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.

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

The Stampin' Up! Facility – Draper, Utah
see page 2.

IN THIS ISSUE

APRIL EVENT

SEAU MEETING

Design with the 2005 AISC Specifications and the 13th Edition Steel Construction Manual.

April 25, 2006
7:30 AM – 5:00 PM
Salt Lake City Marriott
University Park

Presented by
Louis F. Geschwinder PHD, PE.
w/ AISC

Partial Funding by DOPL

MESSAGE FROM THE BOARD

Life-Long Learning

By Mike Buehner,
UEC Delegate Elect

Engineering is my second career. I first earned a degree in Asian Studies and worked in Tokyo for a few years before realizing that what I was doing really had no long term growth potential. By that I mean I felt that I had reached a certain level of skill and saw that there wasn't really much more to accomplish or to learn in my particular occupation. My work in Japan involved consulting with several high-tech companies and through working with them I learned their histories and the interesting paths that their use and development of technology had taken them. For instance, one company had started by making tiny machined parts for wrist watches, but used their knowledge of micro machine control to manufacture dot matrix and then laser printers for computers. This was all fascinating to me and I realized that a technical career offered life-long learning and first-hand involvement in bringing about products that make life better. I also worked in the middle of Tokyo, within a ten minute walk of the Emperor's Palace, the National Diet (Parliament) Building, Japanese Supreme Court Building, the American Embassy, and of course, scores

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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 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:

Mixed-use Boost to Downtown Provo
The Wells Fargo Financial Center

Article by: Don Barker & Rob Marostica
Edited by: Cameron Empey

The Stampin' Up! Facility in Draper, Utah consists of a 200,000 square foot Distribution Center and a 100,000 square foot, four-story Administration Center. The facility was designed as a fast track, design build project. Due to time constraints, the footing and foundation system for the Distribution Center, as well as the footings of the Administration Center which interacted with the Distribution Center's footings, were designed up front. The Distribution Center needed to be constructed quickly so that the state-of the-art product retrieval and storage rack system could be installed and working prior to completion of the Administration Center.

The Distribution Center was constructed with an open web steel joist/girder roof system bearing on interior steel columns and exterior colored concrete tilt-up panels. Due to the size of the building an expansion joint was needed. Due to the orientation of the racking and retrieval system in the building, a moment frame system was required at the expansion joint. A SMRF and an OMRF were considered. Due to the storage rack height, an OMRF could not be used. The SMRF consisted of W14 x 398 and W14 x 283 columns with W33 x 169 beams. At the time the building was designed, only W12 and W14 columns in a SMRF were allowed without qualifying tests.

The Distribution Center had some other unique design challenges. The design schedule required that the footing and foundation be installed prior to the release of final column locations for the product retrieval system. To compensate for this, the concrete slab-on-grade in the area of the retrieval mezzanine was designed to allow a column point load of 80,000 lbs to be placed anywhere on the slab. To complicate matters, the retrieval system supplier was changed after installation of the roof structure had begun. The original design supported all mezzanine loads off the concrete slab-on-grade. The new supplier used the roof structure to support some of the mezzanine loads. This required an economical upgrade of the roof system in a few places to accommodate the retrieval system.

The Administration Center consists of a 5 story office building with four stories above grade and a partial story below grade. The floor is framed with composite beams and topped in most areas with an access flooring system. The lateral system is a special moment frame with dog-bone connections.

FOCUS (cont.)

A large circular atrium is located on the south side of the office space. The atrium is 92 feet in diameter and extends one story below and two stories above grade. At the base a water feature was installed by a specialty contractor. Openings through the main and second floors provide uninterrupted views of the water feature and skylights. At the main and second floors the atrium is encircled with a 10 foot wide catwalk supported off the perimeter columns with knee braces.

At the second floor, approximately one third of the atrium catwalk was omitted. Rolled steel beams span between columns. At these beams the architectural design called for a horizontal offset in the brick veneer. Steel outriggers were welded to the rolled beams to support the weight of the upper lift of brick and to provide lateral support to both lifts of brick. The weight of the upper lift of brick imposes torsion and strong axis bending on the beam while lateral forces induce weak axis bending. Tube steel sections were used to combat the effects of torsion and unbraced biaxial bending.

