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#### ISSUE No. 013

### February 2011

- SEABC's Newsletter is both edited and managed by The Communications Committee. newsletter@seabc.ca
- Submissions to the newsletter are encouraged and all members of the SEABC are asked to actively participate in contributing to our newsletter. Submissions letters to the Editor, questions and comments can be sent to: newsletter@seabc.ca
- SEABC editing staff reserve the right to include or exclude submitted material and in some cases edit submitted material to suit overall space requirements. If submittals are not to be edited, please advise editor at submission time.

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### Message from the President

February 2011 By Dave Davey, P.Eng.; SEABC Charter President



Sustainability – Its Time has Come

Is sustainability a responsibility of the Structural Engineer?

Sustainability has been promoted as a way of life for many years.

Discussion has grown in intensity with the increasing clamour to reduce our carbon footprint in order to hold back global warming. APEGBC has accepted that sustainability is part of the Engineer's responsibility to the community and through our Code of Ethics, is part of our duty to protect the public.

In the 'early' days of ten to twenty years ago, sustainability in buildings and structures was mainly thought of as conservation of energy. Efficiency of heating and climate control was the primary concern of the mechanical engineer, lighting that of the electrical engineer and insulation and building aspect that of the architect. There wasn't much that the structural engineer could do. We probably knew the insulating properties of some building materials and probably knew that masonry and concrete could provide a heat sink to reduce cyclical or peak use of power but the use of different materials was still within the prerogative of the architect.

Today, sustainability is recognized as a necessity if our civilization is to survive. So it behooves us to do whatever we can to promote sustainability.

We must design for the most efficient use of materials. Of course we should be doing this anyway for the simple reason of economy and hopefully we are.

Awareness of durability has increased, as exemplified in the Concrete Standards used today. It goes without saying that repair and replacement of deteriorated materials are wasteful of resources. The 'Leaky Condo' problems experienced within the last ten years were a valuable lesson to many structural engineers who found themselves caught up in litigation, that protection of a building's structure is a critical component of the structure itself.

Material selection can be influenced by the structural engineer. Wood is held up as an example of a sustainable building material, though it has its obvious limitations. The introduction of changes to the BC Building Code to permit the use of wood construction in buildings up to six stories in height is an incentive for us to use more of this renewable resource. The manufacture of all building materials requires the use of resources, whether it be the raw material, itself, or the energy used in its manufacture. Are structural engineers able to compare the sustainability of using different materials?

SEABC offered an evening seminar on Sustainable Structures on February 14 at the BCIT Downtown campus. A recording of the seminar will be available soon, free to all SEABC members by downloading from the SEABC website.

### *Communication Committee Update*

By David Harvey, P.Eng, Struct.Eng. Chair, SEABC Communication Committee



It is a delight to communicate with SEABC members. You are a group of dedicated professionals practising a profession which demands a high degree of skill and understanding, and you are very supportive of structural engineering in British Columbia. As a result, communication is between like-minded

individuals which simplifies the task of the Communications Committee.

As you know we provide you with a great web site - see the Webmaster's report in this issue; email notifications of webinars and events; and regular newsletters. We receive feedback which is remarkably consistent in its support of the efforts we make on your behalf.

Thank you for your ongoing support and encouragement. Just remember to keep renewing your



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subscription and using the excellent services SEABC provides. Do not forget to send in your articles to the newsletter, and enjoy reading the latest information on structural engineering in BC.

#### 2011 Membership

Your SEABC membership expired on December 31, 2010. If you have not yet renewed for 2011, to retain your membership privileges, you must do so at your earliest convenience. Your options are to renew online at :

#### www.seabc.ca/members/login.php

Or complete the application form at:

### www.seabc.ca/documents/forms/Membership Applicati on.pdf

Corporations can submit a bulk application for all their staff members by mail. The membership fee for 2011 is unchanged at \$75, plus \$9 HST. There is no charge for student membership, but students must renew each year. Please remember to keep your contact information up to date in order to receive your SEABC communications.



By Thor A. Tandy, P. Eng, Struct. Eng. Chair, SEABC Structural Practice Committee



Report Period November 2010 – February 2011

**Review and Response by Committee:** 

#### 1. Consulting Practice Committee:

#### a. Shop Drawing Guideline Review

Final committee review and endorsement is pending.

#### b. ASTTBC Issue

APEGBC and ASTTBC have formed two task forces. 'The Limited License Renewal Task Force' and the 'Professional Technologist Task Force' (P.Tech). The Task Forces have already met and will conclude by mid-March. For further information contact G.Larocque at APEGBC.

**<u>c. Guidelines for Direct Supervision</u>** Guidelines are being revised again by APEGBC staff.

### d. Organisational Quality Management (OQM) Program

APEGBC is implementing a Quality Control Program where Organizations rather than members will be reviewed under a pre-established set of quality control criteria. Once an Organization is certified, its members will not be Practice reviewed for a period of five years. For more information, contact G. Larocque at APEGBC.

#### 2) APEGBC Building Code Committee:

No new items at this time.

#### 3) APEGBC Issues:

No new items at this time.

### Vancouver Island Branch

Thor A. Tandy, P. Eng, Struct. Eng.

#### Mission:

To provide a focal point for SEABC members on the Island to meet, discuss SEABC issues and take benefit in the form of exchange items of technical interest.

#### Future Webinars:

The Chapter will be obtaining membership in ASCE so that we can organize more participation in those webinars

#### 2011 Aims:

1) Search for new Representative/Chair

2) Provide economical CPD opportunities to the local membership.

3) Maintain communication with SEABC Board of Directors

4) Have more general meetings.

