EARTHQUAKES, TORNADOES AND STORMS WATER

Earthquakes along the Indus Delta and Baluchistan Coast.

Coastal area of Sindh is in active seismic zone as shown in the **Maps No.26 and 27.** There is geological fault from Ahmedabad and Bhuj and Ormara along Makran coast and another geological fault from Ormara to Gulistan about 80 kms west of Quetta to Jalalabad and then turning eastwards under Himalayan foot hills through Kohistan towards Haryana in India and beyond. It is called Karakoram fault. Another one is located Abbottabad, Mansehra, Kohistan and Swat district. The 2005 earthquake was more intensive than 1974 earthquake, which had created havoc in Pattan, Duba, Palas and other villages. The first causes earthquakes along the northern Gujarat, Kutch, Rann of Kutch and affects Sindh coast and Karachi. In 1945 earthquake with epicentre in Makran between Pasni and Gawadar, Karachi also got shocks and some islands along Baluchistan coast disappeared and new ones emerged. The 2003 earthquake destroyed many houses in Ahmedabad, destroyed almost the whole town of Bhuj and affected coastal area of Sindh including damage to some buildings in Nagar Parker, Islamkot, Mithi, Diplo and Badin and bridges on roads south of Badin, though figures of such damage have not been published.

The 1819 earthquake is well recorded and survey of Sindh Coast by Carless in 1817 and again in 1837 showed lot of changes in the various branches of the Indus. Besides these Sindhri a coastal town on the eastern branch of the Indus called Puran leading to Lakhpat on Koree Creek, submerged about 6 meters below the water in the Rann of Kutch and probably Rann of Kutch got disconnected with sea due to rise of its western edge close to and turned into inland lake. During this earthquake a mound 16 kms wide 80 kms long and 6 meters high, rose across the Puran blocking water supply to Lakhpat for some nine years, when the bund due to water pressure breached again in 1828 AD and channel leading to Basta and Lakhat and Koree creek was restored. This bund was locally called Allah bund (God's embankment).

Mud geysers were recorded south of Jati in 19th century, showing volcanic activity down below. The Sindh and Baluchistan coasts therefore are to be watched against seismic activity. The zone of active seismic zone is shown in the above mentioned maps.

Earthquake related hazards.

Tsunami.

Of the earthquake related hazards, the worse are Tsunamis. November 1755 earthquake destroyed five out of six buildings in Lisbon. People in panic got out of buildings in street and only to face 15 metres high wall of water. Such examples are many, like Tsunami of 2004 near Indonesia. The enormous volume of water in shallow zone can pile up and wave height can be 30-40 meters. In 1945 earthquake in Makran Coast caused minor Tsunami and submerged many villages and some islands disappeared and others rose out of sea. It was period of World War-II and Government did not high light the damage caused in backward areas of Baluchistan with lack of communication of all types, i.e., telephone, telegraphs, and roads and no news papers were issued form the affected areas.

Seiche.

Another phenomen is Seiche (sash) which occurs in enclosed body of water like lake or partially closed bay like estuaries or creeks of Sindh coast. In these waters earth

quakes cause pendulum like oscillation of water. Such oscillations can cause knocking down of trees, eroding ground to nearly level of bed rock. These must have occurred along Sindh coast, and done lot of damage, but are not properly recorded the area is backward and people too poor to project their miseries.

Ground displacement by earthquakes.
Ground displacement and fissure is also connected with severe earth quakes, but usually it is largely surface layer of unconsolidated materials which get displaced and not the deep rocks.

Land slides caused by earthquakes.
Land slides due to earthquakes are also common in mountainous regions, but uncommon in the plains where land uplift or Sinking down occurs and such cases are considered to be responsible for dunes of Thar Parker and Umer Kot districts. These dunes run in south-east-south direction parallel to each other.

Mud volcanoes caused by earth quakes.
Mud volcanoes occur, where there is fine grained soil material saturated with water. It turns into thick mobile like matter. The process is called liquefaction. It rises through fishers and erupts as mud volcanoes. The liquefied sediment can flow out from beneath tall buildings, which then tilt slowly many single storey houses will collapse, but exact damage along coastal areas is not known. The clay that erupts is already heated clean by warm volcanic action and turns light. It has a number of applications in construction and industry, but use of this material has not been made by construction industry in Pakistan, though it is available along Makran coast and possibly near Jati, where mud volcanoes occurred.

Earthquake related fires.
Fire is another occurrence caused by falling structures.

What causes earthquakes.
Earth's outer shell, some sixty miles (100 kilometres) thick is cracked like an egg shell. It is fractured into many huge slabs (one dozen to one score or more), which because of their rigidity are called plates. These plates are not archored to earth, but drift about rubbing and chafing and some times cracking into one another, all in slow motion. This is what makes earthquakes. When plates move, continents move very often it happens that ocean floor and continents move together carried by single plate below them. Plate drift is usually called plate tectonics.

