Design And Modeling of Earthquake Resisting Twin Tower Structure With Skywalk

Prof. Rohit Shinde[1], Mayuresh Anil Bhawari[2], Suraj Atmaram Bhimte[3], Vighnesh Dhananjay Kharge [4], Pundalik Madhukar Paradhi [5]
[1]Assistant Profesor, Dept of of civil engineering
[2, 3, 4, 5]Dept of of civil engineering
[1, 2, 3, 4, 5]Dr. D. Y. Patil College of engineering, Pune, India

Abstract- *It is well known that high-rise buildings act as very important roles in modern cities. First of all, tall buildings can be effectively used to meet the requirements of modern society and solve the problem of limitation of construction site resources. On the other hand, they are the signals of economic properties and civilization. Nowadays high-rise buildings raise higher and higher, with more and more complex and individual plan and elevation, such as multi-tower buildings. "Sky Bridge", "skywalks" or "elevated walkway" bring up images of a narrow, glass walkway connecting two towers usually commercial the only purpose of which, is to let people go from one meeting to the next without having to travel up and down or through fresh air. Dynamic actions are caused on buildings by both wind and earthquakes. But, design for wind forces and for earthquake effects are distinctly different. In this research analyse twin tower structure of G+ 25 with having steel sky walker bridge at 20th floor , the structure analyse for seismic forces, and design steel sky walk bridge for the same by using Staad-Pro.*

Keywords- Skywalk design, Staad pro , Wind load, seismic load.

I. INTRODUCTION

The architectural design of high-rise buildings has become increasingly novel and spectacular in recent decades, leading to the diversity of their exterior and dynamic behaviour. In addition, more and more high-rise buildings are being built in relatively adjacent, due to insufficient land availability in populated areas, particularly in major cities. Consequently, there is an increasing tendency to build high-rise buildings in relatively adjacent as a linked building system. That is a system composed of a number of structures coupled by structural links like sky-gardens and sky-bridges. Hence, there are various kinds of connecting, such as fixed, semi-fixed and hinged.

Many high-rise buildings around the world have been designed with a *phased evacuation strategy* in mind; i.e., evacuating a number of floors at a time and leaving the majority of the building occupants in place. Given the high public profile of the events of the World Trade Center Towers' collapse, it is now doubtful that tall building occupants will feel comfortable to remain in a tall building in an emergency situation, as is required of this phased evacuation approach. The alternative simultaneous evacuation strategy, where all building occupants are evacuated at once, would have a huge impact on the design of tall buildings; e.g., increasing the number and width of fire stairs, the consequential impact on floor space, and retrospective incorporation in existing buildings.

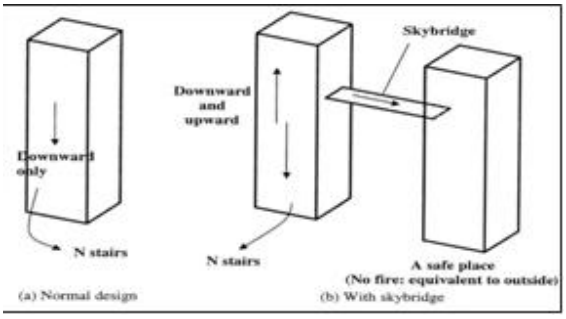

Fig 1 Evacuation in high-rise building

A. Objective

- To Study Foot load calculation for the skywalk bridge.
- To Analyze the Twin building for earthquake resistance
- To design steel Skywalk for the Twin Tower Building with using Stadd Pro Software for seismic analysis As per IS800
- To determine the strength of the specified framework of the sky walk, using FEM Software ANSYS

II. STATE OF DEVELOPMENT

SurendraChaurasiyaet. al. The figurative tower which compliance all the structural state of affairs are in trend. These structures are not only constructed to deliver the present need but also to show the domination among all over the world which is also used as benchmark in the world. A number of

structures were build till date and all of those are symbolic marvels like Petronas Tower in Kuala Lumpur, Huaguoyuan towers in China, Imperial Tower in India, Palm Tower in Doha and the list is myriad. Also a lot of twin towers are under construction not only across the world but also in India too.

Wensheng LU et. al. This paper summarizes tests of several scaled multi-tower high-rise building models on the shaking table. The assumption of rigid floor is obviously unsuitable for the analysis of multi tower buildings. A new analytic model considering the effect of flexible transfer floor is put forward. The theoretical dynamic behavior is compared with the test results.

A. Wood et. al. The possibility of linking currently empty refuge floors with sky bridges is worthwhile to consider, especially for building clusters owned by the same developer. Sky bridges retrospectively into an existing tall building cluster in the central business district of Hong Kong are taken as an example. Possible improvement on the evacuation efficiency is suggested. This can be extended to be a strategy toward the possible inclusion of sky bridges in high-rise design as an improved fire safety provision of tall buildings all over the world.

