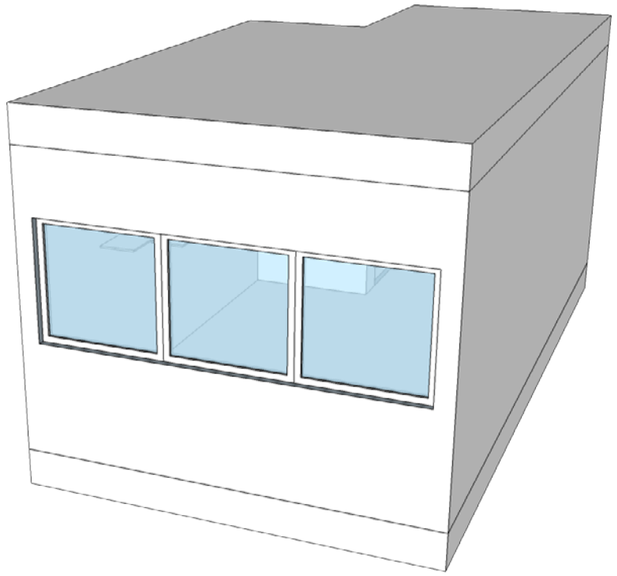
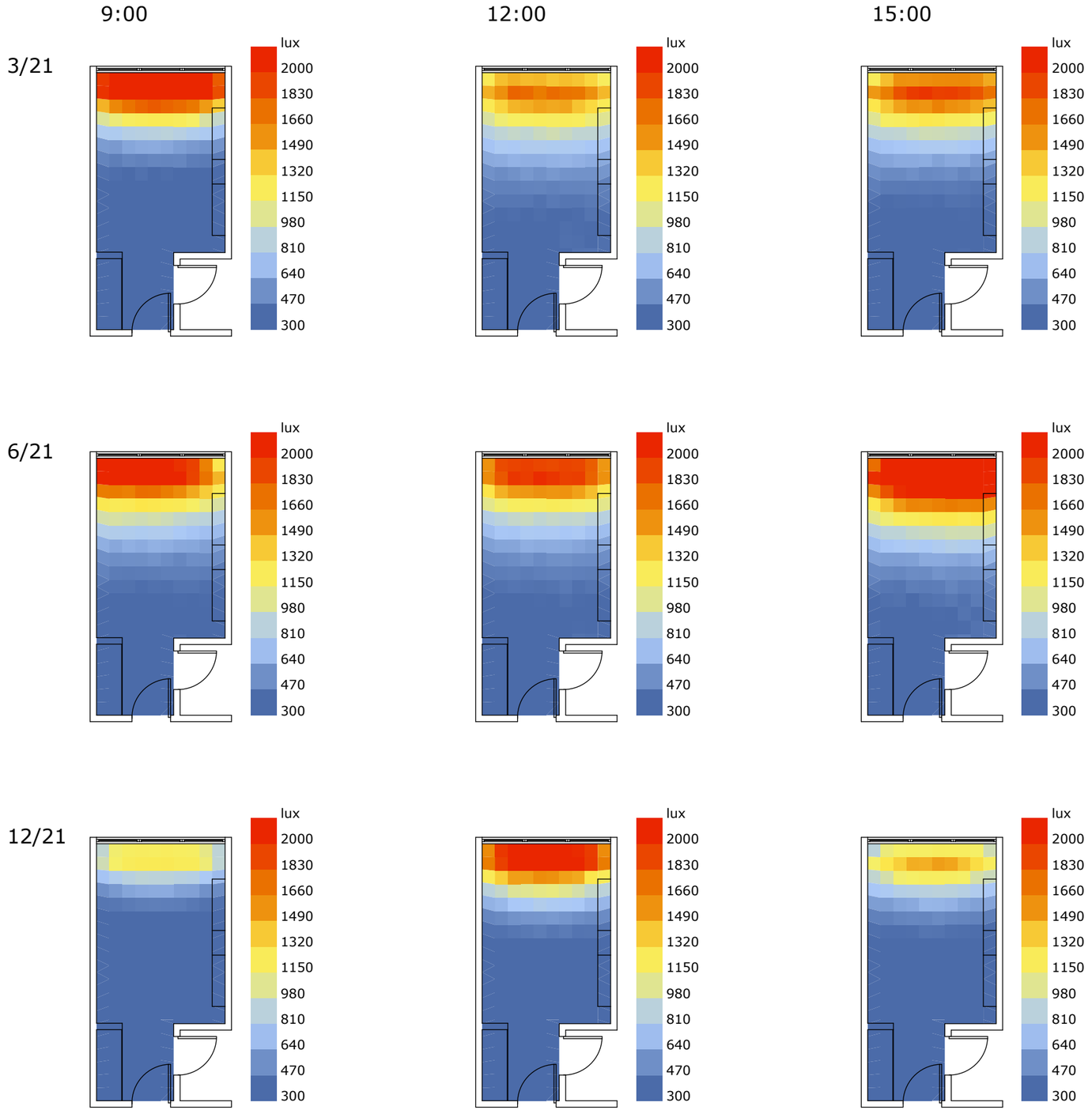


