Available online at www.sciencedirect.com

ScienceDirect

Procedia Engineering 211 (2018) 778–787

Procedia Engineering

www.elsevier.com/locate/procedia

2017 8th International Conference on Fire Science and Fire Protection Engineering (on the Development of Performance-based Fire Code)

Research on the Integration of Fire Water Supply

Chih-peng WANG[a,b], Ban-jwu SHIH[a,*]

[a]*Department of Civil Engineering, National Taipei University of Technology, Taipei City, Taiwan.*
[b]*Keelung Harbor Fire Brigade, National Fire Agency*

Abstract

Hydrant water supply is one of the most common water sources used by the fire fighters at fire scenes. The severe earthquakes in history were often accompanied by fires immediately. However, the fire departments were often stuck in the trouble of lacking water sources by the damage of water pipelines which worsened the fire-relieving work. Through the design of questionnaire, we have got some results of the actual preparations and integrations of fire departments. The results indicate that, over 80% of interviewees approve the establishment of 12 diversified fire water sources which combine natural water sources and artificial water sources; 87.7% of interviewees agree with the establishment and installation of fire-control water supply system especially belongs to the fire departments; About mastering the hydrant instantly supplying water state, 57.5% of interviewees choose the item of water at scene. About the reason of disapproving the fire water source should be listed on the management and checking options, most of interviewees agree that fire departments do not have the rights of water management. The most frequently chosen reason that the natural water sources from rivers within the jurisdiction are not listed on the regulation and checking options is that personnel are not easy to access the water source. In addition, the solution to the problem of the insufficient hydrants in some areas is to investigate in advance as priority.

Peer-review under responsibility of the organizing committee of ICFSFPE 2017.

Keywords: fire water sources , hydrants , reservoirs

1. Introduction

The Great Kanto Earthquake with Richter magnitude scale of 7.9 occurred on September 1st, 1923. The raging fires had lasted for 3 days. According to the statistics, there were 134 raging fires during the earthquake. At a ratio of 53% the raging fires that occurred in 2 minutes after the earthquake broke out [1]. The Great San Francisco Earthquake with Richter magnitude scale of 7.8 occurred on April 18th, 1906. The raging fires had lasted for 3 days. 80% of the buildings were destroyed by the raging fires. Compared with the fire-control responses and actions in the 921 Chichi- earthquake in 1999, Huang, Po-Chuan (2000) [2] pointed out that 6 counties including Nantou County had suffered the most severe loss by breaking out 21 raging fires simultaneously after the earthquake occurred. There were total 90 raging fires in the day after the earthquake and 161 fires in total within 7 days after the earthquake. Ling-tang (1999) [3] indicated that because the destruction of the Eastern Star Building in Taipei had crushed the 300 mm water pipelines, the firefighters were unable to pump the hydrant water sources. They immediately used the large reservoirs nearby and the fire-control reservoirs in the buildings nearby to extinguish the fire. Tainan City Government (2016) [4] pointed out that the Richter Scale of 6.6 earthquake occurred in Meinong District, Kaohsiung City on February 6th, 2016 triggered the collapse of Weiguan Jinlong common building of residence and commerce. This building had a total of 9 buildings, and those building overlapped with each other and distorted, caused the total of 115 deaths. The collapse of building crushed water pipe with 2,000mm diameter. Although the smaller pipes erected temporarily were replaced with the exposed pipes, the lack of water pipeline pressure resulted in the overall shortage of water-supply in Tainan City, and the water supply were unavailable for 50 thousand

* Corresponding author. Tel.:+886-2-2771-2171; fax: +886-2-2781-4518.
E-mail address: bjshih@ntut.edu.tw

1877-7058
Peer-review under responsibility of the organizing committee of ICFSFPE 2017
10.1016/j.proeng.2017.12.075

households until 14th.

