



# SEAU NEWS

The Newsletter of the Structural Engineers Association of Utah

Volume X- Issue III November 2005

*This newsletter is a monthly publication of the Structural Engineers Association of Utah.*

*Articles or advertisements appearing herein may be submitted by anyone interested in expressing a viewpoint on structural engineering.*

*Articles for publication may be submitted to:*

*Richard Seelos, Editor  
(801) 486-3883*

*rseelos@reaveley.com*

*Advertisements for publication may be submitted to:*

*Jerod Johnson, Advertising  
(801) 486-3883*

*jjohnson@reaveley.com*



*Salt Lake Public Library  
see page 2.*

## IN THIS ISSUE

Message From The Board .....	p 1
Focus Article .....	p 2
Staff Article .....	p 4
Presidents Message.....	p-5
Bulletin Board.....	p 5

## NOVEMBER EVENT

### SEAU MEETING

**2005 NDS  
LRFD Wood Provisions**

November 17, 2005 5:30PM  
EMCB Room 101

Presented by

Paul W. McMullin

## MESSAGE FROM THE BOARD

### A Thought About Continuing Education



By Don Barfuss,  
SEAU Treasurer

Many of you, I am sure of, have heard the saying, “The more I know, the more I know I don’t know”. I am reminded of this saying after attending two SEAU sponsored seminars (one for \$75 and the other free – what a bargain).

The first was the AISC seminar for Seismic Braced Frames and the second was the SEAU October Thursday meeting entitled “Seismic Loads on Below Grade Structures”. Both of these seminars were very informative and will help me be a better engineer. Admittedly, I have come away with more questions sometimes, but they are better/more informed questions.

Many states, including Utah, require continuing education as a requirement for licensure. I hope this is not the driving force for attending seminars. We have a great responsibility as engineers. The Code of Ethics for the Structural Engineers Association of Utah is as follows:

1. Engineers shall hold paramount the safety of the public in the performance of their professional duties.

CONTINUED ON PAGE 3

## MEMBER FORUM

## FOCUS

*Salt Lake City and the greater Wasatch Front are growing into a major metropolitan region with many interesting buildings that define our historical, business and cultural qualities. SEAU NEWS will highlight some of our most interesting and important buildings over the next several months. (If you have a particular interest in a building you would like to see highlighted in this space, please contact the Newsletter Committee). This month the focus is on:*



## *Salt Lake City Public Library*

Article by Cameron Empey

**T**he Salt Lake City Public Library was designed and built in 2002. It serves as a complex designed to attract people of all social and economic levels to the downtown area. This complex has established a new city landmark and created an active gathering place with a focus on science, culture, and education.

The 230,000 square foot library complex was created as three separate elements, the main library, the administrative building, and the crescent wall. The main library is a triangular building in the center of the complex that houses the main stacks. This structure is a 5-story concrete moment frame with a steel framed roof top garden. The convex glass enclosure, referred to as the "lens wall", is mirrored on the southeast face by a curved concrete frame. The administrative building parallels the west face of the triangle. This structure is a concrete shear wall system with beams and suspended slabs. The last portion is the easily recognized 600-foot long crescent

wall. This wall slopes from one end to the other and leans into the main library. This creates a large open space between the crescent wall and the main library where community events are hosted. The crescent wall itself is home to reading galleries and serves as an ascending walkway to the roof gardens on top of the main library. Other features include a 350-seat auditorium, an expansive plaza complete with an amphitheater, a reflecting pond at the base of the lens wall, stepping fountains, future theaters, retail space and children's play area. All supported by a below grade two-story 660 stall parking structure.

The \$75 million facility more than doubled the capacity of the old library, established a new city landmark, and created an active gathering place with a focus on science, culture and education. The library is purposely situated to act as an extension of Washington Square, home of the historically significant City & County Building.

The design and construction of the library complex presented many interesting and challenging obstacles. The 60 foot high, 220 foot long glass "Lens Wall", which forms the southeast enclosure of the building, was especially challenging from a structural design and construction perspective. The structure supporting this glass wall, not only must resist high wind forces created by this extreme exposure, but also was required to disappear visually to not interfere with the magnificent views of the Wasatch Mountains. A system of vertical and horizontal pre-tensioned, high strength cables were attached to a grid of steel tube sections to create a sturdy and rigid structure to which the glass could be attached. The 220' long horizontal cables had to be installed with a tolerance of  $\pm 1/16$ " under a 48,000 lbs. pre-tensioned force at 70 °F to attain a straight and true wall. Thermal expansion / contraction is accounted for with a series of expansion joints in the horizontal frame members. The vertical and horizontal post-tensioned cables opposed one another to provide out of plane stiffness sufficient to meet the strict deflection requirements of this large glazing wall. Careful coordination was required between the engineer and the steel fabricator to ensure proper tension and length of the cables. Extensive computer modeling was used to determine accurate design forces to determine cable lengths. The leaning crescent wall also provided unique design challenges that forced a different approach. The structure is composed of steel moment frames that provide the lateral support for the 600-foot crescent

**FOCUS (cont.)**

wall along the curved sides while an aesthetically pleasing “Y” type braced frame system supports the radial direction for lateral forces as the structure leans. Unique cast-steel end caps interconnect the steel pipe braces with a single pin at each connection.



