CONNECTIONS

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Newsletter of the Structural Engineers Association of Oregon

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IN THIS ISSUE:

Upcoming Events

SEAO Meeting - The next meeting will be held Wednesday, January, 26. It will be a lunch meeting at the Governor Hotel. More information will be included in the January edition of Connections.

SEAO Trade Show—Thursday , February 24. To benefit the scholarship foundation.

Structural Engineering Association 2011 NW Conference. The conference this year is hosted by the Spokane and South Central Chapter of SEAW. It will be held September 22-23 in Spokane Washington. See attached brochure.

National Council of Structural Engineers. The Association is holding the 2011 Winter Institute from February 25-26 in Amelia Island, Florida. See attached brochure.

THE WOOD AND STEEL OPEN-WEB TRUSS IN RENOVATIONS

By Dwaine Charbonneau, P.E., RedBuilt

Introduction

Open-web trusses built with wood chords and steel webs have been in common use in Oregon, as elsewhere, for quite some time. In fact this type of truss has been used extensively in floors and roofs throughout the region for fifty years, with installed footage in the millions. The structural engineer charged with a renovation project should not be surprised to encounter them.

To tackle such a project, it is important to understand how the pin-connected open-web truss works – what it is made of, and how it is designed – and what resources are available for assistance. The project objective may be an evaluation of existing trusses under new loading, or it may call for a modification or repair of a truss. Proper execution requires an understanding of the role of the truss fabricator.

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CONNECTIONS is a monthly publication of the Structural Engineers Association of Oregon, published to disseminate current news to our membership and others involved in the profession of structural engineering. The opinions expressed reflect those of the author and, except where noted, do not represent a position of SEAO.

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PRESIDENT'S MESSAGE: LESSONS LEARNED FROM THE VASA

By: Trent Nagele

The story of the ship Vasa chronicled by Commander Bengt Ohrelius in his book, "Vasa, the King's Ship", seems instructive for all of us who have professional responsibilities to ensure public safety.

Vasa was a Swedish warship—the newest in the fleet—and launched with great fanfare and the pride of her nation. She could not have come soon enough for the King who had ordered her construction and personally specified the dimensions. With many years of unrest and at times outright war in the Baltic's, the Navy was in need of strengthening and Vasa was an important step in the campaign.

She cast off on her maiden voyage on a summer afternoon at the order of Captain Hansson from her berth at the gun cranes near the palace where she had been outfitted. Slowly she was warped along Stockholm's quay with a number of dignitaries aboard. Also aboard were a number of wives and children of the crew and soldiers, who were allowed to be part of her historic maiden voyage, but would later depart before official operations commenced.

With much of the town watching the ship as she was maneuvered along the waterfront, her crew manned the lines and anchors from shore and a number of smaller boats that accompanied her through the harbor.

At last she reached the south end of the harbor and the order was given to rig her sails as her keel was pulled toward the east and the waterways that would eventually carry her to the sea some 30 to 40 miles away. Two guns were fired to signal her send-off and she was underway. There was only a faint breeze as she started out and many of the smaller boats found it easy to keep pace with her. But then a stronger gust of wind came off the land and the large ship heeled over a bit unexpectedly, but then quickly righted herself. A little further into the open harbor another stiff breeze came and again the ship heeled over now a bit more strongly than before. This time there was bit more anxiety as the Captain ordered the topsail sheets to be cast loose. But the ship again righted herself, the breeze died down and it was again calm as those on deck now enjoyed the view of the waning sun casting bright colors on the ripples of the water.

As she moved closer to the island of Beckholmen, still within sight of the City and her many well wishers, she was again hit with another gust. Again she heeled over. But this time it continued further than before as water now began to pour through the open gun-ports located just three four feet off the water because of the significant ballast she carried. The list continued to increase until her rails touched the water. "She was doomed. Immediately off Beckholmen she capsized and went gently to the bottom, flags flying and sail set."

