Research on wind resistance bracings of LED billboards

Guangcai Yan[1, a] and Zhaoxia Ma[2, a]

[1]Wuhan Univ, Zhongnan Hosp of Wuhan University, Wuhan, China

[2]School of Construction and Material Engineering, Hubei University of Education, Wuhan, China

[a]zhaoxiama@foxmail.com

Keywords: LED billboard, wind load, bracing forms, additional support bar

Abstract. With the development of society, all kinds of buildings with LED billboards constantly appear. The safety of LED billboards under wind loads is the focus for the public attention because it appears that lots of LED billboards have collapsed in the wind load and have crushed people. It is vital to study on the impacts of different kinds of bracings of LED billboards on their wind resistance. This paper makes a comparison of diagrams bending moment, shearing force and axial force of the relatively common triangular and rectangular bracings of LED billboards. The conclusions can be drawn from such an analysis that the wind resistance of the rectangular bracing of LED billboards is more adverse than the triangular bracing. By observing the engineering example, additional support bars can also enhance the LED billboard wind resistance in the case of the selected bracing.

Introduction

With the proliferation of the larger and higher buildings with LED billboards, wind resistance of the LED billboard on the top of the larger and higher buildings is concerned by more people because there are phenomena that LED billboards are blown over by the wind and have crushed people. In this paper, the wind resistance of different kinds of bracings of LED billboards is analyzed.

The wind resistance of different kinds of bracings of LED billboards

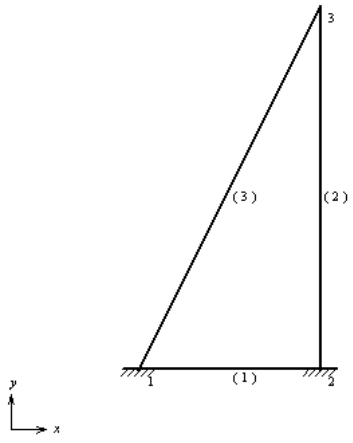

Fig. 1 The triangular bracing

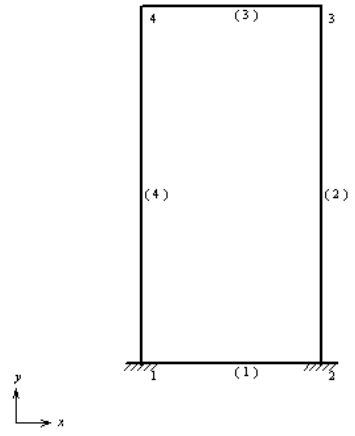

Fig. 2 The rectangular bracing

The relatively common bracings. There are lots of bracing forms of LED billboards, but triangular and rectangular bracings are the most common, as shown in Fig. 1 and Fig. 2.

The qualitative analysis of the wind resistance of bracings. It's possible to predict roughly that the wind resistance of the triangular bracing is better than the rectangular bracing because that the triangle is the most stable structure[1] [2].

The quantitative analysis of the wind resistance of bracings. Assuming that the support horizontal length is 1 m, the Vertical length is 2 m, the length of the LED billboard is 1.5 m, the bottom of the LED billboard is not in contact with the ground, Bar EA are infinite and EI equals 1.

The wind load is simplified to the uniformly distributed load (size of 1), the support and building are rigid, The force diagrams of the triangular and rectangular bracings are shown in Fig. 3 and Fig. 4[3].

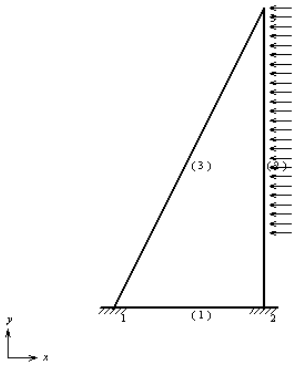

Fig. 3 The triangular bracing force diagram

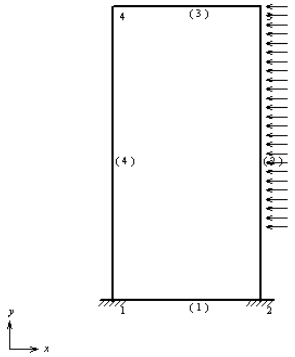

Fig. 4 The rectangular bracing force diagram

The bending moment diagram, the diagram of shearing force and the axial force diagram of the triangular and rectangular bracings are shown in Fig. 5 to Fig. 7 under wind loads.

