

## Research and Development

### 1) Remarks on the 15th Cross-Strait Urban Transportation Conference

Senior Specialist Lin Jhi-Jie

#### (1) Preface

The conference was held on August 24th-27th, 2007 in Fujian Agriculture and Forestry University, Fuzhou City, Fujian Province. The theme of the conference was to discuss the integration of urban and country traffic. Over 200 persons from cross-strait industrial, government, academics, and research sectors attended the conference, delivering 108 topics. After the conference the group paid a visit to the local scenic spots and cities. The conference was of great assistance to the improvement of cross-strait academic exchanges and transport services. The author had the honor with the approval of the Ministry of Transport and Communications to attend this event and shared what he learned from the conference.

#### (2) Overall Construction and Developments

In recent years, the mainland has been growing quickly, particularly in view of the up coming Olympic Games. Driven by the forces of the development of enormous internal market, the cities along the coast are growing exponentially. Although we only visited 4 coastal cities in the Fujian Province (Fuzhou, Putian, Quanzhou, Xiamen), we get an understanding of the rest of China's progress. The following economic development of China will arise from the coast inwards into inland river harbors. By holding the advantage of vast undeveloped land and low prices, the potential for development is huge. Like a locomotive, once China begins to gain its speed, there is very little to stop it. Taking the 4 cities we visited as an example, buildings of 7-20 floors raise up beside the roads to reflect the migration of country people into the cities, just like Taiwan in the 1980's when economy was at a boom. However, their living qualities and cityscapes seem to be better than ours, thanks to cheap, plentiful national lands, lack of Earthquakes and Typhoons, cheap building materials and advanced construction technologies from overseas, allowing China to leapfrog in their progress of economic development and reduce costs.

#### (3) City Transportation Constructions

Taking Fuzhou city as an example, where situated between China's 2 major economy zones (Yangtze River Delta and Jhu River Delta) and Taiwan Economy Zone, and gained a great potential for development. Currently it exercises jurisdiction over 5 districts, 2 cities, and 6 counties, with a total area of 1043 Km<sup>2</sup> and 2.04 million people. Fuzhou city is also a provincial city with sea (and river), land (rail and roads) and air transport. The main axis of traffic is land transportation. The basic formation is centered on Fuzhou urban area, radiating with three national highways, two freeways, four urban highways, and eight

provincial highways as its highway network. The management system is divided into 2, the City Construction Committee on public transportation (based on public interest and aided by profitable interest) and the City Transportation Bureau on transportation market (based on profitable interest). In response to the need of integration, recently there is a movement to combine the two sections. Traffic volume consists mainly of public transportation (buses) trips. Taxi and passenger cars are not the major mode of transportation. Motorcycles and bicycles are the majority transport in the city and in view of the leaping growth rate, passenger cars will soon take over as the main traffic role in the next 3-5 years. This will become a bottleneck for the city's traffic development. To solve this problem, it should spread city development through major lines of network to form satellite cities as well as improve mass rapid transportation system, and utilize better transport control software and transportation system management (TSM) measures.

#### (4) Freeway Management

Currently, the Fujian Province has two major Freeways: the Shenhai Freeway along the south-east coast and the Fuyin Freeway and the Fuyin Freeway along the north-west mountain. The total length of these two major lines is about 2000Km. They intersect at Fujian City. Currently there are numerous other freeway projects under construction and planning. As the Freeway is a closed system, tolls are collected by distance though toll stations in the interchange sections. Other national highways which are not closed utilizes "toll collection on times" . Differences in cost of construction are reflected on the different tolls paid, For example, the freeways along mountains have a higher toll compared to the freeways along coast. The cost is 2.5 time Taiwan's toll for small vehicles and the rates are divided into private or commercial usage, the sub-divided in to 5 categories. Trucks are divided by tonnage to reflect road maintenance costs. Therefore although the cost is greater, the rates are fairer in regards to the vehicle driven. There are less vehicles on the Fuyin Freeway and its service quality can be graded as a B. while the Shenhai Freeway has a much greater traffic volume but still maintains a D grade services. However, the Shenhai Freeway has only 2 lanes. Judging from Taiwan's experience, its service quality will soon deteriorate in to E, F grade in 3-5 years. Therefore, much is needed to be done to accommodate to the demands for transports in the south-east coast regions. In terms of engineering standard, the author can sense that the level degree of the freeway surface is a lot worse than that of Taiwan, It is often seen that of workers are scalloping road surface to pave new roads. They even close whole lanes and conduct vehicles to be driven on the lanes in the opposite direction. Therefore the author feels in the fast growth of China's economy, there is still much refining to be done in many practices.

