CrossRef DOI of original article:

Effect of Seismic Load on Column Forces in RC Structures by Response Spectrum Analysis

Mahdi Hosseini[1]

[1] Nanjing Forestry University, Nanjing, Jiangsu, China, 210037

Received: 1 January 1970 Accepted: 1 January 1970 Published: 1 January 1970

Abstract
In the present research work 30 story building with different type of RC Shear wall at the center in concrete frame structure with fixed support conditions under different type of soil for high seismic zone are analyzed.This paper aims to study the effect of seismic load on column forces in different type of RC shear walls in concrete frame structures under different type of soil condition and different load combination. Estimation of column forces such as; column axial force, column moment, column shear force, column torsion, time period and frequency and modal load participation ratios is carried out. In dynamic analysis; Response Spectrum method is used. It was found that the axial force and moment in the column increases when the type of soil changes from hard to medium and medium to soft. Since the column moment increase as the soil type changes, soil structure interaction must be suitably considered while designing frames for seismic force.

Index terms— seismic load, linear dynamics analysis, column forces, high seismic zone.

1 I. Introduction a) Structural Systems
n the earliest structures at the beginning of the 20th century, structural members were assumed to carry primarily the gravity loads. Today, however, by the advances in structural design/systems and highstrength materials, building height is increased, which necessitates taking into consideration mainly the lateral loads such as wind and earthquake. Understandably, especially for the tall buildings, as the slenderness, and so the flexibility increases, buildings suffer from the lateral loads resulting from wind and earthquake more and more. As a general rule, when other things being equal, the taller the building, the more necessary it is to identify the proper structural system for resisting the lateral loads. Currently, there are many structural systems that can be used for the lateral resistance of tall buildings [2,3].

Structural systems of tall buildings can be divided into two broad categories: interior structures and exterior structures.

This classification is based on the distribution of the components of the primary lateral load-resisting system over the building.

2 b) Shear Wall Structure
Shear Wall-Frame Systems (Dual Systems), The system consists of reinforced concrete frames interacting with reinforced concrete shear walls are adequate for resisting both the vertical and the horizontal loads acting on them.

3 c) Necessity of Shear Walls
Shear wall system has two distinct advantages over a frame system.

? It provides adequate strength to resist large lateral loads with-out excessive additional cost.

? It provides adequate stiffness to resist lateral displacements to permissible limits, thus reducing risk of non-structural damage.

4 d) Seismic Load

The seismic weight of building is the sum of seismic weight of all the floors [8]. The seismic weight of each floor is its full dead load plus appropriate amount of imposed load, the latter being that part of the imposed loads that may reasonably be expected to be attached to the structure at the time of earthquake shaking. Earthquake forces experienced by a building result from ground motions (accelerations) which are also fluctuating or dynamic in nature, in fact they reverse direction somewhat chaotically [2,3]. In theory and practice, the lateral force that a building experiences from an earthquake increases in direct proportion with the acceleration of ground motion at the building site and the mass of the building. As the ground accelerates back and forth during an earthquake it imparts backand-forth (cyclic) forces to a building through its foundation which is forced to move with the ground [1].

5 e) Geo-Technical Consideration

The seismic motion that reaches a structure on the surface of the earth is influenced by local soil conditions. The subsurface soil layers underlying the building foundation may amplify the response of the building to earthquake motions originating in the bedrock.

6 Bearing Capacity of Foundation Soil

Three soil types are considered here: I. Hard -Those soils, which have an allowable bearing capacity of more than 10t/m2. II. Medium -Those soils, which have an allowable bearing capacity less than or equal to 10t/m2.

III. Soft -Those soils, which are liable to large differential settlement or liquefaction during an earthquake.

The allowable bearing pressure shall be determined in accordance with IS: 1888-1982 load test (Revision 1992). a) To understand and evaluation building structures and aims to the effect of Seismic load on column Forces in Different Type of RC Shear Walls in Concrete Frame Structures under Different Type of Soil Condition with seismic loading. b) Modeling a G+29 story high building for five different cases [9][10][11]. c) Analyzing the building dynamic analysis using linear, i.e. Response Spectrum Analysis [1][2][3]. d) Analyzing the results and arriving at conclusions.

7 a) Dynamic Analysis

Dynamic analysis may be executed to get the design seismic force, and its spread in different levels through the height of the building, and also various lateral load resisting element ??1-2-3,8].

8 b) Response Spectrum Method

This method is executed to design spectrum, where as it is specified with a code for specific-site design can be used for a project site for the purposes of dynamic of steel and reinforce concrete buildings, the values of damping for building may be taken as 2 and 5 percent of the critical, respectively. response spectrum method is typically implemented in linear elastic procedures and also very much easier to use. This also called as or mode superposition method or model method, It also made on the idea of the superposition of responses given by the building through various modes of vibrations, each vibration modes is recorded as with its own particular deformed shape, with its own modal damping and its own frequency [7,8].

9 a) Details of the Building

A symmetrical building[15] of plan 38.5m X 35.5m located with location in high Seismic zone considered. Four bays of length 7.5m & one bays of length 8.5m along X -direction and four bays of length 7.5m & one bays of length 5.5m along Y -direction are provided. Shear is provided the center inner core of model building.

Struct I: G+29 story'stall building with Plus shape RC shear wall at the center of structure. Struct II: G+29 story'stall building with Box shape RC shear wall at the center of structure. Struct III: G+29 story'stall building with C-shape RC shear wall at the center of structure.

Struct IV: G+29 story'stall building with E-shape RC shear wall at the center of structure. Struct V: G+29 story'stall building with I-shape RC shear wall at the center of structure.

10 b) Load Combinations

As per IS 1893 (Part 1): 2002 Clause no. 6.3.1.2, the following load cases have to be considered for analysis: "1.2 (DL + IL ± EL)" "1.5 (DL ± EL)" "EQXP&EQYP" Earthquake load must be considered for +X, -X, +Y and -Y Directions [5][6][7]. EQXP & EQYP in different type of soil conditions (soft, medium and hard) were considered, in this regard we compared all column forces in different type of soil condition of structures II, III, IV, V with structure I (plus shape shear wall), also compared forces in hard and medium soils with soft soil for all five structures.

11 a) Discussion on Results