

Connection Model of Steel Pipe Construction of Billboard Structure Pile

Joni Irawan*, Luki Wicaksono, Adderian Noor

Politeknik Negeri Banjarmasin
Banjarmasin, Indonesia

*joniirawan@poliban.ac.id

Abstract—Billboards are one of the media chosen by the industry to promote their products. The location of the billboard greatly influences the effectiveness of the promotion, the more strategic the location of the billboard the higher the sale value or the rent value of the billboard. A strategic position is usually located in a busy area or on the main roads that are traversed by road users. Billboards should be located in a crowded area that has a high level of security, compared to other areas. The billboard structure element consists of primary and secondary elements, the primary element is a pile and the secondary element is a frame. The billboard structure pile is the main structural component, if the pile is weak there will be a failure of the overall billboard structure. The pile strength is not only in the capacity of the stress that meets the requirements, but it also lies in the strength and compliance with the applicable connection standards and static rules. Connection failures which often occur in the field is caused by the ignorance of the executor, hence when the loading reaches a maximum there will be a failure on the connection. This study used a cross sectional descriptive design with the subject of billboard structure. In this study, researchers analyzed the billboard pile connection model, modeled the installed conditions, then made recommendations for safe connections that are in accordance with the steel connection standards and static principles. The observations in the field and analysis show that the connection of the existing billboard is a welding connection with a staple type static modeling, therefore inner force in the form of moment appears in the connection. This implementation is not in accordance with the rules of statics, which stated that there should be no moment in the frame structure. This is what causes cracks in the connection of the billboards. The solution to this problem is the type of connection on the billboard pile must use bolt connection since in the connection will not appear moments, hence it will not cause cracks or failure in the connection of the billboard pile.

Keywords—billboard, connection, moment

I. INTRODUCTION

Billboard is one of the media chosen by the industry to launch their products. The location of the billboard greatly influences the promotion, the more strategic the location of the billboard is, the higher the sale or the rental value of the billboard [1]. Strategic positions are traversed in crowded areas or on main roads traversed by road users [2]. Billboards should

be in a crowded area that has a high level of security, compared to other areas. Billboard structure elements consist of primary and secondary elements; the primary element is a pole and the secondary element is a framework [3].

The billboard structure pole is the main structural component, if the pole is weak there will be a failure of the overall billboard structure [4]. The pile strength is not only in the capacity of the strain that meets the requirement, but also lies in the strength and compliance with applicable connection standards and static rules. Connection failures often occur in the field, this is caused by the ignorance of the executor, hence when loading reaches a maximum there will be a failure on the connection [5-7].

The purpose of this study is to model the pile connection structure of the existing billboard structure, then analyze the model in accordance with the applicable rules of statics [8,9].



Fig. 1. The failure on the billboard pile connection.

II. RESEARCH METHOD

This study used a cross sectional descriptive design with the research subject of billboards found in Banjarmasin and its surroundings. In this study, researchers analyzed the ratio of flexural and axial stresses of the pile as well as the frame of the billboard to assess the level of security of the billboard, then

modeled the connection of the billboard pile in the field and the connection according to the rules of steel construction connections (pipe type).

A. Research Procedures

- All installed billboards that meet the inclusion and exclusion criteria are observed for the type of pile connection.
- Based on the data of the connection type, pile dimensions and billboard frame from the field observations, a structural analysis was performed using SAP 2000 16.0.2 Evaluation Version computer software.
- From the results of the analysis of the structure, the billboard connections that meet the secure criteria were made as a standard billboard connection.

III. RESULTS AND DISCUSSION

A. Billboard Connection

The height of the billboard structure varies greatly, this is related to the view to be achieved by the owner of the billboard. A good view is required so that the purpose of installing the billboard is achieved. To reach the desired height of the billboard, the billboard pile must be connected. Billboards' piles generally have a pipe shape.