In order to deploy a better respond in fire salvage, the fire departments, according to the regulations to the implementation of fire-control service, should clearly list various fire water sources within the jurisdiction on the regulation and checking items, including fire hydrants, reservoirs (over 30 tons), swimming pools, deep wells (limited to those with 63.5mm outlets) and the like (such as rivers, streams, fishponds and so on). Learning from the literatures both at home and abroad, we can know that multiple fires will simultaneously break out when the earthquake occurs. Under the condition of no water in the fire hydrants, the firefighters should look for other water sources to meet the demand of fire saving right away. However, there is less literature instructing how to organize the fire water supply on normal days. Therefore, this research will take a deep investigation on the types of available fire water supply, the reason why streams and other natural water resources are not listed on the management and checking items, routine readiness measures, as well as foreign water source measures that can be learned and emulated. We adopted SPSS version 19.0 statistical software as the main tool for data analysis. The results were judged to be statistically significant when p=0.05 or less. This study used validity analysis, reliability analysis, ANOVA, Chi-square test and t-test to examine differences.

1.1. Research Framework

The research questions will be divided into three dimensions as follows:

- Personal background: gender, age, educational level, seniority, work nature, counties or cities, professional title, rescue hours, experience of earthquake rescue, experience of disaster relief.
- Professional cognition: types of fire water sources, fire water usage, archiving and registering of water sources.
- Measures of Readiness: routine readiness measures, learning from the post-earthquake experience from abroad.

1.2. Pretest Questionnaire

- Randomly choose 37 people of two units of Fire Department, New Taipei City Government, who are in the team that day as the pretest objects. After conducting the analysis of the reliability and validity and consulting the opinions and reaction provided by the interviewee, the formal questionnaire is formed via the discussion and modification of many professors. The investigation of firefighting supervision could be executed in counties and cities around the nation.
- The value of KMO in the pretest questionnaire of this research is more than 0.597, the factor loading is over 0.493 and Cronbach's α coefficient is higher than 0.827.

1.3. Formal Questionnaire

- The questionnaire will be allocated in accordance with the proportion of population in the Fire Department of 22 municipalities, (counties) cities, then choosing the firefighter as the objects at random, we have sent out 432 questionnaires, 407 are recycled and 398 are effective, as shown in Fig 1.
- Analysis of validity, the KMO value in the formal questionnaire of this research is more than 0.854, which indicates that there is a common factor among the variables, so that the factor analysis shall be allowed. The factor loading that is over 0.405 indicates the high homogeneity.
- Analysis of reliability, Cronbach's α coefficient in the formal questionnaire of this research is more than 0.837, showing the good reliability.

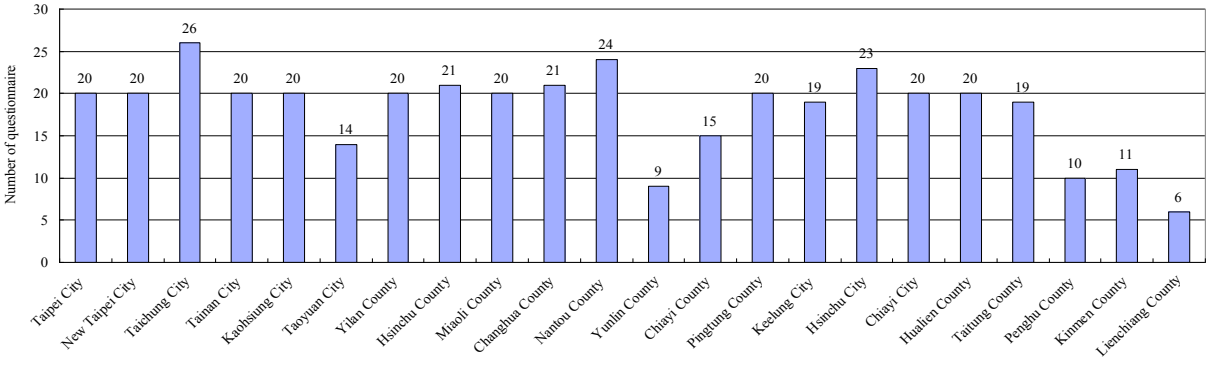

Figure 1. Location-wise distribution of respondents