

**Crash disaster of a construction site - the accident which originated from
inappropriate use of a safety belt**

[On a certain day in August, 2003, Kanagawa Prefecture]

Masahiko KUNISHIMA · Yukihiro ISHIHARA (*Note*)

On a certain day in August, 2003, in a construction site of 12-story condominium, when bolting work on the steel beam of the sixth floor was done during steel erection of the steel column, the ring of the safety belt (spring hook) which the worker used came off, and the worker fell about 17 meters down to the ground. He was taken to the hospital, and he died soon after. Besides this accident, a succession of crash disasters which were thought to originate from the inappropriate use of safety belts has occurred in recent years. And, while the low consciousness of safety of the worker in the construction site was recognized, it became an opportunity to improve the way of safety education in an interested concern.

1 . Event

In August, 2003, in a construction site of 12-story condominium, in Kanagawa Prefecture, the accident occurred. When bolting work on the steel beam of the sixth floor was done during steel erection of the steel column, the ring of the safety belt (spring hook) which the worker used came off, and the worker fell to the ground, and he died soon. Besides this accident, a succession of crash disasters which were thought to originate from the inappropriate use of safety belts has occurred in recent years, and the effective deterrence measures have been fumbled about and examined.

2 . Course

It was the new construction of a condominium involving steel-framed reinforced concrete construction, and the foundation work had already ended by the previous day of the accident. The steel frame of the body part stood to 4 knot part (the 12th floor), the steel frame of central part stood to 2 knot part (the fourth ~ sixth floor), and the steel frame of the remainder had not yet been assembled. The steel erection work on the day of the accident was the work which assembled the steel of 3 knot part (the seventh ~ ninth floor) of the central part, which was assembled to 2 knot part. The work was advanced by the method that the steel of this part was lifted by the transportable crane, and workers A and B did temporary tightening of the steel column of 3 knot part and the

steel column of 2 knot part with an attached board and bolt while lifted by a transportable crane.

From the morning, the work proceeded as planned, and workers attached the safety belt to the main rope and gangway for going up and down on the steel beam of the sixth floor, and did the temporary tightening of the steel column of 3 knot part and the steel column of 2 knot part with attached board and bolt while lifted by transportable crane. A worker A stood on the steel beam of the sixth floor, attached his safety belt to the stretched main rope, and carried out the temporary tightening work. Meanwhile, because there was no appropriate scaffold, a worker B passed the rope of his safety through the gangway of the steel column, put his weight on the rope of his safety belt in the condition of U-hanging, and carried out the work.(Figure1.)

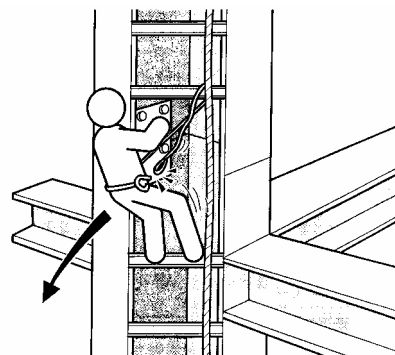


Figure 1. The sketch in the disaster
(Source: Japan Construction Safety and Health Association "The cases and countermeasures of workmen's accidents in construction<6 volume>")

Then, the worker B gave a shout, and he fell about 17 meters down to the ground. He was taken to the hospital, and he died of the blood loss from the thorax bruise after 2 hours.

3 . Cause

The direct cause of this case was that the worker B did not use the safety belt appropriately. The safety belt the worker B used was generally for single-hook hanging which was the type not used for U-hanging. (The explanation of safety belt for single-hook hanging and for U-hanging is described later.) Also, a ring for hanging tools (spring hook), which the worker B used as U-hanging and was attached to the hook of the safety belt, was not originally the thing installed as a part of the safety belt, but the thing which the worker installed to hang tools, etc. after he had purchased the safety belt individually, and it deviated from the standard as directed in "standard for the safety belt".

From a different viewpoint, this case was caused by a management element of the management side, such as the overly optimistic work plan of the original contractor and the careless safety management in the site. In this case, though the work was done where there was the possibility of crash, the treatment of the crash prevention such as the installation of work floors and handrails had not been made. And, it was also a

problem that the chief worker in the site did not watch inspection of the function of safety belts and their use.

It can be said that low consciousness for the way of safety management in high-place work on the part of the worker and the manager was the fundamental factor which caused this case.



single-hook hanging

The safety belt for single-hook hanging is used at the work place with a stable scaffold by which worker may not support his body. It is dangerous to do U-hanging with a safety belt for single-hook hanging.



