

Outline of verification method for steel corrosion for chloride attack

Since the verification method of steel corrosion due to penetration of chloride ion was first indicated in the 1999 revision of Standard Specification for Concrete Structure “Design, verification of durability”, chloride threshold value was defined as 1.2kg/m³. In this revised edition, it was reviewed based on the following policies.

(1) Depending on how to define the originating point of steel corrosion, Cl_{lim} , or chloride threshold value changes. For example, when a generation limit of steel corrosion in the Standard Specification is defined as the point when corrosion product is observed, supply rate of oxygen will have a dominant influence on initiation of corrosion, and thus it is unclear as the definition of originating point of corrosion for the performance verification of structures. In the 2007 revision, the starting point of corrosion was defined as the point when passivation film was broken. In this case, the state that corrosion won't progress unless oxygen is supplied may be defined as the starting point of corrosion. However, since it will lead to the judgment on the safe side, it was specified as the standard.

(2) Chloride threshold value was specified as the function of water-cement ratio. By incorporating previous study results that it can be specified bigger in case of concrete with smaller water-cement ratio, more rational design became available.

(3) Chloride threshold value was specified depending on a type of cement. It enabled the setting of different values depending on cement types. As for the cement that has difficulty in specifying its own chloride threshold value due to less data or less application, a value on safe side was specified as an interim measure. Further study is expected.

(4) There are three ways to describe the concentration of chloride ion in concrete; 1) concentration of chloride ion in pore solution (hereinafter referred to as ion concentration method), 2) ratio of whole chloride mass to cement mass (cement mass method), and 3) whole chloride mass for unit volume of concrete (total concrete volume method). Whole chloride of (2) and (3) can be described as soluble chloride. In this revised edition, total concrete volume method was adopted, following the conventional way. Total concrete volume method is not so based on the mechanism of steel corrosion as much as ion concentration method or concrete mass method. However, it will give a limit value of safer side, because even when chloride concentration remains constant in the cement mass method, it increases as unit cement content increases in the total concrete volume method, and thus give a maximum limit to the concentration of chloride ion. The fact that this method is consistent with the method used in the salinity regulation of ready-mixed concrete or investigation in the maintenance was also taken account.

The following points were also comprehensively considered to lead to the above decision; i.e., the facts that diffusion coefficient of chloride ion was also reviewed, that cover can be specified smaller as chloride threshold value becomes bigger, but on the other hand, there are still unknown points about influence of cover for concentration at initiation, and that the value of mixed cement is estimated by the value of Portland cement. In the future, it is expected to conduct further research on measurement of chloride threshold value of cement types other than Portland cement, which will lead to more rational specification of chloride threshold value.