



BIBLIOGRAPHY OF STUDIES LINKING FACILITY DESIGN WITH PROFITABILITY

Improving Productivity in the Workplace: Reports from the Field (Springer Associates, Inc., 1986).

This document is an excellent comprehensive summary of research completed by Springer and others. A very good starting point for work completed prior to 1986.

Environmental Satisfaction, Personal Control and the Positive Correlation to Increased Productivity (Lomonaco, Carol and Miller, Dennis, Johnson Controls, Inc., Milwaukee, WI, 1997).

Another summary of applicable research. This study cites research completed up to 1997.

Greening the Building and the Bottom Line, Increasing Productivity Through Energy Efficient Design (Romm, Joseph J., US Department of Energy and Browning, William D., Rocky Mountain Institute, 1994).

Eight case studies of various building renovations where the original objective was to substantially reduce energy consumption. Projects included NMB Bank in Holland, West Bend Mutual Insurance Company's headquarters in West Bend, Wisconsin, engineering buildings for Lockheed and Boeing and a post office in Reno. In all cases, reduced energy consumption was achieved. However, another benefit was substantially increased productivity of the building occupants (ranging between 5% and 20%) which overshadowed the energy savings.

Using Office Design to Increase Productivity (Brill, M. with Margulis, S., Konar, E. and BOSTI, Buffalo, NY: *Workplace Design and Productivity*, Vol. 1, 1984, Vol. 2, 1985).

A two volume set that addresses the annual value and net present value of various job satisfaction factors (relative to reduced absenteeism and turnover) such as noise, temperature fluctuation, glare, comfort and ease of communication. Also analyzes annual value and net present value of facets that relate to job performance including design of workstation enclosure and adequacy of workstation layout configuration.

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Promoting Health and Productivity in the Computerized Office: Models of Successful Ergonomic Interventions, Chapter 3, Employee Comfort, Satisfaction and Productivity; Recent Efforts at Aetna by Carol Sullivan (Sauter, Steven L., National Institute for Occupational Safety and Health, Dainoff, Marvin J., Miami University and, Smith, Michael J., University of Wisconsin, Taylor & Francis, 1990).

Controlled experiment involving relocating forms processing personnel at Aetna from open, bullpen work environments to enclosed, open plan workstations with two work surfaces and panel heights allowing privacy while seated. In addition, other improvements were made to the functionality of the space. The result was a 64.2% increase in productivity.

GSA Access Floor Study (Becket, Ellerbe, US General Services Administration, Washington, DC, 1992).

This study compares 25 year life cycle costs of various floor systems. It determined that, based on a 20% churn rate, access floor system with modular wiring saved 12% of the net-present value compared to a cellular floor system. This study assumes no changes in the HVAC system and does not take into account the reduced costs of installing in-floor HVAC systems.

Life-Cycle Costs of Access Floor & Alternative Floor Systems (Tate Access Floors, Inc., May, 1997).

This study calculates the total costs over a 15 year period of "poke thru" concrete slab floor versus an access floor. It includes relocation costs and the tax advantages of access floors. Result, net present value cost of access floor in a 160,000 square foot building is 54% of the cost of a conventional floor (a \$436,000 savings).

The Sound of the effective Workplace (Armstrong World Industries, Inc., 1997).

Previous Armstrong case studies of six major corporations revealed that employees cite noise as the number one distraction in open plan offices. This study summarizes acoustical corrections in each of the workplaces that resulted in a 27% reduction in stress and an average of nearly 20% increase in productivity.

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Underfloor Air Distribution HVAC System Analysis (Milam, P.E., Joseph A., Environmental Design International, Ltd. for USG Interiors, Inc., Marietta, GA, September, 1992).

An analysis comparing underfloor air conditioning systems to conventional overhead air conditioning systems (variable volume) for a prototype office building. The analysis demonstrates that the return on investment for these systems is infinite because the initial installation costs are less and other benefits include: reduced operating costs, increased HVAC and electrical system flexibility, improved ventilation efficiency and indoor air quality, and improved employee occupant comfort and productivity.

Call Center Staffing: Cost of Turnover (FTR, October, 1996).

The study takes into account cost to hire and complete both formal and informal training of call center bankers and estimates the total cost to be \$25,645 per person. It also analyzes the impact of increasing compensation to reduce turnover and indicates, in a 100-person call center, "if a 20% increase in compensation (from \$12 to \$14.40 per hour) would reduce turnover from 30% to 20%, there would be a savings of \$152,000 per year without considering that paying more should mean higher quality staff."

Improve Lighting and Reduce Costs (Armstrong World Industries, 1996).

The study demonstrates that, when using Armstrong high reflectance ceilings, the density of indirect lighting can be reduced by 18% thereby reducing capital costs.

Lighting the Computerized Office (Hedge, Ph.D., Alan, Sims, Jr., Ph.D., William R. and Becker, Ph.D., Franklin D., Cornell University, Ithaca, NY, 1990).

The study involves a side-by-side comparison of indirect lighting and parabolic lighting in computer environments. Occupants were asked several questions unrelated to lighting to mask the fact that the study focused on lighting. The study is based on feedback from workers and is, therefore, less valid than studies that actually measure productivity. Each worker gained approximately 10 minutes in productive work time with indirect lighting fixtures which would result in a simple payback of between 2.6 and 6.1 months depending on worker compensation.

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Office Productivity: Contributions of the Physical Setting (Francis, Jo Ellen, Dressel, David L., MacArthur, Scott A. and Neathammer, Robert D., US Army Corps of Engineers, Construction Engineering Research Laboratory, Champaign, IL, September, 1986).

This study compared productivity changes of three groups of office workers at the Defense Logistics Agency in Columbus, Ohio. The first group was the control and remained in open plan work environments. The second group moved to improved open plan work environments and the third moved into enclosed, open plan workstations. Productivity in the control group increased by 1%, productivity in the improved open bullpen environment increased by 4% and productivity in the open plan workstations increased by 20.6%.

Rensselaer's West Bend Mutual Study: Using Advanced Office Technology to Increase Productivity (Kroner, Walter, Stark-Martin, Jean Anne and Willemain, Thomas, The Center for Architectural Research, Troy, NY, 1992).

An extensive study of the effect on productivity of West Bend Mutual's new (1991) headquarters building. Combined productivity increase attributed to Personal Environmental Modules (PEMs) alone was almost 3%.

Increasing Office Productivity Through Integrated Acoustic Planning and Noise Reduction Strategies (American Society of Interior Designers, Armstrong World Industries, Inc., Dynasound, Inc., Milliken & Co., Steelcase, Inc., Washington, DC, 1996).

Cited studies indicating that noise constitutes 71% of overall workspace distractions (followed by air quality, 20% and lighting, 9%). Also indicates 81% of workers feel they could be more productive in quieter workspace.

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