INTERNATIONAL SOCIETY FOR STRUCTURAL HEALTH MONITORING OF INTELLIGENT INFRASTRUCTURE

ISHMII Membership Notes
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President's Letter

Dear Society Members and Colleagues,

Please join me in congratulating ISHMII Council member Dr. Zhishen Wu on his election as the Vice President of Finance. Dr. Wu will complete the vice presidential term of Dr. Wolfgang Habel in this capacity as Dr. Habel is also the President-elect of ISHMII.

Dr. Wu is a professor of civil engineering at Ibaraki University, Japan, where he directs the Center for Disaster Prevention and Safety Studies. He is also a professor of civil engineering and the founding Dean of the International Institute for Urban Systems Engineering, an interdisciplinary and major center of excellence, as well as a Special Assistant to the President of Southeast University, Nanjing, China. He has served ISHMII since its formative days in many capacities. Dr. Zhishen Wu's full biography is available at ISHMII.org.

Last month, our colleague Dr. Bijan Khaleghi, P.E., State Bridge Design Engineer for the Washington State Department of Transportation (WisDOT), Bridge & Structures Office, wrote on the Skagit River Bridge collapse and the replacement program and I commented on the fast-track funding. As an update, the replacement bridge span was moved into place as planned and, with only a 7 hour glitch, the Skagit River Bridge reopened on time. Interesting time-lapse video of the switchover is available on YouTube.

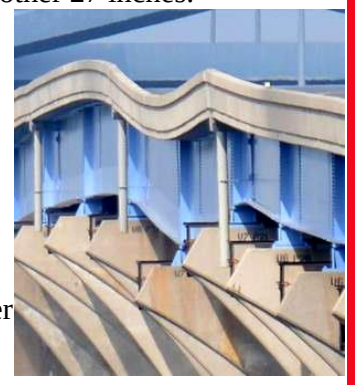
That unexpected collapse was just one of the topics highlighted in the presentations at the 10th US-China Bridge Engineering Workshop last July. International cooperation, leading to the application of new methods and technologies, is a more than a goal for ISHMII. It is a reason our Society exists. Since 2002, this Chinese and US collaborative group has held workshops that mirror the work of ISHMII, and this month I have asked our colleagues Myint Lwin, P.E., Director of the Office of Bridge Technology for the Federal Highway Administration (FHWA), *left*, and Phil Yen, Ph.D., P.E., Principal Bridge Engineer - Structural Dynamics in the Office of Bridge Technology, *right*, to report about that workshop. Most interestingly, they include the 2-day technical tour that our Chinese colleagues took in the Seattle area.

Commentary

Bridges are not supposed to collapse, as did parts of the Skagit River Bridge or the I-35 Bridge in Minneapolis, or ripple and sag as it happened with the Leo Frigo Bridge on September 25, 2013 in Green Bay, Wisconsin.

Damaged Leo Frigo Bridge, Green Bay, Wisconsin

The Leo Frigo Bridge, which carries 40,000 cars a day on Interstate 43 over the Fox River 120 feet below, was vitally damaged and closed indefinitely after one of the piers sank approximately 2 feet into the riverbed. In just a few days, it sunk further, which might be caused by recent rain storms. Now, one side sags 22 inches and the other 27 inches.



News media have made much of the fact that many U.S. bridges are in need of repair, restoration or replacement, depending on the level of concern and defects reported when inspections occur. The Leo Frigo Bridge, inspected in August 2012 after major pavement work, did not appear to have any serious problems. Nonetheless, it did. The WisDOT has now reported that the cause of the damage is likely corrosion below Pier 22 due to a combination of factors - soil conditions and the rise and fall of the water table that caused that pier to buckle.

The repair plan calls for inspection of the adjacent piers to determine if and how far the damage spread.

The preliminary estimate for repairing the Leo Frigo Bridge is $50 million, a price that could change. The Federal government will cover all of the emergency repairs within the first 180 days following the bridge's closure and, after that, both emergency and all permanent repairs will receive 90% federal funding through the FHWA Emergency Relief Program.

SHM is essential, as we know, to more than bridges and other civil structures. Pipelines, both underwater and in or above ground, are of concern. And, one pipeline lies 12 feet from Pier 22. Owned by West Shore Pipe Line Co. of Illinois, it is an 8 inch subsidiary line that carries up to 70,000 barrels a day gasoline and diesel to Green Bay. The WisDOT is watching the situation, and the company can shut off the pipeline, if necessary, and will have its own staff on site during work on the bridge.

Still, worker safety is essential. WisDOT has placed alarmed sensors on Pier 22 and those adjacent to it that will alert crews to any shift and allow them to evacuate.

