MAJOR PROJECT

REPORT ON

COMPARISON AND COST BENEFIT ANALYSIS OF WALL FRAMED STRUCTURE OVER FRAMED STRUCTURE

BY

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2K12/STE/21

STRUCTURAL ENGINEERING

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CANDIDATE'S DECLARATION

I do hereby certify that the work presented in this report entitled "**Comparison and cost benefit analysis of wall framed structure over framed structure**" in the partial fulfilment of the requirements for the award of the degree of "Master of Technology" in structural engineering submitted in the Department of Civil Engineering, Delhi Technological University, is an authentic record of our own work carried out from December 2014 to July 2014 under the supervision of Dr. Nirendra Dev, Professor, Department of Civil Engineering.

I have not submitted the matter embodied in the dissertation for the award of any other degree or diploma.

Date: 30 July 2014

Shubham Jain (2K12/STE/21)

This is to certify that above statement made by the candidate is correct to best of my knowledge.

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CHAPTER 1

INTRODUCTION TO RIGID FRAME STRUCTURES AND WALL FRAMED STRUCTURES

1.1 GENERAL

The primary purpose of all kinds of structural systems used in the building type of structures is to support gravity loads. The most common loads resulting from the effect of gravity are dead load, live load and snow load. Besides these vertical loads, buildings are also subjected to lateral loads caused by wind, blasting or earthquake.
Lateral loads can develop high stresses, produce sway movement or cause vibration. Therefore, it is very important for the structure to have sufficient strength against vertical loads together with adequate stiffness to resist lateral forces.
In India, a considerable number of buildings have reinforced concrete structural systems. This is due to economic reasons.

Reinforced concrete building structures can be classified as

1. **Structural Frame Systems**: The structural system consists of frames. Floor slabs, beams and columns are the basic elements of the structural system. Such frames can carry gravity loads while providing adequate stiffness.
2. **Structural Wall Systems:** In this type of structures, all the vertical members are made of structural walls, generally called shear walls.
3. **Shear Wall–Frame Systems** (Dual Systems): The system consists of reinforced concrete frames interacting with reinforced concrete shear walls.

The analysis of shear wall-frame structures is more complicated than frame systems. Wide column analogy, braced frame analogy and shell element derived by using finite element formulation are the most popular models.
Another important point for the lateral load analysis of building structures is modelling the structural system. A common method which is widely used in design offices is to perform analysis on a two dimensional model obtained from the actual three dimensional system by using some simplifying assumptions. The total number of degrees of freedom is reduced significantly through this method. Some computer programs which model the buildings in series of two dimensional frames in two orthogonal directions use the same logic. The displacement compatibility is established by infinitely rigid slabs at floor levels.Analysis will focus on rigid interactions between structural elements to reduce degree of freedom of the structure and fast processing of the results.

1.2 OBJECTIVE OF THE STUDY

The main objective of this study is to analyze rigid frame and wall framed structures under the action of wind load alter the design specifications according to the output generated after the analysis.

Wall framed structures are the combination of shear wall and rigid frame and hence it requires uneconomical usage of concrete. Efforts are made to minimize the concrete used in wall frame structures as compared to rigid frame without changing the reinforcement.

Also benefit cost analysis of both types of structures is also performed.

As stated previously, the majority of the residential building structures in India have only frame systems which are quite vulnerable to seismic and wind loads Proper analysis and design of building structures that are subjected to static and dynamic loads is very important, for which we have to shift our focus from framed structures to wall framed structures . Another important factor in the analysis of these systems is obtaining acceptable accuracy in the results.
The object of this study is to model and analyze shear wall-frame structures having planar shear walls. In order to reduce the required time and capacity for the analysis of the structural systems, frame elements are used instead of plane stress elements in modelling the shear walls. Two two-dimensional shear wall models are developed for modelling planar shear walls .The proposed models can be used in both static and dynamic elastic analysis of shear wall-frame structures.

1.3SCOPE

Despite extensive research carried out over the years idea of developing wall framed structures is still not conceptualised.

A possible reason may be lack of attention in the design of building towards lateral and seismic loading. But eyeing the current scenario attention has to be shifted towards safety rather than cost. However if these structures are properly designed they might prove to be more economic the traditional frames.

Also, adequate changes in various building code specifications are required to provide for better performance of structures under hazardous conditions. Until restrictions are not imposed by the building code focus of work cannot be shifted towards wall framed structures.

Shear wall is generally used for tall building but buildings having less than ten stories are also susceptible to wind load and seismic load. Analysis of a seven storey building is done considering various types structures and the best results are being demonstrated.

This field has a wide scope with advance software’s like SAP as they various types of alternatives in selection of materials and structural elements and follows the approach of finite element modelling. We can see frame results at various sections and each section can be dealt separately according to the requirement of loading in that section.

1.4 ADVANTAGES AND ARCHITECTURAL ASPECTS OF USING SHEAR WALL IN TALL BUILDINGS

Reinforced concrete (RC) buildings often have vertical plate-like RC walls called Shear Walls in addition to slabs, beams and columns. These walls generally start at foundation level and are continuous throughout the building height. Their thickness can be as low as 150mm, or as high as 400mm in high rise buildings. Shear walls are usually provided along both length and width of buildings. Shear walls are like vertically-oriented wide beams that carry earthquake loads downwards to the foundation.

Advantages of Shear Walls in RC Buildings

Properly designed and detailed buildings with shear walls have shown very good performance in past earthquakes. The overwhelming success of buildings with shear walls in resisting strong earthquakes is summarised in the quote:

"We cannot afford to build concrete buildings meant to resist severe earthquakes without shear walls."
:: Mark Fintel, a noted consulting engineer in USA

Shear walls in high seismic regions require special detailing. However, in past earthquakes, even buildings with sufficient amount of walls that were not specially detailed for seismic performance (but had enough well-distributed reinforcement) were saved from collapse. Shear wall buildings are a popular choice in many earthquake prone countries. Shear walls are easy to construct, because reinforcement detailing of walls is relatively straight-forward and therefore easily implemented at site. Shear walls are efficient, both in terms of construction cost and effectiveness in minimizing earthquake damage in structural and non-structural elements (like glass windows and building contents).

Besides all this major advantages there are some minor advantages also which are listed as follows:

1. Tidier and more workmen like.
2. Easy housekeeping
3. Speed in erecting and dismantling forms.
4. Good appearance
5. Greater control on accuracy and workmanship.
6. Superb concrete finish and quality improvement.
7. Lesser water seepage problem.
8. Strong, Solid, Rigid and low maintenance.

9. Fire resistance.
10. Tornados and hurricane resistance.
11. Termite, Insect and rodent resistance.
12. Sound reducing.
13. Cost saving if advance technology is used.

Architectural Aspects of Shear Walls

Most RC buildings with shear walls also have columns; these columns primarily carry gravity loads (i.e., those due to self-weight and contents of building). Shear walls provide large strength and stiffness to buildings in the direction of their orientation, which significantly reduces lateral sway of the building and thereby reduces damage to structure and its contents. Since shear walls carry large horizontal earthquake forces, the overturning effects on them are large. Thus, design of their foundations requires special attention.

Shear walls should be provided along preferably both length and width. However, if they are provided along only one direction, a proper grid of beams and columns in the vertical plane (called a moment-resistant frame) must be provided along the other direction to resist strong earthquake effects. Door or window openings can be provided in shear walls, but their size must be small to ensure least interruption to force flow through walls. Moreover, openings should be symmetrically located. Special design checks are required to ensure that the net cross-sectional area of a wall at an opening is sufficient to carry the horizontal earthquake force.

Shear walls in buildings must be symmetrically located in plan to reduce ill-effects of twist in buildings. They could be placed symmetrically along one or both directions in plan. Shear walls are more effective when located along exterior perimeter of the building – such a layout increases resistance of the building to twisting.

1.5 WHY DO WE NEED WALL FRAMED STRUCTURES

Every structure has two modes of failure that is shear mode and flexural mode. In order to make the structure compatible to both the modes we need a combination of two structural elements in such a way that counteract their individual failure modes and the results obtained best suits the critical conditions of the structure.

Rigid frame structures generally have flexural mode of failure which becomes more dominant as the height of the structure goes on increasing.it also depends upon the bearing capacity of the soil , topographic conditions and wind/earthquake loading at a particular place. Rigid frame structure can be made equitable to all the conditions but it requires huge amount of cost to be invested and sometimes the size of structural elements becomes so large that the carpet area of the building decreases to a larger extent.

On the other hand shear wall has shear mode of failure which is exactly opposite to rigid frame. So the researchers have developed a common solution to the problem by combining rigid frame structures with shear wall and named it as wall framed structures.

Wall framed structures not only controls deflection but also provides additional stiffness to the building. Now days with advance technology in building design, this method proves to be cost efficient also.

Still national building codes needs to be updated to make it mandatory to use wall framed structures for high rise buildings to ensure safety of the residents. It should be strictly forced in seismic zones 4 and 5.

India lacks advance technology in civil design of wall framed structures and hence workshops should be organised for students to develop wider scope of this method in future and cost efficient also.

More advance technology focuses on steel type and timber type shear wall but this experiment is still under research phase because concrete still remains far cheaper material than wood and timber.

Wall framed structures also provide insulation to the building from hazards like fire and hence act as a protective cover to the main rigid frame.

Researchers have shown that if shear wall design is done in such a way that structure remains symmetric about the axis perform better than non symmetric structure in case of earthquake loading.

CHAPTER 2 LITERATURE REVIEW

[1] William John Goodsir [1985] presented methodology for the design of reinforced concrete frame-wall structures for seismic resistance is presented. By using capacity design principles, plasticity is restricted to well detailed beam and wall base hinge zones where energy is expected to be dissipated primarily via the flexural yielding. Numerous analyses, simulating earthquake attacks, were performed for simplified 6 and 12 storey buildings. Major variables examined included relative frame: wall stiffness, wall base fixity and wall: frame height. Response to the NS El Centro 1940 accelerogram indicated the likelihood of very satisfactory seismic response for prototype structures. Member actions were able to be estimated with good accuracy although the dynamic magnification of wall base shear forces is viewed with concern. Complementary to the analytical study, four approximately 1/3 scale model cantilever structural wall units were tested under a regime of cyclic lateral loading. The units exhibited very good hysteretic behaviour prior to failure via out of plane buckling or material compression failure accelerated by the former mode of response. Features of behaviour of wall sections with large concrete compression strains and lateral instability were the major targets of study in these experiments. Recommendations are made regarding confining hoop reinforcement and dimensional limitations for the plastic hinge zones of structural walls.

[2] Kanat Burak Bozdogan and Duygu Ozturk[2009] study presents an approximate method based on the continuum approach and transfer matrix method for lateral stability analysis of buildings. In this method, the whole structure is idealized as an equivalent sandwich beam which includes all deformations. The effect of shear deformations of walls has been taken into consideration and incorporated in the formulation of the governing equations. Initially the stability differential equation of this equivalent sandwich beam is presented, and then shape functions for each storey are obtained by the solution of the differential equations. By using boundary conditions and stability storey transfer matrices obtained by shape functions, system buckling load can be calculated. To verify the presented method, four numerical examples have been solved. The results of the samples demonstrate the agreement between the presented method and the other methods given in the literature. It has been assumed that the structures are regular i.e. their characteristics do not vary over the height. Aristazabal Ochoa's papers (Aristazabal Ochoa 1997, 2002, 2003), storey-buckling approach was used for the stability of the unbraced frame. Also, Potzta & Kollar (2003) developed a hand method for stability and dynamic analysis of regular buildings. In their paper, the stiffened building structure was replaced by a sandwich beam. Additionally, Girgin & Ozmen (2007) proposed a simplified procedure for determining buckling loads of three-dimensional framed structures. In this study, an approximate method based on continuum system model and transfer matrix approach has been suggested for the lateral stability analysis of the buildings. The effect of shear deformations of walls has been taken into consideration and incorporated in the formulation of the governing equations. The following assumptions are made in this study; the behaviour of the material is linear elastic, the floor slabs of the building have great in-plane and small out-of-plane stiffness, the vertical load acts on storey level and the critical loads of the structures define the bifurcation point.

[3] P. P. Chandurkar , Dr. P. S. Pajgade[2013] explains the seismic design of buildings, reinforced concrete structural walls, or shear walls, act as major earthquake resisting members. Structural walls provide an efficient bracing system and offer great potential for lateral load resistance. The properties of these seismic shear walls dominate the response of the buildings, and therefore, it is important to evaluate the seismic response of the walls appropriately. In this present study, main focus is to determine the solution for shear wall location in multi-storey building. Effectiveness of shear wall has been studied with the help of four different models. Model one is bare frame structural system and other three models are dual type structural system. An earthquake load is applied to a building of ten stories located in zone II, zone III, zone IV and zone V. Parameters like Lateral displacement, story drift and total cost required for ground floor are calculated in both the cases replacing column with shear wall.

[4] Z. Bazant and Z. P. Bazant [2010] shown that framed structures are systems of bars with rigid joints. The rigidity of joints causes the bending of bars with equal rotation of all bars connected ill a joint. Trussed girders, with (actual or supposed) hinged connections at the joints are determinate or over determinate in form, whereas framed structures (without diagonals) having hinged joints are geo-metrically indeterminate. With rigid joints, the bars in plane systems are acted on by axial forces, bend-ing moments, and shearing forces. This greatly in-creases the number of unknowns, framed structures being many times statically indeterminate. Exact solution with usual methods is complicated and la-borious. The greatest possible simplification of analysis for practical purposes is the aim of all new publications. As in the case of all hyper static systems, framed structures can be analyzed by Castiglione's method of least work (I). The statically indeterminate quantities are the components of reactions or internal forces (axial and shearing forces, bending moments) in chosen sections. Expressing by these unknowns the components of internal forces in all sections of the bars, we derive by the theorem of least work as many equations as there are unknowns. We then have a great number of linear equations. This method of analysis is simple if each equation contains only a small number of unknowns. For this purpose, it is possible to choose the sections containing hyper static components and their directions so that each hyper static quantity produces deforma-tion in the least number of directions, least affects the other unknowns (2, 3). For a closed or fixed-end simple frame, each elastic equation can contain only one unknown if the components 0, internal forces in a section or of reactions are transferred to the elastic centre of the frame.

[5] Alberto Carpinteri, Mauro Corrado and Giuseppe Lacidogna [2012] proposed **three-dimensional formulation is proposed to analyze the lateral loading distribution of external actions in high-rise buildings. The method is extended to encompass any combination of bracings, including bracings with open thin-walled cross-sections, which are analyzed in the framework of Timoshenko-Vlasov's theory of sectorial areas. More in detail, the proposed unified approach is a tool for the preliminary stages of structural design. It considers infinitely rigid floors in their own planes, and allows to better understanding stress and strain distributions in the different bearing elements if compared to a finite element analysis. Numerical examples, describing the structural response of tall buildings characterized by bracings with different cross-section and height, show the effectiveness and flexibility of the proposed method. The accuracy of the results is investigated by a comparison with finite element solutions, in which the bracings are modeled as three-dimensional structures by means of shell elements.**
From the structural viewpoint, tall building means a multi-storey construction in which the effects of horizontal actions and the need to limit the relative displacements take on primary importance (Taranath 1988, 2005). A profound understanding of the force flow in these complex structural systems is often very difficult, and a huge commitment in terms of design, technology and economic resources is required. While in the design of low-rise structures the strength requirement is the dominant factor, with increasing height, the importance of the rigidity and stability requirements to be met to counter wind and earthquake actions grows until they become the prevailing design factors. For this reason, the traditional solutions providing for load-bearing main and secondary parts tend to

be forsaken in favor of a global approach, whereby the structure is conceived in a unitary fashion, i.e., as a single cantilever beam or a system of cantilevers projecting out from the foundations. At any rate, the key issue in structural design continues to be the choice of an appropriate design model that is able to reproduce faithfully the actual conditions of a structure.

[6] J. Dorji and D.P. Thambiratnam [2009] say that frame structures are commonly used in buildings, even in those located in seismically active regions. Present codes unfortunately, do not have adequate guidance for treating the modelling, analysis and design of frame structures. This paper addresses this need and first develops an appropriate technique for modelling the frame interface and then uses it to study the seismic response of frame structures. Finite element time history analyses under different seismic records have been carried out and the influence of infill strength, openings and soft-storey phenomenon are investigated. Results in terms of tip deflection, fundamental period, inter-storey drift ratio and stresses are presented and they will be useful in the seismic design of in-filled frame structures.

Treating infill as a non-structural component is a common practice in the seismic analysis and design of low rise buildings in developing countries such as Bhutan. The lateral strength and stiffness of a structure is disregarded in the current seismic codes used in these countries. These codes do not have adequate guidance due to insufficient research information on the complex seismic response of infill frame structures and due to the wide variation of opening sizes and material properties of the structure. Though, some seismic codes imply the presence of infill, it is normally considered through empirical equations. Despite large amount of research performed in this field both experimentally and numerically in the last few decades, present seismic codes such as (IS1893 2002) provide limited guidance which may not be adequate for the varying properties of structure.

[7] Varsha R. Harne[2014] described shear wall systems are one of the most commonly used lateral load resisting systems in high-rise buildings. Shear walls have very high in plane stiffness and strength, which can be used to simultaneously resist large horizontal loads and support gravity loads, making them quite advantageous in many structural engineering applications. There are lots of literatures available to design and analyze the shear wall. However, the decision about the location of shear wall in multi-storey building is not much discussed in any literatures. In this paper, therefore, main focus is to determine the solution for shear wall location in multi-storey building. A RCC building of six storey placed in NAGPUR subjected to earthquake loading in zone-II is considered. An earthquake load is calculated by seismic coefficient method using IS 1893 (PART–I):2002. These analyses were performed using SAP 2000. A study has been carried out to determine the strength of RC shear wall of a multi-storeyed building by changing shear wall location. Three different cases of shear wall position for a 6 storey building have been analyzed. Incorporation of shear wall has become inevitable in multi-storey building to resist lateral forces.

[8] Anuj Chandiwala[2012] analyzed from the past records of earthquake, there is increase in the demand of earthquake resisting building which can be fulfilled by providing the shear wall systems in the buildings. For achieving economy in reinforced concrete building structures, design of critical section is carefully done to get reasonable concrete sizes and optimum steel consumption in members. In the present paper the researcher, had tried to get moment occur at a particular column including the seismic load, by taking different lateral load resisting structural systems, different number of floors, with various positions of shear wall for earthquake zone III in India has been found. In tall buildings lateral loads are premier one which will increase rapidly with increase in height. The design takes care of the requirements of strength, rigidity and stability. The structural system designed to carry vertical load may not have the capacity to resist lateral load or even if it has, the design for lateral load will increase the structural cost substantially with increase in number of storey. To achieve economy in tall buildings special systems to resist lateral load should be adopted.

CHAPTER 3 SELECTION OF MATERIALS FOR DESIGN

The production of high-strength concrete that consistently meets requirements for workability and strength development places more stringent requirements on material selection than for lower-strength concretes. Quality materials are needed and specifications are required. Selection of materials mainly depends upon the results of the trial mixes giving required results.

3.1 PORTLAND CEMENT

The choice of Portland cement for high-strength concrete is extremely important. Furthermore within a given cement type, different brands will have different strength development characteristics because of the variations in compound composition and fineness.

Experience has shown that low-C3A cements generally produce concrete with improved properties.

A further consideration is the optimization of the cement-admixture system. The exact effect of a water reducing agent on water requirement, for example, will depend on the cement characteristics. Strength development will depend on both cement characteristics and cement content.

3.2 FINE AGGREGATE

Fine aggregates with rounded particle shape and smooth texture have been found to require less mixing water in concrete and for this reason are preferable in high-strength concrete.

The optimum gradation of fine aggregate for high strength concrete is determined more by its effect on water requirement than on physical packing.

Sand with a fineness modulus below 2.5 gave the concrete a sticky consistency, making it difficult to compact. Sand with an FM of about 3.0 gave the best workability and compressive strength.

High-strength concretes typically contain such high contents of fine cementitious materials that the grading of the aggregates used is relatively unimportant compared to conventional concrete.

3.3 COARSE AGGREGATE

Many studies have shown that for good compressive strength with high cement content and low water-cement ratios the maximum size of coarse aggregate should be kept to a minimum.

Smaller aggregate sixes are also considered to produce higher concrete strengths because of less severe concentrations of stress around the particles, which are caused by differences between the elastic modulli of the paste and the aggregate.

Studies have shown that crushed stone produces higher strengths than rounded gravel. The most likely reason for this is the greater mechanical bond which can develop with angular particles. However, accentuated angularity is to be avoided because of the attendant high water requirement and reduced workability.

The ideal aggregate should be clean, cubical, angular, 100 percent crushed aggregate with a minimum of flat and elongated particles.

3.4 WATER

The requirements for water quality for high-strength concrete are no more stringent than those for conventional concrete. Usually, water for concrete is specified to be of potable quality. This is certainly conservative but usually does not constitute a problem since most concrete is produced near a municipal water supply.

If we are using lower quality of water then its effect is tested with that concrete which is produced by conventional good quality water. If results doesn’t differ much then use of lower quality can be continued.

3.5 SILICA FUME

Silica fume, also known as micro silica, is an amorphous (non-crystalline) polymorph of silicon dioxide, silica. It is an ultrafine powder collected as a by-product of the silicon and ferrosilicon alloy production and consists of spherical particles with an average particle diameter of 150 nm. The main field of application is as pozzolanic material for high performance concrete.

It is sometimes confused with fumed silica (also known as pyrogenic silica). However, the production process, particle characteristics and fields of application of fumed silica are all different from those of silica fume.

Silica fume is a by-product of producing silicon metal or ferrosilicon alloys. One of the most beneficial uses for silica fume is in concrete. Because of its chemical and physical properties, it is a very reactive pozzolana. Concrete containing silica fume can have very high strength and can be very durable.

3.6 STEEL REINFORCEMENT

Steel reinforcement plays an important role in determining the ductility of the structure and hence selection of steel has to be done under certain quality checks. Generally thermo-mechanically twisted bars are preferred over cold twisted bars in structures.
Steel having characteristic strength of 415 N/mm^2 is considered in the design and analysis of model.

CHAPTER 4: PROBLEM FORMULATION

4.1 MODEL SPECIFICATIONS

4.1.1 SHEAR WALL

Shear walls are vertical elements of the horizontal force resisting system. They are typically wood frame stud walls covered with a structural sheathing material like plywood. When the sheathing is properly fastened to the stud wall framing, the shear wall can resist forces directed along the length of the wall. When shear walls are designed and constructed properly, they will have the strength and stiffness to resist the horizontal forces.

Shear walls should be located on each level of the structure including the crawl space. To form an effective box structure, equal length shear walls should be placed symmetrically on all four exterior walls of the building. Shear walls should be added to the building interior when the exterior walls cannot provide sufficient strength and stiffness or when the allowable span-width ratio for the floor or roof diaphragm is exceeded.

Shear walls are most efficient when they align vertically and are supported on foundation walls or footings. When shear walls do not align, other parts of the building will need additional strengthening. Consider the common case of an interior wall supported by a subfloor over a crawl space and there is no continuous footing beneath the wall. For this wall to be used as shear wall, the subfloor and its connections will have to be strengthened near the wall. For new construction, thicker plywood or extra nailing and connections can be added. For retrofit work, existing floor construction is not easily changed. That’s the reason why most retrofit work uses walls with continuous footings underneath them as shear walls.

Shear walls resist two types of forces: shear forces and uplift forces. Connections to the structure above transfer horizontal forces to the shear wall. This transfer creates shear forces throughout the height of the wall between the top and bottom shear wall connections. The strength of the lumber, sheathing and fasteners must resist these shear forces or the wall will tear or “shear” apart. Uplift forces exist on shear walls because the horizontal forces are applied to the top of the wall. These uplift forces try to lift up one end of the wall and push the other end down. In some cases, the uplift force is large enough to tip the wall over. Uplift forces are greater on tall short walls and less on low long walls. Bearing walls have less uplift than non-bearing walls because gravity loads on shear walls help them resist uplift. Shear walls need hold down devices at each end when the gravity loads cannot resist all of the uplift. The hold down device then provides the necessary uplift resistance.

4.1.2 FRAMED STRUCTURE

Frame structures are the structures having the combination of beam, column and slab to resist the lateral and gravity loads. These structures are usually used to overcome the large moments developing due to the applied loading.

Types of frame structures

Framed structures can be differentiated into:

1. Rigid frame structure

- Pin ended
- Fixed ended

2. Braced frame structure

- Gabled frames
- Portal frames

Rigid Structural Frame

The word rigid means ability to resist the deformation. Rigid frame structures can be defined as the structures in which beams & columns are made monolithically and act collectively to resist the moments which are generating due to applied load.

Rigid frame structures provide more stability. This type of frame structures resists the shear, moment and torsion more effectively than any other type of frame structures. That's why this frame system is used in world's most astonishing building Burj Al-Arab.

Braced Structural Frames

In this frame system, bracing are usually provided between beams and columns to increase their resistance against the lateral forces and side ways forces due to applied load. Bracing is usually done by placing the diagonal members between the beams and columns. This frame system provides more efficient resistance against the earthquake and wind forces. This frame system is more effective than rigid frame system.

Pin Ended Rigid Structural Frames

A pinned ended rigid frame system usually has pins as their support conditions. This frame system is considered to be non rigid if its support conditions are removed.

Fix Ended Rigid Frame Structure

In this type of rigid frame systems end conditions are usually fixed.

Gabbled Structural Frame

Gabled frame structures usually have the peak at their top. These frames systems are in use where there are possibilities of heavy rain and snow.

Portal Structural Frame

Portal structural frames usually look like a door. This frame system is very much in use for construction of industrial and commercial buildings

Advantages of Frame Structures

1. One of the best advantages of frame structures is their ease in construction. it is very east to teach the labor at the construction site.
2. Frame structures can be constructed rapidly.
3. Economy is also very important factor in the design of building systems. Frame structures have economical designs.

Disadvantages of Frames:
In frames structures, span lengths are usually restricted to 40 ft when normal reinforced concrete. Otherwise spans greater than that can cause lateral deflection.

4.1.3 TYPE OF JOINT RESTRAINTS

Restraints concern only the behaviour of individual joints. Restraints differ from constraints in that constraints are associated with relationships among sets of joints. Restraints should not be applied to joints that are part of a constraint. Instead, restraints may be replaced with either stiff springs or large stiffness properties along those DOF. Restraints must be applied when joint displacement is known at specific DOF. Displacement may be zero, as with support points, or nonzero, as with support settlement. The *reaction*, generated during analysis, is the force necessary to produce a specified restraint displacement. Restraints should also be applied when stiffness is zero along specific DOF, as with the out-of-plane translation and in-plane rotation of a planar frame.

For each **joint** of a structural model, **displacement** may either be unknown and solved for, or it may be known and input. Known joint displacement is either zero or nonzero. Zero displacement is specified for fixed DOF at **restraint** support locations. Nonzero joint displacement is specified for such a condition as given support settlement, or application of displacement time history to specific supports, which is described in the Displacement time-history record article.

When joint displacement is known for a given DOF (whether zero or nonzero), a restraint must be assigned along that DOF. A nonzero displacement value may then be assigned using the Assign > Joint Loads > Displacements menu.

Numerical solution proceeds by solving the matrix equation **K u = F**, where:

- **K** represents the stiffness matrix
- **u** represents joint displacements
- **F** represents joint forces

4.1.4 TYPE OF JOINT CONSTRAINTS

Constraint is a set of two or more joints that are constrained such that their displacements relate. Constraints may be used to model (1) rigid-body behaviour, in which joints translate and rotate together in a rigid connection and equal-displacement behaviour, in which displacement along certain degrees of freedom (DOF) is equal and symmetry / anti-symmetry conditions. Constraints enhance computational efficiency by reducing the number of equations necessary for solution. Multiple constraints should not be assigned to a single joint.

Body constraint is applied to a set of joints that translate and rotate together as a rigid body. Rigid behaviour is automatically applied to all DOF within the constraint, though only certain DOF may be specified. Body constraints

(1) Simulate rigid connections

(2) Connect portions of a model that are defined by separate meshes and
(3) Connect frames to shells

A **line constraint**, also known as an **edge constraint**, may be applied to the edge of a shell or solid object. When applied along an edge, the line constraint will constrain all interconnecting objects to the joints selected. These joints will then displace, along those DOF selected, as a function of interpolation between the two masters joints which govern constraint behaviour.

An **equal constraint** is applied to joints such that equal displacement occurs along the translational DOF specified. No coupling occurs between translation and rotation, differentiating an equal constraint from a body constraint. Equal constraints are useful for modelling expansion joints and locations where two elements connect to form a slot-pin connection, as described in the Modelling pinned connections between crossing member's tutorial.

To fully connect meshes which do not share common joint locations, body constraints should be used, rather than equal constraints. Otherwise, the constraint may restrain the system against certain types of behaviour, thus stiffening the model, and generating unrealistic moment values. This will affect analysis and may lead to the reporting of a lack of equilibrium among constraint forces.

A **diaphragm constraint** creates links between joints located within a plane such that they move together as a planar diaphragm, rigid against membrane (in-plane) deformation, but susceptible to plate (out-of-plane) deformation and associated effects. Diaphragm constraints relieve numerical accuracy problems which result when floor diaphragms are modelled with very high in-plane stiffness. They also enhance the computational efficiency of dynamic lateral analysis by reducing the size of the Eigen value formulation.

Plate constraints differ from diaphragm constraints in that plate constraints are flexible in-plane and rigid against out-of-plane bending. Plate constraints are useful for connecting frames and shells to solid objects, and may be implemented in detailed beam models to ensure that plane sections remain plane.

Coupled constraints and restraints may be modelled within CSI Software, though precaution should be taken to avoid the numerical problems which may result. To successfully model coupling behaviour, multiple joints should be connected using a constraint, and then sufficiently stiff objects should connect pairs of joints to the assembly of constraints.
An **interpolation constraint** is applied to a series of joints such that the

displacement of one joint is interpolated from that of two or more others. Interpolation follows a weighted approach which is a function of proximity to the constrained joint. This process prevents the need to create an internal master joint to govern the behaviour of joints associated with the constraint. An interpolation constraint may be applied, for example, at the end of a tendon which is anchored in the of a solid object. Joint displacement at the tendon end may then be interpolated from the eight joints of the solid object. Similarly for frames and shells, the eight corners of a bounding box may correlate with the displacement of a joint assigned an interpolation constraint.

4.2 DESIGN AND ANALYSIS OF SEVEN STOREY RIGID FRAME STRUCTURE AND ANALYSIS FOR WIND LOAD USING SAP v15 2000

4.2.1 MODEL GEOMETRY

This section provides model geometry information, including items such as joint coordinates, joint restraints, and element connectivity.

