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CRISP REPORT

Connecting Research in Security to Practice

From the Ground Up: Security for Tall Buildings

Dennis Challinger

ABOUT THE CRISP SERIES OF REPORTS

Connecting Research in Security to Practice (CRISP) reports provide insights into how different types of security issues can be tackled effectively. Drawing on research and evidence from around the world, each report summarizes the prevailing knowledge about a specific aspect of security, and then recommends proven approaches to counter the threat. Connecting scientific research with existing security actions helps form good practices.

Reports are written to appeal to security practitioners in different types of organizations and at different levels. Readers will inevitably adapt what is presented to meet their own requirements. They will also consider how they can integrate the recommended actions with existing or planned programs in their organizations.

This CRISP report focuses on the security of tall commercial and residential buildings. Author Dennis Challinger examines security threats, building vulnerabilities, and a variety of current responses to the challenge of tall building security. He also reports on research relating to the physical design of—and crime in—such buildings, including risks in car parks. His analysis of that research leads to numerous research-justified security recommendations. This report will help security practitioners think in a more informed way about protecting occupants, visitors, and others who use tall buildings, as well as protecting the buildings and their contents.

CRISP reports are sister publications to those produced by Community Oriented Policing Services (COPS) of the U.S. Department of Justice, which can be accessed at *www.cops.usdoj.gov.* While that series focuses on policing, this one focuses on security.

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Connecting Research in Security to Practice

An ASIS Foundation
Research Council CRISP Report

From the Ground Up: Security for Tall Buildings

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Contents

Executive Summary

As tall buildings, including high-rises, become more common, their security and the safety and security of their occupants merit attention. Tall buildings are exposed to all the normal security risks—crime, disorder, and emergencies—that threaten any street-level or campus-style building. However, the physical nature of tall buildings calls for different security emphases.

Specifically, tall buildings often house many people and much property in an environment where movement is restricted by elevators and stairways. These areas, along with lobbies and corridors, constitute considerable sections of the building where ownership is at best ambiguous. Moreover, the anonymous masses of people that move through these common areas allow offenders a fertile setting in which to operate.

Current security approaches include access control, physical security, CCTV, lighting, security officers, emergency plans, documented procedures, and security awareness efforts. Still, the relevant research suggests that crime, disorder, emergencies, and the fear thereof are continuing issues for security providers in tall buildings.

Research also points to specific security responses that may be most useful. These include situational security approaches, both physical and procedural; promotion of a sense of community within the building; and ensuring the building is well maintained.

Definitions and Issues

Tall Buildings

Many people visit tall buildings, and more and more people live in them. Persons responsible for the security of such buildings should ensure appropriate services are in place to protect occupants and their property.

In this report, a "tall building" is a multi-story structure in which most occupants depend on elevators to reach their destinations. The most prominent tall buildings are called "high-rise buildings" in most countries and "tower blocks" in Britain and some European countries. The terms do not have internationally agreed definitions.

Tall buildings provide a large amount of living or working space on a small land footprint. This means that valuable, often city, land can be used more efficiently. For example, Chicago's Sears Tower, with a footprint of 50,000 square feet (4,646 square meters), provides 4.5 million square feet (418,100 square meters) of floor space—90 times the footprint area ("Sears Tower Skydeck," 2008).

Tall buildings can house many people. For instance, the Sears Tower accommodates about 10,000 workers. Centralizing populations in these buildings reduces the costs of providing utilities and services. In addition, building up instead of out protects green belts around cities and may stop incursion into recreational and farming land. For these reasons, tall buildings are likely to become more common, and it is important to understand their particular security requirements.

Most tall buildings can be categorized according to their primary purpose:

Commercial buildings. Occupants are office workers, visitors, and facilities management staff.

Residential buildings. Examples include apartment buildings and student dormitories. Occupants are residents, visitors, and building support staff.

Specific-purpose buildings. Examples include hotels, hospitals, educational facilities, retail malls, prisons, and car parks.

This report focuses on tall commercial and residential buildings. The various specific-purpose building types have unique security concerns not addressed here.

Tall buildings provide a large amount of living or working space on a small land footprint. This means that valuable, often city, land can be used more efficiently.

Security Threats

Security threats in tall buildings may be grouped into three broad categories:

Crimes

- Theft and burglary in particular, from private spaces, car parks, and delivery docks.
- Property damage including graffiti and sabotage, most likely in common areas or car parks, may be politically motivated.
- Offenses against persons including general violence, domestic violence, elevator assaults, and confrontations in common areas, including angry interchanges with doormen or receptionists.
- Unauthorized access to utilities including theft of telecommunications or electricity, with the possibility of commercial espionage.

Disorder

- Behavioral issues including drug dealing from the building, hostage-taking, trespassing, suicide risks, protests, and drunk or drug-affected behavior.

Emergencies

- Human-caused or related crises including fire, infrastructure and elevator failures, electricity blackouts, biochemical attacks, terrorist attacks.
- Natural disasters including severe weather events such as earthquakes, floods, tsunamis, hurricanes, tornados, and snowstorms.

The accepted security approach is to identify a location's security threats or risks and then put in place measures to prevent those incidents. Some events cannot be prevented, such as natural disasters or attacks by aircraft (like the 9/11 terrorist attacks). In those cases, the security professional must employ measures to minimize the effects of the incidents, generally through emergency preparedness and response plans. Kitteringham (2006a) and Biringer, Matalucci, and O'Connor (2007) provide excellent introductions to the security risk assessment process. Life safety is not the focus of this report but is addressed in Craighead (2003) and Kitteringham (2006a).

Many of the security threats faced in tall buildings are the same as ground-level buildings or campus-style locations. However, tall buildings have specific characteristics that influence the threats they face. In particular, a tall building:

- Has limited entries and exits (making evacuation more difficult).
- Requires the use of elevators (lengthening response times for security teams).
- Has vital utilities concentrated in a service core (making it easier for offenders to find and disturb telecommunication links).
- Houses large numbers of people (enabling offenders to blend in with tenants).

