INTERNATIONAL SOCIETY FOR STRUCTURAL HEALTH MONITORING OF INTELLIGENT INFRASTRUCTURE

The ISHMII Monitor

Sreenivas Alampalli, Ph.D., PE, MBA, FSHMII, Editor-in-Chief
Nancy J. Cohen, MPA, SM, Managing Editor

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Letter From the Editor-in-Chief

Dear Society Members and Colleagues,

Super Typhoon Haiyan, a natural phenomenon that hit the Philippines, caused thousands of deaths and enormous devastation to buildings and the transportation infrastructure in November 2013. Preliminary reports indicate that the typhoon destroyed more than 75% of the structures in its path, including homes, roads, airports, and bridges. This is an indication that a lot more can

be done in improving safety of our infrastructure to enhance the quality of life around the world. Preventing or minimizing such damage through better planning, changes in building and other structural standards and specifications, and better emergency preparedness are now needed around the world. These have to be supplemented with innovative technologies, new materials, and accelerated construction procedures to combat the effects of these disasters and to improve and maintain quality of life.

As mentioned in previous editorials, Structural Health Monitoring has potential to assist in making this possible through monitoring the demands of natural forces on infrastructure, validating new designs and specifications, evaluating new materials, and maintaining construction quality as we move forward with innovative ways to build our infrastructure for better performance and mitigating or managing risk. ISHMII and our members can play an important role in this journey and the letter from Wolfgang Habel, who will be taking over from Farhad Ansari as President to direct our growing society, provides his vision for ISHMII's future.

We also have six technical articles from around the world. The article co-authored by Sreenivas Alampalli and Anil Agrawal describes a study that evaluated the consistency of the New York State Department of Transportation's Bridge Inspection Program. The study notes excellent consistency in the program -- thanks to the manuals, training, and a great QC/QA program. Of course, there is always room for improvement in any program and the study offers some constructive recommendations towards that goal. These types of studies are necessary for evaluating any nondestructive testing program so that owners can be comfortable with decisions they make using the data collected through these programs.

Suspension bridges are a vital part of many nations' urban infrastructure. Thus, ensuring long-term durability of these structures in a cost-effective manner is very important. The article by Barry Colford, Bridge Master of the Forth Road Bridge in the UK, describes the effects of dehumidification systems, which are becoming popular for improving durability. Tunnels are as critical as bridges in maintaining urban mobility. A second article from the UK, by Heba Bevan and Kenichi Soga, explores the use of low-power wireless sensor networks for monitoring existing tunnels to assure safety while excavating new tunnels. Even though box culverts are a lot smaller than suspension bridges or tunnels, these too are very important in maintaining the safety and mobility of our transportation infrastructure. The article by Satrajit Das describes a program, supported by the North Carolina DOT, which used a combination of load testing and finite element modeling to obtain realistic capacity assessment of these structures to extend their service life.

Designing and implementing the SHM system as an integral part of a structure has many advantages. The article by Qi-lin Zhang from China illustrates the use of SHM that was designed to monitor a 117-story tower during construction, as well as in-service, for effective decision-making. Finally, the article by Mohammed Ettouney describes the use of monitoring in a demolition project. The monitoring was used to assure the safety of the near-by buildings and utilities during the blasting demolition of the New Haven Veterans Memorial Coliseum structure.

It was three years ago that Dr. Ansari asked me (or volunteered me) to serve as Editor-in-Chief of *The Monitor*. His article briefly outlines the history of *The Monitor* and its future. This is the last issue on which I will be serving as Editor-in-Chief. Dr. Branko Glisic of Princeton University will take over this responsibility for the next issue. I thank Branko for volunteering to serve ISHMII in this capacity. Please welcome him and assist him as needed to make *The Monitor* a great technology transfer resource.

Looking back, it has been a great experience working with the Associate Editors and Nancy Cohen. I appreciate all the assistance from the Associate Editors and Dr. Ansari for their assistance during the last three years. I am also indebted to Nancy Cohen, Managing Editor, for all the effort she puts in the background to make our electronic magazine (and myself) look good and delivered on-time.

On behalf of *The Monitor* team, Nancy and I wish you all a Happy New Year.

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ISHMII Presidential Transition: A Message from Wolfgang Habel, President-Elect

Dear Colleagues,

Professor Farhad Ansari's presidency of ISHMII ends in December 2013 after a very busy four years. As the second President of our international Society, Prof. Ansari made the still young society stronger in many ways; he recruited a considerable number of new individual and corporate members, and motivated outstanding scientists and practitioners to share their knowledge and to publish their experience and research results in the society's own *Journal of Civil Structural Health Monitoring* (*JCSHM*). He restructured the Executive Committee, developed the strategic concept for presidential transition and established three Vice-Presidents each with clear responsibilities: one for Finance, one for Membership and Organizational Growth, and one for Member Education. As a member of this Executive Committee, until recently as Vice-President of Finance, it is a great honor for me to be elected as next President of ISHMII to lead the Society into the future with the same great success as both of my predecessors, Prof. Aftab Mufti and Prof. Ansari. Of course, the Society must continue to grow by responding to new trends and research results and eventually turning the ideas and new thoughts of our members into practice. *Pictured Right: Presidents Farhad Ansari and Aftab Mufti*

As in all dynamic organizations, we need new visions again and again. And, engaged and enthusiastic people who enjoy their profession and are willing to use the ISHMII platform for intensive exchange of knowledge between the younger experts and experienced professionals. New visions should concern the scientific aspects as well as organizational details. With this as part of our vision, we will continue to make ISHMII more and more attractive to students and young scientists from everywhere by offering knowledge and scientific exchange possibilities, on the one hand, and for managers and owners or even investors and responsible persons from government and insurance agencies, road, highway and waterways authorities, on the other hand, by organizing workshops and conferences and by providing access to recently achieved findings. Focusing on health monitoring methodologies for condition assessment and management of typical civil infrastructure systems such as bridges and tunnels, we should extend our members' expertise in sensors technologies, instrumentation, monitoring strategies, data mining, and interpretation for decision making processes to other safety-relevant structures such as offshore oil platforms and wind turbines, modern lightweight structures, tanks and containments, and to components of major environment, energy and transport infrastructure projects. The broader interest in both existing and new monitoring technologies requires more guideline activities, growing from the expertise of our members, to provide potential users with application-oriented information and directions. Another important objective is continuously improving the quality of the *Journal of Civil*

Structural Health Monitoring. It is very important that our Journal become a standard reference work for all aspects of SHM.

