SEAU *NEWS*

The Newsletter of the Structural Engineers Association of Utah

Volume XII- Issue VI March 2008

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.

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The Elizabeth Stewart Treehouse Museum

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MARCH EVENT

SEAU MEETING
March 20, 2008
7:30 am – 5:00 pm
1230 WEB at the University of Utah

AISC Design Guides: Façade Attachments to Steel Frames & Steel Plate Shear Walls

Presented by
Gabriel A. Jimenez, Ph.D., P.E.
and Rafael Sabelli, S.E.

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MESSAGE FROM THE BOARD

DRIVING LEGISLATION

By Jeff Miller,
Past President

Over the past few months I have been able to observe from afar the efforts of our Structural Licensing and Legislative Committees in getting legislation passed to establish a structural engineering practice act for important buildings in Utah. Senate Bill 0200 has now passed both the Senate and the House, and awaits Governor Huntsman's signature. In the Senate the vote was near unanimous in favor and the vote was 44 to 24 in favor in the House. It looks like the Governor will sign the bill in a ceremony sometime during the week of March 25th. Once the bill is signed it will go in to effect on Jan. 1, 2009.

It is a real success story to get this legislation passed on our first attempt, and I want to express congratulations to the Structural Licensing and Legislative Committees who have shouldered almost all of the workload in this effort. Barry Arnold and Kelly Calder chair the Structural Licensing

CONTINUED ON PAGE 3

Opinions expressed in the SEAU Newsletter are not necessarily those of the Structural Engineers Association of Utah. Technical information contained herein shall not be used without independent verification by an engineer. Advertising rates and information sent upon request. Acceptance of advertising and informational brochures in the SEAU Newsletter does not constitute endorsement or approval by SEAU of the products or services advertised. SEAU reserves the right to refuse any advertising or editorial comment.

FOCUS

SEAU NEWS intends to highlight some of our most interesting and important buildings in Utah, highlight some of the local firms, and provide biographies of famous structural engineers.

If you have a particular interest in a building or person you would like to see highlighted in this space or want your firm highlighted in this section, please contact newsletter committee member Jerod Johnson at (801) 486-3883 or jjohnson@reaveley.com.

Elizabeth Stewart Treehouse Museum

By Troy M. Dye, PE

The Elizabeth Stewart Treehouse Museum is a 28,730 square foot two-story steel structure designed to create an interactive learning environment for children in the Ogden, Utah area. The lateral and gravity resisting systems consist of steel braced frames, steel floor beams, steel open web joists, steel columns, concrete floor slab on metal decking, and exterior metal stud walls creating an economical structure to allow financial resources to be used for the unique features of the building. Some of the unique features of this building are two tree-shaped steel columns supporting the entry roof framing and a 30 foot tall, eight foot diameter man-made tree located in the central atrium of the building. This man-made tree was designed to allow children the opportunity to climb through its trunk, explore exhibits on an activity balcony, and ascend through tree branches on a spiral staircase to the second floor of the building.

The two tree-shaped columns supporting the entry roof framing are a wonderful illustration of how structural elements can be used in an artistic manner to provide function and beauty. These columns consist of shaped steel plates fanning out from a centralized column to a tube steel frame supporting wood trusses. The columns set the tone for all visitors entering the museum.

