SEABC NEWSLETTER

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- 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.

Message from the President

November 2012

By Cameron Kemp, P.Eng.; SEABC President

A Couple of Pointed Reminders

In recent weeks we've had a couple of reminders about who's really in charge; Mother Nature. One, closer to home, was the magnitude 7.7 earthquake and subsequent magnitude 6.4 aftershock south-west of Haida Gwaii.

The other was Hurricane Sandy that started in the Southern Caribbean Sea, hit Jamaica and Cuba, skirted the southeast US and then slammed ashore along the northeastern seaboard notably hitting the cities of Atlantic City, Pittsburgh, New York and the surrounding areas of New Jersey. Fortunately the earthquake was located offshore and in a remotely inhabited area with no loss of life or damage. Sandy, unfortunately, was another story with many deaths and untold billions in damage.

Whether it is an earthquake or a major storm like Sandy a significant factor determining whether these natural events are simply notable or devastating are how well we design and build our buildings and urban infrastructure to withstand them. Too often we find Mother Nature exposes the shortcomings in our designs or the flaws in our construction.

We must continue to improve our knowledge of design and construction to ensure that our structures are tough, durable and ductile enough to withstand what she will throw at them. All of our structures have a long enough design life that they will have a high probability of experiencing, at least once in their lifetime, an earthquake like the one in Haida Gwaii or a hurricane like Sandy.

As the technical experts our responsibility for the safety of the public goes beyond designing and building safe buildings. We must also influence public policies and standards and educate the public about what they can expect from the buildings we design. I have had many conversations with people about the principles behind modern seismic design and most are aghast to find out that "normal" buildings aren't "earthquake-proof" and, in fact, may be severely damaged and need to be torn down after a design level earthquake. Countries like New Zealand are starting to rethink this philosophy in the wake of the recent major earthquakes they've experienced in Christchurch and the fact that they will ultimately end up having to almost entirely rebuild their downtown core.

We need to continually revisit the balance between "safety at any cost" and simply preserving human life (but incurring huge societal and financial hardships) by allowing our buildings to be severely damaged in extreme events. Our role as engineers goes beyond just being technical experts. It needs to include having a voice in how society deals with not only natural events like earthquakes and hurricanes but also the man-made ones we've helped create like global warming and the resulting climate change it is precipitating.

Mother Nature is trying to tell us something and we need to decide how to respond to her.

Education Committee

By Cam Smith, Director SEABC

Wine and Cheese 2012

Following the end of the summer break, the SEABC Education Committee has been busy making preparations for several seminars and events. Two of these events have since passed, including the annual 'Wine & Cheese' which was held this year on September 19th at the British Colombia Institute of Technology. The event was well attended by practitioners, faculty and students and included a presentation by Dr. Svetlana Brzev and Nazli Azimikor summarizing the findings from a recent research project titled "Stability of Reinforced Masonry Shear Walls under Seismic Loading". The project was a collaborative effort between faculty and students from both BCIT and UBC. David Harvey provided opening comments on behalf of the SEABC Executive.

Past Evening Seminar: 'Energy-Efficient Buildings & Passive House'

On October 17th Robert Malcyzk, P.Eng., Struct.Eng., Principal, Equilibrium Consulting Inc. presented the seminar 'Energy-Efficient Buildings & Passive House'.

This seminar provided a brief history of energy efficient buildings in Canada as well as new trends in design and construction. The term 'Passive House' is becoming the accepted worldwide standard for energy efficiency with around 50 PH buildings having now been completed across Canada, more than 500 in the US and over 40,000 in Europe.

Past Evening Seminar: 'Ground Shaking During the 2011 Japan Earthquake: What Have We Learned?'

The November 14 evening seminar was titled, 'Ground Shaking During the 2011 Japan Earthquake: What Have We Learned?" by Dr. Carlos Ventura, P.Eng., P.E., UBC Department of Civil Engineering.

A vast amount of data was recorded during the magnitude 9.0 Tohoku Japan earthquake, including long-period ground motions and data captured from a significant number of buildings that were instrumented. The presentation provided a discussion of the unique characteristics of this earthquake as well as a comparison of its ground motions with those recorded during the recent New Zealand and Chile earthquakes. Special emphasis was placed on the response of instrumented buildings and the associated damage due to the effects of duration of shaking. The seminar concluded with how the lessons learned from this earthquake could affect current design practice in BC.

As a reminder to the SEABC membership, video recording and archiving of seminars and events continues to be done to better serve the SEABC Membership who are unable to attend in person. This service is available through the SEABC website (via *Member Login*, under the *Seminar Downloads* link) where presentation literature from previous seminars is also made available.

We appreciate feedback from members including comments on past events, suggestions for future topics, and proposals for presentations, so please do not hesitate to contact us at: education@seabc.ca.

Communications Committee

By David Harvey, P.Eng, Struct.Eng.
Director SEABC

Many thanks to those who forwarded articles to the newsletter describing their recent work. This edition features research into reinforced masonry walls by Dr. Svetlana Brzev, and an article by John Sherstobitoff and Dr Perry Adebar describing the analysis and repair of a building damaged during the Chilean earthquake. By informing our members of the engineering we carry out, we maintain interest in our well-read magazine and help raise the profile of the profession. There is always much to learn from the information that the structural engineer responsible for the work can provide.

Please continue to let your fellow structural engineers know what you are up to. It is also a great way to raise your profile in the structural community, so why not give it a go? We look forward to hearing from you.

Please forward information for publication to:-

newsletter@seabc.ca

– We'll do our best to include as many interesting articles as we can. Thank you!