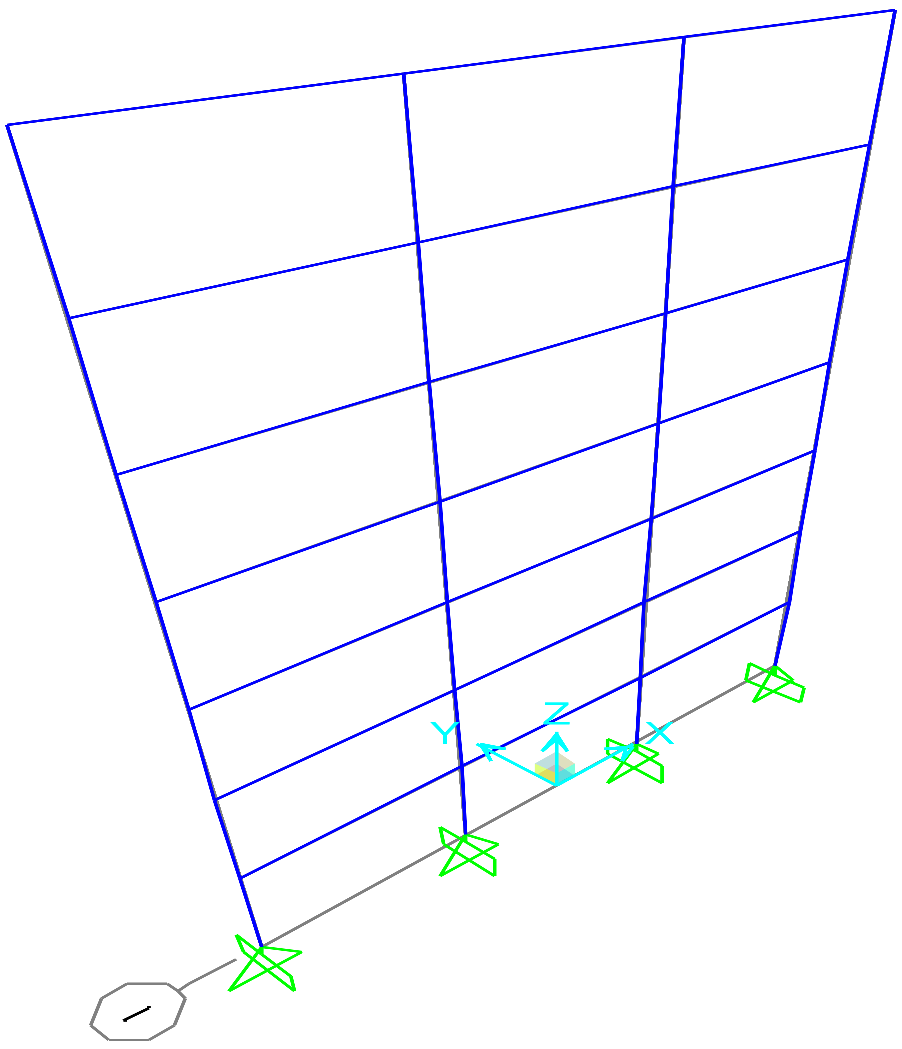

Figure 1: Finite element model

4.2.1.1. Joint coordinates

Table 1: Joint Coordinates

Joint	Coordinate System	Coordinate Type	Global X (mm)	Global Y (mm)	Global Z (mm)
1	GLOBAL	Cartesian	-9144.00	0.00	0.00
2	GLOBAL	Cartesian	-9144.00	0.00	3657.60
3	GLOBAL	Cartesian	-9144.00	0.00	7315.20
4	GLOBAL	Cartesian	-9144.00	0.00	10972.80
5	GLOBAL	Cartesian	-9144.00	0.00	14630.40
6	GLOBAL	Cartesian	-9144.00	0.00	18288.00
7	GLOBAL	Cartesian	-9144.00	0.00	21945.60
8	GLOBAL	Cartesian	-9144.00	0.00	25603.20
9	GLOBAL	Cartesian	-3048.00	0.00	0.00
10	GLOBAL	Cartesian	-3048.00	0.00	3657.60
11	GLOBAL	Cartesian	-3048.00	0.00	7315.20
12	GLOBAL	Cartesian	-3048.00	0.00	10972.80
13	GLOBAL	Cartesian	-3048.00	0.00	14630.40
14	GLOBAL	Cartesian	-3048.00	0.00	18288.00
15	GLOBAL	Cartesian	-3048.00	0.00	21945.60
16	GLOBAL	Cartesian	-3048.00	0.00	25603.20
17	GLOBAL	Cartesian	3048.00	0.00	0.00
18	GLOBAL	Cartesian	3048.00	0.00	3657.60
19	GLOBAL	Cartesian	3048.00	0.00	7315.20
20	GLOBAL	Cartesian	3048.00	0.00	10972.80
21	GLOBAL	Cartesian	3048.00	0.00	14630.40
22	GLOBAL	Cartesian	3048.00	0.00	18288.00
23	GLOBAL	Cartesian	3048.00	0.00	21945.60
24	GLOBAL	Cartesian	3048.00	0.00	25603.20
25	GLOBAL	Cartesian	9144.00	0.00	0.00
26	GLOBAL	Cartesian	9144.00	0.00	3657.60
27	GLOBAL	Cartesian	9144.00	0.00	7315.20
28	GLOBAL	Cartesian	9144.00	0.00	10972.80
29	GLOBAL	Cartesian	9144.00	0.00	14630.40
30	GLOBAL	Cartesian	9144.00	0.00	18288.00
31	GLOBAL	Cartesian	9144.00	0.00	21945.60
32	GLOBAL	Cartesian	9144.00	0.00	25603.20

4.2.1.2. Joint restraints

Table 2: Joint Restraint Assignments

Joint	U1	U2	U3	R1	R2	R3
1	Yes	Yes	Yes	Yes	No	Yes
9	Yes	Yes	Yes	Yes	No	Yes
17	Yes	Yes	Yes	Yes	No	Yes
25	Yes	Yes	Yes	Yes	No	Yes

4.2.1.3. Element connectivity

Table 3: Connectivity – Frame

Frame	Joint I	Joint J	Length (mm)
1	1	2	3657.60
2	2	3	3657.60
3	3	4	3657.60
4	4	5	3657.60
5	5	6	3657.60
6	6	7	3657.60
7	7	8	3657.60
8	9	10	3657.60
9	10	11	3657.60
10	11	12	3657.60
11	12	13	3657.60
12	13	14	3657.60
13	14	15	3657.60
14	15	16	3657.60
15	17	18	3657.60
16	18	19	3657.60
17	19	20	3657.60
18	20	21	3657.60
19	21	22	3657.60
20	22	23	3657.60
21	23	24	3657.60
22	25	26	3657.60
23	26	27	3657.60
24	27	28	3657.60

Frame	Joint I	Joint J	Length (mm)
25	28	29	3657.60
26	29	30	3657.60
27	30	31	3657.60
28	31	32	3657.60
29	2	10	6096.00
30	3	11	6096.00
31	4	12	6096.00
32	5	13	6096.00
33	6	14	6096.00
34	7	15	6096.00
35	8	16	6096.00
36	10	18	6096.00
37	11	19	6096.00
38	12	20	6096.00
39	13	21	6096.00
40	14	22	6096.00
41	15	23	6096.00
42	16	24	6096.00
43	18	26	6096.00
44	19	27	6096.00
45	20	28	6096.00
46	21	29	6096.00
47	22	30	6096.00
48	23	31	6096.00
49	24	32	6096.00

Table 4: Frame Section Assignments

Frame	AnalSect	Design Section	Material Properties
1	Column	N.A.	Default
2	Column	N.A.	Default
3	Column	N.A.	Default
4	Column	N.A.	Default
5	Column	N.A.	Default
6	Column	N.A.	Default
7	Column	N.A.	Default
8	Column	N.A.	Default
9	Column	N.A.	Default
10	Column	N.A.	Default
11	Column	N.A.	Default
12	Column	N.A.	Default
13	Column	N.A.	Default
14	Column	N.A.	Default
15	Column	N.A.	Default
16	Column	N.A.	Default

Frame	AnalSect	Design Section	Material Properties
17	Column	N.A.	Default
18	Column	N.A.	Default
19	Column	N.A.	Default
20	Column	N.A.	Default
21	Column	N.A.	Default
22	Column	N.A.	Default
23	Column	N.A.	Default
24	Column	N.A.	Default
25	Column	N.A.	Default
26	Column	N.A.	Default
27	Column	N.A.	Default
28	Column	N.A.	Default
29	Beam	N.A.	Default
30	Beam	N.A.	Default
31	Beam	N.A.	Default
32	Beam	N.A.	Default
33	Beam	N.A.	Default
34	Beam	N.A.	Default
35	Beam	N.A.	Default
36	Beam	N.A.	Default
37	Beam	N.A.	Default
38	Beam	N.A.	Default
39	Beam	N.A.	Default
40	Beam	N.A.	Default
41	Beam	N.A.	Default
42	Beam	N.A.	Default
43	Beam	N.A.	Default
44	Beam	N.A.	Default
45	Beam	N.A.	Default
46	Beam	N.A.	Default
47	Beam	N.A.	Default
48	Beam	N.A.	Default
49	Beam	N.A.	Default

4.2.2. MATERIAL PROPERTIES

This section provides material property information for materials used in the model.

Table 5: Material Properties 02 - Basic Mechanical Properties

Material	Unit Weight (KN/mm3)	Unit Mass (KN-s2/mm4)	E1 (KN/mm2)	G12 (KN/mm2)	U12	A1 1/C
A615Gr60	7.6973E-08	7.8490E-12	199.94798			1.1700E-05
A992Fy50	7.6973E-08	7.8490E-12	199.94798	76.90307	0.300000	1.1700E-05
Concrete	2.3563E-08	2.4028E-12	24.82113	10.34214	0.200000	9.9000E-06

Table 6: Material Properties 03a - Steel Data

Material	Fy (KN/mm2)	Fu (KN/mm2)	Final Slope
A992Fy50	0.34474	0.44816	-0.100000

Table 7: Material Properties 03b - Concrete Data

Material	Fc (KN/mm2)	Final Slope
Concrete	0.02758	-0.100000

Table 8: Material Properties 03e - Rebar Data

Material	Fy (KN/mm2)	Fu (KN/mm2)	FinalSlope
A615Gr60	0.41369	0.62053	-0.100000

4.2.3 SECTION PROPERTIES

This section provides section property information for objects used in the model.

4.2.3.1 Frames

Table 9: Frame Section Properties 01 - General, Part 1 of 4

Section Name	Material	Shape	t3 (mm)	t2 (mm)	tf (mm)	tw (mm)	t2b (mm)	tfb (mm)
Beam	Concrete	Rectangular	584.200	584.200				
Column	Concrete	Rectangular	736.600	736.600				
FSEC1	A992Fy50	I/Wide Flange	304.800	127.000	9.652	6.350	127.000	9.652

Table 9: Frame Section Properties 01 - General, Part 2 of 4

SectionName	Area (mm2)	TorsConst (mm4)	I33 (mm4)	I22 (mm4)	AS2 (mm2)	AS3 (mm2)
Beam	341289.64	1.640E+10	9706551531	9706551531	284408.03	284408.03
Column	542579.56	4.146E+10	2.453E+10	2.453E+10	452149.63	452149.63
FSEC1	4264.51	96511.77	65724174.70	3301257.17	1935.48	2043.01

Table 9: Frame Section Properties 01 - General, Part 3 of 4

Section Name	S33 (mm3)	S22 (mm3)	Z33 (mm3)	Z22 (mm3)	R33 (mm)	R22 (mm)
Beam	33230234.61	33230234.61	49845351.92	49845351.92	168.644	168.644
Column	66610683.98	66610683.98	99916025.97	99916025.97	212.638	212.638
FSEC1	431260.99	51988.30	491187.50	80716.53	124.145	27.823

Table 9: Frame Section Properties 01 - General, Part 4 of 4

Section Name	A Mod	A2Mod	A3Mod	J Mod	I2Mod	I3Mod	M Mod	W Mod
Beam	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

Section Name	A Mod	A2Mod	A3Mod	J Mod	I2Mod	I3Mod	M Mod	W Mod
Column	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
FSEC1	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

Table 10: Frame Section Properties 02 - Concrete Column, Part 1 of 2

Section Name	Rebar MatL	Rebar MatC	Reinforcement Configuration	Lateral Reinfor-cement	Cover (mm)	NumBars3 Dir	NumBars2 Dir
Beam	A615Gr60	A615Gr60	Rectangular	Ties	38.100	3	3
Column	A615Gr60	A615Gr60	Rectangular	Ties	38.100	3	3

Table 10: Frame Section Properties 02 - Concrete Column, Part 2 of 2

Section Name	Bar Size L	Bar Size C	Spacing C (mm)	NumCBars2	NumCBars3
Beam	#9	#4	152.400	3	3
Column	#9	#4	152.400	3	3

4.2.4 LOAD PATTERNS

This section provides loading information as applied to the model.

4.2.4.1 Definitions

Table 11: Load Pattern Definitions

Load Pattern	DesignType	SelfWtMult	AutoLoad
DEAD	DEAD	1.000000	

4.2.5 LOAD CASES

This section provides load case information.

4.2.5.1 Definitions

Table 12: Load Case Definitions

Case	Type	Initial Condition	Modal Case	Base Case	DesActOpt	DesignAct
DEAD	LinStatic	Zero			Prog Det	Non-Composite
MODAL	LinModal	Zero			Prog Det	Other

4.2.5.2 Static case load assignments

Table 13: Case - Static 1 - Load Assignments

Case	Load Type	Load Name	Load SF
DEAD	Load pattern	DEAD	1.000000

4.2.5.3 Response spectrum case load assignments

Table 14: Function - Response Spectrum – User

Name	Period (Sec)	Acceleration	Func Damp
UNIFRS	0.000000	1.000000	0.050000
UNIFRS	1.000000	1.000000	

4.2.6 STRUCTURE RESULTS

This section provides structure results, including items such as structural periods and base reactions

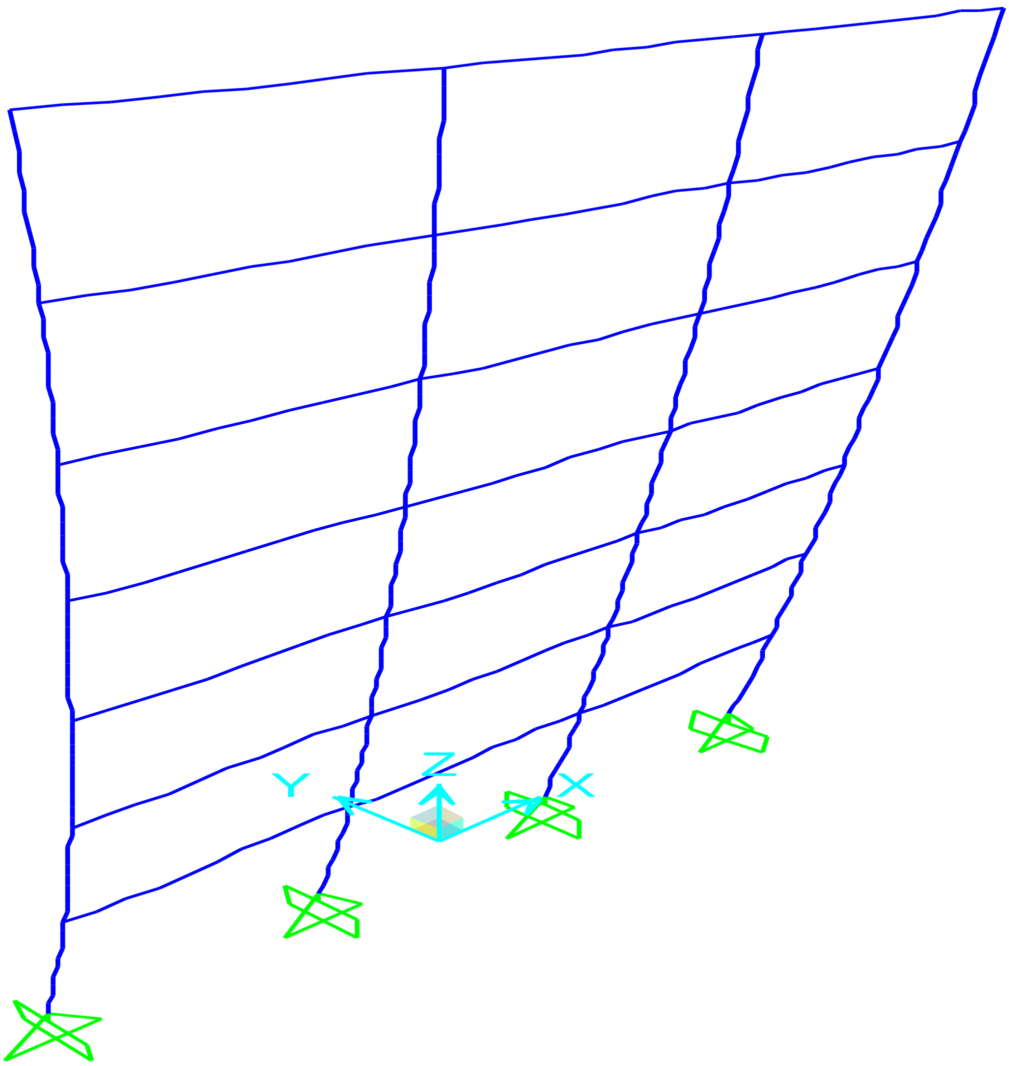

Figure 2: Deformed shape of framed structure

4.2.6.1 Mass summary

Table 15: Assembled Joint Masses

Joint	U1 (KN-s2/mm)	U2 (KN-s2/mm)	U3 (KN-s2/mm)	R1 (KN-s2/mm)	R2 (KN-s2/mm)	R3 (KN-s2/mm)
1	0.002384	0.002384	0.002384	0.00	0.00	0.00
2	0.007268	0.007268	0.007268	0.00	0.00	0.00
3	0.007268	0.007268	0.007268	0.00	0.00	0.00
4	0.007268	0.007268	0.007268	0.00	0.00	0.00
5	0.007268	0.007268	0.007268	0.00	0.00	0.00
6	0.007268	0.007268	0.007268	0.00	0.00	0.00
7	0.007268	0.007268	0.007268	0.00	0.00	0.00
8	0.004884	0.004884	0.004884	0.00	0.00	0.00
9	0.002384	0.002384	0.002384	0.00	0.00	0.00
10	0.009767	0.009767	0.009767	0.00	0.00	0.00
11	0.009767	0.009767	0.009767	0.00	0.00	0.00
12	0.009767	0.009767	0.009767	0.00	0.00	0.00
13	0.009767	0.009767	0.009767	0.00	0.00	0.00
14	0.009767	0.009767	0.009767	0.00	0.00	0.00
15	0.009767	0.009767	0.009767	0.00	0.00	0.00
16	0.007383	0.007383	0.007383	0.00	0.00	0.00
17	0.002384	0.002384	0.002384	0.00	0.00	0.00
18	0.009767	0.009767	0.009767	0.00	0.00	0.00
19	0.009767	0.009767	0.009767	0.00	0.00	0.00
20	0.009767	0.009767	0.009767	0.00	0.00	0.00
21	0.009767	0.009767	0.009767	0.00	0.00	0.00
22	0.009767	0.009767	0.009767	0.00	0.00	0.00
23	0.009767	0.009767	0.009767	0.00	0.00	0.00
24	0.007383	0.007383	0.007383	0.00	0.00	0.00
25	0.002384	0.002384	0.002384	0.00	0.00	0.00
26	0.007268	0.007268	0.007268	0.00	0.00	0.00
27	0.007268	0.007268	0.007268	0.00	0.00	0.00
28	0.007268	0.007268	0.007268	0.00	0.00	0.00
29	0.007268	0.007268	0.007268	0.00	0.00	0.00
30	0.007268	0.007268	0.007268	0.00	0.00	0.00
31	0.007268	0.007268	0.007268	0.00	0.00	0.00
32	0.004884	0.004884	0.004884	0.00	0.00	0.00

4.2.6.2 Base reactions

Table 16: Base Reactions

Output Case	Global FX (KN)	Global FY (KN)	Global FZ (KN)	Global MX (KN-mm)	Global MY (KN-mm)	Global MZ (KN-mm)
DEAD	-215.000	0.000	2338.820	0.00	-4114800.00	0.00

4.2.7 JOINT RESULTS

This section provides joint results, including items such as displacements and reactions.

Table 17: Joint Displacements

Joint	Output Case	U1 (mm)	U2 (mm)	U3 (mm)	R1 (Radians)	R2 (Radians)	R3 (Radians)
1	DEAD	0.000000	0.000000	0.000000	0.000000	0.001340	0.000000
2	DEAD	7.307325	0.000000	0.000000	0.000000	0.000869	0.000000
3	DEAD	9.764356	0.000000	0.000000	0.000000	0.000654	0.000000
4	DEAD	10.974324	0.000000	0.000000	0.000000	0.000576	0.000000
5	DEAD	11.899297	0.000000	0.000000	0.000000	0.000495	0.000000
6	DEAD	13.671292	0.000000	0.000000	0.000000	0.000400	0.000000
7	DEAD	15.000999	0.000000	0.000000	0.000000	0.000277	0.000000
8	DEAD	15.856055	0.000000	0.000000	0.000000	0.000207	0.000000
9	DEAD	0.000000	0.000000	0.000000	0.000000	0.001407	0.000000
10	DEAD	6.904342	0.000000	0.000000	0.000000	0.000723	0.000000
11	DEAD	9.302304	0.000000	0.000000	0.000000	0.000580	0.000000
12	DEAD	9.583457	0.000000	0.000000	0.000000	0.000499	0.000000
13	DEAD	9.823452	0.000000	0.000000	0.000000	0.000430	0.000000
14	DEAD	11.765034	0.000000	0.000000	0.000000	0.000342	0.000000
15	DEAD	13.344034	0.000000	0.000000	0.000000	0.000243	0.000000
16	DEAD	13.780555	0.000000	0.000000	0.000000	0.000139	0.000000
17	DEAD	0.000000	0.000000	0.000000	0.000000	0.001407	0.000000
18	DEAD	6.689582	0.000000	0.000000	0.000000	0.000723	0.000000
19	DEAD	8.243201	0.000000	0.000000	0.000000	0.000578	0.000000
20	DEAD	8.858002	0.000000	0.000000	0.000000	0.000496	0.000000
21	DEAD	9.458212	0.000000	0.000000	0.000000	0.000426	0.000000
22	DEAD	9.870546	0.000000	0.000000	0.000000	0.000338	0.000000
23	DEAD	12.334984	0.000000	0.000000	0.000000	0.000238	0.000000
24	DEAD	12.932055	0.000000	0.000000	0.000000	0.000132	0.000000
25	DEAD	0.000000	0.000000	0.000000	0.000000	0.001357	0.000000
26	DEAD	6.493204	0.000000	0.000000	0.000000	0.000833	0.000000
27	DEAD	7.649578	0.000000	0.000000	0.000000	0.000627	0.000000
28	DEAD	8.118934	0.000000	0.000000	0.000000	0.000546	0.000000
29	DEAD	8.245543	0.000000	0.000000	0.000000	0.000465	0.000000
30	DEAD	8.345577	0.000000	0.000000	0.000000	0.000367	0.000000
31	DEAD	11.876402	0.000000	0.000000	0.000000	0.000254	0.000000
32	DEAD	11.674055	0.000000	0.000000	0.000000	0.000134	0.000000

Table 18: Joint Reactions

Joint	Output Case	F1 (KN)	F2 (KN)	F3 (KN)	M1 (KN-mm)	M2 (KN-mm)	M3 (KN-mm)
1	DEAD	-42.893	0.000	278.339	0.00	0.00	0.00
9	DEAD	-62.198	0.000	668.079	0.00	0.00	0.00
17	DEAD	-62.190	0.000	662.055	0.00	0.00	0.00
25	DEAD	-47.718	0.000	730.347	0.00	0.00	0.00

4.2.8 FRAME RESULTS

This section provides frame force results.

Table 19: Element Forces - Frames, Part 1 of 4

Frame	Station (mm)	Output Case	P (KN)	V2 (KN)	V3 (KN)
1	0.00	DEAD	-278.339	42.893	0.000
1	1828.80	DEAD	-254.958	42.893	0.000
1	3657.60	DEAD	-231.577	42.893	0.000
2	0.00	DEAD	-266.092	21.709	0.000
2	1828.80	DEAD	-242.711	21.709	0.000
2	3657.60	DEAD	-219.330	21.709	0.000
3	0.00	DEAD	-239.237	27.741	0.000
3	1828.80	DEAD	-215.856	27.741	0.000
3	3657.60	DEAD	-192.475	27.741	0.000
4	0.00	DEAD	-205.604	23.382	0.000
4	1828.80	DEAD	-182.223	23.382	0.000
4	3657.60	DEAD	-158.842	23.382	0.000
5	0.00	DEAD	-165.689	18.001	0.000
5	1828.80	DEAD	-142.308	18.001	0.000
5	3657.60	DEAD	-118.927	18.001	0.000
6	0.00	DEAD	-118.456	12.157	0.000
6	1828.80	DEAD	-95.075	12.157	0.000
6	3657.60	DEAD	-71.694	12.157	0.000
7	0.00	DEAD	-62.576	-4.093	0.000
7	1828.80	DEAD	-39.195	-4.093	0.000
7	3657.60	DEAD	-15.814	-4.093	0.000
8	0.00	DEAD	-668.079	62.198	0.000
8	1828.80	DEAD	-644.698	62.198	0.000
8	3657.60	DEAD	-621.317	62.198	0.000
9	0.00	DEAD	-568.118	75.306	0.000
9	1828.80	DEAD	-544.737	75.306	0.000
9	3657.60	DEAD	-521.356	75.306	0.000
10	0.00	DEAD	-471.806	64.636	0.000
10	1828.80	DEAD	-448.425	64.636	0.000
10	3657.60	DEAD	-425.044	64.636	0.000
11	0.00	DEAD	-376.104	58.345	0.000
11	1828.80	DEAD	-352.723	58.345	0.000
11	3657.60	DEAD	-329.342	58.345	0.000
12	0.00	DEAD	-281.353	48.185	0.000
12	1828.80	DEAD	-257.972	48.185	0.000
12	3657.60	DEAD	-234.591	48.185	0.000
13	0.00	DEAD	-187.265	34.742	0.000
13	1828.80	DEAD	-163.884	34.742	0.000

Frame	Station (mm)	Output Case	P (KN)	V2 (KN)	V3 (KN)
13	3657.60	DEAD	-140.503	34.742	0.000
14	0.00	DEAD	-94.240	20.867	0.000
14	1828.80	DEAD	-70.859	20.867	0.000
14	3657.60	DEAD	-47.478	20.867	0.000
15	0.00	DEAD	-662.055	62.190	0.000
15	1828.80	DEAD	-638.674	62.190	0.000
15	3657.60	DEAD	-615.293	62.190	0.000
16	0.00	DEAD	-570.155	75.836	0.000
16	1828.80	DEAD	-546.774	75.836	0.000
16	3657.60	DEAD	-523.393	75.836	0.000
17	0.00	DEAD	-475.801	65.909	0.000
17	1828.80	DEAD	-452.420	65.909	0.000
17	3657.60	DEAD	-429.039	65.909	0.000
18	0.00	DEAD	-381.431	60.056	0.000
18	1828.80	DEAD	-358.050	60.056	0.000
18	3657.60	DEAD	-334.670	60.056	0.000
19	0.00	DEAD	-286.677	50.259	0.000
19	1828.80	DEAD	-263.296	50.259	0.000
19	3657.60	DEAD	-239.915	50.259	0.000
20	0.00	DEAD	-191.580	37.092	0.000
20	1828.80	DEAD	-168.199	37.092	0.000
20	3657.60	DEAD	-144.818	37.092	0.000
21	0.00	DEAD	-96.075	23.878	0.000
21	1828.80	DEAD	-72.694	23.878	0.000
21	3657.60	DEAD	-49.313	23.878	0.000
22	0.00	DEAD	-730.347	47.718	0.000
22	1828.80	DEAD	-706.966	47.718	0.000
22	3657.60	DEAD	-683.585	47.718	0.000
23	0.00	DEAD	-600.337	37.149	0.000
23	1828.80	DEAD	-576.956	37.149	0.000
23	3657.60	DEAD	-553.575	37.149	0.000
24	0.00	DEAD	-483.741	41.714	0.000
24	1828.80	DEAD	-460.360	41.714	0.000
24	3657.60	DEAD	-436.980	41.714	0.000
25	0.00	DEAD	-373.329	38.217	0.000
25	1828.80	DEAD	-349.948	38.217	0.000
25	3657.60	DEAD	-326.567	38.217	0.000
26	0.00	DEAD	-268.633	33.555	0.000
26	1828.80	DEAD	-245.252	33.555	0.000
26	3657.60	DEAD	-221.871	33.555	0.000
27	0.00	DEAD	-170.934	26.009	0.000
27	1828.80	DEAD	-147.553	26.009	0.000
27	3657.60	DEAD	-124.172	26.009	0.000
28	0.00	DEAD	-81.227	19.347	0.000
28	1828.80	DEAD	-57.846	19.347	0.000
28	3657.60	DEAD	-34.465	19.347	0.000
29	0.00	DEAD	0.000	34.515	0.000
29	609.60	DEAD	0.000	39.417	0.000
29	1219.20	DEAD	0.000	44.320	0.000
29	1828.80	DEAD	0.000	49.222	0.000
29	2438.40	DEAD	0.000	54.124	0.000
29	3048.00	DEAD	0.000	59.027	0.000
29	3657.60	DEAD	0.000	63.929	0.000
29	4267.20	DEAD	0.000	68.831	0.000
29	4876.80	DEAD	0.000	73.734	0.000
29	5486.40	DEAD	0.000	78.636	0.000
29	6096.00	DEAD	0.000	83.538	0.000
30	0.00	DEAD	0.000	19.906	0.000
30	609.60	DEAD	0.000	24.809	0.000

