



CONNECTIONS

May 2011 Volume 11 Issue 8

Newsletter of the
Structural Engineers
Association of Oregon

SEAO

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Upcoming SEAO Meetings and Events:

May 19th: Structural Masonry Design Seminar by NWCMA

Location/Time: Embassy Suites Hotel, Tigard / 8:00 am - 5:00pm.
See attached brochure for more information.

May 25th: SEAO Lunch Meeting

Topic: *Modern Timber Bridges*

Speaker: Paul Gilham, Western Wood Structures, Inc.

Location/Time: Portland, Governor Hotel/ check in at 11:30 am w/lunch and presentation at noon.

Videocast Venues: Corvallis (CH2MHill)

Eugene (Artisan Engineering)

Medford (Marquess & Associates)

Bend (Eclipse Engineering Inc.)

See Page 3 for additional information.

July 27th: OACI / SEAO Golf Tournament

Location / Time: Stone Creek Golf Club, Oregon City / 1:00 pm, shotgun start.

See page 10 for more information.

Sept. 22nd and 23rd: Structural Engineering Association 2011 NW Conference:

The conference this year is hosted by the Spokane and South Central Chapter of SEAW and will be held in Spokane Washington. See attached brochure.

Sept. 28th: SEAO Dinner Meeting

Topic: *TBD*

Location: Governor Hotel

PATH TO SEAO LIFE MEMBERSHIP

By: Jenny Carlson, P.E., S.E.

There are six classes of membership established for SEAO. Member, Affiliate Member, Student Member, Member Retired, and Affiliate Member Retired are the first five and relatively self-explanatory. The sixth class of membership is a Life Member. Every year in the fall, SEAO bestows this honor on one or more of our members. This spring, the Board of Directors began considering potential candidates for a Life Member award this coming fall and questions came up regarding the requirements established to qualify for a Life Member award. We thought it would be helpful to summarize the qualifications and selection procedure.

Paraphrasing from the SEAO By-Laws, a Life Member is a member who, in the opinion of the Board, is widely known for his or her outstanding professional accomplishments and devoted service to SEAO. Potential candidates must have been an active member of SEAO for a minimum of 20 years. The By-Laws set a minimum age of 60, but this minimum age can be waived by the Board under special circumstances. For those of you wondering why SEAO has an optional category to volunteer

(Continued on page 7)

CONNECTIONS is a monthly publication of the Structural Engineers Association of Oregon, published to disseminate current news to our membership and others involved in the profession of structural engineering. The opinions expressed reflect those of the author and, except where noted, do not represent a position of SEAO.

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PRESIDENT'S MESSAGE: OF BIM AND CROWNS

By: Trent Nagele, P.E., S.E.



It seems like every A/E journal I've seen for the past few years is touting the benefits of a new paradigm shift that will change our design approach to buildings, and it's breathlessly almost upon us. At the heart of this is Building Information Modeling (BIM), a tremendously powerful concept that promises an entirely new work flow, saving oodles of time and practically creating the building for you. Well maybe.

After reading scores of journals, I'm hard pressed to recall an article or editorial that wasn't promoting the benefits of this wonderful new method and the accompanying software. So I may be the first with a contrary opinion—but I'm not convinced. Don't get me wrong. I think the concept is cool, and frankly it's surprising that it hasn't taken root sooner.

I just don't think that we're being given very good tools to work with—and if we all move in one big pack behind the architectural herd, I'm not holding out a lot of hope for greener pastures just over the horizon. But I know it's possible.

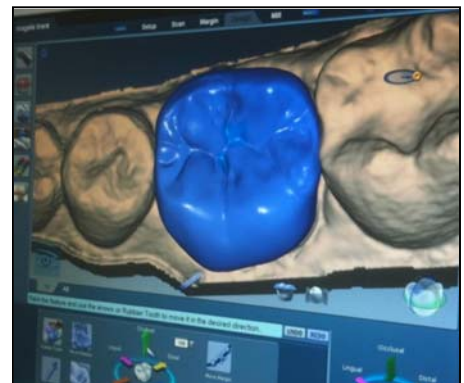
It's just that the primary software being thrust on us like a hot rivet comes from a company that wants to make my desk automatic. And, it is, quite simply, a square peg in a round hole. It will work with a big enough hammer, but it's hardly elegant or simple.

I worked with 3-dimensional modeling software years ago as a mechanical engineering student that was better than what we're being given and was recently reminded of how powerful computer modeling can be by my dentist—yes dentist. So check this out:

If you haven't ever had a crown, or at least not one recently (and I still don't recommend the experience unless it's necessary), the process may have changed from what you last knew or experienced. Gone are the multiple visits and temporary crowns. Instead, I was in the dentist's office for 3 hours and walked out with a new permanent porcelain crown—start to finish.

