SEABC NEWSLETTER

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ISSUE No. 005 **FEBRUARY 2009**

- SEABC's Newsletter is edited and managed by Robert Smith (smithco@axion.net)
- Submissions to the newsletter are encouraged and all members of the SEABC are asked to actively participate in contributing to our newsletter.
- 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

February 11, 2008

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

It has been said before that SEABC exists to promote the interests of Structural Engineers and, in order to achieve this objective, our activities were set up last year under four committees: Technical, Education, Communication and Professional Practice.

The Technical Committee's function is to provide information on technical matters to assist Structural Engineers, or to set up task groups to investigate problems or concerns. It is clear how this can benefit members of SEABC. Likewise it is clear how the Education and Communications Committees provide benefits. What is not so clear is the function of our Professional Practice Committee.

The Professional Practice Committee was set up initially to carry on the work of the Division of Structural Engineers. DSE was a division of APEGBC until December 2007 and, as such, acted at the request of APEGBC in advising on matters relating to Structural Engineering. Its primary objectives were in line with those of APEGBC itself whose interest can best be summarized by its mission statement, namely: To serve the public interest through regulation and leadership of the practice of professional engineering and professional geosciences in British Columbia.

So here (apart from the great discrepancy in size and scope of operations) is the basic difference between APEGBC and SEABC. Our Professional Practice Committee is the bridge between SEABC and APEGBC.

Let me say that the Professional Practice Committee also maintains a relationship with other technical and administrative bodies, which include the IStructE and the SEAs of the Western States south of the border.

Nevertheless, most of work of the Prof-essional Practice Committee relates to maintaining the liaison and cooperating with APEGBC in accordance with a Memorandum of Understanding that was signed in April 2008.

We need to recognize that this is not an easy function. Our members are also professional engineers who are expected (nay required) to hold paramount the health and welfare of the public. So, in representing the interests of Structural Engineers to APEGBC, they have to still take into account the interests of the public. Of course we do have interests in common. Included in our objectives is promotion of the highest standards of structural engineering and raising the image of Structural Engineers. These fit within the objectives of APEGBC.

So how does the Professional Practice Committee serve the interests of our members?

- By representing the views of SEABC when providing input to APEGBC on matters of practice.
- By bringing concerns of SEABC to APEGBC and vice versa.
- By making our members aware of regulations, actions and changes that will affect their practice.

Just one example of this is the impact of the Government's recent initiative to promote the increased use of wood in construction by allowing construction of wood framed buildings up to six-storeys high.

APEGBC's responsibility is to ensure that Engineers have the tools necessary to protect public safety. SEABC's objective is to protect Structural Engineers by ensuring that they have proper guidance and access to technical information that will allow them to responsibly handle these code changes. The assessment of risks introduced by this code change and the production of necessary guidelines is no small task. Although the Government has provided some funding to allow APEGBC to produce these guidelines, the SEABC representatives on the APEGBC Six-Storey Task Force have, and no doubt will continue to, put in a significant amount of unpaid volunteer effort.

How Can You Help?

By bringing any concerns that you feel should be raised regarding the practice of Structural Engineering to our attention, by direct contact with committee members or by communication through the SEABC Newsletter or website. Immediate resolution is not guaranteed but the knowledge is a powerful motivator to address the concerns.

Better yet, volunteer to assist or work on one of the SEABC committees or sub-committees.

Letters to the Editor

15 December 2008

Dear Sirs:

Re: President's Message - August 2008

Did I miss the votes on SEABC supporting the Structural Engineer designation and mandatory continuing education? If I didn't then I would ask the President to make it clear those are his opinions and not those of SEABC. These are contentious issues and any positions taken should reflect the entire membership not just the President or even the Executive.

Dave Davey presented some anecdotal evidence that the Struct.Eng.. program is improving the quality, at least in the short term, but I could present anecdotal evidence that neither the Struct.Eng. program nor mandatory continuing education is effective in the long term. However, as far as I know, there are no credible studies to prove or refute their long term effectiveness. Without credible studies, endless debate is meaningless, as people believe what they choose and discount the opposing evidence.

As engineers are more likely to embrace SEABC if they know their opinions are respected and decisions are made collectively, a referendum would be in order if the Executive deems it critical to take a stand. If not, let's just agree to disagree and focus our efforts on areas where we can make common progress.

Yours truly,
Ralph Watts, P.Eng.

As the current President of SEABC, it is very gratifying to learn that our Newsletter has received its first "Letter to the Editor". I sincerely hope that it will spark interest from many others to pass on their views and stimulate discussion.

I realize that this letter contained some criticism of comments made by myself, but this is good. We want to hear opinions from Structural Engineers on any topic.

I would like to respond regarding the benefits of the Struct.Eng. Program. Our current board of Directors supports the concept of a specialist designation and almost 100 structural engineers are now registered as a Struct.Eng. The establishment of the Struct.Eng. program, meets one of the major recommendations of the Kloskey Commission, which investigated the Save-on-Foods collapse in 1988. This demonstrates to the public that structural engineers take their responsibilities seriously and public perception is important in raising the image of our profession.

While it is not possible to measure directly the benefits of the Struct.Eng. program, it is important to note that the City of Vancouver believes that it is effective in improving the standard of structural engineering in permit applications. As evidence of this, the City has not sent out any Part 3 permit plans for third party review since May 2007 – a practice which was followed prior to that time.

Yours truly,
David Davey, P. Eng.
SEABC Charter President

Dear Colleagues:

On behalf of the Organizing Committee for the Ninth U.S. National and Tenth Canadian Conference on Earthquake Engineering: Reaching Beyond Borders, we would like to invite you to submit an abstract by visiting the conference web page http://2010eqconf.org, where you will also find the Second Announcement and Call for Papers. Please note that the abstract submission deadline is March 31, 2009.

The conference will be held July 25-29, 2010, in Toronto, Canada, and will provide a unique environment to develop synergy between U.S. and Canadian colleagues as well as other participants from around the world. This conference will bring together professionals from a broad range of disciplines, including architecture, structural engineering, seismology, geology, geophysics, geotechnical engineering, social response, regional planning, emergency response planning, and regulation. The conference venue is the Westin Harbour Castle Hotel in Toronto.

We are looking forward to meeting you in Toronto in July 2010!

Kind regards,

Andre Filiatrault and Ahmed Ghobarah,
Conference Co-Chairs

Six-Storey Wood Frame Committee

By Jim Mutrie, P.Eng.
Director, SEABC

SEABC technical committee has a task group working with APEGBC to develop a guideline for structural design practice of six-storey wood frame, or what the government calls Mid-Rise Wood-Frame Residential Construction. We have a deadline imposed on us by the government action so we need to get the guideline to APEGBC council on March 6th.

The document the committee is working on currently contains the following sections:

1. Introduction
2. Wood framed structural practice issues
3. Design and detailing of wood shear walls and diaphragms
4. Design for shrinkage
5. Fire and elevator walls
6. Hybrid systems
7. Example calculations
8. Reference documents

We hope the discussion in the sections will assist structural designer in dealing with the structural issues inherent in six storey wood frame. Shrinkage is a big issue at these heights and we will be recommending a shrinkage design for all projects. Compatibility of wood framing and masonry fire walls is also a large issue and we working towards suggestions on how to deal with the problem. We are also looking at the potential of these buildings developing "soft stories" during earthquake and if so what measures may be required to mitigate any problems.

As soon as the guideline is finished SEABC will inform our member where it will be available. There is a possibility it will be able to be downloaded from the SEABC web site.

If you have any questions or concerns you can email the committee through jim@jkk.com

IStructE News

The Institution of Structural Engineers

By David Harvey, P.Eng., Struct.Eng.;
IStructE BC Representative

IStructE Centenary celebrations wrapped up with the start of the New Year. Canada was honoured by a Presidential visit when Sarah Buck attended the Structures Congress last April and took the opportunity to meet with local members. While we not see a repeat visit this year, there is much to report as the Institution embarks on its second century.

Firstly, we have a new President - Dr Graham Owens took over from Sarah in January. Graham is a very nice man who is passionate about raising the standard of structural engineering practice. He believes this can be achieved by further and better dissemination of technical information and improving the delivery of professional development courses. His plans for 2009 include implementing the new IStructE strategic plan, drawn up following the milestone 2007 membership survey. Graham has just stepped down from heading the UK's Steel Construction Institute, and has a background of teaching at Imperial College, London, and consulting experience with Flint & Neill.

Secondly, the Institution has launched its new rebrand. The new logo is joined by a fantastic brand new website portal and navigation system, while members will now be receiving newly rebranded editions of The Structural Engineer. You can check out the new look at:

http://www.istructe.org/Pages/SeDefault.aspx

Corporate Membership

By Rob Simpson, P.Eng., Struct.Eng.; SEABC Director

SEABC now offers Corporate Memberships.

Benefits of being a corporate member include:

- Participation in workings of the corporate committee
- Access to the corporate committee website (coming soon)
- Access to documents produced by the corporate committee
- Network opportunities for businesses
- Web page (or link) on the SEABC website for your company
- Opportunities for advertising on the SEABC website
- Sponsorship opportunities
- Results of the survey of salaries reported by companies
- Corporate Referral Service – a public service website to be hosted on the SEABC web page (coming soon)
- Best practices information and resources for companies – related to technical and non technical issues
- More to come!

Cost of corporate membership is being finalized. We are planning two levels of membership:

- Basic Corporate Membership
  - Allows access to information, participation in committee activities
  - Includes one individual member dues
- Supporting Corporate Membership
  - Provides enhanced opportunities for recognition, advertising, sponsorship, referral, etc.

Look for membership applications at www.SEABC.net starting in March.

Communications Committee Update

B y David Harvey, P.Eng., Struct.Eng.; Chair, SEABC Communications Committee

Your Communications Committee is working hard to improve member services. You will have noticed our improvements to the website, and new features in the Newsletter. We are pleased to kick-start the Letters to the Editor feature in this edition. We are delighted when our members contact us with their opinions and we want to hear from as many of you as we can. Please note that while we welcome your contribution, we reserve the right to select letters for publication, and to edit material received for length or content. Where possible, it is our desire to present a balance of views on contentious issues.

The Committee reports continue as we believe that SEABC members need to know about the effort being made on behalf of our profession. We strive to provide you with better, more readable news content and we hope you can enjoy the reports we publish. We are delighted that our Young Members Group is

Here is a reminder about our Advertising section. Our commercial advertising rates offer for up to 3 months or exposure on the SEABC website and inclusion in one issue of the SEABC Newsletter are:

- 200 Word Employment: $100
- Quarter page: $270
- Quarter page: $360
- Quarter page: $450

All quoted rates are subject to GST. Note that we offer reduced rates for extending the exposure time of the same content. In addition, unemployed structural engineers seeking employment opportunities and public service announcements will be published at no cost.

Please also send us you news, viewpoint, or technical paper so that your fellow structural engineers can be better informed.

