Pushover Analysis of Elevated Water Tank with Various Orientation of Column

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Abstract- *The present review examines the behavior of an elevated water tank by pushover analysis.it is carried out by considering various parameters like different type of bracing,column placed in radial and parallel, water storage capacity and stagging height which are constant .By intercombing each of these parameters 6 models of tank was created.all tank models have their locality in earthquake zone 4 .we have made use of SAP 2000 computer program. Displacement control pushover analysis is used to apply the earthquake forces at C.G of container. The conduct of each tank as for other will be checked for base shear,roof displacement and plastic hinge formation. It describes structure's behaviours with the help of graph i.e 'capacity curve or demand curve there is a change in magnitude of displacement and base shear.the pushover curve which is a graph plot of base shear versus displacement give the actual capacity of the structure in the nonlinear range*

Keywords- pushover analysis, orientation of column, plastic hing, capacity.

I. INTRODUCTION

Water tanks are very important for public utility and for industrial structure having basic purpose of to secure constant water supply at the longer distance with sufficient static head to the desired destination under the effect of gravitational force. It is also essential to ensure that, requirements such as water supply is not hampered during an earthquake and should remain functional in the post-earthquake period. In such situations the elevated tanks may prove most handy tool for the purpose of water distribution and fire protection. elevated water tanks are utilized for open water dissemination framework furthermore required for flame framework. Being a vital piece of life saver framework, and because of post quake useful requirements, seismic wellbeing of water tanks is of significant importance[1].

Weakling investigation is a roughly examination technique in which the structure is subjected to monotonically expanding parallel powers with a perpetually stature savvy dispersion until an objective removal is come to. Sucker investigation comprises of a progression of consecutive non straight flexible examination, superimposed to roughly a compel uprooting bend of the general structure. An a few dimensional model which incorporates bilinear or trilinear stack disfigurement shap outlines of all horizontal constrain opposing components is initially made and gravity burdens are connected above all else. Weakling investigation is a static, nonlinear system utilizing streamlined nonlinear method to evaluate seismic auxiliary misshapenings of the structure. It is an incremental static investigation used to decide the compel uprooting relationship, or the limit bend, for a structure or auxiliary component. Because of the absence of learning of supporting framework and investigation framework a portion of the water tank were broke down or vigorously harms. So there is have to concentrate on seismic security of life saver structure utilizing as for exchange supporting framework which are Safe amid quake furthermore take more outline powers and uprooting.

Weakling examination comprises consecutive flexible investigation, superimposed to approximatetly a bend compel relocation of the general structure and non direct structure. A two of a progression of or three dimensional model which incorporates bilinear or trilinear stack disfigurement outlines of all horizontal drive uprooting opposing components is initially made and gravity burdens are connected at first.It is utilized to assess nonlinear conduct what's more, gives the arrangement and component of plastic pivot arrangement. Here dislodging controlled weakling examination is utilized to apply the seismic tremor powers at C.G. of compartment. The conduct of every tank as for other will be checked for base shear, rooftop dislodging and plastic pivot arrangement succession and its example inside the organizing. It depicts structure's conduct with the assistance of diagrams i.e.'limit bend' or 'weakling bend'.Indian sub-landmass is profoundly helpless against characteristic fiascos like seismic tremors, drafts, surges, typhoons and so forth. Greater part of states or union domains are inclined to one or different calamities. These characteristic disasters are creating numerous losses and countless property misfortune consistently. Seismic tremors involve ahead of all comers in helplessness. Subsequently, it is important to figure out how to live with these occasions. As per seismic code IS: 1893(Part I):2002, more than 60% of India is inclined to tremors.

Subsequently, a lot of research exertion has been committed to a superior assurance of the seismic conduct of fluid tanks and stores and the change of related plan codes. Disregarding this, there have been moderately few reviews on the seismic conduct of hoisted water tank with soil adaptability. Static push-over investigation is a streamlined nonlinear examination method in which a structure displayed with non-direct properties, (for example, plastic pivot properties) and perpetual gravity burdens is subjected to an incremental parallel load from zero to an endorsed extreme relocation or until the structure can't avoid additionally stacks. The succession of yielding, plastic pivot arrangement and disappointment of different basic segments are noted and the aggregate constrain is plotted against relocation to characterize a limit bend. In the weakling examination it is accepted that the objective removal for MDOF structure can be assessed as the uprooting interest for the comparing proportional SDOF framework changed the MDOF through the shape vector.

