A Question and Answer Guide to

Waldram Diagrams

Preserving Downtown Denver's Sunlight Exposure

Q: What's a Waldram diagram and why do I need one?

A: A Waldram diagram is used to calculate the percentage of sky exposure that a building's profile allows through to the street below. You need one because the City and County of Denver requires that any new construction on over 15,000 square feet of site area allow at least 15% sky exposure.

Q: How does a Waldram diagram work?

A: Imagine a fish eye lens placed in the center of the street, looking up at your building. That's the sort of projected view that you get with a Waldram diagram.

The diagram shows the skyline of the property divided into 100 units. The projected outline of the building is shaded. All the remaining unshaded area is added together to yeild the percentage of sky exposure.

Q: How do you make one?

A: Just follow the step by step instructions outlined in this guide. It's as easy as plotting a simple graph.

First, of course, you'll need all of the accurate measurements pertaining to your building, including its distance from the center of the street. Downtown right of way widths are typically 80' but should be verified. This is important because all of the measurements for a Waldram diagram are calculated from the center point of the street. Thus, stepping a building back from the street or creating a narrower profile can let more sky show through, and this will be represented on the diagram. See **Figure 1** for the type of measurements you'll need.

Start with the point where the center line of the street and the center line of the site intersect. In plan draw a straight line to each sky obstructing point of the building. Find out at what angle to the center line each straight line is (**Figure 2**). You will also need to calculate these angles in section (**Figure 3**), from the center of the street to the building's sky obstructing height points. These angles will dictate the outline of your building on a Waldram diagram. Notice that the non-sky obstructing building edges, such as the second "step" on the building's facade, though architecturaly prominent, are not measured.

To create the diagram begin with a circle. One half of the circle will represent that half of the sky that is potentially visible from the street looking toward the project. The circle's circumference represents the horizon, and the center point is directly over head. The diagram, from horizon to overhead, is divided into ten segments of 9° each, for a total of 90°. The width of the horizon depends on the width of the project site as calculated in degrees from the point where the center line of the street and the center line of the site intersect. It will always be less than 180°. The width of the horizon is also divided into ten equal segments. The example diagrams show horizons for typical Denver full block dimensions: 73.26° for a 266' block face, and 78.69° for a 400' block face (**Figures 6 & 7**). If your site is less than a full block face, the angles will be less.

