CONNECTIONS

September 2010 Volume 11 Issue 1

Newsletter of the Structural Engineers Association of Oregon

SEAO

P.O. Box 3285

Portland, OR 97208

Phone: (503) 753-3075

Fax: (503) 587-0337

E-Mail: seao@seao.org

Web site: www.seao.org

IN THIS ISSUE:

Underlying Concepts in Seismic Design Codes Application to Steel Building Structures

Wednesday, September 29, 2010

Social Hour: 5:30 PM **Dinner:** 6:30 PM **Program:** 7:00 PM

Portland
Governor Hotel, Ballroom
614 SW 11th Avenue
Portland

$32.00 Pre-paid Member
$40.00 Pre-paid Non Member
$18.00 Students

Corvallis (Program webcast)
CH2M Hill
1000 NE Circle Blvd, Bldg 10, STE 10350
Corvallis, OR

Corvallis Social Hour Begins at 6:00pm
$20.00 Prepaid Member
$33.00 Prepaid Non Member
$13.00 Students

PDH CREDIT:
1.5 PDH has been recommended for this program

RESERVATIONS:
Call or email Jane Ellsworth *before 5:00 PM, Friday, September 24, Ph (503) 753-3075, Email: jane@seao.org*.

You can now register and pay online at www.seao.org

About the Program:
This month's dinner meeting topic is taken directly from the NCSEA Winter Institute held last March in San Diego. The Winter Institute Theme was "*Seismic Design: Explaining the "Y" Factor From One Generation to the Next"*

NCSEA asked the speakers to explain the underlying intent behind seismic provisions in the IBC, ASCE 7 and the material standards. Dr. Uang was the first speaker and, taking this request to heart, gave an amazing presentation demystifying the ever-sophisticated steel and seismic codes from a historical perspective. The 2010 AISC Seismic Provisions were used to demonstrate not only how, but **why** various seismic principles are implemented in the code and standards.

Northwest SEA attendees at the Winter Institute discussed this special presentation among ourselves and resolved to try to have this single presentation reprised locally. Dr. Uang has graciously agreed to make back-to-back presentations in Seattle on September 28th and Portland on September 29th.

(continued on page 4)

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.

Send membership inquires to:
SEAO
P.O. Box 2948
Vancouver, WA 98668

PRESIDENT'S MESSAGE

By: Jennifer Carlson

The past 12 months have been an extraordinary experience for me. In the waning days of my term as president, I am reflecting on all I have learned, all the board has accomplished, and most importantly all the people I have served with. Through all the discussions on budgets, code changes, snow load data, trade show, and seminars (to name a few), I have been consistently inspired by numerous dedicated volunteers serving this organization.

I would like to recognize the outgoing board for their efforts this past year. Serving on the board is a unique experience within SEAO because you oversee the many different facets of the organization. And no position gets into the intricate details more than the treasurer. Ken Safe had intended to serve a two year term when he started as treasurer last fall. Ken jumped in with both feet and did an admirable job of keeping our accounts in order. Military duty called and Ken shipped out to Afghanistan this past June. Ken, when you are able to get your email and read this, remember we keep you in our thoughts and look forward to your safe return home. Past treasurer Paul Walker volunteered to take over for Ken until the new board is installed this month. I have said it before, but it bears repeating, the board is very thankful for Paul's help. Gretchen Hall served as secretary for this past year. She has been a devoted volunteer for SEAO both on the board and with the program committee. Thank you, Gretchen. Your service is appreciated and I look forward to working with you in some other capacity in the organization in the future. Kevin Kaplan served for two years as a director and would have been wrapping up his board tour. But in the true spirit of the game, Kevin will be continuing on as our new treasurer. Now that is fortitude! People like Kevin are the backbone of SEAO.

This month will be the last board meeting for Past President Greg Munsell. Greg has volunteered tirelessly in just about every aspect of SEAO there is over the last 20 years and I am sure he will continue to do so. There is no doubt Greg has been instrumental in creating the organization as it exists today. Greg's efforts have greatly enhanced all the benefits the membership enjoys. I hope every one of you will personally thank Greg when you next see him for his dedication.

