



**Special
Lighting Repair/Retrofit
Electrical Energy Study**

**Lighting Repair/Retrofit
Public Assembly Hall**

September 7, 2008

Prepared by

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Purpose

The purpose of this study is to validate the potential savings by Lighting Repairs/Retrofits.

Methods and Assumptions

- This study used measured and estimated data for the energy and lighting audits
- Estimated Amperes of incandescent lamps were calculated from the specified Wattage on the bulbs
- 110V Line Voltage were used for all power calculations

Study

The results of this study significantly favor the use of compact fluorescent lamps, LED lamps and electronic ballasts based on energy conservation and energy cost reduction.

The facility is currently in use and required major lighting maintenance in the public assembly hall. Increases in electricity costs may have cut the maintenance budget. Seven of the existing ten 2-lamp 8' fixtures and six of the existing ten 2-lamp 4' fixtures were not illuminating. The facility also had a history of Exit Light violations during safety inspections.

This study discusses the actual lighting retrofits of existing lighting to improve lighting levels and reduce energy consumption. The lighting design and fixture layouts were left in tact. The following details the scope of work and the comparison between "as found" and "competed" conditions:

Great Hall

- o Relamp Six 3-Lamp Ceiling Fans with [compact fluorescent lamps](#)¹ (4100k, CRI 82 w/electronic ballasts). Reinstall Ceiling Fan Pull Chains as Needed.

Replacing the eighteen 40-Watt incandescent ceiling fan lamps with 23-Watt compact fluorescent lamps more than doubled the lighting levels and reduced the ceiling fan circuit's current draw by nearly 40%.

- o [Retrofit](#)² Ten 8' FR SP SL fixtures and Ten 4' FR SP SL fixtures to Thirty 4' EE G13 Fixtures (5000k [T-8 lamps](#)³, CRI 85, 95% reflectors and [electronic ballasts](#)⁴)

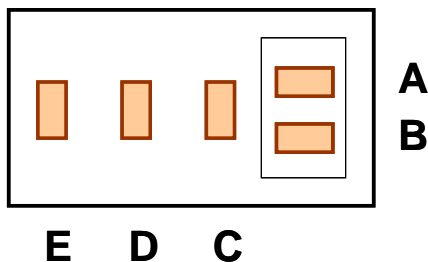
Seven of the existing ten 2-lamp 8' fixtures and six of the existing ten 2-lamp 4' fixtures were not illuminating yet the combined repairs/retrofits still achieved over 8% reduction in current draw. The combined repairs/retrofits achieved nearly 377% increase in lighting levels from the "as found" condition. It is estimated that when all fixtures were operational the total existing Amp draw above was about 36.8 Amps. The retrofit energy savings from the above retrofit activities would be fairly estimated to be nearly 50%. It was also estimated that half of the new 4'lamps illuminated would exceed the lighting levels provided when all the original fixtures were operational.

The retrofit T-8 lamps have a 36,000 hour lamp life rating. These lights are typically operated less than 1,000 hours per year meaning it should be many many years before the lamps may need to be replaced.

