ANALYSIS OF DESIGN OF SHEAR WALLS.

DISSERTATION 1

Submitted by

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IN

STRUCTURES

Under the Guidance of

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CERTIFICATE

Certified that this project report entitled "ANALYSIS OF DESIGN OF SHEAR WALLS" submitted by "**GURPREET SINGH**" registration number 41500017 of Civil Engineering Department, Lovely Professional University, Phagwara, Punjab who carried out this project work under my supervision.

This report has not been sunbmitted to any other university or institution for the award of any degree.

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(GURPREET SINGH)

CONTENTS

ABSTRACT

Reinforced concrete framed structures are generally high rise buildings designed regardless to the structural action of partition in-fill masonry walls. They are considered as non load bearing elements. RC framed buildings with open bottom level storey is known as weak storey, at the same time the effect of soft storey can also originate at the intermediate storey level if a storey is served as service storey. In high rise building soft storey located at lower part are usually undesirable as it attracts large seismic forces. In satellite bus stops the ground soft story is of double height than the normal buildings and has sufficiently larger spans for movement of buses, so the effect will be more. Similarly, the soft storey located at the top level of high rise building doesnot affect the performance of the structure as compared to the masonry in-fill framed structural performance.

Multi-storied buildings are constructed as open ground storey as an unavoidable feature due to the parking requirement. This open ground storey is known as weak storey. Soft storey possess inadequate lateral strength and stiffness due to which the building tends to collapse during earthquake. Infill wall plays an important role in providing lateral stiffness to the building. Present study deals with the seismic analysis of midrise building to analyze the behaviour of framed building with soft storey and subsequently adopting the control measures to reduce the effect of soft storey in terms of storey drift, storey displacement, forces, bending moment and time period

The basic design concept behind earthquake resistance design of structure is to create strong column – weak beam construction to provide safety of user, during earthquake beams yields before columns collapse. Many framed structures that got collapsed during the past earthquake experienced exactly the opposite strong beam weak column behavior means due to soft storey effect on the structure causes the columns failure before the beams yield. The high rise buildings with soft storey are usually very susceptible under seismic load which causes disastrous effect. In-fill walls are usually avoided at ground level parking plots as it affects the soft storey sue to vehicular movements and vibrations. In India mainly 65%-75% of the structures of urban areas falls under the classification of soft storey structure according to IS 1893 (2002) Part-I. For assessment of the storey stiffness of the building with weak storey different models like G+7 will be analyzed using software**.**

KEYWORDS: - Concrete, earthquake, infill, multistory, soft story

CHAPTER – 1 INTRODUCTION

1.1 GENERAL

In India a large portion of country is susceptible to damaging levels of seismic effects. Hence, high in rise structures it is very muc necessary to take seismic load into account for design purpose. The lateral load originates due to earthquake are matter of concern for tall buildings. The critical stresses are induced in the structure due to lateral forces. Usually it induces undesirable stresses, undesirable vibrations or cause excessive lateral sway in the structure. Today's tall buildings are leading to sway and becoming more slender as compared to the earlier high rise buildings. In satellite bus stops due to slender columns and larger spans columns buckles easily and the effect during shorter earthquake will be severe, so to minimize the whole effect of soft storey at ground, and upper storey level of building different types of shear walls need to use.

An open space of parking in ground storey of a building is known as a stilt building along the building height if a sudden change of stiffness takes place, the storey of which the drastic reduction of stiffness is observed is known as a soft storey. When a sudden change of stiffness takes place along the building height, the storey of which the drastic reduction of stiffness is observed is known as soft storey. As per IS1893:2002 (part I). Lateral stiffness in a soft storey is less than 70%-75% of that in the storey above or less than 80% of the average lateral stiffness of the three storey above.

The structural elements of shear walls are used to resist horizontal forces parallel to the plane of the wall. Shear wall has highly in plane stiffness and high strength which can be used to resist large horizontal loads and support gravity loads. Shear Walls are specifically designed structural walls provided in the buildings to resist horizontal forces that are induced in the plane of the wall due to wind, seismic and other forces. They are usually flexural members and are included in high rise buildings to prevent the total collapse failure of the high rise buildings under seismic forces.

Moment Transfer Beams are well-understood phenomenon concept and an unavoidable law of statics that loads must be transferred between beams and columns. Secondary beams are the beams supported on the main beams and main beams are the beams connected to the columns. In the fig Secondary beams are nothing but Moment transfer beams. Main beams can be of two types: 1) Simply supported or Shear Connected. The beam-column junction is designed in such a way that no moment is transferred to the columns only the shear force is transferred from the beams to the columns , the moment is carried by beam itself. 2) Fixed or Moment Connection type. The beam-column junction is designed in such a way that moment as well as shear is transferred to the columns from the beam.

In the parking area the columns in the first storey were badly damaged including spalling of concrete cover, snapping of lateral ties, buckling of longitudinal reinforcement bars and crushing of core concrete (Fig. 1). The columns on the other side had much lesser level of damage in them. There was only nominal damage in the upper storey's comprising of cracks in the filler walls. This is a case of columns damaged as a result of the “soft first storey”.

Fig 1 : Damage to columns at ground floor

Fig 2 : Damage to columns in the soft storey

1.1.1. TYPES OF FAILURE

There are four types of failure for building structures. Soft Storey Failure, Mass Irregularity failure, Plan Irregularity Failure, Shear Failure

Failure due to the shortage of land and for effective use of the sites for new constructions, multi-purpose high rise buildings have been built. The most common structural system for the lower level stories of these buildings has been the moment-resisting space frame because it can usually accommodate a parking area, commercial space, gardens, or open spaces for architectural reasons. Due to these provisions, the lateral displacement of the structure is governed mostly by the deformation at the lower stories. Therefore, it is essential to estimate the demand and supply in the force and deformation of the members at this part of the building to achieve a reasonable design of these structures. No damage in the structure is observed in the upper stories. The SOFT STOREY at the parking level is the major reason for such types of failure.

Most multi-storey buildings have service water tanks constructed on top of them. Usually, these tanks are only connected to the building. Many such tanks have been damaged and separated from the building during this earthquake.

