RECENT TENDENCY OF ACCIDENTS BY OLD AND MIDDLE AGE WORKER IN CONSTRUCTION INDUSTRY

Hiroshi Torihama and Takehiro Tanaka
(Toyo University)
[1]Graduate School of Science and Engineering, Toyo University, Japan
[2]Department of Architecture, Toyo University, Japan
dandori000@gmail.com, tanaka@toyo.jp

ABSTRACT

This is the study on safety and quality improvement technique for construction and maintenance of building facilities. Few researches and studies have been conducted in such fields as safety activities, trainings/exercises, danger/risk prevention measures and analysis/evaluation methods for building facilities or the current state of safety/danger in building facilities is not fully comprehended either. In this paper, the tendency of accidents in building facilities for the past ten years and the occurrence condition of fatalities disaster by heatstroke in construction industry of Japan is summarized.

Keywords: Accident, Building facilities, Risk

INTRODUCTION

This is the study on safety and quality improvement technique for construction and maintenance of building facilities. Few researches and studies have been conducted in such fields as safety activities, trainings/exercises, danger/risk prevention measures and analysis/evaluation methods for building facilities or the current state of safety/danger in building facilities is not fully comprehended either.

Under these circumstances, the purpose of this study is to examine safety and quality improvement technique for construction and maintenance of building facilities. In this paper, the tendency of accidents in building facilities for the past ten years and the occurrence condition of fatalities disaster by heatstroke in construction industry of Japan is summarized.

RECENT TENDENCY OF ACCIDENTS IN BUILDING FACILITIES

The transitions of the number of fatalities in all industries, the construction industry and works related to building facilities for ten years from 2004 to 2013 is shown in Figure1 and the transitions of casualties in Figure 1, Figure 2 was completed on the basis of yearly data from the statistics of occupational accidents "Fatal accidents according to the type of works/Conditions classified according to types of accidents in the construction industry" of The Japan Construction Occupational Safety and Health Association.

In these data "building facilities" under the category of the construction works and "utility construction works (electro-communication, machinery and others)" are distinguished as two different types of works, but they were added in this study to present works related to building facilities.

Figure 1 was completed on the basis of yearly data from the statistics of occupational accidents "Occurrences of life-threatening disasters according to types of industries and accidents (fatal accidents and four days-off or longer) of the Japan Advanced Information Center of Safety and Health in the Japan Industrial Safety and Health Association. In these data "works on building facilities" under the category of the construction works and "other construction work (electro-communication, machinery and equipment installation, and other construction works)" are distinguished as two different types of works, but they were added in this study to present works related to building facilities.

According to these outcomes, the number of fatalities in all industries declined gradually from 1,600s in 2004 to 1,000s in 2013. A sharp fall is observed in 2009 and 2011, which can be attributed to economic slowdown in the construction industry as a result of Lehman Shock in September 2008 and the Great East Japan Earthquake in March 2011. The number of fatalities in the construction industry dropped below 400 for the first time in 2009, whereas no big difference was seen for works related to building facilities where the trend continues to be almost leveling off.

The number of fatalities in the construction industry accounts for about 34% of the total number of fatalities in all industries, out of which nearly 20% is represented by works related to building facilities.

Fatalities in works related to building facilities comprise nearly 7% of the total fatalities in all industries.

As for number of casualties, that of the construction industry accounts for about 16% of the total number in all industries, out of which nearly 19% is represented by works related to building facilities.

Causalities in works related to building facilities comprise nearly 3% of the total casualties in all industries.

The proportion of causalities in the construction industry to those in all industries is about 16% whereas the proportion of fatalities in the construction industry to those in all industry is 34%, suggesting that accidents in the construction industry are likely to lead to fatal disasters.

