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Seismic Analysis of Multistory Open Ground Storey RC Frame Building using ETABS

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ABSTRACT: Open ground building has had as spot in the Indian metropolitan climate because of the way that it gives truly necessary stopping office in the ground story of the structure. Reviews of structures fizzled in past tremors shows that these sorts of structures are discovered to be one of the most vulnerable. The lion's share of structures that fizzled during the bhuj Khalifa earth quake in 2001 and Gujarat earthquake were of the open ground story type Present concentrate primarily center around the development of open ground story outline building. The break does system of such kind of building is predominantly owing the arrangement of delicate story conduct with in the ground story of this sort of building the 15 1893code was reexamined in 2002, joining new suggestions to deal with OGS outline buildings. The principal line with this provision 7.10.30a) of a seismic code state. The sections and light emissions delicate story region and to be intended for the duplication factor of 2.5 occasions the structure shears and minutes determined for seismic heaps of exposed frame The given increase factor of 2.5. applicable for all OGS framed structures

A multistorey working with open ground story put in Hyderabad (semi zone-II) is comidered for this study thin building is dimesons for two different cases by response spectrum analysis method (3) Considering infill strength and stuffies (005).00 Not considering mill strength and Miffiness (Bare frame) Infill stiffness was created in ETABS by using Equivalent Sunting swagger methodology ETABS programming is utilized for auxiliary displaying and Response spectrum analysis. Analysis clamed out for these models and resuchs were compared

KEYWORDS: Infill wall. Open Ground Stormy, Response Spectrum Analysis, Softness Multiplication Facsos, Makey Building aral Equivalent Diagonal Strat

I. INTRODUCTION

1.1 GENERAL

Open Ground Story (OGS) buildings are common in urban areas like India for parking space but are prone to collapse during earthquakes due to the soft-story mechanism in the ground floor. In typical designs, the stiffness of infill walls in upper stories is often ignored, making the upper floors much stiffer than the ground story. This results in large lateral displacements and stresses concentrated in the ground floor, causing failures like snapping ties, concrete crushing, and bar buckling. The Bhuj earthquake led to updates in the IS 1893 code (2002), requiring columns and beams in the ground story to be designed for 2.5 times the story shears and moments of bare frames to compensate for stiffness irregularities. This provision, introduced in Clause 7.10.3(a), has been debated for its conservativeness. The study aims to evaluate this multiplication factor and analyze the impact of infill wall strength and stiffness on the seismic performance of multistory OGS buildings in various zones.

1.2 NEED FOR INVESTIGATIONS

The widespread damage especially to RC building during Bhuj earthquake exposed the construction practices being adopted in India and generated a great demand for seismic evaluation and up-gradation of RC building. The RC building can become seismically deficient since seismic design codal requirements are constantly revised due to extensive experimental investigations in the research fields. Performance based design is experiencing a rapid development in recent years. This concept provides a new approach for establishing design objectives and desired performance levels for new and existing building. Seismic deficient buildings are being upgraded using performance-

based design. Such building, when subjected to severe ground motion, might suffer extensive damage or even collapse. The recent brought the-linear Dynamic Analysis procedure to the forefront. Analysis of structures using of multistorey building using finite element package ETABS 2016.

1.3 OPEN GROUND STOREY BUILDING

In Open Ground Story (OGS) buildings, the absence of infill walls in the ground story leads to increased base shear being resisted solely by the ground floor columns, unlike buildings with infill walls where the shear is shared between the columns and infills. This results in larger bending moments and deflections in the ground story columns, leading to significant displacement and plastic hinges at the column ends. The upper stories, being stiffer, remain intact and move as a rigid body. The ground story columns experience most of the damage, causing the structure to fail in a soft-story collapse due to the sudden reduction in stiffness at the ground level.

1.4 TYPICAL MASONRY INFILLED BUILDINGS

Masonry infilled frames typically have infill walls in all stories, which enhance the structure's lateral stiffness and strength. Though often considered non-structural by design codes, infill walls significantly alter the distribution of forces in beams and columns compared to bare frames. In bare frames, resistance to lateral forces relies on bending and shear in beams and columns, while infilled frames reduce bending moments and increase axial forces. The infill acts like a brace, providing additional support, especially under lateral loads like earthquakes and wind. These walls are most effective when uniformly placed in both plan and elevation.