Repair of an Earthquake-damaged High-rise Shear Wall Building

**By John Sherstobitoff, P.Eng., Ausenco,
Primo Cajiao, P.Eng., AMEC, and
Perry Adebar, P.Eng., UBC**

Perry Adebar

John Sherstobitoff

More than one hundred high-rise concrete shear wall buildings were badly damaged during the earthquake that occurred in Chile on February 27, 2010. A common form of damage was compression failure of thin walls in the lower levels of the buildings. In one 18-story residential building in Santiago, three adjacent shear walls at one corner of the building failed in flexural compression immediately below grade (see Fig. 1). This caused the corner of the building to drop down 75 mm and the top of the building to move 185 mm out of plumb, resulting in a 0.44% permanent drift.

The building has an overall floor plan of about 14 m x 37 m. Like most high-rise residential buildings in Chile, the building had two long shear walls on either side of a corridor running the full length of the building in the long (37 m) direction. In the transverse direction, there are slender shear walls on both sides of the central corridor (see Fig. 1). Most of the transverse shear walls are 200 mm thick; however some are 150 mm thick. The transverse shear walls have a uniform length from above the ground floor to the top of the building; but in the two levels of parking below grade, levels S1 and S2, these walls are narrower (see Fig. 1).

Cracking of concrete walls (see Fig. 1) and cracking of floor slabs occurred throughout the damaged corner of the building causing the entire building to be distorted. As a result, there was concern that it may not be possible to restore all horizontal and vertical alignments of the building within acceptable tolerances by jacking only at the base of the building. A number of different analyses were done to simulate the building damage and to estimate what level of jacking at the base would be required to straighten the building.

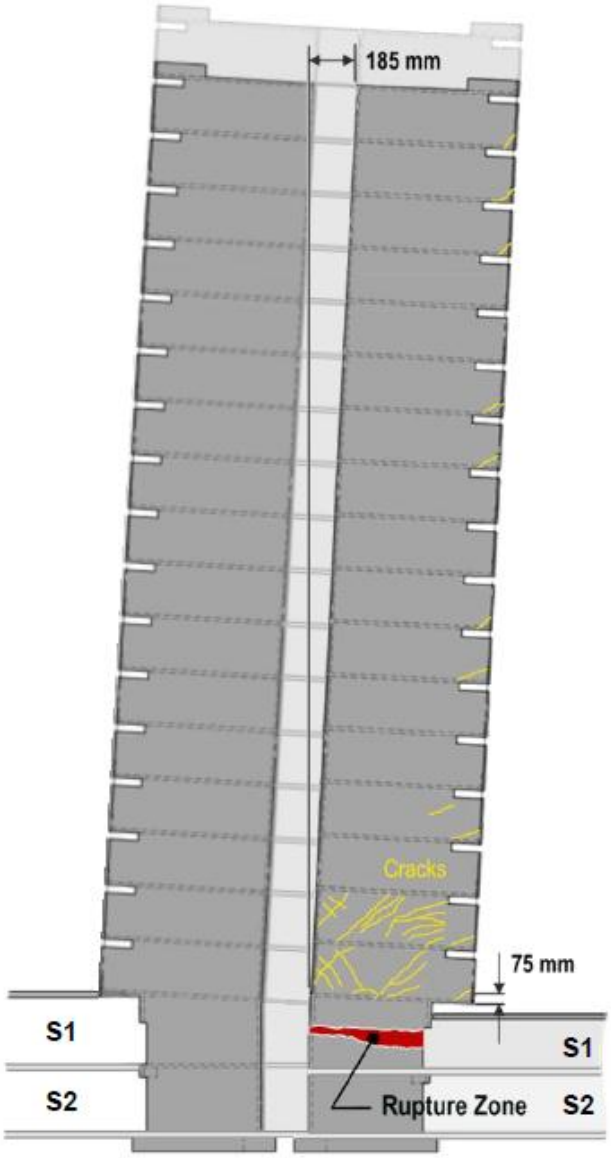


***Fig. 1** – Profile of damaged building with magnified horizontal displacements.*

***Fig. 2** – Close up of damage in one transverse shear wall.*

Compression Failure of Thin Walls

The damage to thin walls in many high-rise buildings in Chile has resulted in significant research being done on this topic at UBC and elsewhere.

Recent experiments on small full-scale concrete wall elements have shown that 150 mm and 200 mm thick concrete shear walls with two layers of horizontal reinforcement may fail very suddenly at compression strains less than 0.0015 (Adebar and Lorzadeh, 2012). The reason for the failure at such low compression strains is that the horizontal reinforcing bars parallel to the wall faces create stress concentrations and micro-cracking in concrete surrounding the bars. As the concrete stress approaches the compression strength, the concrete surrounding the bar, and particularly the concrete cover outside of the bar, becomes unstable.

In a thin wall, the concrete surrounding the two layers of horizontal reinforcing bars and the concrete cover outside these bars make up a very large portion of the wall thickness and so the wall fails when this concrete starts to become unstable.

Nonlinear finite element (NFLE) analyses was used to investigate the influence of the overhanging wall above level S1 (see Fig. 1) on increasing the compression strain demands in the wall at level S1 where compression failure occurred. Such an overhang was a common detail in many high-rise buildings that suffered damage during the 2010 Chile Earthquake. The dashed lines in Fig. 3 are the strains determined from a plane sections analysis for a wall without an overhang, while the NLFE results are for a wall with the overhang.