Frame	Station (mm)	Output Case	P (KN)	V2 (KN)	V3 (KN)
30	1219.20	DEAD	0.000	29.711	0.000
30	1828.80	DEAD	0.000	34.613	0.000
30	2438.40	DEAD	0.000	39.516	0.000
30	3048.00	DEAD	0.000	44.418	0.000
30	3657.60	DEAD	0.000	49.320	0.000
30	4267.20	DEAD	0.000	54.223	0.000
30	4876.80	DEAD	0.000	59.125	0.000
30	5486.40	DEAD	0.000	64.027	0.000
30	6096.00	DEAD	0.000	68.929	0.000
31	0.00	DEAD	0.000	13.129	0.000
31	609.60	DEAD	0.000	18.032	0.000
31	1219.20	DEAD	0.000	22.934	0.000
31	1828.80	DEAD	0.000	27.836	0.000
31	2438.40	DEAD	0.000	32.738	0.000
31	3048.00	DEAD	0.000	37.641	0.000
31	3657.60	DEAD	0.000	42.543	0.000
31	4267.20	DEAD	0.000	47.445	0.000
31	4876.80	DEAD	0.000	52.348	0.000
31	5486.40	DEAD	0.000	57.250	0.000
31	6096.00	DEAD	0.000	62.152	0.000
32	0.00	DEAD	0.000	6.847	0.000
32	609.60	DEAD	0.000	11.749	0.000
32	1219.20	DEAD	0.000	16.651	0.000
32	1828.80	DEAD	0.000	21.553	0.000
32	2438.40	DEAD	0.000	26.456	0.000
32	3048.00	DEAD	0.000	31.358	0.000
32	3657.60	DEAD	0.000	36.260	0.000
32	4267.20	DEAD	0.000	41.163	0.000
32	4876.80	DEAD	0.000	46.065	0.000
32	5486.40	DEAD	0.000	50.967	0.000
32	6096.00	DEAD	0.000	55.870	0.000
33	0.00	DEAD	0.000	-0.471	0.000
33	609.60	DEAD	0.000	4.431	0.000
33	1219.20	DEAD	0.000	9.334	0.000
33	1828.80	DEAD	0.000	14.236	0.000
33	2438.40	DEAD	0.000	19.138	0.000
33	3048.00	DEAD	0.000	24.041	0.000
33	3657.60	DEAD	0.000	28.943	0.000
33	4267.20	DEAD	0.000	33.845	0.000
33	4876.80	DEAD	0.000	38.748	0.000
33	5486.40	DEAD	0.000	43.650	0.000
33	6096.00	DEAD	0.000	48.552	0.000
34	0.00	DEAD	0.000	-9.118	0.000
34	609.60	DEAD	0.000	-4.216	0.000
34	1219.20	DEAD	0.000	0.687	0.000
34	1828.80	DEAD	0.000	5.589	0.000
34	2438.40	DEAD	0.000	10.491	0.000
34	3048.00	DEAD	0.000	15.394	0.000
34	3657.60	DEAD	0.000	20.296	0.000
34	4267.20	DEAD	0.000	25.198	0.000
34	4876.80	DEAD	0.000	30.100	0.000
34	5486.40	DEAD	0.000	35.003	0.000
34	6096.00	DEAD	0.000	39.905	0.000
35	0.00	DEAD	0.000	-15.814	0.000
35	609.60	DEAD	0.000	-10.911	0.000
35	1219.20	DEAD	0.000	-6.009	0.000
35	1828.80	DEAD	0.000	-1.107	0.000
35	2438.40	DEAD	0.000	3.795	0.000
35	3048.00	DEAD	0.000	8.698	0.000

Frame	Station (mm)	Output Case	P (KN)	V2 (KN)	V3 (KN)
35	3657.60	DEAD	0.000	13.600	0.000
35	4267.20	DEAD	0.000	18.502	0.000
35	4876.80	DEAD	0.000	23.405	0.000
35	5486.40	DEAD	0.000	28.307	0.000
35	6096.00	DEAD	0.000	33.209	0.000
36	0.00	DEAD	0.000	30.340	0.000
36	609.60	DEAD	0.000	35.242	0.000
36	1219.20	DEAD	0.000	40.144	0.000
36	1828.80	DEAD	0.000	45.047	0.000
36	2438.40	DEAD	0.000	49.949	0.000
36	3048.00	DEAD	0.000	54.851	0.000
36	3657.60	DEAD	0.000	59.754	0.000
36	4267.20	DEAD	0.000	64.656	0.000
36	4876.80	DEAD	0.000	69.558	0.000
36	5486.40	DEAD	0.000	74.460	0.000
36	6096.00	DEAD	0.000	79.363	0.000
37	0.00	DEAD	0.000	19.379	0.000
37	609.60	DEAD	0.000	24.282	0.000
37	1219.20	DEAD	0.000	29.184	0.000
37	1828.80	DEAD	0.000	34.086	0.000
37	2438.40	DEAD	0.000	38.989	0.000
37	3048.00	DEAD	0.000	43.891	0.000
37	3657.60	DEAD	0.000	48.793	0.000
37	4267.20	DEAD	0.000	53.696	0.000
37	4876.80	DEAD	0.000	58.598	0.000
37	5486.40	DEAD	0.000	63.500	0.000
37	6096.00	DEAD	0.000	68.402	0.000
38	0.00	DEAD	0.000	13.212	0.000
38	609.60	DEAD	0.000	18.114	0.000
38	1219.20	DEAD	0.000	23.016	0.000
38	1828.80	DEAD	0.000	27.919	0.000
38	2438.40	DEAD	0.000	32.821	0.000
38	3048.00	DEAD	0.000	37.723	0.000
38	3657.60	DEAD	0.000	42.626	0.000
38	4267.20	DEAD	0.000	47.528	0.000
38	4876.80	DEAD	0.000	52.430	0.000
38	5486.40	DEAD	0.000	57.333	0.000
38	6096.00	DEAD	0.000	62.235	0.000
39	0.00	DEAD	0.000	7.881	0.000
39	609.60	DEAD	0.000	12.783	0.000
39	1219.20	DEAD	0.000	17.685	0.000
39	1828.80	DEAD	0.000	22.588	0.000
39	2438.40	DEAD	0.000	27.490	0.000
39	3048.00	DEAD	0.000	32.392	0.000
39	3657.60	DEAD	0.000	37.295	0.000
39	4267.20	DEAD	0.000	42.197	0.000
39	4876.80	DEAD	0.000	47.099	0.000
39	5486.40	DEAD	0.000	52.001	0.000
39	6096.00	DEAD	0.000	56.904	0.000
40	0.00	DEAD	0.000	1.226	0.000
40	609.60	DEAD	0.000	6.129	0.000
40	1219.20	DEAD	0.000	11.031	0.000
40	1828.80	DEAD	0.000	15.933	0.000
40	2438.40	DEAD	0.000	20.836	0.000
40	3048.00	DEAD	0.000	25.738	0.000
40	3657.60	DEAD	0.000	30.640	0.000
40	4267.20	DEAD	0.000	35.543	0.000
40	4876.80	DEAD	0.000	40.445	0.000
40	5486.40	DEAD	0.000	45.347	0.000

Frame	Station (mm)	Output Case	P (KN)	V2 (KN)	V3 (KN)
40	6096.00	DEAD	0.000	50.250	0.000
41	0.00	DEAD	0.000	-6.359	0.000
41	609.60	DEAD	0.000	-1.456	0.000
41	1219.20	DEAD	0.000	3.446	0.000
41	1828.80	DEAD	0.000	8.348	0.000
41	2438.40	DEAD	0.000	13.251	0.000
41	3048.00	DEAD	0.000	18.153	0.000
41	3657.60	DEAD	0.000	23.055	0.000
41	4267.20	DEAD	0.000	27.958	0.000
41	4876.80	DEAD	0.000	32.860	0.000
41	5486.40	DEAD	0.000	37.762	0.000
41	6096.00	DEAD	0.000	42.664	0.000
42	0.00	DEAD	0.000	-14.268	0.000
42	609.60	DEAD	0.000	-9.366	0.000
42	1219.20	DEAD	0.000	-4.464	0.000
42	1828.80	DEAD	0.000	0.439	0.000
42	2438.40	DEAD	0.000	5.341	0.000
42	3048.00	DEAD	0.000	10.243	0.000
42	3657.60	DEAD	0.000	15.146	0.000
42	4267.20	DEAD	0.000	20.048	0.000
42	4876.80	DEAD	0.000	24.950	0.000
42	5486.40	DEAD	0.000	29.853	0.000
42	6096.00	DEAD	0.000	34.755	0.000
43	0.00	DEAD	0.000	34.225	0.000
43	609.60	DEAD	0.000	39.127	0.000
43	1219.20	DEAD	0.000	44.029	0.000
43	1828.80	DEAD	0.000	48.932	0.000
43	2438.40	DEAD	0.000	53.834	0.000
43	3048.00	DEAD	0.000	58.736	0.000
43	3657.60	DEAD	0.000	63.639	0.000
43	4267.20	DEAD	0.000	68.541	0.000
43	4876.80	DEAD	0.000	73.443	0.000
43	5486.40	DEAD	0.000	78.345	0.000
43	6096.00	DEAD	0.000	83.248	0.000
44	0.00	DEAD	0.000	20.811	0.000
44	609.60	DEAD	0.000	25.713	0.000
44	1219.20	DEAD	0.000	30.615	0.000
44	1828.80	DEAD	0.000	35.518	0.000
44	2438.40	DEAD	0.000	40.420	0.000
44	3048.00	DEAD	0.000	45.322	0.000
44	3657.60	DEAD	0.000	50.225	0.000
44	4267.20	DEAD	0.000	55.127	0.000
44	4876.80	DEAD	0.000	60.029	0.000
44	5486.40	DEAD	0.000	64.932	0.000
44	6096.00	DEAD	0.000	69.834	0.000
45	0.00	DEAD	0.000	14.627	0.000
45	609.60	DEAD	0.000	19.530	0.000
45	1219.20	DEAD	0.000	24.432	0.000
45	1828.80	DEAD	0.000	29.334	0.000
45	2438.40	DEAD	0.000	34.237	0.000
45	3048.00	DEAD	0.000	39.139	0.000
45	3657.60	DEAD	0.000	44.041	0.000
45	4267.20	DEAD	0.000	48.944	0.000
45	4876.80	DEAD	0.000	53.846	0.000
45	5486.40	DEAD	0.000	58.748	0.000
45	6096.00	DEAD	0.000	63.650	0.000
46	0.00	DEAD	0.000	8.911	0.000
46	609.60	DEAD	0.000	13.814	0.000
46	1219.20	DEAD	0.000	18.716	0.000

Frame	Station (mm)	Output Case	P (KN)	V2 (KN)	V3 (KN)
46	1828.80	DEAD	0.000	23.618	0.000
46	2438.40	DEAD	0.000	28.521	0.000
46	3048.00	DEAD	0.000	33.423	0.000
46	3657.60	DEAD	0.000	38.325	0.000
46	4267.20	DEAD	0.000	43.228	0.000
46	4876.80	DEAD	0.000	48.130	0.000
46	5486.40	DEAD	0.000	53.032	0.000
46	6096.00	DEAD	0.000	57.934	0.000
47	0.00	DEAD	0.000	1.914	0.000
47	609.60	DEAD	0.000	6.816	0.000
47	1219.20	DEAD	0.000	11.719	0.000
47	1828.80	DEAD	0.000	16.621	0.000
47	2438.40	DEAD	0.000	21.523	0.000
47	3048.00	DEAD	0.000	26.426	0.000
47	3657.60	DEAD	0.000	31.328	0.000
47	4267.20	DEAD	0.000	36.230	0.000
47	4876.80	DEAD	0.000	41.133	0.000
47	5486.40	DEAD	0.000	46.035	0.000
47	6096.00	DEAD	0.000	50.937	0.000
48	0.00	DEAD	0.000	-6.079	0.000
48	609.60	DEAD	0.000	-1.176	0.000
48	1219.20	DEAD	0.000	3.726	0.000
48	1828.80	DEAD	0.000	8.628	0.000
48	2438.40	DEAD	0.000	13.531	0.000
48	3048.00	DEAD	0.000	18.433	0.000
48	3657.60	DEAD	0.000	23.335	0.000
48	4267.20	DEAD	0.000	28.238	0.000
48	4876.80	DEAD	0.000	33.140	0.000
48	5486.40	DEAD	0.000	38.042	0.000
48	6096.00	DEAD	0.000	42.944	0.000
49	0.00	DEAD	0.000	-14.558	0.000
49	609.60	DEAD	0.000	-9.656	0.000
49	1219.20	DEAD	0.000	-4.753	0.000
49	1828.80	DEAD	0.000	0.149	0.000
49	2438.40	DEAD	0.000	5.051	0.000
49	3048.00	DEAD	0.000	9.954	0.000
49	3657.60	DEAD	0.000	14.856	0.000
49	4267.20	DEAD	0.000	19.758	0.000
49	4876.80	DEAD	0.000	24.661	0.000
49	5486.40	DEAD	0.000	29.563	0.000
49	6096.00	DEAD	0.000	34.465	0.000

Table 19: Element Forces - Frames, Part 4 of 4

Frame	Station (mm)	Output Case	x3S11Min (mm)
1	0.00	DEAD	-368.300
1	1828.80	DEAD	-368.300
1	3657.60	DEAD	-368.300
2	0.00	DEAD	-368.300
2	1828.80	DEAD	-368.300
2	3657.60	DEAD	-368.300
3	0.00	DEAD	-368.300
3	1828.80	DEAD	-368.300
3	3657.60	DEAD	-368.300

Frame	Station (mm)	Output Case	x3S11Min (mm)
4	0.00	DEAD	-368.300
4	1828.80	DEAD	-368.300
4	3657.60	DEAD	-368.300
5	0.00	DEAD	-368.300
5	1828.80	DEAD	-368.300
5	3657.60	DEAD	-368.300
6	0.00	DEAD	-368.300
6	1828.80	DEAD	-368.300
6	3657.60	DEAD	-368.300
7	0.00	DEAD	-368.300
7	1828.80	DEAD	-368.300
7	3657.60	DEAD	-368.300
8	0.00	DEAD	-368.300
8	1828.80	DEAD	-368.300
8	3657.60	DEAD	-368.300
9	0.00	DEAD	-368.300
9	1828.80	DEAD	-368.300
9	3657.60	DEAD	-368.300
10	0.00	DEAD	-368.300
10	1828.80	DEAD	-368.300
10	3657.60	DEAD	-368.300
11	0.00	DEAD	-368.300
11	1828.80	DEAD	-368.300
11	3657.60	DEAD	-368.300
12	0.00	DEAD	-368.300
12	1828.80	DEAD	-368.300
12	3657.60	DEAD	-368.300
13	0.00	DEAD	-368.300
13	1828.80	DEAD	-368.300
13	3657.60	DEAD	-368.300
14	0.00	DEAD	-368.300
14	1828.80	DEAD	-368.300
14	3657.60	DEAD	-368.300
15	0.00	DEAD	-368.300
15	1828.80	DEAD	-368.300
15	3657.60	DEAD	-368.300
16	0.00	DEAD	-368.300
16	1828.80	DEAD	-368.300
16	3657.60	DEAD	-368.300
17	0.00	DEAD	-368.300
17	1828.80	DEAD	-368.300
17	3657.60	DEAD	-368.300
18	0.00	DEAD	-368.300
18	1828.80	DEAD	-368.300
18	3657.60	DEAD	-368.300
19	0.00	DEAD	-368.300
19	1828.80	DEAD	-368.300
19	3657.60	DEAD	-368.300
20	0.00	DEAD	-368.300
20	1828.80	DEAD	-368.300
20	3657.60	DEAD	-368.300
21	0.00	DEAD	-368.300
21	1828.80	DEAD	-368.300
21	3657.60	DEAD	-368.300
22	0.00	DEAD	0.000
22	1828.80	DEAD	-368.300
22	3657.60	DEAD	-368.300
23	0.00	DEAD	-368.300
23	1828.80	DEAD	-368.300

Frame	Station (mm)	Output Case	x3S11Min (mm)
23	3657.60	DEAD	-368.300
24	0.00	DEAD	-368.300
24	1828.80	DEAD	-368.300
24	3657.60	DEAD	-368.300
25	0.00	DEAD	-368.300
25	1828.80	DEAD	-368.300
25	3657.60	DEAD	-368.300
26	0.00	DEAD	-368.300
26	1828.80	DEAD	-368.300
26	3657.60	DEAD	-368.300
27	0.00	DEAD	-368.300
27	1828.80	DEAD	-368.300
27	3657.60	DEAD	-368.300
28	0.00	DEAD	-368.300
28	1828.80	DEAD	-368.300
28	3657.60	DEAD	-368.300
29	0.00	DEAD	-292.100
29	609.60	DEAD	-292.100
29	1219.20	DEAD	-292.100
29	1828.80	DEAD	-292.100
29	2438.40	DEAD	-292.100
29	3048.00	DEAD	-292.100
29	3657.60	DEAD	-292.100
29	4267.20	DEAD	-292.100
29	4876.80	DEAD	-292.100
29	5486.40	DEAD	-292.100
29	6096.00	DEAD	-292.100
30	0.00	DEAD	-292.100
30	609.60	DEAD	-292.100
30	1219.20	DEAD	-292.100
30	1828.80	DEAD	-292.100
30	2438.40	DEAD	-292.100
30	3048.00	DEAD	-292.100
30	3657.60	DEAD	-292.100
30	4267.20	DEAD	-292.100
30	4876.80	DEAD	-292.100
30	5486.40	DEAD	-292.100
30	6096.00	DEAD	-292.100
31	0.00	DEAD	-292.100
31	609.60	DEAD	-292.100
31	1219.20	DEAD	-292.100
31	1828.80	DEAD	-292.100
31	2438.40	DEAD	-292.100
31	3048.00	DEAD	-292.100
31	3657.60	DEAD	-292.100
31	4267.20	DEAD	-292.100
31	4876.80	DEAD	-292.100
31	5486.40	DEAD	-292.100
31	6096.00	DEAD	-292.100
32	0.00	DEAD	-292.100
32	609.60	DEAD	-292.100
32	1219.20	DEAD	-292.100
32	1828.80	DEAD	-292.100
32	2438.40	DEAD	-292.100
32	3048.00	DEAD	-292.100
32	3657.60	DEAD	-292.100
32	4267.20	DEAD	-292.100
32	4876.80	DEAD	-292.100
32	5486.40	DEAD	-292.100

Frame	Station (mm)	Output Case	x3S11Min (mm)
32	6096.00	DEAD	-292.100
33	0.00	DEAD	-292.100
33	609.60	DEAD	-292.100
33	1219.20	DEAD	-292.100
33	1828.80	DEAD	-292.100
33	2438.40	DEAD	-292.100
33	3048.00	DEAD	-292.100
33	3657.60	DEAD	-292.100
33	4267.20	DEAD	-292.100
33	4876.80	DEAD	-292.100
33	5486.40	DEAD	-292.100
33	6096.00	DEAD	-292.100
34	0.00	DEAD	-292.100
34	609.60	DEAD	-292.100
34	1219.20	DEAD	-292.100
34	1828.80	DEAD	-292.100
34	2438.40	DEAD	-292.100
34	3048.00	DEAD	-292.100
34	3657.60	DEAD	-292.100
34	4267.20	DEAD	-292.100
34	4876.80	DEAD	-292.100
34	5486.40	DEAD	-292.100
34	6096.00	DEAD	-292.100
35	0.00	DEAD	-292.100
35	609.60	DEAD	-292.100
35	1219.20	DEAD	-292.100
35	1828.80	DEAD	-292.100
35	2438.40	DEAD	-292.100
35	3048.00	DEAD	-292.100
35	3657.60	DEAD	-292.100
35	4267.20	DEAD	-292.100
35	4876.80	DEAD	-292.100
35	5486.40	DEAD	-292.100
35	6096.00	DEAD	-292.100
36	0.00	DEAD	-292.100
36	609.60	DEAD	-292.100
36	1219.20	DEAD	-292.100
36	1828.80	DEAD	-292.100
36	2438.40	DEAD	-292.100
36	3048.00	DEAD	-292.100
36	3657.60	DEAD	-292.100
36	4267.20	DEAD	-292.100
36	4876.80	DEAD	-292.100
36	5486.40	DEAD	-292.100
36	6096.00	DEAD	-292.100
37	0.00	DEAD	-292.100
37	609.60	DEAD	-292.100
37	1219.20	DEAD	-292.100
37	1828.80	DEAD	-292.100
37	2438.40	DEAD	-292.100
37	3048.00	DEAD	-292.100
37	3657.60	DEAD	-292.100
37	4267.20	DEAD	-292.100
37	4876.80	DEAD	-292.100
37	5486.40	DEAD	-292.100
37	6096.00	DEAD	-292.100
38	0.00	DEAD	-292.100
38	609.60	DEAD	-292.100
38	1219.20	DEAD	-292.100

Frame	Station (mm)	Output Case	x3S11Min (mm)
38	1828.80	DEAD	-292.100
38	2438.40	DEAD	-292.100
38	3048.00	DEAD	-292.100
38	3657.60	DEAD	-292.100
38	4267.20	DEAD	-292.100
38	4876.80	DEAD	-292.100
38	5486.40	DEAD	-292.100
38	6096.00	DEAD	-292.100
39	0.00	DEAD	-292.100
39	609.60	DEAD	-292.100
39	1219.20	DEAD	-292.100
39	1828.80	DEAD	-292.100
39	2438.40	DEAD	-292.100
39	3048.00	DEAD	-292.100
39	3657.60	DEAD	-292.100
39	4267.20	DEAD	-292.100
39	4876.80	DEAD	-292.100
39	5486.40	DEAD	-292.100
39	6096.00	DEAD	-292.100
40	0.00	DEAD	-292.100
40	609.60	DEAD	-292.100
40	1219.20	DEAD	-292.100
40	1828.80	DEAD	-292.100
40	2438.40	DEAD	-292.100
40	3048.00	DEAD	-292.100
40	3657.60	DEAD	-292.100
40	4267.20	DEAD	-292.100
40	4876.80	DEAD	-292.100
40	5486.40	DEAD	-292.100
40	6096.00	DEAD	-292.100
41	0.00	DEAD	-292.100
41	609.60	DEAD	-292.100
41	1219.20	DEAD	-292.100
41	1828.80	DEAD	-292.100
41	2438.40	DEAD	-292.100
41	3048.00	DEAD	-292.100
41	3657.60	DEAD	-292.100
41	4267.20	DEAD	-292.100
41	4876.80	DEAD	-292.100
41	5486.40	DEAD	-292.100
41	6096.00	DEAD	-292.100
42	0.00	DEAD	-292.100
42	609.60	DEAD	-292.100
42	1219.20	DEAD	-292.100
42	1828.80	DEAD	-292.100
42	2438.40	DEAD	-292.100
42	3048.00	DEAD	-292.100
42	3657.60	DEAD	-292.100
42	4267.20	DEAD	-292.100
42	4876.80	DEAD	-292.100
42	5486.40	DEAD	-292.100
42	6096.00	DEAD	-292.100
43	0.00	DEAD	-292.100
43	609.60	DEAD	-292.100
43	1219.20	DEAD	-292.100
43	1828.80	DEAD	-292.100
43	2438.40	DEAD	-292.100
43	3048.00	DEAD	-292.100
43	3657.60	DEAD	-292.100

Frame	Station (mm)	Output Case	x3S11Min (mm)
43	4267.20	DEAD	-292.100
43	4876.80	DEAD	-292.100
43	5486.40	DEAD	-292.100
43	6096.00	DEAD	-292.100
44	0.00	DEAD	-292.100
44	609.60	DEAD	-292.100
44	1219.20	DEAD	-292.100
44	1828.80	DEAD	-292.100
44	2438.40	DEAD	-292.100
44	3048.00	DEAD	-292.100
44	3657.60	DEAD	-292.100
44	4267.20	DEAD	-292.100
44	4876.80	DEAD	-292.100
44	5486.40	DEAD	-292.100
44	6096.00	DEAD	-292.100
45	0.00	DEAD	-292.100
45	609.60	DEAD	-292.100
45	1219.20	DEAD	-292.100
45	1828.80	DEAD	-292.100
45	2438.40	DEAD	-292.100
45	3048.00	DEAD	-292.100
45	3657.60	DEAD	-292.100
45	4267.20	DEAD	-292.100
45	4876.80	DEAD	-292.100
45	5486.40	DEAD	-292.100
45	6096.00	DEAD	-292.100
46	0.00	DEAD	-292.100
46	609.60	DEAD	-292.100
46	1219.20	DEAD	-292.100
46	1828.80	DEAD	-292.100
46	2438.40	DEAD	-292.100
46	3048.00	DEAD	-292.100
46	3657.60	DEAD	-292.100
46	4267.20	DEAD	-292.100
46	4876.80	DEAD	-292.100
46	5486.40	DEAD	-292.100
46	6096.00	DEAD	-292.100
47	0.00	DEAD	-292.100
47	609.60	DEAD	-292.100
47	1219.20	DEAD	-292.100
47	1828.80	DEAD	-292.100
47	2438.40	DEAD	-292.100
47	3048.00	DEAD	-292.100
47	3657.60	DEAD	-292.100
47	4267.20	DEAD	-292.100
47	4876.80	DEAD	-292.100
47	5486.40	DEAD	-292.100
47	6096.00	DEAD	-292.100
48	0.00	DEAD	-292.100
48	609.60	DEAD	-292.100
48	1219.20	DEAD	-292.100
48	1828.80	DEAD	-292.100
48	2438.40	DEAD	-292.100
48	3048.00	DEAD	-292.100
48	3657.60	DEAD	-292.100
48	4267.20	DEAD	-292.100

Frame	Station (mm)	Output Case	x3S11Min (mm)
48	4876.80	DEAD	-292.100
48	5486.40	DEAD	-292.100
48	6096.00	DEAD	-292.100
49	0.00	DEAD	-292.100
49	609.60	DEAD	-292.100
49	1219.20	DEAD	-292.100
49	1828.80	DEAD	-292.100
49	2438.40	DEAD	-292.100
49	3048.00	DEAD	-292.100
49	3657.60	DEAD	-292.100
49	4267.20	DEAD	-292.100
49	4876.80	DEAD	-292.100
49	5486.40	DEAD	-292.100
49	6096.00	DEAD	-292.100

4.3 DESIGN AND ANALYSIS OF SEVEN STOREY WALL FRAMED STRUCTURE AND ANALYSIS FOR WIND LOAD USING SAP v15 2000

4.3.1 MODEL GEOMETRY

This section provides model geometry information, including items such as joint coordinates, joint restraints, and element connectivity.

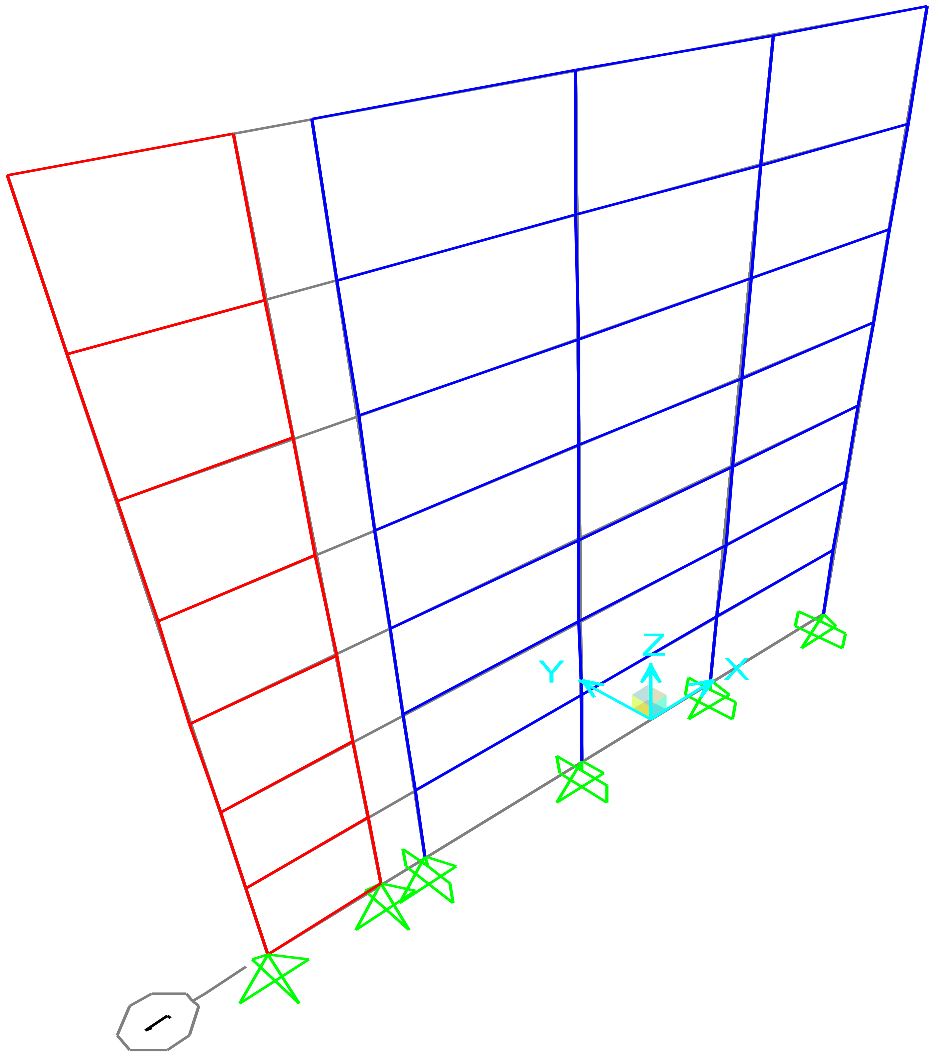

Figure 3: Finite element model

4.3.1.1. Joint coordinates

Table 20: Joint Coordinates

Joint	Coordinate System	Coordinate Type	Global X (mm)	Global Y (mm)	Global Z (mm)
1	GLOBAL	Cartesian	-9144.00	0.00	0.00
2	GLOBAL	Cartesian	-9144.00	0.00	3657.60
3	GLOBAL	Cartesian	-9144.00	0.00	7315.20
4	GLOBAL	Cartesian	-9144.00	0.00	10972.80
5	GLOBAL	Cartesian	-9144.00	0.00	14630.40
6	GLOBAL	Cartesian	-9144.00	0.00	18288.00
7	GLOBAL	Cartesian	-9144.00	0.00	21945.60
8	GLOBAL	Cartesian	-9144.00	0.00	25603.20
9	GLOBAL	Cartesian	-3048.00	0.00	0.00
10	GLOBAL	Cartesian	-3048.00	0.00	3657.60
11	GLOBAL	Cartesian	-3048.00	0.00	7315.20
12	GLOBAL	Cartesian	-3048.00	0.00	10972.80
13	GLOBAL	Cartesian	-3048.00	0.00	14630.40
14	GLOBAL	Cartesian	-3048.00	0.00	18288.00
15	GLOBAL	Cartesian	-3048.00	0.00	21945.60
16	GLOBAL	Cartesian	-3048.00	0.00	25603.20
17	GLOBAL	Cartesian	3048.00	0.00	0.00
18	GLOBAL	Cartesian	3048.00	0.00	3657.60
19	GLOBAL	Cartesian	3048.00	0.00	7315.20
20	GLOBAL	Cartesian	3048.00	0.00	10972.80
21	GLOBAL	Cartesian	3048.00	0.00	14630.40
22	GLOBAL	Cartesian	3048.00	0.00	18288.00
23	GLOBAL	Cartesian	3048.00	0.00	21945.60
24	GLOBAL	Cartesian	3048.00	0.00	25603.20
25	GLOBAL	Cartesian	9144.00	0.00	0.00
26	GLOBAL	Cartesian	9144.00	0.00	3657.60
27	GLOBAL	Cartesian	9144.00	0.00	7315.20
28	GLOBAL	Cartesian	9144.00	0.00	10972.80
29	GLOBAL	Cartesian	9144.00	0.00	14630.40
30	GLOBAL	Cartesian	9144.00	0.00	18288.00
31	GLOBAL	Cartesian	9144.00	0.00	21945.60
32	GLOBAL	Cartesian	9144.00	0.00	25603.20
33	GLOBAL	Cartesian	-14325.60	0.00	0.00
34	GLOBAL	Cartesian	-10668.00	0.00	0.00
35	GLOBAL	Cartesian	-10668.00	0.00	3657.60
36	GLOBAL	Cartesian	-14325.60	0.00	3657.60
37	GLOBAL	Cartesian	-10668.00	0.00	7315.20
38	GLOBAL	Cartesian	-14325.60	0.00	7315.20
39	GLOBAL	Cartesian	-10668.00	0.00	10972.80
40	GLOBAL	Cartesian	-14325.60	0.00	10972.80
41	GLOBAL	Cartesian	-10668.00	0.00	14630.40
42	GLOBAL	Cartesian	-14325.60	0.00	14630.40
43	GLOBAL	Cartesian	-10668.00	0.00	18288.00
44	GLOBAL	Cartesian	-14325.60	0.00	18288.00
45	GLOBAL	Cartesian	-10668.00	0.00	21945.60
46	GLOBAL	Cartesian	-14325.60	0.00	21945.60
47	GLOBAL	Cartesian	-10668.00	0.00	25603.20