The occupants of tall buildings have their own ideas about the security risks and they should be considered in any security threat assessment. One review of high-rise living concludes "high-rises are less satisfactory than other housing forms for most people . . . . Social relations are more impersonal and helping behavior is less than in other housing forms . . . . Crime and fear of crime are greater" (Gifford, 2007, p. 2).

That review identifies the six main incidents that high-rise residents said they fear most:

- Someone falling (or jumping) from an upper-level window.
- Being trapped in the building when a fire occurs.
- Building collapse.
- Attack against the building.
- Strangers in the building.
- Communicable disease (e.g., through sharing elevators).

Security and safety issues were recurring themes in surveys of high-rise residents in Singapore, Hong Kong, and Australia, and all residents named fire among their top concerns (Yuen, Yeh, Appold, Earl, Ting, & Kee, 2006, p. 594). Security measures should be designed to make occupants feel—and be—safer and more secure.

Security and safety issues were recurring themes in surveys of high-rise residents in Singapore, Hong Kong, and Australia, and all residents named fire among their top concerns.

Factors Contributing to the Problem

As noted earlier, tall buildings have characteristics that produce specific security problems. The following is a fuller look at those characteristics and related challenges:

Size. Tall buildings, especially high-rise or very tall buildings can be iconic and therefore targets for security breaches. Their size may also slow down security response.

Anonymity within the building. It is often difficult to tell whether people in a tall building should be there or not. They could be legitimate occupants or visitors, and among them a potential offender may not look out of place.

The reality is that "crime flourishes in large anonymous environments. Small, identifiable communities seem to offer better mutual support and security to their residents and public services seem to work better when they are decentralised to manageable neighbourhoods" (Shaftoe, 2007, p. 29).

Anonymity in a tall building may also lead to a "not my problem" attitude, making it easier for a thief to operate unobserved.

Building contents. A tall building generally provides a concentrated volume of property, making it an attractive target for criminals. Much of that property could be described as CRAVED, an acronym for "concealable, removable, available, valuable, enjoyable, and disposable" (Clarke, 1999).

In commercial buildings, some corporate offices feature expensive fittings and high-value art. Property in upmarket residential buildings also tends to be of high quality.

Occupant characteristics. Tall building occupants may not all have the same exposure to or concern about security problems. A tall commercial building may contain low-risk tenants along with high-risk ones (such as controversial or high-profile companies, political organizations, and government offices). Tall residential buildings may contain a mix of owner-occupiers, rental tenants, and public-housing residents.

Physical features. The physical structure of a tall building provides opportunities for such offenses as elevator crime, stairwell crime, and window crime (Spanier & Fishel, 1973, p. 236).

Surveys indicate elevator crimes and breakdowns are among the top five concerns of high-rise residents (Yuen et al., 2006). Most elevator crime seems to comprise personal

Current Responses

offenses like robbery or assault, and not only by adults: "Children learn to jam the elevator at will. Once it is jammed, they can easily rob the trapped people inside" (Spanier & Fishel, 1973, p. 236).

Stairwells in tall buildings are invariably enclosed because of construction codes. They provide another site for robbery and offer escape routes for offenders.

Lobbies, corridors, and outside plazas, because they are common areas, often have no specific owner or guardian to help prevent crime and disorder.

Windows, if openable, may allow access by cat burglars. People may throw objects from windows, causing criminal damage. In a worst case, a window could be used by a sniper.

Location. Many tall buildings and high-rises are located in central business districts. Their proximity to mass transit facilities and ease of access to the general public puts them at particular risk from professional thieves (Kitteringham, 2006a, p. 56).

The range of security responses found in tall buildings are summarized below.

Access Control

A defining feature of tall, and especially high-rise buildings is the restricted number of entry points. Thus, the security team can more easily control access by people, vehicles, and goods. An access control system with its associated alarm capacity appears to be the most frequently used security measure in tall buildings. Such a system provides visible evidence of security, prevents unauthorized intruders, and may deter criminals from even trying to enter.

The level of access control generally depends on the building's function. For instance, general access may be given to visitors at hospitals. Residential buildings may be more restricted, and access to buildings housing sensitive government departments may be very restricted.

Pedestrian Access in Tall Commercial Buildings

Liability issues, intellectual property concerns, safe workplace laws, and business regulations like the Sarbanes-Oxley Act in the United States, may make it necessary to implement sound access controls in tall commercial buildings.

As technology has become more sophisticated, the old paper visitors' book with its illegible, incomplete, and non-confidential entries is disappearing. Automated access control systems incorporating self-service visitor passes based on scanning a driver's license with timed fade-out printing are becoming common. In some cases, issuance of these passes may be conditioned on acceptance of nondisclosure agreements.

Occupants' and visitors' access passes may also be smart cards—cards fitted with a microprocessor chip, sometimes linked to biometrics, including fingerprints, iris scans, face recognition, and hand geometry. Piazza (2005) provides a good summary of biometrics. Another option is a radio-frequency identification (RFID) card, which can be monitored by readers placed around the building, flagging the security office when someone who has not been cleared to access a certain floor or area enters it.

The Internet has broadened the possibilities of access control. The existing IT network in a building can be used to operate intelligent doors, which have fully distributed intelligence and decision making units at the door itself. These units control the card reader and the door strike and can use power over Ethernet (PoE), eliminating the need for separate power supplies and multi-door controllers. Anderson (2008) provides an overview of these doors.

One example of an Internet-based system is the 54-story One Liberty Plaza in New York City, with 40 tenant spaces, 10,000 employees, and 15,000 visitors per month. The system can pre-register expected visitors, and users can access it from any Internet-enabled computer by typing in a username and password. Authorized users can run reports on employee and visitor access throughout the facility. Entry turnstiles are opened by a photo ID card with an expirable barcode. Tenants have their own security on their floors, and they operate their own employee databases. Access cards that have not been used for some time are flagged and can be cancelled.

Beyond the inherent security benefits, this Web-based system has given the building's tenants peace of mind. They feel safer, according to the system's administrator, and that feeling of safety may have helped sway a few prospective tenants to purchase space in the building (Roberts, 2005, p. 23). Another author (Brown, 2008) agrees that good security should be seen as a selling point to potential occupants noting, "some of the measures that add value include (entry) turnstiles—install them . . . and vandalism goes down and street crime stops."

