

Earthquake and It's Influences on the Valuation of Immovable Properties

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Abstract: - Dwelling is an encompassing one in the series of three essential commodities of human lives. In which food is consuming and changeable according to the requirement of health and taste. Clothing is also changeable with our thoughts and appearance at very low cost, Whereas the Dwellings requires a huge amount of investment and a permanent place and such type of investment is possible once in a life time of an ordinary person. It is common to all except the technical persons and experts, that constructing the shelters by keeping the requirement of living space and final appearance in mind, and with absence of quality, workmanship, and stability of the building. All these lead the age of the building and protects from natural calamities. Most probably major part in the shelter constructions are dependent of financial institution and these institutions are granting the loans based on the valuation certificate given by the practicing valuers. It is possible to bring the stable construction practice in the society using the valuers and their valuation report as a tool by giving certain weightage for the Earth quake resistant designs in the construction and the structure becomes suitable for long life and safe against other natural calamities too. Hence in a view to insist the valuers and the bankers to give their contribution in making stable structures and safe to the society, this article is prepared with descriptive effects of earth quake and its consequences and put forth for publication.

Keywords: - Valuation, Immovable properties, Earth Quake, Infrastructures, Design, Safe Construction.

I. INTRODUCTION

Earth Quake is a natural calamity, which can not be predicted by any body at any time. If earth quake occurs, simultaneously we have to meet not only the effects of Earth Quake and also the effects of earth quake hazard too. An earth quake is a sudden tremor or movement of earth's crust, which originates naturally at or below the surface. About 90% of all earth quakes results from tectonic events, primarily movement of the rock faults. The remaining 10% is related to volcanism, collapse of Subterranean cavities, or manmade effects like atomic bomb blasts and other explosives used at mines, reservoirs etc.

Earth quake occurrence, its magnitude and the consequences are not in the hands of human beings. All human beings are confident; that the earthquake cannot kills the lives. But it effects and damages the man made structures for their safe and comfortable life, like shelters, infrastructures, Dams, Reservoir structures etc. and other

facilities to the human society, and as the consequences of these damages, failure or collapses of these structures are able to kill the human beings in a severe manner, some times results in a disaster to the society. So all the structures forming with available earth quake resistance technology will helps us at least to escape at the moment in a dangerous condition and also protect our properties from total collapse, severe damage or otherwise it may reduces the losses from the earth quakes having lower magnitude. However the earth quake and its hazard influences most probably over the immovable properties particularly buildings and infrastructures on the land and there is no need to give much significance, about movable properties, because of their damages are comparatively very small. Hence here with a discussion is made briefly in the topic "Earth quake and its influences in the valuation of immovable properties" and how the value of the property varies with various factors which are related to earth quake.

II. INFRASTRUCTURE AND SAFE CONSTRUCTION

From seismology, theory of plate tectonics, the epicenters of 99% earth quake are distributed along narrow zones of interplate seismic activity. About 1% of global seismicity is due to intraplate earth quakes, and no region of earth can be regarded as completely earth quake free. So the expectations of earth quake spreads all over the surface of earth and protective measures against devastation of earth quake and earth quake hazard is an important fear full one to the society. Present days the technology is improved in designing the building and other structures, as a first step to protect the structures from sudden collapse and save the human lives from disaster and as a second step the structure to be suitable to withstand the impact and vibration due to ground motion to some possible extent and earth quake hazards and till the research works are going on. It is not possible to form the reinforced concrete structures to resist the vibration and impact completely because of the concrete is a brittle material, used along with steel to form Reinforced cement concrete which is the composite structural material most widely used as suitable material for element of our shelters and infrastructures most particularly for high rise buildings. Perhaps it is possible to a certain limit only, by giving hinges at joints or flexible to form the hinges at particular or selected points. And even at least in

this limit adopting the available earth quake resistant technologies to construct the shelters and structures will be a good practice to make the structure safe against sudden collapse due to earth quake and remains suitable or eligible for retrofitting after occurrence of earth quake and from the effects of earth quake hazard like landslides Tsunamis and seiches etc. Day to day up-dating the improvement in technologies, innovations and inventions through research any where in the world and try to implement such innovations at all the place by Engineers and constructors should be a prime protective measure of the consequences of earth quake, which leads the society of human beings to fearless, Peaceful life. Then only the purpose of shelters will serve to their best fulfillment.

