VII. BREADTH STUDIES

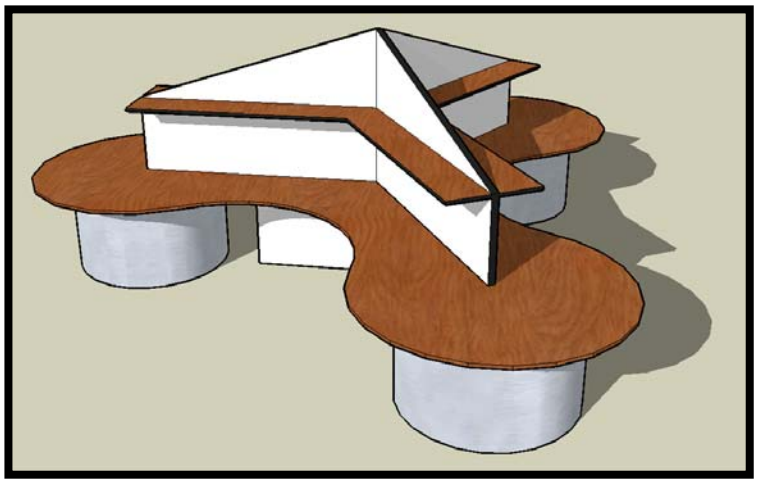
ARCHITECTURE FLOOR LAYOUT

The first breadth study for this thesis was an architectural layout of a typical office floor. An architectural engineering firm was chosen as the tenant since currently there are no companies leasing the space, and there is an obvious familiarity with the needs of such an office. The first step in the process was to set up a schedule of required spaces and approximate square footages. Research also had to be done on the amount of desk space needed per worker and how many additional spaces each employee needs such as conference rooms and common space. General ratios of managers to engineers to drafts men, etc. were also estimated. Thornton Tomasetti was gracious enough to supply floor plans of their New York office for me to approximate such values in addition to drawing off of experience from summer internships.

Use	Percent Area at TT	Resulting Area	Percent Area at 1000	Actual Area of Design	Percent Difference
Cubicles	44.76%	6644	45.50%	6382	-3.94%
Offices	22.40%	3325	13.17%	1847	-44.45%
Conference rooms	13.69%	2032	19.74%	2769	36.29%
Kitchens	4.43%	657	4.56%	640	-2.56%
Libraries	7.24%	1074	9.04%	1268	18.04%
Drafting areas	4.90%	727	5.49%	770	5.94%
Waiting areas	2.59%	384	2.49%	349	-9.08%

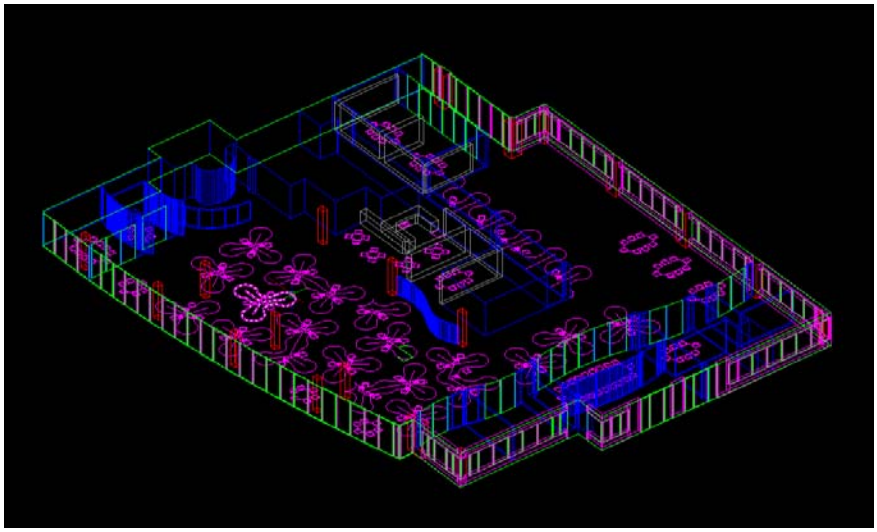
Average areas are within 10 % of those of the Thornton Tomasetti office with the exception of offices, conference rooms, and library space. Everyone who was consulted said there is never enough conference room and open table space which is why offices were sacrificed for it. However, if the need for those office spaces arises there are several conference rooms which are a comparable size to offices and could be converted which would bring both values closer to those of Thornton Tomasetti.

