



EQUILIBRIUM

Newsletter of the Seattle Chapter
Structural Engineers Association of Washington

FEBRUARY 2007

President:
Ade Bright

Vice President:
Shelley Clark

Treasurer:
Theodore E. Smith

Past President:
Peter J. Hart, Jr.

Directors 2005-2007:
R. Scott Douglas
J. Andrew McGlenn

Directors 2006-2008:
Robert Morrison
Peter Somers

Administrator
M. Lynnell Brunswig

Editor
Scott M. Adan

VISIT OUR WEBSITE:
www.seaw.org

In this issue

<i>From the Board</i>	2
<i>Feature Article</i>	3
<i>Calendar</i>	4
<i>News of Note</i>	5
<i>Meetings/Seminars</i>	5
<i>Meetings Recap</i>	7
<i>Opportunities</i>	7
<i>Membership</i>	12

February Mini-Seminar

**Introduction to the
2006 International
Existing Building Code
(IEBC)**

Peter Somers, PE, SE, of MKA, and member of the Earthquake Engineering Committee will be the featured presenter.

Renovation of Tacoma's Historic Stadium High School

February's SEAW meeting, to be held jointly with the American Concrete Institute, will feature a program on the renovation of Tacoma's historic Stadium High School. Overlooking Tacoma's Commencement Bay, the existing 1906 7-story "Castle" Building is a National Historic Landmark. Recently celebrating its 100th year as a school, Stadium High School welcomed back students in the fall of 2006 after a two-year, 80-million dollar construction phase that included a complete reprogramming and life-safety upgrade of the existing historic 150,000 square foot Castle building and the addition of a new 80,000 square foot gymnasium/theatre building and a separate new 2-story parking garage.

Managing Principal Casey Caughie, P.E. of Magnusson Klemencic Associates will present the many interesting structural features of the historic Castle building rehabilitation project. The renovation of the building involved demolishing and reconfiguring classroom, administrative, corridor, and specialty spaces to accommodate a modern high school program, and includes seismic, fire, and ADA upgrades. All mechanical, electrical, elevator, security, and data/tech systems were replaced. Design of the renovation was in accordance with FEMA 356, *Prestandard for the Seismic Rehabilitation of Buildings*. Concrete shear walls were added, chosen for their stiffness characteristics, drawing lateral load from large existing masonry wall elements to

within acceptable stress limitations. The school got a new roof, new fire alarm system and sprinklers, and transformation of the old gym into a cafeteria and commons.

Presenter:

K. Casey Caughie, P.E., is Vice President and Principal at Magnusson Klemencic Associates (MKA) structural and civil engineers, and principal in charge of Existing Building Rehabilitation. Casey has over 25 years experience in the field of structural engineering, with the last 10 years combining his personal interest in history and old buildings into his profession. Casey is Managing Principal in charge of many building renovations, additions, seismic rehabilitations, change-of-use, substantial alteration, building evaluations and risk analysis. He is an active member with the Association for Preservation Technology International (APTI), and the APT Northwest Chapter.



Tacoma's Historic Stadium High School

Owner: Tacoma School District
Architect: Krei Architects (formerly Merritt + Pardini) and Bassetti Architects
Structural Engineer: Magnusson Klemencic Associates
General Contractor: Skanska USA

Meeting Information

Date:	Tuesday, February 27, 2007
Place:	College Club 505 Madison Street, Seattle
Time:	5:15—6:00 FREE Mini-Seminar 6:00—6:30 Social Hour 6:30—7:30 Dinner 7:45—9:00 Program
Menu:	Baked Chicken Divan, New York Style Cheesecake
Cost:	SEAW/ACI Members: \$30.00 Non Members: \$35.00 Students (with ID) \$ FREE
Late registration, add	\$ 5.00

**Register online at www.seaw.org
(Pre-payment is appreciated!)**

Register by Thursday, February 22nd to avoid \$5.00 late charge. No-shows & cancellations after the deadline will be charged full price.

FROM THE BOARD: Where's the Math? (and Please Pay your Dues)

Please pay your dues. When it's my turn to write the "From the Board article", I usually give you budget information and try to persuade you to pay your dues in a timely manner. Last year's dues collection got off to a slow start while working the bugs out of the new internet based association management system. That made my budget graph look bad. It seems to be working now and most of you have paid for 2006. For those who haven't yet, give it a try. You can print your invoice and mail it in, or pay on-line with a credit card. Very handy! The 2007 dues statements are now, or will very soon be, available on-line. And they're due right away.

Where's the Math? Last year I had the pleasure of having my niece and nephew living with us while their family's new house was being built. They attend middle and elementary schools in the respected Shoreline school district. Uncle Ted got to help them with homework, particularly math homework. I found that the kids didn't understand their assignments from the teacher's explanations, and the textbooks' explanations were poorly presented. If an old engineer who's been through differential equations can't understand it,

what do they expect a 5th and 7th grader to do with it?

It also seemed like I kept seeing the same concepts presented in both of their texts, but not presented clearly enough, and not with enough time for thorough understanding or proficiency in either text. It seemed like they were starting from zero on the concepts, year after year.

Nonetheless, it was a blast for me to show them how to do the problems using the text's methods, then showing them how I would do the problems using conventional algorithms that I learned in my childhood and the shortcut mental methods used by those who really use math a lot, and giving them hints about the "next step" beyond whatever they were supposed to be learning. I could just see the lights going on in their heads. Of course, their math grades soared. Far too often I found errors in the books' solutions. The 5th grader particularly got a kick out of having the right answer, and explaining it to the teacher, when the text was wrong.

After this experience, I was not too surprised when my other dear sister-in-law, whose son is now in 1st grade, started getting involved in the PTA and paying attention to the curriculum, especially the math curriculum. We've all read what a disaster the math WASL is. It seems there's a reason for that. The standard math teaching methods used in Washington State are far from the best. I don't know all the names, but connected math, discovery math, reform math are some, and fuzzy math may be a more accurate term. Ten years ago, after unacceptably poor test results, California stopped using the fuzzy methods and moved on to better methods, like Saxon math, that have significantly improved their student performance.

