The TJCAA Quarterly

spring 2022

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TJCAA's Business Certifications

- Alameda County Small, Local Emerging Business
- Bay Area Green Business Program
- California DGS SBE
- City of Colton SBE
- City of Los Angeles SBE
- City of Oakland LBE
- Eastern Municipal Water District SBE
- Inland Empire Utilities Agency SBE
- Metropolitan Water District of Southern California SBE
- Sacramento Municipal Utilities District (SMUD) SEED Vendor
- San Diego County Water Authority SBE
- Port of Long Beach SBE
- Port of Oakland LIABE/SBE/VSBE
- PWC Registration—Dept of Industrial Relations (DIR)
- West Basin Municipal Water District SBE

Message from the President, Gianna Zappettini

I had two photos in my queue for developing my message. One was an analog scale, and one was a male quail. While weighing the decision over using so many rhyming words—scale, male, quail—I figured I'd just go with the bird in the hand and use both. The analog scale is old-school, but it gives me readings that are to my liking. Without a specific number, I can easily round down if the needle falls between two lines. The male quail is a reminder to stop and enjoy nature. Both options fit well in my regimen to try and stay healthy. Another part of that regimen includes interacting with our great staff members at TJCAA. When we get together, we can shoot the breeze before getting down to the fascinating work we receive from our wonderful clients. If you are looking for engineers who specialize in structural, electrical or control systems programming, I recommend talking with us about your next project. We have good-natured, well-qualified folks who on a scale of 1 to 10 always rate above a 10.

Featured Employee: Monica Thow

Our featured employee for this edition is Monica Thow, who has been with our company for ten months. Monica works as an administrative professional in TJCAA's Walnut Creek Office, where she helps to support our Electrical, Control Systems, and Structural Engineers.

When you call our offices, it is likely that the first voice you will hear is Monica's. Monica is our primary phone wrangler, and as an office professional, she also handles a range of other tasks during the workday. In support of our engineers who are providing services during construction, for example, Monica manages the database for all the submittals and requests for information that we receive. She also ensures that our many files are saved to our servers where they belong.

We prepare and deliver numerous specifications, letters, and reports, and Monica formats them to TJCAA or client standards. Maintaining records, managing our supplies, and performing "triage" on everything that comes into our office are the ways she helps us stay organized. Her duties also include coordination with our event committee to plan our community-building company events.

Monica joined TJCAA after 11 years as an instructional aid in elementary schools. She tells us that in this role and while running her own tutoring

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business, she found helping kids to be very rewarding. "It's wonderful when you can help them find the piece of the puzzle that is missing for them," she tells us. "When they understand that piece, and can do their work, their confidence grows and it's a great moment."

When asked about working at TJCAA, she told us that her favorite part is the people she works with. We're glad to hear that Monica enjoys helping us with our puzzles, too!

Creating Basic 3D Models with a Phone App

This model was made with a phone app using more than 100 photos. You can rotate, zoom, and pan this model online here.

We recently took an online tour of a small pump station site using a 3D model created by TJCAA's James Myers, P.E. He wanted an easy way to visualize and share the layout of the station without a set of plans, so he pulled out his phone and scanned the facility using a phone app called Polycam. The resulting model allows the user to zoom in and view the structure from different angles.

To capture the data, James recorded a short video of the structure using the software's "pro" version. He then uploaded it to the Polycam website, where it was processed in the cloud into the 3D model. James explains, "In a situation like this, it is nice to have the model, which we can use to take some gross measurements and remember the layouts. A carefully recorded, clear model could be used for planning and design discussions with our clients."

James cautions that the usefulness of such tools does depend on how much data is collected. Professional-grade surveys with highly accurate measurements are a different beast, but for visualizing general layouts, especially when plans are not available, having the capability of an app like Polycam in your pocket can be very helpful.

Performing 3D Structural Analysis

As Structural Engineers, we often perform evaluations to determine internal forces for existing or new structures. Some structures (simple concrete basins, for example) can be analyzed using time-tested tables and charts to determine internal forces.

For complicated structures, such as multistory buildings, complex frames, or unusual rectangular or circular basins, we often perform analysis using 3-dimensional analysis packages such as RISA-3D.

