

An aerial photograph of a city, likely Taipei, showing a dense urban area with many high-rise buildings and a network of roads. A semi-transparent pink overlay covers the bottom half of the image, where the title is placed.

9 Investigation Trip Abroad and Research Report

1 Report on Participating in the 2011 International Bridge, Tunnel and Turnpike Association (IBTTA), 80th Annual Meeting

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(1) Preface

The International Bridge, Tunnel, Turnpike Association (IBTTA) 80th Annual Meeting was held at Orlando, Florida, U.S.A. from September 9 to 12, 2012.

The annual meeting was hosted by Florida's Turnpike Enterprise, the Miami-Dade Expressway Authority, the Orlando Orange County Expressway Authority, and the Tampa-Hillsborough Expressway Authority, and the theme was "Delivering Real Solutions".

The leaders of related toll collection industries gather together to share their cross-border experience in delivering real solutions. This forum allowed us to learn about transportation policy planning and efficiency, the impact from



economic changes, as well as common issues and problems being faced around the world today, from North America to South America, from Europe to Asia, and the ways to solve them.

This (the 80th) Annual Meeting was the largest and most important event ever for the toll collection industries. It gave us a good opportunity to understand the toll collection industries around the world and help expand our horizons of the related toll collection policies.

There were about 100 vendors on display, showing the latest and most popular technology products and marketing services. Through the exhibition, we were able to get mutually acquainted and carry out discussions. The Meeting provided many opportunities to exchange views with the toll collection vendors, and thus allowed us to discover new solutions.

(2) Arranged Visits

1. On September 9 (Sunday), we visited the Tampa-Hillsborough Expressway Authority (THEA). At the Tampa-Hillsborough Expressway Authority, staff members briefed us on the construction of road bridges and highway electronic toll collection. We also visited their management center (similar to the Far Eastern Electronic Toll Collection Company's IDC in Neihu). At the center, their operators show us how to remotely monitor highway activity as well as other purposes of the center: such as parking lot management.
2. In the afternoon of September 12, we visited Florida's Turnpike Enterprise. We first visited the shopping malls and convenience stores that were still under construction along the roadside, and also went to see solar battery panels that were set up next to a convenience store before visiting the electronic toll collection (ETC) monitoring center. The monitoring center is slightly larger than Tampa-Hillsborough Expressway Authority's monitoring center and its equipment is newer as well. In addition, it utilizes a global satellite positioning system (GPS) to assist in monitoring.



Visit Florida's Turnpike Enterprise's monitoring center



Visit the Tampa-Hillsborough Expressway Authority

We also visited the ETC monitoring center. This monitoring center is slightly larger than Tampa-Hillsborough Expressway Authority's monitoring center. It has three rows of seats; 4 persons per row, 12 persons intotal. Its equipment is newer as well, and it utilizes a global satellite positioning system (GPS) to assist in monitoring. Our tour guide said that the average success rate of collection is 99.95%, which is almost the same as FETC (Far Eastern Electronic Toll Collection Co., Ltd.).



Tampa, Florida SUNPASS, highway electronic toll collection system



(3) Lessons Learned and Recommendations

1. The scheduled agenda, discussion topics, and visits during the IBTTA 80th Annual Meeting were all carefully designed and arranged. A manual was also produced. All of these showed the dedication and thoughtfulness of the Meeting's organizers. Through this Meeting, I learned a few techniques on how to host an international conference as well.
2. After visiting the Tampa-Hillsborough Expressway Authority, I realized that the FETC's Neihu IDC matches the THEA's management center in terms of facilities and technology, maybe even better. For this, FETC should be commended.
3. From the point of view of environmental protection we should reduce traffic accidents and lower the impact to wild life. In addition, it should have a minimal impact on the region and improve the link with wildlife habitats. In this way, the construction of major national construction will not cause serious damage to the ecology.
4. Before the implementation of any major construction project, the transparency and reliability of the plans should be enforced. At the same time, congressional lobbying and social communication should be engaged so that the project can be carried out smoothly.
5. The ISO-6C Tag used by FETC has passed rigorous testing and has implementation experiences around the world. Our Bureau had determined this as a new technology in accordance with the provisions of Article 126 of the ETC contract, and agreed to allow FETC to use this technology during the contractual compliance period in order to be in line with the provisions of this contract.
6. The organizers arranged an exhibition during the Annual Meeting, which allowed us to see the progress and development of toll-ways in other nations. For example: although Greece already has a toll highway, tolls are not collected based on distance; the toll-ways in mainland China total a

length of 155,000 km (including toll expressways and level one and level two national toll-ways). The organizers also arranged for the various toll collection vendors to be onsite at the exhibition so that they could display their latest development in road and bridge construction, electronic toll collection technology, as well as how to leverage smart phones to be used to pay highway toll fees. Going forward, when Taiwan hosts international conferences, related industries can also be invited to support the exhibition, which will make the conferences more interesting.

