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NED UNIVERSITY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING

Cowasjee Earthquake Study Centre NED
NEWSLETTER

Devastating Quake Strikes Northern Pakistan

A strong earthquake, said to be most powerful to hit the region in 100 years, has killed and injured thousands of people and caused massive destruction in northern Pakistan on Saturday, October 08, 2005.

The **Kashmir earthquake** (also termed as the **Northern Pakistan earthquake** or **South Asia earthquake**) of 2005 was a major seismological disturbance that occurred at 08:50:38 Pakistan Standard Time with the epicenter in Azad Kashmir. It registered 7.6 on the moment magnitude scale making it a major earthquake similar in intensity to the 1935 Quetta earthquake, the 2001 Gujarat Earthquake, and the 1906 San Francisco earthquake.

As of 8 November, the Pakistani government's official death toll was 87,350 (including more than 13,000 killed in North West Frontier Province), with reports of 1,360 deaths in Indian-administered region of Kashmir. Some estimate that the death toll could reach 100,000. Most of the affected areas are in mountainous regions and access is impeded by landslides that have blocked the roads. An estimated 3.3 million were left homeless in Pakistan. The UN reported that over 4 million people are directly affected. Many of them are at risk of dying from the cold and spread of disease. It has been estimated that damages incurred are over 5 billion US dollars.

ISLAMABAD: Rescue personnel working at the site of a 10-storey apartment building which collapsed after the quake on Saturday.

Kashmir lies in the area where the Eurasian and Indian tectonic plates are colliding. Out of this collision, the Himalayas began 50 million years ago, and continue to rise by about 5 mm/year. This geological activity is the cause of the earthquakes in the area.

The United States Geological Survey (USGS) measured its magnitude as 7.6 on the moment magnitude scale, with its epicenter at 34° 29′ 35″ N, 73° 37′ 44″ E, about 19 km (11.8 miles) northeast of Muzaffarabad, and 100 km (65 miles) north-northeast of Islamabad (Pakistan). The hypocenter was located at a depth of 26 km (16.2 miles) below the surface (USGS). The Japan Meteorological Agency gave it a magnitude of 7.8. The earthquake is classified as "major" by the USGS. (By comparison, the 2004 Indian Ocean earthquake had a magnitude of 9.15).

The earthquake caused widespread destruction in northern Pakistan, as well as damage in Afghanistan and northern India. The worst hit areas were Azad Kashmir, Pakistan's North-West Frontier Province (NWFP), and western and southern parts of the Kashmir valley in the Indian-administered Kashmir. It also affected some parts of the Pakistani province of Punjab and the city of

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Inside this issue:

EDITORIAL

Cowasjee Earthquake Study Centre NED, shares the grief and expresses its deepest and most sincere condolences to all those who lost life in the October 8, earthquake disaster. The catastrophe has caused the damages beyond imagination. It has opened our eyes as to how much we are prepared for the disasters of such a magnitude. This is the time to learn the lesson from this calamity and start preparing ourselves for mitigating such disasters in future. The relief and rescue efforts by the nation are commendable.

CESNED has continuously been emphasizing on the need for earthquake disaster mitigation both pre and post. An important aspect of pre-disaster mitigation is to develop the design codes and specifications for the structures to make them earthquake resistant to a certain degree so that loss of life from any catastrophe could be minimized. Unfortunately, we in Pakistan do not have our own building design codes and are following the design codes developed else where.

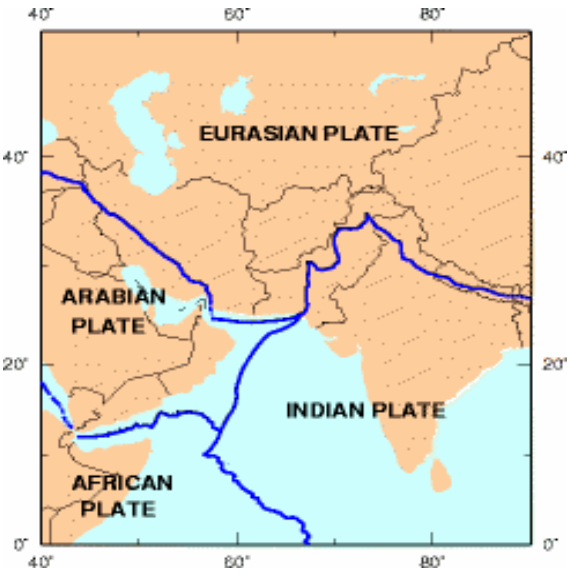
This calls for an urgent action on part of the government to initiate studies on the seismic hazards assessment and development of national building code of Pakistan.