I am sure that both our members and interested persons - our colleagues - will take advantage of the great variety of the information available from our SHM community. In order to achieve this, we need to build membership and to share the wealth of information offered for ISHMII members. We should simplify the procedure to join the Society and pay the membership fees. We should open the Society to members from young and growing industrial nations. With a number of new members from the Middle East and a strong base in some but not yet all nations on the Asian continent, we are well on the way to reaching our ambitious target to become a real global society of outstanding experts. With this approach, we must not forget existing SHM tasks in a number of African and South American countries, and to offer our colleagues there our unbiased scientific and practical cooperation. This is much needed. Such cooperation will provide benefits for those continents and also for all ISHMII members. We have been holding discussions with prospective members creating the hope that we will include African experts in the Society soon. Similar discussions are being planned with experts in Brazil and will also be extended to persons responsible for SHM projects in Peru. The future is exciting.

I am looking forward to serving the Society as next President, and ask all my colleagues, friends as well as current and future Society members for your active support in further strengthening ISHMII during the next presidential period.

With my warm regards,

Wolfgang Habel
President-elect
Berlin, November 1, 2013

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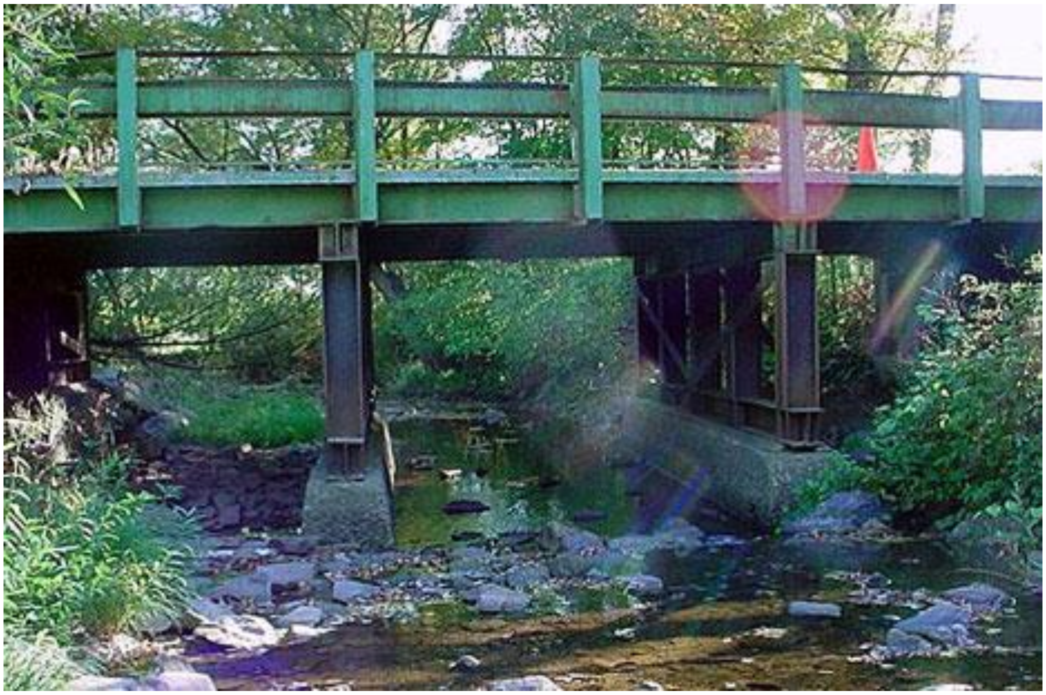
OUR PARTNERS

RESEARCH REPORTS

USA



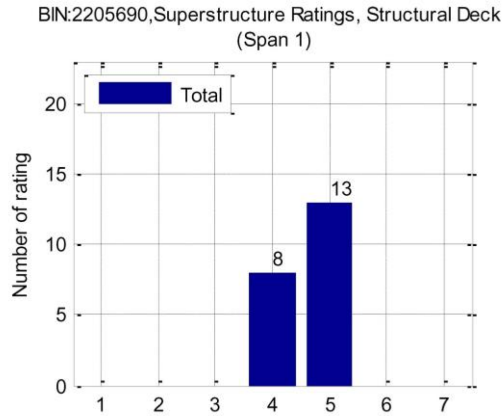
A Study of NYSDOT Bridge Inspection Program Consistency

Sreenivas Alampalli, Ph.D. P.E. New York Department of Transportation
Anil Agrawal, Ph.D., City University of New York

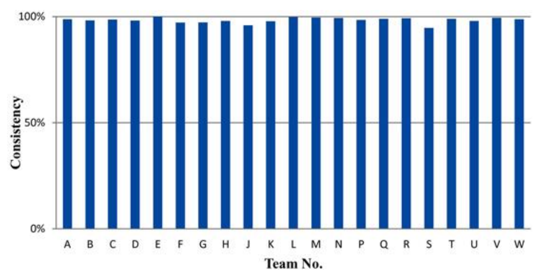
Accuracy and consistency of data is essential for any scientific and engineering SHM project as it ensures safety and cost-effectiveness. When a number of personnel are involved in a project, the policies and procedures have to support consistent data collection. Bridge inspection is not any different. Data consistency is very important for any transportation agency as hundreds of inspectors are involved in the inspection of bridges, especially given that bridge life is many decades. That collective bridge inspection data is useful for both the safety and management of bridges.

