

THE CONSTRUCTION INDUSTRY AND EMERGENCY MANAGEMENT: TOWARDS AN INTEGRATED STRATEGIC FRAMEWORK

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Abstract

Although most emergency events are not entirely unexpected and therefore can, to varying degrees, be mitigated for, the construction industry in the UK does not appear to play a sufficiently integrated role in emergency management. This paper reports on research that is developing a knowledge database and decision support framework to enable more effective emergency planning and response strategies from a built environment perspective. Questionnaire surveys were used to review the opinions of professionals involved with emergency management, construction, planning and insurance (amongst others) on issues related to emergency management in the UK. The early findings suggest that knowledge and awareness of integrated approaches is poor, that training needs to be more interdisciplinary, and the construction sector as a key stakeholder and potential resource is not being used sufficiently. Professions involved with the construction industry, and the expertise they can offer, need to become more integrated with emergency management if lessons are to be learnt from the past and a resilient built environment created in the future.

Keywords: *Construction industry; resilience; mitigation; interdisciplinary training*

INTRODUCTION

Designing, constructing and operating resilient built assets demands an in-depth integrated understanding of how to avoid and mitigate the effects of emergencies and disasters in order to secure a resilient built environment. Resilience should be systematically built-in to the planning and design processes not simply added on as an after thought, however, it is not clear to what extent this is being achieved in the United Kingdom (UK).

Some advances have been made in recent years to incorporate the roles of construction professionals into debates regarding topics such as climate change and sustainability. However, the integration of construction professions with the processes associated with emergency management has largely been neglected

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(Spence and Kelman 2004). Although many emergency events are not entirely unexpected and can therefore be mitigated for, at present emergency management does not play a sufficiently integrated role with the construction industry in the UK. Current and potential threats need to be considered when planning, building and maintaining built assets (Broadbent & Broadbent 2004) and critical infrastructures. Therefore, amidst growing concern for the safety and security of the UK's civil infrastructure in relation to natural and human-induced threats, this paper reports on research that explores the construction sector's knowledge of, and involvement with, emergency management in the UK.

EMERGENCY MANAGEMENT

Traditionally, emergency management has been motivated by immediate challenges or by responding to single events rather than being engaged in long-term planning (Schneider 2002:143) because the profession can be constrained by indifference or outright opposition. The United Nations have adopted a concept of emergency management that combines activities over five phases, incorporating; 1) Pre-emergency preventive and mitigating actions, 2) Formulation of emergency plans and preparedness activities, 3) Emergency relief interventions, 4) Short-term recovery and rehabilitation, and 5) Longer-term reconstruction (UNOCHA 1997). However, only the relief and recovery phases of emergency events receive much public (and media) attention. Schneider (2002) stated that emergency management has largely been viewed as a reactive profession because hazard mitigation is rarely seen as urgent.

“Policy makers and stakeholders alike tend to underestimate hazard potentials. They see a low probability of hazard occurrence, are reluctant to impose limitations on private property, often unwilling to bear the costs incurred by mitigation plans, and frequently are ambivalent toward hazard mitigation, because they see it as being in conflict with other values and goals” (Schneider 2002:144).

Emergency management needs to be placed in a holistic setting and new initiatives found in order to ensure that emergency management duties are viewed as a shared responsibility that not only mitigates potential hazards, but also embraces the sustainability agenda (Trim 2004). Sustainable development is “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED 1987). Emergency management should therefore be concerned with people's capacity to manage their natural and built environment; to take advantage of it in a manner that safeguards their future and that of their children. Part of this shared responsibility could be achieved by integrating more with the construction industry professionals that possess the knowledge and experience of how to design, build, retrofit and operate what are typically bespoke built assets.