Historical earthquakes in coastal area of Sindh.
1819 AD, Earthquake in Rann of Kutch bordering Sindh.
It occurred on June 16, 1819, an eye witness account by the British officers, informing that 7,000 buildings were demolished, 1,150 person were buried alive in the ruins. A shallow stream about 7,000 feet (2133 metres) wide was formed and Rann which was previously disconnected with sea was filled with sea water spreading to large area. Sindri fort 15 feet high above water level, and a Talpur border check-post (now in India), was submerged nearly totally and custom officers on the fort wall were rescued by a British ship. Total displacement of Allah Bund was 30 feet uplift and 10 feet depression due to vertical slipping at the fault plains. The earthquake is reported to have disbursed normal drainage pattern of Rann of Kutch and river Indus and the Indus river branches to the sea changed their course as can be seen from coastal maps of 1817 and 1830 AD.

Due to 1819 earthquake Shah Bunder port was abandoned and two new creeks namely Kukaiwari and Kadewari came in to existence between 1819 and 1837.

1901 AD Earthquake.
The 1901 earthquake caused fissure in alluvium in Badin and Jati Talukas. Warm water and mud gayer erupted for about 12 hours. The gayer holes were 15-20 feet wide and 8-10 feet deep. Records about damage done to houses, roads etc., are not present in Sindh Government records now. Search for them can give useful information for future.

1956 AD Earthquake.
Another earthquake in Rann of Kutch took place on July 21, 1956 at a place called Anjar 80 miles south east of Allah Band and caused great damage to life and property.

Earlier Earthquake of 1668 AD.
In 1668, a severe earth quake caused major topographical changes in the Rann of Kutch and loss of life and property and possibly some damage in coastal Sindh.

Indus lineament and effect of earthquakes.
Snelgrove thinks that Indus lineament is responsible for change in the original course of the Indus 1758 AD. This earthquake is thought to have caused shift in the course of river to the one that it follows today but these hydrological changes were already taking place since 1755 AD and Kalhoras changed their capitals a number of times during a few years.

Hurricanes or Tornadoes.
Coastal area is within hurricane zone, which strikes Sindh coast, Kutch, Kathiawar and some parts of Gujarat periodically. There is lack of record of such hurricanes in the past, but May 1999 AD hurricane struck not only coastal areas of Thatta district, but sufficiently inside. The waves were considered much more than 18 feet high and submerging all areas upto 18 feet contours but suddenly with little notice and . No warning was issued and there was loss of human lives and domesticated animals. The land once submerged into sea water, needed fresh water for washing salts out and vast area of Kotri barrage containing sea salts which in time have been converted in to sodium bicarbonates and carbonates, needs costly reclamation. It is still awaiting reclamation.

History has recorded such a hurricane in days of Shah Jehan when vast areas of present Thatta and Badin districts were submerged and Emperor had to send special funds for help of people.

Many such cases are reported periodically in the past 23 years, when warnings have been issued, but luckily the hurricane got diverted towards Rann of Kutch or Kathiawar, the hilly shores of which reduced impact and damage in those areas. It is proposed to study exact area which was submerged in 1999 and work suggest:
(a) Land reclamation procedures.
(b) Future warning and evacuation system.

Storm water.
Six climatic **Map Nos. 28, 29, 30, 31, 32 and 33** of Sindh show the coastal and near coastal areas and they show that there can be a rainfall of five inches within 24 hours once in five years, which will certainly cause floods. The coastal housings of wooden branch-lets as walls and thatched roofs can not stand any rains more than 1 cm a day and inspite of common use of plastics as a layer above the roof, the houses

leak, every thing inside the house including clothing becomes wet, cooking can not be practised easily, as wood too becomes wet. One effect of rains is spread of diseases like malaria, cholera, dysentery, diarrhoea throat and lung infections etc.

Annual average rainfall is 7-8 inches on the coast near Karachi, 8-9" in Ghorabari and 9-10" in Shah Bander and Karo Chann, all of it falling in about 7 days of July and August. Thus it is annual occurrence of misery to the people of area. Should houses be designed and built, to face the periodic and regular storm water problem, there could be considerable reduction in human misery.

Heavy floods due to heavy rains in the catchment of Indus and its tributaries have occurred in 1821, 1828, 1841, 1858, 1874, 1890, 1892, 1895, 1913, 1916, 1921, 1926, 1929, 1942, 1948, 1955, 1957, 1959, 1973, 1975, 1976, 1977 and 1995 and 2003, almost 21 times in 182 years, i.e., once in every 15 years. There is occurrence of five inches rainfall in one day once in 5 years in Thatta and Badin districts including their coastal areas as afore said. This caused severe floods, loss of at least some domesticated animals, housings and field crops. Proper drainage can take care of it.