Before they propped my mouth in the wide open position, stretched rubber across the opening and clamped it tight, I asked about what to expect. Dr. Grimm (I'm not making this up) gave me a quick overview, but left out the part about carefully making molds of my existing tooth. So I asked him when that part would come—he said it wouldn't. What? How's the crown going to fit? He explained that they didn't need it. They were going to build a better tooth than I had! I was skeptical, but trusted him.

After first prepping my tooth, which is a nice way of saying they ground it down to a stump, they used a laser camera to scan the tooth area and up popped a 3-dimensional model of what was left of my tooth, along with its still intact neighbors. They then selected a new tooth from the computer's library that the computer then shaped and fit between my other teeth, taking into account the biting surfaces they'd scanned from an impression of my upper teeth, and the underlying surfaces of what remained of my previous tooth. Using the software tools, he adjusted the tooth surfaces, adding a little here and taking a little there, until he had the shape, overlap, and bite adjusted to what he wanted—all in virtual space to within fractions of a millimeter. A few more software checks, and the model was sent to a small milling machine that milled the exact tooth needed. He then verified fit of the new crown in my mouth, baked and coated the porcelain, fit and adjusted it into



place, and we were done.

As I watched him work and explain the steps he was taking, I couldn't help but think of my recent 3-d modeling experiences with buildings. Here he was scanning, manipulating, and milling a very complex 3-dimensional solid model with ease. Yet not long ago, I tried to model some

(Continued on page 7)

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MAY LUNCH MEETING ANNOUNCEMENT

Date: Wednesday, May 25, 2011

NOTE THIS IS A LUNCH MEETING

PLACE: Portland, The Governor Hotel, 2nd Floor Library Room, 614 SW 11th Ave, Portland OR 97205
The Max Light Rail System stops just a block away from the hotel (The Galleria Stop) and Portland's Streetcar stops right outside the hotel. Smart Park is located at SW 10th and Yamhill about two blocks from the hotel.

VIDEOCAST VENUES:

CORVALLIS

CH2M HILL
1000 NE Circle Blvd.
Bldg. 10, Suite 10350
(541)752-4271

EUGENE

Artisan Engineering
325 West 13th Ave.
(541)338-9488

MEDFORD

Marquess & Associates
1120 East Jackson Street
(541)772-7115

BEND

Eclipse Engineering Inc.
155 NE Revere Ave., Suite A
(541)389-9659

TIME: Check-in: 11:30 a.m., Program: Noon

COST FOR LUNCH & PROGRAM:

\$32.00 Member
\$40.00 Non-Member
\$18.00 Students

COST FOR VIDEOCAST LOCATIONS:

\$20 Member
\$33 Non-Member
\$13 Students

RESERVATIONS: Pre-registration required. Register and pay online at www.seao.org before noon, Friday, May 20. Note: No-shows will be billed. Contact Jane with any questions: Phone (503) 753-3075 or Email: jane@seao.org.

TOPIC: MODERN TIMBER BRIDGES

Presented by: Paul C. Gilham, P.E., S.E.
Chief Engineer, Western Wood Structures, Inc.

This presentation will be an introduction to the concepts of Modern Timber Bridges. Modern Timber Bridges are suitable for most bridge applications, as they can be designed to carry today's highway loads and are durable enough to provide a 75-year service life with minimal maintenance.

Modern glued-laminated timber construction, computer modeling and detailing, precise fabrication, and environmentally appropriate preservative treatments can be combined to construct a variety of bridge styles with clear spans up to 300 feet. These bridges are often used in parks, golf courses, residential developments, even state highways.

SPEAKER INFORMATION: Paul Gilham is vice president and chief engineer for Western Wood Structures, Inc., where he has worked for 28 years. His responsibilities include designing engineered timber structural systems, including domes, vehicle and pedestrian bridges, storage facilities, arches, and trusses. He also provides inspection services and designs repairs for existing timber structures. Paul earned his B.S. in Civil Engineering from Oregon State University and his M.S. in Civil Engineering from Portland State University.

PROFESSIONAL DEVELOPMENT HOURS: 1 PDH credit will be provided to attendees. Make sure you sign in for your credit.

Call for Entries

NCSEA 2011 Excellence in Structural Engineering Awards Program

NCSEA announces the 14th annual Excellence in Structural Engineering Awards Program. Up to three Excellence in Structural Engineering Awards will be presented in each of the following eight categories: New Buildings under \$10M, New Buildings \$10M to \$30, New Buildings \$30M to \$100M, New Buildings over \$100M, International Structures over \$100M, New Bridge and Transportation Structures, Forensic/Renovation/Retrofit/Rehabilitation Structures, and Other Structural Design Projects. In each category, one of the three projects will be chosen as an Outstanding Project.