1.5 SEISMIC ANALYSIS METHODS

Seismic examination is a subset of auxiliary investigation and is the computation of the reaction of a structure (or non-building) structure to tremors. It is essential for the cycle of auxiliary plan, seismic tremor designing or basic evaluation and retrofit where quakes are pervasive

As found in the figure, a structure can possibly 'wave to and for during a seismic tremor (or even a serious breeze storm). This is known as the basic mode, and is the most reduced recurrence of building reaction. Most structures, in any case, have higher methods of reaction, which are remarkably enacted during earthquakes. The figure just shows the third mode, but there are higher shimmy" (abnormal vibration) modes. Nevertheless, the first and second modes tend to cause the most damage in most cases.

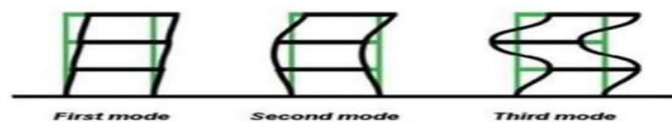


Figure 1.1 Modes of building seismic response

There are different methods to analyze the structures, few of them are

1. Linear static analysis
2. Linear dynamic analysis
3. Non-Linear Static analysis
4. Non-Linear Dynamic analysis

1.5.1 Linear Static analysis

In a linear static strategy, the structure is demonstrated as a proportionate single level of opportunity (SDOF) framework with a direct versatile solidness and an identical gooey damping. The seismic information is displayed by a comparable parallel power with the target to deliver similar anxieties and strains as the quake it speaks to. In view of an assessment of the primary crucial recurrence of the structure utilizing exact connections or Rayleigh's strategy, the phantom increasing speed is resolved from the suitable reaction range which, duplicated by the mass of the structure, brings about the identical sidelong power. The coefficients consider issues like second request impacts, hardens corruption, yet in addition power decrease because of foreseen inelastic conduct. The parallel power is then disseminated over the tallness of the structure and the relating inside powers and relocations are resolved utilizing straight versatile investigation

These straight static techniques are utilized principally for planned purposes and are fused in many codes. Their consumption is fairly little. Notwithstanding, their materialness is limited to customary structures for which the first code of vibration is predominant.

1.5.2 Linear Dynamic analysis

Static methods are suitable for short, regular buildings with insignificant higher-mode effects. For tall, irregular, or torsionally asymmetric structures, linear dynamic analysis is needed. In this method, the structure is modeled as a multi-degree-of-freedom (MDOF) system with linear elastic stiffness and viscous damping matrices. Seismic input is analyzed using either modal spectral analysis or time history analysis, considering higher mode effects. Internal forces and displacements are determined assuming linear elastic behavior. While effective for capturing phase information and higher modes, its applicability decreases with significant nonlinear behavior, which is approximated using global reduction factors. The method may use modal decomposition to simplify the analysis by reducing degrees of freedom.

1.5.3 Non-linear Static analysis

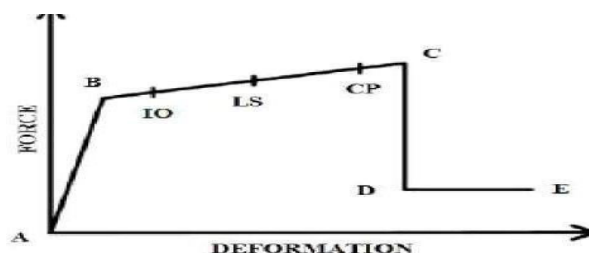
As a rule, direct methods are appropriate when the structure is required to remain almost versatile for the degree of ground movement or when the plan brings about almost uniform dispersion of nonlinear reaction all through the structure. As the exhibition goal of the structure infers more prominent inelastic requests, the vulnerability with straight systems increments to a point that requires a significant level of traditionalism sought after suppositions and agreeableness measures to stay away from unintended execution. Thusly, methods fusing inelastic investigation can diminish the vulnerability and traditionalism.

This methodology is otherwise called "weakling" investigation. An example of powers is applied to a basic model that incorporates non-direct properties, (for example, steel yield), and the complete power is plotted against a reference relocation to characterize a limit bend. This would then be able to be joined with an interest bend (regularly as a speeding up uprooting reaction range (ADRS)) This basically diminishes the issue to a solitary level of opportunity (SDOF) framework.

Nonlinear static strategies utilize proportionate SDOF basic models and speak to seismic ground movement with reaction spectra. Story floats and segment activities are connected in this way to the worldwide interest boundary by the weakling or limit bends that are the premise of the non-direct static systems.