A Federal Highway Administration (FHWA) study completed in 2001 reported that on a national level bridge inspection ratings have high variability and it questioned the quality and reliability of visual-based inspection procedures. This finding was considered a potential vulnerability for New York State (NYS) although the results of the FHWA study may not be applicable in NYS. The NYS bridge inspection program is more robust and detailed than what is mandated by FHWA and differs in several aspects from inspections conducted in other states, including the number of components inspected, rating scale, the quality control and quality assurance (QC/QA) program, and the personnel qualifications as well as the training provided to bridge inspection personnel. In order to confirm that the NYS bridge inspection program provides reliable results using mandated practices and procedures for bridge inspections, a research project was initiated to quantitatively document the variability associated with the bridge inspection program, to suggest improvements to policies and procedures and areas requiring further training, and if needed, to provide recommendations for reducing the variability and for improving the reliability and consistency of the program.

Dr. Anil Agrawal of the City University of NY and Dr. Glenn Washer of the University of Missouri were selected to conduct the project in early 2009. A NYSDOT Technical Working Group consisting of James Flynn, Peter McCowan, Frank Jalinoos, Brian Kelly, Dr. Deniz Sandhu, and John Wong with Project Manager Dr. Sreenivas Alampalli, directed the project. Research objectives have been achieved through a detailed and comprehensive evaluation of the consistency of the bridge inspection ratings through the inspection of 4 bridges by 21 inspection teams. The number of bridges and inspection teams were selected to generate statistically sufficient data for the evaluation of consistency of inspection of different bridge elements.



NYSDOT uses a condition rating scale that ranges from 1 to 9 where 1 indicates "failed condition", 7 means "new condition", 8 indicates "not applicable" and 9 signified "condition and/or existence unknown." The results revealed that 96% of the inspected elements had a consistency of at least 90% for those bridge elements whose rating was supposed to be between 7 and 1. Consistency, in this case, is defined as the percentage of inspectors rating an element within ±1 of the median element. Only seven elements have been identified as having a consistency less than 90%. For elements whose rating was supposed to be 8, approximately 97% of the elements had a consistency of at least 90%, whereas for elements whose rating was supposed to be 9, 91% were inspected with a consistency of at least 95%. Based on the inspection of all elements in the 4 bridges, the overall team consistency was approximately 98%. These results show that the overall consistency of ratings of different elements in NYS is very high.



A qualitative evaluation of all inspection reports has also been carried out to analyze the consistency of report items, such as notes, photographs and detection of damages. The results of this analysis indicated that the current quality control procedures being used to review reports for submission allow variation in the content of the report. However, overall quality of report items, such as notes, photographs, etc., was found to be very high.

Although overall consistency of New York State's bridge inspection program is quite high, several recommendations were made to further improve the consistency through appropriate modifications to the NYSDOT Bridge Inspection Manual and through the training of inspectors during NYSDOT's annual bridge inspectors' meeting.

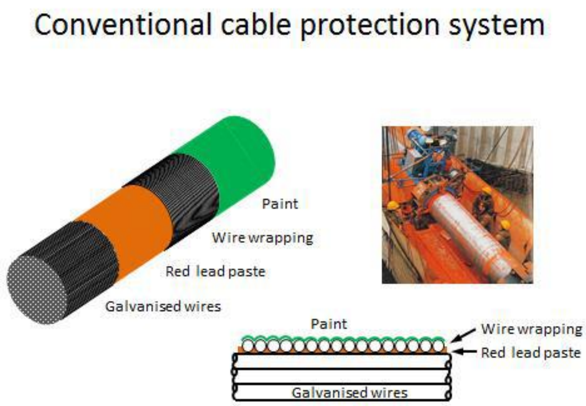
The full report is available at https://www.dot.ny.gov/divisions/engineering/technical-services/trans-r-and-d-repository/C-07-17%20Final%20Report_9-30-13.pdf

For more information, contact Dr. Sreenivas Alampalli at (Sreenivas.Alampalli@dot.ny.gov) or Dr. Anil Agrawal at (agrawal@ccny.cuny.edu).

UK - SCOTLAND

Monitoring the Effect of Dehumidification in Suspension Bridges

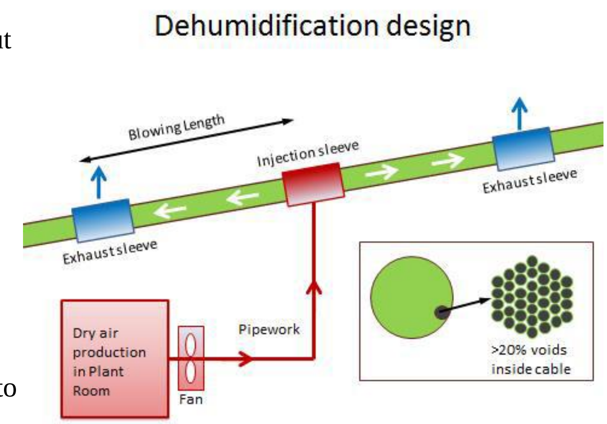
Barry Colford, Chief Engineer & Bridgemaster, Forth Road Bridge, Administration Office
South Queensferry, West Lothian, Scotland



Suspension bridges are a vital part of a nation's infrastructure. To design, build and operate these bridges involves a significant capital spending. These structures often end up carrying traffic loads well in excess of their original design loads. Suspension bridges are cable supported structures. The entire load from the deck is taken in tension by two or sometimes two pairs of main cables in a catenary. These cables are made of thousands of individual, high tensile galvanized wires approximately 5mm in diameter. The wires are parallel and are compacted together until the voids ratio is around 20%. Traditionally, a red lead paste was applied to the outside of the wires, then a softer galvanized wire was wrapped circumferentially around the cables and, finally, a paint system applied. These bridges are highly non-redundant and the majority of the load in the main cables is due to the actual weight of the structure. If one of the main cables is compromised, so is the whole structural stability and load carrying capacity of the bridge.