Another design challenge was the spiral staircases that cantilever into the spaces above the Urban Room and Children’s Library. Box-shaped stringers formed from curved steel plates welded together created the complex geometry of these custom designed stairways.

Special attention was placed on controlling the vibration characteristics to avoid a bouncy sensation.



The library incorporates a distinctive mix of many different structural systems to achieve this spectacular building. Each major component has an independent structural system interconnected by bridges and skylights to create the total facility. The bridges and skylights posed their own design dilemmas. Code required building separation between the different elements was 15”. Therefore each element connecting the different structures required a minimum of 30” movement. A series of Teflon bearing isolators were used to accommodate the drift.

**MESSAGE FROM THE BOARD (continued from page 1)**

2. Engineers shall perform services only in areas of their competence.
3. Engineers shall issue public statements only in an objective and truthful manner.
4. Engineers shall act in professional matters for each employer or client as faithful agents or trustees and shall avoid conflicts of interest.
5. Engineers shall build their professional reputation on the merit of their service and shall not compete unfairly with others.
6. Engineers shall act in such a manner as to uphold and enhance the honor, integrity and dignity of the structural engineering profession.
7. Engineers shall continue their professional development throughout their careers, and shall provide opportunities for the professional development of those engineers under their supervision.

Cannon numbers 1, 2, 6, & 7 supports continuing education. Serving on committees can support cannon number 7. I have learned a great deal from serving with others on the Seismic Committee. Questions are raised and viewpoints shared which broaden my understanding.

Continuing educations is for all engineers. Some may be just out of school and don’t know what they don’t know. Others may be in the middle of their careers and have a good understanding, but codes keep changing. Others yet may be nearing retirement and wonder why they need to change how they have designed in the past. All of this supports educating ourselves. We should be attending and encouraging other to attend. The cost is very minimal compared to \$600-800 seminars. DOPL funded seminars are \$50-\$100 and SEAU offers many free seminars on the third Thursday evening of many months.

## SIGNIFICANCE OF THE LIMITING SLENDERNESS PARAMETER by RICHARD SEELOS

We classify elements into groups depending on how we expect them to fail. These groups are Slender, Non-compact, Compact, and Seismic.

**Slender sections** will buckle prior to developing the yield stress of the element. The buckling expected would be elastic local buckling. Or in other words, if a slender column begins to buckle and the load is removed, the column would return to its original shape with our any permanent deformation.

**Non-compact sections** are capable of developing the yield stress in compression elements before local buckling occurs, but will not resist inelastic local buckling at the strain levels required for a fully plastic stress distribution (Where every fiber is at yield stress) The buckling expected would be inelastic buckling. Or in other words, if a non-compact column begins to buckle and the load is removed, the column would not return to its original shape because it would have experienced permanent deformation while it was buckling.

**Compact sections** are capable of developing a fully plastic stress distribution and possess a rotational capacity of approximately 3 times the rotation at initial yield before the onset of local buckling. The buckling expected would be inelastic buckling.

**Seismic sections** are capable of developing a fully plastic stress distribution and possess a rotational capacity of approximately 7 to 9 times the rotation at initial yield before the onset of local buckling. These sections are usually required in lateral elements where extreme yielding is expected. The buckling expected would be inelastic buckling. Note a seismic section is also considered a compact section.

