



EMERGENCY INSPECTION OF BUILDINGS DAMAGED
BY THE GREAT HANSHIN-AWAJI EARTHQUAKE DISASTER

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ABSTRACT

Immediately after the Great Hanshin-Awaji Earthquake Disaster of January 17, 1995, the Shizuoka prefectural government dispatched 109 registered damage inspectors in accordance with the request of the Ministry of Construction to support in evaluation of impacted buildings. This paper reports the activity of the inspectors from Shizuoka prefecture, results of the inspection and reflection of learned lessons on the preparedness to the predicted Tokai Earthquake.

KEY WORDS

preparedness to Tokai Earthquake ; the Great Hanshin-Awaji Earthquake Disaster; emergency inspection of damaged buildings; registered damage inspectors; buildings and houses damaged by earthquake

INTRODUCTION

Many houses and buildings were damaged by the Hyogoken-nambu Earthquake which hit the Hanshin-Awaji area on January 17, 1995. Responding to the request from the Ministry of Construction, the Shizuoka prefectural government dispatched 109 inspectors to the affected areas to support Kobe city in the emergency inspection of damaged buildings.

Based on the experience of the inspection activity, the Shizuoka prefectural government reviewed the current system and organization taken for disaster preparedness and post-earthquake operation and is to change them to be more practical and effective.

OVERVIEW OF THE GREAT HANSHIN-AWAJI EARTHQUAKE DISASTER

The Hyogoken-nambu Earthquake hit at 5:46AM on January 17, 1995, with a magnitude of 7.2. The epicenter was 14Km deep at Awaji Island at altitude 34.36°N and longitude 135.03°E.

The investigation of affected areas by the Meteorological Agency revealed that some parts of Kobe city recorded a seismic intensity of 7 on Japanese scale (which is comparable to about 11 on the MM scale).

As shown in Table 1, the damage to buildings was considerable:

Table 1. Status of Damage (As of December 27, 1995, courtesy of the Fire Defense Agency)

Deaths	6,308
Injured	43,177
Missing	2
Severely damaged houses	100,302
Partially damaged houses	108,741
Slightly damaged houses	227,373
Total	436,416
Damaged public buildings	750
Other damaged buildings	3,952
Total	4,702

SUPPORT OF EMERGENCY INSPECTION OF DAMAGED BUILDINGS

The emergency inspection of damaged buildings was practiced in Kobe city and other 8 cities and 7 towns to prevent the aftershock-induced secondary disasters which may be brought on by the collapse of and falling objects from the buildings and houses. In accordance with the request from Ministry of Construction, governmental staff, architects and engineers including registered inspectors participated in the inspection activity.

The emergency inspection was classified into two parts (primary and secondary inspections) and each was practiced during the period from January 18 to January 22 and from January 22 to February 9, 1995, and a total of 5,068 people (man-day) were engaged in the operation of the secondary. The support practiced by the Shizuoka prefectural government is illustrated in Fig.1.

