

15

LIGHTING BREADTH

15.1 DESIGN CRITERIA

After performing an energy model analysis on McKinstry Oregon Headquarters 9 (Appendix A), it was apparent that a large portion of building energy consumption comes from lighting. In fact, over 35% of yearly energy consumption is from area lighting. (Appendix A). That is more than cooling and heating combined. This provides a huge opportunity for energy savings. In addition, any lighting load eliminated from the space reduces the load on the cooling system, thus saving energy year round and reducing the chiller size.

The radiant panels create a coordination issue with ceiling space. Luminaires would either have to be coordinated with the panels or removed from the ceiling all together. Finally, the space should have an evenly and adequately illuminated work space. An AGI model provides lighting analysis.

15.2 ORIGINAL DESIGN

The figure to the right shows a typical open office space in the headquarters. The 50'x70' space contains 18 cubicles, each 10'x10'. Over the entire building, there is 23,950 SF of similar open office space. This equates to 52% of the first and second floor (excluding the warehouse) that designated open office with cubicles. Placing an efficient lighting system, such as Tambient, could potentially save McKinstry a lot of energy. Currently, the space produces 1.02 W/SF of lighting load.

The table below shows a lighting schedule for the existing space.

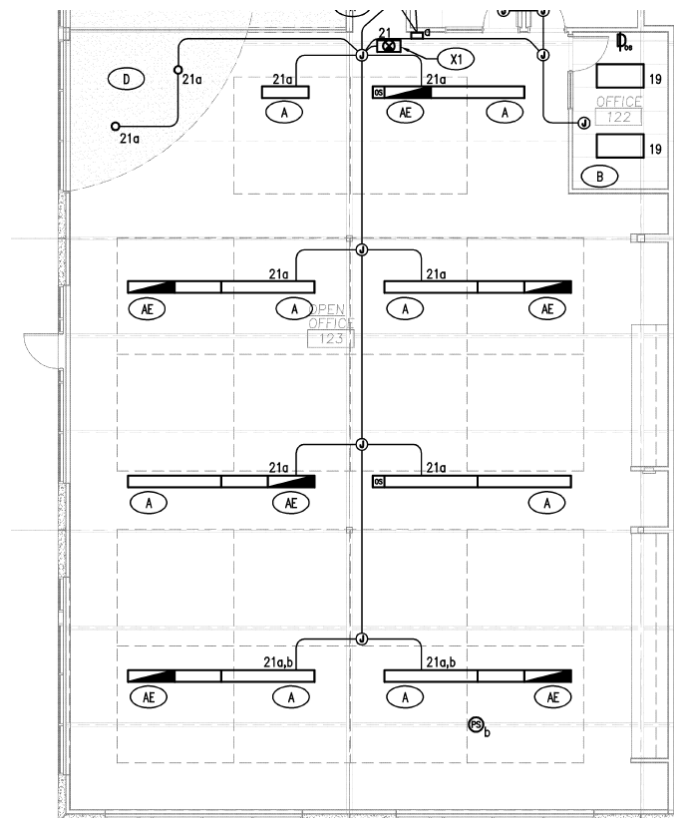


Figure 15.2.1. Lighting Plan for Open Office

Table 15.1. Original Lighting Schedule

Symbol	Description	Manufacturer ¹	Lamp	Total Fixtures
A	Suspended Pendant	Ledalite	2-T5HO	28
D	Downlight	Gotham	1-2/32TRT	2

¹See Cutsheet Appendix

15.3 AMBIENT REDESIGN

Tambient is a new lighting system that places all of the lighting fixtures on the cubicles themselves. By combining intense downlighting for task lighting, floor illumination and diffused uplighting for space illumination, Tambient can provide substantial energy savings in office lighting. The radiant panels provide an opportunity for indirect lighting as the white ceiling panels are very reflective (see Figure 11.1.2). The AGI model assumes 0.8 reflectance.



Figure 15.3.1. Tambient Lighting^m

The redesign includes standard Tambient lights (Figure 15.3.1.) and Tambient uplights (called batwings) which are placed strategically to properly illuminate the rest of the space.