Joint	Coordinate System	Coordinate Type	Global X	Global Y	Global Z
			(mm)	(mm)	(mm)
48	GLOBAL	Cartesian	-14325.60	0.00	25603.20

4.3.1.2 Joint restraints

Table 21: Joint Restraint Assignments

Joint	U1	U2	U3	R1	R2	R3
1	Yes	Yes	Yes	Yes	No	Yes
9	Yes	Yes	Yes	Yes	No	Yes
17	Yes	Yes	Yes	Yes	No	Yes
25	Yes	Yes	Yes	Yes	No	Yes
33	Yes	Yes	Yes	No	No	No
34	Yes	Yes	Yes	No	No	No

4.3.1.3 Element connectivity

Table 22: Connectivity - Frame

Frame	Joint I	Joint J	Length (mm)
1	1	2	3657.60
2	2	3	3657.60
3	3	4	3657.60
4	4	5	3657.60
5	5	6	3657.60
6	6	7	3657.60
7	7	8	3657.60
8	9	10	3657.60
9	10	11	3657.60
10	11	12	3657.60
11	12	13	3657.60
12	13	14	3657.60
13	14	15	3657.60
14	15	16	3657.60
15	17	18	3657.60
16	18	19	3657.60
17	19	20	3657.60
18	20	21	3657.60
19	21	22	3657.60
20	22	23	3657.60
21	23	24	3657.60
22	25	26	3657.60

Frame	Joint I	Joint J	Length (mm)
23	26	27	3657.60
24	27	28	3657.60
25	28	29	3657.60
26	29	30	3657.60
27	30	31	3657.60
28	31	32	3657.60
29	2	10	6096.00
30	3	11	6096.00
31	4	12	6096.00
32	5	13	6096.00
33	6	14	6096.00
34	7	15	6096.00
35	8	16	6096.00
36	10	18	6096.00
37	11	19	6096.00
38	12	20	6096.00
39	13	21	6096.00
40	14	22	6096.00
41	15	23	6096.00
42	16	24	6096.00
43	18	26	6096.00
44	19	27	6096.00
45	20	28	6096.00
46	21	29	6096.00
47	22	30	6096.00
48	23	31	6096.00
49	24	32	6096.00

Table 23: Frame Section Assignments

Frame	Analysis Section	Design Section	Material Properties
1	Column	N.A.	Default
2	Column	N.A.	Default
3	Column	N.A.	Default
4	Column	N.A.	Default
5	Column	N.A.	Default
6	Column	N.A.	Default
7	Column	N.A.	Default
8	Column	N.A.	Default
9	Column	N.A.	Default
10	Column	N.A.	Default
11	Column	N.A.	Default
12	Column	N.A.	Default
13	Column	N.A.	Default
14	Column	N.A.	Default
15	Column	N.A.	Default
16	Column	N.A.	Default

Frame	Analysis Section	Design Section	Material Properties
17	Column	N.A.	Default
18	Column	N.A.	Default
19	Column	N.A.	Default
20	Column	N.A.	Default
21	Column	N.A.	Default
22	Column	N.A.	Default
23	Column	N.A.	Default
24	Column	N.A.	Default
25	Column	N.A.	Default
26	Column	N.A.	Default
27	Column	N.A.	Default
28	Column	N.A.	Default
29	Beam	N.A.	Default
30	Beam	N.A.	Default
31	Beam	N.A.	Default
32	Beam	N.A.	Default
33	Beam	N.A.	Default
34	Beam	N.A.	Default
35	Beam	N.A.	Default
36	Beam	N.A.	Default
37	Beam	N.A.	Default
38	Beam	N.A.	Default
39	Beam	N.A.	Default
40	Beam	N.A.	Default
41	Beam	N.A.	Default
42	Beam	N.A.	Default
43	Beam	N.A.	Default
44	Beam	N.A.	Default
45	Beam	N.A.	Default
46	Beam	N.A.	Default
47	Beam	N.A.	Default
48	Beam	N.A.	Default
49	Beam	N.A.	Default

Table 24: Connectivity – Area

Area	Joint1	Joint2	Joint3	Joint4
1	33	34	35	36
2	36	35	37	38
3	38	37	39	40
4	40	39	41	42
5	42	41	43	44
6	44	43	45	46
7	46	45	47	48

Table 25: Area Section Assignments

Area	Section	Material Properties
1	ASEC1	Default
2	ASEC1	Default
3	ASEC1	Default
4	ASEC1	Default
5	ASEC1	Default
6	ASEC1	Default
7	ASEC1	Default

4.3.2 MATERIAL PROPERTIES

This section provides material property information for materials used in the model.

Table 26: Material Properties 02 - Basic Mechanical Properties

Material	Unit Weight (KN/mm3)	Unit Mass (KN-s2/mm4)	E1 (KN/mm2)	G12 (KN/mm2)	U12	A1 1/C
A615Gr60	7.6973E-08	7.8490E-12	24.82113			1.1700E-05
A992Fy50	7.6973E-08	7.8490E-12	199.94798	76.90307	0.300000	1.1700E-05
Concrete	2.3563E-08	2.4028E-12	0.17237	0.07182	0.200000	9.9000E-06

Table 27: Material Properties 03a - Steel Data

Material	Fy (KN/mm2)	Fu (KN/mm2)	Final Slope
A992Fy50	0.34474	0.44816	-0.100000

Table 28: Material Properties 03b - Concrete Data

Material	Fc KN/mm2	Final Slope
Concrete	0.02758	-0.100000

Table 29: Material Properties 03e - Rebar Data

Material	Fy KN/mm2	Fu KN/mm2	Final Slope
A615Gr60	0.41369	0.62053	-0.100000

4.3.3 Section properties

This section provides section property information for objects used in the model.

4.3.3.1 Frames

Table 30: Frame Section Properties 01 - General Part 1 of 4

Section Name	Material	Shape	t3 (mm)	t2 (mm)	tf (mm)	tw (mm)	t2b (mm)	tfb (mm)
Beam	Concrete	Rectangular	508.000	330.200				
Column	Concrete	Rectangular	482.600	482.600				
FSEC1	A992Fy50	I/Wide Flange	304.800	127.000	9.652	6.350	127.000	9.652

Table 31: Frame Section Properties 01 - General, Part 2 of 4

Section Name	Area (mm2)	Tors Const (mm4)	I33 (mm4)	I22 (mm4)	AS2 (mm2)	AS3 (mm2)
Beam	167741.60	3637062336	3607339022	1524100737	139784.67	139784.67
Column	232902.76	7639320466	4520307968	4520307968	194085.63	194085.63
FSEC1	4264.51	96511.77	65724174.70	3301257.17	1935.48	2043.01

Table 32: Frame Section Properties 01 - General, Part 3 of 4

Section Name	S33 (mm3)	S22 (mm3)	Z33 (mm3)	Z22 (mm3)	R33 (mm)	R22 (mm)
Beam	14202122.13	9231379.39	21303183.20	13847069.08	146.647	95.321
Column	18733145.33	18733145.33	28099717.99	28099717.99	139.315	139.315
FSEC1	431260.99	51988.30	491187.50	80716.53	124.145	27.823

Table 33: Frame Section Properties 01 - General, Part 4 of 4

Section Name	AMod	A2Mod	A3Mod	JMod	I2Mod	I3Mod	MMod	WMod
Beam	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
Column	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
FSEC1	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

Table 34: Frame Section Properties 02 - Concrete Column, Part 1 of 2

Section Name	RebarMatL	RebarMatC	ReinfConfig	LatReinf	Cover (mm)	NumBars3 Dir	NumBars2 Dir
Beam	A615Gr60	A615Gr60	Rectangular	Ties	38.100	3	3
Column	A615Gr60	A615Gr60	Rectangular	Ties	38.100	3	3

Table 35: Frame Section Properties 02 - Concrete Column, Part 2 of 2

Section Name	Bar Size L	Bar Size C	Spacing C mm	NumCBars2	NumCBars3
Beam	#9	#4	152.400	3	3
Column	#9	#4	152.400	3	3

4.3.3.2. Areas

Table 36: Area Section Properties, Part 1 of 3

Section	Material	Area Type	Type	DrillDOF	Thickness (mm)	Bend Thickness (mm)	F11Mod
ASEC1	A992Fy50	Shell	Shell-Thin	Yes	152.400	152.400	1.000000

Table 37: Area Section Properties, Part 2 of 3

Section	F22Mod	F12Mod	M11Mod	M22Mod	M12Mod	V13Mod	V23Mod
ASEC1	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

Table 38: Area Section Properties, Part 3 of 3

Table 13: Area Section Properties, Part 3 of 3

Section	MMod	WMod
ASEC1	1.000000	1.000000

4.3.4 LOAD PATTERNS

This section provides loading information as applied to the model.

4.3.4.1 Definitions

Table 39: Load Pattern Definitions

Load Pattern	Design Type	Self Wt Mult	Auto Load
DEAD	DEAD	1.000000	

4.3.5 LOAD CASES

This section provides load case information.

4.3.5.1 Definitions

Table 40: Load Case Definitions

Case	Type	Initial Cond	Modal Case	BaseCase	DesAct Opt	Design Act
DEAD	LinStatic	Zero			Prog Det	Non-Composite
MODAL	LinModal	Zero			Prog Det	Other

4.3.5.2 Static case load assignments

Table 41: Case - Static 1 - Load Assignments

Case	Load Type	Load Name	Load SF
DEAD	Load pattern	DEAD	1.000000

4.3.5.3 Response spectrum case load assignments

Table 42: Function - Response Spectrum – User

Name	Period Sec	Accel	FuncDamp
UNIFRS	0.000000	1.000000	0.050000
UNIFRS	1.000000	1.000000	

4.3.6 STRUCTURE RESULTS

This section provides structure results, including items such as structural periods and base reactions.

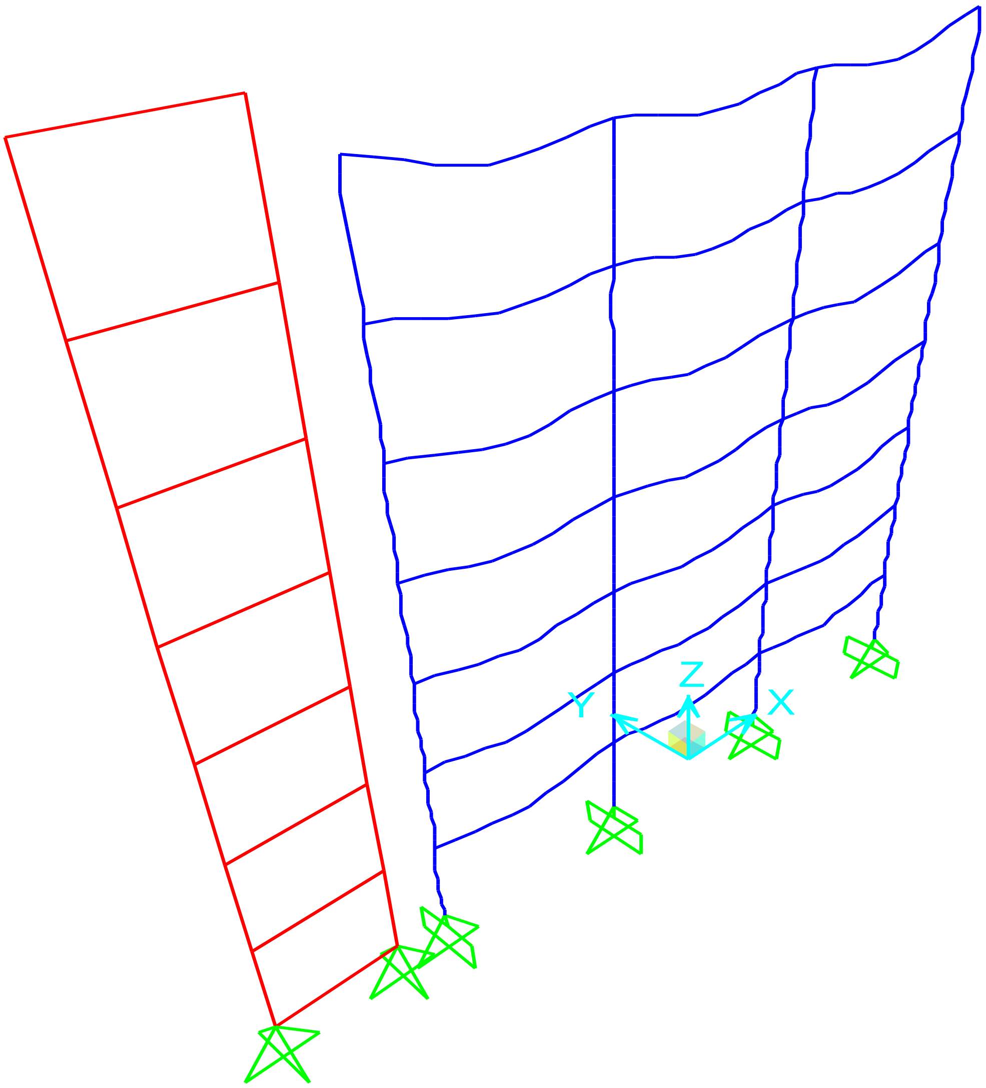

Figure 4: Deformed shape

4.3.6.1 Mass summary

Table 43: Assembled Joint Masses

Joint	U1 (KN-s2/mm)	U2 (KN-s2/mm)	U3 (KN-s2/mm)	R1 (KN-mm-s2)	R2 (KN-mm-s2)	R3 (KN-mm-s2)
1	0.001023	0.001023	0.001023	0.00	0.00	0.00
2	0.003275	0.003275	0.003275	0.00	0.00	0.00
3	0.003275	0.003275	0.003275	0.00	0.00	0.00
4	0.003275	0.003275	0.003275	0.00	0.00	0.00
5	0.003275	0.003275	0.003275	0.00	0.00	0.00
6	0.003275	0.003275	0.003275	0.00	0.00	0.00
7	0.003275	0.003275	0.003275	0.00	0.00	0.00
8	0.002252	0.002252	0.002252	0.00	0.00	0.00
9	0.001023	0.001023	0.001023	0.00	0.00	0.00
10	0.004504	0.004504	0.004504	0.00	0.00	0.00
11	0.004504	0.004504	0.004504	0.00	0.00	0.00
12	0.004504	0.004504	0.004504	0.00	0.00	0.00
13	0.004504	0.004504	0.004504	0.00	0.00	0.00
14	0.004504	0.004504	0.004504	0.00	0.00	0.00
15	0.004504	0.004504	0.004504	0.00	0.00	0.00
16	0.003480	0.003480	0.003480	0.00	0.00	0.00
17	0.001023	0.001023	0.001023	0.00	0.00	0.00
18	0.004504	0.004504	0.004504	0.00	0.00	0.00
19	0.004504	0.004504	0.004504	0.00	0.00	0.00
20	0.004504	0.004504	0.004504	0.00	0.00	0.00
21	0.004504	0.004504	0.004504	0.00	0.00	0.00
22	0.004504	0.004504	0.004504	0.00	0.00	0.00
23	0.004504	0.004504	0.004504	0.00	0.00	0.00
24	0.003480	0.003480	0.003480	0.00	0.00	0.00
25	0.001023	0.001023	0.001023	0.00	0.00	0.00
26	0.003275	0.003275	0.003275	0.00	0.00	0.00
27	0.003275	0.003275	0.003275	0.00	0.00	0.00
28	0.003275	0.003275	0.003275	0.00	0.00	0.00
29	0.003275	0.003275	0.003275	0.00	0.00	0.00
30	0.003275	0.003275	0.003275	0.00	0.00	0.00
31	0.003275	0.003275	0.003275	0.00	0.00	0.00
32	0.002252	0.002252	0.002252	0.00	0.00	0.00
33	0.004001	0.004001	0.004001	0.00	0.00	0.00
34	0.004001	0.004001	0.004001	0.00	0.00	0.00
35	0.008001	0.008001	0.008001	0.00	0.00	0.00
36	0.008001	0.008001	0.008001	0.00	0.00	0.00
37	0.008001	0.008001	0.008001	0.00	0.00	0.00
38	0.008001	0.008001	0.008001	0.00	0.00	0.00
39	0.008001	0.008001	0.008001	0.00	0.00	0.00
40	0.008001	0.008001	0.008001	0.00	0.00	0.00
41	0.008001	0.008001	0.008001	0.00	0.00	0.00
42	0.008001	0.008001	0.008001	0.00	0.00	0.00
43	0.008001	0.008001	0.008001	0.00	0.00	0.00
44	0.008001	0.008001	0.008001	0.00	0.00	0.00
45	0.008001	0.008001	0.008001	0.00	0.00	0.00
46	0.008001	0.008001	0.008001	0.00	0.00	0.00

Joint	U1 (KN-s2/mm)	U2 (KN-s2/mm)	U3 (KN-s2/mm)	R1 (KN-mm-s2)	R2 (KN-mm-s2)	R3 (KN-mm-s2)
47	0.004001	0.004001	0.004001	0.00	0.00	0.00
48	0.004001	0.004001	0.004001	0.00	0.00	0.00

4.3.6.2. Base reactions

Table 44: Base Reactions

OutputCase	GlobalFX (KN)	GlobalFY (KN)	GlobalFZ (KN)	GlobalMX (KN-mm)	GlobalMY (KN-mm)	GlobalMZ (KN-mm)
DEAD	-175.000	0.000	1632.551	0.00	1013346.01	0.00

4.3.7 JOINT RESULTS

This section provides joint results, including items such as displacements and reactions.

Table 45: Joint Displacements

Joint	Output Case	U1 (mm)	U2 (mm)	U3 (mm)	R1 (Radians)	R2 (Radians)	R3 (Radians)
1	DEAD	0.000000	0.000000	0.000000	0.000000	-0.002874	0.000000
2	DEAD	2.504902	0.000000	0.000000	0.000000	0.006154	0.000000
3	DEAD	2.634976	0.000000	0.000000	0.000000	0.004649	0.000000
4	DEAD	2.870692	0.000000	0.000000	0.000000	0.005254	0.000000
5	DEAD	2.990403	0.000000	0.000000	0.000000	0.005291	0.000000
6	DEAD	3.796674	0.000000	0.000000	0.000000	0.005721	0.000000
7	DEAD	5.012124	0.000000	0.000000	0.000000	0.004399	0.000000
8	DEAD	6.251332	0.000000	0.000000	0.000000	0.011264	0.000000
9	DEAD	0.000000	0.000000	0.000000	0.000000	0.000184	0.000000
10	DEAD	2.349240	0.000000	0.000000	0.000000	-0.000197	0.000000
11	DEAD	2.549566	0.000000	0.000000	0.000000	0.000344	0.000000
12	DEAD	2.800763	0.000000	0.000000	0.000000	0.000456	0.000000
13	DEAD	2.905646	0.000000	0.000000	0.000000	0.000654	0.000000
14	DEAD	3.423786	0.000000	0.000000	0.000000	0.000693	0.000000
15	DEAD	4.434308	0.000000	0.000000	0.000000	0.000996	0.000000
16	DEAD	3.423554	0.000000	0.000000	0.000000	0.000484	0.000000
17	DEAD	0.000000	0.000000	0.000000	0.000000	-0.000069	0.000000
18	DEAD	2.321942	0.000000	0.000000	0.000000	0.000328	0.000000
19	DEAD	2.529136	0.000000	0.000000	0.000000	-0.000084	0.000000
20	DEAD	2.692042	0.000000	0.000000	0.000000	-0.000113	0.000000
21	DEAD	2.734126	0.000000	0.000000	0.000000	-0.000253	0.000000
22	DEAD	3.134056	0.000000	0.000000	0.000000	-0.000261	0.000000

Joint	Output Case	U1 (mm)	U2 (mm)	U3 (mm)	R1 (Radians)	R2 (Radians)	R3 (Radians)
23	DEAD	3.455677	0.000000	0.000000	0.000000	-0.000526	0.000000
24	DEAD	2.652334	0.000000	0.000000	0.000000	-0.000173	0.000000
25	DEAD	0.000000	0.000000	0.000000	0.000000	0.002973	0.000000
26	DEAD	2.124966	0.000000	0.000000	0.000000	-0.005991	0.000000
27	DEAD	2.214263	0.000000	0.000000	0.000000	-0.004327	0.000000
28	DEAD	2.234903	0.000000	0.000000	0.000000	-0.004833	0.000000
29	DEAD	2.000678	0.000000	0.000000	0.000000	-0.004798	0.000000
30	DEAD	2.850673	0.000000	0.000000	0.000000	-0.005190	0.000000
31	DEAD	2.905467	0.000000	0.000000	0.000000	-0.003826	0.000000
32	DEAD	1.974454	0.000000	0.000000	0.000000	-0.010808	0.000000
33	DEAD	0.000000	0.000000	0.000000	0.000000	0.000016	0.000000
34	DEAD	0.000000	0.000000	0.000000	0.000000	0.000016	0.000000
35	DEAD	0.219574	0.000000	0.000000	0.000000	0.000108	0.000000
36	DEAD	0.219574	0.000000	0.000000	0.000000	0.000108	0.000000
37	DEAD	0.785537	0.000000	0.000000	0.000000	0.000194	0.000000
38	DEAD	0.785537	0.000000	0.000000	0.000000	0.000194	0.000000
39	DEAD	1.620281	0.000000	0.000000	0.000000	0.000256	0.000000
40	DEAD	1.620281	0.000000	0.000000	0.000000	0.000256	0.000000
41	DEAD	2.646942	0.000000	0.000000	0.000000	0.000299	0.000000
42	DEAD	2.646942	0.000000	0.000000	0.000000	0.000299	0.000000
43	DEAD	3.796674	0.000000	0.000000	0.000000	0.000325	0.000000
44	DEAD	3.796674	0.000000	0.000000	0.000000	0.000325	0.000000
45	DEAD	5.012124	0.000000	0.000000	0.000000	0.000336	0.000000
46	DEAD	5.012124	0.000000	0.000000	0.000000	0.000336	0.000000
47	DEAD	6.251332	0.000000	0.000000	0.000000	0.000339	0.000000
48	DEAD	6.251332	0.000000	0.000000	0.000000	0.000339	0.000000

Table 46: Joint Reactions

Joint	Output Case	F1 (KN)	F2 (KN)	F3 (KN)	M1 (KN-mm)	M2 (KN-mm)	M3 (KN-mm)
1	DEAD	1.052	0.000	225.161	0.00	0.00	0.00
9	DEAD	-0.044	0.000	308.615	0.00	0.00	0.00
17	DEAD	0.046	0.000	308.592	0.00	0.00	0.00
25	DEAD	-1.044	0.000	225.650	0.00	0.00	0.00
33	DEAD	45.505	0.000	574.531	0.00	0.00	0.00
34	DEAD	-260.515	0.000	673.064	0.00	0.00	0.00

4.3.8 FRAME RESULTS

This section provides frame force results.

Table 47: Element Forces - Frames, Part 1 of 4

Frame	Station Mm	Output Case	P (KN)	V2 (KN)	V3 (KN)
1	0.00	DEAD	-225.161	-1.052	0.000
1	1828.80	DEAD	-215.125	-1.052	0.000
1	3657.60	DEAD	-205.088	-1.052	0.000
2	0.00	DEAD	-193.382	-3.492	0.000
2	1828.80	DEAD	-183.346	-3.492	0.000
2	3657.60	DEAD	-173.309	-3.492	0.000
3	0.00	DEAD	-161.300	-3.144	0.000
3	1828.80	DEAD	-151.264	-3.144	0.000
3	3657.60	DEAD	-141.227	-3.144	0.000
4	0.00	DEAD	-129.116	-3.322	0.000
4	1828.80	DEAD	-119.080	-3.322	0.000
4	3657.60	DEAD	-109.043	-3.322	0.000
5	0.00	DEAD	-96.817	-3.455	0.000
5	1828.80	DEAD	-86.781	-3.455	0.000
5	3657.60	DEAD	-76.745	-3.455	0.000
6	0.00	DEAD	-64.462	-3.146	0.000
6	1828.80	DEAD	-54.425	-3.146	0.000
6	3657.60	DEAD	-44.389	-3.146	0.000
7	0.00	DEAD	-31.936	-4.986	0.000
7	1828.80	DEAD	-21.900	-4.986	0.000
7	3657.60	DEAD	-11.864	-4.986	0.000
8	0.00	DEAD	-308.615	0.044	0.000
8	1828.80	DEAD	-298.579	0.044	0.000
8	3657.60	DEAD	-288.543	0.044	0.000
9	0.00	DEAD	-264.120	0.054	0.000
9	1828.80	DEAD	-254.084	0.054	0.000
9	3657.60	DEAD	-244.048	0.054	0.000
10	0.00	DEAD	-219.941	-0.114	0.000
10	1828.80	DEAD	-209.905	-0.114	0.000
10	3657.60	DEAD	-199.869	-0.114	0.000
11	0.00	DEAD	-175.872	-0.182	0.000
11	1828.80	DEAD	-165.836	-0.182	0.000
11	3657.60	DEAD	-155.800	-0.182	0.000
12	0.00	DEAD	-131.923	-0.239	0.000
12	1828.80	DEAD	-121.887	-0.239	0.000
12	3657.60	DEAD	-111.851	-0.239	0.000
13	0.00	DEAD	-88.035	-0.341	0.000
13	1828.80	DEAD	-77.998	-0.341	0.000
13	3657.60	DEAD	-67.962	-0.341	0.000
14	0.00	DEAD	-44.320	-0.267	0.000
14	1828.80	DEAD	-34.283	-0.267	0.000
14	3657.60	DEAD	-24.247	-0.267	0.000
15	0.00	DEAD	-308.592	-0.046	0.000
15	1828.80	DEAD	-298.555	-0.046	0.000
15	3657.60	DEAD	-288.519	-0.046	0.000
16	0.00	DEAD	-264.098	0.022	0.000
16	1828.80	DEAD	-254.062	0.022	0.000
16	3657.60	DEAD	-244.026	0.022	0.000
17	0.00	DEAD	-219.922	0.217	0.000
17	1828.80	DEAD	-209.886	0.217	0.000
17	3657.60	DEAD	-199.849	0.217	0.000
18	0.00	DEAD	-175.856	0.309	0.000

Frame	Station	Output Case	P	V2	V3
	Mm		(KN)	(KN)	(KN)
18	1828.80	DEAD	-165.820	0.309	0.000
18	3657.60	DEAD	-155.783	0.309	0.000
19	0.00	DEAD	-131.910	0.380	0.000
19	1828.80	DEAD	-121.874	0.380	0.000
19	3657.60	DEAD	-111.838	0.380	0.000
20	0.00	DEAD	-88.025	0.483	0.000
20	1828.80	DEAD	-77.989	0.483	0.000
20	3657.60	DEAD	-67.952	0.483	0.000
21	0.00	DEAD	-44.313	0.458	0.000
21	1828.80	DEAD	-34.277	0.458	0.000
21	3657.60	DEAD	-24.240	0.458	0.000
22	0.00	DEAD	-225.650	1.044	0.000
22	1828.80	DEAD	-215.614	1.044	0.000
22	3657.60	DEAD	-205.577	1.044	0.000
23	0.00	DEAD	-193.844	3.536	0.000
23	1828.80	DEAD	-183.807	3.536	0.000
23	3657.60	DEAD	-173.771	3.536	0.000
24	0.00	DEAD	-161.707	3.200	0.000
24	1828.80	DEAD	-151.671	3.200	0.000
24	3657.60	DEAD	-141.634	3.200	0.000
25	0.00	DEAD	-129.452	3.392	0.000
25	1828.80	DEAD	-119.416	3.392	0.000
25	3657.60	DEAD	-109.379	3.392	0.000
26	0.00	DEAD	-97.071	3.533	0.000
26	1828.80	DEAD	-87.035	3.533	0.000
26	3657.60	DEAD	-76.998	3.533	0.000
27	0.00	DEAD	-64.627	3.221	0.000
27	1828.80	DEAD	-54.590	3.221	0.000
27	3657.60	DEAD	-44.554	3.221	0.000
28	0.00	DEAD	-32.005	5.095	0.000
28	1828.80	DEAD	-21.969	5.095	0.000
28	3657.60	DEAD	-11.933	5.095	0.000
29	0.00	DEAD	0.000	-11.706	0.000
29	609.60	DEAD	0.000	-9.297	0.000
29	1219.20	DEAD	0.000	-6.888	0.000
29	1828.80	DEAD	0.000	-4.478	0.000
29	2438.40	DEAD	0.000	-2.069	0.000
29	3048.00	DEAD	0.000	0.341	0.000
29	3657.60	DEAD	0.000	2.750	0.000
29	4267.20	DEAD	0.000	5.160	0.000
29	4876.80	DEAD	0.000	7.569	0.000
29	5486.40	DEAD	0.000	9.979	0.000
29	6096.00	DEAD	0.000	12.388	0.000
30	0.00	DEAD	0.000	-12.009	0.000
30	609.60	DEAD	0.000	-9.600	0.000
30	1219.20	DEAD	0.000	-7.191	0.000
30	1828.80	DEAD	0.000	-4.781	0.000
30	2438.40	DEAD	0.000	-2.372	0.000
30	3048.00	DEAD	0.000	0.038	0.000
30	3657.60	DEAD	0.000	2.447	0.000
30	4267.20	DEAD	0.000	4.857	0.000
30	4876.80	DEAD	0.000	7.266	0.000
30	5486.40	DEAD	0.000	9.676	0.000
30	6096.00	DEAD	0.000	12.085	0.000
31	0.00	DEAD	0.000	-12.111	0.000
31	609.60	DEAD	0.000	-9.702	0.000
31	1219.20	DEAD	0.000	-7.293	0.000
31	1828.80	DEAD	0.000	-4.883	0.000
31	2438.40	DEAD	0.000	-2.474	0.000