Professional Practice Committee Update

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

BCBC 2006 4.3.4.3: "Steel Building Systems"

Members are reminded that this clause is now in effect. While it refers to steel building systems, Engineers of Record (EOR) should make sure that any prefabricated steel building system, or its component thereof, that they may be involved with, complies with the Code.

It has been drawn to our attention that local companies dealing with pre-engineered steel building packages may be acquiring these structures from non-certified facilities and/or from companies that don't make anything; just re-sell packages made by someone else.

The membership must take notice that all manufacturing facilities that want to sell steel building systems in Canada must be A660-04 certified by Quasar in order to be code compliant.

If an engineer allows (or is involved with) a non code compliant building to be erected they may be deemed professionally responsible and bear liability if the building system should fail, even if the failure is a result of someone else's negligence. Some insurance companies say they will pursue the engineer of record and the building (including occupancy) permit issuer in the event a building is not code compliant and/or fails.

If you are the EOR for such a system, make sure you closely examine any pre-engineered building system and confirm the CSA-A660 certification. If the manufacturing company isn't on the Quasar list of approved companies, of which, we believe, there are only 29 at the moment, then consider not working on the project.

CSA-A660 can be found at http://www.cssbi.ca/Eng/_pdf/SBSletter.pdf

We may consider taking this issue further with regards to publicizing the issue in order to advise Canadian consumers not to buy a building without the appropriate certification.

Schedule 'S'

The B.C. Government's Building Policy Branch has formed a "Letters of Assurance Task Force" with a mandate to update the Guide to the Letters of Assurance in the BC Building Code. Barry Thorson P.Eng is APEGBC's representative on the Letters of Assurance Task Force.

The current standard Letters of Assurance (B1, B2, C) can be viewed by clicking on the following website:
http://www.housing.gov.bc.ca/building/guidelo1.html

One of the issues raised is, "what is the role and responsibility of the engineer engaged to provide specialty structural engineering services in terms of issuing Letters of Assurance?"

The APEGBC Guidelines for Structural Engineering Services for Building Projects contains the definitions as given in Bulletin 'K', which describes in detail the intent and reason for Schedule 'S'.

For that detail refer to the link at http://www.apeg.bc.ca/resource/publications/ppguidelines/bulletink.pdf

February 2009 Report

The Professional Practice Committee is the descendent of the Division of Structural Engineers (APEGBC). Although now under the auspices of SEABC, its original functions and aims are at present not that different, and the focus is to ensure that issues affecting the practice of engineers are identified and addressed. SEABC is still settling into its new identity, as is the PPC. Many issues that affect our practice are directly received by SEABC but are then delegated to various committees. In that PPC both initiates and accepts mandates.

The first meeting of 2009 of the PPC will be on February 9, 2009. At that time we will review 2008, activities completed, and underway. 2009 will probably be a busy year for the committee. Incomplete tasks will be expedited and new issues that have arisen in the past few months will become the focus of our attentions. There is always room for new blood and we will be reviewing inviting nominations of interested members.

Structural Checking Guidelines: Due to a number of outstanding issues, reported last year, the final review has yet to be completed. The 2009 the committee will ensure that the remaining issues within our control will be dealt with as soon as possible. Once these issues have been settled, a membership vote will be initiated. Task Group Representative – Jim Mutrie P.Eng.

Guardrails: 2008 was, at the practice level, a busy year for members of the task force and this issue remains to be detailed and completed. The task force will continue to investigate the issue and strike a schedule for reporting to the committee. One of the aims is to develop an acceptable method of dealing with this issue in the field. Practices to date are obstacles to a simple consensus on the design and implementation of code requirements. Task Group Representative – Robert Jirava P.Eng.

Six-Storey Wood Frame Buildings: This issue appears to still be fraught with technical and political issues. It appears that the profession still has work to do. The PPC will stay in touch with the issue, but until the APEGBC has completed the "Guidelines for Practice", the wider implications will be outside the PPC capacity. This is an issue calling on all parts of SEABC. Contact – SEABC/APEGBC

APEGBC Code Committee: Part of the PPC liaison with APEGBC is to stay in touch with the APEGBC Code Committee. Leonard Pianalto, P.Eng. attends those meetings and reports on those code issues that are being dealt with by the committee and that have an impact on practice.

Some of the outstanding issues are:

- *Fire Rating of Seismic Elements:* This is still being reviewed by PPC and the Technical Committee of SEABC.
- *Structural Capacity of Fire-Rated Assemblies:* This is a separate issue that comes out of the proposed changes to the 2010 code and questions the existing published rated assemblies.
- *CAN/CGSB-12.20-M89:* "Structural Design of Glass for Buildings". There is an initiative from the industry (in particular, IGMA) to substitute this standard with ASTM E1300. Contact – Leonard Pianalto P.Eng.

Consulting Practice Committee: The Consulting Practice Committee is made up of members from various disciplines of engineering and geosciences. They deal with issues that primarily concern the business end of initiatives that APEGBC is planning to roll out but they also review all the guidelines that APEGBC wants to publish for member readership. It is important that a structural engineer to sits on the committee (Fadi Ghorayeb, P.Eng, Struct.Eng. from JKK is the current member). It is to our advantage to have a member attend the meetings as this is the only conduit for us to table structural issues to APEGBC as well. Mazeed Abdullah P.Eng has been the PPC/DSE representative for some time but is resigning. We will be searching for nominations to fill his leaving. Contact – PPC/SEABC

Schedule 'S': This schedule should now be common knowledge, however, there are still engineers who are either not aware of, or refuse to use, this Schedule. It is an important Schedule and everyone is urged to review the detail set out in Bulletin 'K'. This can be accessed at http://www.apeg.bc.ca/resource/publications/ppguidelines/bulletink.pdf. Contact – Thor Tandy, P.Eng, Struct.Eng.

Guideline for Design in Existing Buildings: This is a new initiative and while in its infancy will address those issues that concern the renovation and reconfigurations of existing buildings. This proposes to complement the existing NBC 2005 Commentary L. Contact – Thor Tandy, P.Eng, Struct.Eng.

NBCC 2010 Part 9 and Associated Timber Frame Engineering Guide: Public and professional comment has now been submitted. The Engineering Guide has now been reviewed and ballots for accepting a variety of changes have been cast. There will be a final coordination of the Guide and Part 9 in April 2009. Contact - Thor Tandy, P.Eng, Struct.Eng.

Proposed changes to CGSB 12.20: This standard has come under some scrutiny and criticism and it has been proposed to do away with this Canadian standard and substitute it with the ASTM standard but that is a working stress design document and may not be compatible with Limit States Design in Canada. Contact – Leonard Pianalto, P.Eng

General: The Chair thanks all Committee Members who contributed their time to keeping PPC vital and I look forward to further contributions in 2009 from committee, and the general membership.

Current Committee:

- Thor Tandy (Chair)
- David Harvey
- Marian Podlovsky
- Jim Mutrie
- Mazeed Abdulla
- Andrew Watson
- Leonard Pianalto (Code Committee Rep)
- Peter Mitchell (APEGBC Professional Practice)

Sustainability Design Education

By Damien Stoneham, C.Eng., LEED™ AP; Read Jones Christoffersen

Green Building Rating Systems – An Overview

The enormous growth of sustainable building design in recent years has been coupled with the emergence of various third party rating systems around the world. This article aims to provide a snapshot view of some of those systems.

In Canada and the US, **Leadership in Energy & Environmental Design (LEED)** has gathered momentum and is now by far the most recognised rating system. However, there are occasions where other rating systems are used either because of their suitability or preference by building stakeholders.

The **Green Globes** rating system is an online, questionnaire-driven rating tool that can be used for new and existing buildings. It awards ratings with one, two, three or four Globes. Because it is on-line and interactive it serves as a virtual consultant and provides instant feedback on environmental aspects of building design. Green Globes for existing buildings in Canada is owned and operated by BOMA Canada. All other Green Globes products in Canada are owned by ECD Energy and Environment Canada.

Built Green offers certification for new single family homes. It is currently available in BC and Alberta and certifies homes with either a Bronze, Silver, Gold or Platinum achievement level. Built Green is currently developing standards for use in multi-storey and residential towers, communities and renovations.

The **R-2000** Program was created as a partnership between the Canadian Homebuilders' Association and Natural Resources Canada. The R-2000 standard is a performance based standard that sets criteria for how a house must perform rather than how it must be constructed. Since it's inception in 1981, thousands of R-2000 homes have been built and R-2000 technology has achieved international acclaim.

In Europe, several countries have developed their own rating systems. The UK for example has the longest established system, the **Building Research Establishment Environmental Assessment Method (BREEAM)**. This rating system is used to assess both new and existing buildings. It employs eight categories and similar to LEED awards points in each category according to performance. Environmental weightings then enable the points to be added together to produce an overall score. Buildings are rated: pass, good, very good, excellent or outstanding.

Across Europe other rating systems include:

- **CEEQUAL (UK),**
- **SKA-Rating,**
- **HQE (France),**
- **BREEAM-NL (Netherlands),**
- **VALIDEO (Belgium),**
- **LEnSE (EC).**

In the Middle East where construction activity has soared, sustainable design has recently come to the fore. In May 2008, The Abu Dhabi Urban Planning Council (UPC) launched its own green building rating system, The 'Abu Dhabi Estidama Pearls Assessment Method' often referred to as **Estidama** (meaning sustainability in Arabic). Buildings certified under Estidama are awarded one (35%) to five (75%) Pearls. At the beginning of 2009 LEED had a strong presence in the UAE (over two hundred LEED registered projects and three LEED certified buildings) but will that change with the introduction of Estidama?

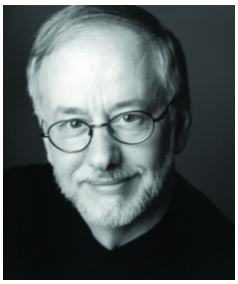
Like the Middle East, China is experiencing a major building boom. The estimated urbanization of 350M people by 2020 will bring its own challenges not least in energy needs. LEED currently has a strong foothold in China due to its international marketability, but Chinese officials are developing their own standards too.

The government has created a framework of minimum requirements on energy efficiency in all new construction. The requirements are based on the average energy efficiency of Chinese buildings in 1980 and aim at decreasing energy use in all new construction in China by 50% before 2010 and by 65% before 2020. They have yet to create any sustainability requirements that look at any other factors besides energy use but these are expected.

Rating systems are tools that assist us in achieving desired levels of building performance. As sustainable design develops over time it will be necessary for us to ensure our own rating systems evolve accordingly. Awareness of alternative rating systems can help us with this process.

Technical Committee Update

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



Structural Shotcrete Committee Update

Co-Chair: Levi Stoelting, P.Eng.
Glotman Simpson Consulting Engineers
Co-Chair: Roland Heere, MASc., P.Eng.
Metro Testing Laboratories

Over the past 6-8 months the Structural Shotcrete Committee has been busy on two fronts. First, working to foster an understanding of Structural Shotcrete within the local Engineering, Materials Testing and Contracting community, we had 4 members of the committee give presentations at the ACI-BC Structural Shotcrete Forum this past October:

Roland Heere, MASc., P.Eng., Metro Testing Laboratories

- Shotcrete Quality Control Inspection and Testing

Neil McAskill, Metro Testing Laboratories

- Shotcrete for Ground Support

Rusty Morgan, Ph.D., P.Eng., FACI, AMEC Earth & Environmental
- Introduction and Structural Shotcrete Specifications

Levi Stoelting, P.Eng. Associate – Glotman Simpson Consulting Engineers
- Structural Shotcrete: Structural Engineers Perspective.

