OREGON DEPARTMENT OF TRANSPORTATION TECHNICAL SERVICES

Access Management BULLETIN

| SUBJECT | FINAL NUMBER | EFFECTIVE DATE | VALIDATION DATE | SUPERSEDES or RESCINDS |
|---|---|---|---|---|
| Sight Distance Standards and Deviations for Highway Approaches | AM 13-06(B) | 05/01/2013 | 08/24/2017 | |
| | WEB LINK(S) http://www.oregon.gov/ODOT/Engineering/Pages/Technical-Guidance.aspx | | | |
| TOPIC/PROGRAM Access Management | APPROVED SIGNATURE Original Signed by: Larry McKinley, Access Management Program Manager | | | |

## PURPOSE

The purpose of this Technical Services Bulletin is to provide guidance to ODOT staff when evaluating sight distance in association with approach applications and deviation requests from sight distance standards for approach applications. This Bulletin also applies to sight distance evaluation as part of the "moving in the direction of" criteria for change of use applications and to "optimizing" access locations for properties with no alternate access.

## GUIDANCE

This bulletin describes the criteria to use in measuring sight distance as used in the standard approval criteria of OAR 734-051-4020(2)(c). If the standard is not met, guidance is provided when determining if a deviation from the sight distance standards can be approved and suggests an order in which mitigation measures be considered.

## DEFINITIONS

"OAR" means Oregon Administrative Rule.

"ORS" means Oregon Revised Statutes

## BACKGROUND/REFERENCE

In 2011, the Oregon legislative assembly passed SB 264. The bill established specific approval criteria for approach applications, one of which is sight distance. ORS 374.311(6) authorizes ODOT to adopt administrative rules for sight distance standards and ORS 374.312(7) authorizes ODOT to approve deviations from the standards. OAR 734-051-4020(2)(c) and 3050(8)-(10), effective June 29, 2012, establish sight distance standards and the procedures and criteria to approve deviations from the standards.

## EXPLANATION

Attachment A, "Sight Distance Standards and Deviations," provides information and guidance on applying sight distance standards and evaluating deviations for different types of approach applications, including "moving in the direction of" and "optimization"

evaluations under OAR 734-051-4020(5). It includes a discussion of using design speeds other than those assumed in Table 2 of OAR 734-051-4020(2)(c). Attachment B, entitled “Sight Distance Measurement Procedure for Intersections with Stop Control at the Approach,” describes the procedure for measuring sight distances.

## *RESPONSIBILITIES*

Department staff in the following positions are responsible for carrying out the guidance in this Bulletin as it relates to their assigned duties and authority:

- Region Managers
- District Managers
- Region Access Management Engineers
- Development Review Coordinators
- Access Management Coordinators
- Permit Specialists

More specific responsibilities include the following:

- The Region Roadway Manager is responsible for approving the use of a design speed that varies from the assumed design speed that appears in Table 2 of OAR 734-051-4020 if the private development involves any construction on the highway other than the access itself.
- The Region Access Management Engineer (RAME) is responsible for approving the use of a design speed that varies from the assumed design speed that appears in Table 2 of OAR 734-051-4020 if the private development doesn’t involve any construction on the highway other than the access itself; approving or denying a deviation to the sight distance standards for an approach application; consulting with the Region Manager on deviations that can only be approved by the Region Manager under OAR 734-051-3050(9)-(10); consulting with the Region and/or District Manager on evaluation of “move in the direction of” and “optimized location” proposals that don’t meet the sight distance standards; and specifying mitigation to address inadequate sight distance.
- Permit Specialists, Access Management Coordinators and others are responsible for accurate sight distance measurements in the field and collection of other relevant information needed to evaluate sight distance.
- The Region Manager is responsible for deviations that can only be approved by the Region Manager under OAR 734-051-3050(9)-(10);

## *ACTION REQUIRED*

Implement this Bulletin upon the effective date.

## *SPECIAL INSTRUCTIONS*

If problems or concerns develop in implementing this Bulletin, or if further clarification is needed, contact the Access Management Program Manager.

## *CONTACT INFORMATION*


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|---|---|
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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

# Attachment B -- Sight Distance Measurement Procedure For Intersections with Stop Control at the Approach

**PROCEDURE**:

If the highway has only two lanes, you may stop measuring at 900'. If the highway has more than two lanes, then you can stop measuring at 1500'.

**Step 1: Record the number of lanes on the highway and their widths.**

**Step 2: Measure Roadway Grades (Highway and Approach Road)**

- Measure the grade of the highway with a Smartlevel at the steepest section within 900'/1500', left and right of the intersection.
- Measure the grade of the approach with a Smartlevel at a point 20' behind the fog stripe, curb or back of sidewalk if the approach is on an upgrade.

**Step 3: Record the Posted Speed:** Record the posted speed (PS) in each direction of the intersection. Record any curve rider speed (CRS) that applies to curves within 900'/1500' of the intersection. Record observations of the apparent running speed (RS) in the area; does it appear to be slower than the PS or higher?