Entries are due July 22, and awards will be presented at the NCSEA Annual Conference Awards Banquet at the Renaissance Hotel in Oklahoma City on October 22, at the conclusion of the NCSEA Annual Conference. Winning projects will be featured in future issues of STRUCTURE magazine. For awards program rules and eligibility, as well as entry forms, see the Call for Entries on the NCSEA website:

www.ncsea.com

SEAO DIGITAL STAMPING - PART 1

By: Sue M. Frey, P.E., S.E.

Digital Stamping Part 1: Overview

The first in a series of informational articles introduces Digital Stamping for Engineering Documents. For answers to common questions, visit:

<http://www.faq.pdf-it.com/DigitalSignature/GeneralQuestions/DigitalSignatureGQ.aspx>.

Terminology

The concept of a digital signature is often misunderstood and is frequently confused as an electronic representation of a physical signature. This is not true. A digital signature is not visible. It is an invisible marker placed in the file. It is possible to show some parts of the digital signature for the human eye but this is not recommended by State Boards. Please take time to familiarize yourself with the following terms before reading further:

- **Digital Certificate or Digital Signature** – A digital signature is a digital identifier assigned to you by a third party agency specializing in digital security. The digital signature uniquely identifies you from anyone else in the world. The signature is comprised of a **public key** which is visible to the world and a **private key** which should be closely held by you. The digital certificate is not necessarily visible in a document.
- **Digital Signing** – Applying a digital signature to a document to secure the document and/or identify the document's owner or approver.
- **Public Key** – Public part of a digital certificate. An analogy is a debit card transaction. Your debit card number is a public key that anyone can read from your debit card.
- **Private Key** – Personal part of digital certificate. An analogy is a debit card transaction. When you use your PIN to authorize a transaction, this is similar to the private key of your digital signature. Only you possess the PIN but anyone can read the debit card number.
- **Raster file format** – A picture or a scan of an image.
- **Vector file format** – Contains line work definitions such as line, curve arc and can be edited in vector format. CAD files are vector files.

From the OSBEELS site, from a document posted there by Ron Singh, PLS, "Digital Signatures for Engineering Documents":

http://www.oregon.gov/OSBEELS/docs/DigitalSignatures.rev.September_2008.pdf?ga=t

- **Electronic versus Digital Signatures**

Often the terms electronic signature and digital signature are used interchangeably to mean the same thing. In the information security world, the two terms are distinctly different. The term electronic signature may include scanned images of hand-written signatures; typed notation, such as Jane Doe, or signature blocks on email messages, etc. without any authentication and/or encryption system included. The term digital signature is more properly used to describe a signature system applied to an electronic document that utilizes specific technical processes to provide significant added security, authentication, and/or encryption.

- **Digital Signature Creation**

*A **self-signed certificate** is one that is created by the individual signer **without the services of a certification authority** and should be avoided. Digital IDs provided by 3rd parties are generally considered more secure, because an independent certification authority has ratified them. A signature applied using a self-signed certificate signature tells a document recipient that "This document is valid, and I am authorized to sign it," while a signature applied using a 3rd party digital ID tells them that "This document is valid, I am authorized to sign it, and [CERTIFICATION AUTHORITY X] verifies my identity." This additional assurance can make a big difference when it comes to legal documents or those sent out to a wide audience.*

*To associate a key pair with a prospective signer, a **Certification Authority issues a certificate**, an electronic record which lists a public key as the "subject" of the certificate, and confirms that the prospective signer identified in the certificate holds the corresponding private key. The Certification Authority performs a **background check** on each individual that is assigned a signing certificate.*

MEMBER OF THE MONTH

By: Trent Nagele

Aaron Burkhardt

With the successful launch of our new website, we would be remiss if we didn't acknowledge the tremendous effort that Aaron has contributed to SEAO to make the website a reality. As the chair of our website committee, Aaron has been the point man in working with our developers to make the vision SEAO had for the site a reality. It's not an easy job, and takes a significant effort to move from the initial concepts and "wouldn't it be great if..." dreams to a final distilled product. I have enjoyed the opportunity to get to know Aaron better this past year and work with him on the web site, bouncing ideas off him, asking him to push the developers for as many "features" as we could within scope; and sharing just one more "vision" with him—which he has patiently taken in stride!

