CHAPTER FOUR
ANALYTICAL MODELING OF FRAMED TUBE

4.1 Introduction:

Using computer programs for the design of reinforced concrete structural member is becoming essential for both the practicing engineer and the student. Such programs speed up calculation and ensure that designers consider all necessary aspects of design limitations. The programs presented easy to apply. The out- put includes calculated value at different steps as well as the final answer. These data will help the user to detect the location of any mistakes made in hand calculations. The program use SI units. The analysis and design procedures and limitations are based on the ACI [6].

Most computer programs are based on the matrix method of structural analysis. Some of this programs incorporate several different types of structural element such as beam and truss elements. These are the so called general finite element programs[6].

All structures are three dimensional, but theoretical analyses of such structures by hand calculation methods are so lengthy as to be impractical. As a result, such systems are normally assumed to consist of two dimensional or planar systems.

Today's electronic computers have greatly changed the picture, and it is now possible to analyze complete three dimensional structures. As a result, more realistic analyses are available and necessity for high safety factors is reduced. The application of computers is not restricted merely to analysis, they are used in all most every phase of concrete work from analysis to design and so on.

Another major advantage of computer analysis for building frame is that the designer is able to consider many different loading patterns quickly. The results are some times rather surprising [2].

4.2 Linear Static Analysis:

A linear static analysis is automatically created for each load case that is defined. The results of different load cases can be combined with each other and with other linear analysis cases, such as response spectrum analyses.

Geometric and material nonlinearity are not considered in linear static analysis, except that the effect of the initial P-Delta is included in every static load case.

Linear static load cases can still be combined when an initial P-Delta analysis has been performed, since the initial P-Delta load is the same for all static load and response-spectrum cases [6].

4.3 Structure System Model:

A two dimensional analysis of the framed tube building comprises beams, columns and shear walls. was performed in E-W direction for the wind and gravity forces using ETABS. The horizontal and vertical loads on the building are usually replaced by end reactions on the members. Is assumed that the wind is resisted by the perimeter beams and subsequently to the column and shear wall. Thus the wind load on the structure is represented only by horizontal point loads at the exterior beam-column connection. In the model, semi-rigid frame and core were assigned at each floor level, the total number of stories is forty and story height 3.2m. The stiffness properties of the members were input assuming uncracked sections.

The behavior of two structural systems under gravity and lateral loads are discussed. This include semi-rigid frame, and combined semi-rigid wall core. Both of models are rectangular on plan show fig. (4.1). The total Configurations of the model is shown in table (4.3).

Table (4.1): Model Configurations

MEMBER	FRAME STRUCTURE	CORE STRUCTURE
COLUMN	800mm*800mm	
SPANDRAL	300mm*900mm	
WALL		300mm thickness for partially closed rectangular core
SLAB	200mm	

4.4 Two Dimensional Analytical Model:

Geometry of two dimensional models is defined with respect to a three dimensional reference system, The basic modeling technique and assumption made by the ETABS program in three and two dimensional modeling are:

- A building is idealized as a assemblage of vertical frame and shear wall systems interconnected by horizontal floor diaphragm slabs.
- The program will produce integrated moments, shears and axial for walls and frame [6].

The program design all concrete frame elements and shear walls according to input data shown in table (4.2). The design is based on asset of user-specified loading combinations. However, the program provides default load combinations for each design code, firstly input design code and system of unit [10].

