TL1.1 General

This technical note provides interim guidance for placing vertical illuminance grids for evaluating vertical light levels for crosswalks in AGi32 software.

As of September 2022, the WSDOT Design Manual requires the evaluation of vertical light levels (illuminance) for crosswalks at mid-block crossings and roundabouts, in addition to horizontal light levels on the surface of the roadway. Vertical light levels are not required to be evaluated at conventional intersections at this time.

For analysis purposes, a single line of points is used at a height of 5 feet (approximately 1.5 meters) above the road surface, with the analysis area oriented towards oncoming traffic. This simulates the illumination of a pedestrian around the upper body as viewed by approaching traffic.

TL1.2 Setup

Evaluation of vertical light levels is not difficult but does take some file preparation to simplify the process. These instructions are based on starting from a Bentley MicroStation CAD file. AutoCAD files may not have the same issues with importing CAD into AGi32, as AGi32 uses AutoCAD file formats (.dwg and .dxf) by default.

TL1.2(1) Preparing the CAD file

It is recommended that all necessary line work be copied into the working base CAD file, and all reference files detached before exporting, to simplify the export and import process.

The process of exporting from CAD and importing into AGi32 typically results in changes to line types (and sometimes weights). Line types will typically either be converted to basic continuous lines, but some may be lost or converted to text (usually level or line type names). Placing additional reference lines helps to ensure that needed reference points are readily available once imported into AGi32.

In CAD, the following reference lines should be added:

- The upstream edge of the horizontal lighting analysis area.
- The upstream edge of the crosswalk pavement marking.
- The centerline of the crosswalk pavement marking.

- The downstream edge of the crosswalk pavement marking.

- The downstream edge of the horizontal lighting analysis area.

Exhibit TL1.2-1 shows these reference lines and their placement.
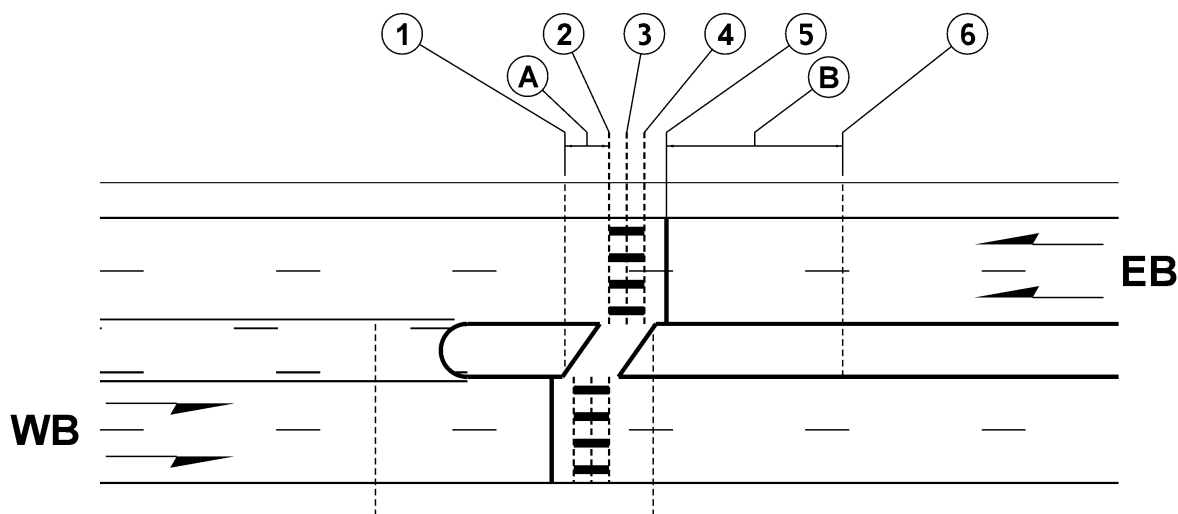
Exhibit TL1.2-1: CAD file reference lines

Exhibit TL1.2-1 Key:

1	Downstream edge of EB roadway horizontal lighting design area.
2	Downstream edge of crosswalk pavement marking.
3	Centerline of crosswalk pavement marking.
4	Upstream edge of crosswalk pavement marking.
5	Stop line.
6	Upstream edge of EB roadway horizontal lighting design area.
A	Distance = 10 feet
B	Distance = 50 feet

After adding the reference lines, save the CAD file and the export to .dxf format. Import the .dxf file into AGi32. Exhibit TL1.2-2 shows what the file above looks like after importing into AGi32.