The next topic which was confronted in this breadth study is the cubicle work space. In Thornton Tomasetti's office the average cubicle is approximately 45 square feet with 27.5 square feet of desk space. However, workers who were contacted said there is almost never enough desk space because of the amount of space drawings and papers take up. Additionally,



traditional square cubicles, although efficient, seem out of place in an AE office where the idea of modern edgy designs is trying to be sold. To remedy these problems a new modular type of cubicle was developed with gives the worker a more desk space, more of which is within arm's reach, while giving the floor plan a little more creativity.

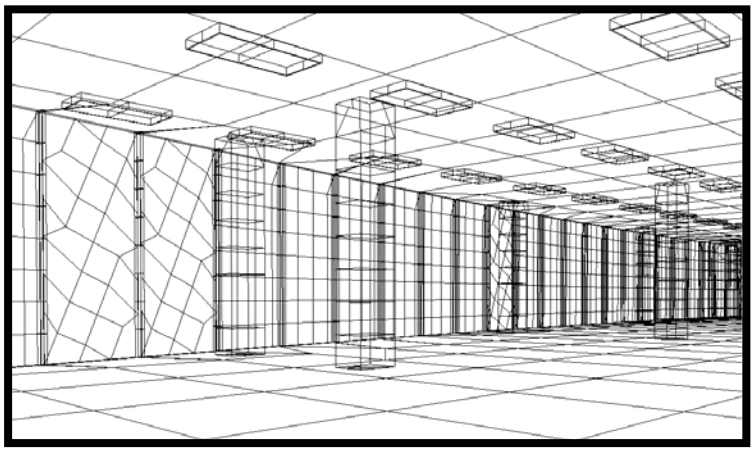
The final architectural detail of the floor plan is taken from the curving line of the north face of the building, elliptical entry lobby, and the freeform shape of the cubicle system. These curvalinear shapes are carried through to the concentric ellipses of the lobby and reception desk, and the surpentine wall at the west end of the office and the divider between the cubicle space and kitchen. Just as the north face of the building breaks the strict rectangular form of the building and adds a much needed architectural intrest to the façade of the building, these curving features break the monotony of a linear floor plan, soften its harshness and add some focal interest.



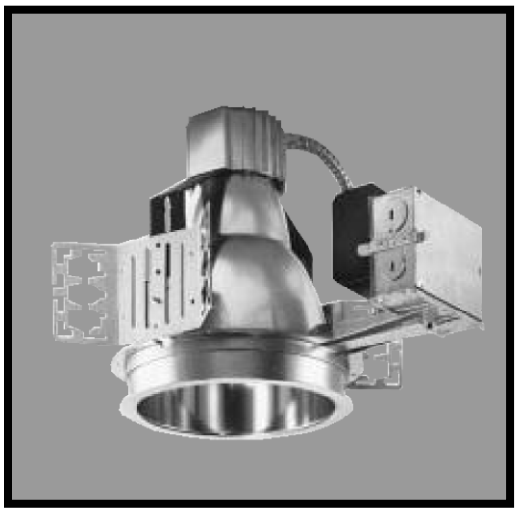
DAYLIGHTING CALCULATIONS

The purpose of the second breadth study of this report is to look into the effects of day lighting on the luminance of the main office area in the cubicles. With the expansive glass on the convex curtain wall of the building there appears to be the potential to save money by using the diffused northern light to illuminate part of the cubicle space. This would require the design of the lighting system to be on multiple zones which could be shut off or put on light sensors to vary the intensity of their output.