Table (4.2): Concrete Frame Design Input Data

ITEM	DESCRIPTION
Material Property Data	
Material Name	Concrete, steel, other
Material Type	Isotropic or orthotropic
Design Property Data	F_c', f_y, f_{ys}

Analysis Property Data	Modulus of elasticity, shear modulus, poison's ratio
Weight Per Unit Volume	Used to calculate self weight of structure
Concrete Colum Property Data	
Section Name	
Material	Concrete, steel, other
Column Depth	
Column Width	
Rebar Pattern	Layout of main flexural reinforcing.
Concrete Cover	Minimum clear concrete cover.
Bar Area	Area of individual reinforcing bar.
Concrete Beam Property Data	
Section Name	
Material	Concrete, steel, other
Beam Depth	
Beam Width	
Rebar Pattern	Layout of main flexural reinforcing.
Concrete Cover	Minimum clear concrete cover.
Bar Area	Area of individual reinforcing bar .
Concrete Slab Property Data	
Section Name	
Material	Concrete, steel, other
Thickness	
Concrete Wall Property Data	
Section Name	
Material	Concrete, steel, other
Thickness	

4.5 Symmetrical Structure Systems:

The Model shown in fig. (4-3) comprises six rigid frames (four in x direction and two in y direction) and core (shear walls connected together in the centre of the building).walls can be considered as pairs of identical walls and beam considered as spandrel. Because of symmetry about the two axes, all beams and columns at a particular floor level will have identical translational behavior in the y direction. The resulting simplified structural floor plan is shown in Fig. (4-1). For the analysis of this model consists of frames and core parallel to the applied load, and these resist the load in proportion to their rigidities. The resultant load distribution are shown in Fig. (4-4), an elevation view is shown in Fig. (4-2). Moment 3-3, shear force 2-2 and axial force diagrams due to gravity loads are shown in Figs [(4-5), (4-6) and (4-7)], and moment 3-3, shear force 2-2 and axial force diagrams due to wind loads are shown in Figs [(4-8), (4-9) and (4-10)].