**Exhibit TL1.2-2: Sample imported CAD file in AGi32 (partial enlargement to show line detail)**
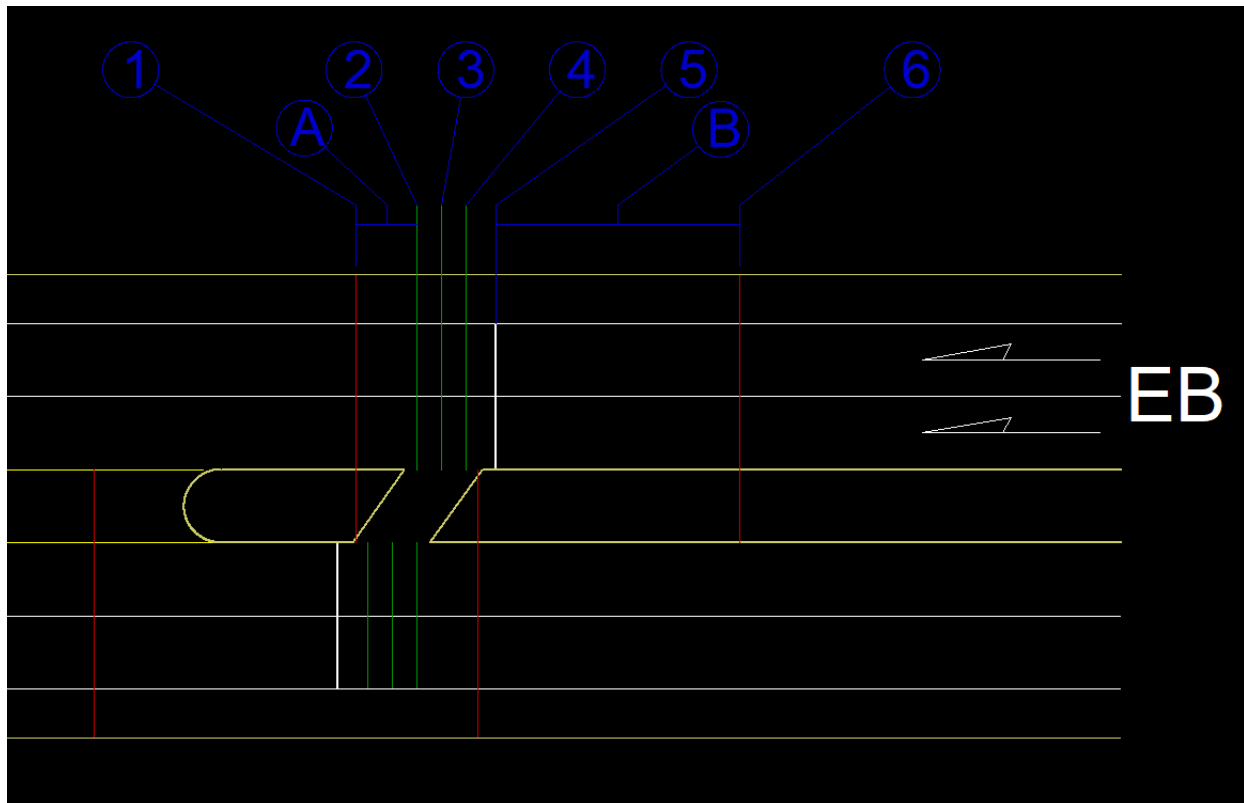
TL1.3 Placing the Vertical Illuminance Grid

Horizontal grids are placed normally. For this Tech Note, only the vertical grids are addressed and shown.

The following steps describe how to place a vertical grid:

1. Zoom in so that the full width of the crosswalk and the upstream end of the roadway area (roughly 50 feet in advance of the stop line) are visible. This view will be needed for placement of the grid and designating the observer point.

