ARM
APPLIED RISK MANAGEMENT

SECURITY DESIGN FOR SUSTAINABLE BUILDINGS AND CAMPUSES

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Introduction

Both sustainability and security are important elements to consider when designing a new building. While the design objectives of sustainability and security sometimes complement each other, there are also many cases in which steps taken to enhance building security can reduce sustainability, and vice versa.

As a risk management and security engineering firm, Applied Risk Management (ARM), LLC is primarily concerned with designing safe and secure buildings and campuses for our clients. We also understand and appreciate the importance of sustainability. Unfortunately, however, security is oftentimes overlooked by building owners and the design community. Thus, one of our primary goals in writing this book is to highlight the importance of including security early in the building design process. Once this is understood, the challenge then becomes how to optimize both security and sustainability. We offer this book as a guide to assist architects, owners, engineers, and other professionals from various industry disciplines with overcoming this challenge.

In this book, we identify key problem areas for achieving a balance between sustainability and security and discuss ideas that are already being put into practice in response to these challenges. We also introduce innovative solutions that are currently being developed, and propose new conceptual ideas that we believe show promise but that have not yet been fully developed or put into practice.

In Section One, we discuss the importance of sustainability, and how security is often mistakenly omitted from green initiatives. In Section Two, we highlight the importance of making security a high priority in the design process and how costly inadequate security can be for a company. In Section Three, we discuss the risk assessment process and the importance of carrying out such an assessment early on in the design process. We also discuss specific risk assessment methodologies and tools that can be used to assist the risk assessment process. Sections Four through Eight then discuss the challenges of balancing security and sustainability, and introduce various solutions that can be achieved through new technologies and systems integration, with respect to specific building elements: Outdoor Lighting (Section Four), Indoor Lighting (Section Five), Heating, Ventilation, and Air Conditioning (Section Six), Exterior Envelope (Section Seven), and Landscaping (Section Eight). In Section Nine, we discuss additional benefits that can be reaped from systems integration. In Section Ten, we provide more specific details about how systems integration can be implemented. Finally, in Section Eleven, we discuss how pre-fabrication of security components can generate LEED credits.

Section One: Sustainability

Source: National Capital Planning Commission (October 2002). National Capital Urban Design and Security Plan.

Buildings have a significant impact on the environment. They account for 40% of global consumption of raw materials, 12% of U.S. potable water (5 billion gallons per day are used just from flushing toilets), 40% of the U.S. total waste stream (approximately 2.5 lbs. of solid waste per square foot of floor space), and 35% of U.S. carbon dioxide emissions.[1] Furthermore, building operation alone accounts for 37% of U.S. energy consumption and 68% of U.S. electricity consumption.[2] In an attempt to reduce their impact on the environment, more and more buildings are going "green," often by acquiring certification from the U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) Green Building Rating System. This system focuses not only on the building design itself (including the use of sustainable architecture, efficient building technologies and systems, and environmentally sound construction practices), but on the design *process*, stressing the importance of integrating the efforts of the various stakeholders involved. Unfortunately, as illustrated by the following quote, security is an important dimension of building design that is often omitted from the USGBC's discussion of integration:

> *Sustainable building projects are, by nature, multi-dimensional. Every project has different needs and opportunities. Site selection, building orientation, landscaping, views, day lighting, building program, architectural aesthetics, building envelope performance, thermal mass, radiant comfort, indoor air quality, moisture and condensation issues, sustainable materials, natural ventilation, night-vent cooling, electric lighting, mechanical systems, noise and acoustics, energy systems, adaptability, the cost of churn, and market success are all fundamentally interdependent.*[3]

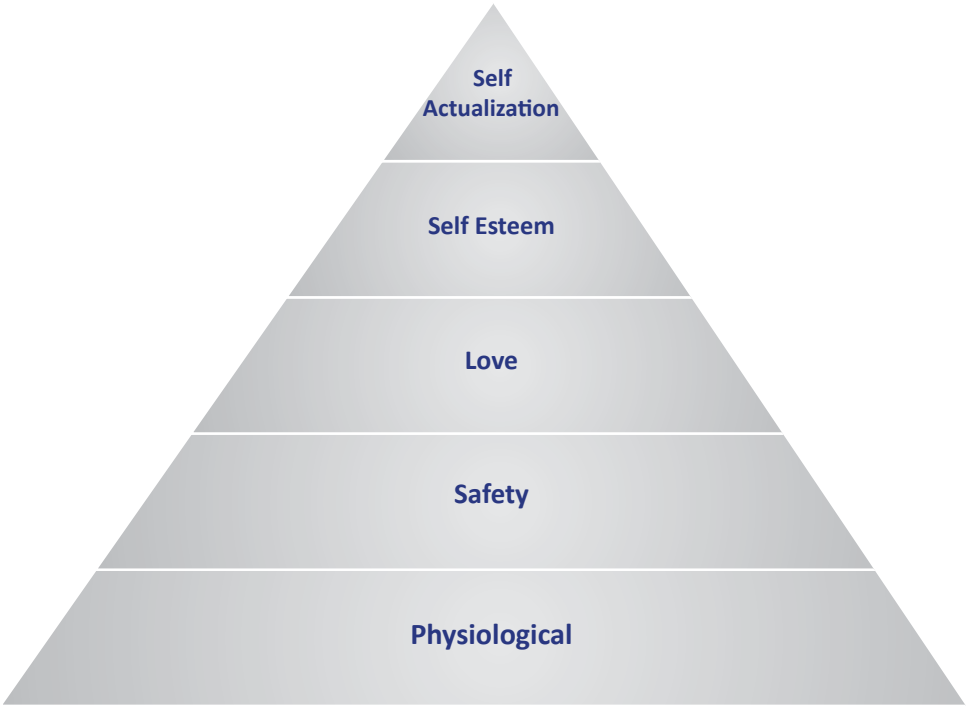
It is our belief that the omission of security from the design process is a grave oversight. As discussed in the following section, taking inadequate security measures can have serious consequences.

1 USGBC Colorado Chapter (January 2007). *LEED professional accreditation study guide and practice exam*; LEED-NC 2.2 Edition. Page 29.

2 USGBC Colorado Chapter (January 2007). Page 29.

3 USGBC Colorado Chapter (January 2007). *LEED professional accreditation study guide and practice exam*; LEED-NC 2.2 Edition. Page 24.

Section Two: Security as a Priority



Maslow's Hierarchy of Needs

Security is a basic human need. Unfortunately, it is not uncommon for building designers to overlook security in their plans, often because security is not an expressed priority of the client. Owners may not be aware that incorporating physical security in a project from the start — rather than retrofitting for security at a later date — can lower the design and installation costs in the long run. Building designers can also benefit from optimizing deployment of security countermeasures in their project designs, as this enables them to provide safe and secure environments for their clients. Therefore, there is much to be gained by making security a high priority in building design.

Real-Life Illustration

A large corporation retained the services of a famous architect to design a grand front entrance for its corporate headquarters facility. Unfortunately, security was not included in the design process. Therefore, once the entrance was completed, security measures had to be retro-fitted — a costly endeavor — in order to ensure the security of the building. Because the construction of the entrance was already completed by the time security was brought in, the options with respect to security measures were extremely limited. In fact, the only operationally and financially practical option resulted in security measures that were highly visible and detracted from the aesthetics of the entrance. Furthermore, these limitations resulted in security measures that were less effective than those that could have achieved had security been included in the entrance design. Therefore, the end result was that both the aesthetics and the security of the entrance —and the entire building —suffered.

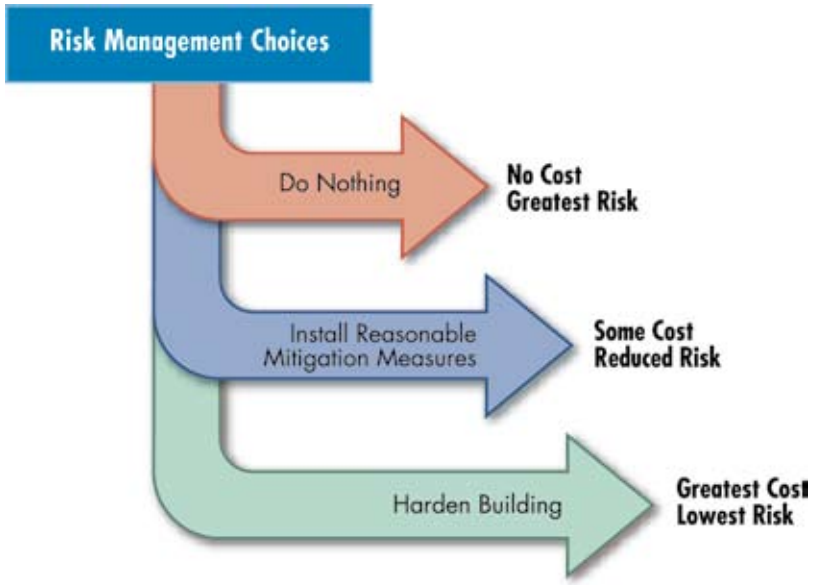
Had the architect consulted with security professionals when designing the entrance, it would have been possible to implement optimal security measures while at the same time maintaining the aesthetics of the entrance.