It is estimated that some 50 people were lost as she went down. The toll would have been greater were it not for the many small boats still nearby who were able to rescue those fortunate enough to not be below deck when she went over.

A court of inquiry was immediately launched. Surely a serious error must have been made. But, as the key witnesses were interviewed, each had done their duty faithfully. The master of ordnance had ensured that the guns were secured. The Lieutenant in charge of rigging had properly rigged the ship. The ship's Master had ensured that all the ballast had been properly placed aboard, and had inspected it himself. Vasa's builder had followed the plans and dimensions detailed in the ship's 'sert', which served as the contract and had been prepared in accordance with the King's orders.

There had been a telling test a few weeks prior. A 'capsizing test' had been conducted, wherein thirty men run from one side of the deck to the other. The ship had rolled over the breadth of one plank on the first pass, and then two planks and three planks on the successive two passes until it was stopped by the Admiral. However, rather than acknowledge the obvious signs that the ship was top heavy, he dismissed it, instead suggesting that maybe the ship had too much ballast putting her gun ports too near the water.

The King had applied significant pressure, repeatedly writing the admiral and insisting that the ship be completed as soon as possible. By some re-

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REPORT FROM 2010 WCSEA ROUNDUP

By: Ed Quesenberry, S.E., SEAO Delegate

Before I launch into the summary of the proceedings of the two conference meetings Sue Frey and I attended, I need to apologize for the quantity of acronyms that are required to tell the story. It takes some effort to keep them all straight, and I will attempt to keep the confusion to a minimum.

The 2010 WCSEA Western Council Roundup was held in Whistler, British Columbia, on October 21 through October 23. The British Columbia chapter (SEABC) incorporated this event with the annual conference of the Canadian Association of Professional Engineers and Geoscientists (APEG), so there were well over 600 attendees present for the conference. There were two main SEA delegate meetings held which Sue and I attended as representatives of SEAO.

The first meeting was the Northwest Conference Committee (NWCC) meeting, the intent of which is to review the previous year's conference and discuss plans for the next one. Delegates from SEAs from Washington, Oregon, Idaho and British Columbia were in attendance. The last Northwest Conference was held in Tacoma and hosted by the Southwest Chapter of SEAW. Due to poor economic conditions and onerous provisions in the contract with the conference facility, the conference lost $11,000. Being that this is the first time that the conference has lost money, there was much consternation and debate about how this loss should be dealt with. Using some reserve funds, the NWC Committee was able to reduce the debt to $8,000. The board rules state that losses shall be shared by all member SEAs based on the number of paid members within their organization. Based on the total number of members in NWC SEAs, the assessment for the loss will be $6.00 per member, which equates to a bill of roughly $2,900 to SEAO. The SEAO Board is currently discussing how to handle this assessment and will be keeping membership posted on its progress. The 2011 NW Conference is going to be held in Spokane, Washington and hosted by the Spokane chapter of SEAW. The contract negotiations with the hotel where the conference will be held in Spokane have gone well, and the event planning is underway. SEAO will be hosting the 2012 NW Conference.

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ASCE 7-05 SUPPLEMENTS

Looking for Supplement No. 1 and No. 2 for ASCE 7-05 that are referenced in the 2009 IBC? Don't worry, you won't find it in ASCE's online bookstore where you bought the book—that would too easy! So here's some help... The key is to notice that it's a joint document, ASCE/SEI 7-05. That 'SEI' part is the Structural Engineering Institute of ASCE. They're the keepers of that which you seek. If you go to www.seinstitute.org and look under publications, you'll find the errata and supplements for ASCE 7-05. Note that the errata and supplement No. 1 are a combined document, and supplement No. 2 stands alone.

DID YOU KNOW?

