UJNR Panel on Wind and Seismic Effects

Panel Update

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HIGHLIGHTS OF THE 40th JOINT MEETING US-JAPAN PANEL ON WIND AND SEISMIC EFFECTS

The 40th Joint Meeting of the U.S.-Japan Panel on Wind and Seismic Effects was held at the National Institute of Standards and Technology, Gaithersburg, Maryland during 19-21 May 2008 followed by three-day technical site visits to northern Virginia and Miami, Florida during 22-25 May. The Joint Panel Meeting centered on seven Sessions: 1) Geotechnical Engineering and Ground Motion; 2) Next-Generation Building and Infrastructure Systems; 3) Wind Engineering; 4) Storm Surge and Tsunamis; 5) Sustainable Design for Buildings and Infrastructure; 6) Dam Engineering; and 7) Transportation Systems. Twenty-three papers were presented during this meeting (11 from Japan and 12 from the US).

During the next 12 months, the Panel is planning two Task Committee Workshops:

a. Task Committee G, Transportation Systems, 24th US-Japan Bridge Engineering Workshop, September 2008, Minnesota, USA
b. Task Committee H, Storm Surge and Tsunamis, 5th International Workshop on Coastal Disaster Prevention, late 2008 or early 2009, South Asia or Japan.

The Panel dissolved Task Committee (TC) A. However, the Panel recognizes the importance of the mission of the TC and requested that the TC be reorganized and to refocus the Task Committee direction. Dr. Mary Ellen Hynes, US Department of Homeland Security has shown strong interest in the geotechnical component of the TC's mission and suggested that the geotechnical part of TC A be aligned with Task Committee C (Dam Engineering Structures). Also, the Panel dissolved Task Committee I on Fire Structure Performance.

The manuscripts, Panel Resolutions, and Task Committee Reports will be available in the Panel's Proceedings, *Wind and Seismic Effects* with an expected publication date of fall 2008. Information about the Panel is available at http://www.pwri.go.jp/eng/ujnr/ujnr.htm.

Group photograph of US-Japan Members attending 40th Joint Meeting of the Panel on Wind and Seismic Effects

Highlights of the Panel's five technical site visits in northern Virginia and Miami, Florida are below.

1. **Woodrow Wilson Bridge Construction Project**, Alexandria, Virginia http://www.wilsonbridge.com. This $2.5 billion Woodrow Wilson Bridge Project (design completed in 1998 and under construction since 2000) crosses the Potomac River south of Washington D.C. between Maryland and Virginia. It is under management by Potomac Crossing Consultants (PCC), a consortium of three firms: Parsons Brinkerhoff; URS; and Rummel, Klepper, and Kahl (RK&F). PCC is responsible for coordinating design activities, performing construction and quality control management, media relations and public interface, project controls, ensuring environmental commitments are carried out, and staffing the Woodrow Wilson Bridge Centers.

The need to replace the original bridge was based on an outdated bridge that opened in 1961 designed for an anticipated traffic volume of 65,000 vehicles daily. Traffic volume in 2008 has been 195,000 vehicles and in 2050 traffic volume is anticipated to be 295,000 vehicles. The former bridge required opening its draw span about 265 times annually for tall mast ships. The new bridge is about 20 m higher that reduces opening the draw span to about 65 times annually.

This 12 lane bridge parallels the old six lane (three lanes in each direction) bridge. Vehicle flow experienced sever bottlenecks as six lanes of highway traffic from interchanges at each end funneled into the bridge's three lanes. This 12 km highway/bridge project replaced 12 percent of the Washington D.C. Beltway's 100 km circumference ring road.

New Woodrow Wilson Bridge view looking south to Virginia

Thirty five contracts were awarded for separate sections of the Maryland and Virginia project in five Section Designs consisting of four interchanges (two each in Maryland and Virginia) and the bridge itself. The new bridge incorporates eight bascule leaves, each with a deck encompassing about 1100 m^2 with movable falsework for the bascule piers. The bridge with gossamer twin spans are supported by curving V piers. One bridge section was completed and opened in 2006; the second section opened on 31 May 2008. Eighty percent of the bridge is completed. As sections of the old Woodrow Wilson Bridge were dismantled they were recycled. Steel was used for the new bridge and concrete was used to construct fish habitats down river. The Project is sponsored by the Federal Highway Administration, Virginia Department of Transportation, Maryland State Highway Administration, and the District of Columbia Department of Public Works. The bridge was funded using 80-90 % Federal Monies and 10-20 % State Monies.

