※Josei Repair Record; Record ③-4

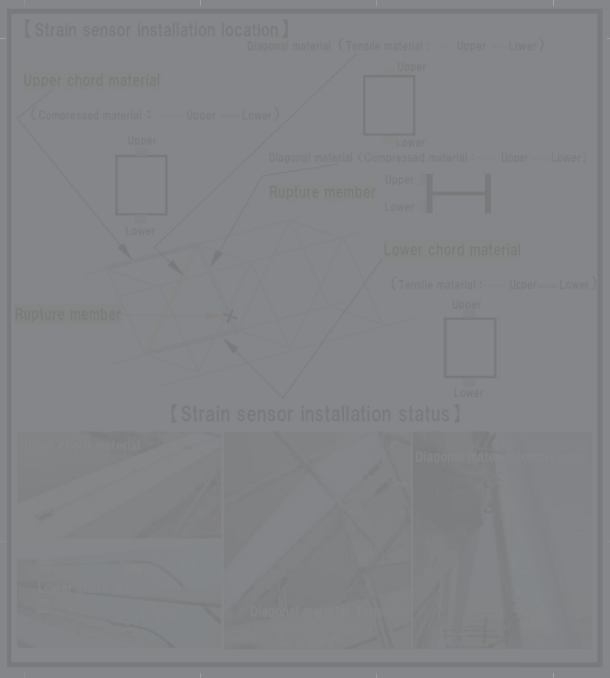
Evaluation of Unexpected Accidents

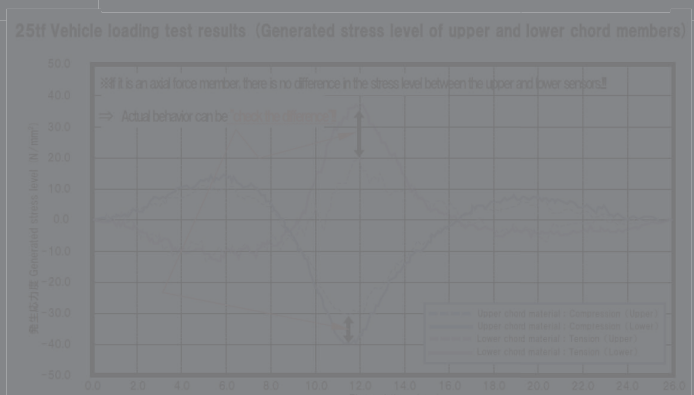
Verification of the Feasibility of Restoration Work for a Truss Bridge with Broken Diagonal Members (Evaluation of Tension Members)

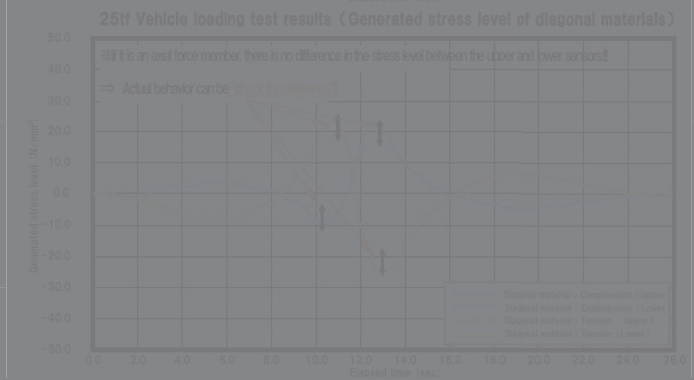
Here, we introduce Kamiharu's efforts to evaluate the appropriateness of restoration work for a truss bridge struck by the unexpected accident of diagonal member failure. This evaluation was conducted through stress measurements during load tests, and it also covers the reinforcement countermeasures implemented.

Truss bridge diagonal members failed!! Secondary stress evaluation of axial force members after reinforcement

The fractured truss bridge diagonal members were covered by concrete deck slabs for the sidewalk. Their coastal location contributed to the corrosion and subsequent fracture of the truss diagonals. Due to the fracture impact, a maximum downward deformation of 78mm was confirmed at grid point A. Full traffic restrictions were implemented. A SEP barge was floated in the river beneath the girders, and shoring was installed to perform jacking. The reinforcement with backing plates shown in the right photo was implemented under these jacking conditions. The key point of this reinforcement work was the stable fixation of the barge. If the situation had been unstable, it might have been difficult to achieve the required jacking amount. This bridge is a pin truss, and the diagonal members are axial force members. If the required jacking amount was not achieved, secondary stresses due to overall deformation effects could potentially be introduced into the axial force members. Therefore, after completing the reinforcement work, Ueharu conducted a load test to measure and verify whether secondary stresses had developed in the diagonal members, which are axial force members.







This time, measurement sensors (using optical fiber sensors) were installed on both the upper and lower sides of each axial force member (chord members, diagonal members, and lower chord members). It was expected that if the planned jacking-up was performed as scheduled, the stress levels obtained on the upper and lower sides would be nearly identical (with no difference). However, stress differences were confirmed in all measured axial force members (see upper right diagram ⟷).
In response to this result, the reinforcement plate area on the web section of the diagonal members was extended (see right photo) to create a structure capable of accommodating the difference in stress levels.

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