

Reading – DESIGN OF BUILDINGS TO RESIST EARTHQUAKES.

In seismic zone, buildings are designed to resist the earthquake forces that are specified by the building code, the magnitudes of these forces depend on the mass of the building, upon the proportion of the building, upon the type of construction, and upon the functions of the building. These specified forces are intended to provide a strength commensurate with the vibration forces the building will experience during a moderately strong earthquake. In the event of very strong earthquake, it is expected that the building will be overstressed and will be somewhat damaged, but there should be no injury or loss of life. To design a building so as to sustain damage in the event of strong ground shaking is justified by economic considerations. The very strong ground shaking occurs so infrequently than the cost of repairing damage is less than the investment required to provide more earthquake resistance.

For very important structures, the consequences of severe damage or failure may be so great that special precautions are required. Nuclear reactor power plants, large dams, long suspension bridges, and exceptionally tall buildings are examples of such special structures. Such structures are not designed according to ordinary building code requirements but are given special consideration. Their potential earthquake vibrations are analyzed, and the maximum stress and displacements produced by earthquake ground motions are

determined by means of digital computers. They accordingly are given more earthquake resistance than ordinary buildings. For example, in the world, nuclear reactor power plants are designed to resist the strongest expected ground shaking without being overstressed.

Buildings are sometimes damaged during earthquakes because of failure of the ground upon which the building is founded. The passage of seismic waves causes the ground upon which the building is founded. The passage of seismic waves causes the ground to vibrate, and the associated stresses and strains may produce a failure of the ground itself. In Alaska in 1964, this took the form of large landslides that destroyed many buildings.

In the city of Niigata in Japan, a different type of soil failure was produced by the earthquake of June, 1964. This seacoast city was built on an alluvial plane of saturated sandy soil. During the earthquake, the stresses produced by the seismic waves caused the sand grains to shift slightly relative to each other and to become more closely packed. When this happened, the weight of the superposed soil and buildings was temporarily supported by the water that filled the spaces between the sand grains and, in effect, for a few minutes the ground. Some of the buildings sank as much as one meter, and many buildings tilted like the Leaning Tower of Pisa and one six-story building rolled over completely without being otherwise damaged.

In I.R. of Iran, it is now common to build large dams of earth; for

example in Khuzestan, the new KARKHEH dam has a height of 127 meters. An earth structure such as this must be analyzed with great care and must be designed to withstand the vibratory stresses and strains produced by earthquakes. At present, there is a great interest in the world, in studying the earthquake behavior of soils and earth structures.

A) According to the reading, determine the best choice in the following sentences.

1- in seismic zone, buildings are designed to

- 1) have mass and proportions which will not be affected by earthquakes.
- 2) meet certain economic criteria only.
- 3) provide a strength commensurate with any forces they will experience.
- 4) suffer damage during a very strong earthquake.

2- certain special structures are

- 1) analyzed during earthquakes to discover their vibration.
- 2) built to higher specifications than those of the normal building code.
- 3) determined by the use of digital computers.
- 4) designed to resist all possible ground shaking.

3- in the niigata earthquake of 1964 damage was caused by

- 1) failure of construction techniques.
- 2) changes in the soil: water ration.
- 3) building rolling over
- 4) the weigh of superposed soil and buildings.

4- soil failure may take the form of.....

- 1) underground collapse
- 2) landslides
- 3) both of these (1&2)
- 4) neither of these (1&2)

5- in designing structures like the karkheh dam, the most important factor is

- 1) height
- 2) mass
- 3) seismic influences on soil structures.
- 4) vibratory stresses produced by earthquakes.

B) replace the underlined parts with synonymous expressions from the reading:

6- during strong earthquakes, buildings may be damaged to some extent.

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| 1) some what | 2) some times |
| 3) other wise | 4) investment |

7- for certain structures, the results of earthquake damage may be very serious.

- | | |
|-----------------|------------|
| 1) consequences | 2)failures |
| 3) requirements | 4) strong |

8- some building are designed to withstand very strong earthquakes.

- | | |
|------------|-----------|
| 1) produce | 2)resist |
| 3) shift | 4)support |

9- different types of soil failure can be caused by earthquakes.