OSBEELS allows the following Professional Development Hours (PDH) for SEAO- related activities:

2 PDH for active committee participation or serving on the SEAO Board.
2 PDH for preparing and delivering a presentation at an SEAO meeting
2 PDH for writing technical articles for the SEAO Newsletter
1 PDH for attending technical SEAO lunch/dinner meetings

There are maximum professional development hour (PDH) units allowed for certain activities. For example, individuals who write articles for a recognized professional or technical publication can claim up to a maximum of 10 PDH units per renewal period according to the Oregon Administrative Rule (OAR) 820-010-0635(3)(f). Additionally, active participation in a professional or technical society has a maximum of 6 PDH units per renewal period. Doing the math, you can get most, if not all, of your required 15 PDH each year just by being involved with and contributing to SEAO!
For your convenience, the link below will direct you to the OARs; specifically review OAR 820-010-0635.

http://arcweb.sos.state.or.us/rules/OARS_800/OAR_820/820_tofc.html

OCTOBER MEETING RECAP

By: David Tarries, P.E.

Drew Parks, president and CEO, of Columbia Wire and Iron presented on a number of CWI's recent projects of interest. He showed slides of the steel fabrication and erection on six projects from McMinnville to Miami to Panama. He discussed some of the challenges and innovations involved with each of them. The following are brief descriptions of the projects in his presentation:

- Troutdale Centennial Arch over the Historic Columbia River Highway in Gresham, Oregon. DXF files were used to CNC the members. Fit up was completed in the shop whenever possible to prepare for field erection. The size of the members was limited by powder coating facilities. The base plates were added after the base structure was constructed and surveyed to ensure fit-up.
- The Astoria Column spiral staircase renovation in Astoria, Oregon. The staircase inside the concrete structure was replaced with a new staircase made of cast A36 treads to match the existing structure. The stairs were lifted into place through the top of the tower while the roof was stored on site.

- The Evergreen Water Park building in McMinnville, Oregon. The building supports a retired 747 from Evergreen's fleet as well as a waterslide. Revit and Solidworks were used to help model the specifics of the structure as well as assist in the sequencing required to lift the aircraft into place on the roof of the building. The detailing was so precise that the landing gear of the 747 was surveyed after it landed in McMinnville. Multiple cranes with spreader bars were used to support the plane as it was "crawled" into position on the building.
- The Biomuseo, a Frank Gehry building with a very complicated and irregular shell, in Panama City, Panama. CWI worked with a fabricator in Panama to produce the components for the building. Many of the basic pieces were constructed in Panama with assistance (and tooling) from CWI. The more complicated and CNC components were fabricated in Portland and shipped to Panama. The tolerances on the original façade on the structure proved to be very challenging and eventually had to be relaxed by using a different manufacturer.
- A CalPERS administration building with elaborate exposed steel members and composite concrete infill in Sacramento, California. The main attraction in the structure is a large column in the entry with beams sweeping out from it like branches on a tree. Headed studs were welded inside of the hollow column to create a composite action with the concrete infill. CWI was also contracted to erect the steel and place concrete within the main column. Special care was taken to pour the concrete inside without overloading the column walls.
- A Miami International Airport light rail station addition with large steel arches. It is a complicated project involving close coordination with the concrete reinforcement detailer as well as as-built surveys to ensure proper fit-up of the steel pieces to the concrete supports in the field. The components were fabricated and painted in Portland and trucked to Miami, Florida.

While divulging the specific triumphs and trials of each project, Drew also touched upon many situations that are especially interesting or useful to designers. Most important is that there are a number of specialty steel fabricators in the Portland area. Local fabricators are not only competitive nationwide on complex fabrications, but they are sometimes the only bidders on specialty work. They are a great resource for local engineers. Steel fabrication has advanced greatly over the last 5 to 10 years and things that were not possible just a few years ago are available today. Shops frequently use CNC machines to produce complex shapes of various sizes, and computerized welding is being used more frequently to increase precision and speed.

