ANALYSIS OF MULTISTOREY FRAME FOR VARIOUS LOADINGS

A Dissertation Report
Submitted in the Partial fulfillment of the
Requirement for Award of the Degree
of
MASTER OF THECHNOLOGY
In STRUCTURAL ENGINEERING
By

Sarpreet Dadra
(11614258)

Under the guidance of
Mr. Manoharan Rajalingam
(Head of Department)

School of Civil Engineering

Lovely Professional University

Phagwara, Punjab (India)-1444110

DECLARATION

I hereby declare that the dissertation entitled, "**Analysis of Multistorey Frames for Various Loadings"** submitted for the M.Tech degree is entirely my original work and all ideas and references have been duly acknowledge. It does not contain any work for the award of any other degree or diploma.

Date: Sarpreet Dadra

Reg. no.

11614258

CERTIFICATE

Certified that this project report entitled "**Analysis of Multistorey Frames for Various Loadings"** submitted independent by student of School of Civil Engineering, Lovely Professional University, Phagwara are carrying out the work under the direction of me for the Award of Degree. The report has not been submitted to a university or institution for the award of any degree.

Signature of Supervisor

Mr. Manoharan Rajalingam

Professor (Head of Department)

ACKNOWLEDGEMENT

Any accomplishment requires the efforts of people and, this is not different. So it has bees also complete with cooperation of many persons. I am thankful to guide **“Mr. Manoharan Rajalingam”** gave me the golden opportunity to do this wonderful research on the topic **“Analysis of Multistorey Frame for Various Loadings”**, which also helped us in doing a lot of Research and I came to know about so many new things.

Secondly I would also like to thank my parents and friends who helped me a lot in finishing this project within the limited time.

Mr. Sarpreet Dadra

Regd. No. 11614258

M. Tech

(Structural Engineering)

ABSTRACT

Multistorey structures are the need of the hour. All metropolitan cities and upcoming cities and major industries use multistory frames in their structural systems. Current knowledge in this area is very vast and many methods are being used to analyses such structures. In this study it is proposed to present the state of the art technology used for the analysis of such frames and to draw / suggest guidance to practicing engineers on the effective usage of the available methods. The manual analysis results of all types of loads and their combination according to Indian standards applied on multistory frames and are compared with real state multistory frames which already exist. This dissertation work tries to provide a comprehensive analysis of all the methods that are being currently used for the analysis of frames. Comparative study of all available methods and techniques for the analysis of multistory frames and their relevant applications are presented.

TABLE OF CONTENTS

List of Tables

CHAPTER 1
INTRODUCTION

1.1 General

The analysis of multistorey frame is used to calculate risk and safety of structure under different load conditions. days word development of infrastructure if analysis based on STAAD Pro with all types of loads and there combination also .the software's for analysis is widely use in all country's for check structures bending deflection and braking points and its supports all the steel standard code. The STAAD Pro is the software which is based on the stiffness matrices method for calculating all reaction of frame after load action.

This paper we can see the comparison and deference of results of manually calculation and stead pro on same frame, same all types and all combination. The analysis of steel frame which is already exists in word without any repeating .so, the results accuracy and comparisons with manual calculation can tell the real risk factor of structure.

1.2 Need of study

In present scenario, we need multistorey infra-structure facilities according to increase in population and work requirements. To cope up with the rapid development last ten years we can see infra-structure development is important to be requirements and it's well more develop in next years. This paper is gone to tell all types of load and load combination act on multistory frame and its reaction with structures risk factor for real state building frames with comparison manual and software calculations. Then we can see the accuracy of bending and deflection in structure.

1.3 Objective of the study

Engineers are learn to use analysis software and according to that software results the make structure but the software like STAAD Pro they based on manually calculating of stiffness method. So the comparison of manually calculation and result we are gone to see the accuracy and deference in this results for the check of risk and safety of all living things exists under or near this types of multistory frames. For the understanding the importance of this research we gone take real states building's analyze data to compare with manually calculate data for accuracy and risk of structure limits in under loads.

CHAPTER 2

LITERATURE REVIEWS

2.1 General

Analysis of multistorey frames for various loadings itself says " Multistorey frames analysis with different-different loads" or determien the effects on frames of various loadings and it's solution. It can calculate by using analysing methods for dead load live load etc. and combination of loads.

Leung & Cheung (1980) had presented a procedure for analysis of frames by 2 level FEM. A two-level finite element technique of construct a frame support elements is introduced to dicers computational efforts for solve large scale of frames problem. The ordinary FEM is used first to yield matrices the beam member. Then the nodal deflection of all the nodes is related to those of small no. of select joint in the frame by mean of global finite element interpolate function. Thus orders of the overall matrices are reduced and frame be considered as support elements to be connected to the other element by mean of the master node. The accuracies of solution are improved either with finer subdivision master nodes insides each support element. The following are the formula for calculation of the consistent tangent matrix in global coordinates.

