

## A concrete wall collapsed under drainage channel improvement work in Tottori

【The accident date : Afternoon in December 20th, 1972

The accident place: Yurayado Daieicho Tohaku District Tottori Prefecture】

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### 1. Event

In December 20th around 13:20 in 1972, the side wall (1.1m height, 22m length, 25cm width, made from concrete) collapsed onto construction workers during the excavation phase of drainage channel improvement work in a Hojosakyu prefecture-run agricultural field at the north-side of the Yura elementary school in the Tohaku District Tottori Prefecture.

Seven female workers, including Ms Ikuko Arao, who were the part-time workers working during the farmer's leisure season, were crushed to death and a worker received seriously injury. Three male workers managed to escape.

[Death: 7 (all were women), Serious injury: 1 (woman), Slight injury: 1 (man)]

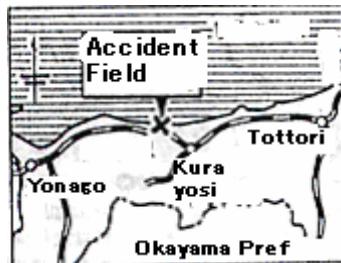


Figure1- Place  
(Source: Mainichi Newspaper)

Picture1-Situation of accident  
(Source: Mainichi Newspaper)

## 2. Course

That day, about 15 cm of water accumulated in the drainage channel because of the long spell of rainy weather, and the ground became soft. Moreover, the concrete side wall had been embedded in the ground about 10cm, and the ground was dug about 15 more centimeters a week before. Therefore the side wall was very unstable. In addition, no safety countermeasure had been made just before the accident, and the foreman in charge of the excavation hastily supported the concrete wall with logs, sensing from the gush of the water during excavation that they were in danger. However, unfortunately, the collapse of the concrete wall began, when the third brace member were being installed.

Workers could not escape from the collapse, because they were working with their head, bent down to lay the cobble at the bottom of the drainage channel; also, since dug up soil had been heaped up on the side of the drainage channel, they could not climb up from the drainage channel.

As a result, 8 female workers and 1 male worker failed to escape, since the concrete wall, which was over 22m in length, collapsed and were buried under the concrete wall.

More than 100 teachers and pupils' fathers and mothers participated in the rescue, since there was a class round-table conference at Yura elementary school on that day. But, unfortunately, the concrete wall was so heavy that they could not save the victims. 30 minutes later, the rescue was carried out using the bulldozer, but 6 workers were instantly killed and one was killed in hospital where he had been carried.

The Yatsuhashi Police Station investigated the construction company over whether there was any omission in the safety management, and, on the night of the 20<sup>th</sup>, Tetsuo Izumi, who was in charge of the construction site, was arrested on charge of professional negligence leading to death. .

### The outline drawing of the accident

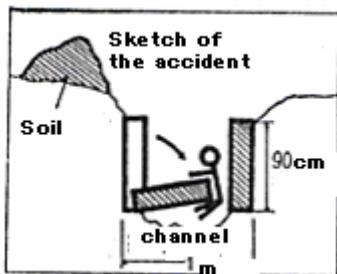
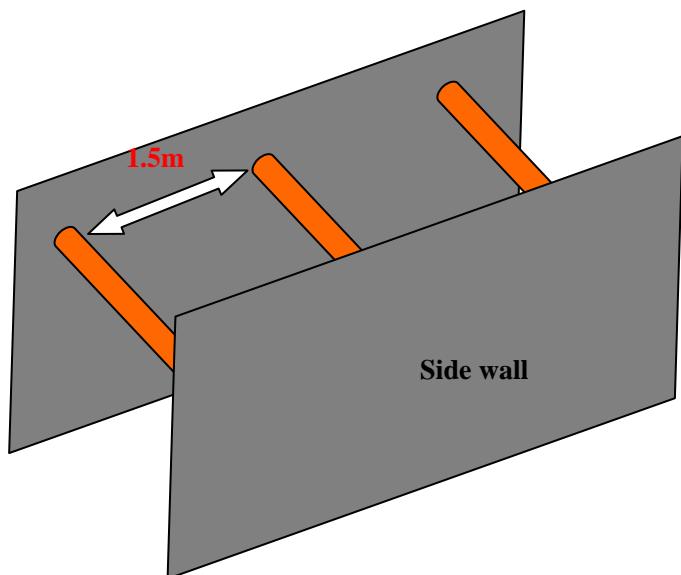


Figure2- Simple figure of the accident

(Source: Author made)

### 3. Cause

1. The concrete wall gradually moved and suddenly collapsed because of the soft ground of the drainage channel due to an accumulated 15 cm- depth of water, and the weight of the soil heaped up on the side of drainage channel.
2. The workers failed to escape, because they worked with their heads bent down and were late to notice the collapse of the concrete wall.
3. The concrete wall was very unstable, because they had dug down 15cm one week before that day, even though the wall was embedded only 10cm in the drainage channel bottom.
4. Since the soil had been heaped up on the side of the drainage channel, it was difficult for the victims to escape from the collapsing wall, even if they had noticed the collapse of the concrete wall.
5. They did not do anything to support the wall just before the accident took place, nevertheless they should have made bars to support the wall within every 1.5m to prevent the collapse of the wall.