Typically an optical or intelligent turnstile is a gateway with readers to check a person's access control token. The turnstile can be fitted with a physical barrier, such as glass or a boom-type gate.

Most turnstiles have software to prevent or detect tailgating by people quickly following authorized occupants into the building or sneaking into the building after someone exits.

Pedestrian Access in Tall Residential Buildings

Most tall residential buildings feature access control systems. A system may require physical access control tokens (such as keys or swipe or proximity cards), personal identification numbers (PINs), or even biometric measures. One Korean high-rise apartment complex introduced electronic fingerprint identification. The fingerprint reader was damaged because it was exposed to the exterior. The solution was to design a fingerprint reader inside the door. The reader slides out for use after a PIN is entered on a robust keyboard ("Hi-Tech High-Rise," 2002).

Visitor access to tall residential buildings is now invariably controlled by a closed-circuit television (CCTV) camera at the building's entrance. Such a system allows occupants to admit visitors remotely and, in some cases, control the elevator so it stops only at the appropriate floor.

Sometimes, of course, an occupant may not recognize a visitor. In Korea, "burglars often disguise themselves as electricity, water, or gas meter readers and persuade residents to let them in" ("Hi-Tech High-Rise," 2002). The solution in the building mentioned above was "a meter-reading system which automatically monitors the resident's energy use and which could be read remotely by the utility companies" ("Hi-Tech High-Rise," 2002).

Vehicle Access in Tall Buildings

Control of vehicle access to parking areas in tall buildings is now generally automated, although in some buildings with sensitive tenants, the use of security staff to physically note license plates and conduct random searches of vehicles, especially delivery vehicles, is still a part of the security regimen.

The automated systems may require the same access control token that the driver uses to enter the building on foot, and CCTV monitoring of car park entrances with vehicle license plate recognition is popular. Web-based systems seem particularly useful. A good example can be found in Longmore-Etheridge (2008).

Goods Access in Tall Buildings

Deliveries to tall commercial buildings are often controlled and channeled through one point, usually a staffed loading dock with camera monitoring. Deliveries, including mail, are usually inspected, possibly X-rayed, and signed in (to ensure no disputes about the delivery). In many buildings, occupants are required to collect their own deliveries from the loading dock.

Physical Security

Many types of physical security measures are used in tall buildings including locks, reinforced doors and windows, intrusion alarms, lighting, perimeter gates and fences, and bollards. Space does not allow a detailed treatment here. However, Craighead (2003) provides a comprehensive 13-page checklist of physical security measures for tall buildings. Fennelly (2004) offers a best-practices compendium that details the essential elements of physical security protection.

Physical security approaches provide target hardening for any building, making criminal access more difficult. While some offenders may be deterred, others may see increased security as a challenge to their ingenuity. Also, an excess of physical security may make occupants feel uneasy. It is important to strike the right balance, as Archibald (2002) notes:

> The question is not whether we can do more to harden a building, for we can always do more to harden any target. The question is whether we should do more to harden a target. Some sense of context is required . . . . It may be too costly and yield too little benefit given the nature of the threats. (p. 37)

CCTV

CCTV is widely used in tall buildings. In addition, technical advances in CCTV have been remarkable. Internet-based CCTV allows occupants to view what is going on at their property while they are not there, motion detectors activate cameras and trip alarms, and large amounts of digitized video can be saved.

However, the promise of CCTV can be misleading. Unless cameras are monitored all the time—a monotonous task—the cameras' main use is to provide a historical record of what has happened. This can be useful for post-event investigations, but in many cases it is simply a record of what went wrong.

On the other hand, the presence of a CCTV camera tells potential offenders that their activities may be noticed. They may then refrain from offending, although no research confidently proves this.

Most CCTV research has focused on public spaces, and it has been equivocal. Some research found reductions in reported crime, but much research has found no change or even an increase in crime. See, for instance, Gill & Spriggs (2005) and Ratcliffe (2006).

Methodological problems bedevil CCTV evaluation. Other measures introduced around the same time, like improved lighting or close police attention, cannot be easily excluded from consideration. For an up-to-date overview of CCTV evaluation, see Honovich (2008).

CCTV can also be misused. For instance, an Australian journalist reported the following (Thomson, 2007):

> When a nearby [apartment] building's owners voted to install state-of-the-art security, local drug dealers loved how surveillance camera pictures were piped into their domestic TVs and that no one could get to their floor without being buzzed in. After police snuck in, it took them a day-and-a-half to discover and count the $500,000 in cash hidden there. (p. 27)

Security Staff

The use of formal security staff is still popular in tall commercial buildings. A uniformed security officer provides an on-site presence that may deter some offenders and reassure occupants. The officers may administer visitors' access, monitor optical turnstile breaches, supervise vehicular access, or manage CCTV control rooms, as well as patrol the premises and respond to emergencies.

In tall residential buildings, a concierge or similar employee provides this human presence. At one site (Bottom, 1997), the role was called "courtesy officer" and consisted of

> off-duty police, themselves tenants of apartment complexes, who agree to perform certain duties in exchange for pay or rent reduction (and who) . . . often patrol in police uniforms and have take-home police cars. (p. 405)

Other employees of building management can also provide security support. The New York City Police Department created a crime prevention training program for personnel of large residential buildings, which taught them to identify potential offenders, prepare descriptions for police, and learn ruses used by outsiders to enter the building (Arbetter, 1993, p. 12).

Stellitano (2005) describes a training program that teaches janitors to watch for unfamiliar or suspicious people or activities, seemingly abandoned packages, unusual smells, malfunctioning lights, and so on. Encouraging all in the building to be similarly alert would provide great support to the security team.

Security and Emergency Plans

It is essential to have procedures in place in a tall building to respond to emergencies and life-threatening situations. Such procedures are often mandated by local security and fire safety regulations, which may include requirements to regularly check fire alarm systems and run fire drills with evacuations.

Evacuation plans are particularly important for high-rise buildings where the fire service will not be able to reach higher floors with their rescue equipment. In its chapter on high-rise structures, the *Protection of Assets Manual* (ASIS, 2008) provides the definitive commentary on life safety and security procedures in that setting. An example of an innovative response to evacuation from tall buildings is an Israeli invention comprising fire-proof pods that are stored on the roof of a high-rise and lowered when evacuation is necessary ("High-Rise Building," 2006).

