

Upper Dublin High School Daylight Analysis

Produced for:

Gilbert Architects

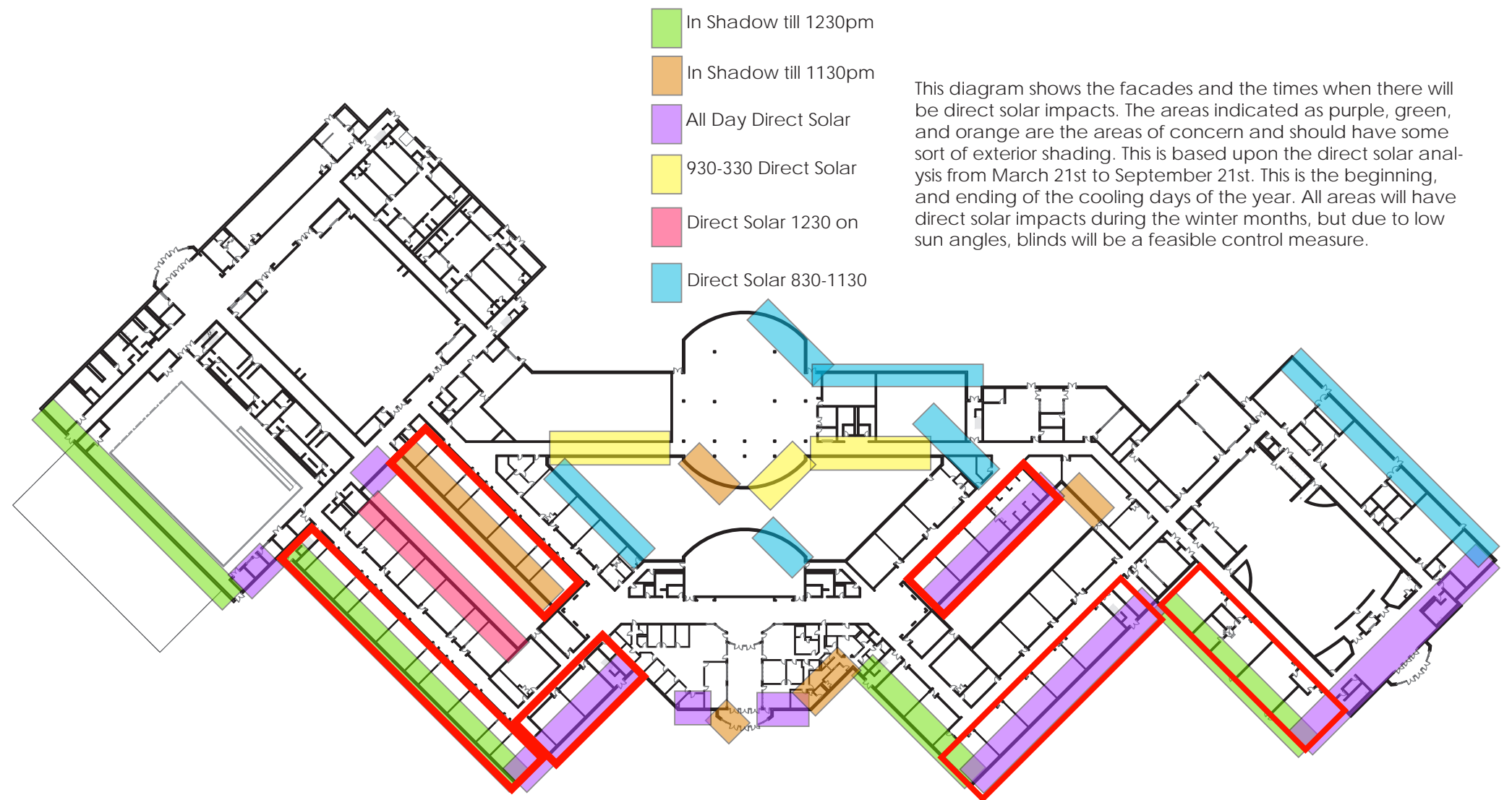
By:



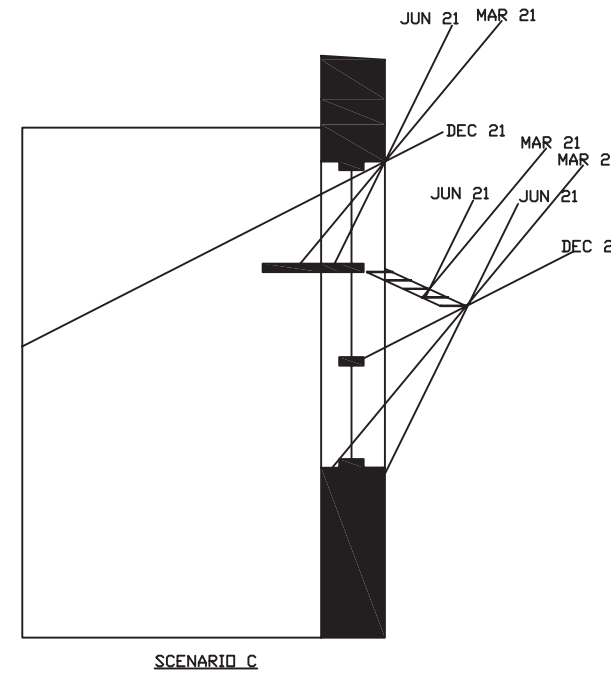
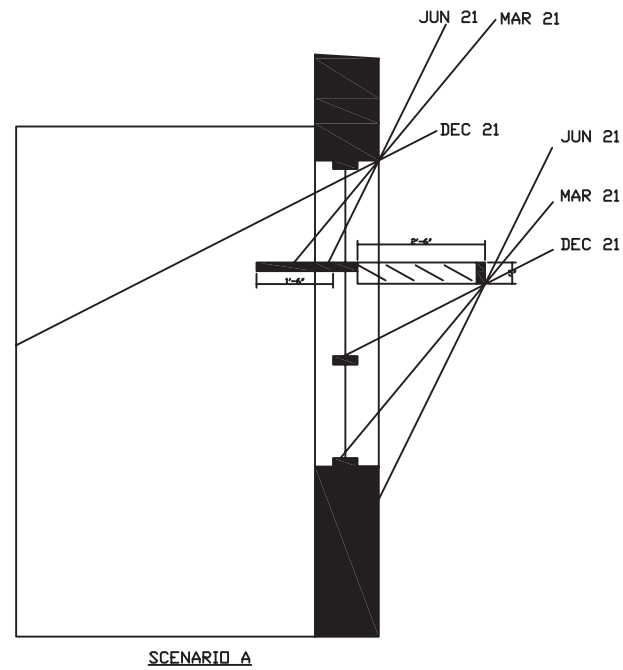
October 16, 2007

The plan to the right includes the direct solar analysis results and the classrooms that will need exterior shading.

Classrooms on the elevations that are boxed in red should use exterior shading devices to stop any direct solar penetration from March 21st to September 21st. This would include both the first and second floors. These spaces will also benefit from interior lightshelves by provided the deepest penetration of daylight.



This diagram shows the facades and the times when there will be direct solar impacts. The areas indicated as purple, green, and orange are the areas of concern and should have some sort of exterior shading. This is based upon the direct solar analysis from March 21st to September 21st. This is the beginning, and ending of the cooling days of the year. All areas will have direct solar impacts during the winter months, but due to low sun angles, blinds will be a feasible control measure.

