SEAU *NEWS*

The Newsletter of the Structural Engineers Association of Utah

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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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Utah State Capitol Building

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JANUARY EVENT

SEAU MEETING

January 17, 2008
5:30 pm
103 WEB at the University of Utah
(Formally the EMCB)

Quality Assurance Plans
for Steel Construction

Presented by
Bill Komlos

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MESSAGE FROM THE BOARD

2008 EVENTS

By Shaun Packer,
Board Member

Happy New Year. 2008 is now upon us after 2007 has flown by. One thing that our professionally licensed members need to consider is whether we need some additional continuing education units for next year's license renewal. I imagine that the majority of us do, and what better way to get those units than to attend some seminars? SEAU is currently planning three quality seminars in the next six months. One currently planned seminar reviews the 2006 International Existing Building Code or IEBC. This code covers the repair, alteration, addition and change of occupancy for existing buildings, while achieving appropriate levels of safety without requiring full compliance with the 2006 IBC for new construction. Keep in mind that if there is a significant change in occupancy, the existing building will need to be brought up to IBC code loading requirements. In many cases, this is not easily accomplished.

I would also like to announce SEAU's nominations for Utah

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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.

Utah State Capitol

January 4, 2008 marked the culmination of a massive undertaking at the Utah State Capitol to seismically base isolate and renovate the 90+ year-old statehouse. For nearly 10 years architects, engineers and contractors have worked to install 265 isolators below the building and to stiffen the superstructure in an effort to improve expected seismic performance.

Early studies painted a grim picture of expected seismic performance for the Capitol. Not only was it designed and built at a time when earthquake resistant design was virtually non-existent, it was built very near the Warm Springs trace of the Wasatch Fault. These issues compounded lead engineers to characterize the building as extremely vulnerable with an elevated threat to life in addition to a high likelihood for loss of the building as a whole.

Intensive studies early in the process not only pointed to seismic base isolation as the most economically feasible solution, it was the solution most amenable to the historic character of the building. By reducing the seismic impact, overall forces were brought to magnitude readily handled by the limited amount of new shear walls introduced in the building. This also meant a far less rigorous seismic treatment of nonstructural elements and components, including massive stone ornamentation, to address life safety concerns. With base isolation, the issues of life safety and historic preservation were satisfied while not compromising the historic character and layout of the building.

As a primary solution, seismic base isolation has the effect of significantly lengthening the fundamental period of the building to approximately 3.0 seconds. When including the effects of cladding stiffness on the building, the original period was approximately 0.60 seconds. The results of which place the spectral response of the building at the peak of both the typical ASCE 7 seismic design spectrum and the site specific spectra developed for the project. The increase to 3.0 seconds places the building at a spectral acceleration ordinate less than one fifth of its fixed base condition. What does this mean? Overall seismic accelerations on the structure are reduced by roughly 80 percent for a large quake thereby reducing forces on the entire structure and all of its nonstructural elements and components.

How were the isolators installed? The process of isolator installation began with an intensive collaborative effort on behalf of the design engineers and the contractor, the results of which enabled complete installation of the isolation system while not moving the building above so much as 1/16 an inch. Due to the sensitive nature of many assemblies above engineers prescribed this limit to prevent damage to the building while loads were temporarily transferred for isolator installation. Temporary load transfer was accomplished by providing a two-way system of new concrete beams, each measuring 5 feet wide and 2.5' high. These beams encapsulated and engaged existing structural columns by shear friction (after preparation of existing column surfaces). In between the columns a deep foundation system of micro-piles was used as the jacking point for temporary load transfer. As jacks were placed between the micro-piles and the load transfer beams, they were inflated just to the point that loads were transferred, but not so much as to lift the building. At this point, line saws were used to cut the

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TECHNICAL ARTICLE by COREY PRICE

VAPOR RETARDERS & BARRIERS UNDER CONCRETE SLABS ON GRADE

Recently, engineers have seen a marked increase in the specification and use of vapor retarders or barriers under concrete slabs on grade. The intent of this technical article is to help explain why and where vapor retarders are needed and some of the technical and construction aspects of vapor retarders. The article is not meant to be an all-encompassing venue for designing and dealing with vapor retarders or barriers. Information for the article was taken from Peter Craig's article entitled "Vapor Barriers: Nuisance or Necessity?" from the March 2004 publication of Concrete Construction as well as information on vapor barrier manufacturer's websites and ACI guidelines.