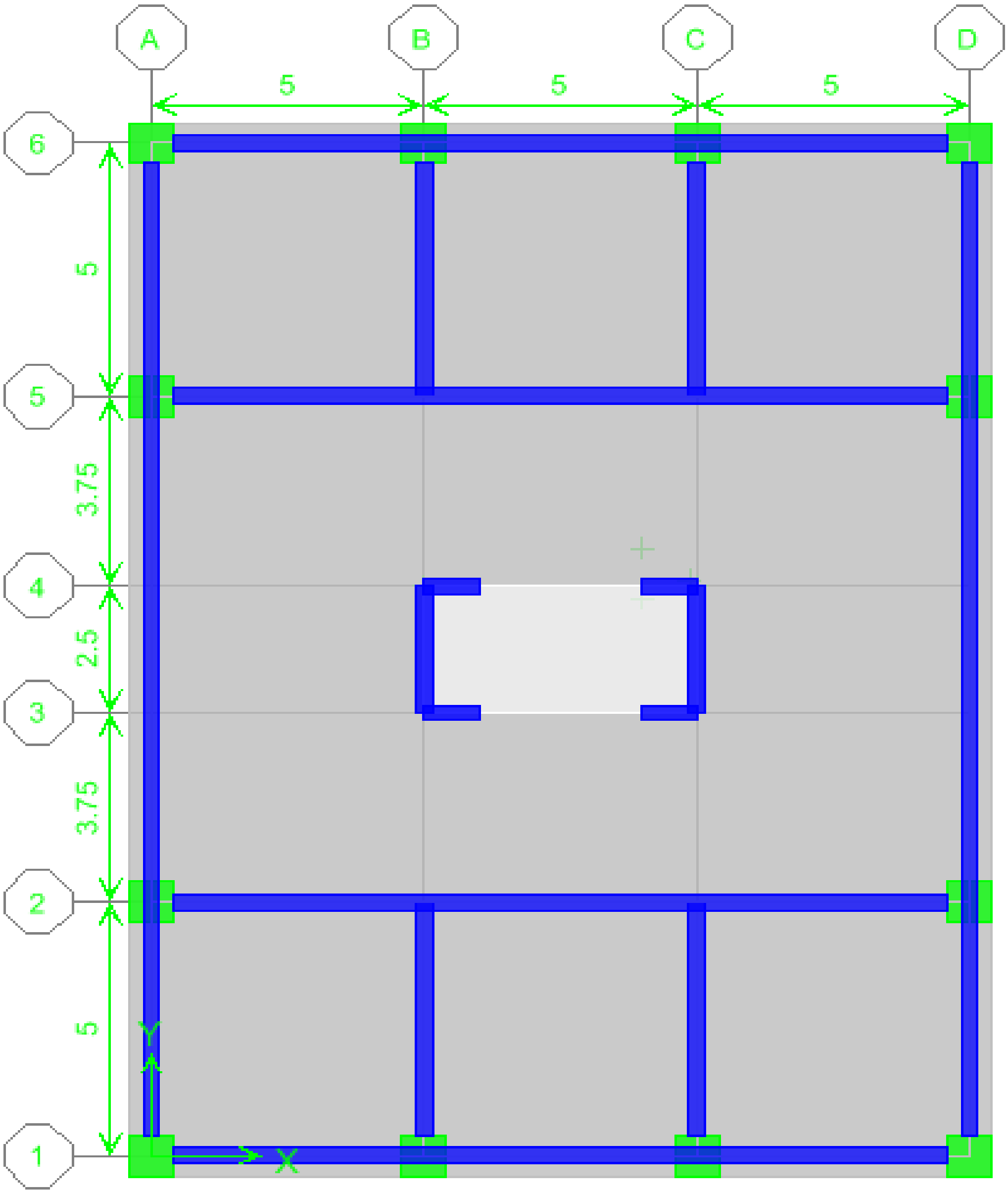

Fig. (4.1): Plan View of Model

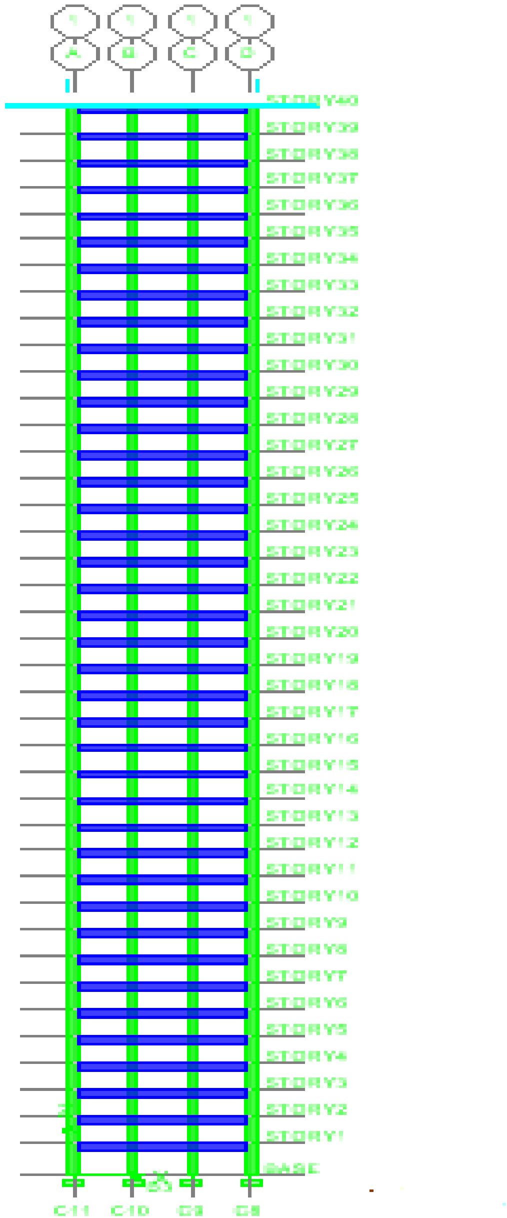