The sucker examination comprises of the utilization of gravity loads and a separate sidelong burden design. The sidelong burden was applied monotonically in a bit-by-bit nonlinear static investigation. The applied horizontal burden was quickening in the X course speaking to the powers that would be experienced by the structure when exposed to ground shaking. Under gradually expanding loads a few components may yield consecutively. Thus, at every occasion, the structures encounter a firmness change as appeared in figure

1.2 where IO, LS and CP represent Immediate Occupancy, Life Safety and Collapse Prevention separately.



Force-Displacement or Moment-Rotation curve for a hinge definition used in ETABS (plastic deformation curve). The plastic deformation curve is categorized by the following are

- Point A represents the origin
- Point B represents the yielding state. No twisting happens in the pivot up to point B. paying little mind to the distortion esteem determined for point B. the dislodging (pivot) at Point B will be deducted from the distortions at focuses C, D and E. just the plastic distortion past point B will be shown by the pivot.

- Point C speaks to a definitive limit with respect to sucker investigation Point D speaks to the remaining quality for Pushover examination
- Point E speaks to add up to disappointment. Past point E the pivot will drop load down to point F (not appeared) straightforwardly beneath point E on the even hub. In the event that the client would prefer not to pivot to bomb thusly, a huge incentive for the miss happening at point E can be indicated.

1.5.4 Non-linear Dynamic analysis

Nonlinear dynamic analysis involves detailed structural modeling combined with ground motion records to provide accurate results with low uncertainty. It considers the nonlinear properties of structures through time- domain analysis and combines modal responses using methods like the square-root-of-sum-of-squares.

This comprehensive approach is used for complex or critical structures and requires multiple analyses with different ground motions to account for variability and ensure reliability. To evaluate responses under varying seismic intensities, multiple nonlinear analyses are performed, leading to advanced methods like Incremental Dynamic Analysis for assessing different earthquake scenarios.

1.6 OBJECTIVES OF THESIS

- a) To study the conduct of Open Ground Storey structures planned considering the amplification factor (M.F) proposed by Is codes.
- b) To study the Performance and conduct of the ordinary OGS nature's wiring Response range Analysis
- c) To study the impact of infill quality and firmness in the seismic examination of OGS
- d) To check the pertinence of the multiplication factor of 2.5 as given in the Indian standard IS 1893-2002 for plan of multi-story outline's structure.
- e) To survey the impact of varying the infill arrangements in the analysis result by taking various combinations of infill thickness strength, modulus of elasticity and openings.
- f) To compare the results of different zones.

II. LITERATURE SURVEY

Bhagavathula Lohitha and S.V.Narsi Reddy et. al (2014) Examine a current RC outlined structure (G-3) with delicate story was investigated for two diverse cases(a) considering both infill mass and infill solidness utilizing programming etabs. Two distinctive help conditions were considered to check the impact of help conditions in the duplication factors. Straight and non-direct examinations were performed for the models. Concluded that help conditions impacted the reactions the reaction significantly and can be significant boundary to choose the power enhancement factor.

D.J. Chaudhari, Prajakta T.Raipure et. al (2015) Analyses RC framed building (G-10) with OGS for the effects of multiplication factor of Indian standard codes and other international codes of the seismic loads and study fragility curves which is generated by staadpro. And after the analysis they started that the OGS frames in terms of OGS drifts are increasing in increasing order of MFs by all codes for all the performance level. As per IS code the first storey is more weak than ground storey but for Israel code it is not true. Also, they stated as per Israel code, MF only in ground storey may not provide the expected results in all other stories. If MF applied also for the adjacent storey OGS building.

Adithya Deshmukh et. al (2015) Studied a RC framed building (G+10) with open ground storey for all different seismic zones with the various cases of building elements: (a) bare frame building storey (b) OGS with stiffer column (c) OGS with corner shear wall (d) OGS with corner bracings (e) OGS with composite columns. And the structures are produced through the Etabs, the lateral displacement graphs he found out that lateral displacement is higher in OGS type compared to other building. Also, he stated that with corner SW. Displacement reduction is higher so that structure of OGS building with corner shear wall. And ductility is found more in the infill frame panel than the open ground storey building model.

Amol karemore, Shrinivas Rayadu et. al (2015) Studied a (G+3) building with OGS for the seismic zone3 and they have done pushover analysis to evaluate effect of seismic behaviour of building. They found that OGS building is more sensitive to earthquake than full infill building due to soft storey effect. Infill walls increase stiffness while decreases lateral displacement. They are no effect of multiplication according to IS 1893-2002 stated that magnification factor of

2.5 to be applied to calculate SF and BM is very much. After linear and nonlinear analysis, they concluded that magnification factor for the BM is in the range of 1.03-1.98. for columns and for beam is in range of 0.92-1.06 of ground storey. Magnification factor for shear force is in range of 1.42-1.52 for column and for beam is in range of 0.97-1.07 of ground storey.

