

# Case study about initial action by disaster prevention staffs at a fire

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## Abstract

I understood how to do initial extinction and the lead for evacuation by investigating the actual fire cases, and aimed at the discovery of the influence that the disaster prevention staff and the equipment for fire fighting gave to initial action.

## 1. Introduction

A fire is a disaster that happens most. However, after a fire from which the heavy loss of lives occurs happens, the laws are amended. It is a doubt to amend the laws by only fires that damage was large and though fires of about 30,000 a year occurred.

Moreover, the delay of initial action to a fire caused a fire where the heavy loss of lives occurs. If they had immediately noticed that a fire had happened or initial extinction and the lead for evacuation had been accurately done, the damage would

have decreased in many fire cases.

Therefore, I aimed at the discovery of the influence that the disaster prevention staffs and the equipment for fire fighting gave to initial action to a fire by collecting fire cases with small damage to which initial action would be done comparatively accurately and investigating how initial action was done.

It is necessary to collect data of the factors that influence the starting time of evacuation because we can say that the variable factors influence it. Therefore, this research aims to collect the cases of initial action to a fire that actually happens in order

to understand the event after the fire occurrence that influences the fire expansion.

## 2. Investigation

The investigation object did not depend on the building construction, the scale of the building and the building use, and chose the fire cases where evacuation (both whole and part) is done from the fires that occurred in Kobe City, Kyoto City and Osaka City.

The investigation is the way the fire fighting bureau in each city made the document of the following contents because of the privacy.

### About a fire

- Date of that a fire broke out
- Time that a fire broke out (outbreak time)
- Time that equipment perceived a fire(perception time)
- Time that person detected a fire ( detection time )
- Time that emergency bell rumbled (rumbling time)
- Time broadcasted emergency (broadcasting time)
- Time when person began to evacuate (starting time of evacuation)
- Time when person who need to evacuate have finished evacuating (evacuation completion time)
- Time that reported fire fighting bureau ( Report time)
- Report method to fire fighting bureau
- Human damage due to a fire
- Material damage due to a fire
- Room that a fire broke out (breaking out room)
- Number of people that breaking out building can accommodate (number of accommodation)
- Number of people that stayed in the building at a fire (number of stays)
- Number of people that stayed in floor

at a fire (number of breaking out floor stays)

- Number of people that stayed in room at a fire (number of breaking out room stays)
- Number of evacuated people
- Cause of breaking out
- What was a fire extinguished?
- Whether the room who manages disaster prevention exist or not. And the place of it(the disaster prevention center etc.)
- Number of staffs that worked in the disaster prevention center etc. at a fire (disaster prevention staff)
- Did the disaster prevention staffs do the lead of evacuation or rescue operation?
- Did the disaster prevention staffs confirm the fire before he reports
- Time that the disaster prevention staffs confirmed the fire
- Details of the disaster prevention staff's action at a fire
- Whether the independent fire-fighting organization exist or not
- Details of the independent fire-fighting organization's action at a fire

### About the fire company

- Time that fire company arrived at the building at a fire(arrival time)
- Time that fire company began to extinguish the fire (starting time of extinction)
- Time that fire company controlled the fire(control time)
- Time that fire company extinguished the fire(extinguish time)
- Did the fire company do the lead of evacuation or rescue operation?

### About management

- Whether Application for fire fighting plan exist or not
- Frequency of fire drill

### About the building

- Building construction

- Number of stories
- Building use
- Building area
- Total floor area
- Installation situation of equipment
- Operation(use) situation of equipment and the effect

The materials for 29 fire cases of the building uses shown in the following Table 1 were obtained.

Table1. Building use of investigation result and the number of cases

Building use	Number of cases
Condominium	11
Accommodations	3
Store	5
Office	3
School	2
Hospital	3
Welfare facilities for elderly people	1
Subway station	1
Total	29

### 3. Results

It is shown to have understood from the situation since it investigates.

- In the building uses of the office, the hospital, welfare facilities for elderly people, the store, accommodations, and the subway station, the disaster prevention center etc. was set up. In two schools, it was not set up. But the reception board of automatic fire alarm system is set up on the staff room, and fire prevention is managed there. In three cases of nine cases about the condominium, it was not set up. And in four cases of remaining six cases it was set up, but there was no disaster prevention staff at a fire. Because the outbreak time is nighttime that was except the office hours. In C office, a part of its building has not completed yet, and

the disaster prevention center was set up in other places as the tentative one. So there was no disaster prevention staff yet. In A welfare facilities for elderly people, the office room is used as the disaster prevention center etc., so there was no person at a fire. In C accommodations, there was no disaster prevention staff in the disaster prevention center because breaking out was early morning.

