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[Actual State of Rescue Operations and Study of Rescue Equipment in the Hanshin - Awaji Earthquake]

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In order to Save More Lives!

Rescue Supervisor, Fire Bureau, City of Kobe
6-5-1 Kanacho, Chuo-ku, Kobe, Japan

1. Overview of Earthquake

At 05:46, on the morning of January 17, 1995, the Hanshin and Awaji areas were struck by a magnitude 7.2 earthquake with an epicenter on the northern end of Awaji Island (Hyogo Prefecture). The epicenter was at 34'364" north, 135'026" east, while depth was 16 km.

Seismic intensity was recorded as magnitude 6 in Shumoto (Kobe), magnitude 5 in Kyoto, Hikone and Toyooka, magnitude 4 in Osaka, Nara, Gifu, Fukui, Wakayama, Takamatsu, Okayama and Tokushima. Quakes of magnitude 1 or higher were recorded as far away as Niigata, Konahama and Kagoshima.

After site inspections, the Meteorological Agency announced that quakes were magnitude 7 across a roughly 1 kilometer wide 20 km long stretch from Suma-ku (Kobe) to Nishinomiya City, and in parts of Awaji Island and Takarazuka.

This earthquake was named the "Hyogo-ken Nanbu Earthquake". It is believed to have been caused by a shallow earthquake occurring along the fault which runs northwest across southern Hyogo Prefecture.

It was the first shallow earthquake since the Fukui Earthquake of June 18 1948 (magnitude 7.1, 3,848 persons dead or missing).

Most of the damage concentrated in the Hanshin area. Severe damage was reported in Kobe, Ashiya, Nishinomiya, Takarazuka and northern Awaji Island. Many of those killed or injured were trapped under collapsed buildings

Also, fire broke out all over the place after the earthquake hit. Some fires were big. More than 640,000 m^2 were burned in Kobe alone. Nagata-ku was particularly damaged by fire.

In the meantime, lifelines were severely damaged. After the earthquake, everything practically came to a standstill with no electricity, gas, water, communications, railways or expressways. Life in the evacuation shelters was miserable for the more than 300,000 persons forced to live there.

2. State of Damage

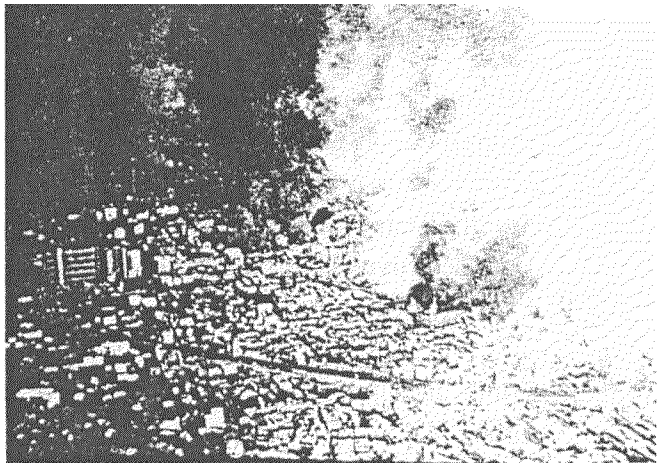
(1)	Vital statistics	Dead:	6,432	
		Missing:	3	
		Injured:	43,793	
(2)	Damaged buildings	Totally destroyed (including burned to ground):		104,906
		Half destroyed (Including partially burned):		144,272
		Partially destroyed:		263,702
(3)	Other damage (Not buildings):	Public facilities:	865	
		Other:	3,983	
(4)	Fires:	285		
(5)	Schools, etc.:	941		
(6)	Roads:	10,069		
(7)	Bridges:	320		
(8)	Rivers:	430		
(9)	Landslides:	378		
(10)	Block fences:	1,480		
(11)	Interrupted water mains:	Approx. 1,300,000 homes (Fully restored by April 17)		
(12)	Interrupted gas supply:	Approx. 860,000 homes		
(13)	Power failure:	Approx. 2,600,000 homes (Fully restored by Jan 23)		
(14)	Interrupted telephone lines:	More than 300,000 homes (Fully restored by Jan. 31)		

(Figures reported on Jan. 11, 2000 by Fire Defense Agency, Ministry of Home Affairs)

3. Situation in Stricken Area

(1) Fires

Fires broke out in many areas when the earthquake struck. The Kobe Fire Bureau reported 101 fires on January 17, while the peak over the next 10 day period was 169. Since the average in non-disasters was just 2 fires per day, it is easy to understand just what sort of chaos fire departments were faced with.