The roof of the three-story atrium features a pair of barrel vault skylights which intersect to form a "t" shape. The remaining diaphragm consists of four wedge shaped segments interconnected with a narrow strip of roof deck. Each wedge has a moment frame along its curved side. The weight of the skylights is supported by steel beams which bind the straight sides of each wedge and interconnect the points of each wedge. These beams function as struts and resolve the rotation created by the eccentricity between the center of mass of each wedge and its moment frame. The strip of metal deck connecting a pair of wedges did not have sufficient shear strength or stiffness therefore, horizontal diagonal bracing was provided to provide continuity between the wedges.

A unique challenge to the Administration Center was that while the steel was being erected, the elevator system was changed from a hydraulic elevator to a hoist elevator. A lot of innovative thought and engineering was required in order to minimize the impact to the structure.

This facility was awarded the 2005 Excellence in Masonry Design Award by the Utah Masonry Council & AIA of Utah.

MESSAGE FROM THE BOARD (continued from page 1)

of modern high-rise office buildings. I derived great enjoyment walking through Tokyo any chance I got to look at the myriad of styles of buildings. (I rode out four or five Richter 5 plus earthquakes during my time in Japan as well!) So, to bring a long story to a close, I decided to completely change directions and go into building design, and structural engineering was the perfect fit.

My reason for telling my personal story is that I recently had the opportunity to conduct a building tour for a class of Civil Engineering students at a project nearing the end of its construction phase. These students were in their first steel design course and appeared somewhat overwhelmed with the prospect of having to account for all the different design concerns in putting together a building structure. My presentation leaned heavily on the complexities of the lateral system load path and seismic detailing issues. The class instructor had to regularly interject comments to point out frame members that demonstrated basic compression, bending, and tension conditions. After the tour was over, it made me stop and think about the students' perspective, try and remember what it was like to be on the first step toward becoming a structural engineer, and reflect on where I currently am in my career.

I've learned quite a bit since those first-year design courses. I remember the learning curve being awfully steep during the first year of working, too. While at times I feel some pride that I know as much as I do about designing building structures, I just as often feel

MESSAGE FROM THE BOARD (continued)

like I'm still a beginner. I have my P. E. License, yet I plan on getting an S.E. too. I'm very happy with my choice to go into structural engineering. It truly has proven to be a field of life-long learning. Oddly, I'm satisfied I'll never know everything there is to know about structural engineering. I will always have something to learn. Having faced the prospect of working long term in a field that would never change much (imagine designing the *same* building over and over the remainder of your working life) structural engineering is a highly more rewarding career choice.

Everyone has their own reason for joining this profession. I very much enjoy listening to other people's stories of what led them to decide to pursue structural engineering. I think it is also healthy to occasionally take time to reflect on where you used to be, how far you have come since then, and the effort you have made to get where you are today. Hopefully, that will give reason to feel good about your efforts, what you have done to benefit society by providing safe and useful building designs, and how you have contributed to the progress of the structural engineering profession.

PRESIDENTS MESSAGE – RAISING THE BAR by JULIE OTT

"Raising the Bar" – over the past umpteen years I have read articles and listened to people preach about raising the bar. Yet in the last year or so we are once again seeing an alarming digression in consistent cut-rate fees of a few.

I realize that once and awhile we all get a fee wrong – however there are groups (and yes there are more then 1 or 2) that are consistently half price. I personally have knowledge of half-a-dozen projects were clients have solicited three fee proposals. Two of the proposals are within a reasonable percentage of each other and the third is 50-60% of the two.

This undercutting phenomenon seems to be a cyclical event in our community. As you recall a few years ago the 'group' with half-price fees ended up driving a large number of firms' insurance rates up while causing very bad publicity for all. And once again we appear to be headed down this bad road … again.

How do we stop/control this? The preverbal question.

When the undercutting topic has been broached with the 'groups' it is amazing that these 'groups' jump on the bandwagon and point out many others while claiming innocence for themselves.

