



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

(ADV-3966) Optimization of Procurement in the Construction Industry: What Today's Environment Has Taught Us

Author(s)/Presenters(s): Robert Raynes

Skill Level: Intermediate
TCM Sections: 7.7. Procurement Planning
8.1. Project Control Plan Implementation
Time & Room: MON 2:00-3:00 (Salon C1-2/Lower Level)

Abstract: In the last 3 years, the global construction industry landscape underwent a dramatic change. Impacts such as COVID-19, the war in Ukraine, economic pressures and focus on social value added additional challenges to procurement in an industry already dealing with several fundamental problems.

The additional impact of a booming construction market for major and mega programs across many sectors in the US, has created an unprecedented challenge in securing supply chain. The competition for scarce resources: materials, services and work, has put an increased emphasis on procurement methodologies and brought procurement planning forward in the project lifecycle.

The wide range of contract and commercial models available today, from traditional design-bid-build, through the progressive design build or CM-GC to various creative hybrid models, offer a wide range of options and opportunities for procurement to ensure project success. However, the selection of a suboptimal procurement strategy can have significant implications on project deliverability within assumed parameters, which may not be felt even for 24 months post contract award, at which time it generally cannot be changed or adjusted.

To ensure creation of a sound procurement strategy, the development of procurement options that aligns with the Total Cost Management Framework offers promising results. The proposed process, in which clients can work through in a structured and methodical way, to identify the criteria, prioritize them and then systematically assess them against a range of contract and commercial options, offers a robust method of arriving at the optimal procurement strategy for the major project today.

(BIM-4057) Leveraging BIM, Automation, and Machine Learning for Future Cost Assessment of Energy Conservation Measures



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Author(s)/Presenters(s): Patricia Kusumadjaja, CEP

Skill Level: Advanced
TCM Sections: 7.3. Cost Estimating and Budgeting
5.1. Asset Cost Accounting
Time & Room: TUE 3:45-4:45 (Salon A5/Lower Level)

Abstract: The existential threat of climate change has been a major source of public concern over the past several decades. The recent climate legislation seeks to accelerate carbon reduction efforts across various sectors and incentivizes leaders to act. The building sector alone is responsible for over 40% of carbon emissions, therefore, the inclusion of high performing design strategies while maintaining cost efficiency is required for successful implementation.

This study builds upon the concepts and analysis previously established within "Impact Assessment of Energy Conservation Measures on Building Energy Consumption, Carbon Emission, and Adaptation Cost Using Future Weather Data", presented in July 2022 at ANNSIM Conference and published by SIMBUILD [1]. The previous study analyzed the current and future energy consumption and carbon emissions of an office building in various US climate zones, using future weather data, to assess three energy conservation measures, their implementation cost, and payback period(s). This paper focuses on the role that BIM, automation, and machine learning plays in deriving energy results along with associated costs through simulation and the use of historical data. Showing how these three methods for building design can facilitate an integrated approach to project delivery to yield better building performance and cost efficacy will provide a clear summary of effective measures to address climate change in the AEC.

(BIM-4065) Key Benefits of 4D BIM Scheduling Implementation in Oil & Gas Projects and the Challenges

Author(s)/Presenters(s): Muhammad Azri Ahmad Baharom; Khairul Hafiz Zolkipli; Rodzleana Abdul Razak

Skill Level: Intermediate
TCM Sections: 7.2. Schedule Planning and Development
8.1. Project Control Plan Implementation
Time & Room: MON 5:00-6:00 (Salon C5-6/Lower Level)



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Abstract: The construction of the 4D scheduling models would enable visualization of the entire duration of construction activities through the project lifetime. It enhances the ability to verify the accuracy of schedules logic, better evaluate and optimize each step of construction process based on 3D view in time, lead progress meetings and site work planning using 4D model for clear, collaborative decision-making with all stakeholders and confirm the actual works put in place for progress verification and payment.

The paper aims at the key benefits of implementing 4D BIM Scheduling in oil and gas projects and its challenges and complexity which has only recently adopted by the industry players, in contrary to building construction industry.

The setup and implementation prerequisite has been established in term of contract requirement, software standardization, team setup & capabilities and expected deliverables however there are various encounters and intricacy in the alignments between project execution plan and project key deliverables such as the 3D models orientations and layers, project schedule coding and structure. Apart from that, obtaining buy-in from project owners, joint venture partners and contractors also pose challenges while concurrently, the capability and maturity level in 4D scheduling also need to be increased for effective implementations.

In this paper it will elaborate how 4D BIM Scheduling as an emerging planning & scheduling technology adopted by industry players nowadays and it is recommended to be implemented on any projects to improve the project delivery efficiency and improvement of productivity i.e., coordination of construction activities, duration, and cost. Plus, the paper will also expand on the ultimate concept and methodology towards additional dimension such as 5D on cost information and 6D on facility management information. However, the constraints and challenges will need to be addressed to enable improvements in the technology adoption.

(BIM-4081) (Presentation Only) Building Information Modeling: Not just Clash Detection Anymore

Author(s)/Presenters(s): Michael Danish; Michael F. Marcell, EVP PSP

Skill Level:

TCM Sections:

Time & Room: MON 3:45-4:45 (Salon C5-6/Lower Level)



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Abstract: The architecture, engineering, and construction industry (AEC) is ever evolving into smarter ways to efficiently accomplish more with less. Within this evolution, is a drive to better integrate all the disciplines that in various ways impact the phases of concept - design - start up - production - close out - & sustainment. Historically the AEC industry has been stove piped among stake holders (owners, primes, and subcontractors) AND throughout all the phases. Building Information Modeling (BIM) dissolves those stratifications by creating a transparent communication path to design and manage programs from the baseline design through the sustainment of the completed product.

(BIM) is not a new technology. It is a degree study in such major universities as Yale's School of Architecture and Purdue's School of Construction Technology. Has been around since the 1980's and has been heavily focused on design and design clash detection¹. This series of discussions presents BIM as an industry best practice and sequentially includes information required for design, 3D modeling, 4D Scheduling, 5D Cost Management, 6D Asset Management, XD future dimensions from the perspective of the integrated program manager of the very near future.

(BIM-4087) BIM and VE Optimization for Construction Schedule and Cost Control

Author(s)/Presenters(s): Dr. Kwame B.O. Amoah

Skill Level: Intermediate

TCM Sections: 7.5. Value Analysis and Engineering
9.2. Progress and Performance Measurement

Time & Room: SUN 1:15-2:15 (Salon C3-4/Lower Level)

Abstract: This paper proposed a framework for integrating building information modeling (BIM) and value engineering (VE) techniques to enhance value, cost-saving, improve project time, and ease information exchange. The paper further explores using BIM models to collect input data for the framework assessment and assist in automating the evaluation process by embedding an Analytical Hierarchy Process (AHP) program into the VE evaluation phase to rank the alternatives. The proposed framework provided an option for virtually evaluating design changes and reducing errors during construction. The author used a case study building project to demonstrate how BIM and VE integration can be harmonized and validate the proposed method. The author conducted a subject-matter experts' survey to validate the benefits of the BIM/VE automation process. The findings indicate BIM and VE improve design modification and detailed data extraction, e.g., cost and schedule. The results further suggest the significance of using BIM and VE enhanced project functionality and team coordination



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throughout the project lifecycle. This study provided the value of the integrated BIM and VE, including understanding the project requirements, improving team dynamics, seamless data exchange, and understanding of linking weighted criteria and functional analysis to BIM processes and validated recommended project solutions.

(BIM-4116) Integration of BIM, CPM Schedule, Short Interval Planning, Schedule Animation, and Progress on Fast Track Projects

Author(s)/Presenters(s): Britton L. Wolf; Martin Figlarz; Tyler C. Simches

Skill Level: Advanced
TCM Sections: 7.2. Schedule Planning and Development
 7.3. Cost Estimating and Budgeting
Time & Room: TUE 2:00-3:00 (Salon A1/Lower Level)

Abstract: The growing power of the BIM toolkit coupled with a burgeoning model knowledge base is creating exciting new opportunities to enhance project execution capabilities.

Aligning the synergies harnessed from the project partners with contractor short interval planning (SIP) and the pull planning processes, coupled with the project master critical path schedule offers a significant venue to enhance coordination and efficiency as well as sharpen time-related forecasting.

Integrating the power of BIM progress tracking with the payment and reporting cycle offers a powerful tool to provide real-time feedback for the team to propel the project forward.

The merger of this project information into an animated progress model facilitates a step change in comprehension for all project stakeholders by leveraging one's inherent ability to digest rich and multidimensional data via a robust visual simulation. This accelerating paradigm shift will continue to push project boundaries and build an organization's future skill base.

(CDR-3955) Assessing Contractor Responsible Concurrency When Using MIP 3.3 – Can a Sensible Procedure be Developed?

Author(s)/Presenters(s): Ronald J. Rider; Dr. Stephen P. Warhoe, PE CCP CFCC FAACE Hon. Life



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Skill Level: Intermediate
TCM Sections: 6.4. Forensic Performance Assessment
7.2. Schedule Planning and Development
Time & Room: TUE 11:30-12:30 (Salon A2/Lower Level)

Abstract: In AACE International’s Recommended Practice 29R-03, Method Implementation Protocol 3.3 (“MIP 3.3”) is an observational, dynamic, contemporaneous as-is schedule delay analysis methodology used to identify and quantify project schedule delay. MIP 3.3 examines work activities within an analysis period (or window) which is typically based on a contractor’s contemporaneous monthly schedule updates. The methodology includes a comparison of planned or forecasted dates and durations at the start of the analysis window to actual or as-built information found at the end of the analysis window. Focus is usually placed on critical and near-critical path work activities through the analysis window.

From the perspective of the contractor, the objective of the methodology is to identify, quantify, and allocate compensable delay days that were the owner’s responsibility as well as assess concurrent contractor-responsible delay and/or contractor pacing delays. Although MIP 3.3 provides some general guidelines, the development of a more comprehensive and detailed procedure for assessing contractor-responsible concurrent delay and pacing issues would be beneficial. This paper explores the complexities and appropriateness of assessing compensable, concurrent, and pacing delays when using MIP 3.3, and proposes a sensible, comprehensive, and detailed procedure for assessing contractor-caused concurrency and pacing issues within an analysis window.

