Arch 701| Initial Observations | 02.23.2011

The Lawrence Arts Center (LAC) is a multi-purpose building housing a wide range of activities including; gallery space, daycare, art studios, dance studios, office space, a black-box theatre, and a large auditorium. Located in Lawrence, Kansas at 9th and New Hampshire St. in the middle of a block-long street, the LAC functions as a sort of community center. Holding art classes, performances, shows and events, the LAC was designed as an infill building, meaning that it was designed to have buildings butting against it on both sides.

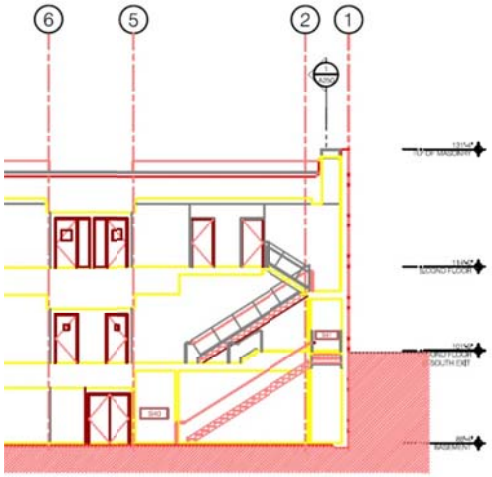
Lawrence Arts Center (view from the parking garage to the west)

There are several distinct features to the building which were heavily influenced by the design intention and response to climate by the architect. The west-facing front of the building was designed with afternoon sun in mind. A large amount of the elevation is brick, and windows that are there have fins strategically placed either above or to the south side of the windows that art as sun shades. In the center of the west elevation the main entrance, about a third of the total building length, is set back about twenty feet. This entire setback entry piece is a glass facade. To combat the harsh afternoon sun, the architect put a large, operable canopy above. The idea of this is that the building operators can roll out the canopy shade in the afternoon and block the direct sunlight, and then roll it back to open up the entry more for morning or night.

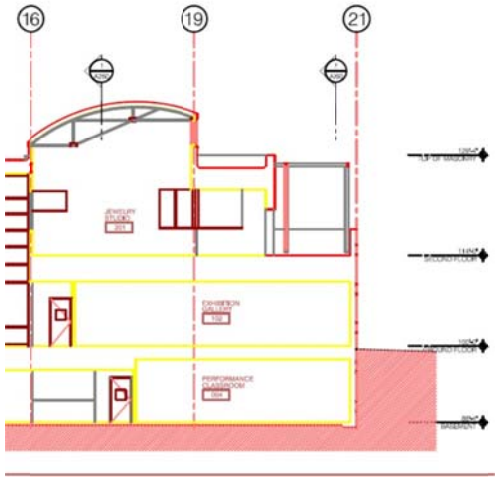
Canopy operators over entry setback

The back of the building, the east face, has only a few openings. This side of the building houses some of the studios, the daycare, some gallery space, and the auditorium wall. The few windows that

are there are addressed in the way that the ones on the west side are, with fins acting as sun shades either above or on the south side of windows. Both the north and south sides of the building are solid brick with no windows. They were designed this way because the building was designed as an infill building in the middle of what would be more buildings that butted up against those walls. The interesting design addressing climate issues comes on the roof. There are three large light wells that bring north light down into the studio spaces on the front of the building. These large, curved volumes that come out of the roof are immediately noticeable and along with serving as a light source, they block the view of mechanical systems on the roof.