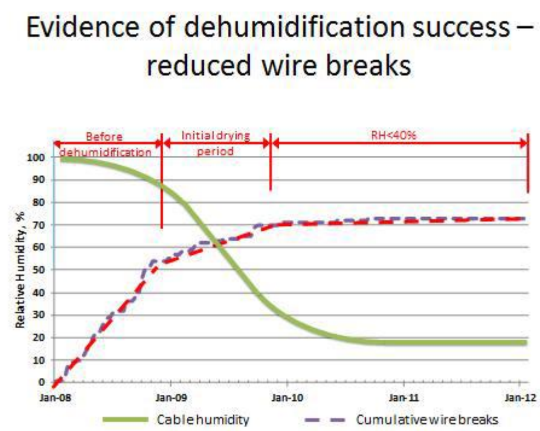
Investigations into the condition of the wires within main cables of suspension bridges were first carried out in the U.S., reflecting the fact that the largest numbers of the oldest long span suspension bridges are found there. There are three long span suspension bridges in the UK that have main cables formed using the same type of construction. The oldest is Forth Road Bridge in Scotland, which opened in 1964, and the other two are the Humber Bridge (*pictured above*) and Severn Bridge (*pictured right*) in England. Although the UK long span suspension bridges are generally newer than those in the U.S., the main cables were designed with a much lower factor of safety.

Investigations in the U.S. found significant corrosion and wire breaks within main cables and so, in 2004, the owners of the Forth Road Bridge decided to carry out an internal inspection of the main cables at Forth. The results of that inspection were surprising. In this relatively young bridge, which had been well-maintained and had no external signs of corrosion or moisture ingress, corroded and more critically cracked and broken wires were found within the main cables. The resulting calculated loss of strength of the main cables, which were already highly stressed, meant that unless action was taken, load restriction would have to be applied at some time in the near future.



A plan of action that involved further inspection and the installation of acoustic monitoring was put in place on Forth Road Bridge. Additionally, a dehumidification system was installed to try to reduce the relative humidity within the voids between the wires in the cables to prevent future wire breaks. This work was completed in 2009.

Following the inspection work at Forth, the authorities at Severn and Humber also inspected their cables internally and found corrosion and wire breaks. Acoustic monitoring and dehumidification has also now been retrofitted into both these bridges.



The results from the installation of the dehumidification systems on all three bridges have been encouraging. It appears that the rate of wire breaks has been slowly decreasing as the cables dry out.

It may be too early to draw absolute conclusions as the acoustic monitoring on main cables has not yet been fully validated. In addition, the degradation model to determine what happens to already cracked wires within a main cable following the application of dehumidification is not yet available. Future monitoring and inspection of main cables will always be necessary. However, there are encouraging signs that this new application of dehumidification will prevent further loss of strength within already damaged main cables of suspension bridges.

For further details, please contact Mr. Colford at Barry.Colford@forthroadbridge.org or visit www.forthroadbridge.org.

Pictured at top: A panoramic view of the Forth Bridges viewed from the south bank of the Firth of Forth. The older rail bridge is to the right, east of the newer suspension road bridge.

UK - GREAT BRITAIN

On-going Research: Monitoring Excavation-Related Tunnel Movements Using Low Power Wireless Sensors Networks

Heba Bevan, Ph.D. Research Student, and Kenichi Soga,Ph.D.
Department of Engineering, Cambridge University, Cambridge, United Kingdom

Built during the 18th and early 19th centuries, aging tunnels require regular structural health inspections physically carried out by trained engineers. This monitoring is even more crucial now that large-scale tunnel excavations are compromising soil stability and submitting existing underground structures to unprecedented structural stresses. Physical structural health inspections are costly and problematic. Engineers must navigate dark, damp and remote areas of tunnels where exact locations of the defects are frequently unknown. Alternatively, wireless sensor networks (WSNs) can autonomously provide constant monitoring of various structural stresses throughout tunnels at a significantly reduced cost.

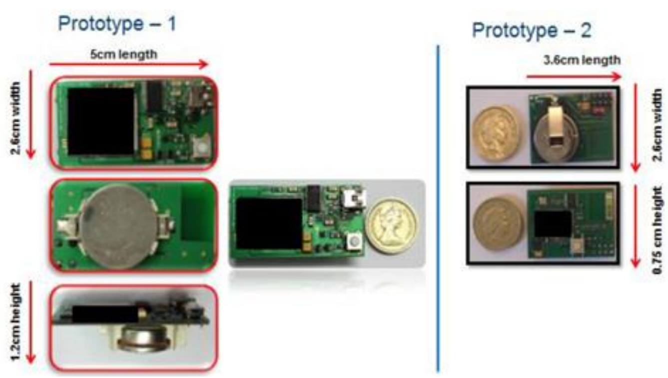
The transportation infrastructure of the UK is experiencing great strain as urban populations grow and transportation needs increase. Older transportation structures are of great concern as they frequently undergo structural stresses beyond those that they were designed to support. They experience extended capacity level usage, material degradation and unanticipated stresses from infrastructure expansion activities that also alter soil stability.

London's subterranean transportation system is representative of these challenges. Every day millions of people commute using London's extensive network of subterranean cast iron transportation tunnels. A vast expansion of the underground transportation tunnel system is underway, with excavations occurring near many structures, both underground and above ground. The majority of these tunnels were built with cast iron during the 19th and early 20th centuries. Apart from age and use related component degradation, these structures experience movements and soil shifts caused by excavations that occur just meters away. Monitoring and maintaining them is a continuous, costly process that requires teams of engineers and technicians to physically inspect even the most remote stretches of tunnels. Now, an alternative exists.

