9.0 Day Lighting Cost/Benefit Analysis

The lighting breadth will be the addition of sky lights on the museum's roof to provided natural light to the fourth floor office spaces.

The use of skylights has grown in recent years, both because they enliven building interiors and because they can save energy dollars through daylighting. Sky lighting can be a solid asset for buildings, and satisfying for building designers, occupants, and owners. Skylights can make a number of major contributions to the built environment since they:

- Provide excellent lighting conditions to the interior of buildings
- Reduce the use of electric lighting, to save energy and reduce peak electric loads when combined with photo controls.
- Satisfy human needs for contact with the outdoors
- Increase safety and security with highly reliable daytime lighting.
- Provide emergency smoke vents.

9.1 Glazing Types

Table 9.1 illustrates the different types of glazing that can be chosen for the skylights (Highlighted Selected)

Type	Layers	Color	VT	SHGC	LSG	U (Flush/Site) Metal w/ Thermal Break
Glass	Single-Glazed	Clear	0.89	0.82	1.09	1.250
		Bronze	0.55	0.64	0.87	
		Green	0.74	0.59	1.25	
	Double-Glazed	Clear	0.78	0.70	1.11	0.650
		Bronze	0.48	0.51	0.94	
		Green	0.66	0.47	1.40	
	Double-Glazed Low-E	Clear	0.72	0.57	1.25	0.580
		Bronze	0.45	0.39	1.15	
		Green	0.61	0.39	1.56	
	Triple-Glazed Low-E	Clear	0.70	0.53	1.32	0.410
		Bronze	0.42	0.37	1.14	
		Green	0.61	0.38	1.61	

Double-glazed low E glass was chosen for our sky lights and based on the following reasons.

It's high visible transmittance (VT) allows the use of smaller skylights, thus a smaller aperture and the fewer heating and cooling losses.

It's low solar heat gain coefficient (SHGC), or the shading coefficient (SC). The lower the SHGC the better the skylight glazing material will be at preventing unnecessary heat gain from the skylights. Also the hotter the climate, this being Nashville, the more important the solar heat gain coefficient (SHGC) becomes.

It's LSG ratio, a high ratio will increase lighting savings while reducing cooling losses.

It's U-value wasn't a dominate concern, Nashville doesn't experience enough cold climate days, but a yet, low-E was chosen.

From the selections of different types of glazing, the only superior glass was triple glazed and was not chosen because of cost in is not used commonly in the United States.

Other advantages were the high ceiling heights (30 ft). High ceiling heights allow larger and/ or father apart skylights which can achieve uniform illumination levels, as well as a less concerns for visual quality. The general rule of thumb is to space skylights at 1.0 to 1.5 times ceiling height (center-to-center in both directions). This rule of thumb works out well. The ceiling height is 30 ft, the roof truss are spaced 30', so a sky light can installed mid-way between each truss, 30 ft center to center.

9.2 Savings

The Lawrence Berkeley National Library provides design aides in calculating the annual day lighting energy savings ($) with the use of nomographs. Nomographs are a quick and simplified tool for cost/benefit analysis, they are a graphic way to present a formula that has several variables. Rather than doing the calculation mathematically, a nomograph user can "walk" through diagrams. Nomographs will not deliver a guaranteed answer about cost-effectiveness, but with good design details, energy costs, and owner's investment criteria, good data results can be used to discuss with the building's owner. The nomograph worksheet can found in appendix B. Total cost savings per year is approximated to $3,600 per year in just lighting.

9.3 Glazing Area

The average useful window ratio is 50 %. The glazing area is the product of the useful window ratio and the perimeter area of the room. The fourth floor perimeter area is roughly 15,000 SF. Applying the general rule, glazing area is approximated at 7.500 SF.