

# Proceedings

# Disasters and the Built Environment

Selected Papers presented at the CIB World Building Congress  
Construction and Society, Brisbane 5-9 May 2013



**International Council  
for Research and Innovation  
in Building and Construction**



CIB Task Group  
TG63 - Disasters and the Built Environment

Papers from the Designated Session Disasters and the Built Environment that took place as part of the CIB World Building Congress, Brisbane, Australia, May 2013, under the responsibility of Task Group TG63 - Disasters and the Built Environment

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CIB Publication 381



## TG63 - Disasters and the Built Environment

Under the 2010-2013 mandate, the aim of the Task Group is:

- to bring together international perspectives and activities related to disaster risk reduction in the built environment from socio-technical and socio-economic perspectives.
- to develop context sensitive ways of incorporating disaster risk reduction principles, and measuring the impacts of such principles, in building, construction and reconstruction activities at community/local, regional and national levels and across a range of low-, middle- and high-income nations.

To accomplish this, the Task Group will:

- encourage new international, collaborative and multi-disciplinary research activities that will interact with the private and public sectors and governmental and non-governmental agencies.
- develop, share and disseminate appropriate research methodologies and disaster risk reduction initiatives that are appropriate to building, construction and reconstruction activities at local, regional and national levels.

In this context the specific research objectives are:

- to define how disaster risk reduction can be implemented in building, construction and reconstruction activities in various contexts and for various stakeholders
- to develop context sensitive disaster risk reduction principles and clear methods for implementation of these principles for building, construction and reconstruction activities
- to validate and refine the disaster risk reduction principles for building, construction and reconstruction activities based on previous and emergent research findings.

Papers from the Designated Sessions that took place as part of the CIB World Building Congress, Brisbane, Australia, May 2013, under the responsibility of Task Group TG63 – *'Disasters and the Built Environment'*.

### **The context**

It has been argued that the broad range of people responsible for the delivery, operation and maintenance of the built environment need to become more proactively involved in making cities resilient to a wide range of known and unforeseen hazards and threats. Accordingly, the United Nations International Strategy for Disaster Reduction (UNISDR) with the support of CIB has been campaigning to help cities and local governments to get ready, reduce the risks and become more resilient to disasters. By drawing upon the UNISDR's campaign, and other global and local initiatives, these conference sessions examined the multi-disciplinary perspectives of how cities can be made more resilient, incorporating associated physical, social, economic and institutional issues.

### **The papers**

The sixteen papers presented in the TG63 sessions have gathered research results and studies related to 'Making cities more resilient' from across the world. The amount of papers submitted for the TG63 sessions also highlights that proactively dealing with disaster risks in the built environment is becoming an increasingly important part of the CIB's activities.

Some of the overriding messages from these insightful papers highlight that despite regulatory guidance designed to increase urban resilience through the use of public and private sector stakeholders, there are a number of operational obstacles that need to be surmounted. It is suggested that there are a range of strategies required to overcome these obstacles; these strategies are likely to include revisions to regulations and building codes, the tightening of planning policy, improvements to professional training and communications, and developing good practice guidance about a broad range of structural and non-structural risk reduction measures etc. However, pragmatically it is clear that there is the need to understand how a broad range of construction stakeholders can be better informed and incentivised to take a more proactive role in building-in resilience. Therefore, while these papers indeed provide valuable suggestions and insights into how disaster risks can be reduced there is still more work to be done to better understand how the operational obstacles can be overcome across a range of contexts. The future work of CIB through TG63 (and related task groups and working commissions) will be tasked with addressing these matters over the next few years.

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**August 2013**

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# Should the Disaster Management Strategies in Bangladesh be just about Constructing New Shelters?

