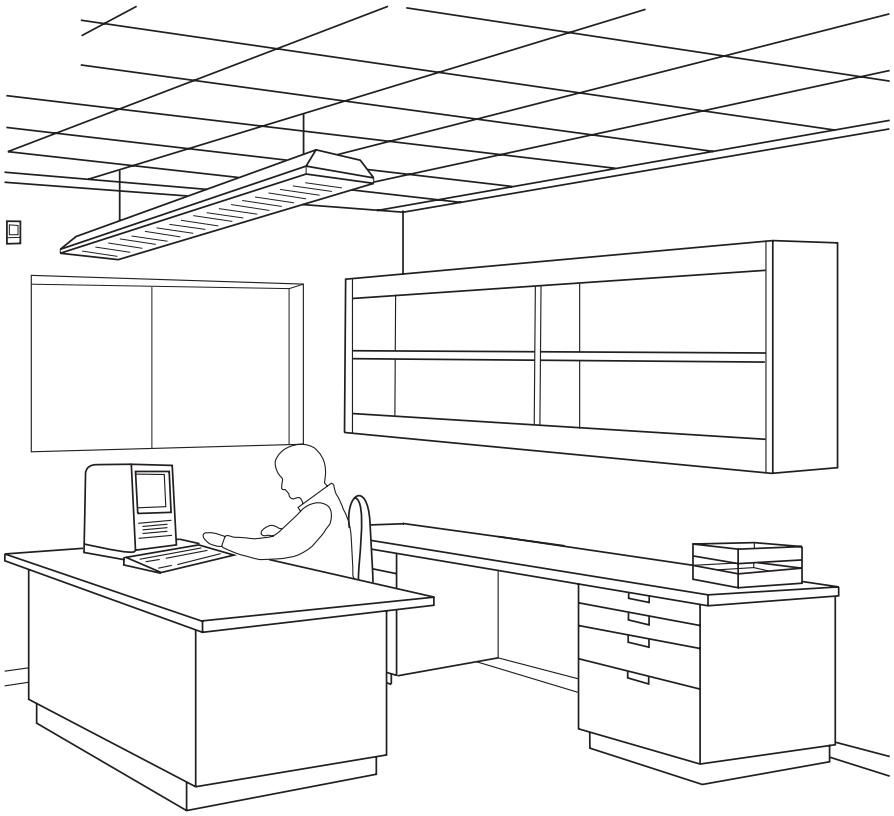
Lighting Research Group

Final Report October 1999

Lighting Recommendations for the Social Security Administration Frank Hagel Federal Building in Richmond CA



Final Report

Lighting Recommendations for the Social Security Administration Frank Hagel Federal Building

Summary

Specific recommendations are made to improve the lighting quality and energy efficiency of the lighting system at the Social Security Administration Frank Hagel Building in Richmond, CA. The main recommendation is to replace the recessed fluorescent lighting system in the general office area with indirect lighting. Indirect lighting will improve lighting quality, will provide an energy efficient solution and will be about the same cost as the direct lighting system originally proposed.

Background

The Social Security Administration Frank Hagel Federal Building in Richmond CA is being renovated. The firm of Beyez & Patel was retained to perform a site investigation and preliminary design approach for renovating the lighting system throughout the six story structure. GSA has requested that LBNL visit the site and make additional recommendations for the lighting system that will be at least as energy efficient as the original recommendations and will explicitly address the issue of providing good lighting quality for the building workers.

Scope of Work

Task 1. LBNL will review the materials provided by GSA, Beyez & Patel and others in order to better assess the original conditions and form the basis for subsequent recommendations to improve the lighting system quality and energy efficiency.

Task 2. LBNL will visit the site at least twice: initially to reconnoiter the site and investigate the original conditions and secondly to make specific recommendations. LBNL will review the materials and information gathered from the site visit(s) and make application-specific recommendations for replacing existing lighting systems with better quality, efficient systems. The lighting recommendations will be tailored for the following specific areas:

1. 1st floor Main Lobby
2. 1st Floor - Medical Unit, Hall and General Office Areas
3. Floors 2-6: Elevator vestibules, corridors, General Office Areas

Task 3. In addition to the lighting recommendations, we would make recommendations with respect to the HVAC controls. The recommendations will comprise:

1. Ways to improve the existing control algorithms; for example through better setpoint selection
2. Suggestions for additional control algorithms/strategies to improve system performance; for example sequencing, setpoint scheduling, reset strategies, etc.