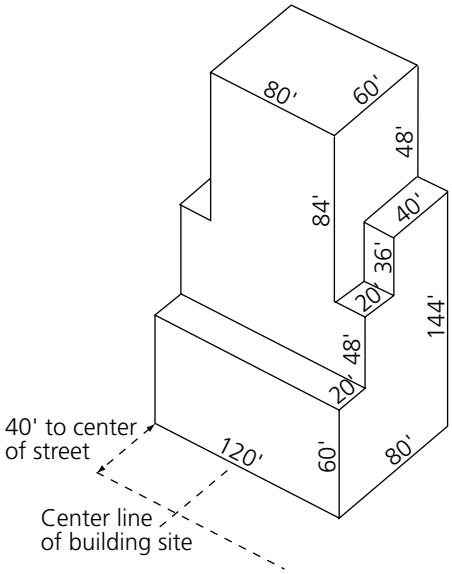

Figure 1

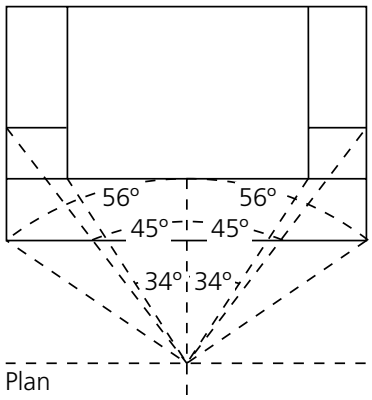

Figure 2

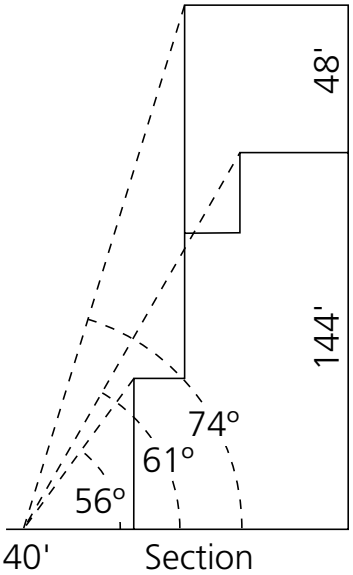

Figure 3

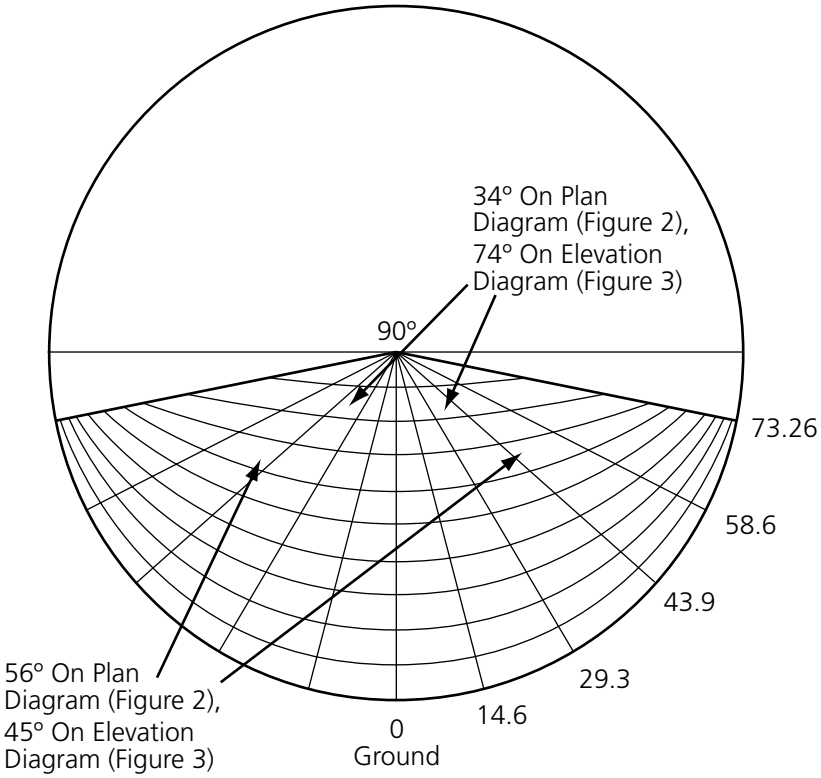

Figure 4

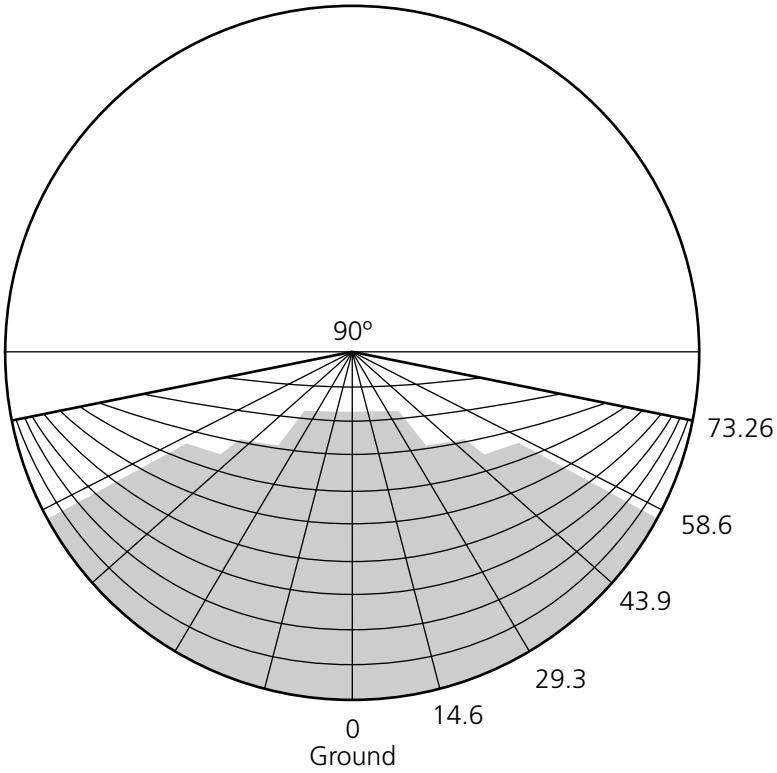

Figure 5

Once you've finished calculating these angles, you're ready to plot the points on your Waldram diagram. This is a simple process that is similar to plotting a graph.

To plot each point, find both the plan and section angles of each sky obstructing point on your building, as determined in **Figure 2** and **Figure 3**. In this case, we'll plot the top-most point of our example building.

The plan angle (**Figure 2**) has its points plotted along the horizontal axis. In this case, the angle from the center point of the street to the corners of this part of the building is 34°.

Similarly, we plot the section (height) angle (**Figure 3**) along the vertical axis, each curved line representing a 10° segment, counting down from 90° at the center of the circle. In the case of our building, the angle of the top-most point measures 74°.

Find out the height and width angles for each of your sky obstructing points. Then, go to the Waldram diagram and place a point at each set of coordinates, as in **Figure 4.** Then, it's a simple matter of connecting the points and shading in the resulting building shape. Count up the remaining white units to get your percentage of sky exposure.

NOTE: DO NOT count the large white areas above 90° and on either side of the maximum angle marked—for instance, 73.26° for a 266' block face, or 78.69° for a 400' block face—in calculating your daylight exposure percentage.

If your site is a full block face, you may use the two templates on the back of this advisory to produce your own base diagram as described above.