TECHNICAL ARTICLE by JESSE MALAN

USGS SEISMIC HAZARD MAPS

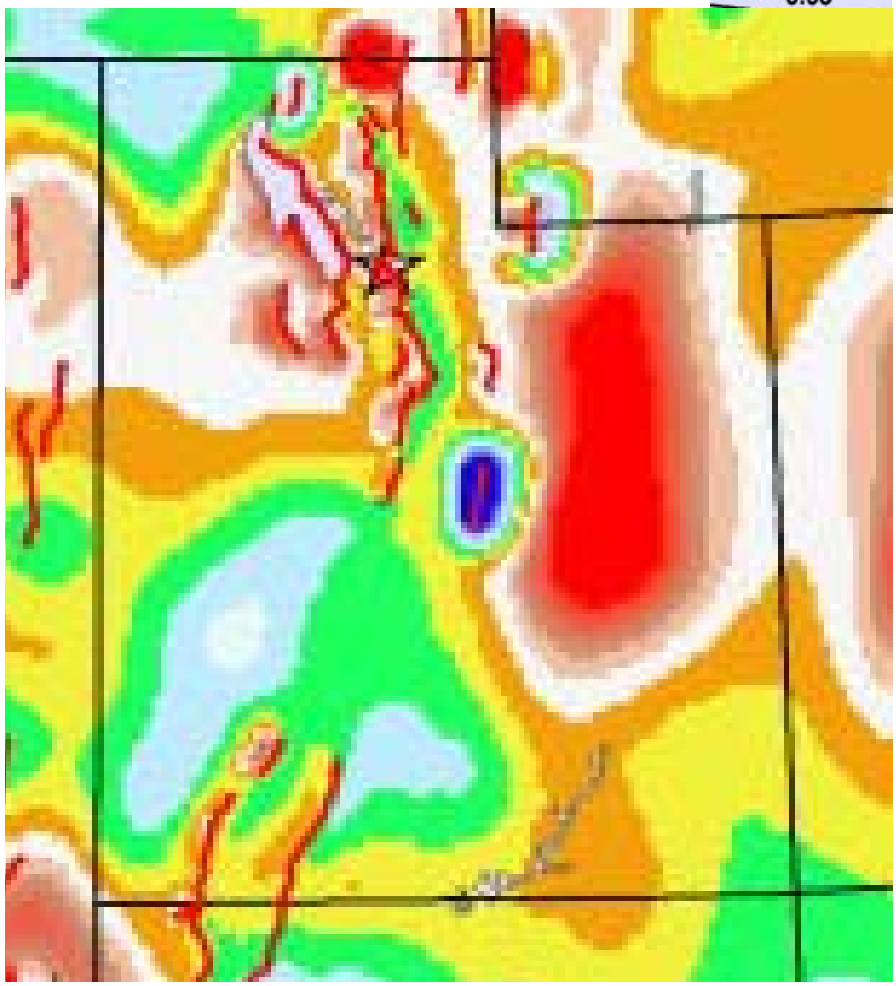
This month's article addresses the proposed changes to the U.S. Geological Survey (USGS) seismic hazard maps. It is prudent that we as engineers understand these changes and how they will affect the design of structures not just in Utah but across the country.

In 2007, during the months of June and July, the National Seismic Hazard Mapping Project (NSHMP) released preliminary information and updates to the national seismic hazard maps for public review and comment. Only the maps for 2% and 10% probability of exceedance in 50 years for 0.2 and 1.0 seconds have been provided with the others soon to follow. It may be beneficial for engineers to take note of these changes and communicate them to their clients and project owners. For example, if a project is scheduled for completion in a few years, or the building is an essential facility, or other important buildings it may be a beneficial to design the building using the updated values from the NSHMP maps. These changes began in 2005 as a result of regional workshops and changes made to attenuation models. It may be only a few short years before these changes are adopted by standard building codes as long as NSHMP deadlines are met. The path to making these new maps appear in the codes begins with their inclusion in the 2008 National Earthquake Hazards Reduction Program (NEHRP) Provisions. Once this occurs they must then be adopted by American Society of Civil Engineers (ASCE) 7-10. The changes to the seismic maps, or rather ASCE 7-10, will then be included as code by the International Building Code (IBC) 2012.

Some engineers have incorrectly assumed that all the required soil data necessary to make these maps has already been gathered. Furthermore, some may say "has the soil change since the last code cycle?" In other words, why do these maps have to be changed so often? The USGS gives the following explanation. "The draft 2007 maps update the 2002 hazard maps by Frankel and others (2002), and build on previous seismic hazard models developed by the USGS over the past 30 years by Algermissen and Perkins (1976), Algermissen and others (1990), and Frankel and others (1996). USGS probabilistic seismic hazard maps and the related design maps (MCE maps) are revised about every six years to ensure compatibility with new earthquake science that is either published or thoroughly reviewed, and to keep pace with regular updates of the building code." According to them, new earthquake science means: information on slip rates across faults, paleoseismic data from fault trenching studies, earthquake catalogs, and strong motion recordings from global earthquakes.