Editor

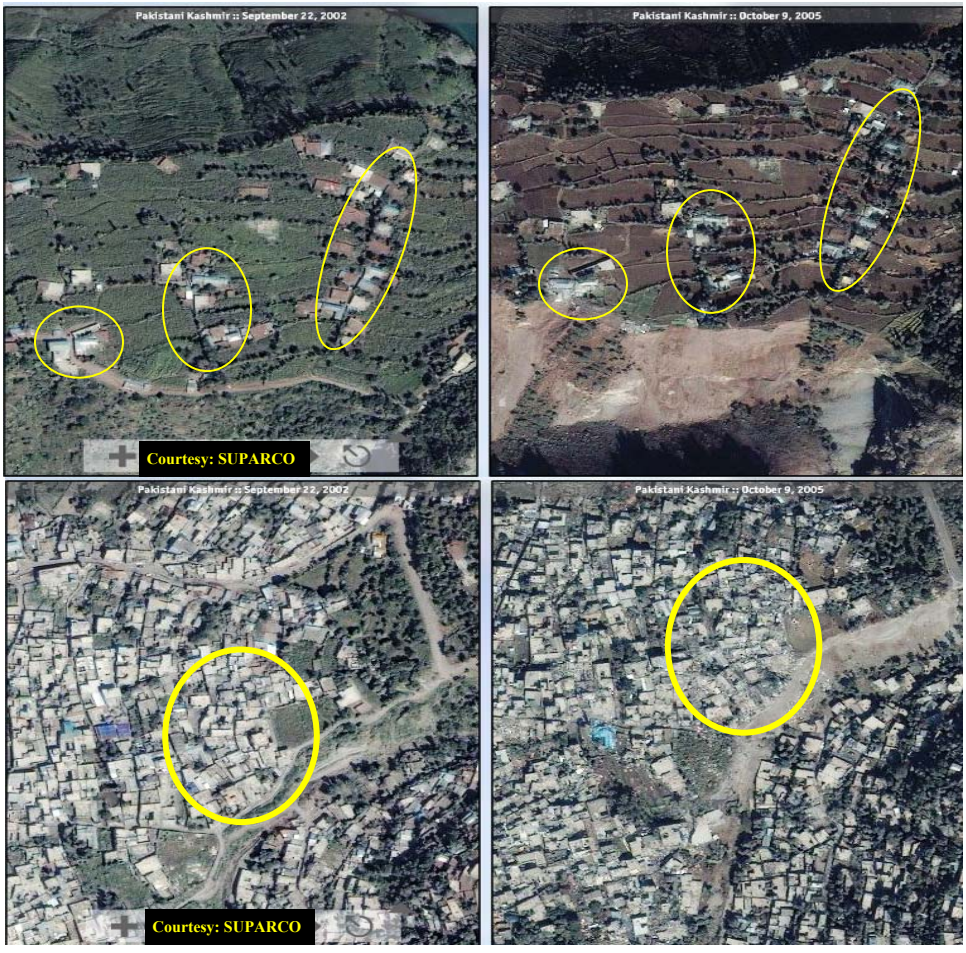
Mechanism of October 08,2005 Earthquake

Earthquakes and active faults in northern Pakistan and adjacent parts of India and Afghanistan are the direct result of the Indian subcontinent moving northward at a rate of about 40 mm/yr (1.6 inches/yr) and colliding with the Eurasian continent. This collision is causing uplift that produces the highest mountain peaks in the world including the Himalayan, the Karakoram, the Pamir and the Hindu Kush ranges. As the Indian plate moves northward, it is being subducted or pushed beneath the Eurasian plate. Much of the compressional motion between these two colliding plates has been and continues to be accommodated by slip on a suite of major thrust faults that are at the Earth's surface in the foothills of the mountains and dip northward beneath the ranges. These include the Main Frontal thrust, the Main Central thrust, the Main boundary thrust, and the Main Mantle thrust. These thrust faults have a sinuous trace as they arc across the foothills in northern India and into northern Pakistan. In detail, the modern active faults are actually a system of faults comprised of a number of individual fault traces. In the rugged mountainous terrain, it is difficult to identify and map all of the individual thrust faults, but the overall tectonic style of the modern deformation is clear in the area of the earthquake; north- and northeast-directed compression is producing thrust faulting. Near the town of Muzaffarabad, about 10 km southwest of the earthquake epicenter, active thrust faults that strike northwest-southeast have deformed and warped Pleistocene alluvial-fan surfaces into anticlinal ridges. The strike and dip direction of these thrust faults is compatible with the style of faulting indicated by the focal mechanism from the nearby M 7.6 earthquake.