1) *The various of steel pipe connections:* There are various types of connections in the pipe-shaped steel profile, including welding connection/joint, threaded connection and connections using flanges.

a) *Welding connection.* The type of welding carried out is dependent on the pipe and its use, for example welding for stainless steel uses a tungsten gas arc welding, and for carbon steel pipes metal welding is used. This type of pipe connection type is suitable for pipes that function to flow large gas, the resistance to leakage is quite good, the connection can be checked for quality using radiography. Pipe joints with welding are shown as in Figure 2.

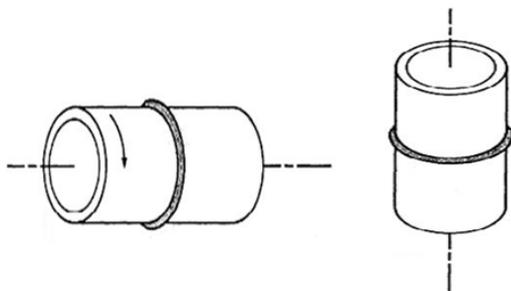


Fig. 2. Weld connection.

b) *Threaded connection.* This connection is used on pipes that are not too high pressure. Leaks on this connection can be prevented by using a gasket. Generally pipes with threaded joints are used on pipes two inches down. Threaded pipe connections are shown as in Figure 3.



Fig. 3. Threaded connection.

c) *Flange connection.* This type of connection the two ends of the pipe to be connected using a flange then connect with bolts. Pipe connections using flange are shown as in Figure 4.

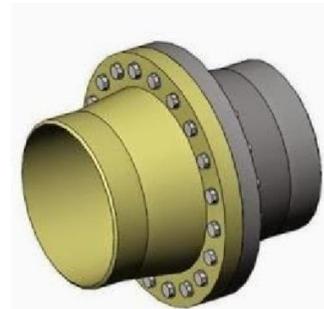


Fig. 4. Flange connections.

A good type of connection for billboards is a connection that can reduce the presence of a moment at the location of the connection. The correct choice of the three connections above is the type of flange connection, as shown in Figure 5.

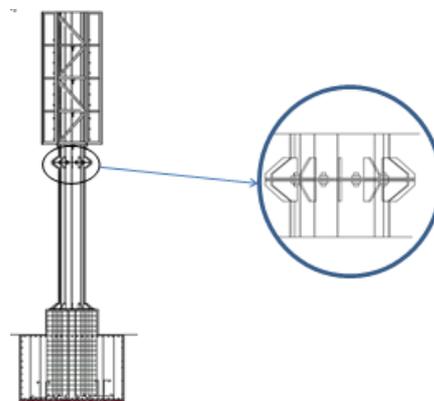


Fig. 5. Connection type of flange on Billboards.

B. Billboard Structure Element Modeling

The welding type of billboard pile connection is a type of fixed joint, according to statics, if a joint behaves as a Fixed then the joint will cause a moment. The billboard structure modeling is as shown in Figure 6.

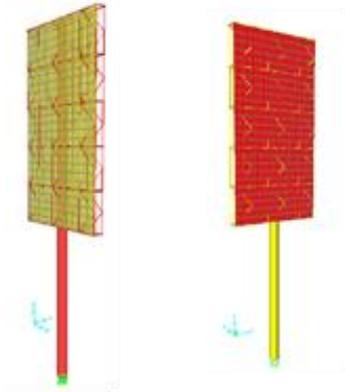


Fig. 6. Billboard structure modelling.

C. Load on Billboard Structure

The main load that works on the billboard structure consists of dead load, live load and wind load. Of the three types of loads, wind loads are the largest loads at work. The distribution of wind loads on the billboard structure is as shown in Figure 7.

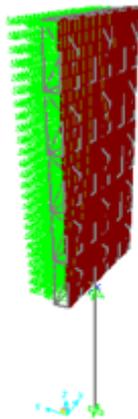


Fig. 7. Distribution of wind loads on billboards structure.

D. Output of Structure Modeling

1) *Fixed connection:* Pile connection with fixed conditions will result in a moment at the joint. The moment that occurred at the billboard connection calculated in this study was 23.895 tm. The moment value is quite large, if at the time of planning the connection of the billboard pile welding the moment that will occur is not considered, then the pile connection failure will occur. Diagram of the moment that occurs is as shown in Figure 8.