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## Abstract

With a population of over 143 million people and a population density of more than 1,200 persons per km<sup>2</sup> Bangladesh is a very densely populated country. The country's geographic location in the waters of Bay of Bengal, often the source of tropical cyclones and storm surges, makes Bangladesh one of the most natural disasters prone nations in the world. A severe tropical cyclone hits the country, every 3 years on average. As 16 major cyclones have hit the country since 1960 with the loss of nearly 500,000 lives, multi-purpose cyclone shelters – that can provide refuge to susceptible population in the events of natural hazards and to a certain extent with the utility of community functionalities during normal times – have become a vital component of disaster management strategies. Country has already constructed more than 2,500 such shelters across 16 of the most disaster prone coastal districts. This paper uses content analysis of disaster management policies, and programs in order to comprehend and assess the distributions of shelters with a lens of integrated strategic asset management framework. Analysis of secondary data indicates that existing cyclone shelters are not equitably distributed to cater the needs of the highly vulnerable population. In the backdrop of the recommendation of The World Bank [TWB] that the country needs 5,500 new shelters (TWB, 2010), this paper contends that future construction of cyclone shelters must be need as well as evidence-based in order to ensure that highly vulnerable population benefits from cyclone shelters the most.

**Keywords: Cyclone Shelters, Disaster Management, Evidence-based Strategy, Leximancer, and Integrated Strategic Asset Management**

## 1. Introduction

With a population of over 143 million people and a population density of more than 1,200 persons per square kilometre, Bangladesh is a densely populated country in the South Asia Subcontinent (BBS, 2012). Bangladesh is also the world's third most vulnerable country to

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sea-level rise in terms of the number of people, and among the top ten countries in terms of percentage of people living in low-lying coastal zones (Pender, 2008). Sixteen coastal districts along the Bay of Bengal are prone to severe tropical cyclones with sustained winds of 64 knots (74 miles/hour) or more that often generate storm surges and huge waves. These surges can rise as high as seven metres and the flood waves can travel up to 30 miles inland. On average, a severe tropical cyclone hits Bangladesh every 3 years and the country has been hit by 16 major cyclones with a loss of nearly 500,000 lives since the 1960s (Karim and Mimura, 2008). It is apparent that the need to reduce natural disasters casualties, particularly cyclone-related deaths, is nowhere more crucial than in Bangladesh.

The country has built more than 2,500 multipurpose cyclone shelters across 16 of the most cyclone-prone coastal districts (CEGIS, 2009). These shelters – that can provide refuge to susceptible population and to a certain extent with the utility of community functionalities during normal times – have become an integral component of country's disaster management strategy. Since the changing climate and associated sea-level rise is predicted to further increase the frequency and intensity of cyclonic events in the foreseeable future (Karim and Mimura, 2008), The World Bank (2010) estimates that Bangladesh needs more than fifty five hundred new cyclone shelters in order to protect the vulnerable population from natural disasters. While the actual number of the need is contested, the current understandings of the way cyclone shelters are distributed and managed are inadequate. It is in this context, this paper makes explores the utility of an integrated strategic asset management (ISAM) framework (AAMCoG, 2012), developed in conjunction with asset management industry associations in Australia, in order to examine the state of cyclone shelters in Bangladesh.

The paper begins with an introductory overview of ISAM framework and its relation to the construction and management of cyclone shelters as assets. An empirical study examining the state of cyclone shelters in 16 coastal districts of Bangladesh is presented next, including the method as well as the results and discussion. The paper ends with the recommendation that future construction of cyclone shelters must be need as well as evidence based so that it can serve the purpose of benefiting highly vulnerable population.

