

INFLUENCE OF ALKALI SILICA REACTION ON FATIGUE RESISTANCE OF RC BRIDGE DECK

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This study aims at investigating the influence of the alkali-silica reaction (ASR) on the fatigue resistance of a RC bridge deck. Firstly, using full-sized RC deck specimens, two sets of accelerated ASR tests were performed under different environmental conditions. Then, a wheel-load tracking test was conducted focusing on the presence or absence of water on the upper face of the specimen. The deflection and crack pattern of the RC deck specimen was recorded after each tracking, while degradation of stiffness due to ASR and fatigue was evaluated by way of a forced vibration test using a small vibration device. The results revealed that the fatigue resistance of an RC bridge deck depends on the ASR environment, which is assumed to be attributable to the introduction of chemical prestress by ASR, and the interaction of crack propagation and water action. The vibration test proved useful in evaluating the fatigue resistance of an RC bridge deck with ASR.



Fig. 1 Wheel tracking machine

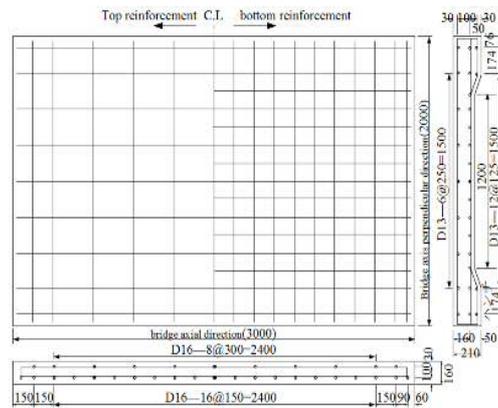


Fig. 2 Summary of specimen

Figure 3 shows the experimental program for the specimens subjected to ASR. Accelerated ASR tests were performed with two different reaction velocities, rapid (R) and slow (S). Then, moving-load wheel tracking tests were carried out under wet (w) and dry (d) conditions.

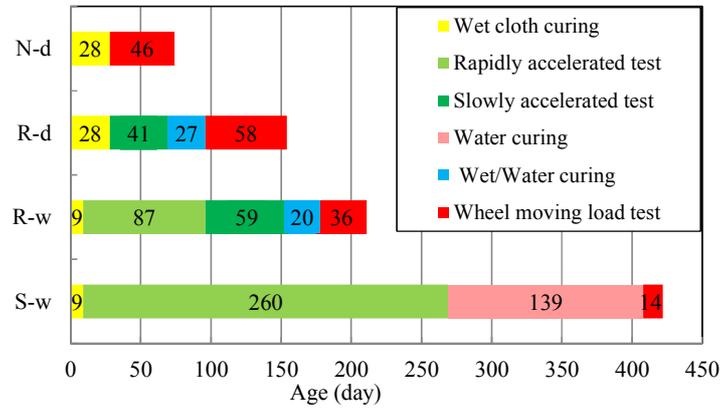


Fig. 3 Experimental program for specimens subjected to ASR

Figure 4 shows the strain behaviour for each specimen during accelerated ASR testing. It is clear that strains in the vertical direction (z) are much higher than those in the horizontal directions (x and y). This is because strain is restrained to a remarkably low level by the rebars in the z direction as compared with that in the x and y directions. In descending order, the ultimate strain at the end of the accelerated ASR tests is ordered as R-w, R-d, and S-w. This means that rapidly accelerated ASR testing causes significantly more expansion of the concrete compared to slow acceleration.

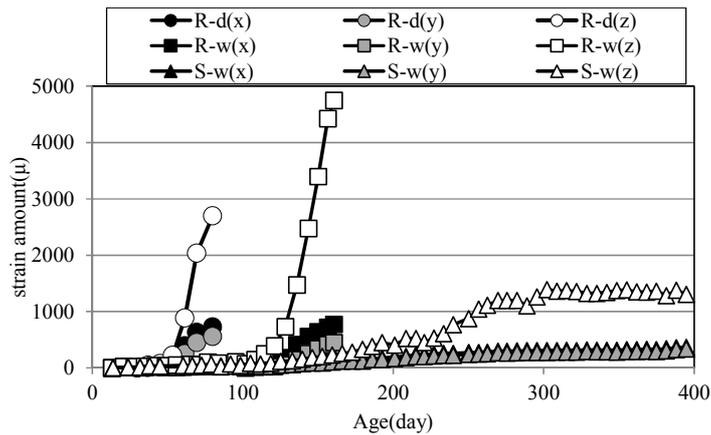


Fig. 4 Strain behaviour of specimens subjected to ASR

Figure 5 shows the results of the moving-load wheel tracking tests on the ASR specimens. While the fatigue resistance of specimens subjected to rapid ASR (R-w or R-d) is higher than that of the specimen not subjected to ASR (N-d), the fatigue resistance of the specimen subjected to slow ASR (S-w) is

extremely low compared with the other specimens. That is, the fatigue resistance of a RC bridge deck subjected to ASR, which determines its resistance to punching shear failure, depends on the ASR reaction velocity. One of the reasons for the greater fatigue resistance in cases R-w and R-d is the introduction of considerable chemical prestress during accelerated ASR.

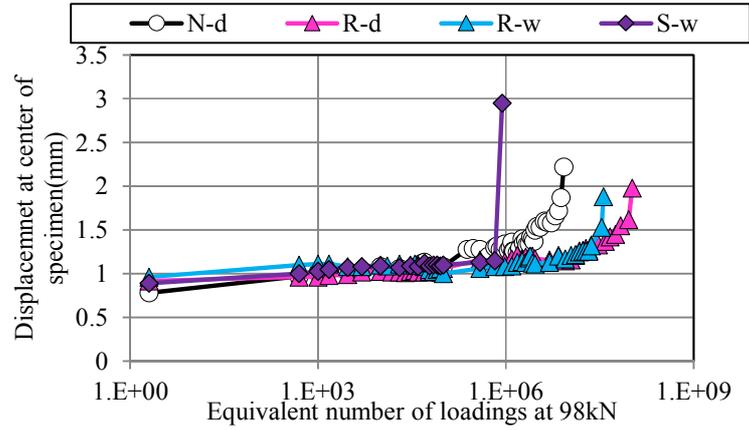


Fig. 5 Results of moving-load wheel tracking tests on ASR specimens