

currents



VIRTUAL REALITY ENHANCED DESIGN

The Next Step in
3D Design Has Arrived

PLUS—

Carollo Cares Program Highlight

Virtual Reality Enhanced Design

Two New WRF Publications on
Co-digestion of Organic Waste

Carollo's Bryant L. Bench
Scholarship

IWA Innovation Award goes to...
City of Altamonte Springs, FL

Carollo's Spotlight

PAUL M. FLICK
CORPORATE COMMUNICATIONS MANAGER



Welcome to 2019!

We anticipate another exciting year in the water industry, and to prove it we're kicking 2019 off with a cover story about how virtual reality has become the latest 3D design tool. So for those of you who received VR toys for the holidays, it's not all lightsabers and hovership racing.

We're also talking about the importance of STEM education in our schools, new guidelines for turning waste into energy, and how some of our engineers are making a big impact on our industry.

As always, we hope you'll find this issue of *Currents* to be interesting and educational, and we look forward to bringing you what's "current" in our world throughout the year. We hope you've had a great start to 2019 and we will see you soon!



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TECHNICAL EDITOR: Jess Brown
(714) 593-5100 | jbrown@carollo.com

CONTENT EDITOR: Nick Webber

DESIGN AND PRODUCTION:
Laura Corrington, Matthew Parrott,
Carol Belisle, Stacy Fuller

**2018 WORLD EDUCATION
TOP 20 POLL
SECOND QUARTER RANKINGS**

- RUSSIA
- UNITED KINGDOM
- SINGAPORE
- SOUTH KOREA
- CANADA
- IRELAND
- CHINA
- JAPAN
- SWEDEN
- FINLAND
- DENMARK
- NEW ZEALAND
- ISRAEL
- INDIA
- USA**
- AUSTRALIA
- BELGIUM
- BRAZIL
- SPAIN
- SWITZERLAND

NJ MED's World Education Top 20 Poll puts the US in the bottom 25th percentile. Source: New Jersey Minority Educational Development, 2018

CAROLLO CARES
PROMOTING STEM EDUCATION
FROM COAST TO COAST

Paul Flick (pflick@carollo.com)

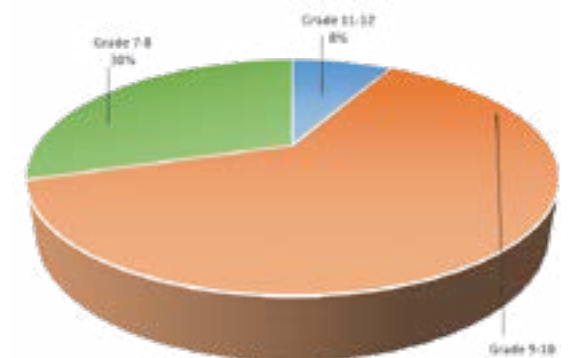
STEM education (Science, Technology, Engineering, and Mathematics) has become an important topic for educators across the country. According to NJ MED's 2018 World Top 20 Education Poll, the United States is currently ranked in 15th place in overall student education, including the STEM categories. While this is a slight bump from our 16th place finish in 2017, the US is still in the bottom 25th percentile overall. And with fewer high-school students pursuing careers in engineering, science, and mathematics, US students are in danger of falling even further behind the world's top countries.



"Near to Peer" team members Matt Sokolowski and Cari Ishida talk to elementary school students in Chicago about the importance of clean water.



"Near to Peer" team members (l-r) Sarah Burns, Tatiana Vargas, Angelica Gregory, and Nancy Lundie talk to teens about water engineering in Miami, Florida.



Keeping older students interested in basic and college prep math is increasingly difficult for US educators. Source: U.S. Department of Education, Office for Civil Rights, Civil Rights Data Collection, 2011-12.



Female 8-12 grade students tour the innovative Pure Water Demonstration Facility in San Diego, California.

At Carollo, we believe that the next generation of engineers and scientists will be key to helping solve some of the world's greatest water challenges, such as creating sustainable supplies, providing reliable water delivery systems against increasingly unpredictable storm events. The Carollo Cares program is our corporate commitment to improving STEM education at a local level, helping clients and communities educate young people about water-related issues, with the hope of encouraging future generations to implement solutions that make our environment and water supplies more resilient.

Our Carollo Cares "Near to Peer" teams look for opportunities to bring engineering education to elementary, middle, and high-school students in their communities. From simple presentations to younger students about where our water comes from (and where it goes) to multi-day engineering contests and events for high-school students, Carollo's young engineers share their enthusiasm, knowledge, and experiences with potential future scientists, engineers, and operators. Our hope is that these young students will see water engineering as a viable and exciting career path, and maintain their interest in STEM careers as they progress through their education.