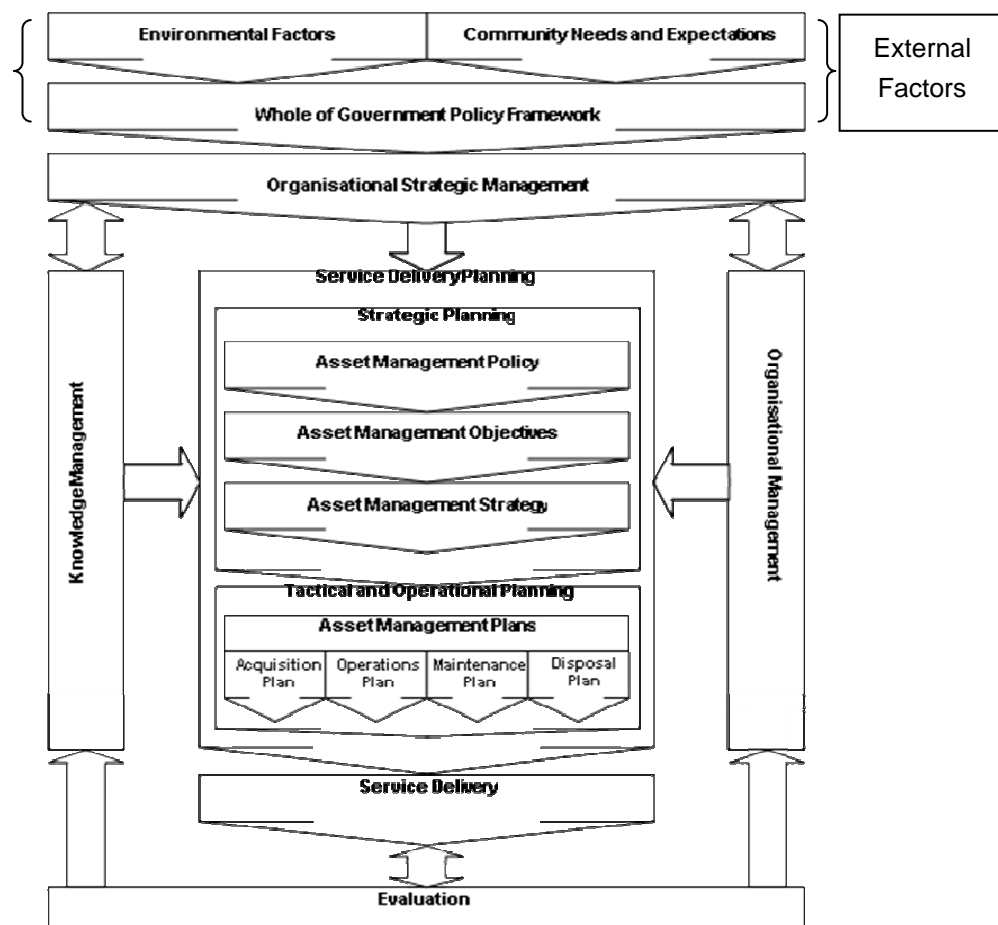
## **2. ISAM Framework and MPCS Management**

According to the BSI (2008), asset management can be defined as '*systematic and coordinated activities and practices through which an organization optimally and sustainably manages its assets and asset systems, their associated performance, risks and expenditures over their life cycles for the purpose of achieving its organizational strategic plan*' (p. 2). In line with this definition and also to provide a contemporary outline to assist asset service owners, providers and operators, AAMCoG (2011) has developed an ISAM framework (Figure 1). The elements of the ISAM framework are put together in order to guide achieving optimisation of service delivery of engineering and infrastructure assets.

The ISAM framework (AAMCoG, 2011) is based on the following five principles:



- i. Assets exist to support service delivery. Therefore non-asset solutions should be considered
- ii. Agencies should manage assets consistent with whole-of-government policy frameworks and take into account whole of life costing, future service demands and balance between capital expenditure and maintenance requirements
- iii. Asset management should be integrated with agency strategic and corporate planning
- iv. Asset management decisions should holistically consider sustainability outcomes: environmental, social, economic and governance
- v. Governance arrangements should clearly establish responsibility for functional performance of, and accountability for, the asset and service delivery (pp. 5).