THE UK CONSTRUCTION INDUSTRY

By and large, the built environment is designed, built and maintained by the construction industry, which can be defined as “all those firms involved directly in the design and construction of buildings” (Morton 2002:39) and includes civil engineering and infrastructure work such as roads, bridges and railways. The UK construction industry is worth some £65 billion a year, accounts for 8 percent of gross domestic product, and employs 1.9 million people (NAO 2001). The construction industry is a critical component of not only the nation’s economy¹, but is also a fundamental factor in the quality of life and the ability of the government to achieve policy requirements. If a resilient and sustainable built environment is to be achieved and critical infrastructures are to be protected, it is feasible that emergency management in the UK should adopt a strategic framework that promotes the integration of construction related disciplines.

There is currently little commentary within the literature on the contribution of the construction industry related to the mitigation of natural and human-induced hazards. In view of this, research entitled ‘Towards a Safe, Secure and Sustainable Built Environment’ is currently being undertaken on this topic. As part of the project, questionnaire surveys were used to obtain the opinions of a range of construction and non-construction professionals on the topic of emergency management in the UK. Perceptions of the most and least significant natural and human-induced threats were obtained, awareness of emergency management involvement by construction disciplines was investigated and opinions regarding the potential role of the construction sector were sought.

THE RESEARCH

Between September and December 2005, 102 questionnaire surveys were completed by a range of professionals involved with construction, insurance, emergency management, local and national government, urban planning, and academic research. The response rate to the questionnaire survey was low at 28 percent so initially it was useful to assess which professions were most engaged with the topics covered by the questionnaire; this was measured by the questionnaire response rate for each sector (Table 1).

Table 1: Response rate to questionnaire survey by sector

Sector	Sent	Returned	Response rate
Engineering Consultancy	13	7	54%
Insurance/Risk	13	6	46%
Academia/Research	31	11	36%
Government department/agency	40	13	33%
Emergency Management	45	13	29%
Construction (large scale operation)	99	28	28%
Utilities (e.g. water, transport)	8	2	25%

¹ Studies show that Gross Domestic Fixed Capital Formation in construction is 45-60 percent of the total capital formation (Ofori, 1990; Hillebrandt, 2000).

Developer	36	8	22%
Trade representation/bodies	27	6	22%
Construction (small – medium scale)	41	6	15%
Urban planner (local authority)	15	2	13%
Total	367	102	28%

Above average responses to questionnaires were provided by engineering consultancies (54 percent), the insurance/risk sector (46 percent), academia/research (36 percent) and Government Agencies (33 percent). Below average responses were from local authority urban planners (13 percent), and small to medium scale construction companies (SMEs) (15 percent). Follow up telephone calls and e-mail correspondences to a broad range of the non-responders highlighted that the main reason for not returning a questionnaire was due to the individual believing that the topics covered by the questionnaire (such as awareness of and involvement with emergency management, and hazard identification, training and mitigation) were not applicable to them.

Perceptions of threats to the UK

Threats to the UK built environment are diverse and include extreme natural hazards (such as floods and storms) and human-induced hazards (such as terrorist attacks, explosions at industrial facilities and mass transportation accidents). Typically, these hazards cause minor disruption to the economy, infrastructure and residents of the UK but some commentators (such as UKCIP 2002; Keane 2005) believe that the magnitude and frequency of these extreme events are increasing. As such, current and potential future threats need to be considered when planning, building and maintaining the built environment. In view of this, the research sought the views of the respondents regarding their perceptions of which natural and human-induced threats they considered to be most or least significant (Figure 1).