7. The use of solar panels can be considered as an auxiliary power source for electronic toll collection facilities on future highways. If the normal power supply fails, solar power would be a good alternative power supply.
8. The toll collection success rate in Quebec, Canada is 98.2%, which is lower than the success rate required by our government for FETC (the times-based electronic toll collection success rate is 99.98% or above; the distance-based electronic toll collection success rate is 99.8% or above). This shows Taiwan's strict demand on the toll collection success rate is higher than the rest of the world.
9. In the Meeting and in discussions with VIPs and lecturers, PPP is a new way of doing business with the private sector. Many shareholders are involved in the development and management of these complex projects, while the financial burden is taken on by the private sector, thereby lessening the budget pressure in the public sector. After obtaining a partnership agreement, the private sector does the construction and the public sector obtains the building. The Bureau-sponsored "Project Freeway Electronic Toll Collection System" is a BOT case based on the Act for Promotion of Private Participation in Infrastructure Projects. FETC is responsible for raising the funds to construct, operate, and maintain the highway electronic toll collection system, as well as performing operation and marketing services. After FETC delivers the collected electronic toll fees to the



Bureau, the Bureau pays service fees to the commissioned company. Once the operating period expires, FETC transfers the electronic toll collection system's ownership rights and the necessary facilities to the Bureau. Since this is a BOT (partnership) cases, there is a partnership relationship between the Bureau and FETC, hence, there must be a strong relationship of trust between the two sides and a consensus toward achieving the same goal (distance-based electronic toll collection). This point should be the future direction which the Bureau and FETC should work towards.

Report on participating in the 8th Annual Taiwan-US Workshop on Bridge Engineering Meeting and 2012 International Bridge Conference

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(1) Introduction

Transportation construction not only carry the task of economic development, but also are closely related to people's lives. Since the first cross-island freeway was constructed in 1970s, our government had launched several major transportation construction projects throughout the years. After nearly 40 years of use, these transportation facilities had faced natural disasters, artificial damage, and been affected by environmental and global climate changes, resulting in damages and the need for maintenance. In addition, global warming and abnormal climate changes have led to the increased frequency of natural disasters such as typhoons, torrential rain, etc. Coupled with the extensive use and gradual depletion of natural resources around the world, such as petroleum and steel, "sustainable development" has become a common global concern as new technologies and concepts are being actively developed. Transportation is no exception to this.

After undergoing years of construction and development, Taiwan's highway transportation network has become more complete, such as the National Freeway 1, 3, 5, 2, 4, 6, 8, 10, the Hsichih-Wugu Viaduct, and the Wugu-Yangmei Viaduct, which was completed by the end of 2012. How to effectively improve the operational efficiency of highway transportation through traffic management practices and replace the plans for building new highways by extending the life of the highway facilities will become the focus of the Ministry of Transportation and Communications ("MOTC") and all the highway authorities under its jurisdiction.

Looking back on 2005, the competent authorities of the MOTC noticed the seriousness and importance of this issue, and thereby formed a cross-departmental organization, the "Highway Maintenance Management Team," made up of the Directorate General of Highways, the National Expressway Bureau, the Taiwan Area National Expressway Engineering Bureau, and the Taiwan Construction Research Institute. The Team was an important channel in building long-term cooperation between Taiwan and official U.S. departments. It also agreed to hold an annual seminar starting from that year to facilitate bilateral exchange, which greatly helped the policy setting, technology and management of Taiwan's public works construction, and enhanced diplomatic relations as well. That year, the 1st "Taiwan-US Workshop on Bridge Engineering" seminar was held in Taipei, Taiwan. During the seminar, valuable technical exchange and experience sharing regarding bridge construction supervision and monitoring, maintenance, reinforcement and disaster prevention and management were conducted. After five years of continuous exchange, the topics have gone from the original bridge maintenance issues, and expanded into the technology and management of highway engineering, which involves the upgrading of specialized technology and the advancement in maintenance and management concepts. This is a test of Taiwan's engineers' wisdom. Gearing up to international standards is believed to be the most effective way to



assist the engineering sector in facing the challenges of this new situation, while learning the maintenance management technology and experience which the U.S. has accumulated over the years will give the best inspiration and support.

