

ENGINEERING SYSTEMS FOR INTERIORS

When planning a new construction or a renovation project, it is important to understand the engineering systems required for today's buildings. Consulting an engineer early in the planning phase will help determine what proposed designs are feasible. Careful and timely consideration of a building's engineering systems can save substantial time, money and design effort.

FIRE LIFE SAFETY SYSTEM

Human safety in a high-rise fire hinges upon the proper operation of the building's fire life safety system.

The fire life safety system contains components for all emergency control and communications required during a

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high-rise fire. When a fire is detected, a properly designed and installed system will simultaneously alert building occupants and notify the fire department. When the fire

department arrives, a command post, usually located in the lobby, becomes and remains the communications and operations center throughout the fire emergency.

The fire life safety system enables fire fighting personnel to control critical building systems such as the elevators, ventilation systems, communications between firefighters and building occupants and alarms. It is crucial that the fire department be in control of these systems in order to effectively initiate firefighting evacuation and rescue procedures. When a new building is constructed or an existing building is renovated, designers and engineers must ensure that the fire life safety system is integrated into the building operating systems.

This can be effectively achieved by adherence to overall building codes and local fire life safety codes. It is imperative that the specific occupancy classification of the building be determined at the outset of the project.

New York City has one of the world's most comprehensive high-rise fire life safety codes. All commercial office buildings must comply with the requirements of a Class E system, which requires an extensive alarm and annun-

ciation system. The City, through Local Law 58, requires that strobe lighting be installed to supplement audible fire alarm systems and notify occupants who are hearing impaired that the alarm system has been activated.

Most large commercial buildings in New York City are serviced by an outside fire alarm system contractor who is exclusively charged with all additions, changes and modifications to the system. Contractors such as these should be used as a resource during the design phase of any construction or renovation project. They are knowledgeable about fire alarm system specifications and applicable codes, and in the case of a renovation project, have specific knowledge of the existing building.

SPRINKLER SYSTEMS

While the fire life safety system alarm alerts the building occupants and the fire department of a fire in a high-rise, a sprinkler system offers the primary defense against its spread. An effective sprinkler system will activate itself and shower water on the fire zone. The sprinkler system is an integral part of the general operating system of a building, and requires a complex layout of piping, sprinkler heads and pumps. The type of sprinkler system to be used in a newly constructed building or in an existing building scheduled for renovation must be determined and understood at the very onset of the project.

There are two categories of sprinkler systems: wet systems and pre-action (dry) systems.

Wet systems are constantly filled with water. They release the water immediately when the sprinkler heads sense an increased level of heat.

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Pre-action systems are normally dry and not filled with water. The piping remains empty until a fire is sensed by a

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heat or smoke detector, and then pressurized water is sent throughout the system. Water discharge will then occur when sufficient heat

is sensed by a sprinkler head similar to a wet system. Pre-action systems are attractive in that they offer an additional stage of operation before water discharge. In the event of a sprinkler head malfunction or damage, there is no chance of accidental activation and release of water. They are generally installed in areas where high-tech equipment such as computer and telephone systems are in use.

A gaseous protection system utilizing FM200 gas is also available for fire suppression in areas such as computer and communication rooms where water damage is a main concern. Because of cost and exhaust requirements, however, a gas extinguishing system is generally not a first-choice system.

HVAC SYSTEMS

The heating, ventilation and air conditioning (HVAC) system is responsible for all of a building's air ventilation and climate control. When planning the construction of a new building, the type of HVAC system should be determined based upon the design requirements of the building. When a renovation project is to be undertaken, the specifications and capabilities of the existing HVAC system must be understood before any design work can begin.

Central HVAC equipment can be stored in large equipment rooms remote from the tenant occupancy or in smaller rooms on each floor.

Most HVAC system distribution components are located within the ceiling cavity, the space between the visible ceiling and the slab and support steel for the floor above.

HVAC ducts are the largest consumer of space. The amount of ductwork present in this space has a significant impact on the height of the ceiling above the tenant's workspace. If the amount of ductwork can be reduced, more configuration options will be available and ceiling heights desired by an architect can be maintained.

There are various means of reducing the amount of ductwork required. For example, if the design of a building provides the opportunity to use water (rather than air) as a prime cooling medium, less ductwork is necessary.

If water cooling systems are not a viable option and ceiling conditions are unavoidably tight, a costly and difficult procedure of boring holes ("steel cuts") into the building's structural beams can free up space within the ceiling so that all necessary services can be housed and desired ceiling heights can be maintained. If steel cuts are to be utilized, the structural capability of the building must be carefully examined because this procedure affects the building's basic support structure.

When planning a construction or renovation project, the structural capabilities of the building and the desired ceiling configurations and heights must be determined at the outset of the project in order to evaluate the impact on space planning.

Supplemental cooling units are local units utilized in areas containing a high concentration of heat generating equipment. They provide cooling above and beyond that of which the base building system is capable. At present, there are three types of supplemental cooling units available for installation in commercial buildings.

