The 2005 Pakistan[1] Earthquake

and

Cyclone SIDR (Bangladesh) 2007

A COMPARATIVE CASE STUDY IN HUMANITARIAN LOGSTICS

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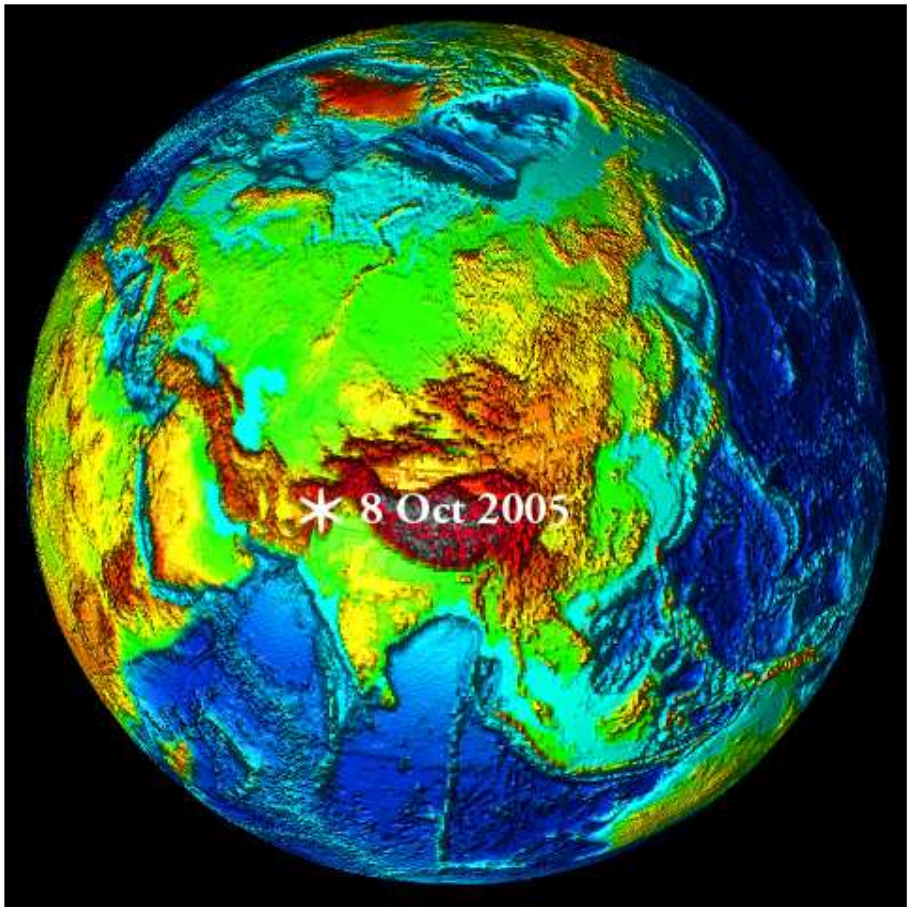
[1] The epicentre of the earthquake was located in the Pakistan-administered section of the disputed region of Kashmir, and over 90% of deaths and injuries took place in either this part of Kashmir or Pakistan itself. Given the politico-geographic sensitivities of this region, the seismic event has also been labelled the Kashmir Earthquake and the South Asia Earthquake. However, the majority of publications including, importantly, those from the UNJLC refer to it as the Pakistan Earthquake and this description will, therefore, be used in this Case Study.