During the years 2005 to 2010, the task of communicating between Taiwan and the U.S. was carried out by the Taiwan Construction Research Institute and then by the China Engineering Consultants, Inc. in 2011. This time, the team visit to the United States was made up of 25 persons from 12 departments, including the Taiwan Area National Expressway Engineering Bureau, the National Expressway Bureau, the Directorate General of Highways, the Taoyuan County Transportation Bureau, the National Center for Research on Earthquake Engineering, the Taiwan Construction Research Institute, National Taiwan University of Science and Technology, National Central University, China Engineering Consultants, Inc., CECI Engineering Consultants, Inc., Taiwan, Sinotech Engineering Consultants, Ltd., and TY-Lin International consultant Corp Taiwan. Taiwan's delegation participated in the 8th Taiwan-US Workshop on Bridge Engineering Seminar held from June 8 to 18, 2012. The Seminar was jointly organized by two U.S. government agencies – the Federal Highway Administration (hereinafter referred to as “FHWA”) and the Boston Department of Transportation Office (“Boston DOT Office”), along with the of Taiwan China Engineering Consultants from Taiwan's private sector.

There were three main topics in the seminar: (1) Bridge Maintenance and Construction Technology (2) Bridge Safety Assessment (3) Hazard Mitigations. The members of Taiwan's delegation not only published reports regarding bridge maintenance and construction technology as well as highway construction applications, but also used the scour monitoring system that was installed on Taiwan's major bridges after the Morakot Typhoon in 2009 as a case study to talk about the erosion conditions of bridges after being hit by typhoon floodwaters and Taiwan's future strategies in disaster prevention. These strategies set up a real-time early warning system and safety assessment model during the

typhoon flooding period. 10 papers were published that were related to the three main topics of the seminar, and 8 papers were published by the U.S. counterparty, a total of 18 papers. The Seminar also held a session to report on the progress of the 3 major cooperative research projects that were agreed upon by Taiwan and the U.S. during last year's (2011) 7th Annual Meeting: "Training the Seed Teacher of Bridges Maintenance Management Technology," "Long-Term Bridge Performance Research Program" and the "Bridge Multi-Hazards Research Program." Through discussions and exchanges, new and innovative perspectives and concepts were brainstormed.

This year we also participated in the 29th International Bridge Conference. The Conference was held from June 10 to 13 in Pittsburgh, Pennsylvania. Pittsburgh is known as "the City of Bridges," and sits at the convergence of three sparkling rivers and is surrounded by lush, green hills. Therefore, Pittsburgh has won the reputation of "the most livable" city in the United States. The conference venue was held at the David L. Lawrence Convention Center, which is located by the Allegheny River and is the world's first and largest green convention center. This year's theme state was Missouri (MoDOT). Through the assistance of the FHWA, the delegation was able to register and enter the venue, then observe the Seminar's subgroup discussions and freely visit the exhibition booths. Four topics were discussed, including design, rapid bridge construction, testing and instruments, and bridge reconstruction.

The itinerary of this trip also included visiting the bridges and highway management units in the Boston Municipal Government, the New England Ecological Highway (I93), the Boston DOT Office, the Central Artery Project, the 2012 29th International Bridge Conference ("IBC"), CAIT of Rutgers University, New Jersey, and the Pavement Material Laboratory). Both parties provided each other with professional and technical exchange and support, which has helped to enhance the global perspective of Taiwan's engineers and promote the development of forward-looking technology in the planning, design, construction



and maintenance management phase of Taiwan's bridge construction life cycle.

In the future, good contact and interaction can be made through this mechanism, whether it be Taiwan's official agencies or private sector organizations. I believe that this channel can help establish a smooth line of communication for both Taiwan and the United States.

