

## Subcommittee of safety securing system for concrete structures

Chairman Prof.Kamada (Osaka Univ.)  
Vice Chairman Prof.Kunieda (Gifu Univ.)

### Background

On December of 2012, 9 people were killed in the serious accident of Sasago tunnel, Chuo Expressway, where concrete ceilings collapsed. This accident brought much attention to the maintenance of infrastructures including concrete structures and led to several actions to enhance the security of structures. For instance, new guide line for bridge maintenance has been published by ministry of land, infrastructure and transportation to prescribe that all the bridges in Japan should be inspected every 5 years and this may contribute to decrease in the incident associated with poor inspection. The concrete structures, however, has not been maintained perfectly at this stage with a consideration of structural safety, because they should be maintained as a system in several aspects.

According to subcommittee of safety and risk for engineering system, the science council of Japan, safety is often interpreted as perfect situation that no danger exists and it is important to define safety as the situation that no unacceptable risk exists (definition in ISO/IDC Guide51). From this point of view, many designers of concrete structures may imagine that no dangerous factor exists in the designed structures simply because safety requirement is satisfied in the design.

Reminding the accident in Sasago tunnel, it may happen due to imperfect performance of chemical anchorage system. The detailed investigation, however, revealed that not a single factor such as faulty anchorage parts but the several factors in design, construction and maintenance may cause the accident. Unlike the other industrial products, concrete structures are designed and constructed to match its individual circumstance and their quality and performance strongly depend on the designer and constructors. Moreover, many processes in the construction are subdivided into more specified sections and many groups and specialists are involved and thus it is not so simple to share the knowledge and experience about the safety. Designer simply considers the requirement from the client in general and it is difficult to consider the user's point of view: the attachments to the structure such as lights and equipment, for instance, are not dealt with in the design of the main structure but the users may think they are also one of the structures.

### Purpose of the subcommittee

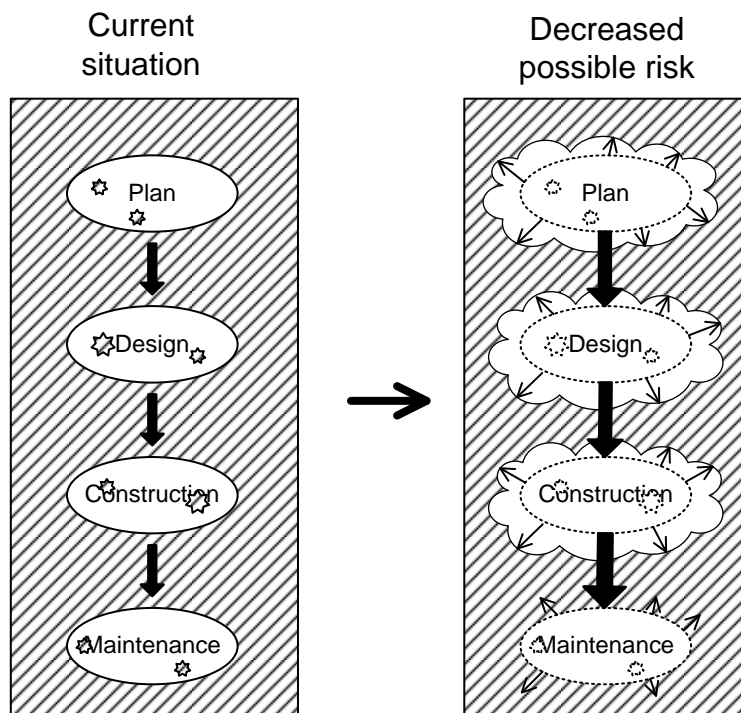
To know the issues about the security of concrete structures, our subcommittee has three working groups as follows:

WG1: Fact-finding investigation WG (chair: T.MIKI, vice-chair M.YAMAMURA)

WG2: Safety issues in other fields WG (chair: Y.OSHIMA, vice-chair S.HATTORI)

WG3: Specification WG (chair: S.ASAMOTO, vice-chair M.AKIYAMA)

WG1 extracted problems related to safety associated with concrete structures through several cases, in particular, focusing on two events: low frequent but highly influent event such as structure collapse due to earthquake, and highly frequent but relatively low influent event such as spalling. Investigating the issues and cases of safety assurance in the other fields, WG2 proposed the scheme to ensure the safety of concrete structures. Figure 1 shows the new scheme in construction process of concrete structures to avoid the possible risk. This illustrates the basic concept to eliminate the possible risk in each section by sharing the idea of total security of the structures with all the involved engineers. In WG3, by reviewing the history of safety assurance in the specification, they also proposed the idea to ensuring the safety through the specification. Finally the subcommittee concluded that to obtain the safety of concrete structures the structures should be dealt as a system from several point of views.










-  : Conventional section area
-  : Beyond the conventional section area or its implicit risk
-  : Decreased risk by expanding the section or sharing the information of the total process in construction
-  : Risk in conventional section area
-  : Decreased risk in conventional section area
-  : Conventional pipe of information
-  : Improved pipe of information

Figure 1: New scheme of decreasing the risk in construction of concrete structures.