Summary of Discussions

Future activities

Call for paper for the International Bridge Conference, Pittsburgh. We hope to have more participation from Taiwan and be able to feature Taiwan in the future.

Recommendations from Taiwan delegation:

Short-term objectives:

1. Developing bridge multi-hazard database with failure cases from earthquake, scour, typhoon, and flooding. Coordinating with Dr. George Lee to get the necessary data format.

2. Establishing bridge Standard Operation Procedure (SOP) of Safety Inspection, Evaluation and Monitoring. Results of a soon-to-complete project will be sent to FHWA for commenting.

3. Exchanging the research results on seismic retrofitting (see Chiang’s presentation). The results will also be sent to FHWA for commenting.


5. Exchanging experience in SCC applications, environmental impact issues.

Long-term objectives:

1. Joining FHWA long-term bridge performance program managed by Dr. Ghasemi.

2. Exchanging the experience of developing Intelligent Transportation System.

3. Developing design criteria for fault-crossing bridges.

Recommendations from US delegation:

Items with common interest that can be further pursued:

1. Seismic Retrofitting.

2. SCC studies with abundant application data from Taiwan.


4. Accelerated Bridge Construction.

5. Developing a bridge seismic design strategy for crossing a known fault.
Short-term action: Sending those documents that need commenting to Phil Yen.
Long-term action: Developing inventory technique to exchange data among the group.
Initiate a cooperative project as soon as possible.

Self-consolidating concrete

- Ordinary concrete used in the past are found not well consolidated (insufficient vibration). SCC is rather a necessity than an option in the future.
- The SCC study sponsored by freeway bureau has yield satisfactory results. No further research is deemed necessary in Taiwan.
- Specifications may be in need for SCC. Relevant documents will be provided by both delegations for sharing.
- SCC has higher strength and higher stiffness (cheaper to produce high strength SCC). Cross sectional size can be reduced and ductility increased.
- The chemical additives have not shown negative long-term effect.
- Taiwanese development: TANEED produces SCC specifications for individual project. The production of such project specifications involves manufacturers. Manufacturers can usually come up with new additive formulas that satisfy the project requirements and compete in the bidding process. Showcase project was produced (Sun-Moon Lake) to increase contractor awareness. In the future, a chapter will be added to bridge construction specifications while design provisions will not be changed. One freeway structure has been instrumented and gone through an earthquake. The seismic performance was verified on this structure.
- US development: Use of SCC is determined by construction contractors. No requirement is set in contract, with a few exceptions (e.g. a drill shaft in Las Vegas). Seismic performance of SCC structures needs to be studied. There is a new NCHRP document for guiding the use of SCC to share with Taiwan.

Multi-hazard

- The current task is to develop a database for bridge failure due to different hazards in order to properly compare hazard level with respect to failure potentials.
- The data collection may not be very successful without FHWA/Congress mandate of turning in the failure data. The states may be reluctant to carry out data collection due to a lack of resource or legal concerns. FHWA also needs to specify items to be documented. The International Scan project had met similar challenge. A mechanism needs to be identified to obtain necessary data without releasing to the public.
- Data obtained from Long-term Bridge Performance Program may be included. Hopefully LTBPP will attempt to obtain quantitative data.
• So far the study is focusing on scour and earthquake. Landslide and wave force should be added in the future.

• Taiwan can contribute much of its abundant cascading events of different hazards.

• Possible method is personnel exchange. US may send people to Taiwan to determine what failure data to collect.

• Ministry of Transportation and Communication (Taiwanese counterpart of USDOT) can only work on the narrow area within the right of way. It may be necessary to coordinate with water resource agencies, as scour is the key for bridge failure. The freeway bureau will discuss among agencies and ask to have all disaster reported in order to assist the development of next generation bridge design.

• When the multi-hazard group is established, Prof. Lee will demonstrate the software developed in Buffalo to the group.

Fault crossing

• There are debates on design methods against surface rupture. UC Berkeley just finished one study on the fault-crossing issues.

• MCEER has proposed the development of earthquake resilience in mountain area since the Sichuan earthquake. We should wait for the report coming out before making any move on the fault-crossing issues. We can set fault-crossing issues to be part of long-term plan.

• After 1999 Chichi earthquake, bridges were often rebuilt at the same site using the same structural system. For bridges over surface rupture, the replaced bridges still crossed surface rupture. Question may be raised in the future for justification of such replacement. The fault-crossing study should therefore cover both old and new bridges, that is, include design and retrofitting. In some cases, the fault-crossing may not be known at the time of construction. This has occurred twice in California. Political pressure makes engineers rebuild at the same site with same system. We need to “engineer” the congress for changing.

ABC

• MCEER has joint study with NTU on ABC and roller bearings.

• ABC is urgent in Taiwan. Prof. KC Chang is studying foundation issues related to segmental pier construction. In southern Taiwan, expressway number 1 connector will go through the city. Viaduct using ABC will be necessary.

Seismic Retrofitting

• There is a 4-stage retrofitting plan discussed in Taiwan, with approx. NT$10 billion on each stage. Adequate criteria are needed.

• Research product of feasibility study will be sent to FHWA for commenting.
Inspection/maintenance/management

- The US is interested in how Taiwan uses NDE on inspection and may learn from it.
- Taiwan may be interested in participating in the Long-term Bridge Performance Program.

Environment

- In the past few years, environmental issues are very tough for both US and Taiwan. The US has developed the practice of sustainable bridges. It is helpful to hear more about individual cases.
- In California, environmental concerns have become a significant pressure on all types of highway projects. There is abundant experience to share.
- Education on sustainable bridges should be increased