When Aaron is not working on the SEAO website, he is an Associate with KPFF Consulting Engineers in Portland, where he has worked for 13 years. Aaron is married to Tara Burkhardt. In his spare "me" time, as he puts it, Aaron likes to spend time with his wife, attend art shows, and work on his yard. Aaron is also an avid baseball and football fan, following closely the Padres and Chargers.

On behalf of all the members of SEAO, Thank you, Aaron! For all you've done to better the Association and make the new web site possible. I know it will serve SEAO well.

EMPLOYMENT OPPORTUNITIES

GENERAL STRUCTURAL ENGINEER

Holmes Culley is looking for structural engineers at all levels to join our growing team in San Francisco. Whether you are a recent graduate looking to broaden your experience or an experienced engineer looking to find an environment to advance your career, we want to hear from you.

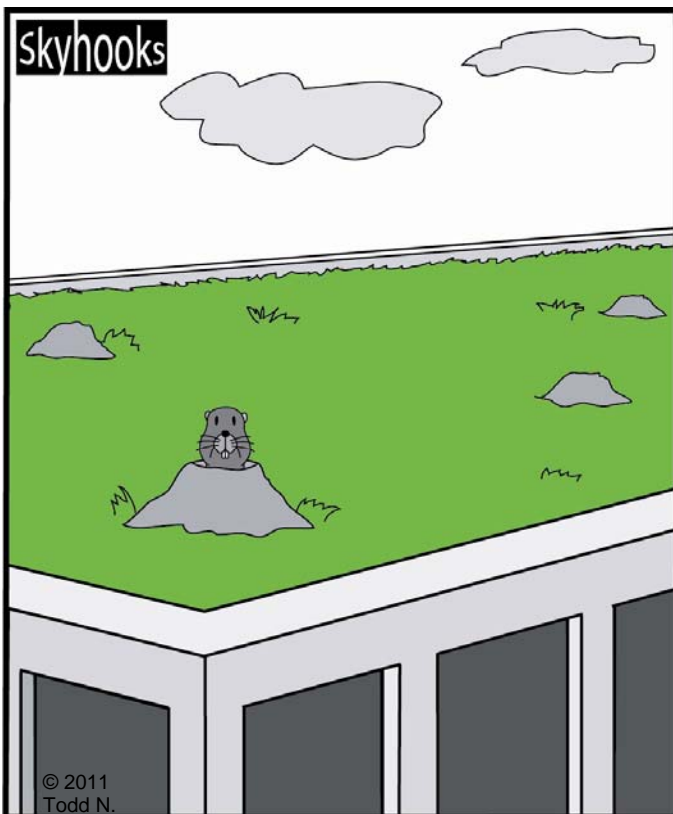
We provide a dynamic working environment with opportunity for professional growth and development. We work on a number of challenging project types, including academic, historic, corporate campus, marine and residential. Please send a cover letter and resume to hr@holmesculley.com.

VLMK Consulting Engineers is seeking a licensed structural engineer with 5 to 10 years of structural engineering experience in the design of wood, concrete, masonry and steel structures. Candidate should be self-motivated, have good verbal and written communication skills, be organized, and be able to adequately prioritize multiple projects simultaneously. PE license and proficiency in AutoCAD is required. SE license and proficiency with BIM/Revit is preferred, but not required.

VLMK is a well established civil/structural firm with broad project experience and client base located in Portland, Oregon. We offer competitive salaries, full medical and dental insurance benefits, 401k and profit sharing plans, incentive bonuses, paid holidays and sick leave, free on-site parking, as well as company funded SEAO membership and professional development education opportunities/seminars.

Submit resume, summary of project experience, references, and salary requirements to:

Kevin M. Kaplan, P.E., S.E.
Principal
VLMK Consulting Engineers
3933 SW Kelly Avenue
Portland, Oregon 97239-4393
or email to vlmk@vlmk.com



One of the lesser known hazards of eco-roofs. If only they were worth extra LEED points.

RECAP OF 2010 NCSEA ANNUAL CONFERENCE

By: Sue M. Frey, P.E., S.E. SEAO delegate to NCSEA

The 2010 NCSEA's 18th Annual Conference was held at the Hyatt on the Hudson Conference Headquarters in Jersey City, New Jersey, located on a pier on the Hudson River. The conference was hosted by SEAoNY who provided an outstanding effort. Despite an early storm day, the weather brightened and offered breathtaking views of the NYC skyline just across the river, including a view of the Statue of Liberty to the south and the George Washington Bridge to the north.

SEAO was represented by Brad Moyes, as an NCSEA Board Member, and Sue Frey, as SEAO's Delegate to NCSEA. Sue was involved in several of the NCSEA committees and participated in both committee meetings and the workshops. Brad is highly involved at the board level.

