Decision support for incorporating counter-terrorism design innovations into public places

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Due to the prevailing threat of terrorism both internationally and within the UK, the British government has recently redeveloped the CONTEST strategy for countering international terrorism into a new and robust form known as CONTEST2. As part of this strategy, the UK government is encouraging those responsible for the protection of the public and ensuring the resilience of public buildings and crowded public areas to incorporate Counter-Terrorism (CT) measures where appropriate. However, it is apparent that there has been a lack of investment and ‘buy in’ from some key stakeholders. This is due largely to: client scepticism about the use of obtrusive, highly visible and unattractive solutions; a lack of informed guidance; differing opinions on the severity of the perceived threat from terrorism; and poor awareness of the cost-benefits of such measures. The outputs from a two year project, that has utilised a pluralistic methodology, are presented in the form of a web-based Decision Support Framework (DSF). The DSF has been developed by three English universities in collaboration with the British security services. The main purpose is to ensure that good practice in the design of effective and acceptable resilient public places can be more widely adopted. The DSF achieves this by providing individuals involved with the planning, design, construction, operation and management of public places with informed guidance on the necessity and use of CT measures; and supporting their operational activities towards the structured and proportionate integration of CT solutions into the varied design, build, operation and management processes. An evaluation of the DSF suggests that it promotes the innovation of passive and more acceptable CT measures, whilst simultaneously maintaining public safety. This greatly promotes the equal weighing of total expected benefits of CT measures against the total expected costs.

Keywords: Counter-terrorism, Decision-support, Design management, Resilience.

INTRODUCTION

Mitigating for an array of traditional and unconventional terrorist threats is increasingly germane to the way towns and cities are designed and managed; and how built environment professionals attempt to enhance levels of safety in urban areas. This is particularly the case with regard to public places such as public shopping areas and sports stadia, as well as on transit systems such as bus, light-rail or tram, which can be particularly vulnerable targets for terrorist attack. It has been argued by Coaffee et al. (2008) that for this to be successful, inter-disciplinary and innovative solutions are required for a wide range of public, private and community stakeholders that are (or should be) involved with the planning, design, construction, operation and management of public places. However, Counter-Terrorism (CT) measures may be considered unduly obtrusive and seen to promote paranoia and fear amongst the general public. In order to
achieve wider scale acceptability, stakeholders need to promote innovative design and build solutions away from typical views of CT measures that can encourage speculation, scepticism and limited buy-in. The research reported in this paper argues that due to contemporary terrorist threats and tactics, counter-terrorism in urban areas should increasingly seek to hybridise hard and soft engineering solutions in order to design and manage the built environment in ways which can reduce the occurrence or impact of a terrorist attack. In light of these considerations, the outputs from a two year project are presented in the form of a web-based decision support framework (DSF). This tool, which has been developed in collaboration with the universities of Birmingham and Sheffield and the British Security Services, seeks to ensure good practice and innovation in the design of effective and acceptable resilient public places.

BACKGROUND

The provenance of how the built environment, cities and critical infrastructure have been protected from the wide range of hazards and threats can be traced back to the earliest civilisations. Coaffee (2003) and Briggs (2005) highlight that since civilisations were formed, defences against hazards and threats have dramatically influenced the structure and landscape of cities. In particular, authorities have tried to secure their interests by keeping out or controlling the movement of undesirables and creating feelings of safety and security amongst the general populations. In the present context, resilience against an array of traditional and unconventional terrorist threats is increasingly important to the way towns and cities are designed and managed and how built environment professionals attempt to enhance levels of community safety (Bosher et al. 2007).

Terrorist methods

Terrorism is a strategy employed by politically motivated groups to create fear. These strategies typically involve the use, or threat, of physical violence to influence the political behaviour of a “Target” group (Neumann and Smith 2008). In essence, terrorist methods should be viewed strategically. Different types of attack and targets are chosen by individuals, groups, organisations and networks, based on perceptions of their target’s weaknesses. The aim is to exploit these perceived weaknesses through symbolic acts of violence.

