B−49 Student Tour of Japan Society of Civil Engineers (JSCE) in Taiwan

~A History of Ware Infrastructure and International Development in Taiwan~

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1. Introduction

This is a report on the 10th JSCE study tour in Taiwan including international seminar on the "Environmental Status and Education in Japan and Taiwan" at Taiwan National University, which has just been carried out in 2~6th March, 2009 at Taipei and Tainan in Taiwan in a framework of the JSCE program of the sub-committee on the overseas environmental education in the environmental engineering committee.

There are two objectives in this JSCE study tour. The first one is to know the current status on water and sanitation of Taipei city. We visited Gongguan water purification plant and Dihua sewage and Wastewater treatment plant in the centre of Taipei city. The second objective is to learn the history of water infrastructure development of Taiwan colonial government when two sanitary engineers of Mr. William Kinnimond Burton and Mr. Yashirou Hamano were invited to Taiwan in 1896. Mr. Yoichi Hatta. who is a successor of Mr. Hamano, commenced the civil work services in Taiwan in 1910. Mr. Hatta engaged in the construction project of Wu-Shantou dam for Chia-Nan irrigation district in the south-western part of Taiwan. We visited Taipei city waterworks and museum, CHIA-NAN irrigation association and Wu-Shantou dam in Tainan.

2. Republic of China (ROC)

The first national govermmrnt of the Chinese republic was establisshed in 1912. Mr. Shinpei Goto, the secretary of civil government in Taiwan decided on colonial policies and leaded to build the effective governmental system for Japan in the complicated international political relationships. He carried out various policies, for example, the spread of medical knowledge and hygienic, the building of infrastructure, the educational administration, and the large scale investigation like census, etc. These policies produced good result for the Japanese colonial rule.

Today, Taipei city is a capital of Taiwan which is located in the north of the country. The population is 1.23 million. The main industry is manufacturing including information system and trade. The Tainan city with population of 0.76 million was old capital in the history which is located in the southwest of the country (see Fig.1)

Fig.1 Location Map of Taipei

3. International Seminar on Environmental Status and Education in Taiwan and Japan

The Committee of Environmental Engineering of Japan Society of Civil Engineers (JSCE) dispatched the study tour to attend the International Seminar on Environmental Status and Education in Taiwan and Japan, which was held at Research Center for Environmental Pollution Prevention and Control Technology at National Taiwan University in March 3rd, 2009. The JSCE study tour, of which the member

consists of Japanese university students, researchers and professors, aims to exchange the views and information on the current environmental problems and applied technologies through the seminar and

Photo 1 International Seminar on Environmental Status and Education in Taiwan and Japan

field excursions in Taiwan. (see **Photo 1**).

4. Water and Sanitation of Taipei City

(1) Gongguan Water Purification Plant

The origin of Taipei's water supply dates back to 1907 with the founding of Taipei Water Office (TWD), when there was only single sand filtration unit at the Xindian Creek, supplying 20,000 m^3/day of drinking water to about 120,000 people in Taipei city. Without clean water, the Japanese colonial government could not have functioned, and Taipei could not have grown as it did. Today the TWD supplies some 2.5 million m^3/day of potable water to over 3.8 million users in the Taipei metropolis. There are 5 water purification plants such as Changhxing, Gongguan, Zhitan, Shuangxi, and Yangmin in the city of Taipei. The Gongguan purification plant, which is located just beside the waterworks museum, is the oldest and the third largest one in Taipei city, supplying drinking water of more than 400,000 m^3/day (see **Fig.2**).

The source of drinking water is dependent on the Xindian river. Quick sand filtration method is applied to purify the raw water. The first step is the flocculation and sedimentation process by adding alum to create the group of flocks. The flocculating precipitates are settled at the bottom of sedimentation basin to separate the clean water with very low suspended solids (SS). (see **Photo 2 & Fig.2**).

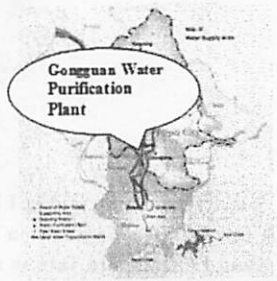

Fig.2 Taipei Water District (TWD)

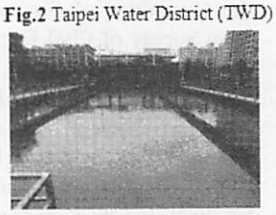

Photo 2. Gongguan Water Purification Plant

The second process is quick sand filtration to purify the raw water after the flocculation and sedimentation process (see **Photos 3**)

Photo.3
Schematic profile of sand filter

(2) Dihua Sewage and Wastewater Treatment Plant

The Dihua wastewater treatment plant occupies a land area of 7.8 hectares in the city center area. It was originally a primary level of treatment plant which stated in operation in July 1980, with an average treatment capacity of 274,000 m^3/day.