The importance of a sound emergency plan was demonstrated by the 9/11 terrorist attacks against the World Trade Center towers in New York. The emergency and evacuation plan for the buildings was activated, and "in each tower, 99% of the occupants below the crash survived. At the impact area and above, survival was limited to just a handful of people in the South Tower who made an amazing escape" (Archibald, 2002, p. 42).

If a good evacuation plan is in place, a building might actually be a less attractive target to terrorists looking to cause maximum damage.

Occupant Involvement and Awareness

Security teams in tall buildings often try to engage occupants in security issues, but tenant participation is invariably underutilized (Archibald, 2002, p. 33). A security professional needs good communication skills to familiarize occupants with security issues and emergency plans, encourage them to be vigilant, and inform them about potential threats and actual incidents.

Security training and awareness programs can lead to increased natural surveillance and can be achieved through mailings, Web sites, elevator bulletins, e-mail, meetings, and guest speakers (Kitteringham, 2006a, p. 60). However, in practice, it is quite difficult to get occupants to ensure that nobody tailgates behind them when they access the building or to ask persons without access passes what they are doing.

Measuring Effectiveness

It is important for security practitioners to demonstrate the value of their efforts, and doing so requires the collection of relevant data. Without such data, it is impossible to conduct a sound security risk assessment, demonstrate the return on investment of any security proposal, or show the effectiveness of a security initiative.

Relevant security data can only be collected through diligent record keeping, which is usually recorded in an incident register. It is essential that the data be complete, current, and accurate.

The following are types of data that could be collected to demonstrate the effectiveness of security measures in a tall building:

- Number of incidents reported to the police or building security.
- Number of incidents discovered by the security team (such as graffiti or drug paraphernalia).
- Number of emergency calls (to police, fire, or ambulance) made from the building.
- Number of false (fire or intruder) alarms.
- Number of successful fire or evacuation drills and the time a full evacuation takes.
- Number and nature of interactions with occupants (including complaints and requests for assistance or advice—an indicator of the readiness of tenants to contact security).
- Results of attitude or climate surveys of building occupants concerning security and safety matters.

As Kitteringham (2006a) points out, the challenge after collecting the data is to make sense of it. Annual statistics for the above measures could be compared with the previous year's data. Comparisons should take into account any peculiar or extenuating circumstance affecting the building or its occupants during the year.

Summary of Valid Research

Much of the research into crime and security problems in tall buildings has focused on residential properties. However, many of the research findings also apply to other tall buildings.

Physical Design and Crime

Three important concepts address the ways that the physical design of a tall building affects crime and other security issues. The actual impact of design, however, may be modest.

The first concept focuses on "defensible space," a term coined by architect Oscar Newman (1972) after analyzing features of residential high-rises in New York. According to Bauer (1981):

> The crime rate (for those buildings) increased in proportion to the number of storeys in the (residential) blocks. In blocks with 13 to 30 storeys, there were 68 crimes per 1,000 families, compared with 30 crimes per 1,000 families living in buildings with no more than 3 storeys. (p. 203)

The second concept is Crime Prevention Through Environmental Design (CPTED), developed around the same time by criminologist Ray Jeffery (1971). Jeffery was concerned about the criminal justice system's lack of success in dealing with crime, and he believed part of the solution was to modify environmental factors that made crime easier.

The third concept is situational crime prevention, developed by British criminologists Clarke and Mayhew (1980). This concept focuses on modifying environmental factors to make crime more difficult.

These concepts all conclude with approaches that many security professionals would see as self-evident. In summary, crime and security problems in tall buildings can be reduced when the following conditions are present:

- Surveillance by occupants and the security team is possible.
- Public and private spaces are clearly demarcated (to encourage a sense of territoriality).
- Occupants demonstrate a feeling of ownership or community (because informal social control by a community sets standards of acceptable behavior).
- Hiding places, blind spots, and easy escape routes are eradicated.
- The target (the building) is hardened with security hardware.

Research confirms the influence of these features. For instance, the Korean Institute of Criminology found that ("Hi-Tech Hi-Rise," 2002)

> large, tall buildings suffer from a high incidence of crime, especially if they lack a dominant central space, a focal access area . . . . Complexes designed on many different levels, and featuring corridors that don't give residents or visitors a clear line of vision, increase both the fear of crime and its incidence level.

Tall Commercial Buildings

The practical application of these environmental considerations is demonstrated by Kitteringham (2006b) in addressing three security problems in Canadian high-rise office buildings. First, after security staff established that thieves were using stairways to access offices, several changes were made in one office tower. Surveillance was increased, and access to the stairwells was tightened. Territoriality was strengthened with stairwell barriers, hiding places were walled up, and after-hours card access was required for elevator use. After these changes, thefts in the building dropped 30 percent over an eight-year period.

Second, disorderly activities in the buildings were becoming problematic. Unwelcome persons were damaging property, drinking, fouling stairwells, blocking fire exits, and harassing tenants. Natural surveillance was enhanced through increased use of lobby officers and CCTV, and unused areas were closed off. Territoriality was confirmed by such moves as publishing rules for the food court and smoking areas, encouraging tenants to report activities, and promoting a sense of building pride among occupants. After the changes, the number of incidents involving these unwelcome persons declined 70 percent over a seven-year period.

Third, skateboarders were causing considerable damage to the buildings and their courtyards. Natural surveillance was improved through officer patrols of plaza areas, and CCTV surveillance was increased. Territoriality was reinforced as notches were cut in flat surfaces, signage was introduced, and wooden benches in the bus areas were replaced with individual metal seats. After these changes, the number of skateboarders noted on the premises dropped from 2,864 to 518 over a seven-year period.

The Canadian Building Owners and Managers Association (BOMA) studied laptop theft in commercial buildings. It found that buildings with more than 1.1 million square feet (102,193 square meters) of office space were twice as likely to be targeted than buildings with less floor space (BOMA, 2007). Buildings also had a 93 percent

chance of repeat victimization in a year, while individual tenants had a roughly 60 percent chance of being victimized more than once per year.