Far more important, however, is the fact that there is much to be lost if security is *not* made a priority. Taking inadequate security measures can have dire consequences not only in terms of personal safety, but also financial loss, legal liability and company credibility. Risk management issues that affect the reputation of the company can be very costly and the damage can be long-term.

Studies conducted by Ernst & Young and Oxford Metrica, which included 438 firms representing $4.3 trillion in market cap, found the following:[4]

- There is a clear, empirical connection between risk quality and shareholder value performance.
- High quality risk management is strongly correlated with low cash flow volatility, a core stock value driver.
- Risk quality is a strategic issue and an essential aspect of effective corporate governance procedures.
- When asset protection fails, the value impact to the corporation can be significant.
- Investment in risk management and property loss prevention procedures minimizes the probability that a loss incident event occurs or escalates into crisis. Failure of management to adequately protect assets may result in tragedy (at worst) or a sudden loss in shareholder value (at best).
- Sudden shareholder losses due to inability to adequately protect assets tend to be sustained, or "destiny-determining."
- Loss prevention and control is not a high-cost activity; therefore, an investment in risk management is prudent.

Given the above findings, one must wonder why security is not always included in the design process for sustainable buildings. Perhaps it is because, as mentioned earlier, security and sustainability measures often clash. For example, security calls for optimal outdoor lighting in order to deter crime and enable camera surveillance, while sustainability calls for minimal outdoor lighting in order to reduce light pollution and energy consumption. Through early collaboration of multiple disciplines, however, these conflicts can become complements. As will be discussed later, strategic installation of lighting and use of variable intensity lighting systems, intelligent lighting control and video analytics can achieve optimal light levels satisfying both sustainability and security objectives.



Source: FEMA (2003). *Reference Manual to Mitigate Potential Terrorist Attacks against Buildings.*

4 Sources: Ernst & Young (2002). *Risks That Matter*; Knight, R. F. & Pretty, D. J. (2001). *Reputation and value*. Oxford Metrica; Research Study for FM Global by Strategic advisory firm Oxford Metrica, 2003.

Section Three: Risk Assessment

When designing a new building, architects should take into consideration the potential threats to which the building might be exposed. Threat-based risk assessments (TRA's) should be conducted in order to identify potential threats, including those due to local crime and natural disasters, as well as insider, outsider, and other business threats. This is the best way to determine the appropriate level of security countermeasures for any given building or facility. Conducting TRA's both ensures that costly, time-consuming, and energy-intensive security measures are not deployed unnecessarily, and maximizes the benefit derived from security measures that are undertaken. In many cases, this approach serves to reduce the need for costly systems that provide minimal security benefits.

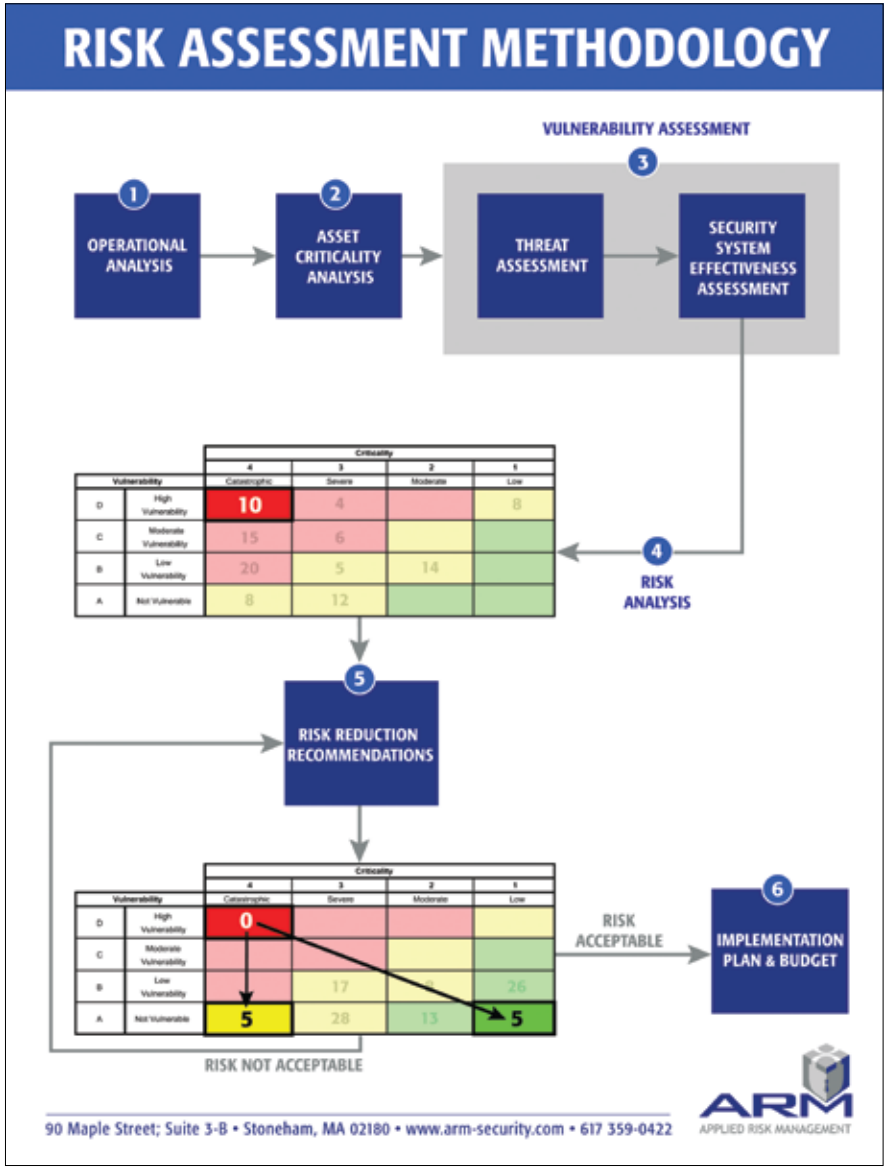
Real-Life Illustration

Applied Risk Management (ARM), LLC, was hired by a Fortune 100 technology company to quantitatively evaluate their security personnel's ability to respond appropriately (i.e., in line with the company's established policies and procedures) to various situations. ARM found that the company's security officers could not consistently meet the requirements of one particular policy: preventing trucks from parking or idling directly in front of the building for more than one minute. The purpose of this very important policy was to mitigate the risk of a truck bomb being detonated at this critical location, which would be extremely costly both in terms of human lives and physical damage to the building. However, limitations in the company's resources prevented the deployment of a security officer outside of the building to monitor truck activity, and CCTV camera footage of the front of the building was not monitored consistently. As a result, ARM recommended the installation of cameras with video analytic software, which could be programmed to recognize large vehicles and to set off an alarm notifying security personnel if a vehicle exceeding a specified size remained parked outside of the building for over one minute. (For more information about video analytic cameras, see Sections 4, 6, and 9). By following this recommendation, and making a total investment of less than $20,000, the company went from 100% failure to uphold this policy to 100% success, thus significantly reducing the threat of a truck bomb being detonated at this critical location, which would have caused immeasurable damage, including loss of life and property destruction.

There are many nationally recognized risk assessment methodologies, including Sandia National Laboratories' Industry-Specific Risk Assessment Methodologies, American Society for Industrial Security (ASIS) International Guidelines for Risk Assessments, Federal Emergency Management Agency (FEMA) Risk Management Series, American Society of Mechanical Engineers (ASME) Risk Assessment Standards for College and University Campuses, National Fire Protection Association (NFPA) Risk Assessment Standards, and others. In addition, Applied Risk Management (ARM), LLC has developed its own risk assessment methodology that can be used across industries. It combines the strongest aspects of the methodologies mentioned above, and also supports objective-based evidence assessment methods. The ARM 6-Step Risk Assessment Method is depicted here:

Before any risk assessment recommendations are made, it should be understood that there is no such thing as 100% security. There is always some level of risk, as countermeasures may be restrained by operational requirements, financial constraints, and other considerations.

Therefore, in order to maximize investments in security, it is important to analyze and understand the operations of the building or campus, the criticality of its assets, the specific threats to the organization, and the effectiveness of the planned or existing security and/or operational countermeasures. Only once this understanding has been achieved can we effectively quantify risk and develop realistic, actionable recommendations for reducing risk to acceptable levels. These recommendations should be considered holistically and should create an overall security philosophy and program. In addition, they should be accompanied by cost-benefit analyses and detailed implementation plans.



Real-Life Illustration

Shortly after 9/11, ARM was hired by a university to peer review a risk assessment that was previously conducted for the client by another firm. The consultants conducting the initial assessment did not develop a realistic understanding of the campus operating environment and consequently did not understand that the university culture was built upon an open learning environment that encouraged freedom of movement, expression and ideas. Their recommendation to lock exterior doors on all campus buildings was counter to the university's desired operating environment and therefore was not going to be implemented. Because the consultant assumed the doors would be locked they did not include other important recommendations that should be considered in open environments such as faculty, staff and student awareness training, deployment of security and police personnel to conduct interior building patrols, and locking unoccupied offices and critical interior areas.