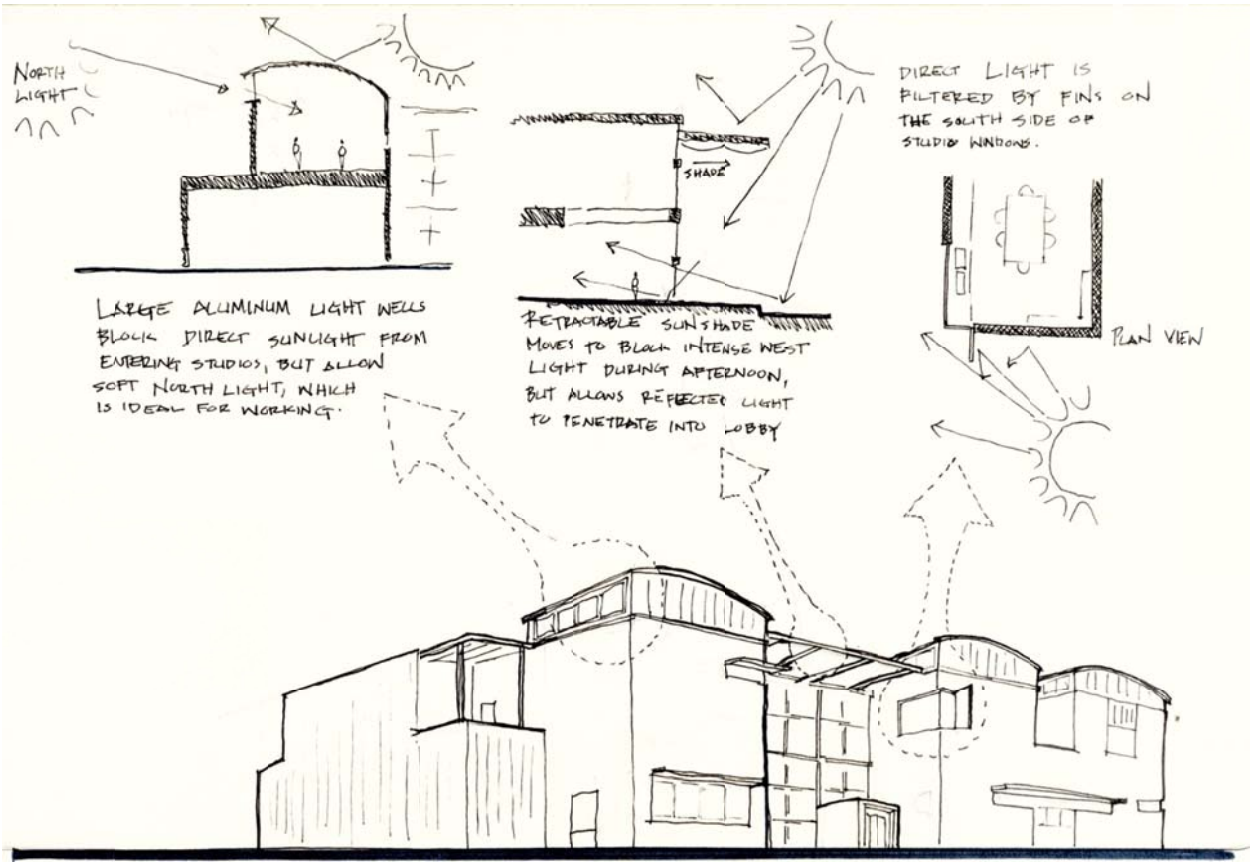
Section through stairs and lightwell.



Section through the roof light scoops.

The design intentions addressing and responding to the climate, especially the sun, seem to be very well thought out and successful. There is very little glazing on the east and west sides of the building, and what windows there are, are protected by well placed fins serving as sun shades. The only large expanse of glazing is the front entrance, which is set back and can be covered and protected by the operable canopy above. The north and south sides of the building, while ugly and lacking design at first sight, are explained when you find out that the building was designed as an infill and those sides were to

be covered by other buildings. The place where the design really excels is the large light wells from above. These bring indirect natural light into the studios, where it is most needed. Overall, the architect executed the design ideas and intentions regarding light and climate issues in an aesthetically pleasing and environmentally and economically friendly way.



Visual analysis of intended architectural responses to climatic conditions

Interview Data Collection

Our second phase was designed to test our three main assumptions and observations. We concluded in our first investigation that the large awning shade structure over the setback building entrance and lobby atrium space keeps the lobby shaded and cool. We also concluded that the large north facing light wells over the studios on the top floor provided ideal light for artistic pursuits, and the vertical fins on the south side of windows kept direct light out of both studios and offices . Our hypotheses were that all three design intentions worked as planned and kept direct sunlight out of the building.

To test these assumptions we conducted face to face interviews. We decided to talk with one art faculty member, two lobby workers (one front desk person and one administration) and three art students. We identified these respondents as the primary users of the building and those most affected by the light management systems. We chose this system because we could more easily guide participants in the interview and ensure that they understood the intent of the questions. We also chose this method because of the limited amount of time we had to complete the exercise.

Survey for Administrative and front desk staff.

- Describe the quality of light in the lobby during the morning (8am – Noon)?
- Describe the quality of light in the lobby during the afternoon (Noon - 5pm)?
- Describe the quality of light in the lobby during the evening (5pm – Dusk)?
- Does the awning/shade structure block direct sunlight in the afternoon?
- Describe the light levels in your office. Does the light affect the quality of your performance ?
- Do you like the large glass wall in the entrance and lobby atrium space?
- Do you notice direct sunlight in the main lobby area?
- Would you change anything about the fins on the windows?
- Would you change anything about the lobby atrium space and its shade structure?