It is helpful for the fabricator to be on board early with complex projects because availability of fabrication facilities, painting facilities, as well as restrictions on shipping dimensions can limit component and connection sizes. It is also a benefit to a project if a fabricator has a facility that allows the components to be erected in the shop before shipping to the field.

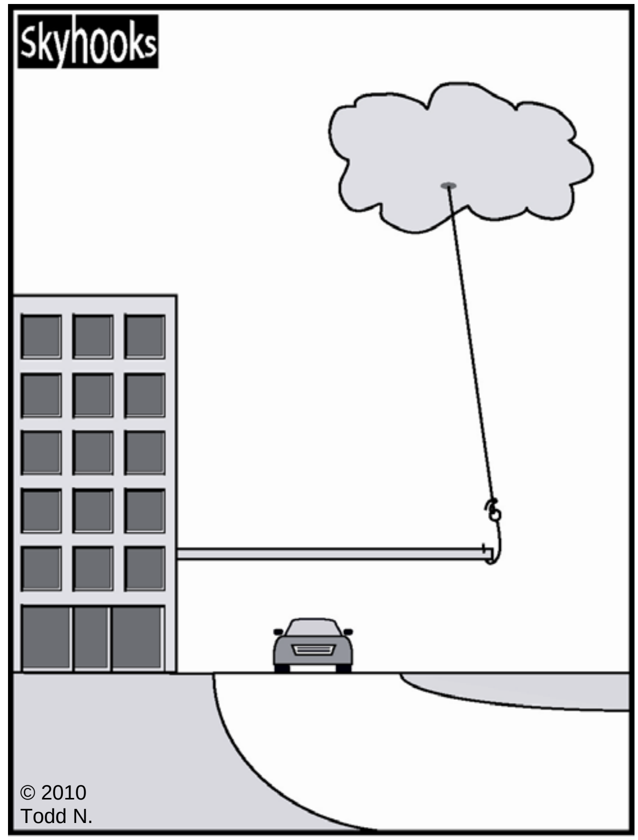
Casting steel members is becoming more common, particularly to match components for historical structures. Standard steel grades can be cast creating parts that exceed the specifications of archaic members. Another fabrication advancement involves the quality field finish repair. Touch up technology has increased greatly over the last 5 years, particularly for powder coating, resulting in cleaner erected assemblies.

Hopefully everyone who attended the presentation was able to take something away that will help make their next specialty steel project go more smoothly. For additional information on specialty steel fabrication, please contact Drew at drew@cwi1.com.

MEMBER OF THE MONTH

Dmitri Wright of Cascade Structural Engineering has been named Member of the Month for his contributions to the Snow Load Committee. He made significant contributions to initial drafts and final editing of the *2007 Snow Load Analysis for Oregon*. Subsequently, Dmitri has led the committee's current efforts to update the *SEAO Ground Snow Load Map* with revised snow load data. He has volunteered hundreds of hours in acquiring, analyzing, and reviewing snow data. Jacob Baglien assisted Dmitri with this work. Dmitri's diligence in resourcing of the data records, corresponding and exchanging data with committee members, and organizing of the results has proved invaluable to this project.

Dmitri received his BS in 1993 and then his Masters Degree in 1996 from Arizona State University. As a licensed professional structural engineer in multiple states, he has designed various residential, commercial, and industrial projects as well as several unique structures using alternate building materials. He lives in Hillsboro with his wife and two sons and he is an avid downhill skier. The SEAO Board greatly appreciates Dmitri's contributions to our organization.

