6th Taiwan-US-Japan Workshop on Water System Seismic Practices

Penal Discussion

1. **Xavier Irias (US):** Why in US we don't really focus on providing temporary water? We do have a plan of water bagging, but it's no way near to provide 1.3 million people for three weeks after earthquake immediately.
2. **Steve Welch (US):** I notice the same thing in the past workshop. The US doesn't plan for water bagging. I do know that we are response to provide the drinking water to the public, but the county don't plan for either. So I agree to Irias, we need to improve working with counties to proving drinking water.
3. **Masanobu Shinozuka (US):** I want to indicate that how useful to have a shake map immediately after the earthquake. It can provide us grand information and let us know what actually happened, so we can guess the damage overall. What we need is real time information of damage, particularly those pipes. The more information we get, the more rapidly we recover.
4. **Jang-Shung Ju (Taiwan, TWD):** I want to indicate that the monitor control center is very important. I think the SCADA system is very important. Taiwan Water Department built this system in 1991 to improve the facility and train engineers. And GIS system also can provide the similar function. We try to integrated the GIS system and the SCADA system, maybe we need new software and hardware, and in this topic we can learn more from Japan and US.
5. **David Lee (US):** We just talk about how to supply the water. My question is the SCADA system. After the earthquake, if you lose the power, do you have the battery or any power generator for back-up?
6. **Jang-Shung Ju (Taiwan, TWD):** We use the back-up system. We have another power transmission from Taipower. We also have individual system.
7. **Xavier Irias (US):** I think paper is still extremely valuable, even if you have good mapping system. I think GIS system is great, but I also think the paper is important.
8. **Masanobu Shinozuka (US):** I want to indicate how important to use the damage data. It's no matter us use GIS system or any other system. The point is that the damage knowledge is important.
9. **Keith Walker (US):** With respect to SCADA supervisor, we now have

pumping facilities have gas power generator, and some location we have solar power supply at remote sites.

10. **John M. Eidinger (US):** In the presentation of Xavier said that East Bay may have 5000 pipes break in future. In Memphis we won't be replacing any pipes. In US, most of water companies are doing almost nothing to replace old pipes, because every study shows they don't break. It's no cost effective to repair, and many presentations from Japan and Taiwan shows aged pipes maybe 65 years, 70 years, it's time to replace for new pipes. It's a serious problem. Only in San Francisco, they spend billions of dollars, but all other water companies spending one million or more. Because San Francisco they want to restore water in 24 hours to 250 liters per day per person after the earthquake.
11. **Akira Suzuki (Japan):** I am coming from Japan, every nation have different point of view of water supply after disaster. Tokyo has 10 million populations. In the presentation, we say that in four weeks time, we try to supply water to citizens. Regard this of the local government or population; we try to supply water in three days in some significant or critical district. En other district we will do our best to supply water as soon as possible. However, in Tokyo metropolitan area, we have public serve about 4000 staffs, and many of them don't live in Tokyo. How can we move back to the job position as soon as possible is an issue. So we like to find some staffs contract that live in Tokyo, so they can come to the side to repair the damaged facilities as soon as possible. If you have any comments or suggestions, you are welcome.
12. **Yang-Long Wu (Taiwan, TWD):** Recently we concern how to provide a stable system. So after 2006, we spend 21 billions in four years to promote a dual system, for example: double water resources system. In some area have damage or disaster, other regions can supply power; in some key area, we establish diesel generators. This is the direction of Taipei City Government. I am wondering in Japan or US how to promoting dual system?
13. **Toru Tomioka (Japan):** The dual system cost a lot. It's very expensive, although it's very important. One of our missions of Japanese government is provide emergency water supply in three days. The dual system is a very good idea. I think every agency will provide dual system if they can afford.
14. **Masao Kadowaki (Japan):** Regarding to the dual system, actually the best situation is that we apply dual system in all the system. The

government also drives to this direction, but to achieve this goal is very difficult. We have many challenges of it, for example: the power resources. The best situation is that we have two power resources, and we can ensure the power safety. In fact, the public utilities are interacted each other. The more effective approach is through every utilities perspective to consider the post-disaster.