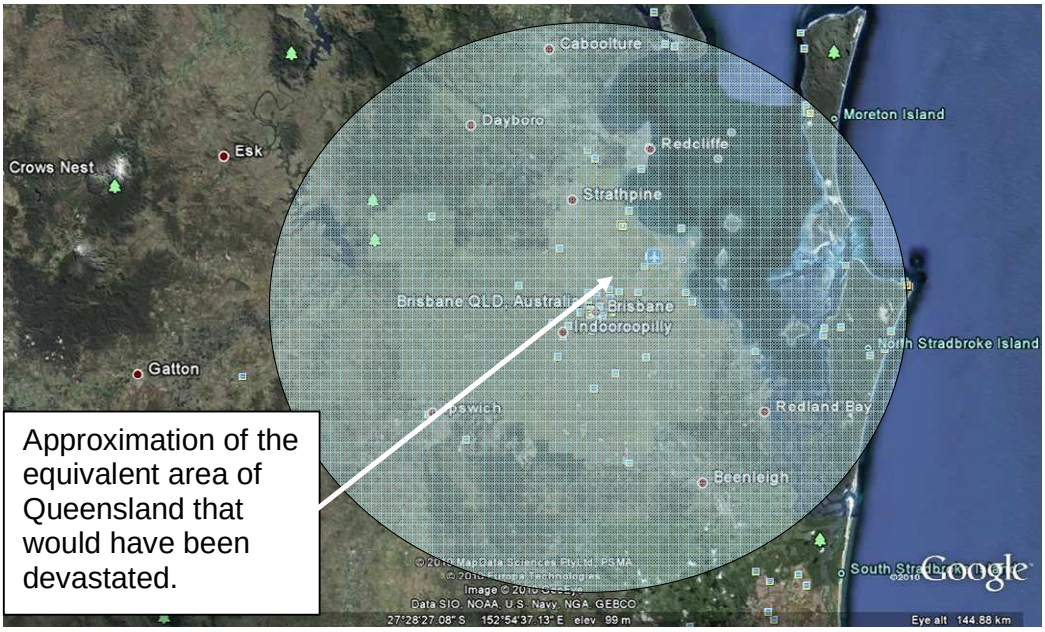
The 2005 Pakistan Earthquake



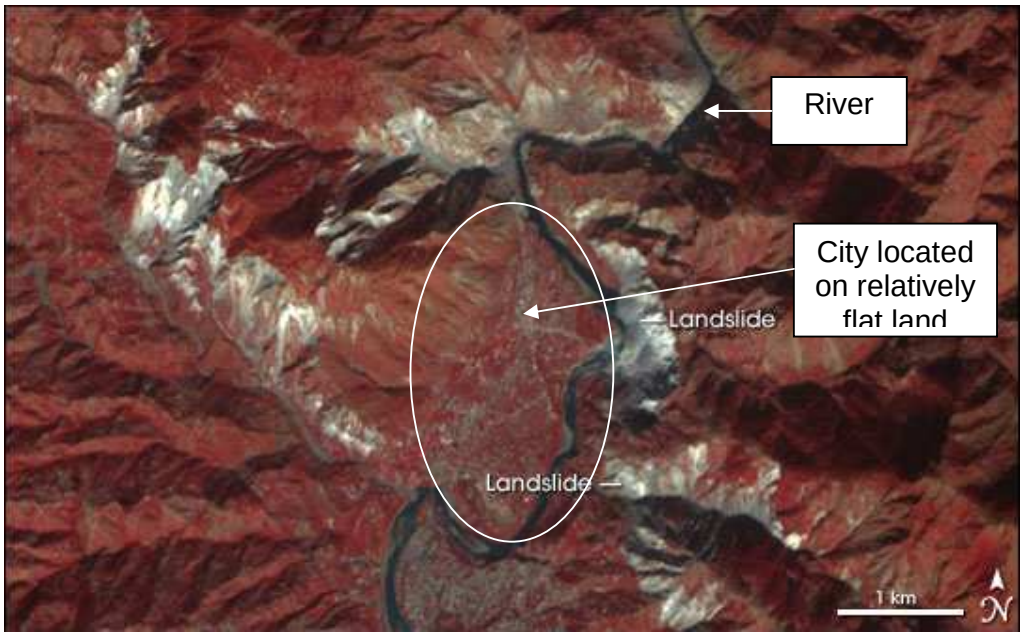
An earthquake of magnitude 7.6 occurred on 8th October 2005 at 0850 local time in an area centred 70mi Northeast of Pakistan's capital (Islamabad), and the main event was followed by 978 aftershocks of magnitude 4.0 or above over the following three weeks.

Although the event occurred close to the Pakistan-administered region of Kashmir, the shock waves travelled along the length of the steep sided valleys and, generally, did not cross the mountain range into the Indian administered region of Kashmir.