As mentioned earlier, a significant component of the risk assessment process is identifying potential threats due to local crime. A useful tool for assessing the local crime rate is the CRIMECAST Report by CAP Index, Inc. The CRIMECAST Report is designed to identify the risk of personal and property crimes at any location in the United States. The CRIMECAST model is based on the strong relationship between a neighborhood's "social disorder" and the amount of crime that is perpetrated in that neighborhood. To identify the level of social disorder, CAP Index examines data on demographics, housing, population mobility, economic stability, education levels, and social changes. Crime data are collected from the FBI Uniform Crime Reports, police records, victim reports, self reports, and loss reports. CRIMECAST produces probability measures that place any location in the U.S. in context with national and local levels of crime, predicting the likelihood of crimes against persons (e.g., homicide, rape, robbery, etc.) and crimes against property (e.g., burglary, larceny, motor vehicle theft, etc.). CRIMECAST scores indicate a site's risk of crime in comparison to the national, state or county average.

The key is to begin the risk assessment process early on when designing a building, well before construction begins. By determining all of the potential manmade and natural threats to a building, it becomes possible to not only implement those security measures that are required to render a facility safe and secure (rather than retrofitting later, which may not be possible, and if it is, it may be far more costly), but it also makes it possible to integrate security with other building systems. Such integration, particularly when done early in the design process, can dramatically improve efficiency and reduce costs over the long run.

In order for systems integration to take place, there must be coordination and collaboration among the building's various stakeholders. A new tool that is commonly being used to improve such coordination is Building Information Modeling (BIM). BIM creates a "digital representation of physical and functional characteristics of a facility,"[5] enabling real-time, integrated design and virtual operation before a single brick has been laid. Before BIM, the design process was fragmented: Each stakeholder (e.g., security, engineers, electricians, etc.) would be sent off to do their own independent projects, and it would not be until all the stakeholders were brought back together (often after construction has already begun) that conflicts would be realized and necessary changes would be made. With BIM, it becomes possible to have continuous collaboration and sharing of ideas throughout the entire life cycle of the building, from earliest conception to demolition. BIM's digital medium enables it to serve as a real-time repository for information that can be shared among all of the stakeholders throughout the design process. With BIM, building design is not only more accurate, but it is more efficient with respect to time, money, and energy.

5 National Institute of Building Sciences , buildingSMARTalliance (2009). *Frequently Asked Questions about the National BIM Standard*™. Retrieved February 26, 2009 from *http://www.buildingsmartalliance.org/nbims/faq.php*.

Section Four: Outdoor Lighting

Security Concerns

With respect to security, the more outdoor lighting a building has, the better. This is because lighting is considered a deterrent to crime. Criminals prefer to carry out their activities under the cover of darkness so that their activities (such as breaking and entering) are not detectable, and/or so that their would-be targets (in the case of personal crime) cannot see them approaching and cannot identify them. From a security standpoint, the optimal lighting level is that at which shadows and blind spots are eliminated. Security also calls for enough outdoor light to support camera surveillance. Lighting is particularly critical in parking lots, which are the leading locations on properties where crimes are likely to lead to a lawsuit.[6] Building owners can be held legally accountable for any foreseeable criminal acts of third persons on their property; this is known as premises security liability.[7] "Inadequate security claims arise when a property owner or an agent/manager fails to provide a reasonably safe environment, and as a result, someone is victimized by the criminal conduct of another person."[8]

These lawsuits can result in huge financial losses.[9] The key role of crime prevention in building design can be found in the fact that the average cost of lawsuits regarding crimes on property has actually decreased over time as property owners and managers have realized the importance of having effective crime prevention efforts in place that can be used to bolster their legal defense.[10]

Sustainability Concerns

Perhaps the greatest sustainability concern regarding outdoor lighting is the issue of light pollution. Light pollution occurs when a building's outdoor lighting disrupts the environment surrounding the building by filtering out and disturbing people or animals nearby. Light pollution is often a serious concern for the community in which a building is located, as citizens may be disturbed by artificial lights shining intrusively into their homes.[11] Artificial light can also be particularly harmful for animals, as the following quote from the Ecological Society of America demonstrates:

> *Artificial light that occurs at unnatural times or places – often called light pollution – can attract or repulse animals, resulting in increased predation, migrating in the wrong direction, choosing bad nest sites or mates, collisions with artificial structures and reduced time available to spend looking for food, just to name a few.*[12]

Another key sustainability issue with respect to outdoor lighting is energy conservation, with a major goal being to minimize the amount of energy consumed in constructing and maintaining a building.

6 Bates, N. D., and Groussman, J. D. (1999). *Major Developments in Premises Security Liability II*. Sudbury, MA: Liability Consultants, Inc.

7 Bates, N. D. (July 1, 1993). Inadequate security: the new liability crisis. *Journal of Property Management*.

8 Ibid.

9 Bates, N. D., and Dunnell, S. J. (1993). *Major Developments in Premises Security Liability*. Framingham, MA: Liability Consultants, Inc.

10 Bates & Groussman, 1999.

11 News-Sentinel.com (December 16, 2008). *Mayor signs 'light pollution' revision*. Retrieved January 21, 2009 from *http://news-sentinel.com/apps/pbcs.dll/article?AID=/20081216/NEWS/812160319*.

12 Ecological Society of America (2009, January 7). Polarized light leads animals astray: 'Ecological traps' cause animal behaviors that can lead to death. *ScienceDaily*. Retrieved January 13, 2009, from *http://www.sciencedaily.com /releases/2009/01/090107092714.htm*.

Security versus Sustainability

The above security and sustainability issues are at odds with each other: Security calls for increased outdoor lighting in order to deter crime, while sustainability calls for minimal outdoor lighting in order to reduce light pollution and conserve energy. Building designers are therefore faced with the dilemma of how to balance these two concerns.

Solutions

Traditionally, outdoor lighting output and coverage are maintained at a fixed level based upon worst-case scenario ambient lighting conditions. However, it may not be necessary for security purposes to provide constant outdoor lighting for the entire outside area surrounding the building. Therefore, one way to balance security with sustainability with respect to outdoor lighting is to strategically install outdoor lighting only in those locations that require it. Depending upon the unique characteristics of the property, it might be more practical to only provide outdoor lighting in particular locations, such as dedicated after-hours parking areas and common pathways defined by landscaping and signage. In this way, security is provided without using more lighting than necessary. Though not the subject of this book, it is important to note that organizational policies, procedures, and operating protocols can also play an important role in energy conservation.

Advancements in lighting technology provide another outdoor lighting solution. Rather than using lights that provide a constant level of illumination, designers can now use variable intensity lighting systems, such as light emitting diode (LED) lights that can be adjusted according to the amount of ambient light in order to achieve the level of lighting selected by the user via a sensor-control system. If, for example, the moon is shining brightly, the LED lights will not illuminate as much as they will when there is complete cloud cover. Under both circumstances, the same amount of outdoor lighting is maintained; the LED lights provide just enough complementary illumination to the natural light in order to achieve the desired level. In this way, outdoor lighting is maintained (which is optimal for security purposes), but light pollution and the amount of energy used is reduced (which increases sustainability).

Solutions to the outdoor lighting dilemma can also be found through intelligent lighting control. In other words, the amount of outdoor lighting can be controlled and adjusted intelligently, rather than providing a constant level of lighting when it may not be necessary. An example of this was illustrated in the case of variable intensity lighting: In this case, light sensors (such as photoelectric cells) are used to control the amount of illumination based upon ambient lighting. These cells detect the amount of natural light and adjust illumination accordingly. Another type of control that is increasingly being used is motion detection: Lights remain off (or at a minimum default setting, depending upon the user's preference) unless activated by motion. Unlike the photoelectric cells, which provide light in degrees depending upon the amount of natural light, motion detection control lighting is either off or on. This is an excellent way of conserving energy and reducing light pollution. However, energy can be wasted when incidental motions – such as trees moving in the wind or animals running by – activate the lights. In addition, many existing lighting systems (such as metal-halide) are incapable of supporting such an approach because they require significant warm-up time (up to 20 minutes) before lighting up.

Finally, cutting-edge innovations in video analytics may provide a new form of intelligent lighting control that not only maximizes both security and sustainability, but also integrates them. This technology is currently used to detect the presence and track the movement of people and other objects of interest (e.g., cars) and distinguish them from other objects (e.g., animals). Advancements in security camera technology may make it possible for these video analytics to control lighting. Security cameras with video analytic capabilities can theoretically be used to detect the amount of natural light around the camera and then increase or decrease the level of outdoor lighting so that the desired lighting level is achieved. In this way, appropriate lighting would be ensured *in the areas where the security cameras are aimed*, thus maximizing surveillance while at the same time minimizing the amount of energy used.