Q = internal force

q = member displacement,∅ = deformations, M = moments

$$\frac{\partial Q}{\partial q} = \frac{\partial B'}{\partial q} M + \{B\}' \frac{\partial M}{\partial \emptyset} [B]$$

Rehan & Naqvi (2012) have presented a procedure for Reliability Analyses of Steel building Frame under seismic Forces. The Simplified fragility analysis of building steel frame is present which can used for preliminary estimate values its probability failure. The risk analysis procedure uses the format of probabilistic to the Risk Analysis and considers bands limited white noise at the bed rock as the all seismic input. The steel structure frame is modeled as tow dimensional frames and Pushover analysis .Then carried out to obtain its capacity using software. To response the steel frame is obtained by response spectrum method of analysis for multidegree of freedom. The PRA includes uncertainties the response due the variations of ground shaking, materials, modeling's & method of analysis. Those of capacity due to the variations of ductility's damage concentration effect. The fragility curve for the frame failures was generated for numbers of parametric variation. The parameters include conditions of the soil, variations of the uncertainty's factor, ductility factor and soil amplifications factor.

Kulkarni et al (2013) have presented a procedure for Analysis of Multi-storey steel Frames to Gravity and Seismic forces with Varying Inertia. Their paper presents an elastic response to seismic of reinforced concrete frames with three, five and seven bay 9 storey structures which have been analyzed for gravity as well as seismic loads and their reaction is studied as the geometric parameters varying from view behavior of predicting similar building frame subjected to similar forces or forces combination. The frame response of various members when geometry changes either physically, in case of linear haunches provided the face of columns at beam column joints of purported section due to monolithic action in b/w beams and slabs, when the slab is available in compression zone of beam was also explained. This attempted has been made to the describe things in dimensionless forms. Results, if is expected, can be readily extended. For the sake of clarity various types and kinds of structures analyzed and results so obtained have been grouped in many types of categories.

CHAPTER 3

DEVELOPMENT OF HYPOTHESIS

According to all references and studies the imaginary solution is to compering results of stiffness matrices method with STAAD Pro. To the check of accuracy and correction of values as results Reaction, Shear forces, Bending moment and Deflection. Because the calculation of STAAD Pro is following formulas of stiffness matrices method .The manually calculation for reaction, shear force, bending moment and deflection with direct stiffness matrices method is going to tell accuracy and difference between values of software and manually calculation.

CHAPTER 4

RESEARCH DESIGN

4.1 Preparation of Research Design:

Analysis of multistorey frames with various loadings is belter to start with simple and single story frame .the benefit of simple frame is to complete all calculation in the limited time and experts can guide to do some correction in direct stiffness matrices method.

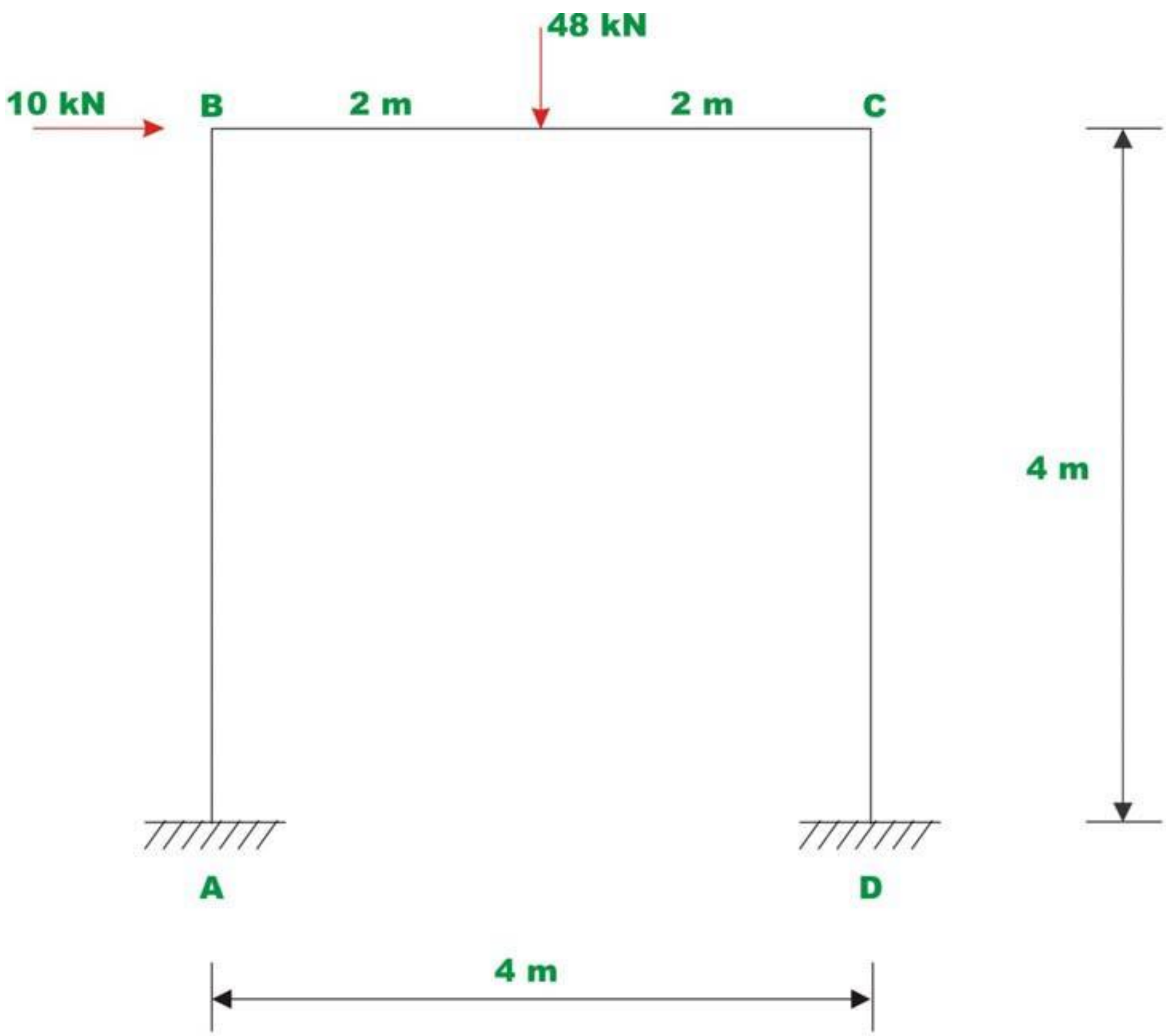
- Reaction’s values of frame
- Shear forces
- Bending moment
- Deflection