#### (5) Conclusion

Mainland China has, under free trade flourished and is learning from Taiwan's past experiences to improve their economy. How to increase this lead by Taiwan is a question that all departments need to consider.

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2) Report on the Participation of 75th Annual Meeting& Exhibition of 2007 International Bridge, Tunnel and Turnpike Association.

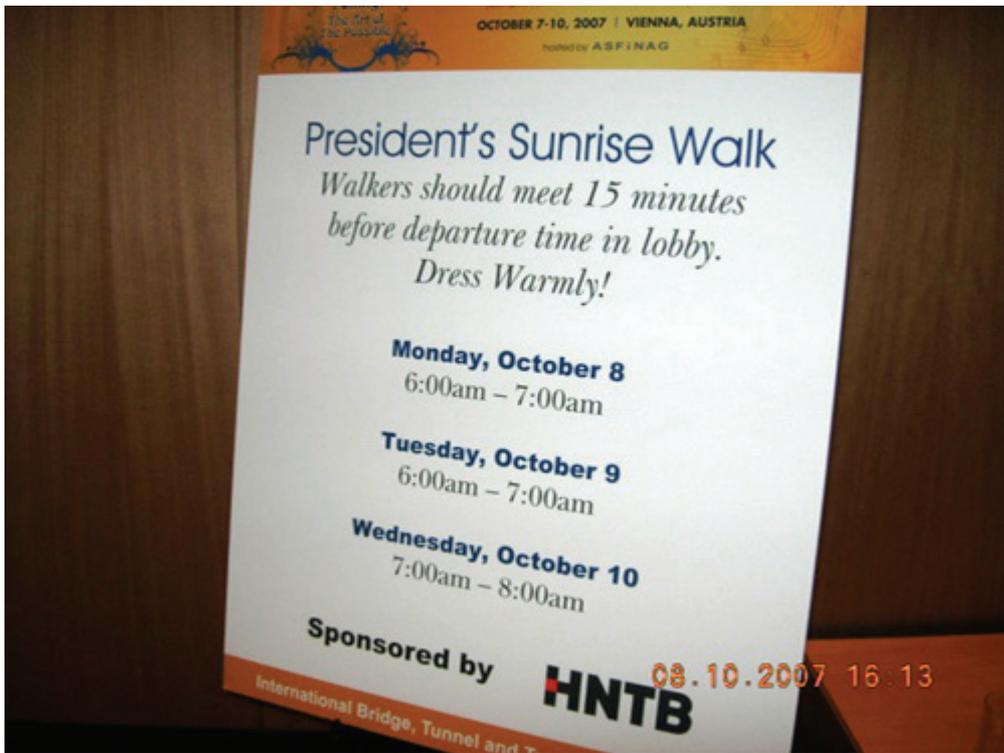
**Head of Planning Section, Technical Division Lin Bing-Song**

(1) Preface

IBTTA (International Bridge, Tunnel and Turnpike Association) opened their 75th Annual Meeting and Exhibition in October 11th, 2007. The purpose of this meeting is to share and compare toll collection technologies and the experiences of operation of toll collection equipments between the United States and Europe. Therefore, this meeting can be regarded as a forum between the US and Europe on toll collection operation experiences and technology development in this field.



