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Building Design to Save Lives when Earthquake May Strike the City

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Abstract**—**When earthquakes strike the city it results in great loss of lives. The present paper talks about a new innovative design system (MegEifel) for buildings which has a mechanism to mitigate deaths in case any earthquake strikes the city. If buildings will be designed according to MegEifel design then the occupants of the building will be safe even when they are in sleep or are doing day wise activities during the time earthquake strikes. The core structure is suggested to be designed on the principle that more deep the foundations are, the harder it is to uproot the structure. The buildings will have an Eifel rod dug deep into earth which will help save lives in tall buildings when earthquake strikes. This design takes a leverage of protective shells to save lives.

Keywords**—**Structure, MegEifel, Save, Life, Earthquake, Design

I. Introduction

THIS document describes about a new invention to save lives in case of earthquake.

We all know when earthquake strikes; the people who are at most danger are the one living in the tall slender buildings. To minimize loss of life and property a number of inventions have been made. Almost all of them focuses on saving the building from collapse and lessen the destruction caused to building in case of earthquake. But all these methods are costly and buildings can still collapse if the magnitude of earthquake is too large. This paper describes a new innovative structure technology to let buildings collapse in earthquake but focus on having a tall SOS rod which should not collapse and will eventually save lives.

The mechanism of saving lives is described in section III and IV. The mechanism is a little bit different for Day and Night as you will eventually see.

Let's first check out some destruction limiting mechanisms employed presently. All the below mechanisms are concentrated on mechanism to lessen the impact of earthquake to building.

A. Lead Rubber Bearing

Lead Rubber Bearing [1][4] or LRB is type of base isolation employs a heavy damping. Heavy damping is a mechanism which is incorporated in vibration control technologies and particularly, in the base isolation devices. It is often considered as a valuable source of suppressing vibrations. So it enhances a building's seismic performance. However, this technology has side effects. For the rather pliant systems such as base isolated structures which may have a relatively low bearing stiffness but a high damping, the so-called "damping force" may turn out to be the main pushing force in the case of a strong earthquake strike.

B. Tuned Mass Dampers

Typically tuned mass dampers[2] are in the form of a huge concrete blocks mounted in the skyscrapers or other structures and are designed to move in opposition to the resonance frequency oscillations of the structures. These design usually device means of some sort of spring mechanism.

One example is Taipei 101 skyscraper. This skyscraper needs to withstand strong typhoon winds and earthquake tremors which are common in its area. To solve the purpose, a big steel pendulum weighing 660 metric tons which will serve as a tuned mass damper was designed and installed on atop the skyscraper. It was suspended from the 92nd to the 88th floor. The pendulum works by swaying to decrease resonant amplifications of lateral displacements in the building caused by earthquakes and strong gusts.

C. Friction Pendulum Bearing

Friction Pendulum Bearing [1] is another name devised of Friction Pendulum System. It is based on three pillars:

Articulated friction slider;
Spherical concave sliding surface;
Enclosing cylinder for lateral displacement restraint

The complete details were too large to be incorporated in this paper.

D. Building Elevation Control

Building pyramid-shaped skyscraper structures [1][7][3][6] promises better stability against earthquakes and winds. Controlling elevation configuration can help control buildings' resonant amplification. A properly configured building disperses the shear wave energy between a wide range of frequencies.

E. Simple Roller Bearing

It is a base isolation device which is intended for protecting various building and non-building structures against the potentially damaging lateral impacts of strong earthquakes.[1] The complete details are too large to be included in present paper.

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F. Springs-with-damper base isolator

It is a base isolation device conceptually almost similar to Lead Rubber Bearing or LRB type of base isolator [1][2].

The complete details are too large to be included in present paper. For reference one of two three-story town-houses designed on this system was well instrumented for recording of both vertical and horizontal accelerations on its floors and the ground. The structure survived a severe shaking during the Northridge earthquake and left valuable recorded information for further study on the subject.