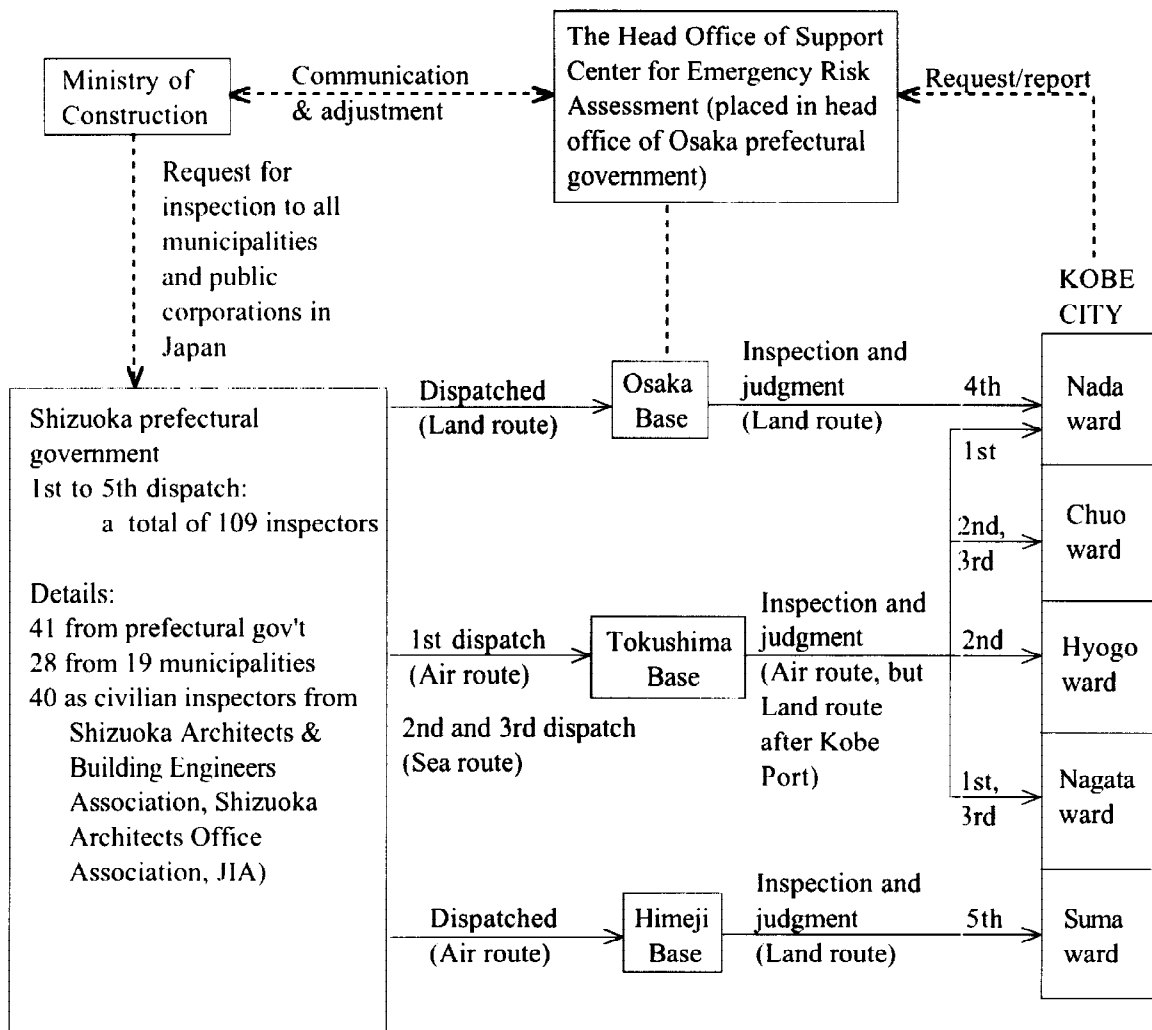


Fig.1 Overview of support by Shizuoka prefectural government for emergency inspection of damaged buildings

Status of Dispatch of Inspectors

The Shizuoka prefectural government dispatched 109 government staff, architects and engineers five times during the period from January 18 to February 10, 1995, and a total of 668 inspectors were engaged in damaged building inspection through the period. The status of dispatch of inspectors is shown in Table 2.

Table 2. The status of dispatch of inspectors from Shizuoka

Dispatch	Period (1995)	Inspectors			Total
		Government staff	City staff	Private architects and engineers	
1st	Jan 18 - Jan 22	10	5	10	25
2nd	Jan 23 - Jan 29	10	5	10	25
3rd	Jan 28 - Feb 3	9	5	10	24
4th	Feb 2 - Feb 7	7	8	10	25
5th	Feb 6 - Feb 10	5	5	-	10
	Total	41	28	40	109

Status of activity of inspectors from Shizuoka

Primary inspection (by inspectors of 1st dispatch from Shizuoka)

Inspections: Identifying houses and buildings (except those owned by individuals) which were clearly judged as dangerous, and posting stickers "DO NOT USE".