Why specify or use vapor retarders or barrier? It seems that most manufacturers of flooring products and adhesives are using more environmentally responsible low VOC (volatile organic compound) adhesives and denser floor coverings. Concrete is permeable, and water from hydration, groundwater conditions, and/or excessively wet subsurface conditions will move through the concrete by capillary action or by becoming a vapor and seeking equilibrium via diffusion. Water/vapor transmission from concrete hydration and ground conditions, the highly alkaline nature of concrete and low VOC adhesives can result in the breakdown of adhesives and/or floor coverings, causing delaminations, blistering, and subsequent failure of the floor coverings. To make matters worse, many of the floor coverings used today, such as rubber, vinyl, urethane, epoxy, etc. are very impermeable, trapping moisture in the concrete and contributing to the alkaline conditions. Water and water vapor transmission through and from concrete is one of the contributing factors that can be controlled using an impermeable barrier, whereas concrete itself is naturally alkaline and not as easily controlled.

In addition to floor covering issues, moisture trapped beneath floor coverings can result in mold, mildew, etc. Mold and mildew growth using organic food sources from the flooring and their release of spores can be detrimental to air quality within a building.

Slabs on metal deck are also under increased scrutiny since non-vented metal deck is generally used, which can be impermeable in places beyond the seams of the metal deck.

Vapor barriers and retarders can significantly reduce the alkaline and mold-attracting conditions, and so why not use them all the time? It seems that the answer to the question of when to use them is complex and riddled with input from many different parties: the developer/owner, architects, engineers, general contractors, concrete ready-mix suppliers, and concrete subcontractors. The first solution is to not use a vapor retarder or barrier and deal with any floor covering issues if they present themselves. Since floor covering suppliers/manufacturers require a low vapor transmission rate from slabs on grade for warranty purposes, the design team and developer/owner may require a vapor barrier or retarder as a second solution due to the floor covering warranties. Contractors and suppliers consider it a nightmarish complication of the relatively uncomplicated task of constructing concrete slabs on grade. If a vapor barrier or retarder is required, the next important question is where to place it- directly under the slab or under a blotter layer.

Placing a vapor barrier underneath a slab interferes with normal moisture migration from concrete hydration and can cause delaminations, curling, crazing, plastic shrinkage cracking, and other finishing concerns. The use of a granular "blotter" layer can help with the excess water that must now migrate out from the top of the slab, but can be a nightmare to keep in one place due to the slick surface of the barrier or retarder. In addition, common construction practices would prevent the protection of the blotter layer from the elements, potentially allowing rain water to collect and cause significant delays in obtaining proper conditions for the application of floor coverings later. The use of a blotter layer can be used effectively where the roof of the structure is in place and a material is selected that reduces the "sloshing" of the material under construction traffic.

Placing a vapor barrier directly under the slab amplifies the potential for the construction problems listed above. Without the blotter layer, water must exit through the top as part of the hydration process, creating even worse potential curling and other finishing problems. Construction traffic also necessitates a tougher membrane to resist punctures from equipment and/or angular sub-base material.