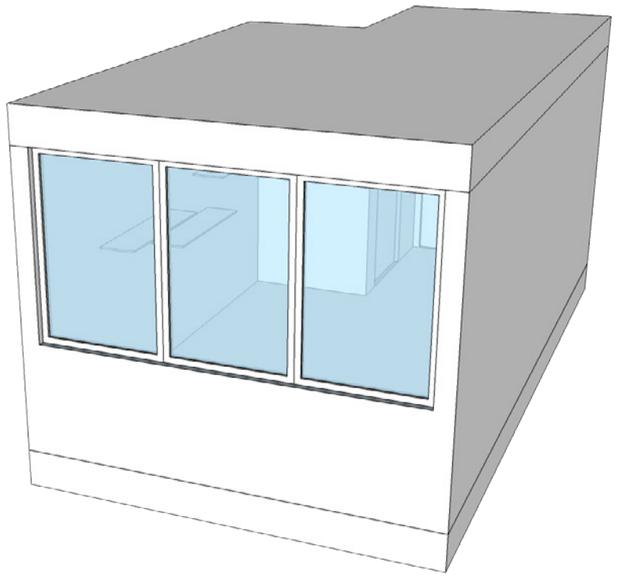
Base Case

The baseline case for this room has three windows that are about three feet by three feet wide, facing the north. This allows for a medium level of light penetration into the space (about to the middle of the room) throughout most of the year, except in the winter when light penetration becomes lower (about a third into the room). The area directly below the window tend to receive the most light, followed by a small band of useful bright light and then the light fades away quickly as it gets deeper into the space.

For the purpose of this analysis, the useful desk surface is located against the middle of the east wall. This location receives acceptable useful light levels only in the afternoon during the equinox months, throughout the day during the summer in June, and never in the winter.

In general, the room does not receive enough sunlight throughout the year, and also has a potential high-contrast glare problem.