U-hanging

The safety belt for U-hanging can be used when the worker wants to put his weight on the safety belt during work. Therefore, it has higher performance such as a thicker rope than the safety belt for single-hook hanging.

Figure 2. 2 kinds of safety belt

(Source: Home page of "What's safety belt?")

About safety belt

The safety belt is used for the crash prevention, when a worker works in a high place. "Labor Safety and Health Regulation" states that the entrepreneur must make workers to use safety belts when the work floor can not be established at the point higher than 2m in height (Section 2 of Article 528), and that the worker must not use the safety belt which does not meet "standard for safety belt", which was established according to the provisions of Article 42 of "Labor Safety and Health Law" (Article 27).

As an explanation edition of "standard for safety belt", there is a technical guide "the structural guideline of safety belt" issued by the independent administrative institution "National Institute of Industrial Safety", and it explains type, name, and usage of safety belts.

The difference between the safety belt for single-hook hanging and the safety belt for U-hanging (Figure 2.)

The safety belt for single-hook hanging is the safety belt for the crash prevention, and is used at the work place with a scaffold by which worker may not support his body. On the other hand the performance requirement of the safety belt for U-hanging is that it can be used with the worker putting his weight on the safety belt during work. Therefore, the rope is thick, and a telescopic motion regulator which can adjust the length has been added. For this reason, U-hanging using a safety belt for single-hook

hanging is dangerous because it means requiring the performance which exceeds the originally assumed ability for the single-hook hanging.

The standard for spring hook

There seems to be an experiment which shows that the substandard spring hook like the one used in this accident is damaged with the mouth of spring hook coming undone even by putting one's weight on the U-hanging rope. In the "standard for safety belt", the thing like the following has be made to be an appropriate spring hook.

(1) of Article 1 of standard for safety belt (definition)

"the ringed instrument for connecting ropes of the lanyard, etc. and attachments, etc. or the ring"

(2) About strength of spring hook, on industrial safety norm regulation of ILO (strength of parts),

It has been prescribed that the belt and ropes of the safety belt must have 1150kgf breaking strength at least.

(3) Article 5 of standard for safety belt (shape of parts, etc.)

"It must be equipped with miss stop equipment which does not come undone unless there are more than 2 consecutive operations".



The left figure is an example of a spring hook. It is used daily even outside construction sites, and it is possible to purchase freely. The right figure shows the aspect in which the mouth of spring hook comes off.

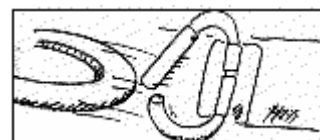
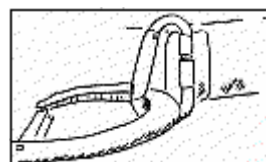


Figure 3. Example of spring hook and its damage

(Source: Kanagawa Labor Bureau, Ministry of Health, Labour and Welfare)

4 . Immediate Action

From Labor Standards Inspection Office in Kanagawa Prefect., where the accident arose, leaflets which appealed for appropriate management and use of the safety belt were distributed to the builders. Also from the Safety Division in Kanagawa Labor Bureau, the leaflets which drew their attention were distributed. And, major constructors carried out general inspections of the field, responding to the improper use of spring hook.

The actual conditions about safety belts known by the general inspection

In the inspection which each field independently did, 20% ~ 40% of safety belts had imperfections. It included things in surprising condition like the following.

- The safety belt whose rope and belt were ragged
- The safety belt which has the belt for work with plastic buckle
- The safety belt which only wound a lanyard round body belt
- The safety belt with 2 of 3 strands cut off which are hidden by taping

5 . Countermeasure

In September, 2003, "a national campaign for proper use of the safety belt "under the sponsorship of Japan Rodo Press was held in Yokohama. Including the movement like this, the trial which improves the attention of the party concerned by taking up the problem of the safety belts in magazines articles, etc. has been made.

Most of discussions in the campaign and those which are reported in the magazines discuss the proper use of safety belts from the worker's side and provide guidance and education for and management of the worker by the original contractor and the specialty contractor (in short, the management side). It seems to take much time for the countermeasures in such soft component side to move to the execution from the proposal, and moreover to be established widely. At present, there are few things to be concretely visible as a countermeasures under the present conditions.

6 . Generalization

Crash disasters, including this accident, occupy near half of all fatal accidents in the construction industry. At present, the parties concerned in the field have low consciousness of the safety management, even though high-place work is dangerous. This fact has been realized again since the time in which this accident arose, and the movement for the improvement in the consciousness of the field in terms of the safety would energetically be sought. The crash accident has the property of some kind of internal completeness, and it is the problem that fundamentally troubled only the parties concerned in the field, and it does not affect the public citizen. Therefore, it seems that it has the property that it is difficult to be utilized as failure knowledge because of not causing the public opinion, even if it happens.