Damaged Daniel Hoan Memorial Bridge

This brings to mind the Daniel Hoan Memorial Bridge, a tied arch bridge that connects downtown Milwaukee, Wisconsin to the Lake Freeway across the Milwaukee River Inlet.

Opened in 1977, it partially collapsed in December 2000 when two of the three support beams of the lakefront span failed due to improperly designed welds between the lower lateral bracing and floor beams. This was exacerbated by extreme winter weather. A 217 foot section of the northbound lanes buckled and sagged about four feet. While the span was reconstructed, traffic flow was impinged as the rest of the bridge was extensively rehabilitated and retrofitted. It reopened in November 2001. Now, in 2013, extensive rehabilitation and structural modifications have begun again and with the new deck, its lifespan is expected to be extended about 40-50 years.

Luckily, no lives were lost in the Wisconsin and Washington events although motorists were on each bridge.

It seems that we learn all too frequently about disastrous events that might have been identified early and potentially prevented if there were SHM systems in place. The Leo Frigo Bridge and Daniel Hoan Memorial Bridge damage shows again that every major bridge needs a real-time sensing and monitoring system that catches distress long before a collapse or failure, long before a major event closes a major transportation channel. In this case and other similar cases, despite the frequency of their occurrences, we should consider them as lessons and warnings. "The odds are against us when we don't use SHM and we can't get lucky every time."

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In November, you will receive *The Monitor*, our e-magazine. And, in December, I will address the achievements of ISHMII over the past four years as I step down as president of ISHMII. My successor, Dr. Wolfgang Habel, is prepared to bring new challenges to our Society and build on the old ones.

In closing, I encourage you to join ISHMII and be part of our vision for civil structural health monitoring of intelligent infrastructure. One way you can do this is to attend **SHMII-6** in Hong Kong in this coming December 9th to 11th.

You are invited to participate in ISHMII's 6th International Conference on Structural Health Monitoring of Intelligent Infrastructure, **SHMII-6 (2013)**, a vital platform for international scientists, engineers, researchers and project managers to discuss recent advances in the SHM of intelligent infrastructure. All of the important links appear below. There, we will share innovative ideas on the state-of-the-art, state-of-the-practice and future trends of smart sensors, advanced sensor networks, signal processing and real-time data management, structural health diagnosis and prognosis, and life-cycle performance assessment for SHM.

Please join me at these significant engineering society events as we explore developments in SHM.

With warm wishes,

Farhad Ansari, President

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10 Years Working Together to Advance Bridge Engineering Technology in the United States and China

The 10th US-China Bridge Engineering Workshop held on July 15-16, 2013 in Seattle, Washington, celebrated a decade of significant and growing collaboration between the two nations that advances highway bridge engineering technology.

The concept of a US-China bridge engineering workshop series grew out of a May 2001 Memorandum of Understanding between the Multidisciplinary Center for Earthquake Engineering Research (MCEER), State University of New York at Buffalo and the State Key Laboratory for Disaster Reduction in Civil Engineering (SLDRCE), Tongji University, Shanghai, China that was signed by Professor George C. Lee of MCEER and Professor Lichu Fan of SLDRCE. Since the beginning, the workshops have alternated between China and the U.S.

The workshop series brings together participants from both countries' bridge engineer and research communities in a forum for the exchange of technical information and construction experience in seismic design, performance of "special" highway bridges and other bridge engineering topics of current interest. "Special" highway bridges include major long-span bridges as well as those with small to moderate spans that have complex geometries or are located on sites exposed to multiple hazards. The objectives are to develop a knowledge base of lessons learned from research, deployment and education for advancing bridge engineering for safe, durable, efficient, economical and sustainable highway bridges.

Themes and Presentations

The major themes of the 10th Workshop were: (1) Truck Overload and Vessel Collision Issues, (2) Bridge Safety and Management, and, (3) Long Term Bridge Performance. Seventeen Chinese delegation members, led by Zhou Haitao, the Chief Engineer of the Ministry of Transportation, and 16 members from the U.S. side, led by Myint Lwin, Director of the Bridge Technology Office, FHWA, participated in the technical exchange and discussion. In addition, the U.S. participants included representatives from State departments of transportation, industry and academia. Their Chinese delegation colleagues included representatives from the Ministry of Transport as well as academia and industry.

Myint Lwin began the technical program with a keynote speech, "Safety Management of Major Bridges" that was followed by five technical presentations on the themes of Truck Overloads and Vessel Collisions Issues. This included a presentation on the Skagit River Bridge Collapse and Recovery Plan was heavily discussed following a presentation of the technology to be used in reconstructing the collapsed section of the bridge.

