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Rotational Steady State Viscose for Buried Structures against Dynamic Loads with Integrating Seismic Damper of Jelly and Plasma Media

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ABSTRACT

Researchers at the office of National Center of Iran's Renewal have succeeded in developing and completing a research methodology that was proposed by the same researchers for the removal of dynamic loads, in particular the load caused by the explosion. The creation of viscous rotary for buried structures against earthquake and dynamic loads with integrating seismic damper with jelly and plasma media can be used in non-operating defense plans in country and for areas with the highest risk. In this research, the summing up of this plan is taken as a solution and the results are presented.

Keywords: *Formation, Soil, Explosion Wave, Earthquake, Microscopic, Polymer*

INTRODUCTION

According to the history of earthquake in Iran, as well as, the way in which the construction was built in recent years and having high potential for the occurrence of earthquakes in the most crowded city, it is necessary to consider earthquake as an important issue of the society. Destruction of national and human capital because of destructive earthquakes, the necessity of paying attention to the construction of buildings and existing buildings is inevitable. In recent decades, some research has been done in the field of earthquake engineering. All people and researchers have believed that the seismic safety of existing buildings should be included in the country's major programs.

One of the ways that have been addressed in different countries in order to cope with the different threats of wave and to the destructive power of earthquakes and explosions was the use of concrete structures, composite structures, retaining walls, concrete shields, virtual structures and etc. The research attempts to develop a new method to improve the behavior and direction of safe havens in country and critical points and special structures.

BACKGROUND

Based on recent studies on recent Northridge earthquakes, such as the earthquake in 1996 in the United States, researcher found that structures constructed in accordance with the regulations were good in terms of providing health and safety, but the amount of damage to

the structures (Such as hospitals and treatment centers whose effectiveness is important) were high and it is economically feasible to repair. In order to reduce earthquake losses, current design guidelines have mostly prepared to decrease earthquake-related loses, and the experiences of recent earthquakes also indicate their effectiveness in reducing the mortality caused by sediment. However, large earthquakes in recent years indicate that the rate of construction and non-construction damages in some cases are very severe and leads to heavy financial losses.

According to the number and extent of vulnerable structures against earthquakes in country, it takes much budget and time to complete and replace all structures. Therefore, the strengthening of existing structures with minimum cost and volume requires only time and materials and it is the best solution to prevent calamities and disasters in the future.

Buried structures like dams that are placed in tunnels, due to the fact that they are one of the most important elements in vital arteries, they should be designed in such a way that during the earthquake and after that they can have good function. It is very important to find ways to improve the seismic structure of buried structures that are not sufficiently resistant to earthquakes.

Some Terms

Different terms and concepts related to the upgrading of the seismic level of reinforcing buildings are used but no definite definitions have been provided for them. Some definitions of some key words are briefly presented.

Reinforcement

Replacing or renovating a new element in an existing building to raise the structural capacity of the main building, so because of the operation, in comparison to the first situation of the building, the strength of the building will reinforce.

Restoration

renovation and/or replacement of a new part in a damaged building and/or a depreciated one in order to obtain a level of resistance or ductility in the building before damage.

Double Modeling

Rebuilding or replacing a new part in the existing building that the owner wants to change its use.

Improvement

It includes building, repairing and re-modeling.

Novation

Renewal or replacement of a new part in a damaged building to achieve the same level of exploitation that the building has had before its damage.

Reconstruction

Reconstruction of buildings in a particular area is used mainly for historical monuments and includes restoration and reinforcement. In order to improve the seismic behavior of buildings against earthquake forces, it is necessary to seismic the capacity of the existing building and the seismic capacity and determine the required capacity.

THE OBJECTIVE OF UNDERGROUND REINFORCEMENT

One of the most important reinforcement functions in safe buildings is protecting the buildings against possible loads. Vulnerability severity, financial cost, and the amount of operation required for the main attributes in the reinforcement of the buildings, especially undergrounds. To achieve these characteristics, we can expand each one as follows:

Vulnerability: Vulnerability of a structure to the earthquake and the importance of the structure. For example, the more important and vulnerable a building, the more need for more safety is felt.

