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SEISMIC REINFORCED CONCRETE DESIGN AND SAND FRICTION DAMPER

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Abstract: The seismic design of reinforced concrete dampers buildings structural design considerations, based on the Intensity of the earthquakes such as minor, moderate, and strong. Usually, a minor earthquake occurs mostly in some frequency and causes of crackings in a loss of durability and collapsibility. The strong earthquake has been rarely some time the probability of occurs of a strong earthquake may exceed the lifetime of the structures. These earthquake resistance building should resist the effect of ground motion. Even though they may get damaged and not collapsed during the strong earthquake. These paper based on same thematic and should provide the special RC foundation and sand friction dampers in a footing and improvements of the ductility resistance strength in related resist the strong movements. Sand friction dampers are provided in a structured frame footing of a building to absorb the seismic energy ground during an earthquake. Thus dampers reduced the shaking the building deforms is less, so a change of damage is reduced. Which having high damping capacity and greatly decreased the seismic energy entering the building. That study based on the analysis in numerically designed to the better way to outcomes the results of beams, columns design included the confining reinforcement spacing is designed in special damper footings columns and beam joints connections improvements of ductility nature. Application and improvements that design concept is effectively work in an under seismic action without collapsed in limitations. Especially constructed in seismic prone zone areas.
Keywords: Ductility resistance, Confining Reinforcement, concrete wall design, columns and beams shear connections, special designs and friction dampers

INTRODUCTION

A large sum of seismic motions is created the horizontal and vertical earth motions are based on an earthquake motion. The vertical ground motions having a smaller magnitude are most usually the vertical ground motion due to earthquake can be resisted the factor of safety provided structure (allowable load/factor of safety). These structures, which are designed to carry only a gravity load, will not able to resist the horizontal ground motions [1].

The horizontal ground motion is effective and causes the most significant effects on the structure of shaking the foundation. It's necessary to check the adequacy of the structures to withstand the horizontal motions. The mass of the building resistance movements shaking by setting up so as to resist an altar inside velocity of a purpose it's like to along with in conflicting directions.

The structural dampers should be properly designed the lateral forces even its expensive [2]. The seismic analysis zones should be done to determine the magnitude referred to the previous loss impacts and designed to the dampers the magnitude directions of lateral earthquake forces [3]. Dampers are works in correlated in base isolation systems [4]. These systems found useful for short period structure says less than 0.7 seconds, including soil structure of interactions its principles of alteration and conventional fixed based design structure and may be cast of effective compared to normal buildings [5].

It provided the new building were very strong ground motion likely [6]. The criteria for the effective damping system is not fit for soft soil, building of low, medium or height ($H/L < 1$), the content of the building sensitive to high frequency of vibrations, building rigid properties effectively resist the lateral loading system, other earthquake loads (wind, live, dead load) < 10% weight of structure [7].

The seismic dampers process that causes an oscillation in a system to decay rapidly to zero amplitude [8]. It is a very important phenomenon in vibration suppression or isolation [9]. Damping causes the energy to be diverted from vibration to other energy sinks. It's installed in structural frames of a building to absorb some of the energy going into the building from the shaking ground during an earthquake [10]. Dampers reduce the energy available for shaking the building.

DUCTILITY RESISTANT IN A BUILDING STRUCTURE

The arrangement is able to continue elastic beneath the action of the utmost expected earthquake in the compliments zones, but increasing the elastic properties with the insist was established as an extravagant method of the construction, that concept is a ductile chain design [11].

The ductility in earthquake-resistant buildings, they have the ability to reverse large lateral deformations before failure during an earthquake and to withstand earthquake effects with some damages but without collapse [12]. These beneficial to purpose structures in some case earthquake vibrated in the structure and form in some cracks without collapsing [13].

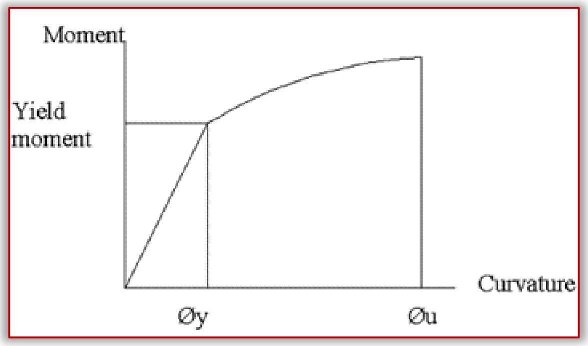

Figure1 - Moment curvature ductility diagram

Moment curvature ductility diagram represent that the result obtained moment curvature ductility resistance, if the Curvature ultimate strength of the idealized bilinear M-ϕ relationship sections, to the curvature at yield in a first section [14]. It's procured from moment-curvature relationships.