Our constant through the years, executive secretary Jane Ellsworth, deserves heartfelt thanks for going above and beyond keeping the organization and especially me on track and on time. Her smile and enthusiasm add fun and humor to board meetings.

We had many successes this past year and one or two less than sterling concerns. Our campaign to reinvigorate our committees is one of those successes. Fifty five of our members are actively serving on one or more committees. In October we plan to hold another committee round table session prior to the dinner meeting. I encourage all members to come and get involved. Kudos to Andy Stember for producing 3 outstanding seminars. Tonya Halog and Brad Larsen revived the Scholarship Foundation Trade Show last February into its historically successful run at the Monarch. We launched our first live webcasts of our dinner meetings. Admittedly there are a few bugs to work out, but this is a very promising path to include membership outside the Portland metropolitan area in our regular meetings. Julie Hayes and the program committee planned and oversaw an excellent variety of dinner meeting presentations. Julie is retiring from the committee after serving three years. Julie, SEAO greatly appreciates your service. I am pleased to say Jason Holland will be taking over as chair of this essential committee.

PRESIDENT'S MESSAGE
(CONTINUED)

Our annual golf tournament was one of those less than sterling events- ok, to be blunt this historically profitable event lost money. This was a result of an unpredictable economy rather than a lack of planning, but a good wake up call for all of us not to take these events for granted. The success nearest and dearest to my heart is officially starting the process of creating a new website for the organization. This is a big investment for SEAO, but will be a great benefit to our members and the future of the group. Aaron Burkhardt is to be commended for lending his expertise and many hours of his time to coordinate this effort.

As I move to the back seat, so to speak, Trent Nagele will be taking over as President. Trent is one of those people that "gets things done", as his efforts over the past year have shown time and again. He infuses the organization with energy and good ideas. He gets involved in the details and keeps the big picture in mind. His care and dedication will serve SEAO well over the next year.

I now want to welcome the new board members. Ed Quesenberry is Vice President, Amit Kumar is secretary, and Norm Farris is the new director. Craig McManus will continue in his second year as a director, and as mentioned above, Kevin Kaplan will serve as treasurer. Trent and I will round out the group, with crack executive secretary Jane keeping us all in line. I can already sense Ed's enthusiasm and I look forward to working with this outstanding group of professionals over the next year.

I appreciate the opportunity all the members gave me when I was elected to this board two years ago and hope my service has been beneficial to SEAO. I think people shy away from serving in a position like this, not just because it demands your time, but also because they are not confident they have the skills to do it. There is an old life saying "Nobody cares if you can't dance well. Just get up and dance." I danced and I have truly enjoyed the experience.

MARK YOUR CALENDARS

Oct 27 - Committee meetings/Dinner meeting

Nov 11 - SEAO Fall Seminar with Ed Huston
(details coming soon)

Jan 26 - Dinner Meeting

Feb 24 - SEAO Tradeshow

YOUNG MEMBERS

Who says engineers can't build? Last month, a team of 14 SEAO members and family members sweated it out at a Habitat for Humanity project site. They helped install sheathing, siding, and exterior trim on a group of new homes in the Lents neighborhood. These houses will be sold at cost to hardworking families in need after they contribute 500 sweat equity hours. Families purchase the homes with a 1% down payment and carry a 0% interest mortgage. Habitat for Humanity is able to do this by way of volunteer labor and donations. Thank you to all who came out; it was a lot of fun!

SEAO will be volunteering with Habitat for Humanity twice a year, during the summer and fall. Friends and family members over the age of 16 are welcome to come out and join us. Please contact Ciera Speer if you would like to be included on the mailing list.

NEW WEBSITE SOON

Development has started on a new SEAO website! To get to this point, information was gathered this past winter and spring about what we would need in a website to better serve our members both now and in the future. This input was then rolled into a formal proposal request and forwarded to a number of qualified web developers. Proposals were received back in June, and a front runner was selected. After meeting and discussing with them to confirm their qualifications and the project scope, the board voted to approve the proposal from A-Vibe Web Development (avibeweb.com) and move forward. A contract was signed at the end of August and the process is now underway.

