Daylight_Glazing_Area_Calculation

Naviate unique daylight area calculation method still finds glazing area although the window is not adjacent to a wall, or the wall is not a room separator.

The daylight area is calculated based on the following steps:

- It gets the room dimensions, including all wall and ceiling faces.
- It gets the glazing panels within all instances, such as windows, doors, curtain walls and other family types.
- It relates the glazing panels to rooms.
- It calculates the glazing area per glazing panel per room.
- It checks whether glazing is internal (faced by two rooms) or external (faced to the outside).
- It reads the glazing properties.
- It sets the shading factors per glazing panel.

It's possible that glazing panels are not adjacent to a room, or are not aligned to the room. For example if you have an internal balcony with a curtain wall in front of it, or if you have a stacked wall.

By using a room offset of 600 mm (2 feet), the app finds all glazing panels somewhat aligned to a room.

Below is an example of a room with a room boundary not related to a window. In this situation the glazing is still found and listed.

Example 1: a room boundary is 300 mm offset to the window. In this case the window is still adjacent to the room.

Example 2: a room boundary is always vertical, as the glazing panel may be inclining. In this case the window is still adjacent to the room.

Example 3: if a window is adjacent to rooms on either sides, then the glazing panel will be marked as interior glazing. If you have disabled the option to "Include interior glazing", this glazing area will be excluded. Please note; when selecting a local standard, the option "include interior glazing" can be disabled.

Minimum height above floor level

By setting the "minimum height above floor level", in the app settings, you can let the app exclude all glazing areas below a specific height above floor level. This area reduction is called "Area below minimum height" and these values are shown as a column in the Window tab in the Naviate app.

Or the Norwegian, Swedish standard, this value is set to 800 mm.

For the Danish standard, this value is set to 0 mm, so that all glass is counted.

For the Dutch standard, this value will be set to 600 mm.
Example: The base height of the window is lower than the minimum height above floor. In this case the glazing area will be reduced up to the minimum height.

This effect can best be shown in the 3D visualisation, where the transparent frame is the area below minimum height, and the dark grey face is the net glazing area.

**Splitting up glass areas**

The glazing geometry will always be compared to the room geometry by geometric boolean intersection methods. The area of the glazing panel will be reduced if the room is partially in front a room.
Subtracting (opaque) spandrel and beading area from glazing area

With curtain glazing systems the outer facade might be completely made of transparent glazing. In front of the flooring, lowered ceiling, and parapet or breastwork, there might be a solid material though. Or, with more detailed designs, the glazing panel can be bigger than the net space between mullions or window frames, because of the mounted space (glazed beading). In this beading area daylight cannot enter. Therefore this solid area must be subtracted from the gross glass area in order to get what area the daylight can enter the room. In the daylight settings you can enter material name(s) of the spandrel panels and window mullions. The daylight application will run a geometric union subtraction on each glazing panel to extract the transparent area of each glazing panel.

Above image explains the different areas:

- The calculation starts by getting the gross glass area (dark blue). This is the glazing panel area with a glazing material.
- The spandrel area (yellow) and glazed beading area (red) will be subtracted from the gross glass area, which results in the net glass area (light blue).
- The other area than the transparent, net glass area will be the opaque, solid facade area (green).

Where there are three materials visible in each window panel:

- Glazing Material
- Spandrel Material
- Mullion / Frame Material

Where, the gross glass area = a + b + c, the spandrel area = C + (A' + B' + C' + D')

Hence, the net daylight surface area = (a + b + c) - (C + A' + B' + C' + D')
Getting glass transparency

The LT value, or light transparency ratio, can be retrieved from the Revit window element by two different parameters:

1. Family Type: Visual Light Transmittance
   A read-only property in the family type properties in the window, door, or curtain wall panel. This value can be changed by selecting another Analytic Construction. If value is not found, value will be set to 1.00

2. Material, Shading, Transparency
   A property of the material asset, called transparency. This value is expressed in an value from 0-100 in percentage, where 100 is 100% transparent.

Adding Balcony area to floor area

Swedish and Norwegian standard requires to add the balcony area to the floor area to decrease window-to-floor percentage ratio, as it has a shading obstruction above the window.

The room area opposite the external window, exactly one level above the window (with a vertical offset equal to the room height next to the window). Any rooms above the calculated room will be included, so this area inclusion is not related to the so called “balcony” rooms, as long as the window itself is external.
Example 1; Swedish; the balcony area will be added to the room area as there is a window between both rooms (is adjacent to both rooms). Without having this window at the balcony, the balcony area will not be added.

Example 2; Norwegian; the area of the balcony above a window will be included in the room area.

Example 3; Only the balcony area in front of the room will be included, where the balcony area is bigger than the adjacent room. An outer hallway to enter the apartments is often used where this situation is applied.

Calculating shading factor(s)

For Swedish, Danish, and Dutch calculation standards, one or more shading factors need to be calculated.

To calculate these shading factors, a frustum projection will be generated for each window, to find surrounding shading obstructions to the window. Dependent on the type of shading factor, view angles will be set. The result will be an average shading angle, which will be converted into a reduction factor according to the conversion table from the local standard. See the explanation of the local standard for more information.

Image 1: a frustum projection method to get shading objects. This method is similar to the Revit Camera view. The camera will be placed in the middle of the window. The angles from the window to the found objects within the projection view will be calculated.

Example 1a: A vertical section view of the frustum projection showing the calculated vertical shading angles for defining Swedish shading factor and Danish F;OMG.

Example 1b: A horizontal section view of the frustum projection with wall height differences for calculating the average shading angle for surrounding buildings F;OMG for Danish standard.

Example 2: Norwegian; the area of the balcony above a window will be included in the room area.