Frame	Station	Output Case	P	V2	V3
	Mm		(KN)	(KN)	(KN)
31	3048.00	DEAD	0.000	-0.064	0.000
31	3657.60	DEAD	0.000	2.345	0.000
31	4267.20	DEAD	0.000	4.755	0.000
31	4876.80	DEAD	0.000	7.164	0.000
31	5486.40	DEAD	0.000	9.574	0.000
31	6096.00	DEAD	0.000	11.983	0.000
32	0.00	DEAD	0.000	-12.226	0.000
32	609.60	DEAD	0.000	-9.816	0.000
32	1219.20	DEAD	0.000	-7.407	0.000
32	1828.80	DEAD	0.000	-4.998	0.000
32	2438.40	DEAD	0.000	-2.588	0.000
32	3048.00	DEAD	0.000	-0.179	0.000
32	3657.60	DEAD	0.000	2.231	0.000
32	4267.20	DEAD	0.000	4.640	0.000
32	4876.80	DEAD	0.000	7.050	0.000
32	5486.40	DEAD	0.000	9.459	0.000
32	6096.00	DEAD	0.000	11.869	0.000
33	0.00	DEAD	0.000	-12.283	0.000
33	609.60	DEAD	0.000	-9.874	0.000
33	1219.20	DEAD	0.000	-7.464	0.000
33	1828.80	DEAD	0.000	-5.055	0.000
33	2438.40	DEAD	0.000	-2.645	0.000
33	3048.00	DEAD	0.000	-0.236	0.000
33	3657.60	DEAD	0.000	2.174	0.000
33	4267.20	DEAD	0.000	4.583	0.000
33	4876.80	DEAD	0.000	6.993	0.000
33	5486.40	DEAD	0.000	9.402	0.000
33	6096.00	DEAD	0.000	11.811	0.000
34	0.00	DEAD	0.000	-12.453	0.000
34	609.60	DEAD	0.000	-10.043	0.000
34	1219.20	DEAD	0.000	-7.634	0.000
34	1828.80	DEAD	0.000	-5.224	0.000
34	2438.40	DEAD	0.000	-2.815	0.000
34	3048.00	DEAD	0.000	-0.405	0.000
34	3657.60	DEAD	0.000	2.004	0.000
34	4267.20	DEAD	0.000	4.414	0.000
34	4876.80	DEAD	0.000	6.823	0.000
34	5486.40	DEAD	0.000	9.232	0.000
34	6096.00	DEAD	0.000	11.642	0.000
35	0.00	DEAD	0.000	-11.864	0.000
35	609.60	DEAD	0.000	-9.454	0.000
35	1219.20	DEAD	0.000	-7.045	0.000
35	1828.80	DEAD	0.000	-4.635	0.000
35	2438.40	DEAD	0.000	-2.226	0.000
35	3048.00	DEAD	0.000	0.183	0.000
35	3657.60	DEAD	0.000	2.593	0.000
35	4267.20	DEAD	0.000	5.002	0.000
35	4876.80	DEAD	0.000	7.412	0.000
35	5486.40	DEAD	0.000	9.821	0.000
35	6096.00	DEAD	0.000	12.231	0.000
36	0.00	DEAD	0.000	-12.034	0.000
36	609.60	DEAD	0.000	-9.625	0.000
36	1219.20	DEAD	0.000	-7.215	0.000
36	1828.80	DEAD	0.000	-4.806	0.000
36	2438.40	DEAD	0.000	-2.397	0.000
36	3048.00	DEAD	0.000	0.013	0.000
36	3657.60	DEAD	0.000	2.422	0.000
36	4267.20	DEAD	0.000	4.832	0.000
36	4876.80	DEAD	0.000	7.241	0.000

Frame	Station	Output Case	P	V2	V3
	Mm		(KN)	(KN)	(KN)
36	5486.40	DEAD	0.000	9.651	0.000
36	6096.00	DEAD	0.000	12.060	0.000
37	0.00	DEAD	0.000	-12.021	0.000
37	609.60	DEAD	0.000	-9.612	0.000
37	1219.20	DEAD	0.000	-7.203	0.000
37	1828.80	DEAD	0.000	-4.793	0.000
37	2438.40	DEAD	0.000	-2.384	0.000
37	3048.00	DEAD	0.000	0.026	0.000
37	3657.60	DEAD	0.000	2.435	0.000
37	4267.20	DEAD	0.000	4.845	0.000
37	4876.80	DEAD	0.000	7.254	0.000
37	5486.40	DEAD	0.000	9.664	0.000
37	6096.00	DEAD	0.000	12.073	0.000
38	0.00	DEAD	0.000	-12.013	0.000
38	609.60	DEAD	0.000	-9.604	0.000
38	1219.20	DEAD	0.000	-7.194	0.000
38	1828.80	DEAD	0.000	-4.785	0.000
38	2438.40	DEAD	0.000	-2.376	0.000
38	3048.00	DEAD	0.000	0.034	0.000
38	3657.60	DEAD	0.000	2.443	0.000
38	4267.20	DEAD	0.000	4.853	0.000
38	4876.80	DEAD	0.000	7.262	0.000
38	5486.40	DEAD	0.000	9.672	0.000
38	6096.00	DEAD	0.000	12.081	0.000
39	0.00	DEAD	0.000	-12.008	0.000
39	609.60	DEAD	0.000	-9.598	0.000
39	1219.20	DEAD	0.000	-7.189	0.000
39	1828.80	DEAD	0.000	-4.779	0.000
39	2438.40	DEAD	0.000	-2.370	0.000
39	3048.00	DEAD	0.000	0.040	0.000
39	3657.60	DEAD	0.000	2.449	0.000
39	4267.20	DEAD	0.000	4.859	0.000
39	4876.80	DEAD	0.000	7.268	0.000
39	5486.40	DEAD	0.000	9.677	0.000
39	6096.00	DEAD	0.000	12.087	0.000
40	0.00	DEAD	0.000	-12.005	0.000
40	609.60	DEAD	0.000	-9.595	0.000
40	1219.20	DEAD	0.000	-7.186	0.000
40	1828.80	DEAD	0.000	-4.776	0.000
40	2438.40	DEAD	0.000	-2.367	0.000
40	3048.00	DEAD	0.000	0.043	0.000
40	3657.60	DEAD	0.000	2.452	0.000
40	4267.20	DEAD	0.000	4.862	0.000
40	4876.80	DEAD	0.000	7.271	0.000
40	5486.40	DEAD	0.000	9.681	0.000
40	6096.00	DEAD	0.000	12.090	0.000
41	0.00	DEAD	0.000	-12.001	0.000
41	609.60	DEAD	0.000	-9.591	0.000
41	1219.20	DEAD	0.000	-7.182	0.000
41	1828.80	DEAD	0.000	-4.772	0.000
41	2438.40	DEAD	0.000	-2.363	0.000
41	3048.00	DEAD	0.000	0.047	0.000
41	3657.60	DEAD	0.000	2.456	0.000
41	4267.20	DEAD	0.000	4.866	0.000
41	4876.80	DEAD	0.000	7.275	0.000
41	5486.40	DEAD	0.000	9.684	0.000
41	6096.00	DEAD	0.000	12.094	0.000
42	0.00	DEAD	0.000	-12.016	0.000
42	609.60	DEAD	0.000	-9.607	0.000

Frame	Station	Output Case	P	V2	V3
	Mm		(KN)	(KN)	(KN)
42	1219.20	DEAD	0.000	-7.197	0.000
42	1828.80	DEAD	0.000	-4.788	0.000
42	2438.40	DEAD	0.000	-2.379	0.000
42	3048.00	DEAD	0.000	0.031	0.000
42	3657.60	DEAD	0.000	2.440	0.000
42	4267.20	DEAD	0.000	4.850	0.000
42	4876.80	DEAD	0.000	7.259	0.000
42	5486.40	DEAD	0.000	9.669	0.000
42	6096.00	DEAD	0.000	12.078	0.000
43	0.00	DEAD	0.000	-12.361	0.000
43	609.60	DEAD	0.000	-9.951	0.000
43	1219.20	DEAD	0.000	-7.542	0.000
43	1828.80	DEAD	0.000	-5.132	0.000
43	2438.40	DEAD	0.000	-2.723	0.000
43	3048.00	DEAD	0.000	-0.313	0.000
43	3657.60	DEAD	0.000	2.096	0.000
43	4267.20	DEAD	0.000	4.506	0.000
43	4876.80	DEAD	0.000	6.915	0.000
43	5486.40	DEAD	0.000	9.325	0.000
43	6096.00	DEAD	0.000	11.734	0.000
44	0.00	DEAD	0.000	-12.031	0.000
44	609.60	DEAD	0.000	-9.621	0.000
44	1219.20	DEAD	0.000	-7.212	0.000
44	1828.80	DEAD	0.000	-4.802	0.000
44	2438.40	DEAD	0.000	-2.393	0.000
44	3048.00	DEAD	0.000	0.017	0.000
44	3657.60	DEAD	0.000	2.426	0.000
44	4267.20	DEAD	0.000	4.835	0.000
44	4876.80	DEAD	0.000	7.245	0.000
44	5486.40	DEAD	0.000	9.654	0.000
44	6096.00	DEAD	0.000	12.064	0.000
45	0.00	DEAD	0.000	-11.912	0.000
45	609.60	DEAD	0.000	-9.503	0.000
45	1219.20	DEAD	0.000	-7.093	0.000
45	1828.80	DEAD	0.000	-4.684	0.000
45	2438.40	DEAD	0.000	-2.274	0.000
45	3048.00	DEAD	0.000	0.135	0.000
45	3657.60	DEAD	0.000	2.545	0.000
45	4267.20	DEAD	0.000	4.954	0.000
45	4876.80	DEAD	0.000	7.364	0.000
45	5486.40	DEAD	0.000	9.773	0.000
45	6096.00	DEAD	0.000	12.182	0.000
46	0.00	DEAD	0.000	-11.786	0.000
46	609.60	DEAD	0.000	-9.376	0.000
46	1219.20	DEAD	0.000	-6.967	0.000
46	1828.80	DEAD	0.000	-4.558	0.000
46	2438.40	DEAD	0.000	-2.148	0.000
46	3048.00	DEAD	0.000	0.261	0.000
46	3657.60	DEAD	0.000	2.671	0.000
46	4267.20	DEAD	0.000	5.080	0.000
46	4876.80	DEAD	0.000	7.490	0.000
46	5486.40	DEAD	0.000	9.899	0.000
46	6096.00	DEAD	0.000	12.309	0.000
47	0.00	DEAD	0.000	-11.723	0.000
47	609.60	DEAD	0.000	-9.313	0.000
47	1219.20	DEAD	0.000	-6.904	0.000
47	1828.80	DEAD	0.000	-4.494	0.000
47	2438.40	DEAD	0.000	-2.085	0.000
47	3048.00	DEAD	0.000	0.324	0.000

Frame	Station	Output Case	P	V2	V3
	Mm		(KN)	(KN)	(KN)
47	3657.60	DEAD	0.000	2.734	0.000
47	4267.20	DEAD	0.000	5.143	0.000
47	4876.80	DEAD	0.000	7.553	0.000
47	5486.40	DEAD	0.000	9.962	0.000
47	6096.00	DEAD	0.000	12.372	0.000
48	0.00	DEAD	0.000	-11.546	0.000
48	609.60	DEAD	0.000	-9.136	0.000
48	1219.20	DEAD	0.000	-6.727	0.000
48	1828.80	DEAD	0.000	-4.317	0.000
48	2438.40	DEAD	0.000	-1.908	0.000
48	3048.00	DEAD	0.000	0.502	0.000
48	3657.60	DEAD	0.000	2.911	0.000
48	4267.20	DEAD	0.000	5.320	0.000
48	4876.80	DEAD	0.000	7.730	0.000
48	5486.40	DEAD	0.000	10.139	0.000
48	6096.00	DEAD	0.000	12.549	0.000
49	0.00	DEAD	0.000	-12.162	0.000
49	609.60	DEAD	0.000	-9.753	0.000
49	1219.20	DEAD	0.000	-7.343	0.000
49	1828.80	DEAD	0.000	-4.934	0.000
49	2438.40	DEAD	0.000	-2.524	0.000
49	3048.00	DEAD	0.000	-0.115	0.000
49	3657.60	DEAD	0.000	2.295	0.000
49	4267.20	DEAD	0.000	4.704	0.000
49	4876.80	DEAD	0.000	7.114	0.000
49	5486.40	DEAD	0.000	9.523	0.000
49	6096.00	DEAD	0.000	11.933	0.000

Table 48: Element Forces - Frames, Part 2 of 4

Frame	Station	Output Case	T	M2	S11Max	M3	PtS11Max
	(in)		(Kip-in)	(Kip-in)	(Kip/in2)	(Kip-in)	
1	0.000	DEAD	0.000	0.000	-0.1478	-2.665E-15	0
1	72.000	DEAD	0.000	0.000	-0.1238	14.584	1
1	144.000	DEAD	0.000	0.000	-0.0997	29.168	1
2	0.000	DEAD	0.000	0.000	-0.0637	-51.810	3
2	72.000	DEAD	0.000	0.000	-0.1181	-2.217	3
2	144.000	DEAD	0.000	0.000	-0.0567	47.375	1
3	0.000	DEAD	0.000	0.000	-0.0517	-44.411	3
3	72.000	DEAD	0.000	0.000	-0.0986	0.916	1
3	144.000	DEAD	0.000	0.000	-0.0370	46.243	1
4	0.000	DEAD	0.000	0.000	-0.0264	-47.838	3
4	72.000	DEAD	0.000	0.000	-0.0784	0.124	1
4	144.000	DEAD	0.000	0.000	-0.0136	48.086	1
5	0.000	DEAD	0.000	0.000	-0.0035	-49.227	3
5	72.000	DEAD	0.000	0.000	-0.0566	0.606	1
5	144.000	DEAD	0.000	0.000	0.0105	50.440	1
6	0.000	DEAD	0.000	0.000	0.0165	-48.137	3
6	72.000	DEAD	0.000	0.000	-0.0339	-1.762	3
6	144.000	DEAD	0.000	0.000	0.0247	44.614	1
7	0.000	DEAD	0.000	0.000	0.0524	-60.060	3
7	72.000	DEAD	0.000	0.000	-0.0025	9.983	1
7	144.000	DEAD	0.000	0.000	0.0893	80.026	1

Frame	Station (in)	Output Case	T (Kip-in)	M2 (Kip-in)	S11Max (Kip/in2)	M3 (Kip-in)	PtS11Max
8	0.000	DEAD	0.000	0.000	-0.2087	1.665E-16	0
8	72.000	DEAD	0.000	0.000	-0.2013	-0.892	3
8	144.000	DEAD	0.000	0.000	-0.1940	-1.784	3
9	0.000	DEAD	0.000	0.000	-0.1757	2.321	1
9	72.000	DEAD	0.000	0.000	-0.1711	0.957	1
9	144.000	DEAD	0.000	0.000	-0.1656	-0.407	3
10	0.000	DEAD	0.000	0.000	-0.1472	-1.224	3
10	72.000	DEAD	0.000	0.000	-0.1422	0.180	1
10	144.000	DEAD	0.000	0.000	-0.1342	1.585	1
11	0.000	DEAD	0.000	0.000	-0.1162	-2.175	3
11	72.000	DEAD	0.000	0.000	-0.1122	0.327	1
11	144.000	DEAD	0.000	0.000	-0.1029	2.828	1
12	0.000	DEAD	0.000	0.000	-0.0851	-3.350	3
12	72.000	DEAD	0.000	0.000	-0.0828	0.075	1
12	144.000	DEAD	0.000	0.000	-0.0724	3.500	1
13	0.000	DEAD	0.000	0.000	-0.0540	-4.525	3
13	72.000	DEAD	0.000	0.000	-0.0526	0.535	1
13	144.000	DEAD	0.000	0.000	-0.0402	5.595	1
14	0.000	DEAD	0.000	0.000	-0.0244	-4.566	3
14	72.000	DEAD	0.000	0.000	-0.0225	-1.058	3
14	144.000	DEAD	0.000	0.000	-0.0145	2.451	1
15	0.000	DEAD	0.000	0.000	-0.2087	0.000	0
15	72.000	DEAD	0.000	0.000	-0.2013	0.879	1
15	144.000	DEAD	0.000	0.000	-0.1940	1.758	1
16	0.000	DEAD	0.000	0.000	-0.1771	-1.210	3
16	72.000	DEAD	0.000	0.000	-0.1713	-0.820	3
16	144.000	DEAD	0.000	0.000	-0.1655	-0.430	3
17	0.000	DEAD	0.000	0.000	-0.1454	2.663	1
17	72.000	DEAD	0.000	0.000	-0.1423	-0.094	3
17	144.000	DEAD	0.000	0.000	-0.1327	-2.851	3
18	0.000	DEAD	0.000	0.000	-0.1141	3.894	1
18	72.000	DEAD	0.000	0.000	-0.1123	-0.266	3
18	144.000	DEAD	0.000	0.000	-0.1010	-4.425	3
19	0.000	DEAD	0.000	0.000	-0.0828	5.238	1
19	72.000	DEAD	0.000	0.000	-0.0829	-0.041	3
19	144.000	DEAD	0.000	0.000	-0.0702	-5.320	3
20	0.000	DEAD	0.000	0.000	-0.0516	6.457	1
20	72.000	DEAD	0.000	0.000	-0.0527	-0.496	3
20	144.000	DEAD	0.000	0.000	-0.0379	-7.449	3
21	0.000	DEAD	0.000	0.000	-0.0217	6.788	1
21	72.000	DEAD	0.000	0.000	-0.0227	0.870	1
21	144.000	DEAD	0.000	0.000	-0.0114	-5.047	3
22	0.000	DEAD	0.000	0.000	-0.1481	2.665E-15	0
22	72.000	DEAD	0.000	0.000	-0.1241	-14.526	3
22	144.000	DEAD	0.000	0.000	-0.1002	-29.053	3
23	0.000	DEAD	0.000	0.000	-0.0631	52.569	1
23	72.000	DEAD	0.000	0.000	-0.1181	2.396	1
23	144.000	DEAD	0.000	0.000	-0.0565	-47.776	3
24	0.000	DEAD	0.000	0.000	-0.0509	45.287	1
24	72.000	DEAD	0.000	0.000	-0.0990	-0.803	3
24	144.000	DEAD	0.000	0.000	-0.0365	-46.894	3
25	0.000	DEAD	0.000	0.000	-0.0254	48.854	1
25	72.000	DEAD	0.000	0.000	-0.0787	-0.043	3
25	144.000	DEAD	0.000	0.000	-0.0128	-48.940	3
26	0.000	DEAD	0.000	0.000	-0.0023	50.316	1
26	72.000	DEAD	0.000	0.000	-0.0568	-0.563	3
26	144.000	DEAD	0.000	0.000	0.0116	-51.443	3
27	0.000	DEAD	0.000	0.000	0.0177	49.218	1
27	72.000	DEAD	0.000	0.000	-0.0340	1.810	1

Frame	Station	Output Case	T	M2	S11Max	M3	PtS11Max
	(in)		(Kip-in)	(Kip-in)	(Kip/in2)	(Kip-in)	
27	144.000	DEAD	0.000	0.000	0.0258	-45.597	3
28	0.000	DEAD	0.000	0.000	0.0539	61.333	1
28	72.000	DEAD	0.000	0.000	-0.0023	-10.137	3
28	144.000	DEAD	0.000	0.000	0.0912	-81.607	3
29	0.000	DEAD	0.000	0.000	0.1012	-80.978	3
29	24.000	DEAD	0.000	0.000	0.0367	-29.345	3
29	48.000	DEAD	0.000	0.000	0.0129	10.288	1
29	72.000	DEAD	0.000	0.000	0.0474	37.921	1
29	96.000	DEAD	0.000	0.000	0.0669	53.554	1
29	120.000	DEAD	0.000	0.000	0.0715	57.187	1
29	144.000	DEAD	0.000	0.000	0.0610	48.820	1
29	168.000	DEAD	0.000	0.000	0.0356	28.453	1
29	192.000	DEAD	0.000	0.000	0.0049	-3.914	3
29	216.000	DEAD	0.000	0.000	0.0604	-48.281	3
29	240.000	DEAD	0.000	0.000	0.1308	-104.648	3
30	0.000	DEAD	0.000	0.000	0.1147	-91.787	3
30	24.000	DEAD	0.000	0.000	0.0480	-38.430	3
30	48.000	DEAD	0.000	0.000	0.0037	2.927	1
30	72.000	DEAD	0.000	0.000	0.0404	32.284	1
30	96.000	DEAD	0.000	0.000	0.0621	49.641	1
30	120.000	DEAD	0.000	0.000	0.0687	54.997	1
30	144.000	DEAD	0.000	0.000	0.0604	48.354	1
30	168.000	DEAD	0.000	0.000	0.0371	29.711	1
30	192.000	DEAD	0.000	0.000	0.0012	-0.932	3
30	216.000	DEAD	0.000	0.000	0.0545	-43.575	3
30	240.000	DEAD	0.000	0.000	0.1228	-98.219	3
31	0.000	DEAD	0.000	0.000	0.1176	-94.081	3
31	24.000	DEAD	0.000	0.000	0.0502	-40.164	3
31	48.000	DEAD	0.000	0.000	0.0022	1.753	1
31	72.000	DEAD	0.000	0.000	0.0396	31.671	1
31	96.000	DEAD	0.000	0.000	0.0620	49.588	1
31	120.000	DEAD	0.000	0.000	0.0694	55.505	1
31	144.000	DEAD	0.000	0.000	0.0618	49.422	1
31	168.000	DEAD	0.000	0.000	0.0392	31.339	1
31	192.000	DEAD	0.000	0.000	0.0016	1.256	1
31	216.000	DEAD	0.000	0.000	0.0510	-40.827	3
31	240.000	DEAD	0.000	0.000	0.1186	-94.909	3
32	0.000	DEAD	0.000	0.000	0.1216	-97.313	3
32	24.000	DEAD	0.000	0.000	0.0535	-42.778	3
32	48.000	DEAD	0.000	0.000	3.025E-04	-0.242	3
32	72.000	DEAD	0.000	0.000	0.0379	30.294	1
32	96.000	DEAD	0.000	0.000	0.0610	48.829	1
32	120.000	DEAD	0.000	0.000	0.0692	55.365	1
32	144.000	DEAD	0.000	0.000	0.0624	49.901	1
32	168.000	DEAD	0.000	0.000	0.0405	32.437	1
32	192.000	DEAD	0.000	0.000	0.0037	2.972	1
32	216.000	DEAD	0.000	0.000	0.0481	-38.492	3
32	240.000	DEAD	0.000	0.000	0.1149	-91.956	3
33	0.000	DEAD	0.000	0.000	0.1232	-98.577	3
33	24.000	DEAD	0.000	0.000	0.0546	-43.715	3
33	48.000	DEAD	0.000	0.000	0.0011	-0.853	3
33	72.000	DEAD	0.000	0.000	0.0375	30.008	1
33	96.000	DEAD	0.000	0.000	0.0611	48.870	1
33	120.000	DEAD	0.000	0.000	0.0697	55.732	1
33	144.000	DEAD	0.000	0.000	0.0632	50.593	1
33	168.000	DEAD	0.000	0.000	0.0418	33.455	1
33	192.000	DEAD	0.000	0.000	0.0054	4.316	1
33	216.000	DEAD	0.000	0.000	0.0460	-36.822	3
33	240.000	DEAD	0.000	0.000	0.1125	-89.960	3

Frame	Station (in)	Output Case	T (Kip-in)	M2 (Kip-in)	S11Max (Kip/in2)	M3 (Kip-in)	PtS11Max
34	0.000	DEAD	0.000	0.000	0.1308	-104.674	3
34	24.000	DEAD	0.000	0.000	0.0611	-48.910	3
34	48.000	DEAD	0.000	0.000	0.0064	-5.145	3
34	72.000	DEAD	0.000	0.000	0.0333	26.619	1
34	96.000	DEAD	0.000	0.000	0.0580	46.383	1
34	120.000	DEAD	0.000	0.000	0.0677	54.147	1
34	144.000	DEAD	0.000	0.000	0.0624	49.912	1
34	168.000	DEAD	0.000	0.000	0.0421	33.676	1
34	192.000	DEAD	0.000	0.000	0.0068	5.440	1
34	216.000	DEAD	0.000	0.000	0.0435	-34.796	3
34	240.000	DEAD	0.000	0.000	0.1088	-87.031	3
35	0.000	DEAD	0.000	0.000	0.1000	-80.026	3
35	24.000	DEAD	0.000	0.000	0.0346	-27.669	3
35	48.000	DEAD	0.000	0.000	0.0159	12.689	1
35	72.000	DEAD	0.000	0.000	0.0513	41.046	1
35	96.000	DEAD	0.000	0.000	0.0718	57.404	1
35	120.000	DEAD	0.000	0.000	0.0772	61.762	1
35	144.000	DEAD	0.000	0.000	0.0676	54.119	1
35	168.000	DEAD	0.000	0.000	0.0431	34.477	1
35	192.000	DEAD	0.000	0.000	0.0035	2.834	1
35	216.000	DEAD	0.000	0.000	0.0510	-40.808	3
35	240.000	DEAD	0.000	0.000	0.1206	-96.450	3
36	0.000	DEAD	0.000	0.000	0.1257	-100.543	3
36	24.000	DEAD	0.000	0.000	0.0582	-46.599	3
36	48.000	DEAD	0.000	0.000	0.0058	-4.655	3
36	72.000	DEAD	0.000	0.000	0.0316	25.289	1
36	96.000	DEAD	0.000	0.000	0.0540	43.233	1
36	120.000	DEAD	0.000	0.000	0.0615	49.177	1
36	144.000	DEAD	0.000	0.000	0.0539	43.122	1
36	168.000	DEAD	0.000	0.000	0.0313	25.066	1
36	192.000	DEAD	0.000	0.000	0.0062	-4.990	3
36	216.000	DEAD	0.000	0.000	0.0588	-47.046	3
36	240.000	DEAD	0.000	0.000	0.1264	-101.102	3
37	0.000	DEAD	0.000	0.000	0.1238	-99.036	3
37	24.000	DEAD	0.000	0.000	0.0564	-45.148	3
37	48.000	DEAD	0.000	0.000	0.0041	-3.260	3
37	72.000	DEAD	0.000	0.000	0.0333	26.627	1
37	96.000	DEAD	0.000	0.000	0.0556	44.515	1
37	120.000	DEAD	0.000	0.000	0.0630	50.403	1
37	144.000	DEAD	0.000	0.000	0.0554	44.291	1
37	168.000	DEAD	0.000	0.000	0.0327	26.179	1
37	192.000	DEAD	0.000	0.000	0.0049	-3.933	3
37	216.000	DEAD	0.000	0.000	0.0576	-46.046	3
37	240.000	DEAD	0.000	0.000	0.1252	-100.158	3
38	0.000	DEAD	0.000	0.000	0.1233	-98.669	3
38	24.000	DEAD	0.000	0.000	0.0560	-44.817	3
38	48.000	DEAD	0.000	0.000	0.0037	-2.965	3
38	72.000	DEAD	0.000	0.000	0.0336	26.888	1
38	96.000	DEAD	0.000	0.000	0.0559	44.740	1
38	120.000	DEAD	0.000	0.000	0.0632	50.592	1
38	144.000	DEAD	0.000	0.000	0.0556	44.444	1
38	168.000	DEAD	0.000	0.000	0.0329	26.297	1
38	192.000	DEAD	0.000	0.000	0.0048	-3.851	3
38	216.000	DEAD	0.000	0.000	0.0575	-45.999	3
38	240.000	DEAD	0.000	0.000	0.1252	-100.147	3
39	0.000	DEAD	0.000	0.000	0.1227	-98.135	3
39	24.000	DEAD	0.000	0.000	0.0554	-44.308	3
39	48.000	DEAD	0.000	0.000	0.0031	-2.481	3
39	72.000	DEAD	0.000	0.000	0.0342	27.346	1