With the software, we create a model of a structure (or part of a structure) by entering data regarding its materials and geometry. For framed structures, in which the elements can usually be defined by endpoints, the data would include materials and dimensions of columns, frames, beams, decking, and/or bracing. For tank and basin structures, we include "plate" elements

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Performing 3D Structural Analysis

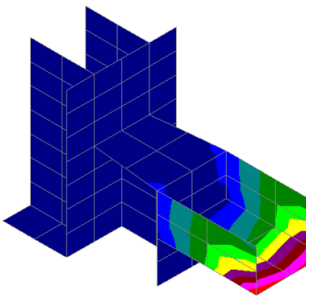
(3- or 4-sided elements) that simulate the geometry of the bottom slab, walls, and upper decks (if any) and/or roof of the structure.

We then model the anticipated loads that will be applied to the structure. "We can do all kinds of things with basic loads and load combinations," explains Terry Cavanagh, S.E. "We create standard loads like dead loads, live loads, soil loads, and surcharge loads. We also create earthquake, wind, hydrodynamic, and "moving" loads as needed for a particular structure." All these loads are combined using load factors as required by the Code.

Terry says the model runs can take anywhere from 5 seconds to several hours on a custom-built computer. "The output tells us the reactions for the supporting elements and the internal stresses of the framing members and/or plates, which helps design the members. We can also let the software design the members through optimization routines based on input we provide. Either way, we can provide members that are structurally adequate without wasting our client's money.

"There are other things we can get out of the model," Terry goes on. "The model outputs include dynamic properties for the structure, so we can determine anticipated dynamic loading and assure that the structure won't have a resonance frequency that's similar to a loading frequency, such as a pump or a specific wind load.

The internal stress results may be displayed in color-coded stress contours, so we can quickly see where problem areas are. Further, the results can display deflected shapes, so we can see how the structure will move when subjected to various loads.



This illustration shows the results of RISA modeling for part of a steel rail system that supported a generator. The assembly had been in a severe vibratory event, which was of sufficient magnitude to bend the engine support rails, while damage to the rail system in the form of warping was not visible. We were asked to determine whether the rail system could be reused.

Richard Thow, S.E., modeled the rail system as a collection of plate elements. With the model, areas of high stress concentrations ("hot-spots") could be readily identified. The portion of the rail system displayed here was an outrigger, which was used to extend the support system to base spring isolator footings. Our modeling found that the maximum stresses in the outriggers under static and dynamic loading (shown in pink in the illustration) exceeded the allowable stresses. TJCAA was able to recommend retrofit options that reinforced the components to withstand the anticipated loads.

Terry modeled the concrete structure shown below using 3-inch square plate elements. Using the software, we could quickly see which parts of the structure were overstressed (in this case, red elements have the highest stress) and design a modification to keep internal stresses below Code requirements.

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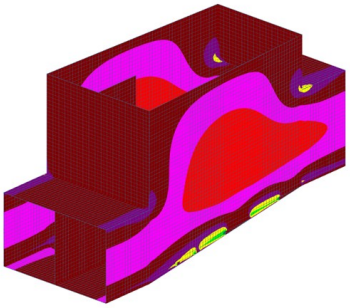
Did You Know?



Terry's experience with computer modeling for structural analysis goes back to his time at the University of California at Berkeley. One of Terry's professors was Professor Emeritus Edward L. Wilson, who was the Vice Chairman of the Civil Engineering Department. Professor Wilson wrote the first automated finite element analysis computer program and analyzed Norfork Dam in 1960–62. During his studies with Professor Wilson in the 1980s, Terry wrote structural analysis routines that were combined to create a package that could analyze structures. Terry was thankful for his Apple IIe, as going to Evans Hall to create and batch process punch cards was no longer required!

Learning how to write this software was important for his career, Terry notes, because this work helped him understand "what's under the hood" in the models. Early on, he learned to create complex structure models so that they represent what happens in the real world. His understanding of the heart and history of these models, and knowing what the software is accomplishing, helps him to understand what the inputs should be and when the output just doesn't make sense.

Terry has modeled structures ranging from circular basins and other water-containing structures to full buildings and oil platforms. "Things in the real world don't always match what the software has," Terry says, "and we need to understand how we can use what the software has available and sometimes trick it to accurately simulate the actual structure. This ability to work effectively with the models helps us to get more representative results."