Expected to be complete by the end of January 2011, our website committee is working hard to coordinate with our committee chairs and board to put together a site that reflects SEAO, its membership and our profession.

This site will be a completely new site, with a new appearance, navigational structure and capabilities. It will have a new interface to register and pay for meetings and seminars. Members will be able to log-in and update their address, phone and employer information, as well as access other member specific resources. Our emergency response committee will have some greatly enhanced abilities to organize and manage our emergency response resources, and be able to quickly access members who have ATC training or other skills and connect them with local emergency response personnel wherever they may be. Though still in the early stages of development, we're anticipating that there will also be resources for people unfamiliar with structural engineering to find information that will help them learn about, and connect, with structural engineers.

In short, we're excited about the opportunities and tools this site will offer to better serve the needs and mission of SEAO and its members. If you're excited about the opportunities too, and have some suggestions and would like to get involved, please contact one of the committee chairs or a board member. We'd love to have you be an active part of SEAO.

SEPTEMBER MEETING

(continued from page 1)

Wherever you are in your career, you will find this presentation invaluable. Those who are in the early part of their career will gain great insight into the "**why**" of seismic provisions in general and in steel design in particular. This will be particularly valuable for those preparing for licensing examinations. Those who are further along their career path will gain insights as to "**why**" the codes and standards are constantly changing. Those who remember the steel manuals before they were even green will be brought up to date on the latest underlying principles.

About the Speaker: Professor Chia-Ming Uang is a Professor of Structural Engineering at the University of California, San Diego. His research area is in seismic design methodology, large-scale testing, seismic analysis and design of steel structures. Professor Uang was a recipient of two awards from the American Society of Civil Engineers: the Raymond C. Reese Research Prize in 2001 and the Moisseiff Award in 2004. He also received the Special Achievement Award from AISC in 2007.

RAFFLE: This month at the chapter meeting there will be a raffle to benefit the SEAO Scholarship Foundation. Each raffle ticket will cost $2.00 so bring cash and plan to support the SEAO Scholarship Foundation. If you would like to donate items for future raffles, please contact Jane at jane@seao.org or 503-753-3075.

SPECIAL INSPECTION

Searching for help as you transition to the new 2009 IBC and 2010 OSSC? When it comes to specifying the special inspections and structural observation program, help is here! With special thanks to all the committee members who worked on the latest version, and especially to the chair, Ray Miller, who tirelessly pushes the process onward, the latest version is now available on the SEAO Website.

Click on the publications tab and you can download word and excel files with the full guidelines, commentary, and tables. Meant as a guide in preparing the special inspection, testing and observation programs, these documents will give you guidance through the process.

Understanding Specifications for Glued-Laminated Timber - Part I

By Paul Gilham, PE, SE, Western Wood Structures

Specifications are included in most construction documents in order to communicate the standard of quality required for the project. In the Construction Specification Institute numbering, glued-laminated construction (glulam) is in division 06180. Several of the items included in glulam specifications are architectural while others are structural. What follows is a description of the specifications as they are commonly used in construction of new buildings. Material specifications generally include General Specifications, Product Specifications and Execution Specifications. Each section has a general explanation followed by an example.

General Specifications

1.Scope: The scope of the specification will include all of the requirements to be met by the contactor supplying and installing the glulam members. This section also delineates the design responsibility for the glulam construction. If the engineer of record (EOR) has designed all of the timber members, assemblies and connections, this may be as simple as instructions to supply members as shown on the plans. If the EOR requires the glulam supplier to design some or all of the glulam members and assemblies, the extent of the design responsibility will be described in this section. The scope may also include requirements for the supply of connecting steel and hardware. In complicated structures or assemblies, it is often advisable to have the glulam supplier include the design and/or supply of the steel connection assemblies. By doing so, the responsibility for fit and constructability rests with one entity thus eliminating the question of liability when conflicts between suppliers occur in the field.