(CDR-3963) Pitfalls to Avoid When Quantifying Extended Field Office Overhead Costs

Author(s)/Presenters(s): Suleiman Al Rai, PE PSP; Cory R. Milburn, CCP CFCC PSP

Skill Level: Basic
TCM Sections: 6.4. Forensic Performance Assessment
10.3. Change Management
Time & Room: TUE 10:15-11:15 (Salon C3-4/Lower Level)

Abstract: In a published paper, James G. Zack Jr and Peter V. Badala detailed 4 different methods for quantifying extended field office overhead costs, including the actual cost methods, total cost methods, stipulated contract methods, and jury verdict. The actual cost methods, which involves calculating an



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average daily rate, is one of the most commonly used and accepted methods when sufficient cost data is available, and there is no other contract specified method. Yet, many practitioners fall into the mistake of over/under claiming damages by calculating the rate based on periods which are not representative of the delay and/or by including incorrect costs in the calculation of the rate. This paper is written from a contractor's perspective to build on prior treatises by defining extended field office overhead costs, and through case studies which were developed based on actual project experience, demonstrate how each method is performed with a particular focus on the actual cost methods.

(CDR-3968) Validating Change Order Requests for Forensic Analysis

Author(s)/Presenters(s): David Carlson; Keefe Mulligan; Khaled Alhamouri

Skill Level: Basic
TCM Sections: 6.4. Forensic Performance Assessment
10.3. Change Management
Time & Room: MON 3:45-4:45 (Salon A2/Lower Level)

Abstract: Due to the dynamic and complex nature of construction projects, it is difficult to anticipate every variable or challenge from the outset. Errors or ambiguities in the plans and specifications and the owner's desire to make certain changes to the project can be addressed by means of a change order request.

AACE Recommended Practice No. 120R-21 (RP 120R-21) Demonstrating Entitlement for Contract Change Order or Claims – As Applied in EPC, provides a guideline concerning the key elements to demonstrate technical support of a change order request on a capital construction project. From a forensic perspective, it is important to analyze change order requests to determine if the scope of work is a valid change and verify that the amount and/or time requested is reasonable. The key elements outlined in RP 120R-21 can be used forensically to determine if all aspects of the change order request are supported and to determine if the change order request is valid. Analyzing change order requests forensically relies heavily upon the accuracy of contemporaneous project source data, thus ensuring the validity of the data is one of the most important steps in the process.

The purpose of this paper is to describe a methodology for validating change order requests using AACE RP 120R-21 guidelines in a forensic application with respect to scope of work, time, and cost. This paper will also include a case study that shows how to implement a forensic change order analysis.



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

(CDR-3977) A Primer for Claims and Disputes (Claims 101)

Author(s)/Presenters(s): John J. Ciccarelli, PE CCP PSP FAACE; Erin M. Fallon, CCP PSP

Skill Level: Basic
TCM Sections: 6.4. Forensic Performance Assessment
10.3. Change Management
Time & Room: TUE 10:15-11:15 (Salon A2/Lower Level)

Abstract: This paper introduces the general concepts associated with claims and dispute resolution, the subject matter in which the AACE International Claims & Dispute Resolution Subcommittee ("CDR Subcommittee") specializes. The CDR Subcommittee is actively involved in preparing technical knowledge around the preparation, analysis, management, mitigation, and resolution of claims and disputes on projects. The goal of the paper is to provide perspective into the claim process so all project participants can better understand the influence that their work product could have on the various analyses typically performed in a claim and on which experts often rely. Claims-related issues are typically focused on the analyses of schedule delay, disruption, and damages quantification, which also include assessments of entitlement and responsibility. The claims analyses performed by claims experts come in direct contact with numerous other AACE International technical functional areas and are important components of the analyses. For example, some of the AACE technical subjects that are frequently addressed during a claims analysis include: contract management, cost estimating, decision and risk management, earned value, planning and scheduling, project and cost control, and value management. The paper serves as an introduction to and primer for claims and dispute resolution for professionals interested in this practice area.

(CDR-3997) Advanced Measured Mile Method Using GMM

Author(s)/Presenters(s): Dr. Wael El Ghandour; Brahim Seddiki; Belkacem Foura

Skill Level:
TCM Sections:
Time & Room: SUN 12:00-1:00 (Salon A1/Lower Level)

Abstract: Loss of productivity, continues to be the most difficult matter to resolve in construction disputes. Practitioners and experts' analysts in the construction industry alike acknowledge that the



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

current methodologies used to estimate productivity loss rely on many assumptions (subjective) , which has led to ongoing controversies that are difficult to resolve. To enhance the current improved measured mile technique [3], a new model is proposed to illustrate and contrast the lost working hours due to disruption. Three methods will be used, including elbow method to determine the number of optimized clusters, the Gaussian mixture model (GMM) to softly assign each productivity data point to every cluster with its membership probability value, and probability theory to calculate the expected value of productivity (EVP) that must be linked to the best possible root causes. Furthermore, Python language classes were used to develop the model. This paper outlines an integrated approach for evaluating the accurate impact of construction productivity changes. To show the benefits and drawbacks of this improved procedure, we undertake two case studies, including a real-world construction claim.

(CDR-4026) The Hybrid Earned Value Analysis – A Proxy for the Measured Mile

Author(s)/Presenters(s): Ryan N. Witters; Russell H. Wodiska, EVP

Skill Level: Intermediate
TCM Sections: 6.4. Forensic Performance Assessment
10.3. Change Management
Time & Room: MON 10:15-11:15 (Salon A2/Lower Level)

Abstract: One challenge associated with estimating loss of productivity (LoP) in construction is a lack of sufficient records from contractor and/or subcontractors. This reality makes the measured mile (MM) methodology, the most widely accepted LoP technique, a near impossibility. Forensics analysts therefore need to rely on another method proffered in AACE’s Recommended Practice 25R-03 “Estimating Lost Labor Productivity in Construction Claims”.

One credible alternative is the earned value analysis (EVA). Yet as described in 25R-03 the analyst must rely on planned values to determine LoP. Another practical option, not identified in 25R-03, is the hybrid EVA that draws on the tenets of the traditional method, yet mimics the goals established by the MM procedure. By using the hybrid EVA method, the analyst can effectively compare unimpacted and impacted periods of actual productivity through payment applications and a corresponding labor report broken out by scope.

This paper: 1) describes in detail the specific steps to calculate productivity using the hybrid EVA approach, 2) compares its results with the MM method and the EVA (as presented in 25R-03), and 3)



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

discusses benefits and shortcomings that should be considered and avoided when choosing this methodology.

(CDR-4027) The Risk of Mitigation - A Case Study of the Impact of Contemporaneously Changing Logic

Author(s)/Presenters(s): Brenton J. Sadauskas, PSP; Russell H. Wodiska, EVP

Skill Level: Advanced

TCM Sections: 9.2. Progress and Performance Measurement

Time & Room: SUN 4:15-5:15 (Salon A2/Lower Level)

Abstract: Delays are an unfortunate reality on almost all construction projects. “Time of the essence” clauses cause contractors to inevitably alter the CPM schedule to demonstrate that the issue is being mitigated. These adjustments come with inherent risk, as the mitigation can alter the true critical path of the project. Many attempts at mitigation can be helpful – if they are achievable and realistic. However, if the mitigation is only occurring in the schedule, not in reality (e.g., paper mitigation), the contractor unknowingly absorbs the risk and may be exposing themselves to unintended consequences.

To understand this risk, the authors have performed both a comprehensive contemporaneous period analysis (MIP 3.3) and a detailed as-planned versus as-built analysis (MIP 3.2) and compared the results. This comprehensive real-world analysis, performed at the request of an Arbitration tribunal, gives a highly accurate and unbiased picture of the delays, and how the different methodologies proffered in 29R-03 measure the impacts.

This paper will demonstrate: 1) the risks associated with paper mitigation, 2) how the two MIPs handle impacts and mitigation, 3) the similarities and differences between the two MIPs, and 4) the importance of mitigation being based on actual capabilities and contractor production.

(CDR-4037) Forensic Delay Analysis of Disrupted Projects: An Alternative Approach Using System Dynamics

Author(s)/Presenters(s): Alexander Voigt; Moneer S. Khalaf; Dr. Sam G. Mattar



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Skill Level:

TCM Sections:

Time & Room: SUN 4:15-5:15 (Salon A4/Lower Level)

Abstract: Generally accepted guidelines regarding the execution of forensic schedule analyses recommend the use of critical path delay analysis methods. However, when projects are heavily disrupted these methods (in all their variants) become less reliable, because they fail to properly quantify (and often cannot even consider) the full delaying impact of disruptive events. This paper reviews the close relationship between delay and disruption, highlighting the limitations of CPM when dealing with schedule impacts caused by disruptive factors like productivity losses, rework, workarounds, changes in resources, design and procurement issues, and the cumulative impact of multiple smaller events. The paper proposes the use of system dynamics as the only forensic schedule analysis method able to effectively and accurately account for all the delaying impacts of disruption, and it addresses a series of practical considerations that may be slowing down the method's adoption.

(CDR-4051) Assigning As-Planned Gains-Delays in MIP 3.4, Split Contemporaneous Period Analysis

Author(s)/Presenters(s): Christopher W. Carson, CEP DRMP PSP FAACE; John J. Ciccarelli, PE CCP PSP FAACE; Kenji P. Hoshino, CFCC PSP FAACE; Greta A. Martin, PE PSP; Mark F. Nagata, PSP

Skill Level: Advanced

TCM Sections: 6.4. Forensic Performance Assessment

Time & Room: MON 2:00-3:00 (Salon A1/Lower Level)

Abstract: Each progress update after the baseline schedule has two components: the as-built portion and the as-planned portion. The actual progress is determined from the as-built portion to the left of the data date, and any future impacts, either gains or losses, forecasted in the as-planned portion are predictions only and not actual progress. Many schedule updates have as-planned changes that may significantly alter the predicted completion date, most commonly in mitigation or acceleration to regain lost time from the actual progress.

In Recommended Practice No. 29R-03, "Forensic Schedule Analysis" (FSA RP), the forensic analysis technique labelled Method Implementation Protocol 3.4, Bifurcated or Split Contemporaneous Period Analysis, is a methodology that uses the updated schedules to identify and quantify gain or loss to the project schedule. The process imports progress from the subsequent update into a copy of the schedule



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

under consideration in order to determine the performance from actual progress. Then any non-progress changes (revisions to logic, durations, calendars, constraints, and other schedule settings) are identified and quantified for the effect on the predicted completion date.

While the FSA RP notes that it is necessary to analyze the net result (acceleration or delay) of the proposed non-progress revisions in the as-planned portion of the schedule, there are two ways to do this. One way is to ignore the as-planned revisions and give credit for gains only from the as-built performance, another way is to credit for both any as-built performance variance and any as-planned mitigation, counting on the analysis to be self-correcting as future period performance often will show if the mitigation was successful or not, and a third way is to acknowledge progress-only delay and conditionally acknowledge planned mitigation and delays only if they are actually realized. This issue is complicated when the mitigation is interrupted by other delays or gains and the analysis does not self-correct, at least not in the subsequent period (this is more often the case).