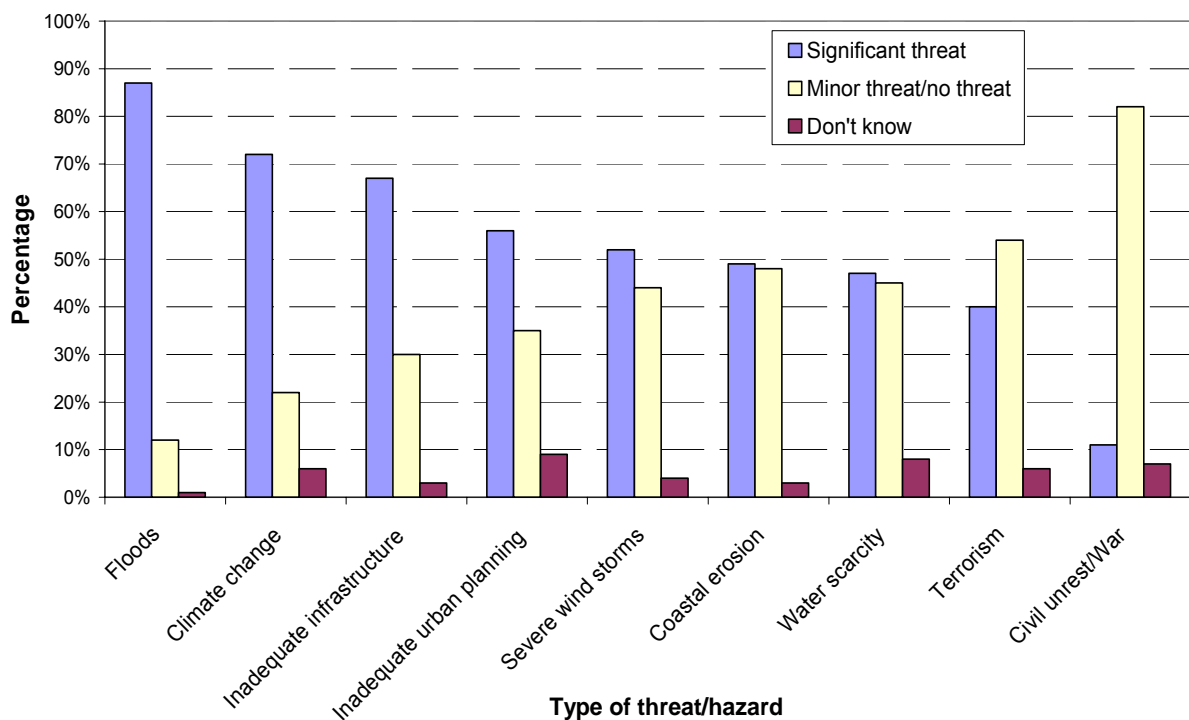


Figure 1: Perceptions of threats to the built environment in the UK

Figure 1 shows that the most significant threats to the built environment in the UK are considered to be floods, climate change, ageing/inadequate infrastructure, and inadequate urban planning. Minor threats were perceived to be civil unrest/war and terrorism. It is interesting that in light of last year’s terrorist attacks in London that terrorism was not generally viewed as a significant threat to the UK’s built environment. However, it is significant that respondents with primary responsibility for public safety, such as urban planners and emergency managers, were the only disciplines that perceived terrorism to be a significant threat.

Perception of threats by sector

All sector categories perceived the threat from flooding to be the most significant threat to the built environment (see Table 2). The respondents involved with the construction sector considered ‘wind storms’, ‘coastal erosion’ and ‘terrorism’ to be of no threat to the built environment, which is in complete contrast to the responses from ‘urban planners’. Respondents from the utilities sector and ‘developers’ did not view climate change as a significant threat, while trade representation, urban planners and engineering consultants considered climate change to pose a significant threat. It is difficult to assess the reasons behind these differing perceptions. Further in-depth analysis of the data did not produce any statistically significant observations or correlations, but this may be symptomatic of low sample sizes. Nonetheless, differing opinions occur and to some degree these opinions are delineated across disciplinary lines.

Table 2: Perceptions of threats to the UK – by respondents’ sector

Sector of respondent \ Threats	Floods	Climate change	Ageing infrastructure	Inadequate urban planning	Severe wind storms	Coastal erosion	Water scarcity	Terrorism	Civil unrest/war
Academia/Research	♦							☐	☐
Construction	♦				☐	☐		☐	☐
Developer	♦	☐	♦	♦			♦		☐
Emergency Management	♦							♦	☐
Engineering Consultancy	♦	♦	☐						☐
Government department/agency	♦			☐					☐
Insurance/Risk	♦		♦			☐			☐
Urban planner (local authority)	♦	♦	♦		♦	♦		♦	☐