Raising the bar dose no good if you continue to limbo under it.

UPCOMING EVENTS

May 18, 2006
ATC 20 Training

May 26-27, 2006
The **University of Utah** ASCE student chapter is hosting the **National Steel Bridge Competition** this year. The competition will be May 26-27. **Judges are needed for the event**. Judges do not need to be PE's, but do need to have a technical background and be able to commit to BOTH days. If you are interested in being a judge for the event, please email asce.uofu@gmail.com

September 15, 2006
Ron Hamburger's presentation at the April SEAU meeting was canceled to due 'airport logistics problems.' We apologize for any inconveniences this caused you. Ron's presentation is scheduled for September 15 at the Marriott Galavian Center in conjunction with the NCSEA Conference.

NOMINATING COMMITTEE by JEFF MILLER

The following members were elected to the 2006 Nominating Committee:

Steve Cohen
David Pierson
J.R. Richards
Leon Tanner
Jeff Miller

The nominating committee met on April 4, 2006. The following members were nominated for next year's officers and board members:

Vice President/President Elect: Barry Welliver
Secretary: Russell Merrill
Board Member: Shaun Packer
USSC Representative: Jake Watson

As established by the by-laws, additional nominations may be made by petition to the Vice President of at least 5% of the voting grade members, up to the April general membership meeting. After that time, nominations will be closed, and ballots will be mailed to voting grade members.

BUILDING INFORMATION MODELING by JEROD JOHNSON

Building Information Modeling – Are you ready? Should you be?

Most of us are at least vaguely familiar with the concept of Building Information Modeling or B.I.M. for short. For more than 20 years it has been touted as the 'wave of the future' in the world of architectural design and all of the associated subconsulting disciplines. In fact, for some 20 years, many proponents of B.I.M. have indicated that it is just around the corner and we should prepare ourselves accordingly lest we be left behind with our slide rules and our Radio Shack desktop computers.

So, what is B.I.M.? In a nutshell it is an intelligent unified model. It is a model which can be accessed and updated by all disciplines and by that token, a model which should make much easier the coordination of the entire building design. This is not all. It is a model replete with capabilities including design/detailing modules, material take-offs, and code compliance checks. The capabilities are limitless and will only increase and improve with each new software release. Imagine the possibilities of having a working three dimensional model through which a section cut can be drawn at any location and the software will automatically produce the two dimensional cross section, complete with mechanical ducts, electrical conduits, and structural elements drawn to their exact scale. Imagine also, you could 'left click' on a structural element and view its description in detail at least sufficient so that the member could be accurately fabricated. Such possibilities and capabilities are endless.

There are industries that have successfully implemented the concepts of B.I.M. as part of their standard practice. These include primarily the automotive and aircraft industries. Among the others are trades which, like the automotive industry, develop a single design and mass produce thousands, perhaps millions of units based on that design. And therein lays the primary difference between those industries and ours. It is a matter of fact that 99+ percent of the projects we work on are characteristically unique. The design of most buildings begins 'from scratch' in a global sense. We can of course re-use details, assemblies, and on rare occasions designs. But, for the large part we are creating a unique design that has never before been used and likely will not be repeated. Hence, developing a building model akin to that used in the automotive industry is extremely cost prohibitive…until now. B.I.M. applications such as Revit, Archicad, and others are expected to bridge this cost prohibition gap.

So, if the B.I.M software is now available, why is it not currently the standard in the architectural/building design industry? There are many answers to this question and perhaps the question itself spawns many more questions for which no satisfactory answers can be found. Currently, the arena of B.I.M. software appears to be rife with incompatibilities and/or internal conflict. For one issue, all of the B.I.M. software must follow a unified format or standard. Consider the discipline of structural design. There are dozens, perhaps hundreds of software packages that are used for structural design. Very few of these are compatible with one another and those that are compatible are most likely produced by the same companies (CSI Berkeley and RAM to name a few). How can a B.I.M. protocol be established to bridge all of the disciplines when there is not even a unified standard for the software within the disciplines themselves? Another issue to consider is this; there are volumes of information used in a structural model that never become part of the contract documents, and in large measure may be overlooked within the current versions of B.I.M. software. Much of this information is crucial for proper design and performance (i.e. end fixities, section properties, unbraced lengths, etc.). If this information is not correct, the results can be catastrophic. The same cannot be said of other disciplines. In short, if an unbraced length is not accurately accounted for in design, the building could collapse. If an airshaft is not sized correctly, the consequences are much less severe. The creators of the B.I.M. software would be well advised to prioritize the means of tracking specific modeling parameters. Unless the B.I.M. software engineer is also a structural engineer, how can we be assured that due respect is given to critical structural parameters in the unified model?

