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The Development Guidelines for Anti-Earthquake DISASTER Training

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Abstract

Purpose; The purpose of this study proposes training steps in preparation of multiple earthquakes disasters and how to plan training situation scenarios reflecting regional characteristics in response to frequent occurrence of earthquakes in Korea these days. There was a series of earthquakes with the subsequent aftershocks of magnitude 5.0 in Kyung-ju and Pohang in Korea in 2016 and2017, which resulted in a lot of damages. The earthquake disaster is what Korea has ever never experienced and we are defenseless for response training by the government institutions and public entities as well as the technologies for preparing disaster However, in the wake of the earthquake in 2016, the importance of training for earthquake has been appreciated and a host of multiple earthquake disaster drills has been conducted in the Safety Korea Training under the control of the Ministry of Public Administration and Security. However, due to lack of understanding on earthquake disasters and lack of experiences of earthquake disaster drills, the drills still remains unpractical. In particular, more jobs are required to establish scenarios explaining from preparation to training. This study presents the 10 steps of PDCA CYCLE for multiple earthquake disaster training. In preparing the drills, the study suggests training for the response situation and making improvements to update the manual for better next drills over time. Earthquake disaster is getting worse through the complicated and continuous situations over time. Considering these earthquake disaster characteristics, characteristics such as weather, time, and season are important variables in determining the response directions. In order for efficient drills reflecting local characteristics, a training situation scenario is needed to take the characteristics of the earthquake disaster, the current status of the region, the characteristics of the characteristics of the facilities into account so as to create a complex disaster situation in response to an earthquake. In this study, we propose a method to set weather, time, and seasonal characteristics and to estimate the damage situation reflecting the surrounding facilities and the affected area in order to create a situation scenario that can cope with over time accordingly. The situation scenario is presented as an example of the Ulsan metropolitan city located on the tip of Southeast Korea. All the examples are based on the damage situations and responding situations are provided in accordance with the Site Action Manual and the Earthquake Disaster Manuals kept by each organization. It is believed that the 10 steps for PDCA CYCLE training and the damaged situation scenario proposed in this study will be conducive to the trainers in charge of preparing for the complex earthquake disasters and simulation scenarios.

[Keywords] ***Disaster, Development, Earthquake, Training Scenario, Training Guide***

1. The Necessity for Earthquake Disaster Training

On Sep. 12, 2016, at 7:44 pm, a 5.1-magnitude earthquake hit Kyung-ju in Kyung-buk province. After 50 minutes, a 5.8- magnitude earthquake occurred and the people could feel the shock nationwide. The earthquake left 31 people injured in Kyung-ju, 17 in Pohang and total damage was estimated at $10.7 billion. There were 75 cases of damage to public facilities and 4011 cases of private property loss[1]. Also, more than 500 aftershocks caused the whole nation to tremble

with fear. An 5.4 magnitude earthquake occurred in Pohang, Kyung-buk Province, at 2 pm on Nov. 15, in 2017. There were over 70 after-tremors since then[2]. The Bank of Korea estimated a total of KRW 332. 3 billion in calamity such as the delay of Korean SAT for a week, which is one of the biggest issues in Korea and the emergency evacuation of the resident for fear of collapse the apartment[3]. This kind of disaster is evidently unprecedented and the people have faced the new fear. The government took more rapid actions in response of the earthquake in Kyung-ju in 2016 than that in Pohang in 2017. The people evacuated much more rapidly through repeated drill in the wake of the earthquake in Kyung-ju in 2016. To minimize the effect, the most important thing is repeated practice. The evacuation drills by ordinary citizens are significantly improved. However, in the case of the trainers in public sectors still fall short of expectations. A seismic mishap is impossible to predict and multiple disasters occur concurrently. Repetitive and efficient training is essential to respond quickly and systematically to sudden disasters such as earthquakes and continuous and complex disasters. Currently guidelines for training personnel for general disaster drills are presented[4].

