



<http://caee-acgp.ca/>

## A New CAEE Newsletter

From the Editor's Desk; by Tuna Onur

Welcome to the new CAEE Newsletter! In this quarterly publication, we intend to share with you short articles, announcements and news items related to earthquake engineering research and practice in Canada. As such, we welcome your contributions, such as a short paper summarizing one of your projects, or any announcements or news you would like to share.

As engineers, we have several responsibilities when it comes to earthquakes. We follow codes, best practices and sound engineering judgement to build structures and infrastructure that the society relies on. After a damaging earthquake we are called on to assess damage, help community decision makers deal with the aftermath of the disaster, and roll up our sleeves and rebuild.

Earthquake engineering in Canada is continuously evolving as scientists and engineers gather new

## 11CCEE – Thanks for a Great Conference!

By Sharlie Huffmann

The 11<sup>th</sup> Canadian Earthquake Engineering Conference was held in Victoria, BC, last summer. Thanks to all the organizers, exhibitors, sponsors, presenters and attendees, it was a great success! We had over 300 delegates and 316 papers were included in the proceedings. We were pleased to receive such overwhelmingly positive feedback.

<http://www.canadianearthquakeconference.ca/>

Attending technical conferences is not only about

### INSIDE THIS ISSUE

A New CAEE Newsletter	1
11CCEE - Thanks for a Great Conference!	1
Message from the New CAEE President	2
Code Corner	3
Earthquake Waves	3
Featured Article: The Need for Multidisciplinary Approaches to Seismic Risk	4
News and Upcoming Events	5

data, discover new analysis methods, and conduct new tests and experiments; all contributing to better understanding of earthquakes and their effects on natural and built environment.

But there is still a long way to go! Earthquakes are teaching us new lessons every time they happen. A key activity to do our jobs well, before and after an earthquake, is to share our knowledge and experience, and learn from others'. We would like to offer this newsletter as a step towards that goal. We hope you find it useful, contribute to it and help us improve it with your suggestions!

technical specialists staying current, nor meeting interesting professionals. It is also about bringing home solutions, ideas, best-practices and an expert network that will professionally and financially benefit the attendees and their affiliations.

Conferences are where it all comes together: new methodologies, lessons learned, research findings, renewed interest or advances in existing approaches, codes and scientific assumptions.

**11CCEE – Thanks for a Great Conference!** *Continued from Page 1*

This is where to find solutions others may have already found, to get inspired and motivated or get a reality-check. This is where plans, policies and projects can be considered or re-considered.

Conferences provide the easiest access to the best minds in this field, both in academia and the industry, allowing excellent networking. A good network provides the opportunity to discuss, share perceptions and evaluations and even debate with international experts, senior practitioners, policy makers, regulatory/code

authors and with fresh, bright young minds. It is much easier and more efficient to build rapport in person than on the phone or online, and have the opportunity to cultivate strong relationships.

Conferences have further benefits beyond access to new information and networking. Interests, projects and advances in science/engineering are shared during conferences. They provide a great forum to showcase businesses. And the best part? Benefits are not just for the attending individuals. They permeate through their organizations.

## Message from the New CAEE President

By Carlos Ventura

CAEE Annual General Meeting (AGM) was held during the 11CCEE in Victoria, BC, and a new Board of Directors was elected as follows:  
PRESIDENT: Carlos Ventura, VICE PRESIDENT:

Sharlie Huffman, SECRETARY: Lydell Wiebe, TREASURER: John Sherstobitoff, DIRECTORS: Trevor Allen, Ghasan Doudak, Jeff Erochko, Martin Lawrence, and Jorge Prieto.

After a long absence, we present our first newsletter in 2016! This issue of our Newsletter is very important for several reasons. It is the first under the direction of the new Editor, Dr. Tuna Onur, and we are most appreciative to Tuna for agreeing to take this role. Although the CAEE has been very active in the last few years organizing conferences, seminars and conducting reconnaissance trips to countries affected by significant earthquakes, we have been somewhat remiss in keeping our members informed. The CAEE Board of Directors decided that there was a strong need to improve on this and maintain a closer contact with the Association members. The Newsletter is obviously a great avenue to achieve this, as well as an active and informative webpage.