Greeting Playbill of conference site



Conference Agenda



Conference Scene



Conference Scene



Conference Scene



Display Stands



Display Stands

Aparting form the US and Europe representatives, Japan, China and Taiwan from Asia all have representatives. With the advance of the electronic toll collection system in Taiwan, the author was appointed to attend this meeting in the hopes of learning from experiences from counterpart countries for any assistance to Taiwan's ETC system.

(2) Thoughts and Suggestions

- a. The 5 day meeting past quickly. Articles and research reports released in the meeting were focused on how to enhance road toll systems, traffic control and their technologies. For convenience to the road users, the ITS system will combine credit card for all options such parking, paying fees, transferring to other transports , giving the road users freedom to travel with only a card in their pocket.
- b. Traffic transport is the artery of a nation. All nations have demands to alleviate their traffic and freeway is a great method to solve this problem. Weather it is a developing nation needing to complete its freeway system or a developed nation facing the problems of congestion. Traffic construction will never catch up to the growths in vehicles. One thing in common with all nations is the source of funds for further development and toll payment is has always been an answer. This is an international trend and prevents further drain on taxpayer's pockets.
- c. The major members of International Bridge, Tunnel and Turnpike Association (IBTTA) are road toll collection units from all over the world as well as toll equipment and related industry companies. The association's key objective is for the exchange of toll services experience and technologies. Judging from the basic arguments of the IBTTA on toll collection, the author thinks they can be served as the reference to ratify on the Freeway toll collection in Taiwan, which will be explained as follows:
  - i. There are no free highways - Only a matter of deciding to collect tolls or not to.  
The planning, designing constructing, running and maintenance all require costs. The key is whether the road user pays or for the cost to fall to the tax payers. By choosing to make the road users pay, the drivers enjoy a service that they paid for directly and it is a direct and simple method of collecting these funds.
  - ii. Highway tolls are not a tax- It is payment by users  
The road users have a choice to pay for the services that the highway offers, and it is only paid when used, whereas Taxes are not avoidable, and everyone has to pay.
  - iii. No one wants to line up to pay money. Some road users are willing to pay the tolls, but are not able to withstand the waiting in the toll stations. Electronic Toll Collection (ETC) can fix this problem and save fuel and man-hours, giving the road users another choice n the future.
  - iv. Many representatives feel that their national incomes are incapable of keeping up with the costs for road constructions. Thanks to the public awareness that toll collection is necessary and widely accepted that this source of income can continue to support new constructions. According to the IBTTA surveys, some road users are not against toll service but the waiting to pay the tolls. Therefore ETC is the future of road tolling and is being actively pursued in the US and Europe.



### 3) Investigation Trip Abroad and Reports on Traffic Construction

**Head of Engineering Section, Widening Construction Office Gao Ming-Jhi**

#### (1) Preface

Due to Taiwan's unique landscape, the planning of a new road often have to take into account of existing freeways, expressways, rail as well as topographical

conditions such as rivers and ravines. Aside from structurally functional bridge designs, they must also blend with the surrounding landscape to show characteristic of the design as well as become a new landmark in the region. Currently, the freeways and the expressway on western Taiwan mostly cross some major rivers and the simplest solution is to build elevated bridges. This method is usually the most economical as land purchases are minimized. However, with increased complexities in bridge design, the upcoming maintenances and related technologies are correspondingly increased.

The Bureau has always stressed the need to combine functionality to environmental friendliness, and tries to avoid bring impacts to natural ecology, transportation with considerate construction methods. Further, for those long spanning bridges, domed bridges, cable-stayed bridges, steel bridges and other bridges that are more integrating into local features are gradually replacing common I-shaped concrete bridges. The bridge engineers are usually tending to use comparatively conservative bridge designs due to the responsibilities of public safety and short budget, which results in standardized bridges everywhere, and further diminish the professional public images of bridge engineers.

The audition this time is to understand firstly the structural functionality of improvements of long spanning bridges in the US as well as detailed designs that takes into account of disaster prevention and emergency response process during work. We should also learn from their experiences to improve working technical quality as well as improve environmental conservation.