ASSUMPTIONS OF EARTHQUAKE DESIGN PHILOSOPHY

Under minor frequency shaking the main member of the buildings that carry vertical and horizontal forces should not damage nonetheless building parts that do not carry load may endure repairable damage [15]. Under moderate shaking, the main members may sustain repairable damaged duration the other parts of the buildings may be damaged and predetermined after the damaged structural members replaced the after earthquakes. Under the strong, but are shaking the main member may sustain severely damaged, but should not collapse [16]. This main design philosophy of helping to protect the building from collapse.

SPECIAL DAMPERS OR SAND FRICTION DAMPERS

Special dampers are used in providing a special structural element for controlling seismic damages in structures [17]. It's absorbed into the lateral force energy and reduces the motion of the building [18]. The sands frictions dampers are costs low and better economical actions compared to other dampers likes viscous, metallic friction, tuned mass dampers.

Sand friction bed dampers are natural parts and base isolation that will absorbed shaking over each other during a strong earthquake, when the part of sand acting at isolation process over each other [19]. The building vibrated the sand damp are compressed pulling and pushing the damp sideway and making it deforms.

DISCUSSIONS

— Site grouting

Grouting technique is provided by the column points. The slow flowing water cement mix (1:1) ratio injected the under pressure the soil in a column marking points [20]. Bulb forms displace is densities the surrounding soil. Compacted grouting is a good option if the foundations. Infeasible to inject the grouting from the include angles to reach beneath the building.

— Building plan

The structural plans have an uncomplicated and usual geometry and consistently dispersed accumulation and rigidity in the plan, undergo have to less compensation than buildings with the uneven pattern. The symmetrical building plan should be prepared for seismic resistance.

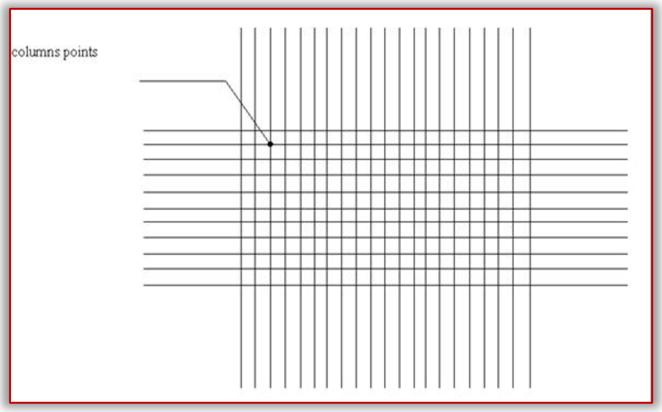

Figure 2- Symmetrical grid line building plan in seismic designs

Each line crossing points represent to decided columns point. Simple rectangular grid line sections plans and are both with respects to mass and rigidity, so that the centre of mass and rigidity of the building coincide with each other. In case of no separate sections other than expansion gap to continuations necessary IS 3414:1968.

— Special RC design

The special reinforced design is followed by a limit state of serviceability. The structures under service load and durability in environmental working conditions. In the design of serviceability and stability of structure as a seismic resistance. But structure situated in high seismic zones required special ductile design and detailing [21]. The code practices of IS 13920: 1993 [22].

Under the severe ground motion, it is ensured that in structure. Designed to resist earthquake forces in a ductile manner, large lateral deformation and vibration will be induced which result in the formation of plastic hinged at a predetermined location in the frames [23]. These requirements apply to frame members which have a factored axial stress in excess of 0.1fck under the effect of earthquake forces. The minimum dimensions of the member need to, not less than 200mm. However in frames which have beams within the centre span exceeding 5m or columns not less. Special confining reinforcement should be provided over a length (lo) from each joint face towards mid-span and on either side of sections. Where flexural yielding may occur under the effects of earthquake forces.

