



TEN MYTHS OF ENGINEERING FOR BUILDINGS

Designing a building is a complicated task that can require input and direction from the large pool of individuals that comprise the design team— typically including facility owners, end users, facility managers, architects, and engineers. While individual members of the design team are responsible for specific portions of the building design, the key to a successful outcome is the coordination of all of these various components. A beneficial tool for achieving this coordination and getting more successful outcomes is a team in which all team members have a basic understanding of design. This understanding can be leveraged to yield more optimal designs, and potentially achieve cost savings. For example, an architect having a basic understanding of structural engineering can create conceptual designs that are more practical and affordable than without this knowledge.

To help other design team members better understand the engineering aspects of building design, PBA has identified 10 of the most common misconceptions or “myths” of engineering for buildings:

Myth 1: Heat always rises.

Actually, heat can transfer in any direction, depending on its mode of transfer. There are three distinct modes of heat transfer: *convection, conduction and radiation.*

The concept that “heat rises” is based on the common observance that heated air rises, because air becomes less dense (more buoyant) as it is heated. In building systems, natural *convection* occurs from heating devices such as baseboard heaters and finned tube radiation. Because heated air does rise due to natural convection from these devices, they are best located at a low height within the heated space.

Heat transfer by *conduction* can occur in any direction through a material, not just upwards. For example, heat transfer by conduction can occur horizontally through a wall, or even downwards through a raised floor.

Heat transfer by *radiation* can also occur in any direction, as the result of a heated object being in view of a cooler object. For example, the sun warms the earth through radiant heat transfer. In buildings, radiant heating devices can be placed high in the heated space and still heat any surfaces which are in view of them. The use of radiant heating devices can be a beneficial alternative when baseboard heaters, finned tube radiation or other convective heating devices cannot be located low in the heated space. Because radiant heaters warm objects, including occupants, rather than the air, they can also be beneficial from an energy efficiency standpoint, as equivalent occupant comfort can be maintained at a lower air temperature.

Myth 2: Emergency generators are a costly option.

Emergency lighting along paths of egress is required in most buildings. There are several possible methods that can be used to achieve this, including emergency generators. Often, owners avoid the purchase of a generator, thinking they are always too costly an option. However, when facilities exceed 20,000 square feet in size, a generator can be more cost effective than battery systems for powering emergency lighting, especially when life-cycle costs for replacement, maintenance and testing are considered.

Myth 3: All energy costs have to be tied back to the cost of oil and natural gas.

As the cost of oil and natural gas continue to rise, other energy sources are becoming more cost effective options and more widely used. For example, electricity can be purchased from wind farms, or even generated by an on site wind mill. Also, boilers don't have to burn natural gas. Instead, many companies are producing boilers that utilize bio-fuels as their fuel source. Wood chips, crop by-products, corn, and other combustible products can be used to heat a building. These systems and other energy sources can be used as cost effective primary or supplemental heat sources in a building.



Myth 4: Telephone and data system cabling is defined by owner equipment.

Actually, this cabling should be designed based on the standards for cabling for all telephone and data systems as developed by EIA/TIA (Electronics Industries Alliance / Telecommunications Industry Association) and BICSI (Building Industry Consulting Services International). Since most data systems are designed to operate on this standard cabling infrastructure, the cabling system can be designed in conjunction with the overall building design, independently of the telephone and data hardware.

Myth 5: The electrical engineer determines how large the utility electrical service will be.

The electrical engineer determines how large the electrical distribution system will be within a facility and code dictates the size of this equipment based on loads that will be located within the facility. However, the electrical engineer does not actually determine how large the utility service will be for the system. The utility company, the owner, and the engineer must collaborate to determine the capacity of the utility service based on historic data from the utility company and the way the owner intends to operate the facility. For these reasons, it is not uncommon for the distribution system within a facility to be much larger than the capacity supplied by the utility.

Myth 6: Day lighting is always beneficial.

When designed and integrated properly, the introduction of day light in a building is a beneficial factor that has been shown to improve the productivity of the users of a space. However, day light can also cause nuisance glare if not properly controlled. It can even be dangerous. For instance, in a pool area if the light is allowed to reflect on the top of the water, it can prevent a lifeguard from seeing a person on the bottom of the pool. To avoid nuisance glare or potentially dangerous situations while still allowing for natural light in the building, a lighting designer can be consulted. Lighting designers can use calculations and develop models to simulate daylight at different times of the day and various times of the year, and then use this information to identify potential difficulties and develop strategies to prevent them while maintaining the benefits of natural lighting.

Myth 7: Everyone is happy with the appropriate indoor HVAC system.

Happiness and satisfaction with an indoor HVAC system is measured by thermal comfort— a product of humidity, temperature, thermal radiation, and the movement of air. Because there is a wide range of personal comfort needs among people, it is nearly impossible for everyone to be comfortable with a given system. For this reason, ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) defines an acceptable indoor environment as one in which 80% of the people feel comfortable. This is an important thing to consider during design and while maintaining a building— satisfaction among 100% of occupants most likely won't be achieved.

Myth 8: Code requires a receptacle located every 20 feet for cleaning.

In a commercial facility, receptacle locations are not determined by code. Instead, they are solely determined by owner requirements and the intended utilization of the space. Code dictates receptacle locations only in dwelling spaces.

Myth 9: Supply air can only come from overhead.

Traditionally, supply air has been delivered from overhead systems in ceilings. However, many of today's most advanced office facilities use the space under a raised access floor as a plenum space to deliver supply air through outlets in the raised floor. With an underfloor air distribution system, cooling is delivered to about 5 feet above the floor, in the occupied zone, and heat is intentionally allowed to stratify near the ceiling. This can be a more cost effective option than traditional overhead air supply systems.



Myth 10: Sustainable design is a new concept in engineering.

By now, most people in the building industry have heard of the trend towards sustainable or “green” design. The LEED Rating System is a benchmark guideline that has been developed to encourage and to quantify sustainable design. However, the concept of sustainable design has been applied for a number of years. Over the past 15 years, government programs like Energy Star and Green Lights have been created in an effort to promote many of these same design practices. The LEED program is comprehensive and requires the entire design team to work together from the conceptual phases of a project through completion of construction to achieve the most efficient sustainable design. Most top engineering firms are well versed in all aspects of sustainable design. Sustainable design can lead to lower maintenance costs, lower energy bills, and make more responsible use of our communal resources.

By understanding the facts behind these common myths, the entire design team can make better upfront decisions during the conceptual stage of projects, more effectively evaluate options and alternatives for the facilities, and potentially achieve cost savings.

For more information on any of these myths or how they impact your projects, contact Terry Cleis, P.E., Senior Associate at Peter Basso Associates at 248.879.5666 ext. 255 or tcleis@pbanet.com.