

Tachikawa City, the falling accident of the pile driver

【16th March 1991、 Tokyo, Tachikawa City, Akebono town】

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In Akebono town , Tachikawa City, Tokyo, at the construction site of Tachikawa JF building which was operated by a joint venture of Taisei Kensetsu and Goyo Kensetsu, the large pile drive for the sheeting(weight: about 100ton, height: about 30m) fell down to the east side with a roaring noise. A total of 7 buildings including private houses and apartments were buried under the machine. Two citizens were killed in the accident.

1. Event

On 16th, March, 1991, the accident occurred at just after 9:30a.m. In Akebono town, Tachikawa city, Tokyo, at construction site of Tachikawa JF building which was operated by a joint venture of Taisei Kensetsu and Goyo Kensetsu, the large pile driver (weight: about 100ton, height: about 30m) fell down to the east side with a big noise. Some private houses and apartments were buried under the machine. "Apartments were crushed completely, 2 buildings were partially destroyed, and the parts of 3 buildings were broken. In this accident, three people were killed. They were university students. The workers in this site were not injured. (Fig. 1)



Fig. 1 The Situation of the accident
(Source : “The construction accident”)

2 . Course

The field was a densely housed area near JR Tachikawa Station. The construction site of “Tachikawa JF building” (7-floor) was undertaken by the cooperation enterprise in Taisei Kensetsu and Goyo Kensetsu. The pile driving work was carried out there. It was started in November, 1990, and the completion schedule was for March, 1992. This accident was occurred in the construction work operated by Seiko Kogyo (the headquarters: Osaka) whose specialty was foundation work. Moreover, Marutoku Kigyo (the headquarters: Sendai) received the pile driving from Seiko Kogyo.



Fig.2 The map of the site
(Source : “Yomiuri Newspaper”)

On the day, the work was started at about 8:00a.m. On the day, they were digging the holes with the pile driver in order to drive the piles for foundation work and reinforcement foot ground on the ground around the site. There were over 10 sheets of steel (width: about 1.5m, length: about 6m, thickness: about 2cm) on the site. The pile driver had moved on the sheets, but the ground was too muddy. Around this area, rocks underground had been removed and soil had been backfilled before the foundation work.

After the same operation of the pile driver on the east side of steel sheets, it moved back and the driver descended. Just after that, the head of the machine shank with the steel sheets started to lean. The driver noticed this and tried to drive and move the machine falling down and hoping one of the eastside steel sheets little up, making a big noise.

The alarm buzzer of the crane truck informed about the danger from tipping over just before the accident. When the buzzer rang, the safety equipment which stopped the work automatically should have worked. But, on the day, the switch of the safety equipment was cut, and it didn't work. This pile driving method is called "the SMW method" (Soil, Mixing, Wall) and the method is as follows as the pile driver empties the hole, the cement is poured from the tip, and in the cement before the solidifications, the H steel was inserted. (Fig.3)

It was heavy with 100 tons of the dead weight, since it had been equipped with 5 drills of the 30m length for the excavation. Though they were fixed with three arms in the excavation, it was not fixed because the work hadn't start in the accident day. The pile driver was carried from the site, by dismantling it.

Until now, they struck and pushed them with the thing like a hammer from the upper part, leaving the H steel.

However, in the thickly housed area, the SMW method would be adopted in, since hardly any noise is made.

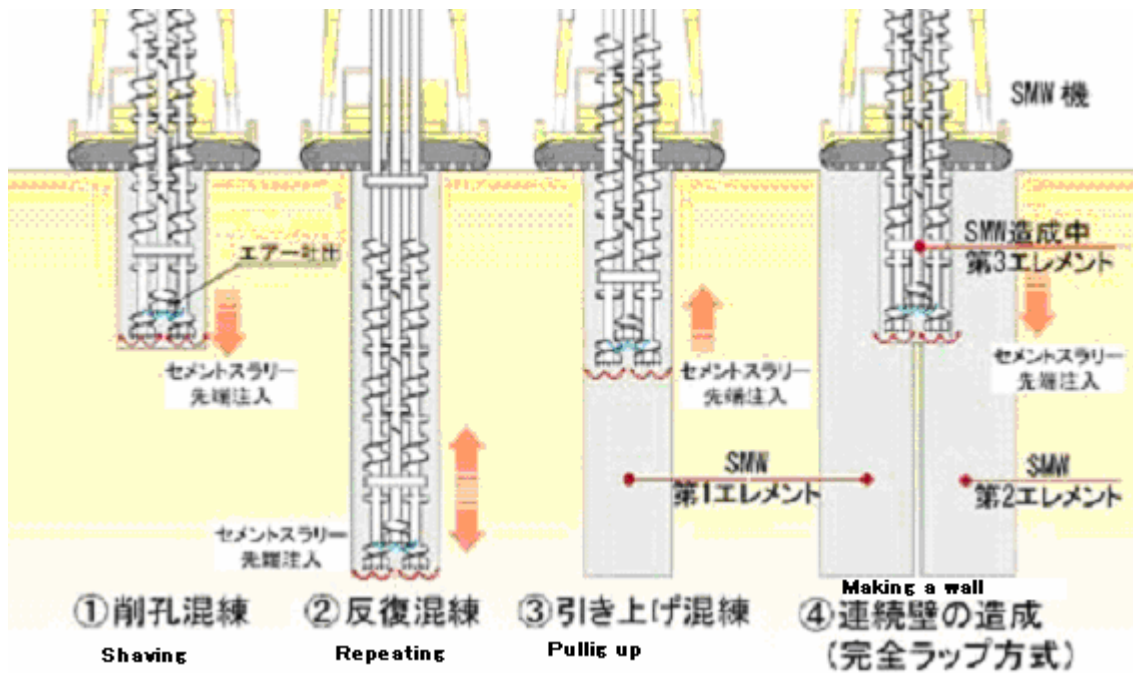


Figure 3. The outline of the SMW method
(Source : Seiko Kogyo home page)



Figure4: The situation of the SMW method
(Source : Marutoku Kigyou homepage)

3 . Cause

- (1) 1 The elaborate geological survey beforehand must be carried out, as it can

prevent tipping over of construction heavy machine .