This paper will address the three approaches and discuss advantages and disadvantages for each, providing the reader additional insight that will strengthen any forensic analysis.

(CDR-4055) Total Cost Claim Versus Global Claim in Construction Claims

Author(s)/Presenters(s): Dr. Tong Zhao, PE CCP CFCC PSP; Robert B. Cavoto

Skill Level: Advanced

TCM Sections: 6.4. Forensic Performance Assessment

7.1. Project Scope and Execution Strategy Development

Time & Room: SUN 1:15-2:15 (Salon A2/Lower Level)

Abstract: The terms “global claim” and “total cost claim” (or “total loss claim”) are often used interchangeably and in many instances, a claim that was presented as a global claim is also a total cost claim. However, not every global claim is a total cost claim, and not every total cost claim is a global claim. This paper discusses the commonalities and differences between a global claim and a total cost claim under different scenarios in damage or loss of productivity quantifications and cites authoritative literature and case law. This paper also provides suggestions and caveats regarding the application of the approach of a global claim or a total cost claim when preparing or supporting a construction claim.



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

(CDR-4059) Benefits for Dispute Boards with the Application of AACE International Recommended Practices

Author(s)/Presenters(s): Luis Otavio Rosa

Skill Level: Basic
TCM Sections: 6.4. Forensic Performance Assessment
6.2. Asset Change Management
Time & Room: SUN 12:00-1:00 (Salon A2/Lower Level)

Abstract: Dispute Boards (DBs) are a mechanism for avoidance and resolution of disputes in complex projects worldwide, with several variations concerning its establishment (beginning of contract or ad-hoc) and scope of decisions (assistance, review, resolution, adjudication, and others). DBs are usually formed employing three impartial professionals with experience and knowledge in the type of the work of the contract. Some AACE International (AACE) recommended practices (RP) are applicable for analysis of usual issues during the DB process in disciplines such planning, schedule control, cost analysis, estimating and others. This paper identifies some of these AACE RPs and their related benefits as a tool to avoid or mitigate claims and disputes.

(CDR-4068) Legal Pitfalls of the "Windows" Delay Analysis Method

Author(s)/Presenters(s): Ahmed Y. El Sayed; Dr. Waleed M. El Nemr; Khalid S. Al-Gahtani

Skill Level:
TCM Sections:
Time & Room: TUE 11:30-12:30 (Salon C3-4/Lower Level)

Abstract: Forensic schedule analysis is a key factor in the preparation and evaluation of any construction dispute involving delay, disruption and extensions of time. Although several industry standards have been developed to improve the practice of forensic schedule analysis, little effort, if any, has been made to address the pitfalls of delay analysis methods, as highlighted in court proceedings. This paper focuses on arguably one of the most popular methods, i.e., the “windows analysis” which is compatible with time slice windows analysis in the Society of Construction Law’s Delay and Disruption Protocol (“SCL Protocol”) and AACE International’s Recommended Practice 29R-03, MIP 3.3 and 3.4, and highlights common pitfalls observed in courts. Such pitfalls include the impact of critical path fluctuation, window size selection, and apportionment of concurrent delays, which might also be sequential, pacing, or



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offsetting delays. Each pitfall is examined in light of the court ruling cited and an illustrated case study. In conclusion, the authors' recommendations are provided with the aim of bridging the gap between the practice of forensic planners and court decisions.

(CDR-4072) Using a Measured Mile Productivity Analysis in Combination with a Collapsed As-Built Delay Analysis

Author(s)/Presenters(s): Michelle McMillan, P.Eng.; Nawfal Merzouk, P.Eng.

Skill Level: Intermediate
TCM Sections: 6.4. Forensic Performance Assessment
7.2. Schedule Planning and Development
Time & Room: MON 5:00-6:00 (Salon A2/Lower Level)

Abstract: A measured mile analysis to evaluate disruption is an established and accepted method to determine lost productivity. Using one of the forensic delay methodologies detailed in the AACE International Recommended Practice 29R-03 to determine delays to the project is similarly accepted. Traditionally, delays and lost productivity have been assessed separately. In order to quantify the lost productivity delays to the project, this paper presents a combined method in which the lost productivity estimated from a measured mile analysis is applied in a collapsed as-built delay analysis for linear projects.

(CDR-4082) Schedule Updates Using Remaining Original Duration versus Remaining Work Duration

Author(s)/Presenters(s): Thomas C. Long

Skill Level: Advanced
TCM Sections: 6.4. Forensic Performance Assessment
Time & Room: SUN 3:00-4:00 (Salon A4/Lower Level)

Abstract: When updating a critical path method (CPM) schedule, calculating remaining durations based on remaining original duration versus remaining work duration, provides profoundly different information. Updating in-progress activities based on remaining original duration can more accurately



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

quantify the impact of a delay or acceleration, whereas progress based on remaining work can more accurately show the cause of delay. Thus, both are important to calculate. When using remaining original duration, progress is linear, which allows calculations to be accurately broken down to the unit day. This provides a continuity and a trajectory over time, which can be used to anticipate delays before their occurrence, allowing mitigation measures to be considered and put in place. This paper examines the differences between the two updating methods, providing simple examples of how the two methods of updating can provide insights on different aspects of a forensic schedule analysis.

(CDR-4098) The Engineer/Initial Decision Maker's Role in Adjudicating Claims under FIDIC 2017 and AIA232-2019 Contracts

Author(s)/Presenters(s): Dr. Rania Fayed; Dr. Waleed M. El Nemr

Skill Level: Basic
TCM Sections: 7.6. Risk Management
6.4. Forensic Performance Assessment
Time & Room: TUE 2:00-3:00 (Salon C3-4/Lower Level)

Abstract: Over the years, the International Federation of Consulting Engineers (FIDIC) published standardized construction contract forms for use in the international arena. The role of the engineer evolved throughout the FIDIC contract editions from being impartial (the 1987 edition) to being an owner's agent who fairly determines disputes (1999 and 2017 editions). In the 2017 FIDIC edition, a new role of the engineer is introduced when determining disputes, namely being "neutral". In other words, the engineer is not deemed to be acting on behalf of the owner in this regard. On the other hand, prior to 2007, the architect in the American Institute of Architects (AIA) contract was the entity assigned to decide on disputes. However, the architect was later replaced with the "initial decision maker" to render initial decisions concerning claims (A201-2007 edition). The purpose of endorsing the initial decision maker approach is to eliminate the architect's potential for bias as being selected and paid by the owner. Hence, AIA232-2019 edition obligates the initial decision maker not to show partiality to either party. This paper delves into a comparison between the role of an engineer and an initial decision maker in determining disputes under FIDIC 2017 and A232-2019 respectively, arriving to distinct similarities and contrasts in this regard between the two contract forms.



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

(CDR-4105) Assessing the Reasonableness and Reliability of CPM Schedules for Use in Forensic Schedule Analyses

Author(s)/Presenters(s): Brian Celeste, CCP CFCC PSP; Andrew Leavitt, CCT CST

Skill Level: Intermediate
TCM Sections: 6.4. Forensic Performance Assessment
Time & Room: TUE 2:00-3:00 (Salon A2/Lower Level)

Abstract: Within the construction claims and dispute resolution field, schedule delay experts face an initial, important question when performing a forensic schedule analysis (“FSA”): To what extent can I rely on the project schedules for my delay analysis? No construction schedule is perfect and schedules do not have to be perfect to be used in a FSA. However, to varying levels based on the analysis methodology chosen, schedules need to be reasonable and reliable to assist the analyst in identifying critical work and analyzing delays. Industry publications including AACE RP 29R-03 and Society of Construction Law (SCL) Delay and Disruption Protocol (SCL Protocol) both recommend a source validation process, and the SCL Protocol recommends that schedules should represent a “reasonable, realistic and achievable” plan.

This paper explores what a reasonable and reliable schedule entails, what a schedule delay expert should look for when performing an evaluation of the schedules, and how this evaluation may affect the methodology choice and implementation of a retrospective delay analysis. This paper offers several considerations from industry publications and practice regarding what to look for in evaluating schedules. Also presented is an example schedule trend chart based on a mixed-use building project, demonstrating schedule evaluation techniques and the associated impacts of schedule quality on forensic schedule analysis methodology.

(CDR-4111) Maximizing Early Claims Resolution Success through Contemporaneous Project Data Capture

Author(s)/Presenters(s): Kristin Glavitsch

Skill Level: Intermediate
TCM Sections: 8.1. Project Control Plan Implementation
9.1. Project Cost Accounting



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Time & Room: TUE 3:45-4:45 (Salon A2/Lower Level)

Abstract: A claims review with management is scheduled for tomorrow, and the project controls team is still extricating the true cost of a subcontractor backcharge (claim). A large portion of the cost was dropped in a non-billable network without appropriate coding, mixed in with other billable cost. Over the course of the project there have been actuals charged to the wrong charge codes, yet no one has corrected the coding. In addition, the team needs to report on project cost in the corporate required reporting format, so the team is manually copying and pasting from various buckets in the cost report to the correct categories in the corporate report. When charging cost to the WBS and creating cost reports in the system, no one thought of aligning with corporate reporting requirements. Throughout the project, the team has been challenged from a cost and schedule perspective in understanding the true cost of changes, backcharges, indirects and directs, and non-billables. Now at the last minute, the team is scrambling to untangle the cost and put together a solid claim. For some in project controls, and those supporting claims development and resolution, this scenario is all too familiar. This paper addresses the importance of strategizing from the outset of the project how to identify, collect, analyze, and report on segregated actual cost from a claims management perspective.

(CDR-4121) Death by a Thousand Cuts: Cumulative Impact Claims

Author(s)/Presenters(s): Colleen Lenz; David M. Ponte, PE CFCC

Skill Level:

TCM Sections: 6.2. Asset Change Management

6.4. Forensic Performance Assessment

Time & Room: SUN 5:30-6:30 (Salon A2/Lower Level)

Abstract: Change orders are a common occurrence in construction projects and should be anticipated by all parties involved. Typically, the costs associated with individual change orders can be easily defined and quantified. When there is an excessive number of change orders, however, it can have an impact on the "unchanged" work. This paper will seek to help all project stakeholders understand how the number of change orders issued on a project can affect the unchanged work. Specifically, this paper will define a cumulative impact, identify the key components of a cumulative impact claim, and explore various methodologies used to quantify such claims.



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

(CDR-4123) The Schedule Delay Analysis for Subcontractors – Different by Necessity

Author(s)/Presenters(s): Charles E. Bolyard, Jr. CFCC PSP FAACE Hon. Life; Laura Freas

Skill Level:

TCM Sections:

Time & Room: MON 2:00-3:00 (Salon A2/Lower Level)

Abstract: This paper explores the unique circumstances of project scheduling and performing schedule delay analyses for the work of subcontractors. It emphasizes the differences between schedule delay analysis for a subcontractor in contrast to schedule delay analyses performed on behalf of contractors and owners. Because a subcontractor does not have privity of contract with the owner and other subcontractors, the courses of remedy for delays caused by others rests solely with the general contractor.