**The figure of the ideal distribution of support bars to support  
(Source: Author made)**

6. Even though this sort of construction work should be started after the side wall is removed, in this construction, the drastic design change was done to recycle the walls in order to reduce the cost, following the request of Tottori Prefecture.

#### **4. Immediate Action**

1. The field chief sensed the danger and tried to make support bars using logs, but unfortunately, the collapse of the concrete wall had begun.
2. The worker near that place witnessed the collapse of the concrete wall and, in order to rescue the victims, called other workers who were working in an agricultural field about 200m away from that place and the teachers and the parents who attended the Round-table conference of Yura elementary school. But the rescue was not carried out successfully, because the concrete wall was so heavy that they could not remove the wall. 30 minutes after the accident, bulldozers and shovel cars arrived and started breaking the concrete to save them.

#### **5. Countermeasures**

Due to this accident, the Safety and Health section of Tottori Labor Standards Inspection Office increased the access to guidance on the support bars for the concrete side wall in case of this kind of construction.

#### **6. Knowledge**

In the construction field, which holds so many inexperienced workers, further safety control should be conducted on materials and safety education than in the normal construction field. For instance, suggestions on this issue are below.

##### **The aspect of safety control on materials**

1. There is no support bar for the concrete side wall.
2. Some treatments should be conducted for the looseness of the ground after a long spell of rainy weather.

##### **The aspect of the safety education**

1. The field manager should inform the workers of the danger for banking up dug soil on the side of the concrete side wall.

However, even if there had been a lot of experienced workers, this accident would have happened, because the safety control on materials was clearly not sufficient. It is definite that not making support bars for the wall standing almost vertically was very dangerous, when working in the drainage channel. Also, even though they can save money, changing the design in order to recycle the wall increased the possibility of the accident; normally, they have to start construction after removing the concrete side wall. Moreover, this accident should be predictable enough, because the field managers knew

that the ground was loose and the bottom of the concrete wall was revealed. In the future, it is necessary that field managers CONTROL MATERIALS SAFELY, EDUCATE CONSTRUCTION WORKERS PROPERLY, PREDICT THE POSSIBLE ACCIDENT BEFOREHAND, DO NOT REDUCE SAFETY COSTS FOR THE SAKE OF OBTAINING MORE PROFIT.

## **7. Background**

One of the factors of this accident might have been the appointment of the inexperienced workers to this construction. Why were the inexperienced workers, who should have been more closely directed than experienced workers, involved in this accident, and became the victims? The background is described in the following.

1972 experienced the excess production of the yam which is locally produced in Tottori. The yam was supplied to such an extent in the market that the price of yams was quite low. Farmers could not get a decent amount of money; therefore housewives had to obtain money for the New Year. That was the reason why they had to work in the construction site, which they were not used to. On another front, there were two reasons for Umano Construction Company was forced to employ inexperienced female workers. One was that they were such a small company with only several hundreds of employee that they had to get human resources locally. The second reason was that there were a small number of male workers in those days.

## **8. Generalization**

It can be said that this accident was, in some senses, inevitable for Umano Construction Company. This is because, since there was a shortage of human resources due to the high economic growth, Umano had to employ inexperienced workers, and they were required by Tottori Prefecture to change the design, which increased the risk of the accident. However, there still remained Umano's faults, because they did not distribute support bars for the wall sufficiently, continued working in spite of the loose ground, and were so late to respond to the accident. In addition, they should have conduct further safe education than usual, because they employed a great amount of inexperienced workers.

Also, it is undoubtedly true that there was a trend of neglecting safety, inferring from Tottori Prefecture's request for the design change even though the design change raised a risk.

## 9. On the Side

In this accident, the excavation was carried out by manpower; though it was legal, it had been planned to be dug by machinery. However, if the mechanized excavation had been done, lives would not have been lost, even if the collapse happened.

**Reference :** Yearbook of Construction Safety and Health (1973 fiscal year), Nihonkai Newspaper (21<sup>st</sup> and 22<sup>nd</sup> December 1972), Asahi Newspaper (21<sup>st</sup> December 1972), Mainichi Newspaper (21<sup>st</sup> December 1972), Yomiuri Newspaper (21<sup>st</sup> December 1972)

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