IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

"Seismic Comparison of OMRF & SMRF Structural System on Zone II"

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***Abstract*:** In recent increase in the rate of earthquake every year & thereby increasing loss of life & property has led to necessity of comparing the methods of analyzing & designing of building structure. The selection of a building configuration is one of the most important aspects of overall design in its role to provide seismic protection that may impose severe limitations on the structure. In India, the zones are divided according to the rate of magnitude of earthquake. Indian codes divided the entire country into four seismic zone (II, III, IV, V) depending on the seismic risk. The study of the building structure according to the zone was done by the classifying into two methods i.e. Ordinary RC Moment Resisting Frame (OMRF) structures & Special RC Moment Resisting Frame (SMRF) structures.

***Key Word*- OMRF system, SMRF system, base shear, Bending moment, Shear force.**

INTRODUCTION

I. Some of the largest earthquakes of the world have occurred in India & the earthquake engineering development in the country started rather early. After, the 1987 earthquake in Assam a new earthquake resistant type of housing was developed, which is still prevalent in northeast India. The Baluchistan earthquakes of 1030s led to evolution of a map of the first seismic zone, the innovative earthquake resistant construction. The institutional development started in the late 1950s & earthquake engineering concepts have been applied to many major projects in high seismic regions in the country. Extensive damage during moderate earthquakes indicates that despite such early gains, earthquake risk in the country has been increasing frighteningly.

The increase in the rate of earthquake every year & thereby increasing loss of life & property has led to necessity of comparing the methods of analyzing & designing of building structure. The selections of a building configuration one of the most important aspects of the overall design may imposed sever limitation on the structure in its role to provide seismic protection.In India the zones are divided according to the rate of magnitude of earthquake. Indian codes divided the entire country into four seismic zone (II , III , IV ,V) depending on the seismic risk . The study of the building structure according to the zone is done by the classifying into two methods i.e. Ordinary RC Moment Resisting Frame (OMRF) structures & Special RC Moment Resisting Frame (SMRF) structures.

In this study comparisons has been done in between OMRF & SMRF structures in zone II of India .Etab software is used for designing structure , for II earthquake zone . OMRF is probably the most common adopted type of structure is lower seismic zone.

However with increase in the seismic risk, it becomes insufficient & SMRF structure need to be adopted. The lateral forces acting on any structure are distributed according to the flexural rigidity of individual component.

Building Details & Modeling For Analysis

The selection and design of building frames as per the design code procedure. The design frame modeled for analysis using Etab software. It is necessary to develop a computation modelto perform any kind of analysis.The parameters defining the building model, the basic assuptions and the geometry of the selected building for the study discuss.

Building configuration and design detail

A frame are selected to vary number of storey , number of bays and design methodology with regard toresponce reduction factor. A detailed description of the frame considerd in present table. The height of each floor is 3.5m and bay width is 8m. The frame is design as OMRF and SMRF considering linear static analysis method . All the load combination suggested by IS 1893(2016).

Considering IS code

Sr. No.	Load	Codes
1	Dead load	IS 875:1987 (Part 1)
2	Live load	IS 875:1987 (Part 2)
3	Earthquake load	IS 1893:2016 (Part 1)

According to IS 1893:2016 the load combinations using in this research are as follows.

1. 1.5DL+1.5LL
2. 1.5DL+1.5LL+1.5EQX
3. 1.5DL+1.5LL-1.5EQX
4. 1.5DL+1.5LL+1.5EQY
5. 1.5DL+1.5LL-1.5EQY
6. 1.5DL+1.5LL+1.5WL
7. 1.5DL+1.5LL-1.5WL
8. 1.2DL+1.2LL+1.2EQX
9. 1.2DL+1.2LL-1.2EQX
10. 1.2DL+1.2LL+1.2EQY
11. 1.2DL+1.2LL-1.2EQY
12. 1.2DL+1.2LL+1.2WL
13. 1.2DL+1.2LL-1.2WL
14. 0.9DL+1.5EQX
15. 0.9DL-1.5EQX
16. 0.9DL+1.5EQY
17. 0.9DL-1.5EQY
18. 0.9DL+1.5WL
19. 0.9DL-1.5WL