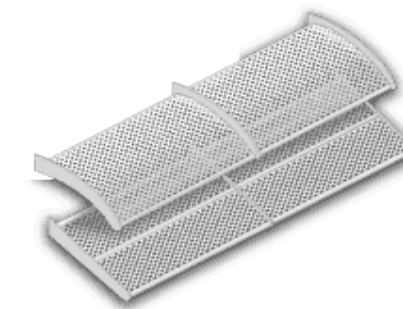
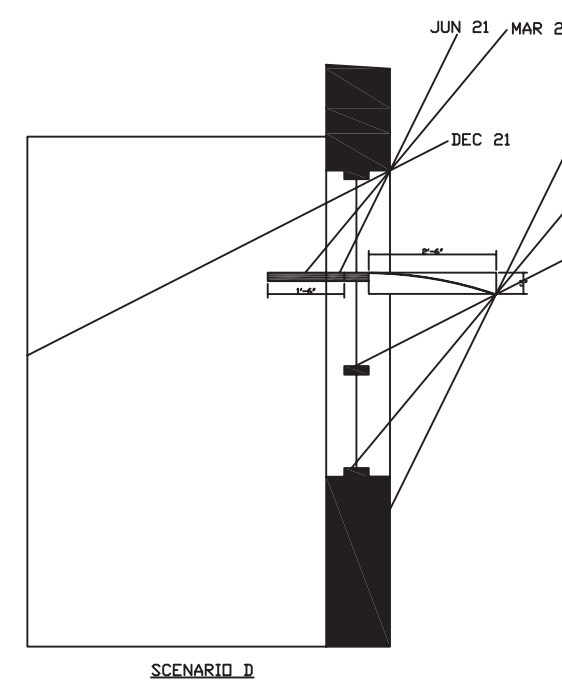
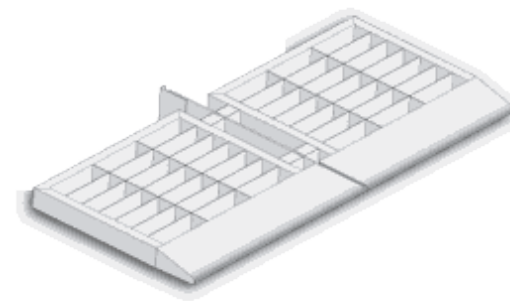
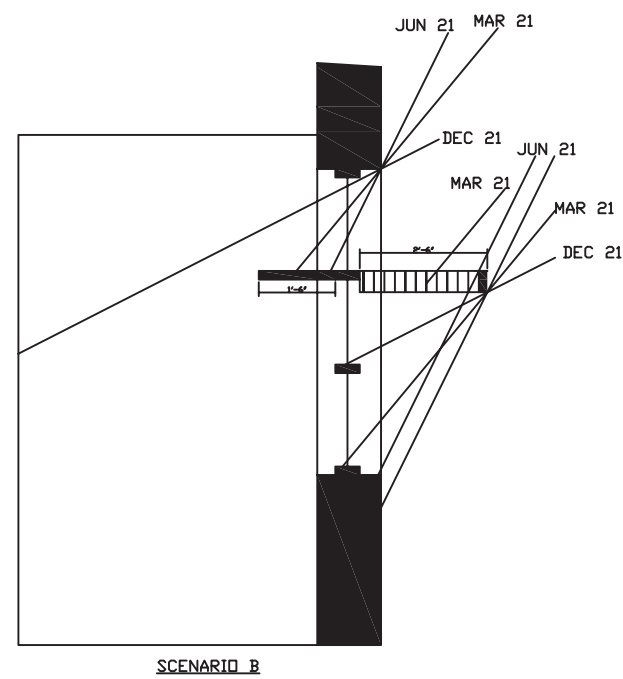


This page includes all the different exterior shading devices and light shelf combinations that were looked at for the classroom analysis.

All scenarios produced very similar results. However, Scenario C is recommended because it produced the higher illuminance values at the window wall with the best contrast ratio.

A shading device similar to Scenario C or D would be well suited for this project. A manufactured shading device for Scenario C was not found, but the C S Group manufactures the ones in all the other scenarios.

Scenario D is a wire mesh shading device. This design will complement the curved roofs of the project.



These two pages contain the illuminance values for Scenario C under clear and overcast sky conditions on March 21st at noon.

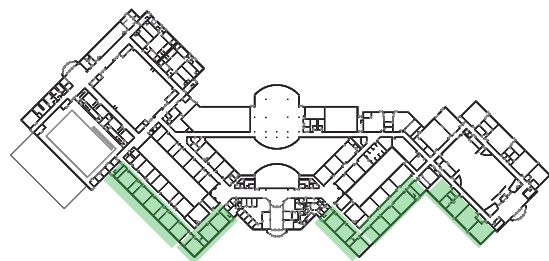
The internal reflectances were 80% for the ceilings, 70% for the walls, 40% for the floor, 80% for the external shading device and light shelf.

The view window has a VLT of 65%. 60% is the usual number used, but because of low window/floor ratio, the VLT had to be increased. The daylight window has a VLT of 70%.

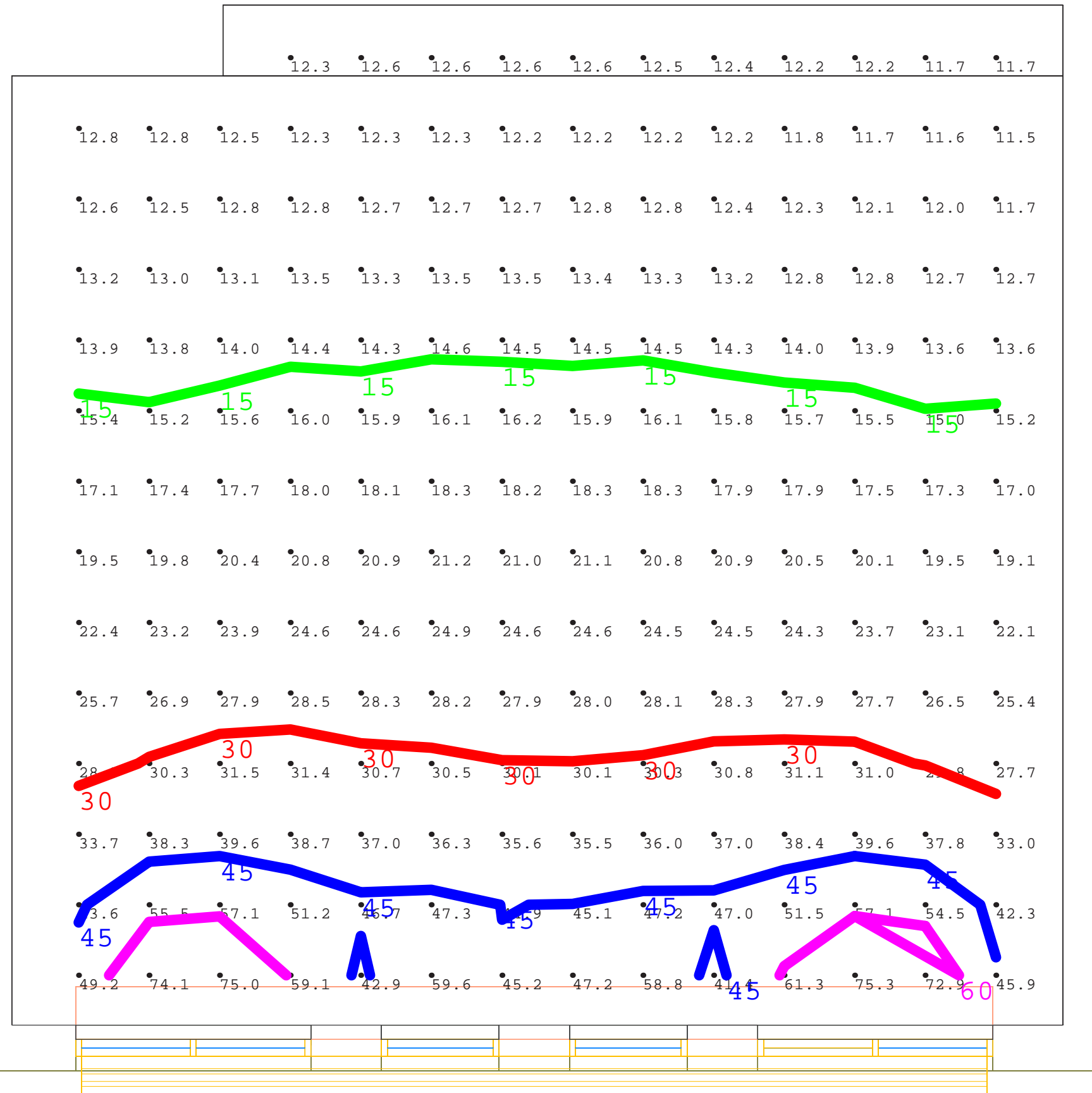
There is only sufficient amounts of daylight for the first third of the classrooms in overcast sky conditions. One of the biggest reasons is there is only 11% window to floor area ratio. South facing classrooms should have at least 15% and north facing with 20%. This will effect the electric lighting scenarios where only the first third of the space can be dimmed or turned off. It is key to remember that the day lighting strategies are for overcast sky conditions.