I'm no expert about this issue, but I find the links my sister-in-

law sends me fascinating. As engineers who couldn't do your jobs without math skills, I think you will too. (You might want to go to the on-line version of the newsletter for these.) Then consider signing the petition at the bottom link, or maybe contacting your legislators.

U.S. declines in engineering graduates: "We have lapsed, and lapsed dramatically in a remarkably short period of time. U.S. engineering graduates have declined 20 percent to 59,500 in the past twenty years. Our middle school and high school students are unprepared in math and science and correspondingly uninterested in these careers. Of the nearly 1.1 million U.S. high school seniors who took the college entrance exam in 2002, less than 6 percent had plans to study engineering. That is a 33 percent decrease from 10 years earlier."

<<http://news.upsd.edu/html3month/2006/060124.SP-Jlschke.rotary.html>>

Seattle Times article <http://seattletimes.nwsource.com/cgi-bin/PrintStory.pl?document_id=2003291546&zsection_id=2002111777&slug=math06m&date=20061006>

The Turkey Problem (after the Sandbox Problem)

<<http://69.57.157.207/issues/1.13.99/nmap.html>>

Some "youtube" videos about reform math

MJ McDermott <<http://www.youtube.com/watch?v=Tr1qee-bTZI>>

Math time trials <<http://www.youtube.com/watch?v=wOH9gwImyXg>>

UW Professor Cliff Mass lays it out clearly. Don't miss this one! <<http://www.youtube.com/watch?v=ymsvFunUjx0>>

David Klein (Department of Mathematics, California State University, Northridge) wrote this guest editorial on math



education for the American Journal of Physics. This is a pre-print of the accepted article. Keep in mind that both TERC Investigations and Connected Math are widely used in Washington State. <<http://www.csun.edu/~vcmt00m/nsf.html>>

NY Times article <<http://www.nytimes.com/2006/11/14/education/14math.html?hp&ex=1163480400&en=e46446d362b96c82&ei=5094&patner=homepage>>

Here's a good paper – it looks long but is actually very easy to skim. Excellent collection of study findings on why discovery learning doesn't work well in the classroom—even shows evidence of NEGATIVE progress due to the false starts associated with discovery learning.

<http://www.cogtech.usc.edu/publications/kirschner_Sweller_Clark.pdf>

If you'd like to improve math education in Washington, go to www.wheresthemath.com and sign the online petition. It only takes a minute. The petition will be first delivered to the Governor on Presidents Day, February 19.

Ted Smith is a principal of Smith & Huston, Inc, Consulting Engineers. He has been a member of SEAW since 1976, and, in addition to other committee involvement, has served as Treasurer of the State SEAW and the Seattle Chapter since 1995. Ted was named SEAW Chapter's Engineer of the Year in 2004.

The SEAW Seattle Chapter *Equilibrium* is printed monthly from September through May and is available online at www.seaw.org. Circulation by mail: approximately 550 copies. Articles, letters, and announcements are accepted by e-mail to seaw@seaw.org.

Advertising rates (prepaid, please): Help Wanted/Job wanted, \$50; Display ads: Quarter page, \$90; Half Page, \$120; Full Page \$150; inserts, pre-printed 8 1/2 X 11 inch flat, \$150. 10% discount for ads running two or more months. Deadline is the fourth Friday of the month. Contact SEAW for an Advertising Order Form.

Except where noted, opinions expressed in this newsletter reflect those of the author and do not reflect or represent the position of SEAW. Portions of this newsletter may be reproduced provided credit is given.

Bowstring Trusses “Fail” to Meet Current Code Requirements

Paul C. Gilham, P.E., Chief Engineer, Western Wood Structures, Inc.

Terry D. McKee, P.E., VP Field Services, Western Wood Structures, Inc.

Introduction

The timber bowstring trusses found in many local buildings have been affected by a series of changes that have rendered them as “dangerous members” as defined by the International Existing Building Code (IEBC). These trusses have been in use for more than seventy years to provide economical, unobstructed spaces in commercial and

glued-laminated chords. The top chord in these trusses was curved in the laminating process.

While these trusses have carried the roof load for decades, it is not uncommon to receive calls regarding broken trusses following a heavy snow event. Fortunately, the breaks seldom lead to a total roof collapse if the trusses can be properly shored and repaired quickly.

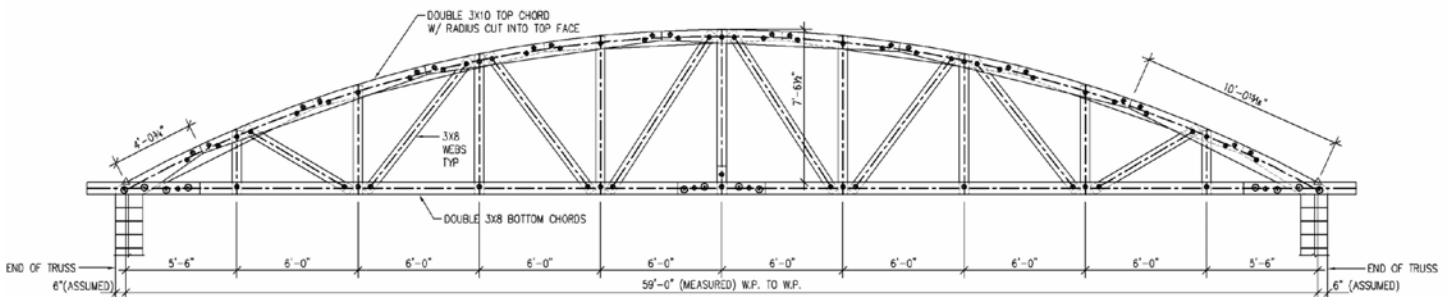
Three factors, including a series of code changes, refinements in analysis methods and revisions to allowable timber stresses, have

identifies secondary moments that the original classical determinate truss analysis ignored. Finally the allowable timber stresses were reduced in the late 1980s.

However, these trusses can be retrofitted to remedy these problems and to increase the load capacity to meet the current code requirements. This is accomplished by first analyzing the trusses using frame analysis software with the current code-required loading and then upgrading each member and connection as required to meet the design requirements.

The bottom chords were made of two solid sawn members and were spliced between web members using wood splice blocks between the chord members and on the outside of the chords. The splices were usually made up of multiple split ring connections.