Trade representation/bodies	♦	♦	♦	♦	♦		♦	□	□
Utilities (e.g. water, transport)	♦	□	♦		□	□			□

Key: ♦ Significant threat
□ No threat

Therefore, it is important to recognise that essential differences, such as perceptions of threats and risk, exist between professional people from different backgrounds (Pavlica and Thorpe 1998). Indeed, differences exist between the disparate professionals working in the area of emergency management (Trim 2004) and construction (Morton 2002) because an individual's identity is formed by history, tradition, politics and education and is further influenced by management learning and development; and shaped also by factors associated with organisational change (Pavlica and Thorpe 1998) and types and methods of employment (Morton 2002). These differences need to be considered when attempting to integrate a wide range of professions into any strategic framework, but before this can be done it is essential to understand who is (and should be) involved with emergency management.

Emergency Management – Who is involved?

The Civil Contingencies Act 2004 (Cabinet Office 2004) attempts to deliver a single framework for civil protection in the United Kingdom to meet the challenges of the 21st century. The Act is separated into two substantive parts: local arrangements for civil protection (Part One) and emergency powers (Part Two). The overall objective for both parts of the Act was to modernise outdated legislation. The Act focuses on three types of threat -

- 1) an event or situation which threatens serious damage to human welfare;
- 2) an event or situation which threatens serious damage to the environment; or
- 3) war, or terrorism, which threatens serious damage to security

Part One of the Act covers local arrangements for civil protection and sets out clear expectations and responsibilities for front line responders at the local level to ensure that they are prepared to deal effectively with the full range of emergencies from localized incidents through to catastrophic emergencies. It divides local responders into two categories (see Table 3).

Table 3: Organisations involved with emergency management in the UK

CATEGORY 1 ORGANISATIONS	
Local Authorities	All principal local authorities (County, District, Borough & Metropolitan)
Government agencies	Environment Agency, Scottish Environment Protection Agency (SEPA), Maritime and Coastguard Agency
Emergency Services	Police Forces, British Transport Police, Police Service of Northern Ireland, Fire Authorities, Ambulance Services
National Health Service (NHS) Bodies	Primary Care Trusts, Health Protection Agency, NHS Acute Trusts (Hospitals), Foundation Trusts, Local Health Boards (in Wales), Welsh NHS Trusts, Health Boards (in Scotland), Port Health Authorities
CATEGORY 2 ORGANISATIONS*	
Utilities	Electricity, Gas, Water and Sewerage, Public communications providers (landlines and mobile networks)

Transport	Network Rail, Train Operating Companies (Passenger and Freight), Transport for London, London Underground, Airports, Harbours and Ports, Highways Agency
Government	Health & Safety Executive (HSE)
Health	The Common Services Agency (in Scotland)

* Cat. 2 organisations are responsible for co-operating with Cat. 1 organisations and sharing relevant information.

Organisations in Category One will have duties placed upon them to:

- a) Assess local risks and use this to inform emergency planning;
- b) Put in place emergency plans;
- c) Put in place Business Continuity Management (BCM) arrangements;
- d) Put in place arrangements to make information available to the public about civil protection matters and maintain arrangements to warn, inform and advise the public in the event of an emergency;
- e) Share information with other local responders to enhance co-ordination; and
- f) Co-operate with other local responders to enhance co-ordination and efficiency

The Civil Contingencies Act 2004 has therefore put in place a framework that enables a wide range of sectors, such as transport operators, utilities companies and communications providers, to be integrally involved with emergency management planning. However, the extent to which the respondents were aware of who is and who isn't involved in emergency management was unclear.

Awareness of who is involved

An integral part of this study involved the identification of which sectors are currently involved with emergency management in the UK. Approximately one in six of the respondents were not aware of whether the construction sector is involved with emergency management processes. Nearly half of the respondents stated that the construction industry is involved on an ad-hoc basis (but mainly related to emergency response, search and rescue and reconstruction). Three quarters of the respondents agreed that there is a pressing need for professions associated with the construction industry to become more involved with emergency management in the UK (only 3 percent disagreed). Of those who construct the built environment (in contrast to those who plan and govern the built environment) only 30 percent are involved in most cases and one third are involved on an ad-hoc basis.

