Structural behaviors of suspension bridge members according to bearing condition rehabilitation method

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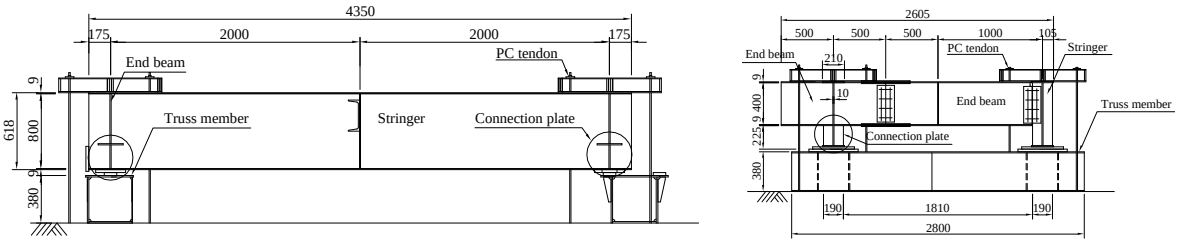
1. Introduction Maintenance, rehabilitation and repair of long span bridge are emphasized with its service periods increase. Thus, various maintenance and rehabilitation methods are developed and applied to aged bridges. For rehabilitation and repair of bridge, it is divided as strengthening and replacement. Strengthening is used for improving load carrying capacity and replacement is used for refining the structural behaviors as well as improving load carrying capacity. In case of long span bridge, it is more important that its difficulty in applications, other environmental factors. This study deals with rehabilitation method of suspension bridge through replacement of bearing conditions. For this purpose, loading test of suspension bridge members and its comparisons were presented.

2. Test specimens To compare the structural behaviors according to bearing conditions, specimen was fabricated based on suspension bridge details as shown in Fig.1. Loading tests were conducted considering real loading conditions. Bearing conditions were changed from line contact bearing to pot bearing as replacement method for its rehabilitation. Static loadings were loaded using actuator with 300kN capacity considering vehicle load and horizontal displacements were also applied to consider the displacement developed by temperature changes. Lvdts and strain gauges were installed to measure the structural response at loading position and strain gauges also were attached in connection plate to check the stress change depending on bearing condition. Figure 2 shows the test set-up and loading conditions. Table 1 shows the loading level and conditions at each loading positions



(a) front view (b) side view

Fig.1 Test specimen

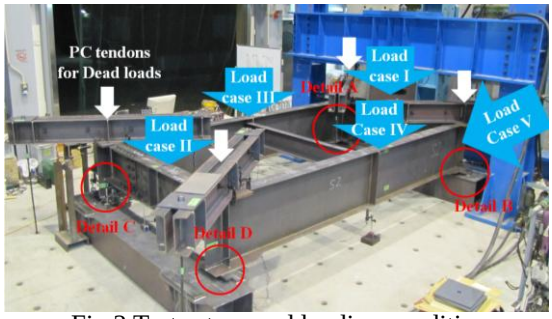


Fig.2 Test set-up and loading condition

Table 1 Loading levels at each loading conditions

Loadings	PC tendon (Dead load)	Oil Jacking (Dead Load)	Static loading	Horizontal disp. (Temperature)
	114kN	30kN	280kN	±5mm

3. Loading test results Figure 3 shows the loading test results according to bearing conditions. As shown in Fig.3, Behaviors of line contact bearing were shown to be unclear owing to the contact surface between line contact bearing and sole plate by PC tendons and loading conditions. Displacement and deformation of pot bearing applied cases were shown to be larger than those of line contact bearing. and it can be confirmed that it gives the stress reduction in connection plate based on bearing change, even if displacement and strain at structural member were increased up to some narrow range, which was very small range. and in case of connection plate around bearing, stress level can be highly changed according to boundary condition. Thus, its stress level also compared, Figure 4 shows the stress distributions of connection plates. The stress level in connection plate was reduced by movable behaviors according to pot bearing like load-displacement relationships.