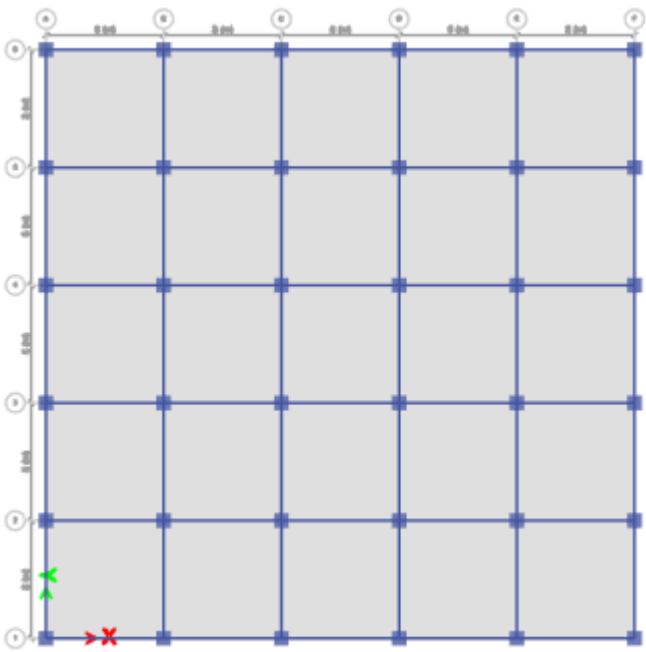
Building description

1	Plan dimension	40m X 40m
2	Number of stories	G+20
3	Total height of building	70m
4	Height of each floor	3.5m
5	Size of beams	250 X 700mm
6	Size of columns	1m X 1m
7	Thickness of slab	300mm
8	Unit weight of concrete	25KN/m3
9	Charact eristics Strength of concrete	40MPa
10	Yielding Strength of Steel	500MPa

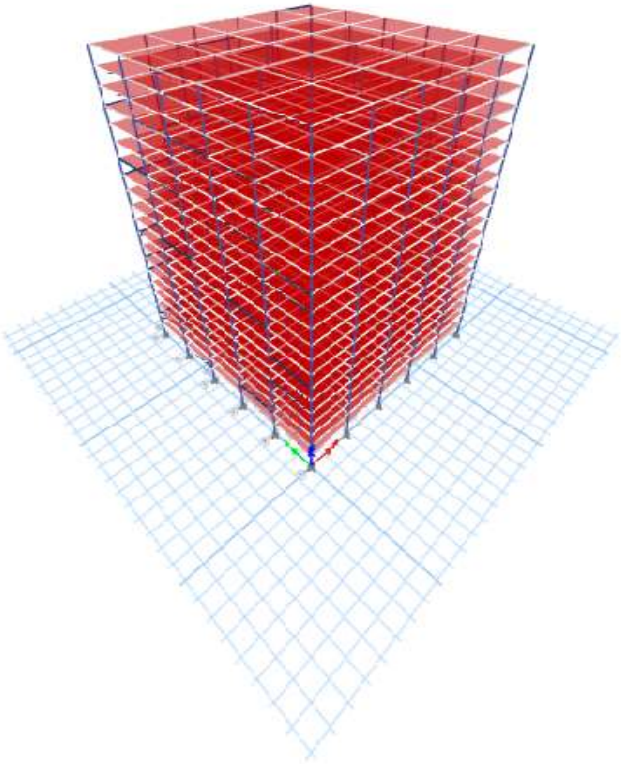
Modelling

This project presents the comparative study of the OMRF (ordinary moment resisting frame) & SMRF (special RC moment resisting frame).The study involves the behavior of the ordinary framed structure and special moment resisting framed structural and orientation which gives the better results for the OMRF & SMRF structure constructed in and around zoneII. The buildings are modeled with floor area of 1600 sqm (40m x40m) . The model is analyzed for high rise buildings located in Nagpure city (zone II). A review of current design and construction practice forms the form work for the selection of the design variables and constants. The design is carried out using Etab software. frame design take the results of the maximum value of the stress contour and calculation done by using the IS456:2000 and the IS1893:2016 .