In the Bridge Safety and Management session, Dr. Farhad Ansari presented a technical paper, titled "Simple and Cost Effective Weigh-in Motion System for Highway Bridges," on an automatic monitoring system that stores and transmits regularly measured data to the server. The three-part monitoring system is composed of a system that stores temperature and water content data that was measured in the pavement sections, a weigh-in-motion system that provides information on the traffic crossing the test road, plus an automatic weather observation station. This monitoring concept was heavily discussed for its cost effectiveness.

A comparison between the technical specifications for bridges inspection and evaluation methods used in China and the US was presented by Yuan Zhong, who applied these two methods to a newly-constructed bridge in China. A fatigue safety assessment and maintenance for existing steel and concrete bridges was then presented by Prof. Chunsheng Wang.

The third and fourth sessions focused on bridge performance. One highlighted area was the FHWA's Long-Term Bridge Performance (LTBP) program. This 20-year research effort will include detailed inspections, periodic evaluations and testing, continuous monitoring, and forensic investigations of a representative sample of bridges nationwide. The data collected will be used to develop a quantitative database for highway bridges that will provide increased knowledge about bridge performance and degradation and support better design methods, improved performance predictive models and advanced bridge management tools.

Technical Study Tour

A guided workshop technical study tour offered the Chinese delegation a 2-day glimpse of bridges and a tunnel under construction and offered insight into the maintenance of bridges, all into in the Seattle area. This exciting opportunity to examine the New Tacoma Narrows suspension bridge, floating bridges and Alaskan Way Tunnel construction site was hosted by the Washington State DOT.

New Tacoma Narrows Bridge

In the summer 2007, the New Tacoma Narrows Bridge opened, parallel to the original 1950 bridge. It was the longest suspension bridge to be built in the U.S. since the completion of the Verrazano Narrows Bridge in New York City in 1964. The retrofitting of the 1950 bridge was completed in 2008. The new Tacoma Narrows Bridge carries eastbound traffic, while the older bridge carries the westbound lanes, improving safety and reducing traffic congestion. Pictured (above right): *The Chinese delegation and US members visit the New Tacoma Narrows Bridges. It is pictured (left) during construction in 2007, with the photograph taken from the top of the original bridge.*

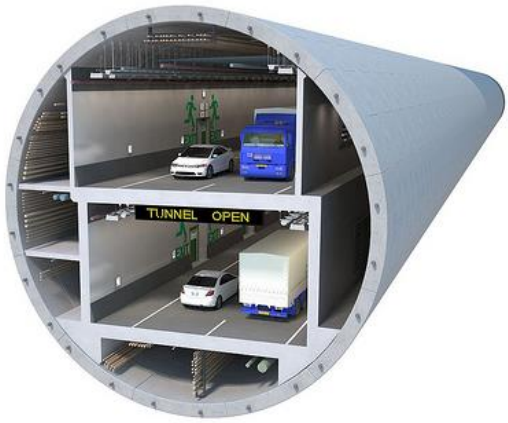
Third Lake Washington Floating Bridge

The Homer M. Hadley Memorial Bridge, also called the Third Lake Washington Floating Bridge, westbound view (left). Eastbound view (right) showing the Hadley Bridge with the Lacey V. Murrow Bridge on its right.

The Third Lake Washington Floating Bridge, one of three floating bridges on Lake Washington, Seattle, crosses a lake that is approximately 1 to 3 miles wide and 20 miles long. The water in most parts is 100 to 200 feet deep and its bottom consists of soft clay and peat extending another 100 to 200 feet deep. With conditions like Lake Washington presented, a floating bridge was estimated to cost 3 to 5 times less than a long-span fixed bridge, tube or tunnel.

The Third Lake Washington Floating Bridge, officially named the Homer M. Hadley Memorial Bridge, is large and impressive. Opened to traffic in June 1989, it was constructed of 18 prestressed concrete pontoons rigidly connected together to form a continuous floating structure. The 5,800 feet long bridge carries over 100,000 vehicles a day on 5 lanes of traffic (3 westbound lanes and 2 reversible lanes), with one sidewalk available for pedestrians and bicycles. A typical pontoon measures 354 feet long, 75 feet wide with cantilevered roadway slabs, and 16 feet deep, and has a water draft of 16 feet. The interior of a pontoon is divided into compartments with watertight bulkheads to control flooding. The technical tour group was able to go inside a pontoon to observe the interior watertight compartments, noticeably dry and clean, and observed an anchor gallery where the mooring cables are anchored to maintain horizontal alignment of the bridge. The tensions in the mooring cables can be adjusted to account for the seasonal variations of the water levels of the lake. It is well-engineered and maintained to form important connection between Seattle and Mercer Island.