15. **David Lee (US):** In the US, the power system company usually has the dual system already, but for water, about dual system, I think we can talk about in two aspects; one is the transmission lines. For instance, we did look at the Kobe system after the earthquake; a lot of times Kobe has dual system for the storage, but that is very expensive for us, so that we make isolation valves for some of our tanks. We look at the geographic area, if we have one tank or two tanks, we make sure that we have isolation valves for one of the tanks, so after the earthquake comes, we have some kind of water storage. For the transmission system, we instead of making dual system. We make our system as a loop. For instance, in East Bay MUD, we have eastern side consumers and western side consumers, and the geographic condition is totally different. So we try to connect these two systems, and usually the earthquake was happened on either from one side or the other, we try to make sure that when earthquake happens on the east side, we can have water coming from west side. So I think it's a dual system, a looping system.
16. **Masanobu Shinozuka (US):** I want to back to the John's comment about shall we reconstruct the entire pipe link which is too expensive. My think that is beyond just engineering issue. I don't suggest that, but we always talk about the model type, research and study, maybe we should look at social point, economic point. We need opinion from other professionals.
17. **Siao-Syun Ke (Taiwan, NCDR):** Before we do the supporting system, we have to identify the weakness, so that we can spend money on it, and have better efficient. I know in US, they have critical infrastructure protection (CIP), and analysis the weakness of water supply system. However, they use the perspective from anti-terrorism. They want to know the influence of water facility from anti-terrorism. In Taiwan, we have more influence from natural disaster. So I want to know how Japan, US or Italy identify the weakness of water supply system before disaster happens.
18. **Mario Rosario Mazzola (Italy):** I would like to introduce how we work in Italy. We have a civil security agency, and all the protect agency and water agency start to be a very directly command from this civil security agency.

In Italy, there are some different situations, one is that all Italy is a old area so it's happen normally that they are looking forward to move the people to a new city to repair old pipes, and it's a serious problem. But in my comment, we are a part of European Community, other country also has similar problem.

19. **Craig A. Davis (US):** I think we are not all focus on 911 terrorism. We do have some people who focus very much only on terrorist in infrastructure water area. But for practice terrorism is not the only thing we concern. About how to identify the vulnerabilities, you do the analysis and determine where the system or critical link is, and the link will be moved. In practice, the operator know that, so the people who operator the system, they are already know where the weak links are. So that is the best approach to identify the weak links, but if you do very detail analysis, you might also find the weak links that won't obvious.
20. **Jin-Song Tsai (Taiwan):** US speaker emphasize the 0 downtime is a mission impossible which made our engineers try all kinds of effort, analysis, and study make the system like a "die hard". However, our US friends also mention that how to make our customers tolerate the government and the system. I think our friends from Japan with this regard they doing very good, at least after Kobe earthquake. Japanese people have very organized systematic. Those citizens very quietly accept the slow response from government. Therefore, I want to pass this question to our friend from Japan, how Japanese people accept the unperfected government efficiency, and how they can work together to overcome the disasters.
21. **Hayato Yokono (Japan):** During the emergency period, we have emergency water supply system. In Kobe, we have 47 water supply points, means every 2 kilometer we have a temporary water supply zones. We also have emergency water resource area, which means during the disaster period we'll have water storage. The water storage is control by government. Like Mr. Suzuki from Tokyo city, he also mentions during the disaster or after the disaster, we need local people to support regarding communication and the emergency respond team.
22. **Munetaka Abe (Japan):** In Japan we have encounters many disasters for example: earthquake, typhoon, and each natural disaster have different character. Regarding the water supply. We can't just consider water alone. We also have to looking at the other utilities, such as gas and power, and provide the multination counter measurement. For example, in Japan, we

have national protection or security articles, which means during the measure of earthquake, each director of utility will come to control center to take charge individual function. So the o downtime is an ultimate goal. Actually in our city, we also want to reach this target, but reality; it's very difficult, especially during earthquake. Our plan is provide temporary water supply. We'll set the first priority and provide water from our storage tank. At least, it's cheaper than bottled waters.

