Analytical Study on the Joint Behavior of GFRP Bracket Connections under Bending

Osaka Metropolitan University Graduate School of Engineering Bridge Engineering Lab Toshie Habukawa

Investigation the optimal bolt arrangement and the bent member shape

BACKGROUND

In areas with severe corrosive environments, corrosion of bridge inspection walkways has become a significant issue (Fig. 1). Therefore, GFRP inspection walkways (Fig. 2) are applied. However, it cannot be said that the current design is rational.

Fig. 1 Example of corrosion in inspection walkways *)

Fig. 2 Application example of GFRP inspection walkway *)

*) Miyaji Engineering Ltd.,: FRP inspection walkways

Purpose Proposing the more rational bracket base joint structures

METHOD

1. FE Analysis Parameters (Fig.3)

H6-N205-CFS250
- └ CFS height (unit: mm)
- └ Frictional joint bolt axial force (unit: kN)
- └ Number of bolt holes

Fig. 3 Case name rules

(In all cases, 4 bolts were used for the frictional joints.)

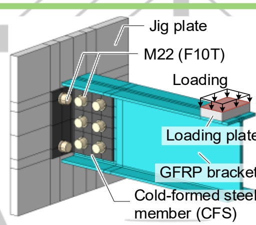


Fig. 4 FE model

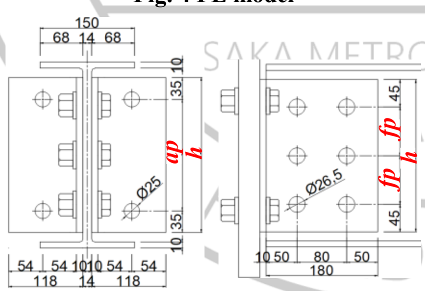


Fig. 5 Structural Specifications

2. Viewpoints

- Relationship between the separation of CFS and the displacement at the loading point
- Progression of yielding in bent components
- Load-loading point displacement/separation relationship

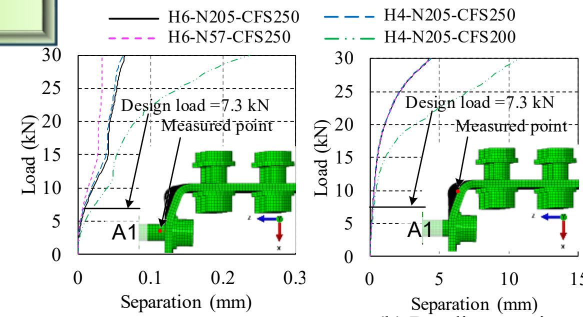
KEYWORDS

GFRP bracket, Joint behavior, Bolt arrangement

RESULTS

1. Load-separation relationship

The height of the angle member had the greatest influence on the load-separation relationship. (Fig.6)



(a) Bolt position (b) Bending starting position of the CFS

Fig. 6 Load-separation relationship

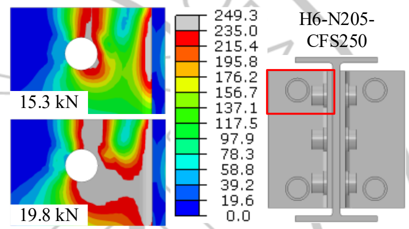


Fig. 7 Mises stress contour diagram of the bent component (unit: MPa)

The reason the separation does not increase despite the increase in load is that yielding of the CFS progresses. (Fig. 7)

2. Load-d/δ relationship (Fig. 8)

At the design load (7kN), the deformation of the GFRP has a significant influence on the loading point displacement.

As the load increased, the influence of the GFRP deformation decreased to around 50%.

(Straight line: Coeffect assuming that the loading point displacement is entirely due to separation at the R-start position of the CFS.)

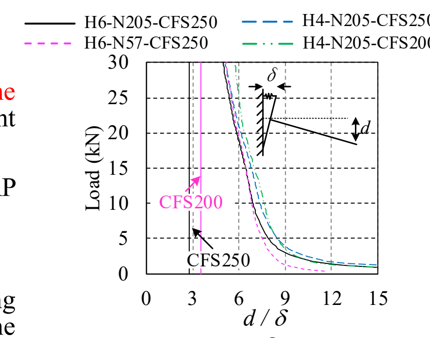


Fig. 8 Load-d/δ relationship

SUMMARY

1. The number and arrangement of bolts in the friction joint had little effect on the separation of the component, but the height of the CFS had a significant effect.
2. The loading point displacement was largely influenced by the deformation of the GFRP up to the design load, but when the applied load reach 4 times the design load, the influence decreased to around 50%.