The first type of unit relies upon outside air. It usually requires access to a window or some other means of air intake as a condensing medium. The second type of unit relies upon condenser water. Such systems draw the condenser water from a cooling tower on the roof of the building and serve individual floor or ceiling-mounted cooling units. The third type of unit relies upon chilled

water. This system cools the building by drawing chilled water directly from the building's central refrigeration plant.

If supplemental cooling units are to be installed, it is important that the individual building be evaluated to determine the most feasible and efficient system. Special considerations must be taken into account. Some units are so large that they cannot be located in ceilings. As a result, valuable floor space must be used to create machine rooms.

The distribution of air within a space is also an important factor (along with the requirement for control zones). In Europe, and to a lesser extent, in the United States, new methods to distribute air have been developed. For example, air displacement technology supplies air from the floor as opposed to the ceiling. These systems may be a viable alternative if the design of the building is compatible with this type of system. Either system will probably require additional power.

If a project's plans include the installation or redesign of the HVAC system, the issue of increased power requirements must also be taken into account. Many existing buildings do not contain sufficient capacity within their HVAC systems to meet modern cooling demands. The result is that the system must be expanded or supplemental cooling units must be installed to augment the existing building systems.

ELECTRICAL AND COMMUNICATION CABLING

Modern buildings make use of a variety of electrical and communication raceway systems. When designing a new building, it is essential that compatible systems

are established based on the proposed occupancy of the building.

It has been found that many buildings do not have base HVAC systems with adequate capacity to meet modern cooling demands.

Electrical raceway systems vary from building to building. They range from poke-through systems that require core drilling to accommodate floor layouts, to sophisticated, high capacity, under floor duct systems where cells placed throughout a space allow maximum flexibility of outlet locations without having to core drill into the ceiling space below.

The power demands of the building must be determined early. Many tenants have special electrical requirements and need more complicated systems containing higher capacity.

When designing a new building or redesigning an existing one to accommodate systems with extensive cabling requirements (such as a computer operations center), a raised floor arrangement presents a viable option. The raised floor is appealing because it allows substantially more space for electrical and communications cabling. However, it is expensive and is not always possible in certain buildings due to limited slab-to-slab heights.

When designing interior electrical systems, it is important to understand that many suppliers of systems furniture offer complete, electrically integrated furniture packages. Furniture may be arranged so that a single point connection can feed as many as eight individual work stations.

In New York City, system evaluation must also take into account the issue of jurisdictional disputes between electrical contractors and furniture system manufacturers regarding the installation of electrical components at the factory versus in the field.

When evaluating requirements for communication cabling systems, an extensive and critical system may require "cable management." This is an accounting system set up to monitor the placement of all communication cables. Cable management offers flexibility because it allows for the future reconnection and reuse of cables for different functions. This eliminates some of the need to install new cables each time a change to a communication or computer system is required.

LIGHTING

Unlike many other engineering systems, lighting is a direct contributor to a building's visual aesthetics. Aside from any functional considerations, designers and engineers must integrate the lighting design into the overall cosmetic scheme of the building. Lighting requirements must be determined before any work begins.

Lighting is a direct contributor to a building's visual aesthetics

There are three general categories of lighting: incandescent, fluorescent and high-intensity discharge. When selecting a lighting system, a number of factors must be considered, the most important being desired color rendition and energy efficiency.

In terms of color rendition (the ability to show "true colors"), incandescent lighting is usually the best. Fluorescent is second and high-intensity discharge lighting a distant third. In terms of energy efficiency, however, the order is reversed, with incandescent fixtures being the least efficient.

Designers must also abide by energy conservation codes. Codes such as those in New York limit the watts per square

foot that a space may consume for lighting. It presents an engineering challenge to achieve the desired functional and aesthetic effects while remaining within the energy consumption parameters set by government regulations.

Tradeoffs between color rendition, efficiency and power budgets must be evaluated to arrive at an optimal design. The solution is typically found through a mixture of lamps and fixture types that enable the installation of incandescent fixtures for aesthetic accentuation and fluorescent fixtures for use in general office areas that require substantial amounts of light. High intensity discharge is usually limited to garages, site/facade lighting and similar service areas.

RELIABILITY OF POWER SUPPLY

Another important element in the design of most building systems is the issue of the reliability of the power supply. This issue can be resolved by utilizing the technology of uninterruptible power supply (UPS) systems. The details and applications of uninterruptible power supply systems are outlined in Systems Report Volume I, Issue I, "Uninterruptible Power Supply Systems."

DESIGN/REQUIREMENT CRITERIA

Perhaps the most difficult challenge to the engineer is to create an environment that satisfies numerous people with differing comfort demands within the same space and served by common systems. It is very useful to develop a list of criteria detailing occupant requirements. A list such as the following may be used to determine the requirements of systems for proposed designs:

1. Desired temperature range.
2. Watts per square foot.
3. Emergency power for operations.
4. Special power surge and grounding requirements.
5. Off-hour operations.
6. Special life safety requirements of occupancy.
7. Reliability of the power source.
8. Need for special electrical raceways.

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