The results in red are for a slightly higher overturning moment than the results in blue. The overhanging wall above causes a concentration of compression stresses – and hence a concentration of compression strains – at the outside edge of the wall below. As shown in Fig. 3, the maximum compression strains are increased by a factor of about 2 or 3.

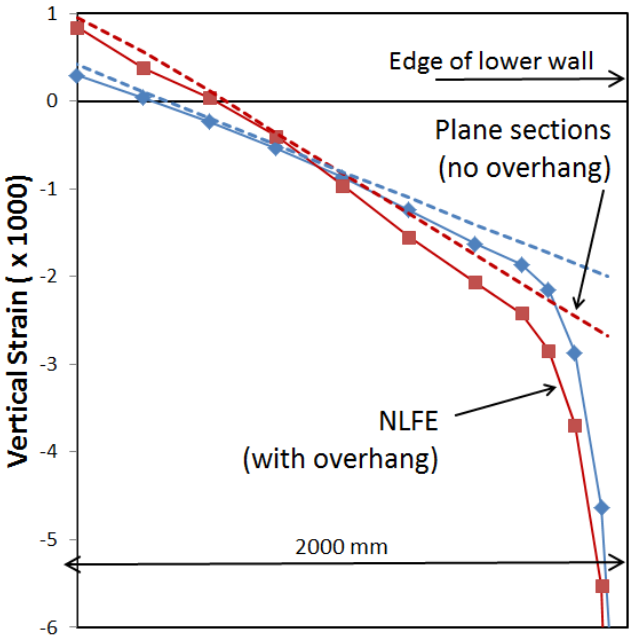


***Fig. 3** – Influence of wall overhang above on maximum compression strains in wall below (from Adebar, 2012).*

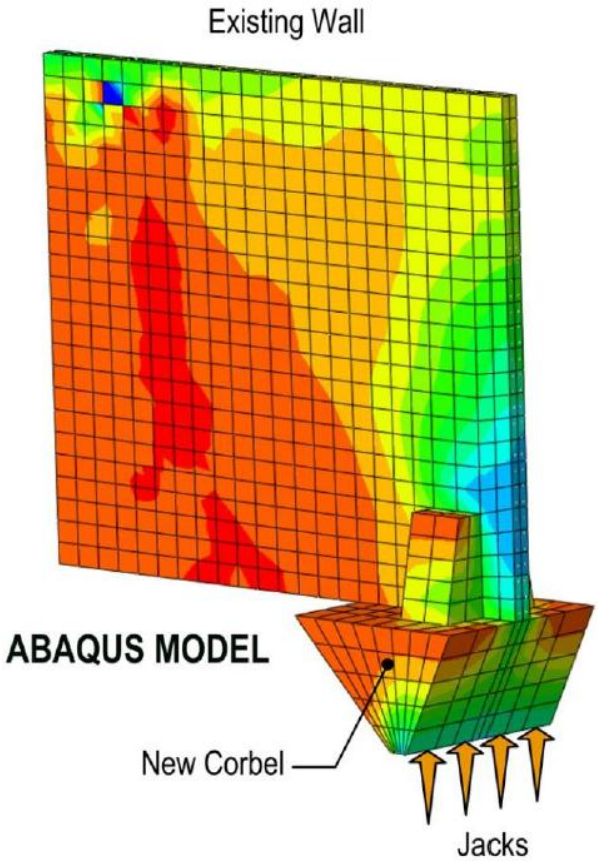


Fig. 4 *– Finite element analysis of building components.*

Analyses of Damaged Building

A variety of different nonlinear finite element analyses were done to better understand the observed damage and to enable design of a jacking scheme including necessary local modifications to the walls (see Fig. 4). Detailed nonlinear analyses of the damaged shear walls and damaged floor slabs were used to develop a complete three-dimensional linear model of the entire building with reduced effective stiffnesses to account for damage combined with applied forces to simulate residual displacements. The shear walls were subjected to a three-step nonlinear analysis: (1) the walls started as undamaged and were subjected to reverse cyclic lateral loading; (2) elements were removed to simulate the observed damage and the walls were then subjected to additional cycles of lateral drift; (3) the simulated applied vertical jacking forces were increased until the residual displacements of the walls were eliminated.

The full three-dimensional linear model of the building was developed using ETABS. The effective stiffnesses and forces used to model the residual damage in the linear analysis were first determined for the individual components – walls and floor slabs – to match the results of the nonlinear analyses of these components. The 3D linear model was then used to estimate the relationship between jacking forces and building movements accounting for the interaction of shear walls and slabs.

Modifications to Structure

New concrete foundations were built around existing foundations of the three damaged shear walls (see Fig. 5). In addition, a 300 mm thick heavily reinforced concrete slab was cast on top of the new and old foundations. These slabs were used to support eight temporary steel HSS columns that extended through holes cut into the first underground level slab S1. A grillage of steel plate girders was used to transfer the loads from four jacks under each wall to the eight temporary HSS columns (see Fig. 6). This arrangement was typical at each of the three damaged walls.

In order to transfer the load from the jacks into the damaged thin concrete walls without crushing the concrete, new reinforced concrete corbels were constructed as can be seen in Fig. 4.

Analysis indicated that the jacking forces could cause new cracks to form in the concrete shear walls. As the concrete walls are lightly reinforced, carbon fibre reinforced polymer (FRP) fabric was added to the highly stressed areas of the wall.

All significant cracks in the concrete shear walls were repaired by epoxy injection. As the jacking was expected to close many of the existing cracks, the injection was not done until after significant jacking of the walls had been done.