**Figure 1: Integrated strategic asset management framework (source: AAMCoG, 2011)**

These principles are particularly useful for shaping management of cyclone shelters in order to internalise the needs and expectations of community stakeholders regarding sustainable management. For the purpose of this paper, we focus on the external factors of the framework and utilise it in order to assess the following three factors: a) environmental, b)

community needs and expectations, and c) whole-of-government policy in relation to cyclone shelters distribution and management in Bangladesh. These three factors are elaborated upon next.

## **2.1 Environmental factors**

Recognition of the environmental risks e.g. the changing climate is a valuable first step towards better planning of new infrastructure investments and mitigating potential damage to existing infrastructure (CSIRO, 2006). Like any other major infrastructure assets, cyclone shelters need to operate in dynamic circumstances where they are exposed to short, medium and long-term variability in ambient environmental conditions. The variability includes the estimation of environmental conditions e.g. river erosion, tsunami, earthquake that can be expected over the life of cyclone shelters. These environmental factors can influence the geographical locations of asset construction, their functionalities, and most importantly, their core purpose of delivering services to the vulnerable people. While statistical view of the variability of environmental conditions is understood to have an impact on the construction and management of assets, incorporation of environmental conditions into asset planning and design has been largely overlooked so far (Rayner, 2010). The capacity for identification, assessment and evaluation of risks associated with environmental factors on micro, meso and macro level needs to be substantially increased in managing assets like the cyclone shelters and the information also needs to be systematically integrated in the planning processes of constructing new and existing assets (Smit et al., 2006; Nelson et al., 2007).

## **2.2 Community needs and expectations**

Community needs and expectations need to be managed through the effective institutionalisation of stakeholder engagement. Stakeholder engagement is the process of mapping and interpreting the expectations of external and internal groups and/or individuals, who have stakes in asset management activities or will be effected directly or indirectly by its outputs. According to the Beach and Keast (2010), stakeholder engagement comprises of stakeholder identification, stakeholder classification, strategy development, stakeholder engagement, and of the maintenance of relationships. From the asset management perspective, stakeholder engagement is essential throughout all stages of the asset life cycle. For instance, community is likely to play a major role by sharing local knowledge about environmental factors and actual needs which eventually assist in planning, designing, constructing, operating, maintaining and disposing phases of any infrastructure assets.

## **2.3 Whole-of-government policy model**

Whole-of-government policy model, which is comprised of legislation, policies, plans, service delivery strategies and standards, capital and recurrent budgets, government institutions; and partnerships including with working groups, community based organisations and private providers. In case of public assets, the identification and analysis of the community's need for services is regularly undertaken by different tiers of government agencies and communicated to various departments in a range of ways, including emerging policy,

legislation, priorities and objectives. These are translated by agencies into specific departmental objectives, performance indicators, services and service standards which are addressed in major documents such as strategic plans, budget documentation and annual reports. Bangladesh has a regulative framework for disaster management that provides guidance for relevant policy documents. The contents of three documents related to the regulative framework: a) the *Disaster Management Act*, b) the *National Plan for Disaster Management*, and c) the *Standing Orders on Disaster* (still in a draft stage) are analysed in the context of whole-of-government policy model under the ISAM framework adopted earlier.

### **3. Methodology**

The central research question that this paper addresses is whether or not cyclone shelters in Bangladesh are distributed as per the actual needs. An exploratory case study approach (Blatter, 2008) which examines an operating environment of cyclone shelters using multiple sources of quantitative and qualitative data was selected as the principal research method for this study.

A case study approach is particularly useful in qualitatively understanding a phenomenon because the method is open to the use of theory or conceptual categories that guide data collection and data analysis (Yin, 1984; Meyer, 2001). We relied on various secondary data sources e.g. the Ministry of Food and Disaster Management (MFDM), and the Bangladesh Bureau of Statistics (BBS) in calculating the ratio between population vulnerable to cyclones and cyclone shelters. We also made use of an ISAM framework in order to explore three of the external factors that are important to consider prior to constructing shelters: a) environmental factors e.g. frequency of cyclones, b) community needs and expectations e.g. vulnerability of the people, and c) whole-of-government policy e.g. disaster related policies and their implementation. The utility of exploring these factors is such that it enables us to triangulate our analysis through the content analysis of disaster management policies, programs and literature on disaster management in assessing the distribution of cyclone shelters.