23. **Masanobu Shinozuka (US):** There are three critical performance criteria for lifelines of water system; one is robustness, then, resilience, and sustainability. If I am not misunderstood. I heard that US won't insist 0 downtime. I don't think that is a case. We do lots of work about resilience, for example: transportation resilience, or high way system resilience, and we also concern about the damages bridge.
24. **Craig A. Davis (US):** To respond to the idea that US doesn't respect any downtime at all. That was the respect from the residents and the society. In Los Angeles, there is much less town than Japan, so in Kobe they will get angry after five weeks because there's out of water. In LA, I don't believe they will prospect to be out of water at all. So is the prospect not from reality.
25. **Toshichika Matsui (Japan):** When there is a earthquake, perhaps the person in charge himself is a victim, therefore, he can't go to the office. I am charge of the water channel design, so when you talk about the repair of the disaster damage. We provide 3 liters water per person per day. Now the bottled water is very convenience and popular, so not many people will actually use running water. During the Kobe earthquake, we not just provided 3 liters water per person, sometime we provided 100 liters per person. Although sometimes we can't reach the target immediately, but we try to meet the goal. I wonder in Taiwan how much water you think is the best capacity for residents?
26. **(US)**: My observation is engineers are doing good job for planning for earthquakes. But I think to be successful in post-earthquake tight situation, you really need to focus on two areas; one is the operation of engineering area in responding to the earthquake to make repairs, and the other part is finance, IT, your contracts, and cash, to set up temporary office to help the public to know what's going on. We don't want to be too narrowly focusing the role of engineers. I think them have done pretty good job getting together regularly to talk about how to response the earthquake. I think it's also our job to communicate the other part of earthquake response.

27. **Yang-Long Wu (Taiwan, TWD):** Our friend from Japan when he came from airport to the office saw there were many water tanks on the top of our house. Actually here in Taiwan, the construction regulation request this, because our water pressure is not so high. Therefore we need underground water storage tank and the water tank on the roof. We request 8 hours' water supply capacities, so in regular when the pipe line replace or maintain, public won't feel the water shortage or downtimes, such system in Taiwan where we have lot of disasters. I think we should sustain this system.
28. **Tsung-Shen Liao (Taiwan, CTWWA):** I would like to spend few minuets to share with you the water supply prevention concept, because I was in charge of these two utilities. Starting in 1993, Taiwan Water Department (TWD) establishes dual water system from the water resource to the household. Because of TWD has budget founding from Taipei city government, so we have very good system set up, and the security level is much higher than other areas. 2 years ago, I went to the Taiwan Water Corporation (TWC), the situation is totally different, because TWC cover areas both city and low population area, so regarding the security of the water supply and the concept of prevention is complex than Taipei city. TWC only can select few major cities, for example: Hsinchu, Taichung, Tainan city, and Kaohsiung to enhance the security level. However, because we have limitation of our budget, our company condition is much worse than TWD. The primary functions of TWC are: first, change the original PVC pipe lines to better DIP pipe lines. The budget is about 200 billion NT dollars. Secondary, because TWC have integrated 625 small systems to a major system, and it cost 40-50 billion NT dollars. And also we want to catch up the standard of TWD. We need to set up an automatic monitory system, SCADA system, or GIS system. The whole system will request 25 billion NT dollars.
29. **David L. Pratt (US):** I have a question about what's the average sizes of the in line system, and how much does it cost?
30. **Tsung-Shen Liao (Taiwan, CTWWA):** Japanese friend ask how many water supply for each person. Our goal is 100 liters per person per day. We set up our system with this capacity, so once the disaster happens, we can at least maintain water supply for a period of time. However, the repair work is depends on the level of damage to the transportation system, because many of pipe lines link with the bridges, so if the bridge is broke or in serious damage, our repair work will be very slow. For example, last

