Kiewit

2023 KIEWIT ENGINEERING TECHNICAL SUMMIT

SPONSORED BY KIEWIT'S CHIEF ENGINEERS' COUNCIL

FEBRUARY 21-23, 2023 VIRTUAL EVENT

ABSTRACTS

PRESENTATIONS FOR FEBRUARY 21, 2023

CHIEF ENGINEERS COUNCIL PANEL: DISCUSSION ON SUBJECT MATTER EXPERTS

GEORGE COTTON, JASON MANNING, HIMANSHU PATEL, SAED KURD, MICHAEL OWENS

9:00 AM – 10:00 AM

The Chief Engineers will conduct a panel discussion on the role of Subject Matter Experts (SME) in Kiewit Engineering Group. The discussion will cover the following:

1. Qualifications and professional attributes of a SME;
2. Career path to becoming a SME;
3. Finding a SME when you need one; and
4. The role of Chief Engineers, SMEs and Technical Reviewers (TRs) in Technical Risk Assessments (TRA).

INNOVATIVE DAM DESIGN & CONSTRUCTION: LOWERING COSTS & MAINTAINING PERFORMANCE

DEL SHANNON

10:10 AM – 11:10 AM

Early Contractor Involvement (ECI) has been successfully used to expedite and improve the design and construction process of many heavy civil engineering projects, including bridges, highways, and multi-story buildings. One of the first applications of ECI for a U.S. dam project was for the Pine Brook Water District (Pine Brook), a small water district located 3 miles northwest of Boulder, Colorado with only 400 customers. This presentation describes the successful implementation of the ECI approach for the Pine Brook Dam design and construction, documents the dam's performance during the 500 year flood event that occurred seven years after completion of construction, and compares the project's success to a similar, but much more expensive, RCC dam built three years later.

HYGIENIC DESIGN OF INDUSTRIAL BUILDINGS

KAYLA BRANDT, SEAN SHERMAN

10:10 AM – 11:10 AM

Product recalls due to pathogen and foreign material contamination cost industrial manufacturers tens of millions of dollars on average in direct costs and much more in indirect costs.

In this session, we would be discussing the basic and universal principles of hygienic design and engineering as it relates to industrial buildings in support of the prevention of the contamination of products.

There will be a focus on practical applications and examples in the food and consumer goods industry as one of the markets most sensitive to hygienic concerns.

Learning objectives for participants would be to develop an eye for and have a basic understanding of hygienic design in industrial buildings.

DESIGN COLLABORATION: UNDERSTANDING ITERATION IN DESIGN

HILARY CHAIMOV

11:20 AM – 12:20 PM

Construction is a linear operation. Design, on the other hand, is inherently iterative. With multiple disciplines working concurrently, a small change in one can lead to weeks of re-work in another. These challenges can be mitigated with frequent communication; however, without a widespread understanding of interdisciplinary dependencies, the efficacy of that communication is limited. A 1995 study conducted by researchers from MIT and the University of Washington presents a method for defining a design process with a structure matrix which incorporates high level workflows, task dependencies, and relative weights for each task. The matrix is run through an eigenvalue computation, and the output represents the amount of re-work caused by iterations in the design. This KIE initiative explored the practicality of applying those analysis methods to the KIE design process. The initiative involved interviewing 15 KIE discipline leads to define high-level workflows and task dependencies. To demonstrate a proof of concept, the matrix evaluation was limited to the roadway and drainage disciplines. A MATLAB computation demonstrated that with defined workflows and known task dependencies, it is possible to qualitatively evaluate the efficiency of the KIE design process. The goal was not to eliminate iterations, but rather to better understand where they exist, and identify certain task pairs that are iterating inefficiently. The results of the structure matrix analysis can help educate better communication, prioritize design automation efforts, inform project schedules, and evaluate risk.

ACHIEVING SUCCESSFUL HAND-OFF TO OWNERS WITH TESTING & COMMISSIONING BEST PRACTICES

GAVIN RISBERT

11:20 AM – 12:20 PM

Testing & Commissioning (T&C) is a program of Verification and Validation (V&V) activities performed throughout a project lifecycle from Requirements Management to Commissioning a project for handover to the Owner. Verification and Validation is the process of developing and recording the evidence necessary to demonstrate that the design achieves the specified requirements and that the completed project complies with the design. This process is realized through a series of requirement reviews and test activities with compliance evidence captured in a matrix. This presentation will describe the V&V process and T&C program, identifying risks and outlining some best practices for success.