Some mitigation strategies for construction problems related to the use of vapor barriers or retarders might include one or all of the following, depending upon where the vapor barrier or retarder is placed:

1. Specify a shrinkage-reducing admixture to help control curling.
2. Specify slab reinforcement to help control curling.
3. Specify a low-shrinkage concrete mix design using larger aggregate, less water per cubic yard, less cement/pozzolan per cubic yard, etc.
4. Placement of concrete when outside temperatures are not excessively hot or cold. When outside temperatures are cold, a warm sub-base will speed hydration, help with finishing, and reduce curling. When outside temperatures are hot, cooler concrete temperatures will also retard hydration and reduce curling.

TECHNICAL ARTICLE (cont.)

5. Specify a monomolecular curing film/surface retarder to minimize surface drying and help control surface crusting during finishing.
6. Placement of the roofing before interior slabs on grade are placed and using a "non-sloshing" blotter layer.

Other mitigation strategies are possible but have not been listed here due to the limited nature of this article. The third solution is control or omission of potential problem-causing floor coverings and would be very effective as it may eliminate the need for the vapor retarder or barrier.

In conclusion, vapor barriers or retarders are being used more than ever to help control floor covering and covering mold issues on slabs on grade. Vapor barriers and retarders can pose significant issues for all parties involved in the industry. Challenges created by the specification of a vapor barrier or retarder below a concrete slab on grade can be somewhat mitigated by proper specification and construction management.

MESSAGE FROM THE BOARD (continued from page 1)

Engineers Council's Engineer of the Year, Educator of the Year, and Fresh New Face. Julie Ott, Dr. Paul Tikalsky, and Justin Nadauld are our much deserving nominees respectively. The winners for each category will be announced at this year's Utah Engineers Council Banquet. The banquet will be held at the State Capital Rotunda on February 15, 2008 the Friday prior to Engineer's Week. This year we are trying something different by kicking off Engineer's Week with the banquet rather then ending with it. The speaker will be David Hart, head of the Capital Preservation Board. Ticket prices are $45 dollars typically, $22.50 for students and seniors. For more information about the Utah Engineers Council Banquet and tickets, please visit their internet web site at www.utahengineerscouncil.org. As always, the council is looking for dedicated committee volunteers. If interested, contact myself by phone or email. The number and address is available in the recently published membership directory.

SEAU MEMBERSHIP APPLICANT

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

No new applications.

SEAU NEWS SUBMITTAL DEADLINE

February SEAU News deadline is **Jan 31st**.

We expect updates from the following:

Board Member – Secretary / Historian
By-Laws Committee
Codes Committee
PR-Web Page Committee

BULLETIN BOARD

SEAU – LICENSING COMMITTEE by BARRY WELLIVER

The licensing committee of SEAU has now jumped the first hurdle on the path to creating a structural practice act in the state of Utah. After meeting with the Division of Occupational and Professional Licensing (DOPL) to determine how to adjust the language in the Professional Engineers and Land Surveyors Licensing Act (Title 58, Chapter 22), the final work was handed over to Senator Fred Fife on December 19, 2007. The bill is presently being written and should be available online sometime during the first part of January 2008.

As now defined, professional structural engineering or the practice of structural engineering means the design and analysis of complex buildings and structures and includes the definition of professional engineering or the practice of professional engineering as defined in section 58-22-102 (9). To create a separate practice act for structural engineering, the first edit was to amend the definition (9) to limit a professional engineer from engaging in the practice of structural engineering.

The definition of professional structural engineering given in section 58-22-102 (14) was then expanded to explicitly indicate the areas of practice for professional structural engineers. This list is a slightly modified version of the type III and IV structures defined in the International Building Code with the addition of buildings over five stories or 60 feet and structures with an aggregate gross area greater than 60,000 square feet. Additionally, the definition includes the practice of professional engineering as defined in section 58-22-102 (9).

To accommodate the perceived need for transitioning some individuals who are currently practicing in the areas now defined for structural engineering, the qualifications section was amended. Section 58-22-302 (f) was expanded to allow an exception to the

SEAU – LICENSING COMMITTEE (cont.)

examinations established by rule for applicants to be allowed to submit a signed affidavit stating that they are competent and currently engaged in the practice of structural engineering. This "window" is set to expire on January 1, 2009, which provides an effective six-month period since the bill would not become law until July 1, 2008.