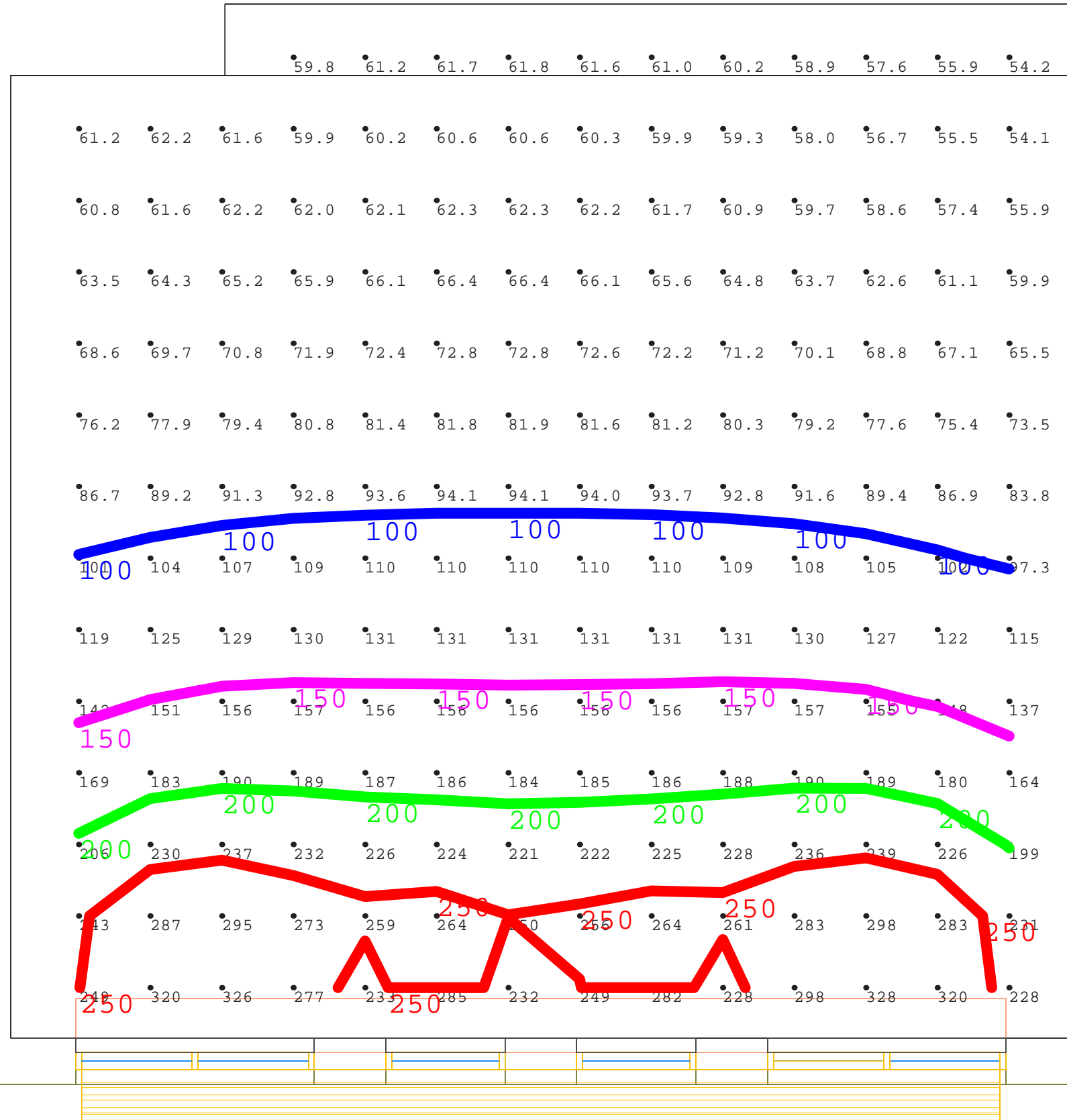
Each of the classrooms will require shades in the view and daylight windows. The shades in the view should roll from the bottom up and the ones in the daylight window should roll from the top down. The shades should have a 10% transparency.

There are a few possible solutions to increase the daylight penetration in the space. One is to increase the window to floor area ratio to 15% for the south and 20% for the north. Another solution is to slope the ceiling from the window wall back to interior wall of the space.



Illuminance Values
 Average: 25fc
 Maximum: 75fc
 Minimum: 12fc
 Contrast Ratio: 1:6.5
 Window/Floor Ratio: 11%

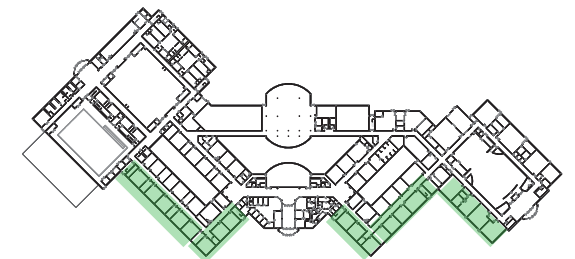




The illuminance levels for a typical south facing classroom in clear sky conditions are sufficient to effectively daylight the space. There will be some glare but not a big concern and the contrast ratio is good.

Blinds will be needed, especially for low winter sun angles.

Illuminance Values
 Average: 131fc
 Maximum: 328fc
 Minimum: 54fc
 Contrast Ratio: 1:6
 Window/Floor Ratio: 11%

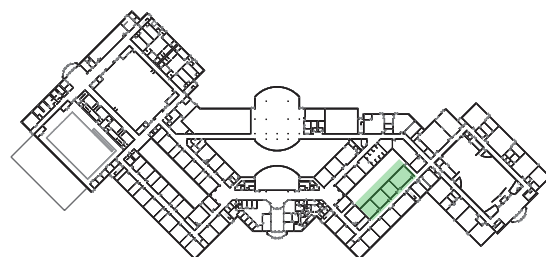


These two pages contain the illuminance values for the north and south facing classrooms in the courtyard in overcast sky conditions.

The internal reflectances were 80% for the ceilings, 70% for the walls, 40% for the floor, 80% for the external shading device and light shelf. Classrooms facing south had Scenario A shading device with a light shelf. VLTs were 60% for the view window and 70% for the daylight window.

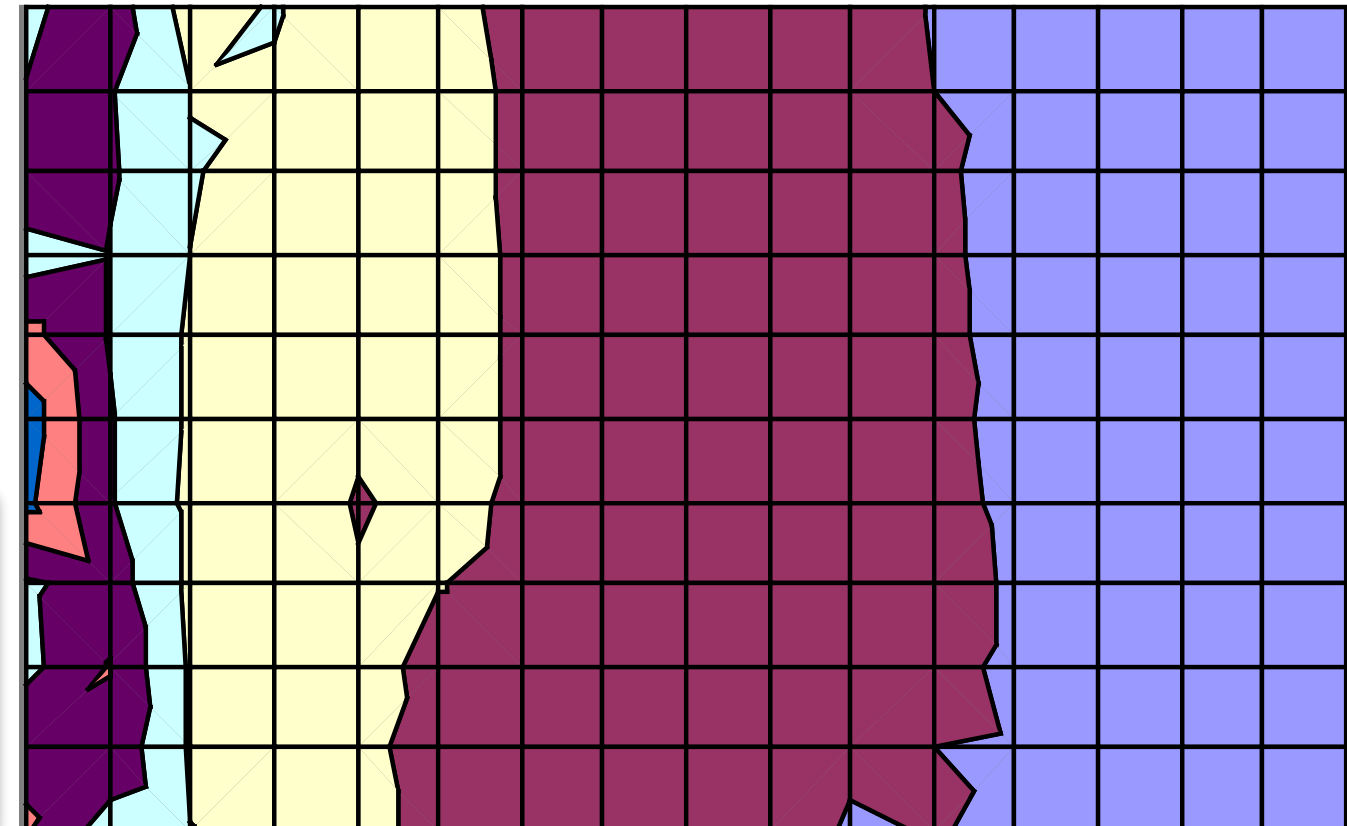
These two surface graphs represent the first and second floor classrooms facing north in the courtyard. Neither space will receive sufficient amounts of daylight. This is due to the window to floor area ratio of only 11%. This should be closer to 20%. This is very important for the first floor classrooms since they have reduced sky vault access. Glare will be an issue in these spaces and contrast is of concern in the first floor classrooms.