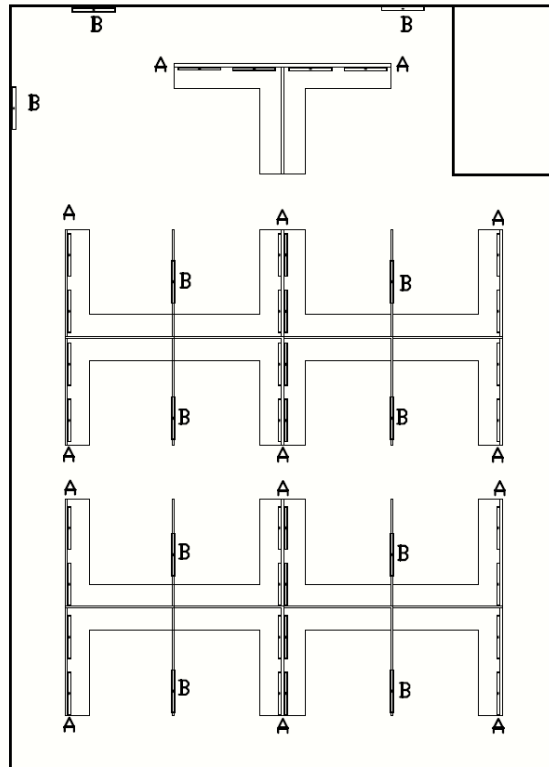


Figure 15.3.2. Redesign open office lighting plan

Table 15.3.1. Redesign Lighting Schedule

Symbol	Description	Manufacturer ¹	Lamp	Total Fixtures
A	Desk/Uplight	Tambient	1 – T5	36
B	Batwing Uplight	Tambient	1 – T5	11

¹See Cutsheet Appendix

Office spaces have several requirements for illuminance. First, task spaces must be illuminated to an average of 30 footcandles ($\pm 10\%$)ⁿ. Egress areas must be an average of 5 footcandlesⁿ. The following figures are from AGI analysis of the space.