Several other portions of the licensing act are to be modified in this bill to help clarify definitions and administrative procedures as recommended by DOPL. These include a fuller explanation of the exceptions to licensure and revision to residential practice, and the allowance for expert testimony by out-of-state professionals.

The proposed bill will create a defined practice for structural engineering instead of just alluding to complex structures. This is a noteworthy effort for our profession and state. It serves to recognize the need for competent and qualified practice in the design of public and private structures where life safety is to be assured.

SEAU – LEGISLATIVE COMMITTEE by JOHN W COFFEY

When I joined the legislative committee it consisted of the committee chair, Dave Brown, and myself. A few months later, I heard that Dave could no longer act as committee chair and that he recommended me to take his place, I was both terrified and excited. I would like to personally thank Dave Brown for all of the hard work that he put into running the legislative committee. It is not easy being a committee chair while still completing the everyday tasks of an engineer.

My first order of business as the committee chair of the legislative committee is to gather enough committee members to not only watch the Utah Legislation but also to help write new legislation that will help the structural engineering society as a whole I am happy to inform you that the legislative committee now has four members besides myself. The committee now consists of Chris Barker, Matt Jackson, Dallan Affleck, and Tait Ketcham.

We have divided up our committee to better watch the Utah state legislation. We will find issues that will affect the engineering community and act as a group to support or oppose the legislation. We are preparing ourselves to support the SE Practice act that is now in the hands of Fred Fife, our Utah senator representing the bill. The SE Practice Act will give meaning to the title of "Structural Engineer". I urge all engineers to actively support the SE Practice Act.

Why shouldn't we have the same respect as doctors, lawyers, or other professionals? Do we not save lives with every building that we build? Do we not improve the lives of every human that lives in or works in a building that we have designed or retro-fitted? How can we obtain the respect of the public? These are the questions that I aspire to have answered before the close of my engineering career. The only way this can happen is if all SEAU members become actively involved in committees We are looking for new ideas to push through the legislation to help improve our profession. If you have any ideas for new laws that could help improve the structural engineering society, please let me know. You can send any comments to SEAU@SEAU.ORG. Please reference any comments to the legislative committee.

SEAU – SEISMIC COMMITTEE by GREGORY S. McCOMBS

Post Installed Anchors in Concrete

Engineers are probably aware of the increased use of post-installed anchors (PIA) in concrete on all types of projects, especially in wood construction. The main types of post-installed concrete anchors are expansion anchors, screw type anchors, and epoxy type (adhesive) anchors.

In the past, PIA's were used to supplement cast-in anchor bolts or holdown anchors where the anchors where misplaced or not installed. The current trend is for contractors to use post-installed anchors on all anchor bolts and all holdown anchors. The concrete contractors like using PIA's because they don't have as many projections coming out of the concrete to finish around and they don't have to figure out anchor bolt and holdown anchor installations along with the framer. Framers like using PIA's because they don't have to figure out bolt placement prior to placing the concrete which greatly reduces placement error. The use of PIA's eliminates the poor construction practice of wet stabbing anchor bolts and holdown anchors in place in lieu of tying the anchors in place as implied by the Building Code.

SEAU – SEISMIC COMMITTEE (cont.)

In the past, PIA's were evaluated for use by the International Code Council (ICC) Evaluation Service based on allowable stress design criteria under AC01, AC58, and AC106. Engineer's should be aware of the new acceptance criteria for PIA's which were developed considering the 2006 IBC. The new criteria are AC193 (Acceptance Criteria for Mechanical An chors in Concrete Elements) and AC308 (Acceptance Criteria for Post-installed Adhesive Anchors in Concrete) which were developed to address strength design, seismic considerations, and cracked concrete. AC01, AC58, and AC106 are no longer applicable for anchorage of concrete products complying with the 2006 IBC.