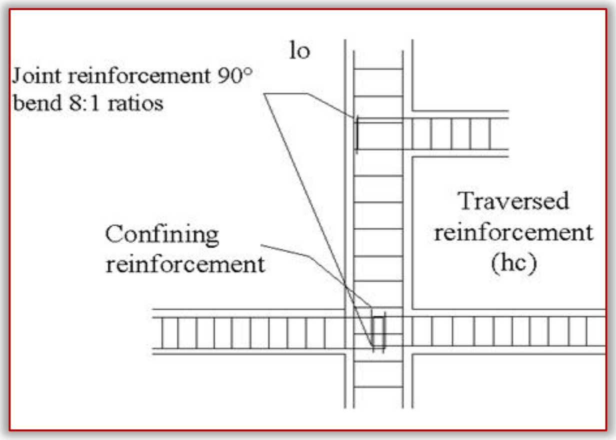

Figure 3- Columns and joint detailing

The columns and joint detailing the section x-y plane represent to the length (lo) shall not be less than large dimensions of the members at a section where yielding occurs, and 1/6 of the clear span of the member and these connections of columns in preferred in 450mm dimensions of structural members. And joint the interlocking beams is jointing reinforcement bents is a 8:1 ratio. The columns and joint detailing the section x-y plane represent to the length (lo) shall not be less than large dimensions of the members at a section where yielding occurs, and 1/6 of the clear span of the member and these connections of columns in preferred in 450mm dimensions of structural members. And joint the interlocking beams is jointing reinforcement bents is a 8:1 ratio.

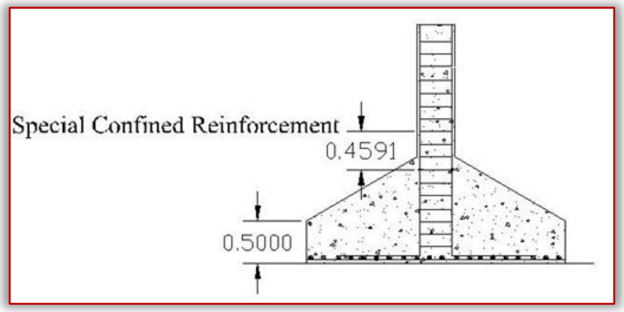

Figure 4- Special confining reinforcement footing

Special confining reinforcement section drawing explained to footing column terminates into a footing mat special confining RC elements extend at least 300mm into a footing. Under the effect of gravity and earthquake loads is not within middle ½ half of span member's clear height, special confining reinforcement provided over the full height of the columns. And the footing paver thickness is 500mm; paver mix is 1:1.5:3.

Sand friction dampers

RC frame sand frictions will damp process that causes an oscillation in a system to decay rapidly to zero amplitude revealed in sand friction dampers are RC frames footing.

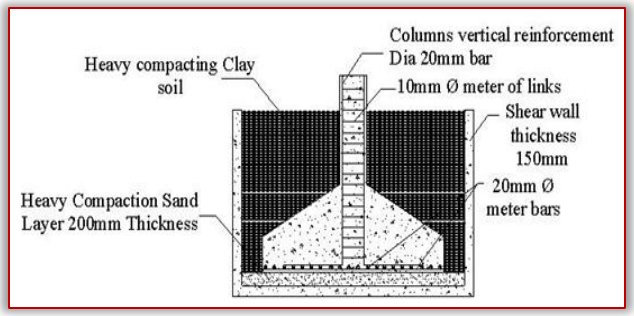

Figure 5- Sand friction dampers are RC frames footing

It's extremely significant in vibration suppression or isolation. Sand friction damping causes the energy to be diverted from vibration to other energy sinks. RC frame sand dampers are mainly used for reinforced concrete structures [24]. That lateral load applied that the footing concrete frames are it compressed the heavy, compacted sand and elastic clay to deform positions.

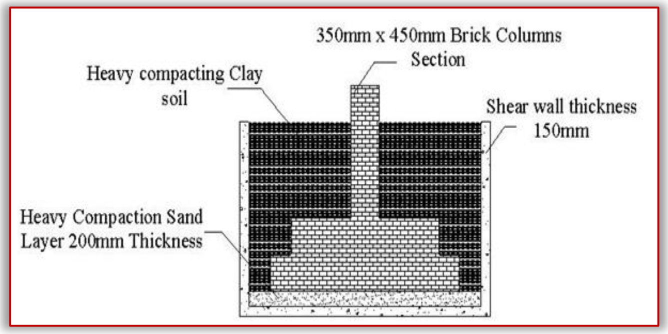

Figure 6. Sand friction dampers Brick batten structural frames

Sand friction dampers Brick batten structural frames that systems reduced the base shear in Load bearing structure (LBS-Structures) primarily because of the natural vibration period of the isolation mode. Sand friction dampers provided most of the response, is much longer than the fundamental period of the fixed base structure [25]. It's leading to much smaller spectrum ordinates higher modes. It's essentially not excited by the ground motion. Sand friction damping in the isolation system and associated energy dissipation vibration and in reducing structural response. Its same methodology in RC sand dampers and change the structural materials.