Increasing the floor to window ratio to 20% along with using a VLT of 70% for all window will help increase the daylight penetration and reduce the need for electric light. Another possibility is to slope the ceiling down from the window wall.



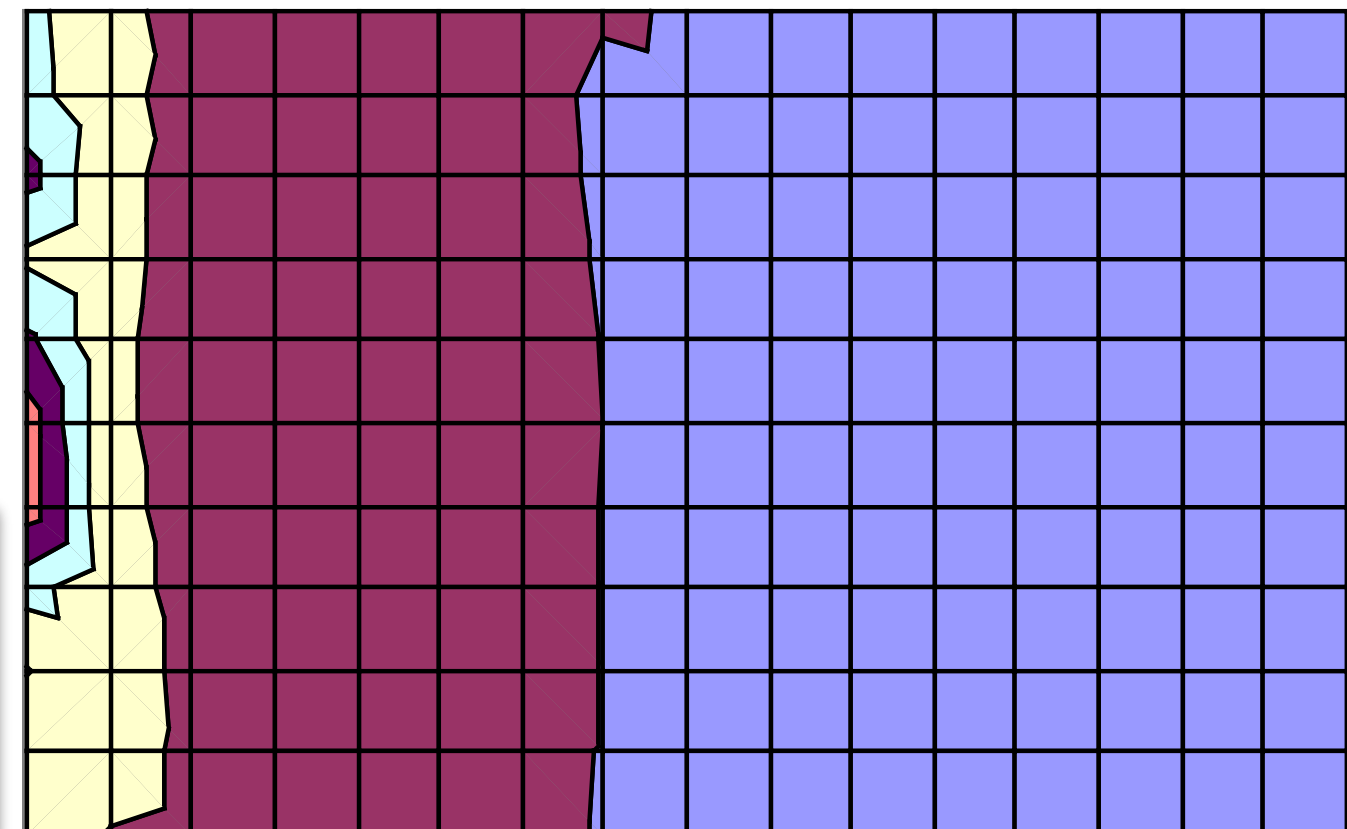
Illuminance Values

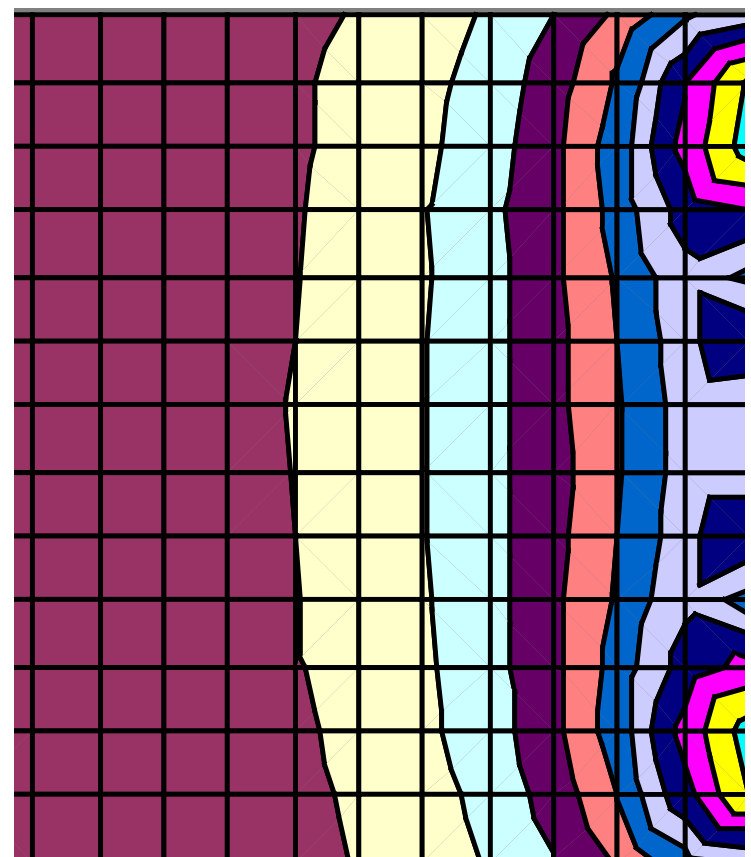
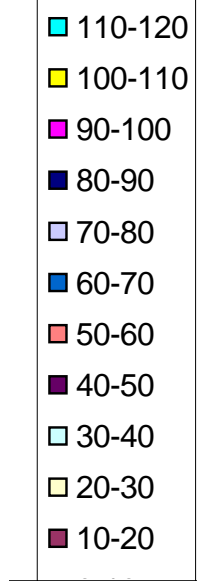
Average: 19fc
 Maximum: 65fc
 Minimum: 7fc
 Contrast Ratio: 1:7
 Window/Floor Ratio: 11%



Illuminance Values

Average: 13fc
 Maximum: 56fc
 Minimum: 4fc
 Contrast Ratio: 1:13
 Window/Floor Ratio: 11%





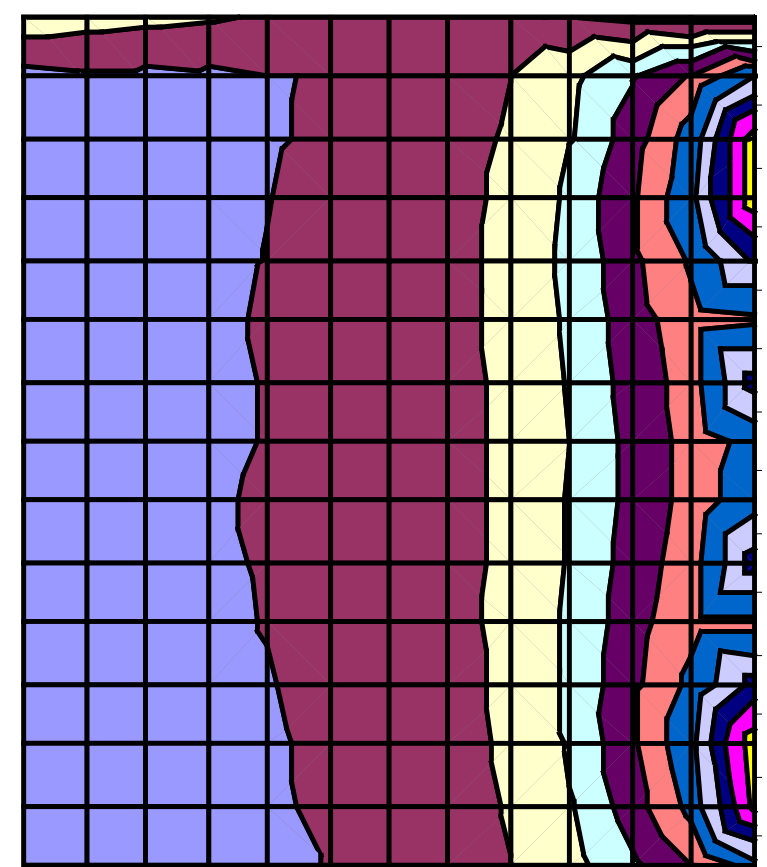
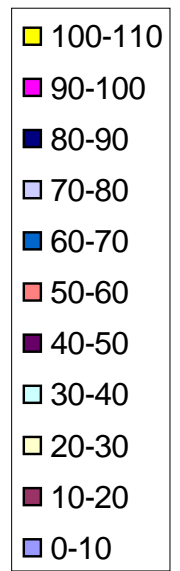
Illuminance Values
 Average: 33fc
 Maximum: 116fc
 Minimum: 9fc
 Contrast Ratio: 1:12
 Window/Floor Ratio: 11%

These graphs are for the classrooms facing south in the courtyard.