III. EARTH QUAKE AND THE PROPERTY VALUE

However the value of the property will fall down immediately after the effects of earth quake and Earth quake hazard. So earth quake plays a significant role in the value of properties and the wealth of society. Hence while doing valuation the immovable properties, it is need to be consider the earth quake and earth quake hazards as factors which are effects the value of the buildings and the land. The building value will fall sudden, based on the size and the intensity of earth quake in that particular locality. The Land value can also gets fallen to some extent because of the failure of infrastructure in the proximity of the lands due to effect of earth quake, until the development has been reinstated.

A. *The buildings:* - The following graphical representation (Chart-1) shows the fallen value of property (building) effected by earth quake occurrence and damages caused by earth quake hazard. In the graph Y-axis shows the fair market value of the (Property) Building in multiples of 10's (i.e. 10, 100, 1000, 10,000...) before the earth quake occurrence. The X-axis shows the intensity of earth quake in MSK scale from I to XII and as well as the descriptive effects.

The Descriptive effects in MSK scale are:-

- I. The tremor is detected by seismographs only and not noticeable (No effects to the building)
- II. Vibration felt by individuals at rest in house and scarcely noticeable (No noticeable effects to the building.)
- III. Structure vibrates, No expectations of damages but able to observe
- IV. Floors and walls crack are largely observing one.
- V. Type "A" buildings – Possibilities to gets damages
- VI. Damage of Grade-I to the type "B" buildings and Grade – II to the type "A" buildings
- VII. Grade – I damages to type "C" buildings, Grade – II damages to type "B" buildings and Grade – III damages to type "A" buildings and damages to the common facility structures.

- VIII. Type "C" building suffers from damages of Grade – II
Type "B" buildings suffers from damages of Grade – III
Type "A" buildings suffers from damages of Grade – IV (Damage of all type of structures possible)
- IX. Type "C" building suffers from damages of Grade-III
Type "B" building suffers from damages of Grade-IV
Type "A" buildings suffers from damages of Grade-V (Changes in land also possible)
- X. Type "C" buildings suffers from damages of Grade IV Type "B" & "A" buildings suffers from damages of Grade V (Major changes in lands and collapse of all buildings possible)
- XI. Severe damage even to well built buildings, bridges, dams, rail way lines, underground pipes.
- XII. All structures destroyed or greatly damaged, surface of ground is radically changes.

Type A: Structures defines, Buildings in fieldstones, rural structures, unburnt brick houses, clay wall houses.

Type B:- Structures define, ordinary brick buildings, buildings of the large block and prefabricated type, timbered structures, and buildings in natural hewn stones.

*TypeC:-*Structures define; reinforced buildings well Built wooden structures.

Grades of damages:-

Grade-I: Slight damages- (Cracks in the Plaster)

Grade-II: - Moderate damage-(Small cracks in walls, major cracks in plaster, Chimney)

Grade-III: - Heavy damage-(large & deep cracks in Walls)

Grade-IV: - Destruction- (walls, and parts of building may collapse)

Grade- V:- Total damage- (Total collapse of Buildings)

The parabolic curve profile shows the fallen fair market value of the building after the occurrence of earth quake and consequences thereof. So the fair market value of building before earth quake occurrence is 100% and after occurrence based on the intensity of earth quake it reduces with divisions of 10's, corresponding to the intensity (failure, damages and further worth for utilization or eligible conditions for rehabilitation / retrofitting etc.) Which also varies with the size of (height) of building, because the high raised buildings has more chances of early failure and to having more damages.