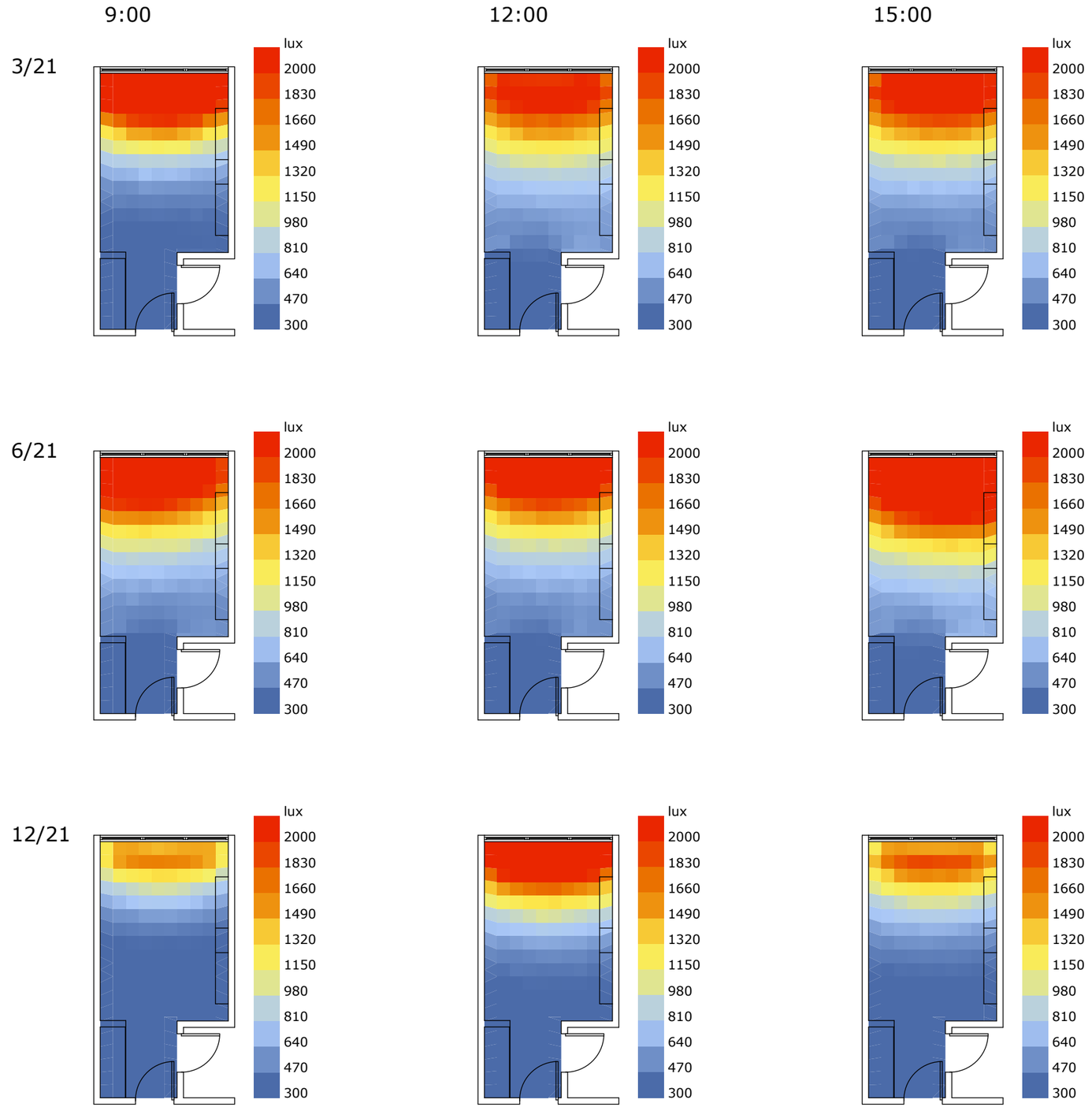


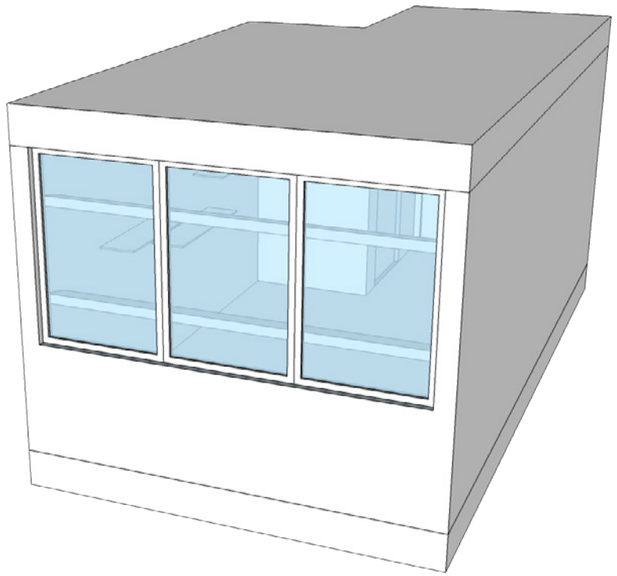


Basic improvement

In order to resolve the low sunlight levels in the room for most of the year, the glazing has been increased to reach all the way up to the ceiling. This has the effect of bringing in more sunlight into the entire room, allowing good light levels even deeper into the useful parts of the room from March to June. The room still does not receive enough sunlight in the winter, but light levels for the useful desk surface is improved during December.

However, with the increased light penetration comes the problem of high glare potential in the area next to the windows. The light intensity in this area is too high throughout much of March to June, and even at noon in the winter. The design solution that should be used here must block the potential glare while retaining the increased sunlight levels in the deeper parts of the room. For this purpose, a light shelf would work for this room's northward orientation.