The web members are connected to the chords with a single bolt with split rings. The centerlines of the webs do not intersect at the centerline of the chords so there is some eccentricity to the connections. This eccentricity induces shear forces and bending moments into the chord members but these were not accounted for in the original design. Shown below is a typical layout of a TECO bowstring truss.



TRUSS PROFILE

industrial buildings, gymnasiums, airplane hangers, etc. From the 1940s through the 1960s they were a dominant roof structural type. In fact, Timber Structures, Inc. of Portland, Oregon claimed to have manufactured so many bowstring trusses that if laid end to end, they would stretch around the world four times. There are many buildings still in use today that use this type of roof structure.

Bowstring trusses are made with a curved top chord and a straight bottom chord. The top chords were originally made with multiple leaf chords where the curvature was cut into the solid sawn chord members. A second style of bowstring truss used

resulted in these trusses now being significantly overstressed. The IEBC defines a dangerous member as one where, “the stress in a member or portion thereof due to all factored dead and live loads is more than one and one third the nominal strength allowed in the *International Building Code*...” Increases in loading and decreases in allowable stresses alone render most of these trusses dangerous.

The application of unbalanced snow loads as prescribed in ASCE 7 results in a localized increase in forces for many truss members and is significantly more severe than the original design loading. The use of computer-assisted frame analysis

Bowstring Truss Configurations.

The trusses existing in most buildings today have one of two dominant configurations. The first configuration is referred to as a TECO truss. TECO trusses were fabricated using multiple leaf chords and single webs. The top chords were made by using wide solid sawn members where the roof curvature was cut into the top of each piece of wood. The members are lapped from side to side so that the splices in the top chord members do not occur at the same location from one side to another. These splices are also located so that they fall in between truss panel points.

The second configuration used single glued-laminated chords. The top chord was curved in the manufacturing process. This type of bowstring truss (as manufactured by Timber Structures, Inc.) was known as a Tim Truss. The webs were often solid sawn members. The web to chord connections were made with steel plates and angles, bolted to the timber members, and arranged so that the web centerlines intersected at the chord centerline.

In both configurations, the most economical truss was obtained by using a top chord radius equal to the truss span. This relationship yields a 30° spring angle at the truss heel.

Feature article cont. on pg. 4

Feature Article, continued

Changes in Loading Considerations

The basic roof snow load has increased in many jurisdictions since the time the trusses were designed and installed. For example, the snow load was increased from 20 psf to 25 psf in the Portland area following a large snow storm in the late 1960s that caused many roofs to collapse. Additionally, the building codes in effect during the design of these trusses required a dead load plus ½ snow load plus wind load combination. Recognizing that some of the truss members experienced a reversal of forces under unbalanced loading, it was common to apply the ½ snow load to one side of the truss and leave the other side unloaded. While this may have changed the force in some web mem-

bers from compression to tension or from tension to compression, it seldom changed the absolute value of the member force and therefore did not change the member size or the connection.

In ASCE 7, section 7.6.2, the unbalanced snow load varies from ½ at the crown to 2 times the roof snow load at a slope of 30°. (This is located at the eave for common bowstring trusses.) The application of this loading condition greatly increases the load in the web members and drives more of the members into stress reversal. It is not uncommon for this loading condition to cause the longer web members to become compression members with very high L/d ratios resulting in the mem-

bers being significantly overstressed.

Changes in Structural Analysis Methodology

The design of both of these types of trusses was accomplished using a graphical force diagram. This analysis method provides an accurate means of determining the member axial forces. In the TECO truss analysis, the eccentricity of the web connections and the continuity of the members at the joints were ignored.

In the Tim Truss analysis, the continuity of the top chords was accounted for by treating the member as a three-span beam to determine the primary bending moments. An additional bending moment was determined by multiplying the axial load by the offset due to the curvature of the member.

The shortcoming of these methods is that the secondary moments produced by the continuity of the members at the joints were not accounted for. These secondary moments can be quite large. The graphical methods also do not account for the shears and moments introduced by the joint eccentricity of the TECO trusses. Additionally, these methods cannot account for the effects of the relative stiffness of the members. Since the trusses are statically indeterminate, the relative stiffness of the members must be accounted for to accurately determine the internal forces.

Today, with the use of general purpose frame analysis methods, it is easy to account for the actual geometry of the truss configurations, the continuity and the relative stiffness of the truss members.

Changes in Allowable Timber Stresses

In the 1980s, the timber industry completed an ex-

tensive testing program to evaluate the allowable stresses of full-size timber members. This program was referred to as the "In-grade Testing Program." Before this program, allowable stresses for timber members were determined by multiplying the stresses obtained by testing small clear samples with a series of factors that accounted for naturally-occurring, strength-reducing defects, duration of load, drying, safety factors, etc. The In-grade Testing Program demonstrated that the testing of these small clear samples failed to accurately determine the appropriate allowable stresses for full-size members.

With the In-grade Testing Program, full-size members for each grade of each species were tested to failure. This extensive testing program resulted in the reduction of the allowable stresses for timber members for many grades and load conditions. This reduction affects the capacity of TECO bowstring trusses because the tension values for the bottom chord members were significantly reduced for many sizes. For example, prior to 1982, the NDS supplement listed the allowable tensile stress of a 3 x 10, Douglas Fir-Larch #1 bottom chord member as 1000 psi. In 1982, the application of footnote 3 reduced this value to 600 psi. In the current NDS, the value is $675 * 1.1 = 742.5$ psi.