The damage is due to Plan Irregularity Failure Due to irregular shape (T-shape, C-shape, L-shape etc.) of the building, torsional motions contributed to the damage. Most of the damage was to walls of the structures on the outer face of the side that are basement storey for parking. Plan asymmetry, flexible ground storey, and weak infill's seem responsible for this collapse.

Shear Failure detailing practice for transverse ties in columns in the affected area offers very light confinement to the core concrete against the large compressive stress generated by the extreme lateral deformation demands during strong seismic shaking. Many oftenly, the mild steel ties were found to be 5-8 mm in diameter. Faulty detailing practice of reinforcement in columns at ground floor leads to failure in brittle shear mode leading to failure of many open ground storey buildings, in some buildings, only a few ground storey columns sustained significant shear and flexural cracking, and these buildings were precariously standing.

PLAN OF IRREGULAR STRUCTURES

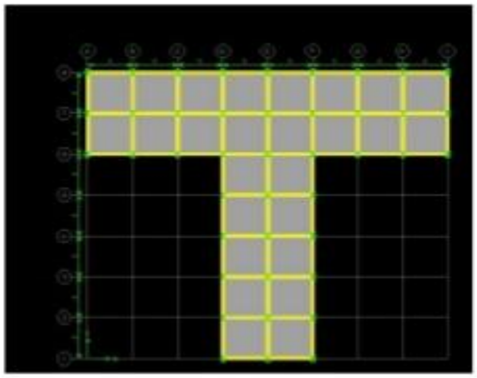


FIG.1. T SHAPE BUILDING

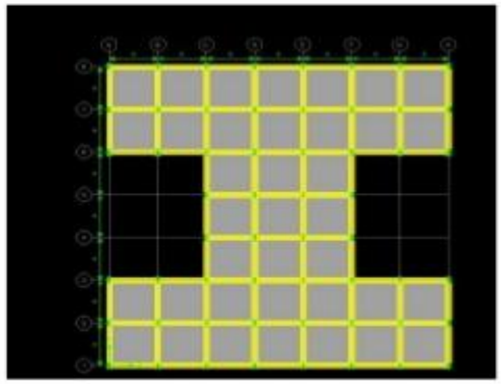


FIG.2. I SHAPE BUILDING

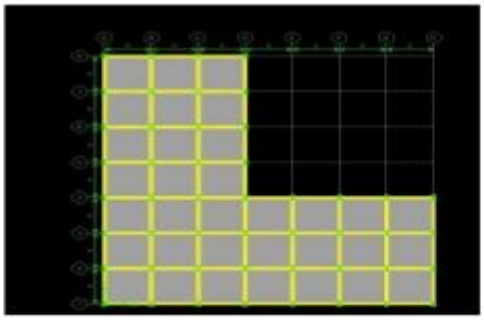


FIG.3. L SHAPE BUILDING

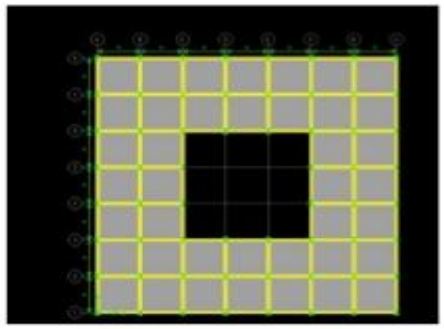


FIG.4. DIAPHRAGHM OPENING

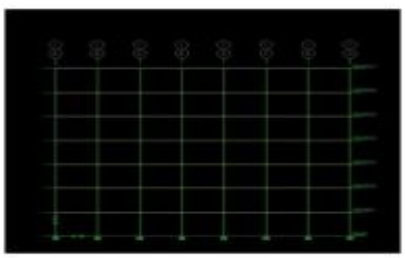


FIG.5. ELEVATION OF G+6 IRREGULAR

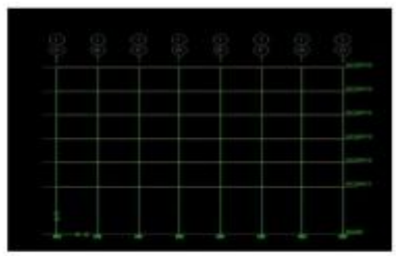


FIG.6. ELEVATION OF G+6IRREGULAR SOFT STOREY BUILDIG

FIG 3 Plan Iregularity

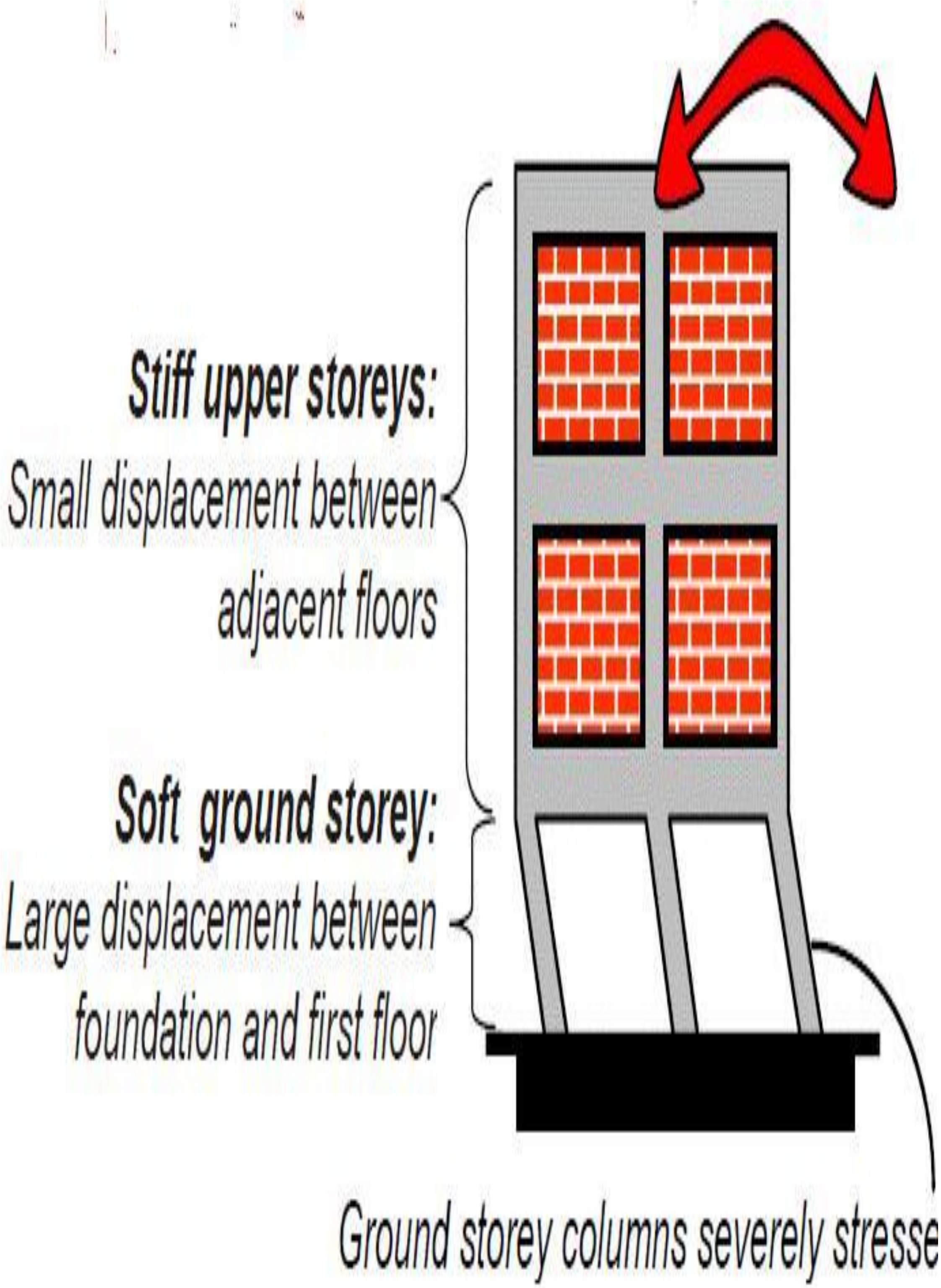


FIG 4 Shear Failure

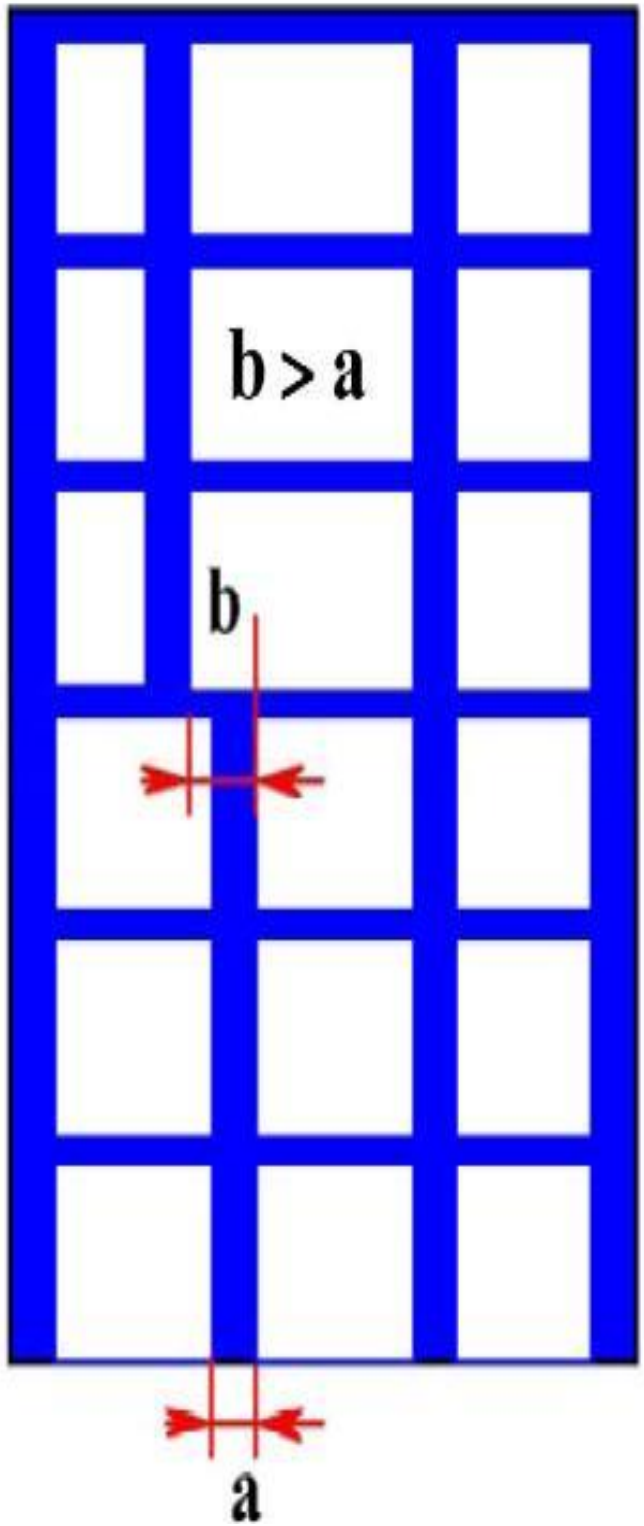


FIG 5 Mass Irregularity

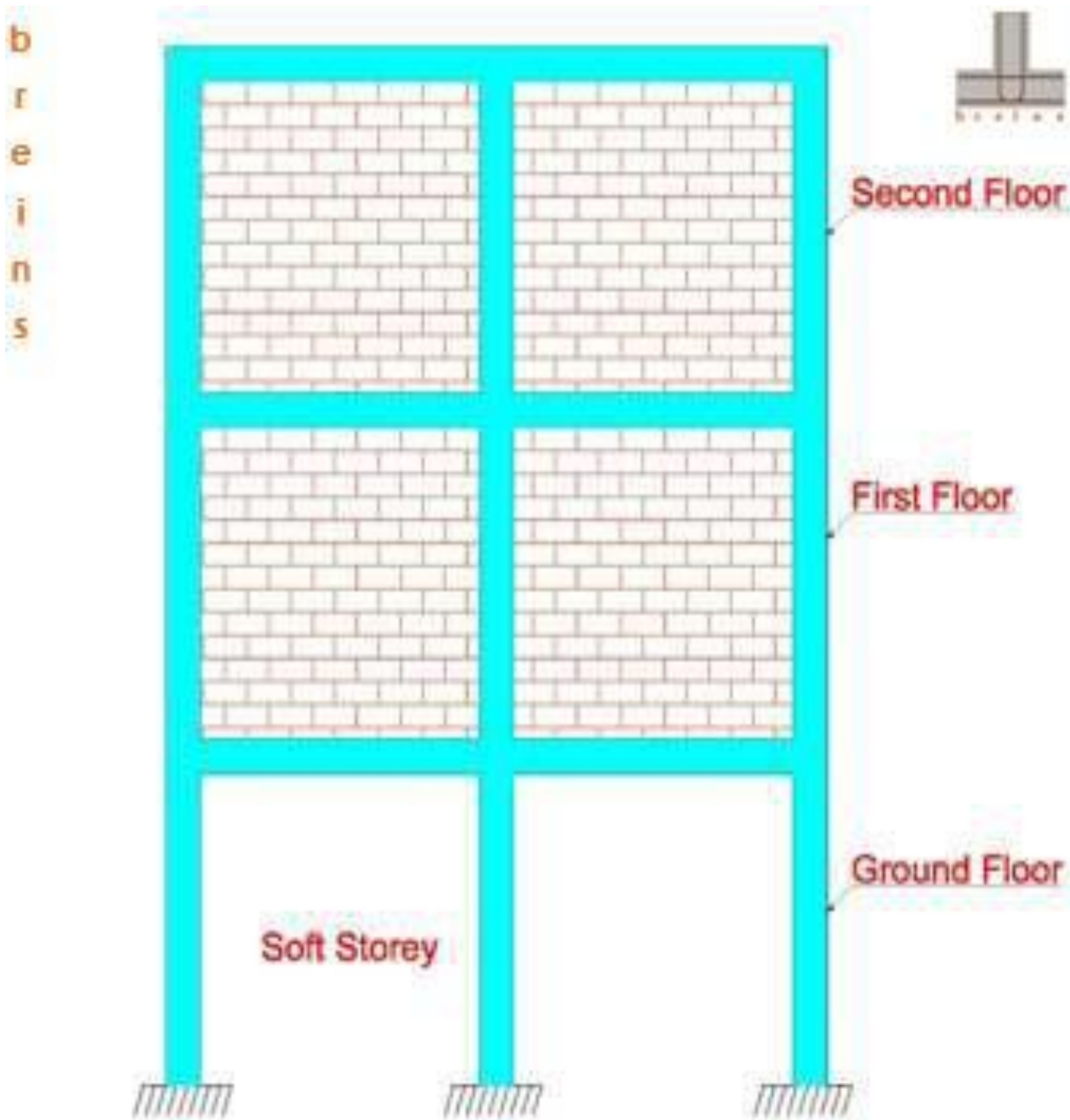


FIG 6 Soft Storey

1.2 OBJECTIVES

To determine the behavior of the multi storey R.C.C framed structure building with soft storey under lateral loading conditions and observing the failure of the soft storey in a multistory high rise building under seismic loading, hence providing the remedial measure to the “SOFT STOREY” against this lateral loading by providing “**SHEAR WALL”** and “**MASONRY IN FILL WALL”**. By hammering the last nail in the end would like to analyze the difference in behavior of the soft storey of the building by providing the shear wall and masonry infill wall and creating difference in it.