Multiple fires broke out at the same time.

Of the 101 fires on the first day, 40 broke out before 06:00, that is to say, within the first 14 minutes after the earthquake. Hence, the earthquake triggered multiple simultaneous fires.

At the sight of red flames rising overhead the collapsed homes, many people had a hard time coming to terms with what had happened. Many stood petrified in fear. Others managed to run to nearby fire stations to cry for help. It was utter chaos.

However, fire-fighting teams and rescue squads were already busy trying to rescue those buried alive and other personnel had to still report-in, so there was nothing to be done.

A raging fire engulfs an entire neighborhood.

The Nagata Fire Station has just 5 fire-fighters and 2 rescue personnel to respond to 10 fires and approximately 100 calls of persons buried alive. Unable to understand the physical impossibility of the situation, the people cried out in anger. It was pure pandemonium. Policemen had to save fire department personnel from being lynched by the people.

No matter what the situation may be, top priority must go to saving lives. But, in the given situation, putting out fires was more important. Of course, rescuing those buried alive is important, but with fires spreading and the fire department the only one capable of putting them out, it was unavoidable to count on other organizations to rescue the people.

Multiple simultaneous fires got bigger, so fire-fighters were busy mainly fighting fires. Search and rescue activities were taken care of by other municipal departments, the prefectural police and the self-defense forces. Most of the rescue work was to dig people out of collapsed buildings or free those trapped in apartment buildings. As of January 31, 12 persons were still reported missing. Rescue activities continued and the number of missing persons is 3 today.

(2) Search & Rescue

- The coldheartedness of the "those alive first" principle

Immediately following the earthquake, many people were buried under rubble. It was necessary to save those who could be saved first. However, only a professional fire-fighter can reason like this. The people expect to be saved and want rescue activities to continue without giving up. Before moving on to the next scene, fire-fighters had a hard time trying to explain to family and friends standing nearby that nothing could be done and that there were other priorities.

This does not mean that it is easy for a professional to abandon rescue when it is discovered that the person whom they are trying to dig out is dead. Many fire-fighters want to continue digging because if it were their family, that's what they would do. Undoubtedly, some fire-fighters felt themselves unqualified to save lives when they left the scene without rescuing someone.

Digging out those alive first had the same meaning as preventing secondary disasters With flames all around them, the fire-fighters had to abandon rescue even though someone trapped in the rubble was calling for help. It also happened on the day after the earthquake that an early morning LPG leak interrupted rescue activities.

(3) State of recovered bodies

According to statistics from the Hyogo Medical Examiner, 91.9% of the earthquake caused deaths occurred before 06.00 on the day of the earthquake (Table 1). Most died instantly. However, the number of survivors amongst those pulled from the rubble decreased rapidly day by day (Table 2). It was also learned that, of the 12.2% of deaths due to fire, many were trapped alive under the rubble before the flames got to them.

Table 1 Presumable time of death (Based on medical examination)

Time of death	Number of deaths	Death toll
1/17 - 6:00	2,221	2,221 (91.9%)
- 9:00	16	2,237 (92.6%)
- 12:00	47	2,284 (94.5%)
- 23:00	12	2,296 (95.0%)
Unspecified	110	2,406 (99.6%)
1/18	5	2,411 (99.8%)
1/20	2	2,413 (99.9%)
1/21	1	2,414 (99.9%)
1/22	1	2,415 (100.0%)
1/25	1	2,416 (100.0%)
Total	2,416	

Table 2 Number of survivors

		1 17	1 18	1 19	1 20	1 21	Total
Fire Department	Bodies recovered	604	452	408	238	121	1,892
	Survivors	485	129	89	14	7	733
Self defense forces	Bodies recovered	83	354	475	246	83	1,378
	Survivors	32	66	44	12	3	157
Total	Bodies recovered	692	806	883	484	209	3,270
	Survivors	518	195	133	26	10	890
	Percentage survivors (%)	74.9	24.2	15.1	5.4	4.8	27.2

The thought of those who suffered underneath the rubble in their few moments and the regret felt for the victims and their family still bring tears to the eyes of us fire-fighters.