Effect of These Changes on Existing Bowstring Trusses

The combination of the three factors (changes to loading, analysis methods and timber stresses) results in an overstressed condition for most bowstring trusses. In a recent example, the maintenance personnel at the Salem-Keizer School District in Salem, Oregon noticed that the pilasters of a gymnasium were cracking. The district called Youngman Locke Engineers of Salem

Mark Your Calendar

Feb 13	SEAW Southwest Chapter Annual Architectural and Engineering Tradeshow seawswchapter@comcast.net
Feb 17	PSEC Engineers Fair – Museum of Flight
Feb 18-24	National Engineers Week – www.eweek.org
Feb 24	PSEC Engineer Award Banquet Museum of Flight http://www.pseconline.org/Events/AwardsBanquet/AwardsBanquetFlyer.pdf
Feb 23	Deadline for March <i>Equilibrium</i>
Feb 28	Chapter Board Meeting Seattle Chapter Dinner meeting: Renovation of Tacoma's Historic Stadium High School – Joint meeting with ACI
Mar 12	EERI "Performance-Based Earthquake Engineering for Structural and Geotechnical Engineers" Seminar https://www.eeri.org/news/meetings/07_tech_seminar_registration.php
Mar 23	Deadline for April <i>Equilibrium</i>
Mar 28	Chapter Board Meeting Seattle Chapter meeting: ASCE Hosts program on Washington Mutual Tower
Apr 3-4	Pacific Northwest Bridge Inspectors' Conference capps.wsu.edu/bridgeinspectors
Apr 21	ASCE Seattle Section Geotechnical Group Spring Seminar http://www.seattlegeotech.org

News of Note

SEATTLE STRUCTURAL GARNERS GOLD

Seattle Structural PS Inc. was recently honored at the American Council of Engineering Companies of Washington's 2007 Engineering Excellence Awards Gala on January 19, 2007. The firm's Seattle Aquarium – Pier 59 Foundation Replacement project won the prestigious Gold award in the Structural Systems category. The project will now go on to compete at the National ACEC Competition I Washington DC.

Seattle Structural was formed in 2002 to provide team-oriented structural and civil engineering services to the public and private sector. Company President

Howard Burton, Vice President Pete Pawlak and engineers Kevin Bonner, Michael Braun, Mark Ma, Ludmila Simontov and Jin Yu are members of SEAW.

EERI RELEASES EARTHQUAKE SUMMARY REPORT

A 108-page book entitled *Summary Report on the Great Sumatra Earthquakes and Indian Ocean Tsunamis of 26 December 2004 and 28 March 2005* is available from EERI. It was prepared by the editorial board for the 900-page special issue of *Earthquake Spectra* (volume 22, Special Issue 3, June 2006). Each editor wrote an article summarizing major lessons from the large re-

port: W. D. Iwan, Summary of Major Observations and Conclusions; H. Kanamori, Seismology; K. W. Hudnut, Earthquake and Tsunami Source; C. B. Crouse, Ground Motion; C. E. Synolakis, Hydrodynamic Observations; L. A. Wyllie Jr., Structural Performance; D. Ballantyne, Lifelines; L. Dengler, Awareness and Preparedness; K. Tierney, Societal Dimensions; and M. Greene, Recovery and Reconstruction. W. D. Iwan was the technical editor of both the summary and full reports. The price is \$15.00 plus shipping (plus sales tax for California residents). To order online, visit http://www.eeri.org/cds_publications/catalog/. This product is listed under "New Products." The full 900-page report was

published jointly by EERI and UNESCO and can be purchased for \$60 plus shipping from <http://publishing.unesco.org/default.aspx>

The great earthquake that occurred in the Indian Ocean west of Sumatra, Indonesia, on 26 December 2004 generated one of the most devastating tsunamis in recorded history. With at least 16 nations directly affected, the death toll is estimated to be close to 300,000. Three months later, on 28 March 2005, another large earthquake struck off the coast of Sumatra near the island of Nias, generating a smaller tsunami; approximately 900 people died.

Feature article cont. from pg. 4

to inspect the building. The inspection uncovered several broken chord members in the trusses. Youngman Locke Engineers prepared a design-build specification for the analysis, design and repair of the trusses on this building and three other buildings. One of these buildings was the district's Technical and Information Services Building. Western Wood Structures, Inc. of Tualatin, Oregon was awarded the contract to complete this work. The TECO trusses on this building are 78 feet long and are spaced at 17 feet on center. The top chords were made using two 3 x 14 members with the roof curvature saw cut into the top of the members. The bottom chords were made using two 3 x 10 members and the webs were single 3 x 6 and 4 x 6 members.

The analysis using current code load requirements and allowable timber stresses resulted in the top chords being overstressed in combined bending and compression by 36 percent. The bottom chords were overstressed on combined bending and ten-

sion by 94 percent. Several of the web members originally designed as tension members became compression members and violated the limit of 50 for L/d ratio. Other web members were overstressed by 63 percent.

Upgrade Techniques

The good news is that these trusses can be upgraded to meet the current code requirements for a lower cost than replacing the roof structure. The trusses at the Salem-Keizer School District were retrofitted to increase their load-carrying capacity. To accomplish this, the trusses were first fully shored to remove the dead load stresses from the members. The compression members in the top chord and webs were upgraded by epoxying and screwing timber side members to the existing member. The addition of the side members reduces the L/d ratio and increases the section size. The upgraded members are analyzed using a transformed section of the new member to account for differences in stiffness.

Feature article cont. on pg. 6

Meetings and Seminars

PSEC ENGINEER AWARDS BANQUET

February 24, 2007

The Annual Puget Sound Engineering Council (PSEC) Engineer of the Year Awards Banquet is on Saturday, February 24th at the Museum of Flight. NASA Astronaut, Dr. Donald Pettit, will be the keynote speaker for the event discussing his "161 Days in Space." This is a great event to network with other professional societies in the area, recognize the award winners below, and celebrate the engineering profession. Please see link below for more details: <http://www.pseconline.org/Events/AwardsBanquet/AwardsBanquetFlyer.pdf>

We highly encourage all engineers to participate and individuals can sign up for the event online at: <http://www.pseconline.org/Events/AwardsBanquet/Registration.html>

The deadline to sign up for the event is Wednesday,

February 21st at 5pm. You may pay in advance or at the door. Cash or checks only – no credit cards will be accepted.

This year's winners:

Academic Engineer of the Year
– Professor Ann Mescher, Ph.D.

Industry Engineer of the Year
– Dr. Naval Agarwal

Young Engineer of the Year
– Erin Fletcher, P.E.

Professional Engineer of the Year
– Alan Werner, P.E.

We look forward to seeing you at the event!

Kelly Griswold

PSEC, President-Elect



Meetings and Seminars

SW Chapter SEAW's 11th Annual Architectural & Engineering Tradeshow

February 13, 2007

This year's event, to be held at the **Tacoma Dome Exhibition Hall**, will feature:

Exhibitor Presentations Vendor Display Areas Complimentary Buffet & Beverages

AIA Learning Units will be offered at selected exhibitor presentations. This event is free for all pre-registered attendees.