Another consideration is this; how does the typical B.I.M. address a performance specification? As structural engineers, we have all dealt with mechanical penetrations having unknown sizes or locations. We are often told that the exact sizes and locations will not be known until the mechanical units are purchased/produced. So, how is this information addressed in the B.I.M. Is there a virtual 'hole' in the model that is not filled until the information is available or must the mechanical subcontractor be retained during design in order to provide this information? The same argument can be made for any discipline specifying products by performance specification.

Clearly, there are far more questions than satisfactory answers regarding the impending era of building information modeling. Will B.I.M. become the standard in the future? I think the answer is clearly, yes. Are there major obstacles that must first be overcome? Again, the answer is yes. Whether B.I.M. will be the standard in five years or thirty years is anyone's guess and prudence dictates that we respond to the market and prepare ourselves accordingly.

BULLETIN BOARD

SEAU – TECHNICAL COMMITTEE by SCOTT M. PETTIT

This year the technical committee has come back to life. We recently invited Carl Erikkson to a committee meeting to discuss the considerable amount of work he has done in developing a formula to calculate site specific snow loads. Carl discussed the data he has compiled, its source and the formula he has derived. His formula is currently in a preliminary state due to the lack of snow data. This fact not withstanding, the formula does predict some areas with snow loads considerably higher or lower than the code currently prescribes.

As our meeting progressed some interesting questions arose that we all have probably wondered about at one time or another. For example, where did the 43psf ground snow load in Salt Lake come from? Why doesn't the snow load formula in the code have coefficients based on seemingly important factors such as the average winter precipitation and winter temperature? How about lake effect or the direction a hills slope faces? It would seem that all of these factors would make a big difference in snow load accumulations over relatively small distances. Yet one blanket snow load is often used for large areas despite the vast differences in these factors that effect snow fall rates and accumulation. All of this brings up the most important question; Are we under estimating snow loads in some areas? Are we being over conservative in others? How do we know?

To really answer these questions in a scientific way and develop a working formula there needs to be data taken over a statistically relevant time period and at numerous locations. As Carl found out during his investigation, there is not a large amount of snow data out there for the populated areas we are most concerned about. Much of the scant data available is in the form of water shed measurements which are most often taken in remote areas. So, again, without data how do we know that 43 psf is right?

Based on our discussions, the technical committee believes that an in depth snow study would be greatly beneficial to all in our engineering community. The goal of the study should be to derive a formula which would take into consideration multiple factors and give results agreeing with the data observed. Let's show what the snow loads should be in a scientific and more exact manner. Sounds like a great opportunity for a combined study with SEAU and possibly some graduate students from a local university? The technical committee hopes to be involved with any decision to more forward with this study.

SEAU – BSSC REPORT FOR 2005 - 2006 by PARRY BROWN, SEAU BSSC DELEGATE

BSSC What?

I would like to give a little background as to what the BSSC has been, what it presently is and what it is trying to become. Also, I would like to discuss SEAU's involvement in the BSSC and what it means to our members. *The Building Seismic Safety Council (BSSC) was established in 1979 under the auspices of the National Institute of Building Sciences as an entirely new type of instrument for dealing with the complex regulatory, technical, social, and economic issues involved in developing and promulgating building earthquake hazard mitigation regulatory provisions that are national in scope. By bringing together in the BSSC all of the needed expertise and all relevant public and private interests, it was believed that issues related to the seismic safety of the built environment could be resolved and jurisdictional problems overcome through authoritative guidance and assistance backed by a broad consensus.*

The original role of the BSSC was to be an advocate for, and to promote the development of seismic safety provisions suitable for use throughout the United States; but not to specifically write code language to be directly incorporated into the model building codes. The BSSC produces and updates the "*NEHRP Provisions*" first published in December 1985 by FEMA.