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### IStructE News

### By David Harvey, P.Eng, Struct.Eng.

Things are definitely happening at IStructE. In January, past president Norman Train handed the baton to Professor Roger Plank, emeritus professor at the University of Sheffield, who became the 91<sup>st</sup> Institution president. Roger is a very approachable individual with a background in steel design. Roger himself was a student who excelled at both arts and sciences and was torn between engineering and architecture; fortunately he chose to be a structural engineer. After an early career as a consultant during which he gained experience with building design, Roger took and passed the IStructE Chartered Membership exam.

Switching to academia, Roger taught structural engineering to architectural students for many years, and helped UK architects gain a good understanding of the significant role played by structural engineering in good building design. RIBA President Ruth Reed was one of Roger's former architectural students who spoke highly of his teaching style.

Roger is currently well known for his work in fire engineering, a topic on which many will recall his informative presentation at the 2008 Structures Congress in Vancouver. Dynamic and committed, Roger will work hard to advance the Institution's position on sustainable design practices, and to implement its strategic international initiatives. I attended Roger's inauguration at Institution headquarters in London and heard his address. The Institution is certainly in good hands for 2011. A shortened version of Roger's address is at:

### www.istructe.org/about\_institution/president/Pages/defa ult.aspx

While at the Institution headquarters, I presented the findings of a performance review of the trustees I had conducted, to a meeting of the Executive Board. I noted some new faces on the Board this year and will certainly miss being involved. I did, however, attend meetings of the IStructE Council; the International Interest Group; and the Nominations Committee which were most enjoyable and productive. I will also continue my involvement with the Structural Awards, the Professional Development Panel and the Examinations Panel. A very special occasion was dinner with the outgoing president, Norman Train, who

spoke of the enjoyable visit he had to British Columbia, last summer – one of the highlights of his presidency.





Pictured left, 2011 IStructE President Professor Roger Plank. Pictured right, outgoing IStructE President Norman Train in Vancouver.

### Young Members Group

### By Kevin Riederer, MASc, P. Eng. LEED AP



The SEABC YMG has another full year of events planned for 2011 including our first event, a site tour of the BC Place Revitalization Project, on February 21. Due to the overwhelming interest in our first tour

at BC Place last year and in response to the feedback we received from members, we've organized another tour to give more members an opportunity to get a closer look at this exciting project. We encourage SEABC Members to continue to contact us with ideas and suggestions for events that are important to you. We hope to build on the success we've achieved so far and continue to add value to your SEABC membership. The YMG events are organized and run by a small group of dedicated volunteers who have given greatly of their time and efforts over the past few years. Be sure to pass along your thanks the next time you run into one of them!

#### YMG Committee:

Kevin Riederer P.Eng; Read Jones Christoffersen Ilana Danzig, EIT, Genivar

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Grant Fraser, EIT, Associated Engineering Dominic Mattman, EIT, Read Jones Christoffersen Michael Roberts, P.Eng, Section T Consulting Kate Thibert, EIT, Ausenco Sandwell



By Renato Camporese, P.Eng. Struct.Eng. Chair SEABC Technical Committee



The volunteer members of the three currently active Task Groups have been very busy in the past few months and therefore progress from these groups has been very limited. Recent activities are as follows:

#### The Guards Task Group

The Guards Task Group draft report is nearing completion and it is expected that an evening presentation of the work of the group will be provided in the summer.

#### The Seismic Design of Basement Walls Task Group

The Seismic Design of Basement Walls Task Group is continuing with its analytical work on lateral seismic soil pressures on basement walls. Professor Mahdi Taibert of the UBC Civil Engineering Department is supervising the work of a grad student, with the results of the analysis to be reviewed later this month.

#### The Temporary Structures Task Group

The Temporary Structures Task Group has developed a 'Draft Guideline for Tent Structures' which is currently being reviewed by the committee. The group will be meeting with the City of Vancouver later in February to discuss a draft Guideline for the demolition of buildings.

### Education Committee

### By Cam Smith, EIT Chair, SEABC Education Committee



The Education Committee has been busy finalizing arrangements for the upcoming Annual General Meeting being held March 7<sup>th</sup> at the Sutton Place Hotel. Keynote Presenter David Campbell of Geiger

Engineers, New York, is the leader of the international team tasked with the BC Place Roof Replacement Project. David will be discussing the design and associated challenges of the world's largest cable-supported retractable roof, which promises to be an interesting presentation on the revitalization of a Vancouver landmark.

To better serve the SEABC Membership, video recording and archiving of seminars and events is now being done, when possible, to allow access to members who may otherwise have been keen but unable to attend in person. This service has been added to the SEABC website, via *Member Login*, under the *Seminar Downloads link:* 

#### www.seabc.ca/seminar\_downloads.php

where presentation literature from previous seminars is made available.

Past seminars included the November 29<sup>th</sup> presentation "Multi-Hazard Strategies" given by Dr. Michel Bruneau, Ph.D, P.Eng, Professor, Department of Civil, Structural and Environmental Engineering at the University of Buffalo. This seminar was recorded and the video is now available on the SEABC website for access to members.

Although coordinated by the UBC Department of Civil Engineering, the Education Committee has archived the November 15<sup>th</sup> seminar "Progress Engendered by Collapses by Record Setting Structures: Malpasset Dam, World Trade Center Towers and KB Bridge in Palau", which is now also available for viewing by SEABC members.

Another recent seminar, the first of the new SEABC Okanagan Chapter, was a presentation by John Sherstobitoff, P.Eng, Vice President of Ausenco



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Sandwell, titled "Seismic Upgrading in BC: a State-of-Practice". This event was held December 3<sup>rd</sup> at the UBC Okanagan Campus. Congratulations to Solomon Tesfamariam on organizing this successful inaugural seminar for the new Okanagan Chapter.