G.Hysteretic damper

These kinds of damper[4] are intended to provide better and more reliable seismic performance than that of a conventional structure at the expense of the seismic input energy dissipation. There are four major groups of hysteretic dampers used for the purpose, namely:

- Fluid viscous dampers (FVDs)
- Metallic yielding dampers (MYDs)
- Visco-elastic dampers (VEDs)
- Friction dampers (FDs)

Each group of dampers has specific characteristics, advantages and disadvantages for structural applications.

II. Explanation Of Working Through Figures

Figures are just illustrative. The actual size may differ a lot from shown.

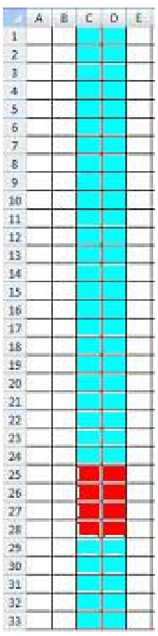

Fig. 1 The MegProp design

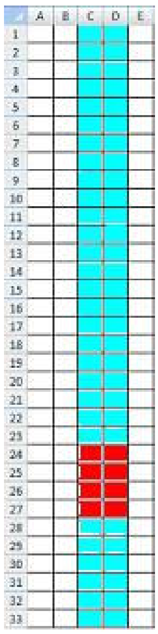

Fig. 2 The MegProp Design

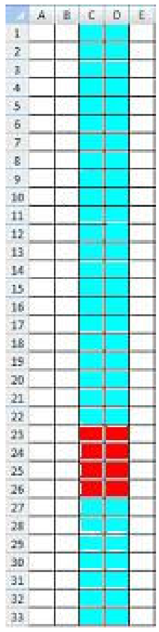

Fig. 3 The MegProp design

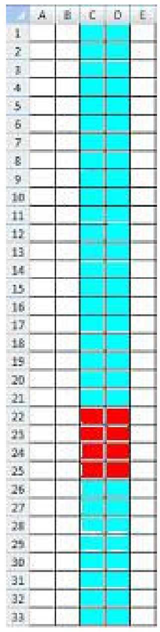

Fig. 4 The MegProp Design

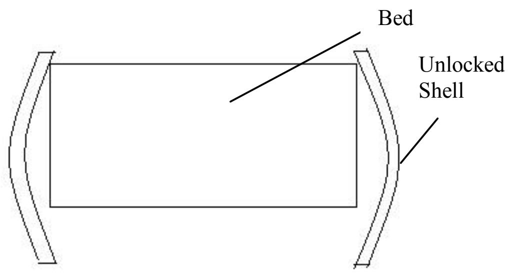

Fig. 5 Night time lives saving- Bed shell in unlocked position.

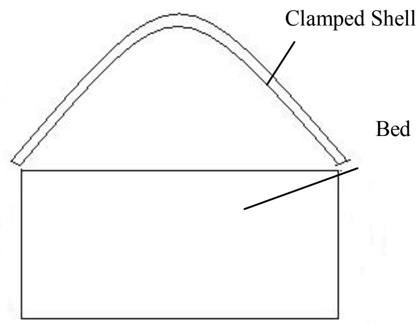

Fig. 6 Night time lives saving- Bed shell in locked position.

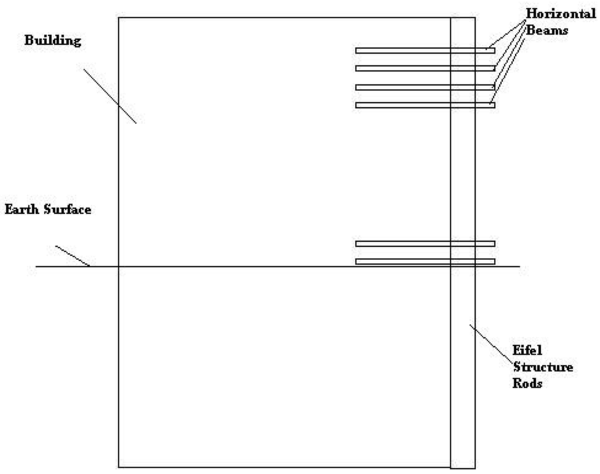

Fig. 7 Cut section side view of building with MegEifel rod at side. MegEifel rods further have horizontal beams at each floor.