Instrumentation

A survey team was used to monitor the inside and outside of the building during jacking. Displacement transducers were used to monitor crack width openings and the compression strains of the shear walls immediately above the jacking points. Bi-axial tilt-meters were used to observe the change in floor and

wall slopes. The steel columns below the jacks were instrumented with strain gauges to monitor the axial load and bending moment in these members. The top of the new foundation used to support the jacks was monitored for vertical movement. All instruments were monitored continuously from a central data acquisition station during jacking.

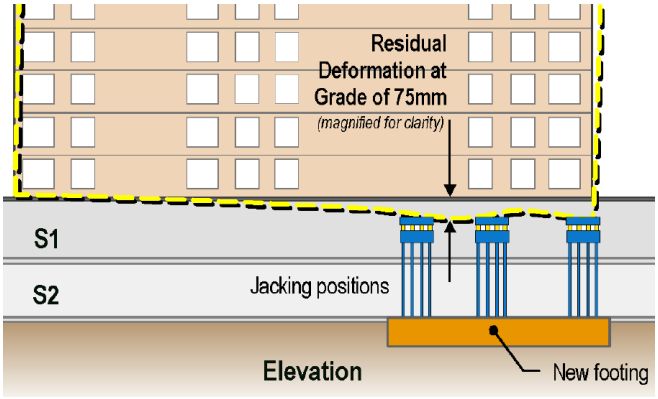


***Fig. 5** – Overview of jacking scheme.*

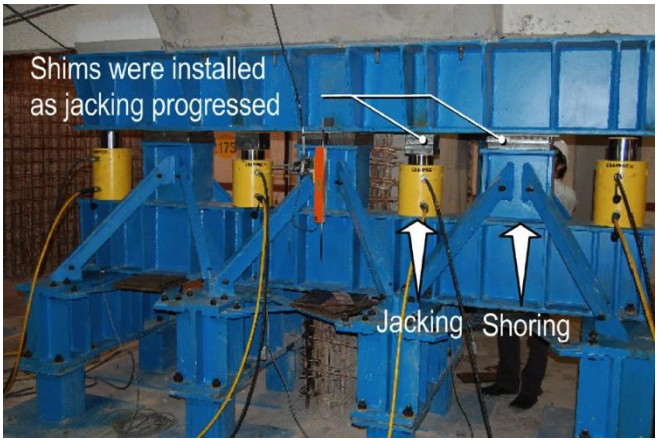


***Fig. 6** – Close-up of jacking/shoring system below each wall.*

Jacking of Building

Jacking of the building took place gradually over a seven day period. The final jacking forces on the three walls were 380, 680 and 420 tonnes (1480 tonne total); while the predicted jacking forces to reach near-zero displacement was 500, 600 and 500 tonnes (1600 tonnes total). The distribution of jacking forces was somewhat different than predicted because of the complex interaction between the three damaged walls, the slabs, and the non-damaged walls; but the total jacking force was 93% of the predicted total jacking force.

Vertical alignment of the building was restored to within 10 mm over 18 stories, and horizontal alignment of the ground floor slab within 8 mm, both of which are well within acceptable tolerances for new construction. The horizontal alignment of the upper floors was good enough that a conventional repair could be used to level the floors.

The building was restored for full occupancy within a few months of completion of the jacking; this was one year after the damaging earthquake had occurred.

The building appears undamaged following the Chilean earthquake – the sign confirms the tenants' refusal to occupy the building which was later repaired by the builder, Socovesa.

Acknowledgements

Many people contributed to the success of project. The structural engineers at Ausenco included Reza Mousavi, Sasan Iranpour and Zahra Riahi. Primo Cajiao was with Ausenco during the course of this project. Stephen Mercer, now with RJC, conducted the VecTor2 analyses while at UBC. The jacking consultant was John Brise of Apex Industrial Movers.

Further Reading

Adebar, P. (2012). Compression Failure of Thin Concrete Shear Walls in 2010 Chile Earthquake, *Canadian Journal of Civil Engineering*, In press.

Adebar, P. and Lorzadeh, A. (2012), "Compression Failure of Thin Concrete Shear Walls," *15th World Conference on Earthquake Engineering*, Lisbon.

Sherstobitoff, J., Cajiao, P. and Adebar, P. (2012), "Repair of 18-Story Shear Wall Building Damaged in 2010 Chile Earthquake," *EERI Spectra*, Special Edition on 2010 Chile Earthquake.

Technical Committee

By Renato Camporese, , P.Eng., Struct.Eng., Director SEABC

2012 BC Building Code

The Buildings and Safety Branch of the Ministry of Energy and Mines has announced the release of the 2012 BC Building Code, Fire Code and Plumbing Code. These codes will come into effect on December 20, 2012. The City of Vancouver has yet to release a date for the issue of the next Vancouver Building By-Law.

Seismic Design of Basement Walls

The Seismic Design of Basement Walls Task Group have been analyzing the design of basement walls for seismic loads based on the 2005 NBC. The current practice of Geotechnical Engineers is to use the Mononobe-Okabe method to estimate lateral earth pressures on walls based on Peak Ground Accelerations resulting from earthquakes. The change in return period from 10% in 50 years to 2% in 50 years incorporated in the 2005 Code has resulted in a significant increase in PGA values. For large values of PGA the Mononobe-Okabe method gives very large lateral pressures, which has resulted in the need for heavy reinforcing in basement retaining walls.

The task group has modeled the soil structure interaction of basement walls using nonlinear two dimensional dynamic finite difference analyses to determine the behaviour of the walls. Preliminary results indicate that walls designed based on the Mononobe-Okabe derived seismic soil pressures are too conservative and that lower design requirements may be appropriate.