The maps are developed for peak horizontal ground acceleration or spectral accelerations with 2%, 5%, or 10% probability of being exceeded in 50 years on uniform firm-rock site conditions (Vs30 = 760 m/s).

Figure 1 is the map of a 2% probability of exceedance in 50 years for Sa of 0.2 sec. The values shown are a ratio of the new 2007 data over the 2002 data.



TECHNICAL ARTICLE by JESSE MALAN

To obtain these maps, use the following URL: http://earthquake.usgs.gov/research/hazmaps/products_data/2007/maps/wus/index.php.

The USGS comments on the maps; "The draft 2007 hazard maps are significantly different from the 2002 maps in som

e areas of the United States. The new maps generally show decreases of about 10% across much of the central and eastern US for 0.2-s and 1.0-s spectral acceleration and peak horizontal ground acceleration for 2% probability of exceedance in 50 years (the hazard level currently applied in building codes). The new maps for the western US show 10-% to 20-% changes for 0.2-s spectral acceleration and peak horizontal ground acceleration, but much larger changes (±30%) for 1.0-s spectral acceleration at similar hazard levels. Most of the changes at 1.0-s can be attributed to changes in the attenuation relations for crustal and subduction earthquakes."

Specifically to our state and surrounding region, the Intermountain West, the USGS lists the following changes to the national seismic hazard maps.

A. Intermountain West

Revise catalog and account for magnitude round off and uncertainty

Revise crustal fault parameters (e.g., faults near Reno)

Add new crustal faults (e.g., Tahoe)

Modify fault dip for normal faults from 60 to 50 degrees

Modify Wasatch fault model –10% of moment applied to floating rupture

Revise shear zones (geometry and rates) based on new GPS strain data

In conclusion, these maps incorporate significant amounts of new information on ground motions and sources. For more information, see: The Utah Geological Survey website http://geology.utah.gov/ghp/workgroups/index.htm, US Geological Survey website http://earthquake.usgs.gov/research/hazmaps/products_data/2007/.