AC193 bases the evaluation on the strength design requirements in ACI 355.2 (Qualification of Post-Installed Mechanical Anchors in Concrete) and ACI 318 Appendix D (Anchoring to Concrete). This concurs with the 2006 IBC section 1912. AC308 was developed and approved by ICC to allow adhesive anchors to be an alternative to expansion or undercut anchors.

What is the impact of the new criteria? The qualification and design of PIA's under the new requirements and criteria differs substantially. It shouldn't be assumed that anchors qualified under the old allowable stress design criteria will satisfy the new criteria. It also shouldn't be assumed that designs under previous Building Code editions will meet the requirements of ACI 318 Appendix D.

In addition to the impact on the design and acceptance criteria, the new criteria also impact the special inspection requirements. 2006 IBC section 1704.13 item 3 requires special inspections for:

"Materials and systems required to be installed in accordance with additional manufacturer's instructions that prescribe requirements not contain in this code or in standards referenced by this code."

Some of the past criteria for PIA's permitted that some of the special inspections could be waived under certain conditions. AC193 now requires continuous special inspection for all expansion and undercut anchors. AC308 specifies two options for the special inspections (periodic and continuous) based on testing data. The specific special inspection requirements are specified in the appropriate ICC ESR reports.

Lastly, what does an Engineer do if PIA's are installed without the ICC prescribed special inspections? The purpose for a special inspection is to verify materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with approved construction documents and referenced standards. There is no definitive answer to this question and the Engineer is going to have to deal with this question on a project by project basis. It is probably appropriate to pull test 100% of the PIA's subject to tension such as holdown anchors whereas pull tests on PIA's subject to shear only such as anchor bolts may only be required on 5%-10% of the anchors. The Engineer should contact the PIA manufacturer for recommended pull test loads on anchors installed without special inspection.

SEAU – EXISTING BUILDINGS COMMITTEE by BARRY WELLIVER

Just over one year ago (December 21, 2006) the Existing Buildings committee of SEAU had its inaugural meeting. The agenda for that meeting was a clean slate in effect, since the goals and interests of the members were yet to be determined. While the need for a new committee devoted to existing buildings seemed obvious to some, the areas of overlap with other SEAU committees was also apparent.

The beauty of starting something new is the ability to explore and establish a direction. The first several meetings were devoted to discussing how we would interface with other committees, organizations, and the board as well as discovering the strengths and interests of the individual members. Several ideas were shared including the need to study the various guidelines and standards associated with existing buildings as well as the desire to work on a position paper or statement about the hazards of unreinforced masonry (URM) buildings. Becoming familiar with the available resources and then becoming advocates for the implementation and uniform use of these standards seemed to set the course of work.

Shortly after establishing the need to address the URM issue, the group joined forces with the ad-hoc committee of the Utah Seismic Safety Commission charged with this similar task. The focus of work was to get a resolution before the Utah legislature regarding the dangers of URMs. This resolution would require a "back fill" story to help educate the legislators and public of the reasons for the need for action. This story is being told in the white paper presently being assembled by the committees, and the resolution is being introduced in the 2008 Utah legislative session.

Another area of interest for the committee is in reaching out to residential URM homeowners. With the high number of URM residences in Utah there is a need to

SEAU – EXISTING BUILDINGS COMMITTTEE (cont.)

help this audience become aware of the problems and help in providing solutions. The committee will address the Greater Avenues Community Council as well as others with programs to be developed in the future.

Existing buildings are among the most challenging types of structures to work on in structural engineering. They also represent an opportunity for our profession to help educate both the public and law-makers about the consequences of ignoring their vulnerability in earthquakes. The committee now has a firm foundation and would welcome your participation!