This role changed significantly in 1989 when *Building Officials and Code Administrators International (BOCA) appointed and ad hoc committee to review and study the 1988 edition of the "Provisions" in order to develop a comprehensive and consistent position on code requirements for earthquake loads reflecting technology, design practices, and national codes and standards. The Southern Building Code Congress International also acted to approve similar seismic provisions for the Standard Building Code in 1991.*

From this time forward, the BSSC changed its emphasis to produce the *NEHRP Provisions* in code language format for the purpose of inclusion into the various model codes with minimal editing. Because most of the participants with earthquake specific background were from the high seismic areas of the western United States, it was no surprise that the first version followed the format of the Uniform Building Code (ICBO).

The Provisions Update Committee (PUC) of the BSSC consists of a board of directors and 12 (or

SEAU – BSSC REPORT FOR 2005 – 2006 (continued)

sometimes more) Technical Committees and has the primary responsibility of proposing revisions to the *Provisions*. New versions have been published on a three year cycle to coincide with the model codes. The Technical Committees were formed by recognized experts in each of the specific areas relating to seismic design.

At the end of the first year of each three year cycle the PUC would publish proposed revisions to be voted on by the member organizations of which SEAU is a voting member. The proposed revisions would then be edited and revised for a second vote at the end of the second year. The accepted proposals would then be included for publication and the cycle would start over again. The model codes would then review and edit the provisions for a three year period for inclusion into the next edition of the building code. These proposals have been reviewed by myself, Parry Brown, SEAU delegate, Dave Pierson, SEAU alternate, and Kim Robinson committee volunteer. Each year the BSSC has an annual meeting to present the direction and progress of each of the Technical Committees.

The BSSC has now come full circle and is trying to return to its original advocacy role. ASCE7 has now taken over the role of developing code language which we are all aware is referenced directly by the International Building Code. The *NEHRP Provisions* is in the process of returning to its original format of being a reference document providing cutting edge technology and new insight into methods for providing safer buildings from earthquake effects.

The next edition of the *NEHRP Provisions* is expected to be published in December 2008. The *Provisions* are expected to continue in the direction of performance based design. Some of the areas where significant updates are expected are:

1. Updated USGS Seismic Hazard Maps for Lake Tahoe Faults, Reno, Salt Lake City, Pacific Northwest, Alaska Denali Fault, and California San Andreas Fault. The USGS Maps are updated on a six year cycle. See eqhazmaps.usgs.gov.
2. Developing Time-dependent vs Time-independent Seismic Hazard Maps (i.e. Taking into account when the last major earthquake occurred). Preliminary Time-dependent Maps have been developed for the Wasatch Fault and are presumably available on the internet.
3. Developing rational and consistent methods to compute design parameter factors R, Cd, and Omega0 associated with equal risk.
4. Proposed methods for Linear Dynamic Procedures for buildings with two different systems similar to the two-stage static procedure.
5. Developing requirements for base plates and anchorage.
6. Revised Drift limits for various systems.
7. Simplifying the number of different seismic force resisting systems.
8. Developing a more rational approach to height limitations.
9. Developing a process for approval of new systems.
10. Developing rational performance criteria for Seismic Base Isolated, Active Damped, and BRBF systems.
11. Developing a rational approach to response factors for non-structural components factors ap and Rp.
12. Guidance for the design of storage racks in public retail stores (Big Box Stores).
13. Strength design of foundations using LRFD bearing pressures.
14. Revising Vertical Ground Motion requirements and load combinations.

As you can see, there is a lot of work going on in developing the art of seismic design of buildings. The next annual meeting has not been scheduled yet, but I hope to report soon on the progress of this effort.

* Portions of the text in italics are re-printed from "The Council and Its Purpose", BSSC.