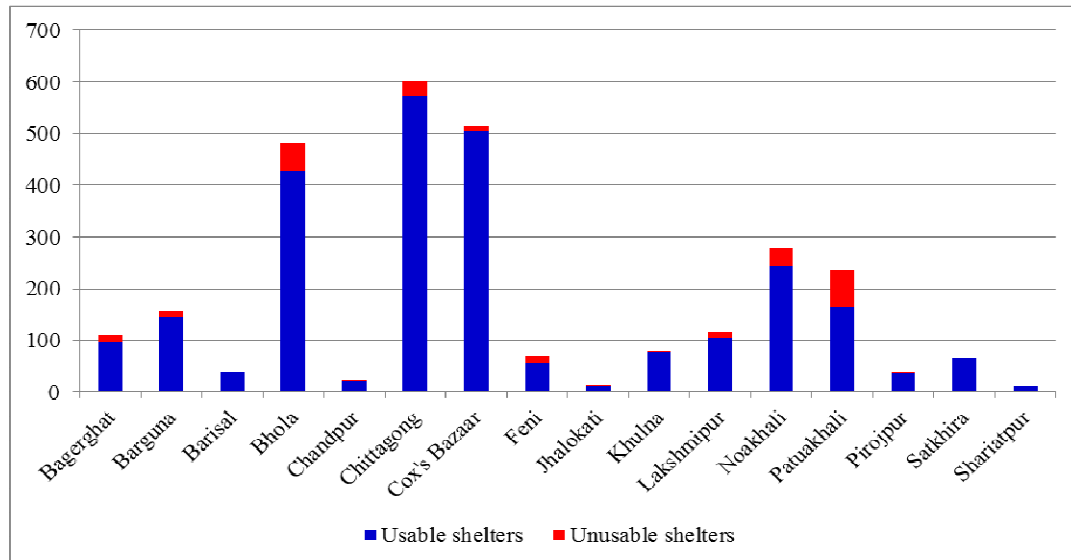
The contents of three policy documents: i) *The Disaster Management Act*, ii) *The National Plan for Disaster Management*, and iii) *The Standing Orders on Disaster* were analysed using a Leximancer software. Leximancer differs from the standard content analysis, which identifies themes and concepts based on the word frequency and co-occurrence of families of terms (Smith & Humphreys 2006; Smith 2003). Leximancer was particularly useful for examining the interconnectedness of central themes contained within the documents outlined above.

## **4. Results and Discussions**

### **4.1 Cyclone shelters**

In order to reduce the cyclone-related casualties, Bangladesh has already built more than 2,583 cyclone shelters across 16 of the most cyclone-prone coastal districts. The analyses indicate that nearly one tenth (246) shelters are deemed unusable (CEGIS, 2009). As Figure

1 shows, Patuakhali district has the highest percentage of unusable cyclone shelters (30.38%) whereas Satkhira and Shariatpur districts have 100% of cyclone shelters usable. While some of the plausible causes behind the high frequency of shelters being unusable are discussed in the next section, they are worthy of further field investigation.