LONG DURATION ENERGY STORAGE CASE STUDY: HYDROSTOR'S WILLOW ROCK ENERGY STORAGE

DIANE FISCHER, ANDREW McGILLIS, JOEL LUNDQUIST
12:50 PM – 1:50 PM

Long-duration energy storage (LDES) solutions are a critical component for transitioning to a zero-carbon future. Hydrostor, a leading long-duration energy storage solution provider, and Kiewit are working on a Front-End Engineering and Design (FEED) study for the 500MW Willow Rock Energy Storage Center, using Hydrostor's Advanced Compressed Air Energy Storage (A-CAES) technology. This presentation will discuss the benefits and drivers of energy storage, give an overview of the A-CAES technology and its advantages, and provide an update on the status of the Willow Rock project and plans moving forward.

SAFETY CONSIDERATIONS IN PLOT PLAN LAYOUT & FACILITY SITING

SANJAY GANJAM, SUSAN GUO
12:50 PM – 1:50 PM

Presentation will introduce code requirements, safety considerations and Kiewit's approach to Plot Plan Layout & Facility Siting to minimize potential impact to personnel and public. It will also cover methodologies such as spacing tables, consequence and risk based methods and how they are used during different project phases with examples.

PUBLIC-PRIVATE PARTNERSHIPS DRIVE DESIGN IN DISTRICT ENERGY

ROSS CLARK, KYLE MOORE, BROCK KING
2:00 PM – 3:00 PM

Many existing district energy systems are reaching their end of life and need major updates. The owners of these systems are moving to Public-Private Partnership (P3) procurement models to update and maintain their systems for the next 20-30 years. This presentation describes the shift in procurement model and how that shift drives an integrated design, balancing O&M and design-build costs for an optimized long-term solution. Considerations of sustainability goals and initiatives, and how they can be incorporated in these procurement models is also discussed.

CREATING CERTAINTY IN SUBSURFACE UTILITY ENGINEERING

TYLOR BOTTORFF, P.E., DAVID NOAH
2:00 PM – 3:00 PM

Existing utilities create significant Execution risks to projects of all kinds! Utility owners are rarely parties to the contracts, typically do not have records of sufficient quality needed for good design decisions or may be reluctant to share. Clients can provide a wide variety of utility information, but this information needs to be analyzed for completeness, accuracy, and reliability, by implementing Emerging Technologies for design and construction purposes. The challenge for Kiewit is to reduce risk to our projects and create certainty for a very complicated topic.

ABSTRACTS
PRESENTATIONS FOR FEBRUARY 22, 2023

TECHNOLOGY & INNOVATION: TODAY & TOMORROW IN THE NEXUS OF CLEAN™
JILL EVANKO
9:00 AM – 10:00 AM

Technology innovation is at the heart of the Nexus of Clean™ – Clean power, clean water, clean food and clean industrials. This presentation will discuss innovation over the past 3 years, successes, failures, and linkages to market trends in energy transition and ESG-linked end markets. The discussion will turn to startup technologies and how they (do or don't) work with existing equipment and infrastructure, and finally conclude with a discussion on what the appropriate balance of scaling not-yet-optimized technology with optimizing technologies before scale.

REDUCING LNG FACILITY CARBON FOOTPRINT & ELECTRIC DRIVE DESIGN CONSIDERATIONS
DIPANJAN BHATTACHARYA, MOHAMMAD MAHDAVIAN
10:10 AM – 11:10 AM

In recent years, electrical drives for main refrigeration compressors in LNG plants have become more popular because of their low-carbon emission capabilities. This presentation outlines some of the key factors for consideration in design of e-drive refrigeration compressors such as boil off gas balance, LNG subcooling, nitrogen rejection, plot and electrical infra structure.

SELECTION OF DEMINERALIZATION TECHNOLOGY FOR A COMBINED CYCLE POWER PLANT
BERNARDO RODRIGUEZ, CAROLINE WILSON
10:10 AM – 11:10 AM

The contract for a combined cycle power plant located in coastal Mexico specified the use of an on-site regenerated mixed bed ion exchange system to produce demineralized water for the project. Kiewit identified a potential alternative technology, electrodeionization (EDI), which could provide the same excellent performance as ion exchange without requiring the use of hazardous chemicals. By proposing this alternative to our first-time Client, Kiewit acted as a partner to present the Client with the best available information to make an informed decision and select a technology which aligned with their safety, sustainability, and operability goals.

A DIGITAL TWIN APPROACH TO IMPROVE ESTIMATION

MATT LAWRENCE, MARINA MOSELEY

11:20 AM – 12:20 PM

This presentation is a follow-up to the introductory one given last year on KADE, or Kiewit Algorithmic Design and Engineering. In that session, we showed how we can use automation to provide significant competitive advantages for improving quality and reducing project schedule and cost.

