SEAU *NEWS*

The Newsletter of the Structural Engineers Association of Utah

Volume VII- Issue VIII May 2003

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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Simpson Strong-Wall shear wall application in a two-story structure, manufactured by Simpson Strong-Tie Co., Inc.

IN THIS ISSUE

SPECIAL JUNE EVENT

COMPOSITE OPEN-WEB STEEL JOIST SEMINAR

Presented by:
David Samuelson, P.E.
Nucor Research & Development

Program Date:
Tuesday, June 10, 2003
3:00 – 6:00 p.m.

Location:
University of Utah Union Bldg.
Little Theater

MESSAGE FROM THE BOARD

THE VALUE OF NEHRP

By Larry Reaveley,
SEAU President

(The following is a written transcription of Dr. Reaveley's testimony before the U.S. House of Representatives Subcommittee on Research of the Committee of Science on May 8, 2003, in a hearing on The National Earthquake Hazards Reduction Program: Past, Present, and Future.)

Chairman Smith, and members of the Subcommittee, it is with great respect that I speak before you today. The National Earthquake Hazards Reduction Program (NEHRP) is a program that I know well and with which I have significant experience.

It is my deeply held belief that the NEHRP program is primarily responsible for most of the major advances in structural engineering that have been achieved during the last 25 years. Research interest in blast loaded structures began to wane in the early 1970's, while the 1971 San Fernando Valley earthquake sparked interest in seismic design due to the poor performance of many structures. Without the knowledge gained from the NEHRP program, it would not have been possible to understand nearly as well the behavior of the

buildings that were recently damaged by terrorist activities. The best example of this is the modeling parameters that are contained in FEMA 356, "Prestandard and Commentary for the Seismic Rehabilitation of Buildings." This document contains guidance for assessing the behavior of structural components of all building types when required to resist the effects of various loadings. These loadings may range from service conditions to extreme loadings. The methodology embodied in FEMA 356 will undoubtedly be the technical basis of future performance-based design codes, which I believe will address the major technical and social/economic issues that are important.

There also have been great advances in understanding the nature of ground motions associated with earthquakes. In Salt Lake City, it was virtually impossible to gain the professional and public support for the seismic design of buildings until Lloyd Cluff and others established, through trenching studies, that the Wasatch Fault was still an active earthquake producing fault system. These studies (USGS) were completed in the mid 1970's and provided the necessary proof that a major earthquake would happen in the future. These were important benchmark studies. Out of this type of study, has grown a body of knowledge that allowed for the development of new maps for the determination of how much ground shaking one might expect from an earthquake anywhere in the United States of America. These maps are now used in the current building codes. The value of these maps is that they are based upon current scientific knowledge and will be easily updated as new knowledge is acquired. The old seismic code maps were somewhat subjective in nature and were sometimes influenced by political pressure. This most important advancement was made possible through NEHRP funding.

NEHRP funding for the FEMA "yellow book" series of publications that deal with structural engineering guidelines and standards has been critical for the process of technology transfer to the design professional community. The typical structural engineer would be completely lost without them. In fact, the process of creating these documents has clearly identified the research needs in the overall field of structural engineering.

We have much more to learn about where and how the ground will shake. How buildings and other structures respond to ground motion is still at a rudimentary stage of prediction. Soil-structure interaction is not very well understood and is critical.

Better information will allow the country to be more efficient in the allocation of resources. We will have greater knowledge as to where, and with what frequency, the ground will shake. We will have the ability to better allocate construction dollars within a particular structure to achieve a desired outcome following an earthquake. We will be in a position to better understand which buildings might be economically rehabilitated to resist the effects of ground motion.

