

SUSTAINABLE
TECHNOLOGIES

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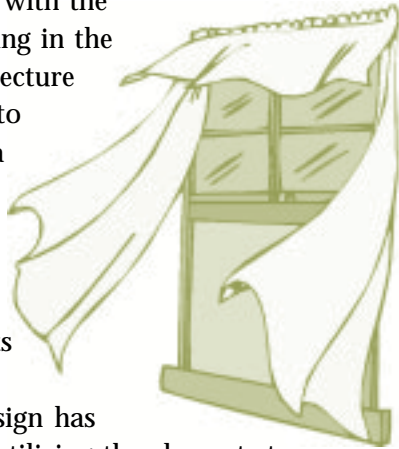
NATURAL
VENTILATION

CONSULTANTS OF CHOICE
TO THE BUILT ENVIRONMENT



DESIGN ASSIGNMENT: DELIVER COMFORT NATURALLY

Since the first structures thousands of years ago, sunlight and airflow have been taken into consideration and harnessed to optimize indoor comfort. But beginning with the advent of air conditioning in the mid-20th century, architecture and engineering began to move away from such a close attention to natural conditions.



In recent years, however, as energy costs have continued to rise, sustainable building design has once again focused on utilizing the elements to provide optimum conditions in a sensible, efficient manner.

To this tradition of building innovation comes modern-day natural ventilation. This is not simply a matter of opening the windows of a building, as it may have been in previous generations. Rather, today's naturally ventilated buildings take advantage of state-of-the-art technological tools for analysis and measurement of airflow to assure that outdoor air is used efficiently to maximize occupant comfort.

Whether it's utilized in conjunction with a small mechanical cooling system or as a stand-alone system, natural ventilation offers the opportunity for significantly reduced cooling loads – both in terms of first costs and ongoing heating and cooling bills. By integrating systems such as building envelope, massing, glazing and internal loads, natural ventilation can be part of an overall architectural-engineering strategy that delivers a better performing building for less.

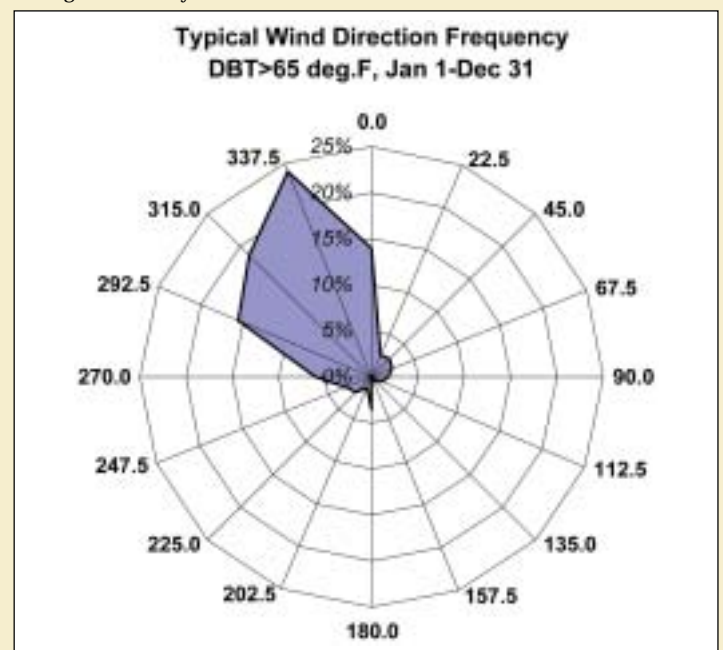
Natural ventilation also restores a more natural sense of occupant comfort. Although people who have worked for years in a sealed, artificially air-conditioned building are used to experiencing one sustained temperature, studies show the human body has evolved

over millennia to respond to varying temperatures in different portions of the day. While its fluctuations are minimal, ventilation restores this natural phenomenon. At the same time, however, the inclusion of operable windows in an overall natural ventilation and HVAC strategy allows greater individual control over thermal comfort.

All told, when included as part of an integrated sustainable building strategy, a naturally ventilated building fine-tuned to occupant needs and desires can measurably improve productivity through greater comfort and harmony with outdoor conditions. Reducing costs for HVAC systems can often free up enough budget to be applied to other sustainable design measures, so that the overall effect is a more comfortable building, cheaper to operate and maintain, with enhanced green building features.

UNDERSTANDING WIND DIRECTIONS

A wind rose can tell us how much the wind blows from each direction. In this case, we can see that for days with air temperatures above 65°F, Portland winds are predominantly from the north and northwest; knowing this, we can design the building orientation and air intake to keep it cool during warmer days.



INTEGRATED DESIGN OPTION

Natural ventilation combines well with radiant space conditioning, daylighting and other energy efficiency options. With radiant conditioning, the goal is to take advantage of an often-ignored factor - the thermal mass of the building itself (concrete walls, floors and ceilings) - that plays a key role in the perceived comfort of a space. As much as one half of perceived comfort is radiant heat gain or loss; air convection and proper humidity levels combine for the other half. Radiant conditioning creates a time lag between rises in outdoor air temperatures and the corresponding rise in indoor air temperatures, thereby assisting the natural ventilation program so that air conditioning systems can be downsized or eliminated altogether. Natural ventilation makes radiant conditioning work through “night flush” ventilation strategies that aim to cool a building’s internal surface and air volumes down to 55°F temperatures before the start of the next working day.