Example:
"This section includes the design and supply of the structural glued laminated timber (glulam) on this project, complete with the design and supply of all glulam to glulam connecting steel and hardware. Design of glulam members and their connections shall be performed by a qualified engineer licensed in the state of Oregon."

2. Submittals: This section specifies requirements for the submittal of shop drawings and/or calculations. Shop drawings provide a means for the glulam supplier to request information that is either omitted from the contract documents or is unclear or conflicting. The answers to these requests can be written directly on the shop drawings and become a permanent record in the building contract documents. For the EOR, the shop drawings confirm that the supplier will provide the size, grade and shape of the members conforming to the structural drawings as well as fabrication for the connections.

If the glulam supplier is supplying calculations as part of his contract, the requirements for these are also included in this section. The qualifications of the person preparing the calculations usually include licensure as a professional and/or structural engineer. In some cases, a minimum experience in the type of work is required.

Often a representative sample of a glulam member is required. This sample will provide an indication of color variation, surfacing, distribution of growth characteristics such as knots, etc that will be supplied. The sample becomes a standard for the material delivered to the jobsite.

Example:
"Shop Drawings: Show layout of glulam system and full dimensions of each member. Indicate species, laminating combination, size and shop performed fabrication of each member.

Calculations: Provide structural calculations for each member and connection showing conformance to the design criteria signed and sealed by a professional engineer licensed in the state of Oregon

Samples: Submit a sample a minimum of 3 1/8" x 12" x 2'-0" showing the range of variation to be expected in appearance of the glulam timber."

3. Acceptable Manufacturers/ Suppliers: The specifier may wish to include minimum qualifications for the glulam manufacturer or material supplier. This may include a minimum time that the manufacturer has been in operation or successful involvement in similar projects. The specification can list known suppliers who meet the qualifications and the process to become approved if not listed.

Example:
"Glulam manufacturer shall be a firm with at least 5 years of continuous operation and be licensed by AITC or APA-EWS or approved."

Product Specifications

4. Manufacturing Standard: ANSI/AITC A190.1 is the current manufacturing standard for structural glued-laminated timber. This is the consensus document referenced in the building codes for glued laminated timber manufacturing. All glulam members should conform to this standard. The standard includes the requirements for manufacturing glulam materials including requirements for the laminating lumber and adhesives. The standard lists the allowable tolerances of the finished product for size, length, camber or straightness, and squareness of the cross section. The requirements for plant qualification testing, quality control testing, inspection, marking, and certificates of conformance are also included in this document.

The design standards used for glulam construction are the "Standard Specification for Structural Glued Laminated Timber of Softwood Species", AITC 117-2004 Design provided by AITC and the "Glulam Design Specification" provided by APA-EWS. These documents contain the allowable stresses for each species and combination grade. The design values listed are derived using the process contained in ASTM D3737, "Standard for Establishing Stresses for Structural Glued Laminated Timber"

Understanding Specifications for Glued-Laminated Timber - Part I

(continued from page 5)

Example:
"All glulam materials shall conform to the requirements of ANSI/AITC A190.1 and be stamped with an AITC quality mark or an APA-EWS trademark. Place stamps on surfaces that will not be exposed to view in the completed structure. Submit Certificates of Conformance indicating that the glulam members conform to the requirements of ANSI/AITC A190.1"

5. Lumber Species: Several wood species are contained in the glulam standards including Douglas fir, Hem-Fir, Southern Pine, Alaskan Yellow Cedar and Softwoods. However, just because a species is included in the standard, it does not mean it is readily available. Douglas fir is the predominate species in the Western United States and Southern Pine is used predominately in the East. Douglas fir should be specified on the west coast as it is the least expensive and easiest to obtain. However, if there are significant considerations such as a requirement for a naturally decay resistant species then a secondary species like Alaskan Yellow Cedar can be specified.

Example:
"Glulam members shall be manufactured from Douglas Fir laminating lumber."