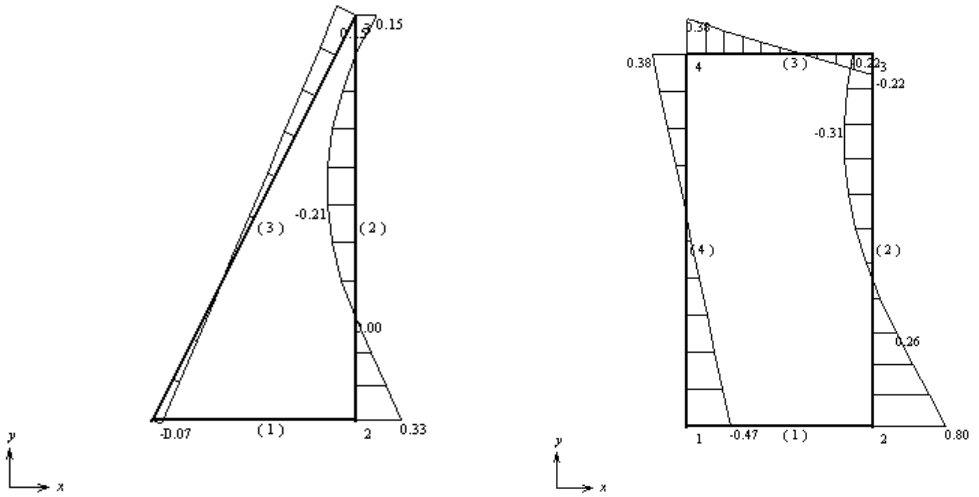

Fig. 5 The bending moment diagram of the triangular and rectangular bracings

From Fig. 5, it can be seen that the bending moment value of rigid joint of the rectangular bracing's bottom and building is significantly greater than that of the triangle support, and the upper bending moment value of triangular support is obviously smaller than that of the rectangle.

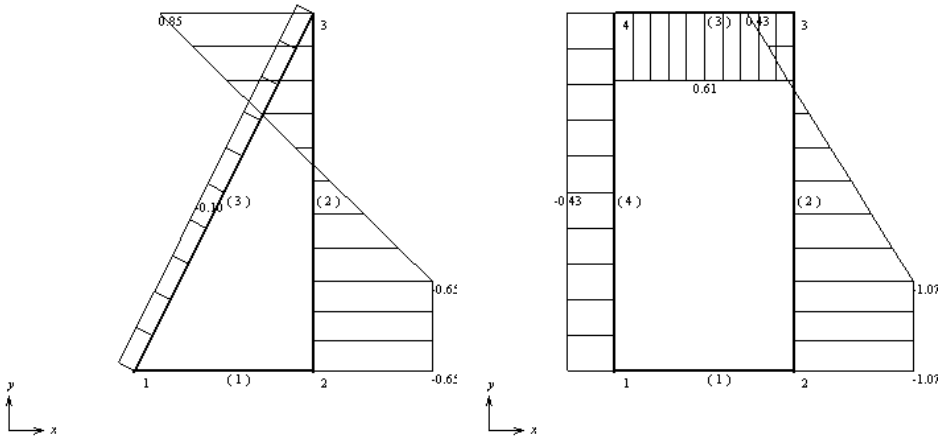

Fig. 6 The shearing force diagram of the triangular and rectangular bracings

The maximum shearing force of the triangular bracing is smaller than that of the rectangular support. The shearing force value of rigid joint of the rectangular bracing's bottom and building is bigger than that of the triangle support, as shown in Fig. 6. The axial force of the triangular bracing is greater than that of the rectangular support from Fig. 7.