Survey for Art faculty and students (Studio users)

- Do you notice the light wells in the ceiling?
- Do the light wells bring indirect light into the studio space?
- Do the fins on the windows help block direct afternoon/evening sunlight?
- Do you mind the lack of large windows in your studio space?
- Is the studio space negatively affected by direct sunlight at any time?
- Would you change anything about the way the light wells or how they look?

Findings

Lobby

The lobby and atrium space does not function ideally, nor how the architects originally planned. The atrium circulation was conceived as an internal street that reflects New Hampshire Street. This secondary street is linked to New Hampshire Street across a large outdoor plaza. This entire relationship is visible through the west facing, two-story glass façade.

To protect what would be an extremely large western exposure from direct afternoon light, the architects conceived an extendable screen that projects horizontally from the façade. However, This screen does not extend and the western façade is left completely exposed.

Interviews with a front desk worker and member of the administrative staff revealed that unfiltered light fills the lobby for the better part of the afternoon. This creates problems both in terms of light levels and temperature. The lobby can become unbearably hot in summer months. The administrator reported that the shading device was to large and expensive to repair.

Studios and Offices

Performance of both studio and office spaces was much better than that of the lobby. The administrative staff member reported that they liked to come to work in their office particularly due to the light levels. The large vertical fin on the south side of their office blocked direct afternoon sun but the window was large enough to let in indirect north light. Windows were reported as generous in size and affording good views.

The Printmaking teacher and students we interviewed reported that the light levels in the studios were ideal for printmaking and also for painting and life drawing. When asked why they thought the light levels were so good, they all identified the light wells in the ceiling. The students and teacher were less likely to comment on the quality of the windows.

Conclusion

Our hypothesis that the light wells and screening/shading devices provided ideal light throughout the entire building was generally true. The exception was the lobby space, which suffered not from poor design, but from a mechanical malfunction.

The lighting design was also crafted in such a way that the building users could identify the reasons for its success.

LAWRENCE ARTS CENTER ENVELOPE DESIGN

DOMINIC SENSKA, EDDY TAVIO & JAMES WELLINGTON

This study was designed to test the success of the building's envelope design in terms of solar performance. We tested the placement of the windows on the west facade along with their associated vertical sun shades. We also examined the north facing light wells in the studios areas and the large shading device above the glass curtain wall at the entrance. To test both of these elements we created a digital model in Revit and analyzed the sun's movement across the facade in Google Sketchup. We tested the facade on the Vernal and Autumnal equinoxes and the Summer and Winter solstices.

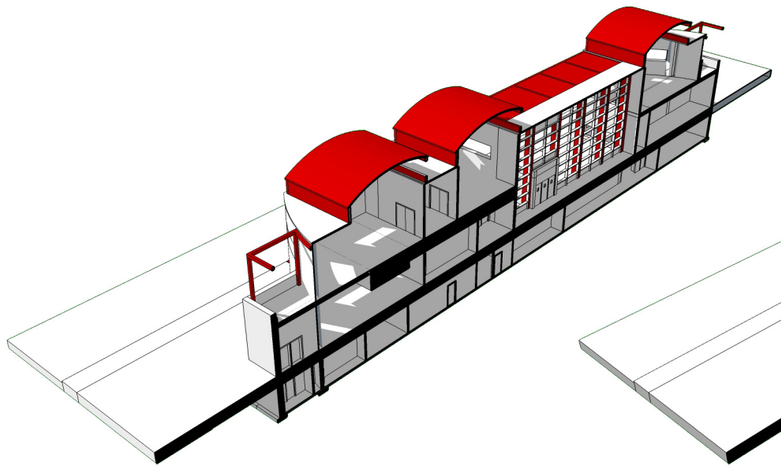
Testing revealed that the vertical shading devices function as intended. They do let a small amount of direct light into the offices, but the effect can be minimized by furniture placement.

The north facing light wells, as expected, perform perfectly. Facing north and not receiving direct sunlight were a major factor in this along with the light wells curving so no light shines directly into a space anyway. The major failure is in the shading structure over the front entrance of the building. There is a large extendable scree that was designed to reach perpendicular to the curtain wall and shade the lobby during the afternoon, but the screen does not extend properly and has not been repared. We modeled the building with the screen and found that it would block a large amount of light. However, the screen does not work and the space gets very warm in the afternoon while the building is exposed to extreme southwest light.