The purpose of this study is to develop the training guidelines for the personnel to prepare for anti- multiple disasters drills caused by the unprecedented seismic catastrophes. In order for the training personnel to prepare for earthquake, it is necessary to respond to the first damages and the subsequent secondary damages in efficient ways. In Korea, Safe Training is conducted annually targeted to the national government, local governments and public organizations under the host of Ministry of Public Administration and Security. This study develops and presents a process that prepares for step by step guidelines of earthquake disaster in the Safe Korea Train

2. The Development of Guidelines for Earthquake Disaster Drills

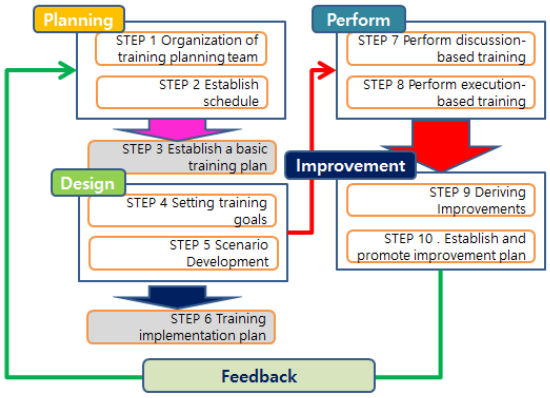
2.1. Setting complex disasters caused by earthquake

<Table 1> shows the results and analysis of the Safety Korea Train's earthquake disaster drills conducted by the central government, local autonomous entities, and public organizations

Table 1. Safety Korea training earthquake combined disaster training.

Disaster	Number of training (Include overlap)
Fire	90
Dam break	1
Nuclear damage	2
Marine pollution	3
Power accident	4

Figure 1. PDCA Cycle for earthquake drills.



Earthquake disaster includes a combination of effects such as fire, collapse of dam, nuclear power plants, toxic chemical leaks(marine pollution), electricity, water, gas, communication facilities and so on, which eventually leads to heavy casualties and victims. In addition, continuous aftershocks may bring about additional collapse of buildings and increase the number of victims. Therefore, the scenarios of anti-disaster drills reflecting all these situations are becoming important, but the understanding of scenarios for anti-earthquake drill and the ability of train personnel to develop scenarios are very insufficient.

The assumption of the damage situations after earthquake should be prioritized for response training of government organizations and public institutions according to the damage situations. For this reason, it is very important to set up a complex disaster situation

and develop the scenario accordingly.

2.2. Establishing 10 steps for complex disaster drills after earthquake

10 steps are set up to ensure that train personnel can prepare for the anti-complex disaster drills step by step.

STEP1. Organization of training planning team
STEP2. Establish schedule
STEP3. Establish a basic training plan
STEP4. Setting training goals
STEP5. Scenario Development
STEP6. Training implementation plan
STEP7. Perform discussion-based training
STEP8. Perform execution-based training
STEP9. Deriving Improvements
STEP10. Establish and promote improvement plan

Figure 2. The location of Ulsan city.

The above 10 steps present the steps to be taken by the train personnel that prepare for a complex disaster drill. Among the 10 steps, from STEP1 to STEP4 are for setting up organizations and training goals prior to the actual drills and the STEP5 is for creating scenarios to implement the drills. The STEP 6 is the final check stage before the actual training. The STEP7~STEP8 is for the debate training and putting the training to work. The STEP9~STEP10 is to find improvements for enhanced drills next time. This cycle is structured to evolve the drill as the training continues.

2.3. The development of a guideline for complex earthquake disaster scenarios for earthquake training.

In order to develop the scenarios for earthquake drills, the continuous damage effects are set up for the government institutions or public agencies to response to them in the complex disaster situations. The complex disaster caused by earthquake can be different from place to place and the complex disaster situation can be set up depending on whether there are an industrial complex, a port, dams and nuclear power plants. The response may differ according to seasons, time and weather. This study explains the procedure for developing a complex disaster scenario for Ulsan metropolitan city in Korea. Ulsan Metropolitan City is located in the south-east of Korea and has a population of 1,195,761 people. It is the most suitable city to simulate all the earthquake disaster situations with mixed environment such as in-zone watersheds, chemical industrial complexes, 6 ports and nuclear power plants.