- 1) specified
- 3) produced

- 2) required
- 4) expected

10- it is now usual for large dams to be built of earth.

- 1) common
- 3) ordinary

- 2) event
- 4) sustain

Read the passage I and answer the 6 following questions.
Passage I :

The effect of earthquake ground shaking is to make buildings vibrate. Low, stiff buildings vibrate with relatively high frequencies of 5 to 10 cycles per second, and tall buildings vibrate with low frequencies of 5 to 10 cycles per second and tall buildings vibrate with low low frequencies. The earthquake induced forces, that a building experiences, depend especially upon the mass of the mass of the building and upon the frequency of vibration. Although a 20 story building may have twice the mass of a 10 story building, its natural frequency will be smaller and, hence, the earthquake forces will be less than twice of those of a 10 story building. This is quite different from the forces by wind storms which will be twice as great for the 20 story building as for a 10 story building of the same width. In other words, for sufficiently tall buildings the wind forces will be greater than the earthquake forces. This leads to the interesting consequence that very tall buildings that have been designed to resist wind forces will also be able to withstand a strong earthquake. Although New York City does not have earthquake design requirements, its skyscrapers will be relatively safe in the event of an earthquake because they have been designed to resist wind forces; however, buildings of 10 stories or less will not be safe.

The most hazardous buildings during an earthquake are those constructed of brittle materials such as brick or stone masonry. These brittle materials are weak in tension and when overstressed during an earthquake will break and collapse. Such brittle materials

of construction were the cause of the high death toll in Agadir, Morocco. In California such buildings are not permitted, but are made of beams and columns, or reinforced concrete. Such properly designed buildings, even when overstressed during earthquake, will not fail and will not be hazardous to the occupants.

Based on above passage, choose the best answer for the 6 following questions:

1-The most dangerous during an earthquake are those made of

- 1) reinforced concrete
- 2) stone and concrete
- 3) brick or stone masonry
- 4) steel beams and columns

2- the skyscrapers of New York City are relatively safe in the event of an earthquake since they

- 1) fail to withstand wind storms
- 2) have earthquake design requirements
- 3) have been designed to resist vibration
- 4) have been designed to resist wind forces

3. the effect of earthquake ground shaking makes tall buildings vibrate with

- 1) frequencies less than 5 cycles per second
- 2) high frequencies of 10 to 15 cycles per second
- 3) high frequencies of 5 to 10 cycles per second
- 4) the same frequencies as that of low, stiff buildings

4- paragraph 2 mainly discusses

- 1) hazardous buildings seen in agadir , morocco
- 2) safety of buildings in relation to the design and material of construction
- 3) desting of occupants when buildings are overstressed during an earthquake
- 4) buildings in California which are made of steel beams or reinforced concrete

5) the best synonym for // hazard //is

- 1)toll
- 2)weak
- 3)venture
- 4)brittle

6)the word toll is closest in meating to wich of the following?

- 1)cost in life
- 2)grievous price
- 3) charge for health
- 4)death of the bishop

Passage II :

Brazilian tower could become the world`s tallest building

A new skyscraper in sao Paulo , brazil , that could be the tallest and largest building in the world when it is completed within planners hope three years . has been designed by minoru yamasaky associates of Rochester hills Michigan . the pyramid . shaped structure would stand approximately 494 m tall and occupy 1.3 million sq m of space .each side of the towers squary base will measure 244 m.

Henry j. Guthard the senior vice president of minoru yamasaky says the maharishi tower will rely on four composity magacolumns for the main vertical support . the magacolumns square, high strength

steel shells filled with concrete . will tilt toward the center as the building rises about two thirds of the way up , they will be tied together with a series of horizontal framing diaphragms and floor slabs . similar connections will be made at other points as the building rises. The columns will meet at the top.

Where the magacolumns join together, it become a unified structure guthard says. This system will transfer horizontal loads to the columns and impart stability so the building can withstand winds and seismic loads, he says. Guthard could not say how many stories the building will have or how tall the stories will be.