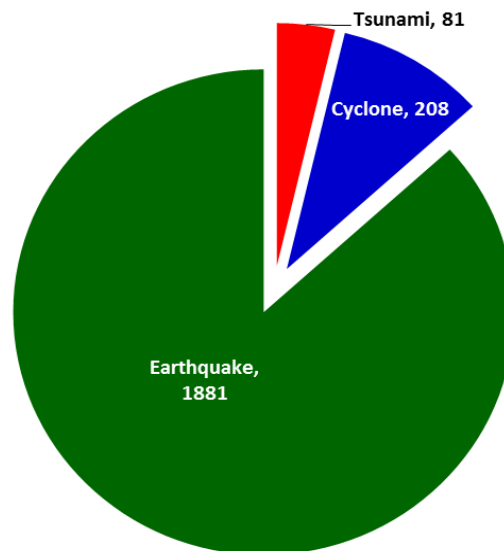


**Figure 2: The State of Cyclone Shelters in 16 Coastal Districts of Bangladesh**

The analyses also indicate that existing shelters are not equitably distributed to cater the needs of the highly vulnerable population. For instance, Noakhali district with a total of highly vulnerable population of 1,807,000 has an existing shelter capacity for accommodating only 266,000 people. That means at present 85% of the vulnerable population in the district are exposed to high risk. Conversely, Khulna district without any highly vulnerable population has an existing shelter capacity for accommodating 76,000 people. These findings clearly indicate that shelters are constructed on an *ad hoc* basis and hence inequitably distributed.

## 4.2 Environmental factors

Most of the cyclone shelters that are deemed unusable because of the lack of day-to-day maintenance and external factors such as river bank erosion, poor quality of construction materials, less consideration given to potential high wind speed at construction. It could also be the case that, people displaced during the cyclones are hesitant to use these facilities because they are worried about the structural well-being of these shelters due to poor maintenance during normal times. Consequently, cyclone shelters are abandoned and become unusable when needed the most.

