

A STUDY ON THE SAFETY INFORMATION SYSTEM TO PREVENT HAZARD OF BUILDING CONSTRUCTION

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ABSTRACT: In Korean cases, the occupation of building construction is below 10% of the total industry workers but from a accident rate point of view, it is a risk serious industry and it's hazard is very considerable which accident rate is up to 30% of the total industry workers. The reason of high accident rate of the building construction is its own characteristic, hazard of the work in which is implicated and the shortage of safety counter plan and information, so it is most required to the building construction that educating, training, short and long period approaching to prevent the hazard. The safety information of building construction which is related to safety accident is divided into human and material such as hazard, work situation, cause and counter plan. The existing hazard cases imply all of the information about the work type and work progress of the building construction, so if the research of the every fact is well accomplished, we can obtain the useful information and prevent the hazard of building construction. From this point of view, the emphasis of this study is based on analyzing the cause of hazard first, suggesting the safety information each part of work type and work progress second, and finally making the all existing hazard cases to the Data Base and developing the safety information system.

Key words : Accidents prevention, safety management, safety information system

1. INTRODUCTION

The safety information for the prevention of construction accident of Building construction is consisted of 3 factors which are the standard of safety technology, a prevention works of accident and accident cases. Among these factors, the information of the accident cases are strong stimulus for the presentation of safety counter plan because they can help us to predict the hazard of becoming work which is similar. Also they proffer the help to predict the hazard elements of construction works, and to manage the serious and important works that accidents are occurred frequently. But the construction managers and the construction supervisors of ripe experience cannot institute the efficient safety counter plan in spite of they experienced many great accident cases because do not remember the past hardships.

Therefore to institute the accident prevention counter plan is essential to the construction safety manager and the construction supervisor such as dangerous works that accidents are frequently. In this situation to obtain the safety information according to work types and situation at the construction field is much useful for the prevention of construction accident and institution of counter plan. Therefore the safety information system is needed urgently

according to various work types for building construction.

From this point of view, this study aims to analyze the range of safety management according to the accident cases for 11years (1992~2002) in Korea, and propose the field useful construction safety management system which can used in searching the accident cases and analyzing the cause of accident and presenting the safety counter plan according to works types for the building construction.

2. CONSTRUCTION OF SAFETY INFORMATION SYSTEM

2.1 Consideration of serious accidents according to work types for building construction

Table 1 shows the quantities of accident cases according to work types for building construction and the occurrence ratio of serious accident in each work. The serious accident ratio is surveyed most highest at the form work (17.4%), and next temporary installation work (11.6%), steel frame work (11%), stone & wall work (7%) according to quantity.

Table 1. Present of serious accident occurrence according to big work types for building construction

Work Type	Quantity	Ratio (100%)	Ranking
form work	285	17.4	1
temporary installation work	190	11.6	2
steel frame work	180	11.0	3
stone and wall work	115	7.0	4
facility work	103	6.3	5
earth and foundation work	100	6.1	6
concrete work	90	5.5	7
mortar and tile work	88	5.4	8
lift work	75	4.6	9
paint work	60	3.7	10
steel bar work	53	3.2	1
E/V work	42	2.6	12
electric work	39	2.4	13
glass and window work	38	2.3	14
etc.	36	2.2	15
masonry work	34	2.0	16
movement beyond work	33	2.0	17
waterproof work	27	1.7	18
break work	21	1.3	19
embellishment and metal work	16	1.0	20
insulation work	7	0.5	21
curtain wall work	3	0.2	22
Total	1625	100	

Generally the acquisition of accident information from construction companies is much difficult, especially such as cause and compensation. Therefore this study is based on "serious accident cases" of Korea Occupational Safety & Health Agency [KOSHA] in consideration of objective analysis.

Table 2. Database of accident cases

Division	data type	contents
I.D	Num	characteristic I.D for searching the accident cases
title	Char	Input the title of accident cases
date	YY/DD/HH	occurrence time of accident
place	Char	occurrence place of accident
company	Char	construction company
Construction work	Char	title of construction
work type	Char	1 work among 28 classifications for building construction
the injured	Char	name of the injured
age	Num	age of the injured
accident type	Char	input the direct cause such as fall, fire, suffocation etc.
accident grade	Char	little injured, hard injured, death

accident cases	Char	input the field situation on the objective mind
scale of construction	Char	total scale of construction ex)basement 3 floor, ground 20 floor
amount of cost	Num	input the amount of construction cost
occurrence 1 ~ 5	Char	input the condition of the injured, the observer, situation etc.
cause 1 ~ 5	Char	input the cause of accident such as object, installation, guard, management etc.
direct cause 1 ~ 5	Char	input the contents of direct cause
indirect cause 1 ~ 5	Char	input the contents of indirect cause

2.2 Formation of "Safety Information Database for Prevention of Building Construction Accident"

"Safety Information Database for Prevention of Building Construction Accident" is classified with 3 parts as construction process, construction unit and detail work according to a work high in rank and presents the detail works of each part. This study abstract the cause by used material and resources from accident cases according to character of each work after classifying of construction and arrange the universal counter plan for the prevention. And it is possible to chain the document of KOSHA and related law in case of need the total safety information in this constitution. Also the safety information can be proffered and each accidents types according to accident cases together because this safety information system is chained with searching code of accident cases. Namely, this system proffers the necessary help for the institution of safety prevention in cases with same work and construction.