Source: USGS



Satellite Imageries, Before and After AJK Earthquake



Devastating Quake . . .

(Continued from page 1)

Karachi experienced a minor aftershock of magnitude 4.6.

There have been many secondary earthquakes in the region, mainly to the northwest of the original epicenter. 147 aftershocks were registered in the first day after the initial massive quake that hit at 8:52 am, one of which had a magnitude of 6.2 (a tremor of magnitude six is rated as a "strong" earthquake). Twenty-eight occurred with a magnitude greater than five during four days after the principal quake and even eleven days after, there were still major quakes. For example, on 19 October there were a series of strong aftershocks one with a magnitude of 5.8 , which occurred about 65 km (40.5 miles) north northwest of Muzaffarabad. There have been more than 978 aftershocks with a magnitude of 4.0 and above, as of 27 October, 2005 and these continue to occur daily.

(*Various Sources)*

Damages & Casualties Caused by the Earthquake

Most of the casualties resulting from the earthquake were in Northern Pakistan where the official death toll has topped 87,000 and is expected to continue to rise, putting it higher than the massive scale of destruction of the Quetta earthquake of May 31, 1935. 1,300 deaths have also been confirmed in India.

As Saturday is a normal school day in the region, most students were at schools when the earthquake struck. Many were buried under collapsed school buildings. Many people were also trapped in their homes and, because it was the month of Ramadan, most people were taking a nap after their pre-dawn meal (Sehri) and did not have time to escape during the quake. Reports indicate that entire towns and villages were completely wiped out in Northern Pakistan with other surrounding areas also suffering severe damage.

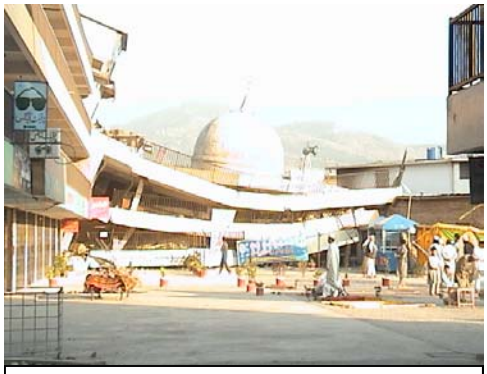
"...a second, massive wave of death will happen if we do not step up our efforts now", Kofi Annan said on 20 October with reference to the thousand remote villages in which people are in need of medical attention, food, clean water and shelter and the hundred and twenty thousand survivors that have not yet been reached.

- Pakistani television reports widespread severe damage to Balakot (almost completely wiped out), Garhi Habibullah, Rawalakot , and Muzaffarabad (near the epicenter) where 30,000 are thought to have died. The Pakistani Army spokesman, Major General Shaukat Sultan, told a press conference on 10 October that reports of damage in Rawalakot were exaggerated;90 per cent of the garrison city is still standing.

- The quake triggered landslides, burying entire villages and roads in many areas of North-West Frontier Province and Azad Kashmir.

- Hundreds of thousands of buildings are thought to have collapsed or sustained severe damage.

- One of two residential towers (Margalla Towers in F-10 sector, Islamabad), believed to contain up to sixty apartments each, collapsed in the earthquake in Islamabad. Pakistani government officials at the site stated the number of people affected by the collapse was in the hundreds, most of who are feared dead. Efforts by rescue workers are ongoing. Over fifty-two people were rescued from the collapsed residential "Margalla Towers".



Abbotabad: Collapsed market in Abbotabad, photo by CESNED team

- Karakoram highway is blocked at several points, hindering relief efforts.

Damage to buildings and several casualties have been reported in surrounding provinces of Punjab and Balochistan.