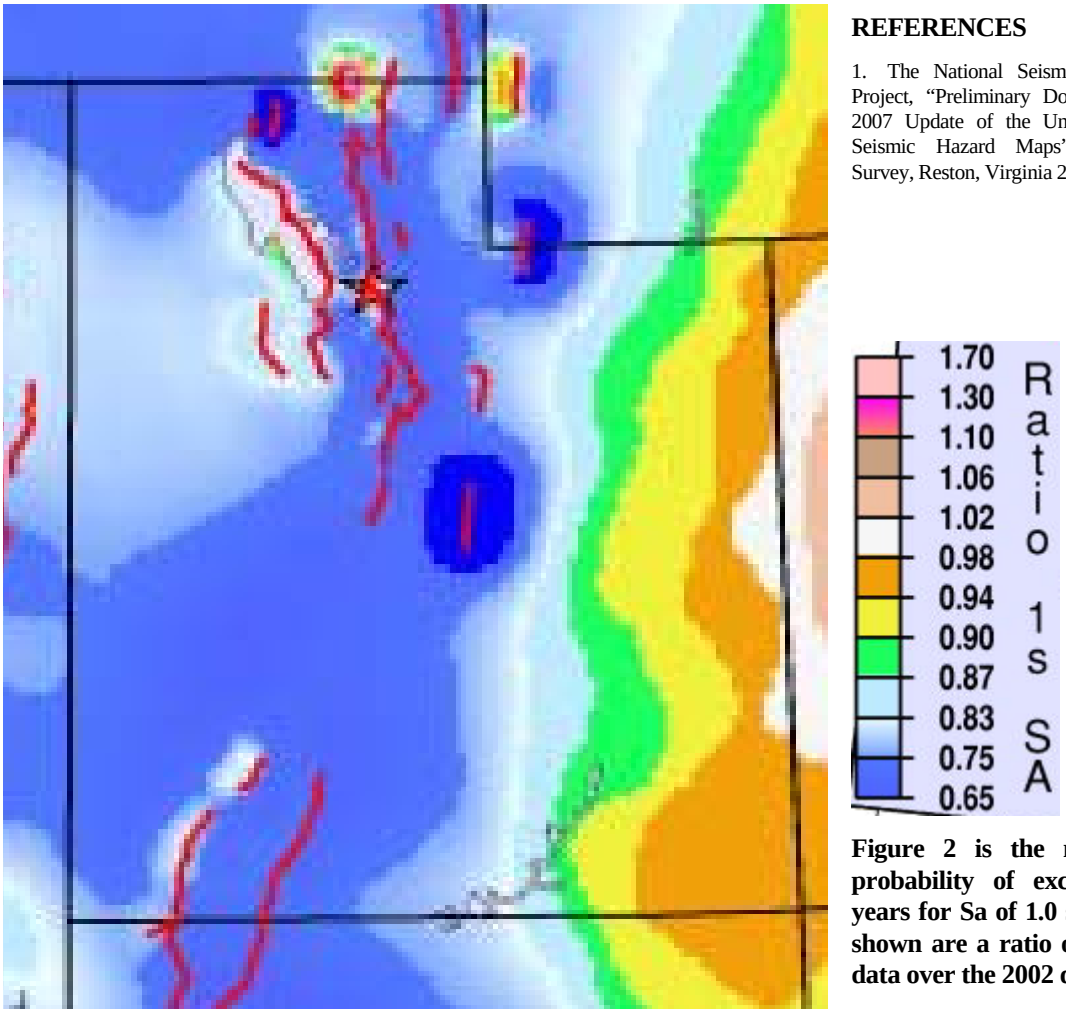


Figure 2 is the map of a 2% probability of exceedance in 50 years for Sa of 1.0 sec. The values shown are a ratio of the new 2007 data over the 2002 data.

REFERENCES

1. The National Seismic Hazard Mapping Project, "Preliminary Documentation for the 2007 Update of the United States National Seismic Hazard Maps", U.S. Geological Survey, Reston, Virginia 2007

FOCUS ARTICLE (cont.)

With normal use, the loads on the man-made tree produce stress reversals in the balcony and spiral staircase connections. These stress reversals cause fatigue loading and could lead to connection failure over time. The welds were sized to prevent this cyclic fatigue failure from occurring over the next 100 years.

As architects continue to provide creative building concepts, the engineering profession is challenged to provide safe and economical solutions. This project is a great representation of how structural engineering canprovide creative and economical solutions to artistic architectural concepts. Through the use of creative structural ideas, architectural concepts, and masterfully fabricated systems the cost of this man-made tree was hundreds of thousands of dollars less than bids provided by specialized man-made tree fabricators from California. Cost saving alternatives was very important to the Treehouse Museum Board of Directors since the funding for this project was wholly based on fund raising efforts and private donations.

Whenever a building is designed to provide educational opportunities for children, there are large social impacts. This structure is the first to be designed and built on the old downtown Ogden mall site. As part of the downtown Ogden redevelopment project, this structure plays a major role in revitalizing the culture of downtown and provides a safe haven for growing minds. This building is intended to be a permanent fixture in the Ogden community.

MESSAGE FROM THE BOARD (continued from page 1)

Committee and John Coffey chairs the Legislative Committee. They, along with their committee members, deserve our appreciation and thanks.

Going in to this effort, I have to admit that I felt it would take at least two attempts to get this legislation passed, if not more. To be able to draft the bill, find a sponsor for the bill, and get it passed by the legislature on the first attempt was a pleasant surprise for me, and a tribute to those who worked on the entire process. We received valuable support from national groups such as NCSEA and ASCE. The local chapter of AIA also gave their support which helped get the bill passed.