The fact that there is such a limited few dollars in the NEHRP budget its simply not justified from a basic economic point of view. The expenditure of previous funds has helped minimize the losses in the most recent domestic earthquakes. Every dollar spent on creating an earthquake resistant structure also creates a more blast resistant structure. Progressive collapse is also minimized. If dollars are limited, my opinion is that the following tasks in order of priority should be emphasized, but all of the programs should be kept active because they are important:

1. Strong-motion networks in regions of highly probable strong ground motion are essential to our progress. Free field data, and data from instrumented buildings are absolutely necessary for the advancement of our abilities to understand the behavior of structures. Lack of this type of data, and the almost negligible amount of funding to study such data is the major roadblock in advancing our understanding of the physics of the earthquake problem. I have brought with me copies of a report titled "The Plan to Coordinate NEHRP Post-Earthquake Investigations." The major NEHRP agencies cooperated in the production of this report. This report summarizes most of the issues with respect to this topic.
2. Performance Based Engineering (PBE) is an all-encompassing concept and should be a structure upon which all the various elements of the program are fit together to achieve the goals and objectives of NEHRP. It must be funded.
3. I personally believe that the most overlooked factor in improving the overall performance of buildings is the lack of qualified personnel at the local government level. Plan review and inspections are critical.

Since the direct losses from a major earthquake in an urban environment can be in the tens of billions of dollars, it seems that we are being foolish in not realizing the overall benefit of a better-funded program. The United States has never experienced the impacts of what will occur if a "real big one" does strike a major urban center. I believe that the economic consequences of a major earthquake, and their effects on the surviving population should drive NEHRP and be the defining parameters in setting

priorities. Unless there is a significant increase in funding, it will not be possible to create a program that can meet the objectives associated with the vision set forth by Congress.

There is a need to empower a central authority to coordinate the activities of the various agencies that expend NEHRP funds. This authority should be charged with achieving the goals and objectives set forth by Congress. There should be established a review mechanism, drawing on experts with leadership and technical experience, to assist in identifying and prioritizing program initiatives.

MEMBER FORUM

FOCUS

Utah Structural Engineers provide a significant contribution to a wide variety of projects for commercial, government, industrial, and residential clients. Each month, SEAU would like to focus attention on the accomplishments, successes, and hard work of our Utah Structural Engineering firms. This month the focus is on:

Larsen and Malmquist, Inc.

Larsen and Malmquist, Inc. Engineers and Surveyors (LMI) was founded in Salt Lake City in October of 1980 by M. Carl Larsen, PLS and Newland J. Malmquist, PE. Larsen's qualifications are in the fields of land surveying and public works administration whereas Malmquist's expertise is in structural engineering and construction management. This combination provided for a wide range of project types to pursue within the target practice area of the western United States. Recently, the management and ownership of LMI has been transferred to Randy D. Smith, PLS and Kevin L. Taylor, PE with Messrs. Larsen and Malmquist as council. LMI projects include a wide range of civil engineering and land surveying disciplines.

Turquoise Ridge Mine Head Frame, Nevada

This special structure was the feature photo on the cover of the SEAU April newsletter. It is constructed of wide flange columns, double angle bracing and HSS pipe back legs. The main frame is 140 feet tall with two 12-foot diameter top sheaves that carry 1 3/4" wire ropes wound on 12-foot diameter hoist drums. The ropes each serve an 11-cubic-yard capacity muck skip. The 24-foot diameter shaft will eventually reach a depth of 4,000 feet. The fabricator/structural detailer is O.J. Industries of Salt Lake City.

Intermountain Power Plant near Delta, Millard County, Utah

Built during the l980's, this is a 1250 megawatt coal fired power plant which delivers electrical power to the main substation in Adelanto, California using a direct current and two conductor transmission lines approximately 450 miles long. This system is in lieu of the usual alternating current three conductor system and requires, a converter station at the generation point near Delta and at the receiving point near Adelanto. LMI designed and detailed the huge multiple bus structures at these two locations. There were 16 separate structures at each location with the largest ones in the order of 150 feet tall with spans of 300 feet utilizing circular pipe sections from 4" to 42" in diameter. The seismic, wind and thermal loads were different at the two sites. Nearly 25 load combinations were considered for each structure. Separate calculation records were required for each welded connection using two different methodologies.