For additional information about the Woodrow Wilson Bridge Project review PowerPoint Presentation at http://www.wilsonbridge.com/powerpoint/0707-ProjectBrief.pdf.

2. **Department of Environmental Services, Arlington County,** Virginia, http://www.arlingtonva.us/Departments/EnvironmentalServices/EnvironmentalServicesMain.aspx. A visit was made to the County's Wastewater Treatment Plant where the Panel delegation learned about its new design and construction program that will upgrade their Water Pollution Control Plant, a 70-year old facility. Discussions about Arlington County's Development Initiative, Fresh AIRE (Arlington Initiative to Reduce Emissions) Initiative & Green Buildings, Transportation Planning, and two presentations from the Japan-side on Flooding Control and Post-Earthquake Emergency Management for Roads followed the Wastewater Treatment Plant visit.

Arlington's Water Pollution Control Plant Upgrade is required to accommodate Arlington County's population of about 225,000 residents and businesses that produce about 120 million liters of wastewater daily. This waste water treatment facility has been under construction since 2001. Its costs is about $570 million that includes modernizing an aging infrastructure, expanding the facility to better manage capacity issues, adding odor control facilities, and complying with new regulations in the liquid treatment areas. The new facility will treat about 160 million liters of waste water per day and will better accommodate high flows during wet weather. The county is working with neighboring residents to reduce the noise from a variety of construction equipment and diesel pile drivers (impact of the hammer on the pile and vibrations from the pile in the air) by using impact cushions, installing noise absorbing blankets in the aeration tank excavation, testing dampening devices on the piles to reduce pile vibration noise generation, and placing shrouds on the pile driving rigs.

Group Photograph of the Delegation at the Arlington County Wastewater Treatment Plant Upgrade

Other Arlington County environmental programs and initiatives were discussed. Arlington County's Infrastructure Development Initiative was started in 1961 following an assessment of the quality of life available in the county. During the past 45 years the County has worked hard to create an "Urban Village" environment that provides residents with shopping within a half kilometer radius of where they live. Five Urban Villages were created over the past 40 years that replaced outdated structures and buildings and created apartment and commercial buildings along the north-south axis over the Washington Metro System (Subway) that was completed in 1997. The Urban Villages provided the opportunity to revitalize the area and provides the five Villages a more traditional "Main Street" environment. The end results is an improved environment that provides a walkable "Main Street" for Arlington County through preservation, revitalization, and new development where people can live, work, and play. These five Urban Villages represent about 11 percent of the county. Continuing planning efforts are underway to revitalize other parts of the county and to evaluate the need to revitalize older portions of the existing five Urban Villages. Arlington County is committed to reduce green house emissions by 10 % by 2012 and then to reduce emissions by 2 % each year thereafter. As part of this program the County is planting more trees and providing free home energy audits and carbon dioxide detectors. The Arlington County Transportation System program stresses preservation and reinvestment in established residential neighborhoods, to pursue increased public transportation rider-ship programs, encourage fewer automobiles in these Urban Villages, provide more public transportation.

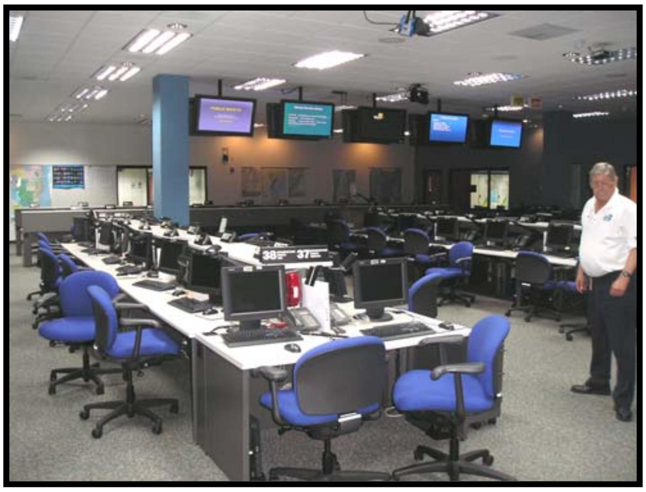
During this visit, the Japan-side presented papers on two related topics that shared related Japan technologies. The papers were:

- *Policy of River, Flood Control, and Large-scale Flood Countermeasures in Japan* by Koji Ikeuchi, Cabinet Office and
- *Post-earthquake Emergency Management for Roads* by Osamu Matsuo, PWRI.