Photographs of the 8th Taiwan-US Workshop on Bridge Engineering



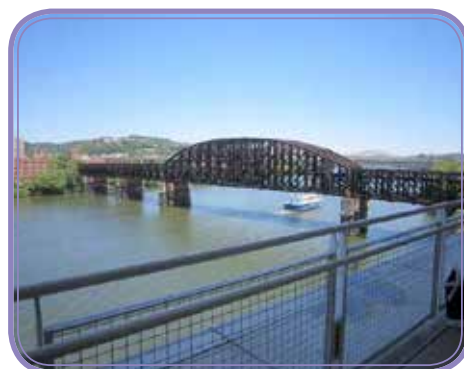
Group photo of all the members at the Taiwan-U.S. Seminar



The U.S. host a welcome party for the Taiwan delegation

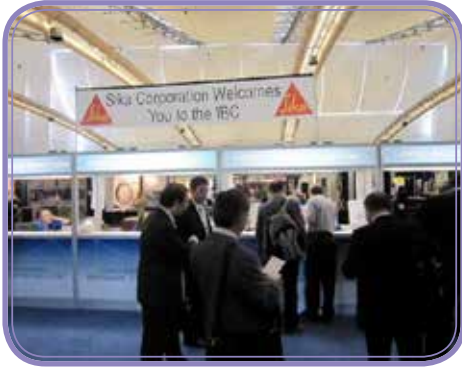


First day of seminar, external view of the conference venue



First day of seminar, external view of the conference venue

Photographs of the 2012 29th International Bridge Conference (IBC)



2012 IBC entrance



IBC seminar group discussions



This year's theme state – Missouri



Venues for subgroup discussion at the convention center

Photographs of visit to the CAIT of Rutgers University, New Jersey



NDT/NDE equipment and field operation drills



Delegation members asking the U.S. representatives about NDT/NDE operation problems



Group photo in front of the Pavement Material Laboratory



Dr. Thomas Bennert introducing the laboratory



(2) Lessons Learned and Recommendations

1. Lessons Learned

- (1) Boston Municipal Government: Boston is one of the oldest cities in the United States. After two hundred years of development, old and new buildings are entwined within the city. U.S. government agencies have tried hard to take into consideration both traffic convenience and maintaining the city's original looks and style during the urban development process. For example, in the downtown area there are two adjacent buildings that were built a hundred years apart, but doesn't look awkward from across the street. This shows how the Boston authorities have cleverly blended in the old building with the city's subway system.

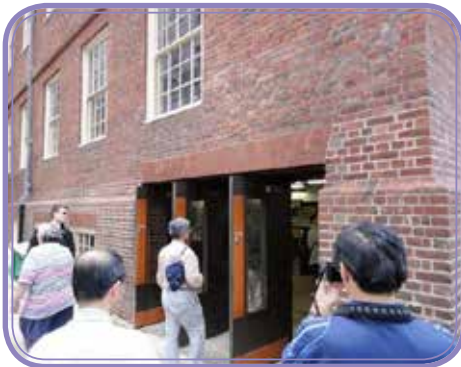
Photos of Boston Municipal Government



Two generations of steel girder bridges within the city of Boston



Two adjacent buildings in Boston that were built a century apart



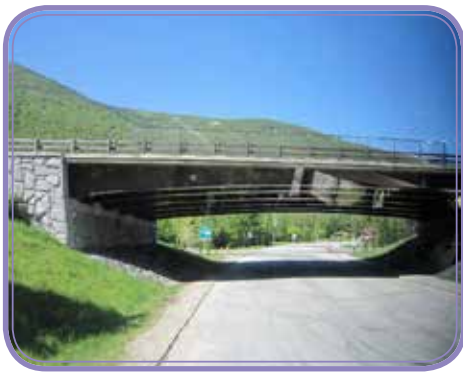
Located at the subway station entrance of the old building



Zebra crossing blended in with the urban image

(2) New England Ecological Highway (I93) Visit: The thought and effort by Americans is fully displayed during the visit. Whether it be the route location and setting, the natural slope processing (1:2 slope), set up of the ecological corridor, or replacing the marking buttons on the outer side of the markings with marking lines and soon. the abutment slopes are laid with large chunks of gravel or granite and non-woven cloth, thereby reducing the use of concrete facilities. Large gravel (granite) pieces are laid on top of the natural slopes to avoid water scouring the slope and reducing the use of concrete retaining facilities. By making good use of the power of nature and minimizing the impact of construction projects on the environment and ecology, this shows the ability of Americans in utilizing local materials, their environmental protection and ecological concepts, as well as their detailed design and thinking process. This is worth the civil engineering sector in Taiwan to seriously contemplate.