**Step 4: Measure Sight Distance:** Measure the Sight Distance (Y), left and right of the intersection as shown on Exhibit "A" using the following values:

Set out four (4) Object Height (OH) markers inline with the center of the proposed intersection at the (X) locations shown below.

#1: **(X) = 0'** (Opposite fog stripe or curb), OH = 2.0'
#2: **(X) = 0'** (near fog stripe or curb), OH = 2.0'
#3: **(X) = 10'** (behind the near fog stripe or curb), OH = 3.5'
#4: **(X) = 15'** (behind the near fog stripe or curb), OH = 3.5'

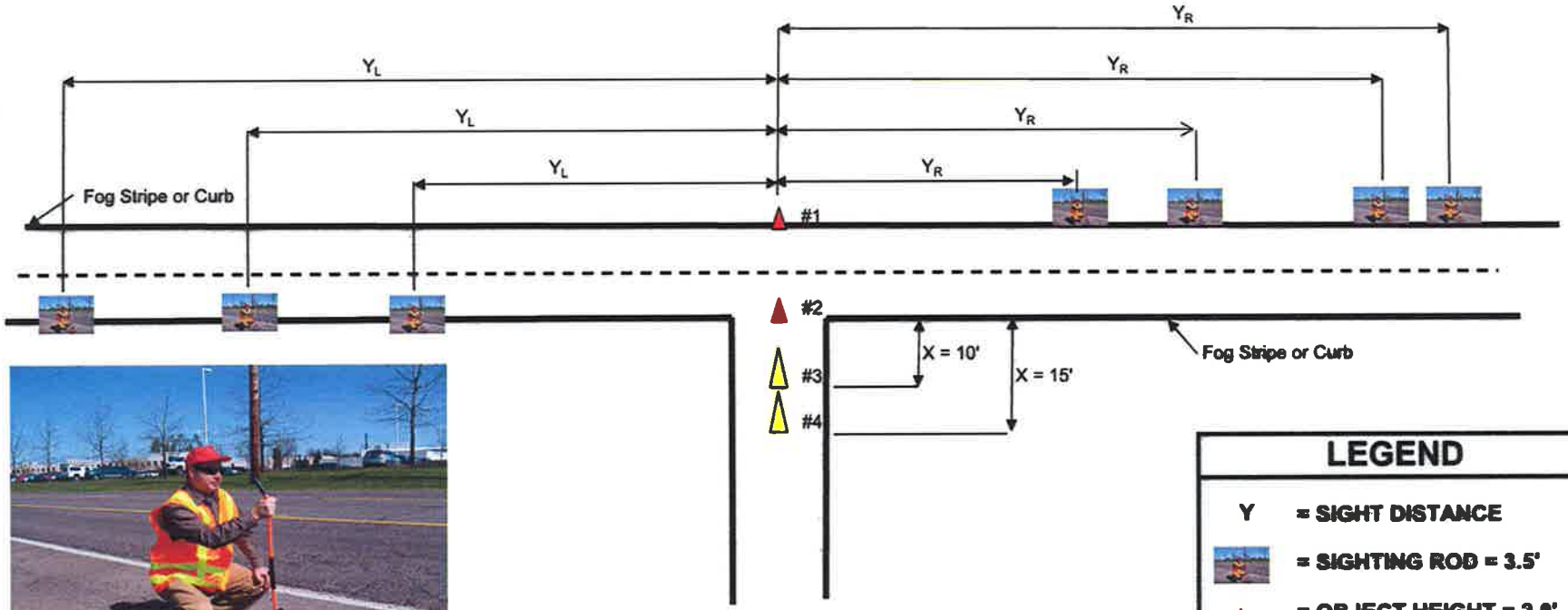
Use a sighting height (Driver's Eye Height) = 3.5'. All measurements to the **left** should be taken from the near fog stripe or curb. All measurements to the **right** should be taken from the opposite fog stripe or curb. This is where you will be sighting and measuring from, for your safety. Starting on or near the fog stripe and at the centerline of the approach, with your measuring wheel set to 0', walk along the highway until you cannot see one of the markers, record the distance (YL#/R#) and marker# ($X_{1, 2, 3 \text{ or } 4}$). Continue the process of walking and recording information for the remaining markers or until you reach the maximum distance of 900' or 1500'.

- **Take measurements from Right of the approach to Objects: #1, #2, #3 & #4**
- **Take measurements from Left of the approach to Objects: #2, #3 & #4**

If the "Y" distance is 900'/1500' or more, and the sight triangle is clear of obstructions, then an actual measurement past 900'/1500' is not necessary. In this case, record the "Y" distance as 900'+/1500'+. This will signify that a measurement was taken at 900'/1500' but the actual sight distance is greater than 900'/1500'.

# *EXHIBIT A*

## FIELD MEASUREMENTS FOR SIGHT DISTANCE






SIGHTING ROD = MEASURING WHEEL = 3.5'

### LEGEND

| | |
|---|---|
| Y | = SIGHT DISTANCE |
| | = SIGHTING ROD = 3.5' |
| | = OBJECT HEIGHT = 2.0' |
| | = OBJECT HEIGHT = 3.5' |