Using wireless sensor networks (WSNs), civil engineers and researchers can remotely examine and monitor the structural health of tunnels. In London, researchers have already deployed static WSN sensors in a cast iron transportation tunnel to successfully monitor movements. In this new original case study, we deployed 33 WSN sensor nodes over a 40m portion of a similar tunnel to study ring and ring segment movements produced by nearby tunnel excavation activities. These new ultra-low power WSN devices were developed at Cambridge University. Their autonomous data collection, processing and transmission abilities are being examined with minimal human intervention. Algorithm scheduling

allows the WSN devices to use a 32-bit processor while using ultra-low power consumption. The sensor nodes measure tunnel tilt, acceleration, temperature and humidity before transmitting these readings to a gateway where the data can be accessed off-site using the internet. The WSN installation has detected movement and deformation in the tunnel coinciding with nearby excavation. We have found that the data readings from the various types of WSN sensor nodes are reliable, accurate and provide an in-depth understanding of structural movements as they occur.

The convergence of communication, internet and computational algorithm technologies combined with recent engineering advances have laid the foundation for a new generation of cost effective, miniature sensors capable of unprecedented performance and accuracy. One of the most important aspects of designing WSN devices is selecting the right CPU. The devices used in this study have a 32-bit ARM Cortex M3 (Seal 2000) processor and use IPv6 network protocol. Some have two radios, one that functions at low frequencies around 800MHz and another that works at higher frequencies up to 2.4GHz. All have a chip antenna.



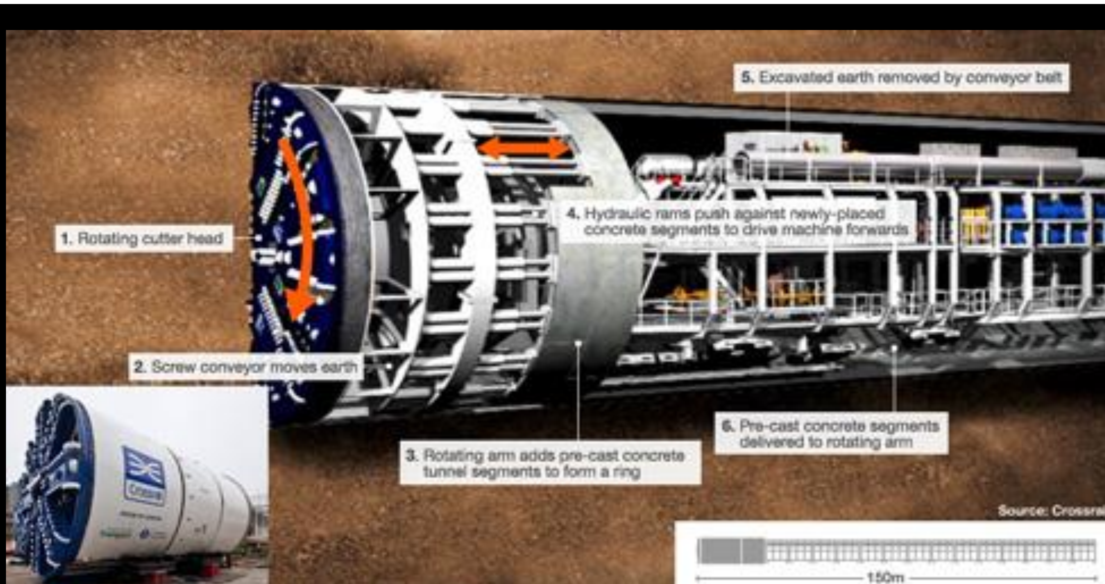
Earlier studies concluded that wireless sensors could either be high performance or low power consumption, but not both. However, in 2007, Sun Microsystems Labs developed a very small WSN based on the 32-bit ARM 920T and reduced power consumption to between 25m and 90m by implementing a sleep mode.

In our WSN system, some of the sensors remain on all of the time to take frequent readings of data such as acceleration. Others remain in sleep mode, only waking up to take measurements four to six times a day. However, the majority take a reading every 15 minutes, comparing the current reading to the previous reading. If the reading is the same or exhibits a minimal difference due to noise, the device returns to sleep mode. If the reading hits a pre-determined threshold or there is a dramatic difference between readings, the device increases the frequency of readings until results return to acceptable parameters.

During our monitoring, we found that the temperature and humidity in the tunnel is relatively constant, with humidity ranging from approximately 68% to 85% and temperatures ranging from around 16° C to 18° C. Meanwhile, we noticed that changes were occurring to the longitudinal horizontal y-axis of the tunnel with the tunnel moving downward towards the location of new tunnel excavation. With the data that we currently have, we have not been able to determine whether the tunnel deformation is due to sheering or bending forces, but we will answer this question in the coming months as we collect further data from the tunnel.

For more information and updates, please contact PH.D. research student Heba Bevan at hy245@cam.ac.uk or Professor Soga at ks207@cam.ac.uk.

For More Information...



Tunneling equipment referred to as a "metal mole" currently in use for the creation of 26 miles of new tunnels in London is pictured above, all part of the Crossrail Project - www.crossrail.co.uk

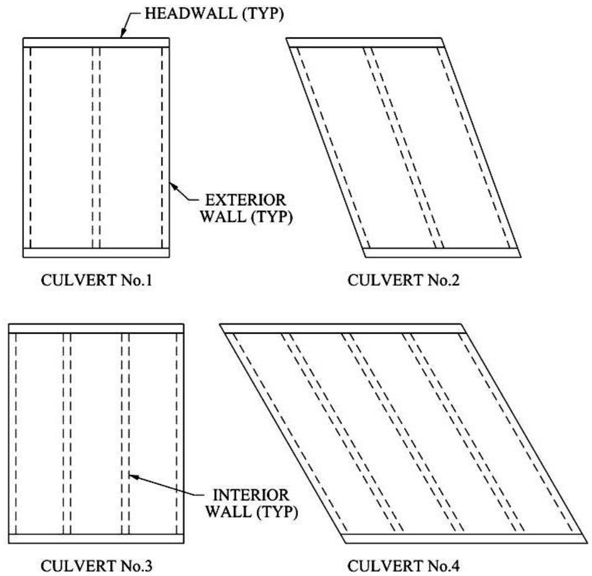
Photos of the metal mole are available at Industrytap.

