

LIGHTING VALUES

The Benefits of Quality Lighting

In recent years there has been a renewed interest in the role of office environments on worker satisfaction, performance and comfort. The past decade marks a shift from thinking of facilities as a way to house the workforce to thinking about the entire building portfolio of a company in strategic terms. Buildings have the potential to add value, reduce costs, and improve corporate image.

Lighting plays a crucial role in the quality of the built environment, and represents a largely untapped opportunity for executives, owners and facility managers. This brochure has been developed to highlight the areas in which lighting can contribute to positive business outcomes.

Strategic Environments

Business performance is impacted by many factors, some controllable and some not. Choices about the built environment are controllable and represent an opportunity to use facilities as support tools for effective team performance. Leading real estate managers are beginning to think of their facilities from a strategic viewpoint, one that supports the vision and mission of the company.

It is commonly understood that poor indoor air quality and acoustic distraction have a detrimental influence on health and performance. New research is providing insight into effective space configuration. It is also true that lighting can help or hinder satisfaction, performance and comfort. The real value of lighting is only now beginning to be understood and quantified.



COMPETITIVE ADVANTAGE

A study by BOMA International found that if interior environmental quality is appreciably better, it can enhance the ability to rent or sell space. The survey found that tenants in class A buildings were much more satisfied overall with the environment than tenants in class B and C buildings. Class A spaces are likely to sell and rent faster than lower class spaces, especially among businesses that want to maintain a high quality image.

Baier, R.D. 1999. Customer service made easy: Deliver what office tenants want. HPAC Magazine. September: 41-45.

FIDELITY INVESTMENTS

BOSTON, MA

Employee preference and well-being was at the top of the priority list when the lighting was designed for Fidelity Investments. This lighting represents a dramatic improvement from their prior space which was described as "gloomy" due to insufficient brightness on the walls and ceilings. By comparison, the new indirect lighting creates a pleasant and upbeat environment and has been well received by employees. In addition to the positive impacts on the workforce, the design is energy-efficient and allows for flexibility in space redesign.

"Corporate America is discovering the only way to remain competitive and stay ahead of the rapid changes in business and technology is to consider your workspace as a strategic tool in accomplishing your business goals..."

"The Integrated Workplace: A Comprehensive Approach to Developing Workspace,"
Office of Real Property in the Office of Governmentwide Policy of the U.S. General Services Administration, May 1999



Light Right Consortium

The Light Right Consortium brings together interested parties and researchers to work toward a common goal — to use research as a basis for market transformation towards quality energy efficient lighting. Light

Right performs research that includes the issues of aesthetics and psychological processes in addition to visual performance. The objective is to more fully understand the way in which lighting can contribute to organizational and environmental benefits. Members are listed on the back page of this brochure. For more information go to www.lightright.org.

WHAT ARE THE POSSIBLE LINKS BETWEEN LIGHTING AND STRATEGIC BUSINESS OUTCOMES?¹

FINANCIAL OUTCOMES

- Performance improvements
- Increased resale value of property
- Enhanced ability to rent space
- Reduced energy costs

HUMAN RESOURCES DEVELOPMENT

- Ability to attract and retain workers
- Improved well-being of workers due to improved moods and comfort.

STAKEHOLDER AND CUSTOMER RELATIONS

- Improved public image
- Increased ability to sell to pro-environmental customers

These categories are drawn from the Balanced Scorecard approach, which is a framework used by organizations to evaluate their performance. (Kaplan and Norton, 1996)

What do we know from the research about lighting?

Turnover costs have been estimated at 25% of annual salary plus benefits.

Saratoga Institute and Kepner-Tregoe, Inc.

A 1999 market research study by Ducker Research interviewed end users responsible for making decisions involving the quality of the office environment and physical facilities. Respondents included CEOs, facility executives, and real estate managers. The respondent set was responsible for a total of 232 million square feet. When asked whether the following prompted factors were considered when making decisions regarding the quality of the built environment, their answers were as follows:

PROMPTED FACTORS	OVERALL	
	FREQUENCY	MEAN
Employee/Occupant Satisfaction	99%	4.28
Worker Output	74%	4.08
Employee Retention and/or Recruitment	70%	3.86
Churn Rate	70%	3.63
Creativity	68%	3.56
Absenteeism	24%	2.80

KEY: Frequency of mention.
Mean importance rating; with 5 being the most important and 1 being least important