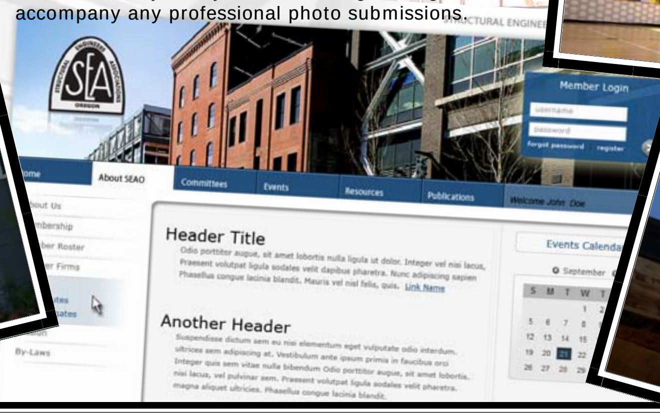


The Elusive Skyhook

Call for Photos

SEAO needs your photos! Our new website is under development, and we need good photographs of your structural projects from around Oregon. If you'd like to see your project be part of the new website, now is your chance.

What to Submit: Quality digital photographs highlighting Oregon structural engineering projects. Photos may be of portions of a structure, the completed project, components or connections, or from construction. We are looking for submissions that represent SEAO and the variety of projects our members work on. Buildings, bridges, marine, non-building, temporary, and others are all fair game.
How to Submit: Email your photos to pictures@seao.org before January 15, 2011. Please do not send excessively large files. Photos need to only be 72 dpi for web presentation. Also, please limit submissions to a maximum of 10 photos from one company. SEAO members only. In your submission, please indicate your company name, contact information and if possible the project name and location.
Photo Selection: Photos will be selected for use on the SEAO website. Photos may be used for the changing site mast picture, or as part of individual page layouts. Photos may also be used in the newsletter. Photos representing Oregon and Structural Engineering are preferred.
License: By submitting photos, you agree to grant SEAO license to publish the photos in our website or newsletter, without compensation, and certify that you have the rights to grant this license. A release should accompany any professional photo submissions.



THE WOOD AND STEEL OPEN-WEB TRUSS IN RENOVATIONS

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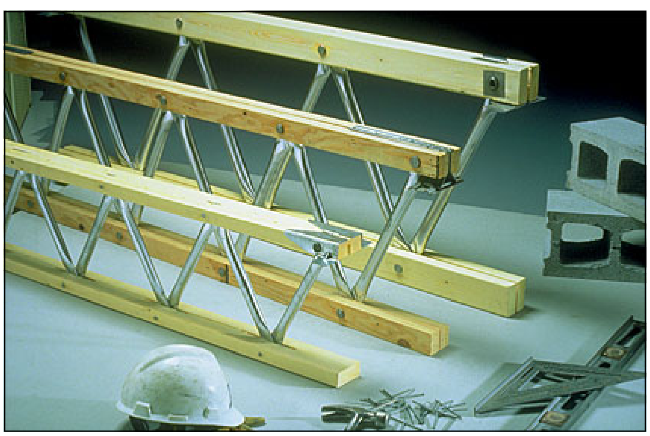
Truss Description

To borrow from an ICC-ES evaluation report, these "open-web trusses are Warren-style trusses that have either parallel, tapered or pitched chord members. The trusses have sawn lumber or engineered wood chords, steel-tube webs, and solid-steel pins used as web-chord connectors... Sheathing materials are nailed directly to the top chord members."

The truss webs are cut from thin-gauge galvanized tubing, with the ends flattened and punched to receive the pins; less frequently the webs are cold-formed, paired steel angles. The chords may be single or built-up, and oriented edgewise or flatwise, drilled and sometimes routed at each pin connection. The pieces are connected with pins, the result being a truss whose behavior is effectively approximated by an elastic, pin-connected analysis model. A steel bearing clip not only provides the means to attach the truss to the supports, but it transfers bearing forces to the first pin without resorting to dowel bearing in the wood.

As mentioned, this kind of open-web truss has been employed for decades. They are found most commonly in low-rise commercial structures, including office, warehouse, multi-family, retail, and school buildings, but they are not unheard of in single-family residences.