This work was aided by the Univac 1100 main frame computer at the University of Utah using the STRUDL FEM program. The computer charges exceeded $15,000 and the computing and drafting schedule exceeded four months. Today, this project could be accomplished with two $2,000 CADD systems in less than one month.

The engineering manager of this project was the Los Angeles Department of Water and Power (LADWP) and the construction manager was Black and Veach of St. Louis. Mark Steel of SLC was the fabricator. Loadings were specified by the ASCE Manual along with a modified LRFD approach. Load factors varied from 0.9 to 1.5.

Sixth Water Vertical Penstock Installation, Central Utah Water Project

LMI was retained by Redpath Construction, Ltd. and O.J. Industries to design a special lifting spider hoist rig and hydraulic operated steel clamp to grip and

hold the 7.33-foot diameter by 40-foot long steel plate penstock sections as they are lowered by a 300-ton capacity Skyhorse track crane vertically down a 650-foot deep shaft. The clamp holds the penstock sections at ground level while the crane picks and positions the were connected, the total gravity load increased by the next 40-foot section for field welding. As sections weight of each section added with the total supported load in excess of 400 KIPS. The clamp also holds the penstock while the annular space between the penstock shell and the rock surface of the excavated shaft is filled with concrete. The concrete fill is placed continuously from the bottom up over a period of 36 hours. As the concrete cures, it locks the bottom of the penstock shell below. However, as the concrete level rises, the shell is heated by the hydration process making the steel expand upwards causing the clamp to rise off of its bearing. As the curing continues and the heat begins to dissipate, the shell wants to return to its original length, thereby creating a pre-stressing condition with axial compression in the concrete and tension in the steel shell.

BULLETIN BOARD

SEAU MEMBERSHIP APPLICANTS

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

1. Jeremy Achter - upgrade from Associate to Professional
2. Matt McBride - upgrade from Associate to Professional

MESSAGE FROM THE EDITOR

I would like to thank the SEAU membership for enthusiastically embracing email distribution of the newsletter this year. It is much more enjoyable to see so many of the great project photos in color. I hope you have noticed that you are receiving important information and notices for meetings and seminars sooner than before. Typically email subscribers are able to get the newsletter 3 to 5 days sooner than regular Post Office mail subscribers. We have saved SEAU a significant amount of money by using email distribution for the newsletter as well. This money is then used to help SEAU members by subsidizing seminar fees and other events.

I would like to encourage all members to make sure their contact information is up to date. Contact the membership committee if you need to change any of your member information. You can subscribe to the email distribution list or update your email address by visiting http://mailman.xmission.com/cgi-bin/mailman/listinfo/seau_members We want to know that all members are receiving information in a timely manner.

Thanks also to newsletter committee members Jerod Johnson and Rick Seelos. Jerod handles advertising and writes our educator highlight feature each month. Rick organizes the Member Focus article and front page Feature Photo each month. Their contributions to the newsletter are greatly appreciated.

BULLETIN BOARD

BULLETIN BOARD EDUCATOR FEATURE

Each month this past association year, SEAU NEWS has highlighted a Structural Engineering educator from one of Utah's engineering schools. This month's feature is on:

DR. MARVIN W. HALLING

Marvin W. Halling has been a member of the faculty at Utah State University for 8 years. In that time he has made tremendous contributions to Department of Civil and Environmental Engineering at Utah State particularly in the field of Structural Engineering. Dr. Halling graduated Summa Cum Laude receiving his Bachelor's Degree from Utah State in 1985. He earned his Master's Degree from Stanford University in 1986 and in 1995, he received his Ph.D. in Applied Mechanics at California Institute of Technology at Pasadena. Dr. Halling has been a member of the faculty at Utah State's Department of Civil and Environmental Engineering since 1994.