Photographs from the visit to the New England Ecological Highway (I93)



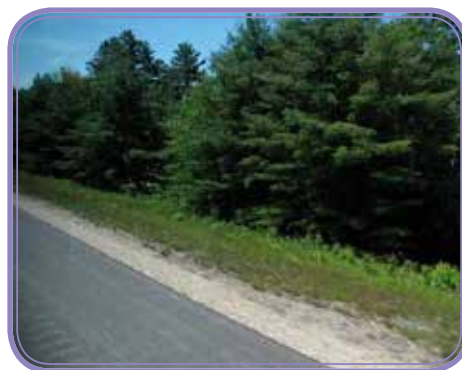
The cross bridge abutment slopes are mostly laid with large chunks of gravel



Interstate 93 winds through the mountains and valleys



Road markings design use marking lines to replace the marking buttons



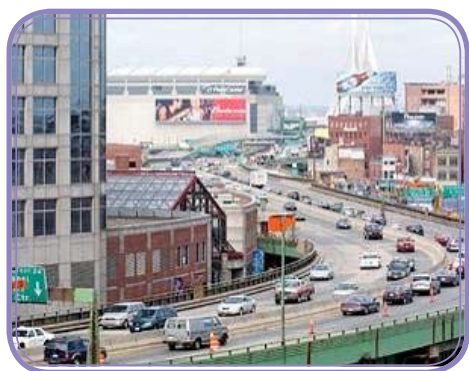
The slopes on the Ecological Highway are natural slopes



- (3) Massachusetts DOT Office Visit: This visit was arranged through the FHWA and hosted by Mr. Walter Heller, the Acting District 6 Highway Director of the Mass DOT Office. Mr. Heller first gave the delegation an overview of the CA/T project, and then both parties exchanged views on a number of engineering techniques and even talked about public protest issues. Models were used to take us through the contents of the project. After the discussions, the District 6 Engineering Division arranged for us to visit ventilation building 4 ("VB4"). Since the highway went underground, a large tract of green space besides the ventilation building was opened for recreational use. In addition, Mass DOT Office Bridge and Structural Engineer, Mr. Lev Bentsman, led the delegation to visit the Leonard P. Zakim Bunker Hill Bridge. The bridge is the nation's first non-symmetric (8 lanes within the bridge tower, 2 lanes outside the bridge tower), steel and concrete composite truss design cable-stayed bridge. It spans a total length of 1,400 meters and has become a new landmark when coming into downtown Boston. From Boston's Central Artery project, we understand how the U.S. government dealt with such a large-scale project, and is worth the public sector in Taiwan to learn and reference to when handling similar large-scale urban transformation projects.
- A. The principles are as follows: Making process public – After filing its application, the competent authorities fully respected the views of the public. There were many opportunities for the public to participate in the discussions and express their views, thereby being able to collectively gather everybody's ideas and comments.
- B. Full government support - The competent authorities of different scales of transportation projects are defined clearly by laws. The central government is responsible for building, maintaining, and reconstructing of highways and general roadways, as well as the sections of the city's main roads connecting to these highways (approved by the central Department of Transportation). When using the central government's funds, the local government is required to provide matching funds of 20% of the total; local fiscal expenditures for transportation construction projects are often related taxes and fees charged to residents, thereby implementing special funds for specific use.

- C. Demolition and compensation issues – the works that was conducted before the “Big Dig” project raised quite a few compensation disputes. Therefore, learning from this experience, the Boston government did not expropriate any civilian residential property during the whole project, but did involve some enterprises. In the end, final compensation was smoothly resolved through legality.
- D. The importance of engineering quality – the long duration of the Big Dig project is related to the thoroughness and dedication that Americans have towards work. The prior works allowed the people of Boston to realize that urban construction can not be taken lightly. Therefore, they did not rush construction for the sake of saving time, but preferred to ensure quality as their top priority. This concept for long-term projects should be respected.
- E. Full disclosure of the entire construction project - the Boston Government set up a special website so that any citizen can query about the construction planning and progress and what has happened each year. They can also express their views and opinions on the website as well. Furthermore, people can browse through pictures of the workers undergoing construction, and even see if anything special was dug up during excavation. This helped to increase the public's sense of involvement.
- F. Astonishing results from the reconstruction - significant improvement in urban transportation, re-building of urban space and appreciation in real estate value.