Our annual tradeshow is the primary fundraiser for SEAW, a non-profit organization. All proceeds from this event go towards scholarships and an equipment grant for Saint Martin's University in Lacey, Washington.

Visit the Tradeshow Website at www.seawtradeshow.com for more information or send your RSVP to Sarah at the SEAW-SW office, seawswchapter@comcast.net.

ASCE Seattle Section Geotechnical Group 24th Annual Spring Seminar

April 21, 2007

University of Washington

The Geotechnical Group of the ASCE Seattle Section is pleased to announce its 24th Annual Spring Seminar. A one-day symposium will be held at the UW to honor Dr. Robert D. Holtz, on Saturday April 21, 2007 at the University of Washington. Well-known for his research, educational, and professional achievements, Bob Holtz is also an esteemed member of our engineering community. The symposium will feature some of Bob's mentors, colleagues and former students speaking on a range of topics.

Scheduled speakers include Bob's mentors Clyde Baker (STS Consultants, Ltd.), Mike Jamolkowski (Technical University of Torino) and Ray Krizek

(Northwestern University), who was Bob's Ph.D. advisor. Bob's long-time colleagues Milton Harr (Purdue University), Barry Christopher (Christopher Consultants) and Steve Kramer (University of Washington) are also scheduled to speak. Presentations by some of Bob's many former students, including Dana Humphrey (University of Maine) and An-Bin Huang (National Chiao Tung University), will round out the day.

The range of topics, the experience and stature of the speakers and the opportunity to honor Dr. Holtz's achievements are certain to make this symposium of interest to current students, recent graduates, and experienced engineering and construction professionals alike.

Registration information will be available at <http://www.seattlegeotech.org>

For further information contact: AH (Tony) Rice c/o Golder Associates Inc. 425/883-0777 ext 2104, or email: trice@golder.com

EERI to Present First in Seminar Series March 12th in Bellevue

March 12, 2007

EERI has developed a new technical seminar series on "Performance-Based Earthquake Engineering for Structural and Geotechnical Engineers: Impact of Soil-Structure Interaction on Response of Structures." The intention of the series is to provide structural and geotechnical engineers with information that they can use in the daily practice to improve the products they provide to their clients. The first in the series is "Practical Applications to Shallow Foundations" and will take place on March 12, 2007, at the Hyatt Regency Bellevue.

This one-day seminar will cover the basic principles of soil-structure interaction and current guidelines for practice. The focus will be on shallow foundations and case studies of actual project applications by practicing engineers. Insight will be provided by Jonathan Stewart of the University of California at Los Angeles, Craig Comartin of CDComartin, Inc., Geoffrey Martin of the University of Southern California, Marshall Lew of MAC-TEC Engineering, Aaron Reynolds of KPFF Engineers, Ryan Shafer of Nichols Consulting Engineers, Mark Moore of Rutherford and Chekene, and Tara Hutchinson of the University of California at San Diego.

Performance-based procedures are revolutionizing all aspects of earthquake engineering. The changes in practice are particularly demanding on geotechnical engineers, as seismic behavior often is controlled by foundation and site geotechnical conditions. Structural engineers also are challenged to develop better understanding of foundation behavior and seismic demand for strong shaking. Communication between the structural and geotechnical engineer is the key, and this seminar is intended to bridge the gap.

The registration fee is \$200 for members of sponsoring organizations and \$300 for nonmembers.

To view the program brochure and to register online, visit: https://www.eeri.org/news/meetings/07_tech_seminar_registration.php. This seminar is funded by FEMA and is co-sponsored by SEAW, SEAOC, SEAONC, SEAOSC, SCEC, the California chapters of EERI, and geotechnical groups in the Seattle, Los Angeles, and San Francisco sections of ASCE.

2007 Pacific Northwest Bridge Inspectors' Conference

"New Developments in Bridge Inspection:

April 3 – 4, 2007

Sheraton Portland Airport Hotel, Portland OR

The Pacific Northwest Bridge Inspectors' Conference provides a forum for bridge inspectors located throughout each of the Pacific Northwest states to share information, innovations, creative ideas, and tricks of the trade.

Conference information and online registration is available at capps.wsu.edu/bridgeinspectors, or by phone at 253-445-4575. Early registrations must be postmarked by March 18, 2007.

Feature article cont. from pg. 5

The bottom chord was upgraded by adding post-tensioning elements. The addition of these post-tensioning elements applies an initial compressive stress to the bottom chord. The trusses on this building had an applied ceiling installed that provided lateral support for the bottom chord along its length. The initial compressive force is calculated so that the total tensile force in the bottom chord is less than the allowable load after the roof load is applied.

Conclusions

Bowstring trusses in existing buildings built before 1980 most likely will not meet current code requirements for load capacity. Recognizing this, the city of Portland, Oregon requires existing bowstring trusses to be upgraded to current code when a change to the building occupancy occurs. Using modern frame analysis methods, these trusses can be accurately analyzed, and by applying specific repair techniques, the members can be upgraded to meet the current code requirements.

* * *

Meeting Recap

Building Information Modeling Tantalizes Engineers

By Scott M. Adan

The January meeting of SEAW featured a taste of what many in the industry regard as the future. The topic was Building Information Modeling (BIM) software, which acts as a single-source repository for information about a building. Unlike other facility management aids, such as CAD or CMMS systems, BIM software is designed to integrate every aspect of a building.

Several industry panelists were on hand to discuss the potential benefits and pitfalls of BIM. They included David Yuan, principal with NBBJ, Jon Magnusson, CEO of Magnusson Klemencic Associates (MKA), and Charles E. Mies, Technical Specialist for Autodesk.

Although the concept of Building Information Modeling (BIM) isn't exactly new, the software that's been developed to model buildings is only in the early stages of use and the full potential has not yet been exercised. Even so, the models are providing several cost-saving benefits

during the design and construction phase of building projects — reducing change orders, for one.

In the mini-seminar preceding the dinner and panel discussion, Mies explained the benefits of BIM in design. "These models can produce virtual 'walk-throughs' and 360-degree rotating views," said Mies. "They're more advanced, and can represent building system components, such as beam, columns, walls, and other real-world building components, including mechanical, electrical, and plumbing routing."