This paper is based on the practical experience of the co-authors in cost estimating, scheduling, performing delay analyses and providing expert testimony on behalf of subcontractors across a wide range of projects. This paper is also supported by research of publications with content relevant to the topic of delays to the performance of subcontractors.

The results of the combined experiences of the co-authors and research substantiates that while AACE International's (AACE) recommended practices (RP) with respect to planning, scheduling and schedule delay analysis remain applicable, it is the preparation and execution of project scheduling and assimilation of contemporaneous documentation regarding project progress and delays at the subcontract level that are required for a subcontractor to successfully pursue a time extension or defend an alleged delay asserted by others.

This paper has not been published or presented previously and differs from other schedule delay analysis papers through being focused on the circumstances of a subcontractor.

(CDR-4138) The Theory of Delay: Timing and Basis for Identifying and Measuring Delay

Author(s)/Presenters(s): Mark C. Sanders, PE CCP CFCC PSP

Skill Level: Advanced

TCM Sections: 6.4. Forensic Performance Assessment



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

10.1. Project Performance Assessment

Time & Room: MON 3:45-4:45 (Salon A4/Lower Level)

Abstract: Following The Theory of Delay, published in 2020 [1], this paper presents corollaries and additional detailed discussion regarding the differences between delay as cause and delay as effect. The paper provides additional guidance on defining delay events, determining when they occur, and measuring their effects. The paper develops additional proofs for the theory of delay and continues to test delay analysis methods against that theory. The analysis methods and characteristics evaluated include observational v. modeled, static v. dynamic, and additive v. subtractive. Delay analysis methods are evaluated and compared for their coherence and for the consistency of their results under a variety of tests. Additional discussion is provided regarding determining the reasonableness of a schedule model, addressing challenges created by unreasonable models, and the robustness of the theory of delay in light of those challenges.

(CDR-4156) Construction Claim Work Book for Forensic Analysis

Author(s)/Presenters(s): Dr. Wael El Ghandour

Skill Level: Intermediate

TCM Sections: 6.4. Forensic Performance Assessment
10.3. Change Management

Time & Room: SUN 3:00-4:00 (Salon A2/Lower Level)

Abstract: Effective construction projects claim management is fast becoming essential. Not only do companies devise different strategies to cope with the claim environment, but the need for clear claim life cycle definition and management approaches and assumptions are being rethought and replaced. Claim management's attention should confront the daily demands of the construction industry and minimize efficiency loss. One of the most important factors in claim management is claim data and information, readily available and properly understood, especially data required for forensic schedule and disruption modeling needs. Construction claims records and information are the mirrors of the claim management performance quality. They not only reflect the status of the claim but also boost forensic analysis work quality control. The endeavor here by introducing new concepts of "claim life cycle," "claim workbook" and "claim data sheet" presents an outline of a new innovative tracking system for claim management during its life cycle from the dispute phase up to the litigation phase. The system stimulates a sustainable approach to define the life cycle of the claim. It manages the claim's



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

information, streamlines its elements, provides for quick retrieval of facts and intelligence, and describes the key forensic elements correlation at different life-cycle phases.

(CDR-4158) Schedule Delay Analysis in a Multi-Prime Environment

Author(s)/Presenters(s): Joseph W. Wallwork, PE CCP CFCC PSP; Matthew A. Street, PSP; Eric J. Wallwork

Skill Level: Intermediate
TCM Sections: 6.4. Forensic Performance Assessment
Time & Room: MON 5:00-6:00 (Salon A1/Lower Level)

Abstract: This paper addresses the issues involved in performing a delay analysis for a project with multiple prime contractors responsible for different aspects of construction. Issues that will be addressed include differences in approach depending upon whether the prime contractors have a common start date (as is common with some municipal work) or whether the multiple primes have differing start and completion dates as needed to suit the overall program. Topics include critical and non-critical delays, pacing delays, relative float, multiple concurrent delays, impacts to follow-on trades, and apportionment of delay between the individual primes and the owner. The paper addresses impacts resulting from change orders which directly impact the project critical path, and also considers the delay-related implications of shifting resources from critical path work to otherwise non-critical change order work.

(CDR-4169) Progress is Best Measured One “Half-Step” At A Time

Author(s)/Presenters(s): Christopher J. Brasco; Dakus Gunn; Glen B. Grant, PSP; Matthew D. Baker

Skill Level: Basic
TCM Sections: 10.3. Change Management
7.3. Cost Estimating and Budgeting
Time & Room: TUE 5:00-6:00 (Salon A1/Lower Level)

Abstract: Significant debate surrounds the appropriate means of evaluating concepts such as criticality and concurrency both of which play a central role in many if not most delay or impact claims. Project



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

schedule updates are intended to serve as valuable analytical tools to identify and evaluate criticality and concurrency. However, in certain circumstances, the utility of schedule updates can be compromised by schedule revisions unrelated to the progress of the work including but not limited to resequencing or other means of recovering lost time. Such revisions, although often appropriate and necessary, can conceal the very real effects of project impacts and delay events and further complicate the evaluation of concepts such as criticality, concurrency, and perhaps most importantly the allocation of costs associated with resequencing and acceleration. To overcome this difficulty, stakeholders have increasingly turned to forensic methodologies such as half-step analysis. This paper will overview the half-step methodology, common circumstances where its use should be considered, how owners and contractors can benefit from its use, and legal issues related to its application.

(COM-4171) (Presentation Only) Planning and Scheduling Subcommittee Meeting

Author(s)/Presenters(s): Daniel P. Gilmour, PSP

Skill Level:

TCM Sections:

Time & Room: MON 3:45-4:45 (Marquette/3rd Floor)

Abstract:

(COM-4172) (Presentation Only) Claims and Dispute Resolution Subcommittee Meeting

Author(s)/Presenters(s): Mark F. Nagata, PSP

Skill Level:

TCM Sections:

Time & Room: MON 5:00-6:00 (Marquette/3rd Floor)

Abstract:



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

(COM-4173) (Presentation Only) Cost Estimating Subcommittee Meeting

Author(s)/Presenters(s): Dave Kyle, CCP CEP

Skill Level:

TCM Sections:

Time & Room: TUE 2:00-3:00 (Marquette/3rd Floor)

Abstract:

(COM-4174) (Presentation Only) Decision and Risk Management Subcommittee Meeting

Author(s)/Presenters(s): Sagar B. Khadka, CCP DRMP PSP FAACE

Skill Level:

TCM Sections:

Time & Room: TUE 11:30-12:30 (Marquette/3rd Floor)

Abstract:

(COM-4175) (Presentation Only) Earned Value Management Subcommittee Meeting

Author(s)/Presenters(s): Michael F. Marcell, EVP PSP

Skill Level:

TCM Sections:

Time & Room: MON 2:00-3:00 (Marquette/3rd Floor)

Abstract:

(COM-4176) (Presentation Only) Asset Management Subcommittee Meeting



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Author(s)/Presenters(s): H. Lance Stephenson, CCP FAACE

Skill Level:

TCM Sections:

Time & Room: SUN 5:30-6:30 (Salon C5-6/Lower Level)

Abstract:

(COM-4177) (Presentation Only) Data Science and Advanced Analytics Subcommittee Meeting

Author(s)/Presenters(s): H. Lance Stephenson, CCP FAACE

Skill Level:

TCM Sections:

Time & Room: TUE 10:15-11:15 (Marquette/3rd Floor)

Abstract:

(COM-4178) (Presentation Only) Business & Program Planning Subcommittee Meeting

Author(s)/Presenters(s): Francisco Cruz Moreno, PE CCP

Skill Level:

TCM Sections:

Time & Room: MON 10:15-11:15 (Marquette/3rd Floor)

Abstract:

(COM-4190) Section Leadership Town Hall



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Author(s)/Presenters(s): Ghath Al-Hiyari, CCP; Dayna L. Anderson; Debra L. Lally; Mary Kathryn Jackson

Skill Level: Basic
TCM Sections: 0.0. General Reference
Time & Room: TUE 3:45-6:00 (Marquette/3rd Floor)

Abstract: Section leaders will meet to discuss important topics, network with other section leaders, and exchange ideas. Headquarters will share information on resources provided to sections in addition to providing training on strategic planning topics, such as budgeting and meeting planning. Hear success stories from other section leaders and learn applications for your section.

(CSC-4005) Field Overhead – Direct or Indirect Cost and the Proper Use of NAVFAC Form 4330/43

Author(s)/Presenters(s): Nickolas Florez, CFCC

Skill Level: Intermediate
TCM Sections: 10.3. Change Management
Time & Room: TUE 5:00-6:00 (Salon C3-4/Lower Level)

Abstract: For federal construction contracts, FAR 31.105(d)(3) allows for certain field overhead costs to be chargeable as indirect or direct costs for contract modifications, provided that these costs are consistent with the contractor's accounting practice and applied to all project costs. While this is simple enough in concept, there remains confusion as to how this FAR requirement is applied in practice. Specifically, construction contracts administered by the Navy require contractors to provide proposals for contract modifications on NAVFAC Form 4330/43, which contain built-in indirect cost rates for home office overhead (HOOH) and field office overhead (FOOH) of 3 percent and 10 percent respectively. The built-in overhead rates listed on the form are applied to the direct costs for labor, material and equipment costs associated with the changed work. Apart from the fact that allocating FOOH costs as an indirect cost may be contrary to a contractor's accounting practice, defining FOOH as an indirect cost prevents a contractor from recovering extended FOOH costs on what would otherwise be a compensable time only change to the contract, as there would be no direct costs to apply the FOOH rate against. This paper discusses the proper use of NAVFAC Form 4330/43 based on compliance with the FAR, historical usage as a contractor optional form and other Navy regulations and policy guidance.



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

(CSC-4023) (Panel Discussion) Project Controls - A Profession on the Edge of Extinction or Rebirth?

Author(s)/Presenters(s): Kim D. Forbes, PSP; Ghaith Al-Hiyari, CCP; Carlos Ortega; Lucia Vernon; Duan van der Merwe (Moderator)

Skill Level:

TCM Sections:

Time & Room: MON 10:15-11:15 (Salon A1/Lower Level)

Abstract: The construction industry is on the cusp of a transformational change, with machine learning and artificial intelligence increasingly encroaching on tasks and deliverables that historically formed part of the traditional project controls and cost engineering profession. These new technological advances are taking on data mining and collection, sanitization, normalization and analysis at much faster rate and efficiency than we have ever imagined. One can start to wonder: Is the project control profession on the edge of an existential crisis?