Inspected area: Nagata-ward and Nada-ward, Kobe city

Secondary inspection (by inspectors of 2nd - 5th dispatch from Shizuoka)

Inspections: Identifying damage of apartments in accordance with the emergency inspection standards, and posting three different colors of stickers for residents' awareness of degree of damage. (The inspection criteria and sticker forms are provisional and provided by the Ministry of Construction.)

Red sticker: "UNSAFE" allows no one into the building. (Fig.2-a)

Yellow sticker: "CAUTION" allows a short time entry. (Fig.2-b)

Green sticker: "INSPECTED" allows a permanent use. (Fig.2-c)

The buildings were visually inspected mainly by their exterior, but those to be judged as "INSPECTED" were checked by the interior, as well.

Inspected area: 2nd dispatch Chuo-ward and Hyogo-ward, Kobe city

3rd dispatch Chuo-ward and Nagata-ward, Kobe city

4th dispatch Nada-ward, Kobe city

5th dispatch Suma-ward, Kobe city

Inspected items: Damage of buildings and houses, land subsidence

Differential settlement of buildings

Inclination ratio of buildings

Damage of structural and non-structural materials

Safety of fallen objects

Damage of interior finish material

危険

(応急危険度判定結果)

この建物に立ち入らないでください。

なお、この建物に立ち入る場合には、建築士に相談し、
応急補強措置等を行った後にしてください。

注 記

判定日時 平成 <input type="text"/> 年 <input type="text"/> 月 <input type="text"/> 日
<input type="text"/> 災害対策本部
問い合わせ先電話 <input type="text"/>
または、支援本部 <input type="text"/>

(a) Red sticker:

“UNSAFE”

(Results of Emergency Inspection)

Do not enter into this building.

要注意

(応急危険度判定結果)

この建物は、使用しないでください。
この建物に立ち入る場合にも、十分
注意してください。

なお、応急的に補強する場合には、建築士に相談してください。

注 記

判定日時 平成 <input type="text"/> 年 <input type="text"/> 月 <input type="text"/> 日
<input type="text"/> 災害対策本部
問い合わせ先電話 <input type="text"/>
または、支援本部 <input type="text"/>

(b) Yellow sticker:

“CAUTION”

(Results of Emergency Inspection)

Do not use this building. Be careful
to enter into this building.

調査済

(応急危険度判定結果)

この建物を応急に調査した結果、
大きな被災は見当たりません。

注 記

判定日時 平成 <input type="text"/> 年 <input type="text"/> 月 <input type="text"/> 日
<input type="text"/> 災害対策本部
問い合わせ先電話 <input type="text"/>
または、支援本部 <input type="text"/>

(c) Green sticker:

“INSPECTED”

(Results of Emergency Inspection)

This building was inspected and
any serious damage was not found.

Fig.2 The stickers posted to the buildings damaged in the Great Hanshin
Awaji Earthquake (Stiker's size: 210 x 298mm)

Results of the inspection.

Table 3. Results of the secondary inspection (as of February 9, 1995, courtesy of the Hyogoken-nambu Earthquake Damaged Building Inspection Support Headquarters)

	Inspected total	“UNSAFE”	“CAUTION”	“INSPECTED”
Total in Hyogo pref.	46,610	6,476 (13.9%)	9,302 (20.0%)	30,832 (66.1%)

Table 4. Results of the secondary inspection by inspectors from Shizuoka

	Inspected total	“UNSAFE”	“CAUTION”	“INSPECTED”
2nd	706	125	126	455
3rd	594	304	150	140
4th	393	37	63	293
5th	149	59	26	64
Total	1,842	525 (28.5%)	365 (19.8%)	952 (51.7%)

Response of citizens.