## (2) Visit programs

### a. SURVEY LAND SLIDE IMPROVEMENT WORKS IN DEVIL' SLIDE, CALIFORNIA :

Devil's Slide is situated on California's No.1 Highway, between the major route connecting Montara and Linda Mar. Built in 1935, the road frequently suffers from falling rock during the rain seasons. In 1995, the road was severely stricken and closed for up to 158 days. It tool almost 3 million USD to repair the road.

On April 2nd, 2006, heavy rain caused severe crack to the road surface due to another collapse. It was re-opened in August 2006 after repairs and reinforcement to the slopes. A special to note was in response to local residents and environmental groups, the slopes were painted with similar color to the landscape to blend the reinforced slope to the surroundings.

The Devil's Slide Project is a twin tunnel project. Each tunnel is 30 foot wide and 4200 foot long, 1 single lane plus a road shoulder lane. The project is executed in New Austrian Tunneling Method with a total budget of 180-200 million USD. The work period of the project is about 24 consecutive months. At the south of the tunnel, the road will be straightened to provide safty in entering and exiting the tunnel. One quarter mile road subgrade will be constructed with reused soil. The project will be completed in 2011 and separate current highway in to 2. The pre-existing 70 acre of land will be converted for parking and tourism purposes. The supervisory task falls to California Department of Transport (Caltrans) during the whole construction period.

At the North, there are 2 elevated bridges each with a total length of 1,000 feet connecting No.1 Highway. The elevated bridge has a main span of 445 feet, bridge columns of 125 feet tall and cross the valley at Shamrock farm. The structure of the bridge is in box girders and constructed with cast-in-situ balanced cantilever method. The project will take 40 million USD and 24 consecutive months and expected to be completed in 2008.

The most striking difference between The project engineering projects in Taiwan is that US has put much attention to the ecological protection during works. To prevent machinery damage to the surrounding scenes and fauna and flora, a clear zone is marked out by environmental specialists to ensure works do not exceed this region.

b. SURVEY OF BAY BRIDGE PROJECT :

The Bay Bridge crosses San Francisco bay to connect San Francisco and Oakland, with a daily traffic volume of 270 thousand vehicles, the bridge has 2 major sections that connect Yerba Buena, the isle in the center. The west section ends at San Francisco, including 2 suspension bridges and is connected by a tower between them. The east section ends at Oakland, including the section from Yerba Buena Isle to Oakland, which is a dual cantilever bridge.

c. TECHNICAL CO-OPERATION AGREEMENT WITH CALIFORNIA DEPARTMENT OF TRANSPORT (CALTRANS) :

On July 12th, 2007, the Bureau and Caltrans signed a technical co-operation agreement. Director General Lee Tai-Ming of the Bureau represented Taiwan and Caltrans's Deputy Minister Randell H Iwasaki (Minister Will Kempton was attending meetings and could not be present) represented the US side. The agreement hopes to improve seismic resistant construction, bridge building maintenance and testing technologies through visits and communications to improve public work safety and reliability for both parties.

The Ministry of Transport and Communications instructs the signing of this agreement. Caltrans showed their appreciation and responded to our honesty and sincerity. Currently, the agreement is mainly on engineering technologies, but we hope that in the future the range can be extended to other topics such as traffic management, financial management, tax, environmental protection, and BOT issues.

The agreement is significant to the Taiwanese people, in the climate of lacking official diplomacy between the 2 nations. Taiwan deeply values the agreement and the Ministry hopes to build upon this to the research units of Federal Highway Administration (FHWA), strengthening substantial cooperation with the United States.

(3) Suggestions and Conclusions

On this visit we met with officials in the Department of Transport, FHWA, and Caltrans, and major members of Chinese Transportation Association of Northern California and Washington DC. Though the meeting topics concerning transportation are discussed and are certain to be helpful to the promotion of future traffic policies.

In addition, the signing of the Transport Engineering Agreement is a valuable achievement with the fact that there is no official diplomatic relations between two countries. The Bureau will follow on to carry out exchanges with Caltrans to improve freeway technologies and we will invite our hosts to attend the 2007 Taiwan- United States Road Engineering Seminar 2007 and further strengthen cooperation between two countries.