Frame	Station (in)	Output Case	T (Kip-in)	M2 (Kip-in)	S11Max (Kip/in2)	M3 (Kip-in)	PtS11Max
39	96.000	DEAD	0.000	0.000	0.0565	45.174	1
39	120.000	DEAD	0.000	0.000	0.0638	51.001	1
39	144.000	DEAD	0.000	0.000	0.0560	44.828	1
39	168.000	DEAD	0.000	0.000	0.0333	26.655	1
39	192.000	DEAD	0.000	0.000	0.0044	-3.518	3
39	216.000	DEAD	0.000	0.000	0.0571	-45.691	3
39	240.000	DEAD	0.000	0.000	0.1248	-99.864	3
40	0.000	DEAD	0.000	0.000	0.1225	-97.985	3
40	24.000	DEAD	0.000	0.000	0.0552	-44.172	3
40	48.000	DEAD	0.000	0.000	0.0029	-2.359	3
40	72.000	DEAD	0.000	0.000	0.0343	27.454	1
40	96.000	DEAD	0.000	0.000	0.0566	45.268	1
40	120.000	DEAD	0.000	0.000	0.0639	51.081	1
40	144.000	DEAD	0.000	0.000	0.0561	44.894	1
40	168.000	DEAD	0.000	0.000	0.0334	26.707	1
40	192.000	DEAD	0.000	0.000	0.0043	-3.480	3
40	216.000	DEAD	0.000	0.000	0.0571	-45.667	3
40	240.000	DEAD	0.000	0.000	0.1248	-99.854	3
41	0.000	DEAD	0.000	0.000	0.1215	-97.193	3
41	24.000	DEAD	0.000	0.000	0.0542	-43.396	3
41	48.000	DEAD	0.000	0.000	0.0020	-1.599	3
41	72.000	DEAD	0.000	0.000	0.0352	28.198	1
41	96.000	DEAD	0.000	0.000	0.0575	45.995	1
41	120.000	DEAD	0.000	0.000	0.0647	51.792	1
41	144.000	DEAD	0.000	0.000	0.0570	45.589	1
41	168.000	DEAD	0.000	0.000	0.0342	27.385	1
41	192.000	DEAD	0.000	0.000	0.0035	-2.818	3
41	216.000	DEAD	0.000	0.000	0.0563	-45.021	3
41	240.000	DEAD	0.000	0.000	0.1240	-99.224	3
42	0.000	DEAD	0.000	0.000	0.1236	-98.901	3
42	24.000	DEAD	0.000	0.000	0.0563	-45.029	3
42	48.000	DEAD	0.000	0.000	0.0039	-3.156	3
42	72.000	DEAD	0.000	0.000	0.0334	26.717	1
42	96.000	DEAD	0.000	0.000	0.0557	44.589	1
42	120.000	DEAD	0.000	0.000	0.0631	50.462	1
42	144.000	DEAD	0.000	0.000	0.0554	44.335	1
42	168.000	DEAD	0.000	0.000	0.0328	26.208	1
42	192.000	DEAD	0.000	0.000	0.0049	-3.920	3
42	216.000	DEAD	0.000	0.000	0.0576	-46.047	3
42	240.000	DEAD	0.000	0.000	0.1252	-100.174	3
43	0.000	DEAD	0.000	0.000	0.1301	-104.070	3
43	24.000	DEAD	0.000	0.000	0.0598	-47.826	3
43	48.000	DEAD	0.000	0.000	0.0045	-3.581	3
43	72.000	DEAD	0.000	0.000	0.0358	28.664	1
43	96.000	DEAD	0.000	0.000	0.0611	48.909	1
43	120.000	DEAD	0.000	0.000	0.0714	57.154	1
43	144.000	DEAD	0.000	0.000	0.0667	53.399	1
43	168.000	DEAD	0.000	0.000	0.0471	37.644	1
43	192.000	DEAD	0.000	0.000	0.0124	9.889	1
43	216.000	DEAD	0.000	0.000	0.0373	-29.866	3
43	240.000	DEAD	0.000	0.000	0.1020	-81.622	3
44	0.000	DEAD	0.000	0.000	0.1213	-97.065	3
44	24.000	DEAD	0.000	0.000	0.0533	-42.665	3
44	48.000	DEAD	0.000	0.000	3.305E-04	-0.264	3
44	72.000	DEAD	0.000	0.000	0.0377	30.136	1
44	96.000	DEAD	0.000	0.000	0.0607	48.536	1
44	120.000	DEAD	0.000	0.000	0.0687	54.936	1
44	144.000	DEAD	0.000	0.000	0.0617	49.336	1
44	168.000	DEAD	0.000	0.000	0.0397	31.736	1

Frame	Station (in)	Output Case	T (Kip-in)	M2 (Kip-in)	S11Max (Kip/in2)	M3 (Kip-in)	PtS11Max
44	192.000	DEAD	0.000	0.000	0.0027	2.136	1
44	216.000	DEAD	0.000	0.000	0.0493	-39.463	3
44	240.000	DEAD	0.000	0.000	0.1163	-93.063	3
45	0.000	DEAD	0.000	0.000	0.1168	-93.402	3
45	24.000	DEAD	0.000	0.000	0.0495	-39.637	3
45	48.000	DEAD	0.000	0.000	0.0027	2.129	1
45	72.000	DEAD	0.000	0.000	0.0399	31.894	1
45	96.000	DEAD	0.000	0.000	0.0621	49.660	1
45	120.000	DEAD	0.000	0.000	0.0693	55.425	1
45	144.000	DEAD	0.000	0.000	0.0615	49.191	1
45	168.000	DEAD	0.000	0.000	0.0387	30.956	1
45	192.000	DEAD	0.000	0.000	9.022E-04	0.722	1
45	216.000	DEAD	0.000	0.000	0.0519	-41.513	3
45	240.000	DEAD	0.000	0.000	0.1197	-95.747	3
46	0.000	DEAD	0.000	0.000	0.1128	-90.201	3
46	24.000	DEAD	0.000	0.000	0.0464	-37.106	3
46	48.000	DEAD	0.000	0.000	0.0050	3.988	1
46	72.000	DEAD	0.000	0.000	0.0414	33.083	1
46	96.000	DEAD	0.000	0.000	0.0627	50.177	1
46	120.000	DEAD	0.000	0.000	0.0691	55.272	1
46	144.000	DEAD	0.000	0.000	0.0605	48.366	1
46	168.000	DEAD	0.000	0.000	0.0368	29.461	1
46	192.000	DEAD	0.000	0.000	0.0018	-1.445	3
46	216.000	DEAD	0.000	0.000	0.0554	-44.350	3
46	240.000	DEAD	0.000	0.000	0.1241	-99.256	3
47	0.000	DEAD	0.000	0.000	0.1101	-88.076	3
47	24.000	DEAD	0.000	0.000	0.0442	-35.335	3
47	48.000	DEAD	0.000	0.000	0.0068	5.407	1
47	72.000	DEAD	0.000	0.000	0.0427	34.149	1
47	96.000	DEAD	0.000	0.000	0.0636	50.890	1
47	120.000	DEAD	0.000	0.000	0.0695	55.632	1
47	144.000	DEAD	0.000	0.000	0.0605	48.373	1
47	168.000	DEAD	0.000	0.000	0.0364	29.115	1
47	192.000	DEAD	0.000	0.000	0.0027	-2.144	3
47	216.000	DEAD	0.000	0.000	0.0568	-45.402	3
47	240.000	DEAD	0.000	0.000	0.1258	-100.660	3
48	0.000	DEAD	0.000	0.000	0.1062	-84.987	3
48	24.000	DEAD	0.000	0.000	0.0415	-33.182	3
48	48.000	DEAD	0.000	0.000	0.0083	6.624	1
48	72.000	DEAD	0.000	0.000	0.0430	34.430	1
48	96.000	DEAD	0.000	0.000	0.0628	50.236	1
48	120.000	DEAD	0.000	0.000	0.0676	54.041	1
48	144.000	DEAD	0.000	0.000	0.0573	45.847	1
48	168.000	DEAD	0.000	0.000	0.0321	25.653	1
48	192.000	DEAD	0.000	0.000	0.0082	-6.541	3
48	216.000	DEAD	0.000	0.000	0.0634	-50.736	3
48	240.000	DEAD	0.000	0.000	0.1337	-106.930	3
49	0.000	DEAD	0.000	0.000	0.1189	-95.127	3
49	24.000	DEAD	0.000	0.000	0.0497	-39.775	3
49	48.000	DEAD	0.000	0.000	0.0045	3.577	1
49	72.000	DEAD	0.000	0.000	0.0437	34.929	1
49	96.000	DEAD	0.000	0.000	0.0679	54.281	1
49	120.000	DEAD	0.000	0.000	0.0770	61.633	1
49	144.000	DEAD	0.000	0.000	0.0712	56.985	1
49	168.000	DEAD	0.000	0.000	0.0504	40.337	1
49	192.000	DEAD	0.000	0.000	0.0146	11.689	1
49	216.000	DEAD	0.000	0.000	0.0362	-28.959	3
49	240.000	DEAD	0.000	0.000	0.1020	-81.607	3

Table 49: Element Forces - Frames, Part 3 of 4

Frame	Station (in)	Output Case	x2S11Max (in)	x3S11Max (in)	S11Min (Kip/in2)	PtS11Min	x2S11Min (in)
1	0.000	DEAD	0.0000	0.0000	-0.1478	0	0.0000
1	72.000	DEAD	-8.5000	-8.5000	-0.1594	3	8.5000
1	144.000	DEAD	-8.5000	-8.5000	-0.1709	3	8.5000
2	0.000	DEAD	8.5000	-8.5000	-0.1903	1	-8.5000
2	72.000	DEAD	8.5000	-8.5000	-0.1235	1	-8.5000
2	144.000	DEAD	-8.5000	-8.5000	-0.1724	3	8.5000
3	0.000	DEAD	8.5000	-8.5000	-0.1602	1	-8.5000
3	72.000	DEAD	-8.5000	-8.5000	-0.1008	3	8.5000
3	144.000	DEAD	-8.5000	-8.5000	-0.1499	3	8.5000
4	0.000	DEAD	8.5000	-8.5000	-0.1432	1	-8.5000
4	72.000	DEAD	-8.5000	-8.5000	-0.0787	3	8.5000
4	144.000	DEAD	-8.5000	-8.5000	-0.1310	3	8.5000
5	0.000	DEAD	8.5000	-8.5000	-0.1237	1	-8.5000
5	72.000	DEAD	-8.5000	-8.5000	-0.0581	3	8.5000
5	144.000	DEAD	-8.5000	-8.5000	-0.1127	3	8.5000
6	0.000	DEAD	8.5000	-8.5000	-0.1011	1	-8.5000
6	72.000	DEAD	8.5000	-8.5000	-0.0382	1	-8.5000
6	144.000	DEAD	-8.5000	-8.5000	-0.0843	3	8.5000
7	0.000	DEAD	8.5000	-8.5000	-0.0943	1	-8.5000
7	72.000	DEAD	-8.5000	-8.5000	-0.0269	3	8.5000
7	144.000	DEAD	-8.5000	-8.5000	-0.1061	3	8.5000
8	0.000	DEAD	0.0000	0.0000	-0.2087	0	0.0000
8	72.000	DEAD	8.5000	-8.5000	-0.2035	1	-8.5000
8	144.000	DEAD	8.5000	-8.5000	-0.1984	1	-8.5000
9	0.000	DEAD	-8.5000	-8.5000	-0.1814	3	8.5000
9	72.000	DEAD	-8.5000	-8.5000	-0.1735	3	8.5000
9	144.000	DEAD	8.5000	-8.5000	-0.1666	1	-8.5000
10	0.000	DEAD	8.5000	-8.5000	-0.1502	1	-8.5000
10	72.000	DEAD	-8.5000	-8.5000	-0.1426	3	8.5000
10	144.000	DEAD	-8.5000	-8.5000	-0.1381	3	8.5000
11	0.000	DEAD	8.5000	-8.5000	-0.1215	1	-8.5000
11	72.000	DEAD	-8.5000	-8.5000	-0.1130	3	8.5000
11	144.000	DEAD	-8.5000	-8.5000	-0.1098	3	8.5000
12	0.000	DEAD	8.5000	-8.5000	-0.0933	1	-8.5000
12	72.000	DEAD	-8.5000	-8.5000	-0.0830	3	8.5000
12	144.000	DEAD	-8.5000	-8.5000	-0.0810	3	8.5000
13	0.000	DEAD	8.5000	-8.5000	-0.0651	1	-8.5000
13	72.000	DEAD	-8.5000	-8.5000	-0.0539	3	8.5000
13	144.000	DEAD	-8.5000	-8.5000	-0.0539	3	8.5000
14	0.000	DEAD	8.5000	-8.5000	-0.0356	1	-8.5000
14	72.000	DEAD	8.5000	-8.5000	-0.0251	1	-8.5000
14	144.000	DEAD	-8.5000	-8.5000	-0.0205	3	8.5000
15	0.000	DEAD	0.0000	0.0000	-0.2087	0	0.0000
15	72.000	DEAD	-8.5000	-8.5000	-0.2035	3	8.5000
15	144.000	DEAD	-8.5000	-8.5000	-0.1983	3	8.5000
16	0.000	DEAD	8.5000	-8.5000	-0.1800	1	-8.5000
16	72.000	DEAD	8.5000	-8.5000	-0.1733	1	-8.5000
16	144.000	DEAD	8.5000	-8.5000	-0.1666	1	-8.5000
17	0.000	DEAD	-8.5000	-8.5000	-0.1519	3	8.5000
17	72.000	DEAD	8.5000	-8.5000	-0.1425	1	-8.5000
17	144.000	DEAD	8.5000	-8.5000	-0.1396	1	-8.5000
18	0.000	DEAD	-8.5000	-8.5000	-0.1236	3	8.5000
18	72.000	DEAD	8.5000	-8.5000	-0.1129	1	-8.5000

Frame	Station (in)	Output Case	x2S11Max (in)	x3S11Max (in)	S11Min (Kip/in2)	PtS11Min	x2S11Min (in)
18	144.000	DEAD	8.5000	-8.5000	-0.1118	1	-8.5000
19	0.000	DEAD	-8.5000	-8.5000	-0.0956	3	8.5000
19	72.000	DEAD	8.5000	-8.5000	-0.0830	1	-8.5000
19	144.000	DEAD	8.5000	-8.5000	-0.0832	1	-8.5000
20	0.000	DEAD	-8.5000	-8.5000	-0.0674	3	8.5000
20	72.000	DEAD	8.5000	-8.5000	-0.0539	1	-8.5000
20	144.000	DEAD	8.5000	-8.5000	-0.0561	1	-8.5000
21	0.000	DEAD	-8.5000	-8.5000	-0.0383	3	8.5000
21	72.000	DEAD	-8.5000	-8.5000	-0.0248	3	8.5000
21	144.000	DEAD	8.5000	-8.5000	-0.0237	1	-8.5000
22	0.000	DEAD	0.0000	0.0000	-0.1481	0	0.0000
22	72.000	DEAD	8.5000	-8.5000	-0.1596	1	-8.5000
22	144.000	DEAD	8.5000	-8.5000	-0.1711	1	-8.5000
23	0.000	DEAD	-8.5000	-8.5000	-0.1915	3	8.5000
23	72.000	DEAD	-8.5000	-8.5000	-0.1240	3	8.5000
23	144.000	DEAD	8.5000	-8.5000	-0.1732	1	-8.5000
24	0.000	DEAD	-8.5000	-8.5000	-0.1615	3	8.5000
24	72.000	DEAD	8.5000	-8.5000	-0.1010	1	-8.5000
24	144.000	DEAD	8.5000	-8.5000	-0.1510	1	-8.5000
25	0.000	DEAD	-8.5000	-8.5000	-0.1447	3	8.5000
25	72.000	DEAD	8.5000	-8.5000	-0.0788	1	-8.5000
25	144.000	DEAD	8.5000	-8.5000	-0.1323	1	-8.5000
26	0.000	DEAD	-8.5000	-8.5000	-0.1252	3	8.5000
26	72.000	DEAD	8.5000	-8.5000	-0.0582	1	-8.5000
26	144.000	DEAD	8.5000	-8.5000	-0.1141	1	-8.5000
27	0.000	DEAD	-8.5000	-8.5000	-0.1025	3	8.5000
27	72.000	DEAD	-8.5000	-8.5000	-0.0384	3	8.5000
27	144.000	DEAD	8.5000	-8.5000	-0.0856	1	-8.5000
28	0.000	DEAD	-8.5000	-8.5000	-0.0959	3	8.5000
28	72.000	DEAD	8.5000	-8.5000	-0.0271	1	-8.5000
28	144.000	DEAD	8.5000	-8.5000	-0.1081	1	-8.5000
29	0.000	DEAD	10.0000	-6.0000	-0.1012	1	-10.0000
29	24.000	DEAD	10.0000	-6.0000	-0.0367	1	-10.0000
29	48.000	DEAD	-10.0000	-6.0000	-0.0129	3	10.0000
29	72.000	DEAD	-10.0000	-6.0000	-0.0474	3	10.0000
29	96.000	DEAD	-10.0000	-6.0000	-0.0669	3	10.0000
29	120.000	DEAD	-10.0000	-6.0000	-0.0715	3	10.0000
29	144.000	DEAD	-10.0000	-6.0000	-0.0610	3	10.0000
29	168.000	DEAD	-10.0000	-6.0000	-0.0356	3	10.0000
29	192.000	DEAD	10.0000	-6.0000	-0.0049	1	-10.0000
29	216.000	DEAD	10.0000	-6.0000	-0.0604	1	-10.0000
29	240.000	DEAD	10.0000	-6.0000	-0.1308	1	-10.0000
30	0.000	DEAD	10.0000	-6.0000	-0.1147	1	-10.0000
30	24.000	DEAD	10.0000	-6.0000	-0.0480	1	-10.0000
30	48.000	DEAD	-10.0000	-6.0000	-0.0037	3	10.0000
30	72.000	DEAD	-10.0000	-6.0000	-0.0404	3	10.0000
30	96.000	DEAD	-10.0000	-6.0000	-0.0621	3	10.0000
30	120.000	DEAD	-10.0000	-6.0000	-0.0687	3	10.0000
30	144.000	DEAD	-10.0000	-6.0000	-0.0604	3	10.0000
30	168.000	DEAD	-10.0000	-6.0000	-0.0371	3	10.0000
30	192.000	DEAD	10.0000	-6.0000	-0.0012	1	-10.0000
30	216.000	DEAD	10.0000	-6.0000	-0.0545	1	-10.0000
30	240.000	DEAD	10.0000	-6.0000	-0.1228	1	-10.0000
31	0.000	DEAD	10.0000	-6.0000	-0.1176	1	-10.0000
31	24.000	DEAD	10.0000	-6.0000	-0.0502	1	-10.0000
31	48.000	DEAD	-10.0000	-6.0000	-0.0022	3	10.0000
31	72.000	DEAD	-10.0000	-6.0000	-0.0396	3	10.0000
31	96.000	DEAD	-10.0000	-6.0000	-0.0620	3	10.0000
31	120.000	DEAD	-10.0000	-6.0000	-0.0694	3	10.0000

Frame	Station (in)	Output Case	x2S11Max (in)	x3S11Max (in)	S11Min (Kip/in2)	PtS11Min	x2S11Min (in)
31	144.000	DEAD	-10.0000	-6.0000	-0.0618	3	10.0000
31	168.000	DEAD	-10.0000	-6.0000	-0.0392	3	10.0000
31	192.000	DEAD	-10.0000	-6.0000	-0.0016	3	10.0000
31	216.000	DEAD	10.0000	-6.0000	-0.0510	1	-10.0000
31	240.000	DEAD	10.0000	-6.0000	-0.1186	1	-10.0000
32	0.000	DEAD	10.0000	-6.0000	-0.1216	1	-10.0000
32	24.000	DEAD	10.0000	-6.0000	-0.0535	1	-10.0000
32	48.000	DEAD	10.0000	-6.0000	-3.025E-04	1	-10.0000
32	72.000	DEAD	-10.0000	-6.0000	-0.0379	3	10.0000
32	96.000	DEAD	-10.0000	-6.0000	-0.0610	3	10.0000
32	120.000	DEAD	-10.0000	-6.0000	-0.0692	3	10.0000
32	144.000	DEAD	-10.0000	-6.0000	-0.0624	3	10.0000
32	168.000	DEAD	-10.0000	-6.0000	-0.0405	3	10.0000
32	192.000	DEAD	-10.0000	-6.0000	-0.0037	3	10.0000
32	216.000	DEAD	10.0000	-6.0000	-0.0481	1	-10.0000
32	240.000	DEAD	10.0000	-6.0000	-0.1149	1	-10.0000
33	0.000	DEAD	10.0000	-6.0000	-0.1232	1	-10.0000
33	24.000	DEAD	10.0000	-6.0000	-0.0546	1	-10.0000
33	48.000	DEAD	10.0000	-6.0000	-0.0011	1	-10.0000
33	72.000	DEAD	-10.0000	-6.0000	-0.0375	3	10.0000
33	96.000	DEAD	-10.0000	-6.0000	-0.0611	3	10.0000
33	120.000	DEAD	-10.0000	-6.0000	-0.0697	3	10.0000
33	144.000	DEAD	-10.0000	-6.0000	-0.0632	3	10.0000
33	168.000	DEAD	-10.0000	-6.0000	-0.0418	3	10.0000
33	192.000	DEAD	-10.0000	-6.0000	-0.0054	3	10.0000
33	216.000	DEAD	10.0000	-6.0000	-0.0460	1	-10.0000
33	240.000	DEAD	10.0000	-6.0000	-0.1125	1	-10.0000
34	0.000	DEAD	10.0000	-6.0000	-0.1308	1	-10.0000
34	24.000	DEAD	10.0000	-6.0000	-0.0611	1	-10.0000
34	48.000	DEAD	10.0000	-6.0000	-0.0064	1	-10.0000
34	72.000	DEAD	-10.0000	-6.0000	-0.0333	3	10.0000
34	96.000	DEAD	-10.0000	-6.0000	-0.0580	3	10.0000
34	120.000	DEAD	-10.0000	-6.0000	-0.0677	3	10.0000
34	144.000	DEAD	-10.0000	-6.0000	-0.0624	3	10.0000
34	168.000	DEAD	-10.0000	-6.0000	-0.0421	3	10.0000
34	192.000	DEAD	-10.0000	-6.0000	-0.0068	3	10.0000
34	216.000	DEAD	10.0000	-6.0000	-0.0435	1	-10.0000
34	240.000	DEAD	10.0000	-6.0000	-0.1088	1	-10.0000
35	0.000	DEAD	10.0000	-6.0000	-0.1000	1	-10.0000
35	24.000	DEAD	10.0000	-6.0000	-0.0346	1	-10.0000
35	48.000	DEAD	-10.0000	-6.0000	-0.0159	3	10.0000
35	72.000	DEAD	-10.0000	-6.0000	-0.0513	3	10.0000
35	96.000	DEAD	-10.0000	-6.0000	-0.0718	3	10.0000
35	120.000	DEAD	-10.0000	-6.0000	-0.0772	3	10.0000
35	144.000	DEAD	-10.0000	-6.0000	-0.0676	3	10.0000
35	168.000	DEAD	-10.0000	-6.0000	-0.0431	3	10.0000
35	192.000	DEAD	-10.0000	-6.0000	-0.0035	3	10.0000
35	216.000	DEAD	10.0000	-6.0000	-0.0510	1	-10.0000
35	240.000	DEAD	10.0000	-6.0000	-0.1206	1	-10.0000
36	0.000	DEAD	10.0000	-6.0000	-0.1257	1	-10.0000
36	24.000	DEAD	10.0000	-6.0000	-0.0582	1	-10.0000
36	48.000	DEAD	10.0000	-6.0000	-0.0058	1	-10.0000
36	72.000	DEAD	-10.0000	-6.0000	-0.0316	3	10.0000
36	96.000	DEAD	-10.0000	-6.0000	-0.0540	3	10.0000
36	120.000	DEAD	-10.0000	-6.0000	-0.0615	3	10.0000
36	144.000	DEAD	-10.0000	-6.0000	-0.0539	3	10.0000
36	168.000	DEAD	-10.0000	-6.0000	-0.0313	3	10.0000
36	192.000	DEAD	10.0000	-6.0000	-0.0062	1	-10.0000
36	216.000	DEAD	10.0000	-6.0000	-0.0588	1	-10.0000

Frame	Station (in)	Output Case	x2S11Max (in)	x3S11Max (in)	S11Min (Kip/in2)	PtS11Min	x2S11Min (in)
36	240.000	DEAD	10.0000	-6.0000	-0.1264	1	-10.0000
37	0.000	DEAD	10.0000	-6.0000	-0.1238	1	-10.0000
37	24.000	DEAD	10.0000	-6.0000	-0.0564	1	-10.0000
37	48.000	DEAD	10.0000	-6.0000	-0.0041	1	-10.0000
37	72.000	DEAD	-10.0000	-6.0000	-0.0333	3	10.0000
37	96.000	DEAD	-10.0000	-6.0000	-0.0556	3	10.0000
37	120.000	DEAD	-10.0000	-6.0000	-0.0630	3	10.0000
37	144.000	DEAD	-10.0000	-6.0000	-0.0554	3	10.0000
37	168.000	DEAD	-10.0000	-6.0000	-0.0327	3	10.0000
37	192.000	DEAD	10.0000	-6.0000	-0.0049	1	-10.0000
37	216.000	DEAD	10.0000	-6.0000	-0.0576	1	-10.0000
37	240.000	DEAD	10.0000	-6.0000	-0.1252	1	-10.0000
38	0.000	DEAD	10.0000	-6.0000	-0.1233	1	-10.0000
38	24.000	DEAD	10.0000	-6.0000	-0.0560	1	-10.0000
38	48.000	DEAD	10.0000	-6.0000	-0.0037	1	-10.0000
38	72.000	DEAD	-10.0000	-6.0000	-0.0336	3	10.0000
38	96.000	DEAD	-10.0000	-6.0000	-0.0559	3	10.0000
38	120.000	DEAD	-10.0000	-6.0000	-0.0632	3	10.0000
38	144.000	DEAD	-10.0000	-6.0000	-0.0556	3	10.0000
38	168.000	DEAD	-10.0000	-6.0000	-0.0329	3	10.0000
38	192.000	DEAD	10.0000	-6.0000	-0.0048	1	-10.0000
38	216.000	DEAD	10.0000	-6.0000	-0.0575	1	-10.0000
38	240.000	DEAD	10.0000	-6.0000	-0.1252	1	-10.0000
39	0.000	DEAD	10.0000	-6.0000	-0.1227	1	-10.0000
39	24.000	DEAD	10.0000	-6.0000	-0.0554	1	-10.0000
39	48.000	DEAD	10.0000	-6.0000	-0.0031	1	-10.0000
39	72.000	DEAD	-10.0000	-6.0000	-0.0342	3	10.0000
39	96.000	DEAD	-10.0000	-6.0000	-0.0565	3	10.0000
39	120.000	DEAD	-10.0000	-6.0000	-0.0638	3	10.0000
39	144.000	DEAD	-10.0000	-6.0000	-0.0560	3	10.0000
39	168.000	DEAD	-10.0000	-6.0000	-0.0333	3	10.0000
39	192.000	DEAD	10.0000	-6.0000	-0.0044	1	-10.0000
39	216.000	DEAD	10.0000	-6.0000	-0.0571	1	-10.0000
39	240.000	DEAD	10.0000	-6.0000	-0.1248	1	-10.0000
40	0.000	DEAD	10.0000	-6.0000	-0.1225	1	-10.0000
40	24.000	DEAD	10.0000	-6.0000	-0.0552	1	-10.0000
40	48.000	DEAD	10.0000	-6.0000	-0.0029	1	-10.0000
40	72.000	DEAD	-10.0000	-6.0000	-0.0343	3	10.0000
40	96.000	DEAD	-10.0000	-6.0000	-0.0566	3	10.0000
40	120.000	DEAD	-10.0000	-6.0000	-0.0639	3	10.0000
40	144.000	DEAD	-10.0000	-6.0000	-0.0561	3	10.0000
40	168.000	DEAD	-10.0000	-6.0000	-0.0334	3	10.0000
40	192.000	DEAD	10.0000	-6.0000	-0.0043	1	-10.0000
40	216.000	DEAD	10.0000	-6.0000	-0.0571	1	-10.0000
40	240.000	DEAD	10.0000	-6.0000	-0.1248	1	-10.0000
41	0.000	DEAD	10.0000	-6.0000	-0.1215	1	-10.0000
41	24.000	DEAD	10.0000	-6.0000	-0.0542	1	-10.0000
41	48.000	DEAD	10.0000	-6.0000	-0.0020	1	-10.0000
41	72.000	DEAD	-10.0000	-6.0000	-0.0352	3	10.0000
41	96.000	DEAD	-10.0000	-6.0000	-0.0575	3	10.0000
41	120.000	DEAD	-10.0000	-6.0000	-0.0647	3	10.0000
41	144.000	DEAD	-10.0000	-6.0000	-0.0570	3	10.0000
41	168.000	DEAD	-10.0000	-6.0000	-0.0342	3	10.0000
41	192.000	DEAD	10.0000	-6.0000	-0.0035	1	-10.0000
41	216.000	DEAD	10.0000	-6.0000	-0.0563	1	-10.0000
41	240.000	DEAD	10.0000	-6.0000	-0.1240	1	-10.0000
42	0.000	DEAD	10.0000	-6.0000	-0.1236	1	-10.0000
42	24.000	DEAD	10.0000	-6.0000	-0.0563	1	-10.0000
42	48.000	DEAD	10.0000	-6.0000	-0.0039	1	-10.0000

Frame	Station (in)	Output Case	x2S11Max (in)	x3S11Max (in)	S11Min (Kip/in2)	PtS11Min	x2S11Min (in)
42	72.000	DEAD	-10.0000	-6.0000	-0.0334	3	10.0000
42	96.000	DEAD	-10.0000	-6.0000	-0.0557	3	10.0000
42	120.000	DEAD	-10.0000	-6.0000	-0.0631	3	10.0000
42	144.000	DEAD	-10.0000	-6.0000	-0.0554	3	10.0000
42	168.000	DEAD	-10.0000	-6.0000	-0.0328	3	10.0000
42	192.000	DEAD	10.0000	-6.0000	-0.0049	1	-10.0000
42	216.000	DEAD	10.0000	-6.0000	-0.0576	1	-10.0000
42	240.000	DEAD	10.0000	-6.0000	-0.1252	1	-10.0000
43	0.000	DEAD	10.0000	-6.0000	-0.1301	1	-10.0000
43	24.000	DEAD	10.0000	-6.0000	-0.0598	1	-10.0000
43	48.000	DEAD	10.0000	-6.0000	-0.0045	1	-10.0000
43	72.000	DEAD	-10.0000	-6.0000	-0.0358	3	10.0000
43	96.000	DEAD	-10.0000	-6.0000	-0.0611	3	10.0000
43	120.000	DEAD	-10.0000	-6.0000	-0.0714	3	10.0000
43	144.000	DEAD	-10.0000	-6.0000	-0.0667	3	10.0000
43	168.000	DEAD	-10.0000	-6.0000	-0.0471	3	10.0000
43	192.000	DEAD	-10.0000	-6.0000	-0.0124	3	10.0000
43	216.000	DEAD	10.0000	-6.0000	-0.0373	1	-10.0000
43	240.000	DEAD	10.0000	-6.0000	-0.1020	1	-10.0000
44	0.000	DEAD	10.0000	-6.0000	-0.1213	1	-10.0000
44	24.000	DEAD	10.0000	-6.0000	-0.0533	1	-10.0000
44	48.000	DEAD	10.0000	-6.0000	-3.305E-04	1	-10.0000
44	72.000	DEAD	-10.0000	-6.0000	-0.0377	3	10.0000
44	96.000	DEAD	-10.0000	-6.0000	-0.0607	3	10.0000
44	120.000	DEAD	-10.0000	-6.0000	-0.0687	3	10.0000
44	144.000	DEAD	-10.0000	-6.0000	-0.0617	3	10.0000
44	168.000	DEAD	-10.0000	-6.0000	-0.0397	3	10.0000
44	192.000	DEAD	-10.0000	-6.0000	-0.0027	3	10.0000
44	216.000	DEAD	10.0000	-6.0000	-0.0493	1	-10.0000
44	240.000	DEAD	10.0000	-6.0000	-0.1163	1	-10.0000
45	0.000	DEAD	10.0000	-6.0000	-0.1168	1	-10.0000
45	24.000	DEAD	10.0000	-6.0000	-0.0495	1	-10.0000
45	48.000	DEAD	-10.0000	-6.0000	-0.0027	3	10.0000
45	72.000	DEAD	-10.0000	-6.0000	-0.0399	3	10.0000
45	96.000	DEAD	-10.0000	-6.0000	-0.0621	3	10.0000
45	120.000	DEAD	-10.0000	-6.0000	-0.0693	3	10.0000
45	144.000	DEAD	-10.0000	-6.0000	-0.0615	3	10.0000
45	168.000	DEAD	-10.0000	-6.0000	-0.0387	3	10.0000
45	192.000	DEAD	-10.0000	-6.0000	-9.022E-04	3	10.0000
45	216.000	DEAD	10.0000	-6.0000	-0.0519	1	-10.0000
45	240.000	DEAD	10.0000	-6.0000	-0.1197	1	-10.0000
46	0.000	DEAD	10.0000	-6.0000	-0.1128	1	-10.0000
46	24.000	DEAD	10.0000	-6.0000	-0.0464	1	-10.0000
46	48.000	DEAD	-10.0000	-6.0000	-0.0050	3	10.0000
46	72.000	DEAD	-10.0000	-6.0000	-0.0414	3	10.0000
46	96.000	DEAD	-10.0000	-6.0000	-0.0627	3	10.0000
46	120.000	DEAD	-10.0000	-6.0000	-0.0691	3	10.0000
46	144.000	DEAD	-10.0000	-6.0000	-0.0605	3	10.0000
46	168.000	DEAD	-10.0000	-6.0000	-0.0368	3	10.0000
46	192.000	DEAD	10.0000	-6.0000	-0.0018	1	-10.0000
46	216.000	DEAD	10.0000	-6.0000	-0.0554	1	-10.0000
46	240.000	DEAD	10.0000	-6.0000	-0.1241	1	-10.0000
47	0.000	DEAD	10.0000	-6.0000	-0.1101	1	-10.0000
47	24.000	DEAD	10.0000	-6.0000	-0.0442	1	-10.0000
47	48.000	DEAD	-10.0000	-6.0000	-0.0068	3	10.0000
47	72.000	DEAD	-10.0000	-6.0000	-0.0427	3	10.0000
47	96.000	DEAD	-10.0000	-6.0000	-0.0636	3	10.0000
47	120.000	DEAD	-10.0000	-6.0000	-0.0695	3	10.0000
47	144.000	DEAD	-10.0000	-6.0000	-0.0605	3	10.0000