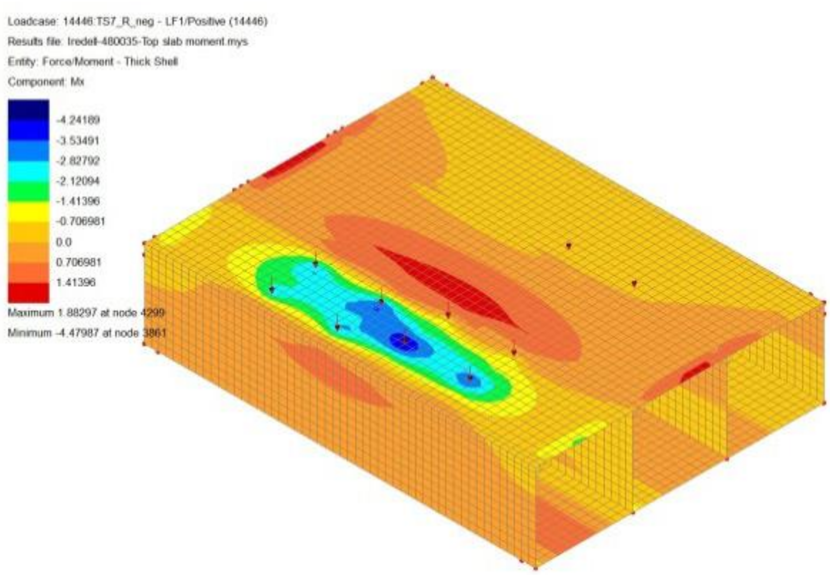
USA

Realistic Assessment of Load Ratings of In-service Reinforced Concrete Box Culverts Utilizing Diagnostic Load Testing and 3D-Finite Element Analysis

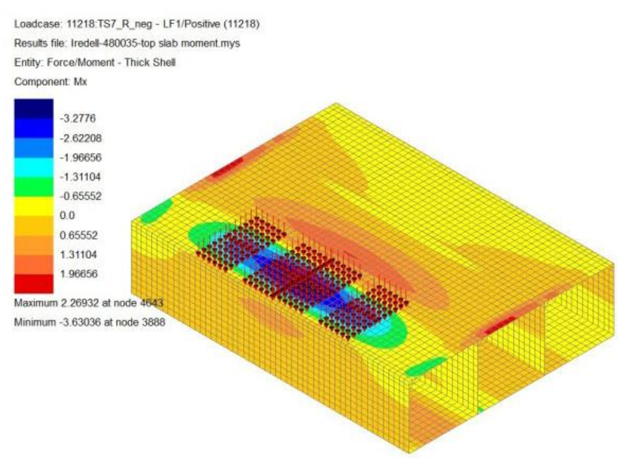
Satrajit Das, Ph.D., P.E., WSP USA

A refined load rating analysis was performed on four reinforced concrete box culverts using a combination of 3-D finite element analyses and diagnostic load testing. Three of these culverts in North Carolina were constructed prior to the 1940s, and the fourth one was constructed in 1985. Based on the conventional rating analysis procedures, the majority of these culverts would currently be posted for North Carolina legal loads. The culvert types included in this project were comprised of double, triple and quadruple barrels that are either skewed or square and have unique geometric, material and structural characteristics. The results of the refined load rating procedure indicate that, depending on the physical condition of the culverts, field measurements and load test data, the controlling rating factors may increase by up to 270% and decrease by as much as 10% when compared with the results from conventional rating analysis procedures. *Pictured above: Schematic Plans of Culverts*





The investigation of each culvert included: (1) review and analysis of information (Biennial Bridge Inspection Report including available construction plans) provided by the North Carolina Department of Transportation (NCDOT); (2) conventional load rating analysis performed using 2-D frame models subjected to maximum force effects due to permanent and live loads; (3) similar rating analysis using 3-D finite element baseline models; (4) field load tests; (5) refinement and calibration of a baseline model using load test results; and, (6) recommendation of load ratings for specified rating vehicles based on the load test and refined analysis results. *Pictured above: Maximum longitudinal bending moment in top slab of the exterior span due to controlling legal load from baseline analysis*.



The improvement in the load ratings obtained by performing refined analyses over that obtained from the conventional analyses is primarily attributed to the appropriate use of the following factors: a realistic live load distribution obtained from 3-D finite element analysis supported by load test data, structural capacity enhancement obtained by using the actual value of concrete strength from core test results, a realistic value of impact factor based on test data, and the height of fill as verified in the field. *Pictured left: Maximum longitudinal bending moment in top slab of the exterior span due to controlling legal load from refined analysis*.

It is noteworthy that the refined analysis methods used in this study calibrated by load test data helped to better predict and provide a realistic estimate of the load distribution among the primary load carrying members and other aspects including the participation of headwalls and haunches, unintended composite action, the influence of fill over the top slab, soil-structure interaction effects, and the effects of skew. In addition, the influence of the actual physical condition of any damaged and/or deteriorated structural component on the overall culvert response could be assessed with higher accuracy.

Field instrumentation and load testing of the reinforced concrete box culverts

A Report of Findings based on the results of the finite element analyses and field load tests was prepared for each culvert structure and submitted to North Carolina Department of Transportation. The conclusions and recommendations derived from the observations made during this study are currently being used by NCDOT as a baseline for the load rating of similar structures.

For additional information, please contact Satrajit Das, Ph.D., at satrajit.das@wspsells.com.