Alaskan Way Viaduct Replacement with Tunnel



The Alaskan Way Viaduct, completed in April 1953, is a double-decked elevated section of State Route 99, which runs along the Elliott Bay waterfront through the Seattle industrial district and downtown. The viaduct was damaged in the 2001 Nisqually earthquake, so some portion of this viaduct will be replaced by a double deck tunnel. The initial phase of demolition and removal of the southern viaduct began on October 21, 2011 with boring the replacement tunnel begun in 2013. The viaduct will be rebuilt to modern seismic standards, especially important as it goes under the industrial area south of downtown. The tunnel will change the way Seattle drivers use SR 99. Drivers approaching the tunnel from either direction will face a choice depending on their destination: use the tunnel to bypass downtown or exit to city streets and head into downtown. Pictured above: *A visualization of the future tunnel of Alaskan Way Viaduct.*

The 11th US-China Bridge Engineering Workshop will be held in 2015 in Chengdu, Sichuan Province, China, with specific dates to be proposed in early 2014. For more information, please contact Myint Lwin (Myint.Lwin@dot.gov) or Phillip Yen (wen-huei.yen@dot.gov).

Articles published in *Membership Notes* may be cited as follows: Name(s) of the authors, (Year), "*title of the article*," ISHMII Membership Notes, Vol. No., Issue No., pp.

ISHMII INTERNATIONAL CONFERENCE

Come to Hong Kong

December 9

SHMII-6 (2013)

6th International Conference on Structural Health Monitoring of Intelligent Infrastructure

Make Your Plans to Attend!

Visit the SHMII-6 Website

www.cee.polyu.edu.hk/shmii-6/home.html

SHMII-6 Website for Registration & Information

OUR CORPORATE PARTNERS

Learn More

WSDOT videos covering the Skagit River Bridge replacemnt: www.youtube.com/user/wsdot?feature=watch.

WisDOT updates on the closure of the Leo Frigo Bridge: projects.511wi.gov/web/i43bridgerepair/overview.

Daniel Hoan Bridge failure: www.wisconsinhighways.org/indepth/hoan_bridge.html

The full Technical Program of the Workshop: www.ishmii.org/wp-content/uploads/2013/10/US-China-10-Anniversary-Workshop-Technical-Program.pdf.

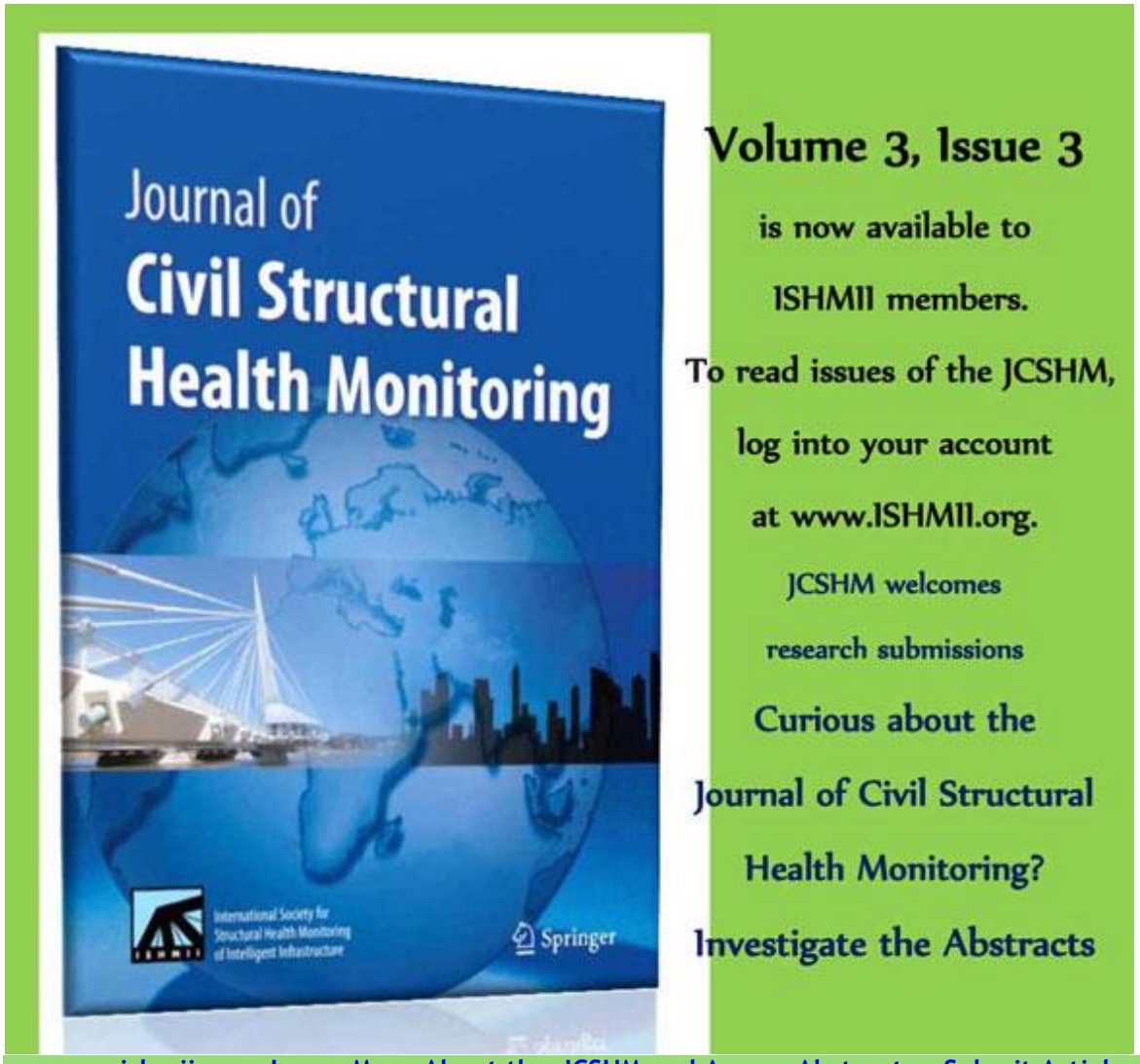
Long-Term Bridge Program: www.tfhrc.gov/structur/ltbp.htm.