Frame	Station (in)	Output Case	x2S11Max (in)	x3S11Max (in)	S11Min (Kip/in2)	PtS11Min	x2S11Min (in)
47	168.000	DEAD	-10.0000	-6.0000	-0.0364	3	10.0000
47	192.000	DEAD	10.0000	-6.0000	-0.0027	1	-10.0000
47	216.000	DEAD	10.0000	-6.0000	-0.0568	1	-10.0000
47	240.000	DEAD	10.0000	-6.0000	-0.1258	1	-10.0000
48	0.000	DEAD	10.0000	-6.0000	-0.1062	1	-10.0000
48	24.000	DEAD	10.0000	-6.0000	-0.0415	1	-10.0000
48	48.000	DEAD	-10.0000	-6.0000	-0.0083	3	10.0000
48	72.000	DEAD	-10.0000	-6.0000	-0.0430	3	10.0000
48	96.000	DEAD	-10.0000	-6.0000	-0.0628	3	10.0000
48	120.000	DEAD	-10.0000	-6.0000	-0.0676	3	10.0000
48	144.000	DEAD	-10.0000	-6.0000	-0.0573	3	10.0000
48	168.000	DEAD	-10.0000	-6.0000	-0.0321	3	10.0000
48	192.000	DEAD	10.0000	-6.0000	-0.0082	1	-10.0000
48	216.000	DEAD	10.0000	-6.0000	-0.0634	1	-10.0000
48	240.000	DEAD	10.0000	-6.0000	-0.1337	1	-10.0000
49	0.000	DEAD	10.0000	-6.0000	-0.1189	1	-10.0000
49	24.000	DEAD	10.0000	-6.0000	-0.0497	1	-10.0000
49	48.000	DEAD	-10.0000	-6.0000	-0.0045	3	10.0000
49	72.000	DEAD	-10.0000	-6.0000	-0.0437	3	10.0000
49	96.000	DEAD	-10.0000	-6.0000	-0.0679	3	10.0000
49	120.000	DEAD	-10.0000	-6.0000	-0.0770	3	10.0000
49	144.000	DEAD	-10.0000	-6.0000	-0.0712	3	10.0000
49	168.000	DEAD	-10.0000	-6.0000	-0.0504	3	10.0000
49	192.000	DEAD	-10.0000	-6.0000	-0.0146	3	10.0000
49	216.000	DEAD	10.0000	-6.0000	-0.0362	1	-10.0000
49	240.000	DEAD	10.0000	-6.0000	-0.1020	1	-10.0000

Table 50: Element Forces - Frames, Part 4 of 4

Frame	Station in	Output Case	x3S11Min in
1	0.000	DEAD	0.0000
1	72.000	DEAD	-8.5000
1	144.000	DEAD	-8.5000
2	0.000	DEAD	-8.5000
2	72.000	DEAD	-8.5000
2	144.000	DEAD	-8.5000
3	0.000	DEAD	-8.5000
3	72.000	DEAD	-8.5000
3	144.000	DEAD	-8.5000
4	0.000	DEAD	-8.5000
4	72.000	DEAD	-8.5000
4	144.000	DEAD	-8.5000
5	0.000	DEAD	-8.5000
5	72.000	DEAD	-8.5000
5	144.000	DEAD	-8.5000
6	0.000	DEAD	-8.5000
6	72.000	DEAD	-8.5000
6	144.000	DEAD	-8.5000
7	0.000	DEAD	-8.5000
7	72.000	DEAD	-8.5000
7	144.000	DEAD	-8.5000
8	0.000	DEAD	0.0000

Frame	Station	Output Case	x3S11Min
	in		in
8	72.000	DEAD	-8.5000
8	144.000	DEAD	-8.5000
9	0.000	DEAD	-8.5000
9	72.000	DEAD	-8.5000
9	144.000	DEAD	-8.5000
10	0.000	DEAD	-8.5000
10	72.000	DEAD	-8.5000
10	144.000	DEAD	-8.5000
11	0.000	DEAD	-8.5000
11	72.000	DEAD	-8.5000
11	144.000	DEAD	-8.5000
12	0.000	DEAD	-8.5000
12	72.000	DEAD	-8.5000
12	144.000	DEAD	-8.5000
13	0.000	DEAD	-8.5000
13	72.000	DEAD	-8.5000
13	144.000	DEAD	-8.5000
14	0.000	DEAD	-8.5000
14	72.000	DEAD	-8.5000
14	144.000	DEAD	-8.5000
15	0.000	DEAD	0.0000
15	72.000	DEAD	-8.5000
15	144.000	DEAD	-8.5000
16	0.000	DEAD	-8.5000
16	72.000	DEAD	-8.5000
16	144.000	DEAD	-8.5000
17	0.000	DEAD	-8.5000
17	72.000	DEAD	-8.5000
17	144.000	DEAD	-8.5000
18	0.000	DEAD	-8.5000
18	72.000	DEAD	-8.5000
18	144.000	DEAD	-8.5000
19	0.000	DEAD	-8.5000
19	72.000	DEAD	-8.5000
19	144.000	DEAD	-8.5000
20	0.000	DEAD	-8.5000
20	72.000	DEAD	-8.5000
20	144.000	DEAD	-8.5000
21	0.000	DEAD	-8.5000
21	72.000	DEAD	-8.5000
21	144.000	DEAD	-8.5000
22	0.000	DEAD	0.0000
22	72.000	DEAD	-8.5000
22	144.000	DEAD	-8.5000
23	0.000	DEAD	-8.5000
23	72.000	DEAD	-8.5000
23	144.000	DEAD	-8.5000
24	0.000	DEAD	-8.5000
24	72.000	DEAD	-8.5000
24	144.000	DEAD	-8.5000
25	0.000	DEAD	-8.5000
25	72.000	DEAD	-8.5000
25	144.000	DEAD	-8.5000
26	0.000	DEAD	-8.5000
26	72.000	DEAD	-8.5000
26	144.000	DEAD	-8.5000
27	0.000	DEAD	-8.5000
27	72.000	DEAD	-8.5000
27	144.000	DEAD	-8.5000

Frame	Station	Output Case	x3S11Min
	in		in
28	0.000	DEAD	-8.5000
28	72.000	DEAD	-8.5000
28	144.000	DEAD	-8.5000
29	0.000	DEAD	-6.0000
29	24.000	DEAD	-6.0000
29	48.000	DEAD	-6.0000
29	72.000	DEAD	-6.0000
29	96.000	DEAD	-6.0000
29	120.000	DEAD	-6.0000
29	144.000	DEAD	-6.0000
29	168.000	DEAD	-6.0000
29	192.000	DEAD	-6.0000
29	216.000	DEAD	-6.0000
29	240.000	DEAD	-6.0000
30	0.000	DEAD	-6.0000
30	24.000	DEAD	-6.0000
30	48.000	DEAD	-6.0000
30	72.000	DEAD	-6.0000
30	96.000	DEAD	-6.0000
30	120.000	DEAD	-6.0000
30	144.000	DEAD	-6.0000
30	168.000	DEAD	-6.0000
30	192.000	DEAD	-6.0000
30	216.000	DEAD	-6.0000
30	240.000	DEAD	-6.0000
31	0.000	DEAD	-6.0000
31	24.000	DEAD	-6.0000
31	48.000	DEAD	-6.0000
31	72.000	DEAD	-6.0000
31	96.000	DEAD	-6.0000
31	120.000	DEAD	-6.0000
31	144.000	DEAD	-6.0000
31	168.000	DEAD	-6.0000
31	192.000	DEAD	-6.0000
31	216.000	DEAD	-6.0000
31	240.000	DEAD	-6.0000
32	0.000	DEAD	-6.0000
32	24.000	DEAD	-6.0000
32	48.000	DEAD	-6.0000
32	72.000	DEAD	-6.0000
32	96.000	DEAD	-6.0000
32	120.000	DEAD	-6.0000
32	144.000	DEAD	-6.0000
32	168.000	DEAD	-6.0000
32	192.000	DEAD	-6.0000
32	216.000	DEAD	-6.0000
32	240.000	DEAD	-6.0000
33	0.000	DEAD	-6.0000
33	24.000	DEAD	-6.0000
33	48.000	DEAD	-6.0000
33	72.000	DEAD	-6.0000
33	96.000	DEAD	-6.0000
33	120.000	DEAD	-6.0000
33	144.000	DEAD	-6.0000
33	168.000	DEAD	-6.0000
33	192.000	DEAD	-6.0000
33	216.000	DEAD	-6.0000
33	240.000	DEAD	-6.0000
34	0.000	DEAD	-6.0000

Frame	Station	Output Case	x3S11Min
	in		in
34	24.000	DEAD	-6.0000
34	48.000	DEAD	-6.0000
34	72.000	DEAD	-6.0000
34	96.000	DEAD	-6.0000
34	120.000	DEAD	-6.0000
34	144.000	DEAD	-6.0000
34	168.000	DEAD	-6.0000
34	192.000	DEAD	-6.0000
34	216.000	DEAD	-6.0000
34	240.000	DEAD	-6.0000
35	0.000	DEAD	-6.0000
35	24.000	DEAD	-6.0000
35	48.000	DEAD	-6.0000
35	72.000	DEAD	-6.0000
35	96.000	DEAD	-6.0000
35	120.000	DEAD	-6.0000
35	144.000	DEAD	-6.0000
35	168.000	DEAD	-6.0000
35	192.000	DEAD	-6.0000
35	216.000	DEAD	-6.0000
35	240.000	DEAD	-6.0000
36	0.000	DEAD	-6.0000
36	24.000	DEAD	-6.0000
36	48.000	DEAD	-6.0000
36	72.000	DEAD	-6.0000
36	96.000	DEAD	-6.0000
36	120.000	DEAD	-6.0000
36	144.000	DEAD	-6.0000
36	168.000	DEAD	-6.0000
36	192.000	DEAD	-6.0000
36	216.000	DEAD	-6.0000
36	240.000	DEAD	-6.0000
37	0.000	DEAD	-6.0000
37	24.000	DEAD	-6.0000
37	48.000	DEAD	-6.0000
37	72.000	DEAD	-6.0000
37	96.000	DEAD	-6.0000
37	120.000	DEAD	-6.0000
37	144.000	DEAD	-6.0000
37	168.000	DEAD	-6.0000
37	192.000	DEAD	-6.0000
37	216.000	DEAD	-6.0000
37	240.000	DEAD	-6.0000
38	0.000	DEAD	-6.0000
38	24.000	DEAD	-6.0000
38	48.000	DEAD	-6.0000
38	72.000	DEAD	-6.0000
38	96.000	DEAD	-6.0000
38	120.000	DEAD	-6.0000
38	144.000	DEAD	-6.0000
38	168.000	DEAD	-6.0000
38	192.000	DEAD	-6.0000
38	216.000	DEAD	-6.0000
38	240.000	DEAD	-6.0000
39	0.000	DEAD	-6.0000
39	24.000	DEAD	-6.0000
39	48.000	DEAD	-6.0000
39	72.000	DEAD	-6.0000
39	96.000	DEAD	-6.0000

Frame	Station	Output Case	x3S11Min
	in		in
39	120.000	DEAD	-6.0000
39	144.000	DEAD	-6.0000
39	168.000	DEAD	-6.0000
39	192.000	DEAD	-6.0000
39	216.000	DEAD	-6.0000
39	240.000	DEAD	-6.0000
40	0.000	DEAD	-6.0000
40	24.000	DEAD	-6.0000
40	48.000	DEAD	-6.0000
40	72.000	DEAD	-6.0000
40	96.000	DEAD	-6.0000
40	120.000	DEAD	-6.0000
40	144.000	DEAD	-6.0000
40	168.000	DEAD	-6.0000
40	192.000	DEAD	-6.0000
40	216.000	DEAD	-6.0000
40	240.000	DEAD	-6.0000
41	0.000	DEAD	-6.0000
41	24.000	DEAD	-6.0000
41	48.000	DEAD	-6.0000
41	72.000	DEAD	-6.0000
41	96.000	DEAD	-6.0000
41	120.000	DEAD	-6.0000
41	144.000	DEAD	-6.0000
41	168.000	DEAD	-6.0000
41	192.000	DEAD	-6.0000
41	216.000	DEAD	-6.0000
41	240.000	DEAD	-6.0000
42	0.000	DEAD	-6.0000
42	24.000	DEAD	-6.0000
42	48.000	DEAD	-6.0000
42	72.000	DEAD	-6.0000
42	96.000	DEAD	-6.0000
42	120.000	DEAD	-6.0000
42	144.000	DEAD	-6.0000
42	168.000	DEAD	-6.0000
42	192.000	DEAD	-6.0000
42	216.000	DEAD	-6.0000
42	240.000	DEAD	-6.0000
43	0.000	DEAD	-6.0000
43	24.000	DEAD	-6.0000
43	48.000	DEAD	-6.0000
43	72.000	DEAD	-6.0000
43	96.000	DEAD	-6.0000
43	120.000	DEAD	-6.0000
43	144.000	DEAD	-6.0000
43	168.000	DEAD	-6.0000
43	192.000	DEAD	-6.0000
43	216.000	DEAD	-6.0000
43	240.000	DEAD	-6.0000
44	0.000	DEAD	-6.0000
44	24.000	DEAD	-6.0000
44	48.000	DEAD	-6.0000
44	72.000	DEAD	-6.0000
44	96.000	DEAD	-6.0000
44	120.000	DEAD	-6.0000
44	144.000	DEAD	-6.0000
44	168.000	DEAD	-6.0000
44	192.000	DEAD	-6.0000

Frame	Station	Output Case	x3S11Min
	in		in
44	216.000	DEAD	-6.0000
44	240.000	DEAD	-6.0000
45	0.000	DEAD	-6.0000
45	24.000	DEAD	-6.0000
45	48.000	DEAD	-6.0000
45	72.000	DEAD	-6.0000
45	96.000	DEAD	-6.0000
45	120.000	DEAD	-6.0000
45	144.000	DEAD	-6.0000
45	168.000	DEAD	-6.0000
45	192.000	DEAD	-6.0000
45	216.000	DEAD	-6.0000
45	240.000	DEAD	-6.0000
46	0.000	DEAD	-6.0000
46	24.000	DEAD	-6.0000
46	48.000	DEAD	-6.0000
46	72.000	DEAD	-6.0000
46	96.000	DEAD	-6.0000
46	120.000	DEAD	-6.0000
46	144.000	DEAD	-6.0000
46	168.000	DEAD	-6.0000
46	192.000	DEAD	-6.0000
46	216.000	DEAD	-6.0000
46	240.000	DEAD	-6.0000
47	0.000	DEAD	-6.0000
47	24.000	DEAD	-6.0000
47	48.000	DEAD	-6.0000
47	72.000	DEAD	-6.0000
47	96.000	DEAD	-6.0000
47	120.000	DEAD	-6.0000
47	144.000	DEAD	-6.0000
47	168.000	DEAD	-6.0000
47	192.000	DEAD	-6.0000
47	216.000	DEAD	-6.0000
47	240.000	DEAD	-6.0000
48	0.000	DEAD	-6.0000
48	24.000	DEAD	-6.0000
48	48.000	DEAD	-6.0000
48	72.000	DEAD	-6.0000
48	96.000	DEAD	-6.0000
48	120.000	DEAD	-6.0000
48	144.000	DEAD	-6.0000
48	168.000	DEAD	-6.0000
48	192.000	DEAD	-6.0000
48	216.000	DEAD	-6.0000
48	240.000	DEAD	-6.0000
49	0.000	DEAD	-6.0000
49	24.000	DEAD	-6.0000
49	48.000	DEAD	-6.0000
49	72.000	DEAD	-6.0000
49	96.000	DEAD	-6.0000
49	120.000	DEAD	-6.0000
49	144.000	DEAD	-6.0000
49	168.000	DEAD	-6.0000
49	192.000	DEAD	-6.0000
49	216.000	DEAD	-6.0000
49	240.000	DEAD	-6.0000

4.3.9 AREA RESULTS

This section provides area results, including items such as forces and stresses.

Table 51: Element Forces - Area Shells, Part 1 of 3

Area	Area Elem	Joint	Output Case	F11	F22	F12
				Kip/in	Kip/in	Kip/in
1	1	33	DEAD	2.6218	8.7393	0.9478
1	1	34	DEAD	-3.5773	-11.9243	0.9478
1	1	35	DEAD	-3.5773	-11.9243	-0.1433
1	1	36	DEAD	2.6218	8.7393	-0.1433
2	2	36	DEAD	2.0128	6.7092	0.2513
2	2	35	DEAD	-2.8213	-9.4042	0.2513
2	2	37	DEAD	-2.8213	-9.4042	0.3601
2	2	38	DEAD	2.0128	6.7092	0.3601
3	3	38	DEAD	1.4739	4.9130	0.3086
3	3	37	DEAD	-2.1354	-7.1180	0.3086
3	3	39	DEAD	-2.1354	-7.1180	0.2909
3	3	40	DEAD	1.4739	4.9130	0.2909
4	4	40	DEAD	0.9755	3.2516	0.2736
4	4	39	DEAD	-1.4900	-4.9666	0.2736
4	4	41	DEAD	-1.4900	-4.9666	0.2641
4	4	42	DEAD	0.9755	3.2516	0.2641
5	5	42	DEAD	0.5529	1.8430	0.2314
5	5	41	DEAD	-0.9204	-3.0680	0.2314
5	5	43	DEAD	-0.9204	-3.0680	0.2166
5	5	44	DEAD	0.5529	1.8430	0.2166
6	6	44	DEAD	0.2357	0.7858	0.1742
6	6	43	DEAD	-0.4562	-1.5208	0.1742
6	6	45	DEAD	-0.4562	-1.5208	0.1540
6	6	46	DEAD	0.2357	0.7858	0.1540
7	7	46	DEAD	0.0536	0.1788	0.0961
7	7	45	DEAD	-0.1271	-0.4238	0.0961
7	7	47	DEAD	-0.1271	-0.4238	0.0842
7	7	48	DEAD	0.0536	0.1788	0.0842

Table 52: Element Forces - Area Shells, Part 2 of 3

Area	Area Elem	Joint	Output Case	M11	M22	M12
				Kip-in/in	Kip-in/in	Kip-in/in
1	1	33	DEAD	0.0000	0.0000	0.0000
1	1	34	DEAD	0.0000	0.0000	0.0000
1	1	35	DEAD	0.0000	0.0000	0.0000

Area	Area Elem	Joint	Output Case	M11	M22	M12
				Kip-in/in	Kip-in/in	Kip-in/in
1	1	36	DEAD	0.0000	0.0000	0.0000
2	2	36	DEAD	0.0000	0.0000	0.0000
2	2	35	DEAD	0.0000	0.0000	0.0000
2	2	37	DEAD	0.0000	0.0000	0.0000
2	2	38	DEAD	0.0000	0.0000	0.0000
3	3	38	DEAD	0.0000	0.0000	0.0000
3	3	37	DEAD	0.0000	0.0000	0.0000
3	3	39	DEAD	0.0000	0.0000	0.0000
3	3	40	DEAD	0.0000	0.0000	0.0000
4	4	40	DEAD	0.0000	0.0000	0.0000
4	4	39	DEAD	0.0000	0.0000	0.0000
4	4	41	DEAD	0.0000	0.0000	0.0000
4	4	42	DEAD	0.0000	0.0000	0.0000
5	5	42	DEAD	0.0000	0.0000	0.0000
5	5	41	DEAD	0.0000	0.0000	0.0000
5	5	43	DEAD	0.0000	0.0000	0.0000
5	5	44	DEAD	0.0000	0.0000	0.0000
6	6	44	DEAD	0.0000	0.0000	0.0000
6	6	43	DEAD	0.0000	0.0000	0.0000
6	6	45	DEAD	0.0000	0.0000	0.0000
6	6	46	DEAD	0.0000	0.0000	0.0000
7	7	46	DEAD	0.0000	0.0000	0.0000
7	7	45	DEAD	0.0000	0.0000	0.0000
7	7	47	DEAD	0.0000	0.0000	0.0000
7	7	48	DEAD	0.0000	0.0000	0.0000

Table 53: Element Forces - Area Shells, Part 3 of 3

Area	AreaElem	Joint	OutputCase	V13	V23
				Kip/in	Kip/in
1	1	33	DEAD	0.0000	0.0000
1	1	34	DEAD	0.0000	0.0000
1	1	35	DEAD	0.0000	0.0000
1	1	36	DEAD	0.0000	0.0000
2	2	36	DEAD	0.0000	0.0000
2	2	35	DEAD	0.0000	0.0000
2	2	37	DEAD	0.0000	0.0000
2	2	38	DEAD	0.0000	0.0000
3	3	38	DEAD	0.0000	0.0000
3	3	37	DEAD	0.0000	0.0000
3	3	39	DEAD	0.0000	0.0000
3	3	40	DEAD	0.0000	0.0000
4	4	40	DEAD	0.0000	0.0000
4	4	39	DEAD	0.0000	0.0000
4	4	41	DEAD	0.0000	0.0000
4	4	42	DEAD	0.0000	0.0000

Area	AreaElem	Joint	OutputCase	V13	V23
				Kip/in	Kip/in
5	5	42	DEAD	0.0000	0.0000
5	5	41	DEAD	0.0000	0.0000
5	5	43	DEAD	0.0000	0.0000
5	5	44	DEAD	0.0000	0.0000
6	6	44	DEAD	0.0000	0.0000
6	6	43	DEAD	0.0000	0.0000
6	6	45	DEAD	0.0000	0.0000
6	6	46	DEAD	0.0000	0.0000
7	7	46	DEAD	0.0000	0.0000
7	7	45	DEAD	0.0000	0.0000
7	7	47	DEAD	0.0000	0.0000
7	7	48	DEAD	0.0000	0.0000

Table 54: Element Stresses - Area Shells, Part 1 of 3

Area	Area Elem	Joint	Output Case	S11Top	S22Top	S12Top
				Kip/in2	Kip/in2	Kip/in2
1	1	33	DEAD	0.4370	1.4565	0.1580
1	1	34	DEAD	-0.5962	-1.9874	0.1580
1	1	35	DEAD	-0.5962	-1.9874	-0.0239
1	1	36	DEAD	0.4370	1.4565	-0.0239
2	2	36	DEAD	0.3355	1.1182	0.0419
2	2	35	DEAD	-0.4702	-1.5674	0.0419
2	2	37	DEAD	-0.4702	-1.5674	0.0600
2	2	38	DEAD	0.3355	1.1182	0.0600
3	3	38	DEAD	0.2457	0.8188	0.0514
3	3	37	DEAD	-0.3559	-1.1863	0.0514
3	3	39	DEAD	-0.3559	-1.1863	0.0485
3	3	40	DEAD	0.2457	0.8188	0.0485
4	4	40	DEAD	0.1626	0.5419	0.0456
4	4	39	DEAD	-0.2483	-0.8278	0.0456
4	4	41	DEAD	-0.2483	-0.8278	0.0440
4	4	42	DEAD	0.1626	0.5419	0.0440
5	5	42	DEAD	0.0922	0.3072	0.0386
5	5	41	DEAD	-0.1534	-0.5113	0.0386
5	5	43	DEAD	-0.1534	-0.5113	0.0361
5	5	44	DEAD	0.0922	0.3072	0.0361
6	6	44	DEAD	0.0393	0.1310	0.0290
6	6	43	DEAD	-0.0760	-0.2535	0.0290
6	6	45	DEAD	-0.0760	-0.2535	0.0257
6	6	46	DEAD	0.0393	0.1310	0.0257
7	7	46	DEAD	0.0089	0.0298	0.0160
7	7	45	DEAD	-0.0212	-0.0706	0.0160
7	7	47	DEAD	-0.0212	-0.0706	0.0140
7	7	48	DEAD	0.0089	0.0298	0.0140

Table 55: Element Stresses - Area Shells, Part 2 of 3

Area	Area Elem	Joint	Output Case	S11Bot	S22Bot	S12Bot
				Kip/in2	Kip/in2	Kip/in2
1	1	33	DEAD	0.4370	1.4565	0.1580
1	1	34	DEAD	-0.5962	-1.9874	0.1580
1	1	35	DEAD	-0.5962	-1.9874	-0.0239
1	1	36	DEAD	0.4370	1.4565	-0.0239
2	2	36	DEAD	0.3355	1.1182	0.0419
2	2	35	DEAD	-0.4702	-1.5674	0.0419
2	2	37	DEAD	-0.4702	-1.5674	0.0600
2	2	38	DEAD	0.3355	1.1182	0.0600
3	3	38	DEAD	0.2457	0.8188	0.0514
3	3	37	DEAD	-0.3559	-1.1863	0.0514
3	3	39	DEAD	-0.3559	-1.1863	0.0485
3	3	40	DEAD	0.2457	0.8188	0.0485
4	4	40	DEAD	0.1626	0.5419	0.0456
4	4	39	DEAD	-0.2483	-0.8278	0.0456
4	4	41	DEAD	-0.2483	-0.8278	0.0440
4	4	42	DEAD	0.1626	0.5419	0.0440
5	5	42	DEAD	0.0922	0.3072	0.0386
5	5	41	DEAD	-0.1534	-0.5113	0.0386
5	5	43	DEAD	-0.1534	-0.5113	0.0361
5	5	44	DEAD	0.0922	0.3072	0.0361
6	6	44	DEAD	0.0393	0.1310	0.0290
6	6	43	DEAD	-0.0760	-0.2535	0.0290
6	6	45	DEAD	-0.0760	-0.2535	0.0257
6	6	46	DEAD	0.0393	0.1310	0.0257
7	7	46	DEAD	0.0089	0.0298	0.0160
7	7	45	DEAD	-0.0212	-0.0706	0.0160
7	7	47	DEAD	-0.0212	-0.0706	0.0140
7	7	48	DEAD	0.0089	0.0298	0.0140

Table 56: Element Stresses - Area Shells, Part 3 of 3

Area	Area Elem	Joint	Output Case	S13Avg	S23Avg
				Kip/in2	Kip/in2
1	1	33	DEAD	0.0000	0.0000
1	1	34	DEAD	0.0000	0.0000
1	1	35	DEAD	0.0000	0.0000
1	1	36	DEAD	0.0000	0.0000
2	2	36	DEAD	0.0000	0.0000
2	2	35	DEAD	0.0000	0.0000
2	2	37	DEAD	0.0000	0.0000
2	2	38	DEAD	0.0000	0.0000
3	3	38	DEAD	0.0000	0.0000
3	3	37	DEAD	0.0000	0.0000
3	3	39	DEAD	0.0000	0.0000
3	3	40	DEAD	0.0000	0.0000
4	4	40	DEAD	0.0000	0.0000
4	4	39	DEAD	0.0000	0.0000
4	4	41	DEAD	0.0000	0.0000

Area	Area Elem	Joint	Output Case	S13Avg	S23Avg
				Kip/in2	Kip/in2
4	4	42	DEAD	0.0000	0.0000
5	5	42	DEAD	0.0000	0.0000
5	5	41	DEAD	0.0000	0.0000
5	5	43	DEAD	0.0000	0.0000
5	5	44	DEAD	0.0000	0.0000
6	6	44	DEAD	0.0000	0.0000
6	6	43	DEAD	0.0000	0.0000
6	6	45	DEAD	0.0000	0.0000
6	6	46	DEAD	0.0000	0.0000
7	7	46	DEAD	0.0000	0.0000
7	7	45	DEAD	0.0000	0.0000
7	7	47	DEAD	0.0000	0.0000
7	7	48	DEAD	0.0000	0.0000

CHAPTER 5: COST BENEFIT ANALYSIS

5.1 METHODOLOGY

Cost-Benefit Analysis is a procedure for evaluating the desirability of a project by weighting benefits against costs. Results may be expressed in different ways, including internal rate of return, net present value and benefit-cost ratio.

Why cost benefit analysis

Whenever a new research or new idea is proposed, cost benefit analysis is the main criteria to determine the feasibility of that idea. Whenever we plan for new substitute to overrule the current trend of analysis we have to be cost efficient to bring our research into reality.

Cost benefit analysis proposes various indexes which shows the benefits and shortcomings of the project in different aspects whether it may be financial or a social aspect.