CHINA

Structural Performance Monitoring System for the Tianjin Goldin Finance 117 Tower

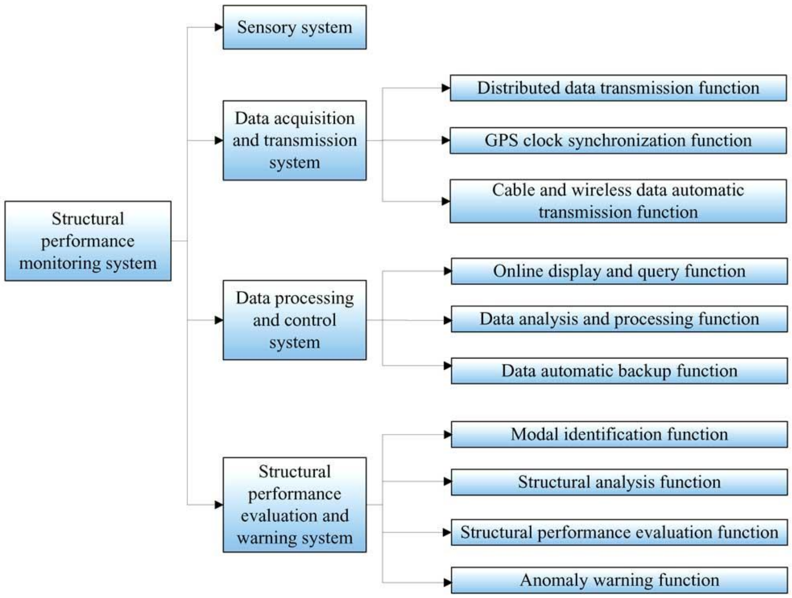
Professor Qi-lin Zhang, Department of Building Engineering, Tongji University, Shanghai, China

The Tianjin Goldin Finance 117 Tower, the tallest skyscraper in North China, is located in the high-tech zone in Tianjin. The architectural height is approximately 597 m with 117 stories. The gross floor area is approximately 370,000 m2. Begun in 2009, construction of this combination hotel, residential and commercial building is expected to be finished in 2015.

A structural performance monitoring system is being designed by a team from Tongji University that will monitor the loadings such as temperature, earthquakes, and winds, and the associated structural responses such as displacement, settlement, inclination, strain, and acceleration. The aim of the SHM system is to provide real-time information of structural performance under daily conditions as well as extreme events, and to evaluate structural safety, reliability, durability, and serviceability through comparisons of the data collected in the field with the design parameters.

As part of the monitoring system, the on-line display and query function will provide remote visualization and query of the monitoring data collected from different sensors, in the Internet Explorer environment, for authorized end-users, who may access the data remotely. The modal identification function ascertains the structural frequencies, mode shapes and damping ratios. This employs various algorithms and the results of the extracted modal properties are combined using the data fusion technique.

Structural analysis is carried out to calculate the structural responses from corresponding finite element models. These results will be compared with field monitoring data to cross-verify the effectiveness of the model and accuracy of the monitoring.



The structural performance evaluation function formulates the assessment criteria for the structural condition through comparisons between the monitoring data and analysis results, design parameters, and design standards. And, an anomaly warning sends alerts via wireless communication, e-mails, and web-based services promptly when the loads and structural responses under extreme events exceed the pre-determined threshold values.

Please direct your questions to Professor Qi-lin Zhang at qilinzhang0@gmail.com.

USA

Monitoring Effects of Demolished Facilities

Mohammed M. Ettouney, Ph.D., E.P., MBA, F.AEI, Dist.M.ASCE
Principal, Weidlinger Associate, NYC, NY

Monitoring the effects of demolished structures on surrounding facilities is necessary to ensure that the demolition process did not produce any undesirable, unintended consequences. In general, a ground peak particle velocity (PPV) of 2.0 in/sec is used as a threshold for such events. Sometimes, the distance between the structure that is to be demolished and nearby facilities is too close to allow for the non-exceedance of such a threshold. In those situations, demolition via blasting (imploding) the structure cannot be used since the large ground PPV that the falling demolished structure might generate cannot attenuate quickly enough before it reaches the nearby buildings or utilities.

Unfortunately, there are situations where the structure cannot be demolished by any method other than blasting. This, of course, might generate a dilemma for the stakeholders. Such a dilemma can only be resolved through mitigation measures that result in a fast attenuation through the ground such that the resulting ground PPV that are generated after the falling structure impacts the ground are within the allowed threshold. In those situations, careful analysis and design of mitigation measures are needed. This can be a difficult process since the uncertainties of the problem (impacting load, dynamic behavior of the falling structure and the ground, etc.) are great. And, coupled with that, the potentially large safety and legal consequences of the analysis and designs illustrates the difficulties and importance of such efforts. In these situations, it is a good practice to monitor the ground PPV during and after the demolition event to validate the adequacy of those mitigation designs – or lack of adequacy.

The demolition of the New Haven Veterans Memorial Coliseum structure (*pictured at top and right*) is a case in point. The coliseum was a huge

structure located in downtown New Haven, Connecticut. The cost implications necessitated that it be demolished by blasting. Unfortunately, it was adjacent to numerous facilities and lifeline utilities. Several mitigation measures were undertaken to reduce the resulting ground PPV. Among those measures were building trenches, berms (*pictured at left*) and temporary bridging structures. These mitigation measures performed flawlessly during and after the demolition. Monitoring of the ground PPV that resulted from the demolition showed that there was a reasonable agreement with the analysis results projected during the design process. Near the structure, within 50 ft., a finite element program was used to estimate PPV. Further away, a close form solution was used to compute PPV. The computed design PPV compares favorably with the monitored PPV. Also, note that at the nearby facilities, around 150 ft. away, the mitigation designs produced PPV that were well below the desired threshold. Due to the precision of execution in the face of large uncertainties, the project and its mitigation designs were later recognized by American Council of Engineering Companies (ACEC) as its Platinum Award Project of the Year (2008).

The full award-winning presentation is found in: Pawel Woelke, Margaret Tang, Scott McClennan, Najib Abboud, Darren Tennant, Adam Hapij, and Mohammed Ettouney (2007), *Impact mitigation for Buried Structures – Demolition of the New Haven Veterans Memorial Coliseum*, Proceedings of ASME PVP 2007 Division Conference, San Antonio, TX.