4.2 Data Collection:

The data for analysis of frame is decided to take form real state building which is completed constructed properly without any repeating. The planning is to collected data from devolved states which have multi-story building and already requests for the blue prints of the structure forwarded to big construction companies.

4.3 Data Processing and Analysis:

The data of frame is takes as standard data for frame is E=2Gpa, I=$1.33 \times 10^{-5}\, m^4$ and A= $0.01m^2$. And simple portal frame with dead load + live load +wind load and dimensions it's shown in diagram.



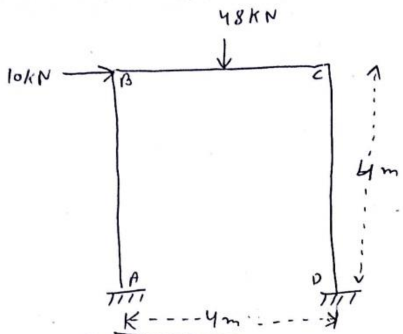
4.4 Data Interpretation:

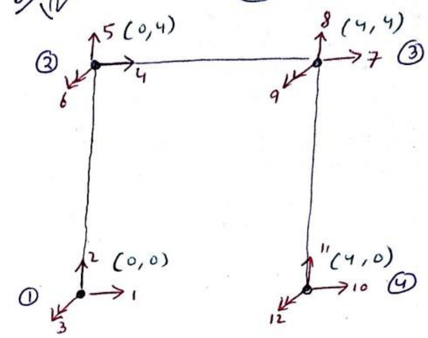
(3)

Example: Analyse Frame by Stiffness Matrix Method.

Assume: $E = 200\ GPa$; $I = 1.33 \times 10^{-5}\ m^4$, $A = 0.01\ m^2$

$\frac{bd^3}{12}$. (bd)





Sol :- ⇒ $\boxed{\text{Member 1}}$:

$L = 4m$; $\theta = 90°$: node points 1-2

$l = \frac{x_2 - x_1}{L} = \frac{0-0}{4} = 0$, $m = \frac{y_2 - y_1}{L} = \frac{4-0}{4} = 1$

⇒ Terms are Common for all elements.

- $\frac{AE}{L} = \frac{0.01\,m^2 \times 200}{4\,m} = 0.5\,m \times 10^6 = \boxed{5 \times 10^5\ KN/m}$

- $\frac{12EI}{L^3} = \frac{12 \times 200 \times 1.33 \times 10^{-5}\,m^4}{(4m)^3} = 4.987\,m \times 10^{-4} \times 10^6 = 4.987 \times 10^2\ KN/m \approx \boxed{0.5 \times 10^3\ KN/m}$

- $\frac{6EI}{L^2} = \frac{6 \times 200 \times 1.33 \times 10^{-5}\,m^4}{16\,m^2} = 9.975 \times 10^{-4}_{m^2} \times 10^6 = 9.975 \times 10^2\ KN \approx \boxed{1 \times 10^3\ KNm}$

- $\frac{4EI}{L} = \frac{4 \times 200 \times 1.33 \times 10^{-5}\,m^4}{4m} = 2.66 \times 10^{-3}_{m^3} \times 10^6 = \boxed{2.66 \times 10^3\ KNm}$

- $\frac{2EI}{L} = \frac{2 \times 200 \times 1.33 \times 10^{-5}\,m^4}{4m} = 1.33 \times 10^{-3}_{m^3} \times 10^6 = \boxed{1.33 \times 10^3\ KNm}$

4

$[K^1] = [T]^T [K'] [T]$ for Member 1

$$
\underbrace{\begin{bmatrix} 0 & -1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}}_{[T]^T}
\underbrace{\begin{array}{cccccc|c} 1 & 2 & 3 & 4 & 5 & 6 & \\ \hline 5\times10^5 & 0 & 0 & -5\times10^5 & 0 & 0 & 1 \\ 0 & 0.5\times10^3 & 1\times10^3 & 0 & -0.5\times10^3 & 1\times10^3 & 2 \\ 0 & 1\times10^3 & 2.66\times10^3 & 0 & -1\times10^3 & 1.33\times10^3 & 3 \\ -5\times10^5 & 0 & 0 & 5\times10^5 & 0 & 0 & 4 \\ 0 & -0.5\times10^3 & -1\times10^3 & 0 & 0.5\times10^3 & -1\times10^3 & 5 \\ 0 & 1\times10^3 & 1.33\times10^3 & 0 & -1\times10^3 & 2.66\times10^3 & 6 \end{array}}_{[K']}
\underbrace{\begin{array}{cccccc|c} 1 & 2 & 3 & 4 & 5 & 6 & \\ \hline 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ -1 & 0 & 0 & 0 & 0 & 0 & 2 \\ 0 & 0 & 1 & 0 & 0 & 0 & 3 \\ 0 & 0 & 0 & 0 & 1 & 0 & 4 \\ 0 & 0 & 0 & -1 & 0 & 0 & 5 \\ 0 & 0 & 0 & 0 & 0 & 1 & 6 \end{array}}_{[T]}
$$