Further study is currently underway to study the effects of (a) the vertical component of ground motion and (b) the soil stress-strain relation, on the results of the numerical analyses to investigate the reliability of the previous findings. The analysis work is being carried out by a grad. student under the direction of Dr. Mahdi Taiebat at UBC. It is hoped that as a result of this analysis the seismic design demands on basement walls can be reduced, permitting more cost effective design of walls.

Temporary Structures

The work of the Temporary Structures Task Group has been turned over to APEGBC. Due to the importance of this issue the association has decided to convert the Task Group into an advisory committee reporting directly to APEGBC council. A notice has been posted in Connections E-News inviting any members interested in participating in this committee to contact Gilbert Larocque at APEGBC.

Fire Rating of Seismic Bracing

A number of years ago, Mr. Jim Mutrie, P.Eng. prepared a draft proposal regarding the Fire Rating of Seismic Bracing. This document has been posted in the Resources section of the SEABC website where it has languished somewhat in anonymity. The proposal has now been forwarded to APEGBC where it can hopefully be endorsed, either as a Guideline or Technical Bulletin. Similarly the Guardrail Design Guideline is currently under review by the association for endorsement and publication.

IStructE News

By Bill Alcock, P.Eng. Struct.Eng. MIStructE. Director SEABC

Graduate Member to Serve on Council for 2013

The SEABC is very pleased to announce that **Victoria Janssens** has been appointed by the IStructE as a Graduate member to serve on Council for 2013. Victoria will be one of four International Group Graduate members to serve on Council and will join with me in London for the next meetings in January 2013.

Victoria graduated from Trinity College Dublin in 2008 with a first class honours degree in Civil, Structural and Environmental Engineering. Following graduation, she remained at Trinity where she completed a PhD in 2011.

Victoria immigrated to Vancouver from Ireland in January 2012 and soon became involved in the Structural Engineers Association of British Columbia (SEABC). In February, she joined the SEABC's Young Members Group (YMG) where she helps to organise events for young members. Victoria is also actively working on developing a link between the YMG of the SEABC and the Institution's YMP (which she joined in 2011 and for which she is currently a corresponding member).

Victoria joined the Institution of Structural Engineers as a student member in 2007 and has been a graduate member of the Institution since 2011. In 2009, she joined the Institution of Structural Engineers, Republic of Ireland Branch committee and remained a member until leaving Ireland this year. During her time with the Republic of Ireland Branch, Victoria served as both the graduate representative and webmaster for the Republic of Ireland Branch and was responsible for organising graduate events and promoting membership of the Institution to students and recent graduates. She also actively served as one of the Republic of Ireland Assessors for the Institution of Structural Engineers publications from 2009 to 2011. In 2011, Victoria joined the Institution's Young Members Panel as the Republic of Ireland Branch representative and was actively involved in this panel. Since moving to Vancouver, Victoria has re-joined the Young Members Panel as a corresponding member.

IStructE Council Meeting and 2012 Awards, Friday November 2, 2012

The following are highlights from the International Group, and Council meetings held on Friday November 2, in London.

In the morning, the International Group met and the following issues were discussed:

- The UAE division is moving closer to official status but will require a physical address in the UAE in order to conduct affairs there. The Institution is seeking assistance from any members who can assist in this regard.
- There was considerable discussion on how the various international groups function: i.e. are they stand-alone, piggy-backing on another local group, etc.? As there are no set parameters on how a group must operate, a wide variety of different arrangements were reported, although an MOU between the group and the Institution is usually required.
- The Institution is currently working on setting up a regional group in the USA, where there are over 200 members. Geographically they are spread all over the country so it will be difficult to set up a single location to meet.
- At the next meeting of the International Group, members will be discussing the registration requirements for practising in their country, and whether or not having IStructE membership is of benefit in that country.
- The Asia/ Pacific Group is encouraging participation in their upcoming conference in Singapore from all International Group members.

At the afternoon Council meeting, following the usual adoption of minutes, etc., President John Nolan recapped his year and thanked all members for their assistance and encouragement throughout the year. The President's report is available through the Institution's web-site.

President Nolan then introduced Glenn Bell, P.E., S.E., CEO of Simpson, Gumpertz & Heger from Boston, Massachusetts. Glenn Bell spoke on the future of structural engineering over the next 40 years (the length of a typical engineer's career). His comments were an eye opener for all in attendance and should be heard by all practising engineers, particularly young engineers starting out in their careers. We are hoping to bring Glenn to Vancouver to speak at an SEABC function in the near future.

The 2012 Structural Awards

The Institution's annual Structural Awards Ceremony took place on the evening of Friday November 2 at the Marriott Grosvenor Hotel in London. These are perhaps the most prestigious awards for structural engineers anywhere in the world.

The SEABC is very pleased to announce that a Vancouver firm, **Fast & Epp** was the recipient of the Award for Best Community or Residential Structure for the Van Dusen Botanical Gardens Visitor Centre, and a Commendation for the **UBC Centre** for Interactive Research on Sustainability. Paul Fast, who is an SEABC Director, was at the ceremony to receive the awards.

The prestigious Sustainability Award went to **Alan Baxter & Associates** of the UK for the Conservation & Restoration of the Iron Market in Haiti following the destructive earthquake of 2010. This firm was able to reconstruct the iconic Iron Market structure from what appeared to be piles of twisted metal and rubble, an outstanding feat.

