Monitoring of Buoyancy Effects to Structures by Tsunami Water after Heavy Seismic Shocks

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Abstract— This work concerns on monitoring of structures under heavy seismic shocks. The author concentrates his interest to introduce some typical problems of structures. Specific references are found in the coastal zones at the event of the 2011 Earthquake in the northwestern Pacific. It is discussed what could be the key in order to realizing the hazardous damages of the structures especially in the coastal zones.

1. INTRODUCTION

This work concerns on monitoring of structures under heavy seismic shocks. The author concentrates his interest to introduce some typical problems of structures. Specific references are found in the coastal zones at the event of the 2011 Earthquake in the northwestern Pacific. It is discussed what could be the key in order to realizing the hazardous damages of the structures especially in the coastal zones.

2. A BASIC NOTE

It must be well understood that structure engineering is noted on the bases of the elastic properties of the members as a parts which forming a structure.

As for a structural construction, there should be considered a systematic combination for the purpose to complete the aim of construction for purpose.

In any case to note about a structural construction, it should be considered to take into account of physical and dynamical parameters at considering to construct a structure to be complete at any conditions of external forcing.

As far as we concern about a structural construction, it should be essential to take the structural construction as a structure systematically constructed by the members of elastic materials.

Then, the structure should be a system structure which could be also an elastic body so that it is necessary to consider a formulation for an equivalent elastic material.

As for any elastic body, dynamics of a structural construction, a formulation should be in need for forcing to the elastic body by using several physical and dynamical parameters.

Essentially, strain-stress relation should be considered (not only pressure). In this case, it should be considered a tensor for elastic body, for example, in a Cartesian coordinate, i.e.,

$$F = \begin{vmatrix} F_{xx} & F_{xy} & F_{xz} \\ F_{yx} & F_{yy} & F_{yz} \\ F_{zx} & F_{zy} & F_{zz} \end{vmatrix}, \tag{1}$$

or, in a simple form as follows;

$$F = |F_{ijk}|, \tag{2}$$

where the notations "i, j ,k" are notifying the x, y, z components.

In this work, the author notes some typical cases of tsunami tragedies in relation to a buoyancy effect of tsunami waters after a destructive earthquake.

Some of the typical cases were found at the 2011 earthquake in the northwest Pacific.

The interested cases can be seen to be possible when buoyancy effect of tsunami water after the seismic shock at the earthquake, for example, at 2011 earthquake.

3. BUCKLNG OF BUILDINGS AFTER TWISTING AND SWINGING

One of the seismic effect is an impulsive impact to the tall buildings.

Since the 1995 Kobe earthquake, the earthquake engineers have had to concentrate their interests to the vertical forcing of seismic action to the public structure.

Nevertheless, the 2011 Tohoku earthquake in the northwest Pacific were a specific case for demonstrating what effects could be appeared to the tall buildings in the urban areas.

In the case of the 201l earthquake, it was found that a typical buckling pattern above the first floor but the ground floor of the tall buildings.

There must be a guideline for construction of tall building, then, it was trusted that all of the buildings are stiff to any external impacts even in nature nevertheless buckling pattern was found even a building ready to any seismic shock.

An example of the buckling patterns at the corner-footing of the tall buildings above the first floor but at the ground floor. This fact tells the burden-loading, and forcing to the steel members for the interested structure.

The author unfortunately would not to describe to the details about this buckling.

It must be taken to be in fact that the seismic action was beyond the critical condition in the guideline for tall building construction.

Adding to the above, the author has his question about the buckling pattern found even in the case of tall building arranged a anti-seismic device in order to protect the structure of the building. It is in need to see whether critical criteria in the guideline are properly set for the purpose of safety.

Anti-seismic devise has been introduced after the 1995 earthquake hit the urban area in Kobe, which was noticed by an leading advisor in earthquake engineering.

The anti-seismic devise had a chance for having the first actual test at 201l earthquake.

4. BUOYANCY EFFECT OF TSUNAMI WATERS

It can be considered simply that the buoyancy effect of tsunami waters can be related to a balance of power between the gravity and buoyancy.

Then, what is important to consider is the vertical component of the forcing in F noted above. This means that it is enough to consider only F_{zz} and the other components can be taken to be zero.