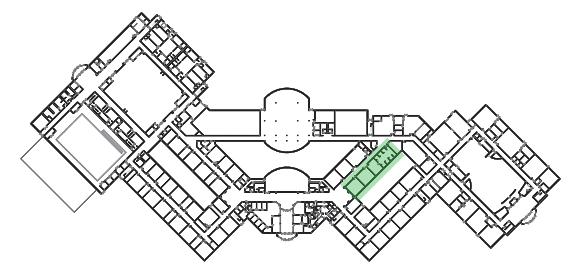
The daylight penetration is good for the second floor classrooms but the first floor has only about a third of the space with sufficient daylight. This is due to its limited access to the sky vault.

Glare is not bad but contrast is an issue. Using 65% VLT for the view window with Scenario C shading device will help with both glare and contrast.

Shades will be required in both the view and daylight windows to help with direct solar penetration.



Illuminance Values
 Average: 25fc
 Maximum: 107fc
 Minimum: 6fc
 Contrast Ratio: 1:18
 Window/Floor Ratio: 11%

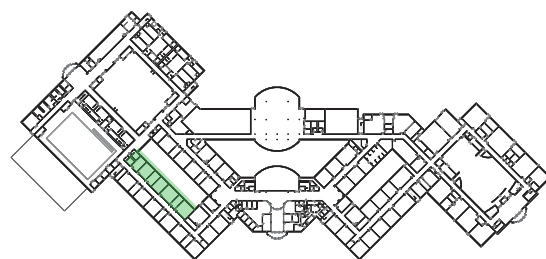


These two pages contain the illuminance values for the east and west facing classrooms in the courtyard in overcast sky conditions.

The internal reflectances were 80% for the ceilings, 70% for the walls, 40% for the floor, 80% for the external shading device and light shelf. Classrooms facing west had Scenario A shading device with a light shelf. VLTs were 60% for the view window and 70% for the daylight window.

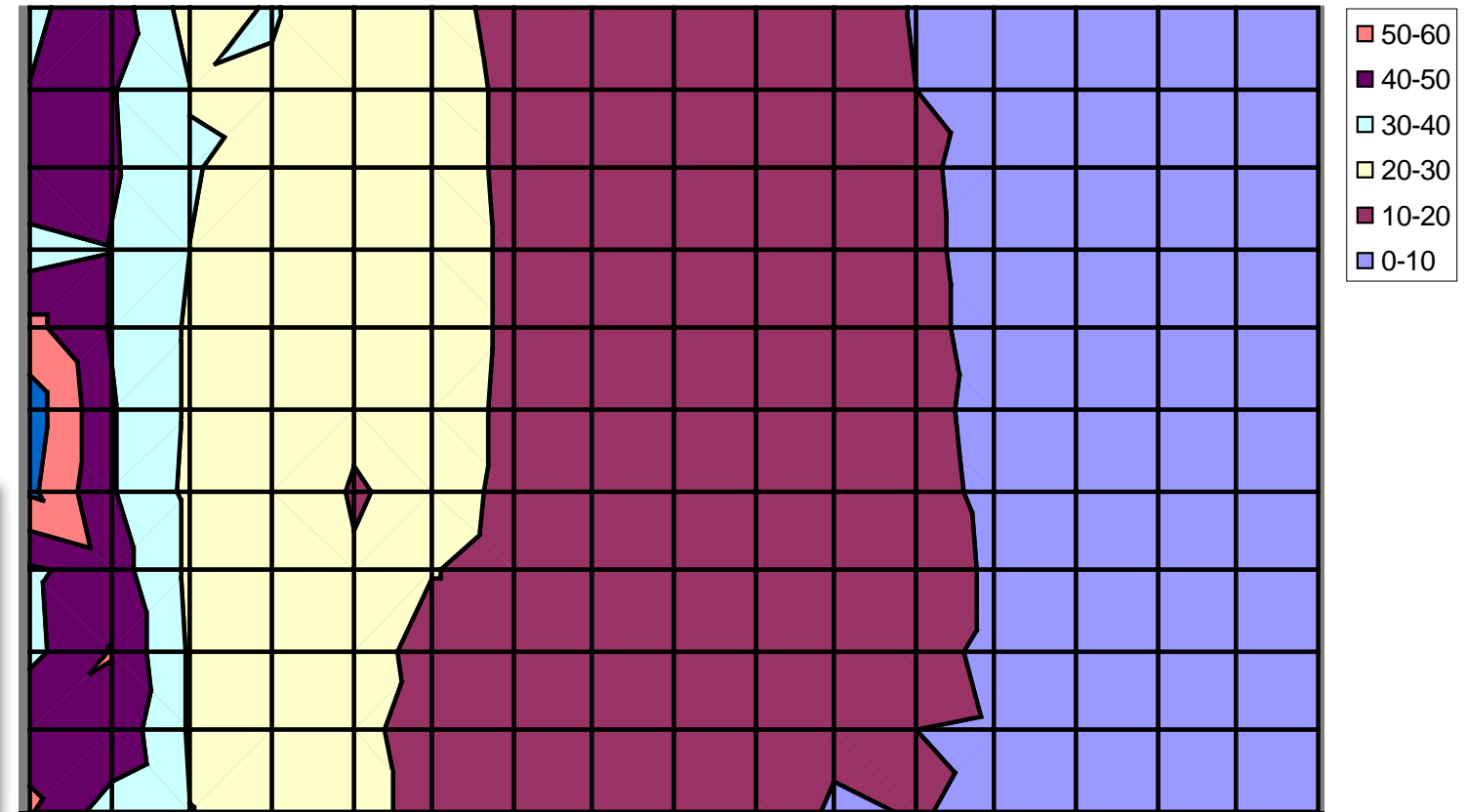
The two surface graphs represent the first and second floor classrooms in the courtyard facing east. Neither classroom receives sufficient amounts of daylight and there are glare and contrast issues in both.

Exterior shading devices and light shelves will not be needed for these east facing windows. Shades will be necessary to deal with the early morning direct solar penetration year round. The window to floor area ratio should be 15% with the VLT of all glazing being 70%.