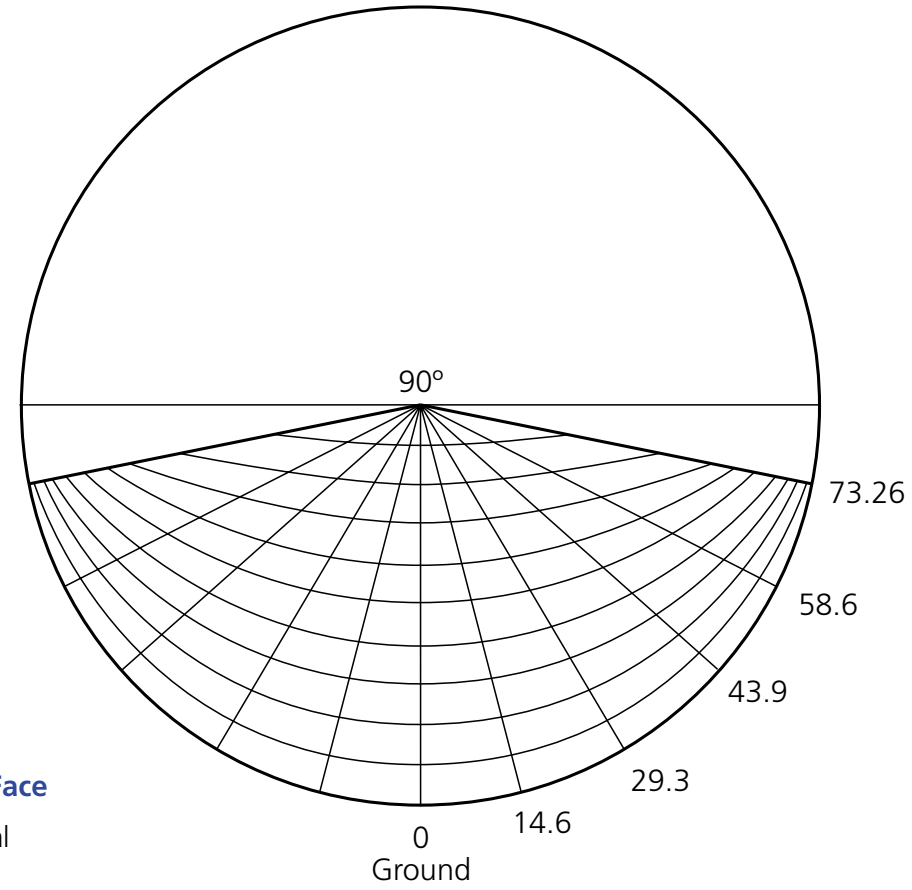

Figure 6 - 266’ Block Face

Divides 90° into 10 equal divisions vertically

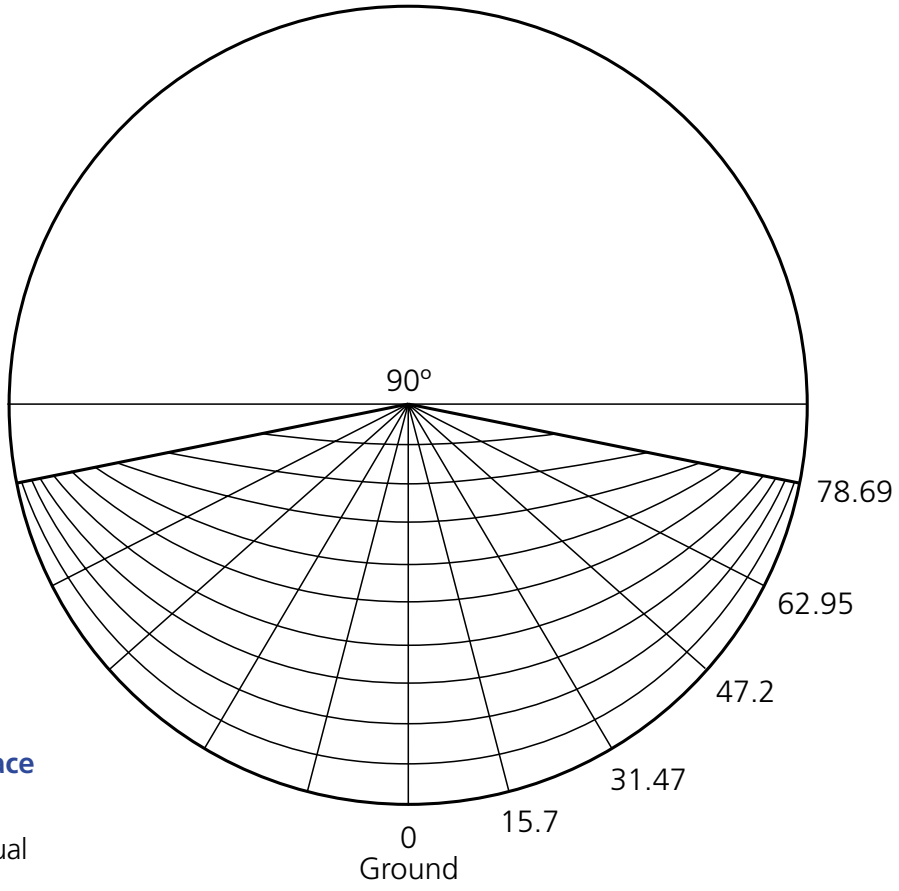

Figure 7 - 400’ Block Face

Divides angle of property width (from ℄) into 10 equal divisions horizontally