The most recent seminar was "Sustainable Design in Structural Engineering" on February 16<sup>th</sup> presented by Duane Palibroda, P.Eng., Struct. Eng., MIStructE, Managing Associate with Fast+Epp. On May 18<sup>th</sup>, Adam Patterson of Genivar will be presenting on the topic of "Buckling Restrained Braces". Please refer to the **Events Calendar** link on the website for additional event listings (<u>www.seabc.ca/events.php</u>).

We appreciate feedback from our members; comments on past events, suggestions for future topics, or proposals for presentations are encouraged, so please do not hesitate to contact us at education@seabc.ca.

### *One Hundred Year Service Celebration*

### By Joel Hampson, 2Lt



6 Engineer Squadron in North Vancouver is celebrating one hundred years of service to Canada (1911-2011). To commemorate this

anniversary, the squadron is pleased to invite all former members, friends, and all members of the community to two events this spring.

The first, 'Exercise Bridge Builder', will take place in Waterfront Park in North Vancouver on April 16, 2011 where the squadron will demonstrate its modern bridging skills as well as a glimpse at original bridging techniques and technology used in the First World War.

On May 7, 2011 the squadron will formally celebrate its centennial anniversary by unveiling a memorial Cairn, performing a full military parade in Mahon Park and inviting guests to its home at the LCol J.P. Fell Armoury for a formal dinner banquet.

For more information on 6 Engineer Squadron's 100th Anniversary, please contact 2Lt Chris Beneteau at Christopher.Beneteau@forces.gc.ca



### SEABC Scholarship

### By Martin E. Bollo, P.Eng., S.E.

Fourth year BCIT Civil Engineering student Jonathan Klop was the recipient of the Structural Engineers Association of British Columbia Award in Structural Engineering at a ceremony held on Wednesday, November 10, 2010 at the Willingdon Conference Centre. Along with two other awards for UBC students, these awards are offered to students entering their fourth year of studies in Civil Engineering who have demonstrated academic proficiency and an interest in structural engineering. The awards are funded through proceeds from the SEABC Certificate in Structural Engineering Program.

BCIT Faculty member Martin Bollo (pictured left and sporting a 'Movember' moustache) presented the award to Jonathan (pictured right).



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# *2011 Board of Directors Elections*

#### **Election Statements**

There are twelve nominations for election as Director of SEABC for 2011 -12. Two nominations are from new candidates – Cam Smith and Bill Alcock; the remaining ten candidates are currently serving as Directors.

Stepping down in 2011 are President, Dave Davey, and Director, Thor Tandy.

Dave Davey will be appointed by the Board of Directors to serve as as SEABC's first Past President.

### David Harvey P.Eng Struct.Eng.



I am privileged to have served as a Director of SEABC and observe its exciting growth over the past two years. Our membership numbers have exceeded expectations, and SEABC has become a strong voice for structural engineers. We have tackled important technical and practice issues, enhanced

professional development opportunities, conducted a membership survey, and established high communication standards for structural engineers. We must build upon this promising start, and if reelected, I will work hard to improve services for the SEABC membership.

### Rob Simpson MBA P.Eng. Struct. Eng. LEED AP



Structural engineering is a unique profession. We have the greatest of responsibility for the lives of the public who occupy our buildings, yet the public barely understands our work. For the most part our clients barely understand our work. Still, we strive for excellence

and soak up technical knowledge at every opportunity. This is where SEABC comes in. Helping each of us become better at the technical aspects of our profession improves our lot as a whole. Engineers in Vancouver are equal with the best in the world, thanks to organizations such as SEABC. It has been a pleasure to serve since the inception of SEABC, and that of its predecessor SECBC in the early 90's. We have come a long way and have much left to do. I would strongly encourage younger engineers to take opportunities for work on technical committees to help continue our growth as a profession.

#### Cameron Kemp P.Eng.



Having been part of the formation of SEABC I feel that this new organization is starting to "catch its stride". We have a strong technical Continuing Education program and great Communications program through the newsletter and website.

We are, however, still in the formative stages of organizing some of the other programs and committees within SEABC and I would like to continue with the Board to ensure that, as the organization matures, we preserve the principles and priorities that guided SEABC's formation.

For 2011 I would like to see a focus on forming and/or strengthening these various technical and business committees. Active committees tackling relevant, topical issues will see the SEABC become a fully mature organization representing all aspects of structural engineering to its members.

With your support I would like to be part of the SEABC's ongoing development.

### Andrew Seeton MASc, P.Eng.



My participation in the local structural engineering societies began in 2005 when I joined the board of directors of the Vancouver Structural Engineers Group Society (VSEGS). I acted as VSEGS President beginning summer of 2007, a position that transitioned to Chair of the

SEABC Education Committee when VSEGS joined DSE and SECBC to form SEABC in early 2008.

For the past two years I have served on the Board of Directors for SEABC while remaining active with the Education Committee. In 2009 I undertook collaborative efforts with other committee members to coordinate successful educational seminars for SEABC members, and look forward to continuing these efforts in 2011.

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My current goal is to develop a video archiving system to allow members to view SEABC events remotely via the web. Continued professional development is vital for all structural engineers; this belief is what motivates my participation in SEABC.

### Paul Fast P.Eng, Struct.Eng.



SEABC has made an excellent start in connecting, equipping and representing the structural engineering community. With close to 30 years structural design experience and serving on various nonprofit boards, I am standing as candidate for

the executive committee with the intention of building on this good foundation, particularly with the aim of encouraging our young engineers to strive for excellence and creativity amidst the rigor of calculations and learning building codes.

#### Cam Smith EIT



My involvement with the SEABC began as a student representative to the SEABC while attending the British Columbia Institute of Technology and has continued in my current capacity as Chair of the SEABC Education Committee.

The majority of my experience has been in construction engineering and industrial and transportation structures, servicing the mining, power transmission, chemical, oil and gas and forestry industries.