The majority of respondents (81 percent) stated that local authorities are involved with emergency management, while 43 percent of the 'developers' believed that local authorities were not involved. This may highlight a potential weakness in the awareness of some developers regarding the key role of local authorities in the planning process. The majority of the respondents (75 percent) did not feel that developers or clients were involved with emergency management. In contrast 57 percent of developers and 71 percent of engineering consultants felt that developers and clients were involved. Two thirds of the respondents believed that civil engineers are involved with emergency management but 69 percent of emergency managers and 67 percent of professionals in the insurance and risk sectors believe that civil engineers are not involved. Again, awareness of who is responsible for

emergency management planning and consultation appears to be very mixed and in some cases extremely limited.

Future involvement with emergency management

Over half of the respondents stated that urban planners, designers, engineers (civil and structural), developers, clients and architects should be more involved with emergency management than they currently are (refer to Table 4). However, the two respondents from local authority urban planning departments did not agree that they should be more involved. The two respondents from utilities companies did not think they were sufficiently involved with emergency management; in stark contrast, the respondents that were not from this sector stated that utilities companies were significantly involved with emergency management. It is possible that this may reflect a delay between what has been set out in the Civil Contingencies Act, regarding involvement of utilities companies etc., and the establishment of the working groups and sub-groups that constitute the proposed framework. Whatever the reasons may be, at the moment there is little evidence that the respondents are aware of who is and who isn't involved with emergency management in the UK; this is an issue that should be resolved urgently.

Table 4: Perceptions of which disciplines are involved with emergency management in the UK

Discipline	Level of involvement with emergency management?			
	Involved but need to be even more involved	Involved sufficiently	Not involved sufficiently, should be more involved	Not involved and don't need to be
Local authorities	X			
Civil engineers	X			
Structural engineers	X			
Utilities companies		X		
Risk managers		X		
Academia/Researchers		X		
Developers/clients			X	
Urban/town planners			X	
Architects			X	
Designers			X	
Main contractors			X	
Construction managers			X	
Insurance industry			X	
Facilities managers				X
Materials suppliers				X
Surveyors				X
Conveyancing				X

There is a need for policy makers, practitioners and the academic community to realise that hazard risk reduction and emergency management should be more integrated than in the past. Hazard mitigation and urban planning is more than a niche issue in the construction industry and knowledge about disruptive events needs to be incorporated into the mainstream risk-management process (Lorch 2005). In view of this it was necessary to assess the extent to which the respondents believed that hazards and risk reduction issues had been integrated into their professional training (see Table 5).

Table 5: The extent to which hazard and risk awareness/reduction is integrated into professional training – by sector

Sector of respondent \ Issue	Natural hazards	Human made disasters	Climate change	Hazard & risk reduction
Academia/Research	Yes	Yes	Yes	Only recently
Construction (large scale)	No	-	-	Only recently
Construction (small-medium scale)	No	-	-	Only recently
Developer	-	No	-	No
Emergency Management	Yes	Yes	Only recently	Only recently
Engineering Consultancy	Yes	No	Yes	Only recently
Government department/agency	Yes	Yes	Yes	Yes
Insurance/Risk	Yes	Yes	-	-
Urban planner (local authority)	-	-	-	Yes
Trade representation/bodies	No	No	Yes	-
Utilities (e.g. water, transport)	-	-	Only recently	Only recently
Respondents that build	-	No	-	Only recently
Respondents that govern/advise	Yes	Yes	Only recently	Yes

Note: 'Yes' - majority of respondents from the sector said issues are integrated

'No' - majority of respondents from the sector said issues are not integrated

'Only recently' - majority of respondents from the sector stated that issues only recently considered

'-' denotes that there was no clear indication that issues are integrated or not.