Section Five: Indoor Lighting

Security Concerns

As discussed in the previous section, lighting tends to serve as a deterrent to crime. This principle applies indoors as well as outdoors. Minimum levels of artificial lighting are often required indoors for safety purposes as well, even after regular business hours when the building may be closed. Safety codes, which vary from state to state, require a minimum amount of light to be maintained indoors at all times. For example, the National Fire Protection Agency (NFPA) 101 Life Safety Code, the Unified Building Code (UBC), and the International Building Code (IBC) all call for a minimum lighting level along egress pathways. While the requirements of these codes may sometimes conflict, they all call for about 1 footcandle of illumination (i.e., about enough light for an average person to read newspaper print) measured at floor level at all points along an emergency egress pathway (e.g., stairs, hallways, and exits).[13]

With respect to natural lighting, guidelines for the design of government and other specific types of buildings call for minimizing fenestration (the percentage of openings versus solid walls) in order to provide blast protection and ballistic protection. In most explosive attacks against buildings, the vast majority of casualties result not from collapse, but from flying glass and debris. Furthermore, security can be compromised by the use of ground- and low-level windows, which can act as points of illegal entry into the building. Therefore, security can be improved by minimizing the number of openings, particularly at the building's lower levels.

Sustainability Concerns

Sustainability initiatives call for "daylighting" — maximizing the amount of natural (e.g., outdoor and ambient) light available within a building through the use of as many windows as possible. The use of natural light reduces, and can even eliminate, the costs of electric lighting and conserves energy. It also boosts employee morale and reduces

13 Lane, K. (October 1, 2007). Exterior egress lighting requirements: Working through the code maze. Lane Coburn & Associates, LLC. Retrieved January 21, 2009 from *http://ecmweb.com/mag/electric_exterior_egress_lighting/*.

depression.[14] "By providing a direct link to the dynamic and perpetually evolving patterns of outdoor illumination, daylighting helps create a visually stimulating and productive environment for building occupants, while reducing as much as one-third of total building energy costs."[15]

Security versus Sustainability

The above security and sustainability issues conflict with each other: Security and safety call for constant lighting and minimal windows, while sustainability calls for minimal indoor lighting in order to conserve energy and maximal use of windows.

Solutions

One solution for integrating security and sustainability for indoor lighting is the use of intelligent lighting controls, which make it possible to use indoor lighting more efficiently. A common method of control is occupancy sensing. With this type of control, indoor lights are off unless the light sensors detect motion indicating that the room is occupied, in which case the lights are activated. Another type of control is scheduling, in which the user specifies when the lights should be off and on according to a pre-set schedule. Lighting can also be controlled according to how much daylight is in the room. For example, Rensselaer Polytechnic Institute has developed a new lighting control system, called DaySwitch, which turns electric lights off when there is sufficient daylight to illuminate a particular space.[16] In each of these cases, lights are either off or on, depending upon occupancy, scheduling, or the amount of daylight in the room. Through the use of intelligent controls, safety and security are maintained while using only the minimal amount of energy.

As with outdoor lighting, variable intensity lighting can also provide an innovative solution for maximizing security and sustainability with indoor lighting. This new technology allows the indoor lights to adjust according to how much natural light is in the room so that the same constant level of light is maintained. In other words, the lighting is reduced when the amount of natural light coming in through the windows is high. In this way, daylight is utilized to reduce energy consumption. Thus, rather than being simply on or off, the lighting level can vary depending upon the amount of daylight.

Security and sustainability can also be improved through integrative enhancements to existing systems. For example, as with outdoor lighting, existing security cameras can be used to detect the amount of light in a room, as well as the presence of a person, and adjust the lights accordingly. This ensures that the area targeted by the security cameras will always be sufficiently lit.

In addition, sustainability and security can be maximally achieved through a cutting-edge innovation involving the integration of indoor lighting with access control systems. Through such integration, indoor lighting can be used intelligently according to who, exactly, is in the building. For example, when the access control system senses that an employee of the building is entering, it may light that employee's work space to full lighting level. However, when it senses that security personnel are entering the building or area, such as during a routine patrol, the lighting may remain at the minimal level. Keeping the lights at a low level is ideal for the security guard, who would not want his/her presence announced to an intruder through light activation. In addition, since the security guard will likely walk throughout the entire building and not remain in any single location for a prolonged period of time, lighting up any one specific area would be an inefficient use of energy.

14 Adams, A. (2004). Employers must take on some responsibility for employees' health in order to prevent obesity and chronic disease. *NaturalNews*. Retrieved January 13, 2009 from *http://www.naturalnews.com/001584.html*.

15 Ander, G. D. (2008). *Daylighting*. National Institute of Building Sciences. Retrieved January 13, 2009 from *http://www.wbdg.org/resources/daylighting.php*.

16 Energy Studies in Buildings Laboratory (2006). *Field test shade control and DaySwitch: Final report on DaySwitch demonstration project*. University of Oregon.

Section Six:
Heating, Ventilation, and Air Conditioning

Security Concerns

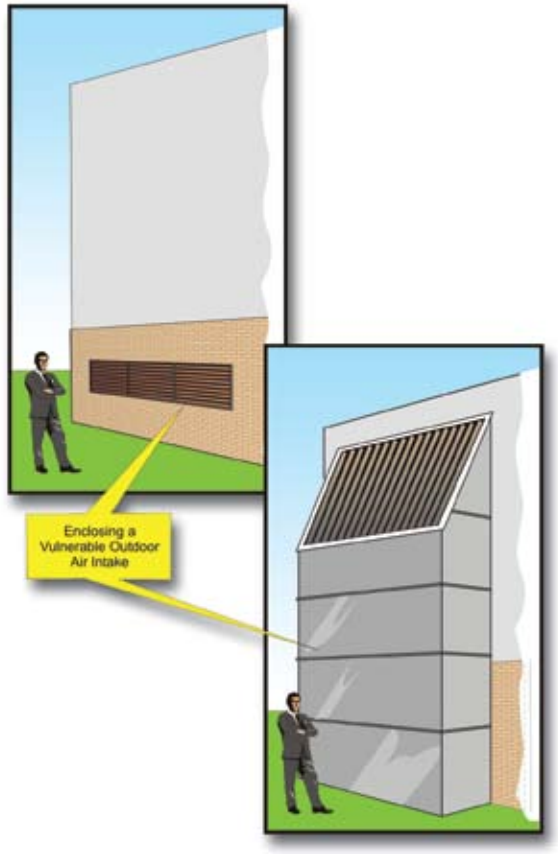
A major security concern with respect to air quality within buildings is potential air contamination due to infiltration of outside pollutants or toxins. Therefore, one goal of security is to prevent the flow of contaminated air into a building. The level of risk posed by outdoor air contamination should be assessed on a case by case basis, taking into account the type of building, who will be occupying it, and its location. This type of security is more of a concern for government buildings than for commercial buildings. Security also calls for all ground- and low-level windows to be inoperable in order to prevent physical intrusion into the building.

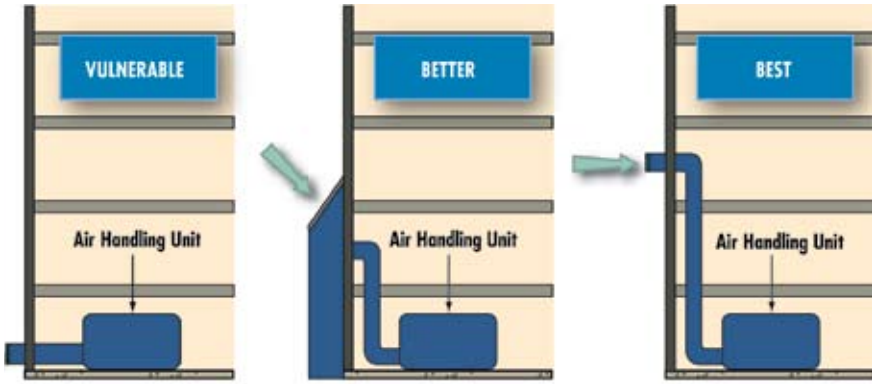
Sustainability Concerns

Sustainability calls for energy conservation by maximizing natural ventilation brought into a building from outdoors. The simplest way to achieve this is for natural air to be brought into the building through open windows and circulated with fans. This is preferable to relying solely upon manufactured ventilation produced within the building through its heating, ventilation, and air conditioning (HVAC) systems, which consume a great deal of energy. In addition, as with daylighting, natural air — which improves air quality by reducing bacteria and mold — is believed to be better for employee morale and mental health than recirculated air.[17]

Security versus Sustainability

Security and sustainability are at odds with each other with respect to HVAC: Security calls for windows to be sealed shut in order to prevent air contamination and physical intrusion, while sustainability calls for windows to be left open in order to allow natural ventilation throughout the building. Another point of conflict between security and sustainability concerns High Efficiency Particulate Air (HEPA) filtration, which is a means of purifying the air in a building in response to a chemical, biological,





Source: CDC/NIOSH (May 2002), publication no. 2002-139, *Guidance for protecting building environments from airborne chemical, biological, or radiological attacks*.

17 M Moser Associates (August 2008). *The business case for sustainable workspace design*. Retrieved January 13, 2009 from *http://www.mmoser.com/2_articles/Sustainable_workspace_design.pdf*.

radioactive, or explosive (CBRE) attack. This security measure consumes a great deal of energy, and is therefore at odds with sustainability.