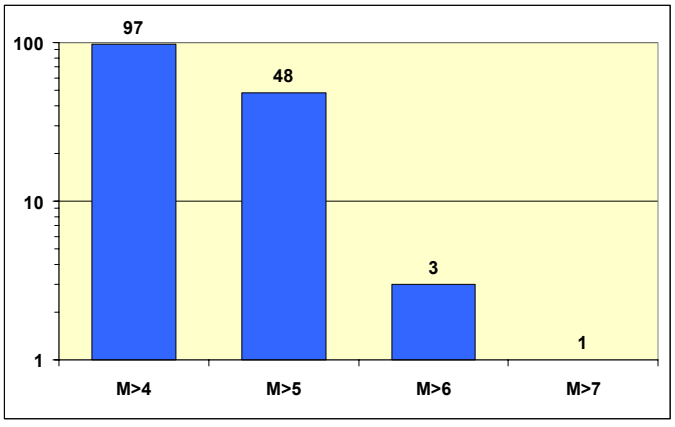
(Various Sources)

2005 Kashmir earthquake casualties
(Various Sources)

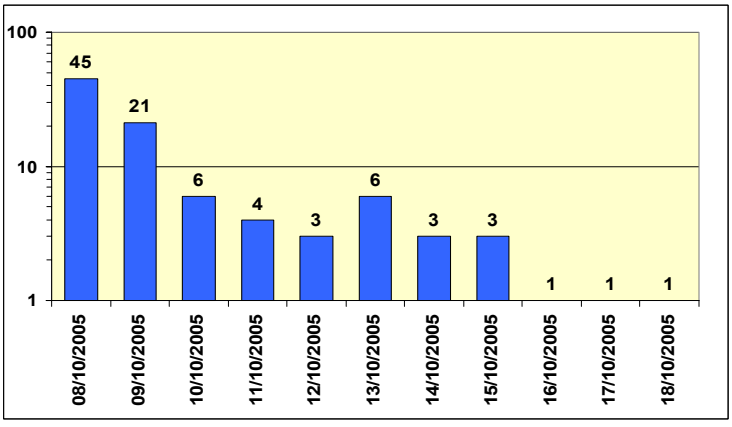
Location	Deaths	Injured
Pakistan	87,350	100,000
India	1,360	6,266
Afghanistan	3	-
Total (Minimum)	**90,000+**	**106,000+**

Note: *The above figures have been taken from various sources. The official figures are being revised continuously and may change.*