Costs of expenditure: Spending money is reasonable to the extent that the value of the cost spent on the security of the building is equal to its equipment and the function of that building at different times.

The amount of operations needed: In some cases, the cost is less important and the feasibility of retrofitting for reasons such as long time and the lack of facilities is impossible. Therefore, the design should be made according to the applicable retrofitting

COMMON WAYS FOR REINFORCING THE BURIED CONSTRUCTIONS

The reinforcement of buried structures has been considered. There are various designs for rebuilding of buried structures in earthquake counteraction. Of course, each one has its own specific features and methods but one of the problems in these plans is their heavy cost

which is often accompanied by an increase in depth. Because earthquake waves and energy losses; Therefore, an increase in depth will increase the immunity to some extent. In contrast, the use of this method reduces the operation of the structure under exploitation conditions and increases the cost of construction. On the other hand, different layers reinforce a part of the earthquake wave that is closer to the natural frequency of the layer and the lack of attention to this plan during designing brings irreparable damage. For economic reasons, the above-mentioned measures are not fully taken into account in buried structures. On the other hand, due to explosions and earthquake hazards, engineers have been trying to find cost-effective alternatives to reinforce and secure structures.

It should be noted that the experimental studies of resistance to earthquake mitigation are less costly and more feasible. Explosive vibrations are often used to study the earthquake properties of various structures.

The Effect of Wave in Soil"

The properties of earthquake wave change through different environments. The high frequencies are rapidly expanding and lower frequencies will stay stable to longer distances. On the other hand, different layers of the earth amplify parts of the spectrum that are closer to the natural frequency of the layer. If there is a layer on the earth that their frequency be more far from the main spectrum of the wave; therefore, the wave won't be amplified and depreciated. Therefore, the type of the soil plays an important role in the depreciation of the wave and energy and also in the stability of the structure due to static and dynamic forces.

Depreciation of the Wave

Increasing the depreciation coefficient reduces the earthquake's forces in the earth.

W Angular Frequency

E Resilience coefficient of materials

μ Coefficient friction

The depreciation coefficient varies from soil to soil and can be varies10 to 20 variables, which are due to various factors, namely:

- Behavior of the waste
- Friction caused by the surfaces and soil.
- The internal viscosity of particles - the friction of porosity between particles and soil resistance.

In grain soils, friction-induced depravation is more important than other factors. It is also noteworthy that the passage of the wave in the porous medium is associated with the distribution of energy (which has been taken into account in the proposed scheme.)

Earthquake Loading on The Structure

It should be noted that laboratory studies of resistance to earthquake explosion are less costly and feasible. Often explosive vibrations are used to study the earthquake properties of different structures.

The behavior of an explosive on an element is generally studied with the help of two important elements:

- The amount of the explosive power, which is measured by TNT.
- Distance of the source of the explosion to the target.

The pressure of the bursts resulting from the explosion decreases exponentially after the blast time interval. According to the tests, this positive pressure can even lead to a negative pressure of depression, which in this case will exacerbate the deterioration. Because of the negative pressure of the structure, it is exposed to forces in the opposite direction. With the explosion (with a given power, TNT) at or near the Earth's surface, the maximum pressure from this spherical burst decreases as a function of distance from the source of the developer.

When an earthquake or explosion occurs in the structure, the structure is exposed to the pressure, reflection and loading results, which may be very complicated. Although this slip is very complicated, the explosion wave can also be calculated based on the load.

The earthquake wave that was a compression before the collision, after the collision and reflection, it becomes a tensile wave. The most damage to the building is due to this tension wave. (Refer to the effect of the earthquake wave).

Impact of Earthquake Wave on Cement

Earthquake waves are released in different parts of the wall of the structure and are reflected and dispersed after reaching the free surfaces of the walls. These waves that were compressed before the collision became a tensile wave after the collision and reflection. The reflection of the stress wave in the structure of reinforced concrete structures results in the creation of a phenomenon called crushing, which is considered as one of the destructive factors of concrete structures made of concrete. Several methods are used to deal with this phenomenon.