THE VALUE OF SATISFACTION

- The distribution of light in a space, particularly the luminances on room surfaces, appears to be a major determinant of room satisfaction. Satisfaction increases when there is high overall brightness of the room surfaces, and when the amount of light on the walls and desks is evenly balanced. High contrast conditions in office environments are consistently rated poorly.²
- Dissatisfaction with dark walls may result from perceptions of gloominess. Researchers suggest that gloom may be psychologically undesirable because it is associated with reduced peripheral vision and thus serves as a primitive warning system that visual acuity is being compromised.³
- It is widely understood that most people prefer daylighting and desire access to a view in most types of work settings. Quality daylighting is a major element of lighting satisfaction.⁴
- One laboratory study gave subjects dimmable ceiling lighting and found that the control feature was well-used with positive results. The subjects who had the controllable lighting were more satisfied with the lighting, felt more comfortable in the room, rated the tasks as less difficult, and rated the lighting quality as higher than subjects who did not have control. Importantly, having the control system produced a 35 — 42% decrease in electrical consumption.⁵
- Another benefit of personal control over lighting is the positive psychological impact on workers. A Canadian study found that subjects who had control of their lighting experienced a greater sense of control in general throughout the day.⁶

THE VALUE OF PERFORMANCE

- Researchers have found that headaches are reduced and task performance increases when energy efficient electronic ballasts are used rather than magnetic.^{7,8}
- Over the past decade research has shown that subjects who experience positive moods solve problems more quickly and come up with more creative solutions than subjects in either neutral or negative moods. This points researchers toward further study of the impact of lighting on mood and emotions.⁹

FIG. 1

THE MYTHOLOGY of

FLUORESCENT LIGHTING

Many office occupants still hold a view that fluorescent lighting is an indicator of poor quality. While this was certainly true when fluorescent lighting was first introduced, modern fluorescent technology is the **best** way to achieve a high quality lighting installation. The improved colors of fluorescent lamps and the tremendous variety of new lamp and fixture options provides the best way to achieve aesthetic excellence. In addition, research shows that energy efficient and electronic ballasts can reduce headaches and increase task performance.

- Personal control can be used to change lighting conditions to reduce glare and increase illuminance to meet the changing needs of different tasks or activities. Studies show that when lighting control is used, significant individual differences are found. This indicates that the “one size fits all” approach of standard building lighting falls far short of the preferences of most workers.¹⁰

THE VALUE OF COMFORT

- An experimental workshop was held by the joint committees of two professional lighting associations¹¹ to study the phenomenon of overhead glare. The results obtained demonstrate that a significant number of people experience discomfort from high luminance lamps and fixtures overhead, even when the glare source is at the edge of the field of view or just outside of the field of view.¹²

THE VALUE OF REDUCED COSTS

- Quality energy efficient lighting can significantly reduce your energy bill. When new lighting systems replace older technologies the energy savings typically ranges from 25% to 50%. Additional energy savings can be found with the use of lighting control systems.
- Some lighting systems are designed for optimal flexibility. Designs that are most supportive of a changing work environment will reduce churn costs that occur with restructuring and growth.

THE VALUE OF A GOOD CORPORATE IMAGE

- Lighting is an important contributor to the aesthetic of a space and can help to convey a positive image to clients and stakeholders. Additionally, the use of energy-efficient technologies provides an opportunity to showcase an environmentally friendly corporate policy.

New Research on Lighting Quality

There is much more that needs to be understood about lighting and its impact on people and business outcomes. Research on indoor air quality is more plentiful, and yet lighting is rated in market research to be at least as important if not more important to companies when they make decisions about the built environment. Fortunately more answers are on the horizon. Starting in the Fall of 2000 the Light Right Consortium is sponsoring new research on this important topic. The results will help businesses to pursue the advantages that quality lighting can bring and will provide additional guidance as to the best design strategies.

RECIPE FOR SUCCESS

LIGHTING TIPS

- Hire an expert who specializes in lighting.
- Don't accept lower quality substitutions that have a lower initial cost but may negatively impact the bottom line by adversely affecting people in the workplace.
- Involve the workplace occupants. Use this as an opportunity to get participation and buy-in, which contributes to a positive corporate culture.

DESIGN STRATEGIES

- Provide brightness on the room surfaces; use light colored finishes.
- Reduce reflected glare. Ceiling lighting should not appear so bright as to appear in VDT screens.
- Reduce overhead glare. Some lamps are too bright (T5, T2) to be placed in direct view of the eye and must be well-shielded or used for indirect or wall lighting.
- Provide personal control of workstation-specific lighting fixtures where possible. Personal control of *shared* lighting fixtures can be problematic due to differences in preferences.
- If ambient light levels are below 40 footcandles, provide compact fluorescent desktop task lights to ensure adequate light for paper tasks.
- Choose lighting systems and layouts that remain appropriate even when the space plan changes. Consider plug and play technologies.