Our webpage has undergone significant changes and our webmaster, Indira Pandey, is committed to keep it up to date and post new information as soon as she receives it. We went to a great effort to secure the domain name for the CAEE website, as it

was initially owned by another organization, but thanks to the skillful negotiating skills of Sharlie Huffman, we now own the domain. The link to our webpage is: <http://caee-acgp.ca/>

We hope that our new Newsletter and website motivate you to contribute articles for future editions, and provide feedback and suggestions.

Finally, the 11CCEE was a success in many fronts: it was well attended, the quality of the papers was very high, and its financial success contributed to a CAEE that is now in a solid financial footing. The Board of Directors would like to thank Sharlie Huffman and the 11CCEE Organizing Committee for their great effort. We are now accepting proposals for hosting the 12th CCEE in 2019. Groups interested in hosting the conference should contact any of the Board members by fall of 2016.

Please do not hesitate to call me (604-822-6946) or e-mail me ([ventura@civil.ubc.ca](mailto:ventura@civil.ubc.ca)) if you have any suggestions on how the CAEE can serve you better.

## Code Corner

New editions of two Canadian design codes were released with major updates recently, the Highway Bridge Design Code (CSA S6-14) and the National Building Code (NBC 2015). Starting with an overall view in this issue, we will highlight some of these changes and new provisions in upcoming issues.

One of the main updates common to both codes is the revisions by the Geological Survey of Canada to the seismic hazard model underpinning the previous editions of the codes. The previous hazard model was more than 10 years old; and some of the science and data behind the model were 20 years old. Hence the update represents significant improvement in the underlying science and data. Also in the new model, the mean rather than the median is used in specifying the seismic hazard. Mean hazard values typically lie between the 65th and 75th percentiles of the distribution and are thus larger than the median (50th percentile) hazard values.

### NBC Updates

By Jag Humar

Beyond the seismic hazard model, changes were introduced in the site effect (or foundation) factors, replacing  $F_a$  and  $F_v$  factors with period dependent factors. The structural design provisions were appropriately adjusted to respond to changes in the estimates of hazard and the new site effect factors.

The update to NBC also includes new provisions related to design in regions of low hazard, buildings with flexible diaphragms, buildings with inclined columns, passive energy dissipation systems, base isolation, rocking foundations, glazing systems, racks, and elevators. We will highlight each of these updates in more detail in the upcoming issues.

The new NBC 2015 can be ordered from NRC at: [http://www.nrc-cnrc.gc.ca/eng/publications/codes\\_centre/2015\\_national\\_building\\_code.html](http://www.nrc-cnrc.gc.ca/eng/publications/codes_centre/2015_national_building_code.html)

### CSA S6 Updates

By Don Kennedy

One of the key changes in CSA S6-14 is the adoption of performance-based design for many bridges in Canada, though force-based design is still permitted in lower seismic zones. Accordingly, seismic hazard is now provided in three return periods, 475 years, 975 years, and 2,475 years.

A new reliability-based approach is introduced for foundations and geotechnical systems, improving both static and seismic design of bridge foundations. In addition, an extensive section on seismic isolation and damping was added. Analysis and design approaches emphasize displacements rather than forces for ductile sub-structures in the new edition. And extensive edits to requirements for steel lateral-load resisting systems are provided. In the upcoming issues, we will further focus on some of these updates.

The new version of S6 (and the commentary S6.1) is available for purchase at: <http://shop.csa.ca>

## Earthquake Waves

By Trevor Allen

Many of the residents of Sidney, Victoria, and Vancouver, BC were woken up on 29 December 2015 (11:39pm local time) by shaking from a Mw4.7 earthquake near Sidney, BC. It was a deep earthquake within the subducting Juan de Fuca plate. Almost 7,000 felt reports were received from various communities in the region. Though widely felt, no damage was reported due to this earthquake.

If you feel an earthquake, please report your experience to the Geological Survey of Canada by filling out the following questionnaire:

<http://www.earthquakescanada.nrcan.gc.ca/dyfi-lavr/index-en.php>

## The Need for Multidisciplinary Approaches to Seismic Risk

By Tuna Onur

Earthquakes, while rare, pose great risk to many communities in Canada, especially where the combination of exposure and hazard is greatest (e.g. southwestern British Columbia, and parts of Quebec and Ontario). Assessing seismic risk is a multidisciplinary challenge. We all share a common goal of understanding the risk to be able to appropriately prepare.