The building inspection after earthquake has not been practiced in Japan, yet the victims were very cooperative because of their knowledge of the inspection system previously and widely reported by news media, and waited for the inspectors to have an exact instruction to determine what they should do.

The inspection this time was limited in apartments, but some advice was given to the residents of houses owned by individuals responding to their earnest requests for judgment. The followings are questions posed during the inspection:

- (1) Location of place to evacuate
- (2) Possibility of rehabilitation of damaged buildings
- (3) Methods of emergency reinforcement
- (4) How to request to demolishers or reinforcement engineering offices.

The Shizuoka prefectural government will reflect the learned lessons in such questions on earthquake preparedness plan. A manual of emergency reinforcement was written in March 1994, and which has been used during training of building inspection specialists. The manual of emergency reinforcement for steel-framed buildings is being edited.

EMERGENCY INSPECTION SYSTEM IN SHIZUOKA

As a countermeasure against the predicted Tokai Earthquake, the Shizuoka prefectural government created an emergency inspection manual to evaluate damaged buildings and houses, and first in Japan, began a licensing program in 1991 in which the governor registers and licenses architects and engineers as damage inspectors. And all these were reported in the previous conference.

There are 1.5 million buildings and houses in Shizuoka prefecture. In accordance with the risk assessment made in 1993, 700 thousands of them would be affected more or less by the secondary disasters.

The inspectors registered from April 1991 through March 1995 are shown in Table 5.

Table 5. Training and registration of inspectors.

Year	Participants in training	Registered persons	Frequency of training
1991	2,010	1,267	12
1992	2,005	2,165	14
1993	1,175	1,228	9
1994	1,062	1,131	9
Total	6,252	5,791	44

The training will be held 6 times in and after April 1995. As of November 1, 1995, three trainings were held for a total of 540 people.

WHAT WAS LEARNED AND WHAT SHOULD BE DONE NEXT

- (1) Securing more inspectors to expedite the inspection operation immediately after the occurrence of the predicted Tokai Earthquake. From the assumption of insufficiency of inspectors in Tokai Earthquake, it is needed to prepare a system which smoothly and promptly accept support from neighboring prefectures.
- (2) Establishing a support system in which inspectors are dispatched promptly responding to requests from local public entities of affected areas or the national government.
- (3) Streamlining the systems responsible in any degree of emergency.
- (4) Making the inspection system known to the public to reduce the frequency of claims and questions during emergency time. The Shizuoka prefectural government prepared a manual called "Self Inspection of Damaged Buildings" for building owners. Developing more powerful system to educate the public, utilizing manuals, too.
- (5) Taking measures against differentiated inspection technique among inspectors to securing more

uniform and consistent evaluation and judgment. Standardizing at-least necessary things for a smooth and prompt offer and acceptance of assistance to/from administrations of local governments throughout Japan.

- (6) Establishing the range of authority and responsibility of inspectors from private sectors, and the range of compensation in the event of injury or death during mission. The inspectors from Shizuoka were covered by a domestic tourist insurance at the expense of the Shizuoka prefectural government.
- (7) Building up a more consistent system for all through the processes from damaged building inspection to permanent building rehabilitation.

CONCLUSION

Through this support operation, it is clearly recognized that the inspection and resulted judgment contributed a lot to prevent the secondary disasters and assuage the fear of victims.

The Japanese government recognized that the nationwide activity of damaged building inspection this time discovered various problems, and placed a “Study Committee of Emergency Inspection of Earthquake-Affected Buildings” to improve the current system.

Utilizing the lessons learned in the Great Hanshin-Awaji Earthquake Disaster, the Shizuoka prefectural government will streamline its organization to make it more functionable in cooperation with the Ministry of Construction, other prefectures and all related organizations, and establish a system which reflects the results of inspection this time on a quick determination of the necessary number of temporary sheltering houses and places immediately after disaster.

ACKNOWLEDGMENT

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