Thanks to all of you, who wrote or e-mailed legislators encouraging them to vote in favor of the bill. The days when the legislature was considering the bill were an interesting time. I looked forward to receiving frequent e-mal updates from Barry Arnold, and want to thank him for keeping all of us updated on developments in the legislature. I'm sure I don't nearly understand all of the time Barry dedicated to working with legislators, tracking the progress of the bill, and keeping us updated on the latest developments. He deserves special thanks for this effort. I know his e-mails prompted many of the engineers in our office (myself included) to write to their legislators and other legislators in support of the bill. I doubt the support would have been nearly as strong without his encouragement. Great job Barry!!

The end result of this is an important step in increasing the safety of the general public in Utah. The bill did not do all that some people wanted, or went beyond what others may have wished. From my observations, it was crafted and adapted so it could achieve the most important objectives while being successfully passed by .the legislature. It lays a great foundation that can be built on or improved in the future if further measures are deemed appropriate. I suppose we could have proposed stricter legislation at the risk of not getting the bill passed. This could have been like so much other

MESSAGE FROM THE BOARD (cont.)

national or state legislation where there are two opposing sides that are unwilling to negotiate some middle ground on an important issue, and the end result is that nothing happens at all. The status quo remains and no progress at all is made. I'm sure that in some cases an argument can be made that the status quo is better than the alternative, but in the case of this legislation, I would argue that the bill that was passed was a whole lot better than nothing at all.

Not too long ago, I ran in to Barry Arnold after a meeting and we were discussing the progress of the bill. Barry filled me in on what was happening and made what I thought was a great analogy to the graduated driver's license system that the state has adopted. A more advanced license is required to perform a more demanding or complex task. This struck a chord with me and hit the nail right on the head. I have a daughter who celebrated (and I mean celebrated) her 16th birthday a couple of weeks ago. About a year ago she was able to get a learner's permit that allowed her to drive with an adult family member supervising her in the car. Early in this period, I really questioned the wisdom of this piece of legislation. I guess they figure that it's your kid so you get to take the risk. I also came to appreciate the fact that driver education instructors are severely underpaid.

When I took driver education classes the passenger side of the car was equipped with a brake pedal for the instructor. I don't know about your car, but ours didn't come with this option although someone in Detroit (or Tokyo) should give this some serious thought. There were a few white knuckle moments, and I think I probably bent the floor on the passenger side of the car by pushing down so hard hoping I had a brake pedal. After a few months on surface streets, I had the choice experience of going with her to drive on the freeway for the first time. We did it on a Saturday morning when traffic was pretty light. What a rush!!

Over the course of the year she gained more experience and eventually became a pretty good driver, even though she didn't have her driver's license yet. Right after school on her birthday my wife took her to get her license. I admit it. We couldn't stand the pressure and we caved. She had to pass both a written exam and a driving test to demonstrate competence before they would issue the license. I have to give credit where it is due; she was nearly perfect on both tests. It's probably safe to say the success on the driving test was largely a result of experience gained during the period of her learner's permit. I guess our experience as potential crash test dummies paid off in the long run. I also had to call my insurance agent that day. Another experience I won't soon forget. The bills will be a frequent reminder.

For the next six month period she has limits on how much she can drive with friends and other non-family members in the car. This has been a source of great consternation to her, but of some comfort to us as her parents. I keep telling her the law is the law, and she'll just have to deal with it. I can blame this situation on someone else, but still have to take the heat. In six months we have another milestone to look forward to, but it will be a time for her gain more experience and improve her driving skills. In her case, I'm guessing this step will be her last, but if she decides she wants to drive a commercial vehicle, she'll need to pass another more rigorous test and demonstrate she won't put the public at too much risk.