The research showed that in 76 percent of thefts, the tenant floor was accessed through an unlocked stairwell door, suggesting that thieves were using stairwells to travel between the floors, particularly after hours when elevator travel was difficult. Thieves entered buildings before lockup, rode elevators to their desired floors, and hid in (often public) washrooms and closets before coming out after hours to steal. Thieves would also often wait in a stairwell until they heard people leaving tenant spaces, then exit the stairwell and enter the tenant space before the tenant-space doors closed.

Some thieves accessed tenant spaces during regular business hours. If approached, most would leave the area, but building security personnel were often not called, and in some cases the building security team was not informed of missing laptops until the next day.

Overall, thieves were less successful in larger buildings, even though those buildings were targeted more. These failures may be a result of the greater security presence in larger buildings: "The larger buildings have an increased security presence, with 24/7/365 guards, a faster response to forced doors, extensive CCTV coverage, and a much larger number of legitimate users" (BOMA, 2007, p.15).

Research has shown the value of installing CCTV in elevators and lobbies and along adjacent sidewalks of a 17-story New York City office building. After two years, the CCTV system was found to have (Roberts, 2004)

> prevented vandalism . . . [and] curbed erroneous and expensive lawsuits from litigious pedestrians eager to take advantage of the city's slip-and-fall laws that hold property owners accountable for injuries occurring on the sidewalks outside their buildings. (p. 31)

Cameras also helped reduce inappropriate behavior in the elevators.

> Having staff in place to provide surveillance is also valuable. Sherman describes an office building that had elevators served by manual operators. After the operators were removed from the elevators, within weeks there was a robbery in an elevator—the first crime of that sort known to occupants of the building. The result was consistent with earlier research that found fewer burglaries in apartment buildings with doormen than in those without them (Sherman, 1995, p. 40).

Tall Residential Buildings

After the Second World War, much tall housing was built to accommodate those who were left homeless. These buildings became the norm for public housing in many countries, and much of the research has focused on socially disadvantaged occupants. More recently, inner-city high-rise apartments have become desirable to affluent occupants.

High-rise buildings have a history of being centers of crime and disorder. One German study states ("High-Rise Buildings," 2000):

> Studies have also proved beyond all doubt that criminal activity is promoted by huge apartment blocks and particularly high-rise buildings . . . This phenomenon is attributable to the anonymity of the residents, as well as to the "pro-crime" environment with elevators, poorly lit corridors devoid of human beings, refuse collection rooms and bicycle garages, laundries, and above all, underground parking lots. It is a proven fact that considerably more murders, burglaries, muggings, rapes, and other crimes are committed in such buildings than in residential areas with smaller rented or private homes. (p. 27)

Similar comments have been made by economists Glaeser and Sacerdote (2000) who found that:

> Building structure matters for behavior in ways that correspond with simple economic ideas. Large apartment buildings appear to have two important effects on behavior. First, they reduce the distance between neighbors. Second, they increase the distance between residents and the streets. Because of these two different effects, the impact of apartments on behavior is often subtle . . . Most strikingly, big apartment buildings are strongly associated with street crime. This is most probably the effect of distance between where people live and the streets. (p. 22)

Recent Japanese research on the spread of lock picking to commit residential burglaries examined the problem in detached houses, low-rise accommodations, and high-rise buildings. The research found that high-rises experienced the bulk of activity and offered three possible explanations. First, apartments in high-rise buildings all have the same type of lock, so burglars have the right picks at hand and do not have to search for the right target. Second, high-rises may "lack territorial and natural surveillance because many households live in one building." Third, occupants may have fewer social ties (Shimada, 2004, p. 180).

A recent Canadian study found 88 assaults per 100 units in high-rise buildings compared with 58 in "garden apartment and row housing" (Kinney, Brantingham, Wuschke, Kirk & Brantingham, 2008, p. 70). Similarly, the study found 125 car thefts per 100 units in high-rise buildings, compared with 77 in the other types of housing.

One suggestion to explain these differences is that social networks and interaction are less established in high-rise buildings. A study in three Taipei high-rise housing projects reported that just under 16 percent of over 30,000 observations of residents showed any sort of social interaction. Most of these interactions occurred in "scenic spaces"—landscaped areas limited to use by residents and thus clearly marked as their private space (Huang, 2006).

The composition of tall buildings' residents is also an important factor. In a study of the fear of crime in high-rise apartment towers in Nebraska, DeLone (2008) found that elderly residents who lived in a tower occupied only by other elderly residents were less fearful of crime than elderly residents in towers housing a mix of ages. Moreover, the fear of crime was not confined to the elderly (DeLone, 2008):

> Residents in the mixed-age towers were overall more fearful than residents in elderly-only towers. While it is true that age may compound the fear of crime at an initial level, it appears to be more the dynamics of the living arrangements that are related to fear. (p. 123)

The fear of crime in tall apartments also concerns the young. A small study of adolescents living in a publicly-subsidized Chicago high-rise found they were exposed to high levels of violence and therefore feared for their personal safety (Sweatt, Harding, Knight-Lynn, Rasheed & Carter, 2002). While the nature of the building's population fueled that anxiety, the fear of crime and disorder, not simply the occurrence, is a matter of which a security team must remain aware.

Car Parks in Tall Buildings

Park (2004) researched car park crime and security in South Korea. He analyzed six street-level and underground car parks for six tall apartment buildings, ranging from five to 25 stories. Over a 54-month period he found that while overall levels of offending were about the same in each sort of car park, there were far more thefts from vehicles in the underground car parks and more offenses against persons in the street-level parks.

Conclusions and Revelations

The study gave each car park a security score (with 100 being best) modified from the British Safe Car Park criteria under four headings: formal surveillance (by security staff); CCTV surveillance; natural surveillance (including lighting and lines of vision); and access control. The street-level car parks scored an average of 61.5, the underground car parks 55.7. The street-level car parks scored higher mainly on natural and formal surveillance.

As the majority of these apartment residents were "relatively affluent," a large number of the parked vehicles were luxury models, often containing "car audio sets, occasionally golf clubs, laptop computers, mobile phones, and even bags with credit cards or cash" (Park, 2004). The vehicles were parked in car parks with no access control and multiple entrances and exits.