I am pleased to be given the opportunity to stand for a position as a Director of the SEABC, and to further my involvement with the Association.

### Bill Alcock, P.Eng. Struct. Eng.



I am a graduate of the University of Toronto, have a Master's degree from UBC, and have nearly four decades of experience, primarily in industrial structures.

As a past director and chair of the DSE, I am gratified to see how well the SEABC has unified the various structural engineering associations in British Columbia into one truly dynamic organization. The newsletter, courses and other initiatives sponsored by SEABC since its inception have been excellent. I am honoured to have been nominated as a Director of SEABC and will do my best to uphold the high standards that have been set by the previous directors.

### Adrian Gygax P.Eng, Struct.Eng.



During the past few years, SEABC has built on the foundations established by its predecessor organisations to become a strong advocacy and support forum for the structural engineering profession. It would be my privilege to serve our

organisation as a board member as we head into a phase of membership development and the hosting of events such as SEA Western Conference at Whistler in October 2010.

I am a graduate in civil engineering from the University of British Columbia, and have three decades of experience in structural and foundation engineering.

Since 1997, I have been the Principal of Gygax Engineering Associates Ltd. where we specialise in structural design for infrastructure. I am a firm believer in professional development and mentoring.

In its 12 years of existence, my firm has trained four engineers-in-training and I serve on the APEGBC "Looking to Exempt" panels. Continued support for the SEABC's Certificate Programme, technical seminars and working groups are vital to our profession. Providing input to for curriculum development at our local universities is also important.

### Stephen Pienaar, P.Eng.



Information technology is becoming increasingly important to organisations. The SEABC is no different.

IT leadership and vision are best displayed at the top: in the boardroom.

As the Association's webmaster, I have been directly involved with setting up the SEABC website and email broadcasts, and development of the online membership and ecommerce systems. The goal posts are continually shifting and much more need to be done in coming years. If re-elected as director, I will aim to help SEABC achieve its online objectives and expand its online presence even further.

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#### Renato Camporese PEng, StructEng;



Director, SEABC; Chair, Technical Committee.

### Surinder Parmar PEng;



Director, SEABC; Secretary/Treasurer.

### Carlos Ventura PhD PEng;



Director, SEABC; UBC Representative.

# History Repeats Itself: Repeats Itself:

### **Repeats Itself:** Repeats Itself.

### By Rob Simpson, P.Eng., Struct. Eng.

In 1835, the well-known explorer and scientist Charles Darwin came upon the same ground and same circumstances that we current-day engineers travelled in Chile. Darwin landed at Concepcion soon after a devastating earthquake, just as we arrived there about 10 days subsequent to the Feb 2010 M8.8 event. Darwin's portrayal is eerily familiar; some of his statements are nearly word for word what I have previously described. If we have difficulty to spawn belief that we live on ground prone to earthquakes, perhaps they might entrust the words of Darwin? Perry Adebar has written an excellent report to help rationalize the problem with thin gravity supporting elements for the public, however, purposefully absent is a key point that engineers familiar with structures should consider. Many of the buildings that survived the Chilean "big one" had a multitude of redundant concrete walls with no irregularities. These buildings were seriously damaged yet remained erect due to redundant load paths unlike our typical structures.

Survival of structures in an earthquake depends fundamentally upon maintenance of gravity support, confinement of cores of concrete columns being the most essential quality of a concrete building to achieve this goal. History will repeat ... will we be ready?

Many thanks go to Adrian Wightman for sending this to me, it's an interesting read, please see below.

#### By Charles Dawin, Concepcion, Chile.

#### From the Voyage of the Beagle

#### March 4th, 1835

We entered the harbour of Concepcion. While the ship was beating up to the anchorage, I landed on the island of Quiriquina. The mayordomo of the estate quickly rode down to tell me the terrible news of the great earthquake of the 20th: "That not a house in Concepcion or Talcahuano (the port) was standing; that seventy villages were destroyed; and that a great wave had almost washed away the ruins of Talcahuano." Of this latter statement I soon saw abundant proofs-the whole coast being strewed over with timber and furniture as if a thousand ships had been wrecked. Besides chairs, tables, book-shelves, etc., in great numbers, there were several roofs of cottages, which had been transported almost whole. The storehouses at Talcahuano had been burst open, and great bags of cotton, yerba, and other valuable merchandise were scattered on the shore.

During my walk round the island, I observed that numerous fragments of rock, which from the marine productions adhering to them, must recently have been lying in deep water, had been cast up high on the beach; one of these was six feet long, three broad, and two thick.

The island itself plainly showed the overwhelming power of the earthquake, as the

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beach did that of the consequent great wave. The ground in many parts was fissured in north and south lines, perhaps caused by the yielding of the parallel and steep sides of this narrow island. Some of the fissures near the cliffs were a yard wide. Many enormous masses had already fallen on the beach; and the inhabitants thought that when the rains commenced far greater slips would happen. The effect of the vibration on the hard primary slate, which composes the foundation of the island, was still more curious: the superficial parts of some narrow ridges were as completely shivered as if they had been blasted by gunpowder. This effect, which was rendered conspicuous by the fresh fractures and displaced soil, must be confined to near the surface, for otherwise there would not exist a block of solid rock throughout Chile; nor is this improbable, as it is known that the surface of a vibrating body is affected differently from the central part. It is, perhaps, owing to this same reason, that earthquakes do not cause quite such terrific havoc within deep mines as would be expected. I believe this convulsion has been more effectual in lessening the size of the island of Quiriquina, than the ordinary wearand-tear of the sea and weather during the course of a whole century.