On the opposite end of the spectrum, the construction industry is increasingly getting more complex and volatile, with more new untested technological inputs, stakeholders' interfaces and global supply chain interconnectivity than ever before. A small event in one area can have a ripple effect through the entire world.

While machine learning and AI are being increasingly deployed, complexity, volatility and uncertainty are on the uptake as well. Four project controls professionals from across different parts of the globe will debate the various aspects of this potential upcoming moment of reckoning for the profession and share their perception of the evolution, revolution or rather the demise of the profession in the coming future.

(CSC-4074) Contingency Drawdown and the Roadmap to the Project Cost at Completion

Author(s)/Presenters(s): Ghaith Al-Hiyari, CCP; Bahy Saleh, CCP PRMP; Sedat Akkaya

Skill Level: Basic



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

TCM Sections: 7.6. Risk Management
10.3. Change Management
Time & Room: TUE 10:15-11:15 (Salon A1/Lower Level)

Abstract: Contingency management continues to be a contentious topic in the world of capital project delivery. Key stakeholders often misunderstand, misuse, or make their assumptions on how to manage contingency during the course of the project. The lack of adopting a standardized and structured approach to the utilization of contingency drawdowns is a common challenge within the project controls profession. Mismanagement of contingency drawdown can lead to poor cost management and curtails the ability to understand and articulate the project cost performance status, Hence, having a negative impact on informed decision-making.

The purpose of this paper is not to talk about how contingency is established, but rather about how to manage its utilization from project sanction to completion. The authors will navigate the various definitions and concepts surrounding contingency drawdown and survey, tabulate and analyze some of the industry-wide used techniques. The authors will then compare the advantages and disadvantages of those techniques and provide the reader with recommendations that can be introduced and incorporated into the capital projects environment, to promote sound contingency management.

(CSC-4102) Why Large Capital Projects Are Too Often Over Budget and What to Do About It?

Author(s)/Presenters(s): Glen R. Palmer, CFCC PSP FAACE; Dr. Lev Virine, P.Eng.

Skill Level: Intermediate
TCM Sections: 7.6. Risk Management
7.3. Cost Estimating and Budgeting
Time & Room: SUN 1:15-2:15 (Salon C5-6/Lower Level)

Abstract: The average cost of large capital projects in North America and Western Europe continues to grow faster than inflation. This includes large infrastructure projects, power plants, pipelines, refineries, mines, terminals, etc. Moreover, a significant number of such projects are over budget and behind schedule. Data analysis from hundreds of large projects over the last ten years and other statistical data from multiple sources was performed.



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

There are many reasons for these projects being over budget, including resource issues, supply chain issues, understated estimates of costs to get projects approved, and poor project planning, all of which led to increased labor and material costs. Political interference, ineffective bidding practices, and mismanagement can also play a significant role in projects being over budget.

The paper proposes a process designed to mitigate some of these problems. It is focused on integrated project risk management, risk analysis, and project controls. Probabilistic cost analysis is performed on each phase of the project and determines the forecasted project cost. Detailed mitigation and response activities are planned in advance. The paper demonstrates this process based on real-time examples.

(CSC-4122) Major Project Execution Cost Forecasting – Back to Basics

Author(s)/Presenters(s): Moses Y. Nkuah, CCP EVP

Skill Level: Basic

TCM Sections: 10.2. Forecasting

Time & Room: MON 2:00-3:00 (Salon A4/Lower Level)

Abstract: The success of any project is assessed by how well its outcome achieves project objectives within budget and schedule to satisfy the stakeholder. The project team's ability to reliably forecast the cost at any point in time is paramount to meeting the budget expectations. As a cost forecast, by definition, is the prediction of the final cost of the project based on status and trends, it includes both objective and subjective elements. Therefore, risk and uncertainty are central to any project cost forecasting, and usually there will be some variance between the final project actual and forecasts. The aim of the project team in the cost forecasting process is to minimize this variance as much as possible. However, due to the abundance of project controls software in the project management environment, there has been an overreliance on system generated cost forecasts rather than an in-depth analysis by project teams. The purpose of this paper is to examine some of the forecasting techniques that can be applied during project execution to produce a reliable projected final cost.

(CSC-4154) Controlling Small Projects

Author(s)/Presenters(s): Sudhakar R. Pulagam, P.Eng. CCP EVP

Skill Level: Basic



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

TCM Sections: 9.2. Progress and Performance Measurement

10.1. Project Performance Assessment

Time & Room: TUE 11:30-12:30 (Salon A5/Lower Level)

Abstract: Controlling a project is the key to its successful completion. The fundamental principles and elements of project controls are the same for all projects, but the rigor of control is usually commensurate with project size and complexity. This paper describes some of the typical problems that are faced by project controls when controlling smaller projects and recommends potential solutions that can be adopted to manage small projects efficiently and effectively.

For this paper, the classification of “small projects” is defined as projects that are approximately 5 to 6 months in duration and less than \$5M in costs, but the notion can be applied at a different scale depending on the organization.

The focus of this paper is to address the project control of small projects, where resources are often limited, but the timeframe to complete project deliverables is tight. As a result, regular and frequent monitoring, along with concise and insightful project updates to keep the project team apprised of the status of completed and planned activities are of critical importance. A few key planning steps are proposed for utilization during the early stages of the project. If properly implemented, these can make a marked difference in establishing a clear path for the project team to execute the work on time and within budget. Various methods are also presented to evaluate project status, progress reporting, and appropriate use of tools for these small projects.

The paper concludes with an emphasis on the critical components of the execution of a small project: the need for collaboration and coordination among the project team members and tracking of issues to take corrective actions on time. The concepts of project controls used in this paper are from a contractor perspective, however, the methodologies can be applied to owner-managed projects as well.

(DEV-4028) (Panel Discussion) Women in Project Controls: Friend, Foe or Bystander

Author(s)/Presenters(s): Tracy Leung, P.Eng. (Moderator); Shoshanna Fraizinger, CCP; Nicole Johnson, CEP; Dr. Rania Fayed

Skill Level:

TCM Sections:



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Time & Room: SUN 4:15-5:15 (Salon A1/Lower Level)

Abstract: Panelists in the project controls industry will share their experiences in:

- Their career paths. How did they end up in project controls?
- What are some unique challenges they faced as a WIPC? How did they overcome them?

Participants will be encouraged to engage in a discussion with each other and with the panel members, and build a network where we support on another on our career journeys. All genders are welcomed to participate and show their support in this important cause!

(DEV-4033) Best Practices in Implementing Emerging Technologies in Construction Controls

Author(s)/Presenters(s): Ben Milner; Dr. Bahadir V. Barbarosoglu, CCP EVP PSP

Skill Level: Basic

TCM Sections: 11.2. People and Performance Management
11.3. Information Management

Time & Room: SUN 12:00-1:00 (Salon A5/Lower Level)

Abstract: The commercial construction industry has traditionally leaned on conventional building techniques and tools for project success. Each year more technology and improved practices are introduced to the construction market. However, many of these never make it to production, but rather end in theoretical application due to prohibitive costs of entry. It is a known issue in the industry that commercial construction is slow to adopt new practices and emerging technologies. And those that do make it to production struggle to gain traction in projects around the world. This is caused primarily by the cost and time associated with training, implementation, and feedback that comes with putting new methods into practice. As the industry progresses projects become more efficient, require less energy and cost less money. These benefits, if harnessed, would improve overall project management and project control for all realms of the construction industry. This paper explores the current market trends, analyzes the effects of new and improving construction technology and determines how to best implement these emerging technologies in construction projects moving forward.



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

(DEV-4077) The Evolution to Well-Rounded Project Controls Professionals in Aviation

Author(s)/Presenters(s): Dana N. Rutledge

Skill Level: Basic

TCM Sections: 11.2. People and Performance Management

Time & Room: SUN 1:15-2:15 (Salon A5/Lower Level)

Abstract: Entry into a professional career in project controls can vary. Contractors, consultants, and owners all have different expectations for project controls. Mega-program as opposed to small projects can also create different requirements for project controls professionals, with mega programs and projects creating finite, boxed-in responsibilities with limited exposure to the big picture, whereas small projects may cause individuals to wear ‘many hats’ and be involved in everything. As a result of many ‘mega-program’ style opportunities in the aviation industry, many owner-representative project controls professionals only have exposure in one discipline of project controls and specialize in that one. This style of project controls is not a practical application for low budget, highly versatile opportunities in project controls, and aviation owners are resistant to spending for highly technical professionals when they need a ‘jack of all trades’ who can manage day-to-day issues and recommend when to bring in experts.

To respond to aviation owner organizations’ need for high versatility requirements for project controls, it is important to develop a ‘well-rounded’ project controls professional with experience and understanding of all disciplines of the trade. This paper will discuss the issues with discipline-specific professionals, and outline benefits of a versatile project controls professional and training requirement to be successful.

While this paper is specific to challenges faced by owners in the aviation industry, there may be parallels to challenges faced in other industries and the approach described may be beneficial in those industries as well.

(DEV-4161) (Panel Discussion) Rising Career Stories in Planning & Scheduling

Author(s)/Presenters(s): Matthew Pringle, PSP (Moderator); Jessica M. Colbert, PRMP PSP; Matthew Freih, PE PSP; Daniel P. Gilmour, PSP; Avi Sharma



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Skill Level:

TCM Sections:

Time & Room: SUN 4:15-5:15 (Salon C5-6/Lower Level)

Abstract: This panel discussion will be a comprehensive discussion with a rising and mid-career planning and scheduling professionals about their careers in the industry. The panel will be comprised of varied experience perspectives in the planning and scheduling communities and represent the perspectives of owners, consultants, and contractors. Discussion topics for the panel will include their own professional journey and career path, advice for young professionals, lessons learned along the way, and how the industry has changed over time. Finally, the panel will field questions from the audience.

(DEV-4195) (Presentation Only) Statistics and Probability for Cost Engineers

Author(s)/Presenters(s): Larry R. Dysert, CCP CEP DRMP FAACE Hon. Life

Skill Level: Basic

TCM Sections: 11.3. Information Management

7.6. Risk Management

Time & Room: TUE 5:00-6:00 (Salon A2/Lower Level)

Abstract: This is a presentation of basic statistic and probability fundamentals that all project controls and cost engineering personnel should be familiar with. The presentation will illustrate basic statistical analysis and the three common forms of central tendency; as well as when you should use one measure of central tendency versus another. The presentation will then discuss probabilities and various forms of probability distributions. The presentation will illustrate various forms of probability distributions that are often used with Monte Carlo simulation (such as for estimate contingency determination), and the impact of choosing one form of probability function versus another.