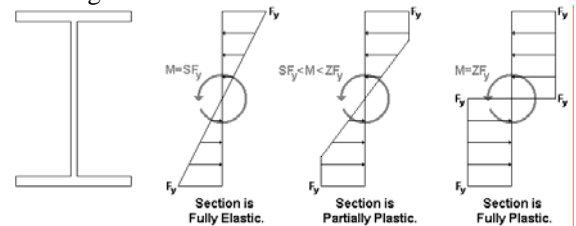
These sections can be differentiated by  $\lambda$  values. They are as follows:

**Slender**  $> \lambda_r \geq$  **Non-compact**  $> \lambda_p \geq$  **Compact**  $> \lambda_{ps} \geq$  **Seismic**

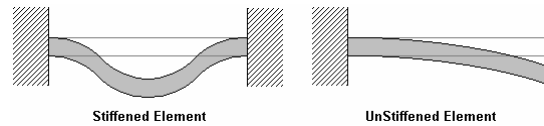
For columns we only care that we do not undergo local buckling in the elastic range. We know that if an element can reach yield stress without experiencing local buckling, that element will fail by yielding and local buckling is never a concern. Because of this fact, there is no definition for noncompact or compact sections for an element in pure compression. This is why there is no  $\lambda_p$  values in table B5.1 (specification for structural steel buildings) for elements in pure compression. In situations where the full plastic stress distribution is required, such as high-seismic applications for columns, then seismic section requirements would need to be met.

For elements in flexure the definitions of slender, noncompact, compact, or seismic sections become

more important. It helps to understand the stress distribution in the element at the time that local buckling occurs.



The first observation we can make is that we would have to worry about the compression flange (an unstiffened element) experiencing local buckling. We wouldn't expect the tension flange to experience local buckling. It is also interesting to note that the web (a stiffened element) is partially in compression and partially in tension. This goes a long way in explaining why the  $\lambda_r$  value is different for stiffened elements in flexure and stiffened elements in pure compression.



A section that is defined as slender will experience local buckling prior to developing a fully elastic stress distribution. A section that is defined as noncompact will be able to develop a fully elastic stress distribution but will experience local buckling prior to developing a fully plastic stress distribution.

A section that is defined as either compact or seismic will be able to develop a fully plastic stress distribution. Once the section has developed a fully plastic stress distribution, it is no longer able to take additional stress, but will rotate due to any additional load. This is referred to as a plastic hinge. Thus the difference between a compact section and a seismic section is no longer related to how much stress can be experienced prior to local buckling, but rather on how much rotation can be experienced prior to local buckling. A compact section will not buckle prior to reaching inelastic rotation 3 times as large as the rotation that would cause initial yielding (the rotation when it is fully elastic). A seismic section will not buckle prior to reaching inelastic rotation 7 to 9 times as large as the rotation that would cause initial yielding.

Thus  $\lambda$  is a simple value based on easily accessible properties ( $b$ ,  $h$ , and  $t$ ), that when compared to easily calculated values ( $\lambda_r$ ,  $\lambda_p$ , and  $\lambda_{ps}$ ), can quickly define the type of section (Slender, Non-compact, Compact, and Seismic) and the corresponding expected behavior the section would exhibit under maximum expected loading.

**PRESIDENTS MESSAGE – SUPPORTING SECB STRUCTURAL CERTIFICATION by JULIE OTT**

As you are aware, the State of Utah has a Structural Engineer title act. Over the years we have had many discussions over what this title act means and how it protects the welfare for the general public. The reality is that the title act protects the use of the title of Structural Engineer. However, there are no restrictions that protect the general public by placing limits on engineers designing structures.

Over the past few years there has been lengthy Board meetings, SEAU News articles, membership meetings (NCSEA May 2005), and SEAU representation at NCSEA meeting on moving from a title act to a practice act.

Currently SEAU is positioning to possibly receive significant backing from NCSEA towards moving from the current title act to a practice act. NCSEA would be supporting Utah with political and financial backing. Most importantly, NCSEA would be focusing efforts toward making Utah the model state for implementation of practice acts for other states in the US.

As we take steps towards the final goal – a State of Utah Structural Engineer Practice Act – we as a collective group must implement many new standards and continue to show our support and commitment. Many of the steps that need to be taken are in

progress, or completed, such as: Standard of Care Document – to set a minimum practice standard in the state, and Ethics and Standard of Practice Committee – to self-police.

Another key item that has to be addressed is that the implementation of a practice act cannot limit the ability of current practicing engineers to continue to practice in the field of structural engineering. Nutshell, a grandfathering provision must be used for current engineers. It is currently NCSEA and SEAU's intent to use the Structural Engineers Certification Board's (SECB) SE Certification for Utah's grandfathering provision. SECB will be grandfathering engineers currently working in the structural field with a SECB SE Certification thru 1215, which should allow ample time for SEAU to have the proper legislation in place.

See Jeff Miller's October 2005 SEAU News article for more information on SECB goals and commitments.

Securing the State of Utah Structural Engineer practice act will require our time and support. Please support your profession. Go to [www.secboard.org](http://www.secboard.org) download the forms, fill them out, and obtain your SE Certification.

