IX. Investigation Trip Abroad and Research Report.

1) Overseas Transportation Construction Survey Report

(1) Preface

A Taiwan representative group of 14 people, representing The National Freeway Bureau, Directorate General of Highways, National Expressway Engineering Bureau, Taiwan Construction Research Institute (TCRI) as well as academia and design consultancies participated in the 4th Taiwan-US Bridge Engineering Workshop. The US representatives of Federal Highway Administration (FHWA), Turner-Fairbank Highway Research Center (TFHRC) and the New Jersey Department of Transportation (NJ DOT) together with TCRI in Taiwan side organized the workshop. This is a chance for the members from Taiwan to participate and share findings in recent bridges seismic assessment and retrofit technologies as well as advanced construction

materials such as self compacting concrete (SCC), sustainable highway construction planning and experiences to increase capacity, to improve operation efficiency and reduce resources consumption when constructing new highways. 9 articles were reported from Taiwan side and 13 articles were shared by US side in the field of bridge technology. After the workshop, the team took time to visit New York City, New Jersey, Virginia Bridge and Highway Administration Units.

Through this excellent medium, the workshop provides not only an opportunity for the private and governmental units from Taiwan exchange technical knowledge and support with our US partners, but also to provide our engineers with a global perspective in terms of construction planning, design, construction and maintenance.

(2) Survey process

a. 2008 Taiwan US Bridge Engineering Workshop

The 2008 Taiwan US Bridge Engineering Workshop was held for 2 days in Princeton, New Jersey. On the opening day FHWA Bridge Technology Office Director Mr. Myint Lwin and our deputy director general Chen made opening speeches. This was followed by TFHRC Dr Phillip Yen and TCRI vice president Dr. Li-Ping Hsu whom made short introductions leading to the beginning of the workshop. Topics covers bridge project plan, design, construction, inspection and maintenance, multi-hazard mitigation, intelligence network, and advance material.

These 2 days, both sides exchanged valuably knowledge and experiences, and came to the following agreements:

(a) Taiwan and US will work together to develop a bridge failure database for earthquake, erosion, typhoon and flood disasters and cooperate with Dr. George Lee for further information.

(b) Establish a bridge safety inspection, monitoring and evaluation SOP and will be followed up in the future.

(c) Exchange results and finding on seismic assessment and retrofit of bridge.

(d) Accelerated Bridge Construction Technology Research currently in progress and wish to continue further cooperation and development.

(e) Exchange experiences with each other in the use of SCC.

(f) Develop crossing the known fault bridge design strategies.

In the near future Taiwan group will provide research results of bridge seismic assessment and retrofit and SOP for bridge safety inspection, monitoring and evaluation to TFHRC for comments and suggestions by US partners. We wish to establish a database within a year to exchange information and to begin cooperation plans.

Workshop meeting room

Group photo of representatives

b. Visit Schedule

(a) Survey New York Bridges Works

New York City is surrounded by the Hudson River. The bridges structures are usually massive steel arch bridges. This advantage is beautiful in shape, but disadvantage in maintenance, particularly corrosion prevention. In bridge field we noticed severe corrosion which requires painting and couldn't maintain due to limited budget. It is a big issue for the NYC DOT to maintain bridge safety.

(b) Visit to the New York City Department of Transportation

The visit was highlighted by the chief of inspection and management Bureau in Bridge Division Mr. Bojidar S. Yanev's seminar on New York City Bridges: Network and Project management. In the seminar he explained how an old city such as New York City manages to maintain bridges requiring annually 90 million USD with a budget of 60 million USD. In a limited budget, the establishment of how to inspect evaluate and maintain bridges is an important issue. This is essential for the inspection to be precise and consistent in order to prioritize and allocate budget.

(c) Visit to New Jersey Turnpike Authority

On this visit we listened to the presentation on the New Jersey Turnpike Interchange 6 to 9 Widening Program. The project includes a 35 mile road widening, which entails an expansion of 3 lanes per side on the existing 6 lanes by dual turnpike roadway method.

Sections of interchange will also be widened and this requires cooperation from the surrounding residents. The complex legal and civil rights law for land use was contracted to professional organizations, allowing the Turnpike Authority to concentrate on inter state negotiation, public participation, environmental protection and project management. As this project involved many government agencies, interest groups and companies, one of the key factors to achieve it is the coordination and integration of works between those agencies, groups and companies.

After the presentation, the team visited the New Jersey Traffic Control Center, to survey New Jersey's coordination of traffic control in the state. It is interesting to see the New Jersey Department of Transportation working in the same office building with the NJ Turnpike Authority and the State Police, allowing for on site discussion for issues and their coping strategies.