UPCOMING EVENTS

January 17, 2008

SEAU Membership Meeting: **Quality Assurance Plans for Steel Construction** presented by Bill Komlos, Senior Certified Welding Inspector for Arc Tech, LLC. Meeting at 5:30 PM University of Utah, WEB 103 (formerly the EMCB)

January 29 & 30, 2008

Jim Suggs with Earthbound will be providing FREE lunch and learn style seminars to structural engineering firms in the Wasatch front area on wood hold down systems. Contact Jim Suggs at (415) 559-2102 or at jsuggs@holdown.com to make arrangements.

February 15, 2008

The Utah Engineers Council is holding the Engineers Week Banquet at the Rotunda at the Utah State Capitol. Reception and tours at 5:30 pm with dinner at 7:00 pm. David Hart, AIA the Architect of the Capitol will be the keynote speaker. Awards for Educator, engineer, new face, MESA teacher, and university student scolarship will be awarded. Contact Trent Hunt at (801) 415-2023 or at tenthunt@trane.com.

February 20, 2008

The Salt Lake Chapter of Construction Specifications Institute is presenting the 2008 Symopsium and Resource Showcase at the Davis Conference Center in Layton, Utah. For details, visit the chapter web site at http://www.csi-slc.org.

February 27, 2008

Simpson Strongtie is providing a FREE workshop on anchoring systems and more from 8:00AM to 4:00PM at the South Towne Expo Center in Sandy. There are a little over 100 seats available. More details can be found at the following web link: http://www.strongtie.com/workshops/workshops.asp

FOCUS ARTICLE (continued from page 2)

column just below the load transfer beam. Once the historic column stub and associated footing were removed, excavation efforts continued to clear the path for the new isolator alongwith its new mat foundation below. To account for settlement that would invariably occur for the new mat foundation, a flat jack was placed between the isolator and the load transfer beam. Inflating of the flat jack enabled a successful transfer of loads from the temporary load transfer system to the permanent system while also accounting for the settlements that accompanied loading of the new mat foundations.

The four rotunda piers, each supported by a 30’ x 40’ footing, represented an interesting challenge for the engineers and contractor. As a solution, the piers were encased by massive post-tensioned concrete beams with a vertical and horizontal compound drape. These beams embraced the piers in such a manner as to enable all of their associated load to be transferred to new adjacent girders which are supported by isolators and new mat foundations. Excavation of the soil below the existing 30’x40’ footing then enabled the final de-coupling of the rotunda assembly from the earth, leaving the existing footing to be isolated with the superstructure and acting compositely with the new post-tensioned system.

Careful coordination with architects enabled engineers to locate new concrete shear walls to stiffen the superstructure. With inter-story drifts minimized, while displacements as high as 24 inches in the base isolation system are accommodated, the effectiveness of the complete renovation solution is optimized. Using abandoned ventilation shafts as well as the walls of new stair and elevator shafts enabled the incorporation of the new shear wall components in a very inconspicuous manner. In fact, the new shear walls are virtually non-apparent and provide an enhancement to seismic performance above and beyond that provided by the isolation system alone. Expected seismic performance of the renovated building is very good with a significant improvement for life safety and a high probability for survival of this most prized piece of architecture owned by the State of Utah.

SEAU Presents:

Quality Assurance Plans for Steel Construction

January 17, 2008
5:30 PM
WEB 103 at the University of Utah
(Formerly the EMCB)
Salt Lake City

Presented by Bill Komlos
Senior Certified Welding Inspector for Arc Tech, LLC.

Mr. Komlos will present a concise method to assure structural steel fabrication and erection quality and address IBC and AISC quality requirements. Effective planning keeps projects on schedule and reduces costs. Planning for quality achieves the same objectives. This seminar offers the responsible Engineer measurable quality benchmarks common to steel fabrication and erection. When production and inspection contractors understand their project quality responsibilities, projects proceed smoothly. The quality assurance plan is a roadmap to a successful project.

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