In order to comply with the new EPA effluent standards, new secondary level of wastewater treatment plant was commissioned in 2005 with (1) design treatment capacity of 500,000 m^3/day and (2) design water quality of the influent of BOD_5=180mg/L and SS=180mg/L and the effluent of BOD_5=20mg/L and SS=20mg/L.

The primary treatment is to remove the greater part of the suspended solids and a small portion of the organic matter in the raw wastewater. The secondary treatment adopts the aeration process to remove organic matter in the wastewater. Microorganisms multiply rapidly by taking the organic matters in the wastewater as a food and the air as oxygen. Various types of microorganisms appear, with variety depending on their concentration, the volume of organic materials and oxygen content in the mix liquor. The effluent from the secondary treatment is disinfected with sodium hypochlorite to remove pathogens before discharge into the Danshui river, and then 10,000 m^3/day of the treated water is again treated by the sand filtration process to recycle it for washing water in the treatment plant.

5. Taipei City Waterworks and Museum

Taipei governor of Mr. Shinpei Goto had invited two sanitary engineers of Mr. Burton and Mr. Hamano to Taiwan in 1896. The purpose is to solve the serious epidemic problem by constructing the water purification plant in the center of Taipei city. The original waterworks, which is located at near the Siyuan Street and Xindian river in the southern part of Taipei city, was built 100 years ago of 1908. Without clean water, the Japanese colonial

government could not have functioned, and Taipei could not have grown as it did. Taipei waterworks museum was built in 1909. The inner displays are even more with historical meaning. The historical pumping station in the waterworks is kept as it is as shown in **Photo 4.**

Photo 4. Pump station in the Museum

6. CHIA-NAN Irrigation Association

The Chia-Nan irrigation district is located in the south-western part of Taiwan including the cities of Chia-Yi Hsien, Chia- Yi, Tai- Nan Hsien, and Tai-Nan, of which the area is bounded by the Taiwan central mountain range to the east, the Pei-Kang river to the north, the Erh- Jen river to the south and the Taiwan strait in the west. The climate is sub-tropical with an average temperature of 21-24℃ and annual average rainfall of 1,600 mm. 80% of the rainfall is concentrated in the wet season from May to September. As the Chia-Nan district was a plain with a little irrigation facilities, the farmers had to get water from nearby stream or brooks. The water supply shortage was the most significant problem to be solved in the area.

7. Mr. Hatta and Wu-Shantou Dam

One of the important purposes of this student tour is to learn about Taiwan history on the water infrastructure development since 1910 when Mr. Hatta commenced the civil work services in Taiwan. He commenced the regional development project with Wu-Shantou dam and reservoir, and Chia-Nan irrigation canal system in 1920. The total project cost accounted for nearly one-half of an annual budget of the Taiwanese government at that time. The project consisted of the construction of the Wu-Shanto dam, and irrigation canal system of 16,000 km in total. It was the largest civil engineering project in Asia at the time to be completed in 1930. An off-channel type of Wu-Shanto reservoir with an effective storage of 83,758,651m^3.takes water from the intake gate at the middle reaches of Tsengwen River by through Tungkou Wushanling tunnel to compensate the small own catchment area of 58km^2. The irrigation project could cover 150,000 ha of farmland within the Chia-nan Plains. The fertile spreads of farmland now seen within Tainan Xian are the direct fruits of this project by Mr. Hatta. (see **Photos 5&6**).

Photo 5. Wu-Shantou Dam and Reservoir

Photo 6. Bronze statue of Mr. Yoichi Hatta

8. Concluding Remarks

It was an exclusively good opportunity to lean the history of water infrastructure development and current status of environmental problems in Taiwan by exchanging view and information with students and professors in the Taiwan National University as well as engineers of CHIA-NAN irrigation association office.

9. Acknowledgements

Many thanks for their kind attention and cooperation with guidance by Mr. Yuuki Kumon and Dr. Hsu Kuang Hui. We look forward to seeing them again after studying environmental engineering more in depth.

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