- The initial action in the condominium was different from those in the other building use because the disaster prevention staff was only the caretaker. The caretaker might not be in the building except office hours. Actually, 3 cases of 9 cases in the condominium did not have the disaster prevention center etc, and 4 cases of remaining 6 cases did not have the disaster prevention staff because the outbreak time wasn't in office hours. Moreover, 3 cases of 11 cases in the condominium have the independent fire-fighting organization. However, the 3 cases were formal and were not active. Therefore, because the condominium has neither the disaster prevention staff nor the independent fire-fighting organization, it is necessary to improve the view of the residents about disaster prevention.
- About initial extinction, 23 cases of 28 cases try to do effective initial extinction such as the water buckets, fire extinguishers and so on. In 4 cases of the 23 cases, it wasn't tried because the fire has already extinguished by the sprinkler system or the room was locked.
- About sprinkler system, 7 cases of 10 cases are uninstalled in the condominium. Because it is not necessary on regulations. In the other building uses, 2 cases of 18 cases are uninstalled. Because there is no

necessity on regulations, too.






- Either the lead of evacuation or rescue operation was done by the fire company in 8 cases of 11 cases in the condominium. Neither the lead for evacuation nor rescue operation was done in all of the 18 cases in the building use except the condominium. Therefore, it is thought that the delay of evacuation often happened in the condominium. Neither the lead for evacuation nor rescue operation was done in 3 cases in accommodations that is the building use for sleeping in spite of what the outbreak time was late. It is thought that this is the difference in the presence of the disaster prevention staffs who can act initially.
- There are 14 cases where the fire extinguisher didn't take effect among 18 cases where the indoor fireplug equipment was set up, and the cases where the people other than the fire company used or tried to use the indoor fireplug equipment were only 3. In general, it is understood that the equipment that they will use in initial extinguish is just the fire extinguisher and isn't the indoor fireplug equipment. 2 cases of the 3 cases are in stores, and it was understood that the employees understood disaster prevention well and that the independent fire-fighting organization functioned because the majority of the building users are unspecified customers.
- The cases where the fire drill is done are 20 cases of 28 cases. In the 8 cases where the fire drill is not done, 6 cases were condominium and remaining 2 cases were office. In the office, the disaster prevention center etc. is set up, and the independent fire-fighting organization is organized. However, in two cases of six cases in the condominium, the disaster

prevention center etc. is not set up. And in two cases of remaining four cases, there is no disaster prevention staff in disaster prevention center etc.. Moreover, the independent fire-fighting organization isn't organized or doesn't function at a fire. In the office, we should rather do the fire drill than rely on the disaster prevention center etc. and the independent fire-fighting organization. In the condominium, the independent fire-fighting organization is organized because it is necessary to make the situation in which the fire drill can be done.

#### 4. Consideration

I expressed the event that happened in each fire case in the time series to use 29 investigation results. The following Figure 1 shows one case in those. And Table 2 shows the legend of Figure 1. The line is the place, and people that stayed there and the equipment for fire-fighting set up there were written. The row is hour: minute and it has changed from each broken line. It doesn't fill it in for the uncertainty. The definitions of words that exist in Figure 1 are previously shown.

Table2. Legend of Figure1.

	:Flow of smoke and heat
	:Flow of signal
	:Transmission of voice information
	:Transition of human behavior or operation of equipment
	:The person's movement

“Breaking out” is that a fire occurred.  
“Extinction” is that the fire was completely extinguished.  
“Detection” is the detector of the automatic fire alarm system detected the smoke and the heat.  
“Rumbling” is that the emergency bell rumbled.  
“Perception” is that the person in the building noticed a fire.

“Confirmation” is that the person confirmed to have actually broken out in the breaking out room after perception.

“Transmission” that the electric signal of equipment was transmitted.

“Reception” that transmission was received.

“Broadcasting” is that the emergency was broadcasted.

“Emitting” is the voice was emitted from the speaker.

“Operation” is Equipment operated.

“Evacuation starting” is that evacuation was started by Perception.

“Evacuation completion” is that persons who need to evacuate have finished evacuating

“Report” is that persons in building reported breaking out to the fire station.

“Departure” is that the fire station received the report of breaking out and the fire company departed.

“Arrival” is that the fire company arrived at the building where the fire broke out.

“Extinction confirmation”: The fire company did not do the fire fighting, and it confirmed extinction.

The following has been understood from the time series of 29 cases.