VIRTUAL REALITY ENHANCED DESIGN

THE NEXT STEP IN 3D DESIGN HAS ARRIVED

Patrick Carlson, P.E. (pcarlson@carollo.com) | Ivan Thorne, CM-BIM | Vincent Hart, P.E. | Chris Cleveland, P.E.



3D design has matured into an effective and efficient platform for delivering high quality projects. Virtual Reality (VR) enhanced design is the next evolution and a significant improvement in 3D design that many in our industry have greeted with both enthusiasm and skepticism. Those who have used it understand its unique benefits, while those who have not often ask, "What's the big deal?" For VR enhanced design, the old adage "seeing is believing" rings true.

WHAT IS VR?

VR uses a stereoscopic headset to simulate a person's visual surroundings. When worn, a person sees and "feels" like they are standing in the virtual environment presented, and are able to walk and look around in all directions. Using VR to tour a 3D design of a plant or other facility makes it feel like you've visited the facility, even though it hasn't been constructed yet.

WHAT IS VR ENHANCED DESIGN?

VR enhanced design merges VR technology with conventional 3D design software and procedures. It includes a VR headset or goggles driven by a powerful computer that runs standard CAD 3D design software with additional software plugins that create the VR images in the headset. When the user wears the headset, they can walk through and experience a 3D design in VR as if it were built full-scale. The engineer can also leverage VR throughout the design process, such as providing virtual site walks at design review workshops.

WHAT ARE THE BENEFITS OF VR ENHANCED DESIGN?

- Increased client collaboration and feedback
- Enhanced quality and project team coordination
- Improved design innovation and project scope definition

One of the greatest benefits of VR enhanced design is increased collaboration with Operations and Maintenance (O&M) personnel.

During the design process, O&M personnel rarely have sufficient time to study design drawings and fully visualize the design. Furthermore, drawing reviews are often time consuming and daunting for non-design personnel who may struggle conceptualizing the facility from the plan and section cuts in the drawings. This results in missed opportunities to obtain O&M feedback and collaboration early in the design.



When virtual tours of the 3D design are provided, collaboration with O&M personnel improves significantly. An individualized 10- to 30-minute VR tour of the design is often more than sufficient to kickstart collaboration. With the tremendous amount of information conveyed quickly to reviewers, they are armed with a clear understanding of the proposed design and are often able to provide design enhancements they otherwise wouldn't.

VR enhanced design allows engineers and designers to periodically walk through the design, allowing for rapid design iteration and improvements. Because VR presents the design in full-scale, design flaws and potential improvements are more apparent in VR than they are in conventional 3D software and paper plan sets. Spatial layouts of piping and equipment are also easier to critique and improve when seen in VR.

HOW IS VR ENHANCED DESIGN DIFFERENT THAN 3D DESIGN?

Current 3D design processes fail to provide the creator and viewer true scale and depth. This is because the 3D design is flattened and shrunk to a 2D surface, such as a computer screen or paper printout. The viewer is thus required to interpret and rescale the image based on cues provided in the 3D image (human silhouettes, vehicles, doorways, etc.).

VR enhanced design, on the other hand, is the full realization and embodiment of 3D design, eliminating the need for the user to reinterpret and rescale. With VR, the human mind processes information using both eyes stereoscopically (60,000 times faster than text). VR leverages this ability by showing each eye a separate image of the stereoscopic 3D design. The mind then effortlessly interprets these images at 100 percent scale and depth, freeing the user to evaluate, critique, and improve the design.

WHAT TYPES OF PROJECTS CAN BENEFIT FROM VR?

Complex projects, such as treatment plant designs and retrofits, yield the most benefits from VR due to their high degree of 3D coordination and O&M staffing requirements. Still, most projects can see the benefits of VR, including projects with a community outreach component to address during design.

HOW MUCH WILL VR ADD TO PROJECT DESIGN COSTS

If the project is set up for VR at the onset, VR will add very little to the cost of a design. Costs include the hardware and software, as well as a set amount of time to set up the software to view 3D CAD files in VR. Some additional time is also spent at each design review workshop to provide one-on-one VR tours and gain direct O&M input.

Transitioning an existing project to leverage VR will take additional time as well, but it is inexpensive as long as the design is already being done in 3D. Nonetheless, the benefits of greater collaboration and quality far exceed the minor additional design costs.



CHUCK HALE, PLANT MANAGER FOR THE DUCHESNE VALLEY WTP, UT, TOURS A 3D VIRTUAL MODEL

WHAT PLATFORMS CAN VR BE USED WITH?

Virtually all major CAD platforms interface with VR equipment with the proper software plugins.

VR enhanced design is here and ready to be implemented on your next design project. Give it a try!