**BULLETIN BOARD****SEAU – USSC DELEGATE REPORT FOR OCTOBER 2004 TO 2005 by BARRY WELLIVER**

The Utah Seismic Safety Commission (USSC) meets quarterly during the months of January, April, July and October. Meetings are typically held at the State Office building and last approximately three hours.

The commission is an advisory body charged with the following responsibilities:

- Review earthquake-related hazards and risks to the state of Utah and its inhabitants;
- Prepare recommendations to identify and mitigate these hazards and risks;
- Prioritize recommendations and present them to state and local government or other appropriate entities for adoption as policy or loss reduction strategies;
- Act as a source of information for individuals and groups concerned with earthquake safety and as a promoter of earthquake loss reduction measures;
- Prepare a strategic planning document to be presented to the State and Local Interim Committee before the 1995 annual general session of Legislature; and

- Periodically update the planning document and monitor progress toward achieving the goal of loss reduction.

Most of these tasks are ongoing concerns for the commission and during the period from October 2004 until the present the following programs and efforts have been made.

The commission issued a letter to the Superintendent of Schools reiterating its support of the 'Duck, Cover, and Hold' policy as the appropriate earthquake safety measure in Utah. This was to respond to conflicting information termed the 'Triangle of Life' which had cast doubt on the appropriate means to protect the public during earthquakes. The Federal Emergency Management Agency also eventually re-endorsed the 'Duck, Cover and Hold' strategy.

This past year we also focused on the problem of existing buildings within our state. The commission supported an initiative to address the most dangerous existing building type, unreinforced masonry buildings (urms), by establishing an ad-hoc

**SEAU – USSC DELEGATE REPORT (cont.)**

committee. The purpose of this committee is to study the problem and provide an on-going effort to help mitigate the problem. A resolution has been prepared defining the unreinforced masonry risk in our state and will be presented to Governor Huntsman and the Legislature during interim committee meetings in November. The resolution calls for an inventory of URM's to be compiled and recommendations put forth to help reduce and eventually eliminate the danger.

The USSC completed a series of user-friendly International Building Code seismic maps. These maps show the IBC spectral response acceleration information in better detail for Salt Lake, Weber, Davis and Utah Counties. It is intended to be a tool to better educate the design community and the public regarding the current earthquake hazard in our state. Future updates are planned to coincide with the most current USGS maps as well as for other counties within our state. These maps are available through links on the SEAU website or at <http://geology.utah.gov/utahgeo/hazards/eqfault/ibcshake/index.htm>

Lastly, the USSC received several awards at the Western States Seismic Policy Council (WSSPC website: <http://www.wsspc.org/>) annual meeting in Boise this past September. In the Response Plans/Materials category the Geosciences Standing Committee of USSC gathered an award for its publication "Utah Earthquake Ground-Shaking Maps: Which One Do I Use?" The commission also received a joint award with the Utah Division of Emergency Services for its Student Research Grant Program.

This coming year we will be busy with our URM Initiative and other efforts to address infrastructure improvements and the seismic safety of schools. The commissions website is at: <http://cem.utah.gov/ussc/>.

Thank you for the opportunity to represent SEAU on this commission. I welcome any comments or suggestions you may have to help support our mutual interests.

**SEAU – SEISMIC COMMITTEE by STEPHEN COHEN**

On October 4, 2005 the Seismic Committee gave a presentation in Richfield, Utah to the Utah Facilities, Operations and Maintenance Association (UFOMA). This organization consists of employees of K-12 public and private schools in the State of Utah who are responsible for the construction, maintenance, safety and facility management of school facilities.

The purpose of the seminar was to create/reconfirm (depending on the background of the individual) a need for seismic strengthening in existing K-12 school buildings. As the central point of this seminar the focus was on FEMA 395, *Incremental Seismic Rehabilitation of School Buildings, K-12*. Below is the outline that was followed for the seminar:

- Introduction (Stephen Cohen)
- History Behind Development of FEMA 395 (Randy Haslam)
- Critical Decisions for Earthquake Safety in Schools (Barry Welliver)
- Planning and Managing the Process for Earthquake Risk Reduction (Stephen Cohen)
- Tools for Implementing Incremental Seismic Rehabilitation (Justin Naser)
- Current Utah Laws Regarding Rehabilitation (Don Barfuss)
- Presentation by School Districts on past and current seismic issues and upgrading programs. (Jim Day,

Greg Smith, Randy Haslam)

- Roadblocks to Seismic Upgrades of K-12 Schools / Wrap-up (Barry Arnold)
- Open discussion with UFOMA members

Each of the above speakers was well versed in their topic and presented their information effectively.

