Sustainable Design Solutions for the Built Environment

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www.csbr.umn.edu

UNIVERSITY OF MINNESOTA

college of architecture and landscape architecture

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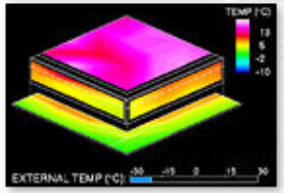
CSBR Center for Sustainable Building Research

News & Events
Who We Are
Research

Welcome to the Center for Sustainable Building Research (CSBR). There is a substantial and growing amount of building research activity in the following areas: sustainable design, energy-efficient buildings, windows & glazing research, improved building delivery process, building science & engineering, and human factors in transportation.





AREAS OF RESEARCH

- Sustainable Design
- Windows & Glazings
- Building Evaluation
- Affordable Housing
- Renewable Energy
- Human Factors
- Building Physics
- Building Foundations

Impact of Buildings on People and the Natural Environment

- *Buildings use one-sixth to one-half of the world's wood, minerals, water, and energy. Buildings generate 40% of the waste going to land fills.*
- *Blame for much of the environmental damage occurring today, from destruction of forests and rivers to air and water pollution and climate destabilization, must be placed on modern buildings.*
- *Many buildings do harm on the inside as well making us both less healthy and less productive than we are capable of being: 30% of the commercial buildings constructed since the 1960's are unhealthy.*

From the U.S. Environmental Protection Agency (EPA), National Resource Defense Council (NRDC), and World Watch Institute

Environmental Impact of Commercial and Residential Buildings in the United States

- 65.2% of total U.S. electricity consumption [1]
- > 36% of total U.S. primary energy use [2]
- 30% of total U.S. greenhouse gas emissions [3]
- 136 million tons of construction and demolition waste in the U.S. (approx. 2.8 lbs/person/day) [4]
- 12% of potable water in the U.S. [5]
- 40% (3 billion tons annually) of raw materials use globally [6]

"...sustainability refers to the ability of a society, ecosystem, or any such ongoing system to continue functioning into the indefinite future…. For architecture, this means design that delivers buildings and communities with lower environmental impacts while enhancing health, productivity, community, and quality of life."

—American Institute of Architects Handbook

Origins in the 1970s

Sustainable Design Advances in the United States

- Several states and cities have adopted green building requirements
- New York has green building tax credits and requires renewable energy systems on state buildings
- Many federal agencies have green building requirements including architect selection criteria based on sustainable design experience
- The US Green Building Council has grown and LEED has continued to evolve into a consensus national set of guidelines

Sustainable Design Guidelines and Tools

US Green Building Council
www.usgbc.org

Minnesota Sustainable Design Guide

Minnesota Sustainable Design Guide
www.msdg.umn.edu

Minnesota Sustainable Building Guidelines
www.csbr.umn.edu/B3

Minnesota Sustainable Design Guide

Address: http://www.msdg.umn.edu/MSDG/strategies.html go

MINNESOTA SUSTAINABLE DESIGN GUIDE

- OVERVIEW
- HOW TO USE
- PROCESS
- STRATEGIES
  - Site
  - Water
  - Energy
  - IEQ
  - Materials
  - Waste
- DOCUMENTS
  - Scoring Form
  - History Report
  - Print Version
  - Other
- CASE STUDIES
- RESOURCES
- CONTACT INFO
- CREDITS
- SEND RESULTS

Building Life Cycle

PREDESIGN | DESIGN | CONSTRUCTION | OCCUPANCY

SUSTAINABLE DESIGN GUIDE STRATEGIES

The design strategies for the Minnesota Sustainable Design Guide fall into six environmental topics: site, water, energy, indoor environmental quality, materials, and waste. Many of the sustainable design strategies relate to more than one environmental topic. Subsequently, linkages are provided between topics. Some of the greatest design and ecological benefits occur when strategies combine with others to address and integrate multiple concerns (such as the relationship between environmental impacts, human experience, economics, and design aesthetics).

Each strategy is explained with step-by-step actions for the design, occupancy, and next-use phases. Performance indicators for each strategy indicate the minimum efforts required to receive credit for the strategy.

Click on each environmental topic to see the specific strategies, actions per phase, performance indicators, resources, and scoring points.