Because of the absence of information of supporting framework a portion of the water tank were caved in or intensely harms. So there is have to concentrate on seismic wellbeing of life saver structure utilizing concerning substitute supporting framework which are Safe amid quake furthermore take more outline powers. Outline of new tanks and security assessment of existing tanks ought to be completed with an abnormal state of exactness in light of the fact that the disappointment of such structures, especially amid a quake, might be grievous. The principle point of study is to comprehend the conduct of various organizing, under various stacking conditions and reinforcing the customary kind of organizing by appropriate plan to give better execution duringearthquake.

II. LITERATURE REVIEW

1. Various literature has introduced for pushover Analysis.

Prof. Laxmikant viragade et. al

It is completed by considering different parameters like water stockpiling limit and organizing tallness are steady, unique sorts of h/d proportion, different sorts of arranging game plan and variety in number of segments. By between joining each of these parameters 54 models of tank were made. All tank models have their area in seismic tremor zone III. A section establishment is to be settled. Damping proportion of 5% is expected for every single common mode.
It is watched that h/d Ratio 0.6 typical organizing sort gives least Axial Force for Eight, Ten and Twelve no of sections as contrast with other h/d Ratio.

N. Vinay et. al

The paper gives pivots are utilized as a part of shaft and section and subsequently sucker chart is acquired from exceed expectations spread sheet.elevated roundabout water tank are demonstrated under burdens has been broke down SAP 2000 programming and the edge is examined by utilizing SAP 2000 programming up to the disappointment and the heap misshapening bend and the outcome are gotten.
In this paper consider a solitary narrows single story casing with a similar cross area throught . the casing is subjectrd to self wt as it were The edge has been showned varity of disappointment, flexural failure and shear disappointments. Conspicuous disappointment are the joint failure

Mr. Bhavin Patel et.al

In this paper portrays that information gathered from lalan school, limit of tank 2.25 liters ESR
Pushing the structure utilizing the heap examples of static sidelong loads, to removal bigger than those connected with target uprooting utilizing static weakling examination
The holder and confining framework is demonstrated utilizing ETABS programming for performing static sucker investigation. The seismic tremor powers are resolved according to IS 1893:2002 Twisting minute relationship for flexural and compressional part have been produced utilizing kaustubh Dasgupta programming. The range from the base to CG of holder is 14m and subsequently target removal is set to 68mm. the relocation is connected well ordered to the structure in an incremental way. There is no numerical reason for the reaction diminishment figure organized Indian outline code didn't follow in this modular The esteem doled out to reaction decrease consider for a given confining framework ought to shift between seismic zones

Ashish M. Bhandari et.al

Author show the result and discussion of the staging height, time period, Base shear, Ductility factor, Redundancy factor Over strength factor are varies in different condition and comparison with full and empty water tank. Water tank of capacity 250m3and 500m3 are selected. Wall and domes are modeled as shell element and foundation are assumed to be fixed

Parth D.Daximi et.al

The introduction of this paper demonstrates the essential thing of the static sucker examination regarding other technique and the audit of halfway investigations of seismic investigation Investigation is completed by full water level

considering the sloshing impact alongside hydrostatic effect. and discover the uprooting for half filled tank is not exactly the relocation for tank with full limit . Detail criteria for seismic examination of hoisted water tank are not specified in IS 1893(part-1)

Twjaswini M.S, Sridhar.R et. al

In this paper comparative study of water tank for different zone 3 and zone 5 and different shape of container square, rectangular and circular with applied load and without applied load. The capacity of tank are varies 5m3,10m3,15m3 and ground soil condition are also varies medium,soft,and hard soil.