The research noted that security staff "looked aged and the majority of them did not appear physically fit enough to work for a security job." Even so, the street-level car parks with visible guard posts had lower victimization rates. CCTV coverage, where available, was unsatisfactory due to poor lighting and inappropriate vegetation. Video was not locally monitored. In summary, Park recommends a holistic approach to improving car park security, including consultation with local police and residents.

The following themes emerged from the research and should be considered when developing a tall building security program.

Physical Security

Physical security is often built into tall buildings when they are constructed; however, refurbishment or modifications to the building provide opportunities for improvements or updates. Examples include improved design of building entrances and common areas, installation of CCTV systems, improved lighting, and redesigned car parks.

As physical changes of this sort are often made at the same time, it is usually impossible to measure the impact of a single change. Still, changes to physical security usually lead to lessening of security problems. In the BOMA survey of laptop theft, the physical security measures that were employed included (BOMA, 2007):

> Astragals or latch guards on doors (preferably full length astragals), solid reinforced door frames, tenant lobby CCTV cameras monitoring areas of access and used for recognition purposes, mortise locks, laminated glass, electromagnetic locks placed on the tenant side of the door, properly installed and working access

> control systems including piezo (local door alarm buzzers), [and] slab-to-slab covering with no crawl space above the drop ceiling. (p. 8)

The BOMA authors concluded that in 2006, "physical security was responsible for stopping 57% of laptop thieves" (2007, p. 12). The difficulty in evaluating a particular physical security measure is reflected in BOMA's comment (2007, p. 9) that "there is strong evidence to support the contention thieves were bypassing tenant floors where CCTV was installed. While thieves did not seem deterred by CCTV in common areas, they did seem to avoid the tenant floors with CCTV."

The installation of security lighting is another useful physical modification. Lighting's impact on crime and disorder has been researched only in public areas and streets. While some research has been contested on methodological grounds, the accepted finding is that "improved lighting, on average, causes a significant 20% decrease in crime" (Farrington & Welsh, 2004, p. 466).

Good lighting increases surveillance, makes intruders feel conspicuous, and increases the chance of their identification and detection. However, it needs to be well-designed, as poorly planned lighting can dazzle occupants, produce its own dark spaces, and at its worst, produce an oppressive environment like a prison compound. Security needs in any location must be carefully considered. For instance, it may only be necessary to install lighted vandal-proof footpath bollards to make occupants feel safer and to deter offenders.

Procedural Security

Given the large number of occupants in tall buildings, well-written and unambiguous security procedures are vital. Particularly important are evacuation plans and procedures for dealing with infrastructure failures, such as electricity (and emergency power) blackouts, disruption to gas supply, disruption or contamination of the water supply, failure of heating or cooling systems, and telecommunication collapse. (See Kitteringham (2007) for a comprehensive outline of necessary procedures for tall buildings.)

Security procedures must be immediately accessible to building occupants. The security team should also ensure that tenants know what the procedures are and why they should comply. For example, regarding access control, occupants need to know why the procedure is in place and how failure to comply could put others at risk. Providing information of this sort emphasizes the importance of the procedure and enlists occupants in the security effort.

Others in the building who have regular contact with tenants—janitors, maintenance staff, concierges, and receptionists—should also have a full understanding of security procedures. Providing information sessions for them also ensures their familiarity with the building's security team.

The security team's own procedures must also be well-documented and well-known to the team. Quick security responses may deter future offenders, who may observe alarm response times to assess the likelihood of successful escape.

Cooperation Among Occupants

Because the architecture of tall buildings promotes anonymity and reduces natural surveillance, any program that engenders cooperation among occupants should be a positive. In one Canadian estate of five high-rise apartment blocks, the introduction of an apartment watch program—based on the Neighborhood Watch model—led to an increase in the likelihood that a neighbor would report a break-in. However, few occupants actually joined (Meredith & Paquette, 1992).

After the program was introduced, police data showed an 82 percent decrease in break-and-enter offenses, but the number of vehicle-related offenses did not change. The program could not take sole credit for the reduction in burglaries because considerable target hardening was also undertaken. For instance, door frames were reinforced, dead bolts installed, and the car park door timers reduced to 30 seconds.

Holistic Security Approach

Various security responses are often introduced together. However, a combination of approaches that works in one place may not work in another. Research suggests that what appears to be a sound security approach may not be.

In a review of high-rise housing in five European cities, the British estate (Hartcliffe) appeared to have the highest crime rate, despite the fact that it (Shaftoe, 2007)

> had the most physical security and design improvements explicitly aimed at crime reduction. These consist of direct fortification measures, such as new security doors, through electronic measures, most notably CCTV, to design measures such as new perimeter fencing. (p. 32)

Approaches Suggested by the Research

By contrast, the most successful (and the one that had been transformed most radically) was the German estate (Marzahn), where a holistic approach aimed at overall quality of life improvement was implemented (Shaftoe, 2007):

> Although Marzahn has some good security practices such as a concierge scheme, with linked CCTV in one of the biggest high-rise blocks . . . it also has some design features (such as ground floor balconies adjacent to luxuriant foliage) that, from a CPTED point-of-view, are distinctly dubious. (p. 33)

No amount of security can prevent all security breaches, crimes, or disorder in tall buildings. A sobering illustration is provided by the following press report (Reichgott, 2006):

> Even with all the security gizmos and gadgets, a lone gunman with a grudge against an attorney marched into Chicago's Citigroup Center last week and forced a security guard to take him to the 38th floor, bypassing turnstiles that require photo-ID cards. When he reached his destination, he killed three men and shot a woman in the foot before he was shot by SWAT snipers.

The aim of the security team is to do all it can to prevent breaches, crimes, or disorder. When that is not possible, the team should aim to reduce the number of such incidents. If an incident does occur, the team should respond and assist in recovery. The following are key actions for the security team.

Select Appropriate Security Actions

A security threat assessment, based on accurate and comprehensive data, is a prerequisite to any security action. The next step is to think broadly about possible actions that could be taken to reduce a particular security risk. For instance, increasing physical security may not be the only, or indeed the best, action to take.