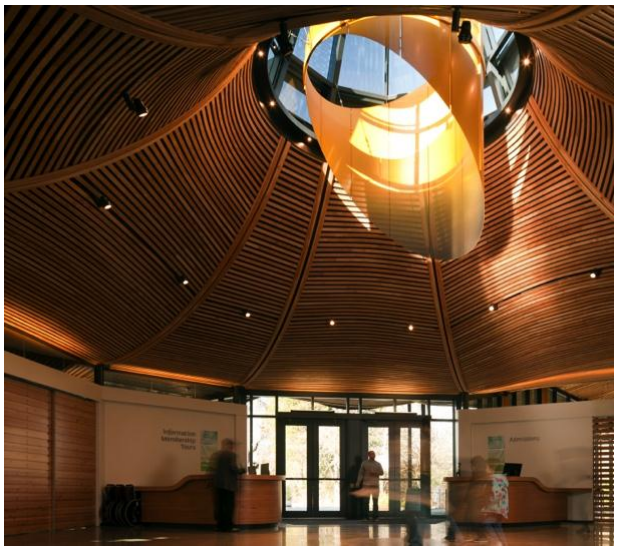
The Supreme Award for Structural Engineering Excellence went to the consulting engineers **Flint and Neill** and **Sinclair Knight Mertz**, for the strengthening and widening of the West Gate Bridge over the Yarra River. The engineering of the 2600 metre long bridge allowed construction to be completed while keeping the existing lanes in operation.

Paul Fast displays his plaques at the Structural Awards

Glenn Bell addresses the IStructE Council

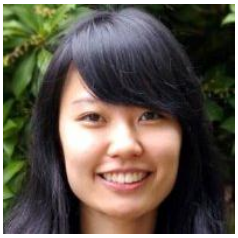
Van Dusen Botanical Gardens Visitor Centre

These stunning images of the Van Dusen Gardens building won the Structural Award this year from Fast & Epp.



Steel Day Tour

By Yuki Kishimoto, UBC Student Representative for SEABC YMG



September 24th 2012 marked the third National Steel Day, during which a group of UBC Civil Engineering undergraduates and graduates had the exciting and rare opportunity to participate in guided tours of major steel fabrication facilities in Vancouver.

Steel Day is a public annual event, held to promote the design, fabrication and construction of steel as a structural material. Organized by the Canadian Institute of Steel Construction, architects, engineers, contractors and students were invited to visit steel fabricators, mills, service centres and other specialized steel facilities who are committed to promoting the importance of steel across Canada. This year, UBC students toured 'George Third and Son' (GTS) in Burnaby and 'AI Industries', both of whom are major names in the steel fabrication industry of Western Canada.

Transportation for the trip was sponsored by SEABC in collaboration with the Canadian Society for Civil Engineering Student Chapter at UBC, which enabled 12 undergraduate students and several masters students to participate. Steel Day afforded UBC students excellent networking and learning opportunities and sparked interest and understanding in the processes steel fabricators go through from receiving raw material to shipping high quality steel to the construction site.

This year, UBC students witnessed several exciting events: demonstrations of the use of information technology to increase production efficiency, a blacksmith in operation, the use of various advanced machinery to produce steel products, seismic testing equipment and large steel storage yards. The students were challenged to estimate total steel tonnage in the yard and as an exciting bonus for a few of our stressed-out engineering students, we had a chance to smash an old car with sledgehammers! Enjoying ourselves and forging a strong connection between true industry operations and our steel design courses at UBC, the students left the facilities satisfied with having gained this experience from a new perspective.

For more photos of the tours, please visit:-

ubccsce.ca/Gallery.php.

On behalf of the UBC students, we would like to extend our appreciation to SEABC for making this event possible.

BIM Model Demonstration at George Third and Son tour on National Steel Day

Students witness a rare blacksmith forging a steel link

AI Industries expert explains how advanced machinery is used to streamline steel production

UBC students inquire AI Industries expert about the steel fabrication process

Donald Bridge

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

The new Donald Bridge has recently opened to traffic. A replacement for an aging two-lane structure dating from the early 1960's, the new crossing of the Columbia River eliminates a sharp bend at the bottom of the Donald Hill, a notorious hazard on the Trans-Canada Highway in winter driving conditions. Part of a 4 km section of four-laning of Highway 1, located 30 km west of Golden, BC, the project also includes a replacement for the Donald Overhead which crosses the CP Rail mainline.

The 300 m long Donald Bridge comprises six steel plate girders and was valued at $25 million. The 120 m long Donald Overhead comprises eight steel plate girders which cross the rail tracks at skews of nearly 60 degrees, and is valued at $8 million. The snaking alignment shown in the photograph shows the east end of the Donald Bridge in the foreground and the Overhead in the distance. The project was built by contractor Flatiron. Bridge design was by consultant Associated Engineering who teamed with sub-consultants Urban Systems (civil engineering) and Golder Associates (geotechnical engineering).

Reinforced Masonry Research

By Dr Svetlana Brzev, BCIT

Lateral Instability of Reinforced Masonry Shear Walls Subjected to In-Plane Seismic Loading.

Reinforced concrete and reinforced masonry (RM) shear walls subjected to combined gravity axial stresses and overturning moments due to lateral seismic loads can experience lateral instability when the longitudinal reinforcement in the wall end zones is subjected to compression loads subsequent to cycles of high tensile strain. Lateral instability is characterized by out-of-plane buckling of the wall end zone along the plastic hinge height. A significant damage due to lateral instability was observed in a few reinforced concrete wall buildings affected by the February 2010 Maule, Chile earthquake (M 8.8) and the February 2011 Christchurch, New Zealand earthquake (M 6.3); however, there is a lack of evidence of similar damage to RM shear walls in past earthquakes. Canadian masonry design standard CSA S304.1-04 placed stringent limits on the height-to-thickness (h/t) ratio of ductile masonry walls (from 14 to 20) to prevent lateral instability in these walls, however these restrictions prevent the use of masonry in some of the common applications (such as fire halls or warehouse buildings).