$$
[K^1] = \begin{array}{cccccc|c} 1 & 2 & 3 & 4 & 5 & 6 & \\ \hline 0.5\times10^3 & 0 & -1\times10^3 & -0.5\times10^3 & 0 & -1\times10^3 & 1 \\ 0 & 5\times10^5 & 0 & 0 & -5\times10^5 & 0 & 2 \\ -1\times10^3 & 0 & 2.66\times10^3 & 1\times10^3 & 0 & 1.33\times10^3 & 3 \\ -0.5\times10^3 & 0 & 1\times10^3 & 0.5\times10^3 & 0 & 1\times10^3 & 4 \\ 0 & -5\times10^5 & 0 & 0 & 5\times10^5 & 0 & 5 \\ -1\times10^3 & 0 & 1.33\times10^3 & 1\times10^3 & 0 & 2.66\times10^3 & 6 \end{array}
$$

(I)

<u>Member 2</u>: $L = 4$; $\theta' = 0$ node point 2-3 ;

$$l = \frac{4-0}{4} = 1 \quad , \quad m = \frac{4-4}{4} = 0$$

$$[K^2] = [T^T][K'][T]$$

(6) <u>Member 2</u>:.

(6)

$$= \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{array}{c} \begin{array}{cccccc} 4 & 5 & 6 & 7 & 8 & 9 \end{array} \\ \begin{bmatrix} 5\times10^5 & 0 & 0 & -5\times10^5 & 0 & 0 \\ 0 & 0.5\times10^3 & 1\times10^3 & 0 & -0.5\times10^3 & 1\times10^3 \\ 0 & 1\times10^3 & 2.66\times10^3 & 0 & -1\times10^3 & 1.33\times10^3 \\ -5\times10^5 & 0 & 0 & 5\times10^5 & 0 & 0 \\ 0 & -0.5\times10^3 & -1\times10^3 & 0 & 0.5\times10^3 & -1\times10^3 \\ 0 & 1\times10^3 & 1.33\times10^3 & 0 & -1\times10^3 & 2.66\times10^3 \end{bmatrix} \end{array} \begin{array}{c} \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \end{array} \begin{array}{c} \begin{array}{cccccc} 4 & 5 & 6 & 7 & 8 & 9 \end{array} \\ \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \end{array} \begin{array}{c} \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \end{array}$$

$$[K^2] = \begin{array}{c} \begin{array}{cccccc} 4 & 5 & 6 & 7 & 8 & 9 \end{array} \\ \begin{bmatrix} 5.0\times10^5 & 0 & 0 & -5\times10^6 & 0 & 0 \\ 0 & 0.5\times10^3 & 1\times10^3 & 0 & -0.5\times10^3 & 1\times10^3 \\ 0 & 1\times10^3 & 2.66\times10^3 & 0 & -1\times10^3 & 1.33\times10^3 \\ -5\times10^6 & 0 & 0 & 5\times10^6 & 0 & 0 \\ 0 & -0.5\times10^3 & -1\times10^3 & 0 & 0.5\times10^3 & -1\times10^3 \\ 0 & 1\times10^3 & 1.33\times10^3 & 0 & -1\times10^3 & 2.66\times10^3 \end{bmatrix} \end{array} \begin{array}{c} \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \end{array}$$

Member 3: $L = 4; \theta = 270^\circ$; node point 3-4;

$$l = \frac{4-4}{4} = 0, \quad m = \frac{0-4}{4} = -1 \qquad \left[\because m = \frac{y_2 - y_1}{L}\right] \left[\text{or, } \sin(270) = -1.\right]$$

$$[K^3] = [T]^T [k'] [T]$$

7

Member 3

$$= \begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 0 \\ -1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{array}{c} \begin{array}{cccccc} 7 & 8 & 9 & 10 & 11 & 12 \end{array} \\ \begin{bmatrix} 5\times10^5 & 0 & 0 & -5\times10^5 & 0 & 0 \\ 0 & 0.5\times10^3 & 1\times10^3 & 0 & -0.5\times10^3 & 1\times10^3 \\ 0 & 1\times10^3 & 2.66\times10^3 & 0 & -1\times10^3 & 1.33\times10^3 \\ -5\times10^5 & 0 & 0 & 5\times10^5 & 0 & 0 \\ 0 & -0.5\times10^3 & -1\times10^3 & 0 & 0.5\times10^3 & -1\times10^3 \\ 0 & 1\times10^3 & 1.33\times10^3 & 0 & -1\times10^3 & 2.66\times10^3 \end{bmatrix} \end{array} \begin{array}{c} 7 \\ 8 \\ 9 \\ 10 \\ 11 \\ 12 \end{array} \begin{array}{c} \begin{array}{cccccc} 7 & 8 & 9 & 10 & 11 & 12 \end{array} \\ \begin{bmatrix} 0 & -1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \end{array} \begin{array}{c} 7 \\ 8 \\ 9 \\ 10 \\ 11 \\ 12 \end{array}$$

8.