Dr. Halling's effectiveness as a professor and an educator at Utah State is remarkable. Within his 8 years as a professor at Utah State he has three times been recognized for "Outstanding Teaching" in the Department of Civil and Environmental Engineering (1996, 2000, and 2001). He has also been recognized as an "Outstanding Advisor" (1996) and an "Outstanding Researcher" (1999) for the department. He has also gained similar recognition from Utah State's College of Engineering (Outstanding Advisor – 1996, Outstanding Teacher 2000). In addition, Dr. Halling was the SEAU nominee for the Utah Engineers Council (UEC) Engineering Educator of the Year (2002).

Dr. Halling's influence extends beyond his role as an educator. He is a member of the American Society of Civil Engineers (ASCE), the Earthquake Engineering Research Institute (EERI), and the Utah Seismic Safety Commission -Geoscience Sub-committee. He is also involved with the ASCE Student Chapter, Tau Beta Pi Student Chapter, Faculty Senate, and is a member of the ASCE Seismic Effects Committee. He has also been involved in numerous earthquake reconnaissance efforts including: Turkey (1999), Taiwan (1999), Nisqually (2000), Kobe (1995), and Northridge (1994). These reconnaissance efforts have been directed at the causes of structural damage and their relationships to strong ground motion. Dr. Halling has also garnered fame as the co-creator of the 'Marv & Joe' sandwich available at The Hub at Taggart Student Center on campus at USU.

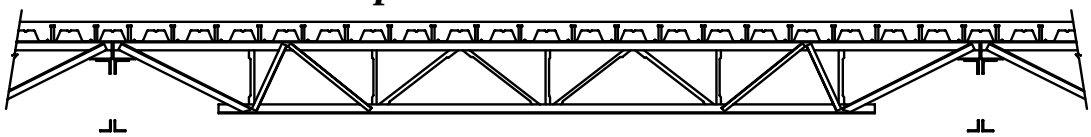
Dr. Halling's research is particularly noteworthy to structural engineers. He has authored publications too numerous to list and his research includes: graphite composites for concrete joints, dynamic field testing of bridges, development of deterministic bedrock acceleration maps for Utah, testing of full scale pile groups, full scale testing of concrete beam-column joints using advanced carbon-fiber composites, application of graphite composite for increased ductility of concrete bents, and a comparison and contrast of post earthquake reconstruction in the U.S. and Japan.

SEAU News is proud to feature Professor Halling in this month's newsletter and offers its sincerest gratitude for his efforts in preparing the future structural engineers of Utah.

This is the concluding article for the Educator Highlight feature of *SEAU News.* We (the newsletter committee members) hope that this feature has provided some interesting insights into those who have made significant contributions in preparing future structural engineers in Utah.

If you have ideas regarding a feature article or highlight that you would like to see in SEAU News, please contact anyone on the SEAU Newsletter Committee or email your idea to Jerod Johnson (jjohnson@reaveley.com).

Special June Seminar:



Seminar on Vulcraft Composite Steel Joist Design

Cosponsored by SEAU, and University of Utah Department of Civil and Environmental Engineering

Some of the topics to be covered include the following:

- Advantages of composite steel joists
- Models for predicting moment capacity
- Deflection calculations
- Capacity of welded shear studs in metal deck
- Concrete placing considerations and cambering
- Predicting vibrational characteristics
- Research on Composite Joist Girders
- Status of Steel Joist Institute's Specifications for Composite Joists

Date: Tuesday, June 10, 2003
Time: 3:00 PM – 6:00 PM
Location: Little Theater, A. Ray Olpin Union Building, University of Utah
200 South Central Campus Drive
Salt Lake City, UT

Presenter: David Samuelson, P.E., Structural Research Engineer,
Nucor Research and Development, Norfolk, NE

3 Professional Hours (0.3 CEU's) will be awarded to each seminar participant.

Please register for this seminar by contacting Mark Miller, Vulcraft, 1875 West Highway 13 South, PO Box 637, Brigham City, UT 84302, Phone No. (435) 734-9433, Fax (435) 723-5423, E-mail markmiller@vulcraft-ut.com

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