Solutions

Primary air intakes installed high up on the building provide fresher air and also provide natural protection in the event of an exterior chemical-biological attack. Air intakes that are at or near ground level should not be horizontal (such as grating over a sidewalk) or have a shallow slope, as this would allow a small contaminant to be thrown on top. As with lighting, both security and sustainability for HVAC can be maximized through the use of intelligent controls. With occupancy sensing, HVAC systems will only be activated when there is movement in the room, indicating that a person is present. In this way, energy is conserved by deactivating the HVAC systems when no one is in the particular room or floor of the building. And, as with lighting, scheduling can be used to pre-determine when HVAC systems will be on and off.

Further solutions can be found in enhancements through integration. For example, as with lighting, security camera video analytics can be used to detect unwanted activity located near a building's air intake vents. Outdoor contamination, such as toxic fumes from an idling truck, can enter a building through these vents. In addition, these vents can be maliciously tampered with if a person were to approach them from the outside and release a toxin into the ventilation system. Security cameras aimed at the vents could use video analytics not only to detect the presence of a person near the vents, but also the presence of heat plumes (as from a nearby idling truck). However, only thermal cameras can be used in this way, and these are highly expensive and consume a large amount of energy. Therefore, these cameras should not be deployed for this purpose alone. However, if they are already deployed — as they often are at high-security sites such as some government, infrastructure and transportation facilities — they can be put to use for this additional function. This would enable security personnel viewing the thermal camera video to respond immediately and appropriately. The video can also be displayed in other locations through the use of modern IP-based video management systems; for example, the building engineer might be given access to the thermal cameras in order to survey a facility for thermal plumes, as these are signs of heat/energy losses. In addition, thermal cameras could be integrated with the building automation system (BAS) so that the vents could be automatically shut when such threats are detected.

Integration of HVAC with access control systems can also be used as an innovative solution to maximize security and sustainability. In this way, HVAC can be used intelligently according to who, exactly, is in the building. If the access control system senses that an employee of the building is entering, it can activate the HVAC systems in that employee's work space. However, if it senses that a member of the security team (or housekeeping, maintenance, etc.) is entering the building or area, the HVAC systems will remain off, since there is no need to activate these systems for a security guard as he/she sweeps the building without remaining in any one particular area for long periods of time.

Section Seven: Exterior Envelope

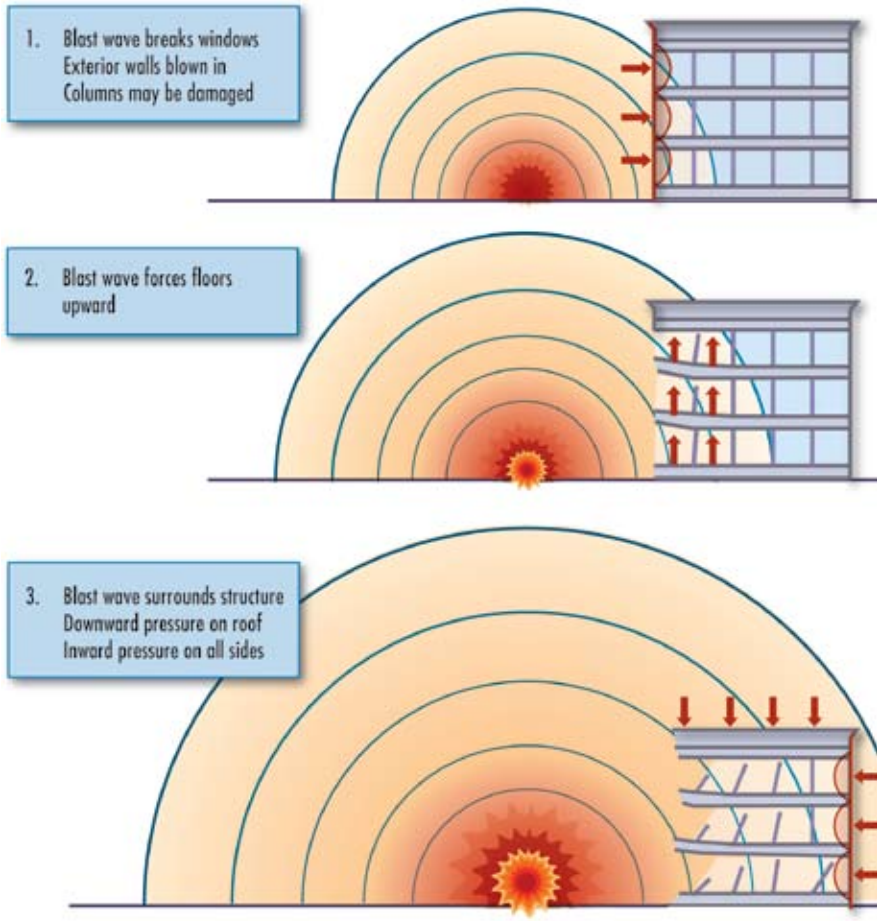
Security Concerns

Security's greatest concern regarding a building's structure is that it be able to withstand a blast, such as from an explosion. The primary structural concern is to prevent progressive collapse of the building. Beyond this, the blast that enters the building can cause enormous destruction and injuries even if the building remains standing. These concerns are addressed first and foremost by providing adequate "stand-off" distances
(i.e., the distance at which a protective perimeter around a building is defined in order to limit the approach of a postulated blast threat), structural design, exterior envelope design, or (most commonly) a combination of these elements.

Sustainability Concerns

Sustainability calls for energy conservation through the use of heat reservoirs in cooler climates, and through barriers that provide heat deflection in warm climates. In the former case, walls or other structures built around the perimeter of a building can be used to absorb heat during the day, thereby insulating warmer air around the building and providing heat during the night. In the latter case, barriers around the building can provide shading from the sun, thereby reducing the amount of energy consumed in cooling the building from within.

In addition, sustainability calls for minimal disruption to the environment. Ideally, a building's structure should blend in with its environment and incorporate the environment wherever possible, rather than destroying or altering the environment and its inhabitants. Therefore, sustainability generally frowns upon the creation of "heat islands" – areas or surfaces that absorb solar radiation rather than reflecting it, thereby raising the surrounding air temperature and increasing the need for air conditioning.[18] Increased temperature due to heat islands also increases smog production and reduces air quality.[19] Heat islands can be created whenever there are large areas of pavement, such as parking lots. Sustainability is also concerned with water run-off due to a building's inability to absorb natural precipitation, as this displaces large amounts of water and affects the environment.



Source: Naval Facilities Engineering Service Center (May 1998), *User's guide on protection against terrorist vehicle bombs*.

18 Portland Cement Association (2009). *Heat island reduction*. Retrieved January 13, 2009 from *http://www.concretethinker.com/Papers.aspx?DocId=29*.

19 Environmental Protection Agency (2008). Heat island. In C. J. Cleveland (Ed.), *Encyclopedia of Earth*. Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment). Retrieved January 13, 2009 from *http://www.eoearth.org/article/Heat_island*.

Security and/vs. Sustainability

In many ways, the concerns of security and sustainability regarding the exterior envelope are aligned with each other. Both call for an energy reflecting and/or absorbing exterior envelope in order to conserve energy and provide blast mitigation. However, security and sustainability are at odds with each other with respect to heat islands. For example, sustainability would be maximized by placing a building's parking garage underneath the building, rather than creating a heat island in the form of an outdoor parking lot. Security, however, would view the placement of a parking garage beneath a building as a serious threat, as a truck bomb parked beneath the building could do far more damage than one located outside the building. For this reason, security would call for parking garages and parking lots to be located external to the building.

Solutions

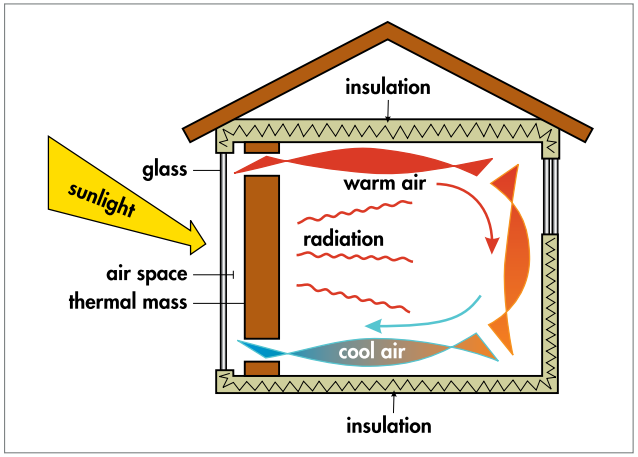
Many solutions can be found that will maximize both security and sustainability. For instance, thermal mass walls, also known as Trombe walls, can be used to provide a building with both blast mitigation and heat insulation.

> *A typical Trombe wall consists of an 8- to 16-inch thick masonry, stone, adobe, or concrete wall coated with a dark, heat-absorbing material and faced with a single or double layer of glass. The glass is placed from about 3/4" to 6" away from the wall to create a small airspace. Heat from sunlight passing through the glass is absorbed by the dark surface and stored in the wall. As it cools gradually during the night, it slowly releases its stored heat indirectly into the space.*[20]

Not only do Trombe walls reduce energy consumption, but by acting as a barrier around the building they also provide blast protection. Rainwater

Trombe Wall

Source: NREL's Solar Energy Research Facility—Golden, CO; Courtesy: DOE/NREL-Credit: Warren Gretz.