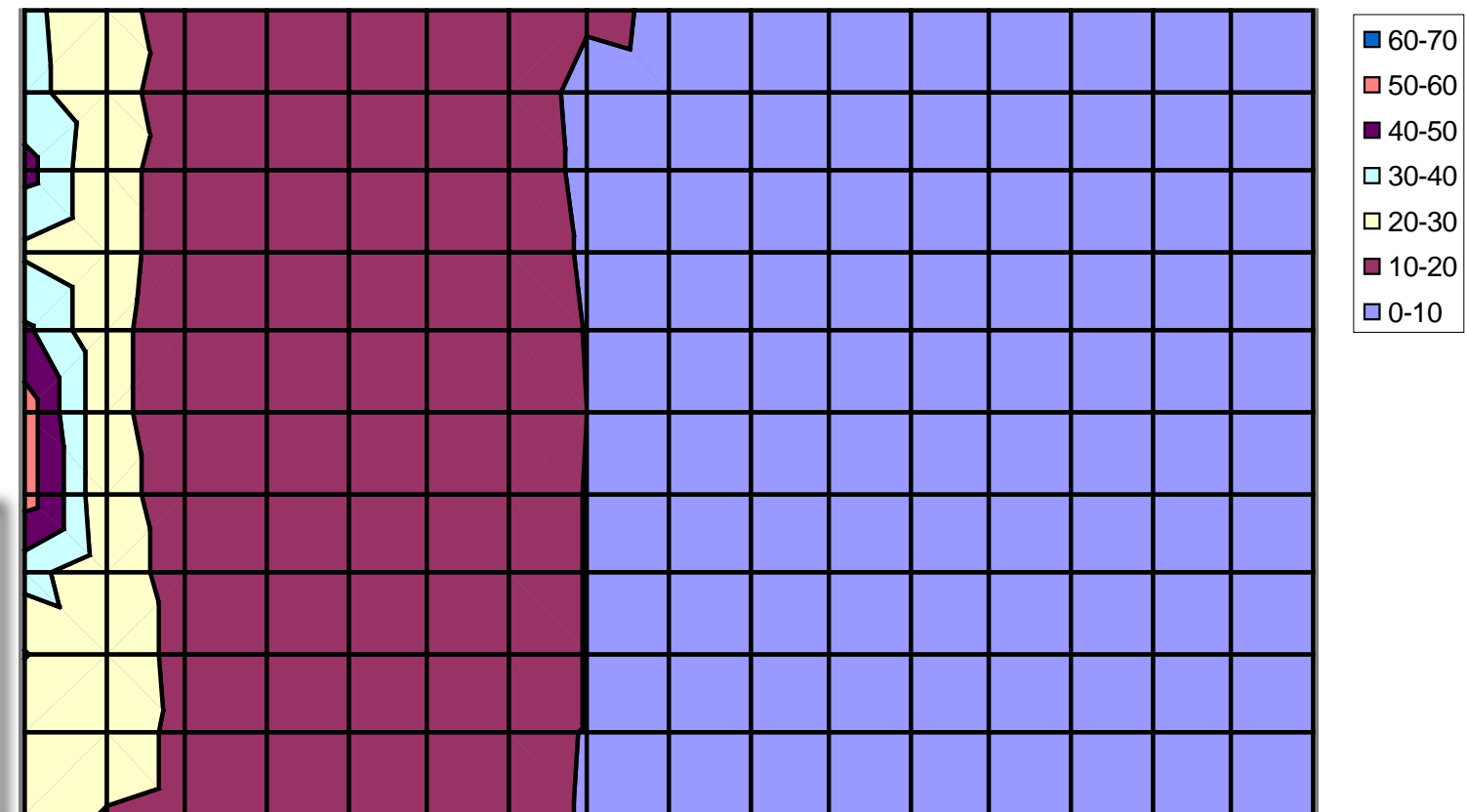
Illuminance Values

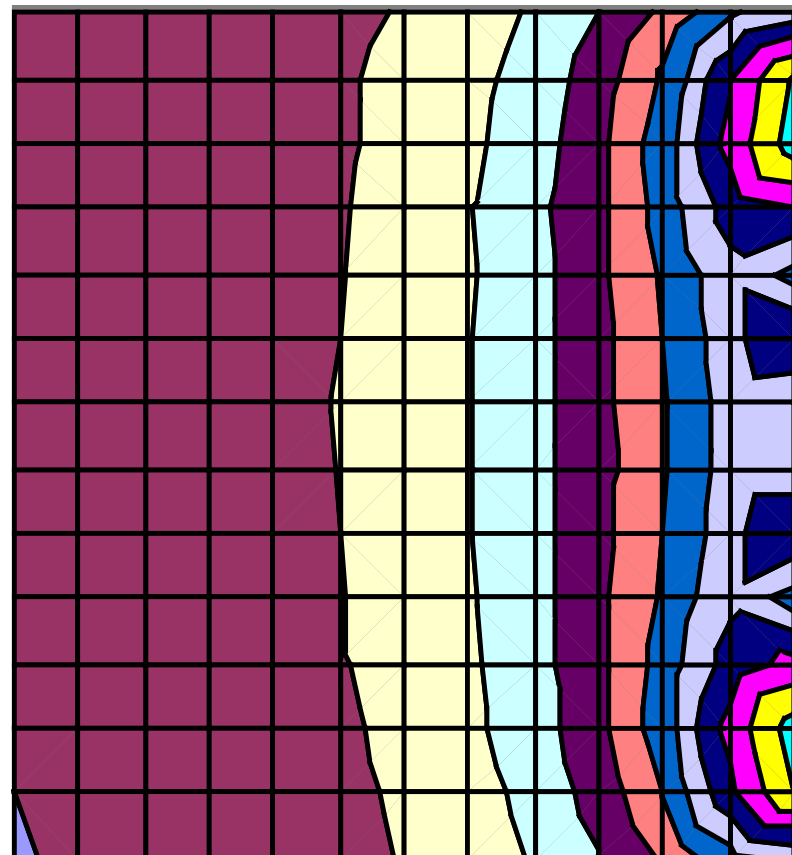
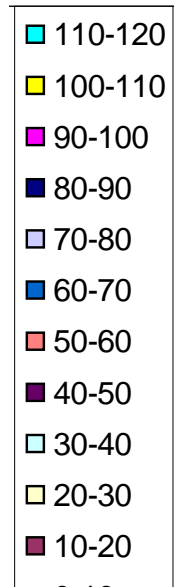
Average: 18fc
 Maximum: 65fc
 Minimum: 7fc
 Contrast Ratio: 1:9
 Window/Floor Ratio: 11%



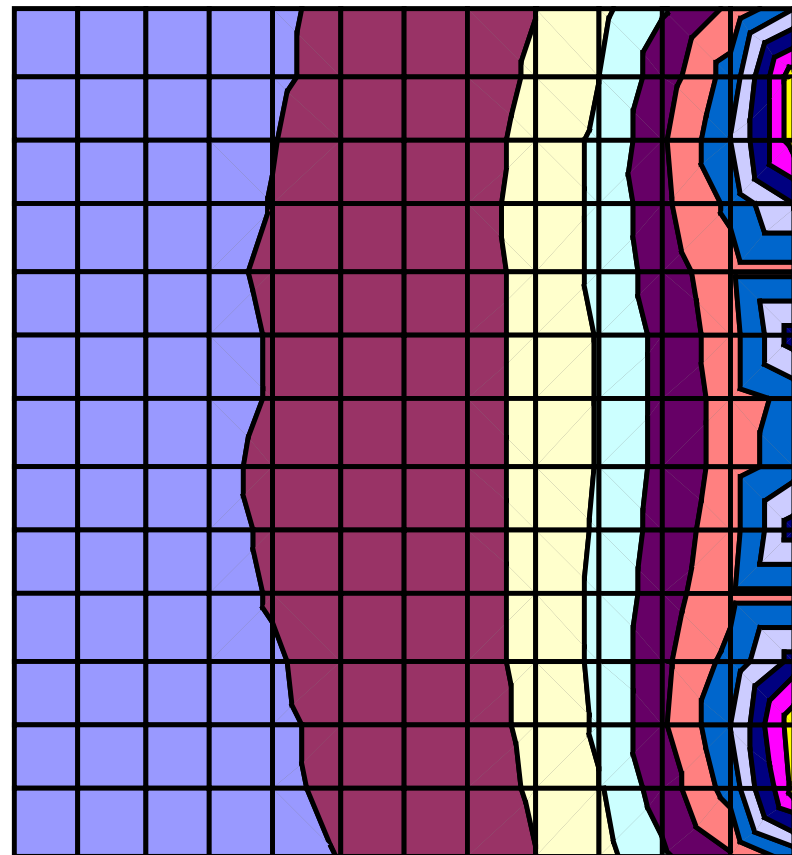
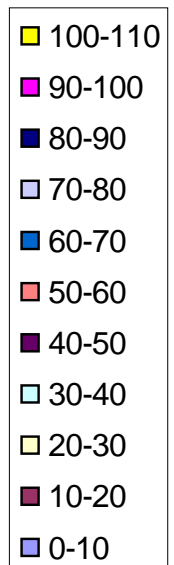
Illuminance Values

Average: 12fc
 Maximum: 56fc
 Minimum: 5fc
 Contrast Ratio: 1:11
 Window/Floor Ratio: 11%





Illuminance Values
 Average: 33fc
 Maximum: 116fc
 Minimum: 11fc
 Contrast Ratio: 1:11
 Window/Floor Ratio: 11%



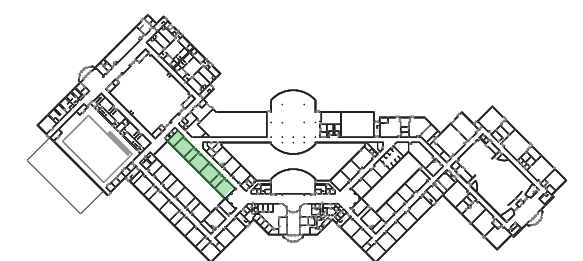
Illuminance Values
 Average: 24fc
 Maximum: 107fc
 Minimum: 7fc
 Contrast Ratio: 1:15
 Window/Floor Ratio: 11%

These graphs are for the classrooms facing west in the courtyard.

The daylight penetration is good for the second floor classrooms but the first floor has only about a third of the space with sufficient daylight. This is due to its limited access to the sky vault.