7 . Knowledge

The matter of work planning

- 1 . In the steel assembly work of buildings, etc. work plans that show methods and

procedures of the work and installation methods of the crash prevention facility, etc. Beforehand are determined, and it is necessary to carry out the work based on those work plans.

2 . When the work is done in the position with a danger of crash, it is necessary to realize again that crash prevention measures such as making work floors and handrails are taken first of all, and in the unavoidable case, safety belts and safety nets are installed.

The matter of guidance and management of use of the safety belt (manager)

1 . With the safety belts, periodic general inspections, general exchanges, and blanket purchases by the field are desirable. In terms of the expenses, paying not by the individual but by the company is desirable.

2 . The strand of safety belt becomes weak in ultraviolet rays, and its strength reduces by half after about 2 years, even if there is not so much damage to the surface. Writing the beginning of use date on the safety belt, and management checking the period are necessary.

3 . It is necessary that the chief worker of steel assembly of the building, etc. checks the function of safety belts before the work starts and watches their use.

4 . It does not become the essential solution that the use of inappropriate safety belt by workers is unconditionally prohibited. Daily attention to directing and education of knowledge, skill, and attitude about safety are necessary.

The matter of the use of the safety belt (worker)

1 . It is necessary to use the safety belt which has an appropriate structure for use with U-hanging, when the work is carried out, requiring a safety belt with U-hanging.

2 . It is realized again that conscience reform about safety leads to protecting one's own life, and workers try to improve the safety of the whole field by calling out to each other, etc. with voluntarily learning and practicing about safety.

8 . Background

Though usage rate of safety belt is 100% in the construction site of major construction companies, more and more accidents involving safety belts ironically occur with the increase in their use.

One of the causes is that until now, the safety belt was a fact of a passport of the field entrance, and workers had only to wrap the safety belt around their waist. Though there are use and inspection and disposal standards in all companies, there seem to be

no precedents for putting these standards into practice. Under the actual situations, the importance of safety belts is downplayed in the sites, and they are not perfectly used for the reasons including the work takes a little time, or that it is troublesome. It can be said that such low consciousness for safety has induced the unsafe action on the sites.

On the expenses of safety belt, the companies in the manufacturing industry and the construction industry pay the expenses, but workers of many cooperation companies pay their own expenses, and the replacement period, type and management of safety belts, etc. is left to the workers. Therefore, some workers personally purchase safety belt at do-it-yourself stores, etc. on a holiday. When the safety belt purchased in such store is a name-brand item which is "standard for safety belt", is no problem. But in many cases, goods (spring hook, body belt, etc.) are sold as an accessory at the same place as that of safety belts without enough explanation, so though they don't suit the standard, and there is a possibility of misunderstanding over whether they are safe to use.

9 . On the Side

The present state of the problem of the safety consciousness in the organization is that each organization is entrusted with the education and management of it and it is not strange that the accidents like this have been occurring one after another. Especially about crash disasters in construction sites, since the victims of the accidents are limited to a worker himself, the occurrence of the accidents does not cause large public outcry, and the problem tends not to come to the surface, even though the accidents occupy nearly half of all fatal accidents in the construction industry. It is not easy to find the basic solution, but for example, it may be necessary for Labor Standards Bureau to have things like surprise inspections which have legal force. Or, it may be effective to give the social discipline (suspension of a business license and tender exclusion, etc.) to the organizations which pay lip service to safety by merely making rules and laws and not applying them. After all, it should be known that the times that the construction industry itself is not permitted, if the idea of the compliance is not urgently adopted, has come.

< Reference >

Anzen staff 2004.2.15

Anzen staff 2004.10.15

"What's safety belt?" http://www.fujii-denko.co.jp/anzenn_what.html

Japan Construction Safety and Health Association "The cases and countermeasures of workmen's accidents in construction<6 volume>"

Japan Construction Safety and Health Association "Statistics of workmen's disaster by looking graphs"

Kanagawa Labor Bureau, Ministry of Health, Labour and Welfare

<http://www.kana-rou.go.jp/index.html>

Safety Division, Industrial Safety and Health Dept., Labor Standards Bureau, Ministry of Health, Labour and Welfare "The situation of workmen's disaster in 2004(news flash)"

(Note) Department of Civil Engineering, Faculty of Engineering, the Univ. of Tokyo