- When 13 cases where evacuation was started before evacuated people would know the result of initial extinction are compared with the other 10 cases, the starting time of evacuation of the latter was more than one of the former. It was able to be confirmed that the time for the initial extinction influenced the delay of starting evacuation.
- A About the accommodations and the condominium that are the building use for sleeping, when 5 cases whose outbreak times were from 22:00 to 7:00 the next day were compared with the other 9 cases, the starting time of evacuation of the former was more than one of the latter. It was able to be confirmed that having delayed knowing outbreak by sleeping influenced the delay of starting evacuation.
- When 12 cases where the fire company do neither the lead for evacuation nor rescue operation are compared with the other 8 cases, The time required for evacuation of the former was short.(In the B condominium, though the lead for evacuation by the fire company was done, the time required for evacuation is short. That is why the lead for

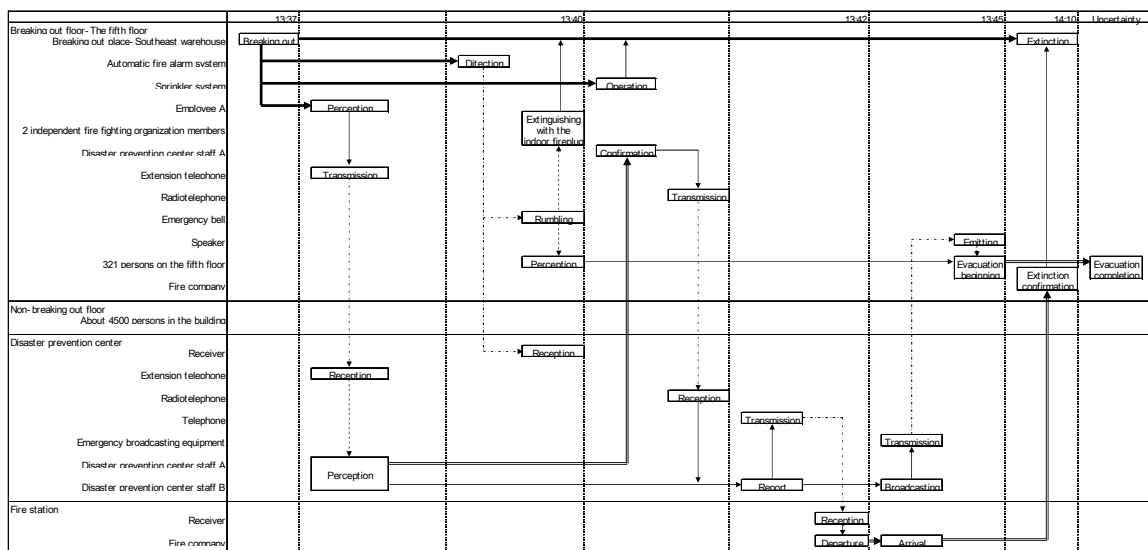


Figure1. Series at the time of A Store

evacuation was done on the way that person had evacuated. ) It is because the lead for evacuation and the rescue operation by the fire company are done when there are persons that evacuation was late.

- In the case of accommodations and the condominium used as the building for sleeping, when 4 cases of 6 cases that the outbreak time was from 22:00 to 7:00 the next day are compared with the other cases, the time required for evacuation was long. ( In B accommodations, the time required for evacuation is not so long. That is why only the part evacuation inside the building. In E condominium, the time required for evacuation is not so long. That is why the number of evacuation persons of this case are only 3 and the evacuation is just from balcony to downstairs because the corridor was filled with smoke at the evacuation starting. ) It seems that the gap of the perception time by sleeping made the time required for evacuation long.
- There is no correlation between the time required for evacuation and the number of evacuation person or the scale of the building.

## 5. Conclusion

The following has been understood from this study.

- In the condominium, because there are a lot of buildings where only one caretaker exists as disaster prevention staff, initial action won't do enough.
  - In the condominium, the independent fire-fighting organization wasn't organized or was formal.
  - Though the condominium and accommodations are the same building use for sleeping, the initial action of the former is very different one of the latter.
- It was understood that in stores, he employees understood disaster prevention well and that the independent fire-fighting organization functioned because the majority of the building users are unspecified customers.
  - In general, it is understood that the equipment that the people in the building will use in initial extinguish is just the fire extinguisher and isn't the indoor fireplug equipment.
  - It was able to be confirmed that the time for the initial extinction influenced the delay of starting evacuation.
  - It was able to be confirmed that having delayed noticing the outbreak by sleeping influenced the delay of starting evacuation.
  - There is no correlation between the time required for evacuation and the number of evacuation person or the scale of the building.

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