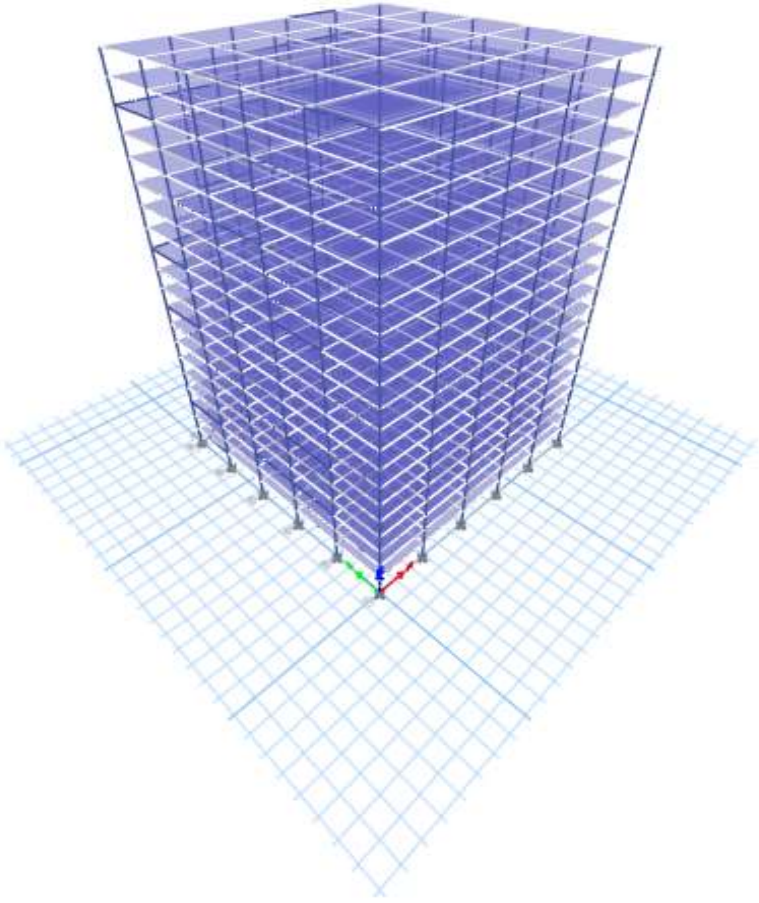
Proposed Plan of OMRF & SMRF



Isometric view of OMRF



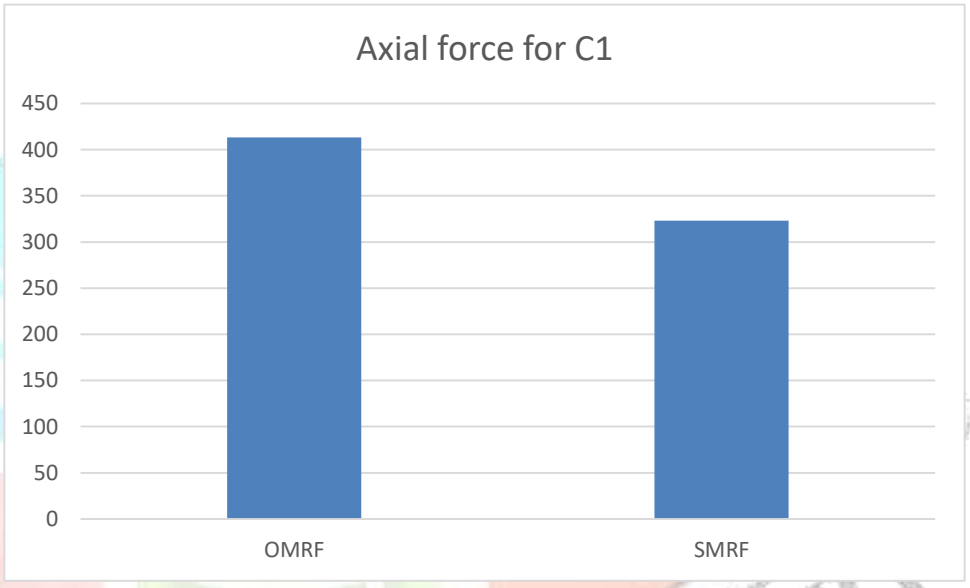
Isometric view of SMRF

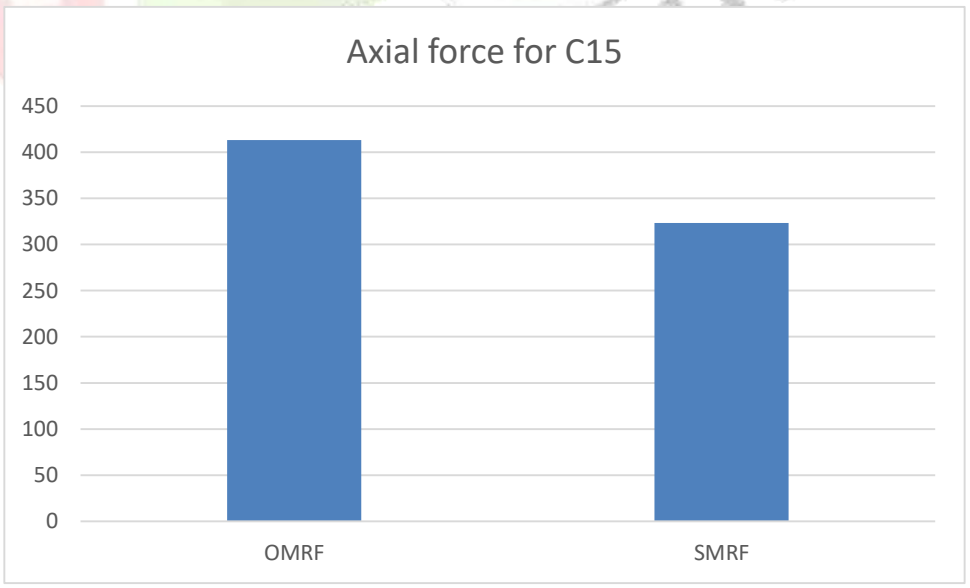