There have been a wide range of methods used by terrorist organisations, such as the use of improvised bombs (in various guises), assassinations of key political figures and kidnapping. However, the most common method employed by terrorist groups in recent years has been Vehicle Borne Improvised Explosive Devices (VBIEDs, also known as car- or truck-bombs). Employing VBIEDs to attack targets can be an attractive option for terrorist groups, as they are mobile and capable of causing significant damage or a large number of casualties. Other methods of attacks, such as the use of Person Borne Improvised Explosive Devices (PBIED), such as those used in the London bombings in July 2007, have also become more widespread in recent years. However, the VBIED has, perhaps, been the most likely device used by groups and networks to cause mass casualties and is therefore the focus of counter terrorism measures considered within this paper.
Threats to Crowded Public Places

Terrorist methods and targets have been known to change over time. Traditionally, terror groups and/or networks have chosen to attack targets due to a certain cachet – in which case such targets may be symbolic, iconic or emblematic sites. However the emphasis has now shifted, and in recent years attacks against ‘crowded public places’ have become an aim of some groups and networks involved in terrorism (Home Office 2009). According to the British Government (Home Office 2009), public targets include Bars, Pubs and Night Clubs; Restaurants and Hotels; Shopping Centres; Sports and Entertainment Stadia; Cinemas and Theatres; Visitor Attractions; Major Events; Commercial Centres; Health sector; Education sector; Religious sites/places of worship; and, Transportation hubs (such as rail and bus stations). This targeting of ‘soft’ (non-military) targets, has resulting in a number of large-scale terrorist attacks such as New York (2001), Casablanca (2003), Madrid (2004), London (2005) and Mumbai (2003 and 2008) to name a few. These crowded public places are typified by mass public congregations/congestion, lack of inherent security and protection.

Although debates continue about the relationship between new and traditional threats, the methods and tactics adopted by terror groups tend to be novel, innovative and increasingly focused on sites that will lead to mass casualties; or on multiple coordinated attacks for a similar impact. Typically these crowded areas have features in common such as their lack of access control, but may be bounded (e.g. a stadium or train) or unbounded (e.g. a shopping area). Such attacks and targeting have led to a considerable amount of research interest, and there has been an increase in taking on multi-disciplinary approaches that can be paramount to developing strategies to maintain community safety and deterring terrorism in public places, while simultaneously ensuring acceptability of the measures in the public eye.

Current Counter-Terrorism Methods in Public Places – A British Perspective

The CONTEST strategy was developed and made publicly available in 2006 and updated in 2009 (HM Government 2009). Contributing factors to the public dissemination of the CONTEST strategy included corporate concern that there was no national threat warning system or publicly available counter-terrorism strategy (Gregory 2007). Nicoli and Johnstone (2009: 1) summarise the strategy’s aims, which are based on four pillars of action, as follows: “Pursue terrorists with the aim of bringing them to justice and stopping attacks; Prevent the next generation of political terrorists from coming into being by combating the ideology which might produce them; Protect against the threat of terrorism by taking a range of protective security measures; and, Prepare for the inevitability of an attack by optimising national resilience capabilities”. CONTEST has major implications for the design, construction and operation of the built environment, as the ‘Protect’ strand states that in regard to the built environment, crowded places are at greatest risk from being the target of terrorist attacks. Therefore, the protection of crowded public places is perceived to be one of the most important priorities for security services and policy makers (Coaffee et al. 2008), part of which involves the use of specific products and measures to reduce the impact an attack could have and/or stop a certain method of attack completely, which can involve the design and adaptation of the environment, surroundings and structures.
A wide range of measures are used to counter the threat of terrorism in urban areas, utilising both ‘hard’ measures, such as engineering, and ‘soft’ measures, such as the management of space (Coaffee et al. 2008). The aim of such measures, therefore, are to create an environment that is difficult for terrorists to attack, is protective of its population and assets and is resilient to the consequences should an attack occur (Grosskopf 2006). Grosskopf (2006: 1) defines counter-terrorism methods (CTMs) as “those physical, technological and operational measures intended to devalue, deter, deny and defend against acts of terrorism”. Stand-off, which is the distance between a potential target and an explosive device, is considered the most effective CTM against a vehicle-borne explosive device (Little 2004; Kemp 2007), due to the levels of energy created by an explosive device decreasing rapidly per cube of distance (Little 2004), meaning that as the distance increases, levels of damage decrease significantly. Where stand-off cannot be achieved, which is highly likely in sites or structures that have already been developed in urbanised areas, other CTMs are available and can include and are not limited to:

- Providing perimeter fencing.
- Installing parking security safeguards for both employees and delivery persons.
- Purchasing on-site surveillance cameras.
- Using landscaping and vertical impediments to preclude vehicles from getting close to the site.
- Obtaining some type of employee identification recognition process.
- Using security guards to protect the facility against possible purposeful human wrongdoing Kemp (2007: 617).