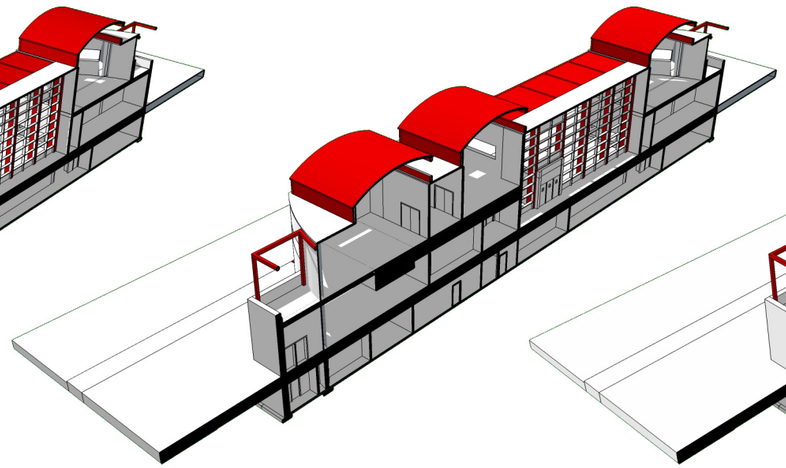
The initial assumptions we came up with when first looking at the building are mostly correct. We assumed all of the shading devices would block out direct sunlight. In reality, two of the three work well, and the third would work if the screen were not broken.

In terms of design lessons learned from our research, we learned two things. The first is that simple and often inexpensive solutions like the vertical fins and north facing light wells are usually the best. They are easy to fix and have little in the way of maintenance cost. The second lesson is that material choices are important. The architects' initial conceptual ideas about a creating a secondary street might have been realizable in a different material. The fantastic amount of heat in the lobby can actually counter act the good conceptual idea because visitors are unwilling to be inside the lobby for any amount of time to experience the architecture.

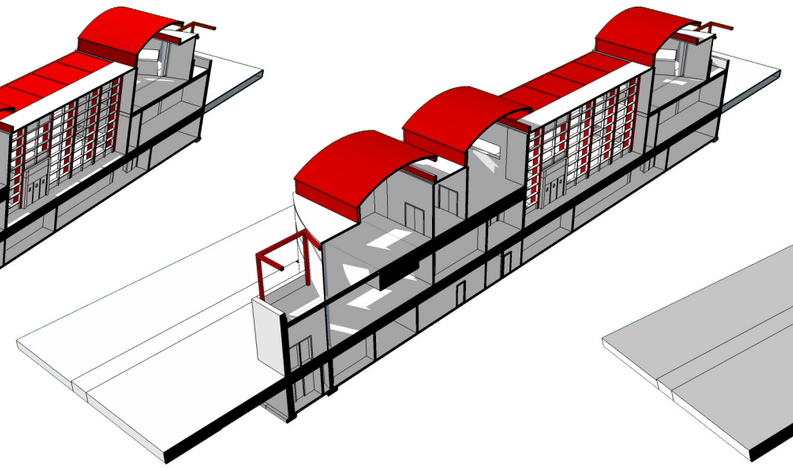
TESTED SYSTEMS



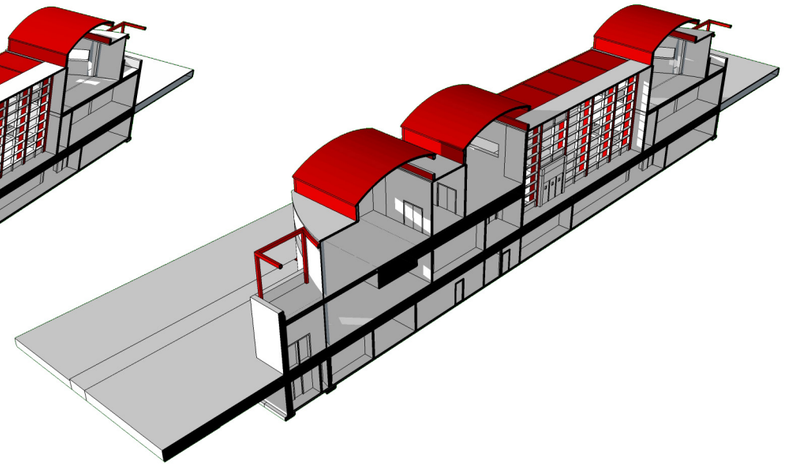
MARCH 21 [4:00 PM]



JUNE [4:00 PM]



SEPTEMBER [4:00 PM]

