To ensure water supply routes to capital's central agencies at the time of an earthquake

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INTRODUCTION

Ensuring the continuity of the functions of the capital after disasters

Japan is one of the world's most earthquake-prone countries, and it is estimated that Tokyo-Epicentered Major Earthquake will occur with a probability of about 70% within the next 30 years. When that happens water service suspension rate could reach a maximum of 50.4% (average in Tokyo ward area)[1]. Tokyo, the capital city of japan, has many central institutions including political and administrative functions such as National Diet and economic functions such as Head office of Bank of Japan. Not only that, there are many hospitals saving the lives of 13 million Tokyo residents in the event of an earthquake. If these institutions lose their functions due to an earthquake, it will affect not only the lives and economic activities of citizens across Japan, but also in foreign countries. Therefore, Japanese government have decided to promote seismic retrofitting of these facilities and ensure continuity during the emergency response period for 3 days (72 hours) after a disaster[2].

Launching the Waterworks Emergency Services Unit

In response to this decision, the Tokyo Waterworks formulated the "Waterworks Earthquake Disaster Emergency Countermeasures Plan" (2006)[3].It defines important facilities such as the capital's central institutions and disaster base hospitals of which there are 119 locations in the Wards Area at present, and aims to restore damages done to waterworks supply pipelines within 3 days of a disaster. In 2008, for that purpose, we established the "Waterworks Emergency Services Unit" possessing the necessary skill for rapid restoration and the capability to respond all the time, all the year.

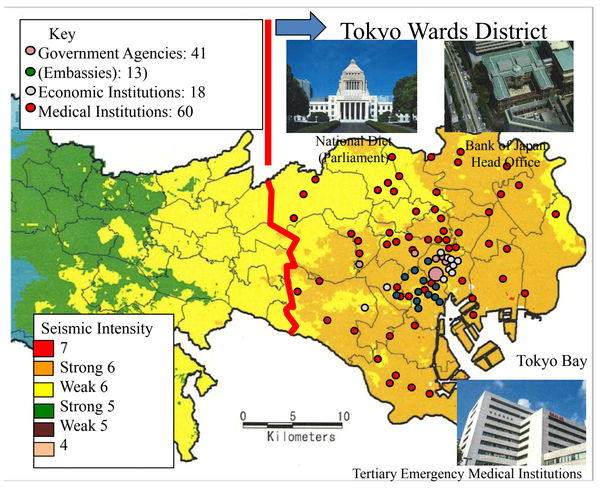


Figure 1 Estimated seismic intensity distribution of Tokyo-epicentered earthquake (Northern Tokyo Bay Earthquake Magnitude 7.3) and distribution of the capital's central institutions

Structure of the Waterworks Emergency Services Unit

1. Waterworks Emergency Services Unit System

We deploy at least 12 staff all the time through a shift system with five squad in order to respond disasters, accidents and so on.
After disasters, we secure waterworks supply route to the capital's central institutions within 3 days(72hours) , transport water to hospitals by water supply vehicle and support emergency restoration by branch office.

2. Equipment (Picture 1)

We have 36 vehicles, including a special emergency vehicle equipped with mobile computers, a printer, and scanner, to send on-site information about accidents to the main unit, as well as PR vehicles, water supply vehicles, gate valve operation vehicles **(Table 1)**.

3. Various Training（Picture 2）

Squads undergoes regular training to advance technical skill for emergency response.

Special Emergency Vehicle

Equipped with computers and a printer. Can send on-site information about accidents to the main unit.

Water Supply Vehicle

A vehicle for carrying drinking water to areas or facilities that cannot use waterworks. It has a pressurizing function to send water to high floors.

Public Relations Vehicle

A vehicle for conducting advance public relations activities in areas affected by water service suspension due to accidents. It can turn on the red light on the roof to drive in an emergency.

Gate Valve Operation Vehicle

This truck is equipped with a device for turning gate valves of water pipelines with its drive power. It is mainly used for water service suspension and restoration of large diameter pipelines.

Picture 1 Equipment

Model	Quantity	
Water Supply Vehicle	10	36
Public Relations Vehicle	2	
Gate Valve Operation Vehicle	2	
Bike	10	
Other	14	

Table 1: Vehicles Owned

High Location Water Pumping Training

Training to secure water supply routes to the capital's central institutions

Picture 2 Training

Securing Supply Routes to the Capital's Central Institutions

1. Procedure to ensure water supply routes（Figure 2）

1-1 In the event of an earthquake of seismic intensity strong 5 or higher, we deploy several teams of 2 or 3 staff to capitals central institutions.

The waterworks supply routes to each facility are set up as two lineages; one is the main route from the nearest main distribution pipe from each facility, and the other is the sub-route from the main distribution pipe of other lineage as a backup.

1-2 We will first go check the nearest fire hydrant from target facility to confirm whether the required water pressure (0.17 MPa) is available.

If the water pressures are insufficient, we will check sub route water pressure.

1-3 If pressure has dropped on both sides, we will close the valve on the sub route side, then conduct reconnaissance on the main route up to the main distribution pipe, and close branch valves if there are any leaks on the way.