Hitesh A. Patel et. al. Pedestrians form the largest single road user group and also are the most vulnerable road users. Ahmedabad acts as role model in providing infrastructure to the various sections of society. I have selected Income tax intersection are such an intersection, which are facing these problems such as a High Pedestrian Traffic, Heavy Conflict of Pedestrian-Vehicular Traffic, Major Trip generator and attractor areas, the traffic flow is continuous, the pedestrian flow is of mixed type . In the present work study of pedestrian planning is taken up, to improve the pedestrian facility at these intersections.

III. PROBLEM STATEMENT

Study of vibration analysis of Sky Walk Bridge is carried out. From literature survey it is found that which work was done on this type of bridge and which works are limited or not done. Vibration analysis of Sky walks bridge with seismic load done by Finite Element Method by using Staad Pro. The FEM has become a powerful tool for the numerical solution of a wide range of engineering problem. In this method partial differential equations are generated and solved. The response of Sky Walk Bridge under forced vibration will be determined. The results of Sky Walk Bridge are analysed and design sky Walk Bridge for twin tower.

A. Bay Frame Size

Bay Frame = 40 x 35 m
Column Size = 300 x 750
Beam Size = 300 x 650
Grade = M25

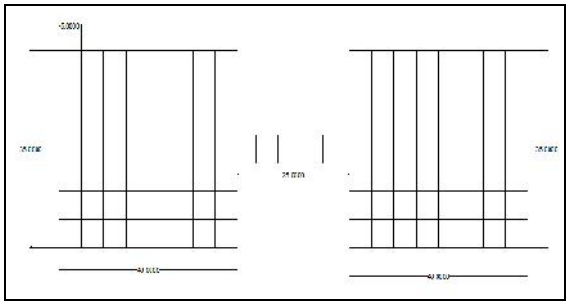

Fig 2 Model Details

B. Bracing Member design

Refer Cl. 4.6.1 & 4.6.2
$Pt = p_y Ae$
$a_2 = Ag - Dt$
$Pt = py(Ag - 0.3a_2)$. If higher than Ft. **OK**
If less, choose new size (larger size)

sizing the bracing member
Force of members: Ft = 617.40kN
$py = 275\ N/mm^2$
Area needed = $617.4 \times 10^3/275 = 2234.4\ mm^2$
Refer Table of properties of angle L types:
Try 125 x 95 x 12L where Ag = 24.8 cm2
D*t= 125x12 = 1500mm2
a2 = 2482 – 1500 = 982 mm2
$Pt = py(Ag - 0.3a_2) = 275\ (2482 - 0.3(982)) = 821\ kN > 617.4\ kN$
→ OK