The next day I landed at Talcahuano, and afterwards rode to Concepcion. Both towns presented the most awful yet interesting spectacle I ever beheld. To a person who had formerly known them, it possibly might have been still more impressive; for the ruins were so mingled together, and the whole scene possessed so little the air of a habitable place, that it was scarcely possible to imagine its former condition. The earthquake commenced at half-past eleven o'clock in the forenoon. If it had happened in the middle of the night, the greater number of the inhabitants (which in this one province must amount to many thousands) must have perished, instead of less than a hundred. As it was, the invariable practice of running out of doors at the first trembling of the ground, alone saved them. In Concepcion each house, or row of houses, stood by itself, a heap or line of ruins; but in Talcahuano, owing to the great wave, little more than one layer of bricks, tiles, and timber, with here and there part of a wall left standing, could be distinguished.

From this circumstance Concepcion, although not so completely desolated, was a more terrible, and if I may so call it, picturesque sight. The first shock was very sudden. The mayordomo at Quiriquina told me, that the first notice he received of it, was finding both the horse he rode and himself, rolling together on the ground. Rising up, he was again thrown down. He also told me that some cows which were standing on the steep side of the island were rolled into the sea. The great wave caused the destruction of many cattle; on one low island, near the head of the bay, seventy animals were washed off and drowned.

It is generally thought that this has been the worst earthquake ever recorded in Chile; but as the very severe ones occur only after long intervals, this cannot easily be known; nor indeed would a much worse shock have made any difference, for the ruin was now complete. Innumerable small tremblings followed the great earthquake, and within the first twelve days no less than three hundred were counted.

After viewing Concepcion, I cannot understand how the greater number of inhabitants escaped unhurt. The houses in many parts fell outwards; thus forming in the middle of the streets little hillocks of brickwork and rubbish. Mr. Rouse, the English consul, told us that he was at breakfast when the first movement warned him to run out. He had scarcely reached the middle of the court-yard, when one side of his house came thundering down. He retained presence of mind to remember, that if he once got on the top of that part which had already fallen, he would be safe. Not being able from the motion of the ground to stand, he crawled up on his hands and knees; and no sooner had he ascended this little eminence, than the other side of the house fell in, the great beams sweeping close in front of his head. With his eyes blinded, and his mouth choked with the cloud of dust which darkened the sky, at last he gained the street. As shock succeeded shock, at the interval of a few minutes, no one dared approach the shattered ruins; and no one knew whether his dearest friends and relations were not perishing from the want of help. Those who had saved any property were obliged to keep a constant watch, for thieves prowled about, and at each little trembling of the ground, with one hand they beat their breasts and cried

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"Misericordia!" and then with the other filched what they could from the ruins. The thatched roofs fell over the fires, and flames burst forth in all parts. Hundreds knew themselves ruined, and few had the means of providing food for the day...

Shortly after the shock, a great wave was seen from the distance of three or four miles. approaching in the middle of the bay with a smooth outline; but along the shore it tore up cottages and trees, as it swept onwards with irresistible force. At the head of the bay it broke in a fearful line of white breakers, which rushed up to a height of 23 vertical feet above the highest spring-tides. Their force must have been prodigious; for at the Fort a cannon with its carriage, estimated at four tons in weight, was moved 15 feet inwards. A schooner was left in the midst of the ruins, 200 yards from the beach. The first wave was followed by two others, which in their retreat carried away a vast wreck of floating objects. In one part of the bay, a ship was pitched high and dry on shore, was carried off, again driven on shore, and again carried off. In another part, two large vessels anchored near together were whirled about, and their cables were thrice wound round each other; though anchored at a depth of 36 feet, they were for some minutes aground. The great wave must have travelled slowly, for the inhabitants of Talcahuano had time to run up the hills behind the town; and some sailors pulled out seaward, trusting successfully to their boat riding securely over the swell, if they could reach it before it broke. One old woman with a little boy, four or five years old, ran into a boat, but there was nobody to row it out: the boat was consequently dashed against an anchor and cut in twain; the old woman was drowned, but the child was picked up some hours afterwards clinging to the wreck. Pools of saltwater were still standing amidst the ruins of the houses, and children, making boats with old tables and chairs, appeared as happy as their parents were miserable. It was, however, exceedingly interesting to observe, how much more active and cheerful all appeared than could have been expected.

It was remarked with much truth, that from the destruction being universal, no one individual was humbled more than another, or could

suspect his friends of coldness—that most grievous result of the loss of wealth. Mr. Rouse, and a large party whom he kindly took under his protection, lived for the first week in a garden beneath some apple-trees. At first they were as merry as if it had been a picnic; but soon afterwards heavy rain caused much discomfort, for they were absolutely without shelter.

### BCIT Professional Night

#### Correction of date from previous issue

The Canadian Society for Civil Engineering,(CSCE), Student Chapter at BCIT, is hosting a Civil Engineering "Professional Night" on **February 24, 2011**. All engineering professionals are invited to attend this year's event.

Apologies for the incorrect date given in the November newsletter.

### Seismic Design of Concrete Buildings

By Perry Adebar, Ph.D., P.Eng., Chair, SEABC Technical Subcommittee on Concrete Design



#### Proposed Changes for 2014

The Concrete Design Subcommittee of SEABC Technical Committee, which is the local group providing input to CSA Technical Committee A23.3, has an ambitious list of major changes that it is working on for the 2014 edition of Clause 21. This article briefly

describes some of the proposed changes.

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#### Reorganization of Clause 21

The current Clause 21 provisions were written with a focus on ductile systems (e.g.,  $R_d$  = 3.5 cantilever walls and coupled walls). Requirements for systems with lower ductility have gradually been added over the years. For 2014, the entire clause is being reorganized so that the requirements for systems with lower ductility (e.g.,  $R_d$  = 2.0 walls) are presented first, followed by the increased requirements for systems with higher ductility (e.g.,  $R_d$  = 3.5 walls).

The exercise of reorganizing the wall provisions has highlighted the need to rationalize and clarify exactly which requirements for ductile walls also apply to moderately ductile walls. In the current Clause 21, that is left to the discretion of the engineer, which was the main impetus for the reorganization of the clause.