SCOPE OF STUDY

The Multi storey building can be protected against collapse failure due to soft storey in the R.C.C framed multi storey building. This collapse failure generally takes place when the ground floor stiffness is less than the 70-75% of the stiffness of the storey above the ground floor. Therefore it is very much crucial that ground floor stiffness shall be larger than the first storey or other stories at the top of it. So, generally when seismic lateral loading occurs during earthquakes, the ground floor provided with large open space parking or large open spaces like large windows, doors, arches etc leads to the formation of SOFT STOREY or WEAK STOREY which is related to stiffness or strength. Thus to prevent this failure during earthquake various remedial measures are adapted out of which one is providing SHEAR WALL all around for boundary periphery with this remedy multi storey failure against lateral seismic loading can protect from causing major collapse failure.

CHAPTER -2 LITERATURE REVIEW

2.1 LITERATURE

A significant amount of research work has been done on seismic behavior of soft storey building has been done by many investigators research area Such as

[1] Suchita hirde and ganga tepugade discussed in 2014 that the performance of a building with soft storey at different level along with at ground level. The nonlinear static pushover analysis is carried out. Concluded it is observed that plastic hinges are induced in columns of ground level soft storey which is not acceptable criteria for safe design. Reduction in the displacement takes place when the soft storey is provided at higher level of the building.