Link: http://www.msdg.umn.edu/MSDG/site.html

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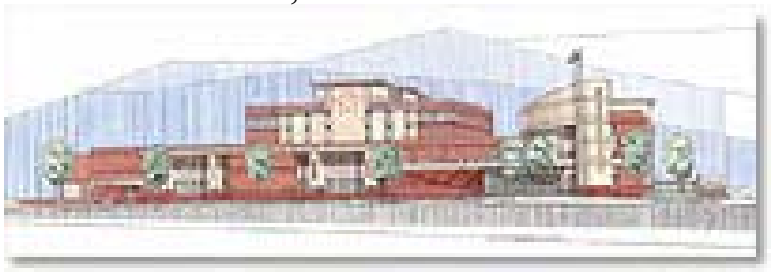
Lebanon Hills Visitor Center, Dakota County

Northern Service Center, Dakota County

County and State Projects

DNR Area Office, Windom Minnesota

Eden Prairie Library, Hennepin County



Law Enforcement Center, Ramsey County

Jackson Meadow, Marine on the St. Croix

Regional Projects

Green Institute, Minneapolis

Wolf Ridge Environmental Learning Center
Ely Minnesota

Northland College, Wisconsin

Downtown Minneapolis School

Applicable Minnesota Legislation Sustainable Building Guidelines

The guidelines must

- Exceed existing energy code by at least 30 percent
- Achieve lowest possible lifetime costs for new buildings
- Encourage continual energy conservation improvements in new buildings

MSBG Team:
LHB Inc., CSBR,
The Weidt Group

Applicable Minnesota Legislation Sustainable Building Guidelines

The guidelines must

- Define air quality
- Create and maintain a healthy environment
- Facilitate productivity improvements
- Specify ways to reduce material costs
- Consider the long-term operating costs of the building including the use of renewable and distributed energy sources

MSBG Team:
LHB Inc., CSBR,
The Weidt Group

Organization of Minnesota Sustainable Building Guidelines

The guidelines are organized into the following categories

- Performance Management
- Site and Water
- Energy and Atmosphere
- Indoor Environmental Quality
- Materials and Waste

MSBG Team:
LHB Inc., CSBR,
The Weidt Group

Site and Water Strategies

Minnesota Sustainable Building Guidelines

- Avoid Critical Sites
- Erosion and Sedimentation Control
- Stormwater Management
- Reduce Site Disturbance
- Reduce Site Lighting Pollution
- Brownfield Redevelopment
- Efficient Transportation Alternatives
- Reduce Site and Building Water Use

MSBG Team:
LHB Inc., CSBR,
The Weidt Group

Energy and Atmosphere Strategies

Minnesota Sustainable Building Guidelines

- Reduce Energy Use by At Least 30%
- Efficient Equipment and Appliances
- Renewable and Distributed Energy Generation
- Atmospheric Protection