Insufficient experimental evidence prompted a need for research program which would characterize out-of-plane instability in RM shear walls and develop rational criteria for lateral instability in these walls. The presenters will explain the phenomenon and share the key results of a comprehensive two-phase research program which started in November 2010. Phase 1 was recently completed and it involved testing of five reinforced masonry uniaxial specimens under reversed cyclic tension and compression. The specimens represented the end zone of a RM shear wall and were 3.8m high, corresponding to (h/t) ratio of 27 (based on 140 mm block thickness). The purpose of the testing was to gain insight into the factors influencing out-of-plane instability. The design parameters considered were longitudinal reinforcement ratio and height-to-thickness (h/t) ratio. Phase 2 (currently in progress) involves experimental and analytical study of full-scale RM shear wall specimens subjected to reversed-cyclic lateral loading. The objective of this phase is to develop a rational analysis procedure and criteria for assessing the lateral instability of RM shear walls, which could be used by design practitioners in Canada and incorporated in CSA S304 standard.

This research project is a collaborative effort of civil engineering faculty and students from UBC and BCIT, and it is sponsored by NSERC and masonry industry (CCMPA and MIBC). The presentation will be made by the project team members: Dr. Svetlana Brzev and Julien Levasseur (BCIT Department of Civil Engineering), and Dr. Ken Elwood, Dr. Don Anderson, Brook Robazza and Nazli Azimikor (UBC Department of Civil Engineering).

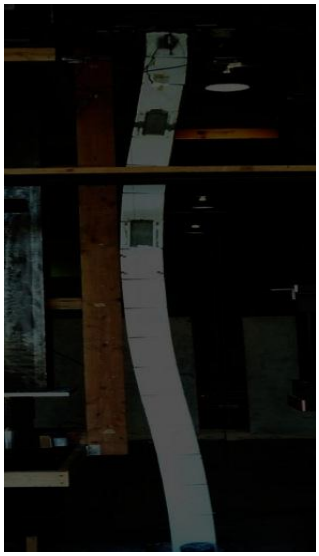


Figure 1 *Figure 2*

Figure 1~Lateral instability of a reinforced concrete shear wall in the 2010 Chile earthquake.

Figure 2~Lateral instability of a reinforced masonry uniaxial specimen in the UBC Structures Lab (Azimikor, 2012)

SEABC Wine and Cheese

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

This year SEABC's popular Wine and Cheese event was held at BCIT. Over 50 people registered for the event in which SEABC members met with faculty and students at the BCIT campus in Burnaby. Our annual networking event is a great opportunity to meet fellow practitioners and academic staff, as well as to mingle with students who are always keen to meet practicing structural engineers.

Having sampled the excellent refreshments, we were treated to a presentation on the UBC/BCIT research work being undertaken on masonry walls. Research team member Dr Svetlana Brzev was joined by research students who described their investigation into the lateral stability of slender reinforced masonry walls. Their research is summarized in Dr Brzev's article on Page 13. BCIT's research page which contains information about the project is at:

commons.bcit.ca/civil/research

Please note – whether you are a student, young member, practitioner, or researcher, please join your structural engineering community at future SEABC Wine and Cheese events. You will meet new friends, enjoy the hospitality, and discover the latest research activities at our local learning centres.

***The Presenters**: Julien Levasseur, BCIT Department of Civil Engineering; Nazli Azimikor, Fast&Epp; and Dr Svetlana Brzev, Faculty, BCIT Department of Civil Engineering.*

***Listening:** SEABC members and students paying close attention.*

***Networking:** David Harvey and Peter Trainor enjoying the refreshments.*

Confederation Bridge

By Andrew Seeton, P.Eng.

Andrew took these photographs this summer of the Confederation Bridge which links Prince Edward Island to New Brunswick. The 12.9 km - long structure is the world's longest bridge over ice-covered waters.

Photos of Interest

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

Elkford

The Community Centre is a new landmark facility in the District of Elkford, BC, which includes a community hall, meeting rooms and tourist facilities. To meet the District's energy conservation and carbon footprint reduction goals, the design was created with sustainability promotion in mind. The structure is predominantly wood, and features structural insulation panels and cross-laminated timber panels with the potential for end-of-life reuse. Building design was by Associated Engineering, with Douglas Sollows Architect.

Clanwilliam

The new Clanwilliam Overhead opened recently to traffic. Part of a 2 km section of four-laning of Highway 1, located 12 km west of Revelstoke, BC, the new crossing of the twin-track CP Rail mainline eliminates the former aging steel through-arch bridge which was structurally deficient, and the hazardous dog-leg in the highway. The 111m long, twin three-span bridges cross the rail tracks at an extreme skew angle. Valued at $8 million, each bridge features four steel plate girders supporting the concrete deck. Bridge design was by consultant Associated Engineering who worked with Urban Systems (civil engineering) and Golder Associates (geotechnical engineering).

Young Members Group

By Grant Fraser

In September 2012, the YMG held its second annual 'Day at the Races' event at Hastings Racecourse in Vancouver. A small but enthusiastic group spent the afternoon cheering on their chosen horses and jockeys and meeting fellow young structural engineers. Some of us even learned what a 'furlong' was!