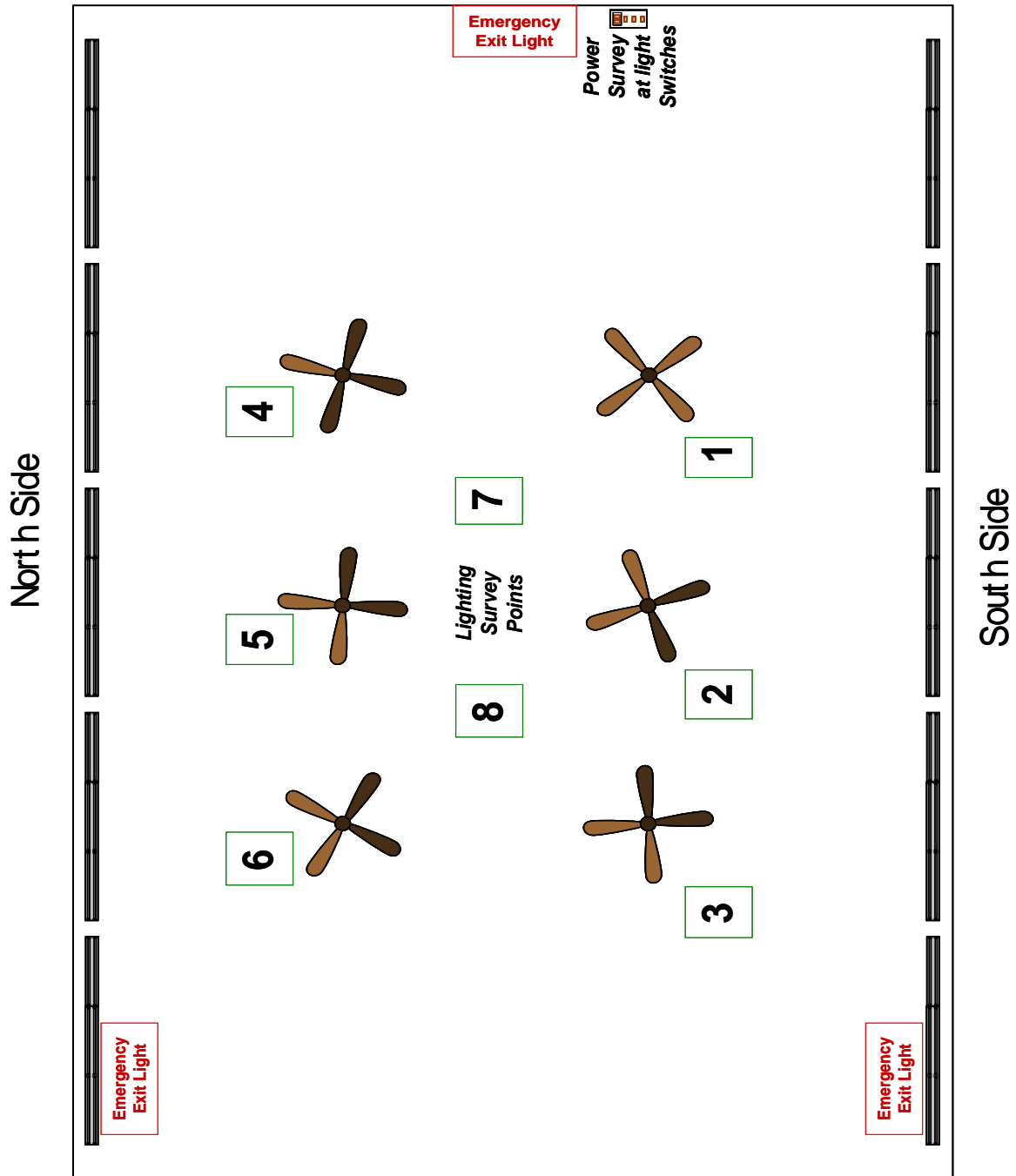
More savings may be achieved by operating without the ceiling fans and now by operating one row of 15 lamps each side and choosing the rows without the spotlights. A key point is using only the light that is needed is very good energy conservation practice.

Energy Audit	Initial Measurements Amps	Initial Estimates (Full Ops) Amps	Calculated Final Amps	Final Measurements Amps
Switch A				
Select South Side Fixtures	1.3	6.1		
South Side Row 5 EE Ballasts w/15 4' 25W Lamps			3.4	2
Switch B				
Ceiling Fans w/3 lamps (6)	7.9	7.9	5.1	4.8
Switch C				
Select South Side Fixtures	5	8.3		
South Side Row 5 EE Ballasts w/15 4' 25W Lamps Plus Metal Halide Stage Spot Light			5.7	4.7
Switch D				
Select North Side Fixtures	3.9	6.1		
North Side Row 5 EE Ballasts w/15 4' 25W Lamps			3.4	2.7
Switch E				
Select North Side Fixtures	2.2	8.3		
North Side Row 5 EE Ballasts w/15 4' 25W Lamps Plus Metal Halide Stage Spot Light			5.7	4.4
Totals	20.3	36.7	23.3	18.6
Percent Reduction		49.3%	-14.8%	8.4%

Electrical Amperes were measured at the switches with a Cen-Tech Digital Clamp-on Multimeter 95652. To avoid measurement interference, only the switch being measured was energized and the remainder of the switches were off.



Wall Switches



Lighting levels were measured in Foot Candles with an Extech 401027 Light Meter. Care was taken to measure all lighting levels at the same elevation.

Lighting Audit	Initial Measurements w/All Lights On	Final Measurements w/Ceiling Fan Lights On	Final Measurements w/All Lights On	Final Measurements w/Ceiling Fans Lights Off
	Foot Candles	Foot Candles	Foot Candles	Foot Candles
Location 1				
Directly Under Ceiling Fan 1	3.2	9.8	18.4	
Location 2				
Directly Under Ceiling Fan 2	4.5	12.2	19.0	
Location 3				
Directly Under Ceiling Fan 3	5.2	9.2	17.9	
Location 4				
Directly Under Ceiling Fan 4	2.9	9.0	18.1	
Location 5				
Directly Under Ceiling Fan 5	4.6	10.4	19.2	
Location 6				
Directly Under Ceiling Fan 6	9.4	14.2	18.5	
Location 7				
Centered Between Ceiling Fans 1, 2, 4 & 5	2.9	7.4	13.7	6.8
Location 8				
Centered Between Ceiling Fans 2, 3, 5 & 6	4.0	8.1	13.5	7.4
Averages	4.6	10.0	17.3	7.1
Percent Improvement		218.8%	376.8%	154.8%

- Replace Three Recessed Exit Lights with LED Combo Emergency Exit Light Red/White Battery w/Back-up

Exit lights typically are operated 24 hours per day 365 days per year which is may be why they burn out too frequently. These three exit lights had two 40 Watt incandescent bulbs each.