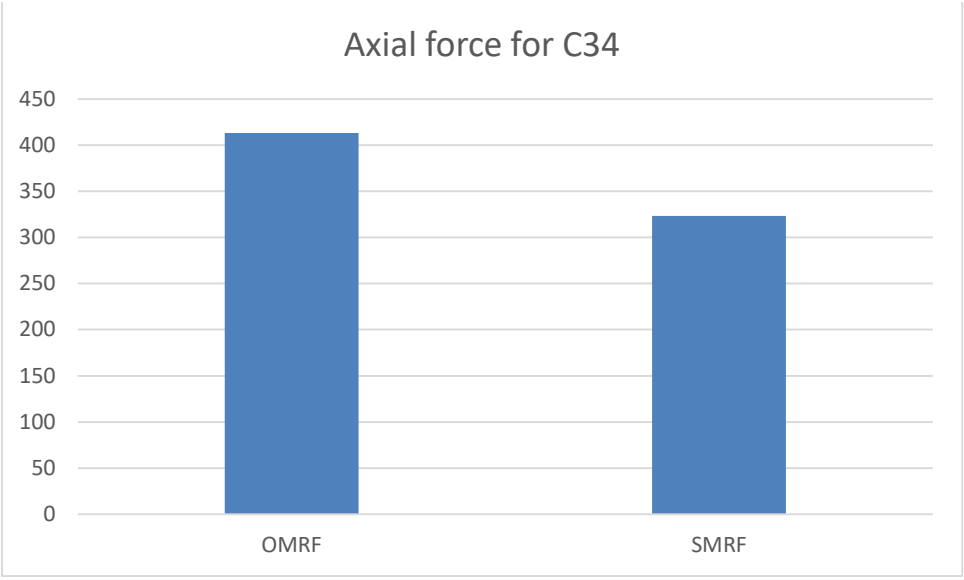
Result and Analysis

Maximum Axial load for columns

Column	OMRF	SMRF
C1	12254.3821	12119.2998
C15	37500.8715	29997.8266
C34	24777.3066	23457.4358