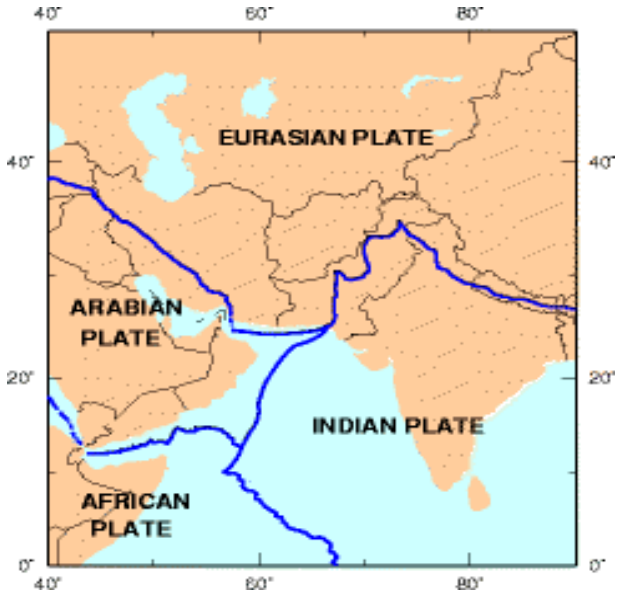
The quake caused damage over an area of some 30,000 sq km (ie a circle with a radius of approximately 100km from the epicentre). A map of Australia showing an equivalent area is below, and it is approximately the same size as the country of Belgium or the State of South Carolina in the USA.



However, the terrain of the area is severe with many deep valleys and few roads. Although there are a number of large cities (such as Muzzafarabad) which are located on relatively flat land, some 40% of the population of the area lives at an altitude of over 3,000m. These village communities are supported by a network of tracks that are frequently only passable on foot or with pack animals. Furthermore, it is typically the poorer section of the population that lives at altitude often on subsistence farms and with adults working away from the home (eg as truck drivers or within the cities).



The area is geologically active being along the confluence of the Eurasian and Indian Plates and has, therefore, seen a number of significant earthquakes including Quetta (1935) and Gujerat (2001), as well as those in adjacent countries such as BAM (Iran) (2003) and Kocaeli (Turkey) 1999.



The Earthquake Impact

The Impact on People

Whilst the bald statistics of around 75,000 deaths and a similar number of people injured give a clear view of the magnitude of this disaster, an even more stark appreciation can be obtained from the following vignettes:

- The earthquake struck on Saturday morning which is a normal school day in Pakistan. As a result, most students were at school and were trapped when many of the buildings collapsed (see below). Meanwhile, because it was the month of Ramadan, many adults were taking a nap after their pre-dawn meal and, again, were caught in collapsing houses.

- Some 10,000 school buildings were damaged or destroyed in the earthquake. As a result, approximately 850 teachers and around 18,000 students died.

- Around 65% of the 800 health facilities in the area were destroyed or badly damaged.

- In addition to the destruction in the towns and cities (eg collapsed apartment blocks), over 400,000 rural homes were damaged or destroyed.

The Impact on Infrastructure

Almost all of the buildings (of whatever construction) collapsed in the areas close to the epicentre, and the destruction continued for up to 100km. For example, in regions some 30 km from the epicentre 25% of the buildings collapsed and 50% were severely damaged.

In general terms, the construction of the buildings falls into one of four categories:

- Single story stone buildings (75% of the stock in the affected villages and 15% in the urban areas). These were unable to resist the earthquake's lateral movements because:

    - The quality of the mortar was poor (1 part cement to 10 parts sand) or, in some cases, mortar was not used at all.

    - There were few, if any, horizontal beans other than door plinths.

    - Similarly, there were few, if any, vertical members. As a result any collapse of a particular portion of the wall continued uninterrupted around the whole house.

- "Con Block" buildings (60% of the urban stock). These also provided limited quake resistance due to:

    - The poor quality of the con blocks themselves.
    - Poor quality of the mortar.
    - Inadequate wall thickness – one tier of con blocks was insufficient to resist the shear effects.

Figure 4: Collapse of unreinforced concrete block masonry houses in Kamsar near Muzaffarabad (Latitude N34° 24.6' and Longitude E73° 28.5')

- Reinforced concrete. Such buildings have been frequently used for locations such as schools and hospitals. These frequently collapsed because of:

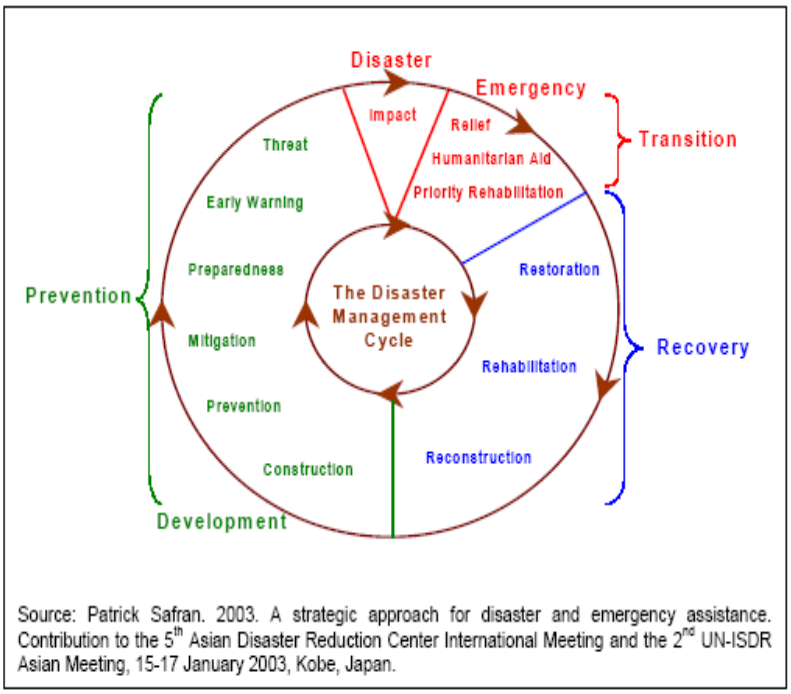
    - Deficient design for seismic forces.
    - Improper length and location of column pieces.
    - Improper spacing and anchorage of lateral ties.
    - Poor quality concrete.

Figure 6: Collapse of Sangam Hotel, a 5 story RC frame building in Domel, Muzaffarabad (Latitude N34° 21.3' Longitude E73° 28.3')

The Response to the Earthquake

Although many academic models talk in terms of three phases of Disaster Relief (eg Preparation, Response, Rehabilitation), it is clear that in the case of the Pakistan Earthquake the situation was more complex and more closely aligned to the model of Safran (2005) in that there was a clear distinction between the initial Disaster Phase and the Emergency Phase (see below).

The Disaster Management Cycle



Source: Patrick Safran. 2003. A strategic approach for disaster and emergency assistance. Contribution to the 5th Asian Disaster Reduction Center International Meeting and the 2nd UN-ISDR Asian Meeting, 15-17 January 2003, Kobe, Japan.

This evidenced by the broad order timeline that is shown overleaf. In particular, it will be noted that, apart from the International Rescue Teams, the majority of International Support did not reach the country until after E+7. Thus, until then, Pakistan was very much on its own.

By the same token, E+30 represents the point at which the flow of goods into the country by air began to decrease and road, rail and sea transport took over.

PAKISTAN EARTHQUAKE – TIMELINE – E Day = 8th October 2005

E Day + n	Event
0	• Earthquake strikes at 0850 (local). (0350 GMT) • 1030 (GMT) IRC rescue team mobilises - 78 personnel (mainly from 5 fire services) + 4 rescue dogs.
1	• 8 strong UNDAC Assessment Team arrives in Islamabad. • IRC team arrives Islamabad and 1st section (of 3) moves to Muzaffarabad via helo and starts rescue work. • Pakistan Army mobilises some 50,000 personnel
2	• First USAID Aircraft arrives in Pakistan • UN Humanitarian Relief Coordination Meeting • Team Leader for USAID (DART) arrives in Pakistan • UN Disaster Management Team coordinating interagency rapid assessments • Pakistan Red Crescent assessment teams due to file reports within 24 hours • S&R teams from UK (62 pax); Austria/Germany (50); Turkey (87); Russia (27) other Int Orgs (30+) in the Muzaffarabad area.
3	• IFRC FACT with members from Australia, Austria, Norway, Spain, Turkey & USA begins arriving in Pakistan. • Red Cross/Crescent Regional Disaster Response Teams being mobilised. • Red Cross ERUs (Field Hospital, Logistics, Basic Health Care) deploying
4	• UNJLC activated. • IFRC FACT Team now 16 strong and almost all have arrived in country. • 11 ICRC/IFRC ERUs deployed/deploying.
5	• IRC withdraws from Muzaffarabad area having saved an estimated 75 casualties who would otherwise died whilst trapped. • First formal request from UN to NATO for air transport assistance.
6	• All S&R operations in Muzaffarabad cease. • As road access improves, the shortage of transport is becoming critical. • 58 Helicopters (mainly Pakistan Air Forice) made 310 flights on this day alone. • First UK Aid Flights arrive • First NATO Aid Flights arrive