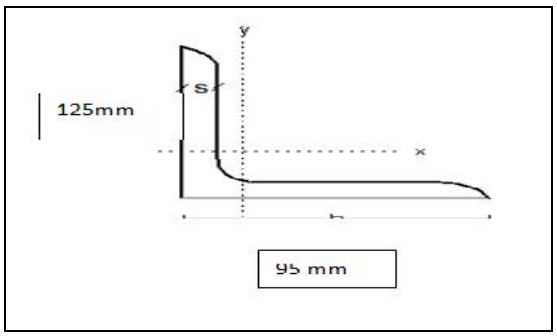

Fig 3 Angle designed

IV. RESULT AND DISCUSSION

A. Prepare Modeling In Staad

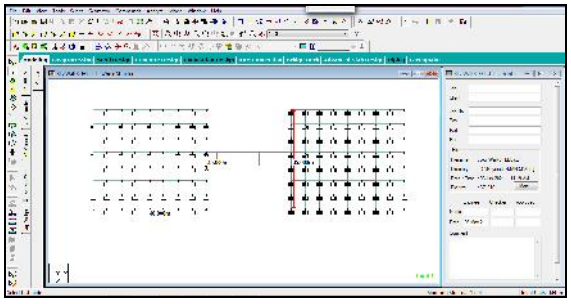

Fig 4Top view of Model in staad pro

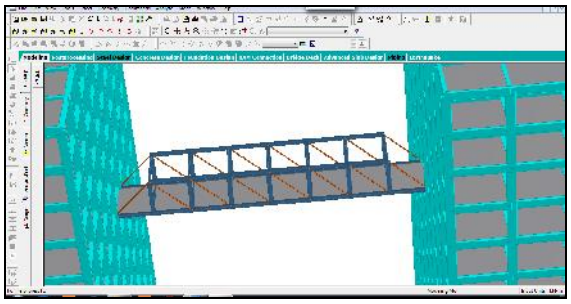

Fig 5 3D view of Bridge Model in staad pro

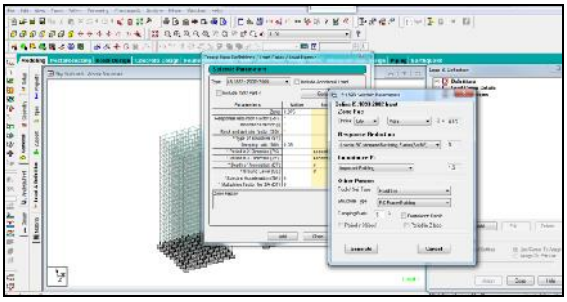

Fig 6 Seismic Load Apply in Staad

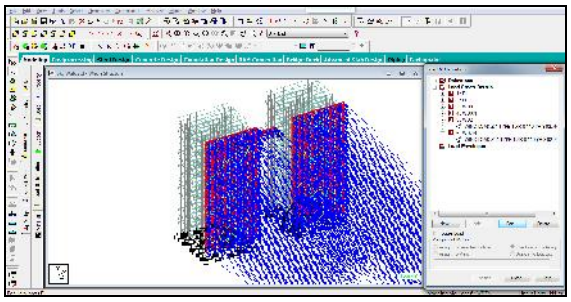

Fig 7Wind Load Apply in Staad

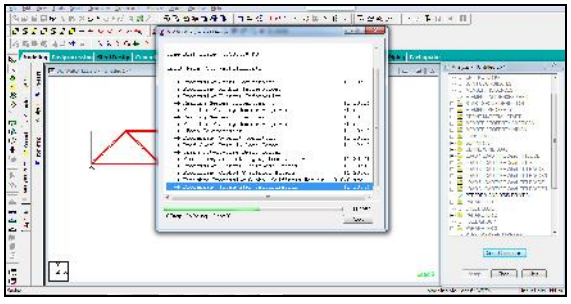

Fig 8Model Simulation in Staad

After the analyzing in staad some Members are getting failure that staad give replacement of that members and will revise design as follow

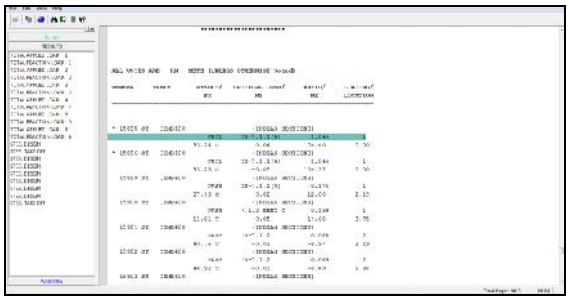

Fig 9 Failure Members in Staad

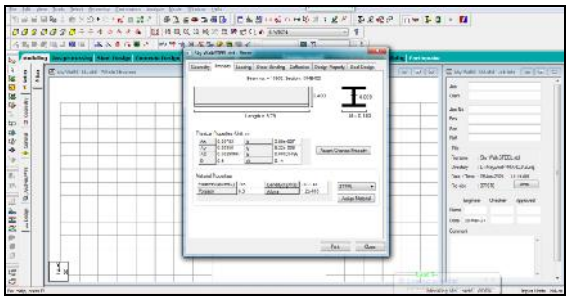

Fig 10 Assigned property of member is ISMB400

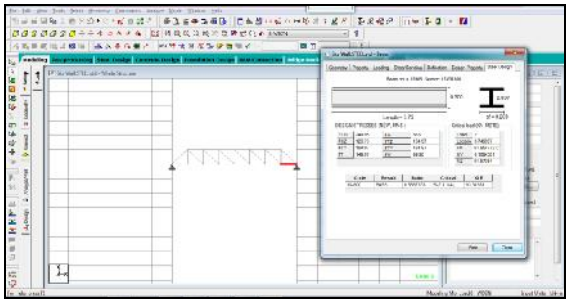

Fig 11 Replacement recommend from staad are ISWB300

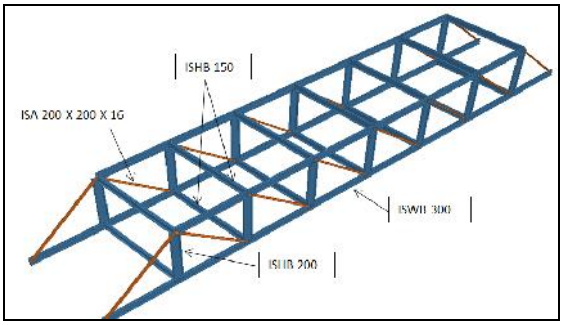

Fig 12 Revised Design Property of the members

IV. CONCLUSION

For the research work as per given problem statement, prepare twin tower model in staad pro with having bay size of 40 x 35 m with having sky walk of 25 m length

and 5 m width at level of 20th floor, and analyse the model for Seismic load, Wind load and vibration analysis of foot load, and design steel sky walk bridge using Staad Steel design data. As per design manually staad replace members and give economic sky walk (shown in figure 12) and for the purpose of checking the accuracy as per given analyses from staad pro prepare modeling in Ansys for Cross check for strength of the bridge and the strength and strain capacity of the bridge are economic as per given sizes in staad hence design are safe as given in staad.

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