Figure 1: Example of unattractive ‘stand-off’ barriers used in central London
Nicoli and Johnstone (2009) acknowledge that whilst the range of CTMs that are used is fairly small and the promotion of their use is widely publicised, vast criticism of their need, use, cost, aesthetic appearance (see Figure 1) and other factors cause concern that need analysing in greater detail. What is also constantly alluded to in the academic and policy literature is the need to balance higher levels of security with concerns for the functionality of places (Coaffee et al. 2008). As resilient planning and design continues to evolve what is required are increasingly inter-professional solutions and an interdisciplinary perspective that can integrate effective and acceptable counter-terrorist innovations into the design of public places.

POTENTIAL FOR INNOVATION IN AEC

It is argued that terrorism and the methods that terrorists use will always be innovative, in order to increase their chances of causing as much harm and fear as possible (Briggs 2005). There is no logic, necessarily, in repeatedly attacking a particular target, or a specific type of target, as the levels of preparedness, planning and security in relation to a terrorist attack will be significantly higher, most likely, following the first attack. Therefore, it could be argued that the innovation of terrorists will need to be bettered by the innovations of those attempting to counter terrorism.

The role of counter terrorism should be a shared responsibility across the professional domains; nonetheless, from an architectural, engineering and construction (AEC) perspective, Bosher et al. (2007) argue that there are a number of key actions that can be undertaken to address systems in the built environment that are at risk from threats such as terrorism. These actions are categorised as broadly relating to: innovation and knowledge (transdisciplinary training and hazard awareness); operations (information exchanges between a wide range of stakeholders such as planners, designers, engineers and the emergency and security services); planning (well designed and suitable locations); and legislation and regulatory incentives (building codes and good practice guidance). It has been argued that innovations for CT in public places can include a number of issues, such as incorporating CT into sustainable urbanism (Coaffee and Bosher 2008), the ‘branding’ of security (Coaffee and Rodgers 2008), the dual use of CT measures, related to natural hazard mitigation (see Coaffee and Bosher 2008) and even how to sensitively incorporate CT for heritage sites (Benton-Short 2007). Recent innovations in the field of CTMs have included: collapsible pavements (strong enough to bear the weight of pedestrians but not large vehicles); large but reconfigurable planters; and an ever widening range of blast resistant materials and cladding. However, for this type of innovation to be expanded, Coaffee et al. (2008) suggest that a framework is required to help construction and non-construction stakeholders to devise and integrate innovative counter-terrorism methods during the earliest planning and design stages (of new projects and retrofits). Accordingly, the research reported in this paper proposes an innovative decision support tool to inform and guide stakeholders and decision makers in their assessment of appropriate and proportionate measures to counter-terrorism.
DECISION SUPPORT FOR CT DESIGN

The RE-Design Decision Support Framework (DSF) has been developed by the universities of Loughborough, Birmingham and Sheffield as a project-focused tool that can help a range of key decision makers to consider the proportionate use of CTMs in new and existing developments. The focus of the tool in application is on crowded public places which are regarded as anywhere in, or adjacent to, locations to which large amounts of the general public have access. This web-based tool has been developed with the assistance of the Centre for the Protection of National Infrastructure (CPNI) and the National Counter-Terrorism Security Office (NaCTSO). By raising awareness of terrorist threats and the implications of such threats in a proportionate manner, this web-based tool helps project decision makers in developing a suitable design and construction strategy. The tool has been designed for a wide range of users (i.e. technical/project managers, risk assessors, architects, designers, chief engineers) and in a way that allows recommendations to be produced within a short period of time. This tool has been developed to encourage more joined-up thinking in relation to how the built environment is designed, built and operated, and will therefore complement broader frameworks such as ISO14001 (International Environmental Management Standard), ISO2600 (Social Responsibility) and BS 25999-1:2006 (Business continuity management: Code of practice). However, it has been developed to represent a contingent tool which can be appropriated and applied to a variety of different situations and contexts. A summary of the process will now be discussed.