7	• Only 30% of 900 outlying villages accessible by road.
8	• 19th IFRC Flight arrives – total to date 450 Tons
9	• 1st UNJLC Bulletin • IFRC reports that outlying villages are only just being reached in order to conduct Needs Assessments an, for example, one area of 14 villages (population 15,000) has yet to receive any relief assistance at all. • IFRC reports that relief effort is now in full swing with 87 staff from 24 countries operating in country • 19 IFRC Flights to date.
10	•
11	• Estimated that 1 in 5 villages in disaster area has yet to receive any assistance. • Over 100 National and International Relief Agencies are operating in country. • Islamabad airport normally handles 15-20 flights/day, but this has been doubled. In addition, the military section is receiving one flight every 20 minutes. • Existing warehouse capacity at Islamabad is full.
12	• Recognition that dealing with outcome of the Earthquake is potentially more difficult than 2004 Tsunami • Demand for transport has pushed up hire rates. • 69 Helos deployed but only 4 have cargo capacity >5 tons. 24 Helos en route (5 with 5 ton capacity) • NATO “airbridge” implemented primarily for carriage of support from NATO governments. • Road access improving, but continually being blocked by aftershock generated avalanches. But Pakistan Army heavy machinery is able to clear routes quickly. • UN has lifted ban on high resolution images of earthquake zone following pressure from NGOs.

13	• Airport congestion reducing, not least by deployment of private venture Airport Emergency Team handling personnel & equipment to supplement Pakistan army.
	  • But delays caused by failure to remove unloaded cargo from the airport remain (esp NGOs).
	  • Pakistan authorities threatening to seize unclaimed goods.
	• Airbridge flights planned to increase.
	• UNHAS Helicopter Passenger Service inaugurated.
	• Major difficulties experienced in clearing NGO imports of light vehicles through customs.
	• Pakistan Ministry of Foreign Affairs has established a 24hr Emergency Coordination Cell.
	  • ECC seeks details of all NGO POCs + current and planned activities.

14	• Free transport for road goods available from Atlas Logistique (Pakistan based charity) and from Pakistan National Logistic Corporation. • Major pressure to persuade NGOs to maximise use of rail network to reduce pressure on roads

16	• As op enters Week 3, most UN & NGO Agencies have completed the immediate phase of their relief programme.
	  • Concern over lack of coordination with easy-to-reach areas over-serviced and other localities not addressed at all.
	  • Only limited attempts made by NGOs to coordinate and deconflict their activities.
	• Helo cargo carrying capacity likely to double over next 10 days.
	  • 73 a/c (10 heavy) rising to 120 (28), giving theoretical daily capacity of 570 tons

18	• 40th IFRC Flight arrives; total to date 1000 Tons

20	• Current concerns are:
	  • Poor engagement by Donors in on the ground decision making.
	  • Lack of visibility of UN and NGO pipelines.
	  • Availability of trucks to service “final mile” from Hubs as many truckers only interested in the main routes.

25	• As snow is beginning to fall on the higher areas, major efforts are focussed on these areas. Issues include:
	  • Reluctance of some farmers to come down to valleys through fear of loss of title to their land, concern over animals livelihood or desire not to be in a tented camp.
	  • Pakistan army is taking lead on provision of support to these people, but this is not easy as helos can often not land.
	  • Development of “Quake Jumper” concept with teams landing on ridges and descending to the valleys to assess needs calling in support (eg food or medical) as required.
	• Airport congestion reducing, not least as sea and overland transport are replacing air as the primary form of strategic transport.

30	• 70th IFRC Flight Arrives – total to date: 1750 MT. Cost to date: $7,000,000. Total cost to date across all NGOs of air transport estimated at no less than $20,000,000 and probably nearer $25,000,000. • UNJLC states that sea freight is now the primary means by which relief supplies are entering the country.

CYCLONE SIDR – BANGLADESH, 2007

Bangladesh is a relatively poor country with a *per capita* Gross Domestic Product (GDP) that places it 196 out of 229 countries in the world. Its geographic location in the Bay of Bengal means that it is particularly vulnerable to a broad range of disasters including cyclones, flood, droughts, earthquakes, tornados and famine. Furthermore, it has a large population (some 140m – approximately 45% of that of the United States), and yet the country is similar in size to the State of Iowa.