This year we will discuss the key benefits of using KADE as an estimating tool to rapidly-produce a Front-End Digital Twin. This allows us to consider more design alternatives to ultimately deliver higher quality estimates, in a shorter time with less risk and greater financial certainty.

EVOLVING AMMONIA DEMANDS & TECHNOLOGIES DRIVEN BY ENVIRONMENTAL SUSTAINABILITY

RON BOLO, KEVIN TURINI

11:20 AM – 12:20 PM

The ammonia market is evolving with the demands of decreased CO2 footprint and environmental sustainability. We will discuss the drivers for the ammonia markets and how emerging technologies are affecting the manufacture of ammonia. With the global demand for renewable fuels increasing, that is increasing the demand for agricultural products and the fertilizer to produce them. Additionally, ammonia is considered itself a no carbon fuel and can be utilized in additional applications to produce electricity. On the technology side, the design of the blue or green ammonia production facility has been adapted for the current market need.

MORE THAN JUST FOR EARTHWORK: USING 3D MODELS FOR ESTIMATING & BEYOND

JESSE BARTON, COREY WOLLEN

12:50 PM – 1:50 PM

In the past, the 3D roadway model has been developed to ensure engineering design requirements and criteria is met, resolve conflicts, and help with the creation of the roadway plans and get cross sections for earthwork. As the model capability and software improves, the information that can be pulled from the model has a greater impact on design, estimating and construction. KIE has been developing methods to put more intelligence into the 3D models so that quantities can come directly from the model and so the model will be ready for the hand off to construction. Collaboration among the designers, the quantity take off team, estimator and construction team to include more information in the models allows for faster quantities generation and quicker estimate turnaround and better information for construction. This integrated approach allows KIE to discuss project risks with the owners and drive design decisions sooner throughout the execution of a project.

HWY 417 RAPID BRIDGE REPLACEMENT: ADVANTAGES OF THE CMGC MODEL

NANOR BALIAN, MICHAEL RAKOWSKI
12:50 PM – 1:50 PM

This session will review the evolving engineering methods, application of new technologies, and innovative contract model used at the HWY 417 Rapid Bridge Replacements (RBR) Project in Ottawa, Canada. The project was delivered using the CMGC contract model and includes the RBR of 11 rigid frames as well as other conventional highway reconstruction along the 4 km corridor. This project demonstrates Canada's first rapid rigid frame replacement during a full weekend highway closure. Emerging technologies will be presented for heavy lifting and movement such as SPMT systems with high-capacity jacking towers, as well as innovative design and construction methods for the realization of RBR-s during this short timeframe.

RAPID HYDROTECHNICAL MODELING FOR RESILIENT BRIDGE DESIGN

REBECA HERNANDEZ, CELIC RESENDIZ
2:00 PM – 3:00 PM

A severe atmospheric river meteorologic event related to climate change impacts occurred in November 2021, flooding and damaging five bridges at three sites crossing the Coldwater River, Juliet Creek and Coquihalla River throughout British Columbia. The challenging nature of the steep, high-energy channels with high sediment and debris loading required a collaborative approach between multiple disciplines to produce hydrotechnical models to evaluate many options and work together towards a new bridge design solution.

CHANGING CYBER SECURITY REQUIREMENTS FOR WATER FACILITIES

JEFF MILLER
2:00 PM – 3:00 PM

While power generation and power distribution facilities have strenuous cyber security policies and procedures dictated to them, the water industry generally has not to date. The presentation will discuss the types of cyber attacks that have already occurred and the support that's already in place to help water utilities. Lastly, cyber security provisions that are likely to become enforced will be covered.

ABSTRACTS
PRESENTATIONS FOR FEBRUARY 23, 2023

POWER OF TRANSFORMATION
KARI GONZALES
9:00 AM – 10:00 AM

The rail industry is working through another revolutionary period. The introduction of new technology and innovative solutions to long-standing challenges is making today's railroads more resilient. Ms. Gonzales will provide insight into the ongoing technology developments in rail along with highlighting the need for new talent as we set the stage for the next generation of railroading. Additionally, Ms. Gonzales will provide a look at the transformation from TTCI to MxV Rail and how the vision of the future will benefit railways globally.

CRITICAL CARBON CAPTURE CONSIDERATIONS
ERIC EISENBARTH, ADAM RANDLES
10:10 AM – 11:10 AM

With the growth of carbon capture technologies, Kiewit has gained experience applying various methods of carbon capture across different power generation and industrial emissions sources. Much focus has been placed on selecting the correct type of carbon capture technology; however, correct selection of the pre-treatment processes, post-treatment processes, and steam integration of the host site is also of critical importance. This presentation will review the above topics and provide an overview of how Kiewit is addressing these key considerations on carbon capture applications.