A Buried Solution for Earthquake Instruments

When introducing new strategies for earthquake or earthquake retrofitting, an explosion of the structure should be considered in many respects. The structure is one of the most important structures in each military and non military subcategory which is referred to as "safe" structures. However, the cost of rebuilding these structures may be very high, but it can be justified in light of the reduction of financial and life damage occurring in the event of an accident.

Therefore, regard to the above, it is necessary to apply new methods of retrofitting to safety and to reduce the cost-effectiveness of safe structures. In order to rehabilitate these structures, optimal solutions are needed. However, before proposing the proposed method, we should consider the materials in this application.

Polymer Composite Materials (FRP):

These materials are generally a combination of two fibers and resins, in which fibers create reinforcement and resin creates cohesion and integrity, as well as a factor in the distribution and uniform transfer of loads to fibers. Protecting the fibers and connecting them to the surface and transmission of the force from the structure to the fiber is also the responsibility of the resin, while the resin-bonded fiber is used, the tensile strength of the resin is reduced to a factor of two or three times smaller than the tensile strength of the steel.

These materials are very diverse, but a few of them are mentioned below:

(VFRP) Polymer composite materials with carbon fiber

(AFRP) Composite polymer material with aramid fibers

(GFRP) Polymer composite materials with glass fiber

(E-Glass) The most common type is vulnerable to alkaline materials.

AR-Glass: Alkali resistant glass fiber

The reasons for using these materials are:

- The ability to increase the resistance to the desired direction;
- Corrosion and wear resistance;
- Very low weight (to reinforce the wall, the weight of the wall will not be greater and there will be no need for reinforcement)
- Resistant against intermittent loads, dynamic and repetitive loads (they are used on bridges because of tireless.
- Increase the structural behavior
- High speed and high installation
- The behavior is roughly the same in terms of expansion and contraction with concrete.
- Easy transportation.
- Economic efficiency(in spite of the higher unit price of composite materials than other materials, the use of these materials in reinforcement is advantageous for the following reasons):
  - Low weight and no need for reinforcement
  - Low thickness and no reduction of sound infrastructure
  - High installation speed and no need for heavy and heavy machinery
  - Resistant to clogging and no costs for maintenance

Frictional Damper

The damper as one part of the system of side braces includes steel plates that are bolted to each other and generally placed in the middle of the X bracing(shape 1). There is a system for such dampers that can be used at the junction of the column- mounting. These dampers converge

earthquake energy by slipping steel plates on each other to heat energy. Some of the researchers at Tarbiat Modares University managed to construct this better-quality damper a few months ago, which is more detailed.

The method used in this research is on the way that in several stages the energy of the earthquake wave is absorbed so that at least energy of the wave reaches the final concrete; then, by a new type of concrete and with the reinforcement of the armature specifics and the use of dampers and the effects of earthquakes will thwart and minimize the damage. As stated above, this method can be divided into several stages.

Figure1. Friction damper in a steel building

The First Step (Absorption of Energy)

At this stage, the earthquake wave is depleted relative to artificial soil layers, so that the energy generated by the seismic wave is spent only on the displacement of these layers. Increasing the creep behavior in the earth's layers is used for resilient (dense PVC) materials in soils with high porosity.

Then the micro-candles are used which in this method is used by the US Army the earthquake effect decreases.

At the end of this stage, a kind of jelly (plasma) media is used to spread the load at a wider plane; consequently, the load of the earthquake or explosion cannot damage the concrete wall directly. In this case, the destructive effects on building will reach to the least amount; therefore, we can decrease the strength and load intensity within the desired time; consequently, we reduce the amount of destruction.

In this proposed design, the plasma storage environment has the design of separated panels that in a rupture or collapse of a panel, the remaining panels can continue to carry and resist earthquakes or subsequent explosions.

The Second Stage

In this stage is a combination of new materials with FRP concrete the effect of the earthquake will decrease to the minimum (this type of concrete is designed at the Eastern Azarbaijan Jihad Engineering Research Center that minimizes the impact of the earthquake's devastating effect on concrete).

The Third Stage

At this stage, the dampers with the use of frictional dampers and by considering reinforcement method and the minimum distance between reinforcement will neutralize the effect of earthquake.