Second, we have begun the formation of a draft Structural Shotcrete Guideline for General Materials Requirements, Structural Design Recommendations, Construction Mock-ups, Construction Practices, and Quality Control Practices. Ultimately this guideline document intends to provide direction to all parties involved in Shotcrete construction. The guideline is also intended to seek consensus within the local Engineering community; providing our clients and end users with a product that they can rely on while providing the Engineering community with the confidence they need to design with shotcrete.

Look forward to reviewing the Interim Structural Shotcrete Guideline online at the SEABC website sometime soon.

If anyone should have any questions or comments, please email:

lstoelting@glotmansimpson.com

Young Members Group

By Kevin Riederer, MASc, EIT

In December, the SEABC Young Members Group held their first planning meeting. The meeting was attended by 16 members who discussed suggestions for the types of activities the YMG could have. Based on the discussions, the group decided that the YMG should focus its efforts in 5 areas:

1) Social / Networking events. The group believes that this is an important function for the YMG. The group can use these events as the main method for reaching out to young members and getting them involved in the group.

2) Technical Talks (Professional Development). Specifically professional development events more relevant for younger members. Topics could also be non technical (e.g. Business skills). The group will also aim for some presenters to be young members. Settings for the talks could be formal or informal depending on the type of event.

3) Professional Registration Assistance. Provide assistance to young members where possible as they pursue registrations in BC and in the US. (P.Eng., Struct.Eng., P.E., S.E.)

4) Communication. Communicate with SEABC members through articles in the association's newsletter, and possibly a page on the association's website. Explore option of an online blog for young members to communicate within the association and discuss relevant issues.

5) Outreach. Career / Professional awareness events geared towards high school students, university students, and the general public.

The group also held a meeting in Early February to begin planning the first YMG event. More information will follow soon.

If you're interested in becoming involved with the SEABC Young Members Group please contact ymg@seabc.ca

On the Web

By Stephen Pienaar, P.Eng; SEABC Webmaster

Online Membership

Our new online membership management system went live in December. The system enables members to keep their contact details up to date, set email preferences, and pay annual membership fees online. To date, roughly 15% of SEABC members have

activated their online accounts. We are inviting the remaining 85% of members to activate their online accounts at www.seabc.ca/members.

Members-Only Content

We are in the process of adding content to the website that will be accessible to members only. Members with online accounts can log in to access:

- Confidential information such as meeting minutes.
- Privileged content such as technical reports.

CSE Courses

We have just gone through the second (and very successful) round of online applications for the CSE courses. This term, we are going one step further with the introduction of a file repository where students can download course material.

In The Pipeline

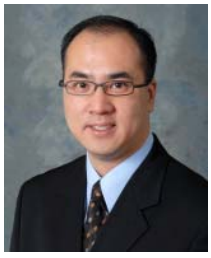
We are in the planning stage for a searchable directory of corporate members. The directory will address the often expressed need for website visitors to identify firms with specific fields of expertise.

Staying Up To Date

The various SEABC committees are doing valuable work, and we are trying to reflect this by keeping the information on our website current. Please bookmark www.seabc.ca and check in regularly for upcoming events, seminars and courses.

ATC Report

By Steven Kuan, P.Eng.;
Building and Safety Policy Branch;
Ministry of Housing and Social Development



My three-year term as the representative for SEABC and WCSEA on the Board of Directors of the Applied Technology Council (ATC) has ended. The experience was truly rewarding and fun.

The Board meets four times a year at various locations in the U.S. Even though these meetings took place on Saturdays and a few Fridays and I attended on my own time, I looked forward to going each time. Discussions were lively, and comments were made and received freely and professionally. Casual conversations at the dinners were always enjoyable and completed the meetings nicely.

In my last report in the Feb 2008 issue of this Newsletter, I gave some background on ATC and mentioned some of their on-going projects. I will not repeat them here. But I would like to emphasize that ATC has contributed significantly to improving the practices of seismic engineering and structural engineering in the U.S. Many ATC documents have become key or 'must-have' reference documents in design and research offices. A few upcoming documents, like the ATC-58 report on testing protocols for non-structural components and the ATC-63 report on R-factors, might attain the same level of legendary status. With more involvement in wind and flood engineering in the near future, the contribution of ATC is going to expand and increase.

Part of the success of ATC is their ability to initiate and manage projects on relevant topics and produce high-quality work. One can see the enthusiasm and dedication in the consultants who work on the projects. Most of these consultants are practicing engineers and designers with busy schedules. Having had an in-depth look at the operations of ATC, more specifically at the system of funding and knowledge transfer, I would say that the study and practice of seismic structural engineering in B.C. could be advanced if a similar organization and the same kind of funding system exist here in B.C. or Canada.

It was valuable to learn of and participate in discussions on a variety of topics and issues present in the field of mitigation of natural hazards. Many of them, such as vertical evacuation from tsunamis, wind design, reducing risks of non-structural damage and design of port facilities, are relevant to B.C.

Presently, ATC is organizing in partnership with SEI of the ASCE a conference on Improving Seismic Performance of Existing Buildings and Other Structures. This conference will be held in December 2009 in San Francisco. The deadline for submission of abstracts is February 27.

You can find out more about ATC's current projects and seminars from www.atcouncil.org. Their publications can be purchased on-line; some documents are available for download for free. ATC also has an endowment fund, and any financial support from organizations or individuals to this fund is most welcomed.

In closing, I want to thank SEABC for having given me the opportunity for a wonderful experience. I will be glad to answer any of your questions regarding ATC and their activities. Moreover, I am enthusiastic about discussing any of the topics to see how we can move forward on reducing risks from natural hazards here in B.C.

Beijing in 2008 Presentation

Featuring Water Cube and Bird's Nest Stadium Structures

By Martin E. Bollo, P.Eng., S.E.;
SEABC Education Committee

SEABC members were invited to attend the 2008 CISC B.C. Region Steel Design Awards of Excellence at the Vancouver Convention and Exhibition Centre on November 19, 2008. The evening featured keynote speaker Stephen Burrows of Arup Engineering, whose talk "Beijing in 2008" featured aspects of the Beijing National Aquatics Center (Water Cube) and Beijing National Stadium (Bird's Nest Stadium) structures constructed for the 2008 Olympics.

Mr. Burrows started his presentation with a background discussion on his firm's philosophy and some previous projects of note – the Imperial War Museum, the Salford Arts and Media Center, the Millennium Bridge, and stadiums for Manchester City and Valencia football clubs. He is the global leader of Arup-Sport in Europe.

The Water Cube and Bird's Nest stadium structures were constructed next to each other at the Olympic Green site, six miles north of the Forbidden City in Beijing. The two structures were intended to act as contrasts – the Water Cube represents qualities of water, femininity, poetry, and the colour blue, whereas the Bird's Nest Stadium represents qualities of fire, masculinity, heroism, and the colour red. Both projects were fast-tracked.

The Water Cube structure housed the Olympic swimming events and held 17,000 seats during the Olympics, but will be reduced to 10,000 seats now that the Olympics are complete. The structure is recognizable for the unique 'bubble' appearance of its outer walls, which surround a 70,000 square meter floor area on a 177m by 177m footprint. Mr. Burrows demonstrated how the optical appearance of complexity in the wall construction is intentionally created by offsetting the inner and outer skin walls, which were constructed with a series of tubes and spheres as a space frame. The complex design, including connection research and testing of nodes and local buckling was completed within the total project design time of seven months. The structure is designed as a multi-purpose facility, housing the main pool, warm-up area, leisure pool, and a restaurant.

The Water Cube image from **www.flickr.com**

Ethylene Tetrafluoroethylene (ETFE) material was used as the facade material, and special fire code work was done as the ETFE is expected to disappear in a fire so that people can get out.

In contrast to the rectangular Water Cube, the adjacent Bird's Nest Stadium is an ellipse in plan. It was designed to seat 91,000 audience members over an underground shopping center, and is 254,600 square meters in area. Interestingly, the original concept was not based on a bird's nest, but rather on ancient “scholar's stones”, which are heavily veined pebbles mounted on small plinths. But after the Beijing Mayor stated that he liked the “Bird's Nest” conceptual design the name stuck. The original concept had a moving roof that was later removed for budgetary reasons. Sight lines drove the stadium design from the beginning, and then the exterior shape was designed to fit around the seating configuration.

Mr. Burrows demonstrated how the seemingly random orientation of the structural steel members are actually a combination of primary structural steel shapes that form a series of portal frames that are tangent to the roof opening, in combination with secondary shapes added for visual effect.

These secondary elements were the same outside dimension as the primary members but the plate thicknesses varied according to structural requirements. There are 24 columns – one for each hour of the day – none of which are vertical. A CATIA model was used to integrate analysis and design with construction document preparation.

In total, the structure utilizes 46,160 tons of steel in the exoskeleton, requiring 700 km of welds by 7,000 welders. Construction was done in relative secrecy, and the design was checked by forty-two professors. The project was performed with a great sense of national pride, and Mr. Burrows remarked how mock-ups of elements were built by local fabricators for free, and that there are currently one-hour long lineups for tours of the Olympic Green area.

The evening also featured presentation of the 2008 B.C. Steel Design Awards of Excellence. Sandwell Engineering Inc. was part of the winning Engineering submission for the 2010 Olympic Ski Jumps project, and Fast & Epp Structural Engineering was part of the winning Architectural submission for the Griffiths Pedestrian Bridge.

Night-time view of the Bird's Nest Stadium
image from **www.flickr.com**

In-Plane Monotonic and Cyclic Testing

By Carlos E. Ventura, Ph.D., P.Eng
Director of Earthquake Engineering Research Facility;
Department of Civil Engineering; The University of British Columbia

In-Plane Monotonic and Cyclic Testing of Steel Roof Deck Diaphragms with Nailed and Welded Connections

A series of in-plane shear tests of steel roof deck diaphragms was recently conducted at the Earthquake Engineering Research Facility (EERF) of the University of British Columbia (UBC) in collaboration with Pneutek Inc., Flynn Canada Ltd. and Krahn Engineering. The tests included monotonic and quasi-static reversed cyclic inelastic deformation. This test program was initiated and designed to evaluate the seismic inelastic response of steel roof deck diaphragms with two types of deck-to-frame connections. Previous studies of steel roof diaphragms have shown that severe deformation zones are concentrated near the end supports of the roof. The sketch shown in Figure 1 illustrates this behaviour. Therefore, the test program was designed to represent a half portion of a roof diaphragm and replicate the observed behaviour.