The results of the first two tasks, which are on lighting issues, are covered in this report. The results of the third task which presents recommendations for the HVAC side is presented a separate report entitled "GSA Building at 1221 Nevin Avenue in Richmond HVAC System Inspection" by Tim Salsbury dated September 7, 1999.

Recommendations

First Floor Main Lobby

This area was apparently renovated relatively recently. General illumination is provided primarily by indirect suspended luminaires. This solution is an appropriate one for this lobby space and we do not recommend any significant modifications to this lighting system other than routine cleaning and lamp maintenance.

1st Floor - Medical Unit, Hall and General Office Areas

Medical units

For each of the small offices with ceiling high partitions in the medical units, we recommend a single 3-lamp indirect lighting fixture located in the center of the room. Each indirect fixture would contain one single-lamp electronic ballast and 1 two- lamp electronic ballast with T-8 fluorescent lamps. Dual switching should be installed to allow 1/3, 2/3 or full lighting in these offices. Full lighting will be about 30-40 footcandles. For a 100 square foot office, this will result in a power density of 0.9 watts/square foot. This will provide pleasant indirect lighting for the various tasks performed in these areas and will accommodate the occupants' needs for different light levels. The estimated equipment cost of each of these fixtures is about $200. This does not include labor to install. Supplemental task lighting should also be provided to bring desktop light levels up to 50 footcandles if necessary.

General office areas

The general office areas on the first floor offer the greatest potential for a quality lighting solution that will also meet GSA's requirements for energy efficiency. The roughly 14,000 sq. ft. open planned office area is punctuated with 3 wide foot columns on 30 foot centers. The entire space is currently lit with prismatic lensed 2 x 4 recessed fluorescent luminaires arranged in a checkerboard pattern. There are 17 recessed fixtures within each 30 by 30 foot "module" defined by the column spacings.

The following are physical characteristics of the space

- Ceiling height of the open plan area on the first floor is - 14 ft.
- Size of cubicles -55% 8x8, 30% 8x10, 15% 9x12.

- Height of cubicles -five feet 6 inches
- Color of partitions - 99% light blue, 1% gray
- All ceiling lights are switched in banks or large blocks.

Rather than simply updating the lamps and ballasts in these outdated fixtures, we recommend the use of rows of indirect lighting suspended from the ceiling. This will require replacing the existing luminaires with new ceiling panels. It may also be necessary to "rehabilitate" the ceiling throughout the space to obtain a uniform looking ceiling plane.

Examples of indirect lighting installations similar to this building are provided below to allow the reader to visualize how the indirect lighting will appear.:

Figure 1. Typical open office area lit with indirect lighting

Figure 2. Another example of indirect lighting

The specific indirect lighting solution that we recommend will use rows of indirect luminaires with only one lamp per 4 ft section. To provide more accurate information, we have selected a particular manufacturer (Finelite) and product (Series 1) for modeling the lighting impact of the indirect lighting system. Other manufacturers may have similar products with similar performance characteristics that would perform satisfactorily also. The technical specifications (in PDF format) for each of the recommended fixture types is given as an attachment to this report. (Use of a specific company name does not denote endorsement of this or any other product. See disclaimer at end of report).