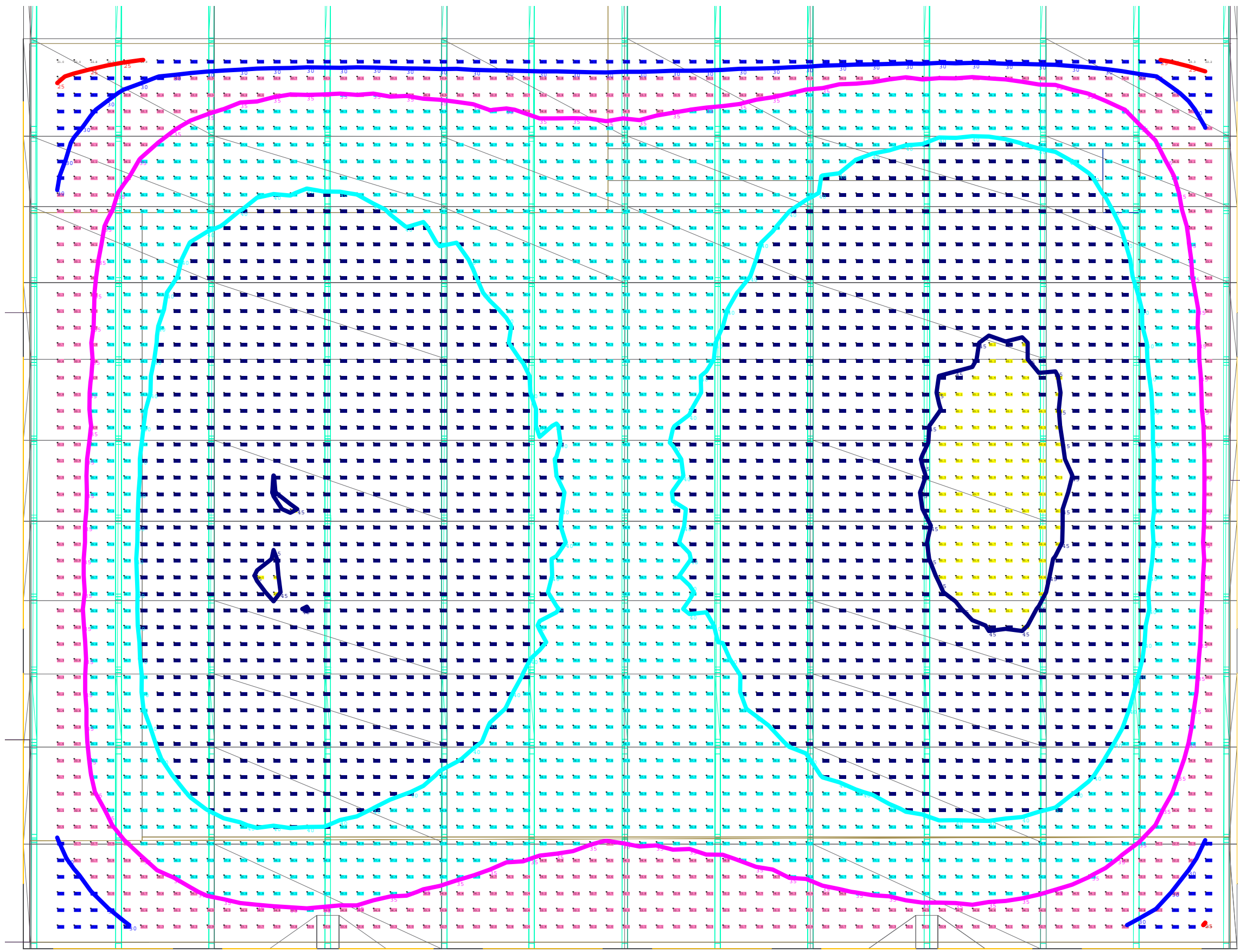
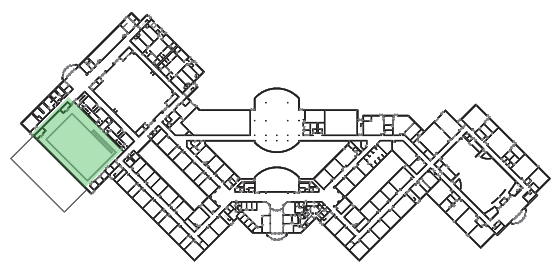
Glare is not bad but contrast is an issue. Using 65% VLT for the view window with Scenario C shading device will help with both glare and contrast.

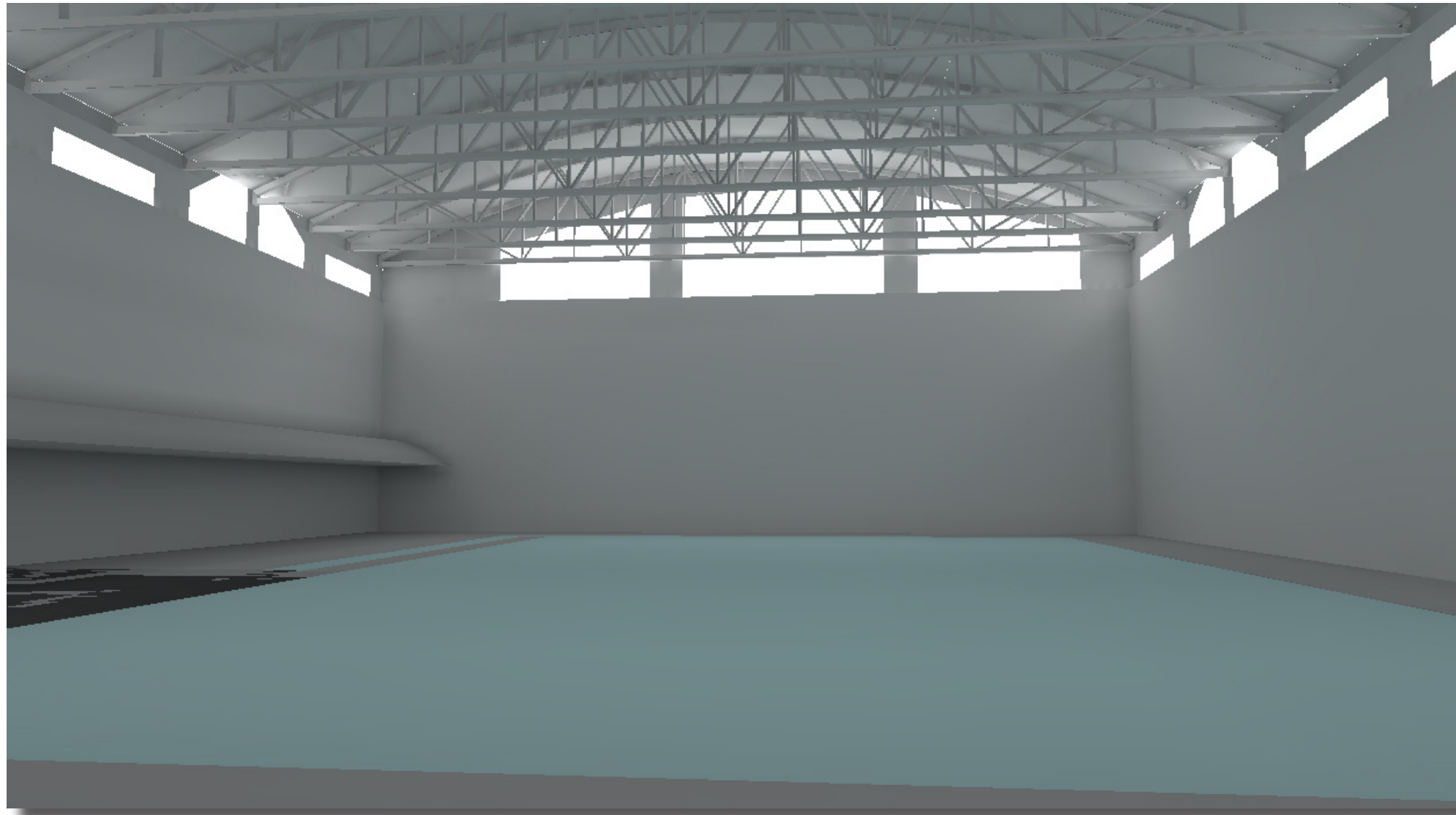
Shades will be required in both the view and daylight windows to help with direct solar penetration.



25-30 fc Light Blue
 30-35 fc Red
 35-40 fc Aqua
 40-45 fc Dark Blue
 45-50 fc Yellow

Illuminance Values
 Average: 40fc
 Maximum: 50fc
 Minimum: 21fc
 Contrast Ratio: 1:2





The natatorium was modeled with the internal reflectances the same as the classrooms. The glazing was simulated as Kal Wall with a 30% transparency.