The 25 techniques of situational crime prevention (Home Office, 2008) provide a useful spectrum of actions that could be taken by a security team. However, these techniques were developed for addressing offenses in the public arena, so some are not applicable in tall buildings and others require actions in society at large—well beyond the scope of the security team.

After identifying a particular security problem, the team should consider the techniques one by one and assemble a list of security responses. BOMA (2007) did just this when considering the problem of laptop theft from Canadian office buildings. The organization concluded with 120 possible security actions, some of which are listed below alongside the formal techniques.

Table 1. Techniques of Situational Crime Prevention

Techniques of Situational Crime Prevention (Home Office, 2008)	**Examples of Security Responses to Address Laptop Theft (BOMA, 2007, pp. 25-26)**
Techniques **that increase the effort** for the offender to commit the offense:	
1. Harden targets	• Install metal doors and frames • Use laptop locking devices
2. Control access to facilities	• Install electronic turnstiles • Program elevators for after-hours use
3. Screen exits	• Consider electronic article surveillance tags on laptops • Search people exiting
4. Deflect offenders	• Conduct background checks on employees and contractors • Keep laptops inconspicuous by using simple carry cases
5. Control tools/weapons	• Put away laptop paraphernalia, such as docking stations and power cords • Disable audible tones on card readers, as they can signal to waiting thieves that the door will be opening
Techniques **that increase the risks** for the offender to commit the offense:	
6. Extend guardianship	• Install global positioning system monitoring • Fix multiple ID labels on laptops
7. Assist natural surveillance	• Improve office lighting • Encourage staff to monitor work areas for suspicious activity
8. Reduce anonymity	• Challenge visitors • Escort all visitors
9. Use place managers	• Reward vigilant staff who inform security or police of incidents • Train employees to protect data and laptop devices
10. Strengthen formal surveillance	• Install CCTV at main access points • Increase security guard controls

Techniques **that reduce the rewards** from committing the offense:	
11. Conceal targets	• Lock laptops in secure area after hours and when unattended • Regularly backup laptop data
12. Remove targets	• Conduct frequent security laptop audits to identify employees not following procedures • Have employees take laptops home
13. Identify property	• Mark in more than one location with company logo • Register laptop with manufacturer
14. Disrupt markets	• Monitor pawnshops • Seize stolen property
15. Deny benefits	• Password protect the device and change the password regularly • Install biometric protection on USB thumb drive
Techniques **that reduce provocations** to commit the offense:	
16. Reduce frustration and stress	• Reduce workplace hostility
17. Avoid disputes	
18. Reduce emotional arousal	• Lock away equipment when not in use
19. Neutralize peer pressure	• Educate potential end-users of stolen laptops
20. Discourage imitation	• Punish thieves • Seek restitution
Techniques **that remove the excuses** for offender to justify offending:	
21. Set rules	• Have documented, specific policies in place • Make individuals responsible for their laptops
22. Post instructions	• “Lock up your valuables” • “All visitors must report to Reception”
23. Alert conscience	• Submit victim impact statements to courts • Educate employees on company and personal responsibility
24. Assist compliance	• Educate employees of theft MOs • Institute a security awareness education program
25. Control drugs/alcohol	

The impact of any security measure on building occupants must always be considered. In particular, the security team should remember that "harsh, fortified and neglected environments may reinforce fear and actual risk...[and] there is evidence to suggest that brutal surroundings may provoke brutal behavior" (Shaftoe, 2007, p. 27).

Encourage Community Buy-In

It might sound ambitious, but the benefits from drawing a building's occupants together can be considerable, in that a community can establish accepted standards of behavior that are enforced through informal social control.

Shaftoe (2007) points out that in high-rise residential communities

> people can identify with "their" community and feel they have a stake in its well-being; they are more likely to observe and respond to inappropriate or offensive behaviour; they are more likely to know and support their neighbours and know who to go to for help. (p. 29)

Inform the Community

Occupants of a tall building, be they residents or workers, must be informed of security measures that have been adopted for the benefit of all. The security team should not only tell tenants what those measures are, but elaborate on them and encourage occupants to be partners in the security effort.

For instance, tenants can be told of the importance of the access control policy, which keeps unauthorized persons out of the building. They can then be told the two ways potential offenders most often beat the access control procedure. The first is tailgating—simply passing through the access barrier immediately behind an authorized person. The second is social engineering, in which thieves and others try to talk their way in with sob stories, name-dropping, offers of help, or ingratiating or over-friendly behavior. They may also pose as legitimate users like couriers, contractors, maintenance workers, or job seekers who, when confronted, offer convincing cover stories.

With an understanding of the risks, occupants are more likely to challenge unfamiliar persons and to contact security when they encounter strangers in the building. Additionally, tenants may better understand the need to keep their access control tokens secure. That understanding, in turn, may reduce angst when it is necessary for the security team to review the tokens in circulation and cancel those not used for some time.

Occupants can also be informed about general security issues relating to their building. A useful tool is the Queensland Police pamphlet, Secure Multi-Residential Living (2002), which includes the checklist in Table 2.

Table 2. Security Checklist

General
❑ Do you know your complex manager?
❑ Has your key holder registered his or her details with the police?
❑ Do you know your neighbour?
Internal
❑ Does your building have video surveillance?
❑ Do you keep visitors under supervision in communal areas?
❑ Do you always close communal doors?
❑ Do you have keyed access to communal areas?
❑ Have you removed your valuables from the garage?
❑ Do you have a bike?
❑ Have you noted the model and serial number?
❑ Is it secured to something solid?
❑ Is it engraved with your personal identification number?
❑ Does your home have deadlocks?
❑ Are your doors and windows keyed alike?
❑ Do you know who has duplicate keys to your home?
❑ Is your balcony secure?
❑ Do you always lock your screens?
❑ Has your personal property been engraved with your own individual code?
External
❑ Are the exits, entries, fire exits, stairwells, and other communal areas well lit?
❑ Do your gardens allow clear vision?
❑ Do you remove valuables from your vehicle?
❑ Do you remove your remote from the garage?
Source: Queensland Police, Secure Multi-Residential Living, 2002.