#### Coupled Wall Systems

In Canada we currently have three ductility levels for cantilever shear wall systems – ductile, moderately ductile and conventional; but only one level of ductility for coupled or partially-coupled wall systems (ductile). Moderately ductile coupled walls with an  $R_d$  = 2.5 and partially-coupled walls ( $R_d$  = 2.0) are expected to be added as new concrete wall systems in 2014 CSA A23.3 and 2015 NBCC.

The design requirements are expected to be relaxed versions of the requirements for the more ductile systems. At the same time, the current requirements for ductile coupled walls will be reviewed with an eye to relax some of the more onerous requirements.

#### **Design Shear Forces in Cantilever Shear Walls**

The current CSA A23.3 requires that:-

"The shear due to the effects of factored loads shall account for the magnification of the shear due to the inelastic effects of higher modes;"

But neither the clause nor the commentary give any guidance on how to achieve this. A major research project is currently underway at UBC to better understand the phenomenon often referred to as "dynamic magnification of shear forces." The outcome will hopefully be a simplified procedure to magnify the design shear forces determined from response spectrum analysis without having to do a nonlinear dynamic analysis. Recent results indicate the required increase in design shear forces may not be as large as initially thought but are still about twice the values currently used in design.

### Design/Detailing of Walls for Flexural Yielding Near Midheight

The current design philosophy for concrete shear walls is to provide a plastic hinge zone at the base of the wall that will protect the upper portions of the wall from yielding. It is now well known that the higher modes generate large bending moments near the mid-height of the wall and that yielding of the wall at the base will not prevent yielding at the wall mid-height due to higher modes. The solution is to use a different bending moment envelope to design the vertical reinforcement at the wall mid-height and/or provide minimum detailing for ductility (e.g., anti-buckling ties) over the full height of the wall.

### Seismic Design Requirements for Conventional Shear Walls

The intent is that conventional systems are those without any special seismic design requirements. Thus there are currently no requirements in Clause 21 for conventional shear walls; however NBCC permits conventional shear walls in buildings up to 30 metres high (about 12 stories) in the highest seismic regions of Canada. This is felt by some to be potentially unsafe, and thus some requirements for conventional shear walls may be added to Clause 21.

#### Gravity-load Columns in Buildings

NBCC design provisions that ensure buildings can tolerate the expected level of earthquake motion without collapse are force-based. As a result, the portion of the building that resists most of the lateral seismic force – called the SFRS – is treated very differently than the rest of the structure even though the whole building is subjected to the same earthquake induced deformations.

In Canada, it is common for gravity-load columns to be elongated (like a wall) rather than square in cross section. At the base of a building, the shear walls contain special seismic detailing, while the wall-like gravity-load columns do not contain such reinforcement even though they are more heavily loaded than the shear walls and will experience similar deformation demands.

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Since the 1984 edition, Clause 21 has had a requirement to check whether gravity-load columns remain elastic under the design earthquake. Unfortunately, the way that these provisions have been applied using linear analysis has not ensured the safe design of gravity-load columns. Recent nonlinear analysis has shown, for example, that a 2.4 m (8 ft) long column can lose over 50% of its axial load carrying capacity at an inelastic drift ratio of only 1%, which is less than many columns will experience due to the design earthquake. Concern over the safety of gravityload columns has resulted in an emergency change to Clause 21.12 in Update No. 3 of A23.3 issued by CSA in August 2009. If nonlinear analysis is not done, closely spaced seismic hoops shall be provided in all columns and walls that support gravity loads. Also, over the plastic hinge height, all columns and walls must be made wide enough to meet the same limit on maximum compression strain depth as concrete shear walls.

While the quick fix to Clause 21.12 in August 2009 should essentially eliminate elongated columns and heavily loaded gravity-walls over the plastic hinge region of shear wall buildings, the issue is much larger and additional significant changes to Clause 21.12 are expected in 2014. For example, as discussed above, concrete shear walls - and the gravity-load columns tied to these walls - are expected to have large curvature demands near the mid-height of taller buildings and thus an additional check needs to be made on the ability of gravity-load columns and walls being able to tolerate the required bending at midheight. Also, simple methods are needed to estimate the inter-story drift at every level accounting for the inelastic behaviour of the shear walls. This information is needed, for example, to check the rotational demands on slab-column connections, as well as other demands on the gravity-load frame.

#### Thin Concrete Shear Walls

One observation made during the reconnaissance trip to Chile about one year ago is that many of the badly damaged buildings were brand new, and a common feature of the damaged buildings was that they had thin concrete shear walls. Tests were recently conducted at UBC to determine the compression strain capacity of thin concrete shear walls. As the requirements of Clause 21 are based on the assumption that unconfined concrete can tolerate a compression strain of 0.0035, the sudden failures of 6-inch thick walls at compressions strains just over 0.001 was surprising and helps explain the failures in Chile. In Chilean high-rise residential buildings it is common for every partition to be a concrete shear wall. The numerous shear walls result in stiff buildings with significantly smaller fundamental lateral periods than typical high-rise concrete wall buildings in Canada of the same height. The smaller fundamental lateral periods result in smaller displacement demands and hence smaller compression strain demands during the earthquake, which explains why there was a relatively small number of badly damaged buildings in Chile.

Most of the damaged buildings had additional undesirable characteristics such as reduced length shear walls in the lower levels or discontinuous shear walls supported on columns that were reinforced as walls.

All the tests conducted recently at UBC have been on 6-inch wall elements. Additional tests are currently planned on 8-inch walls; however based on the observed behaviour of the 6-inch walls, the 8-inch walls are not expected to have significantly larger compression strain capacity.