The main events were:

- Committee meetings
- Two days of technical presentations.
- Workshops gathering input toward finalization of NCSEA's Strategic Plan for 2011-2015.
- Outstanding projects presented with awards at the closing reception and banquet.

Saturday's workshops asked for delegate input into the following subjects:

- Promote the Structural Engineering (SE) Profession to the media, general public, students, aligned professionals, clients, code officials, government agencies, and others.
- Represent the SE Profession: Strengthen SEER committee work, member services, and liaisons with related organizations.
- Improve the SE Profession: Promote separate SE licensure in all states and territories, advocate for appropriate SE education and degrees, increase legislative process, raise quality of practice, and encourage quality based selection.
- Enhance communication with NCSEA's member organizations (MO) by supporting at-risk MOs, delegate calls, visits by board members, update website, and provide e-newsletters.
- Increase and energize committee activity by appropriate chair person, website use, effective members, better efficiency and communication, connect MO and NCSEA parallel committees and evaluate committees regularly.
- Provide financial security through replacement of paper with electronic deliverables, add value to name brand, and increase attendance at conferences and training as well as evaluate dues increases.
- The full detailed plan can be found at: <http://www.ncsea.com/About.aspx>



Related Downloads:

| Title | Date Uploaded |
|--|---------------|
| NCSEA Strategic Planning 2011 - 2015 | 5/1/2011 |
| Letter from the President | 3/8/2011 |
| State Activities Matrix | 4/12/2006 |
| NCSEA Bylaws | 7/15/2005 |

NCSEA 2011 Conference: October 20 - 22, 2011 Oklahoma City, Oklahoma

With many events and opportunities being offered, Oklahoma City is proud to host this year's NCSEA Annual Conference. Held at the Renaissance Convention Center, the program will include:

- Committee meetings, trade show, and reception on Thursday.
- Presentations by speakers from across the country on Friday.
- Dinner at the Oklahoma City Museum of Art, including abundant opportunities for networking and sharing ideas with your peers on Friday evening.
- Committee and business reports, followed by lunch, panel, and workshops on separate licensing on Saturday.
- Reception and Awards Banquet on Saturday night, honoring finalists of the 2011 NCSEA Excellence in Structural Engineering Awards Program



OF BIM AND CROWNS

(Continued from Page 2)

minor slopes on a flat roof of a building. We're talking simple members with defined constant geometries and connection points, yet it was like manipulating delicate threads in a loom. I had to have the manual next to me, following the steps in exact order using oddly placed and named commands, cross my fingers, and hope it worked. I think it could have been more difficult, but I'm not sure how.



Yet, after watching my dentist work on my crown for 15 minutes, I'm pretty sure I could do more with his software and teeth than I can with my building software after 3 days of training. Even the instructor was stumped by the complexities of a flat roof with girders, joists and sub-purlins—you know, really complex stuff. But why, in 2011, aren't the tools better? I can download free modeling software that my 10-year-old can run, and I can buy a software package at Costco for \$50 that will model my house.

But I'm a professional—so I have professional tools! I just don't feel very professional when my software takes four days to replicate what the guy down the street was able to do in an afternoon when he got home from Costco.

So maybe I'm in the minority, but I just don't think it's as hard as the prevailing software makes it. Like trying to boil everything in structural engineering down to a beam, column, wall or stair? I talked recently to a software developer who said it had taken him untold hours to figure out that he could only import walls with the needed geometry into the modeling platform if he told the software they were slabs. Brilliant. Maybe I'll start labeling my drawings that way too. Or, maybe we should agree to start looking for some greener grass?

RESPOND TO OUR SURVEY:

How are you using BIM?

- a) Yuck, I won't touch it.
- b) I'm waiting for greener pastures.
- c) A little, but only when I have to.
- d) Somewhat regularly, but not to its full potential.
- e) Love it! I'm in for the whole enchilada whenever possible.
- f) Forget engineering, I'm going into dentistry.

Register your response at:

<http://www.seao.org/publications/newsletter/>. We will issue the results in July's newsletter.

PATH TO SEAO LIFE MEMBERSHIP

(Continued from Page 1)

your age along with your personal data when you register on the website, it is because we wish to keep track of potential Life Members. The Board's past president and first-year director form a committee in the spring of each year to review potential candidates for a Life Member award. Usually one member is chosen, but in the past multiple awards have been given. The award is presented at a dinner meeting, usually along with the installation of new officers and scholarship award presentations. The chosen Life Member is given a certificate entitling him or her to all the privileges of membership and exemption from paying dues for life. If you know a member that meets the above qualifications and you would like the board to consider the member for a future Life Member candidate, please notify the Board.