Although earthquakes most frequently occur near plate boundaries on the Pacific Coast of Canada, the possibility of a major earthquake cannot be ruled out for any location in Canada, including seismically quiet regions away from plate boundaries. Global stable continental analogues such as Australia, parts of China and the eastern United States demonstrate the potential for rare large earthquakes ( $M > 7.0$ ) in regions with sparse contemporary seismicity. In western Canada, seismic hazard is dominated by two major fault zones: the Queen Charlotte Fault system and the Cascadia Subduction Zone (CSZ). Seismic hazard from all potential earthquake sources is typically analysed in a probabilistic framework to provide a quantitative measure of the ground shaking hazard at a location of interest.

Quantifying seismic hazard alone is not enough, however, to understand earthquake risk. In a given urban area, two nearby locations may have vastly different seismic risk even if the hazard is relatively similar. The two largest contributors to

this risk differential are: 1) the local ground conditions at the site, and 2) the dynamic characteristics of the structure that determine its capacity to withstand strong ground shaking.

In general, locations on deeper softer sediments shake stronger, longer, and at a lower frequency (longer period) compared to locations on stiff rock. Since deep sedimentary basins amplify long-period shaking, tall buildings and other long-period structures such as bridges are particularly susceptible to damage in these areas. In Richmond, BC for example, there are over 100 high-rises built on Fraser River Delta sediments.

Seismic vulnerability of structures is dependent on many factors including but not limited to construction material, the lateral load-bearing system, age of the structure, the seismic provisions used in design, construction quality, height of the structure, and presence of stiffness irregularities. Vulnerability and fragility functions are needed to quantify the damage potential of structures in terms of these parameters.

Once physical impacts are thus quantified, we are much closer to understanding the full picture of risk. Quantification of physical impacts is the gateway to quantifying other downstream impacts, such as human impacts (e.g. casualties and food/shelter needs), economic impacts (dollar losses related to rebuilding costs, business interruption, etc.), and those related to response and recovery (e.g. debris volume estimates).

Multidisciplinary conversations are critical: 1) to understand various stakeholders' needs and 2) to develop robust estimates of seismic risk that addresses these needs.

*“Quantification of physical impacts is the gateway to quantifying other downstream impacts”*

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*Visit us at:*

<http://caee-acgp.ca>

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## News

### New Civil Engineering Program at UVic

The University of Victoria started a new Civil Engineering program with a strong sustainability focus. The program offers a five year Bachelor of Engineering (BEng) degree in Civil Engineering. Its first cohort of undergraduate students started four years ago, and will graduate next year. For more information, visit their web site:

[www.uvic.ca/engineering/civil/](http://www.uvic.ca/engineering/civil/)

## News and Upcoming Events

We appreciate your contributions of news items, announcements, and events you would like to share.

### Upcoming events

#### 6<sup>th</sup> International Conference on Recent Advances in Geotechnical Earthquake Engineering & Soil Dynamics

1–6 August 2016

Roorkee, Uttarakhand, India

[6icragee.com/nw6ic/](http://6icragee.com/nw6ic/)

#### 1<sup>st</sup> International Workshop on Resilience

20–22 September 2016

Torino, Italy

[www.workshop-torino2016.resiltronics.org/index.html](http://www.workshop-torino2016.resiltronics.org/index.html)

#### 69<sup>th</sup> Canadian Geotechnical Conference

2–5 October 2016

Vancouver, BC

[www.geovancouver2016.com](http://www.geovancouver2016.com)

#### 2016 SEAOC Convention (Theme: Recovering, Learning, and Rebuilding after Recent Pacific Rim Earthquakes)

12–15 October 2016

Maui, HI

[convention.seaoc.org](http://convention.seaoc.org)

#### SSA Eastern Section and NGA–East Joint Meeting

24–26 October 2016

Reston, VA

[www.seismosoc.org/meetings/ssa2016/es/](http://www.seismosoc.org/meetings/ssa2016/es/)

#### World Engineering Conference on Disaster Risk Reduction

5–6 December 2016

Lima, Peru

[www.wecdr2016.com/index.php](http://www.wecdr2016.com/index.php)

#### 16<sup>th</sup> World Conference on Earthquake Engineering

9–13 January 2017

Santiago, Chile

[www.16wcee.com](http://www.16wcee.com)