For caution, you can use candles that are attached to the hardwood floor. The performance of the pleasing piles is on a way that increases the resistance of the vertical walls and consolidates the concrete wall and thus prevents the wall from falling to the inside and damaging the equipment. On the other hand, due to soil mass control and stabilization, it increases the soil resistance around the structure. This way, they will depreciate the dynamic energy; therefore, the use of this method is very suitable for retrofitting various structures. It should be noted that this method seems to be very costly. But the following are noteworthy:

- Some places are important enough to be damaged by earthquakes or explosions.
- Due to the fact that this method is for buried structures and also the compulsion of excavation in this type of structures; thus; the cost of this method is not high.

As you can see in Fig. 1, the conventional and existing methods in country do not meet the burden and are quickly damaged by primary waves. Several different approaches have been proposed to improve many of these burial galleries built and used today. In this research, due to the significant structural weaknesses of these guides, there is no gallery that suggests the use of mechanical fascicles composite shield which combines a flexible metal medium or a plasma environment.

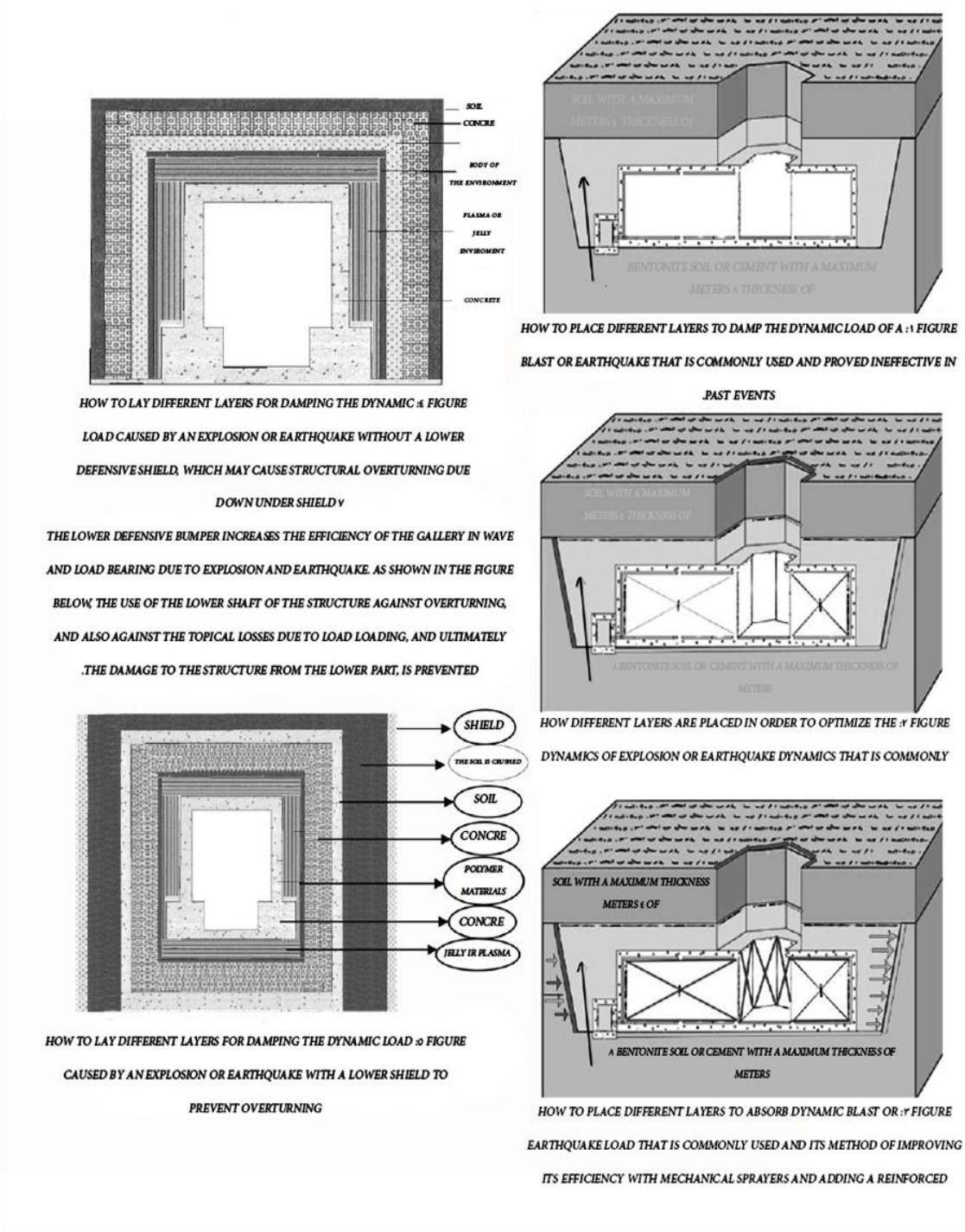

Figure1. *The method of placing different layers for damping the dynamic load caused by an explosion or earthquake that is commonly used and proved ineffective in past events.*

Figure2. *The method of placing different layers of dynamical load induced by explosion or earthquake which is commonly used, and its method of optimizing with sponge absorbers and adding shield of composite environment.*

Figure3. *Different placement patterns for damping the dynamic load caused by an explosion or earthquake which is commonly used to improve the efficiency of it with mechanical drives and to add reinforced composite shields.*

Figure4. *How to lay a different layer for dynamic damping due to explosion or earthquake without lower defensive shield which may cause structural overturn in high intensity wave.*