Signing of Cooperation Agreement with Caltrans



Inspection of California San Francisco Devil's Slide Improvement Project (Bridge Construction)



Inspect California San Francisco Bay Bridge Marine Construction Operation Operating By Construction Ship



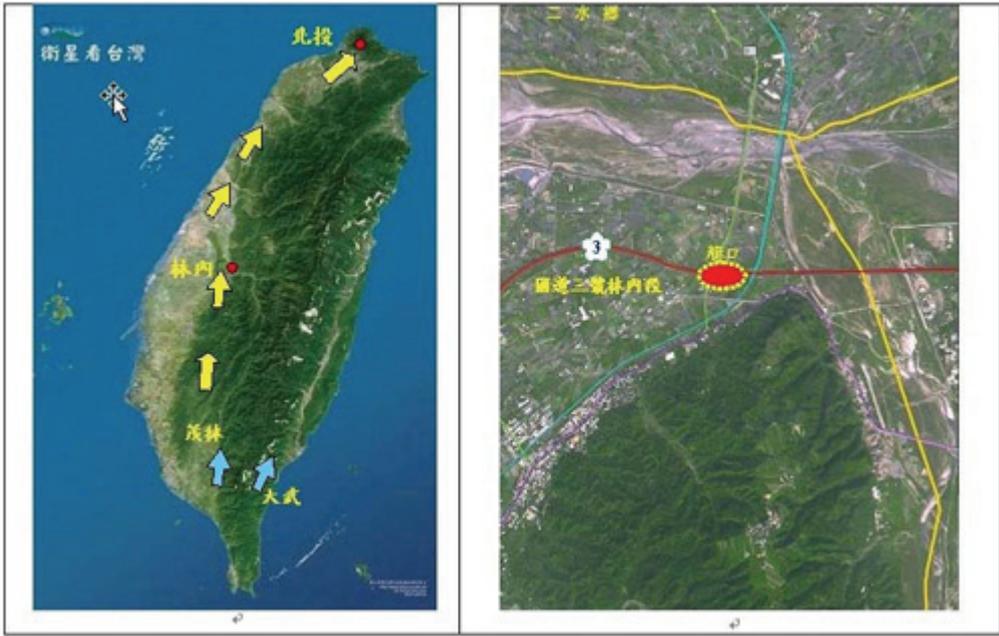
#### 4) Special Report on the Safe Migration of Purple Crow Butterflies.

##### (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" . Currently, the PCB stays in the Kaohsiung Maolin and Taidong Dawu region during the winter time. Further, the documentary film " Taiwan to the World Series - Butterfly Code" , a work collaborated by National Geographic Channel and the government Information office, is now broadcasted in over 160 nations world wide, making the over-wintering and migration of the butterfly a global conservation issue.

Western Taiwan PCB spring migration route (Picture 1).The pathway crosses Freeway No. 3 Linneh section, near Linneh Township of Yunlin County. According to researchers of Taiwan Butterfly Conservation Association, in April 3rd, 2005 an estimated 11,500 butterflies crossed this region each minute (Picture 2) and over 1 million PCB was estimated to migrate over this point that day. According to a investigation done by I-Shou University Department of Civil and Ecological Engineering in 2006, the traffic flow on freeway not only hinders the migration of PCB, it also causes some PCB casualties.

To reduce the freeway impact upon our butterflies, the bureau was actively involved in the conservation by the formation of PCB migration protection and promotion team (Picture 3).



Picture 1



Picture 2



Picture 3

## (2) Measures taken by the Bureau

According to the traffic volume and route of the PCB migration, the bureau took the following initiatives:

After the butterflies cross the road guards, their flight height was still too low. Therefore, during peak migration periods (with the exception of the Tomb Sweeping Festival) the outer lane was closed on the northbound direction to reduce the impact of traffic on the butterflies.