Member 3:-

$$[K^3] = \begin{array}{c} \begin{array}{cccccc} 7 & 8 & 9 & 10 & 11 & 12 \end{array} \\ \begin{bmatrix} 0.5\times10^3 & 0 & 1\times10^3 & -0.5\times10^3 & 0 & 1\times10^3 \\ 0 & 5\times10^5 & 0 & 0 & -5\times10^5 & 0 \\ 1\times10^3 & 0 & 2.61\times10^3 & -1\times10^3 & 0 & 1.33\times10^3 \\ -0.5\times10^3 & 0 & -1\times10^3 & 0.5\times10^3 & 0 & -1\times10^3 \\ 0 & -5\times10^5 & 0 & 0 & 5\times10^5 & 0 \\ 1\times10^3 & 0 & 1.33\times10^3 & -1\times10^3 & 0 & 2.66\times10^3 \end{bmatrix} \end{array} \begin{array}{c} 7 \\ 8 \\ 9 \\ 10 \\ 11 \\ 12 \end{array}$$

(a) The assembled global stiffness Matrix [K] is of order 12×12.

$$
[K] = 10^3 \times
\begin{array}{c}
\begin{array}{cccccccccccc} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 & 11 & 12 \end{array} \\
\left[\begin{array}{ccc|cccccc|ccc}
0.50 & 0 & -1.0 & -0.5 & 0 & -1.0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 500 & 0 & 0 & -500 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-1.0 & 0 & 2.66 & 1.0 & 0 & 1.33 & 0 & 0 & 0 & 0 & 0 & 0 \\
\hline
-0.50 & 0 & 1.0 & 500.5 & 0 & 1.0 & -500 & 0 & 0 & 0 & 0 & 0 \\
\hline
0 & -500 & 0 & 0 & 500.5 & 1.0 & 0 & -0.50 & 1.0 & 0 & 0 & 0 \\
-1.0 & 0 & 1.33 & 1.0 & 1.0 & 5.33 & 0 & -1.0 & 1.33 & 0 & 0 & 0 \\
0 & 0 & 0 & -500 & 0 & 0 & 500.5 & 0 & 1.0 & -0.5 & 0 & 1.0 \\
0 & 0 & 0 & 0 & -0.5 & -1.0 & 0 & 500.5 & -1.0 & 0 & -500 & 0 \\
0 & 0 & 0 & 0 & 1.0 & 1.33 & 1.0 & -1.0 & 5.33 & -1.0 & 0 & 1.33 \\
\hline
0 & 0 & 0 & 0 & 0 & 0 & -0.5 & 0 & -1.0 & 0.5 & 0 & -1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -500 & 0 & 0 & 500 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1.0 & 0 & 1.33 & -1 & 0 & 2.66
\end{array}\right]
\end{array}
\begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \\ 10 \\ 11 \\ 12 \end{array}
$$

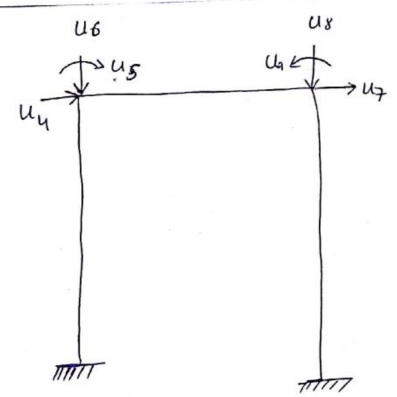
$$\begin{bmatrix} P_{12} \end{bmatrix} \quad \begin{bmatrix} \vdots \\ 0 \end{bmatrix}$$

⇒ **Displacement [u] : System displacements :**

$$① \; [P] = [K][u] \Rightarrow ② \; [U] = [P][K]^{-1}$$

$$\begin{bmatrix} 10 \\ -24 \\ -24 \\ 0 \\ -24 \\ 24 \end{bmatrix} = \begin{bmatrix} 500.5 & 0 & 1.0 & -500 & 0 & 0 \\ 0 & 500.5 & 1.0 & 0 & -0.5 & 1.0 \\ 1.0 & 1.0 & 5.33 & 0 & -1.0 & 1.33 \\ -500 & 0 & 0 & 500.5 & 0 & 1 \\ 0 & -0.5 & -1 & 0 & 500.5 & -1 \\ 0 & 1 & 1.33 & 1 & -1 & 5.33 \end{bmatrix} \begin{bmatrix} u_4 \\ u_5 \\ u_6 \\ u_7 \\ u_8 \\ u_9 \end{bmatrix}$$

$$\begin{bmatrix} U_4 \\ U_5 \\ U_6 \\ U_7 \\ U_8 \\ U_9 \end{bmatrix} = \begin{bmatrix} 1.43 \times 10^{-2} \\ -3.84 \times 10^{-5} \\ -8.14 \times 10^{-3} \\ 1.43 \times 10^{-2} \\ -5.65 \times 10^{-5} \\ 3.85 \times 10^{-3} \end{bmatrix} \checkmark$$