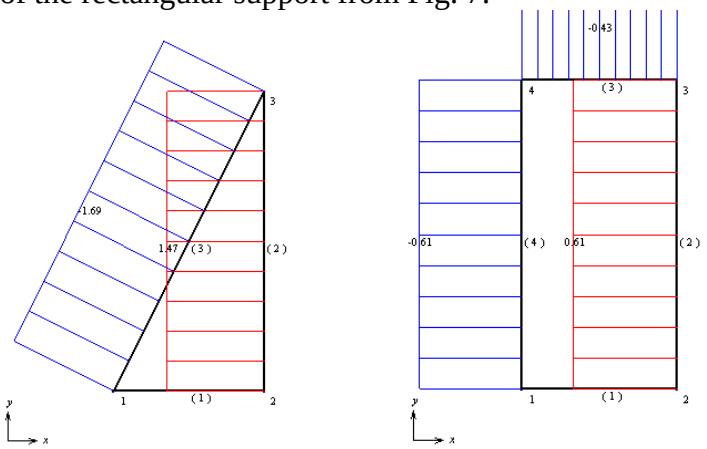

Fig. 7 The axial force diagram of the triangular and rectangular bracings

By comparison of the bending moment diagram, the diagram of shearing force and the axial force diagram, The triangular bracing will be more beneficial to the wind resistance than the rectangular bracing from the bending moment and shearing force analysis, though the axial force of the rectangular support is smaller than that of the triangle support[4].

The Led brand support forms in practical engineerings

There are the triangular and rectangular bracings in practical Led brands based on the length, width and height of the Led brand.

The triangle supports are used in the led brands of Kowloon hotels. The press's building is higher than Kowloon hotel, but the rectangular bracings has been adopted, which is added with additional supports, as shown in Fig. 8. The bending moment diagram of the press's building bracing are shown in Fig. 9.

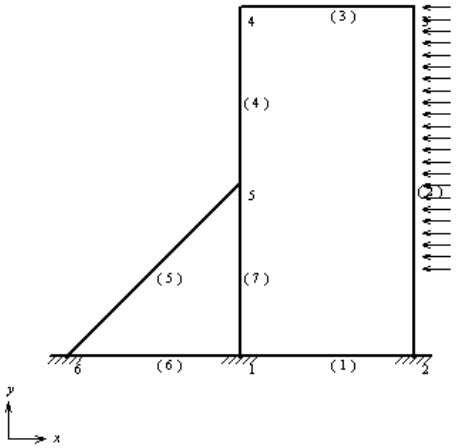

Fig. 8 The bracing of the press's building

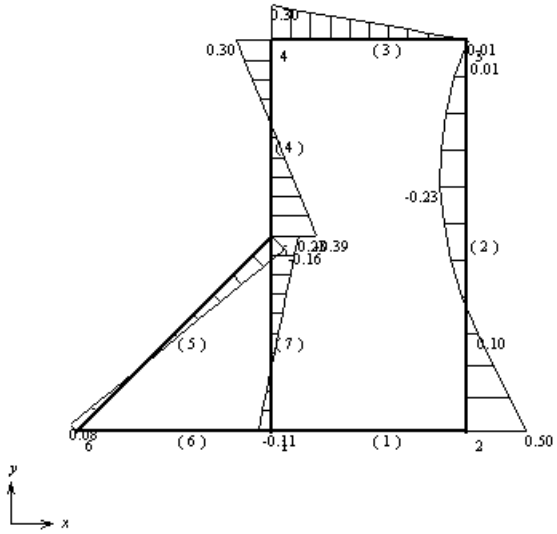

Fig. 9 The bending moment diagram of the press's building bracing

From Fig. 9, the bending moment value of rigid joint of the bracing's with additional supports is smaller than that of the rectangle support, and it's easy to see that the design of the press's building bracing is reasonable[5].

Conclusions

In this paper, the triangular support is more powerful than the rectangular support in wind resistance. The selected bracing with the reasonable additional support also can increase the wind resistance, which provides reference for the design of the wind bracing type.

References

[1] Yu-qiu long, ShiHua Bao. The structure mechanics Ⅰ, Beijing: The higher education press, 2006.

[2] Yu-qiu long, ShiHua Bao. Structural Mechanics(second edition), Beijing: Higher Education Press, 1994.

[3] Jian Shan. The interest structure mechanics, Beijing: The higher education press, 2006

[4] Kenneth M. Leet. Fundamentals of Structural Analysis, Second Edition. New York: McGraw – Hill, 2004.

[5] Tianjian Ji, Adrian Bell. See and Touching Structural Concepts. London: Taylor and Francis, 2008.