A Study on Doubler Plate Method for Repairing Corrosion in Multiple Areas at Ends of Steel I-Girders

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To elucidate optimal doubler plate shapes for end corrosion in steel I-girders

BACKGROUND

- ✓ The ends of steel I-girders are prone to corrosion. As shown in Figure 1. Repairs of these corrosion using high-strength bolts have been carried out. However, since various forms of corrosion damage have been observed, the cost of inspection and repair design for all cases may be very high.
- ✓ It is expected that the repair design process can be simplified or omitted by elucidating the shape of cover plates that can accommodate various forms of corrosion.

Purpose Elucidate effective repair methods for corrosion damage at girder ends

Fig. 1 Corrosion Damage and Doubler Plate Repair

METHOD

The model shown in Figure 2 was used in the analysis. The repair using doubler plates was studied under the assumption of simultaneous corrosion at the bearing stiffeners and at the end side of the web, where a significant drop in maximum load occurs. In this form of corrosion, the maximum load capacity is reduced to 22% of that of the intact condition.

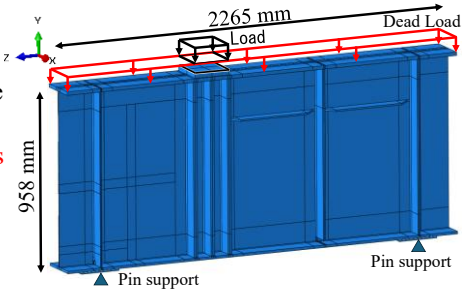

Fig. 2 Analysis model

Three cases with different shapes of the plate as shown in Figure 3 were considered. However, the number of bolts and cross-sectional area are the same in each case.

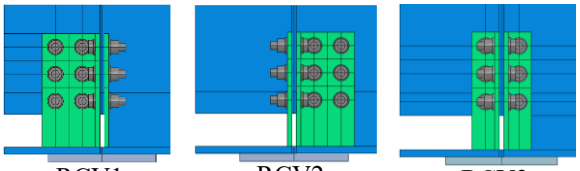

Fig. 3 Repaired case

KEYWORDS

Girder End, Doubler Plate Repair, Repair Effectiveness

RESULTS

- ➢ As shown in Figure 4,It was confirmed that RCV3, which repairs the area closest to the bearing where the support reaction force acts, is the most effective repair method.
- ➢ The same level of recovery effect was also confirmed in the case of repairing primarily the web on the girder end side.
- ➢ This may be due to the use of angle materials in RCV3, which resulted in a large second moment of area of the plate, and in RCV1, which reduced the bending of the plate by controlling the lifting of the lower flange.
- ➢ In RCV2, as shown in Figure 5, the bottom flange is observed to be lifted, which may indicate that the plate has bent and is no longer able to resist the load.

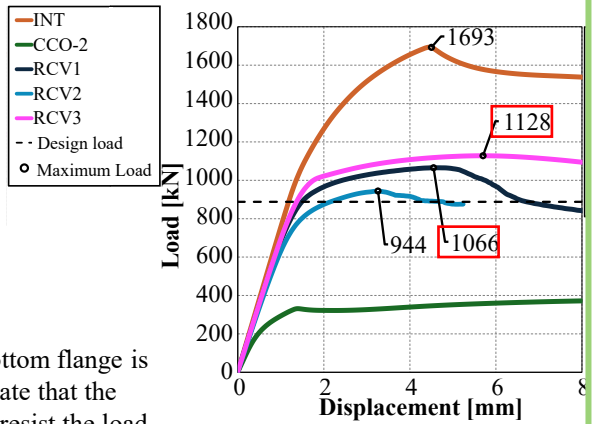

Fig. 4 Load–displacement curve

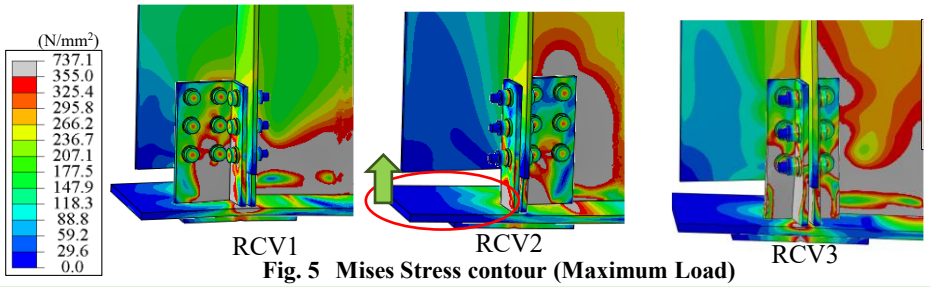

Fig. 5 Mises Stress contour (Maximum Load)

SUMMARY

1. In the case of the doubler plate repairs studied in this research, the maximum load is reached when the doubler plates can no longer resist the applied load.
2. Since bending occurs due to flange lifting, it is desirable to adopt repair methods that can suppress this behavior.