Exhibit TL1.3-1: Example window area for placing a vertical illuminance grid
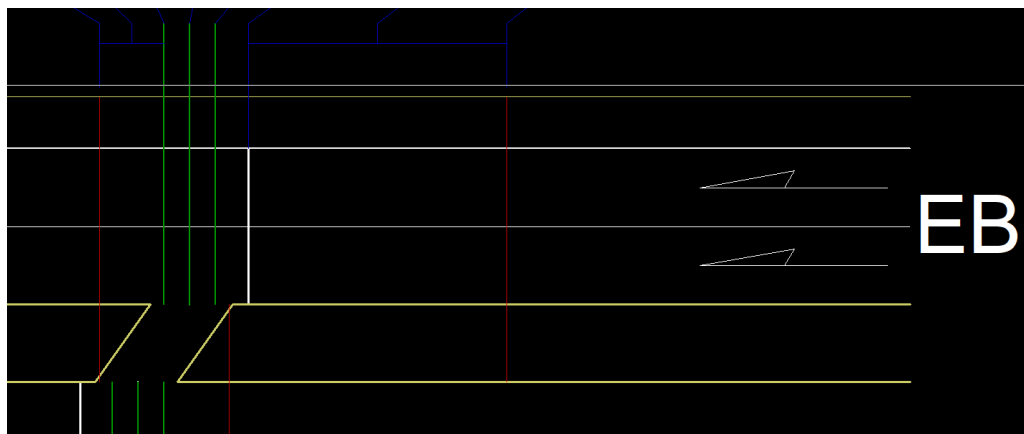
2. Select the "Specify Calculation Points on a Line" tool from the Calculations Toolkit.

Exhibit TL1.3-2: Location of Specify Calculation Points on a Line tool
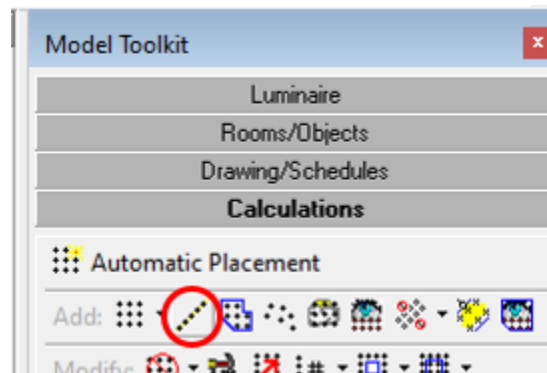
3. In the "Calculation Points – Line" dialog box that opens, set the following:

    a. Label: Identify as Crosswalk_Vertical_??; Replace ?? with something that will help identify the crosswalk, such as EB, SB_01, North_Leg_Exit, etc. More detailed identifiers may be needed if there are multiple crosswalks, such as at roundabouts. For this example, the label Crosswalk_Vertical_EB is used.

    b. Description: Entering a description is optional, as it is usually too long to include in reports and schedules.

    c. Point Spacing: Set to 1.5 ft

    d. Check the box for Center Points Relative to Each Line Segment.

    e. Light Meter: Select Variable – Meter Aiming Point. The use of this will be addressed in step c.

    f. Summary: Select Average, Maximum and Minimum, and Average/Minimum Ratio. All other boxes should not be checked.

    g. Display Options: Select all check boxes and verify that Decimals is set at 2. Color should be changed to something distinct (bright green or orange are recommended).

    h. Lines: Select Manually Specify Line

    i. Array: Select None

    j. **Do not click on any buttons in the dialog box yet**.

Exhibit TL1.3-3: Completed Calculation Points – Line dialog box

4. Once the dialog box is filled out, click on the "Specify…" button in the Light Meter section. This will temporarily close the dialog box and allow for designating the observation point for metering.

Exhibit TL1.3-4: Location of Specify button

5. Select a point in the center of the approach roadway at the upstream edge of the lighting calculation area (or about 50 feet in advance of the stop line or crosswalk). The point should be in the center of all approach lanes, so it may be on a lane line or in the center of a lane. Do not include two-way left turn lanes or medians when determining the center of the approach.