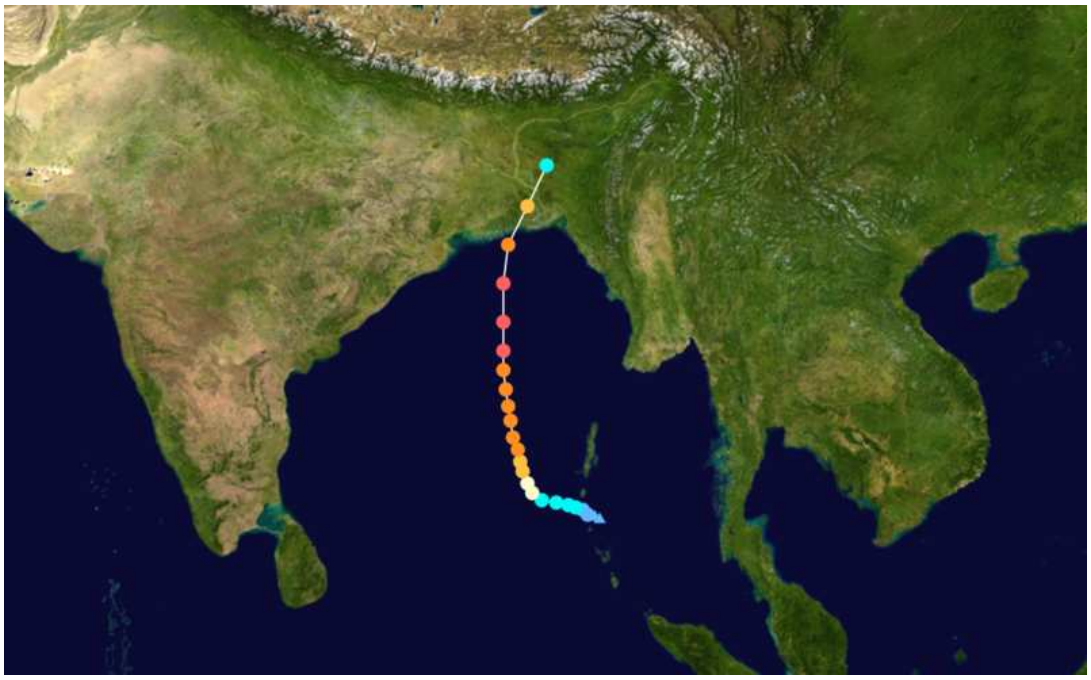
Whilst cyclones of varying strengths strike the country with great frequency, there have been 14 serious events in the last 25 years and, of these, three (BHOLA (1970), GORKY (1991) and SIDR (2007)) have been particularly disastrous. The table below provides an overview of these three, together with Cyclone NARGIS that struck neighbouring Burma in 2008.

Cyclone Name	Date	Wind Speed on Making Landfall & Category on the Saffir/Simpson Scale	Estimated Tidal Surge Height (m)	Estimated Deaths
BHOLA	12 Nov 1970	115 mph/185 kph (Cat 3)	6-9	300-500,000
GORKY	29 April 1991	155 mph/250 kph (Cat 4)	6-7.5	138,000
SIDR	15 Nov 2007	150 mph/240 kph (Cat 4)	3-5	4,234
NARGIS	2 May 2008	135 mph/215 kph (Cat 4)	3-4	150,000-1,000,000