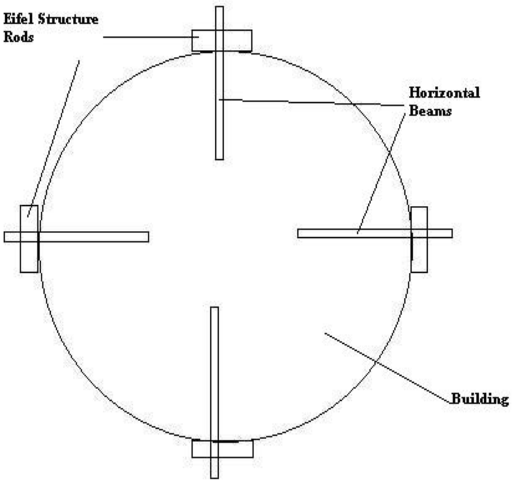

Fig. 8 Cut section top view of building with MegEifel rod at side. MegEifel rods further have horizontal beams at each floor.

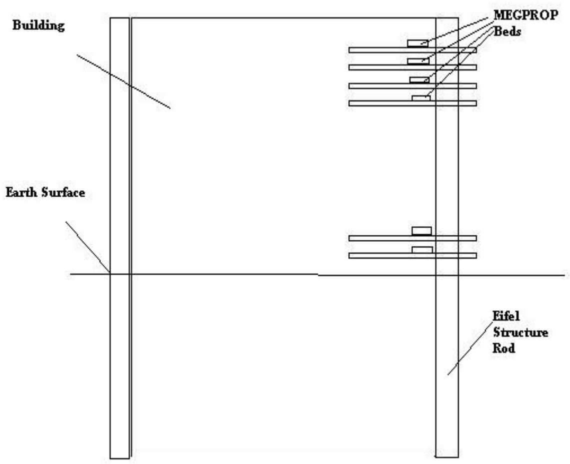

Fig. 9 Cut section side view of building with MegEifel rod at side. MegEifel rods further have horizontal beams. Shells\MegProp beds resting on horizontal beams in normal condition are also shown.

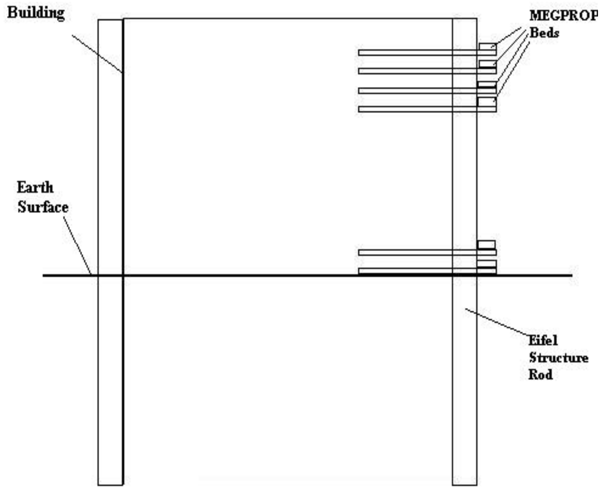

Fig. 10 Cut section side view of building with MegEifel rod at side. MegEifel rods further have horizontal beams at each floor. Shells or MegProp beds resting on horizontal beams and moved to outside of building when earthquake has struck are shown.

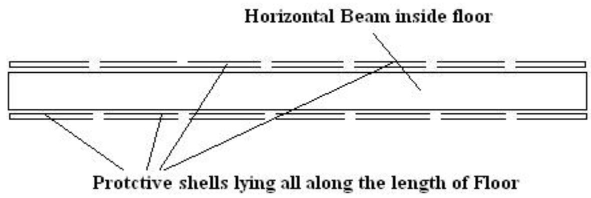

Fig. 11 Day time lives saving – shells lying along the horizontal beam of MegEifel rods are shown.