[2] Hiten L. Kheni and Anuj K. Chandiwala Investigated in 2014 that many buildings that collapsed during the past earthquake exhibited exactly the opposite strong beam weak column behavior means columns fails before the beams get fractured mainly due to soft storey effect. For proper assessment of the storey stiffness of buildings with soft storey building, different models were analyzed using software. Whereas he concluded the displacement estimates of the lateral load patterns are observed to be of lesser value for the lower stories and larger for the upper stories and are independent of the total number stories of the system models.

[3] Dhadde_Santosh Investigated in 2014 that nonlinear pushover analysis is conducted to the building models using ETABS software and the evaluation is carried for non-strenghtning normal buildings and retrofitting methods are suggested like infill wall, increase of ground story column stiffness and shear wall at central core. He concluded storey drift values for soft storey models maximum values compare to other storey's and the values of storey drift decreases gradually up to the top.

[4] Rakshith Gowda K.R and Bhavani Shankar Investigated in 2014 that the soft storey's are provided at different level for different load combinations and ANSYS and E-TABS are used for modeling and analysis RC buildings. Concluded the inter storey drift was observed to be maximum in vertically irregular structure when compared with that of regular structure.

[5] Mr.D.Dhandapany Investigated in 2014 that the seismic behavior of RCC buildings with and without shear wall under different soil conditions. Analyzed using ETABS software for different soil conditions (hard, medium, soft). The values of Base shear, axial force and Lateral displacement were compared between two framed structures. Concluded the design in STAAD PRO was found to be almost equal results to compare in ETABS for all structural members.

[6] Susanta Banerjee, Sanjaya K Patro and Praveena Rao in 2014 , Analysed the response parameters such as floor displacement, storey drift, and base shear. Modelling and analysis of the building are performed by nonlinear analysis program IDARC 2D. Hence, concluded lateral roof displacement and maximum storey drift is reduced by considering infill wall effect than a bare frame.

