Can Fire Protection and Life Safety Lead to LEED Points?

by Lisa E. VanBuskirk, P.E., LEED AP

"Green" and "sustainable" are among the latest buzzwords in the building industry. Jurisdictions across the U.S. are adopting green design criteria for both public and private buildings, and numerous major developers and construction firms are committing to have all of their future projects meet sustainable design criteria.

The U.S. Green Building Council's LEED (Leadership in Energy and Environmental Design) system is the nation's leading sustainable design evaluation criteria. LEED is a methodology for evaluating building design from several perspectives—sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality—which are broken down into design prerequisites and credits. A design that meets all of the prerequisites and a certain number of credit requirements is granted Certified, Silver, Gold or Platinum certification, as appropriate.

It is important to recognize that the various levels of LEED certification represent minimum sustainable design thresholds and are often achieved as a result of trade-offs between one or more areas and another. Obviously, in order to fully address the underlying intent of green building, it is essential that design teams work together so that all of a project's systems and components contribute to the overall goal of environmental responsibility—even in areas that may not intuitively lead directly to LEED credits.

Fire protection and life safety systems may not play as critical a role in green design as some other building elements, but they nonetheless affect the overall environmental impact of a project. By examining design options worth credits under the latest LEED Green Building Rating System for New Commercial and Major Renovation, LEED-NC 2.2, and their application in certified buildings, we can begin to better understand the role of fire protection and life safety in green design.

Examples

- Energy and Atmosphere Credit 4, Enhanced Refrigerant Management, disallows the use of suppression systems containing ozone-depleting materials. The fire suppression industry has supported this measure for years by offering a variety of "clean agent" systems in addition to the more common water, foam and carbon dioxide fire suppression systems.
- Sustainable Sites Credit 6.1, Stormwater Design, Quantity Control, allows the use of nonpotable stormwater reclamation for fire suppression. The Center for Health and Healing at the Oregon Health & Science University (LEED Platinum rating) harvests both stormwater and pumped groundwater for use in its nonpotable water systems. The nonpotable water is stored in a tank large enough to meet both firefighting water requirements and nonpotable water uses.[1]

  Note that if nonpotable water is used in the sprinkler system, the design team may need to consider the potential for sediment build-up within the pipes or microbiologically influenced corrosion, which can reduce the life span of sprinkler piping and can often only be controlled through the introduction of chemicals into the water supply, which may negate the building's environmentally friendly design goals.[2]
- Sustainable Site Credit 7.1, Heat Island Effect, Non-Roof, can also employ fire protection methodology. The design team for the U.S. Census Building in Suitland, Maryland, (LEED Silver rating) desired an exterior wood screen on the facade of the building which, besides serving as a striking visual element, would act as a shading device for the wall. The applicable building code does not permit exterior wood elements to the height and extent imagined by the design team, so the National Institute of Standards and Technology (NIST) Fire Dynamic Simulator (FDS) software package was used to evaluate the screen to determine the conditions under which it might ignite.

  The FDS model demonstrated that the screen could safely be installed on the exterior of the building, justifying a code variance that served to effectively reduce the heat island effect of the building.
- As use of straw bale construction expands, Materials and Resources Credit 4, Recycled Content, and Credit 5, Regional Materials, become applicable. Straw bale construction has been evaluated for up to 2-hour

fire resistance using ASTM E-119 test standards.[3, 4] However, many building and fire safety code officials may be hesitant to allow such construction because straw is quite flammable in loose form.

As successfully demonstrated in the design of the Friends Community School in College Park, Maryland (LEED registered project), educating code officials regarding the safe use of straw bale construction may be necessary.[5]

- Providing under-floor ventilation as part of Indoor Environmental Quality (EQ) Credit 2, Increased Ventilation, may offer appealing fire protection design opportunities. One example might be the installation of automatic sprinkler piping within the subfloor system with the sprinkler heads penetrating the floor slab (with appropriate fire stopping), eliminating the need to install a false ceiling on the level below to hide exposed piping.

  Note that the use of under-floor ventilation systems requires the review of fire barriers and partitions to ensure that they extend appropriately through concealed spaces—which could impair the effectiveness of ventilation delivery. In addition, depending upon jurisdictional interpretation of the under-floor concealed space, installation of sprinkler or smoke detection systems may be required.[6]

- As demonstrated on Portland, Oregon's Brewery Block (one phase of which has achieved LEED Gold rating), natural ventilation worth LEED points under EQ Credit 2 can also be integrated into a passive smoke control system. In this case, CONTAM—an airflow modeling software program developed by NIST—was used to justify the use of operable windows in several high-rise buildings.

Atria

Perhaps the greatest opportunity for coordination between green building and fire and life safety protection is when a fundamental design goal is to provide natural light in compliance with EQ Credit 8, Daylight and Views.

Commercial buildings are often enhanced through the incorporation of atria surrounded by glazing systems that transfer daylight and views to interior work spaces. Building codes typically require that atria be separated from adjacent spaces by 1-hour fire barriers, but most allow glazing systems in conjunction with sprinklers which wet their glass surfaces or appropriate fire-resistant glazing as acceptable alternatives. It is, however, important to note that the extensive use of glazing in commercial buildings can affect the placement of fire detection and protection devices—many of which do not mount well on glass. In fact, this emerged as a major issue in the location of such required devices in the Genzyme Corporate Headquarters (LEED Platinum rating) in Cambridge, Massachusetts, and Sara Lee Knit Corporate Headquarters in Asheboro, North Carolina (proposed sustainable design).[7]

Building codes also typically require smoke control systems for atria. Although the codes offer prescriptive methods for calculating the necessary exhaust and make-up air in order to maintain the smoke layer 6 to 10 feet above walking surfaces, such calculations may not accurately account for the unique configuration of a specific atrium. In such instances—with the approval of the building official—performance-based design may be employed to reduce exhaust and make-up fan capacities and egress modeling may be used to justify the allowance of smoke layer descent lower than permitted by the building code as long as occupants can still safely exit the atrium. At the Oregon Health & Science University Center for Health and Healing, for example, timed egress analysis was combined with the use of parking garage exhaust fans during emergency conditions to provide the necessary exhaust capacity.[8]

Again, NIST's FDS program is an excellent tool, allowing the fire performance of an atrium to be modeled during the design stage—including exhaust and make-up air capacities and sprinkler interaction to limit fire growth and predict tenability conditions (temperature, visibility and carbon monoxide concentration). For example, the design team for the Sara Lee Knit Products Corporate Headquarters employed FDS to justify the reduction of smoke control requirements from almost 2 million cubic feet per minute to 840,000 cubic feet per minute,[9] and FDS was used in conjunction with advanced egress modeling software to justify variances in ventilation inlet and smoke detector locations for the atrium in the Portland Center Stage Armory Theater (LEED Platinum rating). In both projects, use of FDS contributed to the design of integrated fire protection and life safety systems whose performance exceeds that of the prescriptive code requirements under "real-world" conditions.

Conclusion

While effective fire protection and life safety engineering alone will not yield sufficient credits to achieve LEED rating, the impacts of sustainable design upon related code requirements cannot be ignored. By the same token, engineering analysis may help demonstrate that a sustainable design meets or exceeds the intent of the building code in terms of providing occupants a reasonable level of life safety protection during an emergency event. ◆

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