year, we have pipe line from Taichung to Changhua was broken by the flood. We used 36 hours to recover it. Why we took 36 hours, because we set up a temporary pipe line on the top of the bridge, so it's only took 36 hours. Recently Executive Yuen has provided 19.8 billion NT dollars per year to TWC to replace all the aged pipe lines. Regarding the size of inline pipe, depends on the population, water usage per person per day, and the flow rate we use per meter per second. Right now, the diameter of the largest transmission line in TWD is 4000 mm diameter. In TWC, the largest pipe line is about 2000 mm to 2400 mm, and the majority size is 300 mm to 500 mm. The diameter large than 5 cm are the responsibility by company, and the diameter less than 5cm will be responsibility of each residents. About the cost, 1000 kilometer we cost will be divide in 3 parts, first one is the construction fee; secondary is regarding the material fee of pipe line, and the third one is the excavation, each categories is 30%, and per 1000 kilometer cost 6.8 billion NT dollars.

31. **Masanobu Shinozuka (US):** I am completely agreed with the Dr. Liao's comment. I think US prospect did include the interaction among other system, such as transportation, power, and water system. Xavier is already presented in his presentation, and I've presented the importance of SCADA system. SCADA system can not only use for pumping system, but also can use for recovering water system.
32. **Yuki Sagara (Japan):** Recently in Osaka city, we have observed about the H1N1, we also have to consider regarding the pipe materials. During the process for the emergent H1N1, when we have lots of sick staffs in water department, I want to know are there any similar issue being talk about or review in Taiwan or US?
33. **Chin-Tse Cheng (Taiwan, TWD):** To the flu condition in Japan and in Taiwan. In the serious condition, we dress the office area separate. We separate it two; one is the back-up. In this flu period, right now we have another plan on the substitute team by the sick ones; we have prepared 4-5 manpower supporting. That's the situation gets work, just like the SARS periods. That's something we share with you.
34. **Tatsuo Ohmachi (Japan):** To the thing I have heard, to the US and Japan there are some different, each nation has its weakness. Between Japan and US, the different are the thought of general public is different. In Japan, during the emergency time, we'll highlight the fallowing one is help yourself and seeking the help from government, but in US, I think normally they don't believe to the government, they rely on themselves.

35. **Craig A. Davis (US):** We would like to think in US will be completely self-relying, as you can see from Katrina as an example, not everybody intends to be self-relying. We have quite different situation across the country, and different parts of lots cities. There are group of people want to rely on from government, and other group want self-rely independent. My first observation is that I am appreciating for everybody, so give yourself a hand. I'll also say due to my observation from all the past discussion secession in the workshop, this is the one of the best part of the workshop. Another observation is very similar to Dr. Ohmachi's comment. There are great differences, aspects from Taiwan, US, and Japan, but I also have to say maybe there are not so different. I think there is maybe a cultural aspect of different, but the practice might not be so different. Another observation is that I think lots of good information was pass between three countries. I can say for my perspective of US part. We learned from different country, different perspectives, and I also learned from other US organizations. The key point of the observation is we have ability to getting together and learn from different international perspectives. I think it's the most interesting thing in this workshop.
36. **Jin-Song Tsai (Taiwan):** In these two days participation. We are appreciating very much to your discussion. I also learn a lot myself. I also observe that between three countries we see lots of different. In the US, they come from a lot of private sectors, their water supply districts compare with Taiwan, we serve more people and our government involves more. That's the different system. Therefore, our budget is coming from central government, and many of time we have to meet the expectation of government. I also want to mention a point that we didn't mention yet. That was the visional system. Another observation that I have is that between Japan and Taiwan, we have more academy sector take involvement, but in US, individual and real practices people they have more power. Therefore, I feel we have lots of responsibility to enhance that, because our system relies on government, and our school system also under the system of government.