

## **Design for Safety in Korea: Development of Construction Participants' Roles at the Plan, Design and Construction Stage**

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**Abstract:** This paper explained the Design for Safety (DfS) regulation in Korea that mandates a designer to consider the safety of workers from the design stage. In addition, this paper proposed the construction participants' roles to develop a DfS manual which contributes to implementation of successful DfS. As a duty of a designer, the safe design in Korea has traditionally considered only the safety of users using the intended objects while the duty for safety of construction workers has imposed on the contractor. The occurrence of serious accidents on the construction site has not decreased despite of the various efforts of the Korean government and private sector. Thus, the regulation of DfS was introduced to enforce a designer to consider the safety of workers from the beginning of the design stage for limited construction projects defined in the related Law. Following DfS regulation, a designer has to identify hazards in advance from the design stage based on a hazard profile and perform a risk assessment for the identified hazards. For the non-allowed risks, the risk reduction measures should be prepared and reflected into the design documents. To transfer the information with DfS results to the contractor, the designer should make the DfS report and submit it to clients. The clients should confirm the DfS report and give it to the contractor. However, designers and clients have a difficulty in performing the DfS due to the lack of knowledge about construction and the safety measures of workers. Thus, this paper investigated and proposed the construction participants' role, work contents, and work flow to carry out DfS. The major role of client is to support the designer performing safe design. The key role of the designer is to design out the non-allowed risks based on the risk assessment prepared the document including the DfS result. The contractor has to make the document for safety management plan reflecting the DfS results.

**Keywords:** Design for Safety, Designer, Construction participants' roles, Client

### **1. Introduction**

Despite various efforts by Korean government and private region over the past few years, more than 25,000 people have injured and about 500 have died each year at construction sites. In addition, construction accidents are increasing again after a sharp drop in 2013, which shows the necessity of fundamental countermeasures to control the root causes of construction accidents. The measures to solve the root causes of construction accidents can be found only when all construction participants are appropriately assigned the duty about workers' safety. Traditionally, the safety management system of construction sites in Korea is a contractor-oriented safety management system and the duty for the construction safety were concentrated on the contractor. Recently, Korea government has changed the construction safety policy to include all construction participants in safety management system. By this change, the Design for Safety (DfS) regulation was introduced in the Construction Technology Promotion Act by benchmarking foreign regulations to ensure that designer make documents considering the safety of construction workers.

In accordance with the DfS, the designer should perform design process considering the safety of construction workers and make the DfS report including measures to eliminate or mitigate hazards. However, the designer does not have sufficient knowledge related to construction workers' safety. Therefore, it is necessary to provide the designer with procedure for the DfS in order to help the designer in implementing the DfS and to ensure successful implementation of the DfS, so that the designer can also fulfill their role in reducing construction accidents. This paper explained the DfS regulation in Korea and proposed the client, designer, contractor and supervisor's roles to ensure stable settlement of the DfS.

## 2. Design for Safety in Korea

The Design for Safety (DfS) regulation in Korea was benchmarked other countries' regulations such as UK, Australia, Singapore, et al. In order to enforce a designer to consider the safety of workers from the beginning of the design stage DfS regulation started from May 19, 2016. The designer designing the objects that accounted for submitting the legal safety management plan should prepare the DfS report and receive confirmation of the DfS report from clients. The DfS report should include the identify hazards in advance from the design stage based on a hazard profile and results of performing the risk assessment for the identified hazards. The DfS process presented by guidelines for safety management of construction projects in Korea is shown in Figure 1. The DfS process is based on general risk assessment process. However, all risks cannot be completely solved at the design stage and residual risks should be communicated through the contractor's "Safety Management Plan". The DfS report usually prepared by the designer when design process reached to about 80%. The process of DfS are carried out pre-preparation, hazards identification, risk estimation and evaluation, reduction measures establishment, the risk assessment of reduction measures, implementation and record.