Six test specimens, each 6.15m long by 2.75m wide, were tested. Figure 2 shows details of a typical deck configuration and the connections pattern. Each specimen was constructed on a rectangular 6.1m x 2.8m steel test frame with pinned corner connections and an intermediate joist beams spaced at 1.52 m. The decks were built with six 0.91 or 1.2 mm thick corrugated steel panels with a depth of 38 mm and flutes spaced at 152 mm o/c. Deck panels were 0.94m width and 3.2 m long with an end lap connection at the specimen midpoint. They were connected to one another using side laps and to the perimeter test frame members, as well as to the joist beams. Self-drilled screws were used for the lap fasteners. Figure 3 shows details of a typical test setup and the instrumentation used to measure the deformation of the different parts of the deck.

The behaviour of two types of deck-to-frame fasteners was investigated: Pneutek K64062 nails and 16 mm diameter arc spot welds. For simplicity, the fastener types are referred as “Nail-Screw” and “Weld-Screw” in the text and figures below. For all these specimens, the spacing of the fasteners was 152 mm in a direction perpendicular to the applied loading, and fasteners were installed at every flute in the direction parallel to the loading.

A loading protocol was developed for performing the reversed cyclic tests based on the ATC-24 guidelines. Monotonic load-deformation response was used to determine the deformation parameter required for defining the amplitudes of the loading sequences. The results obtained from these tests are illustrated in Figures 4, 5 and 6. Tables 1 and 2 present a summary of the deck configurations tested and of the resistance values obtained from each test, respectively. Important observations from these tests include the following:

1. Monotonic and cyclic testing of all specimens confirmed that the inelastic deformation of a deck is mainly concentrated on the edge of the diaphragms parallel to the lateral loading (at end beam).
2. For the specimens with Nail-Screw fasteners inelastic response was developed by tilting of the screws at the side laps and ductile inelastic deformation of the panel where it is attached to the joists and to the end beam. Limited damage was observed elsewhere in the specimens.

3. For the specimens with Weld-Screw connections bonding failure of the welds happened along the end beam shortly after by local buckling and distortion of the steel panel near the welds. The rest of each specimen, including side laps and perimeter frame members, showed no damage or evidence of inelastic action.
4. The results of monotonic tests of diaphragms with nail deck-to-frame fasteners exhibited a ductile behaviour with progressive failure. The diaphragm with welded connections showed brittle failure and limited ductility. However, the maximum load capacity for each configuration was similar.
5. The monotonic load-deformation curves show that the diaphragm strength decreased rapidly after the peak load was reached. All the specimens showed a reserved capacity up to approximately 50% of the peak strength after failure of the connectors started.
6. The load capacity of the specimen with a 1.2mm thick panel is about 30% higher than the capacity of the specimen with a 0.91mm thick panel. Both systems have a comparable initial stiffness and ductility but exhibited significantly different resistances and post peak resistance responses.
7. The cyclic tests showed a pinched hysteretic behaviour. Nail-Screw specimens sustained large inelastic deformation cycles with progressive strength degradation. In contrast, Welded-Screw specimens showed very significant deterioration and very rapid strength deterioration after the peak load was reached.
8. Under cyclic loading, the peak resistance of the specimen with Weld-Screw connections was substantially less than the resistance under monotonic loading. This clearly indicates that a sudden brittle failure of welded deck-to-frame connections is likely to occur during actual earthquake induced motions. This difference in resistance was not observed in the specimens with Nailed-Screw fasteners.
9. The onset of failure for each specimen was the end beam of the support frame, and as this failure propagated in this region, bending behaviour of the undamaged panels and test frame members was observed.

In conclusion, the results from this series of tests show that the Nail-Screw connections show a more ductile behaviour than the Weld-Screw connections. Although the initial stiffness of both systems is practically the same, the resistance under cyclic loading of the Nail-Screw connections is about 50% higher than that of the Weld-Screw connections. Although it is recognized that additional testing is required to confirm this same kind of observed behaviour for other types of decking systems, it is clear from these tests that the R factor for steel deck systems with Nail-Screw systems should be greater than the current value in the NBCC 2005.

At the time of this writing a second round of tests is being started at the EERF. At least ten more tests will be conducted to complement the results presented here. Once the tests are completed, we will share our findings with the SEABC members.

EERF Personnel involved in this project: Dr. Mehrtash Motamedi, a post-doctoral researcher at the EERF is the project manager, and Mr. Felix Yao, P.Eng is the EERF Laboratory Manager responsible for coordinating the lab operations and test activities. Several graduate students and technical staff at UBC have assisted with the tests.

Figure 1
Inelastic deformation of steel roof diaphragms in typical single-storey structures during a severe earthquake

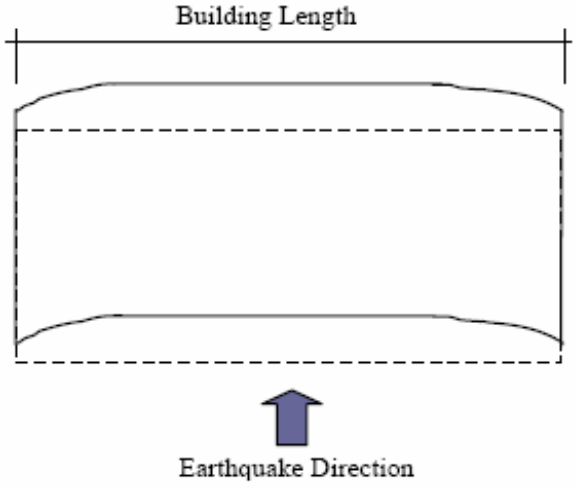


Figure 2
Schematic plan view of test specimens and layout of deck-to-frame and sidelap connections

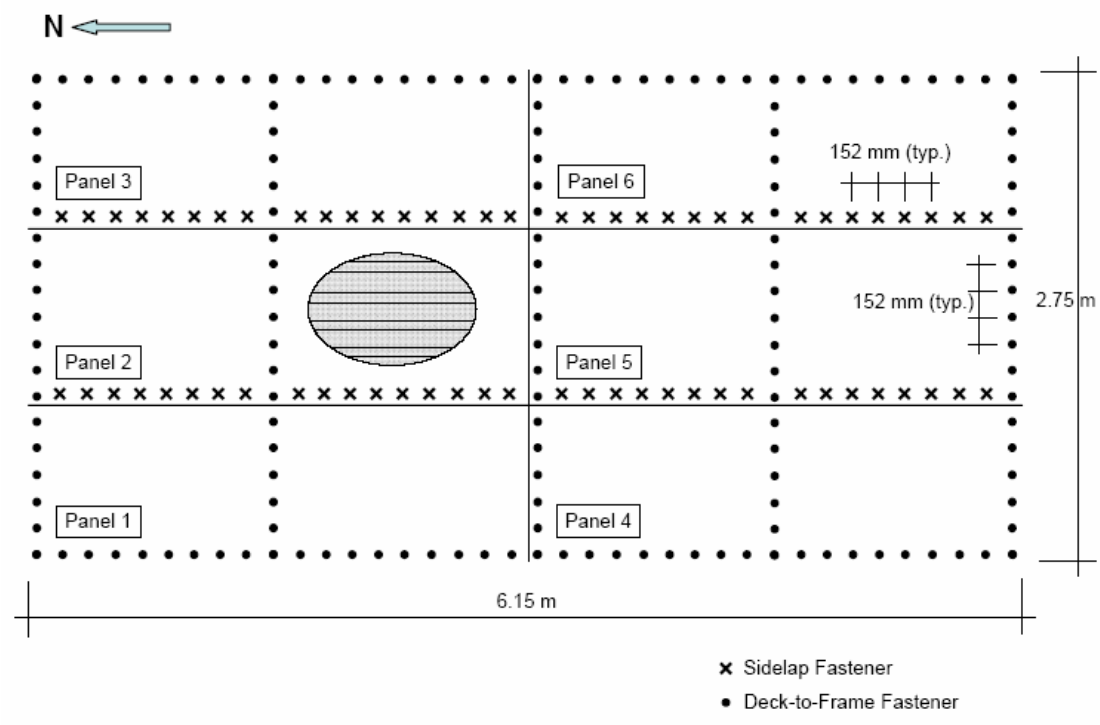
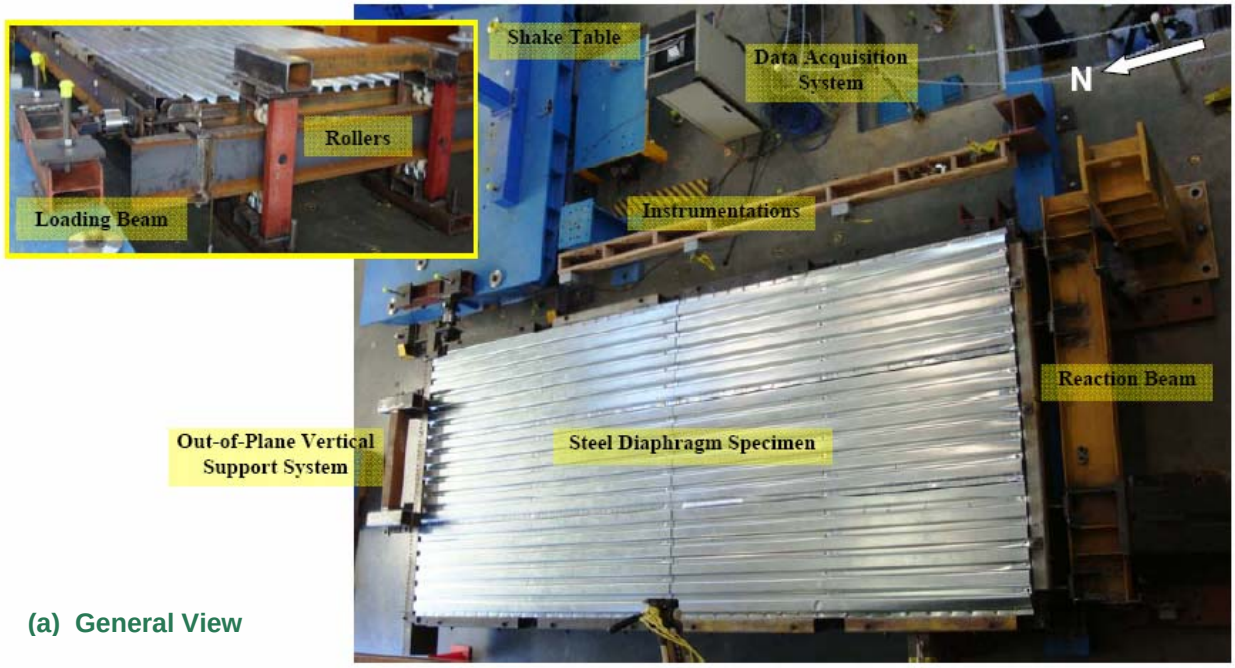
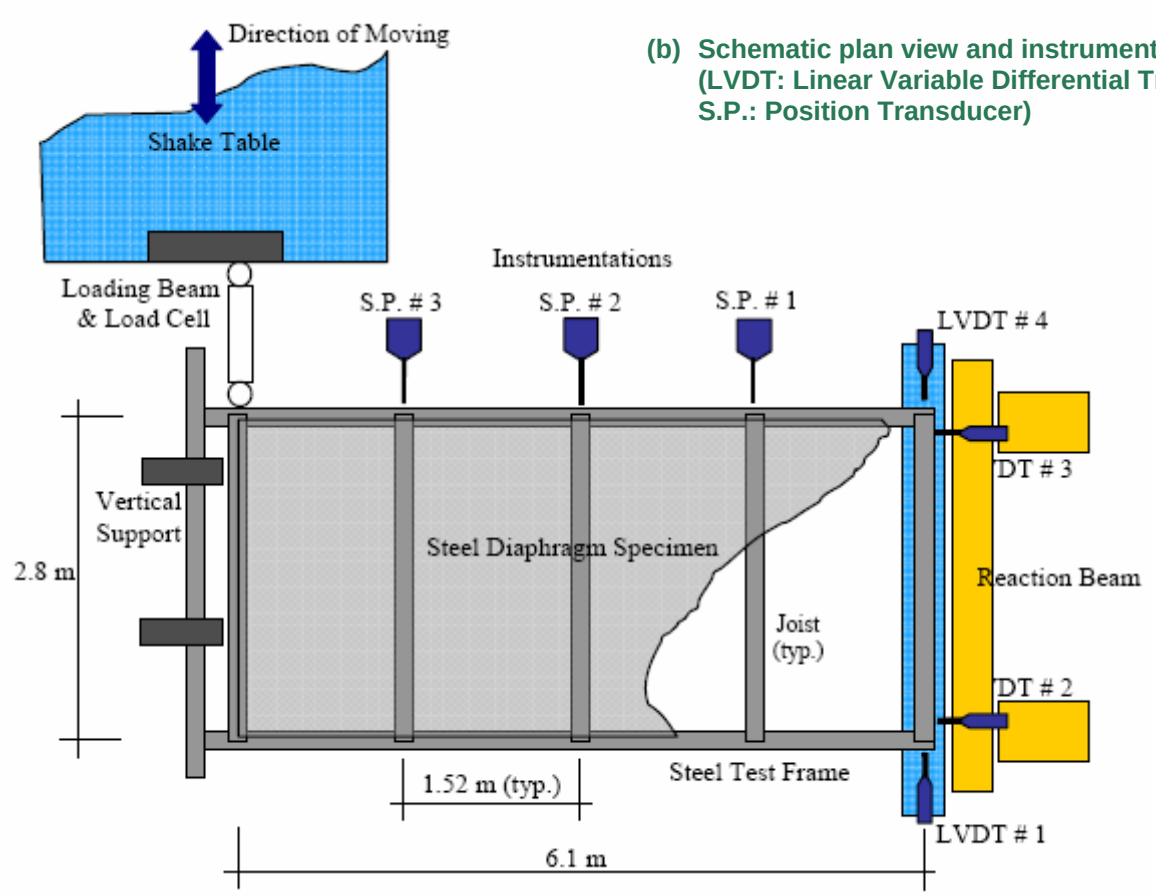