Truss Analysis

Design standards evolve. It is unlikely a truss designed fifty years ago was analyzed as it would be today, but the fundamental concepts are the same. A typical analysis of the truss accounts for continuity in the chords, and includes the following elements:

- Dowel bearing of the pin in the wood chord, parallel and perpendicular to grain, with end distance considered
- Bearing and net-section shear at the connection of web to pin
- Tension and compression capacity of the web, with buckling considered
- Shear in the chord
- Combined bending and axial force in the chord net section (at the pins)
- Combined bending and axial force in the chord gross section (in the "panels" between the pins), with buckling considered
- Capacity of the bearing clip, with eccentricity considered

Based on testing or a more rigorous analysis, the manufacturer may choose a method that is more conservative than that prescribed by the relevant design standards, which include the *National Design Specification for Wood Construction* and the *North American Specification for the Design of Cold-Formed Steel Structural Members*. This is a crucial fact that bears repeating: An open-web truss is a proprietary assembly whose design elements may not be adequately prescribed by the design standards, in which case the design is also proprietary. The engineer must not assume that the instructions for designing such a truss are contained in a book on his or her shelf.

Truss Design

The layout and materials in an existing truss represent a set of choices made within the contemporary framework of analytical methods and manufacturing limitations. The truss designer today has a number of tools which may be called upon to tailor the truss to the specified loads. Of particular interest to the structural engineer are:

- *Chord section:* Larger sections are better able to withstand combined bending and axial forces. Although those forces are most intense in regions of high bending moment, the same chord section is generally used throughout the length of the truss. Chord section may define a truss *model* or *series*. Since the truss series is usually determined in the specification, the designer resorts to a change of chord section as a last resort, and only upon agreement by all parties to the construction project.
- *Panel layout:* When it comes to labor, the factor that influences productivity more than any other, given a chord section, is the number of panels. Assemblers are not so much building trusses as they are building panels, so it is beneficial to use an open-web layout that is more open, so to speak. The mantra "deeper is cheaper" means simply this: a deeper truss experiences lower chord compression, therefore a longer effective length and increased bending stress in the panel are tolerable. Up to a certain point, the savings in labor will more than offset the cost of the longer webs.
- *Chord grade:* Greater bending strength and axial stiffness, though they come at greater cost per foot of material, may allow for a more economical panel layout. Again, labor savings may trump material cost.
- *Web section:* Large diameter, thicker-gauge webs are required in the portions of the span dominated by shear. Lighter sections are employed where shear is low in order to reduce cost.

Truss design is a complex task made possible by proprietary design software. The computer performs the analysis, of course, but

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may also automate the selection of materials and layout to optimize the cost.

Evaluating New Loads on Existing Trusses

The engineer may be tempted to refer to an archive of the manufacturer's load tables to evaluate an existing truss subject to revised loading. Examine these tables with care to determine their basis. Commonly, load tables demonstrate the *maximum feasible* resistance in pounds per foot, given a chord section (i.e. truss series), span, and depth. As such, trusses represented by the load tables may incorporate the highest grade of chord, the heaviest web sections, and the shortest panels. It is more economical to specify a truss that carries less than the table load – sometimes significantly less – and so the manufacturer's representative will usually steer the specification in that direction.

It is important to understand that the manufacturer's designer will use the aforementioned design tools to optimize material use and labor requirements, given specified loads. It is likely that the as-built truss will have at least one component (and usually several components) designed very near the allowable stress. Typically that means the top chord panel lengths at midspan are tuned with the chord grade to maximize the combined stress, and web sections are then chosen by diameter and gauge to meet the demands of the chosen panel layout.

Thus it would be a mistake to use maximum feasible load tables to determine the capacity of an existing truss. Most likely the truss can carry the loads for which it was designed, and nothing more. A possible exception to this rule is a truss of the same series, depth, and spacing, but shorter span than other trusses in the same structure. The series, depth, and spacing may have been applied to smaller areas of the plan for consistency – even the panels may be the same length to facilitate the passage of ducts through the webs – and so the design strength of the shorter truss may not have been put to maximum use.