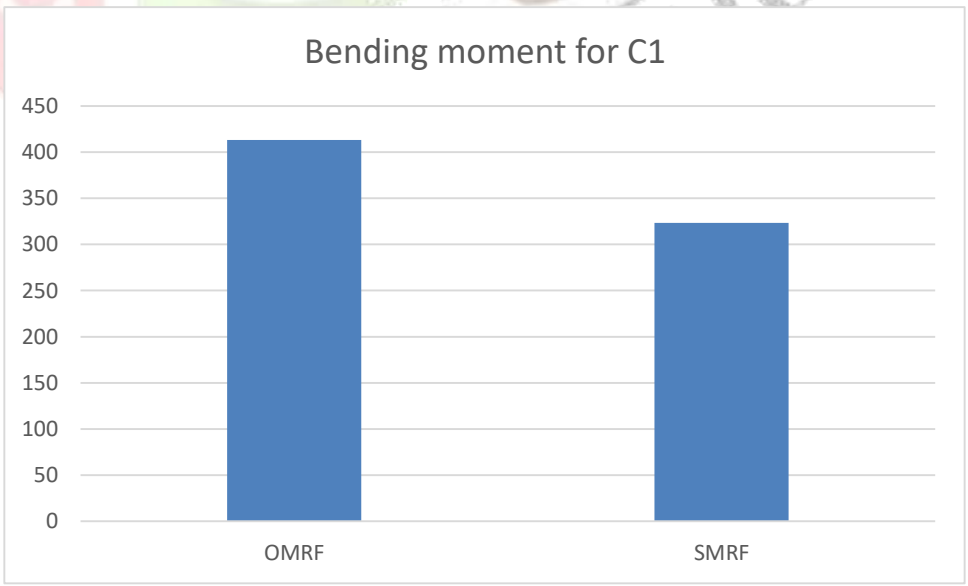


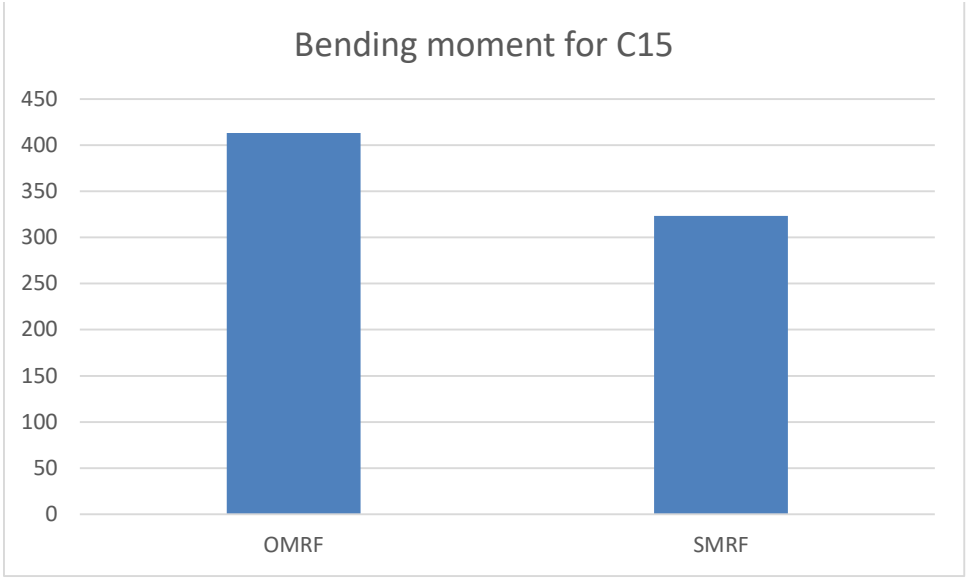


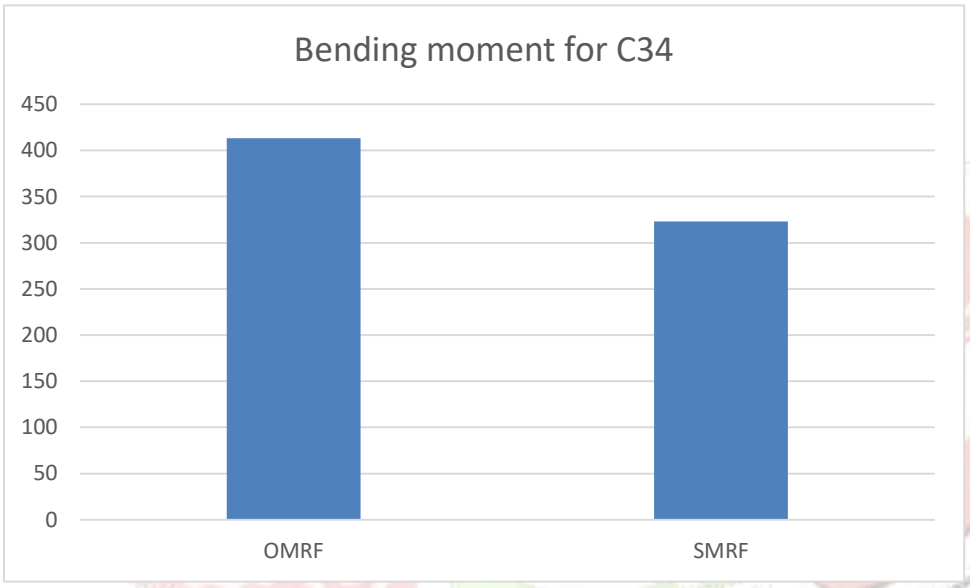


Maximum bending moment for column

Column	OMRF	SMRF
C1	603.6184	348.4752
C15	1238.0338	741.9344
C34	1054.4706	500.833