The following assumptions were made in modeling the resulting light levels from the indirect lighting system:

Fixture type: 24' Finelite Series 1 fixture with EP reflector
Lamp: 1 T-8 per 4 ft. section, 2850 lumens
Ballast: 2-lamp electronic ballast with ballast factor = 1.25
Suspension length: 21 inches
Light maintenance factor: .75
Ceiling/wall/floor reflectances: 80/50/20

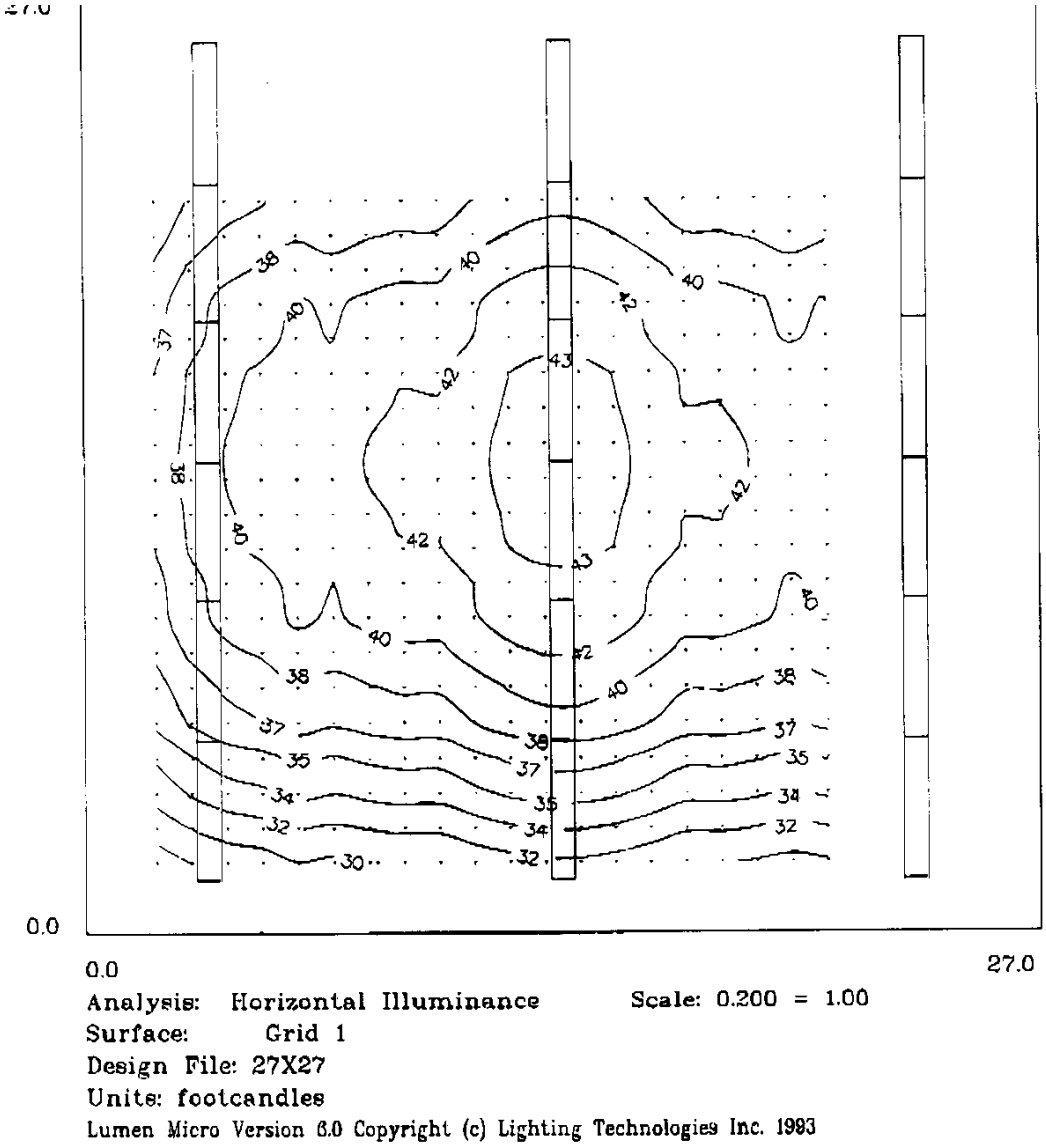


Figure 3. Illuminance distribution from indirect lighting system. Values calculated using Lumem Micro Version 6.0.