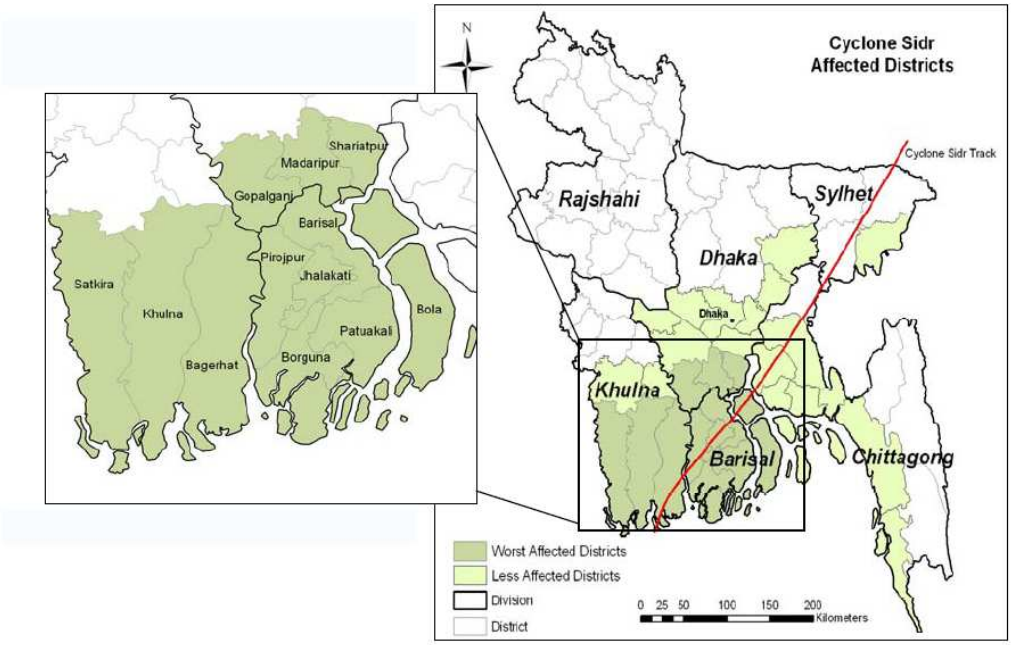
Cyclone BHOLA resulted in a loss of life that was of a similar level to the 2004 Asian Tsunami. Indeed, it has been argued that this disaster was one of the causes of the break up of the country of Pakistan with those in the former East Bengal (now Bangladesh) suggesting that the country as a whole had paid insufficient attention to the risk of cyclones and their concomitant effect on the Eastern part of the country. Although more powerful than BHOLA, Cyclone GORKY that struck the country in April 1991 killed far fewer people. This is a testament to the preparatory efforts that had gone on over the preceding 20 years, as well as the increasing effectiveness of the post-disaster management processes.

Against this background of an improving national disaster management system, a similar magnitude cyclone (SIDR) struck in November 2007 and followed a similar track to its two major predecessors and devastated a similar area of the country. However, the estimated casualty figure of 4,234 deaths reflects a hundredfold improvement over the preceding 37 years.

SIDR began to develop on 9th November before being upgraded to a "cyclone" on 12th November, a "severe cyclone" later that day, and a "very severe cyclone" early on 13th November. It reached its peak strength on the morning of 15th November before making landfall at around 6.30pm local time across an area of some 1,000km in diameter. Figure 5 provides an overview of the cyclone's track. The arrival of the cyclone was accompanied by heavy rain and a storm surge of some 10-15 feet (3-5 metres) although, fortunately, it struck at low tide otherwise the effects would have been greater still.



Some 35M people (20%) of the population live in the 19 coastal districts of Bangladesh which have a resulting high population density of some 1000 persons/sq km. Many of these people live on off-shore islands known as “chars” (meaning “children of the land”) which have been created by the silt that flows down the main rivers (the Padma (Ganges), the Brahmaputra, and the Meghna), as well as over 230 lesser ones). The chars are, typically, less than 3 feet (1 metre) above sea level and have very limited forestation leaving them vulnerable to cyclones, and it was areas such as these that took the main force of Cyclone SIDR.



The population pressures within the country that result in the poorer sections of society tend to live on the chars have broader implications including the desire for households to continue earning (for example through fishing) and a parallel tendency to ignore cyclone warnings and/or to delay cyclone preparations, a reluctance to leave their homes and possessions, and relatively low educational levels which adds to the challenge of ensuring that warnings are understood and acted on. Furthermore, the population of the chars tends to adopt relatively conservative attitudes, and this raises further cultural issues leading to particular vulnerability for women.

Bangladesh Comprehensive Disaster Management Plan (CDMP) and Cyclone Preparedness Programme (CPP)

As a result of their experience of regular disasters, the Government of Bangladesh (GoB) has developed a Comprehensive Disaster Management Plan that aims to integrate the pre- and post-disaster activities of National and International organisations, and a key element of this is the Disaster Preparedness Programme (CPP).

The CPP is initiated by warnings of an impending cyclone that are now given some 72 hours in advance as a result of improvements in aerial (satellite) surveillance and computer modelling. This is a far cry from the situation reported in 1971 when the estimates of the strength and landfall for Cyclone BHOLA were based around a combination of reports from shipping, coastal based radar systems and manned aircraft.

