



(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.699

Volume 14, Issue 6, June 2025

⊕ www.ijirset.com ⊠ ijirset@gmail.com 🖄 +91-9940572462 🕓 +91 63819 07438





www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 6, June 2025

|DOI: 10.15680/IJIRSET.2025.1406059|

Dynamic Response Analysis of Sky-bridge Connected Reinforced Concrete Buildings

Dhananjay Gopinath Gund^{1*}, Prof. A. A. Sengupta^{2*}

PG Student, Dept. of Civil Engineering, Dr. Vithalrao Vikhe Patil College of Engineering, Ahmednagar, India^{1*}

Professor, Dept. of Civil Engineering, Dr. Vithalrao Vikhe Patil College of Engineering, Ahmednagar, India^{2*}

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 rise 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 analyze twin tower structure of G+25 with having steel sky walker bridge at 20th floor , the structure analyze for seismic forces, and design steel sky walk bridge for the same by using Staad-Pro.

KEYWORDS: Sky Bridge, Seismic, Steel Design, Wind Forces, High-Rise Building.

I. INTRODUCTION

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.[5] 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.[3] 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.[5]

Incorporation of physical connections at height throws up considerable challenges: structurally, operationally, and psychologically as well as in design and occupant terms. If sky bridges are to become a realistic proposition for the improved safety of tall buildings in dense cities such as Hong Kong, the following implications should be studied. [7]



Fig 1 Evacuation in high-rise building.





www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 6, June 2025 |DOI: 10.15680/IJIRSET.2025.1406059|

II. AIM AND OBJECTIVES

Aim:

To analyze and evaluate the dynamic response of reinforced concrete twin-tower buildings connected by a skybridge under lateral loads, with a focus on improving structural performance and stability through advanced modeling and analysis techniques.

Objectives

- To study benefits, feasibility of skywalk bridge for twin tower buildings
- To analyze the sky Walk Bridge with different type of truss patterns by response spectrum method.
- To design skywalk for the twin tower building using Staad Pro Software.
- To determine structural performance of twin tower building with and without Skywalk Bridge.

III. PROBLEM STATEMENT

The Sky walk bridge analyses with effective span 30m with different type truss patterns. The results of Sky Walk Bridge are analysed for the response spectrum analysis method for Pratt and how each type of truss gives better performance than Pratt truss. After then analysing the Howe type of truss for two different types of spans, one with a 5 m span and the other with a 2.5 x 2.5 m span, according to the results, no major difference was found after changing the span. After analysing the different type truss patterns Howe type of bridge need to Design economic structure of Skywalk for the Twin Tower Building with using Stadd Pro Software analysis As per IS800 for wind and vibration loads.

Bay Frame Size

- Bay Frame = $40 \times 35 \text{ m}$
- Column Size = 300×750
- Beam Size = 300×650
- Grade = M25
- Steel Grade = Fe 500



Fig 2 Building Plan



Fig 3 Truss sizes Used for Analysis

IV. METHODOLOGY

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. 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 for twin tower.





www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 6, June 2025

|DOI: 10.15680/IJIRSET.2025.1406059|

- Collection of relevant research data from national and international journals, web source, textbook, reference book to get acquainted with past research.
- Identification of scope of research with regard to twin tower and sky walk bridge
- Study the applications of Dynamic Forces with Response Spectrum analysis.
- Study the properties Different type of Truss patterns use for sky walk bridge
- Prepare Modelling with Different type of Truss and width in Staad.Pro software
- Analyse models of Response Spectrum analysis
- Find economic truss pattern useful for the sky walk from the Response spectrum analysis with different Design Parameters Such as Deflection, Natural Frequency, time Period
- Prepare Modelling of twin tower structure With Sky Walk Structure
- Design Sky Walk Bridge for Wind Load, Dead Load, and Live Load.