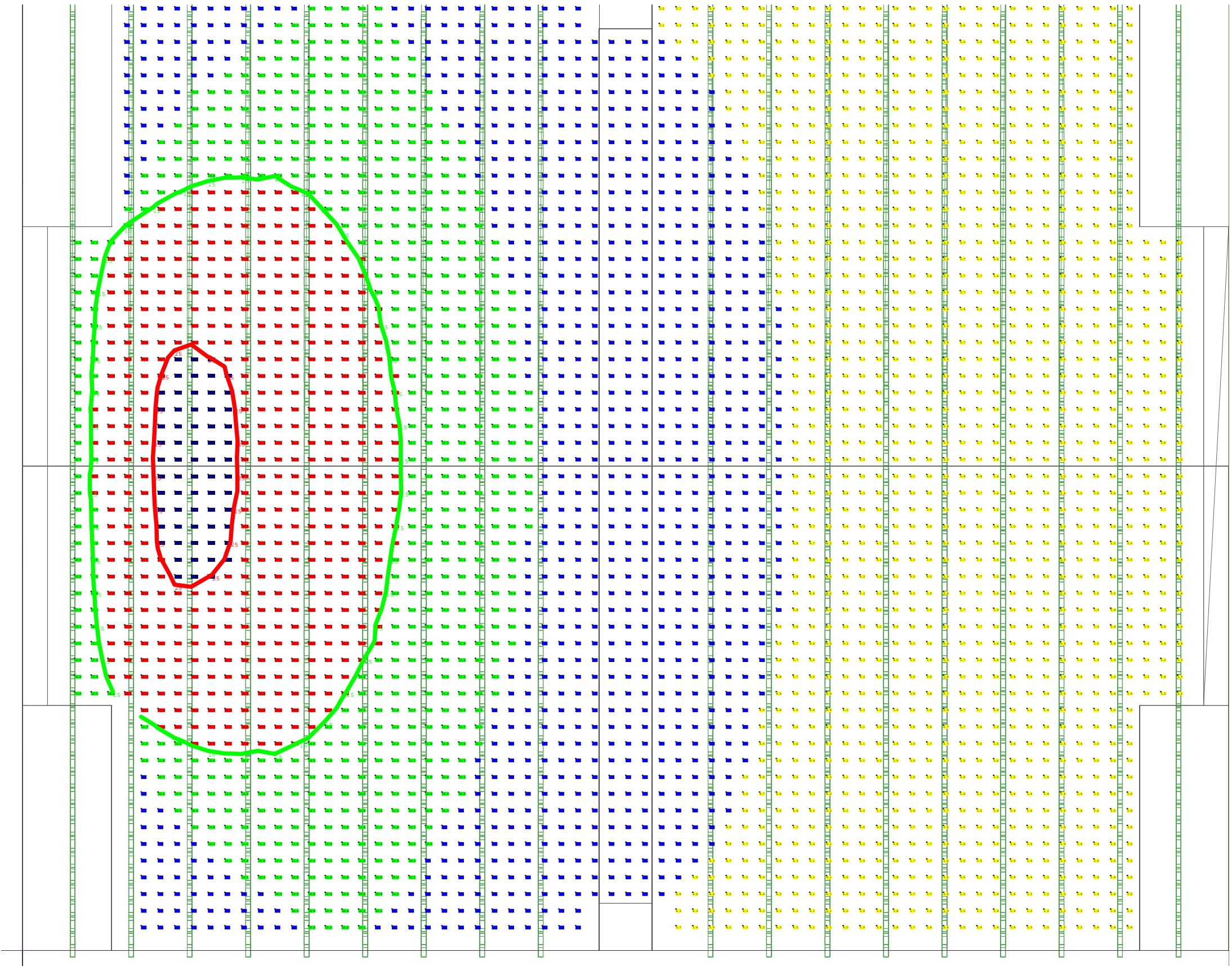
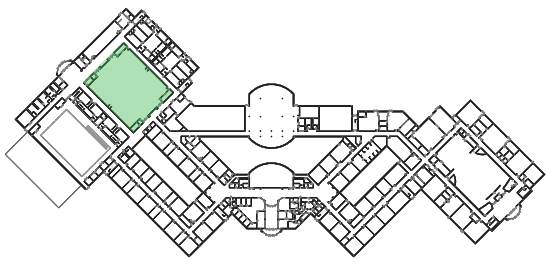
There is sufficient daylight in overcast skies. There will be well over a 50 fc average in clear sky conditions.

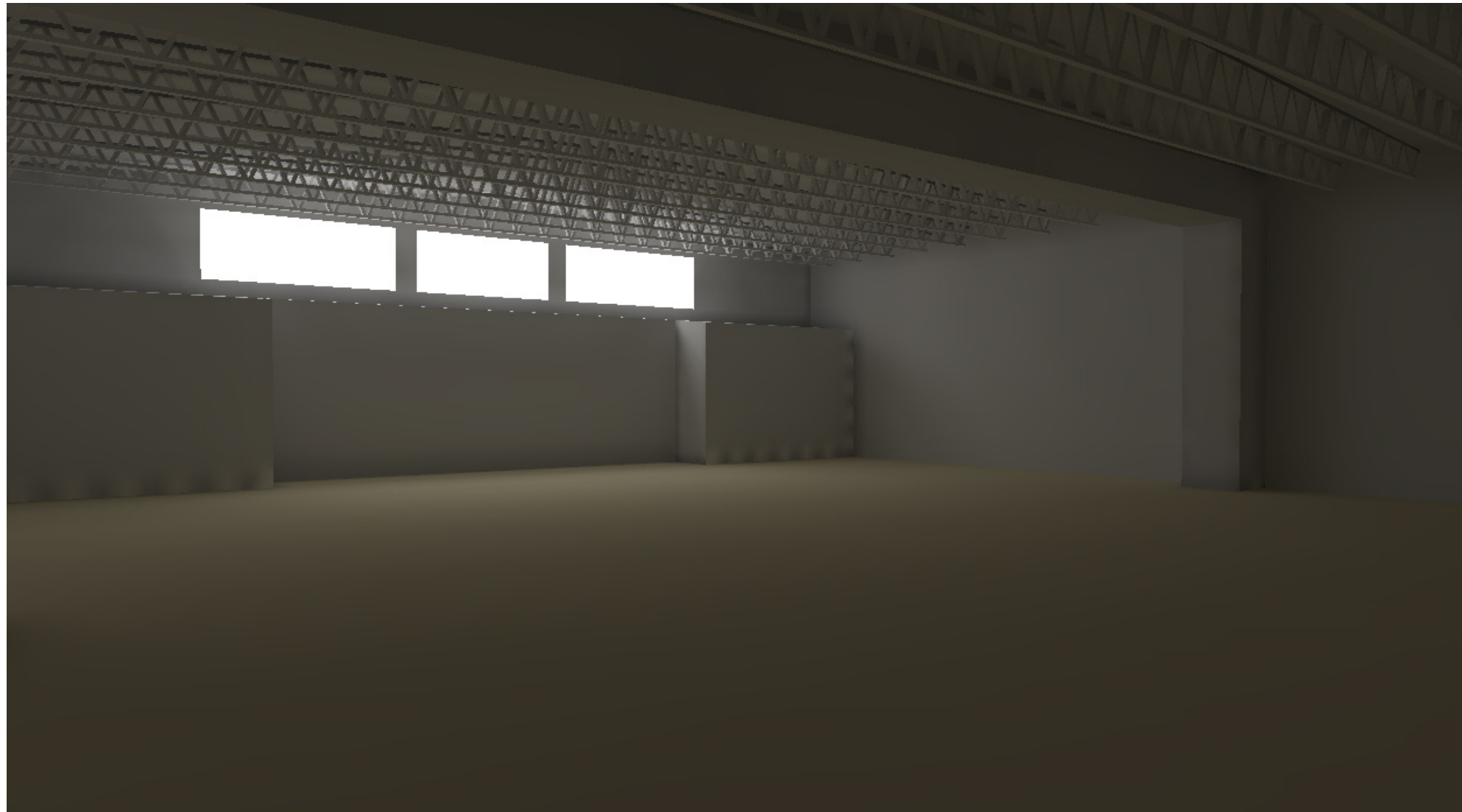
Glare may be an issue only because of the water. Contrast is not an issue as long as the major color of the ceiling is white.

Electric lighting can be greatly reduced and or dimmed in the space.

1-5 fc Yellow
5-10 fc Light Blue
10-15 fc Green
15-20 fc Red
25-30 fc Dark Blue

Illuminance Values
Average: 9fc
Maximum: 27fc
Minimum: 2fc
Contrast Ratio: 1:12





The main gymnasium was modeled with the internal reflectances the same as the classrooms. The glazing was simulated as Kal Wall with a 30% transparency.

There is not sufficient daylight for the gym and the lighting quality is quite poor. This is due to only one side of the gym having any type of glazing.

Implementation of side lighting from the opposite side of the gym will help along with top lighting.