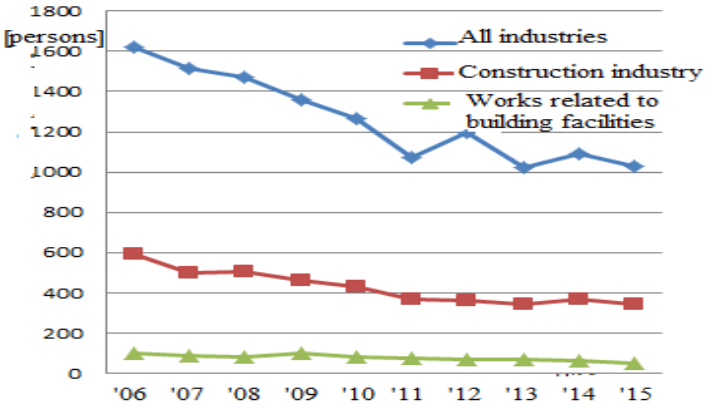

Figure 1. Transitions of the number of fatalities between 2003 and 2012

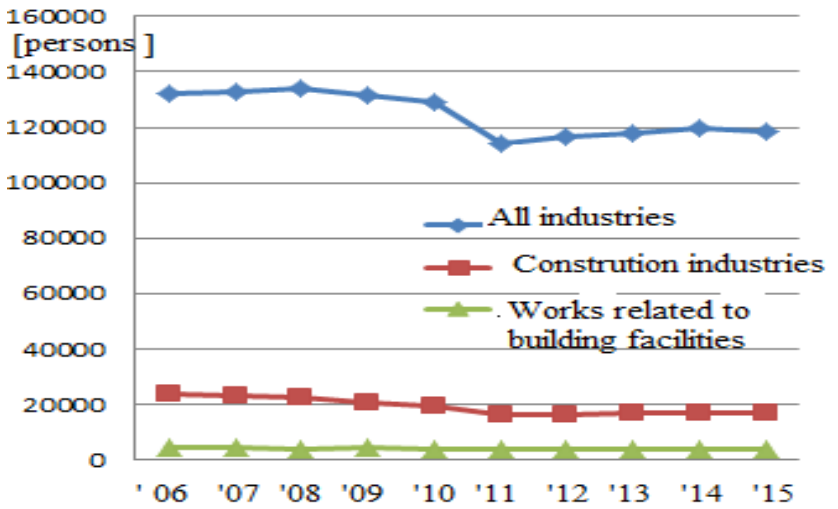

Figure 2. Transitions of the number of casualties between 2003 and 2012

On the basis of above mentioned data, the numbers of fatalities in construction works and works related to building facilities according to types of accidents for the first five years between 2003 and 2007 and for the second five years between 2008 and 2013 are surveyed and shown in Figure 3, Figure 4 and Figure 5, respectively. Likewise, the numbers of causalities according to types of accidents are shown in Figure 6, Figure 7 and Figure 8.

To make their comparison easier, the numbers of fatalities/casualties in construction works were obtained by subtracting the numerical values for "building facilities" (or "works on building facilities") from those of construction works of the statistical data.