**Threat identification**
A threat assessment will typically consider a range of threats (i.e., criminal, terrorist, etc.) for a given development/location (new build or retrofit). The assessment would examine supporting information to evaluate the likelihood of occurrence for each type of threat. Threat identification through a threat and risk assessment will help identify the vulnerabilities and levels of security required. Integrating security needs within the original design allows for the optimal use of resources, and early consideration of the most appropriate solutions, considering factors such as location, operational risk, underground services, aesthetics and other practicalities. Integrating security and counter terrorism measures can prove to be considerably less expensive if incorporated into the original design of a development, rather than retrofitted at a later stage. However, at whatever stage physical security needs are assessed, it is important that the various stakeholders are consulted as to the most appropriate and cost-effective solution to the security needs. Information associated with details of terrorist threats will typically be security restricted. However, in the UK it is possible to access this sensitive information from Counter-Terrorism Security Advisors (CTSAs) that are located within the intelligence services of regional police constabularies. CTSAs can also provide construction professionals with advice on whether counter-terrorism measures should be adopted and what types of measures could be used (see Harre-Young et al. 2009).

**Implications of the Threat(s) (vulnerabilities)**
Once the credible threats are identified, a vulnerability assessment should be performed. The vulnerability assessment can be a relatively simple process that considers the potential impact of specific threats as well as the vulnerability of the building/site. Impact
of loss is the degree to which the operation of the building/site could be impaired by the impact of a given threat. A key component of the vulnerability assessment is properly defining the ratings for impact of loss and vulnerability. These definitions may vary greatly from building to building. For example, the amount of time for which capability is impaired is an important part of impact of loss. If the facility being assessed is a major component of critical infrastructure, a downtime of a few minutes may be a serious impact of loss, while for a travel agent’s office a downtime of a few minutes could be quite minor. Bosher et al. (2009) have devised a set of generic ‘impact of loss’ definitions that have been adapted for the RE-Design tool, these are:

- **Devastating**: The building/site is damaged/contaminated beyond habitable use. Most items/assets are lost, destroyed, or damaged beyond repair/restoration.
- **Severe**: The building/site is partially damaged/contaminated. Some items/assets in the building are damaged beyond repair, but the building/site remains mostly intact. The building/site may be closed for a period of up to 2 weeks or a portion of the building/site may be closed for an extended period of time (more than one month).
- **Noticeable**: The building/site is temporarily closed or unable to operate, but can continue without an interruption of more than one day. A limited number of assets may be damaged, but the majority of the building/site is not affected.
- **Minor**: The building/site experiences no significant impact on operations (downtime is less than four hours) and there is no loss of major assets.

Vulnerability is defined here (after Bosher et al. 2009) to be a combination of the exposure of the building/site to threats and the level of deterrence and/or defence provided by the existing countermeasures. In the context of terrorism, the exposure of the building/site to an attack is determined by a number of factors, such as the likelihood of an attack (based on information provided by the security services) and the extent to which the asset or facility is protected from an attack. Sample definitions for vulnerability ratings are as follows:

- **High**: The building/site would be highly vulnerable to a terrorist attack
- **Moderate**: The building/site would be moderately vulnerable to a terrorist attack
- **Low**: The building/site would have low vulnerability to a terrorist attack

**Risk Analysis**

Once an assessment has been made, a combination of the impact of loss rating and the vulnerability rating (in consultation with leading government agencies and stakeholders) can be used to evaluate the potential risk to the facility from a given threat. An example of a risk matrix is depicted in Table 1.

<table>
<thead>
<tr>
<th>Level of vulnerability</th>
<th>Impact of loss</th>
<th>High</th>
<th>Moderate</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Devastating</td>
<td>H</td>
<td>H</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td>H</td>
<td>M</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>Noticeable</td>
<td>M</td>
<td>M</td>
<td>L</td>
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</tr>
<tr>
<td>Minor</td>
<td>M</td>
<td>L</td>
<td>L</td>
<td></td>
</tr>
</tbody>
</table>
The risk ratings illustrated in Table 1 can be interpreted as follows:

- **H** - Risks are high. Counter-terrorism measures are recommended to mitigate these risks and these should be implemented in a proportionate manner as soon as possible.
- **M** - Risks are moderate. Counter-terrorism measures could be important to the long-term sustainability of the development and are recommended.
- **L** - Risks are low. Counter-terrorism measures may enhance security and contribute towards ‘future proofing’ but are not essential.