Fig. (4.2): Elevation View-1 of Model

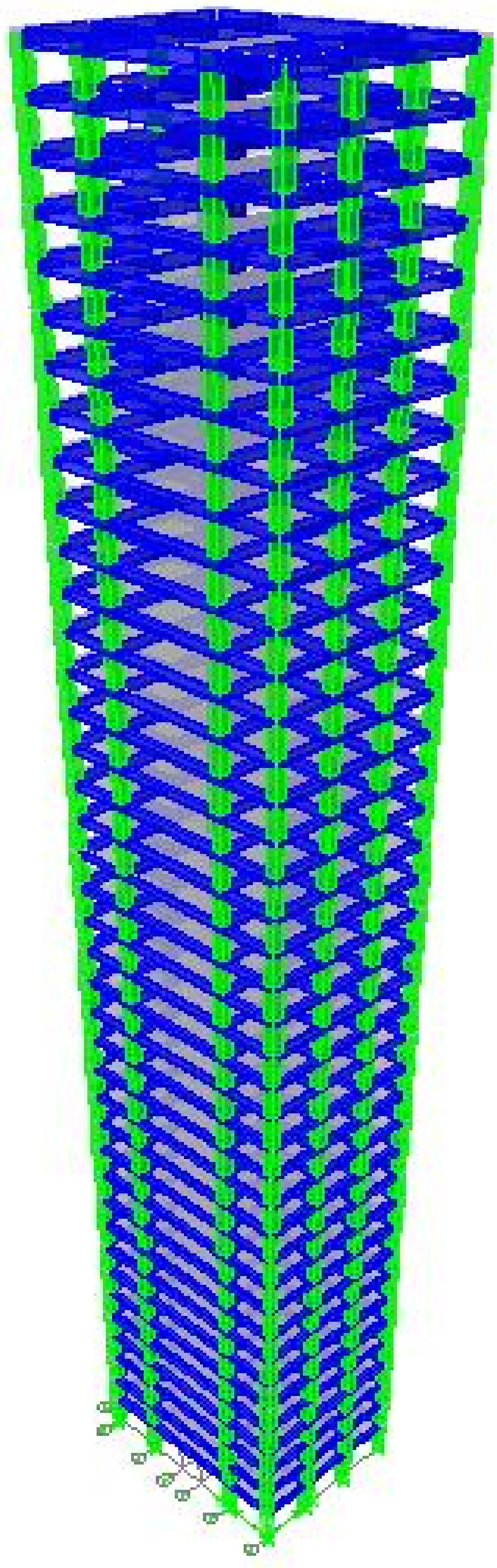

Fig. (4.3): 3D View of Model

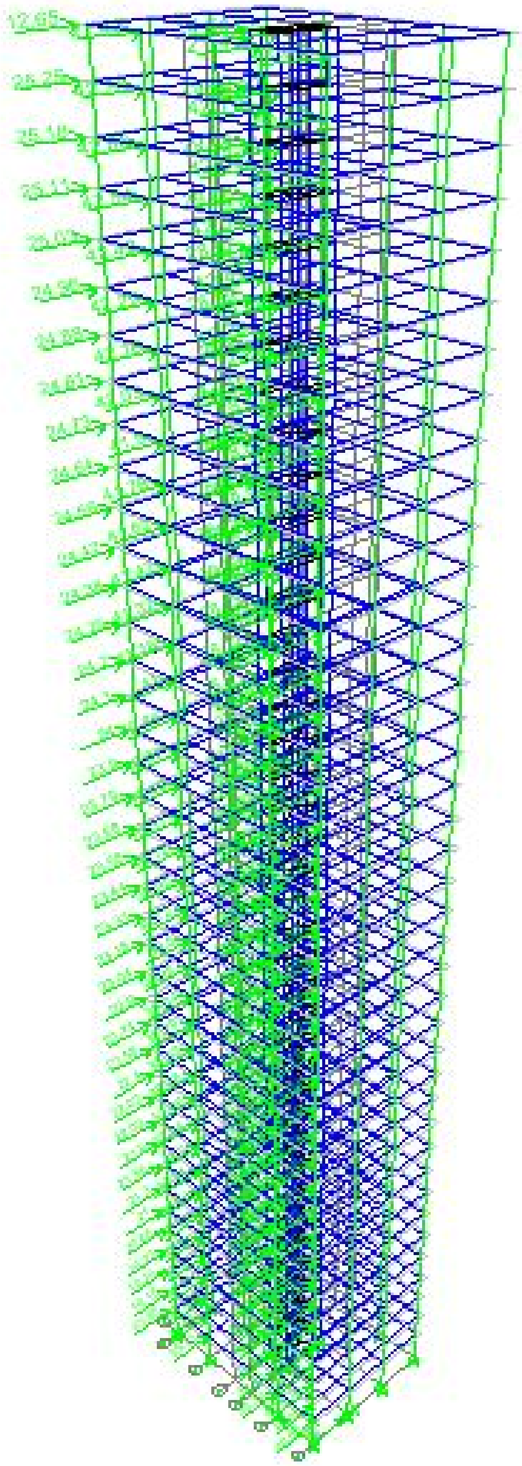