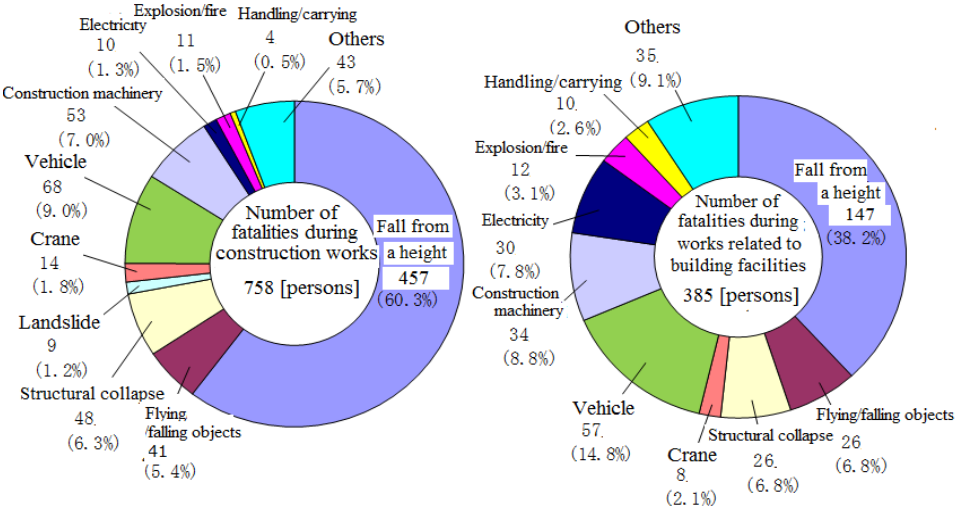

Figure 3. Causes of construction fatalities between 2003 and 2007

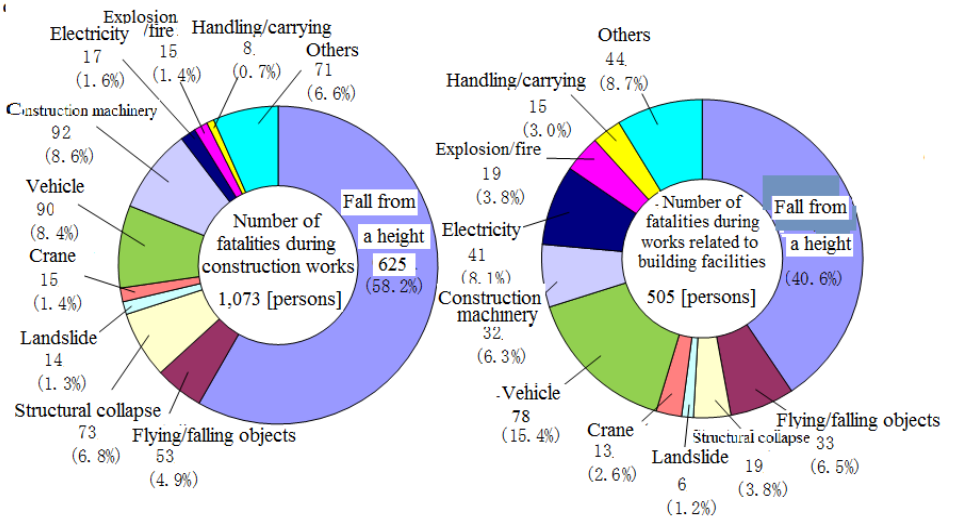

Figure 4. Causes of construction fatalities between 2008 and 2012

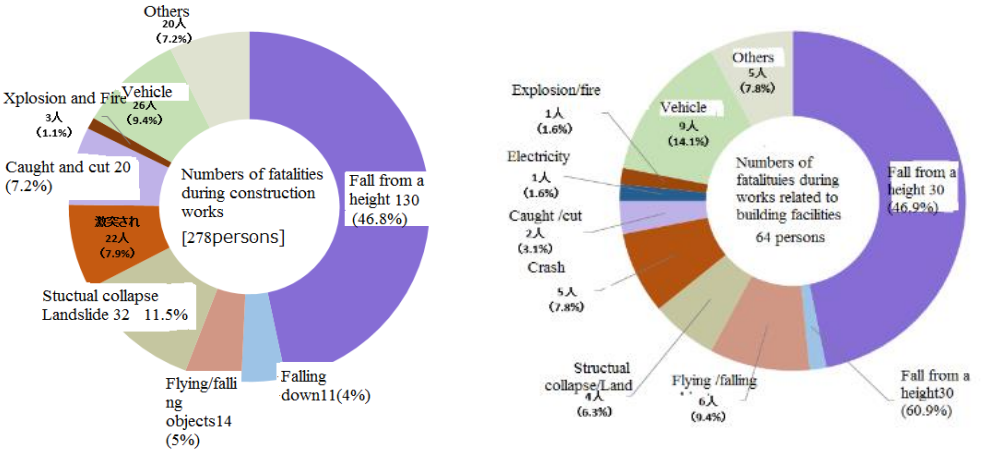

Figure 5. Causes of construction fatalities in2013

According to Figure 3, Figure 4 and Figure 5, fatal accidents during works related to building facilities are characterized by a smaller proportion of falling accidents in comparison with construction works. To the contrary, traffic accidents (mostly while driving to work) and accidents caused by electricity, explosion, and fire take a larger proportion. This may be because many high lift works on exterior walls, roofs and scaffolds are required in construction works while most works related to building facilities are carried out indoors.

In comparison between the first five years (2003-2007) and the second five years (2008-2012) and (2015) the proportion of structural collapse and construction machinery for works related to building facilities show an increasing tendency but significant changes are not observed in general.