[7] D. B. Karwar and Dr. R. S. Londhe in 2014 , Investigated that the behavior of Reinforced Concrete framed structures by using nonlinear static procedure (NSP) or pushover analysis in finite element software "SAP2000".and the Comparative study made for different models in terms of base shear, displacement, performance point. Hence, Concluded base shear is minimum for bare frame and maximum for frame with infill for G+7 building.

[8] Miss Desai Pallavi T in 2013, Investigated that the behavior of reinforced concrete framed structures by using Staad Pro. Modelling four structure and compare stiffness this models. whereas, Concluded provide the stiffer column in first storey.

[9] Amit and S. Gawande in 2013, Investigated that the seismic performance and design of the masonry infill reinforced concrete structure with the weak first storey under a strong ground motion.

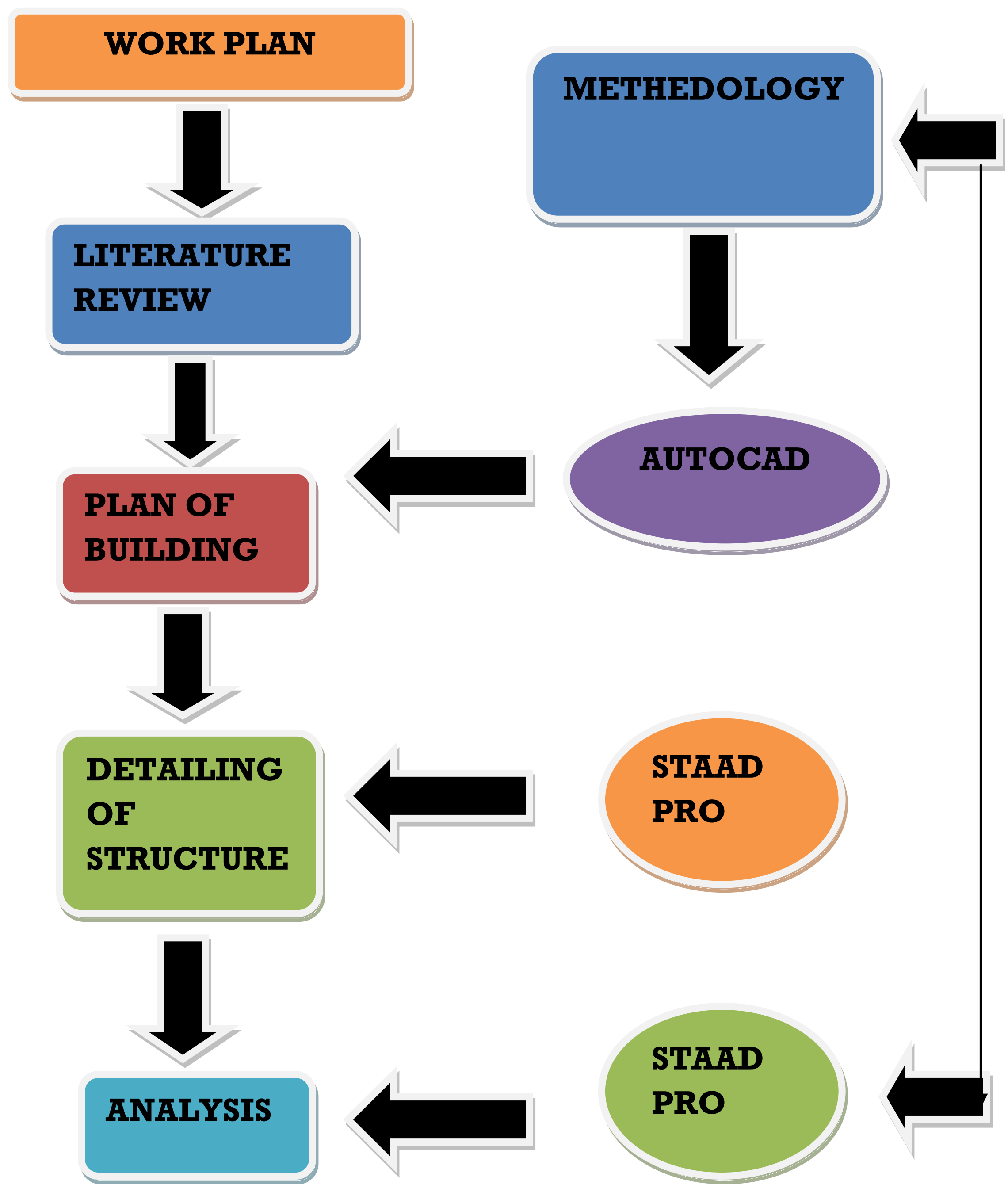
[10] Nikhil Agrawal in 2013, Analysed the performance of masonry infilled reinforced concrete framed structure including open first storey of with and without opening. The increase in the opening percentage leads to a decrease on the lateral stiffness of infilled frame. Hence, Concluded Infill panels increase stiffness of the structure

2.2 RESEARCH GAP

At the very first step would like to tell that various researches has been done over the soft storey failure under seismic lateral loading but my topic is to analyze the remedy in STAAD PRO which has been provided against this seismic loading and design this in AUTOCAD. Here I would like to elaborate my Research topic such as that in my research work I am analyzing the remedy in STAAD PRO i.e. SHEAR WALL AND MASONRY IN FILL WALL and setting up the difference in the behavior of the Multi storey building (framed structure) after providing these remedial techniques in SOFT STOREY.

