EFFECT OF ALKALI-SILICA REACTION TOGETHER WITH CREEP ON THE BENDING REINFORCED CONCRETE BEAMS

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Abstract
Alkali silica reaction is the reaction between alkali in cement and certain forms of silica in aggregates. The reaction produces gel resulting in cracking and disintegration of concrete.
A laboratory study was carried out to investigate the effect of deleterious ASR expansion on the structural behavior of reinforced concrete beams. The specimens were made with reactive or non-reactive aggregates. All beams had 100×150×1100 mm dimensions and internal reinforcement. After loading, specimens were kept under long-term observation at $38^{\circ}C$ and 100 percent relative humidity.
It was quite clear that the beams containing reactive aggregate showed a significant increasing strain. Ultimate loads are reduced in ASR affected beams due to large irreversible steel strains.

Keywords: Alkali silica reaction (ASR); Expansion; Reinforced concrete beams; Flexural strength

1 INTRODUCTION
Many structures, such as dams, bridges and hydraulic structures, are suffering from deterioration due to alkali silica reaction (ASR) that impair durability and might also affect the safety of installations. Some researchers investigated beams affected by ASR [1, 2, 3, 4, 5, 6, 8]. In all researches, ASR created large irreversible concrete and steel strains. But there are contradictory results of ASR effects on the overall serviceability, strength and stability of structural concrete members. In an investigation, ASR affected beams under load exhibited considerable losses of flexural strength [1]. Other researches indicated that even though the reactive reinforced beams experienced visible cracking due to ASR, their flexural loading capacity was nearly the same as that of the non-reactive aggregate beams [2,5]. However, few researches showed that ASR increased the shear capacity of reinforced concrete beams [3]. This paper focuses on the new results obtained from the effects of ASR on flexural behavior of reinforced concrete beams.

2 EXPERIMENTAL PROGRAM
2.1 Constituent materials
Type II Portland cement in accordance with ASTM C1260 standard [9] was used. Aggregates used in Ostoor dam were selected as reactive aggregates.
This aggregate has been confirmed to be reactive by the accelerated mortar-bar ASTM C1260 test method. Figure 1 shows that the expansion in both fine and coarse aggregates has exceeded the maximum allowable value of 0.2 percent. For comparison purposes, a non-reactive aggregate was selected. The result of mortar-bar test is shown in Figure 2.
The measured value of the yield strength of the ribbed bar was about 370 MPa.