Ankita Pramod Shelke, Dr.Rajashekar S.Talikoti et. al (2015) Concluded from the literature reviews that the R.C framed building with open ground storey perform poorly at the time of earthquake shaking. The parallel stiffness is below 70% of that of the adjacent upper story of below 80% of the average stiffness of adjacent 3 storey top it causing soft storey effect to produce for an OGS non shear wall or bracing the strength is very week and easily collapsed during earthquake. Also, they stated that after analysis base shear can be more than twice to that expected by equivalent earthquake force method without infill or by response spectrum method when no fill in the analysis of model.

Anchal.V.Sharma and Laxmikant C.Tibude et. al (2016) Studied a RC framed building. It was analysed for analysis through the manually or commercial software its concluded that the displacements for OGS is lesser than the fully unfilled wall framed and bare framed building for all the seismic zones.

III. METHODOLOGY

3.1 Introduction

The response spectrum method is a widely used tool in seismic analysis, offering computational efficiency by focusing on the maximum displacements and forces in structural systems. It overcomes the need for site-specific real-time earthquake records and accounts for the building's dynamic properties and the frequency content of ground motion. This method uses smooth design spectra based on average responses to multiple earthquakes, simplifying the prediction of seismic responses. Codal provisions in IS: 1893 (Part 1)-2002 guide its application for multi-story building design to ensure safety and stability during earthquakes.

3.2 Response Spectra

Response spectra are curves showing the maximum response of an SDOF system to earthquake ground motion as a function of its natural period. They help estimate peak structural responses and lateral forces for earthquake-resistant design. By analyzing responses for different periods and damping ratios, the spectra provide critical data for safe and efficient structural design.

3.2.1 Factor Influencing Response Spectra

1. The reaction ghostly qualities rebes on the accompanying boundaries, Energy release mechanism
2. Epicentral distance
3. Focal depth
4. Soil condition
5. 5 Richter margined
6. Damping in the system
7. Time period of the system

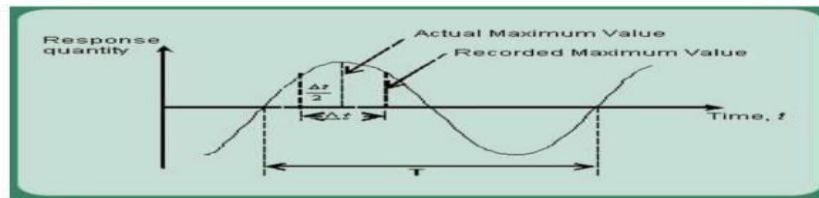
3.2.2 Errors in Evaluation of Response Spectrum

The accompanying mistakes are presented in assessment of reaction spectra (Nigam and Jennings, 1969),

1. Straight line Approximation: In the computerized calculation of spectra, the real tremor record is supplanted by straight fragments between the purposes of digitization. This is a minor estimate gave that the length of the time stretches is a lot shorter than the times of intrigue.
2. Truncation Error: as a rule, a truncation blunder exists in mathematical techniques for coordinating differential conditions. For instance, in third-request Runge-Kutta techniques the blunder is corresponding to $(\Delta t)^4$.
3. Error Due to Rounding the Time Record: For tremor records digitized at unpredictable time spans, the joining procedure proposed in this report requires adjusting of the time record and the chaperon blunder relies upon the manner in which the adjusting is finished. For adjust to 0.005 sec, the normal blunder in range esteems is required to be under 2 percent.
4. Error Due to Discretization: In any mathematical strategy for processing the spectra, the reaction is acquired at a lot of discrete focuses. Since ghostly qualities speak to greatest estimations of reaction boundaries which may not happen at these discrete focuses, discretization presents a mistake which gives range esteems lower than the

genuine qualities. The blunder will be a greatest if the most extreme reaction happens exactly midway between two discrete focuses as appeared in Figure 3.1

A gauge for the upper bound of this blunder is appeared in Table 3.2 by taking note of that at the hour of most extreme removal or speed, the reaction of the oscillator is almost sinusoidal at a recurrence equivalent to its regular recurrence. Under this presumption the blunder can be identified with the most extreme time frame, t_i and the time of the oscillator as appeared in Figure 3.1.