Materials

Quality and grade mainly depend on the structural strength response to the seismic energy. The high-grade material is used to the structures its improvements of the ductility resistant capacity of building structural elements. It resists the moderate vibrations in seismic waves. And is uses second-grade quality materials it is not resisting capacity of the vibrations. The structural ability of the buildings is constantly low efficient. 53-grade types of cement are preferable in seismic designs for residential buildings and better construction values and its use OPC used in

RCC and pre-stressed concrete. If 53 it is higher grades of cement concrete applications its uses for special soil grouting immediate plugging mortars. Anywhere initially higher strength of concrete. Loses and hardened broken sands are used. Its high comprised grains of disintegrated rocks. The grain diameters are 0.06 and 2 mm sizes.

It's a generally available river sand material is essentially used in constructions in sand friction dampers. Gravels are known as other names of coarse aggregates. It's sharp and fine irregular angular darks grey blues textures. It occupies 70 to 80 percentages of the entire volume of concrete. It's 20 and 40mm sizes of aggregates are most useful in building constructions. 20mm sizes - structures (Ordinary Portland Cement) mixes and 40mm sizes – foundations PCC mix. Brick batten is a moulding clay in a rectangular section of blocks it is uniform sizes (19*9*9 cm) burning these blocks. It's according to the quality of the mortar.

The quality of the bricks and thickness of the mortar joints. Brickworks in cement mortar in first class. In this type of brickworks, cement or lime mortars are used. These bricks are manufacture in table moulded and of standard shapes. The surface edges are sharps and straight. A thickness of mortar joints has not exceeded in 10mm. Safe permissible load on brick masonry is 44 to 55 t/m2. It's considered as the strongest bond in brickworks. Alternate courses consist of stretcher and header. That brick work bind with mortars are a binding material of bricks and stone works. It's mixtures of cement, sand and water. It's also similar in concrete, but except coarse aggregate. It mixes ratio is (1:2) dry mix, wet mix (1:1.5).

Water required for these two functions is about 0.50 to 0.60 times the weight of cement. These ratios of the amounts of water to the amount of cement by weight is termed as w/c ratio and the strength and quality of concrete primarily depend upon these ratios. W/c ratios for structures which exposed to the weather should be carefully decided. For instance, a structure which regularly wetting and drying, water cement ratio by weight should be 0.45 and 0.55 for thin section mass concrete respectively.

Clay soil is natural materials and pure clay is best of back filling of concrete footing and brick masonry wall footing systems. It's composed of particle they have synthetic and glue properties. Heavy compaction natural clay is a better action to resist the lateral movements 40 to 50 % of clay content soil has a good ability to improve high plastic index their structure basement resist earthquakes. And in conventionally controlled moderate seismic engagements. Mixing proportions of concrete is volumetric proportions of cement, sand and aggregate. Fixed arbitrarily such as 1:1.5:3 (M20) grade depending upon the nature of the works.

SPECIAL DESIGN OF WEB REINFORCEMENT

Special RC web reinforcement are shall consist of vertical hoops. Vertical hoops have a closed in 4 corner sides having a 135-degree hook with 10mm diameter extensions <75mm. At each end that is embedded in confined core completing contains circumstances.

Strips bending in 2 types, first one is u-bend; box bends each hook a 10mm diameter extension. The hooks shall engage peripheral longitudinal bars. The minimum diameters are used in strips; the hook is 6mm & 8mm diameters in either Mild steel or HYSD bars.

CONCLUSIONS

This paper studied in seismic design, numerical analysis concrete in structural frame buildings. These types of sand fictions dampers used only in a 2 and 3 stores residential and apartment buildings.

Its cost lays wise economical and better seismic resist actions in moderate earthquakes. It contains improvements of ductility resistance and resists lateral loads depend upon seismic philosophy. This severity of these forces and the demands of the performance of these brace joints for greater understanding of their seismic behavior.

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