Fig. (4.4): Point Loads (Wind)

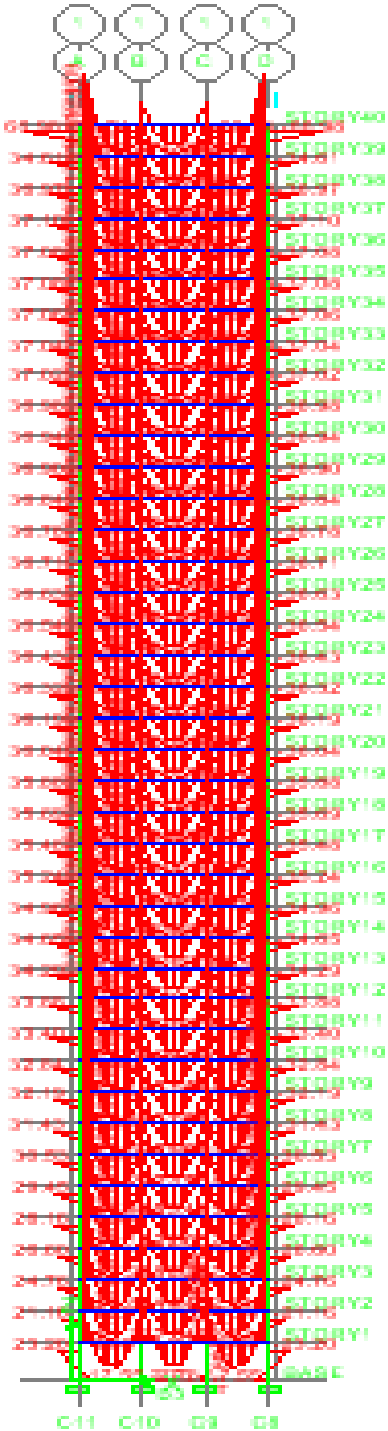

Fig. (4.5): Elevation View-1 Moment 3-3 Diagrams (Gravity)