Δt_1	Maximum error(%)
$\leq T/10$	≤ 4.9
$\leq T/20$	≤ 1.2
$\leq T/30$	≤ 0.3

Table 3.1 Variation in %error in response with time chosen

3.2.3 Response Spectra of El-Centro-1940 Earthquake Ground Motion

The reaction spectra of the El-Centro, 1940 seismic tremor ground movement are processed. utilizing the specific technique portrayed in the previous Chapter (allude Appendix-1, for digitized estimations of the quake). The spectra are plotted for the three damping proportions for example -0.02, 0.05 and 0.1. The removal, speed and quickening spectra are appeared in the Figures 3.2, 3.3 and 3.4, separately.

Further, correlation of the genuine and pseudo spectra for speed and quickening reaction is appeared in the Figure 3.5. True to form, there is no contrast among genuine and pseudo total speeding up reaction spectra. Be that as it may, the speed reaction spectra may have some distinction.

The digitized estimations of the reaction spectra S_d , S_v and S_a of the El-Centro, 1940 tremor is given in the Appendix II at a timespan sec time-frame for damping proportion of 2% and 5%.

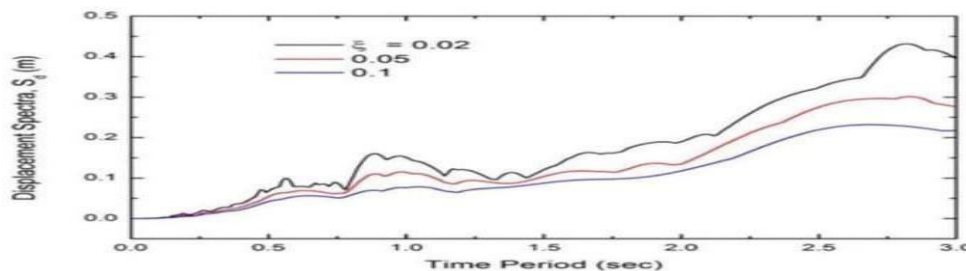


Figure 3.2 Displacement reaction spectra of El-Centro, 1940 tremor ground movement.

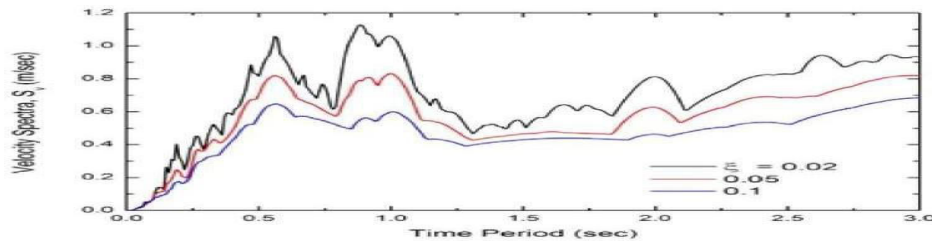


Figure 3.3 Velocity reaction spectra of El-Centro, 1940 earthquake ground movement

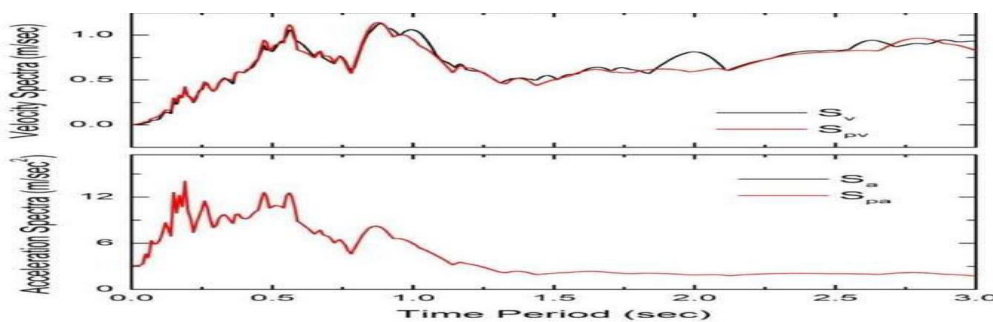


Figure 3.4 Acceleration reaction spectra of El-Centro, 1940 tremor ground movement.