Figure5. *How to lay a different layer for damping the dynamic load caused by explosion or earthquake with lower shield to prevent overturning.*

LOWER DEFENSIVE SHIELD

The lower defensive shield increases the efficiency of the gallery in wave bearing and load caused by the explosion and earthquake. As seen in the figure below, the use of the lower shield of the structure against overturning and also against the topical losses due to load loading. Finally, the damage to the structure of the structure prevents the lower part.

THE SKEWED CANDLES

The function of the flying piles is on a way that they increase the reinforcement of the vertical walls and consolidation of the concrete wall with two functions; therefore, they prevent the wall from falling to the inside and damaging the equipment and cause the increase of soil resistance around the structure inasmuch as they stabilize the soil well.

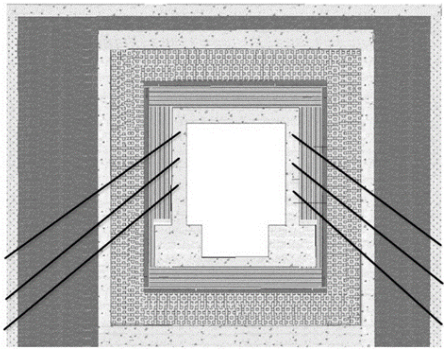

Figure6. *How to put different layer for damping the dynamic load caused by explosion or earthquake with lower shield to prevent overturning and using diagonal (micro-candle) for increasing load.*

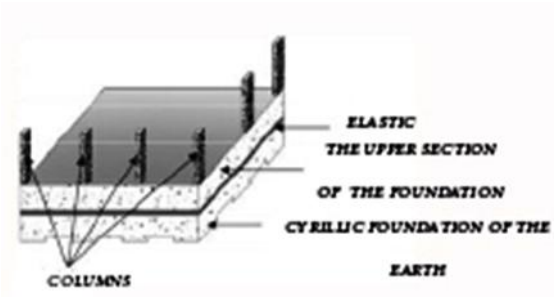

Figure7. *Load attenuation method from Infrastructure*

RESULTS AND SUGGESTIONS

1. According to the research, the use of the above methods while increasing the structure of the load prevents damage to its internal equipment and allows us to use a safe structure after an earthquake or explosion.
2. The earthquake waves are reflected, fractured and absorbed by the various layers of the earth. In this paper, porosity properties are used to increase absorption in the proposed design.
3. Explosive resilient structures are generally well tolerated against earthquakes.
4. In order to distribute and absorb the wave in the earth, geo membrane is used as very thin layers with thickness in the soil layers.
5. Due to the similarity of the borehole and explosion, it is better to use these two reinforcements simultaneously in different structures.

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