Exhibit TL1.3-5: Location of the observation point

6. After clicking on the observation point, the dialog box will reopen. Under the Light Meter section, set the Meter Aiming Point Z value to 5 (for 5 feet).

Exhibit TL1.3-6: Location to set Z value of observer
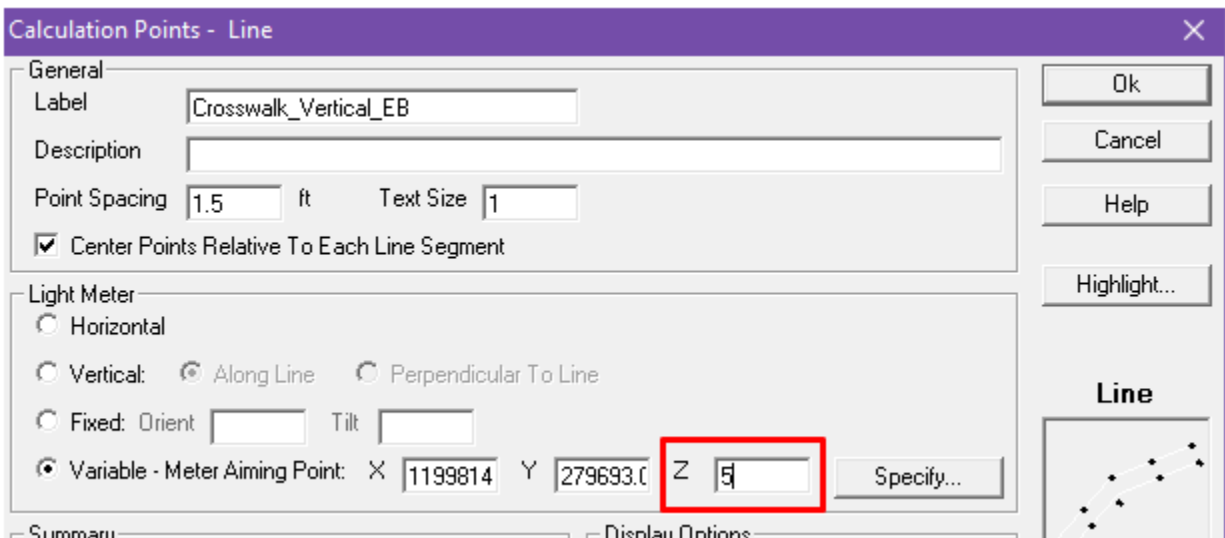
7. After setting the Z value, click on the "OK" button. Before placing the line, enter a Z value of 5 in the lower right corner of the window to set the height of the line.