(DSAA-4001) Lean Operating Systems – Project and Portfolio Management Data Visualization Using Integrated Reporting

Author(s)/Presenters(s): John W. Blodgett; Bria Goggins; Erica Sinkey; Randy Smith

Skill Level: Intermediate



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

TCM Sections: 11.2. People and Performance Management

11.3. Information Management

Time & Room: MON 3:45-4:45 (Salon A1/Lower Level)

Abstract: The lean operating system is a management method that was developed as part of the Toyota production system and is now used by many companies to drive more effective decision-making and reduce the human struggle that many people face in their day-to-day work. Lean provides clear visibility into the company's key performance indicators (KPIs) across safety, delivery, quality, cost, and morale. Good visual management can be understood by anyone, quickly! Effective visual management uses visual cues to communicate key information 'at a glance'. Visual management is a way to communicate and display information about expectations, performance, standards, and warnings. However, in the construction and utilities project and portfolio management space, simple visualization has been elusive where the need is to visualize daily changes of problem areas in a massive portfolio of thousands of projects.

Project and portfolio management is responsible for the development and management of scope, schedule, and budget anywhere from one to thousands of projects. Often, project managers rely upon data from several systems including a scheduling tool, such as Oracle Primavera P6, an enterprise resource planning (accounting) system, such as SAP, and various other software and databases used for materials status, purchase orders, invoicing, permitting, community engagement, Excel spreadsheets, etc. Integrated reporting can be used to pull data from these disparate sources into a SQL reporting database, where data visualization tools, such as Tableau, Microsoft Power BI, and Microsoft Excel, can be used to present the data in a simple dashboard. These interactive dashboards can be used for 15 minute Daily Operating Reviews (DORs), where status and action items can be captured, saved, and reported upon.

This paper will present a real-world case study on the use of a DOR application (app) that provides quick daily scorecard data on a large project and program portfolio in the electric utilities industry. It will present how Lean is used by the project management team, the technically integrated reporting solution developed, and the results seen since its implementation.

(DSAA-4094) Integrated Real-Time Location System Information and 3D Point Clouds for Object Localization Onsite Using Deep Neural Networks

Author(s)/Presenters(s): Hassan Bardareh; Dr. Osama El Sayed Moselhi, P.Eng. FAACE



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Skill Level: Advanced
TCM Sections: 11.3. Information Management
0.0. General Reference
Time & Room: MON 5:00-6:00 (Salon C1-2/Lower Level)

Abstract: A considerable body of literature exists to enhance the level of automation in object localization and tracking of construction operations. Various technologies are used for this purpose including real-time location system (RTLS) and light-detection and ranging (LiDar) devices. In this study, a newly developed method for localization and tracking of objects in construction is introduced. The method utilized the technologies referred to above and examined the benefits of the integrated use of RTLS and 3D point cloud data acquired by the laser scanner. The method is supported and validated by a set of laboratory experiments considering three scenarios. In the first scenario, the use of radio frequency identification RFID-based method for object localization and tracking is experimented with. While in the second scenario, the use of 3D point cloud data for object recognition and localization is investigated. In the third scenario, the integrated use of these two sensory data is tested and utilized for enhancing the recognition and localization of objects.

(DSAA-4101) Data-Driven Schedule Risk Forecasting for Construction Mega-Projects

Author(s)/Presenters(s): Vahan Hovhannisyan; Peter Zachares; Alan Mosca; Yael Grushka-Cockayne; Carlos Ledezma

Skill Level: Advanced
TCM Sections: 7.2. Schedule Planning and Development
10.4. Project Historical Database Management
Time & Room: SUN 12:00-1:00 (Salon A4/Lower Level)

Abstract: Accurately forecasting and mitigating schedule risks in construction projects is an incredibly valuable and equally challenging task. In recent years this task has gained added attention from the machine learning community. State-of-the-art methods, however, both in academia and in industry still rely on expert opinions and heuristic methods for estimating parameterized models. This paper studies the performance of machine learning models compared to more traditional state-of-the-art approaches for construction mega-project schedule risk forecasting. To better understand the importance of data-driven methods for project risk forecasting, extensive experimental results on thousands of projects from various industries and sectors are reported. These results convey a clear message: construction



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

mega-project schedule risks should be analyzed using data-driven models to enable more accurate and scalable risk analyses when appropriate data is available. Based on these observations an outlook for further developments in academia and industry both from the machine learning and project risk management perspectives is suggested.

(DSAA-4109) A Milestone in a Digital Transformation Journey: Implementation of ISO 19008 Taxonomy as Part of Chevron’s Cost Engineering Data Transformation

Author(s)/Presenters(s): Emily Smith; Abbas Shakourifar, PSP

Skill Level: Intermediate
TCM Sections: 10.4. Project Historical Database Management
11.3. Information Management
Time & Room: MON 2:00-3:00 (Salon A5/Lower Level)

Abstract: In recent years, owner companies have begun implementing digital transformation initiatives. Digital transformation achieves a step change in performance, enabling new business workflows by applying evolving technologies and a fresh way of thinking and working across the enterprise. Cost engineering is a focus area in the digital transformation process which considers the importance of cost and schedule data for making quality decisions in a very competitive market. Chevron implemented a three-pronged approach for cost engineering data transformation including a comprehensive study of its current state, a detailed definition of the need to change, and a projection of the future vision. One of the key success factors to achieve the future vision is the establishment of a common language that enables standardization of cost engineering data, creating benchmarks, and determining project competitiveness. This paper describes the journey of looking at different alternatives, the selection of ISO 19008 taxonomy, and the implementation of it as the data standard in Chevron’s internal cost engineering tools and processes.

(DSAA-4162) Insights on Project Performance from 500,000 Projects

Author(s)/Presenters(s): Dev Amratia; Richard Bendall-Jones; Taylor Burns; Gerard Cardoso Negrie



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Skill Level: Advanced
TCM Sections: 7.2. Schedule Planning and Development
10.4. Project Historical Database Management
Time & Room: TUE 5:00-6:00 (Salon C1-2/Lower Level)

Abstract: Big data and machine learning are increasingly being used to solve some of the world's greatest problems, one of these being the global need for better project management to increase efficiencies, and reduce costs and negative impacts during construction. This paper presents a unique data-driven approach to enable improved project scheduling and execution by predicting future project risk. This has been made possible over the past few years thanks to the fact that machine learning algorithms are now able to process schedule data at an unprecedented rate. Today the authors have data from over 500,000 project schedules, containing 252M activities and representing over \$1.5T of capital deployed (the largest volume of project data in the world). This paper outlines key findings from the research conducted on this dataset, including exciting new developments in project forecasting, turning backwards-looking KPIs into forward-looking ones, as well as insights into how projects around the world have performed and are likely to continue to perform.

(DSAA-4192) (Panel Discussion) AI in Project Controls and Forensic Analysis

Author(s)/Presenters(s): **Avi Sharma (Moderator); Kenji P. Hoshino, CFCC PSP FAACE; Dev Amratia; Daniel P. Gilmour, PSP; Patricia Kusumadjaja, CEP; Lucia Vernon**

Skill Level: Basic
TCM Sections:
Time & Room: SUN 3:00-4:00 (Salon C5-6/Lower Level)

Abstract: One of the leading discussion topics of 2023 has been the introduction of ChatGPT and the capability of AI tools to help with our day-to-day tasks. This panel discussion will focus on using artificial intelligence (AI) in various aspects of the construction industry, including scheduling, estimating, project controls, and claims. This discussion is unique because AI software will generate all the questions, creating a dialogue between construction experts and a machine. In addition, the panelists will explore the capabilities and limitations of AI in construction. As a result, attendees can expect to gain valuable insights into the potential of AI to transform the construction industry and the challenges that must be addressed to realize its benefits fully.



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

(EST-3995) (Presentation Only) Uncovering the Mystery: Dialing in the Productivity Impact to Project Field Labor Cost

Author(s)/Presenters(s): Christopher L. Kinney

Skill Level:

TCM Sections:

Time & Room: SUN 12:00-1:00 (Salon C3-4/Lower Level)

Abstract: A critical need exists to understand and communicate the influence of craft labor productivity in our cost estimates, project cost management, and normalization of data collection for future estimates.

The impact to cost (and schedule) from field craft productivity continues to increase in both cost and complexity. It's a different world than it was 50+ years ago when popular labor databases were printed and widely accepted. Many influences are continually increasing labor costs globally. Some of the significant changes are intentional, a result of new technology, occur from cultural shifts in society, or a result of natural causes (flooding, pandemic, etc.).

This presentation identifies a major new cost estimating concept for determining field productivity adjustments and normalizing historical cost data collections.

A sharable tool in Excel is demonstrated for the development and application of Labor Productivity Factors specific to each project supporting both competitive and predictive cost estimates.

Questions addressed:

- What is the Base Labor Productivity Factor (LPF) of 1.0 used in an estimate BEFORE the application of a project-specific multiplier? How much additional LPF is already built-in to that 1.0 library database (Estimator book values)?
- Is there SOMETHING ELSE BESIDES hands-on productivity that significantly impacts the field labor cost estimate (and schedule)?
- What are the ranges to consider? Which are DIRECTLY instigated (often unintentionally but at a high cost) by the Plant Owner/Investor? How are strategies developed and documented for developing Labor Productivity Factors, enabling optimized construction and operation decisions?



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

(EST-4013) Confronting Price Escalation and Volatility Issues with Construction Materials

Author(s)/Presenters(s): Neil D. Opfer, CCP CEP PSP FAACE

Skill Level: Intermediate
TCM Sections: 7.3. Cost Estimating and Budgeting
7.7. Procurement Planning
Time & Room: SUN 4:15-5:15 (Salon C3-4/Lower Level)

Abstract: The construction industry in the United States is currently beset by significant price escalation beyond normally expected year-to-year increases along with material-supply issues impacting construction schedules as well with construction materials. This presentation concerns how owners and contractors can deal with these issues including value-engineering alternatives, construction-contract protections, escalation/inflation-indexing, project pre-purchasing, client transparency/open-book management, and other solutions currently being implemented in the industry. In some cases, due to the wane of the worldwide pandemic and vaccinations, supply-line issues are expected to achieve some degree of resolution. Issues concerning the significant escalation in material pricing may not be transitory but instead will be here for some time due to federal monetary policies and other factors. Many economists believe that a primary cause of escalation and inflation in the economy is deficit spending by the federal government and resulting increases in the money supply. While the in the early 2000s ceased after several years with the advent of the 2008 financial collapse, the current trends may be more in concert with what was seen in the 1970s. While the focus of the paper concerns the U.S. experience, those in other countries experiencing similar issues may find useful information to also deal with these challenges as escalation historically takes place at varying rates in various countries.