It is also an important tool to quote the tender price for a project which is also called the base price so that even at lowest bidding your cost benefit ratio remains one which means input to a project is equal to the output from the project.

The concept of CBA dates back to an 1848 article by Jules Dupuit and was formalized in subsequent works by Alfred Marshall. The Corps of

Engineers initiated the use of CBA in the US, after the Federal Navigation Act of 1936 effectively required cost–benefit analysis for proposed federal waterway infrastructure. The Flood Control Act of 1939 was instrumental in establishing CBA as federal policy. It demanded that "the benefits to whomever they accrue in excess of the estimated costs
Cost-benefit analysis (CBA), sometimes called benefit–cost analysis (BCA), is a systematic approach to estimating the strengths and weaknesses of alternatives that satisfy transactions, activities or functional requirements for a construction. It is a technique that is used to determine options that provide the best approach for the adoption and practice in terms of benefits in labor, time and cost savings. The CBA is also defined as a systematic process for calculating and comparing benefits and costs of a project, decision or government policy .

Broadly CBA has two purposes:

1. To determine if it is a sound investment/decision.
2. To provide a basis for comparing projects.

It involves comparing the total expected cost of each option against the total expected benefits, to see whether the benefits outweigh the costs and by how much.
CBA is related to, but distinct from cost-effectiveness analysis. In CBA, benefits and costs are expressed in monetary terms, and are adjusted for the time value of money, so that all flows of benefits and flows of project costs over time (which tend to occur at different points in time) are expressed on a common basis in terms of their "net present value."
Cost–benefit analysis is often used by governments and other organizations, such as private sector businesses, to appraise the desirability of a given policy. It is an analysis of the expected balance of benefits and costs, including an account of foregone alternatives and the status quo. CBA helps predict whether the benefits of a policy outweigh its costs, and by how much relative to other alternatives (i.e. one can rank alternate policies in terms of the cost–benefit ratio). Generally, accurate cost–benefit analysis identifies choices that increase welfare from a utilitarian perspective. Assuming an accurate CBA, changing the status quo by implementing the alternative with the lowest cost–benefit ratio can improve Pareto efficiency. An analyst using CBA should recognize that perfect appraisal of all present and future costs and benefits is difficult, and while CBA can offer a well-educated estimate of the best alternative, perfection in terms of economic efficiency and social welfare are not guaranteed.

Process

The following is a list of steps that comprise a generic cost–benefit analysis.

List alternative projects/programs.
1. Select measurement and measure all cost/benefit elements.
2. Predict outcome of cost and benefits over relevant time period.
3. Convert all costs and benefits into a common mode of calculation.
4. Calculate net present value of project options.
5. Perform sensitivity analysis.
6. Adopt recommended choice.

Risk and uncertainty

Risk associated with project outcomes is usually handled using probability theory. This can be factored into the discount rate (to have uncertainty increasing over time), but is usually considered separately. Particular consideration is often given to risk aversion—the irrational preference for avoiding loss over achieving gains. Expected return calculations does not account for the detrimental effect of uncertainty.
Uncertainty in CBA parameters (as opposed to risk of project failure etc.) can be evaluated using a sensitivity analysis, which shows how results respond to parameter changes. Alternatively a more formal risk analysis can be undertaken using Monte Carlo simulations.

The value of a cost–benefit analysis depends on the accuracy of the individual cost and benefit estimates. Comparative studies indicate that such estimates are often flawed, preventing improvements in Pareto and Kaldor-Hicks efficiency. Causes of these inaccuracies include
1. Overreliance on data from past projects (often differing markedly in function or size and the skill levels of the team members)
2. Use of subjective impressions by assessment team members
3. Inappropriate use of heuristics to derive money cost of the intangible elements
4. Confirmation bias among project supporters (looking for reasons to proceed).

5.2 RESULTS

Table 56: Cost benefit analysis

Type of structure	Beams		Columns		Total (feet^3)
Structural Elements	No. Of Beams	Volume of concrete (feet^3)	No. of columns	Volume of concrete (feet3)	
Rigid Frame	21	1541.84	28	1961.25	3503.09
Rigid Frame + Shear wall	21	841.97	28	758.251	1600.221
Material saved by using wall framed structure					1902.869
Extra material required to construct full length shear wall On both sides	432×4				1728
Total material saved from structure after shear wall construction					<u>174.869</u>

Cost benefit ratio (considering only concrete) $= \frac{\textbf{Volume of concrete in framed structure}}{\textbf{Volume of concrete in wall framed structure}} = \frac{1902.869}{1600.221} = \underline{1.189}$

CHAPTER 6 RESULTS AND DISCUSSIONS

This chapter shows the displacement, base reaction, joint displacement and moment plots of wall framed structure over framed structure.

First storey displacement plot

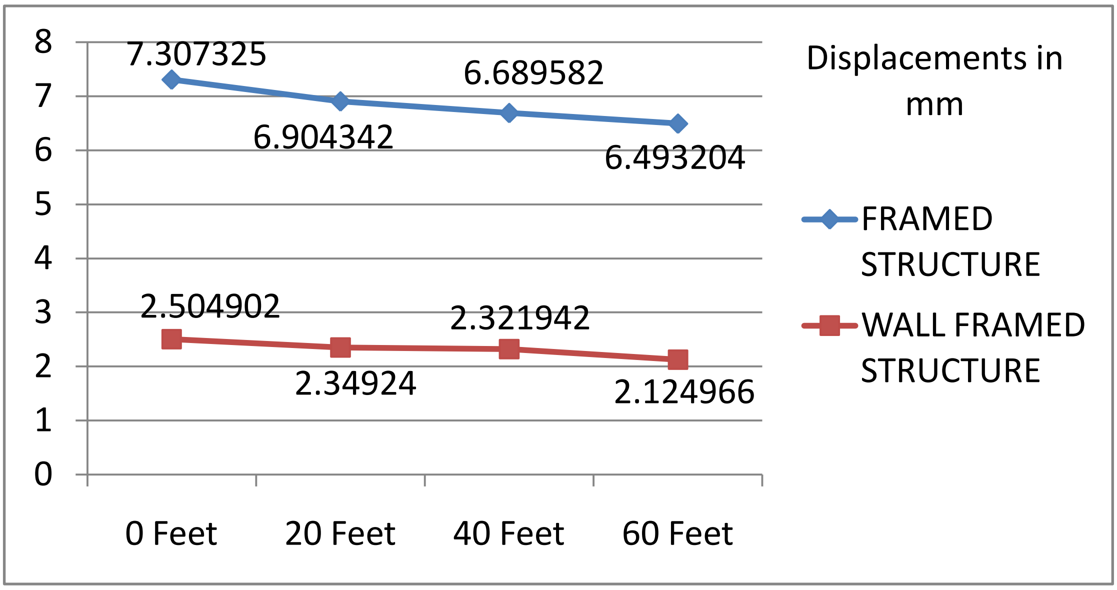

Figure 5: First storey displacement plot

Second storey displacement plot

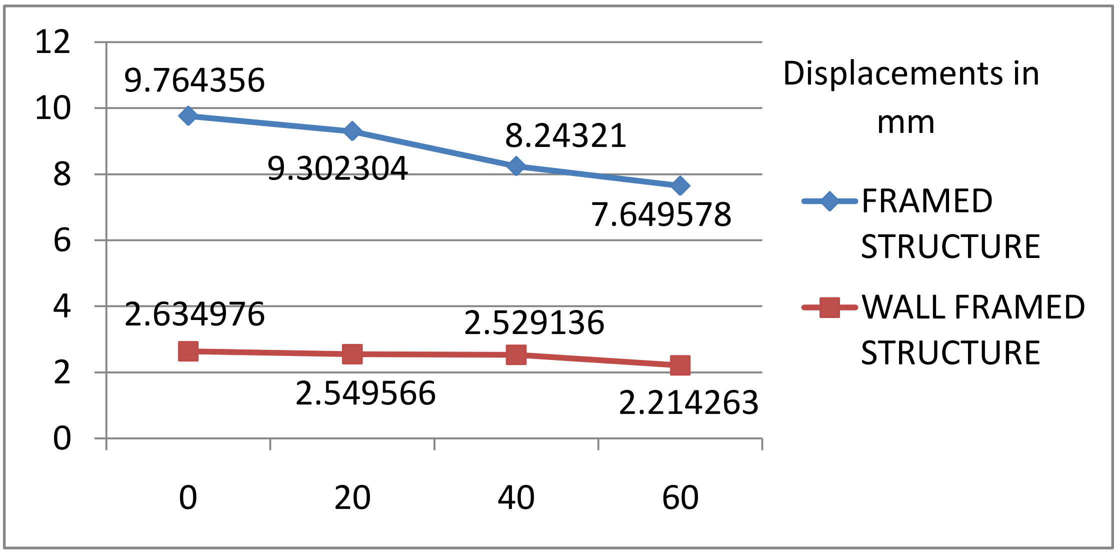

Figure 6: Second storey displacement plot

Third storey displacement plot

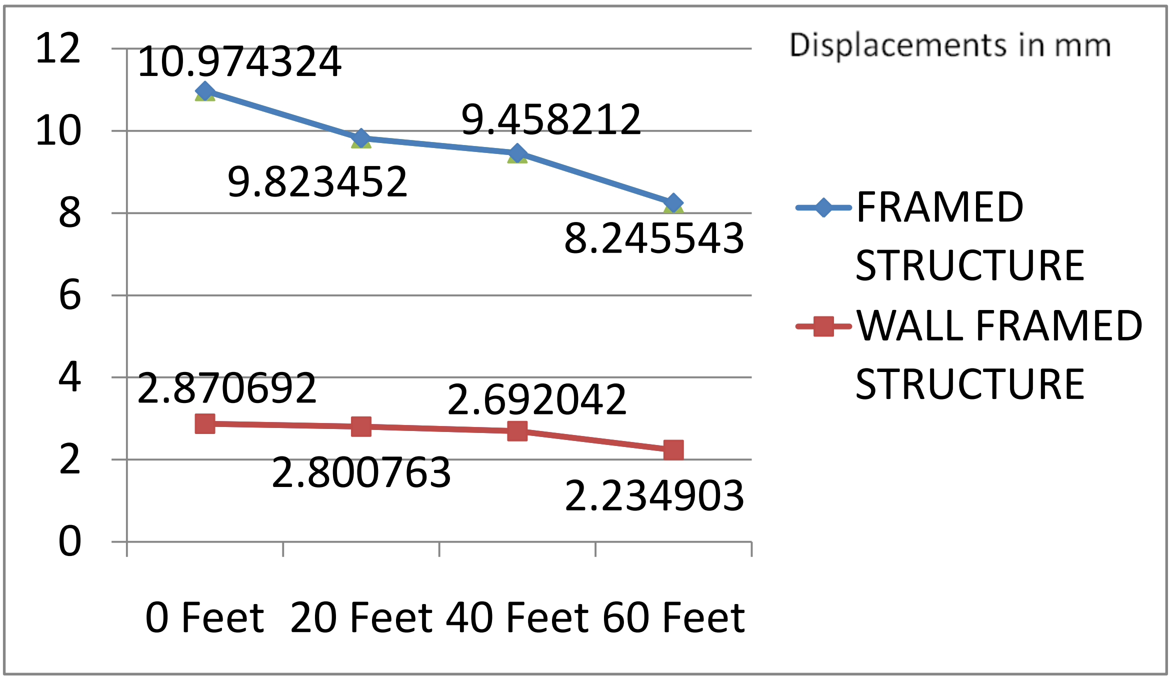

Figure 7: Third storey displacement plot

Fourth storey displacement plot

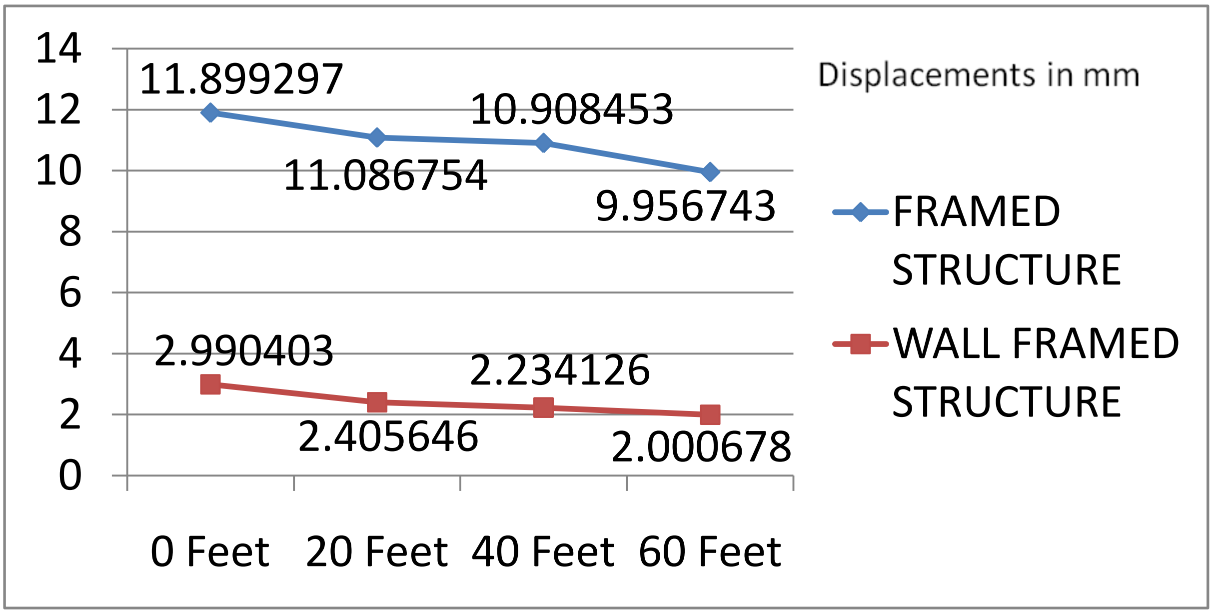

Figure 8: Fourth storey displacement plot

Fifth storey displacement plot

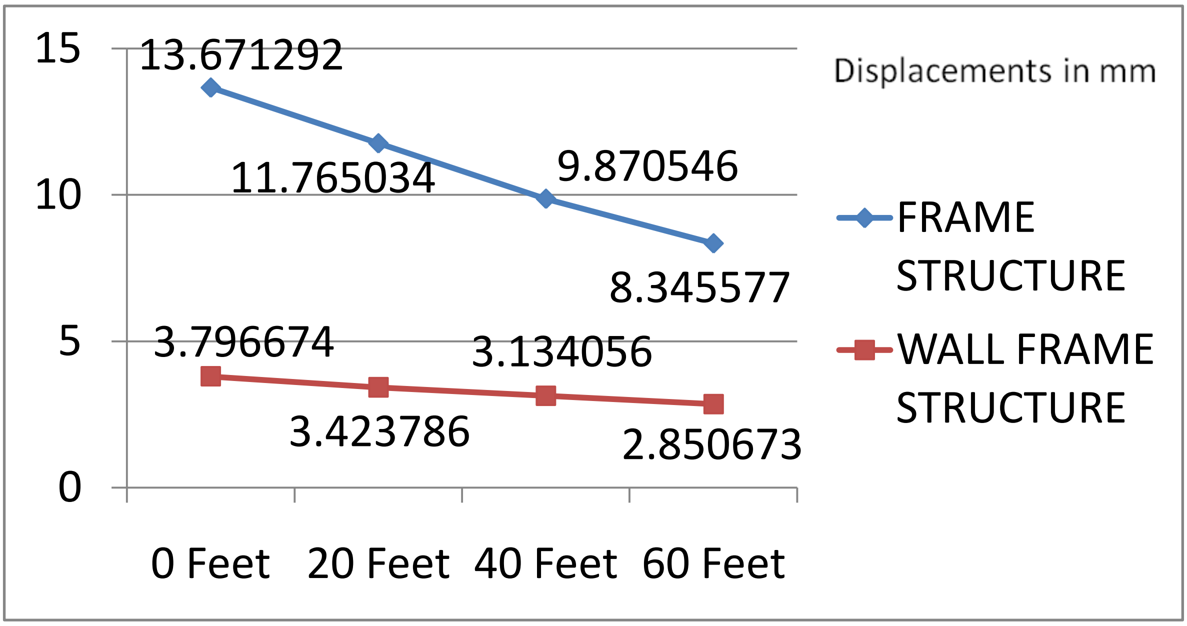

Figure 9: Fifth storey displacement plot

Sixth storey displacement plot

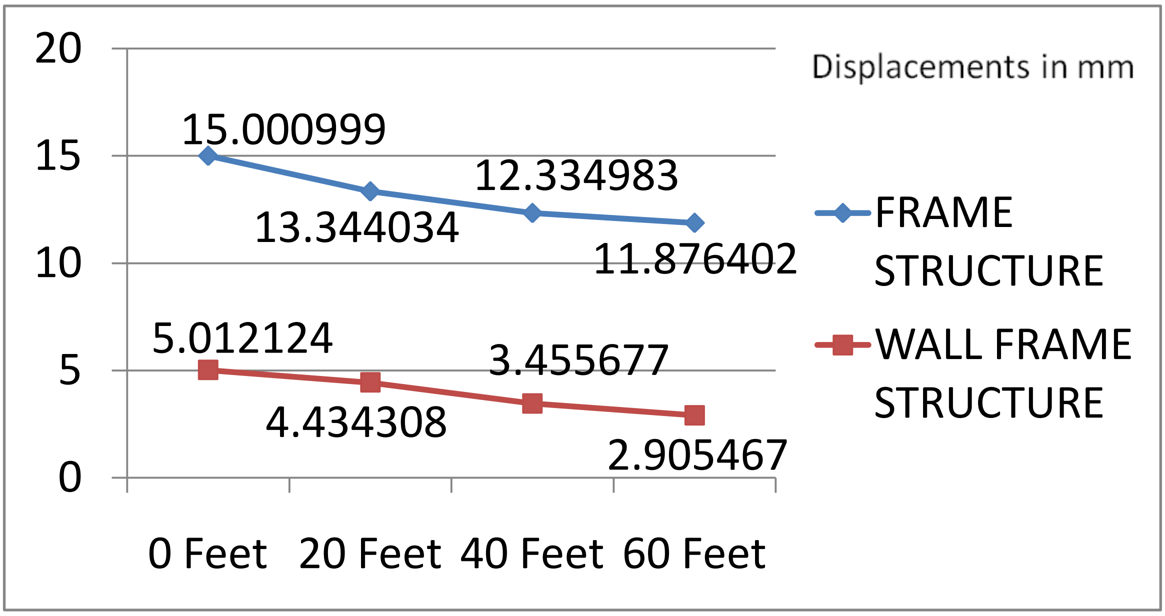

Figure 10: Sixth storey displacement plot

Seventh storey displacement plot

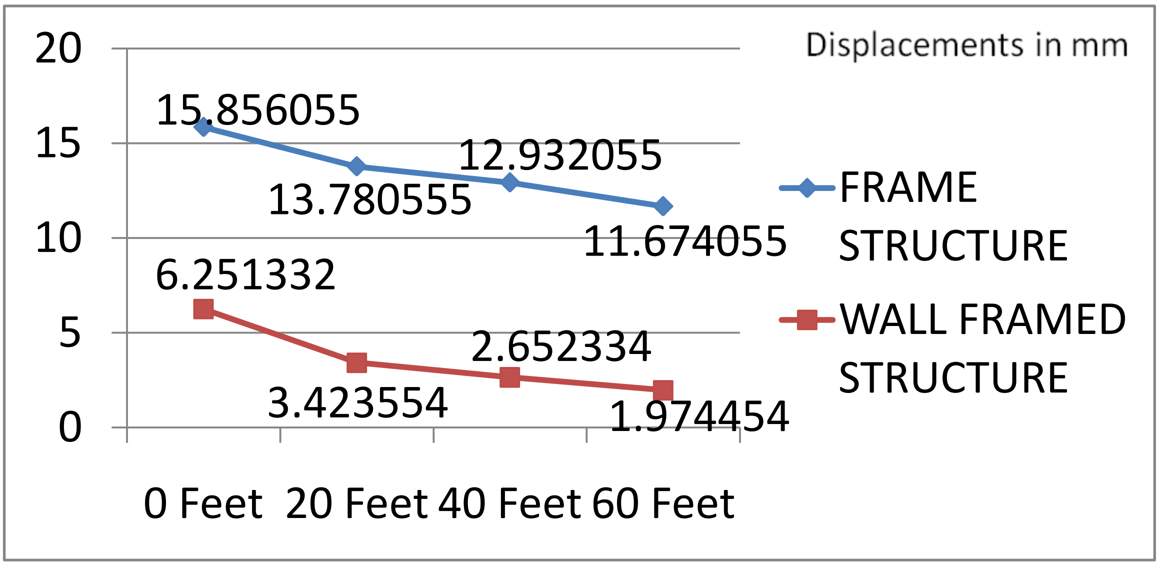

Figure 11: Seventh storey displacement plot

Base reactions plot

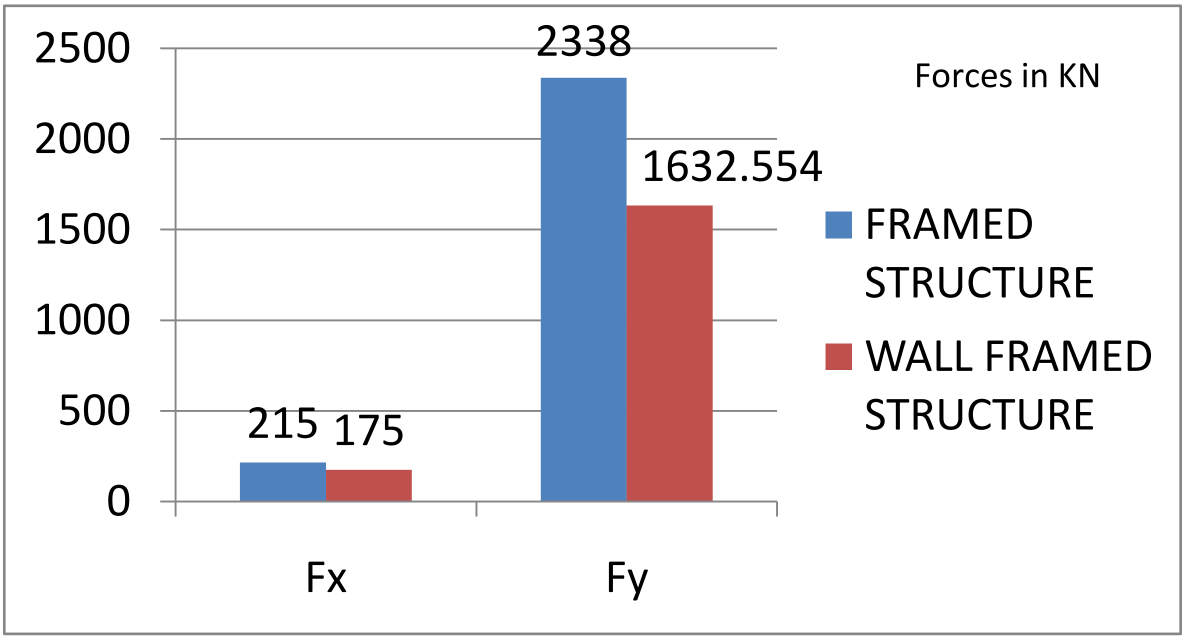

Figure 12: Base reactions plot

Joint reactions plot

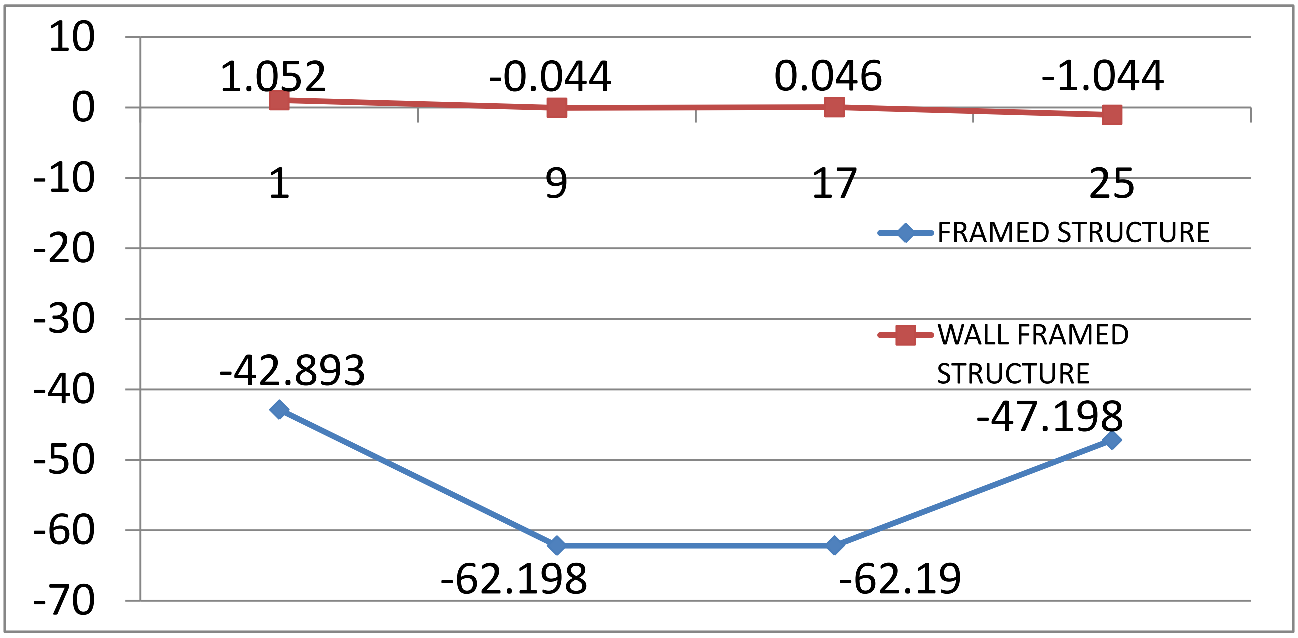

Figure 13: Joint reactions plot

Moment at base plot

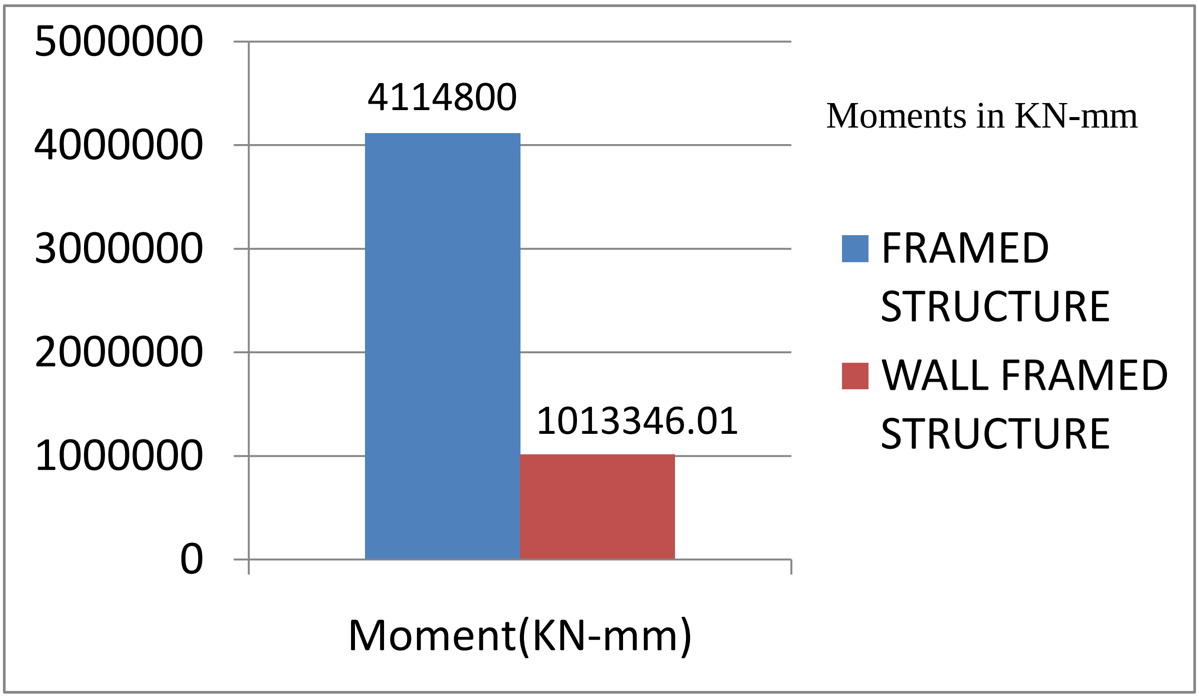

Figure 14: Moment at base plot

DISCUSSION

The above analysis shows the advantages of using wall framed structures over framed structures. Without disturbing the preliminary design and reinforcement ratio of the frame the deflections were reduced to minimum and acceptable level. However there lies still a scope to further reduce the area of concrete but a minimum has to be provided to meet the structural requirements and joint constraints.

However the advantages does not end up here .from the graph it can be seen that there is considerable decrease in joint displacements and moment at the base which shows that we can further increase the dead and wind loading on the structure.

The factor of safety in wall framed structures is quite high as compared to framed structures. It is also observed that the curve of deflection rises linearly with increase in wind loading on wall framed structures where as it shows exponential behaviour when we deal with frame structure.

In framed structure even under the design specifications of load partial damage to structural elements is for sure which ultimately weakens the structure but wall framed structures are based on counter effects of shear wall and frame due to which structural damage is prevented.

Considerable decrease in base reaction is also observed due to decrease in dead weight of the structure which is positive sign for construction of wall framed structures at a place where bearing capacity of soil is low.

However lacking advance technology and proper casting methods construction of shear wall is quite tedious process and there are chances of cracks and weaker planes to develop during construction stage which completely overrules the advantages of shear wall and makes structure more vulnerable to hazards.

Cost benefit analysis results show that material cost of wall framed structure is considerably less than that of framed structure but however labour cost and erection may go high.

CHAPTER 7 CONCLUSION

1. The proposed method of modelling and analysis of wall framed structures using SAP v15 is most advance method of design as trial and error analysis and different loading conditions can be changed by analysing the worst local conditions.

2. Type of joint constraints and restraints plays a important role in determining the behaviour and deflection pattern of the structure. Also the support conditions determine the magnitude of the base reactions.

3. Main focus of analysis should be given on safety rather than making it cost efficient because some extra cost can be incurred by the owner against safety and when we find results to be on the safer side we should proceed for cost benefit analysis on trial and error basis.

4. The size and shape of the shear wall should not affect the preliminary design of the structure and we should try to make structure symmetric about both the axis. It is feasible to add an extra wall to the design rather than designing an un-symmetric structure .However SAP is capable of analyzing non symmetric structures also but it is quite tedious process.

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