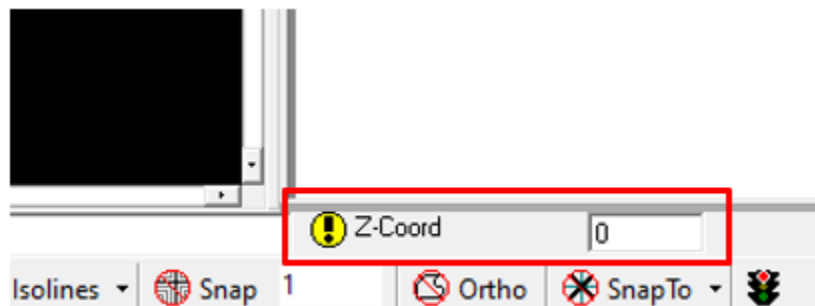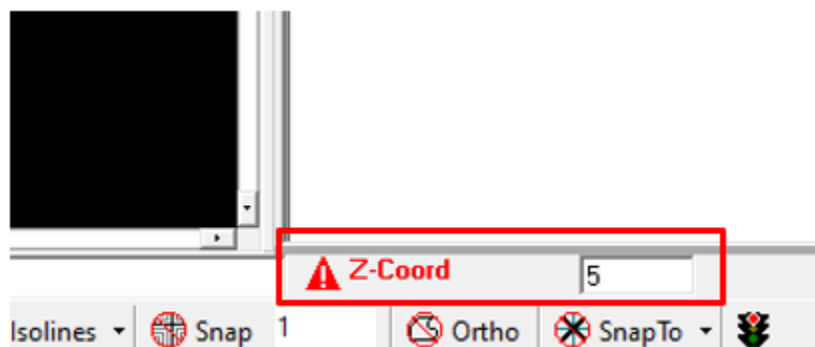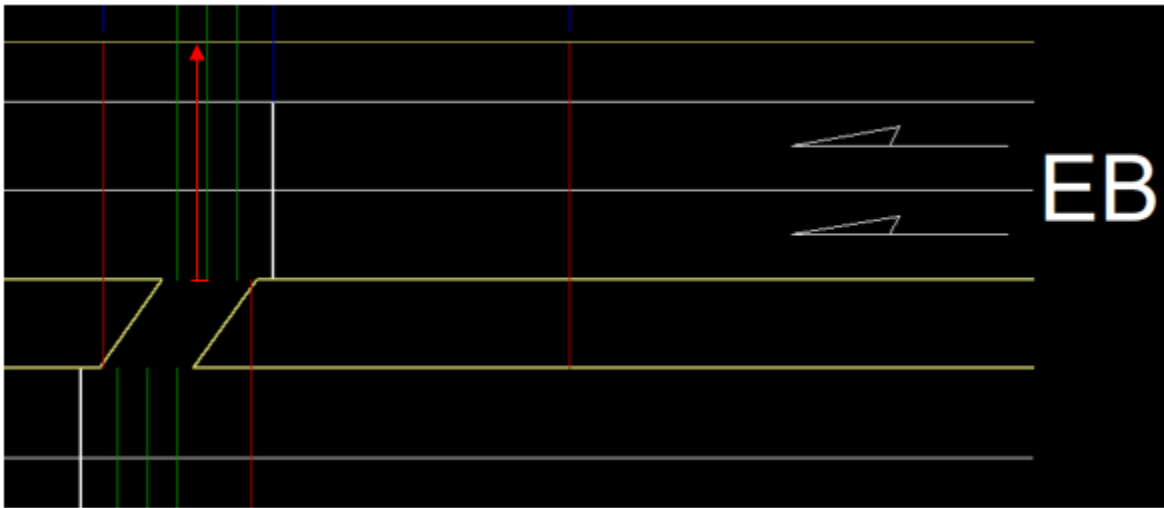**Exhibit TL1.3-7a: Location to set Z value of line**

Exhibit TL1.3-7b: Location to set Z value of line after entering value
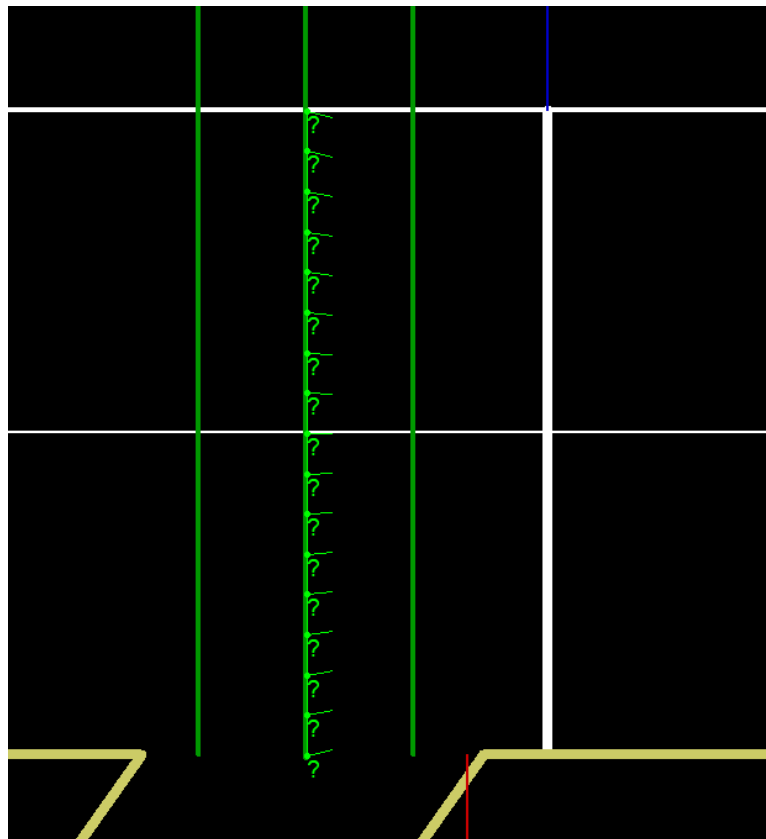