North-bound outer lane closed during peak migration volume (Picture 4)

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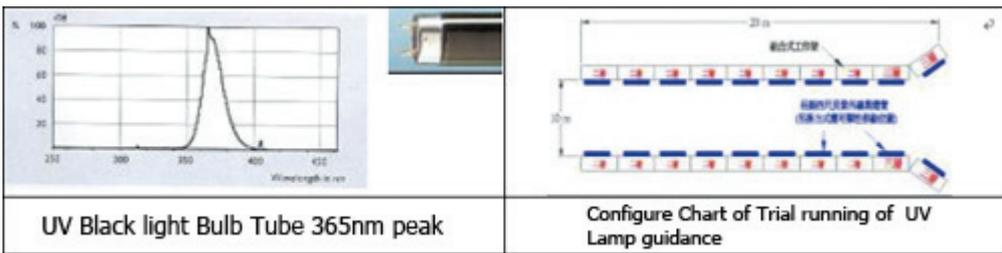
When the PCB reached Chingshui Bridge, they often opt to travel over the bridge and into the traffic. By placing UV lamps under the bridge, the trial running hopes to attract the butterflies to cross under the bridge.

Setting Protective Nets on Road Embankments (Picture 6)

To understand the effect of protective nets on PCB migration, the Bureau set up protective nets along the road embankments of west side of the Chingshui Bridge. Its length is 20 meters long, 2.5 meters high (later extended to 3.5 meters high).



Picture 4 The outer lane was closed on the Northbound direction to reduce the impact of traffic on the butterflies.



Trial running of UV lamp guidance (Picture 5)



Picture 6

### (3) Observation and result

#### 1. Higher Officers inspected PCB migration sites

Former Premier Su, his wife, Minister Tsai of Ministry of Transportation, and Magistrate Su of Yunlin County visited the Chingshui Bridge on April 6th, 2007 in person to listen to the presentation of the Director General. They showed their recognition to the Bureau's efforts in executing lessening measures and tests in the shortest and limited budget. They wished us to continue the measures.

#### 2. Result Analysis

Professor pointed out that due to the cold and wet weather during the observation period, the PCB did not migrate northboundly in peaks. As a result, the daylight florescent tubes didn't reach their expected performance. Hence, the Bureau adopted a different strategy. On April 2, 2007, a white screen was installed behind the trial site to try to attract the butterflies. However, due to weather condition, there is not enough data to determine whether the measure can efficiently guide the butterflies to fly under the bridge.

Only a small number appeared on March 29th, 2007 (200 to 300 butterflies per minute), but later tapered off to 20 to 30 per minute (only 1/10 of the maximum number).

According to experience, PCB from the Maolin area appear in numbers near Tomb Sweeping Festival to fly along the central mountain ranges and pass through Linnei region. However, with an unseasonably warm winter in 2006, the PCB migration to the South was late by about 1 month. By mid March 2007, PCB numbers in Maolin reduced significantly as they returned north. This is also influenced by the unstable weather before and after the Tomb Sweeping Festival of 2007, which may delay or alter the migration course.



2007/4/6 Former Premier Su inspected PCB migration scene



2007/4/6 Former Premier Su and County Magistrate Su had brief

#### (4) Conclusion

The Butterfly Protection Movement made the public aware of the Taiwanese Purple Crow Butterflies migratory pattern and to understand the important of ecological diversity. The government and citizens worked together to improve our

environment and setup ecological corridors and maintain our care to Taiwan's environment.

The Bureau looks forward to changing our mindset from traditional construction works to the overall ecosystem of the freeway and its surrounding lands. Aiming for a non-invasive construction technique 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 a little at the same time. By giving way to the butterflies in site where the freeway meets nature's highway, the millions of butterflies will replay us with their dance, year after year.

(5)Thanks

Most of the photographs and content were provided by Mr. 詹家龍 of the Taiwan Butterflies Conservation Society, I-Shou University Department of Civil and Ecological Engineering's Assistant Professor Cheng, Juey-Fu and Associate Professor Lin, Tie-Shyong. The Bureau shows their appreciation for their assistance and efforts.