All wall elements that failed at low compression strain were subjected to uniform compression strain (simulating the small strain gradient in a long shear wall) and had no cross ties connecting the two faces of wall reinforcement. Wall elements with non-seismic column ties connecting the two faces of reinforcement (i.e., column elements) had compression strain capacities similar to what is assumed in the code about 0.0035 - because the concrete nominally confined within the ties stabilized the rest of the walls. Similarly, wall elements that had a large strain gradient due to local bending were able to tolerate the traditional value of maximum compression strain (0.0035) because the concrete subjected to lower compression strain stabilized the concrete subjected to higher compression strain.

Previous tests to investigate the compression strain capacity of unconfined concrete have all been on members subjected to significant strain gradient.

The recent test results provide a clear definition of the difference between a column and a wall. A column with ties satisfying Clause 7.6.5 (including ties arranged so that every alternate vertical bar has lateral support provided by a cross tie, and no vertical bar is farther than 150 mm from such a laterally supported bar) is able to tolerate a maximum compression strain of 0.0035. A wall without a core that is nominally confined by Clause 7.6.5 ties will have a maximum compression

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strain capacity of only about 0.001. As wind forces also cause bending of a shear wall, significant changes to the design of walls are expected in both Clause 14 and Clause 21.

#### Seismic Design of Tilt-Up Buildings

The 50-year old idea of casting walls on the ground and then tilting them up to form a building is simple; but the seismic behaviour of these systems is surprisingly complex. There are two very different types of concrete tilt-up walls: solid walls, where all the inelastic deformation is in the panel-to-panel or panel-to-slab connectors; and walls with large openings, which are essentially weak-column strong-beam frames with detailing that provides less ductility than conventional cast-in-place frames. In addition, the diaphragm that connects the heavy concrete wall panels is typically a very flexible metal deck diaphragm. The flexibility of the diaphragm is a very important part of the seismic behaviour of tilt-up buildings.

Currently NBCC does not include provisions for flexible diaphragm systems; but the Standing Committee on Earthquake Design (SCED), which writes the NBCC provisions, has formed a task group on single-storey buildings with flexible diaphragms to develop provisions for 2015. Members of the SEABC Concrete Design Subcommittee are part of that group.

Currently, the fundamental lateral period used to design concrete tilt-up systems is based only on the wall height, and as a result is typically much smaller than the actual system period, which depends largely on the diaphragm flexibility. When the fundamental lateral period is increased to account for diaphragm flexibility, the design displacements will increase but design forces will reduce and the  $R_d R_o$  factors need to be adjusted to ensure the resulting system has adequate displacement capacity.



Sudden failure of a 6-inch thick concrete shear wall element with a single layer of reinforcement

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### On the Web

### By Stephen Pienaar, P.Eng; SEABC Webmaster



The SEABC website remains a valuable resource for announcing and managing of upcoming seminars and courses. The Communications Committee continues their mission to encourage interaction and knowledge sharing between members, and cooperation with other

SEAs and IStructE.

#### SEABC Website

New resources on our website:

- 2010 IStructE exam and examiners report. More at <u>www.seabc.ca/struct-eng</u>.
- SEABC seminar recording: "Changes in the Steel Standard S16-09" presented in October by Andy Metten, P.Eng, Struct. Eng. (Bush, Bohlman & Partners). Log in at www.seabc.ca/seminar-downloads.
- UBC Guest Speaker seminar recroding: "Progress Engendered by Collapses of Record Setting Structures" presented in November by Dr. Zdenek P. Bazant, Ph.D. (Northwestern University). Watch this presentation at www.seabc.ca/seminar-downloads.

Work in progress:

- SEABC is currently in discussion with IStructE regarding reciprocal access to seminar recordings and other online resources. Watch this space for developments!
- Planning of a public, searchable directory that will display the skills and expertise of corporate members is in an advanced stage. We hope to launch this new service in the near future.

#### SEABC Forum

After a quiet holiday season, activity on the Forum remains subdued. We invite all members to participate in the discussions on the Forum. Please post your practice and technical questions, and share your experience by replying to fellow members' messages. Sharing your knowledge helps building our profession. Your participation is free; its value is immeasurable! Log in today at <u>www.seabc.ca/forum</u>.

#### Housekeeping

We encourage members to keep their contact information and communication preferences up to date. To do so, please log in at <u>www.seabc.ca/members</u>. If you have not logged in before, you will need to first activate your online profile by entering your membership number and email address on record (the address where this newsletter would have reached you).

#### Suggestions

We welcome your comments for improving our website and online member services. Please send your suggestions to webmaster@seabc.ca or post it on the SEABC Forum.

Follow us on Twitter! Receive timely announcements of upcoming events on your cellphone. www.twitter.com/SEABC



### By Stephen Pienaar, P.Eng, SEABC Webmaster

Things have been a bit quiet on the SEABC Forum after the holiday season. We encourage all members to participate in the discussions and help build this valuable resource.

Your SEABC membership automatically grants you access to the SEABC Forum. The Forum provides an invaluable resource for information—your fellow SEABC members—and is a great instrument to expand your professional network.

Here is a summary of recent topics discussed in the General Technical Discussion forum:

- Tejas G notes that there are 800 technical changes coming to Canada's Building Code. <u>Read more ></u>
- Stephen P solicits opinions on the use of the Reinforcing Steel: Manual of Standard Practice. <u>Read more ></u>
- Laxman S has a question about using r<sub>z</sub> for calculation of kL/r of angle compression members. <u>Read more ></u>

# February 2011

# Ask Dr. Sylvie

CISC published Ask Dr. Sylvie articles in Advantage Steel up until Edition 34 available at: <u>www.cisc-icca.ca/content/publications/</u> <u>publications.aspx</u>

See also the list of CISC technical resources at: www.cisc-icca.ca/content/technical/default.aspx



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#### Seminars

### SEI and ASCE 2011 Structures Congress

Date: April 14-16

Venue: Green Valley Ranch, Resort & Spa, Las Vegas NV, USA

**Overview:** The Structural Engineering Institute (SEI) and American Society of Civil Engineers (ASCE) are inviting SEABC members to the 42st Structures Congress. This year's Congress consists of 10 concurrent technical tracks that focus on the theme: "Don't Gamble on your Future - Come to the Structures 2011 Congress." The Congress will demonstrate what is redefining structural engineering in the areas of bridge and transportation structures, buildings, and advances in research.