5. BUILDING LIFT UP

After the seismic shock of an interested earthquake, tsunami waters hit the structures on the coastal zones.

Strong seismic shock affects as an impulsive force to the arranged piles supporting the building to be suffered.

Seismic waves force to make arranged and loosed piles which fail support any building against the vertical forcing of the gravity.

Then, tsunami waters easily make the building in a floating state because the weight of the building is less than the water mass removal corresponding to the buoyancy effect of the tsunami water to float the building in the tsunami water.

When the tsunami water depth beyond the height of the building, the piles never work as supporting function for the building. Then, the building must be easily lifted up to float in the tsunami waters.

When the sea level becomes higher after increasing the tsunami water than the height of the building, then, the tsunami forcing to the building horizontally to pull down on the ground surface after filling up the water into the vacant space of the building, or to force drifting in the tsunami waters.

Now, action of the drifting building should be a problem of a water wave motion in the afield of hydrodynamics. Nevertheless, the author, here, has to be in wondering whether the designed the building never considering with any possibility of up-lift of the structure. In addition, the author is anxious in mind considering the building was constructed under some consideration about strain-stress relation in the building with the piles arranged for an effective support to the structure in safe.

It is pity that the author has to leave his mind leaving to ask some complete procedure must be required at starting to design and to construct the structure.

6. TOPPING BOAT ON A BUILDING

An unexpected tsunami high water shed out almost all of the wooden houses to destroy one block of the residents.

The tsunami high water brings a drifting boats and tankers on the water surface though the tsunami waters kindly put a drifting boat on a roofing flat of building submerged building. Oc-

casionally, a traffic system must be blocked by a tsunami water sitting of a big tanker crossing a route of the life line.

The tanker on the sea had left on land at the top of the building suffered by the flood of the tsunamis generated by the earthquake on 11 March 2011 in the coastal zone in the northwest Pacific.

This happening should be considered as a result caused by a buoyancy effect of tsunami water accompanied by the earthquake on that day.

7. CONTAINER DRIFT IN COASTAL ZONE

In the coastal zones and harbors, there are located many of the tanks and containers for fossil fuel tanks. Those should be called as a base location where the fuel containers were put on the ground surface of the coastal zone at the head of the bay facing the ocean. There are various kinds of containers in size and in shape for fitting to the surrounding coastal configurations.

Some of them are cylindrical shape with a circular bottom in an isolated state from the ground surface and with a circular top cover for roofing of every one of the containers.

Then, the containers can be easily to lift up by the buoyant effect of the tsunami water flow raising the water level beyond the designed tsunami protection level around the coast at a hazardous earthquake under sea. The containers surely start to flow on the water surface after the effect of the tsunami water in a horizontal motion out of the ocean across the bay mouth to hit the land area facing the sea waters on the coastal zone.

The containers' design is under an assumed condition only for put on the land surface, so that the floating containers on the tsunami water are in drifting and rolling under on the way to the land area of the coastal zones. Some one of the drifting containers get a crack at the top or bottom, then, the contained materials of fossil fuel flow out of the container to the water surface to spread on. During the containers drifting, their cracks appeared to break the containers' structure, and, some shocks of metallic collapses must be act easily as trigger for firing and burning of the fossil fuel. Then, the burning fuel and containers float and hit the coastal area where some communities and industries are located for active social services. It is unfortunate that landing of the fired containers make to fire most of the functions in service for the colonies and industries.

Adding to the above, the buildings for the buoyant local governments are forced to burn and to be suffered by the tsunami water up-lift as well as that of the containers.

These are in drift after the buoyant effect at a horizontal flow of the tsunami water motion rather than that caused by the seismic effects at the earthquake under sea.

In fact, what noted above was seen in the coastal zones at 2011 earthquake in the north-west Pacific.

8. CONCLUSION

This work concerns on buoyant effects of the tsunamis generated by the offshore earthquake to the structures and hazardous damages in the coastal zones. There are the other patterns of the destructive processes at the actions of the tsunamis induced by the strong earthquakes undersea. Then, the author has to close his notices in a restricted dynamic processes in the costal zones. As for the other related problems, the author might be able to describe in the other chance.

This work was accepted just after the Nepal eathquake on 25 April 2015.