For additional information, please contact Dr. Ettouney at ettouney@wai.com.

AWARDS

Journal of Bridge Structures’ Book Award

The inaugural *Journal of Bridge Structures’* Book Award has been presented to Dr. Mohammed Ettouney and Dr. Sreenivas Alampalli for their two-volume book “Infrastructure Health in Civil Engineering, Volume I: Theory and Components, and Volume II: Applications and Management,” published by CRC Press.

Dr. Ettouney PE is a principal at Weidlinger Associates, New York City and bring over 40 years of experience in structural engineering and hazard-related disciplines to this publication. Dr. Alampalli PE is the Director of the Structures Evaluation Services Bureau for the New York State Department of Transportation. Both have an extensive record of publications in technical journals and books. ISHMII congratulates both authors.

Dr. Alampalli, a member of the ISHMII Council, chairs the National Academies Expert Task Group on “Bridge Evaluation and Monitoring” to support Federal Highway Administrations’s Long-Term Bridge Performance Program. He currently serves on the editorial board of the *Journal of Bridge Structures* and *Journal of Structure and Infrastructure Engineering*.

“Infrastructure Health in Civil Engineering” describes the authors’ philosophies and experiences in dealing with infrastructure assets and has potential to enhance understanding of both researchers and practitioners in the area of structural health with emphasis on decision-making in infrastructure maintenance and renewal.

According to the *Journal* honoring this two-volume set, Dr. Ettouney and Dr. Alampalli “present strong and comprehensive methodologies for enhancing bridge and other civil infrastructure with emphasis on risk monitoring, life cycle analysis, and decision-making. The book set is pointing the way to a cost-efficient and high performance civil infrastructure future.”

The full review may be read at http://iospress.metapress.com/content/83m12128925848x3/fulltext.pdf

Celebrating SHM Awards

Congratulations to ISHMII Council members Dr. Branko Glisic, Princeton University, and Dr. Helmut Wenzel, Vienna Consulting Engineers, who were honored at the 9th Annual International Workshop on Structural Health Monitoring at Stanford University, California, in September 2013.

Named SHM Person of the Year, Professor Glisic was selected by the editors and associate editors of *Structural Health Monitoring: An International Journal*. He is celebrated for recent outstanding accomplishments and contributions to the field of SHM, made in the form of theory, analysis, applications, education, or in other ways that support the discipline of SHM and benefit society.

Dr. Helmut Wenzel, recipient of the SHM Hans-Juergen Schmidt Award, received this unique award, which was created to honor and recognize persons especially from industry or government organizations for their continuing efforts and successful contributions to the field of SHM and for his outstanding leadership in advancing SHM technologies in industry and government.

You may extend congratulations to Dr. Glisic at bglisic@princeton.edu and to Dr. Wenzel at wenzel@vce.at.

TRANSITIONS

Note from Farhad Ansari, President, ISHMII

Dear Friends,

Early in the history of ISHMII, we inaugurated a research magazine known as *The Monitor* which brought pertinent reports of practical significance to members. As ISHMII expanded, it became more costly to produce the hard-copy magazine and distribute it to members around the world. Thankfully, we live in an electronic world where our members have access to the Internet and e-communication is now the norm. Today, you receive *The Monitor* as an e-magazine. Much has changed.

As we envisioned *The Monitor* in this exciting format, I turned to Dr. Sreenivas Alampalli, P.E., Director of the New York Department of Transportation Structures Evaluation Services Bureau, for direction. An ISHMII Council member, Dr. Alampalli accepted the responsibility for developing the e-magazine, which has transformed and grown over the past two years. All of this has been under his leadership as Editor-in-Chief. I want to thank Sreenivas for making this commitment, knowing that by being Editor-in-Chief, he has set aside other commitments to assure that readers receive a quality e-magazine. Now, his term comes to an end, and the ISHMII Council and its Executive Committee and the ISHMII staff extend their gratitude.

In the new year, Dr. Branko Glisic, already an Associate Editor for North America, will assume that post. Dr. Glisic will be an excellent Editor-in-Chief as he has already proven himself as both a contributor and editor. It is likely you will see changes in the future as all of our publications are dynamic; we appreciate his decision to join the staff.

Thank you, Sreenivas, for all of your efforts and for recommending Branko Glisic to follow you.

Bringing new ideas to members – sharing knowledge – is a goal of ISHMII. We do it in many ways. One of those is through our e-newsletter, *Membership Notes.* The other is through conferences and workshops. I hope that I will meet you in December at SHMII-6 in Hong Kong. In the next issue of *Membership Notes*, I will more thoroughly sum up the development of ISHMII over the past four years and reflect on that time as I prepare to turn over the presidency of ISHMII to Dr. Wolfgang Habel.

Please join us in Hong Kong, and always consider your opportunity to present practical reports of significance through *The Monitor*.

With best wishes,

Farhad Ansari, Ph.D., President

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MEMBERSHIP & BENEFITS

Credits and Recognition

The Monitor thanks the authors of articles and their institutions for providing photographs to accompany the articles.

The photograph of the collapsed bridge in Maribojoc, Bohol Island, Phillipines on Oct. 18, 2013 was taken byJay Directo/AFP/Getty Images and is found at www.bloomberg.com/news/2013-11-10/record-typhoon-damage-shows-aquino-s-task-in-philippine-tragedy.html.

In addition, the Firth of Forth panoramic photograph appears at en.wikipedia.org/wiki/Forth_Road_Bridge.

The photographs of the New Severn Bridge by Paul Mutton and the Humber Bridge are found at: photos.jibble.org/Miscellaneous/The_New_Severn_Bridge_A8V8922.html and www.humberbridge.co.uk.

The historic photograph of the construction of the London tunnel system is found at www.dailymail.co.uk/news/article-2388642/Fascinating-archive-pictures-reveal-transport-network-keeps-millions-Londoners-day-built.html.

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