8. Place the line along the centerline of the crosswalk, starting from the left side of the roadway.

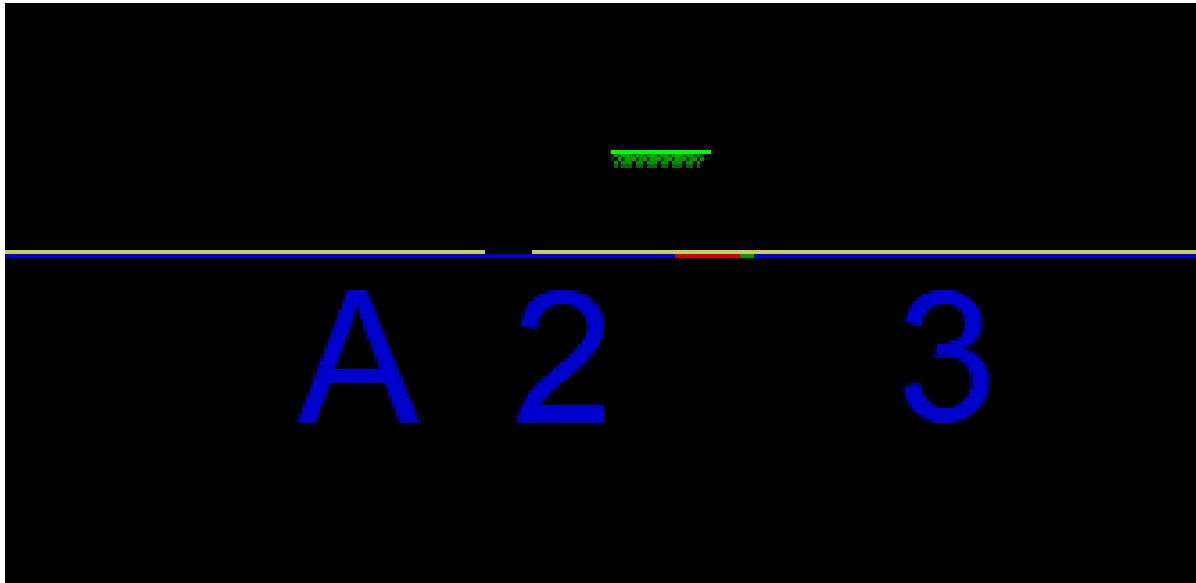**Exhibit TL1.3-8: Placing the calculation line**

9. After the line is placed, there should be a line of points with metering lines pointing towards the observer point.

Exhibit TL1.3-9: Completed vertical grid

The line can be verified at the correct height using elevation view.

Exhibit TL1.3-10: Elevation view of completed vertical grid

Repeat these steps as needed for each approach to each crosswalk. Crossings of single direction roadways may only have one linear grid. Crossings of bi-directional roadways will always have two separate grids, though they may be separated by a median or splitter island.

TL1.4 References

The following references are used in the development of this Technical Note:

1. *Design Manual*, M22-01, WSDOT

2. *American National Standard Practice for Roadway Lighting*, IES RP-8-18, Illuminating Engineering Society (IES), New York, NY 2018

3. *Roadway Lighting Design Guide*, 7th Edition, AASHTO, October 2018

The following software is referenced in this Technical Note:

- AGi32® is a registered trademark of Lighting Analysts, Inc. See www.lightinganalysts.com for additional information.

- MicroStation® is a registered trademark of Bentley Systems, Inc. See www.bentley.com for additional information.

- AutoCAD® is a registered trademark of Autodesk, Inc. See www.autodesk.com for additional information.