Mohammad HadikhanTehrani et. al

The paper gives detail of soil structure and fluid structure interactions and the effect of soil type variation are investigated.water tank model assume that foundation act as a rigid and soil behaves homogeneous half space

Siddharth G.Shah et.al

The numerous construct movement impact with respect to hydrodynamic weight, speeding up of tank and liquid surface height issue in Elevated water tank is comprehended as Soil structure Interaction issue. Where, Soil-Structure association causes shaking movement and soil Structure cooperation causes the hydrodynamic conduct of water tank.

In the wake of playing out a nonlinear static weakling examination we came to realize that to playing out a sucker investigation on the pole arranging tank is exceptionally troublesome and when it is important to incorporate the dirt adaptability impact .

The reaction diminishment element is reductions while day and age is increments from settled base to adaptable base and most extreme day and age accomplished in the delicate soil. So it can watched that evasion of soil adaptability impact may prompt to mixed up and poor consequences of RC edge structures.

The base estimation of reaction decrease consider is watched delicate soil so it can be presume that evasion of soil adaptability impact may prompt to unseemly flexible specifying.

Miss.Soni M. Maidankar et.al

To concentrate the reasonableness of various sorts of bracings considering tanks in various seismic zones and distinctive statures of arranging for a steady limit of the roundabout water tank. To check the productivity of a specific propping in various seismic zones To concentrate the seismic investigation of water tank by utilizing reaction range technique utilizing FEM Software SAP2000v15 Segment minute in supporting increments by expanding tallness of organizing of water tank. Cross propping gives least esteem for base shear for all zone and arranging tallness.

Upsetting minute is least for cross supporting. by considering aftereffects of investigation spiral propping performs better in all way when contrasted with cross supporting and typical supporting. Pivotal segment drive and base shear is very little influenced by tallness of organizing.

to concentrate the seismic execution of raised roundabout water tank for different seismic zones II,III,IV of India for different statures of arranging 12m,16m and 20 m for specific limit of hoisted water tanks. Twenty seven models are made for examination of hoisted water tank. Seismic examination is finished by reaction spectrummethod.

Priya S. Kadam et.al

In this review, a strengthened hoisted water tank with settled base organizing framework has been considered for the present review. The lifted tank has a limit of 900 m3 with arranging stature of 16 m considering 4 m tallness of every board is considered for study .The tank is of intze sort. Holder of the tank has an inward width 11.5 m and stature of 13 m.. Review of cement and steel utilized are M20 and Fe415, separately. Zone of the tank has chosen in seismic zone IV

The basic day and age and base shear values utilizing IS 1893-Part II and from SAP2000 The base shear is diminishing and era is expanding if there should arise an occurrence of programming results. In sucker investigation, at yield point amid a lifted water tank with 90 slant of segments with vertical shows preferred outcomes over other three models with 00, 30, 60 Inclinations The era for raised water tank having 90 inclnation of sections with vertical is least and particular base shear is most extreme than other three considered models.

III. PROCEDURE

- Create three dimensional model of tank.
- Implementation and application of gravity loads, live loads, and water load, etc. .
- Define properties and acceptance criteria for the pushover hinges. The program includes several built-in

default hinge properties that are based on average values from ATC-40 for concrete members and average values from FEMA-356 for steel members.

- Locate the pushover hinges on the model by selecting one or more frame members and assigning them one or more hinge properties.
- Define the pushover load cases.
- Push the structure using the load patterns of static lateral loads, to displacements larger than those associated with target displacement using static pushover analysis.
- The numbers of hinges are shown in the fig(a)and fig(b) in each member showing the hinges in columns the immediate occupancy, life safety, collapse prevention to define the force deflection behavior of the hinge.

IV. CONCLUSION

This research work using cross arrangement 8,10,12 number of column and h/d ratio 0.4 following conclusions

1) It is observed that h/d ratio 0.4 normal staging type gives minimum Axial Force for 8,10,12 no. of column as compareto other h/d ratio
2) Full tank and empty tank condition as the numbers of column go on increases water tank capacity increase
3) Base shear is more for h/d ratio 0.4 cross staging type as compare to other h/d ratio

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