Upcoming Seminar on Field Reviews

The YMG's next event will be a technical seminar on Field Reviews. Andy Metton and Peter Mitchell will provide insight and guidance into this important aspect of construction services. The event will be held on Wednesday, November 28th 2012 at UBC Robson Square at 6:00 pm, followed by a social event at a nearby pub. Registration will be through the SEABC website and will be required for attendance.

We have also turned our attention to the New Year and have begun planning some exciting events for 2013. After the success of our inaugural Presentation Competition in February 2012, we are excited to be planning a similar event for early 2013. Stay tuned for details and begin brushing up on your presentation skills!

On the Web

By Stephen Pienaar, P.Eng; Director SEABC

Summer is pleasant memory and SEABC website is back to its normal business…

Current hot topics

- Registrations for Young Members Group evening seminar:
  Conducting Field Reviews
  To be presented on Wednesday, November 28 by Andy Metten P.Eng. Struct.Eng., Bush, Bohlman & Partners, and Peter Mitchell P.Eng., APEGBC
  www.seabc.ca/ymg#upcoming
- Registration for the January 2012 Term of the Certificate in Structural Engineering is now open.
  www.seabc.ca/cse-current
- Administrative:
  Annual membership renewal
  www.seabc.ca/renewal
- Certificate in Structural Engineering Program:
  The next term is drawing closer.
  www.seabc.ca/cse
- Join our Twitter feed:
  SEABC events announcements and interesting structural engineering snippets.
  www.twitter.com/seabc
- Video recording available for the October evening seminar:
  Energy-Efficient Buildings & Passive House
  Presented on October 17 by Robert Malczyk, P.Eng, Struct.Eng., Equilibrium Consulting Inc.
  www.seabc.ca/seminar-downloads

Suggestions

We welcome your comments for improving the SEABC's website and other online services. Please send your suggestions to webmaster@seabc.ca.
Sincerely,

Stephen Pienaar, P.Eng, SEABC Webmaster

Membership Renewal

It is the time again for all SEABC members to renew their membership. Please renew your membership before December 31 to continue enjoying the benefits of membership: free monthly seminars, discounts on full-day seminars, access to the SEABC's web archive of seminars and more.

Membership Fees:

The SEABC Board is pleased to confirm that annual membership fees remain unchanged from 2012. This is in largely thanks to successful events hosted by the Education Committee.

The membership fees for 2013 are as follows:

- Individual Members: $75 plus HST
  Structural and civil engineers who hold P.Eng. or E.I.T. status.
- Associate Members: $75 plus HST
  Technologists and non-structural engineers.
- Affiliate Members: $75 plus HST
  Individual members of organisations that share the interest of the SEABC.
- Student Members: Free
  Engineering students enrolled full-time on January 1, 2013.

Renewal:
You can renew your membership online (credit card payment) or offline (mail in a cheque). Corporations can also do a bulk renewal for their employees. For more information, please go to:

www.seabc.ca/renewal.

Invitation to new members: Please invite your colleagues that are not yet members of SEABC to join at this time. Joining now will grant them membership until the end of 2013

Ask Dr. Sylvie

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

See also the list of CISC technical resources at:

www.cisc-icca.ca/content/technical/default.aspx

Advertising

If you would like to advertise in our newsletter and our website, our pre-paid rates per edition are $270, $360 or $450 plus HST for a quarter, half, or full page advertisement, respectively.

50-word "Available for Employment" ads are free.

Please address advertising enquiries to: newsletter@seabc.ca

Please support our advertisers

Mark Your Calendars

Seminars

Conducting Field Reviews
Presenters : Andy Metten P.Eng. Struct.Eng., Bush, Bohlman & Partners
Peter Mitchell P.Eng., APEGBC
Venue : HSBC Hall, UBC Robson Square, 800 Robson Street, Vancouver, BC
Date : Wednesday November 28, 2012
Time : Refreshments 6:00 pm, Presentation 6:30 pm
Online Registration: Pre-registration is required at:- www.seabc.ca/fieldreviews.

Mentoring That Makes a Difference
Date: Thursday 29 November 2012
Time: Registration and dinner 4.30-5.00pm, Seminar 5.00pm – 7.30pm
Location: Hilton Vancouver, Metrotown
More information: www.apeg.bc.ca

Courses

CAN/CSA-S6-06 Design of Aluminum Bridges and Footbridges
The Canadian Society for Civil Engineering (CSCE) will present a course on the contents of Section 17 - Aluminum Structures of CAN/CSA-S6-06, Canadian Highway Bridge Design Code. The course provides details on the main characteristics of structural aluminum and covers all the recommendations of Section 17.

Date: November 27

Venue: Sandman Hotel, Vancouver

More information: CSCE website

January 2013 Term of the Certificate in Structural Engineering (CSE) Program

The January 2013 Term will run on Tuesdays and Thursdays from January 8 to March 28. The following courses will be offered:

C4-1 Introduction to Earthquake Engineering & Seismicity More information and course outline

C12 Practical Design of Reinforced Concrete I More information and course outline

E13 Computer Software Applications in Structural Engineering More information and course outline

E17 Time Histories Interpretation and Processing for Dynamic Analysis More information and course outline

The course will be available in classroom lecture setting at the Vancouver Public Library as well as live interactive webcast.

Workshops

Presentation and Training Skills Workshop

Date: Thursday 6 December 2012

Time: Registration & Breakfast 8.00am – 8.30am, Workshop 8.30 – 4.30pm

Location: Burnaby, BC- Venue TBD

Instructors: Greg Campeau Learning and Development Inc.

Credit: 7.0 Professional Development Hours (PDH)

More Information: www.apeg.bc.ca