If you would like to discuss structural analysis for your facility, please give us a call.

Did You Know?

The world's first ski area chairlifts opened on Dollar and Proctor Mountains at Sun Valley Resort in 1936, and they were invented at a railroad company. Back then, the Union Pacific Railroad operated passenger service through the mountains and throughout the west, making it a viable option for vacation travel. In fact, the 1939 UP system map boasted, "If it's a National Park, it's probably on the Union Pacific."

Dollar Mountain Lift. Sun Valley, Idaho. Idaho Cities & Towns Collection, Digital Initiatives, University of Idaho Library. Reference Link

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Did You Know?

Employment Opportunities

The chairman of UP, W.A. Harriman, wanted to explore the idea of a resort that could be accessed via UP passenger train service, and an Austrian developer was interested in creating a European-style ski resort in the USA. They identified a beautiful location in the Sawtooth Mountains northeast of Boise, Idaho, where enthusiasts could reach the resort with UP service, yet "get away from it all."

Guest Riding Lift on Proctor Mountain. Idaho Cities & Towns Collection, Digital Initiatives, University of Idaho Library. Reference Link

Rope tows and J-bars, both surface lifts, were already proven methods of transporting skiers uphill, but as a transportation company, UP decided to work on finding a better, more comfortable way to move skiers up the slopes at its new resort.

Jim Curran, a UP Structural Engineer was working on the task. Curran drew inspiration for the chairlift from his previous experience at an iron works company, where he had become familiar with a system that moved bananas onto ships. The loading system transported the huge bunches of bananas on hooks, hanging from a moving cable. He reasoned, you could just replace the bunches of bananas with a hanging chair, and you could transport skiers over the snow, even wearing skis. They tested prototypes at the company's headquarters in Omaha to determine how fast the machine could run safely. To do so, they attached a prototype hanging chair from a rig on the side of a truck.

In December 1936, the Sun Valley ski area opened, and that was the frosting on the cake of a big year for skiing. In January 1936, the first issue of SKI Magazine was published. In addition, the year brought the first ski instructor certified in the United States and the first ever Olympic alpine skiing events.

What, you may ask, became of that innovative structural engineer? We hear that he never profited from his invention, but in 2001, he was inducted into the U.S. Ski and Snowboard Hall of Fame, 32 years after Harriman. UP, now a freight company, sold Sun Valley on November 15, 1964, and ended its 105 years of passenger service in 1971.

Employment Opportunities

TJCAA is looking for qualified engineers to work on great projects with great people. To view and apply for open career positions, visit our website at www.tjcaa.com.

VISION
WE ARE A SUCCESSFUL ENGINEERING FIRM RECOGNIZED FOR OUR PROFESSIONAL EXPERTISE, RESPECTED FOR OUR QUALITY, AND KNOWN AS A GREAT PLACE TO WORK.

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Dates to Note

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Mar 20	Spring Solstice
Mar 27	Earth Hour
Mar 27–31	ACI Concrete Convention, Orlando, FL
Mar 27–30	AWWA Sustainable Water Management Conference, Denver, CO
Mar 28	F1, Bahrain Grand Prix
Apr 4–6	ICRI Spring Convention, Baltimore, MD
April 7	Major League Baseball Opening Day
Apr 7–10	Masters, Augusta, GA
Apr 11–14	CA-NV AWWA Spring Conference, Anaheim, CA
Apr 18	Boston Marathon, MA
Apr 18	Tax Day
Apr 20–23	ASCE/SEI Structures Congress, Atlanta, GA
Apr 22	Earth Day
Apr 22	SF IEEE/IAS Annual Engineering Seminar, Pleasanton, CA
Apr 24	Opening Day on the Bay
May 2	Stanley Cup Playoffs
May 4	Star Wars Day
May 7	Kentucky Derby
May 16–22	PGA Championship, Tulsa, OK
May 21	147th Preakness Stakes, Baltimore, MD
May 22–Jun 5	French Open
May 26–29	Monaco Grand Prix
May 29	106th Indy 500
Jun 2–19	NBA Finals
Jun 10–11	Belmont Stakes, Elmont, NY
Jun 11	King Kamehameha Day
Jun 12–15	AWWA ACE22, San Antonio, TX
Jun 16–19	US Open, Brookline, MA