3. **Department of Emergency Management and Homeland Security**, Miami-Dade County, Miami, Florida http://www.miamidade.gov/oem. The Miami-Dade County Office of Emergency Management (OEM) is a division of the Miami-Dade Fire-Rescue Department with responsibility to prepare the citizens of Dade County and the County and City agencies for large-scale emergencies and disasters. The EOC coordinates rescue operations and provides resources to address emergencies following disasters. During large disasters and emergencies, more than 70 agencies operate out of OES' Operations Center as they provide the necessary coordination and operations. OEM operates through three Branches:

- Public Safety Branch that includes the Police, Fire Rescue, Coast Guard, Marine organizations and others who provide the security and reentry into disaster areas;

- Human Services Branch that includes the American Red Cross, hospitals and health organizations, and others that provide evacuation services and the feeding and caring for disaster victims; and
- Infrastructure Branch including officials from the water, sewerage, ports, airports, etc. who are responsible for debris clearance, communications, transportation, energy, etc.



Miami-Dade County Emergency Operations Center

OES provides extensive GIS services to assess the damages and recovery and relief services needed following a sever disaster. Foe example, OES has the capability to identify grocery stores and gasoline stations with generators that can provide services to the public following a disaster; identify locations susceptible to damages; classify transit conditions of roads and highways; identify chemical industries and other industries having the potential to release toxic gases; and etc. The OEC operate with 25 staff and cooperates with nine Dade County universities, coordinates work with the surrounding county and local governments, and conducts periodic training drills working with the County's public and private organizations. OEC closely works with Florida Power and Light to monitor the nearby nuclear power reactor (Turkey Point Nuclear Power Plant).

4. **National Hurricane Center**, Miami, Florida, http://www.nhc.noaa.gov. The National Hurricane Center (NHC) is responsible for providing the current status of storms and future forecasts of their behavior. The Center operates with 46 staff and an annual budget of $6.4 million. NHC collaborates with international partners in the Caribbean, South America, and Pacific-rim countries, and informs key decisionmakers, the media, and the public to provide current weather information. Discussions centered on the National Oceanic and Atmospheric Administration's (NOAA) improved capability for forecasting and decrease in uncertainties and errors in modeling for forecast during the past 40 years. During the past several decades, the threat to US population has increased greatly with a larger percent of the US population living along the coast line. NOAA/NHC relies on the local municipal officials to disseminate data/information to their citizens. While NOAA includes updated data/information on their web pages, much of this data requires interpretation that can best be provided by local officials.

A Mini-Symposium was conducted with three presentations:

a). *Hurricane Impact Research on Physical Infrastructure* by Mark Powell, NOAA who spoke about improvements to storm intensity forecasting, diagnosis, prediction of hurricane impacts, improved forecasts, and understanding climate vulnerabilities. His NOAA research is performed with academia, local community officials, and commercial firm in developing adaptive observation networks by installing sensors in advance of the storm. He is developing new metrics for hurricane impacts and developing better communication tools to notify the public about impending severe storms and how to protect themselves. The public requires information to better plan for and survive severe storms. Despite excellent forecasting and warnings, people continue to act on their perceived vulnerability. Past experience influences people's perceptions about how to act during a disaster and those who experience significant disaster losses are more likely to act to reduce damages to their property and themselves in the future.

b). *Mitigating Wind Induced Damage to Roofing Systems in Japan* by Hitomitsu Kikitsue, Building Research Institute (BRI), Japan. BRI is improving standards for clay tile and steel roofing to better resist wind force. The Japan building code for earthquake load satisfies the requirement for resistance to wind-induced shear force on walls. Hence, design requirements for wind-induced loads are already in the Japan building code. BRI is testing a new roof tile that performs satisfactory to wind speeds up to 46 m/s contrasted to normal tiles and normal installation to wind speeds up to 30 m/s. Load tests explicitly evaluate wind resistance performance of roofing systems.

c). *New Engineering Research on Tatsumaki* by Yasuo Okuda, Building Research Institute (BRI), Japan. Dr. Okuda discussed new engineering research on flying debris, transient wind forces, numerical simulations of Tatsumakis (tornado-whirlwinds) and down bursts.