Structural engineering firms can coordinate their design and documentation with the architect, leveraging digital representations from multiple design sources including AutoCAD. The structural engineer starts with the architect's CAD files, and traces or converts geometry. The structural engineer can enhance the files with structural elements and then export structural components as intelligent building objects. The engineer can then share the structural model

directly with an architect enabling review of the structural design inside the architectural model and check it for interferences with architectural elements. The structural files can also be shared with MEP engineering firms enabling engineers to layout their pipe/duct systems within the context of the structural model — resulting in a better-coordinated design with minimal collision issues.

BIM is able to capture all of the design and construction information in one source. Ideally, you are able to use the same data for your analysis, for documentation, and during construction without running the risk of duplicating information or having to manually synchronize all of that data. "Structural engineers are a natural fit for the process since they already understand 3-D models," added Mies.

More than simply a collection of tools for representing designs and



Engineers take note of advances in BIM technology.

engineering parameters, BIM is a practical technology shift that directly benefits engineers' productivity, collaboration, and accuracy. BIM affords an opportunity for structural engineers to take a leadership role as the rest of the building industry begins to adapt and adopt model-based tools.

Scott Adan is a structural engineer with KPFF Consulting Engineers in Seattle WA. He is a professional associate member and is the Editor of the Equilibrium. He also is a member of the Earthquake Engineering Committee. Scott can be contacted at scott.adan@kpff.com.

Opportunities

Structural Engineers

rfa structural engineers is seeking a structural engineer with at least three years of design experience to join our team in Seattle. We are a dynamic family friendly firm run by one of Seattle's top professional engineers Robert J. Fossatti.

Our office is located in downtown Seattle. We have a relaxed work environment that has "First Friday's", where everyone is invited to dine together at one of Seattle's many spectacular restaurants.

We offer an outstanding compensation and benefits package that includes medical, dental, vision, disability and life insurance. We also pay for 90% of your spouse and dependents insurance premiums, without a waiting period!

You will also be eligible right away for the company quarterly bonus program!

You will work directly with some of Seattle's best architect's working on a broad range of projects that include both commercial and residential buildings.

Fax your resume for immediate consideration to (206) 615-7737, or email to mjacasse@rfaengineers.com. To learn more about rfa structural engineers, visit our website at www.rfaengineers.com

Design Engineers Structural Steel

Garco Building Systems is a Spokane-based manufacturer of industrial and commercial steel building systems. Founded in 1958, Garco's dedication to quality and service gives us a global reach, with complex heavy industrial projects scattered across five continents. Our design and production teams work closely

together to meet project specifications and customer needs. Garco's 30-member engineering department is looking for a design engineer to join our team. Must have BSCE degree; structural steel design experience preferred but not required. Garco offers a competitive wage and benefits package, 401(k) plan, profit sharing, and flex-time opportunities. Qualified applicants interested in joining a growth oriented manufacturing company with a diverse product mix are asked to apply with cover letter and resume to:
Garco Building Systems
2714 S. Garfield Road
Airway Heights, WA 99001
or employment@garcobuildings.com EOE

Staff Engineers



Structural Engineering design firm seeks outstanding individuals to fill immediate openings for Staff Engineers in both our Seattle and Tacoma offices. All experience levels considered and encouraged. We're a mid-size dynamic company recognized for our team work, creativity and innovation. We combine a very progressive benefits package with a fun, flexible and informal office culture. Email resume to bbresko@swensonsayfaget.com or fax attention Blaze Bresko at 206-443-4870. No phone calls please.

Opportunities cont'd next page



Grays Harbor County Courthouse Renovation



University of Alaska Anchorage Library



Naval Hospital Bremerton Seismic Upgrades



U.S. Navy PSNS Parking Garage



SeaTac Airport Seismic Improvements Program

Career Opportunities for Structural Engineers

**Live in the north end? Thinking of moving to the north end?
Would you like a reverse commute?**

Imagine living only minutes away from your office and not having to spend hours per day away from your family commuting to Seattle or Bellevue for work.

Reid Middleton is an employee-owned and -focused structural and civil engineering firm with a 53-year history of design excellence. Our north-end location offers an easier, more convenient and affordable life-style poised within one of the country's most dynamic consulting engineering markets.

Reid Middleton engineers are encouraged to be leaders in their design practice and to embrace technology to solve problems to help our clients succeed. We are experts at creating outstanding solutions by providing the right balance of technical expertise, leadership, management, and teamwork.

If this sounds interesting to you and you have a BSCE or MSCE we would like to help you build your career within our diverse and dynamic firm. PE preferred for candidates with five or more years experience. Send your resume to jobs@reidmiddleton.com

Project Types:

- Aviation
- Civic/Public
- Federal/Military
- Historic
- Academic
- Healthcare
- Commercial
- Transportation/Bridge
- Parking
- Waterfront

Services

- Structural Engineering
- Civil Engineering
- Seismic Design
- Parking Consulting
- Transportation Engineering
- Protective Design
- Sustainable Design

ReidMiddleton

728 - 134th Street SW
Suite 200
Everett, WA 98208
www.reidmiddleton.com
EOE

Opportunities

Structural Engineers

Peter A Opsahl Structural Engineering is a young, dynamic and growing Seattle firm. We are located in the Capitol Hill area and are currently looking for Structural Engineers with 2 to 5 years of experience. A competitive salary and benefits package is offered. We have a flexible and relaxed work environment and our projects cover all material types. Please email admin@paostructural.com with letters of interest and resumes.

Structural Engineers

INCA seeks staff for its expanding structural group!

With a reputation for engineering excellence in the design of flood control, locks, and dam structures, INCA is looking for talented structural engineers. You will work with the premier engineering firm and establish a career path. Join our innovative and exceptional team!

INCA Engineers, Inc. has openings in its Bellevue, WA office for

mid-level structural engineers, with 3 to 8 years experience in analysis and design of concrete and steel structures. MS in Structural Engineering is preferred; EIT and experience with bridge and marine structures is desirable.