The findings suggest that awareness of natural/human-induced/climate change related hazards tends to be most prominent with respondents who govern/advise on the built environment (such as the Environment Agency, the Department for Environment, Food and Rural Affairs and the insurance sector), rather than those who actually design, build and maintain it. The respondents from the construction sector (including developers and trade representation) typically stated that the issues highlighted in Table 5 were not integrated into their professional training. The findings suggest that the levels of training provided to construction professionals on the awareness of these hazards needs to be more integrated into their professional training than it has been in the past.

INPUT FROM THE CONSTRUCTION INDUSTRY

It has been suggested that emergency management is too focused on response, while mitigation activities are overlooked (Schneider 2002). Presently, the construction sector is involved with response on an ad-hoc basis and it would make sense if construction professionals were more involved with mitigation activities, via consultation related to the design and engineering of structures. However, Lorch (2005) believes that some of the non-technological problems of emergency planning are a demonstration of the disciplinary boundaries within the scientific community and between the scientific community and the policy community. Consequently, there is a need for policy makers, practitioners and the academic community to realise that hazard risk reduction and emergency management should be more integrated than in the past. Hazard mitigation and urban planning is more than a niche issue in the construction industry and knowledge about disruptive events needs to be incorporated into the mainstream risk-management process (Lorch 2005). So how can this integration be facilitated?

Government Offices, through the work of the Regional Resilience Teams (RRTs) and Regional Resilience Forums (RRFs), have an important role to play in the promotion and implementation of the regional tier of emergency management as set out in the Civil Contingencies Act 2004. Regional Resilience Forums have been formed to bring together key players within each region, such as local authorities, central government agencies, the armed forces, and the emergency services. This study has assessed the extent to which the respondents are involved with these RRTs/RRFs. Table 6 shows that emergency managers (as one would expect) are likely to be regularly involved with RRT/RRFs. However, professions associated with the construction sector and development are not currently involved with RRT/RRFs.

Table 6: Involvement with Regional Resilience Teams/Forums

Sector	Percentage involvement?			
	Regularly involved	Involved on an ad-hoc basis	Would like to be involved	No
Emergency Management (n=13)	62	23	15	0
Government Dept/Agency (n=13)	31	8	8	53
Engineering Consultancy (n=7)	14	29	0	57
Insurance/Risk (n=6)	0	50	17	33
Urban planner (local authority) (n=2)	0	50	0	50
Trade representation (n=7)	0	20	20	60
Academia/Research (n=11)	0	9	45	46
Construction (broad sector) (n=33)	0	3	18	79
Developers (n=8)	0	0	0	100
Utilities (n=2)	0	0	0	100
Total (n=102)	13	13	15	59

$\chi^2 = 79.917$; significant, $p < 0.01$

Roles within Regional Resilience Teams/Forums

These findings suggest that despite the introduction of the Civil Contingencies Act 2004, there is still a lack of involvement from private sector stakeholders (91 percent of respondents not involved) compared to public sector stakeholders (62 percent of respondents involved)². Arguably, the emergency management sector needs to be more proactive and initiate involvement from private sector stakeholders by, for instance, inviting representatives from construction companies or contractors to become involved with Regional or Local Resilience Forums. For example, those involved with construction projects could be classed as temporary (whilst they are involved with a project under a certain local authority's jurisdiction) 'Category Two responders' (as a requirement of the Civil Contingencies Act 2004). This would mean that representatives for the various disciplines/contractors/stakeholders would be obliged to become intrinsically involved with Regional Resilience Forums. This could be made a prerequisite for any contractor/organisation that is involved with the design, planning, construction and operation of critical infrastructure or any large scale projects (such as hospitals, transport infrastructure, or any other project that is essential to the safe and secure operation of the built environment, including the 2012 Olympic games facilities). To make this suggestion more workable it may be necessary for the relevant parties to provide a representative that holds a suitably broad perspective of the project being undertaken. This representative should ideally possess sufficient knowledge of the potential hazards that could affect the project and be aware of the impacts of the project on safety, security and sustainability.