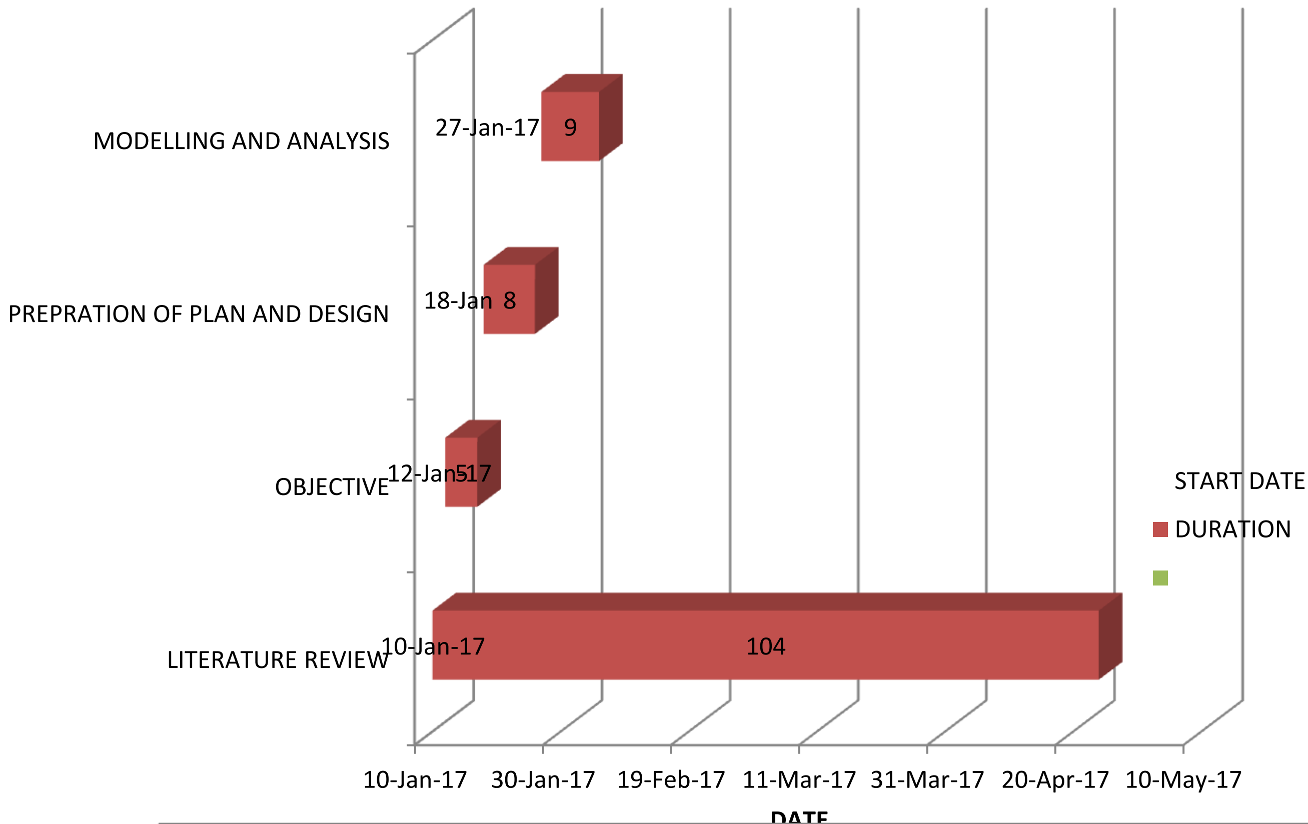
CHAPTER -3 METHEDOLOGY

3.1 METHOD USED



3.2 WORK SCHEDULE

This is the work schedule carried out for the research work. This graph depicts the time period on horizontal axis and activities on vertical axis.



	LITERATURE REVIEW	OBJECTIVE	PREPRATION OF PLAN AND DESIGN	MODELLING AND ANALYSIS
START DATE	10-Jan-17	12-Jan-17	18-Jan	27-Jan-17
DURATION	104	5	8	9

TABLE 1.1

3.2.1 PLAN ON AUTOCAD

STUDY OF BUILDING WITH DETAILING AND PLAN ON AUTOCAD:

The plan layout of the reinforced concrete moment resisting frame building with one open storey at bottom level of the building with Un-reinforced brick infill walls in the other storey's , shown in **Fig. 7**. The building is kept symmetric in both orthogonal directions in plan to avoid torsional response under pure lateral forces. The building is considered to be located in seismic zone III and intended for commercial use. The building is founded on medium strength soil through isolated footings (of size 2.5m×2.5m) under the columns. Elastic moduli of concrete and masonry are 30,500 MPa and 4,500 MPa, respectively, and their Poison's ratio is 0.33. Performance factor (K) has been taken as 1.0 (assuming ductile detailing). The unit weights of concrete and masonry are taken as 25 kN/m3 and 20 kN/m3 is considered.

- The other building parameters are as follows. G+7Building Symmetrical Medium strength soil Isolated footings M20 and Fe415
- Column size: 350 mm X 450mm Beam size: 450mm X 300mm Office Building (Commercial) Zone III Dead load: 25KN/m2 Live load 4 KN/m2 Floor finish: 1.5 KN/m2