All this dovetails pretty well with the process we as engineers go through to become licensed first as a P.E. and then if we desire and have the expertise, an S.E. I'll leave it up to you to make the comparison of the different steps of a driver's license. In the end, a higher level of competence and expertise needs to be demonstrated to perform more difficult and complex tasks. The legislation will soon be there to provide an increased level of protection for the general public. Sure it could do more, but let's leave that discussion for another day. We still need to remember to be ethical in practicing only in those areas where we are experienced and qualified. We need to stay current with the latest engineering practice and continue our education. Our foremost responsibility is the safety of the public. SEAU as a whole, and all those who worked hard to get this legislation passed, have achieved a great success. Thanks again to all of those who worked on this effort.

One last note: As my time on the SEAU board nears its end, I want to thank all of those I have worked with over the past three years. Thanks to all of the committee chairs, committee members, and all those who work toward the success of SEAU. It's been a great experience.

SEAU MEMBERSHIP APPLICANT

The following individuals have submitted applications to the SEAU membership committee for new members:

No new applications.

SEAU NEWS SUBMITTAL DEADLINE

April SEAU News deadline is **March 27th**.

We expect updates from the following:

Board Member – Jr. Board Member
BSSC Representative
Seismic Committee
Proffesional Practice and Ethics Committee

BULLETIN BOARD

SEAU – SEER COMMITTEE by BLAKE HOSKISSON

The Emergency Response Committee has been very active as of late. As I write this blurb, several volunteers are mobilized in Wells Nevada performing ATC-20 post-earthquake evaluations. The city has expressed it's appreciation for SEAU's efforts. If you are interested in being a volunteer or attending our tentatively planned May ATC-20 training in Ogden, please send me an email: bhoskisson@dbswest.com.

The other task we have recently undertaken is investigating the possibility of a program similar to San Francisco's 'BORP' (Building Occupancy Resumption Program). BORP is a collaborative effort between building owners, the building department, the local mSEA, AIA, and BOMA. BORP allows building owners to precertify private post-earthquake inspection of their buildings without waiting for the building department or the volunteers it summons following an earthquake. This benefits the owner by allowing a quicker occupancy. It benefits the building department by reducing the quantity of evaluations it has to perform following an event. For more detailed information, see San Francisco's web site: www.sfgov.org.

If you are looking for a nice refresher course on ATC-20, see the following link: http://ccelearn.csus.edu/oes/

The Urban Search and Rescue that responded to Katrina and 911 is looking for licensed engineers to volunteer as a Structural Specialist on their rescue teams. They are a national FEMA sponsored team and respond only when required. They will require half-day trainings once or twice a month and a one week training in the fall. You are not compensated for this training time; however, you and your employer will be compensated if you are deployed. For information you can call or email Robert Conder at 801-597-4860 or robertconder@gmail.com. You can find other information about this at www.uttf1.com and www.utahtaskforce1.org.

Finally, we would like to offer a $50 discount on the SEER kit for anyone who has completed the ATC-20 training. Please see the following link for the kit: www.beehivepreparedness.com

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Dean L. Webb & Associates, a Consulting Structural Engineering Firm in Utah is seeking a Licensed Structural Engineer with at least 6-years experience and a desire to be part of an established firm specializing in design, analysis, and detailing of structures.

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Attn: Dean L. Webb
Fax: (801) 576-6424
Phone: (801) 576-6414
Email: dlwebbeng@digis.net

UPCOMING EVENTS

March 20, 2008

SEAU Membership Meeting: **AISC Design Guides: Façade Attachments to Steel Frames & Steel Plate Shear Walls** presented by Gabriel A. Jimenez, Ph.D., P.E. and Rafael Sabelli, S.E. An AISC Seminar sponsored by the University of Utah Civil and Enviromental Engineering Department, SEAU, and the Division of Occupational and Professional Licensing Meeting at 5:30 PM University of Utah, WEB 103 (formerly the EMCB)

Registration is limited to 90 people. Cost: $120 general. $60 student. See seau.org for more information.

End of March 2008

It is expected that Governer John Huntsman will sign SB0200, the SE Practice Bill, into law .during this time. If you would like to be present for the signing please contact the Structural Licensing Committee so that you can be notified when a final date has been set. We thank everyone for supporting this bill.