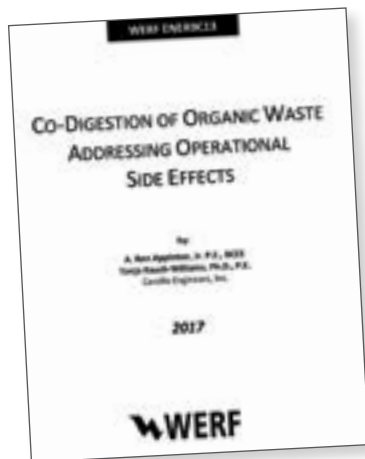
WRF Publishes Two Carollo Research Studies:

INDUSTRY GUIDANCE FOR High-Strength Organic Waste Co-digestion to Increase Energy Recovery

Tanja Rauch-Williams, Ph.D., P.E. (trauch-williams@carollo.com)



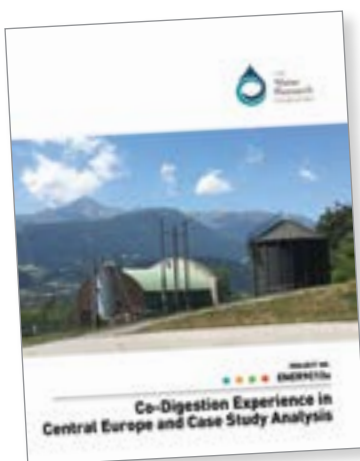
We are pleased to announce that WRF Projects “Co-Digestion of Organic Waste Addressing Operational Side Effects (ENER9C13)” and “Co-Digestion Experience in Central Europe and Case Study Analysis (ENER9C13a)” have been finalized and are now available through the WRF’s website. (<https://www.werf.org>).



CO-DIGESTION OF ORGANIC WASTE ADDRESSING OPERATIONAL SIDE EFFECTS (ENER9C13)

This study evaluated operational side effects associated with co-digestion of high-strength waste (HSW) and conventional wastewater solids (thickened primary sludge and thickened waste activated sludge) at water resource recovery facilities (WRRFs). HSW co-digestion provides an opportunity to increase energy recovery through additional methane production with anaerobic stabilization. However, HSW co-digestion also presents several challenges to WRRF operations and maintenance staff.

This study provides guidance for co-digestion facility design. It evaluated the performance data, and operation and maintenance experience of five case studies located in New York, Texas, Oregon, and California that are accepting different co-substrates for energy production. The project further assessed the impacts of co-digestion of HSW on methane production, sludge production, and nitrogen and phosphorus concentrations in recycle streams.



CO-DIGESTION EXPERIENCE IN CENTRAL EUROPE AND CASE STUDY ANALYSIS (ENER9C13A)

This study provides a comprehensive literature review and summary of the regulatory and administrative, logistical, technical, and operational experience gained in Central Europe with co-digestion systems at WRRFs over the past two decades.

In this review, emphasis was placed on topics of relevance for utilities in North America to help with practical guidance for the successful implementation of co-digestion programs. An overview of the historical, regulatory, financial, organizational, and administrative framework of digestion and co-digestion systems is included. The study also describes co-digestion case studies in southern Germany and Austria, illustrating design and operational solutions and experiences with these systems at WRRFs of different size and complexity.

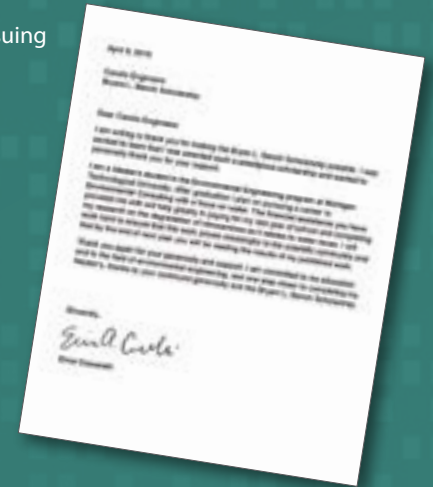
Our Carollo-led team was just recently awarded two additional co-digestion WRF efforts in 2019/2020: “Characterization and Contamination Testing of Source Separated Organic Feedstocks and Slurries for Co-digestion at WRRFs” and “Workshop: Parameters to Calibrate Anaerobic Models for Co-digestion and High Strength Waste Digestion – Standardizing Terminology and Characterization” (WRF #4915).

Carollo Awards BRYANT L. BENCH SCHOLARSHIP to Michigan Technological University Student

Carollo awarded its third Bryant L. Bench Scholarship to Erica Coscarelli, a student who is currently pursuing her Master's degree at Michigan Technological University. The scholarship was presented to her at the AWWA ACE18 Conference in Las Vegas, Nevada.



