

## Example of RC slab deterioration caused by combined ASR and frost attack and verification of its mechanism

Koichi KOBAYASHI, Gifu University, Gifu Japan  
Yutaka KANO, Komaki City, Aichi, Japan  
Keitetsu ROKUGO, Gifu University, Gifu, Japan

Japan is proud of its widely varying climate. This climate means, however, that concrete structures in the country are exposed to a wide variety of degradation actions, resulting in a great number of deterioration mechanisms. Recently, unusual deteriorations that may be triggered by an increased use of de-icing salt have been observed in cold mountainous areas.

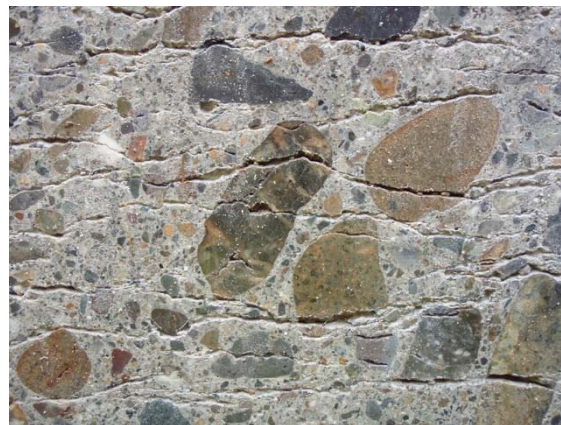
The first step in this study of the phenomenon was to examine the deterioration of an RC deck from a steel girder bridge constructed in a cold mountainous region at an altitude of 1,000m. A large pothole was found on the deck and the surface concrete was ground into muddy remains. On the under surface of the deck, mesh-pattern cracks with white deposits had formed (**Photo 1**). On overhanging sections of the deck, wheel guards and an abutment, surface scaling was observed (**Photo 2**). **Photo 3** shows part of the cross section of the bridge deck removed from the girder. Across the entire section, many horizontal cracks are seen that penetrate the coarse aggregate. The Young's modulus of concrete cores taken from the deck was as low as 9.7GPa, which accords with the typical characteristics of ASR-deteriorated concrete. In addition, it is known that ASR in bridge decks results in horizontal cracks, as there is no vertical confinement. Therefore, the cause of the severe damage observed in the case of this bridge can be assumed to be composite deterioration under ASR and frost attack.



**Photo 1** Mesh-pattern cracks and white deposits on under surface of bridge deck



**Photo 2** Severe scaling of wheel guard concrete



**Photo 3** Horizontal cracks in the cross section of the bridge deck