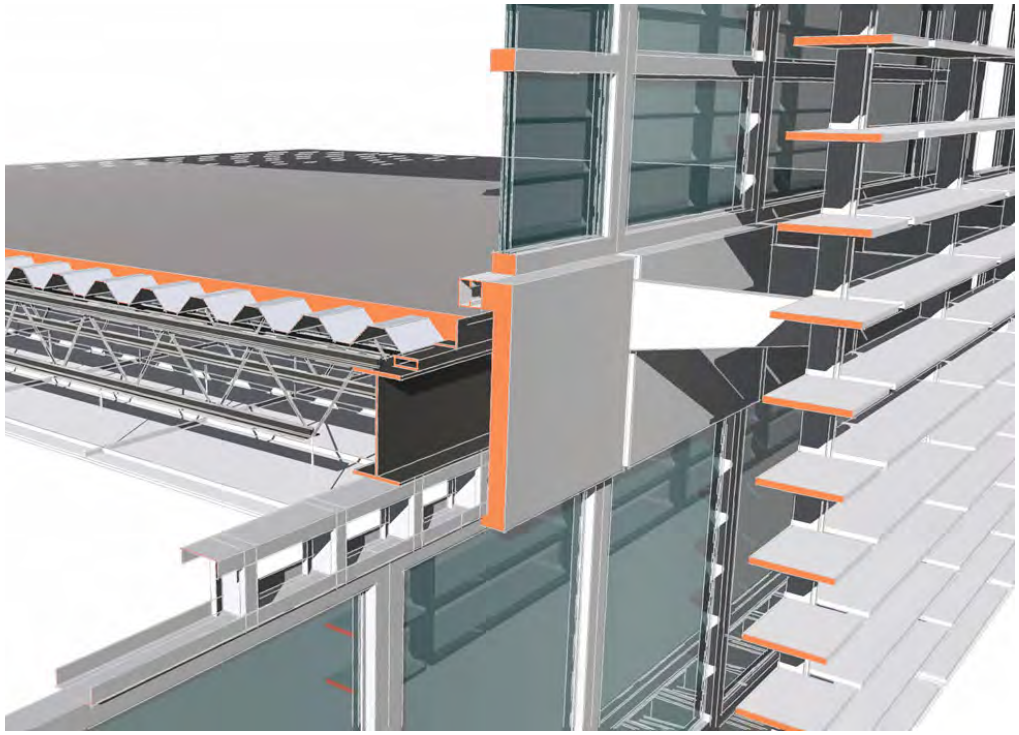


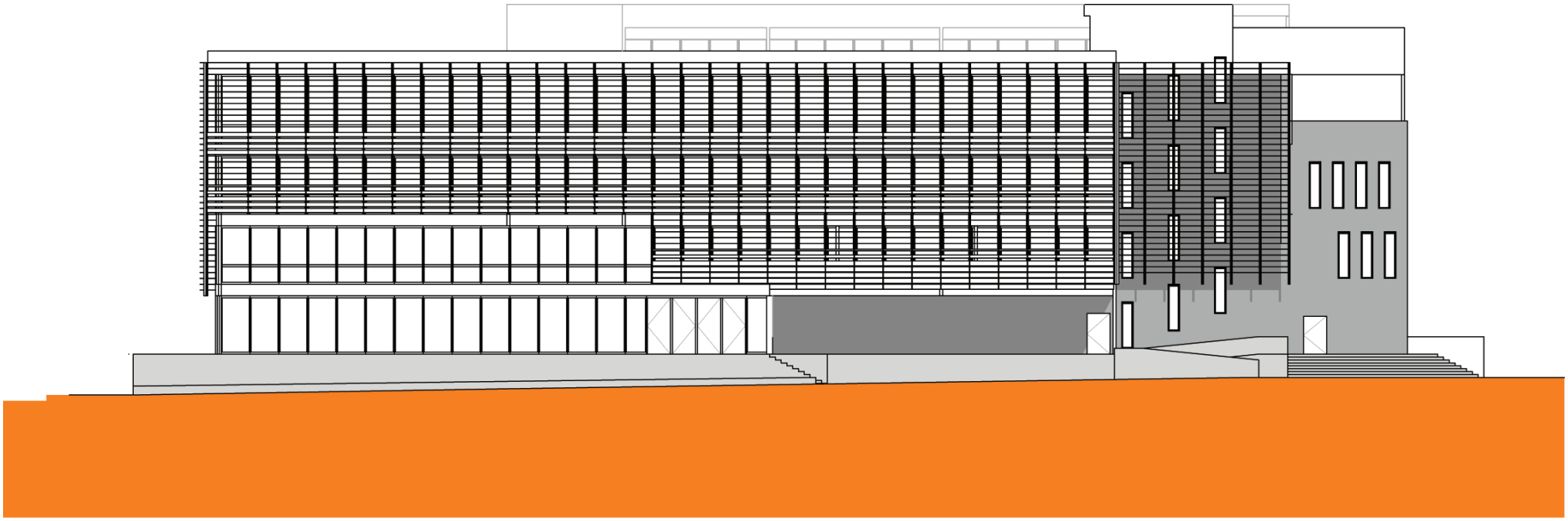
DECEMBER [4:00 PM]