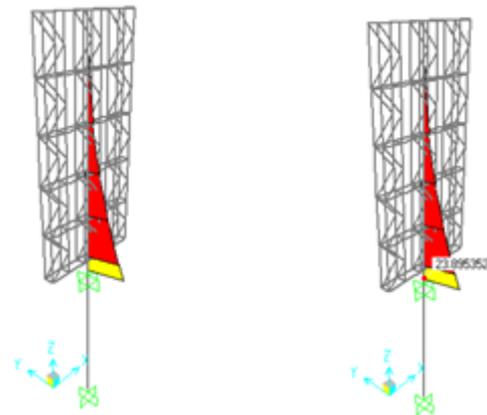


Fig. 8. Diagram of the moment plane for the fixed connection.

2) *Hinge connection:* Billboard connection with hinge modeling will not create moment, or the moment that occurs in the connection is 0 (zero), as shown in Figure 9. The joint connection is a bolt connection or flange connection.

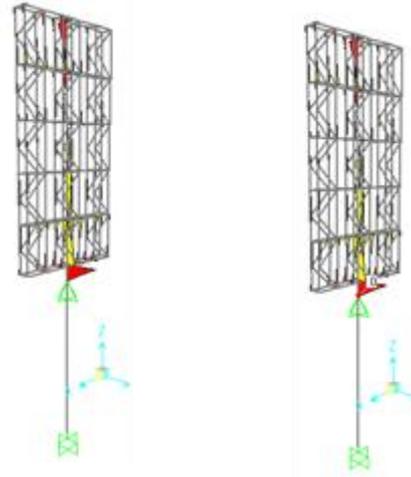


Fig. 9. Diagram of plane moment of hinge connection.

IV. CONCLUSION

Based on the field observations, billboard connections that experience cracks or failures are welded joints. Welding connection cannot be used for pipe profile pile connections, because they can cause moments. The right connections to use are connections with joints modeling, i.e. bolt connections or flange connections.

REFERENCES

[1] J. Irawan, H.F. Agoes and R.F. Cahyani, Model Prototypes of Billboard Constructions in Banjarmasin, Presented and Proceeding in International Conference ICAST 2018 Manado Indonesia, 2018.
 [2] A.F. Reza, J. Irawan and F.C. Rinova, A Review of Safety Construction of Billboard Around Banjarmasin, Jurnal Teknologi Universiti

- Teknologi Malaysia Volume 77 No.23 Tahun 2015 E-ISSN 2180-3722 : 93-99, 2015.
- [3] J. Irawan Permasalahan dan Solusi Konstruksi Baliho di Banjarmasin, Jurnal Poros Teknik Politeknik Negeri Banjarmasin Volume 4 N0.2 Desember 2012 Issn : 2985-5761, 2012.
- [4] J. Irawan, Pengaruh Beban Angin Terhadap Konstruksi Billboard, Prosiding Seminar Nasional Himpunan Ahli Konstruksi Indonesia Komda Kalimantan Selatan, 2009.
- [5] T.G. Mara, Influence of Solid Area Distribution on The Drag of a Two-Dimensional Lattice Frame , Journal of Engineering Mechanics 140:644-649, 2014.
- [6] Baheru et al., Distribution of Wind-Driven Rain Deposition on Low-Rise Building : Direct Impinging Raindrops Versus Surface Runoff, Journal of Wind Engineering and Industrial Aerodynamics, USA, 2014.
- [7] P. Warnitchai, S. Sinthuwong and K. Poemsantitham, Wind Tunnel Model Test of Large Billboards, Advances in Structural Engineering, Vol. 12 No. 1, 2009.
- [8] A.J. Rokach, Theory and Problems of Structural Steel Design, McGraw-Hill Inc, New York, 1991.
- [9] D.A. Smith, Zuo., K.C. Mehta, K.C., Characteristics of Wind Induced Net Force and Torque on a Rectangular Sign Measured in The Field, Journal of Wind Engineering and Industrial Aerodynamics, USA., 2014.