Model in staad pro



Fig 4 Top view of Model in staad pro



Fig 6 3D view of Total Model in staad pro



Fig 5 Side view of Model in staad pro



Fig 7 3D view of Bridge Model in staad pro

V. RESULTS AND ANALYSIS

Wind load intensity are applied on model which are calculated, wind loads are applied by X, -X, Z and -Z directions.

Seismic load -

- Zone III -0.16
- Response Factor- 5
- Importance Factor 1.5
- Soil Condition Medium





www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 6, June 2025

|DOI: 10.15680/IJIRSET.2025.1406059|

Properties of Failure element ISMB 300

- Properties of Bottom span section = ISMB300
- Revised Property of Section = ISWB600H



Fig 8 Properties of Failure element ISMB 300

Properties of Failure element ISMC 150

- Properties of top span section = ISMC 150
- Revised Property of Section = ISMC 400



Fig 10 Properties of Failure element ISMC 150

Properties of Failure element ISMB 150

- Properties of Side Vertical section = ISMB 150
- Revised Property of Section = ISWB600H
- Revised Property of Section = ISHB 300



Fig 12 Properties of Failure element ISMB 150



Fig 9 Properties of Revised element ISWB600H



Fig 11 Properties of Revised element ISMC 400









www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 6, June 2025

|DOI: 10.15680/IJIRSET.2025.1406059|



Fig 14 Properties of Revised element ISHB 300

Properties of Failure element ISA 50 x 50 x 5

- Properties of Angles = ISA 50 x 50 x 5
- Revised Property of Section = ISA 200 x 200 x 25





- Fig 15 Properties of Failure element ISA 50 x 50 x 5
- Fig 16 Properties of Revised element ISA 200 x 200 x 25

Sections before Design



Fig 17 Sections before Design





www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 6, June 2025

|DOI: 10.15680/IJIRSET.2025.1406059|

Sections after Design



Fig 18 Sections after Design

VI. CONCLUSION

- Buildings connected by sky bridges exhibit varying structural behavior based on their location, stiffness, and connection to neighboring buildings. Rollers, hinges and stiff connectors are among the connections used to attach the sky bridge to the building. The design and construction of such a structure must consider a variety of issues, including wind load, seismic load, and safety rules. In this analysis of the Sky Walk Bridge, we consider two types of bridges: Howe trusses and Pratt trusses.
- The Sky Walk Bridge data are examined using the response spectrum analysis method for Pratt and Howe trusses. In the analysis The Howe type of truss performs better than the Pratt truss. After evaluating the Howe type of truss for two different spans, one with a 5 m span and the other with a 2.5 x 2.5 m span, the results showed that there was no significant difference after changing the span.
- For the maximum displacement of the model before and after the design of the bridge, it is concluded that the model reduces the displacement after the design of the bridge; it is ISWB600H; for the mid-vertical section,
- After the design of the Howe Truss, the bottom span portion is ISWB600H, the top span section is ISMC 400, the side vertical section is ISHB 300, and the angles are ISA 200 x 200 x 25.

REFERENCES

- [1] Chandan Ahir et. al. "Research on the Effect of Horizontal Walkway Location Connecting Two High-Rise Buildings (G+20) Under Seismic Loading" International Research Journal of Engineering and Technology, Vol 11, (2024)
- [2] Nisarg Patoliya et. al. "Seismic Analysis of Tall Buildings Connected with Sky Bridge" International Advanced Research Journal in Science, Engineering and Technology (2023)
- [3] Vanni Nicoletti et. al. "Experimental Tests and Numerical Analyses for the Dynamic Characterization of a Steel and Wooden Cable-Stayed Footbridge" MDPI (2023)
- [4] V. R. Shinde et. al. "Comparative Analysis of Truss Bridges" International Journal of Engineering Research & Technology (2021)
- [5] Surendra Chaurasiya et. al. "Twin Tower High Rise Building Subjected To Seismic Loading: A Review" IJAERS (2019)
- [6] Mr. Kaushal Kumar et al "Analysis of Truss Bridge and Cost Optimization by Using Hollow Sections" Academia (2019)
- [7] Wensheng LU et. al. "Seismic Model Test And Analysis Of Multi-Tower High-Rise Buildings" WCE (2018)
- [8] Heena Dewangan et al "A Review on Comparison of Different Types of Trusses in Vibration Analysis Using Staad Pro" IJESRT (2018)