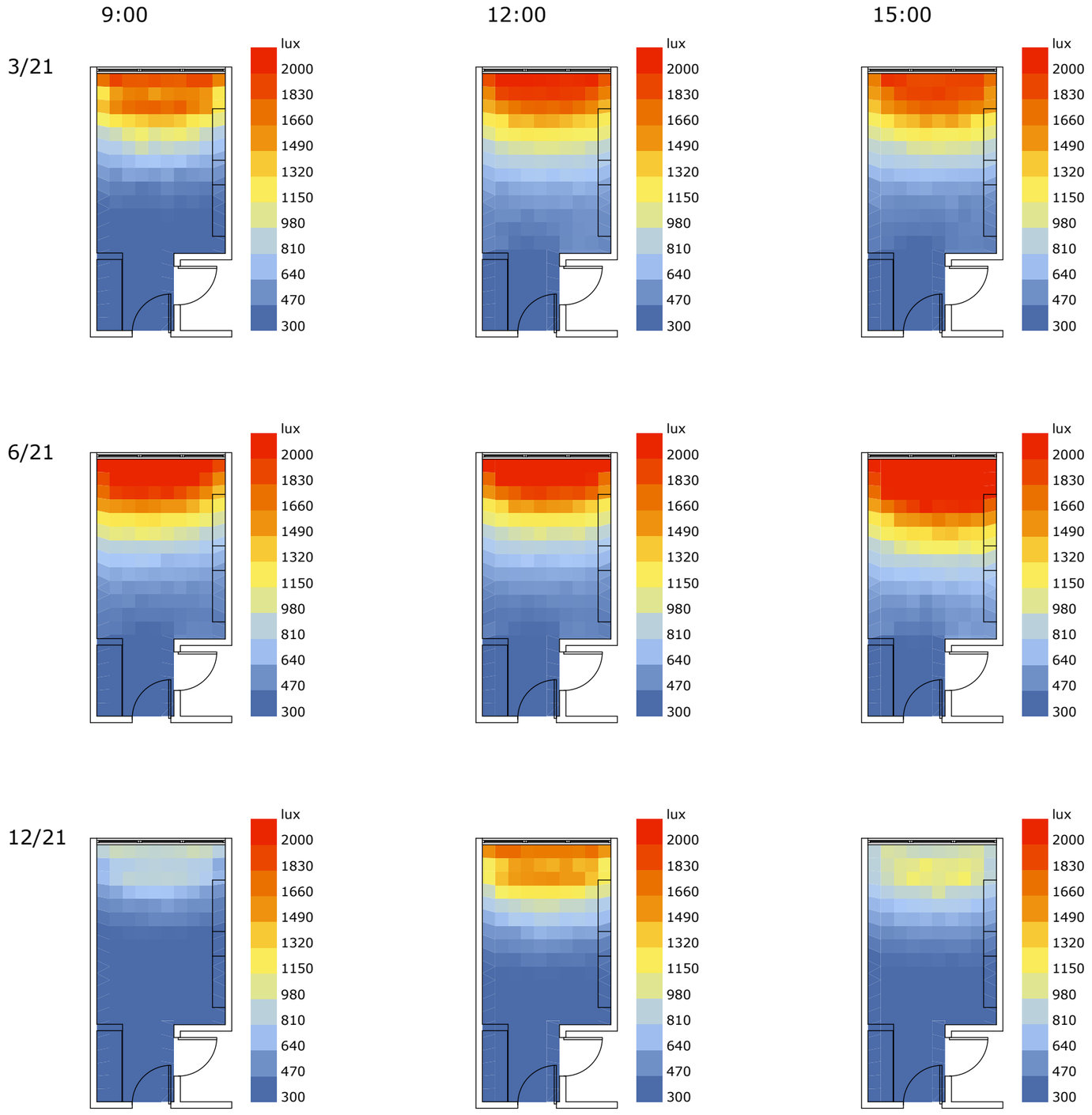


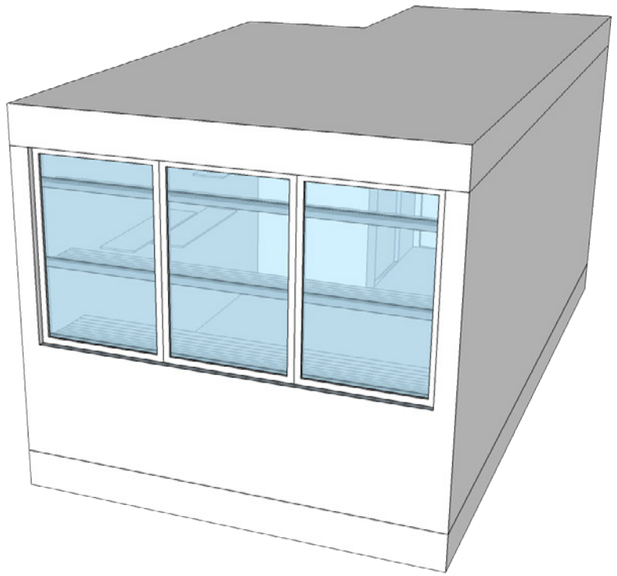
Initial light shelf configuration

The initial light shelf configuration consists of two light shelves located a third of the way up and down the edges of the window. The light shelves reach about a foot into the space.

The resulting daylight simulation shows that this light shelf configuration provides shading benefits to the area immediately under the windows for the morning in March and throughout the winter. However, it is inadequate to address the glare issue during the summer.

Using light shelves do seem to provide the benefit of shading glare areas without losing the good light levels that penetrated deeper into the room, so it is simply a matter of finding the right light shelf configuration.





Final design

To further reduce the glare introduced by the increased glazing area, a third light shelf is added and the light shelves moved to align with the bottom of the windows. The light shelves have also been changed to a curved design to maximize reflection of light deeper into the space. The bottom light shelf is extended to reach 2’ deep into the room, while the middle light shelf is extended to reach 1.5’ deep.

This light shelf configuration largely eliminates the glare issue introduced by the increased glazing area, while at the same time maintaining ideal light levels deeper into the room. The useful desk surface in the middle of the east wall now receives acceptable sunlight levels throughout March to June. Only in the winter is there a case of low light levels.

This final design is an improvement from the base case because it introduced even and good light levels deep into all the useful parts of the room, while blocking away most of the glare under the windows, except in the winter in which light penetration levels have not changed much from the base case. To mitigate the low light levels in the winter, the designer may want to consider making the light shelves a roller-shade design which can be rolled up in the winter to allow light to penetrate the room.