Figure 3
Steel Diaphragm Test Setup



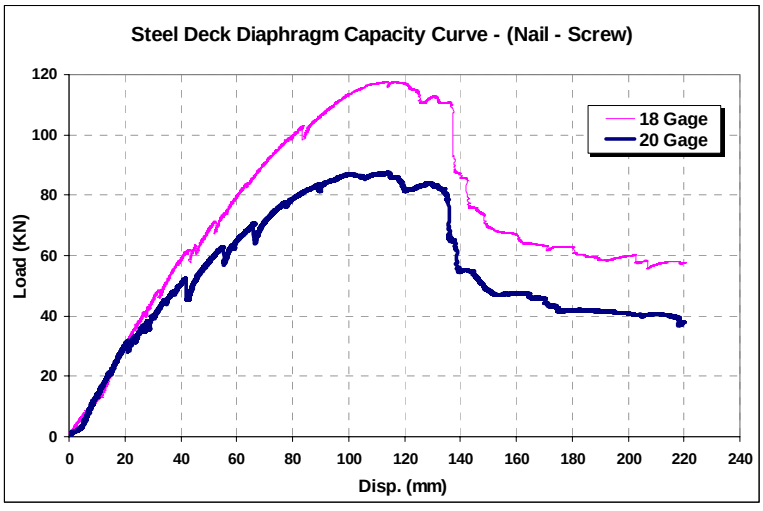
(a) General View



(b) Schematic plan view and instrumentation layout (LVDT: Linear Variable Differential Transformer, S.P.: Position Transducer)

Figure 4
Monotonic load-deformation response of diaphragm specimens # 2, 4 and 5
(a) Nail-Screw fasteners, 0.91mm versus 1.2mm thick panel; (b) 0.91mm thick panel, Nail-Screw versus Weld-Screw fasteners

(a)



(b)

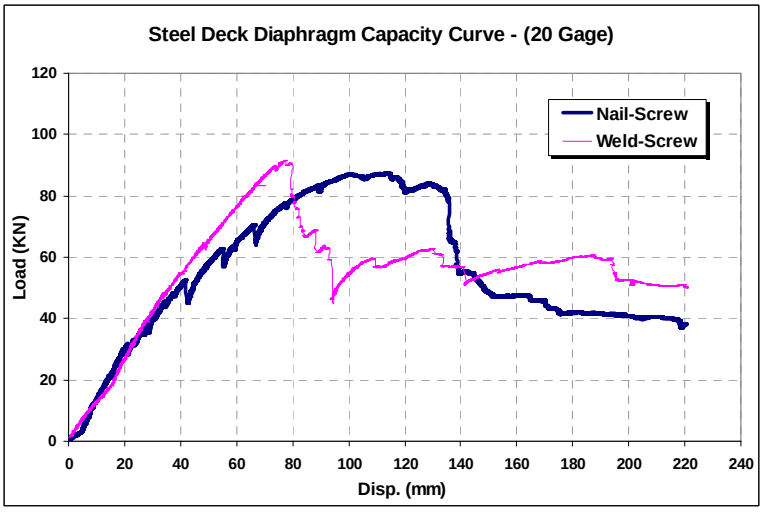
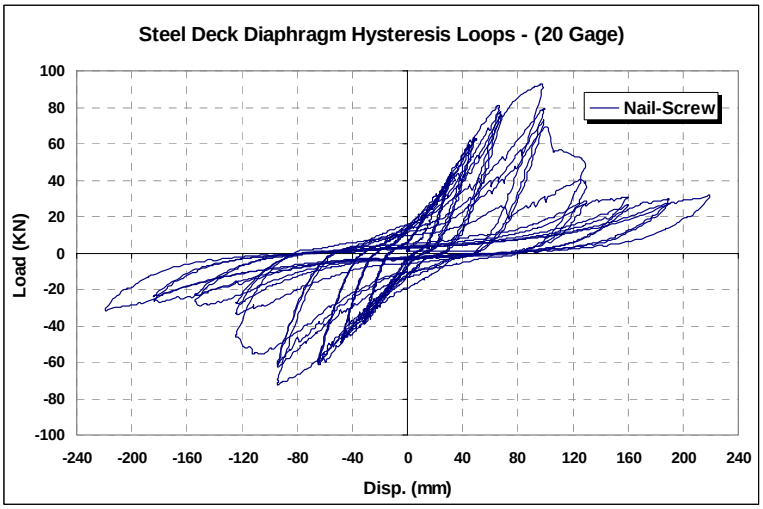


Figure 5
Load-deformation response of diaphragm specimens # 3 and 6 under cyclic loading: 0.91mm thick steel panel
(a) Nail-Screw fasteners; (b) Weld-Screw connections

(a) (b)



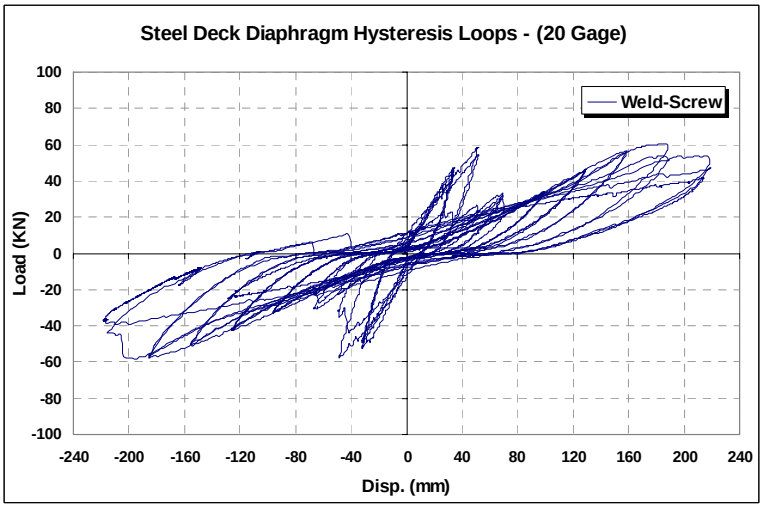
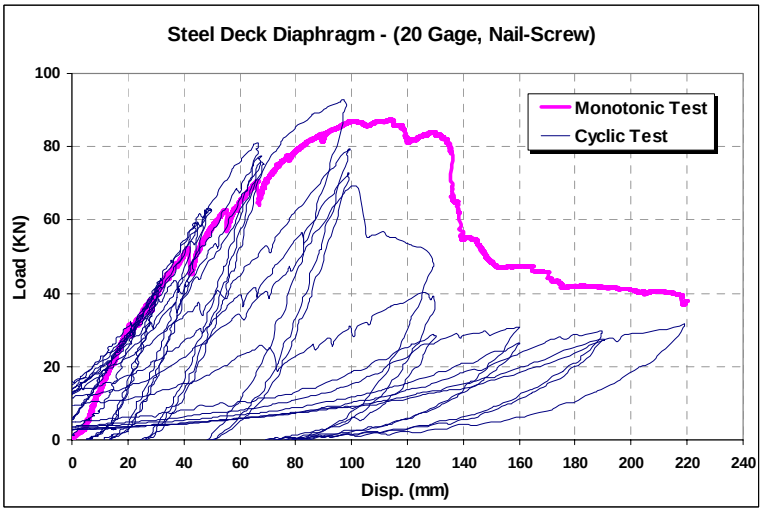


Figure 6
Load-deformation response of diaphragm specimens # 2, 3, 5 and 6 with 0.91mm thick steel panel, under monotonic versus cyclic loading
(a) Nail-Screw fasteners; (b) Weld-Screw fasteners

(a) (b)