However, the data is alarming. Many times when a person is buried alive, the difference between life and death depends on the smoothness of rescue activities. Because of this, the following can be said.

① After 72 hours, the chances of survival are very low. After 1 week, it would take a miracle to survive.

② In the field of disaster medicine, prompt medical assistance can save the life of 1 in every 4 persons pulled out from under a collapsed building.

These points emphasize the importance of quick search and rescue operations.

4. Actual Rescue Activities

(1) The biggest obstruction to rescue activities

The biggest obstruction to rescue activities was the fact that there was an overwhelming shortage of rescue equipment. Because rescue personnel were outnumbered 100 to 1, nearby residents spontaneously lent a hand. Later on, police and self defense forces joined in and operations finally started heading in the right direction. Nonetheless, the shortage of rescue equipment caused repeated trouble; there was no other choice than to use what could be found nearby in an attempt to save lives.

In other words, whatever came to mind was used such as saws, shovels, car jacks, iron balls, broken frames, kitchen knives, etc. Even thick books and telephone books were used as foundations because block supports were fragile.

(2) State of rescue activities

The following problems were incurred in search and rescue operations.

① Work had to proceed under the fear of aftershocks

② Noise from nearby and mass-media helicopters was too loud to hear those buried under the rubble calling for help.

③ Removing furniture onto which roofs had fallen or cutting through beams and rafters ran the risk of the entire building collapsing.

④ It was not possible to find safe and sturdy places for jacks and winches.

⑤ Some places were filled with gas, presenting the danger of explosion and asphyxiation.

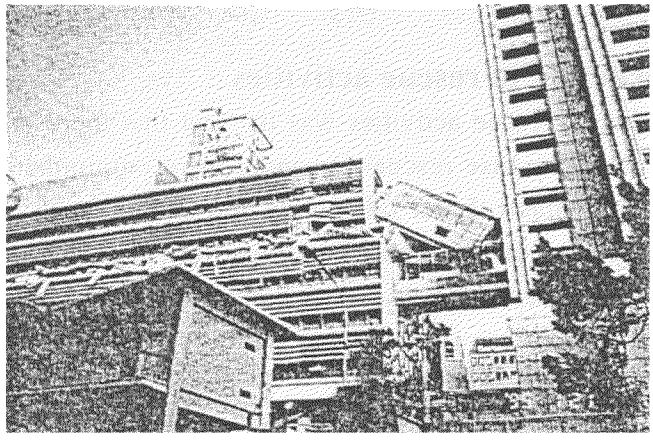
Some of the situations presented because of the above problems are described in greater detail here following.

(3) Fire-proof buildings

① A long time was needed for search and rescue with buildings in which entire floors were squashed.

② The squashed floors slid 3 to 5 m to the side, so it was extremely hard to locate survivors even if holes were dug from above.

③ In the initial stages, heavy-duty equipment was not used to knock buildings down out of fear that it would kill survivors. Rescue activities had to be done carefully with available equipment.



A buckled 6-story building buckled.

④ The breakers which rescue quads had were too weak and those with attached engines could not be used in the narrow spaces where rescue operations were needed. Jack hammers were effective. Nevertheless, hands and arms became numb after breaking reinforced concrete for 10 minutes and a pair of leather gloves didn't last even one day.

⑤ Gas torches couldn't be used because of the dangers of leaking gas and sparks.

⑥ Operators of heavy-duty equipment could not be contacted.

⑦ It was much harder than originally believed to break super heavy H beams and elevated sections of the expressway.

Rescuers looking for survivors in a 2-story apartment building

(4) Wooden buildings

① The 1st floor of many 2-story buildings collapsed and those living on the 1st floor were buried alive if not crushed to death. The 2nd floor had to be dismantled and this could only be done with help from neighbors.

② Because heavy-duty equipment was unavailable, beams and pillars had to be cut manually into smaller pieces with saws and chain saws.

③ Furniture such as bureaus had to be removed and an unbelievable amount of physical strength was needed to remove clothes and futons from the rubble. It was almost impossible to cut through wet futons With tatami mats, it seemed as though we were wasting time. The tremendous physical demand kept work from progressing.