1-4 If water pressure is still inadequate, they will close the branch valve from upstream until water pressure recovers.

1-5 If water pressure cannot be secured on the main route, then they will do the same work on the sub route.

2 Improvements made using lessons learned from the Great East Japan Earthquake

2-1 Introduction of motorbikes and development of a folding valve key

At the time of the Great East Japan Earthquake, we only confirmed water pressure, but it took a lot of time, 22 hours, to complete. It was because the movement was extremely difficult due to unexpected traffic congestion.After that, we made several revisions to speed up the work. As a measure to avoid traffic congestion, we introduced 10 motorbikes**(Picture 3)**. We also developed a folding valve key that can be carried on motorbikes **(Picture 3)**.

2-2 Introduction of tablet devices

It is hard to carry sizeable paper, such as a route map, on motorbike. Therefore, we recorded on a tablet device **(Picture 4)** to improve portability and browsability.

2-3 Introduction of pressure confirmation devices using telephone lines

We developed device to confirm water pressure remotely by using telephone lines **(Figure 3)** and installed it to the water meter of each facility. By using it, we no longer need to go to them for confirmation water pressure. As a result, we expect to save a lot of time, because we can instantly grasp which facilities have been lost water pressure.

Image of work to ensure water supply routes to capital's central agencies, etc.

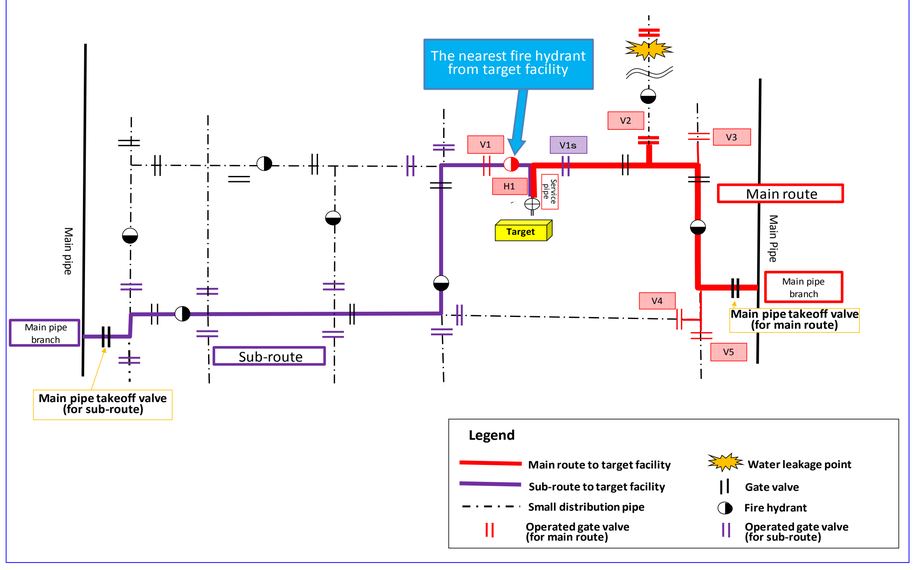
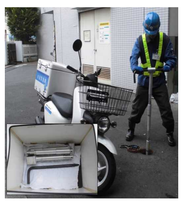


Figure 2 Conceptual diagram of how to ensure water supply routes to the capital's central agencies, etc.



Picture3 Motorbike and folding valve key

Picture4 Tablet device

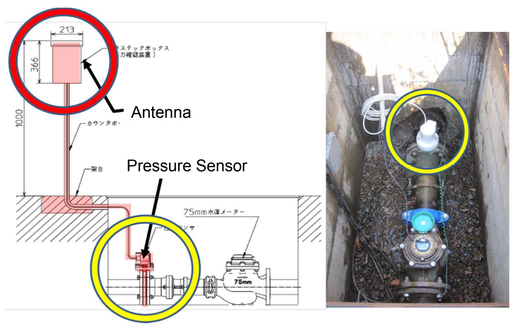


Figure 3 Water pressure confirmation device using telephone lines

CONCLUSION

In the event of an impending Tokyo-epicentered earthquake, it is the mission of the Tokyo Waterworks to ensure water supply routes to functions of the capital's central institutions within 3 days after a disaster, so as to ensure that the functions of the capital are maintained in the disaster. It is important to understand and solve unexpected issues beforehand as much as possible before the disaster even strikes. In addition, we must enhance the effectiveness of the measures in the event of a disaster will be further enhanced by repeating daily emergency drills.

Sources:
1) Tokyo Disaster Management Council.2012. *"Estimated Damage from a Tokyo-Epicentered Major Earthquake"* (Japan) ＜http://www.bousai.metro.tokyo.jp/japanese/tmg/pdf/assumption_h24outline.pdf＞
2) Central Disaster Management Council. Amended in 2005 and 2010. *"Outline of Measures against Tokyo-Epicentered Major Earthquake"* (Japan)
3) Bureau of Waterworks, Tokyo Metropolitan Government. 2006. *"Waterworks Earthquake Disaster Emergency Countermeasures Plan"* (Japan)