Trombe Wall Diagram

Source: California Energy Commission, Consumer Energy Center, *http://www.consumerenergycenter.org/home/construction/solardesign/indirect.html.*

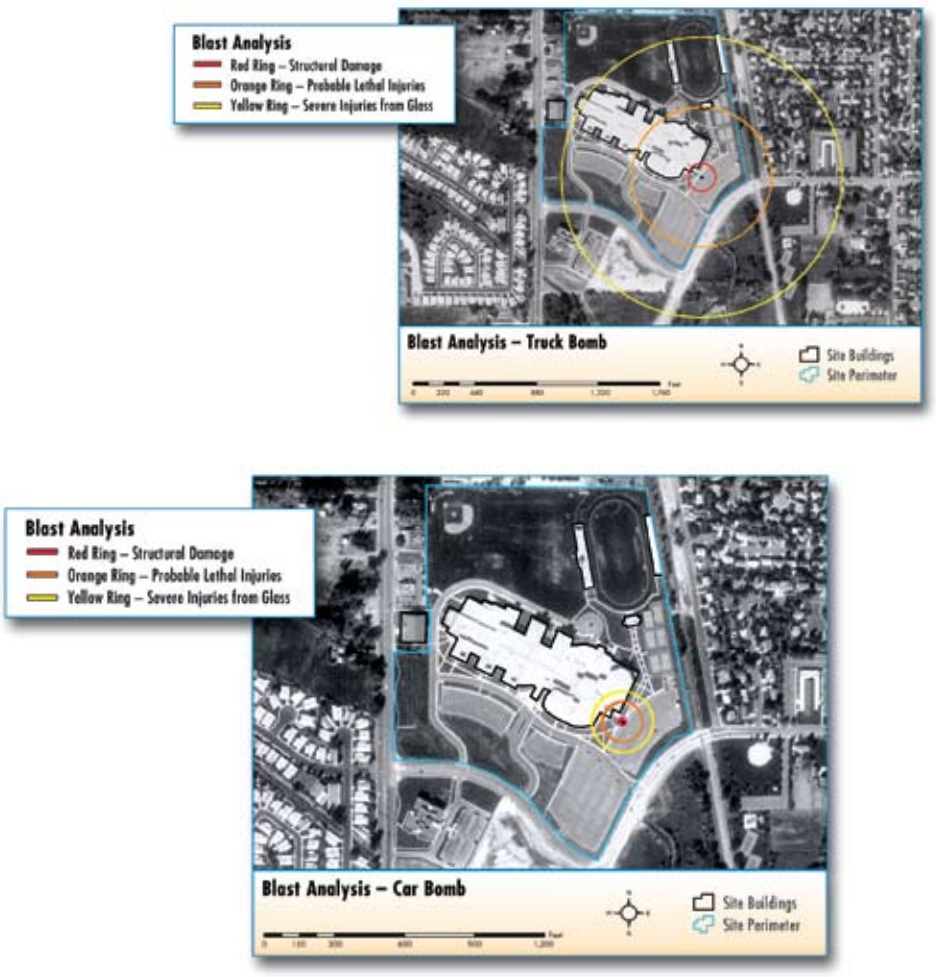
20 Paradis, R. & Tran, B. (2008). *Balancing security/safety and sustainability objectives*. National Institute of Building Sciences. Retrieved January 13, 2009 from *http://www.wbdg.org/resources/balancing_objectives.php*.

reservoirs used for energy conservation can also provide blast mitigation, essentially acting as moats protecting the perimeter of a building.

Green vegetative walls or water walls, partially buried structures, as well as buildings with roof gardens, are also aligned with both security and sustainability goals. Earth is highly beneficial for providing blast mitigation because of its mass. Furthermore, vegetative or water walls can disguise unattractive blast walls without windows.

Poured-in-place reinforced concrete structures and facades that are constructed using local aggregate provide mass and ductility that can provide excellent blast resistance. Concrete compositions that include slag enhance sustainability and increase concrete strength. Sandwich wall products that have reinforced concrete on the outer faces and an energy absorbing center also provide blast resistance and absorption properties. Steel does not have the mass, but it does have ductility and recycled content properties that are desirable for meeting both blast resistance and sustainability goals.

As mentioned earlier, parking garages are a source of contention between security and sustainability. In order to minimize disruption to the environment and avoid the creation of heat islands, sustainability would call for a parking garage to be located underneath a building. However, this creates a threat to security in that a truck bomb that can gain access to this garage will be far more destructive than if such a bomb were restricted to the building's exterior. One solution to this conflict is the use of vehicular access management, which can be used to control exactly which types of vehicles are allowed access to a below-ground parking garage. For instance, given the fact that a truck bomb would be far more devastating than a car bomb, the garage could be designed with low ceilings so that cars can gain access but trucks cannot. Vehicular access management can also be achieved through controlling the size of parking spaces (i.e., only placing smaller parking spaces close to the building, and larger parking spaces further away) and signage. Thus, by carefully managing the types of vehicles allowed in vulnerable areas, sustainability goals can be achieved while minimizing security risk.



Source: FEMA (2003). *Reference Manual to Mitigate Potential Terrorist Attacks against Buildings*.

An additional structural solution is glazing, which involves the placement of a heat-reflecting laminate over a building's glass windows. There are particular types of laminates that not only deflect heat from the building, thereby lowering the amount of energy needed for cooling, but that can also mitigate blast by providing extra structural support to the windows and by holding the shards of glass together to reduce injuries. Double- or even triple-paned windows provide energy conservation and acoustical benefits, as well as blast mitigation if properly designed.

Using larger windows, and many of them, will enhance daylighting (as discussed in Section Five) as well as provide the most blast protection. This is particularly true if they are placed on 1) the upper floor levels, 2) the sides of the building furthest from the perimeter and on site roads, and 3) interior courtyards or atriums. Orienting the building such that stand-off is maximized on the sides that have the most light and warmth and reduced on the sides that are cooler helps to align sustainability and security.

Window surfaces should be inset so that they are oriented perpendicular to the perimeter, as this provides indirect lighting and also reduces the blast loading on the window. If skylights are used, providing a taut catchment system beneath these products has been shown to both mitigate blast injuries and to enhance energy conservation.

Light shelves are preferred over sunshades because sunshades tend to become flying debris. If sunshades are used, it is advisable to use as light a material as possible, such as recycled aluminum or sustainable wood products. Also, it is helpful to provide connections into the building that are able to hold the sunshade in place up to the ultimate load capacity of the sunshade element. This serves to limit flying debris by preventing the entire sunshade from becoming a projectile.

Section Eight: Landscaping

Security Concerns

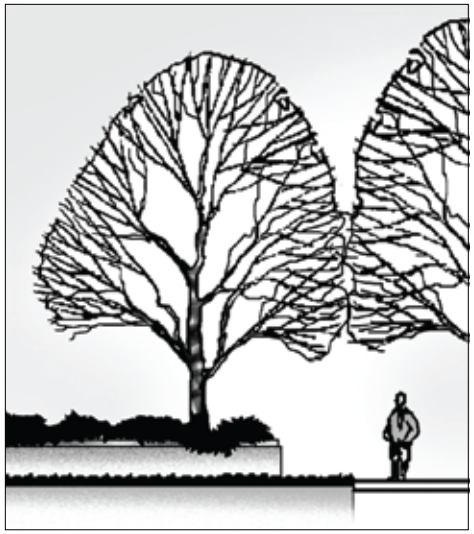
Landscaping can best be used to increase security through the use of Crime Prevention Through Environmental Design (CPTED) techniques. CPTED is "a strategy that uses natural access control, natural surveillance, and territoriality and boundary definition to reduce the opportunities and fear of predatory stranger to stranger crime and improve the quality of life."[21] For example, natural vegetation and other natural elements of the landscape, as well as signage and lighting, can be used to direct foot traffic in particular paths (wayfinding). Security also calls for the strategic placement of vegetation so that it does not block security cameras and/or visibility of critical assets and areas. And, as with structural concerns, security also calls for blast mitigation through the use of landscaping, such as using trees as additional protective barriers around the building to keep vehicles away from the building (i.e., maintaining a stand-off distance). Trees used for this purpose are generally located in concrete planters or other engineered landscape features.

Sustainability Concerns

As discussed in the previous section, sustainability calls for minimal disruption to the environment. Therefore, the more vegetation left in place around the building, the better. The building should ideally be an extension of the environment around it. Therefore, heat islands should be eliminated, not only because they increase air temperature due to heat absorption, but also because they are disruptive to the natural landscape. Landscaping can also be used to conserve energy. For example, trees can be used to provide natural shading of buildings in warm climates, thereby reducing the amount of energy needed to keep the building cool.

Security vs. Sustainability

While sustainability calls for maximal vegetation and natural landscaping, security requires vegetation and other aspects of the landscape to be strategically arranged in order to achieve blast mitigation and crime prevention through protective wayfinding and unobstructed fields of view (camera or human).