As for disasters resulting in injury and death, Figure 6, Figure 7 and Figure 8 show a similar tendency to that of fatal disasters, with a small proportion of falling accidents and a large proportion of traffic accidents as well as those caused from electricity, explosion and fire during works related to building facilities. However, tumble/crash accidents and trapped/cut accidents form a large proportion.

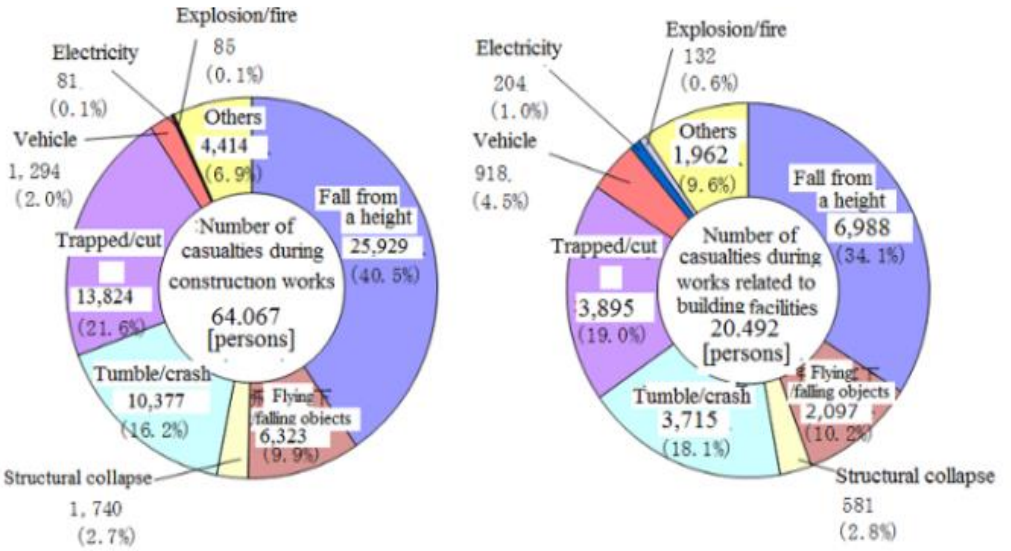

Figure 6. Causes of construction casualties between 2003 and 2007

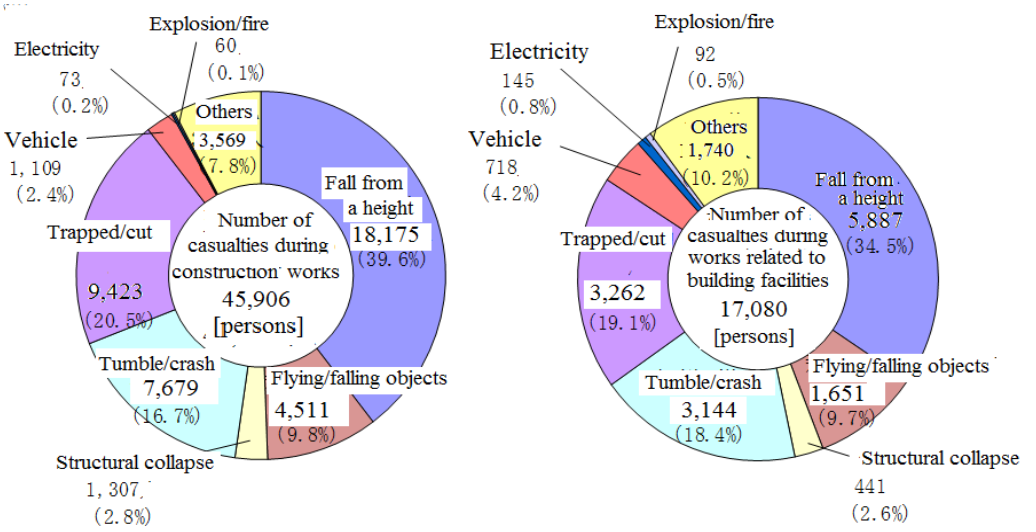

Figure 7. Causes of construction casualties between 2008 and 2012

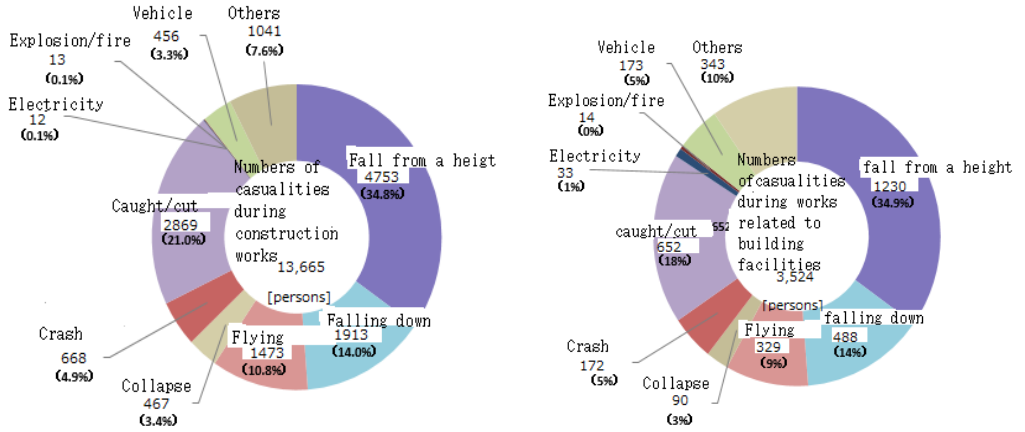

Figure 8. Causes of construction casualties in 2013

Thus, unlike the data of fatal disasters, no conspicuous difference is observed in the data of casualties. In the comparison of general tendency between the first five years (2003-2007) and the second five years (2008-2012), (2013) no big differences are observed either.

In order to prevent disasters during works related to building facilities, from the viewpoint of the above analysis according to accident types, disaster prevention activities need to be promoted as a part of construction works while fatal accidents which are typical of works related to building facilities such as electricity, explosion and fire) are taken into consideration.

HEATSTROKE

Heatstroke

Heatstroke is a generic term for physical disorders which occur when the water and sodium balance in the body system fails or the body is no longer able to regulate its internal temperature in a climate of high temperature and high humidity. Its symptoms include dizziness, faint, muscle pains/cramps, excessive perspiration, headache, indisposition, nausea, vomiting, fatigue, despondency, consciousness disorder, convulsion, limb movement disorder, and hyperthermia.

People at risk of heatstroke

Those susceptible to heatstroke include:
(1) Old people
(2) Those who have little sleep, drink alcohol the day before, skip breakfast, or have an obese body.