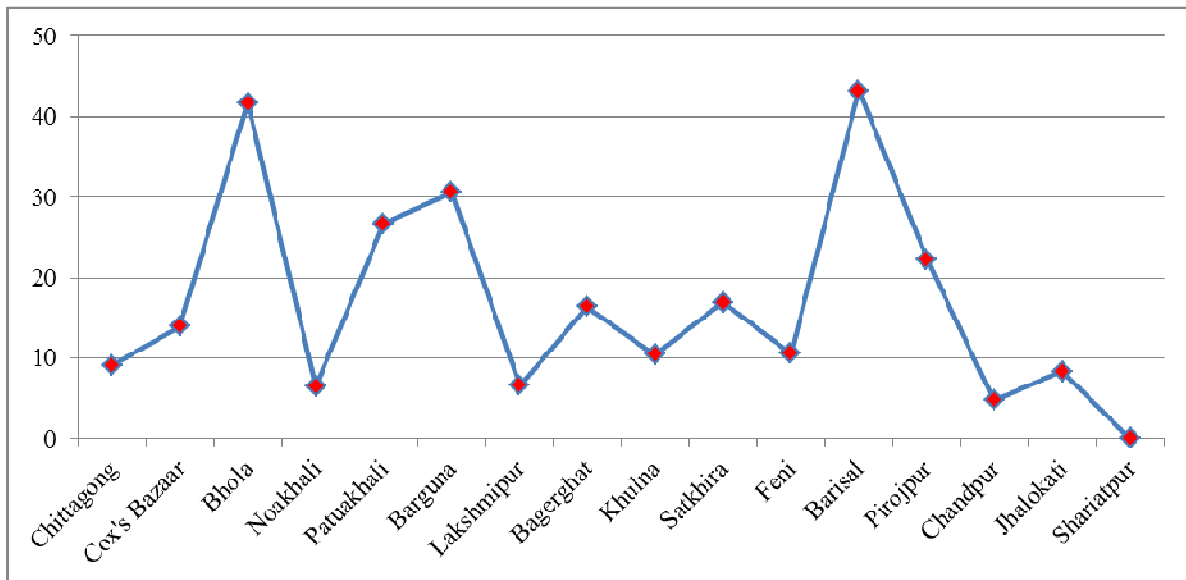


**Figure 3: Vulnerability of existing cyclone shelters**

For instance, as Figure 3 indicates the structural assessment of 2,583 cyclone shelters conducted by CEGIS (2009) revealed that around 3% of shelters were vulnerable to tsunami, nearly 8% were vulnerable to cyclone and a whopping 73% were vulnerable to earthquake. If these shelters are to be the backbone of the overall disaster management strategy, the construction and management cyclone shelters need to take into hazards other than cyclones in consideration as well. Cyclone shelter construction decisions must rely on evidence-based decision-making and consider environmental factors over the entire life-cycle of proposed shelters and not just the construction phase. Unless these considerations inform the design, specification, construction materials selection and techniques, operating models and disposal procedures of the cyclone shelters, the overall utility of these assets are likely to be reduced in the event of cyclones or other natural disasters for that matter.

### **4.3 Community needs and expectation**

Although there is no unanimous agreement over what constitutes a genuine community stakeholder, an individual or an organisation with a stake or an interest in various stages of cyclone shelters can be considered one. The needs and expectations of these community stakeholders are more or less represented through management committees that are often democratically governed by the local people at the grassroots. However, only 19% of shelters have community participation mechanism in place during the operation phase (CEGIS, 2009).

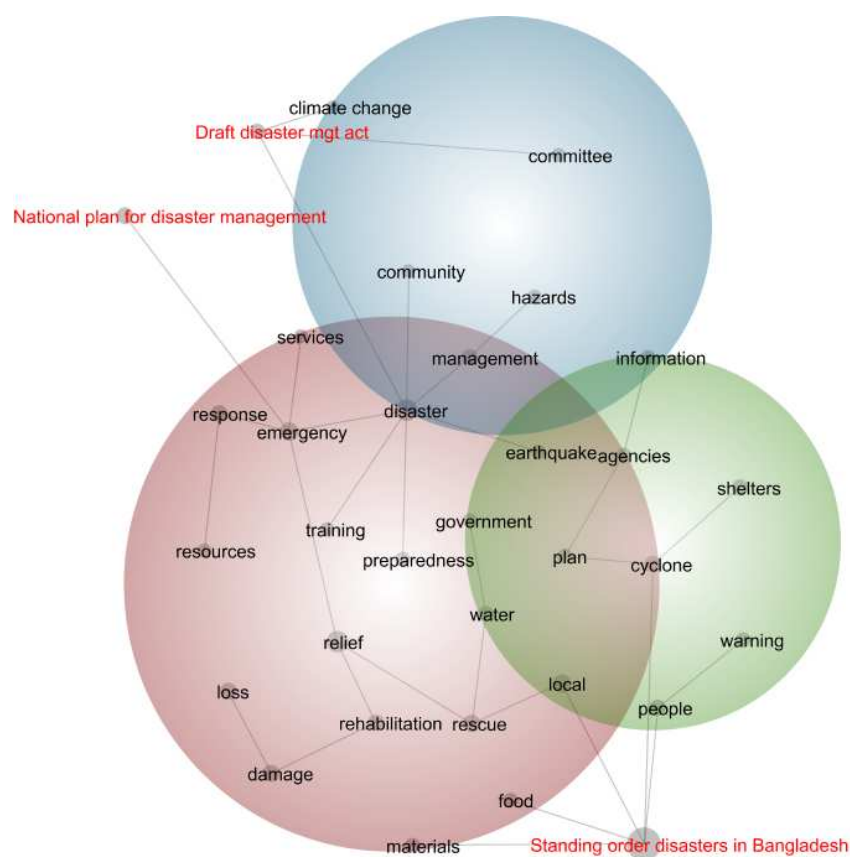


**Figure 4: Community participation in the governance of cyclone shelters (%)**

These findings suggest that disaster management strategy is more or less concentrated on constructing the shelters for the sake of it instead of long-term utility of the shelters. As Figure 4 suggests, the majority of cyclone shelters do not have community based participatory governance mechanism in place. In particular, Shariatpur district performs very poorly in this regard with none of the shelters having participatory governance mechanisms.

