



Corrosion evaluation of gusset plate connection removed from steel truss bridge

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Summary

Many steel bridges currently in use in Japan were built during the country's period of high economic growth. As a result, the number of bridges over 50 years old will increase drastically in the upcoming years. Due to heavy traffic and Japan's severe natural environment, deterioration and damage will increase rapidly. Concerning steel truss bridges, in particular, serious corrosion damage has been reported recently, especially on the diagonal members and the gusset plate connections. This study concerns the evaluation of a corrosion measurement method using laser equipment, which was used to determine the detailed corrosion state of connection P25u that was cut out from a five-span steel truss bridge. The actual corrosion state of the outer and inner surfaces of the gusset plates and the flange surfaces of diagonal members was investigated on the basis of the corrosion depth distribution. Based on the detailed results of corrosion measurement, the corrosion state and the corrosion characteristics of the connection were clarified.

Keywords: corrosion, laser measurement, gusset plate, steel truss bridge.

Conclusions

Detailed corrosion measurements carried out on the connection P25u removed from a dismantled steel truss bridge lead to the following conclusions:

- 1) Localized corrosion had occurred on the outer surfaces of the upper chord members as shown in Figure 1. On the sides of tensile diagonal members, in the transition area between gusset plate and chord member, corrosion is more severe as a result of deformation.

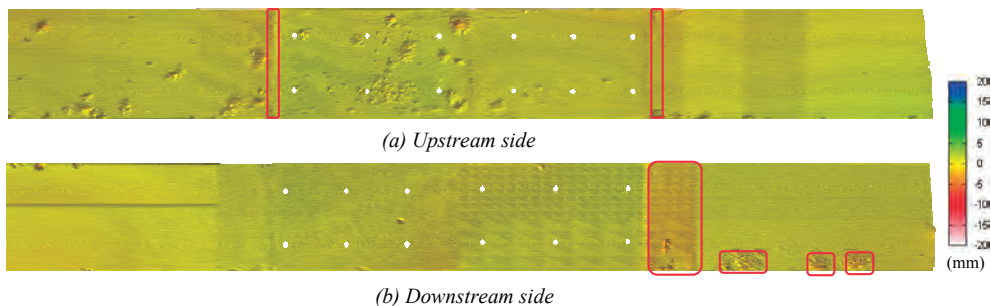


Fig. 1: Corrosion depth distribution of upper chord on the upstream side

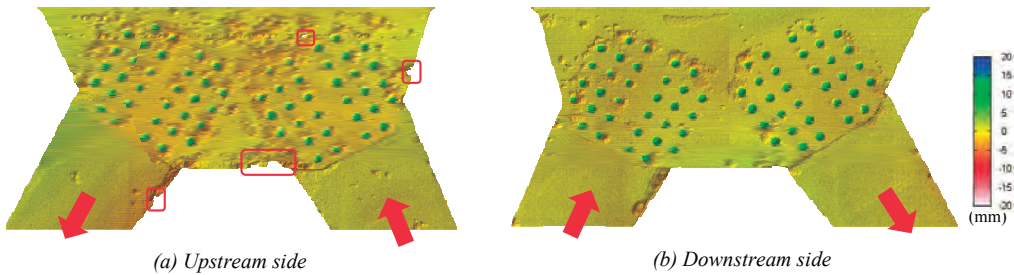


Fig. 2: Corrosion depth distribution of gusset plate of outer surface

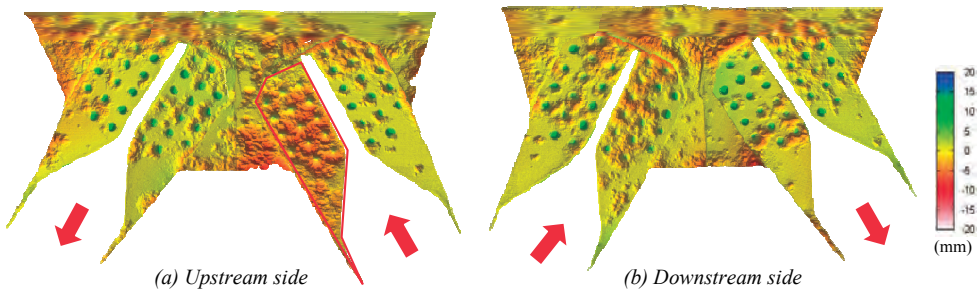


Fig. 3 Corrosion depth distribution of gusset plate of inner surfaces

2) Corrosion was more severe on the upstream side of the connection. Three holes had appeared, on the steel edges and at the end of compression members, as a result of severe corrosion. On the outer surface, localized corrosion had occurred over the whole gusset plate, as shown in Figure 2. As indicated clearly in Figure 3, on the inner surface, there was extreme corrosion on the flanges of the diagonal members, around the rivet heads, at the edges of the gusset plate and in the transition area between gusset plate and diagonal member flanges.

3) On the downstream side, localized corrosion had occurred in several specific areas on the outer surface. On the inner surface, there was also severe corrosion at the edges of the gusset plate and around the rivet heads.

4) The severe corrosion seen on the inner surfaces may have been caused by salt accumulation resulting from seaborne wind vortices.

References

- [1] National Transportation Safety Board: Collapse of I-35W Highway Bridge Minneapolis, Minnesota, *Highway Accident Report*, 2004.01
- [2] H. KASANO, T. YODA: Collapse mechanism of I-35W bridge in Minneapolis and evaluation of gusset plate adequacy, *Journal of the Japan Society of Civil Engineers*, Vol.66, No.2, 2010, pp.312-323 (in Japanese)
- [3] J. MURAKOSHI, N. TOYAMA, K. NOGAMI, T. YODA: Evaluation of the ultimate strength of steel truss bridge with corroded members, *Construction and Technology Development Report of Ministry of Land, Infrastructure and Transport*, 2012.10 (in Japanese)
- [4] J. MURAKOSHI, K. NOGAMI, T. YODA: Evaluation of the ultimate strength of steel truss bridge with corroded members, *Construction and Technology Development Report of Ministry of Land, Infrastructure and Transport*, 2013.10 (in Japanese)
- [5] K. NOGAMI, N. YAMAMOTO, T. YAMASAWA, T. YODA, H. KASANO, J. MURAKOSHI, N. TOYAMA, K. ARIMUARA, M. SAWADA: Measurement of corroded gusset plate connections in steel truss bridge and characteristics of corrosion state, *Journal of Structural Engineering*, Vol.58A, 2012, pp.679-691 (in Japanese)