6. Adhesives: Before 1970, the laminating industry used both waterproof adhesives and non-waterproof adhesives and designers specified which type of adhesive was most appropriate for the project. Today, all of the laminators use, and the ANSI standard requires, 100% waterproof adhesives. It is sufficient to require that adhesive conform to ASTM D2559. A few laminators offer clear adhesives that minimize the distinction between the laminations and cause the member to look more like a solid sawn timber.

Example:
"Adhesives used in the glulam manufacturing process shall conform to ASTM D2559 for wet use adhesives."

7. Stress Class or Combination: There are three ways that the design stresses of glulam members are specified. The first is called the **stress class**. This method is intended for specifying the required stresses for bending members. In this system the allowable stresses are designated by specifying the allowable bending stress and the modulus of elasticity. For example, 24F-1.8E applies to any layup combination that attains a 2400 psi bending stress and a 1.8×10^6 psi. modulus of elasticity. The stress class designation includes minimum design values for horizontal shear, axial tension and compression, compression perpendicular to grain and specific gravity. There are several species/layup combinations that meet this designation and the supplier is allowed to choose any of the combinations that meet the design values of the class. This method was developed to reduce the number of combinations a designer had to consider and give the supplier the ability to choose the least expensive combination available.

The second method of specifying the allowable stresses is to directly specify the **layup combination** desired. For example, a DF 24F-V4 is used to specify a Douglas fir member with a bending stress of 2400 psi. The V indicates that this is a visual grade as opposed to an E-rated grade, which uses an "E" in the second term. The number 4 simply refers to the fourth combination with a 2400 psi allowable bending stress. These combinations are shown in Table A1 of the AITC 117 specification and Table 1 of the APA-EWS document and table 5A of the National Design Specification Supplement. These tables are specifically for bending members with loads applied perpendicular to the wide face of the lamination. The combinations in these tables have up to five zones of laminations each with a different grade of laminations as shown in figure 1. The highest strength laminations are placed on the outside faces where the stresses are the greatest. Lower grade laminations are placed in the middle of the beam corresponding to the lower bending stresses. This method of laying up the bending members optimizes the resource since the higher grade members are less available and more expensive.

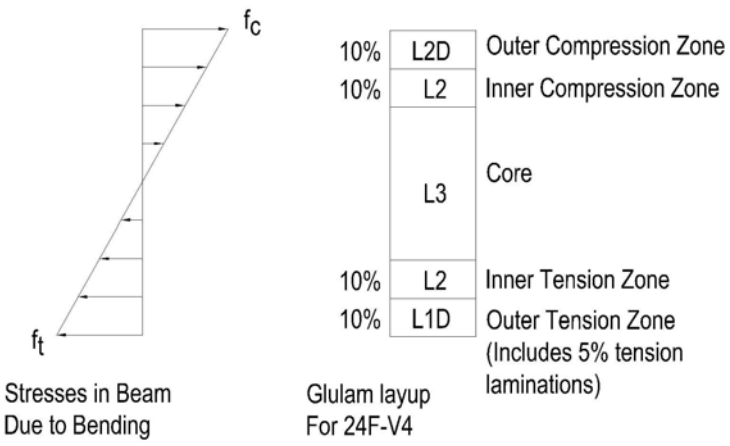

Figure 1. Lamination Layup for Bending Member.

In choosing bending members, it is important to distinguish between balanced and unbalanced layups. A balanced layup refers to a beam where the laminations are symmetrically placed so that the top of the beam has the same tensile strength as the bottom of the beam. This is required for beams with moments causing tension on the top of the beam such as cantilevers and continuous members.

Design values for members that are not stressed principally in bending are found in Tables A2, 2 and 5B in the AITC, APA and NDS documents respectively. With these members, a constant grade of lamination is used for the entire member. These combinations are used for columns, truss chords, and some arch members. In these loading conditions the stress in the members is nearly uniform and there is no advantage to providing stronger laminations in the outer zones. These combinations are also used for bending members with the loads applied parallel to the wide face.