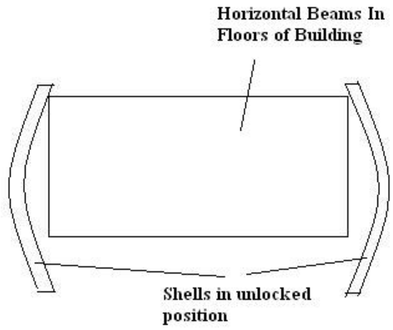

Fig. 12 Day time lives saving – shells lying on horizontal beam, embedded into floor, in unlocked position are shown.

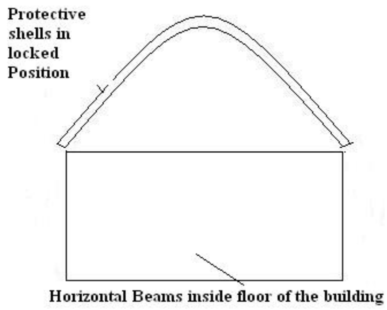

Fig. 13 Day time lives saving – shells lying on horizontal beam, embedded into floor, in locked position are shown.

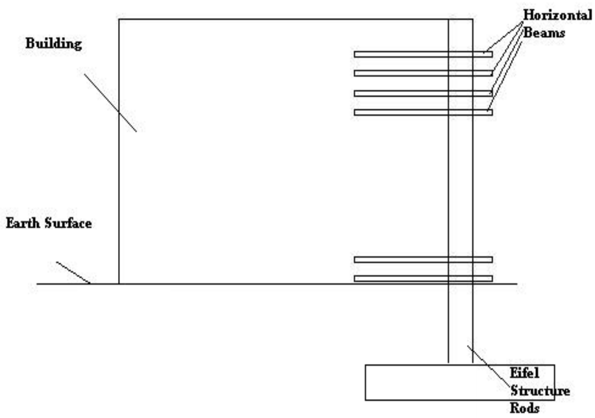

Fig. 14 Alternate kind of MegEifel structure that is not deep but has a flat foundation to not let Eifel rod get uprooted

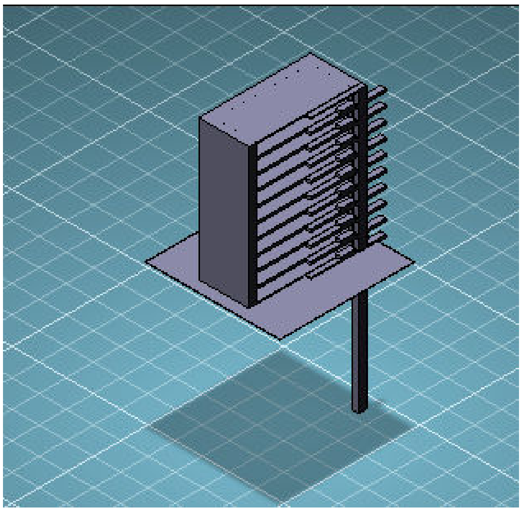

Fig. 15 3D view in Catia on what is described in Fig. 9

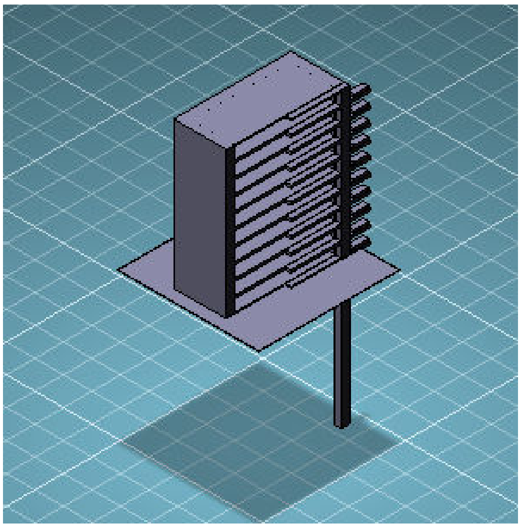

Fig. 16 3D view in Catia on what is described in Fig. 10

III. Night Time Lives Saving Using MegEifel Design

MegEifel design was named MegEifel because its idea came while thinking about Eiffel Tower of France. It has suffix MEG because a magnetic system called MegProp is supposed to be used in design. The magnetic system used is described in below section – "Magnetism used in MegEifel called MegProp". Here is what MegProp design is all about:

A. Magnetism system used in MegEifel Called MegProp

Take two magnets and a sheet of cardboard. Place one magnet M1 above the sheet and one magnet M2 below. If you will move the magnet M2 the magnet M1 will also move. You can test it by placing a toy car with ferrous base above any cardboard. Place a magnet below the cardboard surface on which toy car is standing. Now if you will move magnet along the surface of cardboard, the toy car will also move along. This is the basic principle of MegProp vehicle.