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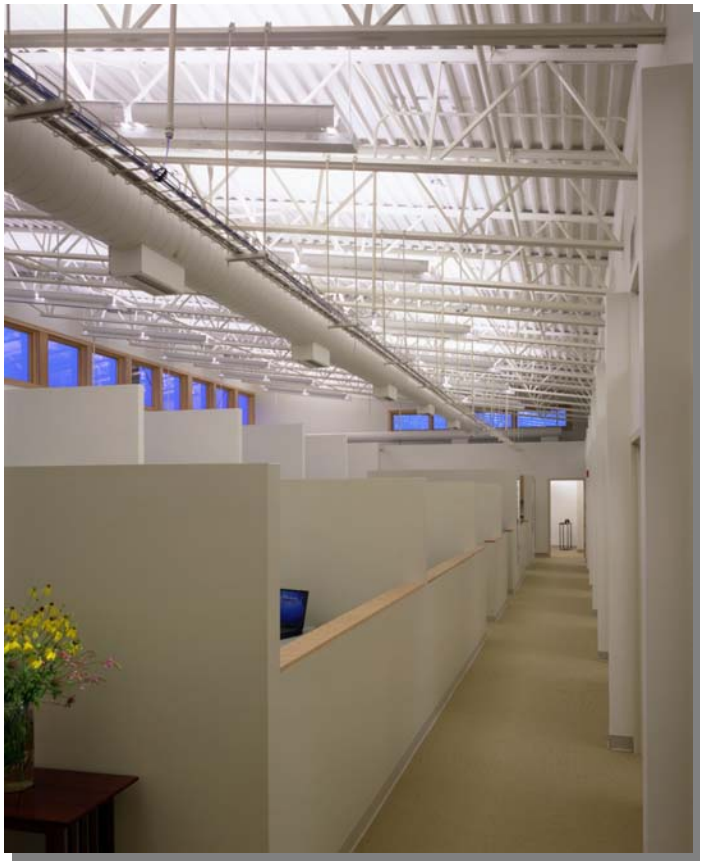
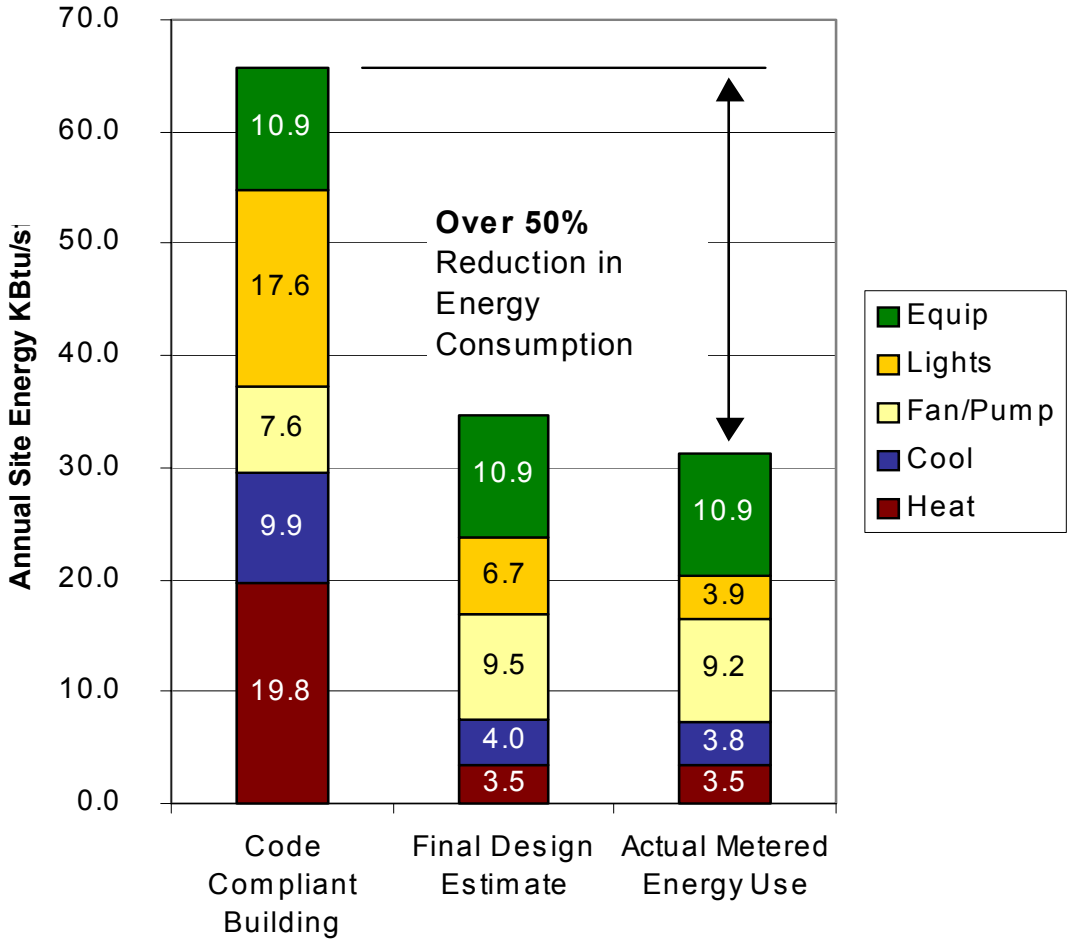
Case Study: Iowa Association of Municipal Utilities



Case Study: Iowa Association of Municipal Utilities
Energy Performance



Energy Simulations utilizing DOE2.1E were performed to investigate various strategies and estimate the final performance.

Long term building environmental and energy monitoring will be performed to further evaluate and improve the building's operation.

Indoor Environmental Quality Strategies

Minnesota Sustainable Building Guidelines

- Specify Low-Emitting Materials
- Ventilation Based on Anticipated Pollutants and CO2 Limits
- Moisture Control
- Thermal Comfort
- Daylight
- Quality Lighting
- View Space and Window Access
- Effective Acoustics
- Personal Control of IEQ Conditions
- Encourage Healthful Physical Activity

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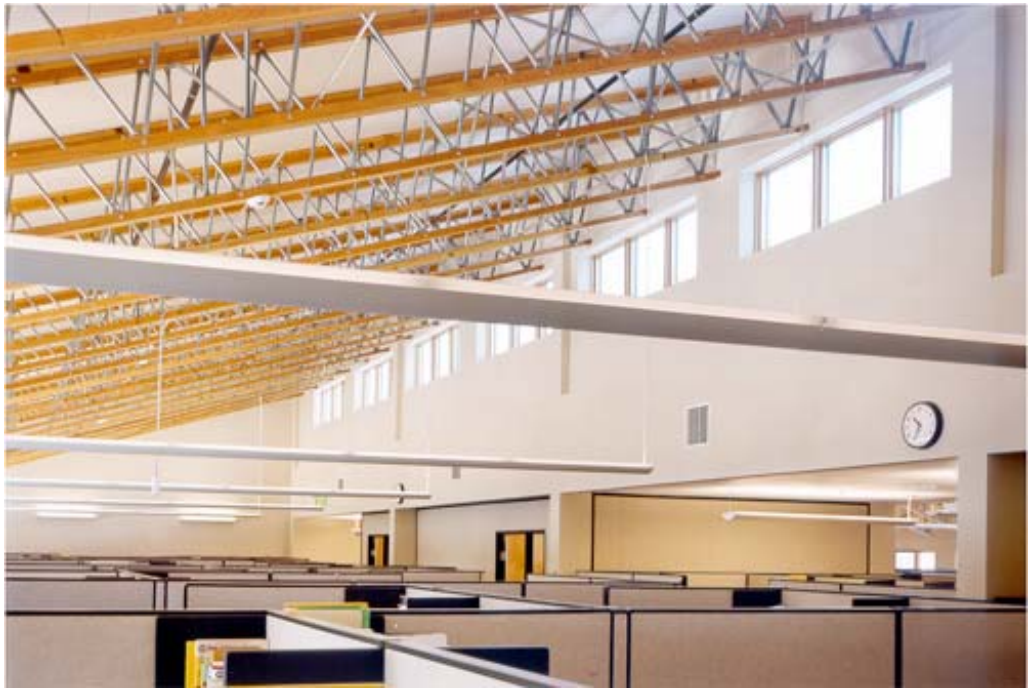
Materials and Waste Strategies