Keywords: structural behavior, bearing condition, rehabilitation, suspension bridge, loading tests
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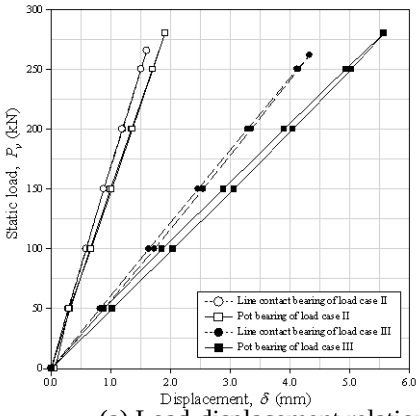
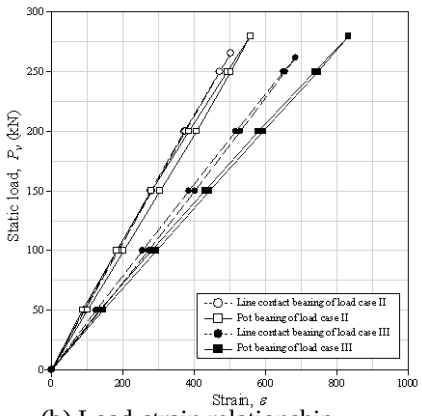
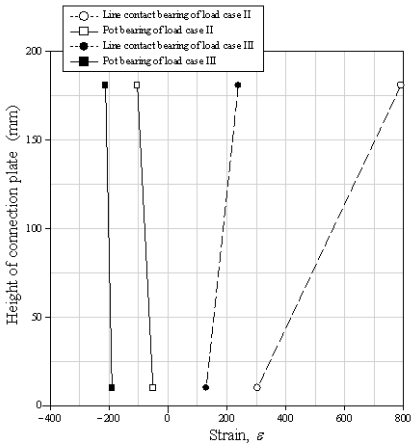


(a) Load-displacement relationship

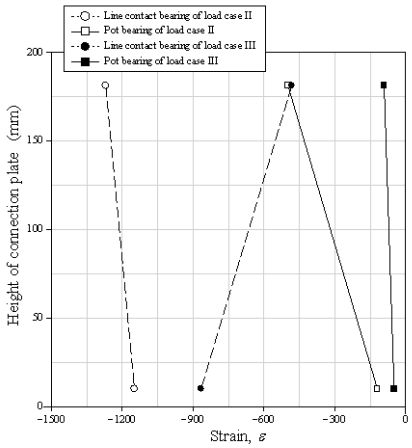


(b) Load-strain relationship

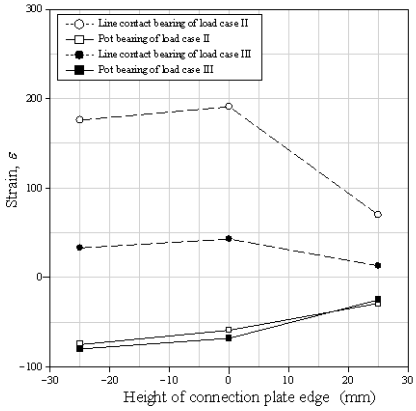
Fig.3 Loading test comparisons based on bearing conditions



(a) Strains distribution of left connection plate



(b) Strains distribution of right connection plate



(c) Strains distribution of stringer web

Fig.4 Strain distribution comparisons based on bearing conditions

4. Summary of findings In this study, structural behaviors of suspension bridge members were examined according to bearing condition rehabilitation method. Thus, its behaviors were compared according to bearing conditions from loading test on suspension bridge details. After bearing change, stains in connection plate were decreased and general structural behaviors were improved according owing to improvement of fiction behavior on bearing surface. Therefore, bearing replacement can be applied to improve the structural behaviors with old type line bearing in suspension bridge as rehabilitation method

References 1) Y. Yamamoto, I. Inada, K. Tokuda and M. Iwasaki (1996), A study on the applicability for replacing and the durability of pot bearings, Journal of Structural Engineering in JSCE, Vol.42A, pp.891-900.(in Japanese)
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