The MegProp vehicle base is to be of ferrous material like iron steel or magnetic itself. MegProp vehicle base is preferred to be as close to earth as possible. It will preferably have spheres in place of tires. The cars will be driven by central computing system of building.

Movement of vehicle using Meg Prop:

1) Fig. 1: Figure shows top view of the MegProp vehicle resting over array of electromagnets (road). Electromagnet boxes are arranged in an array. Box with no color represents an inactive electromagnet. The vehicle body is not shown. Only the area which the vehicle will occupy is shown in red color. The boxes with red color represent electromagnets which are active. The figure at present shows only section of road which can be extended to any length. For giving reference number to electromagnets, the column are marked as A,B,C etc and rows are marked as 1,2,3 etc. So B1 marks electromagnet in 2nd column and 1st row and so on. then the magnets in front of vehicle will be activated and the ones at the rear will be deactivated which will move the vehicle forward. In figure 1 vehicle is stationary (the vehicle is standing over area in color red) with electromagnet set (C25, D25, C26, D26, C27, D27, C28, D28) just below the vehicle marked in red color being active. Means electricity is flowing to them only and rest of electromagnets are not supplied with electricity.

2) Fig. 2: To move forward central real time computing system takes control, if central computing system allows, the poles then activates two electromagnets(C24, D24) in front and deactivates two electromagnets (C28, D28) in the rear. The active set of electromagnets is now (C24, D24, C25, D25, C26, D26, C27, D27). The faster the forward electromagnets are activated and rear set deactivated the faster the car moves.

3) Fig. 3: Shows vehicle still moving forward. The active set now is (C23, D23, C24, D24, C25, D25, C26, D26) and (C27, D27) are now deactivated.

4) Fig. 4: Shows vehicle still moving forward. The active set now is (C22, D22, C23, D23, C24, D24, C25, D25) and (C26, D26) are now deactivated.

To know more about MegProp kindly go to Authors website www.megprop.com.

B. Complete MegEifel System to save lives in Night

Here we are describing complete system using MegProp system to move shells. However we can have other system such as chain pulleys, or rockets or any other mechanism to move the shells out of danger also. For illustration purpose we are describing whole system with MegProp design below:

Let's suppose Earthquake strikes the city at Night and many people may not have any idea that there is earthquake as is usually what happens at earthquake. Then this system will help. There are various kinds of sensors that can be fitted in building which detects Earthquakes as soon as they strike. At minimum usually it takes 9 to 10 seconds for building to start getting demolished to ground. The earthquake sensors will give indication of earthquake with in a second. As soon as there is earthquake detected by sensors, the CCSB (central computing system of Building) will activate MegProp beds which will have shells to protect and move occupants to safety as you can see in Figure 5 to 10.

FIG. 5: This figure shows MegProp Beds. The MegProp beds will be kind of chambers. A kind of shells or coffins so that occupants should be safe from falling debris and other stuff when it is clamped shut. While sleeping these shells may be hidden on side of Beds but get activated by CCSB as soon as earthquake strikes and covers occupant from injury as shown in FIG 6.

The whole Mechanism is as stated below:

Fig.7: It shows a Building. The building has some outer supporting structure rods of Iron designed in the fashion so that it is half up and half down under earth (The length under earth will be decided by the highest expected severity of earthquake that can strike). Having been dug deep into earth, it is supposed that if earthquake strikes then the rod won't fall down onto earth although the building will. At every floor of the building there will be horizontal beams. These will be designed as MegProp roads for MegProp Bed to move.