INCA, founded in 1983, is a medium-sized company of professionals and support staff who emphasize innovation and design excellence. Structural projects include bridges, retaining walls, transit centers, navigation locks, dams, fish bypass structures, and hydropower plants. Project locations have ranged from the Puget Sound region to New Orleans, and to Mexico, Puerto Rico, the Panama Canal, and the Philippines. Additional details can be found at www.incainc.com.

INCA offers competitive compensation packages, an opportunity for company ownership participation, and diverse, interesting project work. Please send resumes to

jobs@incainc.com or to the following address: INCA Engineers, Inc., ATTN: SEAW, 400 112th Avenue NE, Suite 400, Bellevue, WA 98004.

Engineers

Seattle Structural

Seattle Structural PS Inc is a downtown Seattle firm looking for engineering candidates at all experience levels. Share in our vision of client-based service and hard working enthusiasm on diverse and challenging projects in the US and overseas. Join our collaborative staff of 10 in one of Seattle's most vibrant office towers, specializing in public, commercial, retail, industrial and specialty projects. We offer excellent benefits and stimulating work in a casual environment. Visit our website at www.SeattleStructural.com

Send resumes to: Pete Pawlak, PE, 1420 Fifth Avenue, Suite 425, Seattle, WA 98101.

206-343-3000 phone, 206-343-3013 fax. PPawlak@SeattleStructural.com

Structural Engineers

Looking for a Structural Engineer who appreciates the finer things in life.

Northwest Datum & Design is looking for a Structural Engineer. NWDD is a small, growing civil/structural and land surveying company which has served the Burlington, WA, area for the past 15 years. Nestled between the Cascade Mountains and Puget Sound, Burlington is about an hour north of Seattle, WA.

NWDD is a friendly work environment utilizing a progressive, participative management style. We're looking for people who value their integrity and want to help create a fun, productive, successful company. The position requires a BSCE with a structural emphasis, or equivalent experience; a P.E. license; and five

EXELTECH BELIEVES IT IS PEOPLE, NOT COMPANIES, WHO DELIVER PROJECTS.

Engineering Solutions for a Changing World

Exeltech Consulting, Inc.

is a 45-person professional engineering, environmental and construction services consulting company that specializes in bridge, roadway, transportation and facilities related projects. The distinguished professionals at Exeltech are passionate about client service and responding to client needs with relentless dedication to excellence. We have extraordinary people that are diverse in background and experience, yet come together in one respect - a unified culture of teamwork. Join with top minds in civil, structural, seismic, and engineering construction management and environmental services in the beautiful Pacific Northwest.

Exeltech Position Openings:

- Structural Engineer(s) (Seattle and Lacey, WA)
- Project Construction Engineer (Eddyville, OR)
- Construction Inspector(s) (Salem and Eddyville, OR)
- Roadway Engineer (Lacey and Seattle, WA and Salem, OR)
- Bridge Engineer (Lacey and Seattle, WA and Salem, OR)
- Deputy Director of Environmental Planning Services (Lacey, WA)
- Roadway Engineer(s) (Lacey and Seattle, WA and Salem, OR)

Join the Team!

Exeltech's comprehensive benefits package includes health, dental, vision, and prescription care, 401K matching, incentive compensation and life insurance for eligible employees at no cost. Visit our website at www.xltech.com to learn more about our vibrant and growing firm.

Please send cover letter and resume to: hr@xltech.com



Opportunities

years' experience of successful, independent completion of structural engineering projects.

NWDD is located in the beautiful Skagit Valley, about an hour north of Seattle, Washington. Nestled between the Cascade Mountains and the Puget Sound, Burlington offers a more relaxed pace of life, with easy access to cities and an abundance of recreational delights. We offer competitive salary and benefits, great co-workers, and more. For more information, contact hr@nwdd.com.

Structural Engineers

Spokane

DCI Engineers is one of the fastest-growing engineering firms on the West Coast, and was named as one of the 2006 "Best Firms to Work For" by Structural Engineer magazine. Our Spokane office is actively seeking structural engineers of all experience levels who would like the opportunity to work for the top structural engineering firm in a city consistently voted one of the

most livable and affordable in the nation. Please email your resume to mlindsay@dc-engineers.com

Engineers



As

AHJ Engineers celebrates over 22 years of providing quality structural engineering services in the northwest, Boise, Idaho continues to enjoy a steadily growing economy and a reputation as a hotbed for development for years to come. Forbes Magazine, 2005, calls it the "Best place in the USA for business and careers".

We are expanding our team to provide increased capacity in the design of new, significant structures and historic restorations. We offer a flexible, encouraging work environment in which talented professionals can achieve their unique ca-

reer objectives as well as pursue their personal goals.

We are seeking eager EIT's, as well as proven Project Engineers that are technically competent and can express their knowledge to our clients both verbally and through their work. The successful candidate must enjoy proactive teamwork, have a personal commitment to excellence, the ability to manage multiple projects and a passion for creating quality structures.

Boise is a vibrant city where the arts thrive, the sporting events are intense and the recreational opportunities are endless. If your interest is piqued, e-mail your resume to: dhaugland@ahjengineers.com or mail to AHJ Engineers, 12501 W. Explorer Dr., Suite 100, Boise, ID 83713.

Structural Project Manager

Bellevue

DCI Engineers is currently seeking Structural Project Managers for our Bellevue office. Applicants should be able to demonstrate abilities in team management and communication, project planning, scheduling, writing, organization, documentation, coordination, contracting and budgeting. Experience with all building materials and building types preferred. Projects will be diverse including commercial, mixed use and residential. PE Required. Please submit resumes to: resumes@dc-engineers.com or via mail to HR @ DCI Engineers 10900 NE 4th St, Ste 1200, Bellevue, WA 98004.

Structural Engineers

DLR Group, an employee-owned national A/E design firm has an opening in our downtown Seattle office. Design-minded structural engineer with building design experience wanted. Leadership position available for individual interested in working in an integrated design office. Collaborative design environment in an open, diverse, A/E environment. Opportunity for BIM software design experience.

PE/SE preferred.

Interested? Submit resume to seattle@dlrgroup.com. DLR Group is an AA/EEO firm.