#### **4.4 Whole-of-government framework**

Of the three policy documents identified earlier, The *Disaster Management Act* forms the legal basis (i) for the protection of life and property (ii) to manage long term risks from the effects of natural as well as technological and human induced hazards, and (iii) to respond to and recover from a disaster. The *National Plan for Disaster Management* provides the overall guideline for the relevant sectors and the disaster management committees at all levels to prepare and implement specific plans for their respective areas. The plan also identifies the key sectoral policy agenda for disaster management. *The Standing Orders on Disaster* provide a detailed institutional framework for disaster risk reduction and emergency management. These *orders* are expected to outline detailed roles and responsibilities of Ministries, divisions, departments, various committees at different levels, and other organizations involved in disaster risk reduction and emergency management.



**Figure 5: Leximancer generated content analysis map of three policy documents**

As Figure 5 shows, the *draft Disaster Management Act* and the *National plan for Disaster Management* are relatively close together when compared to the *Standing Order on Disasters in Bangladesh*, indicating more overlap in terms of the contents analyses. Based on the Leximancer analyses, five of the most prominent concepts in the three documents are concisely included in Table 1 below. The table clearly shows that the concept of community shows high connectivity between the *Act* and the *Plan*. However, the notion of community is disconnected from where it is needed the most, from the *Standing Order*.

**Table 1: Five prominent concepts identified by Leximancer**

Policy Document	Prominent Concepts
Disaster Management Act	Committee, services, hazards, community and climate change
National Plan for Disaster Management	Climate change, hazards, community, emergency and information
Standing Order Disasters in Bangladesh	Materials, local, rescue, rehabilitation and food

In order to comprehend community needs and expectations in the construction of cyclone shelters, it is important to involve local people including vulnerable groups for improved management of the shelters. However, the *Standing Order* as it is seems to have failed in serving as guidance to community based cyclone shelters management.

## 5. Conclusion

This paper began with an introductory overview of ISAM framework and utilised this framework in order to explore the construction and distribution of cyclone shelters in Bangladesh. The results indicated three main findings. First, there was a lopsided focus on constructing the shelters for the sake of it, rather than ensuring ways to manage these assets by engaging communities. For instance, nearly 9% of the existing shelters were deemed unusable in the event of natural disasters. In some cases e.g. Patuakhali upto one-third of the cyclone shelters were unusable. Second, the current distribution of cyclone shelters was disconnected from the on-ground needs. The cyclone shelters were not equitably distributed to cater the needs of the highly vulnerable population e.g. 85% of the vulnerable people in Noakhali district are at risk in the event of future natural disasters. Third, while the actual construction of the shelters was the responsibility of several layers of government agencies, these agencies did not have clear guidelines for the management of the cyclone shelters. The fact that less than one-fifth of the shelters have community participation mechanism in place during the operation phase means that the existing planning mechanism is myopic and has failed to take into account the operation phase and beyond.

Based on these findings, the paper sees some value in the ISAM framework as an integrated guidance for need-based construction and evidence-based management of cyclone shelters. In order to achieve this, hazard and risk maps and related information need to be not only updated regularly but also used in planning processes at all levels for cyclone shelter construction and management. There is no doubt that existing and new shelters are vital for mitigating or minimising the casualties of vulnerable populations in the event of natural disasters. If cyclone shelters are to be the backbone of disaster management strategies in Bangladesh, these facilities cannot be disconnected from the very local communities that they service. This paper recommends that policy level direction on the distribution and management of cyclone shelters might be more effective when: a) it promotes democratic election the management committee at the bottom-up level rather top-down level, and b) incorporating community needs and requirements in designing the facilities and finalisation of proposed shelter locations.

## Acknowledgement

This paper was developed within the CRC for Infrastructure and Engineering Asset Management (CIEAM), established and supported under the Australian Government's Cooperative Research Centres Programme, in collaboration with the Collaborative Research Network (CRN) program within Southern Cross University.

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