The structure will house a hotel, a convention center, retail establishments , high tech businesses, and apartments and condominiums. Guthard estimates 50.000 people will live or work in the building , and the conection center and business could pull in as many as 30.000 visitors a day . an extensive people mover system will transfer people between parking facilities and mass transit outside and the buildings interior, as move people around within the city to support a structure that can take advantage of the city and country`s economic recovery, guthard says.

The approximately \$1.6 billion that will be needed to fund the multiuse facility is being raised by the brasilinvest group, of sao Paulo, and the maharishi global development fund, of new york city.

Minoru Yamasaki has designed a similar tower the India tower Planned got jabalpur , India that at 677 m would be taller than the maharishi tower . but guthard says the brazilian structure is " on the fast track " and is likely to be completed first .

Based on above passage , choose the best answer for the 5 following questions:

7- the megacolumns are

- 1) high strength hollow steel columns filled concrete
- 2) high strength concrete with steel shields
- 3) square concrete columns
- 4) tilted columns

8) the horizontal framing diaphragms are used to.....

- 1) support floor slabs
- 2) tilt the columns toward the center of the building
- 3) provide a working platform for the people mover
- 4) brace the columns together for additional stability against horizontal loading.

9) the people mover system will.....

- 1) have the same function as the elevator
- 2) transfer people between parking and the main transit system
- 3) transfer people horizontally on the horizontal diaphragm system
- 4) handle movement of people within the structure and provides a connection to the main transit system.

10 – when it is completed , the maharishi tower will

- 1) be locate in brazil's third – largest city
- 2) accommodate at least 80,000 people a day
- 3) be the tallest and largest building in the world
- 4) be the most earth quake – resistant building in the world

11- designers believe that the maharishi tower will be completed before the India tower because.....

- 1) its investors plan to proceed more rapidly with construction that do the India tower investors
- 2) it is located on a high – speed rail line that will facilitate movement of construction material
- 3) there is a higher demand for the residential and commercial space in sao paulo than there is in jabalpur
- 4) the people movers system will transport construction workers between the work site and site and their homes more rapidly

Read the passage III and answer the 4 following questions

Passage III:

Pedestrian bridge commemorates town's sailing heritage

Modeled after the hull, rigging and masts of a sailing ship, the turkey creek pedestrian bridge in la sale, Ontario , was designed to honor the town's eponym, the French explorer Robert la sale (1643 . 87) the cable stayed footbridge, which is 40 m long and has a span of 30 m , was a community supported project

Designed and built with donated materials by volunteers from local high schools , colleges and engineering firms in response to the increasing number of pedestrian roadway accidents.

After meeting periodically for several months, volunteers came up with the final design; a wooden structure with a deck consisting of 2 m wide by 2.4 m long sections and two 9.8 m masts with a bearing capacity of 45.360 kg each . the masts are each supported by 18.140 kg of concrete and employ about 1km of galvanized steel cables . in accordance with an old shipbuilding tradition the volunteers placed pennies under each mast for good luck .

Because a crane was not used in the construction the designers built each half of the deck on opposite sides of the creek parallel to the shore .they then rotated the halves over the creek and a 5m center span was set in place using a system of ropes and pulleys in the months since its completion this past spring the \$130.000(us\$88.000) footbridge has quickly become a recognizable and well used structure in the community . " it "s become something of a land mark " notes norm becker an engineer who played a major role in the planning and development of the project

12) the footbridge.....

- 1) has a span of 40 m .
- 2) is located in a small town in turkey .
- 3) was developed and constructed by members of the local community
- 4) was built of materials salvaged from an old sailing ship

13) the masts of a bridge are.....

- 1) made of concrete
- 2) the beams that span the valley
- 3) capable of carrying at least 18,140kg
- 4) the vertical poles at each end of the bridge

14) the deck was primarily constructed

- 1) in one section in place over the bridge
- 2) in sections on the shore and then turned
- 3) separately and put in place using a crane
- 4) from 9.8m long wooden planks from the original sailing ship

15) the word " eponym " means.....

- 1) " turkey creek " in French
- 2) a person for whom a place is named
- 3) the wealthiest member of a community
- 4) the person who contributes the most to a project