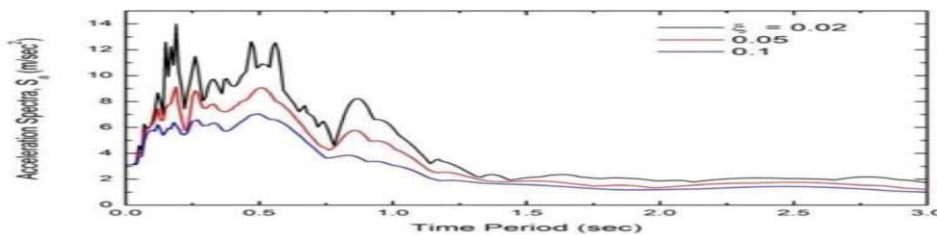


Figure 3.5 Comparison of genuine and pseudo speed and increasing speed reaction spectra of El-Centro, 1940 tremor ground motion ($\delta_r=0.02$)

3.3 RESPONSE SPECTRUM METHOD (DYNAMIC ANALYSIS)

3.3.1 General Codal Provisions

Dynamic examination ought to be performed to get the plan seismic power, and its conveyance to various levels along the stature of the structure and to different parallel burden opposing components, for the accompanying structures:

- Regular structures Those are more prominent than 40 m in tallness in zone IV, V and those are
- Greater than 90 m stature in zones II, III, and
- Irregular structures All outlined structures higher than 12 m in zone IV and V, and
- those are more prominent than 40 m in tallness in zone II and III.

Dynamic investigation might be performed either by time history strategy or by the reaction range technique. Anyway, in either technique, the plan base shear V_b will be contrasted and a base shear V_b determined utilizing a key period, T_a . At the point when V_b is not exactly V_b all the reaction amounts will be duplicated by V_b/V_b .

The benefits of damping for a structure might be taken as 2 and 5 percent of the basic, with the end goal of dynamic investigation of steel and fortified solid structures, separately.

3.3.2 Modes to be Considered

The quantity of modes to be considered in the investigation ought to be with the end goal that the aggregate of the all-out modular masses of all modes considered is in any event 90% of the complete seismic mass and the missing mass

remedy past 33%. If modes with common recurrence past 33 Hz are to be thought of, modular mix will be done uniquely for modes up to 33 Hz.

3.3.3 Modal Combination Rules

The usually utilized strategies for acquiring the pinnacle reaction amount of enthusiasm for a MDOF framework are as per the following:

- Absolute Sum (ABSSUM) Method,
- Square foundation of whole of squares (SRSS) technique, and
- Complete quadratic blend (CQC) strategy

In ABSSUM technique, the pinnacle reactions of the apparent multitude of modes are included arithmetically, expecting that all modular pinnacles happen at same time. The ABSSUM technique gives a much traditionalist gauge of coming about reaction amount and hence gives an upper bound to top estimation of all out reaction. (Chopra, 2007).

In the SRSS strategy, the most extreme reaction is gotten by square base of aggregate of square of reaction in every method of vibration. The SRSS technique for consolidating greatest modular reactions is on a very basic level sound where the modular frequencies are all around isolated. Notwithstanding, this technique yield helpless outcomes where frequencies of major contributing modes are near one another

The elective methodology is the Complete Quadratic Combination (CQC) technique.

3.4 Design of Earthquake Resistant Structure Based on Codal Provisions

- Ground Vibrations: Depend on earthquake size, depth, distance, wave path, and soil conditions.
- Vertical Forces: Significant in cases like large spans or restricted settlement.
- Structural Response: Influenced by soil, materials, construction, and ground motion.
- Design Goals:
 - Withstand minor quakes (DBE) with no damage.
 - Resist moderate quakes with limited damage.
 - Survive major quakes (MCE) without collapse, relying on ductility and overstrength.
- Materials: Design reinforced and steel members for strength and ductility.
- Soil-Structure: Ignore for rock-based foundations.
- Lateral Forces: Analyze forces in two horizontal directions as per IS:1893 (Part 1)-2002.
- Occupancy Changes: Upgrade design for higher importance structures.

3.5 Design Criteria

To decide the plan seismic powers, the nation (India) is arranged into four seismic zones (I, II, III, IV, and V). Already, there were five zones, of which Zone I and Zone II are converted into Zone II in fifth amendment of code. The plan flat seismic powers coefficient A_h for a structure will be dictated by following articulation

$$A-ZISa/2Rg$$

Z zone factor for the greatest extensive tremor (MCE) and administration life of the structure in a zone. Calculate 2 denominator is to lessen the MCE to plan premise seismic tremor (DBE).