(EST-4016) Does Historical Data on Unique Government Nuclear Facilities Have an Expiration Date?

Author(s)/Presenters(s): Robert G. Fatzinger, CEP; Alfred G. Levinson

Skill Level: Basic
TCM Sections: 10.4. Project Historical Database Management



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

7.3. Cost Estimating and Budgeting

Time & Room: MON 5:00-6:00 (Salon A4/Lower Level)

Abstract: This paper attempts to examine if historic data has an expiration date. It has been estimated that the United States spent \$5.6 (BY1996\$) trillion on the buildup of nuclear arms and delivery systems from 1940 to 1996 (roughly \$10.6 trillion in 2022 dollars). The early phase of this Cold War build-up required the development of the nuclear industrial complex, an unprecedented capital mobilization that includes numerous, arguably successful, mega projects and subprojects. This rapid deployment of industrial capacity yielded over 30 thousand nuclear warheads from 1950 to 1967 [1].

Today, the U.S. Nuclear Security Enterprise (NSE), remains an evolving infrastructure designed to ensure the U.S. nuclear stockpile is safe, secure, and reliable to perform as the Nation's nuclear deterrent. Rather than produce new weapons, the United States must continue to maintain its warheads through life extension programs and warhead alterations that require the production of nuclear materials, fabrication of nuclear and nonnuclear components, assembly and disassembly of nuclear warheads, and support operations. These unique missions require a significant infrastructure recapitalization of Cold War facilities. The first set of these major infrastructure recapitalization projects have experienced significant challenges. This paper examines if recommended practices of RP 114R-20 [2] can be leveraged to develop a project historical database of dated but similar information from Cold War efforts to improve future recapitalizations outcomes; or, if too much time has passed for these efforts to be relevant.

(EST-4062) Using Case Based Reasoning to Improve Top-Down Estimate Accuracy

Author(s)/Presenters(s): Dr. Nils J. Gransberg; Saf'a Maraqa; Beau Solimando

Skill Level: Advanced

TCM Sections: 7.3. Cost Estimating and Budgeting

7.4. Resource Planning

Time & Room: SUN 1:15-2:15 (Salon A4/Lower Level)

Abstract: Conventional wisdom assumes that the larger the database, the greater the accuracy. This does not necessarily apply in case-based reasoning models. The accuracy of top-down estimating tools using case-based reason can be improved by using a small sample of highly similar projects. This estimating tool's case-based reasoning algorithm compares characteristics between the planned project



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

and projects in the database to identify historical projects for high levels of similarity and then uses these projects in a Monte Carlo simulation to produce a range of acceptable values based upon statistical confidence levels. This tool was validated using three historical projects producing estimates that fell within one standard deviation of the actual values by limiting the total number sample projects to ones that were highly similar for use in the simulation model. Reducing the sample size reliably improved accuracy of the estimated values for each simulation.

(EST-4104) FY2022 Department of Energy Project Management Escalation Study for Capital Assets

Author(s)/Presenters(s): Matthew Zachary West; Dipali R. Amin

Skill Level: Intermediate
TCM Sections: 7.3. Cost Estimating and Budgeting
7.6. Risk Management
Time & Room: MON 10:15-11:15 (Salon A4/Lower Level)

Abstract: The U.S. Department of Energy (DOE) Office of Project Management (PM) helps develop and implement department-wide policies, procedures, programs, and management systems for project management and independently monitors, assesses, and reports on project execution performance. As part of the process to generate budget requests to Congress, the office validates project performance baselines—including scope, cost, and schedule for capital asset construction and environmental cleanup projects, an active portfolio of over \$117 billion. As part of this effort, DOE PM worked with subject matter experts (SMEs) to develop a model to establish realistic escalation rates for capital asset projects in specific locations across the DOE complex.

The composite calculated escalation rates largely consider two factors: local conditions for labor and materials specific to the project and site and economic trends. Escalation factors apply for estimates across all major cost category inputs (such as craft, non-manual labor, subcontracts, and materials) associated with the total project cost. In addition, the DOE PM escalation rate is a weighted composite calculation of site-specific indices and economic trends.

Working with various agency partners, DOE PM reviewed the model process and outputs, seeking to improve the model, identify differences between agencies, and validate the analysis. These partners included the National Nuclear Security Administration (NNSA) Acquisition and Project Management (NA-APM), NNSA Management and Budget (NA-MB), NNSA Cost Estimating and Program Evaluation (NA-



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

CEPE), Lawrence Livermore National Laboratory (LLNL), Los Alamos National Laboratory (LANL), National Aeronautics and Space Administration (NASA), Architect of the Capitol (AOC), Office of Cost Assessment and Program Evaluation (CAPE) in the Office of Secretary of Defense, and U.S. Army Corps of Engineers (USACE). The collaboration engendered a general acceptance of the analysis and better understanding of the differences between agencies.

DOE PM developed both short- and long-term rates for use in capital asset estimates. DOE capital asset projects on average are nine years long. Given current volatility in inflation, DOE PM recommends using a short-term rate calculated from a 2-year compound annual growth rate (CAGR) for the next three years, for example in Fiscal Year (FY) 2022, for FY2022–FY2024 use the short-term rate, then use the long-term rate from the 30-year CAGR for the outyears, FY2025 and beyond. For a DOE site in Tennessee, the model identified a short-term rate of 8.3%, and a long-term rate of 3.7%. The model is updated annually.

(EST-4120) Project Code of Accounts – Enhanced by Adding Construction or Environmental Remediation Industry Standards

Author(s)/Presenters(s): Corey Clemmons; Dan Melamed, CCP EVP FAACE; Bryan A. Skokan, PE CCP; Jake Lefman; Rodney Lehman

Skill Level: Intermediate

TCM Sections: 7.3. Cost Estimating and Budgeting

7.1. Project Scope and Execution Strategy Development

Time & Room: TUE 11:30-12:30 (Salon A4/Lower Level)

Abstract: A code of accounts (COA) is a highly useful tool, used to support project and program management in the development, collection, organization, and reporting of project data. This paper provides a discussion of general COA principles applicable to all types of projects. COA-charge numbers, consisting of alpha/numeric unique identifiers, are designated by corporate and/or industry standards that are the primary vehicles for identifying and tracking costs on a project. Corporate charge numbering systems benefit from code of account with small footprints but high impact. In addition to capturing the normal labor, equipment, materials, and other direct costs, COAs can include other important cost information categories. Examples of standard components for COAs include MasterFormat, UNIFORMAT II, as well as the Environmental Cost Element Structure (for the environmental remediation industries). The examples used in this paper focus on environmental remediation projects through the use of RP 124R-22 Project Code of Accounts – As Applied in the



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Environmental Remediation Industries. Benefits such as project cost sharing, metrics, measurements, and future estimating are discussed and can all benefit and be better understood and controlled by including industry standards as a part of a project's COA.

(EST-4129) Utilization of Internal Cost Benchmarking in EPC Bidding

Author(s)/Presenters(s): Mu Chen, CCP

Skill Level: Intermediate
TCM Sections: 7.3. Cost Estimating and Budgeting
10.4. Project Historical Database Management
Time & Room: TUE 10:15-11:15 (Salon A3/Lower Level)

Abstract: Internal cost benchmarking will optimize the bid performance of EPC contractors. The result should be a competitive bid which takes into consideration factors which include intense competition, execution risk, complicated bidding process, and tight bid preparation schedule. By comparing the proposed bid cost with benchmarks developed from internal historical cost data which has been cleaned and adjusted, internal cost benchmarking plays a significant role in bid validation. This process, as described, is a vital component in the continuous loop of the costing process.

This technical paper will focus on the utilization of internal cost benchmarking in EPC project bidding, illustrating the workflow of internal cost benchmarking and the methodology of benchmark development. The advantages of internal versus external cost benchmarking in the EPC bidding environment will also be discussed. Finally, a case study from the author's experience will demonstrate the effectiveness of an internal cost benchmarking practice in EPC project bidding.

(EST-4160) (Presentation Only) Material Increase, Supply-Chain Issues, and Market Volatility Impacts

Author(s)/Presenters(s): Peter R. Bredehoeft, Jr. CEP FAACE

Skill Level: Basic
TCM Sections: 7.3. Cost Estimating and Budgeting
Time & Room: MON 3:45-4:45 (Salon C1-2/Lower Level)



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Abstract: This presentation will outline the current price increases in construction materials, supply-chain issues, COVID-19 impacts, the Russian invasion of Ukraine, impacts of the Infrastructure Bill, and the Buy American Build America Act. This presentation aims to provide owners, municipalities, and consultants with current data that may impact their investments for future capital projects outlining current inflation impacts, material impacts, market volatility issues, and COVID-19 impacts as well as suggested actions and cost estimating best practices. Sources include Engineering News-Record, U.S Bureau of Labor Statistics, Associated General Contractors of America, and other industry resources, as well as data from the recent bid tab history of current projects. The reader will have a better understanding of the current market volatility impacts.

(EST-4191) (Presentation Only) Common Misapplication of Estimate Classification RPs

Author(s)/Presenters(s): Larry R. Dysert, CCP CEP DRMP FAACE Hon.Life

Skill Level: Intermediate
TCM Sections: 7.3. Cost Estimating and Budgeting
Time & Room: SUN 5:30-6:30 (Salon A4/Lower Level)

Abstract: AACE International has published many recommended practices (RPs) on estimate classification as applicable to various industry sectors. In addition, AACE publishes an online document, the Professional Guidance Document to Estimate Classification, that provides an overview and discusses key concepts and principles. Unfortunately, estimate classification RPs continue to be misapplied in basis of estimate documents, as well as in claims and dispute documentation. This presentation will identify several typical ways in which the estimate classification RPs are misrepresented and will provide clarifications and suggest verbiage that may be used when attempting to refer to estimate classification concepts.

(EVM-4025) Fully Integrating Earned Value and CPM Schedule Analysis at a Causal Level – A New Analytical Approach

Author(s)/Presenters(s): J. Gerard Boyle, CFCC

Skill Level: Advanced



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

TCM Sections: 9.2. Progress and Performance Measurement

10.1. Project Performance Assessment

Time & Room: SUN 3:00-4:00 (Salon C3-4/Lower Level)

Abstract: Labor productivity is a major, world-wide problem in the construction industry. Not coincidentally, this productivity problem is accompanied by enormous cost and time overruns on construction projects. Moreover, a recent study found that the world has an “annual shortfall in infrastructure spending of \$ 1 trillion”. If these performance problems could be corrected, citizens and customers across the world stand to benefit.