(3) Those who are under medical treatment for diabetes, high blood pressure, heart disease or psychoneurosis.
(4) Those who do not take in enough water and sodium.
(5) Those who have diarrhea or dehydration.

Heatstroke prevention measures

(1) Lowering the wet bulb globe temperature (WBGT)
Efforts should be made to decrease WBGT in the workplace by taking the following measures:
① Place a shield between heat source and workers to block the heat in the workplace where a measured WBGT value has exceeded or will possibly exceed its standard value (hereafter, a hot and humid workplace).
②Install a roof to easily block direct sunlight and reflection off surrounding wall and ground in a hot and humid outdoor workplace.
③ Equip a hot and humid workplace with a proper ventilation or air-conditioning facility. The facility installed in a hot and humid indoor workplace should have a dehumidifying function. After water sprinkled in an ill-ventilated hot and humid workplace, caution should be taken not to raise the humidity.

(2) Making arrangements of facilities in a rest area
Efforts should be made to arrange a rest area for workers by taking the following measures:
① Provide a rest area near a hot and humid workplace, which is equipped with an air-conditioner or kept cool in the shade, affording ample space for lying down.
② Prepare items and facilities to cool the body off properly such as ice, cooling towels, a cold bath and a shower in or near a hot and humid workplace. Drinking water must be provided in a hot and humid workplace so that workers can take water and sodium regularly and easily.

Work management

(1) Shortened working hours

According to working conditions, efforts should be made to take heatstroke prevention measures such as making continuous working time shorter in a hot and humid workplace by securing downtime and break time; avoiding a work which require a higher physical working capacity (metabolic rate); and changing working places.