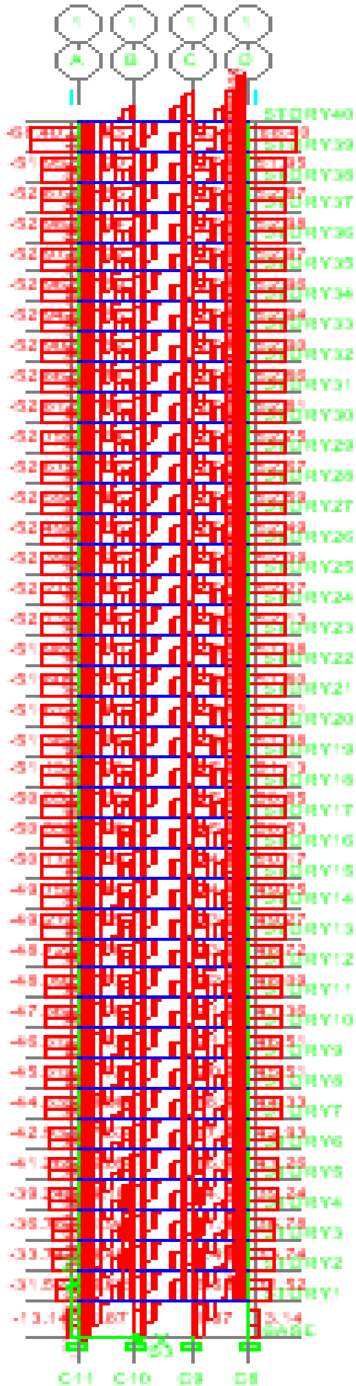

Fig. (4.6): Elevation View-1 Shear Force 2-2 Diagrams (Gravity)

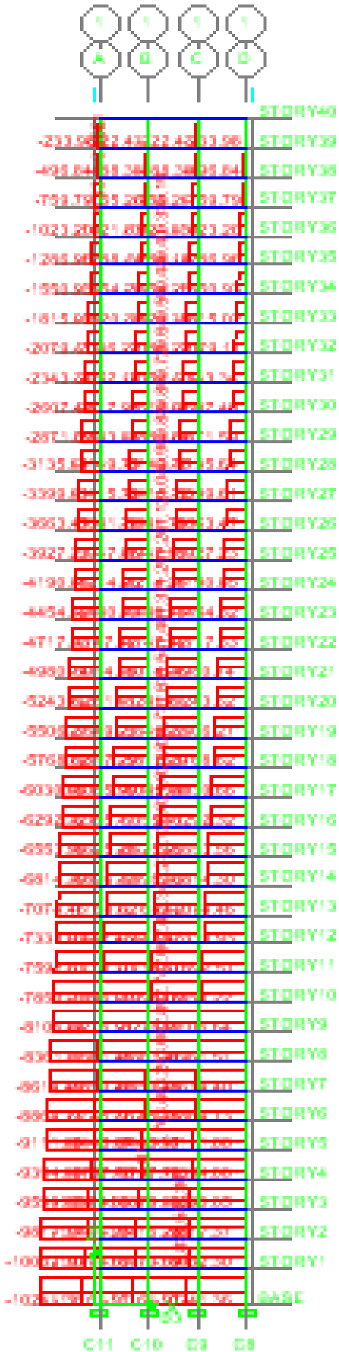

Fig. (4.7): Elevation View-1 Axial Force Diagrams (Gravity)

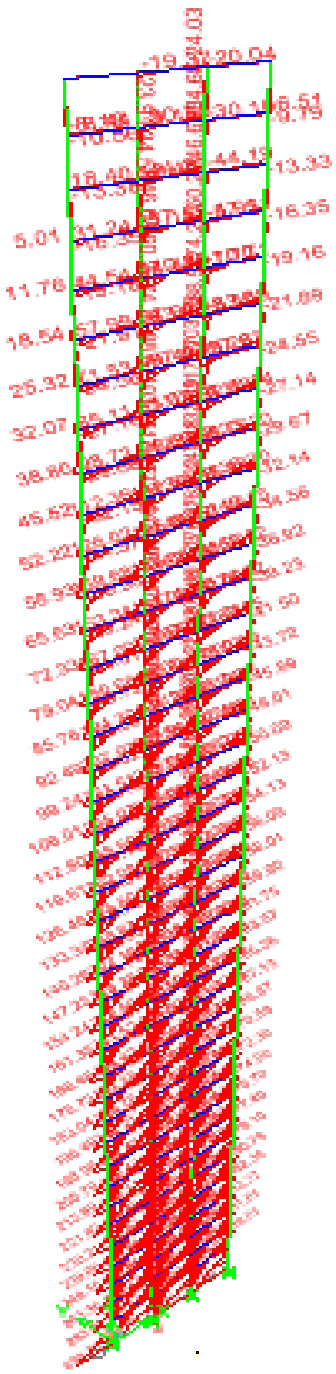

Fig. (4.8): Elevation View-1 Moment 3-3 Diagrams (Wind)