The results of the lighting analysis are:

Average illuminance: 38.7 footcandles
Minimum: 28 footcandles
Maximum: 44.1 footcandles

It should be noted that this solution requires a ballast with a high ballast factor (1.25) to obtain satisfactory light levels. Use of normal ballast factor will result in lower illumination levels. It should be noted that the above analysis does not include the effects of the partitions which will reduce the delivered light levels by about 20%.

To provide higher light levels than the 38 footcandle average will require supplemental task lights which could either be located under the storage cabinets or as articulated arm task lights that are mechanically connected to the desks. Because of variability and user preference, this report does not make specific recommendations for type of task light. The articulated arm task lights used in other portions of the building would serve this purpose well.

Because there is only one lamp per 4 ft section of fixture with this economical solution, there is no opportunity for providing multi-level switching of the lighting system. It is recommended that the lights be switched in rows.

In response to questions from GSA and SSA personnel, we also considered the use of an indirect/direct lighting fixture instead of the purely indirect one. The illuminance levels from this system are estimated and given in the table in the next section.

Floors 2-6: Elevator vestibules, corridors, General Office Areas

Most of the corridor lighting on these floors is supplied with 2 x 2 recessed fluorescent fixtures with pattern K-12 lenses. Each fixture currently uses two 2 ft T-8 lamps. Many of these fixtures have previously been installed with specular reflectors which tend to mar the fixture appearance. We recommend replacing the two lamps in each fixture with a single 2 ft. T-8 U-bend fluorescent lamp and removing the specular reflector. This change may or may not require a ballast change also. There will be minimal energy savings resulting from this change. However, maintenance would be simpler as the U-bend lamps are more common and their use would simplify lamp inventory for maintenance personnel.

The recommendations for the general office areas on these floors is similar as proposed for the 1st floor.

Discussion

The following table compares the anticipated results of the different proposed lighting solutions for the general office area

	Originally Proposed	Indirect Lighting	Indirect/direct Lighting
General lighting power density	1.1 W/sf	1 W/sf	1 W/sf
Task lighting power density	0.1 - 0.2 W/sf	0.1 - 0.2 W/sf	0.1 - 0.2 W/sf
Total lighting power density	1.2 - 1.3 W/sf	1.1 - 1.3 W/sf	1.1 - 1.3 W/sf
Maintained average illuminance	50 70 footcandles	38 footcandles	40 footcandles (estimated)
Lighting Quality	Average	Good	Good
Cost	~$2/sf	$25/linear foot	$30/linear foot

From this table, it is seen that the indirect lighting solution is slightly more energy efficient than the originally proposed solution but will provide higher quality lighting at about the

same cost. It is important to note that the originally proposed design will supply more illumination than the indirect lighting design we propose. However, with the influx of computer-based tasks, recommended illuminance for routine office work is about 300 lux (30 footcandles). So the lower levels provided by the indirect lighting solution are quite appropriate to this task.

The costs shown in the table above are preliminary estimates from the manufacturer and include usual distributor mark-up. Actual prices may vary depending on how the equipment is purchased. These costs do not include labor or lamp charges.

Summary

The lighting quality in the general office areas can be significantly improved by replacing the recessed fluorescent fixtures with indirect lighting and supplemental task lighting where necessary. This solution will be as energy efficient as the originally proposed solution, but will result in higher lighting quality for the building occupants.

Contact:

For more information, contact:

Francis Rubinstein
Lawrence Berkeley National Laboratory
Lighting Research Group
1 Cyclotron Rd.
Mail Stop 90-3111
Berkeley, CA 94720
Phone: (510) 486-4096
E-mail: FMRubinstein@lbl.gov

Acknowledgement

This work was supported by the General Services Administration, Pacific Rim Region. Partial support was provided by the Assistant Secretary for Energy Efficiency and Renewable Energy, Office of Building Technology, State and Community Programs, Office of Building Equipment and by the Office of Federal Energy Management Programs of the U.S. Department of Energy under Contract No. DE-AC03-76SF00098. The author acknowledges the assistance of Doug Avery and Danielle Neils (both of LBNL).

Disclaimer