From the presentation the following quotes were given to the group:

- Schools play a vital role in every community. They are the places where students learn and teachers teach, and they are used for social gatherings, theatre and sports. Schools are a measure of community well being.
- School buildings also play an important role in responding to and recovering from natural disasters. When a hurricane or flood is expected, schools can serve as emergency shelters and, as such, can be used to house, feed and care for the local population. After an earthquake, schools provide shelter for people whose homes were destroyed or damaged.
- Earthquake-threatened communities need earthquake-resistant schools. When schools are closed because of earthquake damage, education is hampered, community life disrupted, and emergency shelters unavailable.

**SEAU – SEISMIC COMMITTEE (cont.)**

- Where school attendance is compulsory, communities have a moral obligation to provide a safe study and work environment. But most importantly, earthquake-threatened communities need earthquake-resistant schools to protect their children and teachers.

The above quotes are from a conference held by OECD Programme On Educational Building And Geohazards International in Paris, France in February 2004 titled "Ad Hoc Experts' Group Meeting On Earthquake Safety In Schools."

The FEMA 395 document was well received. The concept of incremental seismic upgrades occurring during the maintenance of the school buildings was felt feasible by some of the school districts, however, many remain concerned because funding is tight. Some of the school districts, especially the small rural school districts have trouble getting the funding for re-roofs without considering a seismic upgrade occurring during the re-roofs.

In the concluding portions of the presentation we discussed with the group some opportunities that could be used to continue to encourage seismic safety in schools. Some suggestions were as follows:

- Have UFOMA form their own seismic committee

**PHOTO OF INTEREST**

This 'footing' is not actually a footing at all. It's a heavily reinforced pile cap with no less than 5 battered micropiles, each rated for a load of about 100 kips.

**CONGRATULATIONS TO ARW ENGINEERS**

We would like to congratulate ARW! Structural Engineer Magazine rated ARW the #3 Structural Engineering firm in the US to work for.

**SE REVIEW COURSE**

Send email to [seau@seau.org](mailto:seau@seau.org) if you are interested.

to interface with our seismic committee. Together we would develop strategies to push seismic safety in schools ahead. Randy Haslam volunteered to spearhead this task.

- Have either SEAU or FEMA give a presentation to the UFOMA group in their Spring Conference in 2006 on FEMA 154, Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook. While many of the larger school districts have already been through this inventory process, many school districts still need to create a basic inventory of the seismic vulnerability of their buildings.
- Work with the legislature to create funding for Incremental Seismic Rehabilitation of School Buildings. While this may be a pie in the sky dream, I personally feel very strongly that this is a direction that we need to head. Many school districts will not be able to move forward in reducing seismic hazards without outside funding.

With these goals in mind, our committee is in need of interested parties that will be willing to help us in these and other areas. Please call and volunteer your time and talents. We try and meet once a month during the lunch hour. Lunch is provided.

**SEAU MEMBERSHIP APPLICANTS**

The following individuals have submitted an application for approval by the SEAU membership committee for new members:

Chris Kimball – Professional

**CLASSIFIED**

ABS Consulting is seeking Engineers, all experience levels, for immediate deployment to the hurricane effected areas.

Assignments are a 3-4 month commitment with a rotation schedule of 4-5 weeks in the South and 1 week home. Candidates must be able to pass a FBI background check.

ABS Consulting is looking to temporarily rebadge engineers thru there current employers or hire individuals on a contract basis.

Contact Julie Ott at 801/333-7676, 801/870-4531 cell, or [jott@absconsulting.com](mailto:jott@absconsulting.com)

SEAU Presents:  
**2005 NDS**  
**LRFD WOOD PROVISIONS**

November 17, 2005  
5:30 PM  
Engineers & Mines Classroom Building  
EMCB Room 101  
University of Utah Campus

Presented by Paul W. McMullin

The presenter will discuss the new NDS which has combined ASD/LRFD wood provisions. The focus will be on the nuts and bolts of the LRFD provisions.

Members may want to access a summary article about the new NDS provisions located at <http://www.awc.org/pdf/WDF14-4-2005NDSarticle.pdf> to better understand the topic and prepare for the discussion.

**STRUCTURAL ENGINEERS ASSOCIATION OF UTAH**

P.O. Box 58628  
Salt Lake City, Utah 84158-0628  
[www.seau.org](http://www.seau.org)



**Board of Directors**

Julie Ott, *President*  
Jeff Miller, *Vice Pres./Pres. Elect*  
Barry Arnold, *Past President*  
Donald Barfuss, *Treasurer*  
Don Barker, *Secretary/Historian*  
Jake Watson, *Member of the Board/UEC Delegate*  
Mike Buehner, *Member of the Board/UEC Delegate Elect*

---