JURISDICTIONAL ANNOUNCEMENT



City of
Portland, Oregon
Bureau of Development Services
FROM CONCEPT TO CONSTRUCTION

Dan Saltzman, Commissioner
Paul L. Scarlett, Director
Phone: (503) 823-7300
Fax: (503) 823-6983
TTY: (503) 823-6868
www.portlandoregon.gov/bds

DEVELOPMENT SERVICES CENTER
HOURS OF OPERATION
& SERVICE AVAILABILITY
MAY 2011

If you are planning a visit to the City of Portland's Development Services (Permit Center) to ask general questions or submit any type of permit, the hours of operations and service availability have been modified. You can find a complete listing of available service hours and more detailed information for the Development Services Center (DSC) online at www.portlandoregon.gov/bds/dsc.

DSC HOURS OF OPERATIONS (Limited Summary):

- DSC is open: Tuesday thru Friday – 8:00 am to 3:00 pm. Closed Mondays.
- Building Permit Submittal, Review & Intake: 8:00 am to 12:00 pm. Note that if your procedure for submittal is not completed before 12:00 pm, you will need to return on another day to complete the process.
- The New Single Family Construction Permit Set-up and Intake service timeframe has been modified to Tuesdays and Thursdays. Please see website above for more information.
- General Customer Questions: 12:00 pm to 3:00 pm. For such information as Planning & Zoning, Life Safety Plan Review, Engineering and Site Development. Assistance with these issues will likely not occur until after 12:00 pm and wait times may be substantial.
- Records Requests: 8:00 am to 3:00 pm

Also, The Bureau of Development Services will be raising most of their fees beginning July 1, 2011. For more information visit the SEAO web site: www.seao.org/publication/newsletter.

APRIL MEETING RECAP

By: David Tarries, P.E

Seismic Upgrade of a 15 story Steel Moment Frame Building Satisfying Performance Criteria with Application of Experimental and Analytical Procedures
Presented By James O. Malley, S.E. of Degenkolb Engineers

General Project Information:

The project involved the retrofit of a mid-rise building in the Bay area owned by the State of California. The lateral system is a Special Moment Resisting Frame (SMRF) designed under the 1988 UBC and was constructed in 1991, after the Loma Prieta quake. The building is located four miles from the Hayward fault and has a mat foundation. The ground level of the building is lobby/public space, levels two through four are parking, and the upper 10 levels are office space. The state purchased the building from a developer a few years after construction and it now houses the Caltrans District 4 headquarters and a Traffic Management Center for the area.



The moment frames are located at the perimeter of the building and along an atrium space in the center of the building. They consist of heavy W27 columns and W36 beams which are larger than assemblies typically tested for pre-qualified connections. Caltrans determined the moment connections may be at risk during a seismic event and commissioned full scale lab testing to determine the capacity of the existing frames. Four tests were performed at the University of California, Berkley which modeled the large beams and columns present in the structure. The results of the testing indicated that the joints experienced non-ductile failure at 55% to 60% of M_p with about 3% drift. As a comparison, testing of similar moment connections with smaller members typically achieve M_p before non-ductile failure occurs.

As a result of the testing, Caltrans contracted Degenkolb in conjunction with Crosby Group Engineers and Ratcliff Architects to design a seismic retrofit for the building. ASCE 351 was used as the design standard. Due to the importance of the facility in maintaining infrastructure after a seismic event, the risk level was set at 3. At this level the building is expected to suffer minor structural damage during the Maximum Considered Earthquake (MCE) event with a 50% confidence level that local collapse will not occur, and a 90% confidence level that global collapse will not occur.

Four design schemes were considered utilizing the existing foundation system:

- Installing Buckling Restrained Braced Frames (BRBFs) throughout the building to remove load from the moment frames
- Base isolating the building
- Retrofitting the existing moment connections
- Retrofitting the existing moment connections and installing dampers

Retrofitting the moment connections and installing dampers was determined to be the most efficient option. The final design modified 746 of the 1218 moment connections in the building. Dampers were used to absorb some of the lateral force and reduce the demand on the modified connections. Damper capacities ranged from 225k to 650k and were typically installed in a two story X-bracing configuration. Connection modifications and dampers were installed in perimeter bays starting near the corners of the building at the base and shifting bays towards the center at the upper levels. This distributed the axial forces throughout many columns and also kept the corner offices of the higher floors free of dampers. Modifications were not made in the area of existing built-up box columns at the extreme corners of the building to avoid complicated detailing and analysis. In addition, dampers were not installed in the moment frames of the interior atrium to maintain an open lobby layout.

