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COWASJEE EARTHQUAKE STUDY CENTRE NED NEWSLETTER

Inside this issue:

EDITORIAL

Since the publication of second issue of the Newsletter, this region has witnessed some more earthquakes, which have gone unnoticed due to other burning issues confronting this region. The experts in the area of earthquakes, however, have to remain alert and should exert more efforts regarding mitigation of this natural hazard. CESNED is aware of its role and is determined to proceed with the same vigour with which it started a year ago. The 1st issue of 2002 in hand thus reflects the purpose for which this Newsletter was supposed to be published.

We are making sure that the Newsletter is sent to all those organizations who may have link with the cause for which CESNED is established, we would, however, appreciate new addition to our mailing list.

CESNED is striving hard for its cause and hope that the Newsletter would receive your personal attention and patronage, keeping in mind that every effort, how modest it may be, needs at least a moral support.

Editor

CESNED Participates in Seminar on Natural Hazard Monitoring

Pakistan Space and Upper Atmosphere Research Commission (SUPARCO) organized a five-day international seminar on "Natural Hazard Monitoring", on January 7, 2002, in collaboration with the Inter Islamic Network (ISNET), Standing Committee on Scientific and Technological Cooperation (COMSTECH) and Islamic Development Bank (IDB) at Karachi. The Seminar was attended by a large number of participants both from and outside Pakistan. Cowasjee Earthquake Study Center at NED (CESNED), contributed towards Seminar by presenting a paper "Earthquake-2000- Consequences and Response" apart from sending a team of two members to attend the proceedings. The presentation focused on the activities, endeavours and targets especially in the context of the events of earthquake 2001 in the Sub-continent. The presentation was very much appreciated and it helped creating awareness and realization, among the participants, of the danger of this potential hazard. It also created the realization of the role that NED University of Engineering and Technology is playing regarding awareness. The Seminar helped CESNED to project its mission and future targets both at national and international level. Experts took interest in the programmes of CESNED and assured their co-operation and support both at intellectual and financial level. They also expressed their desire to work together with the CESNED, as this is very much a national cause. The proceeding of the Seminar is published now and would surely serve the intended purpose.

Strong Earthquakes Hit Hindu Kush Region Twice

A couple of strong earthquakes hit both Pakistan and Afghanistan in only three weeks gap. The origin of both earthquakes was Hindu Kush region, Afghanistan. The first earthquake occurred about 45 miles (75 Km) south-southwest of Feyzabad or 150 miles (240 Km) north-northeast of Kabul at 5:08 AM MST, on Mar 3, 2002 (4:38 PM local time in Afghanistan). This earthquake was felt in 7 countries -- Afghanistan, India, Kazakhstan, Kyrgyzstan, Pakistan, Tajikistan and Uzbekistan. The National Earthquake Information Center at the U.S. Geological Survey (USGS) in Golden, Colo., described the tremor as lasting for approximately 90 seconds. Pakistani and Indian seismologists measured it at 6.7 on Richter Scale.

This subduction zone earthquake occurred near the boundary of the Eurasian and Indian tectonic plates. It is being said that the two plates are converging towards each other at a rate of about 4.4 cm per year. The earthquake occurred in a subducted part of the Eurasian plate, at a depth of about 195 km. It is reported that the faulting that produced the earthquake reflects internal deformation of the subducted Eurasian plate rather than slip on the boundary between the Eurasian and Indian plates. It is observed that on an average, there are four earthquakes of magnitude 5 or greater per year, whose epicenters are within 60 km of this event. Earthquake depths in this region range from the surface to depths of 330 km.