From left to right: David LaFrance (AWWA CEO), Erica Coscarelli (Bryant Bench Scholarship Recipient); Dr. Jess Brown (Director of Carollo's Research and Development Practice); and Brenda Lennox (AWWA President)



The scholarship was established in honor of Carollo Engineers' Water Practice Director Bryant Bench, who dedicated his career to water treatment and developed unique treatment methods to improve drinking water quality for millions across the country. Bryant was also a mentor and teacher, setting "Benchmarks" to care for, trust, and learn from those with whom and for whom he worked. Applicants for this scholarship must be pursuing a Master's degree in a water engineering-related field and have shown a passion and dedication to providing innovative solutions to the world's water challenges.

The scholarship consists of a one-time \$10,000 award that students can use to complete or further their education in their chosen field.

Congratulations to Erica!



CITY OF ALTAMONTE SPRINGS RECOGNIZED WITH IWA INNOVATION AWARD

Pranjali Kumar (pkumar@carollo.com)



The City of Altamonte Springs, Florida, received an Innovation Award at the 2018 International Water Association World Congress in Tokyo, Japan, for their Direct Potable Reuse (DPR) demonstration system, the pureALTA project. The 2018 award for "Market-changing Water Technology and Infrastructure" celebrates innovations in water and wastewater technologies and infrastructure. There was fierce competition for these awards featuring 160 entries from 45 countries. The City was ranked in the top three in the Market-Changing Water Technology and Infrastructure category, and was honored as the only project from the U.S. to receive this award.

The City is leading the potable reuse industry by exploring a unique approach to water purification that centers on ozone and biological filtration. Carollo Engineers served as the Engineer of Record on the project, and continues to assist the City on this important project.

IN THE SPOTLIGHT

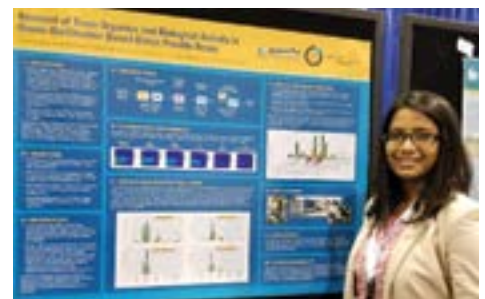
“It’s an honor to be recognized with this award,” says Pranjali. “Carollo has offered me a unique blend of opportunities, resources, and a sense of purpose, helping me succeed in my chosen career path. My mentors have been instrumental in fueling my passion for water reuse. It’s an exciting time to be in this profession, and I look forward to helping our clients with their water supply challenges.”



Last September, **PRANJALI KUMAR**, an environmental engineer with Carollo, received the “WateReuse 2018 Up and Comer” Award. The WateReuse Association presented the Annual Awards for Excellence on September 10th, during the 33rd Annual WateReuse Symposium in Austin, Texas.

The Up and Comer award recognizes a professional with less than 10 years in the recycled water industry for his/her leadership and commitment to pursuing water recycling as a career path. Recipients of the Awards for Excellence are advancing the development of alternative water supplies, and advocating the use of enhanced water reuse systems to meet increasing water needs.

In her four years as a water engineer, Pranjali has taken on technically challenging aspects of the water reuse business, resulting in advances for the industry and her clients. Her passion for reuse is evident in everything she does, from supporting industry-leading projects, communicating results and ideas effectively, and participating in young professionals groups and events.



Pranjali also won first place for her poster, “Removal of Trace Organics and Biological Activity in Ozone-Biofiltration Based Direct Potable Reuse” at the Florida Water Resources Conference in April 2018.

DR. CAROLINE RUSSELL joined Carollo in September 2016. She serves as the Water Innovation Lead for Carollo’s Research Group and is located in Austin, Texas. She has more than 17 years of experience addressing drinking water supply and treatment challenges for water systems across the U.S. Caroline has led treatment alternative evaluations and regulatory assessment/compliance studies for both surface and groundwater treatment

plants. She has also supported over a dozen water systems in addressing distribution system water quality challenges, including: pipe corrosion, taste and odor concerns, nitrification, and disinfection by-product (DBP) formation.

Caroline recently won awards for the following two American Water Works Association publications:

The “2018 American Water Works Association Management & Leadership Division Best Paper Award” for her paper titled “*Estimating the National Costs of Regulating Perchlorate in Drinking Water.*”

The 2018 Opflow Publications Award for her article titled “*Lead in Drinking Water: Past, Present, and Future.*”



Performing jar testing for a client in Texas.

“It can be extremely difficult to find time to write articles for publication, while balancing other work (and life) demands and goals. But, the process is rewarding and worthwhile. I have appreciated and benefited from access to other scientists’ and engineers’ published work throughout my career and firmly believe in the value of sharing findings that may be beneficial to others working on similar topics/challenges.”