When evaluating new loads on existing trusses, there are two paths to a solution. The first is taken if a realistic appraisal of new loading is within the original design parameters of the existing truss, in which case the truss is deemed sufficient. The total magnitude of the loads must not exceed the original design loads, of course, but also the distribution of the loads must be the same. A truss designed for uniform loads only cannot be affirmed for concentrated loading without analysis. It is not enough that the new shear and moment diagrams remain within the envelope of the originals; introducing a new point load brings with it a number of design considerations, including pin bearing and combined bending and axial force in the panel supporting the point load.

These considerations lead to the second method: Contact the truss fabricator for assistance in the analysis. The manufacturer may have records of the actual truss design on file; failing that, a representative may do a field survey of the truss to record the span, depth, panel layout, and web, chord, and pin materials. A designer will then use modern software and methodology to determine whether the truss is able to carry the new loading. In the event that the existing truss is insufficient, the designer may be able to recommend modifications that will increase the capacity.

Modifications

The conditions of use, as stated in the ICC evaluation reports for these products, clearly state that cutting of the truss chords is not permitted. It goes without saying that the webs, pins, and bearing clips must not be altered by the owner. This does not mean, however, that modifications are out of the question, as there is a distinction between conditions of use and proper engineering. With the truss manufacturer's engineering assistance, many types of modifications are possible. The manufacturer's expertise is crucial in accounting for all design aspects of the proposed modification.

To shorten a truss in order to, for example, make way for a new elevator shaft, it may appear to be as simple as removing a few panels from the truss. Nonetheless, while the relocated bearing clip may be sufficient for the reduced reaction and the chords may be adequate for the reduced axial forces, it would be a mistake to assume the webs are sufficient. Recall that the webs in the middle portion of a truss may be of the lightest diameter and gauge. The pins may also be of a smaller diameter to maximize net chord section at midspan. Shortening a truss may move a web into an area of greater shear; it may also place compression on a web designed exclusively for tension.

This is but one example of a truss modification and the potential for oversight. Trusses should not be modified without the manufacturer's design assistance. Again, the manufacturer may have records of the original truss design on file. It is a fairly simple process, given the proper design software, to analyze a truss with a proposed modification. The fabricator may be able to provide detailed drawings and instructions, as well as the necessary parts to complete a modification.

Truss Repairs

By now the reader can guess that the design of truss repairs should involve the truss manufacturer. Whether the repair calls for replacement components, design work, or both, the manufacturer is an essential resource.

Truss chords may be damaged in a number of ways. Common causes are accidental cutting or drilling by plumbers, electricians, HVAC installers, etc.; breakage due to rough handling; fire damage; and rot due to faulty roofing. Rough handling is usually the cause of web damage, though cutting by the trades is not unheard of.

A truss that is damaged in handling prior to installation may best be repaired by returning it to the plant. One advantage of the pin-connected truss, however, is that on-site modifications and re-

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pairs are not out of the question. A skilled carpenter is able to accomplish the required tasks without special tools, provided those tasks are detailed by the manufacturer.

Chord repairs on installed trusses generally involve shoring, cutting, and drilling. Sheathing must be removed for access to the top chord. Portions of a chord may be replaced, but damage to a tension chord at midspan may preclude mechanical connections, in which case the entire chord must be replaced. The manufacturer can furnish entire or partial chords drilled and routed to the original specifications for easy installation. Sharp photos of the damaged area should be provided to the repair designer to give a clear understanding of the character and extent of the impairment.

Pins are friction-fit on this type of truss. They may be driven out without the use of special tools, but driving them in is more of a challenge, as the holes in the chord and two webs must be aligned. Adjustable shoring is an aid in this task, as is a tapered alignment tool provided by the manufacturer.