Understanding Specifications for Glued-Laminated Timber - Part I

(continued from page 6)

The third method of specifying glulam grades is to list the **required allowable stresses** for the members. Typically the bending stress, shear stress, modulus of elasticity, compressive stress, tensile stress and compressive stress perpendicular to grain are specified. The supplier then has the freedom to choose any species/laminating grade that meets these requirements. Again this is done to permit the supplier to choose the least expensive combination available meeting the design requirements.

Example:
"Simply supported beams shall be combination symbol 24F-V4. Cantilever beams and those continuous over a support shall be 24F-V8. Glulam columns shall be combination 2. Truss chords shall be combination 3 with tension laminations on both faces and truss webs shall be combination 2."

8. Sizes: Standard sizes of glulam members are given in AITC 113, "Standard Dimensions for Structural Glued Laminated Timber." The widths of glulam members are based on the width of the laminating lumber with an allowance for surfacing. For example a 2x6 board has net dimensions of 1 ½" x 5 ½" inches. After surfacing, the net size of the glulam member made with 2x6 lumber is 5 1/8". Table 1 shows the standard widths of glulam members.

Table 1. Standard Widths for Glulam members.

Nominal Width	Western Species	Eastern Species
3	2-1/8 or 2-1/2	2-1/8 or 2-1/2
4	3-1/8	3 or 3-1/8
6	5-1/8	5 or 5-1/8
8	6-3/4	6- 3/4
10	8-3/4	8-1/2
12	10-3/4	10-1/2
14	12-1/4	12
16	14-1/4	14

Table 1. Standard Widths for Glulam Members.

The depth of the members is generally multiples of the lamination thickness used. Western Species members are made with 1-1/2" laminations and Eastern Species are made with 1-3/8" laminations. A member with 8 laminations will measure 12" and 11" for Western Species and Eastern Species respectively.

Non standard widths or depths can be made by planing a larger size to the desired size. This adds expense to the member.

Example:
"Sizes of glulam members shall be as shown on the drawings. The depth designated for shaped members refers to the depth at the bottom of the top shape. Add additional laminations as required to provide for depth of top shape."

9. FSC Certification: If the project has requirements for sustainability or green building, it is important to specify these requirements. More than half of the laminators in the United States and Canada are currently FSC certified. If the credit for a maximum 500 mile distance requirement from the plant to the jobsite is sought, this should also be specified.

Example:
"The glulam members on this project shall have an FSC certification for each member. Glulam members shall be manufactured at a plant located within 500 miles of the project site."

10. Camber and Curvature: One of the advantages of glulam construction over solid sawn timbers is the ability to add camber to glulam members to offset the deflections due to dead load and long term creep. Camber is defined as, "the small amount of curvature built into a glued laminated timber to offset anticipated deflection or to facilitate roof drainage." Stock beams typically use a 3500 ft. radius camber. This is adequate to keep most floor framing members from sagging under dead loads, but does not provide too much camber which makes it difficult to frame a flat floor. Camber can be specified in terms of the radius used, a percentage of the span length such as L/500 or in the case where the supplier is providing calculations, the camber can be specified as a multiple of the dead load deflection, such as 1.5 times D_{DL}. Camber is usually calculated as 1.5* D_{DL} to account for the immediate dead load deflection plus an allowance for long term creep. This provides for a relatively flat member after the building is completed. Cantilever beams are commonly cambered with a positive deflection in the main span and the cantilever end also cambered upward. When more pronounced curvature is desired, it is almost always described on the drawings by specifying the radius. It should be noted that the tolerances for straightness or camber apply to straight or slightly cambered members and are not applicable to curved members such as arches. There is a certain amount of "spring-back" when members are manufactured with a tight radius. The laminators attempt to account for this by over-bending the members to allow for spring-back. However the process is more of an art than a science. In most instances there is no disadvantage to having the shape of the member slightly off. However, if the curved glulam member needs to match the curve from another building element, the allowable tolerance in bending radius needs to be specified.

(part II next month)