According to the reports, about 150 people were killed in this earthquake. The casualties and damage toll, however, would have been much

Location of the epicenter of the earthquake on March 3 *Source: www.usgs.com*

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Deaths from Earthquakes in 2001

Date UTC	Region	Magnitude	Number Killed *
2001/01/13	El Salvador	7.7	852
2001/01/26	India	7.7	20,023
2001/02/13	El Salvador	6.6	315
2001/02/17	El Salvador	4.1	1
2001/02/23	Sichuan, China	5.6	3
2001/03/24	Western Honshu, Japan	6.8	2
2001/04/19	Yunnan, China	5.6	2
2001/05/08	El Salvador	5.4	1
2001/05/23	Sichuan, China	5.3	2
2001/06/01	Hind Kush Region, Afghanistan	5.0	4
2001/06/21	Germany	4.2	1
2001/06/23	Near Coast of Peru	8.4	139
2001/07/07	Near Coast of Peru	7.6	1
2001/07/17	Northern Italy	4.7	4
2001/07/24	Northern Chile	6.3	1
2001/08/09	Central Peru	5.5	4
2001/10/27	Yunnan, China	5.7	1
2001/12/04	Southern Peru	5.8	2
Total			21,358

* Includes "missing and presumed dead"

Source : www.usgs.org

Aspects of Mitigation

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are, sectional and material properties, damping in the system and load-deflection characteristics of the building components. Some guiding principles for planning and designing of buildings would be further elaborated in the next issue of the Newsletter.

Recorded Earthquakes of Magnitude 7.0 and Greater upto April 2002

	Year	Month	Day	Time UTC	Depth (km)	Magnitude	Region
1	2001	8	21	06:52:06.2	33	7.6	Near Coast of Peru
2	2001	10	12	15:02:16.3	33	7.0	East of North Island, New Zealand
3	2001	10	19	03:28:44.4	37	7.0	South of Mariana Islands
4	2001	11	14	09:26:10.0	10	7.5	Banda Sea
5	2001	12	12	14:02:35.0	10	7.8	Qinghai-Xinjiang Border, China
6	2001	12	12	14:02:35.0	10	7.1	South of Australia
7	2002	1	2	17:22:49.92	33	7.3	Vanuatu Islands
8	2002	3	3	12:08:06.0	195	7.4	Hindu Kush Region, Afghanistan
9	2002	3	5	21:16:09.76	33	7.5	Mindanao, Philippines
10	2002	3	31	06:52:50	33	7.1	Taiwan Region

Source : www.usgs.org

Aspects of Mitigation

Planning and designing aspects of dwellings, houses and/or buildings was the first issue that has been taken up as mentioned in the second issue of this Newsletter under Aspect of Mitigation.

From the safety point of view, primarily the lives have to be protected and the buildings should be planned and designed in such a fashion that they remain functional with minimum of damage. Most of the lives have, however, been lost due to the collapse of buildings, which were either ill planned, non-engineered or were constructed with materials not suited for earthquake resistant structures.

In an event of a probable maximum earthquake intensity of a region the building/ house should be planned and designed such that:

- The building should not suffer total or partial collapse, the building should be robust and should have the capacity to demonstrate sufficient warning of distress.
- The building should not suffer from damages par repair leading to rebuilding and demolition.
- Structural damage should be confined to a level, which may easily be repaired, strengthened and put in place for the required function.