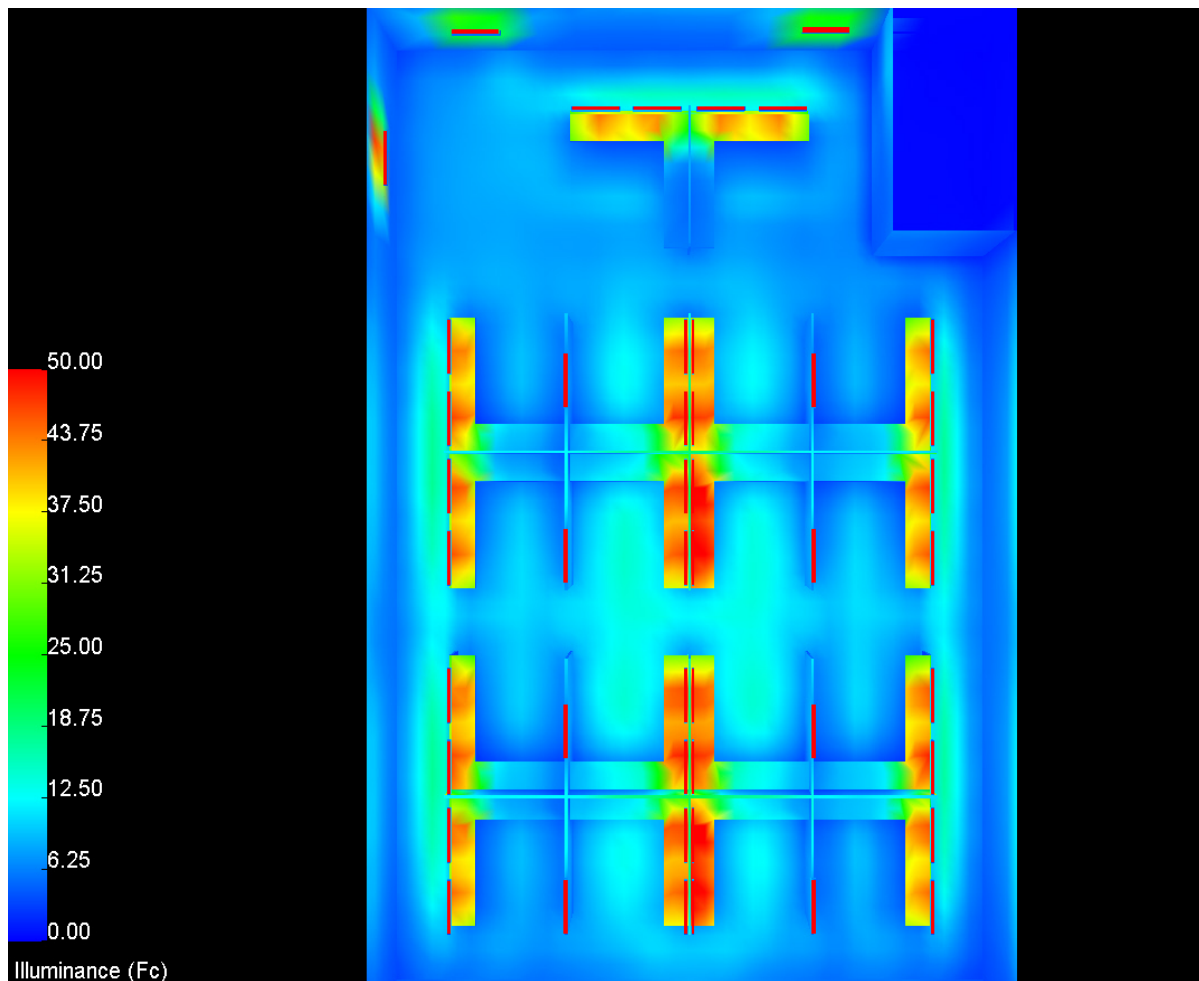


Figure 15.3.3. Pseudocolor illuminance rendering

Table 15.3.2. Floor Calculation summary

FLOOR ILLUMINANCE (fc)			
Average	Maximum	Minimum	Max/Min
9.43	15.7	4.5	3.49

Table 15.3.3. Work Plane Calculation Summary

WORK PLANE ILLUMINANCE (fc)			
Average	Maximum	Minimum	Max/Min
29.19	48.7	7.6	6.41

Table 15.3.2 shows that floor illuminance is easily above the required average of 5 fc. Work plane illuminance is within 10% of the required average of 30fc. However, the Max/Min value is very large. This is obvious in the pseudocolor rendering as well. An easy solution to this is to provide task lighting. Finelite produces an LED desk lamp that runs on 3W and can produce 20+ foot candles on an 11”x17” surface (Cutsheet Appendix). At a mere 3W, 18 of these (one for each cubicle) will use only 54 extra watts. The table below shows energy usage for the original design and redesign in the open office.

Table 15.3.4. Open Office Lighting Power Density

	Area	Total Watts	Lighting Power Density
Original	3353 SF	3424	1.02 W/SF
Redesign	3353 SF	1678	.50 W/SF

The Tambient lighting system provided a very significant savings in lighting power, over 50% reduction. This is great for the building, as over 35% of its total load is lighting. In addition, by locating lighting on the cubicles rather than the ceiling, it eliminates all of the coordination issue. Finally, as seen in the rendering below, the Tambient lighting system produces an even light distribution across the ceiling. It also gives a better aesthetic to the office space by eliminating clutter from the ceiling space and making the office look more open.

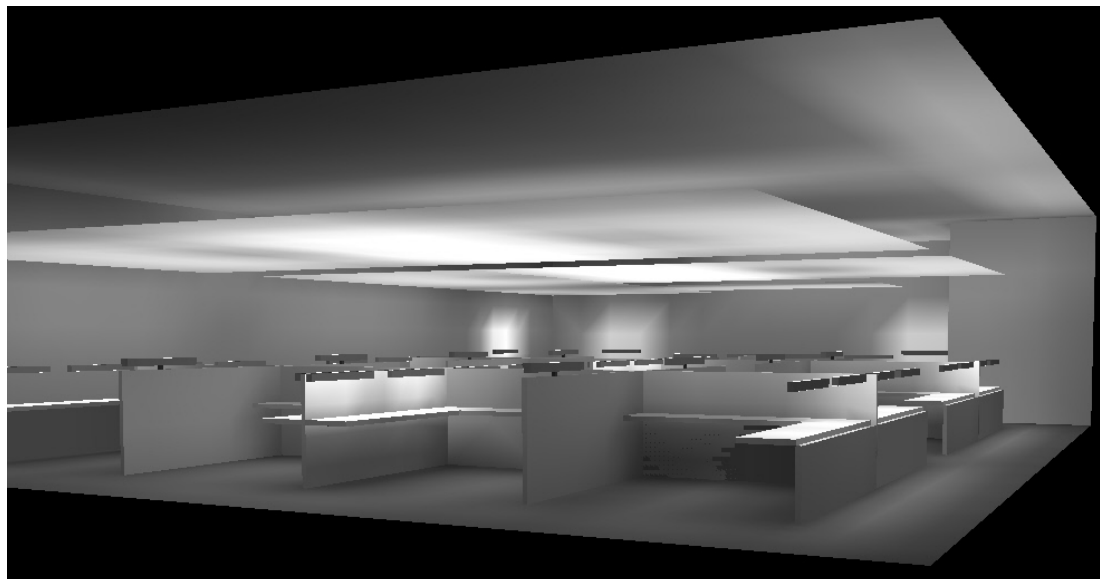


Figure 15.3.4. Perspective Greyscale illuminance rendering