5. **International Hurricane Research Center, Florida International University**, Miami, Florida, http://www.ihc.fiu.edu. Following Hurricane Andrew of 1992, Florida International University (FIU) and Dade County worked in a public-private partnership to help rebuild Dade County. The creation of the International Hurricane Research Center (IHRC) at FIU was an outgrowth of the partnership. The IHRC is part of FIU's Civil and Environmental Engineering Department (CEED). Included in CEED is its Structures and Construction Testing Laboratory used to test full-scale structural members, components, and systems. The lab provides engineering and scientific support for forensic investigation, structural diagnosis, non-destructive testing and rehabilitation recommendations. The Laboratory consists of a 10.7 m x 19.8 m strong floor, 1780 kN test frame, 1201 kN and 672 kN fatigue actuators, and 1780 kN compression machine. Research includes performing:

- Seismic performance of bridge systems with connective and innovative materials,
- Evaluation of the performance of manufactured home roof decks,
- Testing for full scale roof uplift,
- Bridges health monitoring using NDEs,
- Scour monitoring,
- Studies on portable systems to identify heavy trucks on highways,
- Research to determine concrete performance.

IHRC is composed of four Laboratories, each addresses a specific area:

1. Insurance, Financial and Economic Research that defines the hurricane threat to the economy.
2. Social Science Research that studies how individuals and groups respond to hurricanes.
3. Coastal Research that quantitatively assesses vulnerability of coastal areas to storm induced beach erosion.
4. Wind Engineering research that investigates solutions to make houses and buildings more hurricane resistant.

The IHRC includes its "Wall of Wind" (WOW) full-scale test research facility. This facility tests to failure full-sized structures such as site-built or manufactured houses and small commercial structures. WoW projects are funded by federal and state agencies and private industry whose findings will help create a technical basis for developing risk-and performance-based design criteria and contributes to achieving more sustainable coastal communities.

Wall of Wind 6-Fan Research Facility

IHCR's Phase One, WOW in 2005 developed a two-fan system funded by the Florida Department of Community Affairs to test full-scale roof models under wind and wind-driven water conditions. In 2007, Phase Two designated, RenaissanceRe WOW uses a six-fan array. Each fan is powered by a 373,000 W engine that generates 58 m/s winds with water fed into the system to simulate wind induced rain. The engines can be controlled separately and vary engine speed to generate wind gusts. High-speed cameras monitor the effect of wind and wind-driven rain on individual building materials and full structures. Phase Three of the project, is a proposal to develop a 12 fan-array costing $5.8 million under a "Center of Excellence" grant from the State of Florida. FIU partners with universities in other coastal states for resources and also receives support and funding from private and government sectors. IHRC works closely with the National Hurricane Center located at the FIU University Campus. Their research addressed the relationship between roof edges and wind loads, determines causes of water infiltration, develops prediction and behavior of windborne debris, performs impact assessments, and develops the technical basis for improving building standards and codes for improved design and construction practices of houses and buildings.

Several presentations were made that highlighted IHRC research:

- *RenaissanceRe Wall of Wind Research – Making Innovations from Theory to Applications* discussed the Wall of Wind, full scale wind testing on structures, and simulation of wind driven rain to assess water infiltration. The WoW will be expanded from six to 12 fans having a capability of generating 63 m/s wind speed.
- *Wind Tunnel Initiative* addressed several wind tunnel testing programs and tests on the upper portion of the Burj Dubai Tower during construction with a Tower Crane.
- *Mitigation of Wind Loads on Roof Equipment* discussed reducing wind loads by shielding HVAC equipment on roofs.
- *Water Suppression Research* discussed water suppression by aerodynamic eddy shapes.
- *Computational Blockage Assessment for a New Full-Scale Testing Facility* that reviewed optimum size specimens that can be tested in the WOW facility and suggested solutions if blockage becomes an issue.