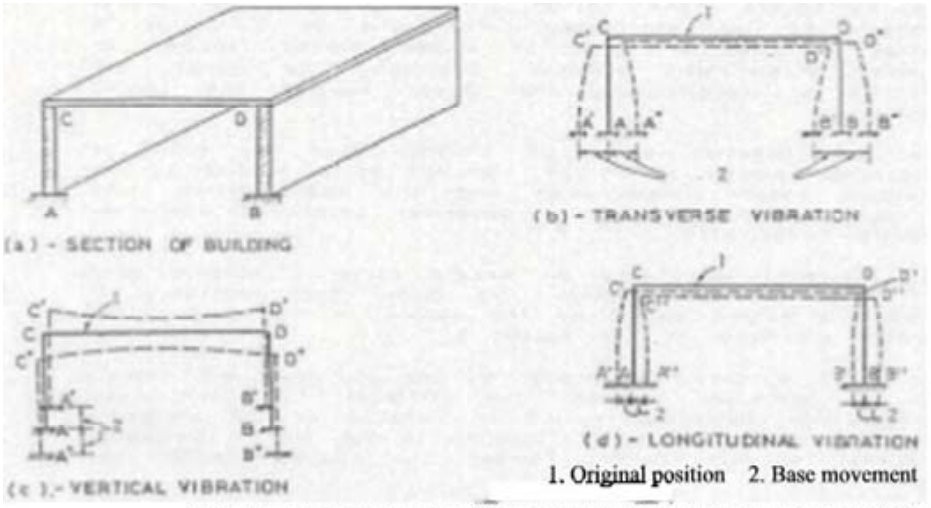
To achieve the desired as mentioned above it is imperative first to study the effects of earthquakes on structure. The earthquake forces are inertia forces and, therefore, the main factor contributing to increase in the force is the weight, and heavy weights, therefore, remains the main contributors to the damage in many respects.

Earthquakes are essentially vibrations of the earth's crust caused by subterranean ground faults. The point within the earth where rock moves and sends out earthquake waves is focus and the location on the ground surface directly above the focus is the epicenter of the earthquake. Any disturbance and consequent movement of the faults give rise to different waves. The propagation of these shock waves through the earth mass make the ground surface moves in all directions during an earthquake as shown Figure 1. The most damaging effects on buildings, however, are the movements in a direction parallel to the ground surface (that is, horizontal) because of the fact that buildings are usually designed for vertical gravity loads. The extent of these movements depends on the energy of these waves, which is affected mostly by the distance of the buildings from the epicenter, but they are also influenced by the geological conditions directly beneath the building and by the nature of the entire earth mass between the epicenter and the structure. The building must be able to absorb the remaining part of the energy. Failure of which can cause its disintegration.

The following may well be observed when an earthquake triggers vibration of a building

1. The building including its contents is shaken from its position of rest.
2. The movement is reversible in all diretions and there could be many reversals in each second. The number of cycles per second would not only depend on the characteristic of earthquake but also on the structure itself, e.g its flexibility and rigidness, simplicity and symmetry, length in plan, shape in elevation, uniformity and continuity, stiffness and ductility (would further be elaborated in next issues).
3. As inertia forces would be created on the masses due to the ground acceleration, these forces would depend on the mass density of the material used. The lighter the material, smaller would be the earthquake forces.
4. The supporting members such as beams, columns and load bearing walls, which otherwise would only be resisting vertical loads, have to resist horizontal forces, which will produce bending and shearing of structural members. The stress conditions on an element can have reverse effects e.g, compression may change to tensile stresses, and if the construction material is weak in tension (any material weak in tension will be weak in shear too) will give up and may lead to brittle failure i.e without warning.
5. Damping in the building system has the effect of reducing the effective accelerations on the masses and a higher damping ratio will lead to reduced effects. Some mechanism should, therefore, be introduced to increase the damping ratio.
6. The dynamic response (earthquake is dynamic in nature) of the structure of the building is a function of the stiffness (sectional property) and strength (sectional and material property) characteristics of the structural elements of the building resisting the earthquake forces. This could well be represented by load vs displacement graph of the elements from zero load level to the ultimate failure load.
7. For stiff buildings with short time period as are most low height buildings, the effective acceleration may be much larger than peak ground acceleration and, therefore, must have deformation capability at higher loads, which is demonstrated by a plateau in the load vs . displacement diagram.

Thus the most important properties and characteristics from the seismic point of view



(After "Manual of International Association for Earthquake Engineering (IAEE))

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

Strong Earthquakes ….

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more, if the earthquake would have occurred within 35 km (20 miles) of the Earth's surface. The earthquake triggered landslides, blocking a river, which then flooded homes in Samangan. About 300 houses collapsed leaving 400 families homeless. Fallen rubble blocked the town's dam, causing water levels to rise thus placing about 500 homes at risk. According to the U.N. World Food Program (WFP), two villages in the northern Samangan province suffered the most damage. In Pakistan, the government news agency reported four injuries to persons including three children in Peshawar near the Afghan border.