PROVIDING SAFE & RELIABLE POWER BACKUP OPTIONS WITH SODIUM METAL CHLORIDE (SALT) BATTERY SYSTEMS
WAYNE ROY
10:10 AM – 11:10 AM

Sodium Metal Chloride (SMC) or "Salt" batteries are an emerging technology used to produce the latest generation of secondary (rechargeable) batteries. They use metal-based cathode and a molten sodium anode to provide exceptionally safe and reliable power. Advantages also include stable chemical reactions, zero maintenance and insensitivity to temperature and storage aging. They are 100% recyclable and do not contain rare earth elements. They offer significant reductions in weight and space (up to 80%) over competing technologies.

PERSPECTIVE FROM ACROSS THE CARBON CAPTURE & STORAGE VALUE CHAIN

ERIC LEIGH, DR. MATT LUCAS, BOB SLETTEHAUGH, BRET LOGUE, JAN SHERMAN
11:20 AM – 12:20 PM

There are several components that make up a successful carbon capture and storage (CCS) project. The physical components typically include the capture plant, CO2 compression, transportation, and permanent storage. In addition, many projects will make use of a developer and some newer technologies may require unique approaches to address risk. Kiewit has generally focused on the capture and compression aspects of CCS projects. However, as the market moves towards complete solutions, Kiewit has been working closely with a variety of industry-leading companies focused on other aspects of the value chain. This session will provide a general CCS market overview, and perspectives from Kiewit and each of the panelists, including opportunities and challenges in their focus area as well as the value of working together. The panelists include executives from Carbonvert, Elysian, Navigator CO2, and Tuatara Each panelist will have 5 minutes to introduce their company and share perspectives, followed by an interactive discussion and closing with a question and answer session.

SUPPLi CHALLENGES

THOMAS BOUNDY, COLT EVERLY, P.E.
11:20 AM – 12:20 PM

Soaring demand for electric vehicles and lithium ion batteries is expected to cause order of magnitude changes in the global production rate of lithium in the coming decades. While North America has not been a major contributor to the lithium market, development of a number of North American resources will be key to supporting global lithium supply. Key technology developments, including direct lithium extraction, or DLE, and the elevated price of lithium have the potential to make many deposits commercially viable that have historically been uneconomic. Efficiently navigating permitting, design, and construction of these projects will be vital to supplying this critical material to satisfy market demand.

PROTECTING A NEW PARADIGM-TRANSIENTS & RENEWABLES

NICK MECHLER, RAHUL SINGH
12:50 PM – 1:50 PM

Transients refer to very short-duration events in an electrical power system. They are brought about by intermittent changes in a power system; For instance, the energization of a new piece of equipment or a lightning strike onto an overhead conductor. Transients occur on all electrical projects, but the rise of renewable generation sources like wind and solar are leading project developers and owners to take a second look. Kiewit designs systems with these events in mind, helping clients mitigate risk and understand the threat of transients to their
renewable facilities.

THE NEW NUCLEAR

LINUS DROUHARD, JOEL ROOT
12:50 PM – 1:50 PM

Nuclear Power is making a comeback. This presentation will attempt to cover, at a high level, some background on the current state of nuclear power and how that leads to new technologies in development. We'll cover some of these technologies and take a glimpse into the future.

ENGINEERING ETHICS AND THE LAW – EMERGING ISSUES

MISHELLE DRAKE, MATTHEW HENRY, CHARLES HENLEY

2:00 PM – 3:00 PM

A panel composed of Mishelle Drake and Matthew Henry, Assistant General Counsels for Kiewit, along with Charles Henley, KEGI's Chief Engineer – Piping and Materials Applications, will review engineering ethics principles as they relate to emerging business and legal issues. In particular, the panel will highlight selected principles under the "Fundamental Canons within the Code of Ethics for Engineers," as defined by the National Society of Professional Engineers, discuss its rules of practice, and share case studies which illustrate an engineer professional's role in complying with ethical and legal obligations.

TIPS AND TRICKS TO DEVELOPING SIMPLE CYCLE UNITS FOR RENEWABLE LOAD

JOHN GILES, MAX SHERMAN

2:00 PM – 3:00 PM

Utilities are planning to install simple cycle combustion turbines to help respond to variation in energy production from renewables. Simple cycle CTs can provide a significant amount of low emission power with fast startup times and are ideal for renewable load following. This presentation will discuss issues with development of new simple cycle projects and provide recommendations to avoid pitfalls and achieve success.