Since the layout of the floor space is the responsibility of the tenant if follows that there are not fixtures in the rental spaces before they are leased. As a result the first step in the lighting calculations is to layout a general lighting plan. This was laid out to match the architectural floor plan from the first depth study. Two different general



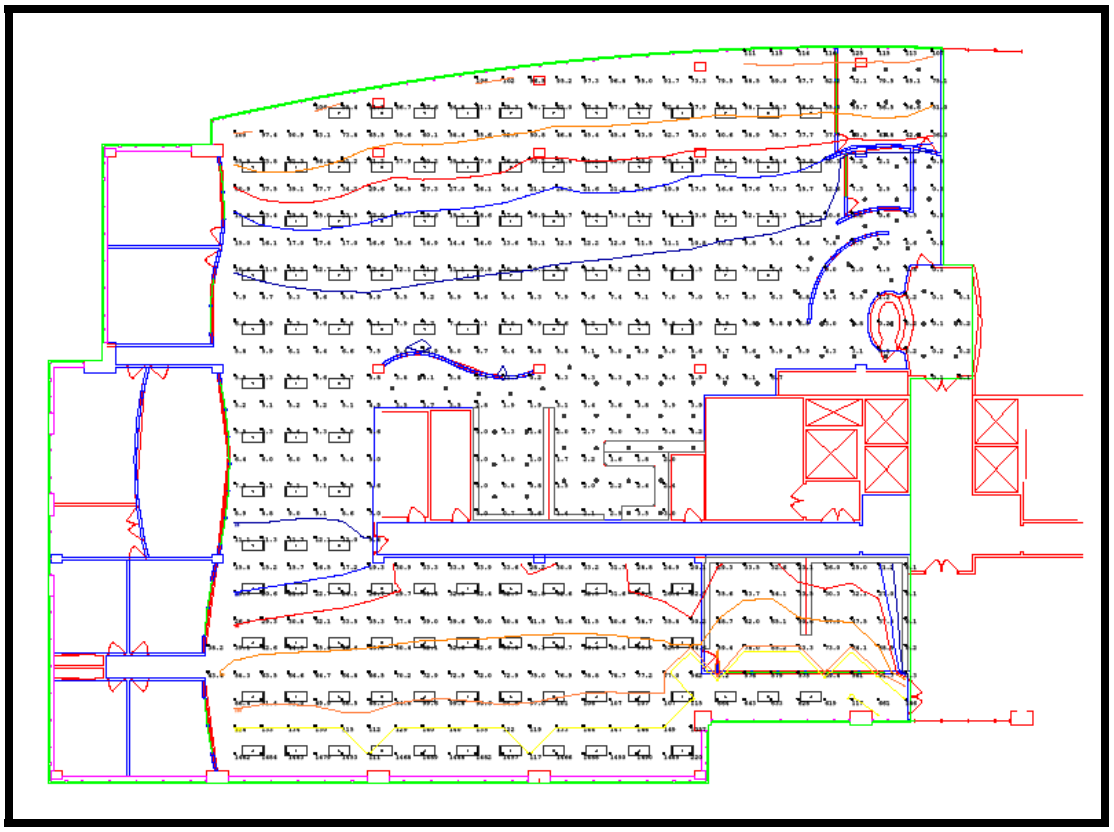
lighting fixtures were picked to achieve different goals. The lobby space, kitchen area, and walkways are light by recessed downlights made by Cooper Lighting. These were picked because they will create a more interesting lighting pattern as the fall on the curved walls. Additionally, the smaller fixtures are able to follow the curves in these areas better than the larger 2' x 4' fixtures.