If a 'high' or 'moderate' risk has been identified it is advisable to consult with the lead Government agencies responsible for dealing with the specific aspects of the threat, such as mitigation and preparedness (details of these agencies are provided on the project website www.resilientdesign.co.uk). Users would need to consider the implications of the terrorist threats in a number of ways because such threats can have far reaching impacts upon the operations of construction companies, the structural and materials requirements, associated infrastructure, the project's neighbours and the local community.

**Upgrade Options/Recommendations**

Based on the findings from the risk analysis, the next step in the process is to identify CTMs that can lower the various levels of risk. If minimum standard CTMs for a given facility level are not currently present, these should automatically be included in the upgrade recommendations. Additional CTM upgrades above the minimum standards should be recommended as necessary to address the specific threats identified for the facility. The estimated installation and operating costs for the recommended CTMs will need to be considered but also the possible long-term benefits of using such measures.

Studies on the cost effectiveness and return ratios of investments related to mitigating crime and natural hazards have been carried out and can offer an insight into the long-term benefits of proactively considering CTMs. For example, Armitage (2000) showed that in regard to mitigating crime in residential properties, designing in and retrofitting measures cost 26% and 36% respectively of the average cost of a burglary in the UK. With regard to the study of natural hazards, research into Federal Emergency Management Agency grants by the Multihazard Mitigation Council (2005) showed that for every dollar that was spent on mitigation, society saved $4 in the event of a disaster or a hazard causing damage. Benefits of adopting CTMs in the design stage of a project could include reduced insurance premiums, reduced maintenance costs and reduced service disruptions in the event of a terrorist attack. Williams *et al.* (2000) highlighted the implications for those that do not take such action by showing that within two months of the Manchester city centre bombing in 1996, the loss of turnover from local businesses was estimated at £50 million and the subsequent rebuilding programme cost over £500 million. To date insufficient research has been conducted on the costs and benefits of incorporating CT measures, but it is clear that it would nonetheless be prudent to adopt a long-term view of any initial additional costs and how they could be recouped (Harre-Young *et al.* 2009).

The implementation of the recommended security, design and/or structural upgrades should have a positive effect on the impact of loss and/or the vulnerability ratings for
each threat. The final step in the process is to re-evaluate these two ratings for each threat in light of the recommended upgrades. Using a car bomb as an example, the installation of blast protection/resilience measures (i.e. the use of laminated glass and blast proof cladding) will not prevent a bomb blast from occurring, but would reduce the damage caused to the target. Therefore, in this case the impact of loss rating would improve, but the vulnerability rating would stay the same.

The final component of the toolkit is the 'Action plan', a project-specific report that can be used by clients or other interested parties to demonstrate that CTMs have been considered (even if it is merely demonstrating that terrorism did not actually pose a threat). The ‘Action Plan’ is a brief, printed outline of the key actions and issues that should be considered prior to, and during, the construction project. This action plan should ideally be reviewed at each stage of the design, construction and operation process and upon completion of the project the 'Action Plan' can be included in the project's legacy archive.

**Validation of the tool**
The on-line version of the RE-Design toolkit is being validated by a range of construction and security stakeholders. Once this process has been completed the toolkit will be revised (if necessary) and launched nationally in March 2010. The toolkit will be free and publicly accessible to use, merely requiring the users to register their details. The toolkit provides the user with a simple interface to guide them in their decision making with additional guidance documentation and internet links to supporting information as a key component.

**CONCLUSIONS**
Due to the threat of terrorism that exists within the UK and internationally, the British government is encouraging those responsible for the protection and resilience of public buildings and crowded areas to incorporate the use of CTMs where appropriate. While there have been a number of innovative CTMs there is arguably scope for more to be achieved. There is also scope for those who plan, design, build and manage crowded public areas to become more proactive in initiatives to counter the threats of terrorism. The web-based tool represents an innovative approach to meeting these objectives encouraging good practice in the design of resilient public places and the incorporation of effective and acceptable CTMs. By informing the decision-making processes of key stakeholders that are involved with the planning, design, construction, operation and management of crowded public places, opportunities for CTM innovations are more likely to emerge. It is therefore anticipated that AEC professionals will view the required innovations as opportunities to become leaders in the fields of CT and security design, resilient engineering, and public safety (amongst many others).

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