University of Washington clearinghouse for the Nisqually Earthquake: www.ce.washington.edu/~nisqually/.

Tacoma Narrows Bridge project: www.tacomanarrowsbridge.com.

Third Lake Washington Floating Bridge article by Myint Lwin: www.concrete.org/PUBS/JOURNALS/AbstractDetails.asp?ID=3040.

Alaskan Way Viaduct Replacement and Tunnel: www.wsdot.wa.gov/Projects/Viaduct/About.



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What is Coming Up

WORKSHOPS AND CONFERENCES

THE MONITOR

, Ube, Japan

Structural Health Monitoring & Maintenance of Short & Medium Span Bridges

Registration & information is available at

http://civil.design.csse.yamaguchi-u.ac.jp/CSHM-5/index.html

European Transportation Research Arena (TRA) - Symposium on Composite Materials in Transport Infrastructures, Vehicles & Vessels

Paris La Défense (France) 14-17 April 2014

http://tra2014.sciencesconf.org/

EURODYN·2014

IX INTERNATIONAL CONFERENCE ON STRUCTURAL DYNAMICS

30th JUNE » 2nd JULY PORTO PORTUGAL

http://paginas.fe.up.pt/~eurodyn

Publish Research Reports in *The Monitor*

Brief research reports for publication in the November 2013 issue of *The Monitor*, ISHMII's e-magazine, are due by October 24. Articles should be 600 - 750 words in length with photographs or graphics.

Please submit through the members of the Editorial Board.

Recognition & Credit

ISHMII extends it thanks and appreciation to the authors and to those who have provided artwork to accompany the articles above.

Photographs and information may be located at the following sites:

Leo Frigo Brigde at www.todaystmj4.com/news/local/226476841.html and www.postcrescent.com/article/20130927/APC0101/309270329/Governor-hopes-federal-funds-fix-Leo-Frigo-bridge

Daniel Hoan Bridge at www.wisconsinhighways.org/indepth/hoan_bridge.html

New and original Tacoma Narrows bridges at www.flickr.com/photos/wsdot/522295695/in/set-72157600239213983

Photograph of the participants in the 10th US-China Bridge Engineering Workshop is provided by Dr. Bijan Khaleghi, WSDOT.

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THE AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTIN

2014 ASNT SMT Conference

August 25-27, 2014
Washington, D.C.

The 2014 ASNT Conference will provide a forum for the exchange of theoretical, scientific & application information to meet the challenges of the current economy.

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Membership Notes and *The Monitor* are delivered to members and their colleagues. Refer them to or forward contact information to NancyC@ishmii.org.

Photograph of the
Third Lake Washington Floating Bridge at
en.wikipedia.org/wiki /Homer_M._Hadley_Memorial_Bridge

Visualization of the Alaska Way Viadut at
en.wikipedia.org/wiki/Alaskan_Way_Viaduct_replacement_tunnel.

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