Structural Licensing Committee Heads:

Kelly Calder (801) 328-2726

Barry Arnold (801) 782-6008

UPCOMING EVENTS

March 26, 2008

New research being conducted at the Network for Earthquake Engineering Research on bridge systems offers a more accurate picture of how well current design codes stand up to significant earthquakes.

University of Nevada, Reno Professor Mehdi "Saiid" Saiidi and Michael Keever of the California Department of Transportation will host a free 90 minute online webinar will outline this new research and its practical implications. To participate, you must preregister at www.nees.org.

This session is co-sponsored by the Network for Earthquake Engineering Simulation (NEES) and the Earthquake Engineering Research Institute (EERI).

June 18, 2008

Associated General Contractors & the University of Utah Student Chapter of the American Society of Civil Engineers present the Swing Into Summer Golf Tournament

Sposorships are available. All Proceeds benefit the University of Utah AGC and ASCE student chapters

Contact Richard Franz, 801 694 2783 or rjf_r4v3n@yahoo.com, or Amanda Gilliland, 801 336 7544 or mandagilliland@gmail.com, for registariton or sponsor information.

See additional information on this Tournament below with more information (including sponsorship information) is available on seau.org.

GOLF TOURNAMENT INFORMATION

Associated General Contractors & American Society of Civil Engineers
Present

Swing Into Summer

Golf Tournament

Course: Thanksgiving Point, Lehi Utah

Date: Wednesday, June 18, 2008

Cost: $100 per person or $300 per foursome
Price includes golf, cart rental, and buffet dinner

This year's tournament will be a **four man scramble.** Individual golfers may create their own foursomes, or singles will be placed in foursomes by the tournament committee.

All Proceeds benefit the University of Utah AGC and ASCE student chapters

MEMBER COMMENTARY

It is my understanding that the Seismic Committee and the Codes Committee for the Structural Engineers Association of Utah has been discussing and debating whether in moderate to high seismic areas if concrete tilt-up panels need to be tied directly or indirectly to the footings (See SEAU Newsletters dated February 2007, March 2007,and October 2007). I have read several articles (Tilt-up Building Seismic Design by Joe Stenbicker and Jon Lawson in the January 2008 Structure magazine and also the TCA Position Draft Paper dated September 10, 2007) which indicate that the concrete tilt-up walls do not need to be tied to the footings if there is no design uplift force calculated. I have also many articles and opinions (SEAOC Seismology Committee's Position Statement and an article in the Structure Magazine dated October 2003, titled Tilt-up Seismic Design) that indicate there should be a direct or indirect attachment to the footings in moderate to high seismic regions.

The Tilt-up Building Seismic Design article in the 2008 Structure magazine and TCA's draft paper each say the following:

"Many tilt-up panels, due to their large size and relatively low force levels, are stable as individual elements and do not require panel-to-panel connections to resist overturning (tension) forces due to earthquake forces Thus, tie down connections to the footings are not required since no design tension force is calculated."

MEMBER COMMENTARY (cont)

In the June 2003 Structure magazine there was a Guest Column tilted "Tilt-up Seismic Design". In the last paragraph it states the following:

"Tilt-Up buildings are very effective at resisting lateral loads from wind and earthquakes. The design for seismic loads is no more complex than designing for wind loads; there are just additional requirements to consider."

When I read these above statements, I always ask myself what seismic design loads should be used in determining the overturning forces on the tilt-up panels? It must be remembered that depending on the "R" value (Response Modification Coefficient) used, the actual earthquake forces could be as much as 4 times greater than the seismic design forces.

I disagree with the statement that seismic loads are no more complex than wind loads. Every time there is a major earthquake in California, codes are revised to account for our lack of understanding.

When determining earthquake design forces, the Maximum Considered Earthquake, after being modified by a soil site class factor, is multiplied by 2/3. The commentary to "NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures" says

"The collective opinion of the Seismic Design Procedure Group was that the seismic margin contained in the Provisions provides, as a minimum, a margin of about 1.5 times the design earthquake forces. In other words, if a structure experiences a level of ground motion 1.5 times the design level, the structure should have low likelihood of collapse."