(2) Heat acclimatization

When a worker needs to be assigned to labor in a hot and humid workplace, heat acclimatization (adapting to heat in a given environment) is an effective way to diminish the risk of heatstroke. Thus, it is recommended to afford a planned heat acclimatization period. Particularly from a rainy season to a summer season, it must be noticed that a worker is not yet acclimatized to heat in most cases when he/she stays in a hot and humid workplace where a temperature rises rapidly; when that work is newly launched; or when he/she has been away from that work and resumes it after a long while.

The followings are important points related to heat acclimatization:

(a) Heat exposure time for a unacclimated worker must be gradually increased by spending more than seven days.
(b) Discontinuation of heat exosure causes the deacclimatization to start clearly in four days and heat acclimatization will vanish completely after three to four weeks.

(3) Water and sodium intake

Dehydration may develop even before the patient is aware of its symptoms. Whether subjective symptoms are felt or not, workers should be advised on the intake of water and sodium before and after work as well as their regular replacement at work. At the same time, the regular practice of water and sodium intake among workers should be strictly observed by creating a checklist or making a tour of inspection to confirm the practice. It should be particularly noticed that a patient of dehydration may have no subjective symptoms because of aging or ailment. A worker with a disease which requires dietary sodium restriction should take counsel from his/her family doctor or an occupational physician.

Although the necessary amount of water and sodium taken in regularly while at work differs depending on the physical working capacity, it is desirable to take at least one or two cups of 0.1-0.2% salt water, or sports drink or oral rehydration solution containing 40-80mg/100mℓ sodium, every 20 to 30 minutes, when a measured WBGT value in the workplace exceeds its standard value.

(4) Working clothes

Workers should be advised to avoid clothing that absorbs or retains heat, and wear moisture-permeable and breathable clothes. It is also desirable to have such clothes that possess the above mentioned properties and cool the body off. A breathable cap is recommended to put on under direct sunlight.

(5) Inspection during working hours

In a hot and humid workplace, a frequent inspection tour during working hours should be planned to make sure of the regular intake of water and sodium by workers and to check their health condition so that an emergency halt of work or other appropriate measures can be taken immediately when symptoms of heatstroke are discovered. Results should be discussed thoroughly in this section, if necessary with the aid of figures and tables. The tables and figures should fit within column width of 8.52 cm.

CONCLUSION AND FUTURE ISSUES

This is the study on safety and quality improvement technique for construction and maintenance of building facilities. In this paper, the tendency of accidents in building facilities for the past ten years and the occurrence condition of fatalities disaster by heatstroke in construction industry of Japan was summarized.

The mortality in the construction industry is increasing in comparison with other industries. Also, it has been found out that the number of heatstroke cases has increased due to aging among constructors on one hand, and global warming under the influence of abnormal weather and other factors on the other hand. The rainy season particular to Japan and the summer season also have some impact. It is hoped to take appropriate measures to deal with the situation by conducting on-site environmental research, and compare the results with those of other Asian nations.

REFERENCES

[1] Uda, H., Kajimura, M., Tsuchikawa, T., Tanaka, T., and Matsuura, F. (2009), *Study for Evaluation of Dangers in Construction and Maintenance of Building Facilities: The Nature of Accidents and Safety in Building Facilities and Risk Management Procedures (Part 1)*, Proceedings of the Symposium of the Society of Heating, Air-Conditioning and Sanitary Engineers of Japan, pp. 1463-1466.

[2] Wariishi, H., Torihama, H.**,** Tanaka, T., Mikami, Y., and Hosokawa, T. (2013), *Recent Tendency of Accidents in Building Facilities & Investigation of Causes of Risk in Each Stage of Construction*, Symposium on Building and Urban Environmental Engineering (BUEE2013 in Taiwan), pp. 68-73.

[3] Wariishi H., Torihama H., Tamura N., Tanaka T., and Mikami T. (2015). *Study on Improvement Technique of Safety and Quality for Construction and Maintenance in Building Facilities (Part 10) Current situations and measures for fatal accidents caused by heatstroke,* Technical Papers of the Society of Heating, Air-Conditioning and Sanitary Engineers of Japan. pp. 2-4.

[4] The Japan Advanced Information Center of Safety and Health, Industrial Accidents Statistics in Web site http://www.kensaibou.or.jp