Natural ventilation works hand-in-hand with daylighting to make windows a transparent skin for the building that harnesses sunlight and air in order to optimize human comfort and productivity. Natural ventilation also allows a greater temperature band for comfort than a strictly forced convection solution.

UNDERSTANDING BUILDING WIND VELOCITY AND PRESSURE DISTRIBUTION
Using sophisticated computational fluid dynamics (CFD) and network air-flow programs, we help shape buildings that take best advantage of local air flows.

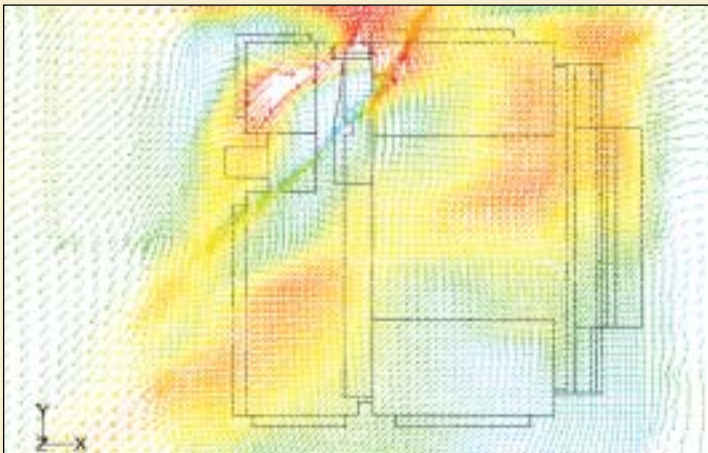


Image courtesy of YGH Architecture.

BEHAVIORAL AND SOCIAL SCIENCES BUILDING
Humboldt State University; Arcata; California

ISSUE

Reduce Energy Use and Secure a LEED® Gold Rating

SOLUTION

Locate individual offices on the north side, provide operable windows on all offices, structure interior air pathways and employ exterior ventilation via the rooftop and stairs to exhaust internal corridors, reducing overall energy use by more than 35% compared with a conventional building in California.



Image courtesy of LMN Architects.

SALEM CONFERENCE CENTER
Salem, Oregon

ISSUE

Build an Energy-Efficient, Comfortable Conference Center on a Conventional Budget

SOLUTION

This integrated mechanical and electrical design features natural ventilation in concert with radiant heating and cooling and a smaller HVAC plant. Complementary strategies include reduced ambient lighting levels, daylighting and extended roof overhangs for solar control.

EVALUATING THE RAINWATER HARVESTING OPTION

OPPORTUNITIES

- Energy savings of 50-100% in air conditioning operating costs
- Significantly reduced size of mechanical cooling system
- Fewer environmental costs
- Physical plant occupies less space
- Long-term flexibility for changing uses
- Superior occupant comfort and productivity
- Individualized control
- 100% outside air for ventilation

CHALLENGES

- Adjustment to varying conditions throughout day/night
- Requires narrow floor plates and large internal openings
- Requires more coordination between architect and engineer
- Not suitable for sites with poor outdoor air quality
- Dependency on microclimate, including wind speed and direction, annual temperature regime
- Susceptibility to outdoor noise penetration
- Poorer interior acoustics because of more openings

SYNERGIES

- Radiant conditioning approaches
- Daylighting
- Designed for change of use
- Night flush ventilation in cooler climates
- Passive solar design

Interface Engineering approaches each project with a proven, step-by-step approach to optimize occupant comfort, minimize energy consumption and meet project cost objectives, while reducing carbon dioxide and regional pollutant emissions from excessive energy use. This commitment informs our decision making at every stage of the design process.

Recently, we have focused attention on using natural ventilation as an efficient, cost-effective way to meet human comfort needs in buildings, particularly in coastal and Pacific Northwest microclimates. We know that for thousands of years, buildings have optimized orientation, window placement and overall building form to regulate how fresh air flows in, through and out of a space. Today, Interface is combining that experience with state-of-the-art analysis and design simulation tools that enable us to simulate wind-driven and "stack effect" ventilation. We use sophisticated computer software, including network airflow modeling and computational fluid dynamics, to optimize naturally driven airflows, particular to each building.

Any building can be heated and cooled, given sufficient mechanical equipment, brute force and wasted energy, without taking advantage of free natural forces. But increasingly, design is seen as not truly effective unless it is also efficient in resource consumption. Interface's approach elegantly optimizes each design to make the most of available natural forces to heat, cool, ventilate, light and delight.

INTEGRATED DESIGN: BUILDING ENVELOPE

Good design views the entire building as a system of interdependent units, in which individual changes affect the whole system.



Adapted from Bunting Coody Architects.

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