The support reactions along degrees of freedom.

$$[R] = [P] + [K][u]$$

$$\begin{bmatrix} R_1 \\ R_2 \\ R_3 \\ R_{40} \\ R_{12} \\ R_{12} \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} + 10^3 \begin{bmatrix} -0.5 & 0 & -1.0 & 0 & 0 & 0 \\ 0 & -500 & 0 & 0 & 0 & 0 \\ 1.0 & 0 & 1.33 & 0 & 0 & 0 \\ 0 & 0 & 0 & -0.5 & 0 & -1.0 \\ 0 & 0 & 0 & 0 & -500 & 0 \\ 0 & 0 & 0 & 1.0 & 0 & 1.33 \end{bmatrix} \begin{bmatrix} 1.43 \times 10^{-2} \\ -3.84 \times 10^{-5} \\ -8.14 \times 10^{-3} \\ 1.43 \times 10^{-2} \\ -5.65 \times 10^{-5} \\ 3.85 \times 10^{-3} \end{bmatrix}$$

$$\begin{bmatrix} R_1 \\ R_2 \\ R_3 \\ R_{10} \\ R_{11} \\ R_{12} \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} + \begin{bmatrix} 0.99 \\ 19.71 \\ 3.43 \\ -10.99 \\ 28.28 \\ 19.42 \end{bmatrix} = \begin{bmatrix} 0.99 \\ 19.71 \\ 3.43 \\ -10.99 \\ 28.28 \\ 19.42 \end{bmatrix}$$

The Shear forces along degree of freedom : $[S] = [P] + [K][u]$

$$\begin{bmatrix} S_4 \\ S_5 \\ S_6 \\ S_7 \\ S_8 \\ S_9 \end{bmatrix} = \begin{bmatrix} 10 \\ -24 \\ -24 \\ 0 \\ -24 \\ 24 \end{bmatrix} + \begin{bmatrix} 0.99 \\ 19.71 \\ 3.43 \\ -10.99 \\ 28.28 \\ 19.42 \end{bmatrix} = \begin{bmatrix} 10.99 \\ -4.29 \\ -20.57 \\ -10.99 \\ 4.28 \\ 43.42 \end{bmatrix}$$

Banding moment and is still in process.

CHAPTER-5

RESULTS

The manual calculations by direct stiffness metrics method and the analysis of staad pro .the conclusion comparison of the values of Reaction and Deflections is follows;

Table 1
COMPARISON OF REACTIONS

S.NO.	Reactions	Manual cal.	STAAD Pro.cal.	Deference
1	R_1	0.99	0.98	0.01
2	R_2	19.71	19.71	0
3	R_3	3.43	3.46	0
4	R_{10}	-10.99	-10.98	0.01
5	R_{11}	28.28	28.28	0
6	R_{12}	19.42	19.40	0.02