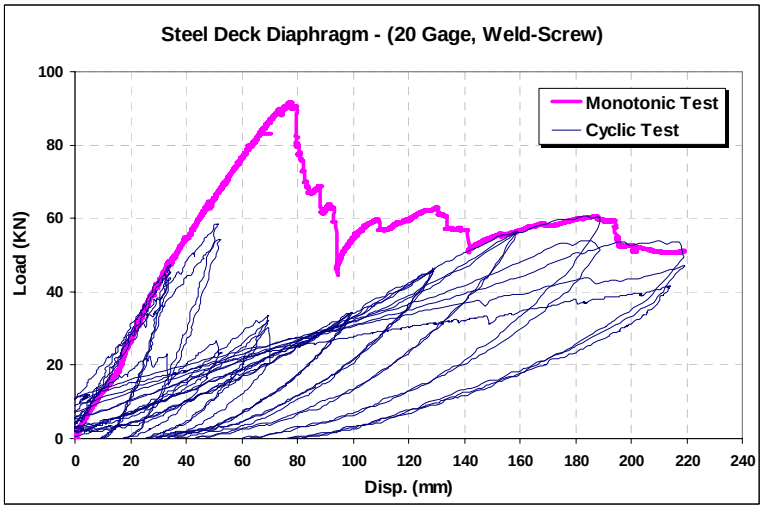


Table 1
Characteristics of the Diaphragm Test Specimens

Specimen No.	Deck Thickness (mm)	Side lap Fastener	Deck-to-Frame Fastener	End Beam Condition
Specimen # 1	0.91 (20 Gage)	Screw	Nail	Flexible
Specimen # 2	0.91 (20 Gage)	Screw	Nail	Rigid
Specimen # 3	0.91 (20 Gage)	Screw	Nail	Rigid
Specimen # 4	1.2 (18 Gage)	Screw	Nail	Rigid
Specimen # 5	0.91 (20 Gage)	Screw	Weld	Rigid
Specimen # 6	0.91 (20 Gage)	Screw	Weld	Rigid

Table 2
Test Program and Results for Testing of Six Specimens

Specimen No.	Date of Test	Loading Type	Peak Shear Resistance (KN)	Initial Stiffness (KN/mm)
Specimen # 1	28 & 31/Oct./2008	Monotonic / Cyclic	85	1.5
Specimen # 2	13/Nov./2008	Monotonic	88	1.5
Specimen # 3	18/Nov./2008	Cyclic	93	1.5
Specimen # 4	24/Nov./2008	Monotonic	118	1.5
Specimen # 5	26/Nov./2008	Monotonic	92	1.5
Specimen # 6	28/Nov./2008	Cyclic	60	1.5

SEABC Membership of Regional Groups

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

SEABC is a member of the Western Council of Structural Engineers Associations, and its sub-set, the North West Council of Structural Engineers Associations. SEABC succeeded into membership from its forerunner, the Division of Structural Engineers, which had joined WCSEA and NWCSEA in 1996. However, many SEABC members will be unaware that we are strong contributors to regional structural engineering issues and events.

WCSEA comprises eight western states along with BC, while NWCSEA consists of Washington, Oregon, Idaho and British Columbia. The two Councils meet each year, and run annual conferences open to the membership of all member associations.

SEABC belongs to these organizations because we have we have received a great deal of development help from our sister associations over the years and have discovered the value of dialoguing with regional SEAs. At a modest cost, we are able to pool resources to organize conferences and other presentations. WCSEA has been able to influence licensing and practice laws in the Pacific Northwest, and we view WCSEA as the strongest advocate for the harmonization of structural engineering qualifications across the region. WCSEA has worked hard to shape codes of practice, and produced technical guidelines and code commentaries.

In past years SEABC has provided presenters for WCSEA and NWCSEA conferences, and included several outside speakers in BC events. This process all helps us to learn from each other while opening up new professional development opportunities to SEABC members. BC will be hosting the WCSEA and NWCSEA Council meetings in October, 2010, which will be held in conjunction with the structural engineering program at the APEGBC Annual Conference.

President's Request for Volunteers

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

SEABC has achieved a number of important goals in 2008 and has exciting plans for 2009 and future years. To maximize effectiveness, SEABC relies heavily on its volunteers. The enthusiasm for making SEABC into the best it can be is widespread, however, we need to strengthen our existing structure of committees and task groups. You can help us.

No doubt you will be interested in Membership, Education, Communications, Professional Practice, the Young Members Group, or the Technical Committees, so please let me know where you believe you can make the greatest contribution. Please contact me at: djdavey@shaw.ca

Thank you for supporting your structural engineering advocate.

Fee Payment Reminder

Please note that SEABC membership fees for 2009 were due on January 1, 2009. The 2009 dues were set at $75 + GST or $78.75 and (for this year only) can be paid as part of your APEGBC registration. Dues can also be paid on-line via the SEABC web site. By February most members will have paid; however, any 2008 members who have not yet paid their 2009 membership fees by the end of March will be removed from the register. Of course new members can apply to join (and delinquent members re-join) SEABC at any time. Check out:
http://www.seabc.ca/membership.html

If you have not yet renewed your membership, please do so as soon as possible. You can then continue to support your profession. Be a part of the strong, dynamic, and forward-thinking Structural Engineers Association of BC!

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Copenhagen Harbour gets Landmark Towers

Designs for a new landmark in Copenhagen Harbour were revealed last week – two towers connected by a public walkway 65 m above the harbour.

The towers are linked by a cable-stay pedestrian bridge. Designed by Steven Holl Architects and with HNTB Corporation as the structural engineer, the towers will eventually contain offices with some public spaces. The project will use a variety of sustainable technologies. Both towers have glazed facades which are shaded by solar screens made of photovoltaics. The towers are connected to a seawater heating and cooling system which provides radiant heating in the floor slabs and radiant cooling in the ceiling.

Watson Steel Sues Over Clyde Arc Hanger Failure

Contractor claims certificates accompanying hangers failed to match product supplied.

By Jessica Rowson

Fractured: Poor manufacturing and faulty steel have been blamed

Clyde Arc fabricator Watson Steel is suing its connection supplier Macalloy for £1.8M over the failure of two hanger connections on the troubled Glasgow bridge in January last year.

Watson was forced to replace all 14 hangers on the £20.3M bowstring arch structure, and now blames poor manufacturing of connection holes and faulty steel for the failures.

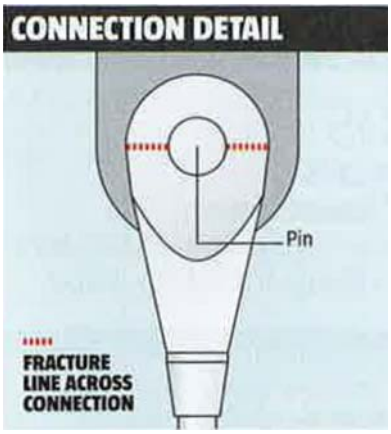
In legal papers obtained by NCEI, Watson claims Macalloy's connections did not meet specifications and failed to match supplied test certificates.

The Clyde Arc had to close on 14 January last year after a connection on the two year old road bridge failed, causing a 35 m long Macalloy bar to fall onto the carriageway below.

The bar was one of 14 tension bars which suspend the deck from the bridge's bowstring arch.

A second crack in another connection was found 10 days later, prompting a decision to replace all the existing connections.

The connection had two flattened lugs sitting either side of a fin welded onto the main arch structure. A pin through the two lugs and the fin connected the two. The connection failed in a brittle fracture in the lugs across the holes for the pin.



Watson claims that investigations show that the steel used to create the lugs did not match any grades of steel recognised by *BS 3100:1991 Specification for steel castings for general engineering purposes.*

Tests found that the steel had an elongation value more than 10% below the 13% minimum specified and a Charpy impact value which was significantly below that specified. A Charpy impact value is a measure of brittleness.

Certificates supplied by Macalloy, which was responsible for the testing of components before delivery to ensure that they met the specification, failed to match results of tests on the steel in the bridge forks taken after the event, Watson claims.

The carbon content of the forks was 0.33% rather than between 0.18% and 0.28% as indicated in the certificate. Traces of other metals were found in the fork including 0.096% chromium, but these had not been mentioned in earlier certificates.

Poor manufacture of the forks was also thought to have contributed to the failure. Watson Steel claims that the pin bores were neither concentric to each other nor perpendicular to the forks with the result that forces were distributed unevenly across the holes allowing stress concentrations to build up.

Macalloy has yet to respond to Watson's claim and was unavailable for comment.

The Clyde Arc was designed by consultant Halcrow and built by contractor Nuttall for Glasgow City Council. It opened to traffic in September 2006 but was closed in January 2008 due to the connection failures.

Repair works, undertaken by Nuttall and supported by Halcrow and fabricators Watson Steel, resulted in the cast steel connection components being replaced by milled steel. The bridge reopened in June 2008.

Designers Blamed for I-35 Collapse

By Damian Arnold

Official report on Minneapolis bridge collapse puts spotlight on load path connections.

Bridge engineers urged greater vigilance in the design of vital bridge components after an official investigation revealed that under designed gusset plates contributed to the collapse of the I35W Bridge in Minneapolis in 2007.

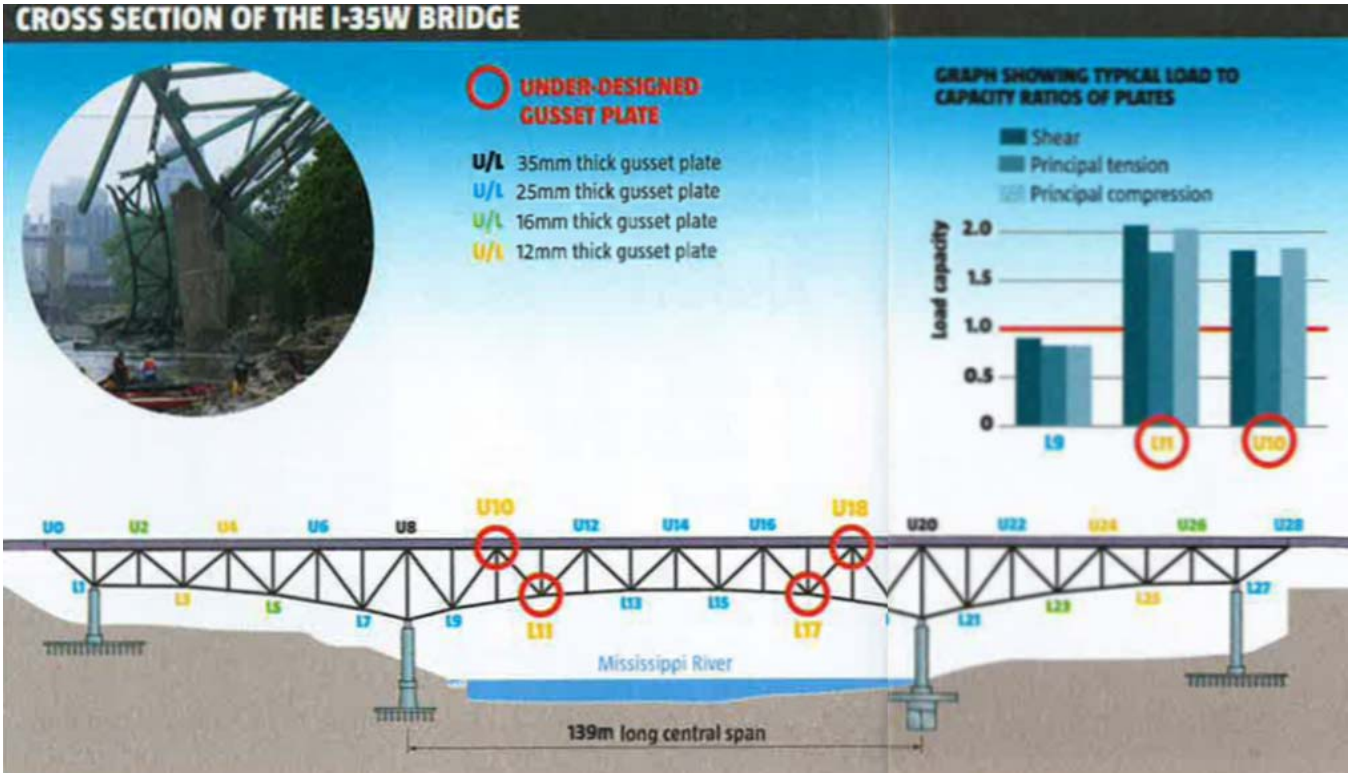
The collapse of the bridge's 300 m main span of the I35W in August 2007 killed 13 people.