SEAU MEMBERSHIP APPLICANTS

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

Cody G. Nunley - Professional

SEAU NEWS SUBMITTAL DEADLINE

The **May SEAU News** deadline is **April 24th**.

We expect updates from the following committees:

Legislative Committee
Audit & Memebership Committee
SEER Committee
Seismic Committee

SEAU – SEISMIC COMMITTEE by BARRY H. WELLIVER

When I first moved to Utah in 1995, I wanted to understand the issues the local structural engineering community was involved in and specifically how important earthquake design would be for a newbie. I quickly found one of the most active committees in SEAU, joined, and listened to the years of experience sitting around a conference table in an engineering office in Bountiful. Although the meeting place has changed, the commitment of the members of the seismic committee has remained strong and active.

One of the first issues identified and one that continues today is public schools. The need to have reliable design and inspection practices for these structures was discussed often. Over the years a number of noteworthy efforts have originated in the SEAU seismic committee and the most recent was our presentation to the Utah Facilities Operations and Management Agency (UFOMA) last fall. This introduced the concept of incremental seismic design and attempted to offer solutions for the "all or nothing" mentality that often stifles seismic rehabilitation work.

Recently, several local school districts have begun to embrace the need to understand the seismic liability of their building inventory and are investigating tools such as FEMA 154 "Rapid Visual Screening" as a means to quickly identify problem buildings and push them up the priority ladder. The seismic committee of SEAU has been encouraging the systematic review and preliminary evaluation of these buildings and has made a concerted effort to help the Utah Facilities, Operations and Maintenance Association encourages districts to begin or augment their inventories.

Another ongoing concern for the seismic committee has been the need for uniform regulations for the treatment of existing buildings. Utah presently allows the use of various "existing building" codes and guidelines however the application of these regulations for seismic improvements has been, for the most part, left up to the discretion of the building official. The seismic committee has endorsed the adoption of the International Existing Building Code (IEBC) as an appropriate companion document to the International Building Code. The IEBC establishes thresholds of work which will determine whether a structure will be required to have improvements made to its seismic fitness and offers a uniform treatment of all existing buildings.

The SEAU seismic committee invites your opinions and participation. Contact Stephen Cohen, chairman, with your interests and become involved in committee work which can lead to changes that may affect the way you will practice in the future.

SEAU – CODES COMMITTEE by MARK HARRIS

A shiny new copy of the IBC 2006 sits on the corner of my desk. At first glance not much has changed. But look carefully and you will find that there a subtle changes located throughout the structural sections that will change how we design structures.

As you review the new code sections you will notice a significant number of heavy black bars indicating sections that have been revised or added. Many of these changes and additions are a reflection the changes in ASCE 7, others are not.

One new addition that caught my attention is section 1604.10 Wind and Seismic

Detailing. This is a new section. It sounds very simple, but for design in areas of low seismicity this little passage may have significant impacts. It reads as follows: "*Lateral force resisting systems shall meet seismic detailing requirements and limitations prescribed by this code and ASCE 7, Excluding Chapter 14 and Appendix 11A, even when wind code prescribed load effects are greater than seismic*".

Did you know that the minimum requirement for partition loads has decreased from 20 psf to 15 psf? The tiny little bar in the margin of section 1607.5 marks this change which could be very significant for some floor structures.

Occupancy categories for building with multiple occupancies have been specifically addressed in a new section 1604.5.1. This section states that where multiple occupancy categories occur in the same structure, the structure shall be classified according to the highest occupancy. In addition it states that in structures having two or more portions that are structurally separated, that each portion can be classified separately. However, if one of the sections provides required access, required egress, or shares life safety components, then both portions shall be assigned the higher occupancy category.

These are but a few of the many subtle changes tucked away in your shiny new IBC that need our study and understanding before they become law next year.

ANSI/AISC 358-05

The new standard ANSI/AISC 358-05 *Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications* is now available for free download.

To download the new standard, visit www.aisc.org/aisc358.

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AND YOU THOUGHT YOU HAD A BAD DAY!

Either late 2/13 or early 2/14 a track hoe on top of a flat bed trailer was going east bound on I-70 near the west edge of Hays KS and hit an overpass.

This is the results.