The pile driver was put on the ground which had reburied once. The back filling is a general process for removing piping and bedsills of the building before, etc., when buildings a gent, etc. are constructed. Generally they don't congeal the ground with coagulating, etc. because the reburied ground may be drilled again in the process of the construction. It is not solidified.

However, the soil of the site was weak, "the Kanto- loam-layer", and considerable groundwater gushed on from the boring trace. Therefore, the loose ground seemed to be unable to resist the dead weight of the pile driver of 100 tons.

(2) Even while the construction heavy machine is not driven, it must be kept in the stable condition by supporting it with the arms etc.

Though the pile driver was fixed with three arms in the excavation, but it was not fixed because the work hadn't started in the accident day. For that reason, the weight of the pile driver leaned to the other side because of losing balance, and it came to tipping over.

(3)The safety equipment didn't work.

The alarm buzzer of the crane truck informed about the danger from tipping over just before the accident. When the buzzer rang, the safety equipment which stopped the work automatically should have worked. But, on the day, the safety equipment was not put into motion because the switch of the safety equipment was switched off.

4 . Immediate Action

The site was near the JR Tachikawa station. The JR TACHIKAWA station was the center oh the town and has heavy traffic. Tens of fire trucks and ambulances rushed there, and the rescue operation by the helicopter was carried out. The rescue team searched for the bottom of the collapsed house using the fiberscope. They tried to extend the clearance by hydraulic jacks, etc. for the rescue, but the rescue operation was difficult because of the fallen arms.

5 . Countermeasure

As a safety countermeasure in the case of the construction using heavy machine in the place with the soft ground, the tipping over prevention, and the ground made to be reliable by injection of coagulating agent, etc.; are necessary before the construction is carried out. After they should put materials such as the outrigger outside in the circumference of heavy machine, it is a considerable countermeasure to prevent falling.

6 . Generalization

The direct cause of the accident is based on the fact that they did not take the safety countermeasure of congealing the ground, in spite of carrying out the work over the weak ground and even though the pile driver wasn't fixed with the arms. For that reason, the loose ground seemed to be unable to resist the dead of pile driver of 100 weight tons , and the weight of the pile driver leaned to the other side because of losing balance, it came to tipping over.

In the meantime, the indirect background of the accident was the followings: that tower building construction in the residential section was increasing and that construction work itself was enlarging in scale. This accident had occurred because the leveling of ground work was not sufficient in order to introduce the large machine into the place like the residential section without sufficient space.

The accident which originates from the slipshod safety management in the place near residential area arises becomes a factor which produces the society distrust for the whole construction industry, and it also has a big social effect. It is necessary to do the safety management in the handling of heavy machines thoroughly in order to prevent the recurrence.

7 . Knowledge

- 1 The elaborate geological survey beforehand must be carried out, as it can prevent tipping over of heavy construction machines .
- 2 In the case of using the heavy machine over the weak ground which has the possibility of tipping over, the coagulating agent must be injected, etc. to make the ground firm.
- 3 Even while the construction heavy machine is not driven, it must be kept in the stable condition by supporting it with the arms etc.
- 4 The condition of the safety equipment can always be operated .

That is to say, the accident always happens in the point of variation. It happened during construction in the case of the construction. It is seldom that the finished building decays naturally. However, they should know that the oblong pile driver itself is unstable. It is insufficient to only use suspension and outrigger.

8 . Background

At that time, tower building constructions were increasing in Tokyo because of

the economic growth. Especially in Tokyo, the construction of high buildings was increasing in residential towns. According to it, the case in which the industrial accident involved nearby inhabitants and passers-by increased. There are many cases which made a collapse, because the leveling of ground work is not sufficient, in order to introduce the large machine into the place without the even space. Again, according to the enlargement of the construction work, over-heavy objects were held by the high machine for construction, for example, pile drivers and crane trucks. It makes the machine to lose balance easily. Especially it is said that it is extremely dangerous to work on the soft ground.

9 . On the Side

This accident happened only 2 days after the big disaster “the bridge girder falling accident in a new transportation system construction site, Hiroshima”. That accident became a social problem because many people were injured in the accident (2 dead, 8 injury). Many residents around the site had felt the anxiety about the construction before the accident because that the pile driver (height: 30m) was used in the thickly housed area before the accident because it was right after the accident in Hiroshima.

< Information Source >

“The construction accident”(2000)

Nihon Keizai Simbun (16th March, 1991 the evening edition, 17th March 1991 the morning edition, 18th March 1991 the morning edition)

Asahi Simbun (16th March, 1991 the evening edition, 17th March the morning edition, 18th March the morning edition, 20th March 1991 the morning edition)

Mainichi Simbun (16th March 1991 the evening edition, 17th March 1991 evening edition)

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Seiko Kogyo homepage <http://www.seikou-knet.co.jp/>

Marutoku Kigyou homepage <http://marutokukigyou.co.jp/>

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