(d) Visit to the Woodrow Wilson Bridge Construction

The project will widen the original 6 lane to 12 lane bridge, with 2 lane specifically for HOV to encourage public transportation or car-pooling, relieving growing traffic load. The bridge also provides sidewalk and bike lanes to provide more services to the users.

(e) Visit to Turner Fairbank Highway Research Center

The Center is FHWA's research branch, the visits includes surveying steel structure Lab, Ultra high Performance Concrete lab, Non-invasive analysis lab, water movement and wind testing laboratories as well as outdoor reinforced earth abutment and pavement loading testing sites. One item of interest was the famed collapsed Minnesota Bridge which was suspected of sabotage and was sent to the Center. The team gets a chance to observe the failure bridge pieces.

(f) Visit to Washington DC and Virginia highways.

The team has a chance to see up close the local road facilities and operations. We find the US North Eastern area are subject to high temperature changes between seasons and this often causes cracks on the highway. Instead of re-pavement the roads, a polymer resin was injected to repair the cracks. The repaired road still maintains a high degree of surface smoothness. In addition, no marks are put on the roads to endure drivers comfort during lane changes.

(3) Thoughts and Comments

This survey was arranged by private research institute (Taiwan Construction Research Institute) to allow a platform for government and private engineering units to cooperate and exchange findings with the United States government and research organizations. Each year the participants take turns as hosts to a workshop and discuss new findings and exciting proposals. Both parties then can formulate a consensus and share in the results. Currently, the running of the technique / information exchange mechanism is smoothly; and further, by using private research institution as contact window, the exchange of ideas can then be not influenced by unnecessary interruptions.

Currently, the Ministry of Transportation and Communications has sponsored many institutions to conduct various researches on road engineering, but do not have research laboratories of its own. For short term topics for local roadwork, sponsorship may provide a good source of information. However, in the long run, the Ministry should take consideration of the necessity for setting up a standing research institution, similar to the Turner-Fairbank Highway Research Center which is affiliated to US Federal Highway Administration to conduct long-term researches on relevant issues. This will not only elevate our knowledge but also provide the numerous researchers in our nation a place to demonstrate their abilities.

2) Special Report on the Safe Migration of Purple Crow Butterflies.

(1) Introduction

During the winter, Taiwan's Purple Crow Butterflies (PCB) gather at valleys in the South and migrate towards central and northern Taiwan during the Spring. This behavior is similar to the Monarch Butterflies of Americas, which migrate from Canada to the Mexican valleys for the winter. The book "Butterflies", published by British Museum in June 2003, recommends Purple Crow Butterfly Valley in Taiwan and Monarch Butterfly Valley in Mexico as the two largest "over-winter butterfly valley".

At the beginning of March 2007, The Bureau received information from I-Shou University regarding the migratory flight path of the purple crow butterflies (PCB) crossing over Linneh section of National Freeway No. 3. The butterflies require flight path guidance to minimize damage caused to the butterfly population. As a part of the environmental protection initiative, the Bureau formed the PCB migration protection promotion task team and actively began the environmental protection of PCB through the "Give way to butterflies" promotion. Bringing international media's attention and raise Taiwan's image for natural conservations. Attention at home and also for PCB ecology and migration behaviors to the public.

(2) Process and measures taken by the Bureau

This year we continue our PCB migration protection initiatives in Linneh section of national freeway No. 3 the following process and measures were taken by the Bureau:

a. Establish an Alarm System

In order to stay informed with PCB migratory information and close traffic lanes before the butterfly crossing and minimize casualties. This year the bureau has install early warning mechanism operation.

Observation of PCB migratory movement.

b. Closing of the outer lanes of the freeway in the peak migratory duration

According to the research of 2007, traffic speed reaches 100 km/Hr in Linneh section outer. During high migratory volume of around 500 butterflies per minute. The drivers find the butterfly highly noticeable. In order to minimize butterfly damage and road users right, when butterfly crossing volume exceeds 500 PCB per minute, the outer lanes of the freeway are closed. The closed section was extended from 251k+700-252k+300 to 251k-253k, further reduce the impact of the freeway to the butterflies.

Closing of the outer freeway lanes during peak migratory time

c. Protective nets experiment

The setup of protective nets along bridge and road embarkments have raise the flying height of the PCB. To improve the effective in raising the flying height of PCB and minimize PCB with traffic in the 2007 experiments. The experiment also found some butterflies crossing the nets will lower their flying height or be blown off course due to wind and traffic turbulence. In order to raise the protection of the butterflies migration, this year the Bureau installs of the protection net raises to 4 meters and adopts a continuous mounting method, also establishing on north bound freeway No.3 at 252k+100~251k+700 outer sides protection columns, among them, the bridge segment 300 meters, embarkment segments are 100 meters, adding up to 400 meters, having already completed mounting currently.