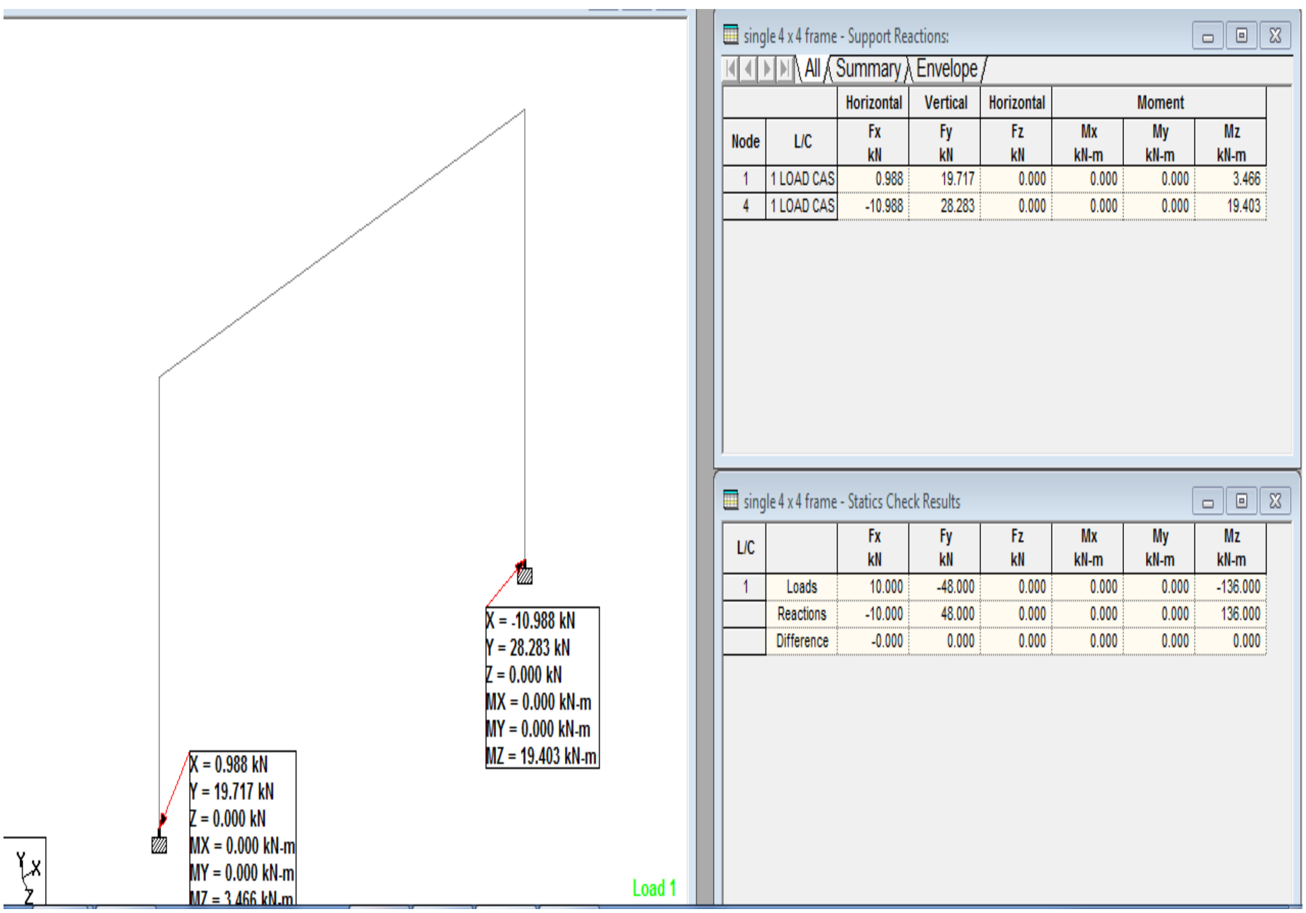
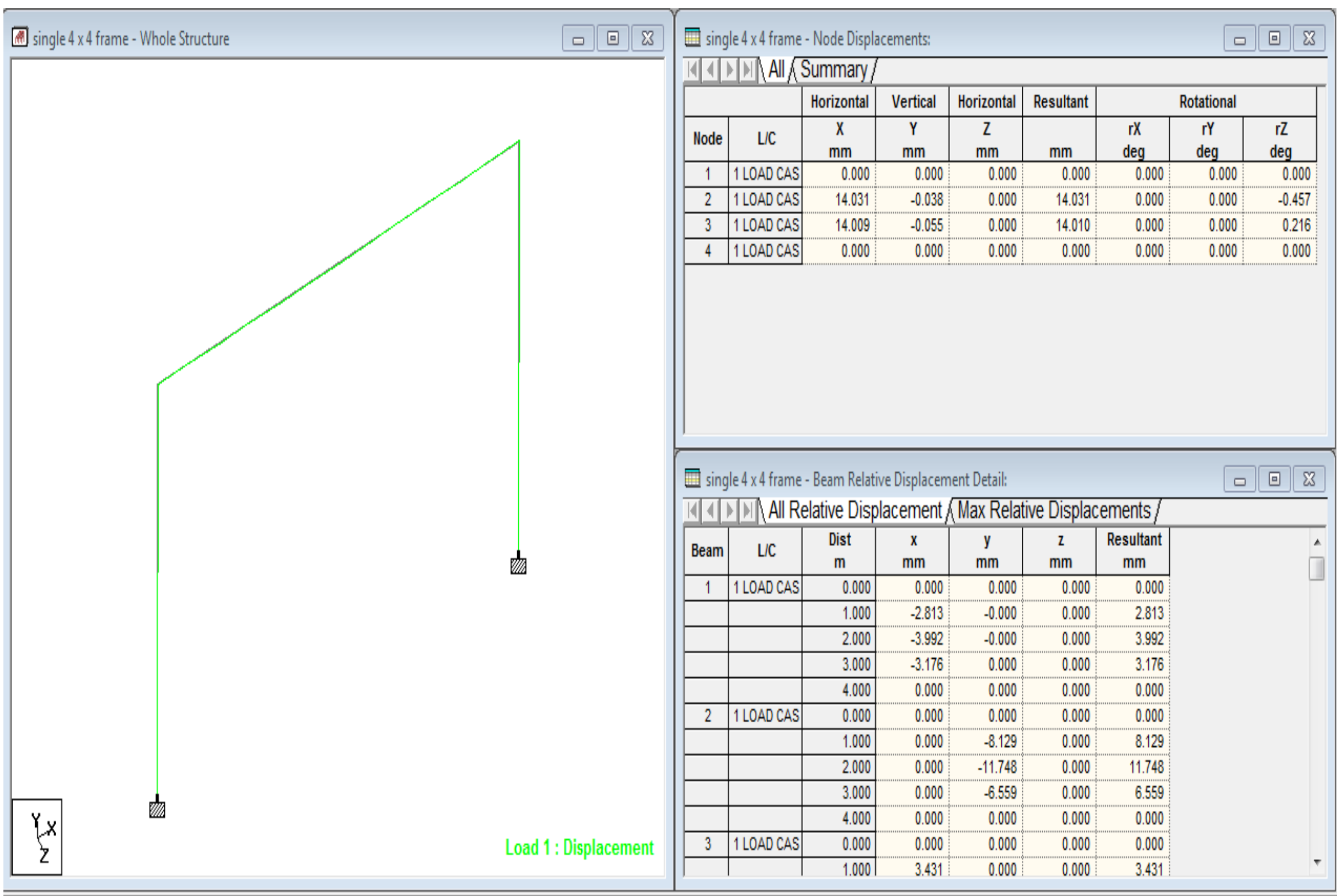