EARTHQUAKE AFTER SHOCKS



Number of events located by interval of magnitude since 08/10/2005

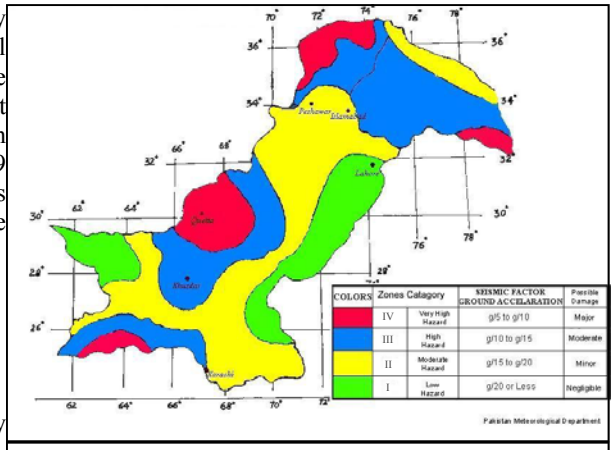


Number of events located since 08/10/2005

Source: EMSC

SEISMICITY OF PAKISTAN

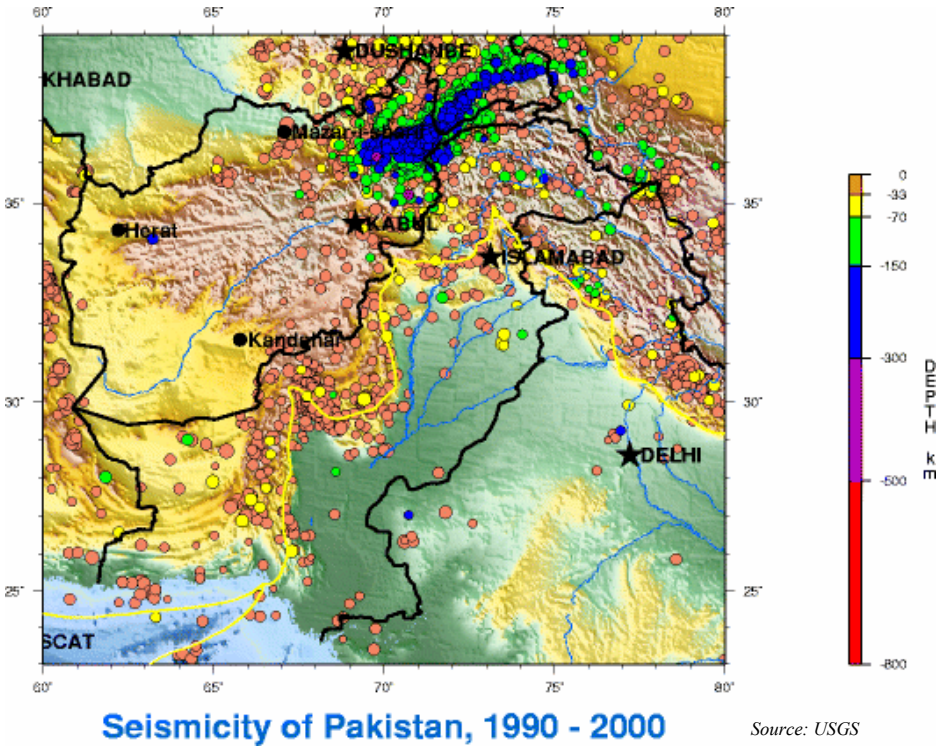
Earthquake activity in Pakistan is mainly concentrated in the north and western sections of the country, along the boundary of the Indian plate and the Iranian and Afghan micro-plates. The Chaman Fault runs along Pakistan's western frontier with Afghanistan from Kalat, in the northern Makran range, past Quetta and then on to Kabul, Afghanistan. A fault also runs along the Makran coast and is believed to be of the same nature as the West Coast fault along the coast of Maharashtra, India. An active subduction zone exists off the Makran coast. The great 1945 earthquake was centred in this region. This zone forms the boundary between the Arabian and the Iranian micro-plate, where the former subducts or dives beneath the latter. Thrust zones run along the Kirthar, Sulaiman and Salt ranges. There are four faults in and around Karachi and other parts of deltaic Indus, and Makran coast. The first is the Allah Bund fault that passes through Shahbundar, Jah, Pakistan Steel Mills, and runs through eastern parts of the city and ends near Cape Monz. This fault, in fact, has caused extensive damage in the past many centuries in the deltaic areas. The destruction of Bhanbhor in the 13th century and damage to Shahbundar in 1896 were caused by this fault. The other one emanates from the Rann of Kutchh. The third one is the Pubb fault which ends into Arabian sea near Makran coast and the last one is located in the lower Dadu district near Surajani and falls in the vicinity of Karachi. Tsunamis or tidal waves have also affected the coast of Pakistan. The worst case was in 1945 when an earthquake of magnitude 7.9 struck the Makran coast, waves as high as 12 meters were reported.



Seismic Risk Map of Pakistan
(***Pakistan Meteorological Department***)

SEISMIC ZONES

According to a map created by the Pakistan Met. Department, the country is divided into 4 zones based on expected ground acceleration. The areas surrounding Quetta, along the Makran coast and parts of the NWFP, along the Afghan border fall in Zone 4. The rest of the NWFP lies in Zone 3, with the exception of southern parts of this province which lie in Zone 2. The remaining parts of the Pakistani coast till Karachi also lie in Zone 3. The remaining parts of the country lie in Zone 2. The major cities of Peshawar, Rawalpindi and Islamabad both sit in this zone. But despite this, they are regularly rattled by strong earthquakes from the north or from neighbouring Afghanistan. The upper westernmost part of Balochistan and regions along the border with India lie in Zone 1. This zone also includes Lahore where there was serious damage caused by the 1905 Kangra earthquake in neighbouring India. According to the GSHAP, the most vulnerable parts of Pakistan are parts of Balochstan province in and around Quetta stretching to the Afghan border and western parts of Balochistan, which include the Makran coast till the Iranian border. These regions could expect to have a maximum peak ground acceleration (PGA) ranging between 0.24g to 0.4g. Parts of northern Punjab could expect a maximum PGA ranging between 0.24g to 0.32g. Similar values of PGA could be expected in northern sections of the North-West Frontier Province (N.W.F.P.) and around Karachi, in Sindh Province. Maximum PGA values for the rest of the country do not fall below 0.8g. These values steadily decrease towards the Indian border. The region with the lowest maximum PGA is a region between Khangarh and Fort Abbas, along the international border with India.



Seismicity of Pakistan, 1990 - 2000

Source: USGS

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Information, news items, short notes on research findings are invited from across the globe.