Fencing to raise butterfly's flight heights.

d. Roadside embarkment trees

In addition to guiding the butterflies flight path, the ascetic and environmental improvement by using guidance trees is the best solution. Before these trees reach to suitable heights, netting are still setup on the embarkments. The Bureau has selected 150 local trees with 2.5 meters height and 100 bushes with 100x60 cm height were plated, with 350 trees in total along with west side of Chingshui Bridge westwards.

At roadside embarkment, cultivate trees so as to guide PCB migration.

In order to promote and arouse the interests of PCB, to establish the correct ecology protection ideology toward the public. The bureau has held one educational training workshop and two Specialists seminars to incorporate learned information and concepts.

2008 PCB Specialists Seminar

The comparison of PCB migration protection works within 2007 and 2008

Work	2007	2008
Setup of Protection Nets	1. Road embarkment section: 2.5m and 3.5 m high 20m netting. 2.Bridge section: 3.3m high and 50m long nets	1. Road embarkment: 4m high 100m net. 2. Bridge section: 4m high 300m nets 3. Continupus fencing between the bridge and road embarkment nets.
Outer lane and road shoulder closing	1. 1600 meter section: 252k+300 Chingshui Bridge section 2. Closing condition: Butterfly volume reaches 2000 per minute.	1. 2 km section: 251k+000-253+000. 2. Closing condition: Butterfly volume reaches 500 per minute.
Planting of guidance Trees	none	1. 50 meters south of Chingshui Bridge. 2. Trees: 150 2.5 high trees. 3. Bushes: 100 60cm high *Seashore ardisia*, 100 100m *Ardisia*.
Under bridge guidance experiment.	1. Under bridge ultraviolet light on work frames, 6m wide and 3.6-5.4m high and 18m long, totaling 100 UV lamp rods. 2. Simulate transparent white sash.	Lined light rods placed under the bridge: 25m high, 17m wide. The light rod is 1.2m long and ar5e arranged thus: 400 sets of light 7m distance on the ends of the work frame and 50cm distance between light rods at the centre of the frame
Others		Conducted “Road ecology works and PCB ecology seminar ”

(3) Observation and result

According to the researchers of Taiwan Ecological Engineering Development Foundation studies, National Freeway no. 3 Linneh section experienced peak PCB migration from March 22nd to April 7th. Migration volume from March 25th to April 5th reached 1000 per day. Peak migration was observed in March 22, 27 and April 4th to 6th to 500/ minute. Other times are smaller migration groups and was lowered to below 100 per day after April 10th. Compare to last year's result, the peak migration time did not differ significantly to this year. And peak volumes were obsere3vd in both March and April. The daily pattern begins from 8 am and reaches greatest migration volume by 10-12 am, peaking at 11:30am.

Weather condition is an important factor of PCB migration. During spring migration period, there are 6 medium peak volume (500 butterflies/ minute) were observed during warm and clear days. This is the alarm mechanism which can support the decisions of closing outer lanes and provided 70% of the butterflies a safer condition to cross the freeway.

Protective nettings were increased in height and length compared to 2007 and the condition for closing outer lanes and road shoulders are lowered to 500 from 1000. In addition, the planting of guidance trees, reducing the casualties rate for medium peak butterflies migration by an estimated 2.35%.

(4) Conclusion

The initiative of the Bureau has stirred up responses and reports. International media such as UK BBC and Japans Asahi Shimbun have both reports of Taiwan's PCB migration protection, which provides a positive image of Taiwan conservation movements. Inside the nation, a purple crow butterfly trend is growing in popularity, cultural publishing and academics are all contributing for the citizens to learn and to know our beautiful and precious ecological resources. To promote conservation concepts nation wide.

Bureau Chief Interviewed by UK BBC

The Bureau will continue to do their best in other PCB conservation methods, aiming to lower PCB casualties and maintain our reputation as the butterfly nation. All fellow colleagues working in this project are honored and give their best to their tasks. The Bureau looks forward to changing our mindset from traditional construction works to the overall ecosystem of the freeway and it surrounding lands. Aiming for a non-invasive construction techniques where we will not destroy nor disturb the existing natural systems. By using a little more patience, we can reduce casualties to the PCB and perhaps enhance our national image at the same time. By giving way to the butterflies in site where the freeway meets nature's highway, millions of butterflies will show their beautiful dancing in return.