Early bird registration deadline is February 23. More info...

# SEAI - Transitioning from the 2006 IBC to the 2009 IBC Structural Provisions

The Structural Engineers Association of Idaho (SEAI) is holding a full-day seminar on March 15 dealing with the major new features of the 2009 IBC structural provisions.

Changes to the structural loading requirements as well as to the special inspection, foundation and material provisions are presented:

• Updated material standards (with emphasis on ACI 318-08):

- New structural integrity requirements:
- Revisions to the ASCE 7-05 seismic provisions:
- Revised live loads:
- Revised wall anchorage requirements:
- New alternate all-heights wind design method:
- New rainfall intensity maps:
- New special inspection requirements in Chapter 17:
- Reorganization and reformatting of Chapter 18

The seminar will be presented by speakers who have been involved with the development of national codes and standards. Attendees can earn 8.0 professional development hours.

SEABC members qualify for SEA member discount. For a seminar brochure and registration form, please see the <u>SEABC Events Calendar</u>.

#### ASCE Live interactive Web Seminars

- Learning from Failures of Wood-Framed Structures February 28. <u>More info...</u>
- Moment-Resisting Connections in Steel Structures March 1. More info...
- Wind Design for Non-Residential Wood Structures
   March 7. More
   <<u>https://secure.asce.org/ASCEWebSite/WEBINAR/ListWebinarDetail.aspx?ProdId=175</u>
   <u>50</u>> info...
- Structural Design for Residential Applications: Gravity-Load Systems and Lateral-Load Systems
   Part I March 8, Part II March 10. More
   <a href="https://secure.asce.org/ASCEWebSite/WEBINAR/ListWebinarDetail.aspx?ProdId=175\_51">https://secure.asce.org/ASCEWebSite/WEBINAR/ListWebinarDetail.aspx?ProdId=175\_51</a> info...
- Seismic Bracing for Mechanical and Electrical Building Components March 14. More
   <a href="https://www.secure.asce.org/ASCEWebSite/WEBINAR/ListWebinarDetail.aspx?ProdId=1755">www.secure.asce.org/ASCEWebSite/WEBINAR/ListWebinarDetail.aspx?ProdId=1755</a> 5> info...
- Facility Damage Assessments Differences in Perceptions of Damage Severity March 17. More
   <a href="https://www.secure.asce.org/ASCEWebSite/WEBINAR/ListWebinarDetail.aspx?ProdId=1755">www.secure.asce.org/ASCEWebSite/WEBINAR/ListWebinarDetail.aspx?ProdId=1755</a> 9> info...
- Design of Building Floors for Concentrated Loads March 18. More
   <a href="https://www.secure.asce.org/ASCEWebSite/WEBINAR/ListWebinarDetail.aspx?ProdId=1756">www.secure.asce.org/ASCEWebSite/WEBINAR/ListWebinarDetail.aspx?ProdId=1756</a> O> info...

**Site Registration Option:** Use the **SEABC Forum** to arrange a get-together with other SEABC members and share the costs of a single site registration fee.

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#### **BCIT Professional Night**

The Canadian Society for Civil Engineering (CSCE) Student Chapter at BCIT is hosting a Civil Engineering "Professional Night" this Thursday, February 24. They are extending an invitation to all SEABC members to attend this year's event.

The "Professional Night" is an opportunity to mingle with Civil Engineering students and faculty and to meet prospective employees. There will be several 2nd and 4th year students nearing the end of their studies who will be looking for technologist and EIT positions, respectively. Please visit <u>www.cscebcit.ca</u> or email <u>foaadsm@gmail.com</u> for more information.



www.seabc.ca E-mail: info@seabc.ca

### Annual General Meeting, Dinner & Presentation

Date:	March 7, 2011
Venue:	Sutton Place Hotel, 845 Burrard Street, Vancouver
Time:	5:30 pm (pre-registration required; register online or mail in the attached form)
Cost:	\$40+HST (SEABC Members), \$100+HST (Non-Members)
Keynote:	BC Place Roof Replacement Project, David Campbell, P.Eng., Geiger Engineers
AGM:	Address from SEABC President



BC Place Stadium opened in 1983 as the first domed stadium in Canada covered by the largest air-supported roof in the world. As part of a major revitalization project the stadium dome is being replaced with a new retractable roof structure, now well into construction. The new roof is the largest of its kind in world and the first of its type in North America. David Campbell P.Eng., leader of the international team that designed the roof, will present the roof design and its challenges.

David Campbell began working with Geiger Associates in 1979 and was made an Associate and head of the Vancouver BC office in 1982. He is one of the founding principals of Geiger Engineers and has managed the firm as its Chief Executive Officer since its beginning. In his twenty eight years of engineering practice, he has had a significant role in over 25 large spectator sports facilities. In addition, he has provided construction engineering consulting to contractors for number of major sports buildings. David has authored numerous technical papers on long-span and tensile structures.





The Structural Engineering Association of British Columbia

Mail-in Registration Form: AGM, Dinner, & Presentation March 7, 2011 You can also register online! www.seabc.ca/agm (secure credit card payment via PayPal)

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An administration fee of \$25 will apply to any cancellations received by February 28, 2011. No refunds given after February 28, 2011.