Structural Engineers

MLA Engineering, pllc seeks an engineer who has at least 4 years of experience designing buildings. Candidates who are motivated to use their technical, organizational, and communication skills and who work well with a small group of professionals will welcome this opportunity. Our services include structural engineering for local, regional and national projects, designed with concrete, steel, masonry and wood. We provide a flexible work schedule and environment that allows our staff to meet their professional and personal goals. Please mail or email your letter of interest and resume to Michael Leonard, Principal: mleo-nard@mlaengineering.com

MLA Engineering is an Equal Opportunity Employer.

MLA Engineering, pllc
1411 Fourth Ave, Suite 760
Seattle, WA 98101

Q QUANTUM | CONSULTING ENGINEERS

STRUCTURAL ENGINEERING: From Vision to Reality

Are you able to prepare structural calculations and construction drawings for various project types? Do you have experience in structural detailing, seismic design, and possess a B.S. degree in engineering?

The good news is we are expanding and if you answered 'yes' to these questions, then we would like to know more about you.

We provide superior wages, excellent benefits and have a top-notch flexible and casual work environment. Additionally, we are a rapidly growing and friendly team offering:

- Friday office social
- Cinco De Mayo open house
- Company sailing excursions
- Professional development
- Annual paid ski day
- Bonuses & 401K

For more information about us, visit:
www.quantumce.com

Send resumes to:
HR@quantumce.com

Quantum Consulting Engineers
1511 Third Ave, Suite 323, Seattle, WA 98101
tel 206-957-3900 · fax 206-957-3901

HELP WANTED ADS are accepted through the fourth Friday preceding the publication month. The cost for text ads is \$50 per insertion **pre-paid**, with a 10% discount for ads running two or more consecutive months. Ad copy should be limited to 180 words or less and must be submitted by e-mail. Advertising order forms and information about display advertising, can be requested by e-mailing seaw@seaw.org.

Help wanted ads must be purchased through the newsletter to be included in the SEAW online job board.

BROWN AND CALDWELL

BECOME PART OF AN ENVIRONMENTAL ENGINEERING and CONSULTING FIRM WHERE YOU CAN DELIVER YOUR FINEST WORK.

Brown and Caldwell, a nationally recognized environmental engineering and consulting firm has an excellent career opportunity for a Structural Engineer to join our Seattle, Washington office. Are you a self-directed person who values challenging work and a creative learning environment? If so, then come be a part of our team! We are looking to hire immediately.

Structural Engineer III - Requisition #14-30-06-211

Responsibilities: Provide detailed structural engineering on design projects for new and existing water and wastewater treatment systems, as well as other types of structures. Support project design teams and other engineers in development of specifications, detailed drawings, reports and plans.

Qualifications: BS degree in engineering (civil with structural emphasis) and a minimum of five years of experience with industrial structures is preferred. Master Degree in structural engineering is desirable. Washington PE Required, SE preferred.

We offer a competitive salary, benefits and 401(k). For more details visit us at www.browncaldwell.com. Please reference position/requisition number in cover letter and e-mail mthullen@brwncald.com. We value workforce diversity. EOE/AA.



**STRUCTURAL ENGINEERS ASSOCIATION
of WASHINGTON • Seattle Chapter**

PO Box 44 • Olympia WA 98507 • 206/682-6026 • www.seaw.org

**PRESORTED
FIRST CLASS
US POSTAGE
PAID
SEATTLE, WA
PERMIT #5506**

Committees & Chairs

House/Program	Shelley Clark	Earthquake Eng	Mike Valley	Presentations/Awards	Brian Glover
Code Advisory	John Tawresey	Legislation	Robert Bourdages	Professional Practices	open
Exam Liaison	Ed Huston	Wind Engineering	Don Scott	Emergency Prep	Dave Swanson
Refresher Course	C. Chey Chase	Finance & Auditing	Ted Smith	Public Information	Steve Arnold
Scholarship	Bill Mooseker	Newsletter	Scott Adan	Building Committee	Philip Brazil

Membership

APPLICATIONS FOR MEMBERSHIP

APPLICATIONS ACCEPTED

Farid A. Chouery

FAC Systems Inc
MSEE '79 University of Washington
MSCE '84 University of Washington
Licensed Structural, WA
Class: MEMBER

Daniel Currit

Magnusson Klemencic Associates
BSCE '05, Brigham Young University
MSCE '06, University of Washington
EIT, Washington
Class: Associate

Brian Holloway

ABKJ
BA '96 Cal State San Bernardino
MSC&Env Eng '01 Cal Poly San Luis
Obispo
Licensed PE, WA
Class: Professional Associate

Jerry Jackson

Autodesk Inc
MBA '07 Cal State Sacramento
Class: Affiliate

Darin Koliis

Harriott Engineers
AA '04 Green River Community
College
BSC '06 U of Washington
EIT Washington
Class: Associate

Brian Matsumoto

Coughlin Porter Lundeen Inc
BSC '00, Seattle University
Licensed PE, WA
Class: Professional Associate

Janet Miller

Magnusson Klemencic Associates
BSAS '04 U of Illinois Urbana-
Champaign
M-Arch '06 U of Illinois Urbana-
Champaign
Class: Associate

Hamid R Naderi-Asrami

Tetra Tech/KCM
BSCE '80 University of Iowa
MSCE '90 University of Iowa
Licensed PE, WA
Class: Professional Associate

Lori Szewczyk

Magnusson Klemencic Associates
M-Arch '06 U of Illinois Urbana-
Champaign
Class: Associate

- MEMBER:**
Jeff Baerwald
- Professional Associate:**
Robert E Mantz
- Associate Members:**
Megan Jacks
Peter Hewko
Roi Chang
Bryan Sean Baldwin
Adam S Christopoulos
Mariya Chorbova
Becky Lee
Patrick D Lindblom
Robyn Lee
Brent Meacham
Matthew D Olsen
Katrina Reed
Fabio Rosas
Keith Walsh
Daniel Yeager
Sze-Lyn Sim
Ryan Morgan
Jared A Plank
Shawn Roberge
Kevin Wang

Watch Your E-mail for Your 2007 SEAW Membership Dues Invoice

At press time we were still finalizing data for 2007 dues invoicing. We're hoping to have invoices delivered to members by e-mail in the next week. Please save time and administrative costs by paying your dues online. Simply log in to the Members Only portion of the website, click on "My Membership" and then the "Membership Renewal" tabs.