The final report into the cause of the collapse from the US National Transportation Safety Board (NTSB) says that gusset plates used to connect load bearing columns and trusses had inadequate load bearing capacity.

Bridge designer Sverdrup & Parcel & Associates, now owned by Jacobs, was found to be at fault.

Independent steel bridge consultant Joyon Gill told NCEI that UK bridge designers would need to be more vigilant as a result of the report.

"People will look more carefully at each component of the bridge and especially at gusset plates," said Gill.



"It's particularly important to put the nuts and bolts in the right place."

"The report will put the spotlight back on load path connections."

Head of consultant Benaim Simon Bourne added that the report showed that small details in bridge design needed more attention.

"There is a tendency with a lot of schemes for people to concentrate on the main elements, such as flanges, but there is very, very rarely a problem with the main sections," said Bourne.

"It's invariably the details of the design of maintenance that can lead to problems and these are the things that need more engineering."

The NTSB found 24 under designed gusset plates on the I35 structure. They were about half the thickness of properly sized gusset plates, and escaped discovery during the original design review.

Sverdrup & Parcel & Associates were found to have failed to ensure that the appropriate main truss gusset plate calculations were performed and inadequate design review was found to have been carried out by federal and state transportation officials.

NTSB acting chairman Mark Rosenker said: "Bridge designers, builders, owners, and inspectors will never look at gusset plates quite the same again, and as a result, these critical connections in a bridge will receive the attention they deserve in the design process, in future inspections, and when bridge load rating analyses are performed."

The NTSB report also found that "substantial increases in the weight of the bridge, which resulted from previous bridge modifications" put further strain on the inadequate gusset plates. Concentrated construction loads on the bridge on the day of the collapse as a result of works being carried out added to the problem it said.

Inspections carried out had not identified the problem because gusset plates had been largely ignored.

Channel Challenge

By Bernadette Redfern

Engineers claim that Abu Dhabi's unique Sheikh Zayed Bridge is the most difficult ever built thanks to its complex and irregular structural form.

Eighteen years ago the Abu Dhabi Public Works Department first invited tenders for the design and supervision of an 850 m crossing of the Maqta channel, which separates Abu Dhabi island from the mainland. Nine consultants submitted bids.

High Point-Rendel (HPR) was eventually appointed but its designs were never approved. "The client wanted something more spectacular," explains chief bridge engineer Joe Barr. "So in 1997 they requested Zaha Hadid present architectural concepts and models," he says.

The result was two very different structures, one a linear frame that appeared to zig-zag over the water, the second an undulating pair of asymmetric arches that resembled sand dunes. By 1999 the client, which is today known as the Abu Dhabi Municipality, had its spectacular structure in the shape of the second design and HPR had to make it work.

"I would say this is the most difficult bridge ever built," says HPR assistant resident engineer Mike Davies. "Nothing about this bridge is regular, all the spans are supported differently, every piece is specifically designed and engineered. It is all one-off stuff," he says.

"Nothing about this bridge is regular, all the spans are supported differently, every piece is specifically designed and engineered"
Mike Daview, HPR

It took the team two years to produce the detailed design which essentially consists of 11 deck span sections and three major arches with four main piers and two additional sets of supports at the western end (see diagrams). The entire structure is supported by 16 km of 1.5 m diameter bored piles, each around 30 m long. There are 144 under the central pier alone and the pile cap is 5 m deep.

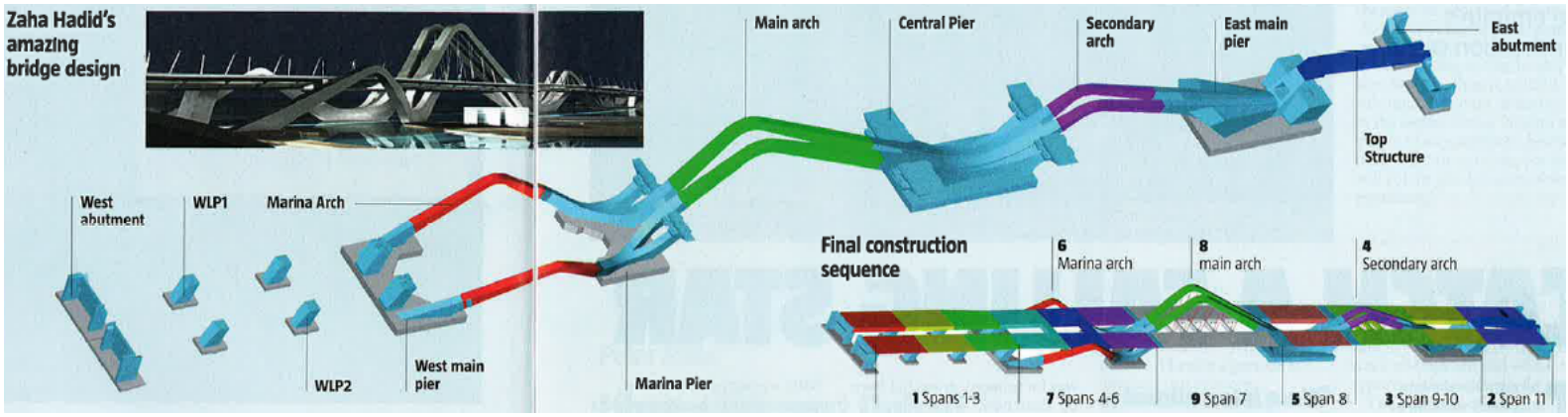
"The early design just wasn't possible," says Barr. "Part of the compromise to achieve structural stability was the inclusion of cross beams and the central pier was deepened."

Following the lengthy and complex design process, the bridge moved into construction but the project did not get any easier. The AED 635M ($169M) contract was awarded to Archirodon Construction Company in July 2003 as a 44 month contract, but the timescale soon slipped. The completion date moved from the end of 2006 to the end of 2009, with Archirodon taking most of the risk. A new price, understood to be in the region of AED 800M ($214M), was negotiated by Archirodon.

The first delay occurred when it emerged that Archirodon had a different construction sequence in mind to that proposed by the designers.

"The irregular shape of the bridge meant that no obvious sequence presented itself, and the one chosen by the contractor was different from the one assumed for design," explains HPR technical director John Dawson. "Since the support structure is continuous, this change in construction sequence - and hence structural system during construction - required a review of the complete design to check that the stress distribution throughout the system remained within the design limits."

Archirodon therefore bought in its own engineering advisor, Buckland & Taylor from Canada.



The original sequence created by the designers was to build the arches and then the deck spans. But Archirodon wanted to go from west to east building arch and deck as they went, so had to remodel the structure to check its method was buildable.

But late arriving arch steelwork scuppered this plan. The 60 m tall arch sections were designed in steel rather than concrete to simplify construction, but the Thai fabricator was struggling to supply them on time. Archirodon therefore changed the construction sequence so that the main arch could be done later, allowing work to continue elsewhere on the structure (see diagram). This introduced more redesigns which added further delays.

Another challenge was connecting the steel arches to the concrete piers. "We have a steel jacket around the concrete. It was the only way to handle the high torsion in the concrete as there is bending in both directions," explains Davies. Full penetration butt welds up to 100 mm deep were then used to connect the steel segments to each other and to the jacket.

The secondary arch segments were lifted into position using strand jacks located on a turntable supported by a portal frame system of towers and beams. The next arch to be lifted in is the Marina Arch which will be positioned on temporary supports by a 1600 t crawler crane. It is hoped this will happen next spring, depending on the steel fabricators. Finally the main arch will be lifted in using the same method as the secondary arch and the plan is to complete the structure by the end of 2009.

Complex lift: A portal frame system supports a turntable used to lift the arch segment into place

Keeping it Simple

By Jessica Rowson

The sleek and simple Handball arena for the London 2012 Olympics will be the perfect vessel for the cornucopia of events it will look. ***Jessica Rowson*** *reports on its below- ground challenges.*

From a distance, you might be forgiven for thinking that the 2012 handball arena looks dull. It certainly doesn't have the curves of the Aquatics centre or the pomp of the main stadium. It is in essence, a box.

However that is where its fundamental beauty lies. What designer Make architects and consultant Arup have done is taken the space needed for the Games and built the structure around it, keeping the structure tight and efficient. Many ideas were explored but the fundamental idea of a box was returned to.

"We won the job on the mandate: 'keep it simple'," says Arup associate director Andy Pye. "We looked at a steel frame solution, portal frames, arches, masts - we looked at everything going. We worked up timber and steel solutions and looked at solutions not only from the economic but also the architectural point of view. Domes create a large internal volume and increase the roof area - they were going away from simplicity. We kept returning to the box."

However this is no cattle shed. It is a beautifully detailed project - the designers likened it to a jewellery box. The reinforced concrete base on a piled foundation is separated from the copper clad steel framed upper "floating" box by a band of glazing.

ROOF DESIGN

The steel truss roof is the art of simplicity – standard purlin, with short spans.

"We are keeping the spans as short as possible to keep down the cost of the roof structure and the cost of the building," says Arup associate director Andy Pye. "We are dealing with spans of 65m in the short and 90m in the long."

Unusually the roof is designed as two way spanning. This design helps the buildability of the structure.

The six trusses which span in one direction can be put up initially and are self supporting until the two other long trusses are in place, when two way spanning action is achieved.

The geometry of the trusses was chosen carefully so only four different truss types are needed. Also they were chosen so that the points where the trusses start to taper are in line with the start of the seating – the outline of the field of play is reflected in the ceiling plan. The roof design looks simple – but it has been carefully co-ordinated with the architecture.

"Light pipes, electric light clusters, speakers, HDTV lighting – we need to ensure all these things are co-ordinated in the ceiling so everything in the roof looks like it has its place," says Pye. "We want it to look considered."