Table 2
COMPARISON OF DEFLECTION

S.No.	Deflections	Manual cal.	STAAD pro. cal.	Deference
1	u_4	0.014	0.014	0
2	u_5	-0.00004	-0.00005	0.00001
3	u_6	-0.0081	-0.0081	0
4	u_7	0.014	0.014	0
5	u_8	-0.000056	-0.000056	0
6	u_9	0.004	0.004	0



CHAPTER-6

CONCLUSION

From this study followed by comparison of the analysis results of the manually calculation for single structural frame was analyzed for dead load, live load and wind load with direct stiffness matrices method. The same frame with the all loads was analysis using the STAAD Pro software. The results obtained in STAAD Pro are matching perfectly with manual calculations. The reaction at support (node 1and 4) of the frame in horizontal, vertically and moment values and deflection (node no. 2 and 3) values of horizontal, vertical and moment are perfectly matching manual calculation. So, from this conclusion has been create a M S exile file for calculate reaction, shear force, bending moment and deflection easily as compare to STAAD Pro.

References

1. Alidad et al. (2006). Shake-table experiment on reinforced concrete structure containing masonry infill wall. Earthquake Engineering and Structural Dynamics, 35,1825-1852.
2. Chuh& James. Nastran nonlinear vibration analysis of beam and frame structures,259-284.
3. Cipollina et al.(1995). A Simplified damage mechanics approach to nonlinear Analysis of frames. Computers & Structures, 54, 1113-1126.
4. Deierlein.(1997). Steel-framed structures. Construction Research Communications Limited, 365-0556,10-17.
5. John & Glenn. (1975). Analysis of Flexibly connected steel frames. Canadian Journal of Civil Engineering, 2, 280-291.
6. Jones et al. (1983).The Analysis of frames with Semi-Rigid Connection – A State-of-the-Art Report.Journal of Constructional Steel Research, 3, 2-13.
7. Glenn et al.(1995). Accounting for connection behavior in steel frame design. Canadian Journal of Civil Engineering, 22, 955-969.
8. Kaveh&Moez. (2007). Minimal cycle bases for analysis of frames with semi-rigid joints. Computers and Structures, 86, 503-510.
9. Kondoh&Atluri. (1987). Large-deformation, elasto-plastic analysis of framesunder neoconservative loading, using explicitly derived tangent stiffnesses based on assumed stresses. Computational Mechanics, 2, 1-25.
10. Kulkarni et al.(2013). Analysis of Multi-storey Building Frames Subjected to Gravity and Seismic Loads with Varying Inertia. International Journal of Engineering and Innovative Technology, 2, 132-138.
11. Kwak&Filip. (1990).Finite element analysis of reinforced concrete structures under monotonic loads.
12. Lei. (2001). Second-order analysis for semirigid steel framedesign. Canadian Journal of Civil Engineering, 28,59-76.
13. Leung & Cheung.(1980). Dynamic Analysis of frames by a two-level finite element method.Journal of Sound and Vibration,74(1),1-9.
14. Lo&Stiemer.(1994).A practical method for incorporating flexibleconnections in plane frame analysis. Canadian Journal of Civil Engineering,22, 871-882.

15. Loy et al.(1997).Analysis of Cylindrical shells using Generalizeddifferention quadrature. Shock and Vibration, 4, 193-198.
16. Luccioni et al. (2004). Analysis of building collapse under blast loads. Engineering Structures, 26, 63-71.
17. Main et al.A Preliminary Structural AnalysisSpace-Based Inflatable Tubular Frame Structures, A31-A36.
18. Miodrag&Ratko. (2001). Nonlinear Analysis of frames with flexible connections. Computers and structures, 79, 1097-1107.
19. Miodrag et al. (2002). Dynamic analysis of steel frames with frames with flexible connections. Computers and Structures, 80, 935-955.
20. Nasreddin et al.(1981). Analysis of frames with Nonprismatic members. Journal of Structural Engineering, 117, 1573-1592.
21. Paulina et al. (2015). Nonlinear seismic analysis of steel frame with semi-rigid joints. Gradevinar, 67, 573-583.
22. Ranganathan&Deshpande. (1986). Generation of Dominant Modes and Reliability Analysis of frames. Structural Safety, 4, 217-228.
23. Rehan&Naqvi. (2012). Reliability Analysis of Steel Building Frame under Earthquake Forces.International Journal of Emerging Technology and Advanced Engineering,2,356-361.
24. Remo. (2000). Force-based Finite Element for Large Displacement Inelastic Analysis of Frames,1-205.
25. Richard & Robert. (2010). Design of Structural Steel Pipe Racks. Engineering Journal, 4, 241-252.
26. Robert.(1992).Framing: Toward Clarification of a Fractured Paradigm. Journal of Communication, 43(4),51-58.
27. Rozvany&Hampson. (2016). A More Accurate Method Of Analysis Of Multi-Storey Frames For Vertical Loading, Considering One Floor Only. Architectural Science Review, 5:1, 39-44.
28. Siu.(1992). Vibration and modal analysis of steel frames with semi-rigidconnections. Engineering Structures, 16, 25-31.
29. Yu &Shanmugam. (1985). Stability of frames with Semi rigid Joints. Computers & Structures, 23, 639-648.
30. Yanchao et al. (2010). A new method for progressive collapse analysis of RC frames under blast loading. Engineering Structures, 32, 1691-1703.