Minnesota Sustainable Building Guidelines



- Design for Minimum Resource Use
- Evaluation of Material Properties for Improved Performance
- Waste Reduction and Management

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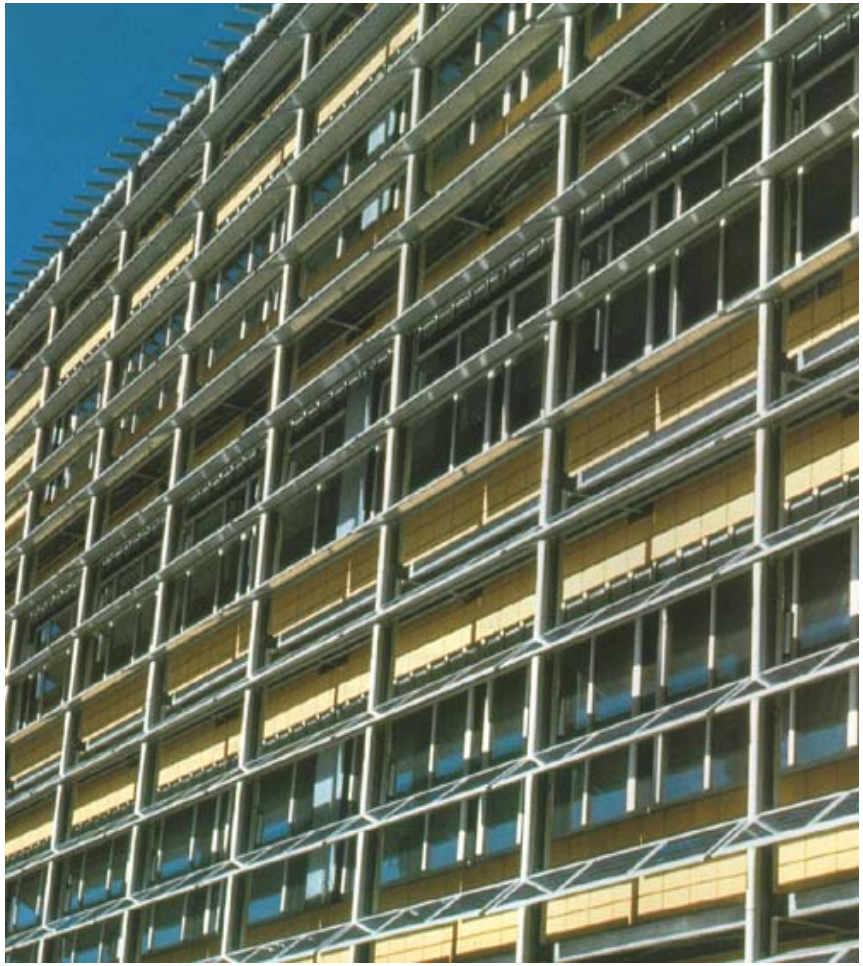
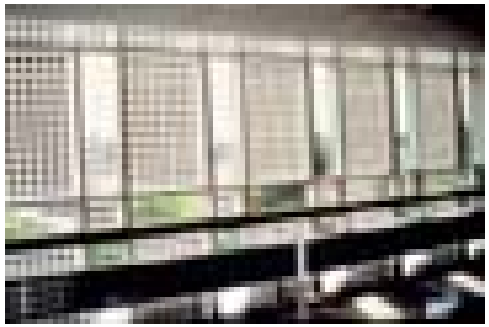
Emerging Glazing Technologies
Photovoltaic Facade Systems





Los Angeles County Courthouse

Eastgate Building, Harare, Zimbabwe

Natural ventilation modeled from termite mounds.

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.