This safety information database is composed with necessary contents of ID, construction process, construction unit, detail work, man & machine & material, cause of accident, safety counter plan, related law, technological documents of KOSHA CODE. Table 3 is a prototype presentation of database about construction safety information

Table 3. Construction safety information database

Division	Data	Contents
I.D	Num	characteristic I.D for searching the accident cases
Construction process	Char	1 work among 28 classifications for building construction
Construction unit	Char	Divided total construction into 158 works.
Detail work	Char	not divided because accident cases are not sufficient
man, machine, material	Char	present the man, machine and material related to construction
method of work	Char	present the method of construction work
cause of accident	Char	input the accident cases for safety information

safety counter plan	Char	input the needed machine, man, etc. for the prevention of construction accident
related law	Char	input the contents of related law for construction and detail work
technological documents of KOSHA CODE	Char	input the safety work standard of construction & machine & electric etc.

2.3 Formation of database according to hazard grade

This study analyzed the hazard probability for hazard evaluation about 22 types of building construction by using 1635 statistical instances of building construction accident which is collected from 1992 to 2002 at Korea Occupational Safety Health Agency. Namely annual cases of serious accident can be presented to 149 cases because 1635 cases are collected for 11 years. This study assumed that the occurrence probability of remote (grade D) ratio is below 0.7% according to table 5 because probability of 1 accident instance is below 0.7% among 149 serious accident cases. And on the assumption that 148 accidents occurs every year, this study assumed that the occurrence probability of occasion (grade C) ratio is '0.7%~4%' because 1 accident instance is occurred for 2 months (4%). Also this study assumed that the occurrence probability of probable (grade B) ratio is '4%~8.1%' because the probability of monthly occurrence ratio is 8.1%, and the occurrence probability of frequent (grade A) ratio is upper 4%.

Table 4 shows basic contents of database on the basis of accident probability according to work types for building construction by quantitative analyzing to acquire the necessary safety information.

Table 4. Database according to accident probability

Division	Data type	Contents
I.D	Num	characteristic I.D for searching the accident cases
Construction process	Char	1 work among 28 classifications for building construction
Construction unit	Char	divided into 158 works.
Detail work	Char	not divided because accident cases are not sufficient
quantity of accident	Num	occurrence quantities among 1625 accidents
probability of accident	Num	present the probability of accident
grade	Char	present grade such as A~B according to probability

2.4 Constitution of safety information system

The safety information system must manage and support the safety management work executed in the field of construction so as to institute the necessary and useful system. And it must be possible that to use for the supervisor

and manager without any adding program. This safety information system is divided into 3 groups largely such as searching system, safety information system according to work types and grade presentation system. And each part system can be chained efficiently.

First this study divided total building construction work processes into 3 parts such as work process, work unit and detail work process according to "Standard specifications of building construction", Architectural Institute of Korea, Ministry of Construction and Transportation and constituted the safety management system by using MS-Visual Basic program. And constituted the safety information database according to "Serious accident cases and counter plans of the building construction", Korea Occupational Safety & Health Agency, by using MS-Access program. Also this system could be connected with other programs and chained for upgrading.

Therefore the various application of this safety information system to many kinds of construction processes and construction types is possible because continuous updating of documents and data could be executed. Also the joint using of information is possible by using the telecommunication.

3. DEVELOPMENT OF SAFETY INFORMATION SYSTEM

3.1 Safety information system

Figure 1 shows the total flow of developed system which contains the database of accident cases, construction safety information and hazard grade according to work types. This system is developed to be connected so searching information is possible at 3 parts.