FEMA 351 required a limit of 1.8% drift; however, the building owner requested a 1.5% limit be used. Extensive analysis was completed to allow for the local drift requirements to be reduced between 1.1% and 1.3%.

Analysis:

A fiber model was created for the moment frame connections. An element was used for each flange as well as one for each of the bolts. The fibers representing the flanges were limited to 60% of the flange capacity to accurately model the existing condition. The non-linear model considered column hinges, beam hinges, panel zones, and soil springs. The fiber model indicated that the existing connections considering only the bolts would fail at around 2 ½% to 3% drift.

The analytical model was tested by comparing results with those of the full scale lab testing completed prior to the retrofit project inception. The analytical model was used to verify existing moment connections in the building that were not modified as part of the project. The model indicated that the existing connections could support Design Basis Earthquake (DBE) level forces with 2% drift when all the

(Continued on page 9)

APRIL MEETING RECAP

(Continued from Page 8)

connections were modified and no dampers were installed. The drift was reduced to 1.4% when 60% of the connections were modified and dampers were included. Drifts were around 2% at the MCE level when 60% of the connections were modified and dampers were included. The addition of the dampers absorbed about 60% of the energy and also allowed for reduced accelerations to be used in modeling. The model indicated that the majority of the remaining unretrofitted connections could maintain gravity capacity at beyond the 1.4% design drift. A small number of existing moment frames in short bays were retrofit as pinned connections and removed from the lateral system to accommodate building drift.

Testing:

Caltrans agreed to pay for full scale testing of four different retrofit options to verify the connection retrofit design. These tests were in addition to the four tests on the existing connections completed before the retrofit project. The retrofit testing cost approximately \$250,000, and was completed at the University of California, San Diego. Test specimens used construction representative of the actual building, including composite deck at the top flanges. Pre-Northridge welding methods were used on the existing connection portion and the retrofit additions were completed using current methods with access restrictions similar to those that would be experienced in the field. A plywood wall was constructed prior to retrofit installation, which represent the existing façade as it would occur on the actual building. The following table summarizes the testing results:

| Test | Description: | Failure Mode: |
|------|---|--|
| 1 | A bottom haunch retrofit designed to be installed with access from below the connection only. Stiffener plates were welded between the column flange and the beam bottom flange. The test used W27x336 columns and W36x170 beams. | At 2% drift the column flange fractured at the connection to the beam top flange. |
| 2 | A top and bottom haunch retrofit. Stiffener plates were welded between the column flanges and the beam top and bottom flanges. The test used W27x281 columns and W36x210 beams. | At 4% drift the doubler plate and bottom flange began to buckle. At 5% the beam bottom flange fractured outside the haunch. |
| 3 | A top and bottom bolted haunch retrofit. Modeled after the Kaiser bolted bracket and intended to allow for easier field installation. Stiffener plates were bolted between the column flanges and the beam top and bottom flanges. The test used W27x281 columns and W36x210 beams. A354 1 5/8" diameter bolts were used. The bolts could only be obtained from one manufacturer in the US and drilling 2 1/4" diameter holes with a mag-drill was very time consuming. | At 4% drift bolts fractured and shot across the room. Combined shear and tension in the high strength but brittle bolts caused the failure at the connection to the column flange. |
| 4 | A top and bottom connection with gusset plates on one side to represent the damper connections. Stiffener plates were welded between the column flanges and the beam top and bottom flanges. The test used W27x336 columns and W36x170 beams. | At 3% drift the bottom flange began to buckle. At 5% drift the beam bottom flange fractured outside the haunch. |

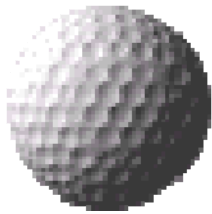
Based on the test results it was determined that the top and bottom haunch option with gusset plates for the dampers was the best solution. Modeling of the connection revealed that the haunches relieved much of the concentrated stress in the panel zone and distributed it as shear into the beams beyond the haunch.

Additional Design Considerations:

Extensive photos of existing conditions were taken at all retrofit locations and were provided on a compact disk in the bid package. The photos were provided to limit the possibilities for contractor change orders resulting from unknown conditions and limits on construction access.

Work was completed in three phases: A preparation phase, a retrofit phase, and an architectural refinish phase. Each phase was completed on half a floor at a time and the phases were staged so that they could be completed simultaneously. The building remained occupied during construction and work took place after normal business hours. Noise meters were installed in the surrounding neighborhood to monitor disturbance levels to residents. Work on the project was completed in 2010, after approximately 33 months of construction. Seismic instrumentation was added to the building and wired to Degenkolb's office. Degenkolb is under contract to evaluate the data and inspect the structural systems of the building following the next major seismic event in Northern California.