The U.S. institute called the quake the strongest in the region since another 7.2 quake of Dec. 30, 1983, which killed 14 persons in Pakistan and 12 in Afghanistan, besides injuring hundreds. Although small near-surface earthquakes have been generated by human activity such as mining and reservoir loading, the depth and magnitude of this event preclude any connection with human activity including the recent bombing.

Location of the epicenter of earthquake on march 25

The second powerful earthquake shook Afghanistan and northwestern Pakistan on March 25, 2002. The earthquake occurred in the Hindu Kush mountains in Afghanistan, about 200 miles (350 Km) northwest of Peshawar and about 90 miles (158 Km) north of Kabul at 3:00AM GMT, (7:30 PM local time in Afghanistan). The earthquake rocked the Nahrain and Burqa districts of Baghlan and was felt as far away as Peshawar and Islamabad. The magnitude of earthquake was measured 6.0 on Richter scale.

According to Afghan officials the death toll was between 1,800 and 4,800, while 3,000 people were injured and at least 30,000 people were displaced. Nahrain was the most devastated town besides 14 others surrounding villages.

Are Earthquakes Really on the Increase?

The world has now shrunk and is termed as global village. News travel across the globe in seconds. Any natural disaster how modest it may be is recorded, reported and communicated to common man in the remotest of the areas. In such a scenario it is quite understandable that a common person may get an impression that the occurrence of earthquakes are on an increase.

The United States Geological Survey, National Earthquake Information Centre (NEIC) states that, however, there is an increase in the reported earthquakes, but it is merely due to the fact that there had been a tremendous increase in the number of seismograph stations in the world, which clearly indicates that many past occurrences were never recorded or reported, giving a false impression of an increase. In 1931, there were about 350 stations operating in the world as compared to 4000 stations that we have today. The reporting time today has also decreased many folds. The increase in the number of stations and the more timely receipt of data has allowed seismological centres to locate many small earthquakes, which were impossible to detect in the past. NEIC now locates about 12,000 to 14,000 earthquakes each year or approximately 35 per day. More awareness among masses, improvement in communication skills, equipment and increased interest in natural disasters has also been the cause of this impression.

Although earthquake is the most severe of the natural disaster and remain so if mitigation efforts are not done in a planned and orderly manner, still the large number of earthquakes of small intensities are not much of a concern in general, and thus there is no need of extra concern, as it is the earthquakes of large magnitudes, which are potentially hazardous, and which fortunately till date, have either remained fairly constant or actually seemed to have shown a decreasing tend.

A list of major (7.0 - 7.9) and great (8.0 or above) earthquakes as shown in Table1 reveals that both major and great earthquakes remained fairly constant.

According to NEIC about 18 major earthquakes (7.0-7.9) and one great earthquake (8.0 or above) is expected in any given year. This average is based on the long-term record since 1900. Table1, however, reveals that this average exceeded only in 1992 since 1971, for major earthquakes. Major earthquakes, therefore, remains constant, and the impression of its increase is not based on facts.

Year	Major Earthquakes	Great Earthquakes	Year	Major Earthquakes	Great Earthquakes
1969	15	1	1983	14	0
1970	20	0	1984	08	0
1971	19	1	1985	13	1
1972	15	0	1986	05	1
1973	13	0	1987	11	0
1974	14	0	1988	08	0
1975	14	1	1989	06	1
1976	15	2	1990	12	0
1977	11	2	1991	11	0
1978	16	1	1992	23	0
1979	13	0	1993	15	1
1980	13	1	1994	13	2
1981	13	0	1995	22	3
1982	10	1	1996	21	1

Table 1 Major and Great Earthquakes Per Year *Source : www.usgs.org*