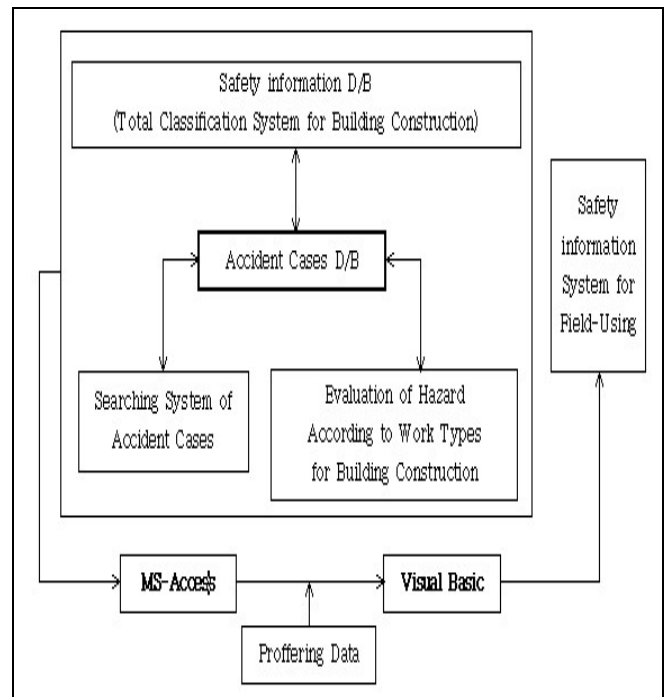


Figure 1. Progress of safety information system

3.2 Searching system of accident cases

Searching algorithm of past accident cases is calculated by selecting searching condition of this database. Figure 2 shows the composition of searching system such as place, process, date, supervisor, the injured, the scale of construction, the total cost of construction etc.

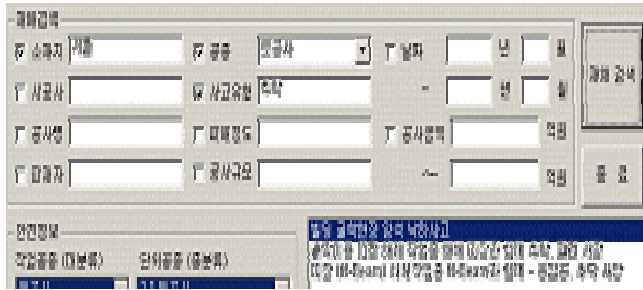


Figure 2. Searching accident cases

3.3 Safety information searching system

The searching system of past accident cases is constituted to be possible searching of detail safety information according to construction process, construction unit and detail work by proffering the detail contents of past accident cases. So construction manager and construction supervisor can acquire the necessary information accordant with work for the construction safety management.

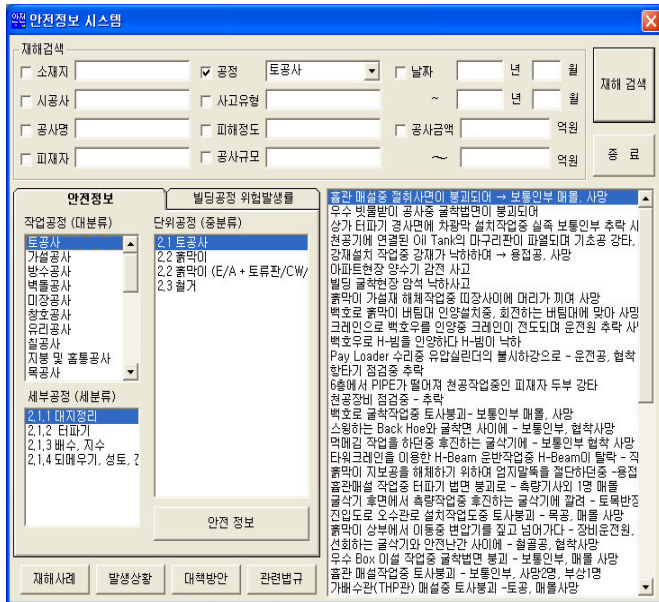


Figure 3. Searching safety information

3.4 Safety information system according to hazard grade

Safety information system according to hazard grade used the information of hazard grade index according to work

types for building construction. Also this system used the database of detail work. Figure 4 shows the constitution of searching system according to hazard grade.



Figure 4. Hazard grade according to work types

4. CONCLUSION

Generally the serious accidents of building construction are occurred repeatedly at the same work types. Therefore prevention and counter plan for construction condition and situation must be done first. From this point of view, this study constituted the safety information system by collecting databases of past accident cases, construction safety information and hazard grade according to work types, so as to manage and support the safety management work in the field of building construction.

The result of this study is as follows.

- 1) After analyzing the "serious accident cases" of [KOSHA] in consideration of objective analysis, constitute the safety information database contained past accident cases, safety information and hazard grade according to work types for building construction.
- 2) By developing the algorithm accorded with accident cases, safety information and hazard grade according to work types for building construction, constituted the database of 1000 cases by using MS-Access program. Also this system could be connected with other programs and chained for upgrading.
- 3) A searching for total safety information could be possible such as place, process, date, supervisor, the injured, the scale of construction, the total cost of construction etc. on this safety information system.

On the progress of this study, important focus is based on the field-using safety management especially. Also this safety information system is thought to be used in constructing the green-building efficiently on the point of safety management.

ACKNOWLEDGEMENT

This study is researched successfully with the support of Regional Research Centers Program, Ministry of Education & Human Resources Development 2005.

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