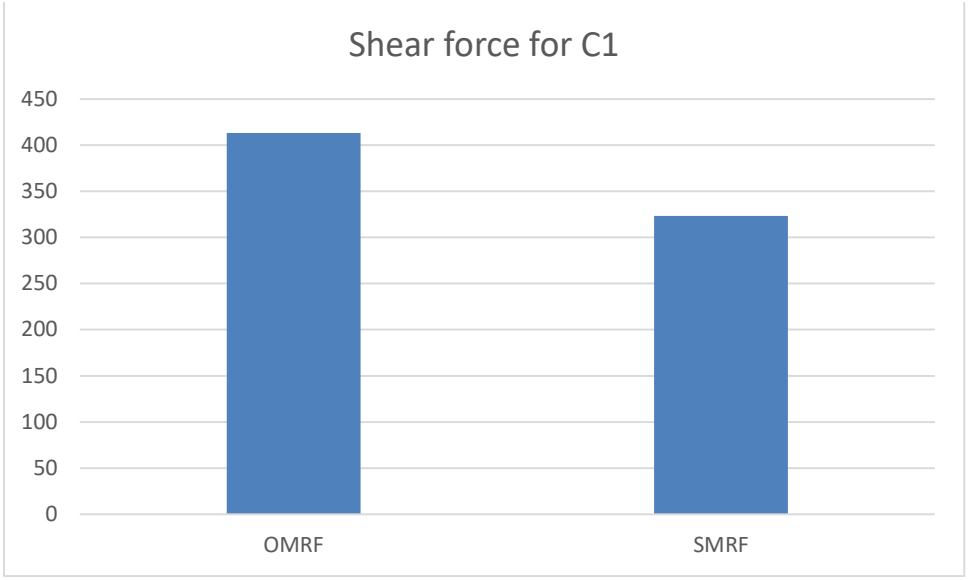


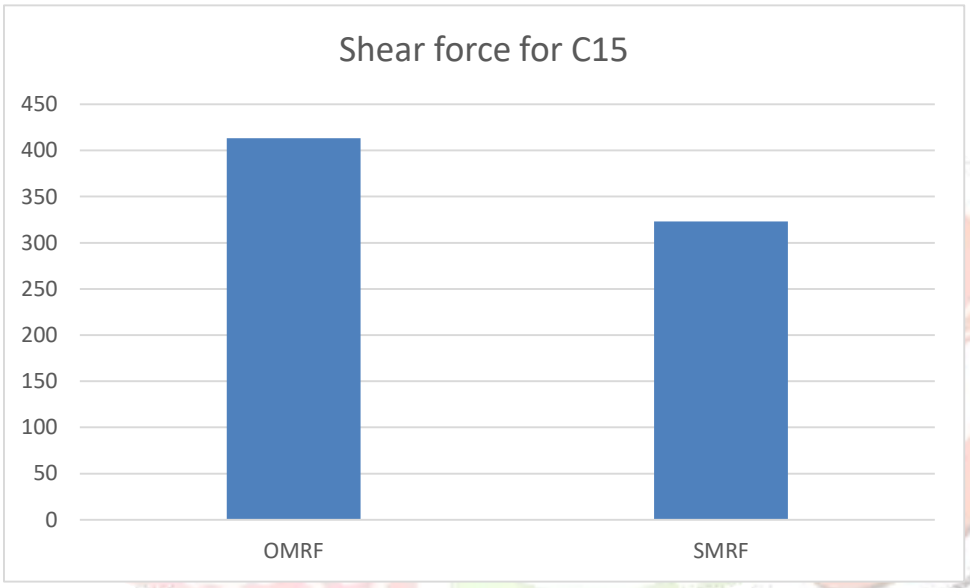


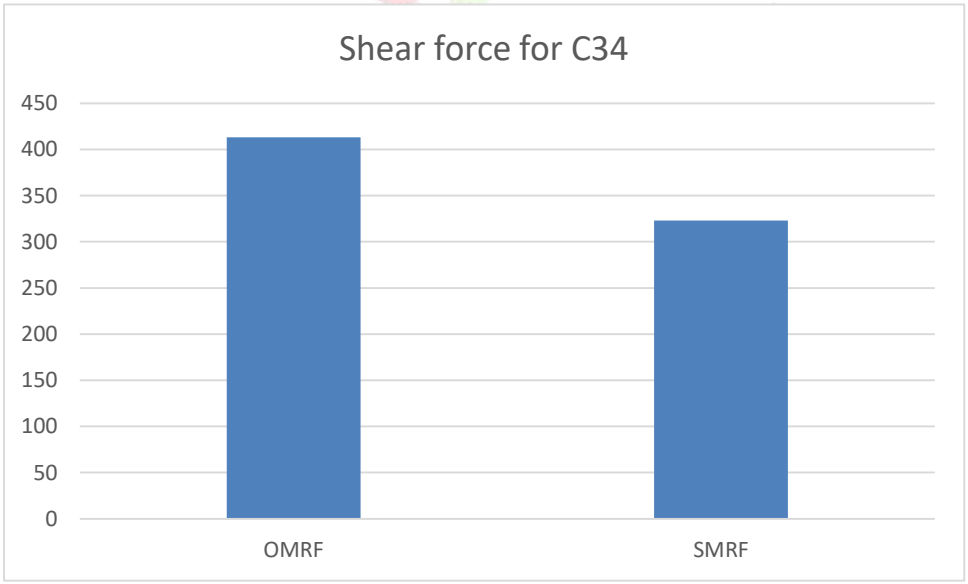


Maximum shear force on column

Column	OMRF	SMRF
C1	215.578	123.3286
C15	569.7504	341.4913
C34	413.1269	323.2079

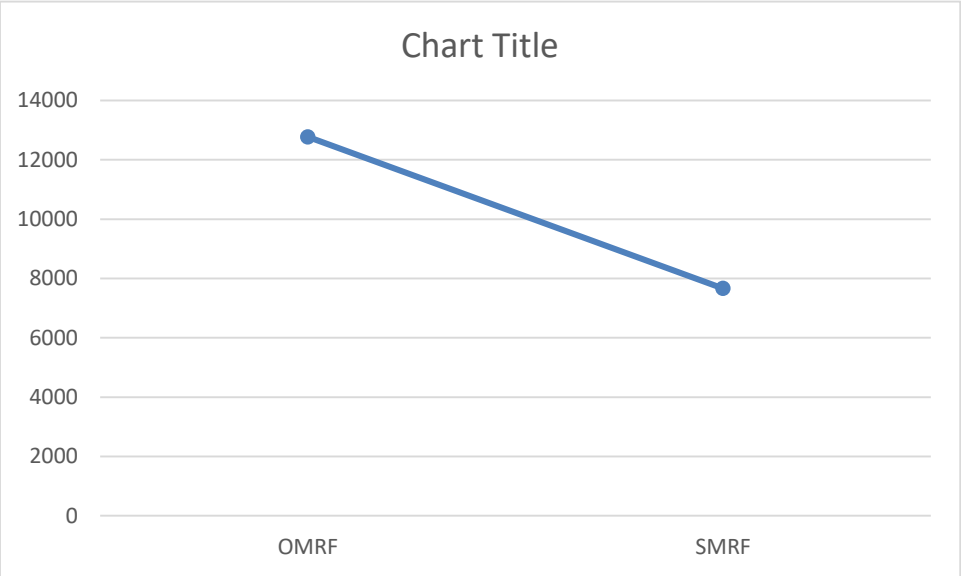

Shear force for C1
450
400
350
300
250
200
150
100
50
0
OMRF
SMRF


Shear force for C15
450
400
350
300
250
200
150
100
50
0
OMRF
SMRF


Shear force for C34
450
400
350
300
250
200
150
100
50
0
OMRF
SMRF

Base shear on OMRF and SMRF structure

OMRF	SMRF
12771	7663



Conclusion

Above graph shows the comparison of OMRF & SMRF frame structure.

Above graph shows the maximum axial force acting on the C1, C15, C34 column of the OMRF structure system than the SMRF structure.

Maximum bending moment acting on the selected column of the OMRF structure compare to the SMRF structure.

Shear force carries on the columns are the maximum of the ordinary moment system compare the special moment resisting system.

It observes that the base shear of the ordinary moment resisting frame is greater than the special moment resisting frame. Is

The SMRF is more efficient than OMRF frame & SMRF reduces moment means reduces area of steel. Also SMRF reduces the shear forces means reduce shear reinforcement

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