The resultant warning system is based on a scale of 1 ("low") to 10 ("great danger"), and once this reached level 4 some 44,000 volunteers from the CPP (that is managed by the Bangladesh Red Crescent Society) are activated. Working in small teams, they are able to get to the outlying areas typically using bicycles for transport, and loud hailers and flags to transmit their message. It has been estimated that, as a result of this activity, around 40% of the population living in the predicted path of the cyclone (some 3 million people) were evacuated in the 36 hours immediately preceding the landfall, and of these some 1.5 million were accommodated in cyclone shelters. In addition, the CPP volunteers were able to employ many of their skills in basic rescue techniques, first aid, post-cyclone security, destruction damage assessment, and distribution of relief materiel to good.

It has also been recognised that, in the face of high levels of illiteracy within certain sections of the population, the use of symbols is the most effective approach of communicating warnings. Warning flags were hoisted on public buildings, community centres, port facilities using a simple code of 1 = caution; 2 = danger; 3 = great danger, and this simple strategy helped overcome some considerable cultural issues. For example, one study of Cyclone GORKY (1991) reported that many women perished with their children at home whilst waiting for their husbands to return and make the evacuation decision. Even now, in a Moslem country, the absence of segregated facilities in cyclone shelters can act as a disincentive to evacuation. Similarly, the absence of facilities for livestock within cyclone shelters places families in some considerable difficulty – whether to save themselves and, potentially, lose their livelihood and livestock or to take a chance of remaining in their dwelling with their livestock and accept the high risk of both perishing.

There was also some concern over the potential for what has been described as “warning fatigue”. In essence, if there are repeated warnings that do not crystallise into a disaster, the community begins to ignore them leading to an underestimation of, and under-preparedness for the danger. This is not a new phenomenon, for example it was noted that, in respect to Cyclone BHOLA (1970):

> “…people had been drastically over warned and this breeds apathy – which is the greatest enemy to a storm warning service. Time after time, coastal residents had been warned of “Great Danger” (the highest degree of danger), then found conditions were not as bad as expected. Without question, apathy was one of the main reasons for the lack of emergency action prior to the November cyclone. It is estimated that over 90% of the people in the area knew about the storm; yet less than 1% sought refuge …”

There is also a cost to both evacuation and false alarms. Clearly the figures are not comparable, but US estimates indicate that the former is some $1M/mile and the latter $1Bn/event.

Physical Mitigation

The experience of major cyclones in 1970 and 1991 led the GoB to engage in a number of physical infrastructure projects. As a result, in the period 1970-1991, some 300 cyclone shelters were built to accommodate 350,000 people.

In the next 15 years, the number of shelters had increased to 2,400, albeit a recent survey identified a number of deficiencies. For example, the total number of shelters was not enough to hold the evacuated population; more than 65 percent of all shelters had no provision for the special needs of women despite the special needs of women in a Moslem country; few had facilities for people with disabilities; three quarters of shelters surveyed had no provision for storage of water; four-fifth had no provision for the shelter of valuable livestock; and a large percentage of the shelters surveyed had some structural vulnerability.

Of equal importance is the construction of over 5,000mi of embankments along river banks and across the low-lying areas. These act as physical barriers to reduce the power of the tidal surge, as well as protecting the surrounding areas from its effects. They also act as the means for rapid transit between areas – be this to allow the population to escape or to provide access for the emergency services.

Unfortunately, due to the shortage of suitable land, in some cases the embankments have been used for housing and their destruction by the tidal surge was, at least in part, one of the major causes of the loss of life in Cyclone SIDR. This destruction of the embankments has been a consistently reported problem, and it is clear that, as in the case of the shelters, greater emphasis needs to be placed on their ongoing maintenance.

A further key element of the preparedness and mitigation strategy has been the coastal afforestation programme that has been in place since the 1960s. As a result, the area of the country that SIDR initially struck consisted of the world's largest mangrove forests, and this had a key effect of reducing the intensity of the wind and tidal surge before they reached more populated areas. In stark contrast to the reports following the 2004 Asian tsunami in which the clearing of mangrove forests was seen as one of the key causes of the significant loss of life in certain areas, the GoB use of such natural defences is to be applauded.

Class Exercise

Let us assume that you have arrived in a country shortly after a major natural disaster has struck and that you have been appointed the head of logistics for your organisation.

Working in your group, prepare a short presentation that discusses the information that you would seek to gather in order to achieve an efficient and effective Needs Assessment.

Your presentation should also comment on the difficulties that you would envisage obtaining the relevant data.