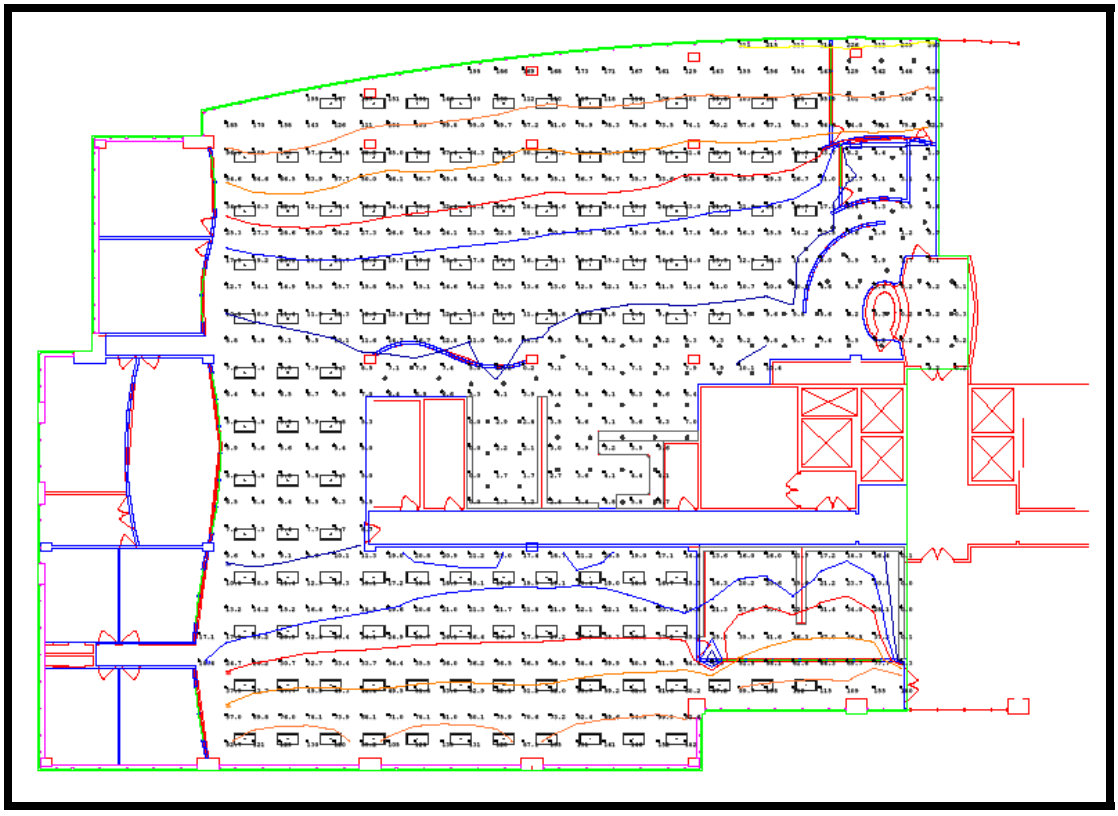


The other type of general light fixture is a 2x4 recessed troffer designed by Lightolier. These will provide an even light over desks in the work space. The specific luminary which was picked has wavy shields over the halogen tubes which serve to diffuse light and prevent glair on computer screens. However, these shields should also echo the curving walls which surround the cubicle area.