Security teams should be ready to provide helpful information on any security problem in the building. For instance, if occupants are concerned about elevator problems, they should be given written information suggesting they:

- Not get into an elevator with someone who makes them feel uncomfortable.
- Leave an elevator if others exit and they will be left alone with such a person.
- Leave the elevator if they notice that another person in it has not pushed a floor button.
- Not get off at their floor but go to the main floor and find a safe place if they feel uncomfortable with another elevator occupant.
- Press as many buttons as possible if they find themselves in a dangerous situation and wish to leave the elevator. With the doors opening at several floors, there is more opportunity for escape as well as more chance someone will see what is happening.

Distributing these types of pamphlets provides an opportunity for the security team to engage occupants either one-to-one or at building meetings. In addition, security tips could be included in newsletters bringing tenants up-to-date with incidents in the building or its vicinity. Occupants could also be invited to visit the security office for dialogue.

Involve the Community in Security Measures

The next step is to involve at least some tenants in security activities. In commercial buildings, occupants may be appointed as floor wardens and trained to assist in life safety and security operations, most notably evacuation. In residential buildings, occupants may be appointed as contacts in a Neighborhood Watch type of program with informal surveillance and property marking activities.

In a building with a strong community, occupants can be especially actively involved. For instance, in the former East Germany, residents tended to be closely involved in the management of housing estates (Woldendorp & Smits, 2007):

> Block representatives are still active and well accepted . . . Residents are involved in the planning, management, maintenance and provision of services in the neighbourhood, which helps to maintain cohesion and enhances social capital. Additionally, "multifunctional concierges" combine the role of a concierge, a guard, and a resident aide. Aside from preventing damage to

> communal property, the concierge functions as a contact person, creating a centre of social life in otherwise—due to their enormous size—anonymous apartment buildings. (p. 100)

Another example of occupants' active involvement in building management comes from England (Hodgson, 2008):

> In the 1980s, Notting Hill's Trellick Tower was London's most notorious housing block. Stories concerning vicious rapes in dimly lit stairwells, children being attacked outside their homes by heroin addicts, and squatters setting fire to flats made lurid newspaper headlines. The block's fortunes were unexpectedly revived when ownership transferred to a tenant's management organization that introduced a range of improvements including a concierge, intercoms, and CCTV. Crime dramatically fell and the block was boldly reinvented as an icon of urban cool. Now a mixture of private and social housing, it gained the ultimate seal of approval when English Heritage listed it. (p. 20)

The security team should work with any tenant who wishes to maintain the security of the building and the safety of its occupants.

Keep the Building Well-Maintained

The "broken windows" theory (Wilson & Kelling, 1982) suggests that if visible disorder is left unchecked, more will occur, so it is important that tall buildings be kept in good condition. In the past, much public housing has deteriorated due to lack of maintenance, but there has been considerable refurbishment of many tall buildings in recent years.

Refurbishment provides a chance to upgrade security. Davies (1995) describes the upgrades of some tall residential buildings in England. In one case, three 11-story buildings were provided with such general improvements as rain-screen cladding, double-glazed windows, a new heating system, and new kitchens. On the security side, security doors with intercoms were installed at entrances to the buildings, perimeter security fencing and gates were installed around the estate, additional lighting was provided, and nighttime security patrols commenced.

The second refurbishment was undertaken on a 20-story block of flats. The same physical improvements were made, and the security changes included a concierge system (operating from 8 a.m. until midnight), CCTV, new security fences, additional lighting, and a video intercom entry system that made tenants feel safer in their own units (Davies, 1995, p. 23).

Research Needs

The new housing conditions were described as "greatly improved" by 82 percent of residents in the first estate and 72 percent in the second. Occupants' perceptions of the scale of social problems, defined as graffiti, litter, vandalism, and crime, also improved. At each site, 72 percent of occupants said there had been improvement in those issues.

Apart from installation of security hardware during refurbishments, changes to the fabric of the building provide psychological signals and cues for occupants, encourage pride in their new surroundings, and increase the likelihood that they will engage in greater surveillance. Even as simple a change as building a new, friendlier entrance to the building has a positive security impact by establishing a sign of territoriality for occupants. A high-quality, cared-for property encourages respect for that environment. Security teams should work closely with maintenance crews to ensure that damage—with its negative message—is quickly repaired.

Tall buildings have seldom been subjects of security research, although the problems of public high-rise residential buildings have received some attention. If it is true that tall buildings are becoming more common, then researching their particular security problems makes sense. Future research topics could include the following:

- Ways elevators might be designed to minimize incidents within them and make occupants feel safer (for example, windows could be installed in elevator doors, "a much-desired safety feature" in Singapore (Yuen et al., 2006, p. 595).
- Effectiveness of regular stairway security sweeps to reduce the presence of loiterers and potential offenders.
- Effectiveness of temperature-based motion detectors that alarm when a person enters a room (as a backup to existing perimeter alarms).

A high-quality, cared-for property encourages respect for that environment. Security teams should work closely with maintenance crews to ensure that damage—with its negative message—is quickly repaired.

- Whether offices with good lines of sight and low cubicle walls are less likely to be the location of thefts in a commercial building.
- Effectiveness of new technologies and procedures for evacuation.
- Comparison of burglary and theft rates in tall buildings, campus-style buildings of a similar purpose, and detached housing.
- Offending patterns in different types and sizes of tall buildings (along the lines of the BOMA laptop theft surveys).
- Occupants' feelings of safety and security in and around the building.
- Effect of regular security crackdowns on occupants who leave attractive property unsecured (including whether such crackdowns affect security awareness).
- Effect of regular "red team" exercises, aimed at detecting security vulnerabilities by taking an attacker-like approach, on security compliance.

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Immediately prior to working for Telecom, Dennis was assistant director of the Australian Institute of Criminology in Canberra from 1986 to 1989. He had left the University of Melbourne as head of the Criminology Department in 1986. During his 13 years at the university, his main research interests were penology, juvenile offending, and crime prevention. From 1974 to 1986, he was an executive member of the Victorian Branch of the Australian Crime Prevention Council, was Victorian chair from 1981 to 1986, and national vice president from 1982 to 1986.

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