The upper part of the building is clad in copper and the colour will develop as it ages.

"Copper has a high recycled content – some people quote as high as 70%," says Make partner Stuart Fraser. "Afterwards it's 100% recyclable."

One of the challenges of the project was how to found the building on poor ground.

"We are dealing with contaminated ground and difficult piling conditions," says Pye.

> **"We are dealing with contaminated ground and difficult ground conditions. We have to pile down to the Thanet sands"**
> Andy Pye, Arup

"We have to pile down to the Thanet sands. Also there are two Channel Tunnel Rail Link tunnels within 10 m of the building footprint which could affect our building.

"We're using continuous flight auger (CFA) piles as they disturb the contamination less and are better for the water course. We will be working at the limit at what CFA piling rigs can do. We will be drilling deep, 26 m to 27 m. For that we need a rig with high torque. By keeping the diameter down, we can reduce the torque on the rig."

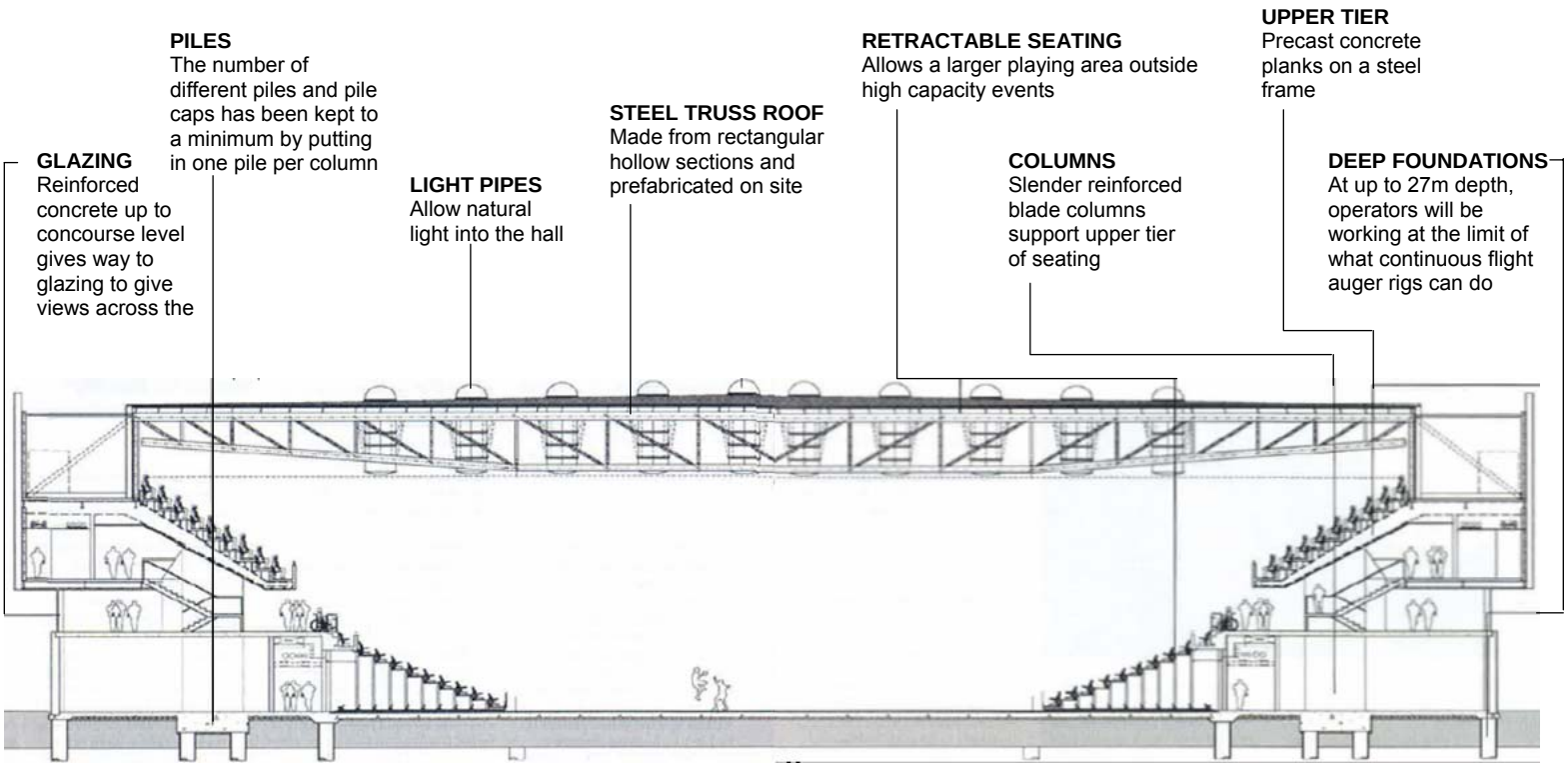
Arup has managed to stick to its remit of keeping it simple by using one type of pile and altering the depth where needed. Also, it has tried to eliminate pile caps by allowing for just one pile per column. However, the final pile design will be by the to-be-appointed design and build contractor.

Piling and Structural features of the arena
Final pile designs will be done by the design and build contractor who was expected to be announced after NCEI went to pres. The shortlist announced in September includes Barr, Buckingham Group, Byrne Group, Mansell Construction Services and Verry Construction. Construction is expected to finish in 2011 in time for test events before the games.

The first tier of seating is situated in the reinforced concrete base of the building. The seating is brightly coloured to give the arena a sense of "vibrancy" even when it is not being used, but what makes the seating special is that it is fully retractable. This maximises the playing area, when the demand for somewhere to play may be high, but the number of spectators less so.

"The retractable seats are fundamental to the success in legacy," says Olympic Delivery Authority project sponsor Colin Naish. "The whole point is to maximise the field of play." Reinforced concrete is used for the building up to concourse level. At this level, glazing gives views out across the Olympic Park and slender concrete "blade" columns are used to support an upper seating tier.

The structure above is a steel frame with precast concrete members forming the seating and floor. The steel structure cantilevers out from the columns calling for a complicated moment connection. However by replicating the same connection a number of times, Arup was able to stick by its "keep it simple" principles. Construction is expected to finish in 2011 in time for test events ahead of the Games.



Tower heralds China's first super tall district

Groundbreaking ceremonies were held last week to mark the start of construction on 632m tall Shanghai Tower. The building is located in the Lujiazui Finance and Trade Zone, an area poised to become China's first super-tall district.

Shanghai Tower is being designed by architect Gensler and structural engineer Thornton Tomasetti and developed by Shanghai Tower Construction & Development.

The tower will house offices, shops, a hotel and the world's highest non-enclosed observation deck. The basement will include connections to the Shanghai Metro and three floors of parking.

The development is estimated to be completed in 2014.

Ask Dr. Sylvie

To access Dr Sylvie's information, and to read the current or earlier issues of Advantage Steel, click on the following link:
http://www.cisc-icca.ca/content/publications/publications.aspx

Advertising

From November 2008, we plan to carry Employment Opportunity advertisements in our newsletter and also on our website for the duration of that edition. If you would like to advertise, our pre-paid rates per edition are $270, $360 or $450 for a quarter, half, or full page advertisement, respectively. 50-word Available for Employment ads will be free. Advertisements will be available for purchase through the SEABC website.

Mark Your Calendars

Ninth U.S. National & Tenth Canadian Conference on Earthquake Engineering: Reaching Beyond Borders

Dates: July 25-29, 2010
Venue: Westin Harbour Castle Hotel in Toronto
Website: http://2010eqconf.org

Convened jointly by:
Earthquake Engineering Research Institute
The Canadian Association for Earthquake Engineering
L'Association Canadienne du Génie Parasismique

Technical Program

The technical program will consist of Keynote Lectures, Technical Sessions (oral and poster), and a small number of Special Sessions. Proceedings will be provided to all participants as part of the registration package.

Exhibits

There will be space available for exhibits. Interested individuals should contact Donald Goralski goralski@mceermail.buffalo.edu.

Instructions for Prospective Authors

Submission of Abstracts – Authors must submit abstracts and papers online. Additional detailed instructions are available at the conference website www.2010eqconf.org. The deadline for submission of abstracts is March 31, 2009.

The Canadian Society for Civil Engineering (CSCE) Vancouver Island Section

Masonry Design Seminar

Date: March 13, 2009
8:00 a.m. to 12:00 noon
Venue: Camosun College

Registration deadline: March 6, 2009
More information: http://www.seabc.ca/documents/external/CSCE_Masonry_Seminar_20090313.pdf

The CSCE Vancouver Island Section along with the Masonry Institute of BC are presenting a masonry design seminar for structural engineers and technologists.

The presentation will introduce the new "Guide to Seismic Design of Low- and Medium- Rise Masonry Buildings in Canada" and will provide a copy of the new guide on CD to all attendees.

Presentation Topics

Bill McEwen, P.Eng., LEED AP
Executive Director, Masonry Institute of BC
Presenting the following topics:

- Review of the latest editions of the 6 CSA standards for masonry
- Materials: block, brick, mortar, grout
- Construction Details & Examples: reinforced masonry, masonry claddings, ties
- Design tools: textbooks, software, MIBC manual
- Masonry Sustainability & LEED

Svetlana Brzev, Ph.D., P.Eng.
Department of Civil Engineering
British Columbia Institute of Technology
Present the following topics:

- Review of NBCC 2005 and CSA S304.1-04 seismic design requirements for masonry structures
- Seismic design of masonry in B.C.
- Introduction of the new "Guide to the Seismic Design of Low- and Medium- rise Masonry Buildings in Canada"
- NBCC 2005 & CSA S304.1-04 seismic requirements
  - Changes between current and previous codes & standards
  - Extensive design examples

SEABC AGM and Dinner Presentation

Date: March 25, 2009
Time: 6:00 p.m.
Venue: Plaza 500 Hotel

Main Presentation:
Convention Center Expansion
Presenter: Rob Simpson, P.Eng., Glotman Simpson Group

Other Presentations:
1) SEABC Committee Summaries
2) Address from the President

SEABC's inaugural Annual General Meeting will be held at the Plaza 500 Hotel, Vancouver, on March 25, 2009, commencing at 6 p.m. This will be a dinner event which will be available for registration on-line. Book early to avoid disappointment!

There will be a presentation from SEABC President Dave Davey, and several committee reports. Keynote speaker will be Rob Simpson who will describe the Vancouver Convention Centre Expansion Project.

For more details check the website events page:
http://www.seabc.ca/index.html

CSCE UBC Chapter - Professional Night 2009

Venue: Civil Design Studio,
Civil/Mechanical Engineering Building, UBC
Date: March 4, 2009
Time: 7pm to 10pm

For more details check the website events page:
http://www.seabc.ca/events.html

Employment Wanted

Looking for Summer 2009 Position

Third year engineering student from Ireland on a four year B.Eng. structural engineering course is immigrating to British Columbia, Canada in the summer of 2009 and is looking for a summer job in an engineering office.

Please contact: neilmurphy21@hotmail.com