Improved training

Because the impacts of natural and human-induced hazards have not been sufficiently integrated into the professional training of people in the construction sector (refer to Table 5), improvements to training programmes would be required. At the same time research communities will need to be more integrated if the temporal concepts of life cycle, hazard and impact are to be better understood in the future. Lorch (2005) believes that higher education and training can play a major part in the integration of sustainable development and hazard, vulnerability and risk reduction principles into the domain of built environment students and asks, "Should we be investigating the capabilities of the built environment under extreme circumstances as well as subtle, protracted circumstances?" (Lorch 2005:210). For example, in Europe, much work has been done to re-educate architects to design eco-friendly and more resilient buildings, which not only have lower carbon emissions, but are more resistant to floods and storms (Roaf *et al.* 2005).

Increasing competitiveness

The construction sector should embrace, and possibly pre-empt, regulatory changes regarding resilient construction requirements and use it as an opportunity for

² $\chi^2 = 41.517$; significant, $p < 0.01$

competition within the sector, nationally and globally and as a 'reputation damage' avoidance measure. In this way the construction industry could significantly contribute towards actions related to mitigation initiatives whilst viewing the required innovations as opportunities to become leaders in the field of resilient structures.

CONCLUSIONS

Recent natural and human-induced events have highlighted the fragility and vulnerability of the built environment to disasters and emergencies. These physical systems have traditionally been designed, built and maintained by the myriad professions involved with the construction industry. However, the construction industry has not been involved sufficiently in the planning and mitigation of natural and human-induced hazards (Spence and Kelman 2004). Resilience should be systematically built-in to the planning and design processes not simply added on as an after thought, however, it is not clear to what extent this is being achieved in the UK. In view of this, the key findings from this research so far are:

- The most significant threats to the built environment in the UK are perceived to be floods, climate change, ageing/inadequate infrastructure, and inadequate urban planning. Minor threats were perceived to be civil unrest/war and terrorism. Only those with responsibility for public safety (such as emergency managers and urban planners) believed that terrorism is a significant threat to the UK.
- There is a lack of awareness demonstrated by the respondents regarding who is responsible for, and involved with, emergency management planning and consultation in the UK.
- Of those who construct the built environment, only 30 percent are involved in emergency management in most cases and one third are involved on an ad-hoc basis. The majority of the respondents (75 percent) agreed that there is a pressing need for disciplines associated with the construction industry to become more involved with emergency management in the UK.
- Awareness of natural/human-induced/climate change related hazards tends to be most prominent with respondents who govern/advise on the built environment, rather than those who actually design, build and operate it.
- Professions associated with the construction sector and development are not currently involved with RRTs/RRFs.

Emergency management needs to be more proactive than it currently is and also embrace a strategic framework that integrates a wide range of professions from the construction sector. Emergency management that does not integrate the range of experience and skills that the construction industry can offer is tantamount to mismanagement of the built environment.

Recommendations

If a resilient built environment in the UK is to be achieved, emergency management needs to become more integrated with professions from the construction industry. This could be achieved by:

- Involving construction related stakeholders in Regional Resilience Teams and Forums thereby facilitating the integration of skills that construction disciplines can offer. Emergency management and construction professions could then become more involved with locational planning and building design codes related to future developments in hazard risk areas; this is of particular importance regarding the protection of critical infrastructures.
- The construction sector should embrace and pre-empt regulatory changes regarding resilient construction requirements and use it as an opportunity for competition within the sector, nationally and globally and as a 'reputation damage' avoidance measure. In this way the construction industry can significantly contribute towards actions related to mitigation initiatives whilst viewing the required innovations as opportunities to become leaders in the fields of resilient structures and sustainable construction etc.
- All stakeholders should increase their awareness. Risk and hazard awareness training needs to be systematically integrated into the professional training of architects, planners, engineers, developers etc. Trans-disciplinary training for construction professionals and emergency managers should be encouraged. At the same time clients and consumers should be made aware of the benefits of resilient and sustainable built assets in contrast to the 'lowest price' options.
- Research needs to be expanded to assess the resilience of materials, fixtures and fittings to a wide range of potential hazards. Studies should also be conducted to find alternative options regarding resilient and sustainable materials, designs and processes.

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