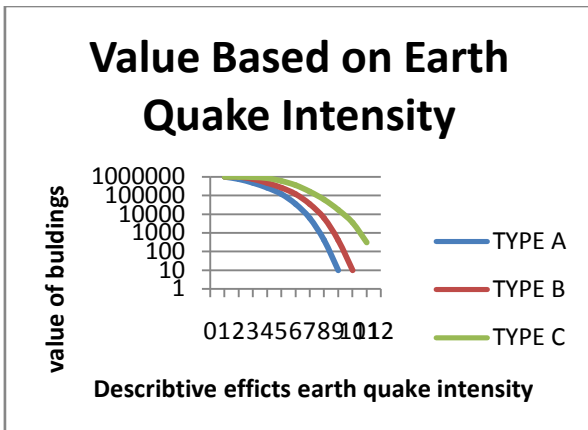


Chart-1. Value of various types of buildings as consequences of various intensities of earth quake.

B. The land:- The Land value will also fell down but not as much as building the land value may get 10% to 50% of peak market value to the intensity of M.S.K. Scale VII. Beyond this intensity there is no need for further reductions. The representation (Chart- II) shows the fair market value of a particular land in Y-axis i.e. (1,00,000, 2, 00,000, 3, 00,000.....) and intensity of earth quake in X-axis from I to XII in MSK scale units.

We may expect the fallen value for the intensity from O to II up to 10% and from II to VI up to 50% and VII to XII up to 60% based on the failure, damages of the buildings and the failure range of common facilities and infrastructures,. Some time the terrain and extent may also be changed slightly due to severe effect of earth quake.

Lands of Forests, Agricultural lands and some area for mines and quarries are beyond the scope of representation (Chart- II). Forest lands need not be loose their value considerably due to earth quake. The Agricultural land may shows their fallen value as mild one, lands of mines and quarries can get their changes in value slightly. So the representation Chart-II can be taken for the lands lying at the zones – viz – Residential, Commercial, Industrial, Institutions zones Which are having or reliable to have large number of buildings.

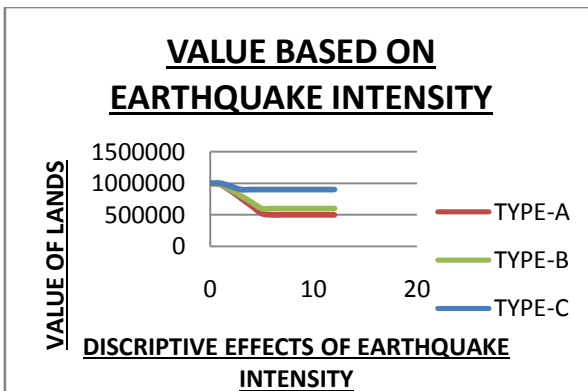


Chart-II. Value of lands having various types of buildings as consequences of various intensities of Earthquake.

IV. FACTORS EFFECTING THE VALUATION RELATED TO EARTH QUAKE

Any human being can expect the above circumstances any where on the earth surface with some variations accordingly some of the factors, like

- (i) Zones in which the property lies
- (ii) Effects of surface topography
- (iii) Local site effects
- (iv) Tsunami, etc.

So while doing valuation taking in to considerations of these factors regarding earth quake and earthquake hazard will be a good practice of the valuers.

Zoning considerations for valuation

Based on the chances of earth quake occurrence and their magnitude, the earth surface is divided in to various zones Viz

Zone – II, Zone – III, Zone IV and Zone – V

According to seismologist no area is fall under Zone – I, (i.e. earth quake free). In India we shall refer the map of ‘Seismic zones of India’ published in IS 1893 (part-I) – 2002, by Bureau of Indian standards. With in a certain marginal value, reference to the zoning map, the structures which has been analyzed and designed as per earth quake resistance technology can be given full value. This marginal value can be fixed by some expert organizations like Institutions of valuers, Structural Engineers and Surveyors, etc. as a guideline to the practicing valuers to avoid the remarkable variations from person to person during the valuation of immoveable properties.