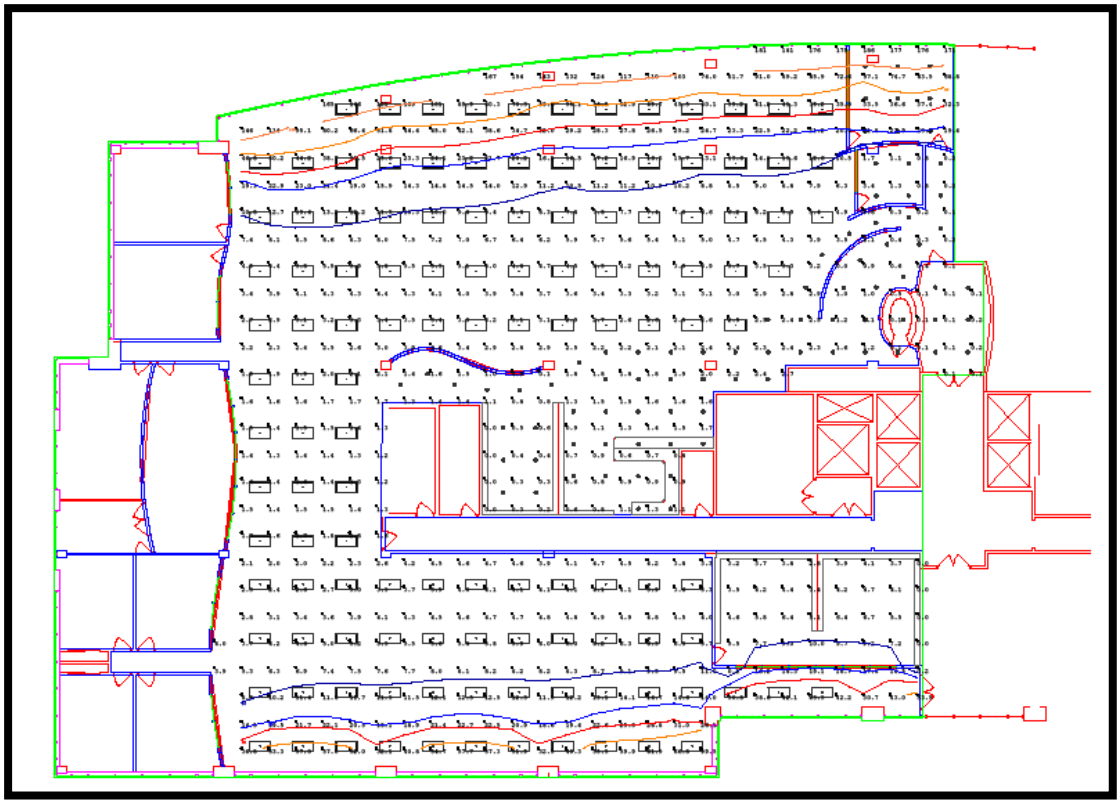
Preliminary spacing was determined for each luminare by multiplying the spacing criteria by the 7.5' distance between the ten foot ceiling and the desk tops. This resulted in an approximate spacing for the downlights to be six feet, and eight and ten feet for the long and short directions of the 2x4 troffer respectively. These guidelines should ensure even consistent lighting over the work plane. It was also determined that since the space is an office with high VDT use, this area should fall under luminance category "D" which results in a required luminance of 30 foot candles.

The first diagram shows the potential of daylighting in what is effectively the best case scenario, the winter solstice around 1 o'clock, where you can see the red line which marks where the luminance drops below 30 footcandles. Light clearly penetrates the entire depth of the southern side of the building and since most of that space is not used by engineers it is ok if it is light by direct harsh sunlight. The ambient northern light which is much better to work by still penetrates about 20' into the space which would allow most of the first two rows to be shut off.





This next diagram is of the summer solstice when the least direct sunlight will enter the building on the south side. This is obvious from the fact that the 30 footcandle line only at the third row of lights about 25' in. However, this will still save three rows of lights from being turned on. More interesting is that the ambient northern light actually penetrates deeper about 25' as well, allowing three rows on that side of the building to be shut off as well. The final diagram is the worst case scenario which is when it is cloudy or overcast. Even under this situation ambient light still reaches past the first row of light approximately 10' into the building which would allow one row of lights on both sides of the building to be shut off.



To determine the total power savings average the luminaries which are not used during the winter and summer. Then figure the total unused fixtures per year based on the statistic that 53% of days in Philadelphia are sunny. This totals 15,659 fixtures per year, which when multiplied by the average work day and the wattage per fixture results in 13,529 kilowatt-hours saved per year. At the current price of energy in Philadelphia, $0.151 per kWh, that totals $2042.87 per year. This calculation includes only the general area of the office and does not include the offices or conference rooms which also have the same potential for savings. This is also only half of one floor. The best way to make use of these savings would be to have the first four rows of lights nearest he windows be on four individual zones and turn a whole row on or off as needed. The savings could also be even greater if dimmers with light sensors were attached to the different zones; the luminaries and ballast are already compatible with such systems. Then as the light fluctuated throughout the day from sun movement or cloud cover the light could gradually adjust their output to match.