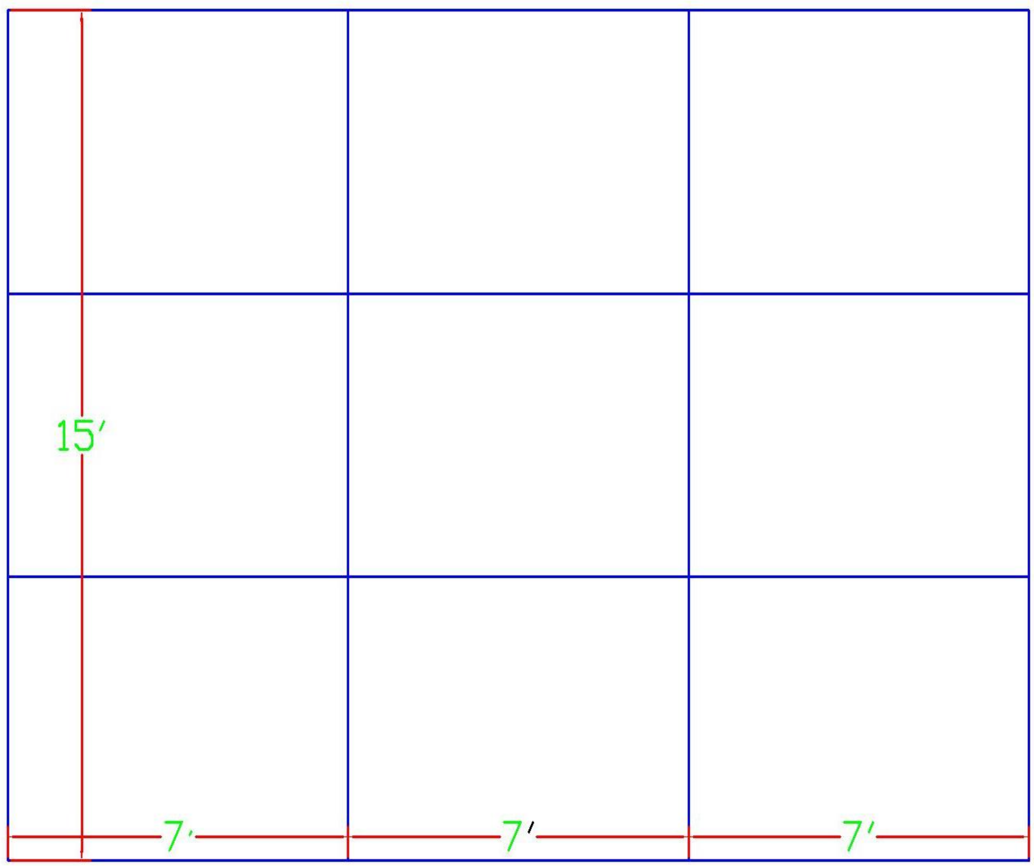
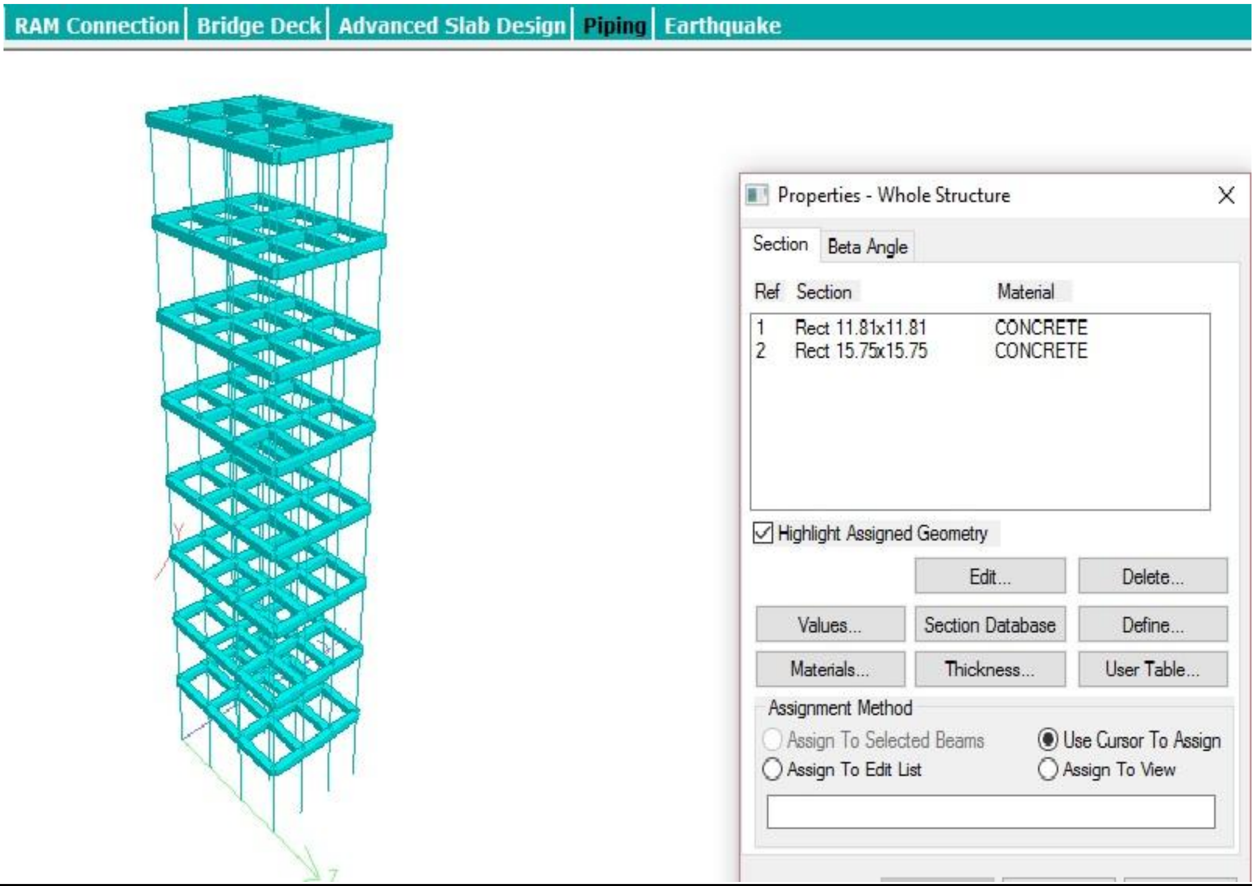
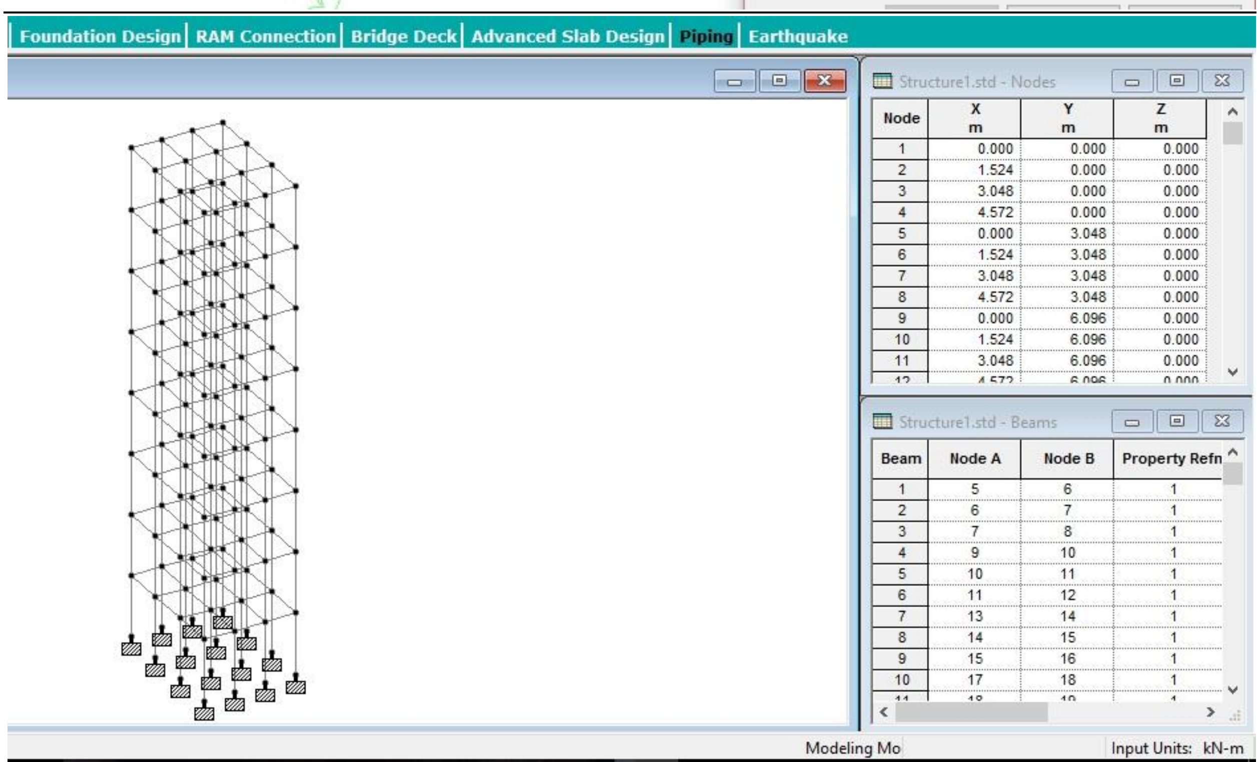