I significance factor, relying upon the useful motivation behind the structure, described by risky results of its disappointment, post seismic tremor practical requirements, recorded worth, or financial significance.

R= reaction decrease factor, contingent on the apparent seismic harm execution of the structure, described by bendable or weak disfigurements anyway the proportion I/R will not be more prominent than 1.

Sa/g normal reaction increasing speed coefficient (Figure 3.13) For rough, or hard soil destinations

$$Sa/g = \left[\begin{array}{l} 1+ 15T \text{ (} 0.00 < T < 0.10 \text{)} \\ 2.50 \text{ (} 0.10 < T < 0.40 \text{)} \\ 1.00 / T \text{ (} 0.4 \leq T \leq 4.00 \text{)} \end{array} \right]$$

For medium soil sites

$$S_a/g = \begin{cases} 1 + 15T & (0.00 < T < 0.10) \\ 2.50 & (0.10 < T < 0.55) \\ 1.36 / T & (0.4 \leq T \leq 4.00) \end{cases}$$

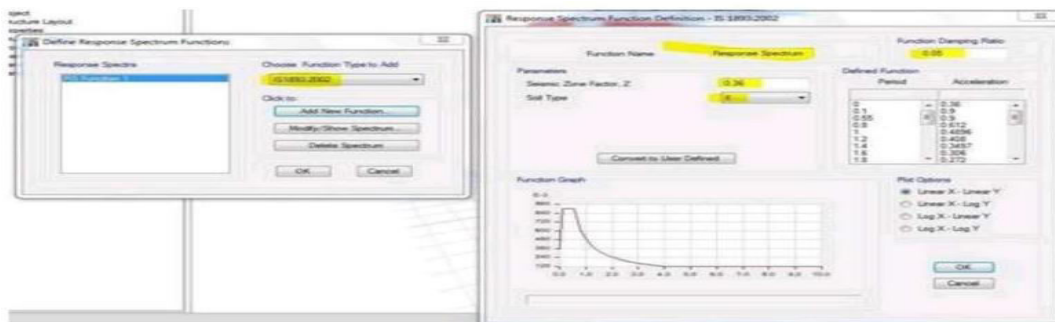
$$S_a/g = \begin{cases} 1 + 15T & (0.00 < T < 0.10) \\ 2.50 & (0.10 < T < 0.67) \\ 1.67 / T & (0.67 \leq T \leq 4.00) \end{cases}$$

3.6 Response Spectrum Analysis Procedure: -

Step-1: -Delete the load patterns defined for linear static analysis

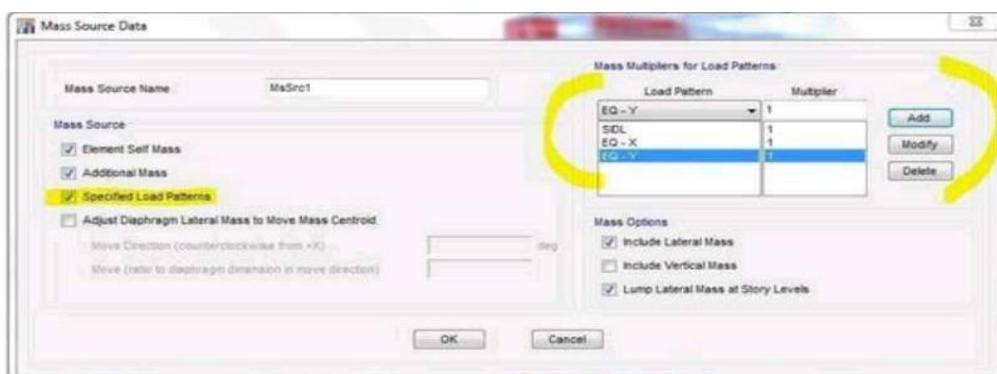
Step-2: - Go to Define ---> Function --> Response spectrum -> Choose Indian Seismic code IS 1893-2002, the window should look like the figure shown below.

Step-3: - Once the function is next defined then go to Define Load Cases -> Define two, cases for Spectrum-X and Spectrum-Y and new load as shown below.