Source: National Capital Planning Commission (October 2002). *National Capital Urban Design and Security Plan.*

21 Paradis & Tran (2008).

Solutions

Security and sustainability can both be achieved through the use of variable grading, which is when a building's structure is designed to accommodate the natural contours of the land, rather than razing the land in order to create a flat foundation. By erecting a building within the natural landscape, not only is the environment preserved, but hills can actually provide blast mitigation and prevent vehicles from being able to ram into the building.

Another solution involves the strategic use of vegetation. For example, the strategic placement of high-canopy trees in particular locations can be optimal for security purposes, for these trees can be used to shade the building from sunlight without blocking the sightlines of security cameras, which can be placed below the trees' canopies. Furthermore, existing trees on the site with at least an 8-inch diameter may be used to resist vehicle ramming. A small grove of closely spaced trees would be ideal for protecting the building. Another idea which was popular for centuries is to use a native plant that has thorns to deter pedestrian intrusions. This is a solution that historically has been used along property lines along country roads for discouraging trespassing. Vegetation solutions may also be integrated with seating, statues, and retaining walls to create a park-like setting.

Similarly, trees and water features can be used for the purposes of wayfinding. Meandering foot paths, which may follow the natural height variations of the environment surrounding the building, can also be used to deter vehicles from getting close to the building.

Water features can also increase both sustainability and security. Storm retention ponds and preserved wetlands on the site provide excellent vehicle intrusion devices. Monumental fountains, used for centuries in Mediterranean countries, provide natural cooling on hot days as well as vehicle impact protection. Another Mediterranean concept is the use of solid walls on the outside of the building to provide security and insulation. Furthermore, a garden using native vegetation in an interior courtyard can be used by those who work or live in the building.

Retaining Wall

Source: Eve Hinman, Hinman Consulting Engineers.

While trees can potentially be problematic around the perimeter of a building because they may obscure the view of video cameras placed outside, they can also be used to camouflage security devices. While today's cameras are already difficult to spot because they are very small and unobtrusive, camera manufacturers can make them even less detectable by creating silk-screen camera housings in any number of colors and patterns so that the camera blends in with the environment.

Other ideas include installing large, low planters. These may be used as seating, but they can also be designed to serve as "truck traps." This means that a truck becomes trapped when either the front wheels mount the planter but then sink into the soft soil or the truck's undercarriage gets trapped on the planter itself, preventing it from continuing forward.

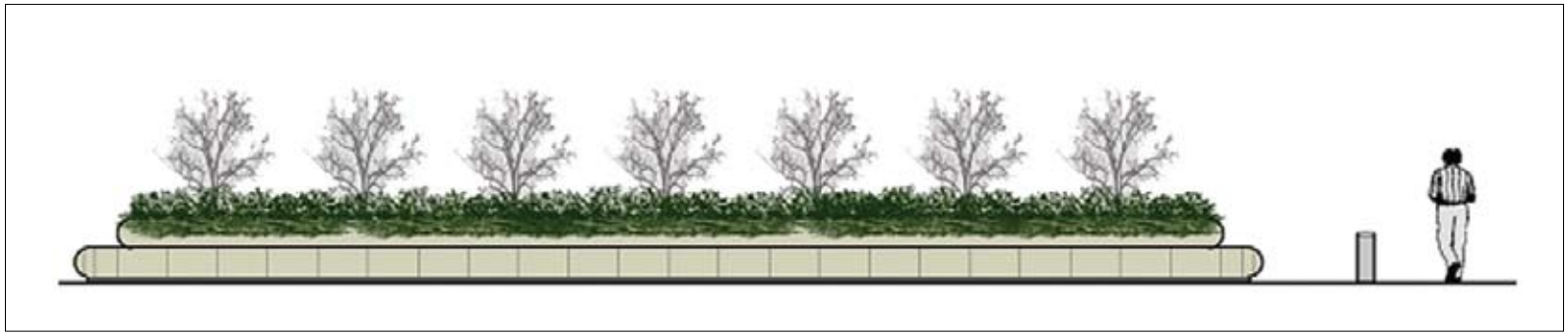
Another possibility is to provide a dry or wet moat around the building. Pedestrians can be given access to a bridge over the moat. The bridge should be designed such that it is sturdy enough for pedestrians but will fail if a vehicle attempts to traverse it. Furthermore, a dry moat permits a submerged public plaza to provide a pleasant refuge from a bustling city just beyond.

If vehicles are permitted on site, a winding path that does not have straight-on access is recommended for security. Placing a pond strategically at the turning points is recommended, as this further deters high-velocity impact.

Consistent with both sustainable and security goals, parking lots and parking garages should be eliminated or minimized in order to encourage the use of public transit. Van transport may be provided if the building is not within

walking distance from a bus or train station, and this also provides greater ability to control the vehicles on site. Bike paths adjacent to the property provide additional setback, and bike racks provide an additional obstacle that must be traversed in order for a vehicle to impact the building.

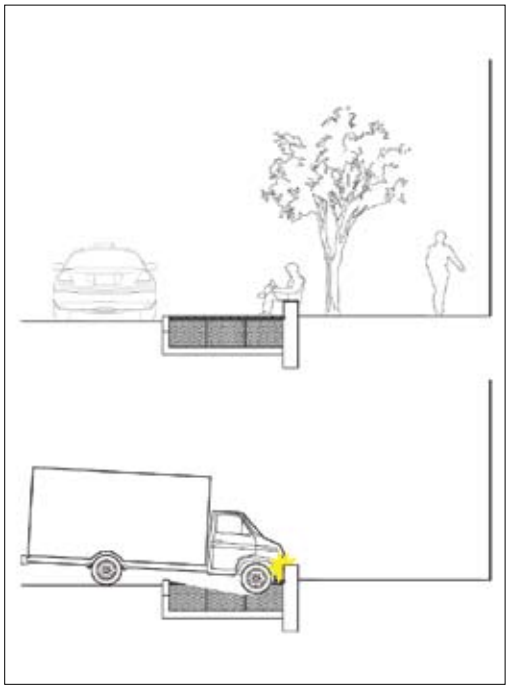
Placing public lobbies within a separate glass pavilion outside the building can permit both nature and light to enter while providing a more efficient way of insulating the interior spaces. This also provides enhanced security to the people inside the building.



Source: National Capital Planning Commission (October 2002).
National Capital Urban Design and Security Plan.

Real-Life Illustration

New York City-based Rogers Marvel Architects and Rock Twelve Security Architecture have developed an innovative CPTED solution called the "Tiger Trap." This consists of material underneath the surface of the exterior of the facility that is designed to support the weight of pedestrians and small items that are common to public spaces such as bikes and carts; however, the material will collapse if subjected to the weight of a vehicle. The material's collapse causes vehicles to stop abruptly, thus preventing them from hitting the facility. ARM has plans to deploy this system around the perimeter of a tall building in an urban environment. This solution will increase the stand-off distance to safe levels without having to use bollards, planters or walls.



Tiger Trap
Source: Rogers Marvel Architects, PLLC & Rock Twelve Security Architecture.

Section Nine: Additional Benefits

An additional benefit of integrating sustainability with security can be found in occupancy sensing for emergency response. The same occupancy sensing technology used to conserve energy can, when integrated with security cameras using advanced video analytics, be used to direct emergency responders to the right location in the event of a fire or medical emergency. Not only will this reduce the response time, thereby increasing the chance that the victim will receive assistance as quickly as possible, but it also increases the safety of the responders themselves, who will not need to go searching through dangerous areas (as in the case of a fire) in order to find the person in need.

The usefulness of such technology can be illustrated with a theoretical scenario:

Theoretical Scenario: Fire at Building Alpha

Background

Building Alpha is part of a large suburban, multi-building pharmaceutical company's corporate campus located on the outskirts of Boston, MA. Building Alpha is a modern biomedical research facility housing both administrative and clinical laboratory spaces. Clinical research activities include the use of various biological select agents, such as anthrax, botulism, and tularemia. As is common in such facilities, the building also contains several irradiators used for sterilization of biological samples. These devices employ highly radioactive source materials consisting of Cesium-137 to effectively kill any and all pathogens that are exposed to them. A number of hazardous chemicals used in biomedical research are also stored and handled in the building.

Green

Sustainability was an important component of Building Alpha's design process. As such, the facility is equipped with advanced energy management and building automation systems in addition to an integrated security management system. Information is exchanged among the security management, energy management, and building automation systems for the purpose of controlling lighting, HVAC, and other building systems in order to conserve energy. As in most biotech facilities, scientific research takes place at often unpredictable hours. Therefore, sensors connected to the building automation system are used to determine if various spaces within the building are occupied at any given time and thus require operation of lighting and HVAC systems. The exchange of occupancy information with the security management system is used to determine the classification of persons present in these spaces. Therefore, the energy management system has the ability to distinguish between individual occupants in order to provide services that are uniquely tailored to the needs of their particular classifications.

FIRE!