Surface topography

Regarding surface topography

1. Surface waves are generated near, the top of the topography
2. De-amplification accurse in valley relative to the top of the valley
3. Ridge Amplification increases with elevation
4. Ground motion amplification increases with ridge – slope
5. The presence of neighboring ridges accentuates the topographic effects.

Therefore after destructive earth quake in hilly areas that the building located at hill top suffers much more damage than those located at the base. Like wise, complicated damage pattern occurs on hills with variable slopes. Generally houses situated on or near the slope – change, suffers from more damages. Hence Hill top (ridge) structures, and slope – based structures are particularly noticeable in the event of valuation, where the structures lying in higher seismic zones.

Local site effects

Significant differences in structural damage in basin as compared with the surrounding exposed rocks, because of the amplitude of shaking in basin can be much stronger than the surrounding rocks. So the buildings at basin location leads to more damages, and the buildings and structures gets their value fallen at lower most level, unless the extra care was not insisted at the time of construction stages. One more thing in the basin, if the soil is very loose, suppose the foundation is with friction piles. The frictional resistance also is changeable with the rate of moisture content of the surrounding soils. At the time of earth quake occurrence if simultaneously soil gets its higher rate of moisture content, due to ground motion and vibration. The soil and the pile will loose their friction in a rapid manner and attains their failure very soon.

Perhaps all these things are in design part of the foundation Engineer, Valuers should also be knowledgeable and well versed to point out the unfavorable activities attended and favorable activities un-attended in construction stages on the earth quake point of view.

Tsunami

Tsunami is also an earth quake hazard and able to do devastation at seashore and nearby areas. It is also to be considered for valuation of the properties which are located at seashore and nearby areas. So many towns and cities are developed near by seashore area because of the major transportation is being by means of water way such cities are developed as business centers and they have chances of attack by Tsunami. The small islands having their surface at near by sea level Nuclear island (just few metres above the sea level) are subjected to Tsunami wash. So Tsunami consideration while doing valuation of properties in these locations is major and mandatory one.

Beyond all the above factors, the abnormal and uneven vertical growth in construction is also dangerous one along with earth quake. The high rise buildings shows the intensity of an earth quake as larger one even its magnitude is lesser because of the greater sway at top and the series damages from top to bottom, and the additional cantilever action induced by the sway to the foundation, and the impact might be more than the stability of foundation and results in total failure of buildings or heavy damages. The adjacent building may fails either in this way or by another building fallen on this building, so the priority may be given to the **satellite towns and parallel growth of vicinity towns.**

V. CONCLUSION

When seeing all the consequences of earth quake and earth quake hazard against the value of the property, it is far from satisfaction, that the general practice exists in countries like India the so many structures (Particularly dwelling houses) are constructed with poor quality, and workmanship under supervision of non-technical supervisory persons which are also fails very soon and leads

the society to the devastation. Recently so many multistoried buildings particularly corporate office complexes and commercial buildings are covered with Aluminum Composite Plate cladding and Glass panel cladding to shield the buildings with an excellent Architectural view, nice finishing and attractive visualization. But in the seismic point of view the ACP cladding is an acceptable one but the Glass cladding is dangerous one and far from satisfaction because the glasses will be broken into pieces and the broken glass pieces will comes like arrows towards anywhere in the surroundings where the peoples may flow. Hence to create awareness about serious deficiencies in the prevalent design and construction practice, earth quake and the consequences and the defective construction through non-technical guidance is essential in the society. The most suitable solution is the earth quake resistant structures only.

An insistence of earth quake resistance structures at all the places will be the best one to the wealth of the society. So all the practicing valuers, and surveyors shall write about the structural stability in the earth quake point of view and some marginal value could be given to the earth quake safe design and stable construction, along with an advise of insuring the properties against earth quake to its full value to compensate the losses if any occurred due to the earth quake and it's consequences, as mandatory one. So as to aware the whole society about earth quake and earth quake resistance structures, deficiencies in the designs and construction practice essentially. Finally there is no doubt and clear that the earth quake plays an important role in the valuation of immovable properties and an unavoidable part of the valuation.

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