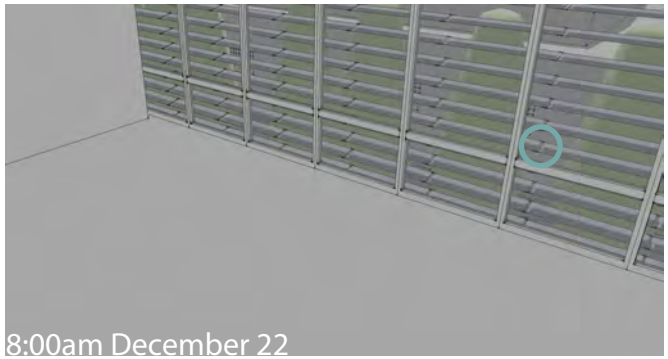
Daylighting Strategy

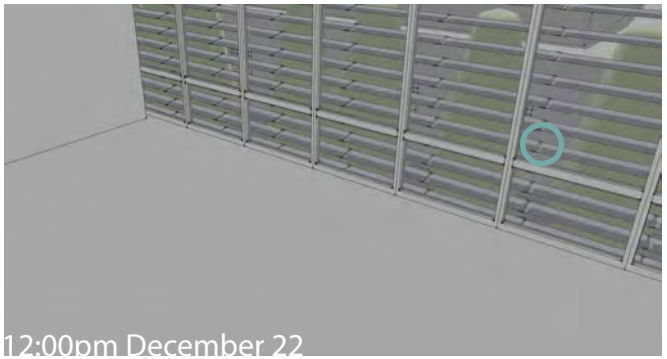
For the Dallas Fashion Institute, I chose to use a system of aluminum louvers and Low-E triple glazed windows to block the extereme sun that buildings in Dallas can be sublect to. I was important to ensure that the studios on the southern side of the building recevied enough natural light, so the louvers have been spaced generoulsy and extended ouwards to act as light shelves.

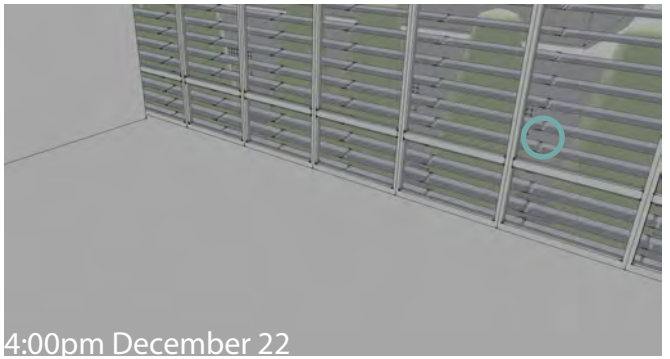
The louvers are rotated along the facade to respond to the particular light characteristics they encounter thorughout the day. From right to left along the elevation below the louvers rotate from a five degree downward angle to a 15 degree upward angle in the middle on the building. The angle returns to a five degree downward angle by the time it reaches the far left side of the elevation. This allows for optimum light capture in each studio.