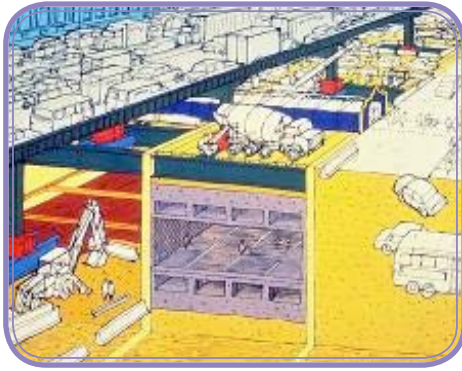
Photographs of the Mass DOT Office Visit



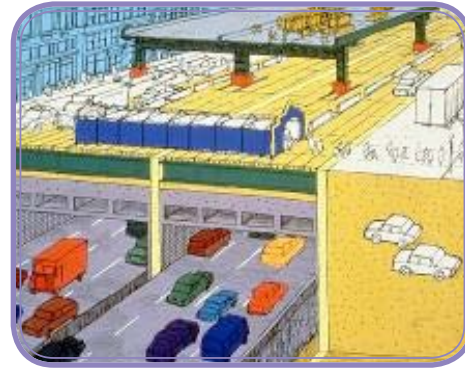
Central Artery before improvement



Central Artery after improvement



Tunnel construction schematic diagram



Schematic diagram of tunnel after completing removal of the ground overhead



Comparing the Central Artery before and after improvement



Green Belt after improvement



Overlooking the Zakim Bunker Hill Bridge



Photo taken underneath the Zakim Bunker Hill Bridge

- (4) The U.S. FHWA has launched the Long-term Bridge Performance Program. During the next 20 years, the nation's representative bridges will be inspected, recorded, evaluated and periodically monitored by advanced technology. The information collected can increase the understanding of the long-term performance of bridges, and then feed back to the original design so that later designs can be improved. This concept of a full life-cycle view of the various stages of its facilities is also being actively promoted by the Ministry of Transportation. I believe that the experience and forward-looking

planning of the U.S. in this regard is worth learning by the engineering sector in Taiwan.

- (5) In comparison of the Bridge Scour Real-time Monitoring System, the U.S. is currently focused on utilizing climate data to estimate bridge scour conditions, while Taiwan is establishing real-time scour depth, flow velocity and water level measurements during a typhoon's floodwater period to determine the immediate safety situation of our bridges. Therefore, Taiwan's scour monitoring method is more direct and more reliable. However, domestic highway units have been gradually moving toward using regional early-warning models such as accumulated rainfall to replace the onsite bridge monitoring, which greatly increases the warning time.
- (6) Due to lack of manpower, Our Bureau outsourced the testing works to external specialized vendors, resulting in the problem of inadequate expertise within the engineering unit staff. After the retirement of the senior engineering staff, the lack of expertise and technical experience to oversee the outsourcing vendors will quickly surface. How to conduct on-the-job training to enhance the expertise and technical skills of the Bridge Maintenance Engineering Division is a problem that needs to be considered in the future. At the same time; how to improve the quality of the testing vendors and their personnel is also a topic that needs to be handled carefully as we face the increasingly serious problem of the deterioration of our bridges.

2. Recommendations

- (1) Continue to proceed the interactions of Taiwan-US bridge engineering technology: During the eight years of bridge engineering seminars between Taiwan and the United States, the two sides have made substantial and in-depth exchange in technology and experience. The two sides have shared their experiences on how to improve bridge conditions and standards of service, and mutually explored advanced technology through research, development and training. If the scope of technical exchange can be expanded, such as sending staff to the United States to visit or take training on specific topics, then a more solid foundation and smooth channel can be laid out for future official Taiwan-US engineering and technological



exchanges.

- (2) Professional training for engineering staff: Due to the lack of manpower and the outsourcing of works, the professional competence of the government's engineers in the future is clearly deteriorating. Training for related personnel should be strengthened. Staff can be sent to the U.S. or other developed countries through the technical exchange channel to visit or participate in the training of new technologies and concepts. As for the training of newly hired employees on their current technical skills, requiring education and training or collaboration projects be included in the commissioning contract is an option that can be considered, or providing colleagues with actual design, testing or monitoring and supervision experience. Another option is to do some of the testing, design or monitoring and supervision operations by ourselves in order to achieve the results of training.
- (3) Strong support from domestic engineering academic units: Taiwan and the United States have already established an ongoing technical exchange platform. Through the research of human resources and high quality research institutions, corporate entities and U.S. research agencies, not only can the results of technical exchanges continue to accumulate, but also avoid the problem of the exchange activities being affected if the official hosts are changed or replaced. However, if this mechanism is to be sustained, then in addition to the continuing involvement of research institutions and corporate entities, support and promotion from government project agencies, academic institutions and Taiwan's large consulting companies must also play key a role in the sustainable development of this mechanism.