IJIRSET©2025

15430





www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 6, June 2025

|DOI: 10.15680/IJIRSET.2025.1406059|

- [9] S Radhakrishnan et. al. "Collapse of Trust Moulivakkam Twin Towers" International Journal of Research (2017)
- [10] Hitesh A. Patel et. al. "Feasibility Study for Skywalk Proposed as in Urban Area "A Case Study" International Journal of New Technologies in Science and Engineering (2015)
- [11] Jianing Hao et al "Natural Vibration Analysis of Long Span Suspension Bridges" 5th International Conferences on Civil Engineering and Transportation (2015)
- [12] Nandar Lwin et. al. "Time History Analysis of Truss Bridge" International Journal of Scientific Engineering and Technology Research (2014)
- [13] Ji Dongyu et. al. "Seismic Behavior Analysis of High-rise Connected Structure" International Conference on Mechatronics, Electronic, Industrial and Control Engineering (2014)
- [14] Diagoro Isobe, et. al. "Numerical Simulations on the Collapse Behavior of High-Rise Towers" International Journal of Protective Structures (2012)
- [15] Amitabh Kumar et. al. "High Rise SKY Towers, Mumbai Construction Challenges" CTBUH World Conference (2011)
- [16] Ji Dongyu and Li Xiaofen, (2014), "Seismic Behavior Analysis of High-Rise Connected Structure", International Conference on Mechatronics, Electronics and Control Engineering, Atlantis Press, pp. 1167-1170.
- [17] Diagoro Isobe, Li Thi Thai Thanh and Zion Sasaki , (2012), "Numerical Simulations on the Collapse Behavior of High-Rise Towers", Vol. 3, No. 1.
- [18] Xiaohan Wu, Jun Wang and Jiangyong Zhou, (2018), "Numerical Simulations on the Collapse Behavior of High-Rise Towers", Volume 2018, Artcle ID 1865761.
- [19] S Radhakrishnan, Dr K g Selvan, Dr S Senthil Kumar, (2017) "Collapse of Trust Moulivakkam Twin Towers", Volume 4, Issue 1, ISSN: 2394- 5923(p), pp 37-46.
- [20] M. R. Willford and R. J. Smith, (2008) "Performance Based Seismic and Wind Engineering for 60 Story Twin Tower in Manila", 14th World Conference on Earthquake Engineering.
- [21] Andrew Luong and Michael Kwok, (2012), "Finding structural Solutions by Connecting Towers", CTBUH Journal, Issue 3, pp. 26-31.
- [22] Eldemery Ibrahim, (2007), "High-Rise Buildings Needs & Impacts", CIB, World Building Congress, pp. 1998-2008.
- [23] Ji Dongyu, Li Lamei, (2014), "Modal Analysis of Frame Structure Teaching Building", International Conference on Mechatronics, Electronics and Control Engineering, Atlantis Press, pp. 1167-1170.
- [24] Niels H. Harrit et.al., (2009), "Active Thermitic Material Discovered in Dust from the 9/11 World Trade Center Catastrophe", The Open Chemical Physics Journal, Volume 2, pp. 7-31.
- [25] D. Mohan, "Traffic safety and health in Indian cities," J. Transp. Infrastructure, vol. 9, no. 1, pp. 79–94, 2002. D. Mohan, "Work trips and safety of bicyclists," Indian J. Transp. Manag., vol. 26, no. 2, pp. 225–232, Apr.–Jun. 2002









INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY





www.ijirset.com