8:00am December 22

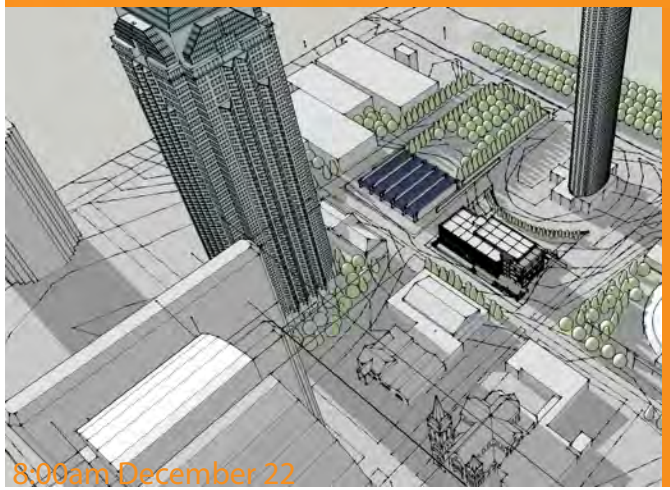

12:00pm December 22

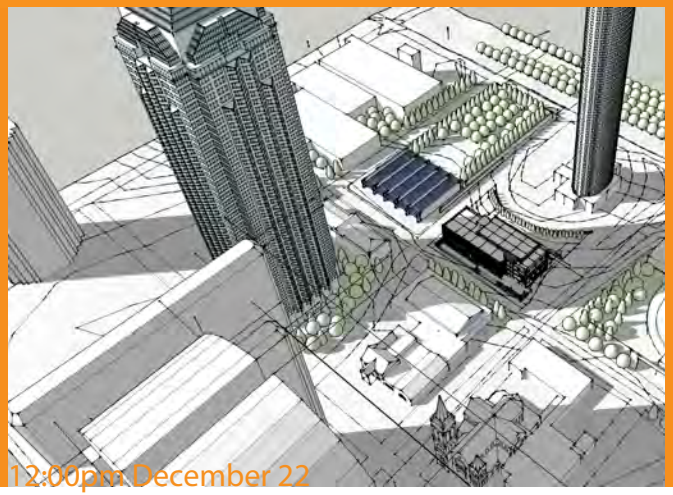

4:00pm December 22

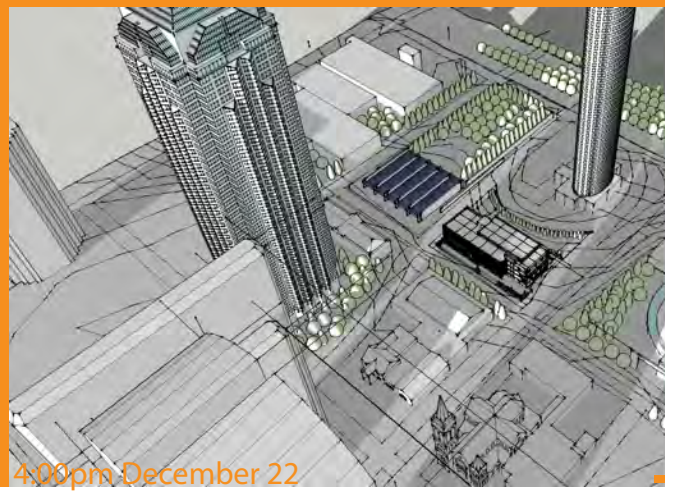
Winter Analysis

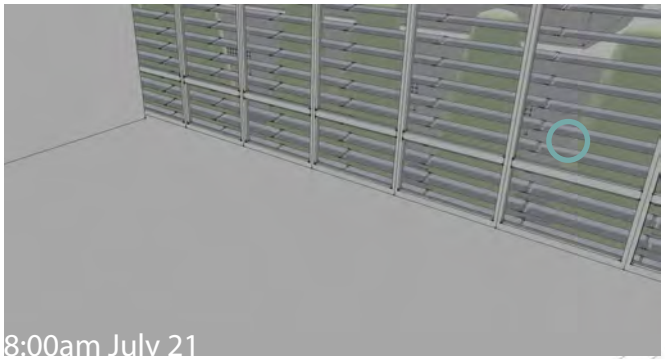
The louvers on the front of the building work particularly well in the winter. The light areas indicated on the front of the screens indicate that they are taking direct light, but blocking direct light from entering intothe studios. Instead, they are acting as light shelves and casting the reflected light into the studio and bouncing it off the ceiling.

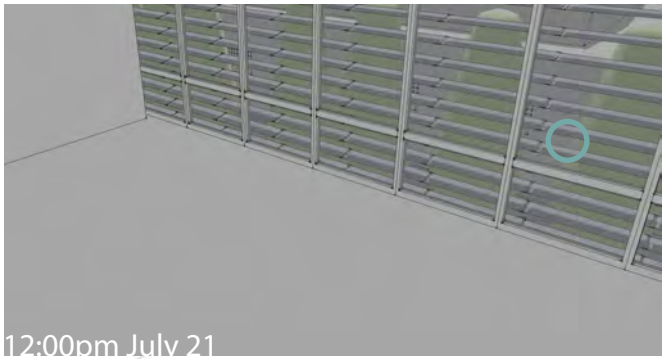
The large, multi-story expanse visible on the left of the section faces north and receives no direct daylight throughout the day. It is served, however, by a large clerstory window which, along with the roofplane adjacent to it serves as another light shelf.