At approximately 3:00 AM on Sunday morning, the corporate control center located in the center of the campus receives a fire alarm signal from Building Alpha. The fire department, on-duty facilities engineer, and corporate security personnel are quickly notified and dispatched to the scene. The fire alarm system indicates the presence of smoke on the fourth floor of the eight-story building. The fourth floor houses the majority of the biological sample storage units, as well as the irradiation equipment. Upon arrival, the fire department discovers that chemicals contained inside a biological fume hood have ignited a fire that has spread through a significant portion of the building's exhaust ductwork, out of reach of the building's automatic fire sprinkler system. The chemical fire has produced toxic smoke clouds that have infiltrated the building's HVAC system and have been dispersed throughout the facility.

Biological and radiological contamination

No one is certain if the building was occupied when the fire started. There are no indications of any persons trapped within the building.

The building's automatic sprinkler system is effectively suppressing any flames that have escaped from the exhaust ductwork, and therefore, the damage has been well contained. Nevertheless, there is concern that the automatic sprinkler system water has infiltrated several biological storage units and irradiation units, possibly spreading biological and radiological contaminants throughout lower floors. Due to the highly toxic nature of the smoke from the chemical fire and the risk of hazardous material contamination, the Fire Chief on site is initially inclined to allow the chemicals to burn themselves out prior to sending his firefighters into the building. The Chief calls for specialized HAZMAT units to respond from Boston. These are expected to arrive on scene within one hour, and should be ready to enter the building within ninety minutes.

Someone's trapped in the building

At approximately 3:20 AM, while still waiting for HAZMAT to arrive, the corporate control center operator receives a panicked phone call from a man on a cell phone who reports that he is trapped somewhere in Building Alpha. He is disoriented, and barely able to breathe. The man reports that he has been unable to locate the exit because his vision is impaired by the toxic smoke, and that he cannot tell what room he is in. The control center operator quickly informs the Fire Chief of this development. Though risky, the Fire Chief begins to assemble a team of firefighters to search the building so that they can locate and rescue the man.

Rescue

While the firefighters prepare to enter the facility, the control center operator suddenly notices that the building automation system has initiated a new lighting zone occupancy sequence in the Northwest quadrant of second floor of Building Alpha. This area of the building is fairly remote from the previously identified fire location. He immediately informs the Fire Chief of this development. Upon receiving this information, the Fire Chief directs the firefighters to enter the facility through the Northwest stairwell, and to go directly to the second floor to initiate their search. Following these directions, the firefighters quickly locate the unconscious man, whom they rescue in short order. The man is transported to a nearby hospital, where he is treated for toxic smoke inhalation and makes a full recovery.

Morals of the story

In the after-action review, it was noted that the following were of tremendous benefit in saving the victim's life and prevented complete destruction of the building:

- Security was effectively designed and integrated with energy management and building automation systems, including lighting, HVAC, and occupancy sensing systems.
- Complementary aspects of the sustainability and security efforts allowed for effective energy management, biohazard containment, and emergency response.
- Personnel were adequately trained on using the building automation systems and the security systems.
- Systems integration significantly reduced the risk to emergency response personnel and saved the life of the individual in peril.
- Sustainability and security joined forces and prevailed over evil.
- "It's a good thing security was designed into such a beautiful and environmentally friendly building," said the rescued man from his hospital bed.

Section Ten: Systems Integration

Given that both security and sustainability provide important benefits to building occupants and building owners, and that the two can sometimes be at odds with each other, it is critical to develop efficient and cost-effective implementations of each. Upfront planning is often the key to meeting this goal.

Many of the solutions presented in this book involve technology. This technology is commonly provided by different systems. The process of connecting these different systems to provide solutions is referred to as systems integration – and it's through this integration that cost-effective, valuable solutions are created.

Systems integration can be done several ways. One way is to "hard-wire" inputs and outputs from the different systems. This is a fine, and cost-effective, way to integrate a small number of data points and in the past, this was sometimes the only option. But when large amounts of data need to be integrated, hard-wiring can be costly and inflexible. An interchange of data via a communications protocol may be a more cost-effective solution in this case. In the 1990s, when microprocessor-based controls were becoming popular, it seemed like every manufacturer had their own communication protocol. This was a step ahead of hard-wiring all the points, but it required implementation by someone with a *thorough* knowledge of both systems and the communication methods associated with each. These days, many systems have adopted the use of *open standards* — standards that are publicly available and that are often developed and maintained by a committee of interested parties. Using open standards can provide a means to integrate cost-effectively. Common building automation open standards that make integration easier include BACnet, Modbus, LON and OPC Server.

BACnet, the open standard promoted by the American Society of Heating and Refrigeration and Air Conditioning Engineers (ASHRAE), is working toward the creation of open standards for the security industry.

Although not a building automation standard, another protocol that has facilitated integration is TCP/IP, the internet protocol. It has become rare to find building devices and systems that cannot communicate via TCP/IP. A device may not necessarily have an internal TCP/IP interface, but it most likely can be connected to another device (such as an Ethernet gateway) that allows the data from the device to be sent via TCP/IP. This, however, does not mean that all the legwork to integrate systems is done – but it often opens up a path to that integration that may avoid costs and complications that were common just a few years ago.

So what does all this mean to the building owner and/or building operator? It means that technology available today can be used to easily integrate security and many of the other technologies that monitor and control a building's energy consumption. In addition, there are building automation systems on the market today that don't need to integrate security and energy management because the two are *natively* part of the same system.

The applications most often integrated into a single system are access control/security camera systems and lighting control/energy management/HVAC controls. A single system that natively integrates these applications can be very cost-effective and comprehensive. First, being *one* system eliminates some of the coordination required to integrate different systems. Second, it means a single interface can be used for all system operators. Third, it reduces workstation hardware costs. Fourth, it requires training on just one system — this is a very important benefit that is often underestimated. The more your daily operators (whether in-house or outsourced) are informed about the system(s) with which they work, the better your building will run. Selecting a system where the manufacturer's training philosophy encourages complete system knowledge for the building operator will make that building run more efficiently. If you solely rely on contractors who only visit your building when it is time for preventive maintenance or in reaction to a problem, it is more likely that both security and sustainability will be reduced over time. The automation systems may

run the building, but ultimately it is still people who run the automation systems. And the more knowledgeable those people are, the better the building will run and the higher the return on investment of the systems.

One of the solutions discussed earlier in this book involved using security cameras with video analytic capabilities to measure and control light levels. How would this be done? The security camera system components would typically be produced by one manufacturer and the lighting control system components would typically be produced by a different manufacturer. Each system would likely be installed by different companies. The common link here would most likely be TCP/IP, as each system would run on it. The video analytics camera system would probably be set up by the security contractor and the lighting control would be part of the building automation system (BAS). The key is that each system has a database that is linked together over TCP/IP, and in this way they can interact with each other.

For example, a camera on the system can monitor activity in its field of view (note that it is the camera doing this task — not a person). When it determines that there is a potential threat, the camera not only notifies security personnel via an alarm, but it also triggers an event in the lighting control portion of the BAS that increases the light level in the specific location where activity was detected. When the alarm is cleared in the camera system another event is triggered in the BAS to return the lighting to its pre-alarm level. This provides greater energy savings than a simple motion sensor controlling the lighting because it uses the intelligence of the video analytics to increase the lighting only during a threat. This is also “greener” in the sense that light levels can be reduced during non-threat periods (thereby reducing light pollution and increasing energy conservation). This strategy could be used for both indoor and outdoor lighting.

This is just one example of integrating security and building automation in order to meet the needs of both security and sustainability. The important thing to remember is that the technology is available today to accomplish this type of synergy and it can be particularly cost-effective if done early in the building design stages.

Section 11: Packing Material

In our research, we have found that most security system equipment manufacturers are concerned with preserving the environment and have made efforts to recycle old equipment and reduce packaging requirements. Some manufacturers and suppliers of security equipment will pre-fabricate security systems such as cameras, rack, servers and other equipment. This has been proven to reduce the amount of boxes and packaging material that is delivered to construction sites. For large projects, the weight difference between the original packaging materials for all components compared to the weight of the pre-fabricated shipping materials can be significant and can add to points to the Materials and Resources Category for LEED Certification.

Obtaining LEED certification credits can be difficult, so every pound of waste that is saved should be measured. When security is involved early in the design process, waste reduction ideas such as pre-fabrication of equipment can be written into specification documents and construction contracts. Pre-fabrication can also reduce labor costs and improve the overall quality of the installation.

Conclusion

This book has demonstrated that while there are many challenges that arise when attempting to design a building that is both secure and sustainable, there are new developments and technologies available today that make it possible to overcome these conflicts in cost-effective and efficient ways. The key is to consider both security and sustainability *from the outset of the design process*. By doing so, it becomes possible to integrate systems and achieve goals that satisfy both objectives. If, however, sustainability alone is kept in mind throughout the design process and security is simply an afterthought, the safety of the building is sure to suffer. Indeed, if a balance of sustainability and security is not sought from the beginning of the design process, it is highly unlikely that the necessary steps for establishing adequate security levels will ever be taken, resulting in greater risk for the building's owners, occupants, and the entire community. If, however, security is brought to the table with other stakeholders early on in the building's design, it becomes possible to integrate security and sustainability so that both are maximized. The risk management and sustainability solutions that can be found through such integration will benefit all the stakeholders involved.

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