FIG 7 – Plan at a Ground Floor of The Building Shown in The Study





Node	X m	Y m	Z m
1	0.000	0.000	0.000
2	1.524	0.000	0.000
3	3.048	0.000	0.000
4	4.572	0.000	0.000
5	0.000	3.048	0.000
6	1.524	3.048	0.000
7	3.048	3.048	0.000
8	4.572	3.048	0.000
9	0.000	6.096	0.000
10	1.524	6.096	0.000
11	3.048	6.096	0.000

Beam	Node A	Node B	Property Refn
1	5	6	1
2	6	7	1
3	7	8	1
4	9	10	1
5	10	11	1
6	11	12	1
7	13	14	1
8	14	15	1
9	15	16	1
10	17	18	1

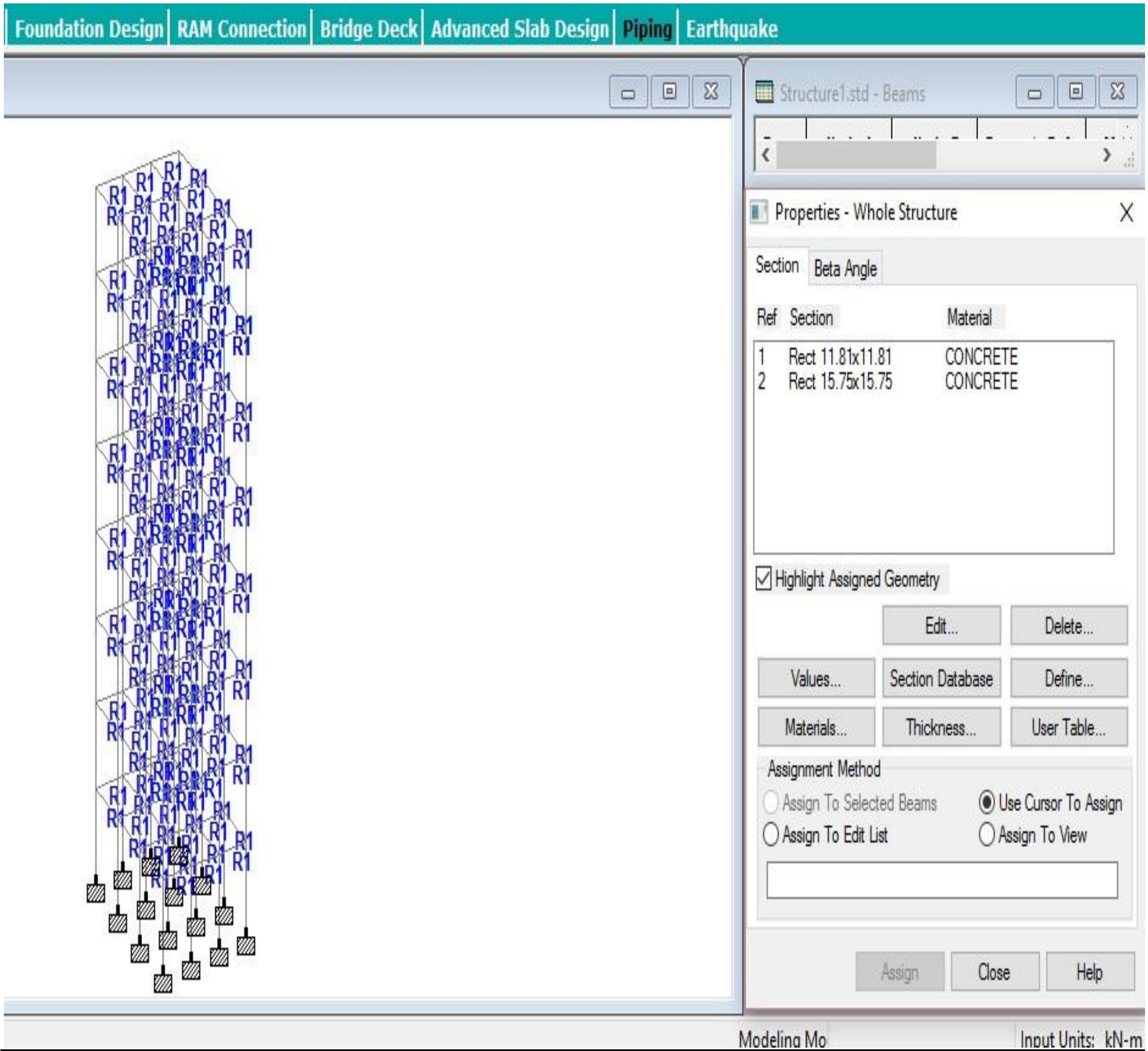


FIG8 – Elevation Of The Building With Soft Storey and G=7 Building Worked On Staad Pro

CHAPTER – 4 REFRENCES

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