8:00am December 22


12:00pm December 22


4:00pm December 22

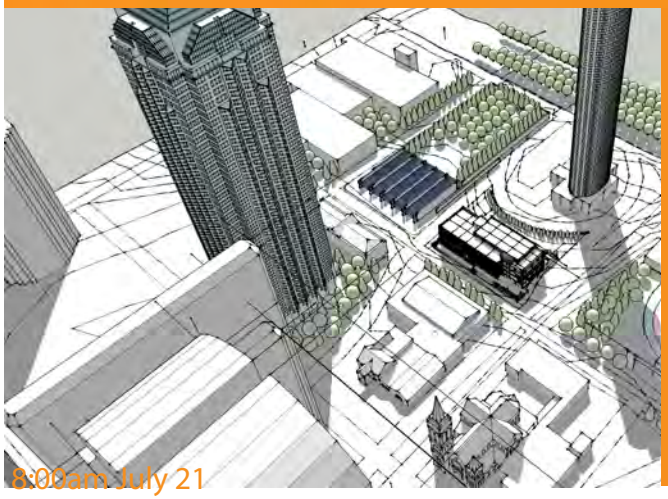


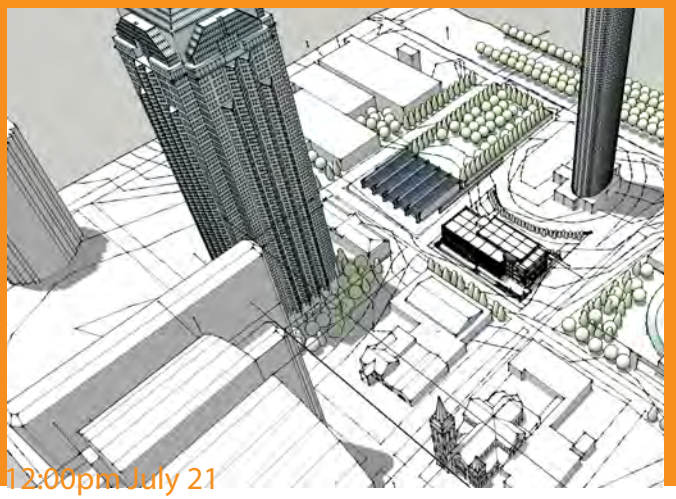


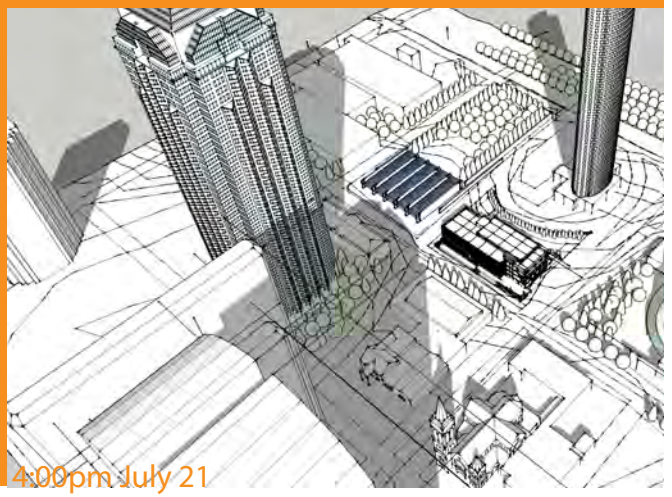
Summer Analysis

The louvers work similarly in the summer as the winter. Again, the light reaches the louvers and is cast deep into the studio space, but no direct light actually reaches the studio spaces.

By 4pm the light has moved off the southernly studio spaces and rounded the building to light the large milti-story space. Vertical louvers in the large space protect students from direct sun.







Conclusion

My design hypothesis was that large external louvers would both protect the DFI from direct solar gain and act as lightshelves to carry indirect light throughout the studio space. I also assumed that the large glass expanse on the northern side would receive a negligible amount of direct light in the afternoon. To test these hypotheses I modeled the DFI in Google Sketchup.

For the most part, this strategy worked well. The aluminum louvers are successful in blocking the intense direct sun in Dallas. However , without a more sophisticated modeling exercise than Sketchup, it is difficult to assume that the lightshelves move as much light as I hope. I doubt, for example, that as much light reaches the studios during the summer when the angle is steepest. This strategy of rotated louvers would have to be evaluated on a louver by louver basis, which i didn't have the time to do.

Furthermore, with regard to the large northern open space, the summer sun that enters into the space might overheat it. The vertical fins I installed are inside the glass and would better block the sun if installed on the outside. This was an aesthetic decision on my part.