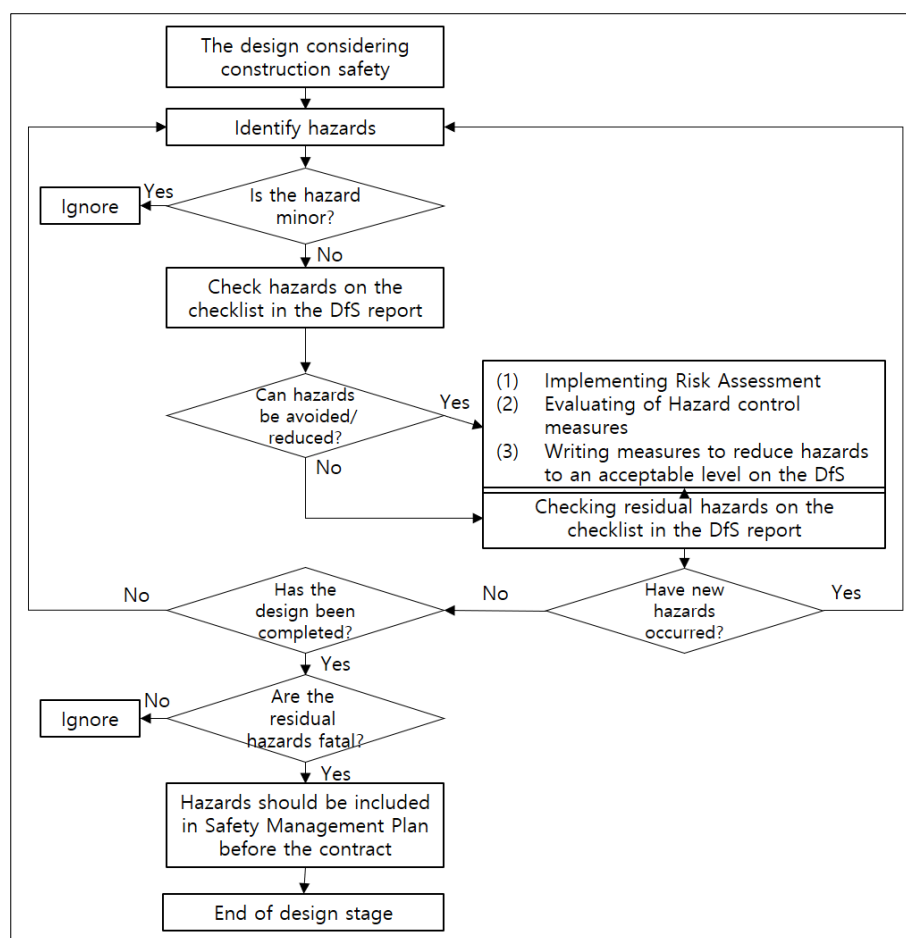


Figure 1. Design for Safety Evaluation Process

## 3. Suggestion of DfS procedure and participants' role

The contents and procedures carried out by the client, designer, contractor and supervisor at each stage of the DfS are suggested (Figure 2). At the planning stage, the client has to identify in advance hazards that should be managed intensively and establish reduction measures. At the design stage, the key role of the client is to consult with the designer to determine the detail schedule including the review of the DfS report, communicate to the designer about risk assessment, and



Figure 2. Proposed Construction Participants' Roles at Plan, Design and Construction Stage

cooperate with the designer to ensure that the risk reduction measures established in design documents. When the client receives the DfS report from the designer, the client has to review its adequacy and inform the designer of its approval after the review. Upon completion of the design, the client should review the final DfS report and send it to the contractor.

The designer should identify fatal hazards and make risk reduction measures that can eliminate or mitigate hazards. After reflecting the risk reduction measures into design documents, the designer has to prepare the DfS report according to the prescribed format and submit it to the client for review. The contractor should reflect the results of DfS report to the safety management plan submitted to the client. A supervisor should verify that the safety management documents reflected the result of the DfS report and implemented during the construction. In case that the designer and client did not have sufficient knowledge of construction safety, clients or designers should include construction safety experts in the DfS team to ensure procedural rationality of the DfS and establish effective reduction measures.

## 5. Conclusion

This paper explained the DfS regulation in Korea and proposed the client, designer, contractor and supervisor's roles to ensure the successful implementation of the DfS regulation. A client as being involved in the whole process from the planning of the object to the design and construction has a great influence on the safety of the construction project. The client should participate in the overall decision-making process in design. The role of the client is to consult with the designer about the detail schedule of the DfS process, communicate to the designer about risk assessment, and cooperate with the designer to reflect the risk reduction measures into design documents. In addition, the client has to review DfS report prepared by the designer and inform the designer of its approval. A designer as a construction participant that can most effectively resolve technical problems of fundamental hazards is substantially perform the DfS through consultation with a client. Thus, the designer should identify hazards, perform the risk assessment, establish reduction measures, prepare the DfS report, and deliver relevant information during construction. Problems due to lack of safety knowledge about workers should be solved through collaboration or consulting with construction and safety experts. A contractor has to make and submit safety management documents reflecting the contents of the DfS report to the client and implement them.

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