The Value of the Investment

The departments who make decisions about lighting investments are primarily concerned with first costs and schedule. However, these limited criteria can be at odds with the overall objectives of corporate management and human resources. When one looks at the organization as a whole it is clear that the cost of people far outweighs all other costs combined.^(FIG.2) If the criteria of facilities investments were guided by strategic business outcomes, then the organization would be able to mine opportunities in the built environment. Consider the following incentives:

- The capital cost of a new installed lighting system in offices can range between \$2.50/SF and \$6/SF. Financing for a lighting project can reduce the immediate cash flow impact.
- Even modest improvements in worker productivity or staff retention will offset the costs of a high quality lighting system.
- Once the initial investment is made the positive business outcomes continue as an ongoing revenue stream.

Those organizations who use lighting as a tool to improve the well-being of their workforce will realize an advantage that makes a concrete difference in today's competitive environment.

ANNUAL OFFICE COSTS / SF

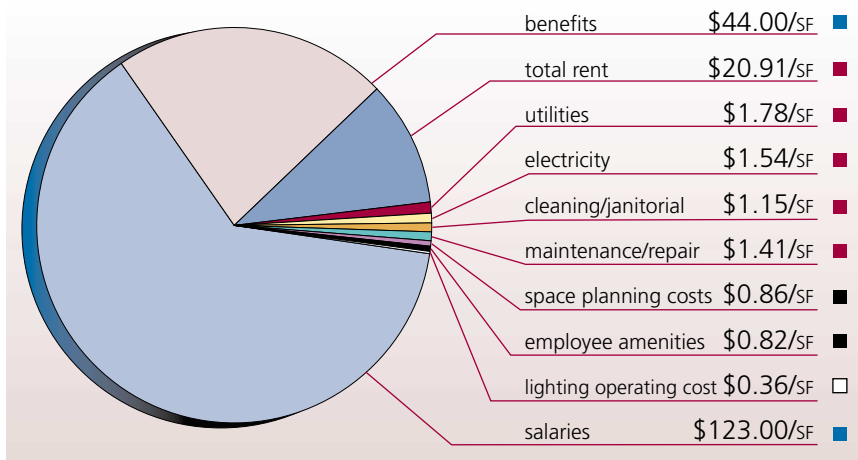


FIG.2

DATA SOURCES:

- Department of Labor, Bureau of Labor Statistics, June 2000. Based on an average annual salary of \$53,373 and annual benefits of \$14,040. Average office space per worker is 319 sf, from the BOMA International 2000 Experience Exchange report.
- Building Owners and Managers Association, 2000 Experience Exchange Report.
- International Facility Management Association, Benchmarks III, Research Report #18, 1997.
- Assumptions include an energy rate of \$.08 per kWh, annual burn hours of 3,640, and a power density of 0.9 watts/sf.

FOR MORE INFORMATION

Additional lighting resource information can be found at the following web sites:

Architectural Lighting — www.QualityLighting.com
 Building Owners and Managers Association — www.boma.org
 DesignLights Consortium — www.designlights.org
 Energy Cost Savings Council — www.plug-in.org
 International Facility Management Association — www.ifma.org
 Illuminating Engineering Society of North America — www.iesna.org
 International Association of Lighting Designers — www.iald.org
 Lighting Design Lab — www.northwestlighting.com
 Lighting Research Center at Rensselaer Polytechnic Institute — www.lrc.rpi.edu
 National Council on Qualification of the Lighting Professions — www.ncqlp.org
 National Lighting Bureau — www.nlb.org
 National Research Council Canada — www.nrc.ca/lrc/ie/light
 Northwest Energy Efficiency Alliance — www.BetterBricks.com

LIGHT RIGHT CONSORTIUM MEMBERS • PHASE II

Alliance to Save Energy
 Illuminating Engineering Society of North America
 International Association of Lighting Designers
 International Facility Management Association
 Johnson Controls
 National Electrical Manufacturers Association
 New York State Energy Research and Development Authority
 Steelcase
 US Department of Energy
 US Environmental Protection Agency

MEMBERSHIP SPACE IS STILL AVAILABLE.
 visit us at www.LightRight.org

The Light Right Consortium project is managed by Pacific Northwest National Laboratory, operated by Battelle for the US Department of Energy.

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- ⁹ Isen, A.M., Daubman, K.A. and Nowicki, G.P. 1987. Positive Affect Facilitates Creative Problem Solving. *Journal of Personality and Social Psychology*. 52(6): 1122-1131.
- ¹⁰ Newsham, G. and Veitch, J. 2000. A new method of deriving illuminance recommendations for VDT offices. IESNA Annual Conference 2000, Washington DC.
- ¹¹ The workshops were held by the Illuminating Engineering Society's Quality of the Visual Environment Committee and the International Association of Lighting Designers Metrics of Quality Committee.
- ¹² Ngai, P. and Boyce, P. 1999. The Effect of Overhead Glare on Visual Discomfort. *IESNA Proceedings 1999 Annual Conference*.