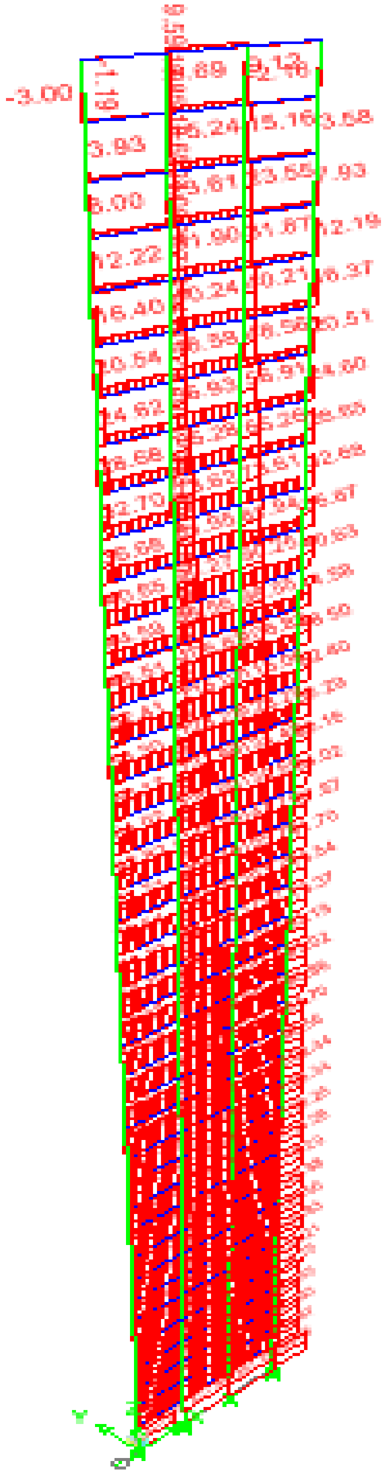

Fig. (4.9) Elevation View-1 Shear Force 2-2 Diagrams (Wind)

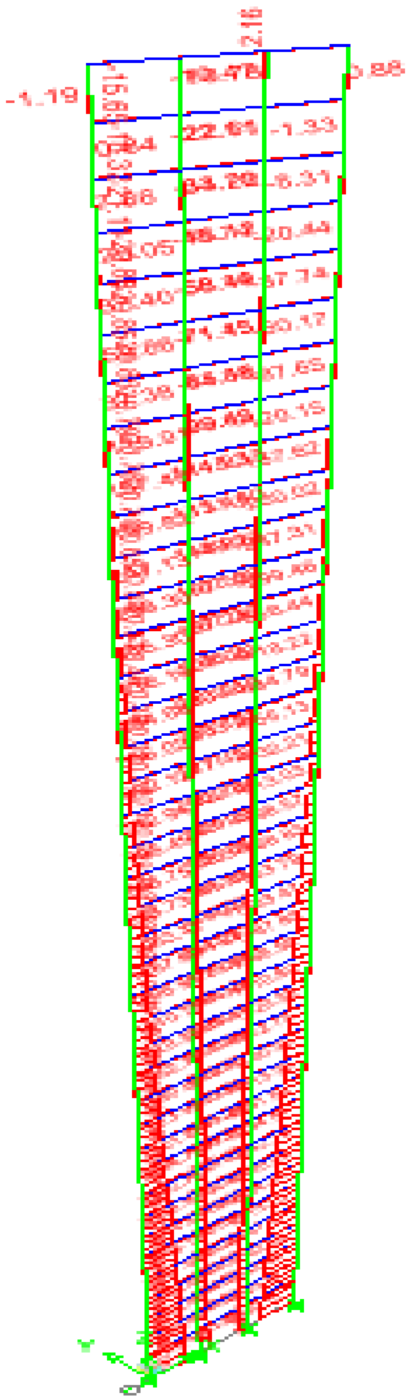

Fig. (4.10): Elevation View-1 Axial Force Diagrams (Wind)