The [retrofit fixtures](#)⁵ are illuminated with 25-year LEDs (light emitting diodes) using very little energy, stay illuminated during power outages while emergency lights illuminate paths to exits using battery back up power that can last about 90 minutes.

Energy Audit	Initial Estimates Amps	Final Estimates Amps	Percent Reduction	Annual Energy Cost Savings
3 Emergency Exit Lights*	2.2	0.1	95.0%	\$239.67
4 Exit Lights**	0.7	0.1	85.0%	\$71.48

* 3 Fixtures Cost = \$138.08

** 4 Fixtures Cost = \$76.55

The major selling points for these LED exit light fixtures is that they pay for themselves quickly in energy savings (95%) and seldom or never burn out thus virtually eliminating the most common safety inspection violation. The cost to replace burned out bulbs is also eliminated.

Other

- Replace Four Ceiling Mounted Exit Lights with [LED Thermoplastic Exit Light Red/White w/Battery Back-up](#)⁶

These four Exit Lights had two 20 Watt incandescent bulbs each. The retrofit fixtures are illuminated with 25-year LEDs using very little energy, stay illuminated during power outages using battery back up power that can last about 90 minutes.

Again, the major selling points for LED exit light fixtures is that they pay for themselves⁷ quickly in energy savings (85%) and seldom or never burn out thus eliminating the most common safety inspection violation. The cost to replace burned out bulbs in exit lights is also virtually eliminated for the retrofitted/replaced fixtures.

Conclusion

This retrofit project provided an opportunity to accomplish badly needed lighting maintenance, improve lighting levels with newer technology and improve exit light reliability. The cost to retrofit was about the same as to repair the lighting to their original configuration. By exercising the energy efficient retrofit option, the energy consumption and costs may be reduced 50% or more and provide better functionality.

End Notes

¹ Grainger Compact Fluorescent Lamps, self ballasted screw in lamp, HLX (Helix) lamp shape, lamp Watts 23, length 5.6 In., lamp designation 23MINITWIST/41, cool white lamp tone, incandescent equivalent 100 Watts, average life 10000 hours, 1600 initial lumens, 4100K color temp, 82 CRI, 1375 mean lumens, standard base, long life

² Grainger Retrofit Kits, fluorescent T12 to T8 conversion, specular reflector, converts 1 or 2 lamp industrial fixtures with reflectors, steel and plastic construction material, G13 medium bipin socket type, for use with 4 or 8 foot fixtures, kit contains parts to convert (10) 4 ft fixture sections, includes reflectors, socket brackets, sockets, and hardware, length 48.20 in., width 10.80 in.

³ Grainger Fluorescent Lamp, T8 lamp shape, medium bi-pin (G13) base, length 48 in., 25 Watts, lamp designation F32T8/25W/SPX50/ECO, low mercury, 1 in (26mm) dia., average life 36,000 hours, very cool lamp tone, 5000K color temp., 85 CRI, 2350 initial lumens, 2209 mean lumens, rapid start.

⁴ Home Depot Hi-Performance Electronic Ballast. Multi-voltage technology means a single ballast handles voltage from 108V to 305 V. Simply change the ballast to realize a 23% energy savings compared to standard F40T12 magnetic ballasts. Instant on, quiet operation in a low profile and lightweight housing.

⁵ Contractor Lighting Combination LED Exit Sign and Emergency Lighting Unit in one compact, modern design. Arrows, mounting, single or double face decisions, all can be made in the field. Universal mounting canopy for top installation. Energy consumption of less than 4 Watts.

⁶ Contractor Lighting LED Exit Signs are completely self-contained and they provides clean look and give an excellent energy savings. Arrows, mounting, single or double face decisions, all can be made in the field.

⁷ Energy cost used in the energy saving calculations was \$0.12 per kWh. The total energy savings for this project will be over \$400 per year. If such a project were done as a purely energy conservation project, the payback period is well over 10 years. In this case, the cost for the maintenance work would have been incurred whether or not there was an energy conservation retrofit. This project therefore has a very strong payback of less than 7 years excluding the cost reduction for replacing burned out lamps.