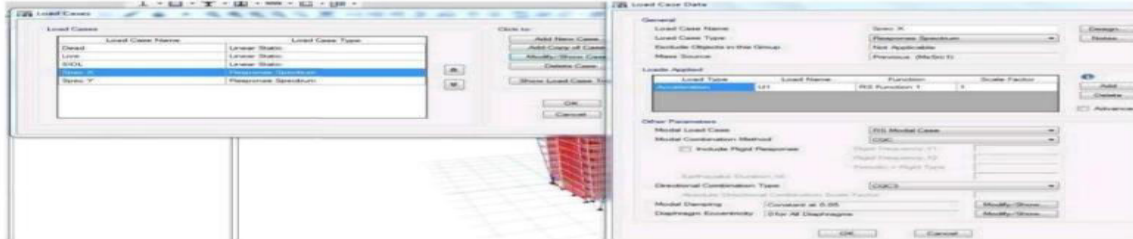


Step 4: Go to Define---> Mass Source---> and add all those lateral load which it has to consider for seismic analysis Usually the following 3 loads are considered.

1. SIDL
2. EQ-X/Spec X
3. EQ-Y/Spec Y



Step 5: - Go to Define---> Modal Mass---> and define the Seismic wave types and accelerations the modal mass editing window should look like below figure



Step 6: - Create load combinations and Envelope ---> Save the model ---> Run analysis Step 7- Check the following results

1. Maximum storey Drift should be either 0.004 or 0.004 times the storey height.
2. Modal mass participation factor Sum x and Sum y
0.9 0.9
i.e.: 90% of the lateral loads should be considered.
3. Check the deformed shapes or mode shapes, first 3 modes should be transition that is Esther in x direction or in Y direction.

RS analysis is satisfying all the above criteria's then the model is said to be safe and no corrections to be done

IV. RESULTS AND DISCUSSION

Displacement and Storey Drift: The analysis assesses the building's lateral displacement and storey drift under seismic loads, ensuring that they are within acceptable limits.

Storey Shear and Base Shear: ETABS calculates the storey shear and base shear forces, which help in designing the building's structural elements, such as beams and columns.

Stress and Strain: The analysis provides the stress and strain values for different structural elements, enabling designers to check for potential failures.

Natural Period and Frequency: ETABS determines the building's natural period and frequency, which are essential for seismic design.

Mode Shapes and Participation Factors: The analysis generates mode shapes and participation factors, helping designers understand the building's dynamic behavior.

These results enable designers and engineers to evaluate the seismic performance of the building and make necessary design modifications to ensure compliance with seismic design codes and standards.

V. CONCLUSION

1. Infill walls significantly impact seismic performance, providing stiffness and strength to structures. Their absence at the ground storey results in underestimation of base shear, leading to increased earthquake vulnerability.
2. Base shear and global stiffness are higher when infill walls are included, highlighting their importance in resisting lateral loads.
3. Response Spectrum Analysis (RSA) shows that the moment factor (M.F) for beams and columns in Zone II, III, and IV is considerably below the prescribed IS code value (2.5) when infill walls are present.
4. For structures without infill walls, M.F values are closer to the IS code requirement but still insufficient, indicating reduced structural performance.
5. To improve seismic resistance, stiffer columns or a concrete service core can reduce lateral drift and strengthen first-storey columns in Open Ground Storey (OGS) buildings.
6. Proper inclusion of infill walls and structural enhancements is crucial to minimizing risks and ensuring safer designs against seismic loads.

REFERENCES

1. Akshay S. Paidalwarl and G. D. Aweha, "Seismic Analysis of Open Ground Story Buckling," Int. J. Civ. Eng. Res. **8**, 69 (2017).

2. D. Jivani, R. G. Dhamsaniya, and M. V. Sanghani, "Effect of Infill Wall on Seismic Performance of RC Building with Open Ground Story," *Int. J. Adv. Eng. Res. Dev.* **4**, 1 (2017).
3. A. Yadav and A. K. Mishra, "Tremor Resistant Design of Open Ground Story Low Rise Building," in *Proc. 2nd Int. Conf. Emerg. Trends Eng. Manage. Res.*, May 28, 2017.
4. A. Kumar, S. Vijaya Mohan Rao, and A. Rammohana Chary, "Earthquake Resistant Design of Low-Rise Open Ground Story Framed Building," *Int. J. Sci. Eng. Technol. Res.* **5**, 9701 (2016).
5. S. Ghildiyal, S. Dhyani, and C. P. Gusain, "Earthquake Resistant Design of Low-Rise Open Ground Story Framed Building: A Review," *J. Emerg. Technol. Innov. Res.* **3**, 3 (2016).
6. A. V. Sharma and L. C. Tibude, "Effect of Position of Infill Wall for Seismic Analysis of Low-Rise Open Ground Story Building," *Int. J. Emerg. Trends Sci. Technol.* **3**, (2016).



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