Damaged webs are not repaired; the only recourse is replacement. The basic task is simple enough – shore the truss, drive the pins out, replace the web. Generally the most difficult part of the job is gaining clear access, depending on how many ducts and pipes are in the way. On a construction project that is underway, repairs should be initiated as soon as the damage is discovered.

The truss fabricator may have a copy of the original truss design on hand. Since the web sections and hole sizes vary throughout the length of the truss, the critical information to pass along to the manufacturer is the web number, and from which end of the truss does the counting start. If a truss end was painted for orientation during installation, the painted end is a good reference.

Conclusion

One advantage of the pin-connected wood truss is that it is amenable to modification or repair. The engineer contemplating any sort of truss renovation, however, must understand that collaboration with the truss manufacturer is imperative. Even design tasks which appear to be straightforward carry potential risks, of which only the experienced truss designer may be aware. The fabricator can provide not only proprietary truss components, but proprietary design methods, using software and manufacturing equipment to efficiently deliver a complete and timely solution.

Dwaine Charbonneau, P.E., writes from his perspective as an employee of RedBuilt LLC. Readers are advised to consult with their truss fabricator for specific recommendations. RedBuilt™ provides technical and manufacturing support for their RedBuilt™ Open-Web trusses, as well as the former Trus Joist® models, such as the TJL™, TJW™, TJS™, TJM™, and TJH™ (trademarks of Weyerhaeuser Company). For assistance with RedBuilt™ trusses, please call (866) 859-6757, or visit www.redbuilt.com and enter your zip code to contact your local RedBuilt™ technical representative. Mr. Charbonneau may be contacted at DCharbonneau@redbuilt.com.

REPORT FROM 2010 WCSEA ROUNDUP

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The second meeting was the Western Council of Structural Engineers Associations (WCSEA) Board Meeting. This meeting included all of the delegates from the NWCC meeting along with delegates from the Arizona and Hawaii organizations. The delegates from Montana were unable to attend. The main purpose of this meeting is to review the previous year's activities of each member organization, discuss what resources can be shared between organizations in the coming year, and to review the status of upcoming code revisions. The "hot" topic was a discussion of the professional engineer reciprocity requirements between the United States and British Columbia. Professional Engineers in the U.S. obtain their registration through a process of examinations, whereas the British Columbia system is based on an apprenticeship process. Consequently, reciprocity agreements with BC vary greatly from state to state here in the U.S. As it stands now, it is apparently straightforward for a licensed SE in the U.S. to obtain reciprocity and registration as a PEng in British Columbia, however it is not easy for a PEng from BC to obtain reciprocity here. The delegates from BC voiced dissatisfaction with the current negotiations with the State of Washington to loosen its reciprocity requirements to make them more equivalent. SEABC requested a letter of support from the WCSEA Board, but the issue was tabled for further discussion by the member SEAs.

These are the highlights of the meetings, but many more topics were discussed and ideas exchanged. If you are interested in seeing a more thorough summary of either or both of the meetings, email me at edq@equilibriumllc.com and I'll send you a copy.

LESSONS LEARNED FROM THE VASA

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ports, changes in the ships dimensions had also been demanded by the King and accommodated by the builders.

In the end, no sentences were handed down. There had clearly been warning signs, but it seems that with increasing pressure, there was no one willing to step forward and point out the obvious flaws. Instead, each claimed he'd fulfilled the duties of his job –no more, no less. Yet, the results were disastrous.

Balancing our professional duty to ensure public safety with the popular expectation that "the customer is always right" can sometimes feel like a high-wire act. We want to take care of our clients and ensure that their expectations are met, yet we sometimes have to draw a line when their instructions are not realistic or conditions have reached an unsafe point. Doing so is usually not easy, but sometimes it's imperative.
Vasa sank in 1628. Though many tried to recover her, she lay in only a little more than a hundred feet of water for nearly 330 years. Successful salvage operations finally brought her to the surface in 1959. Today she is on display in the Vasa Museum in Stockholm.