This project successfully integrated non-linear time history analysis, reduction of lateral floor accelerations using dampers, and project-specific full-scale laboratory testing to justify an efficient lateral system retrofit on an occupied building with significant importance to post-earthquake response activities. It also demonstrates the advances in moment frame connection design over the last 20 years and the importance of locating and repairing these connections in buildings where they are inadequate. Special thanks to Jim Malley for presenting this project at our April dinner meeting.



2011 SEA0/OACI GOLF TOURNAMENT



WHEN: **Wednesday, July 27th**
Shotgun Start 1:00 PM
 Social Hour: 6:00 PM
 Dinner & Awards: 6:30-7:30 PM

14603 S. Stone Ridge Dr., Oregon City
 Phone: (503) 518-4653
 (exit 10 off I205, head east on HWY 213. After 6 miles
 turn right on to Leland Rd. Stone Ridge Dr. is on right)

WHERE: **Stone Creek Golf Club**
TOURNAMENT 4-person scrambles ONLY

DINNER: Lasagna dinner & beverage.

FEES: Golf & Dinner: \$90. (Includes cart & driving range)

INFO: Jane Phifer 503-753-3075 jane@seao.org
 Melissa McFeron 503-246-1250 melissa@miller-se.com
no refunds for cancellations after July 15th.

Appropriate "country club" attire is recommended: collared shirts, no denim, shorts must have a 6" inseam. Soft spikes only.

Once again this year S.E.A.O. and O.A.C.I combine forces for return engagement of golf and merriment at *Stone Creek Golf Club*. *Stone Creek* is the newest golf course in the Portland area and is the pride of designer Peter Jacobsen. Participants will all enjoy the team spirit of playing a 4-person scramble.

We will have a shot-gun start, allowing us to all finish at the same time to share stories of the day's glory and despair, along with dinner, beverage and lots of prizes. Please note that in an attempt to encourage participation, the cost of the tournament has been reduced from last year's rate. We hope that you will come out and support both organizations.

The course offers a driving range, and large putting green to hone your skills prior to the tournament so come early. Power carts and range balls are included in the golf fee.

Don't forget to bring money for the raffle prizes and mulligans! This year's raffle prizes will be: Nintendo WII, Flat screen TV, Pressure washer, golf club, golf club cart and much more!!

PLEASE RETURN THIS ENTRY FORM BY: July 5th to:

S.E.A.O., 9220 SW Barbur Blvd. #119, PMB #336, Portland, OR 97219

Phone: 503-753-3075; Fax: 503-214-8142

| Player Name's | Membership | Pmt. Enclosed |
|---------------|---|---------------|
| _____ | <input type="checkbox"/> SEA0 <input type="checkbox"/> OACI | \$ _____ |
| _____ | <input type="checkbox"/> SEA0 <input type="checkbox"/> OACI | \$ _____ |
| _____ | <input type="checkbox"/> SEA0 <input type="checkbox"/> OACI | \$ _____ |
| _____ | <input type="checkbox"/> SEA0 <input type="checkbox"/> OACI | \$ _____ |

VISA/MC Accepted

Total \$ _____

Name: _____

Card # _____ exp date: _____

2011 SEA0/OACI
GOLF TOURNAMENT

DONATION / HOLE SPONSOR FORM

Sponsor Info:

Company: _____

Contact: _____

Phone / Fax #: _____

Email: _____

General Sponsorship

HOLE SPONSOR/KP/Long Drive/Long Putt (\$125. / HOLE)

Hole Preference _____

Special Sponsorship

19th Hole Sponsor (\$375.)

Host keg of Micro-brew

On Course Refreshment Sponsor (\$375.)

Host drink cart for one beverage per participate to be redeemed during play

Golf Cart Sponsorship (\$200.)

Host the golf cart with a sign in each cart with your company name.

Scorecard Sponsor (\$200.)

Host the scorecards with the name of your company on each card.

Tee Prize Sponsor (\$300.) (Requires a minimum of 3 sponsors)

Host tee bag to be given to all participants. (Quantity = 125)

Raffle Sponsor

*Golf committee will purchase raffle prizes

Ninteno Wii (\$300)

Air Compressor (\$300)

Flat screen TV (\$300)

Golf club (\$100)

Pressure washer (\$300)

3-wheeled golf pull cart (\$200)

INFO: Melissa McFeron 503-246-1250 melissa@miller-se.com

Jane Phifer 503-753-3075 jane@seao.org

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