1)Setting the location of earthquake

- A spot 5km away from the south of Ulsan Metropolitan City

2)Setting the time of earthquake occurrence and weather conditions

- Jan. 7 at 7 am, minus 6 degrees, snowfall 6

3)The scale of the earthquake

- Scale 6.5

4)Possible elements of complex disaster in Ulsan

- Kori, Wolsung Nuclear Power Plant
- Mipo Port, Changsa Pohang, Ulsan New Port, Bang-a-jin Port, Jung-ga Port, Onsan Port
- Ulsan chemical complex, heavy industry complex, shipyard
- The collapse of old buildings, the collapse of the dam, the landslide
- Disable electricity, gas, water and communication
- Large fire
- The Tsunami on the East Coast
- Ground liquefaction, etc.

5)Setting goals and direction of training

- Set the detailed goals to be checked during the response drill against the Ulsan chemical complex fire and toxic chemical spill accidents caused by the earthquake

- Set response directions for complex disaster situation such as continuous disaster due to earthquake

6)Identification of the training place and possible mobilization organizations

- 13 collaboration functions of Ulsan city Disaster Prevention Headquarters
- Operating the organizations according to on-site Action Manual for earthquake response[5]
- Related organizations

7)Expectations the first damage scale and countermeasure

- Assumption of facilities damage, human injury, social damage
- As an example, Ulsan Hanhwa chemical fire caused by earthquake and 2 tons of harmful chemicals leakage into Duwon stream
- The Evacuation of the residents due to risk of building collapse at Doowon Plaza
- Risk of collapse due to dam leakage
- Description duties and roles of 13 collaborative functions based on the on-site Action Manual for Ulsan Earthquake Disaster
- Assuming continuous and complex disaster situations and describing 13 cooperation functions of Ulsan city disaster countermeasure headquarters and the response situations of the related organizations over time.

8)Expectation the secondary aftershock and additional effects and countermeasure

- As an example, roughly 150 people evacuated to the vicinity of a middle school for fear of the Duwon Plaze building collapse
- Destroyed over 100 buildings near Ulju-gun area
- Emergency recovery of Electricity, telecommunication in the Chungliang-Myun area
- Harmful chemicals flow into the outer river through Duwon stream
- Develop the continuous accidents caused by an additional explosion on the Hanhwa

Chemical fire site and describe the countermeasures of 13 cooperation functions of Ulsan city disaster countermeasure headquarters and other related organizations based on the On-site Action Manual for earthquake.

As the above examples, the example scenario of the Ulsan city earthquake, the types of complex disasters can be different according to regional characteristics, hence preparation for appropriate training and earthquake disaster scenarios are necessary. Only the training scenario reflecting regional characteristics can be an effective training. Also, participation of public officials familiar with the local situation in the assuming disaster scenario makes possible pre-detecting potential risks caused by earthquake and preventing unexpected disaster in advance.

In particular, weather conditions, time and seasonal conditions are also critical variables in the response of an earthquake disaster. In the case of the Pohang Earthquake in November in 2017, it was necessary to prepare for the cold of November, and what's worse the Korea SAT was delayed due to overlapping with the earthquake. In most cases, these seasonal and meteorological situations are not taken into account in the stage of preparation for drill and they must be considered in the development phase of situation scenarios

3. Conclusion

This study examines the training of earthquake disaster that is becoming increasingly important as earthquakes occur frequently in Korea recently. In the wake of the earthquake in 2016 and 2017, response to earthquake has become significant and the importance of anti-earthquake disaster has come to the fore. However, unlike other anti-disaster training, as earthquake drills take place under the complicated and continuous disaster, 10 steps for the PDCA CYCLE are presented for seismic training. Next, Ulsan is taken as an example of how to plan earthquake training scenario for training personnel. In the study, the scenarios describe the complicated and continuous situations due to the earthquake reflecting the regional characteristics. In the example of Ulsan city in the study, scenario is created reflecting the regional characteristics of Ulsan city, chemical industrial complex, dams and 6 ports. This study suggests guide-

lines to assist the training personnel to prepare for the disaster-relief drill in a more efficient and practical way. The study is also intended to acquire information on possibility of disaster in local regions and take belt and brace approaches for the future disaster.

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