As soon as there is earthquake CCSB will activate MegProp Beds to be moved to the periphery of the building for them to be safe from falling debris.

Note: The rods can be either dug deep into earth or can have perpendicular beams inside earth as shown in FIG. 14. Thus the base of rod can also be circular plate or X-shaped beams etc. For illustration purpose we will be using plain simple rod dug deep into earth as shown through FIG. 7 to FIG. 10.

Note: The rods can either be placed on peripheries of building or can be in centre or any other suitable position that goes with the architecture of building.

Fig. 8: The Figure shows the top view of Building design.

Fig. 9: This is the position when occupants of the building are sleeping at night as usual. The beds are shown as lying idle over on Beams.

Fig. 10: Now suppose earthquake strikes. The Earthquake sensors will inform CCSB that there is earthquake. The CCSB will activate all MegProp Beds. The shells will be activated too to cover the occupants. The car will be propelled out of building to other side of the rod as shown in this FIG. 10. The whole building may collapse but the Eifel structure rods will stand tall so and will save the occupants lives at night.

You can also see magnetically propelled beds system as cut opened and laid over stator of electric motor [8][9][10][11][12]. In electric motor there is stator and rotor. Stator runs the magnetic field in a circular fashion which moves the rotor. If we cut down the stator and lay it over like road then this will be exactly like road we have talked in this section.

To save lives in night either magnetically propelled beds will be used or either only protective unmovable shell will be used to save cost. The beds will be as like in FIG 5 and 6 but they will not have any propulsion. As beams will not fall during earthquake as they are supported by Eifel rods so occupants will be safe. Moreover the beds will be designed to be lined one below another so that debris passes from side and don't strike the shells.

The shells may have life support materials like water, mobile and chocolates etc.

IV. Day Time Lives Saving Using MegEifel Design

In day time Occupants will not be in bed so MegEifel design for night time may not work as occupants will be away from bed. Moreover most of the buildings house Businesses. So Employees and occupants will be roaming free or sitting somewhere unprotected in case Earthquake strikes. So for day time lives saving the mechanism is different as defined below:

The Mechanism is almost same as saving lives in Night as defined in previous segment. However the beams will not have magnetic propulsion system and shells will not be fitted at sides of beds only. The Building will have Eifel rod with Horizontal Beams as shown in FIG. 7 and FIG. 8. But magnetically propelled beds will not be used in this case. Instead beams will itself house a number of shells.

In Fig. 12 you can see Beams will have shells immersed inside floors. Right now they are in unlocked position. The FIG. 11 shows top view of these shells. There will be different shells lying all along the horizontal beam immersed in floor. There will be safe lines defined on floor marking for occupants to see; these are the areas of beams marked for their safety.

When Earthquake strikes then immediately alarm will go buzzing. The employees will run to and lie down on these lines. Every shell will have button to signal shell to activate. As soon as the button is pressed within second the shell will lock as shown in FIG. 13. These shells will save employees from falling debris. And as these are supported by Eifel Rods on side of the building as shown in FIG. 7 to 8 so these will not fall off to earth and the occupants will be safe. These horizontal beams will be lined up one below another and so on so that the falling debris will only strike only on top of the shell of top floor. For rest of shells the debris would fall from sideways and not strike the shell too hard.

The shells may have life support materials like water, mobile and chocolates etc till the time rescuers come and rescue them.

The full earthquake lifesaving mechanism will be a hybrid between night time lives saving and day time lives saving.

V. Conclusion

From as described we can conclude that the MegEifel design mechanism will help save lives even if the occupants are sleeping and not able to wake up when earthquake strikes. The mechanism will also help support saving lives in case occupants are roaming freely inside building in day time and suddenly earthquake strikes. The building design will have strong rods at side or inside of the buildings which will have horizontal beams. The rods will be almost half inside earth as half outside so as after earthquake these Rods and Beams will not fall with building and will help save building occupants lives. To save lives in night time magnetically propelled beds will be used along horizontal beams which will be controlled by CCSB (Central Computing system of Building). CCSB will activate them to save lives as soon as earthquake strikes. To detect earthquake there will be earthquake sensors giving information to CCSB.

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