed to come to a complete stop after an obstacle on the road becomes visible.

GUIDANCE

Sight Distance Measurement Procedure

The procedure for measuring sight distance is provided in Attachment B entitled "Sight Distance Measurement Procedure for Intersections with Stop Control at the Approach." The measured sight distances to objects #1 and #2 in the diagram correspond to the stopping sight distance at the subject approach. The measured sight distances to objects #3 and #4 in the diagram correspond to the intersection sight distance at the subject approach.

Sight Distance Standards and Deviations

OAR 734-051-4020 specifies the intersection sight distance standards for highway approaches to be used by ODOT. For all approach applications, the available sight distance at an existing or proposed approach will be compared to these standards.

For undivided two-way highways, the standards are based on the intersection sight distance for left turns from a stop-controlled minor road as determined using the methodology in the 2004 edition of AASHTO's "A Policy on Geometric Design of Highways and Streets" and assumed design speeds that are 5 to 15 miles per hour above the posted speed.

For divided highways (one-way streets), the standards are based on AASHTO's methodology for determining the intersection sight distance for right turns from a stop-controlled minor road using the same assumed design speeds.

Table 2: Intersection Sight Distance Standards (ISD)[1]
(from OAR 734-051-4020(2)(c)

Posted Speed (mph)	Assumed Design Speed[2] (mph)	Two-Way Highway -- Number of Lanes Crossed by Vehicle Making Left Turn from Approach[3]			One-way Highway[4]
		1 Lane	2 Lanes	3 Lanes	
		ISD (ft)			
20	25	280	295	315	240
25	30	335	355	375	290
30	35	390	415	440	335
35	40	445	475	500	385
40	45	500	530	565	430
45	55	610	650	690	530
50	65	720	765	815	625
55	70	775	825	875	670
60	70	775	825	875	670
65	70	775	825	875	670

[1]Standards in Table 2 are based on the methodology for sight distance calculations for passenger vehicles in the 2004 AASHTO Policy on Geometric Design of Highways and Streets

[2] Assumed design speed is shown for purpose of correlating generally accepted highway design speeds with posted speeds. If the Department establishes a higher design speed for a highway segment, the higher design speed, rather than the assumed design speed, shall be used to determine intersection sight distance (ISD) in accordance with the methodology for sight distance calculations in the 2004 AASHTO Policy on Geometric Design of Highways and Streets.

[3] Left turn made from approach to nearest lane in direction of travel. Number of lanes includes right and left turn lanes and traversable medians. Calculation of ISD in this table is based on the methodology for sight distance calculations in the 2004 AASHTO Policy on Geometric Design of Highways and Streets for left turn from stop-controlled minor road. Four or more lanes require calculation of ISD in accordance with AASHTO procedure.

[4] Left or right turn made to nearest lane in direction of travel. Calculation of ISD in this table is based on 2004 AASHTO Policy on Geometric Design of Highways and Streets methodology for the right turn from stop- controlled minor road. Standards also apply to sections of highway where turning movements are restricted to right turns only by a non-traversable median and to approaches that prohibit left turns from the approach across opposing traffic.

If the available sight distance is less than the standard, further evaluation is necessary as follows:

- For applications prompted by a change of use, further evaluation consists of a collaborative process with the applicant to determine if agreement can be reached on improvements that "move in the direction of" the sight distance standard or if the existing condition without change is sufficient to support approval.
- For landlocked property, further evaluation consists of determining if agreement can be reached with the applicant on an optimum location.
- For all other applications where sight distance is less than the standard, further evaluation consists of determining if a deviation can be approved.

The process for determining whether ODOT can agree to a proposal based on "moving in the direction of" or an "optimized location" is essentially the same process as evaluating a sight distance deviation. In all cases, the objective is to establish a basis for concluding that the intersection sight distance at the approach is, or can be made acceptable. The main difference in the processes is who is responsible for providing the supporting documentation. In the case of a deviation, it is always the responsibility of the applicant to provide supporting documentation, unless waived by ODOT. In the case of "moving in the direction of" or "optimized locations," supporting documentation could be provided by ODOT, the applicant or both as part of a collaborative process.

Deviations and Mitigation

When the measured intersection sight distance is less than the standard in Table 2, the following actions should be considered in the order listed to determine if a deviation can be approved. Some of the actions are intended to increase the available sight distance at the approach, while others would reduce the intersection sight distance required. In some cases, it may be necessary to implement multiple actions to reach a determination that the intersection sight distance is adequate.

- Remove sight distance obstructions (vegetation, signs, utility apparatus, embankments, etc.)
- Use the intersection sight distance measurement taken 10 feet from the edge of the traveled way. This is most appropriate in urban areas where the posted speed is 35 mph or less or on the inside of horizontal curves.

  (Note: The standard location for measuring sight distance is from a point on the approach 15 feet from the edge of the traveled way. According to AASHTO, this allows for a typical position of the driver's eye when a vehicle is stopped relatively close to the major road. The 10-foot distance assumes the motorist stops unusually close to the major road, with the front of the vehicle just outside the edge of the travel lane.)
- Determine if a lower design speed would be appropriate. In accordance with Chapter 2 of the Highway Design Manual, this requires consultation with the Region Roadway Manager if the private development involves any construction on the highway other than the access itself. The intersection sight distance standard is

based on an assumed design speed that is 5 to 15 miles per hour higher than the posted speed to help ensure a safe environment for motorists that may be going faster than the posted speed. The speed characteristics at a particular location may be different than the assumed design speed. The Region Access Management Engineer (or the Region Roadway Manager, when highway improvements in addition to the access are involved) needs to approve the use of a lower design speed and may require the collection of speed data and other information from the site to support approval. The formula for determining the intersection sight distance is linear using the design speed, so the sight distance required for a different design speed can be interpolated from the data in Table 2.