The commentary also says:

"The design ground motions are based on a lower bound estimate of the margin against collapse inherent in structures designed to the Provisions. This lower bound was judged, based on experience, to be about a factor of 1.5 in ground motion. Consequently, the design earthquake ground motion was selected at a ground shaking level that is 1/1.5 (2/3) of the maximum considered earthquake ground motion.

My understanding from the above statements is that there is an inherent 1.5 safety factor in the material and connections against collapse. It could be assumed that if there is no connection, there is no safety factor.

The other thing to remember is that the Design Earthquake forces are divided by "R" (Response Modification Coefficient). I consider this "R" value to be a ductility factor. The more ductile a building is or the more able the lateral resisting elements (including connections) are able to absorb energy without breaking, the larger the "R" value. For an ordinary plain concrete shear wall, R = 1.5; for an intermediate concrete shear wall, R = 4; and for a special concrete shear wall, R= 5. The seismic design forces for a special concrete shear wall (assuming the same Design Earthquake) are 30% of an ordinary plain concrete shear wall. Keep in mind, an earthquake does not care what R value has been used in the design of a building. If two buildings sitting next to each other are the same except that they have been designed with different "R" values are hit by an earthquake, they will hit the same force. However, the building designed with the higher R value will be better able to absorb these forces without damage.

Now back to the question of what seismic design loads should be used in determining the overturning forces on tilt-up panels, if the desire is not to create ductile tension ties or no ties at all to the footings. In the case of a special reinforced concrete tilt-up shear wall, should the design forces be multiply by 5/1.5 = 3.33 in order to account for no ductility? Also, should the factor of 3.33 in turn be multiplied by 1.5 since there is not an inherit safety factor of 1.5 in the connection as assumed by NEHRP?

Intermediate and special reinforced concrete tilt-up panels should meet the requirements of ACI section 21.8 and 21.13. I am not sure if TCA's interpretation of the word "or" in ACI section 21.13.2 is correct as defined in the TCA Position Draft Paper dated September 10, 2007 and the article in the January 2008 Structure magazine titled Tilt-up Building Seismic Design by Joe Stenbicker and Jon Lawson. TCA's interpretation is that "or" in this case means no connection between panels and footings are required to resist uplift forces if there are no calculated forces. If TCA's interpretation is correct, what force then should be used in determining uplift since not ductility is being provided?

As a side note, does section 1604.8 and 1604.9 in 2006 International Building Code apply to all walls but not to concrete tilt-ups? Also does ACI 14.2.6 and 14.2.8 apply to slender wall design found ACI 14.8?

Don Barker S.E.
BHB Consulting Engineers PC

SEAU Presents:

Façade Attachments to Steel Frames & Steel Plate Shear Walls

February 21, 2008
7:30 AM to 5:00 PM
WEB 1230 at the University of Utah

Presented by
Gabriel A. Jimenez, Ph.D., P.E. and Rafael Sabelli, S.E.

The AISC Design Guide on façade attachments provides clear explanations of façade system fundamentals, highlights building performance issues that impact attachment design, and includes practical design examples.This short course will provide an overview of what is in the guide, highlight the key recommendations, and present many of the numerous figures and numerical examples in the guide.

This short course introduces engineers to steel plate shear walls, a new system for resisting lateral forces. The course also covers the additional detailing, proportioning, and design requirements necessary for use of steel plate shear walls as a seismic system with R > 3.

The course handouts include a copy of the Seminar Course Notes, a copy of AISC Design Guide 22: Façade Attachments to Steel- Framed Buildings, and a copy of AISC Design Guide 20: Steel Plate Shear Walls.

Registration is limited to 90 people. Cost: $120 general. $60 student. See seau.org for more information.

STRUCTURAL ENGINEERS ASSOCIATION OF UTAH

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