- On two-way highways with continuous left turn lanes, assume left turning vehicles turn into the continuous left turn lane, thus reducing the number of lanes crossed. This maneuver is commonly referred to as a "two-stage left turn." This assumption should only be used on highways with more than 15,000 AADT where there are fewer than 10 vehicles per hour making conflicting left turn movements in the continuous left turn lane.
- Relocate and/or regrade the driveway to improve sight distance.
- Use the stopping sight distance provided in the table below as the required intersection sight distance. Typically, this should only be done on low-volume approaches. *(Note: In these cases, it may also be appropriate to assume the driver's point of view is 10 feet from the edge of the traveled way.)*

Design Speed (mph)	Stopping Sight Distance (feet)
25	155
30	200
35	250
40	305
45	360
50	425
55	495
60	570
65	645
70	730

The values in the table are based on the stopping sight distances in the 2004 edition of AASHTO's A Policy on Geometric Design of Highways and Streets for locations with highway grades between -3 percent and +3 percent. For locations with highway grades outside this range, check with the Region Access Management Engineer to determine the appropriate stopping sight distance.

- Regrade and/or realign the highway. This should be considered for high-volume approaches and public streets.

EXAMPLES

Example 1

- Two-lane highway
- Posted Speed: 55
- Measured Intersection Sight Distance: 525 feet
- Design Speed: 60 mph
  For this example, assume the Region Access Management Engineer approved this design speed because there was no construction to be done on the highway other than the access. See Responsibilities section of Bulletin.
- Intersection sight distance could be increased by 150 feet by removing vegetation

For a two-lane highway, a left turning vehicle must cross one lane of traffic. For a posted speed of 55 mph, Table 2 indicates the intersection sight distance standard to cross one lane is 775 feet. The measured intersection sight distance does not meet this standard.

If the vegetation was removed, the intersection sight distance would be 675 feet, which is less than the required 775 feet, so further measures are necessary.

There is no intersection sight distance standard corresponding with a 60 mph design speed in Table 2. Thus, the corresponding sight distance for 60 mph needs to be interpolated between the values for a 55 mph design speed (610 feet) and a 65 mph design speed (720 feet) as follows:

$ISD_{60} = ISD_{55} + [((DS_{60} – DS_{55}) / (DS_{65} – DS_{55})) \times (ISD_{65} – ISD_{55})]$
$ISD_{mid} = 610 + [((60 – 55) / (65 - 55)) \times (720 – 610)]$
$ISD_{mid} = 610 + [((5) / (10)) \times (110)] = 610 + [55] =$ 665 feet

As noted above, if the vegetation is removed, there would be 675 feet of intersection sight distance, which is more than the intersection sight distance of 665 feet required for a 60 mph design speed. Therefore, the intersection sight distance could be made acceptable and a deviation approved if a 60 mph design speed is used and the vegetation is removed.

Example 2

- Two-lane highway
- Posted Speed: 35 mph
- Measured Intersection Sight Distance: 300 feet
- Design Speed: 40 mph
  For this example, assume the design speed was approved by the Region Roadway Manager because of highway improvements in addition to access. See Responsibilities section of Bulletin.
- Intersection sight distance could be increased by 100 feet by removing vegetation and by another 100 feet by measuring the intersection sight distance from a point 10 feet back from the edge of the travel way.

For a posted speed of 35 mph, Table 2 indicates the intersection sight distance standard to cross one lane is 445 feet. The measured intersection sight distance does not meet this standard.

If the vegetation was removed, the intersection sight distance would be 400 feet, which still is less than 445 feet, so further measures are necessary.

In Table 2, the assumed design speed for a 35 mph posted speed is 40 mph, the same design speed approved by the Region Roadway Manager in this example. Therefore, no adjustments to the intersection sight distance requirements can be made based on the design speed.

If the vegetation was removed and the sight distance measured from 10 feet back from the edge of the traveled way, the available intersection sight distance would be 500 feet, which is more than the intersection sight distance standard of 445 feet. (Again, using the sight distance measurement 10 feet back is most appropriate when the approach is located in a low-speed urban area or on the inside of a horizontal curve.)

Therefore, the intersection sight distance could be made acceptable and a deviation could be approved if the vegetation is removed and the intersection sight distance is based on the available sight distance measured 10 feet back from the edge of the traveled way.

SPECIAL INSTRUCTIONS

The Region Access Management Engineer shall determine what sight distance is required at a location if:

- The approach has a high percentage of truck traffic (roughly more than 10 percent), as trucks require larger gaps to enter and accelerate on to the highway and have a taller height of eye (7.6 feet);
- Approximately 20 percent or more of the traffic exiting the approach is crossing the highway rather turning into a travel lane, as a larger gap may be required on one-way, multilane highways, to cross the highway than to make a turn into a travel lane; or
- The approach or highway has grades in excess of 3 percent, as grades steeper than -3 percent on an approach can affect the gap required to enter the highway, and grades more than +3 percent on a highway can affect the stopping sight distance on the highway