Poor project management and execution basics has been identified as a “root cause” of low productivity as well as time and cost overruns. Earned value project management (“EVPM”) is one of the management tools that is cited as failing to deliver performance improvements. It is clear, not only from studies, but also based on the author’s experience in conceiving and implementing EVPM systems for major construction programs, that existing EVPM has not fulfilled its promise because of: significant and fundamental limitations and flaws in its analytics and practice; deviation from its own stated objectives, and; associated flaws in its management emphasis.

The practice of EVM requires a major overhaul and rethinking if labor productivity, as well as the project time and cost outcomes which suffer as a result, are to improve. This article introduces new EV formulas that have been practically and successfully tested on construction projects. They connect the causal productivity and resource input factors to the durations that is seen as CPM schedule output, and together, support a truly integrated and enriched analytical system which improves time and cost outcomes.

(EVM-4050) Effectiveness of the Earned Schedule vs. the Earned Value

Author(s)/Presenters(s): Keight Charles Navarro Hurtado, PSP

Skill Level: Intermediate

TCM Sections: 9.2. Progress and Performance Measurement

10.1. Project Performance Assessment

Time & Room: SUN 3:00-4:00 (Salon A5/Lower Level)

Abstract: The earned value method (EVM) is a method that measures the amount of work actually done on a project. The purpose of this paper is to learn about the technique of the earned schedule (ES) as a



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

tool additional to managing the schedule in construction projects, and observe its effectiveness compared to the EVM, and determine the amount of delay when the project does not finish on the planned date. The results on a real case have shown a difference between both these tools, when the project has finished the $SV = 0$ of the EVM. This represents the $EV = PV = BAC$, and the $SV(t)$ of the ES represents a negative value. It indicates the amount of delay in the project; meanwhile, when the project has also been completed, the $SPI = 1$ indicates that the $EV = PV = BAC$ and the $SPI(t)$ of the ES can have different values from 1. This represents the rate of progress per period toward completion. Another difference is the SPI trend toward 1, which starts at $2/3$ of the progress. The calculations made with the $ES(t)$ on the SV and SPI are more reliable than the EVM, and the effectiveness of the $ES(t)$ is observed in the projects with late completion.

(EVM-4080) Using Earned Value and Parametric Methods to Estimate Remaining Costs of Construction

Author(s)/Presenters(s): Glauco Bezerra da Silva

Skill Level: Intermediate
TCM Sections: 9.2. Progress and Performance Measurement
10.1. Project Performance Assessment
Time & Room: SUN 5:30-6:30 (Salon C3-4/Lower Level)

Abstract: Large industrial plant projects are complex construction and may be subject to strategic changes by the owner during their life cycle.

This typical situation has been common and can lead to discontinuity of projects and implementation of new projects in place of the previous one, which reflects more restricted economic conditions. Such changes imply the need for parametric cost estimates for feasibility assessment or decision support.

This paper presents a study model applied to preview the costs of construction of the remaining works of a discontinued project. It is achieved with the use of a parametric cost estimate of revamping existing facilities, and it is associated with a comprehensive estimate of completion (EAC) of the original project.

So, this study uses the techniques of earned value management and conceptual cost estimating to project the costs of these remaining works.



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

From the indicators of performance, time, and cost of the construction it is possible to determine the costs of the project in the states in which they are. It is applied in the result of a parametric cost estimate of the revamp project to forecast the cost of this new project.

The results obtained allow the definition of Class 5 or 4 cost estimate for remaining works and compared with a detailed cost estimate.

This cost estimate is also nominated revamp to completion (RTC) from the definition of the remaining cost index (RCI).

(EVM-4093) Use of Duration-Day Resource Earned Value to Monitor Performance

Author(s)/Presenters(s): Christopher W. Carson, CEP DRMP PSP FAACE; Andrew Dick, PSP

Skill Level: Intermediate

TCM Sections: 9.2. Progress and Performance Measurement
10.1. Project Performance Assessment

Time & Room: MON 5:00-6:00 (Salon A5/Lower Level)

Abstract: Cost loading of project schedules can be difficult and resource loading can be even harder to achieve with the complexities for the contractor to accurately understand detailed resource and cost requirements early during schedule baseline development. However, monitoring and forecasting performance is enhanced when schedules are resource/cost loaded by the use of earned value management (EVM) metrics.

Effective monitoring of project performance is achieved through several means; critical and near-critical path analysis, to monitor the activities most likely to be delayed, and trending of all activity progress, which is necessary to maintain planned performance. Monitoring trending performance against plan can be achieved using EVM which provides the knowledge of how the project is performing against its time and cost baselines, among other methods.

Without cost or resource loaded schedules, EVM is not employed, and the project has one less opportunity to monitor performance. In these cases, Mr. Carson uses duration-days as a resource to enable implementation of EVM. Using duration-days has some benefits and some risks, however, Mr.



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Carson has had great success over the past twenty years or so using duration-days EVM when cost or resource loaded schedules by the contractor are not available.

Mr. Dick is also an expert in the use of traditional earned value, and he and Mr. Carson have debated the value of duration-day EVM. That is the source for this paper, and it will demonstrate how duration-day earned value can be implemented appropriately, the benefits and shortcomings of the use, and the authors believe the comparison will help practitioners and might introduce a new tool that is not commonly used.

(EVM-4133) Comparing Different Methods of Performance Measurement for Earned Value for Linear Infrastructure Industry with Recommendation

Author(s)/Presenters(s): Abbas Saifi, CCP EVP PSP

Skill Level: Intermediate

TCM Sections: 7.1. Project Scope and Execution Strategy Development
8.1. Project Control Plan Implementation

Time & Room: MON 10:15-11:15 (Salon C3-4/Lower Level)

Abstract: There are different methods to measure and report on the progress using earned value management. Each method has its advantages and disadvantages. The author believes we are still far from reaching a consensus on precisely which progress measurement method or methods to use for the linear construction industry. In absence of such a recommendation, there is always a debate between the contractor and the owner before these rules of measurement are agreed upon. This paper uses a linear construction project as a case study to evaluate the performance using the different earned value measurement methods and to provide recommendations on the appropriate method that will help the construction industry. Readers of this paper will benefit by understanding the limitations of each measurement method and the advantages of using the recommended method as applied to the linear infrastructure construction industry.

(EVM-4159) A Case Study on Implementing the Integrated Project/Program Management Maturity and Environment Total Risk Rating using an Earned Value Management System



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Author(s)/Presenters(s): Melvin G. Frank; Hala Sanboskani; David Kester; Mounir El Asmar; Dr. G. Edward Gibson Jr; Matthew Z. West

Skill Level: Intermediate

TCM Sections: 7.1. Project Scope and Execution Strategy Development
7.3. Cost Estimating and Budgeting

Time & Room: MON 3:45-4:45 (Salon A5/Lower Level)

Abstract: The Department of Energy (DOE) Order 413.3B, Program and Project Management for the Acquisition of Capital Assets — like other government agencies' directives — sees the use of an effective earned value management system (EVMS) compliant with the EIA-478 Standard as essential to delivering its capital asset projects/programs on time and within budget. To help achieve this goal, the DOE Office of Project Management (PM) initiated a multi-year academic research study in November 2018 (that is currently still ongoing) with Arizona State University (ASU), involving over 30 government, industry, and academic organizations. Study results show that those project/program environments (namely government and contractor cultures, people, practices, and resources) genuinely committed to managing their projects/programs with an effective EVMS compliant with the EIA-478 Standard are significantly more likely to succeed in meeting budget targets than those projects/programs managed without it. The integrated project/program management (IP2M) maturity and environment total risk rating (METRR) (pronounced “IP2M meter”) is a novel assessment mechanism developed as part of the study that consolidates all the key variables and provides a tailorable roadmap for defining and determining the maturity (or effectiveness) of an EVMS and identifying environmental barriers that prevent its full implementation and benefits. The application of IP2M METRR shows promising results in many DOE capital asset projects/programs, an example of which will be provided in this paper.

(IND-4179) (Presentation Only) Industry Showcase - Contruent: The Human Element of Capital Project Management

Author(s)/Presenters(s): Karl Vantine

Skill Level:

TCM Sections:

Time & Room: MON 11:30-12:30 (Salon A1/Lower Level)

Abstract:



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

(IND-4180) (Presentation Only) Industry Showcase - InEight: Seeing the Bigger Picture Together: Connected Data for Smarter Decisions

Author(s)/Presenters(s): Rick Deans, EVP; Matt Gramblicka

Skill Level:

TCM Sections:

Time & Room: MON 11:30-12:30 (Salon A2/Lower Level)

Abstract:

(IND-4181) (Presentation Only) Industry Showcase - SmartPM Technologies, Inc.: Using Project Schedule Data to Identify Organizational Risks

Author(s)/Presenters(s): Michael Pink, CCE PSP

Skill Level:

TCM Sections:

Time & Room: MON 11:30-12:30 (Salon A3/Lower Level)

Abstract:

(IND-4182) (Presentation Only) Industry Showcase - Deltek

Author(s)/Presenters(s): TBD

Skill Level:

TCM Sections:

Time & Room: MON 11:30-12:30 (Salon A4/Lower Level)

Abstract:



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

(IND-4183) (Presentation Only) Industry Showcase - Cleopatra Enterprise: Revolutionizing Total Project Management: How Cleopatra Enterprise is Shaping the Future of Project & STO Management

Author(s)/Presenters(s): Elmer Sachteleben

Skill Level:

TCM Sections:

Time & Room: MON 11:30-12:30 (Salon A5/Lower Level)

Abstract:

(IND-4184) (Presentation Only) Industry Showcase - Planisware

Author(s)/Presenters(s): TBD

Skill Level:

TCM Sections:

Time & Room: MON 11:30-12:30 (Salon C1-2/Lower Level)

Abstract:

(IND-4185) (Presentation Only) Industry Showcase - Hatch Ltd.: Ensuring Cost Effective and efficient delivery with Integrated Project Controls & Risk Management

Author(s)/Presenters(s): Leslie E. McMullan, FAACE; Camelia Bucur; Ashwin Lala

Skill Level:

TCM Sections:

Time & Room: MON 11:30-12:30 (Marquette/3rd Floor)



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Abstract: Our organization is passionately committed to the pursuit of a better world through positive change. We embrace your visions as our own and partner with you to develop better ideas that are smarter, more efficient, and innovative. Our global network of 9,000 professionals works on the world's toughest challenges. Our experience spans over 150 countries around the world in the metals, energy, infrastructure, digital, and investments market sectors.

Our exceptional, diverse teams combine vast engineering and business knowledge, working in partnership with our clients to develop market strategies, manage and optimize production, develop new game-changing technologies, and design and deliver complex capital projects. We believe in long-term relationships with our partners and are committed to our clients' lasting success. We are "entrepreneurs with a technical soul."

Our people are passionate about our corporate purpose and values, one of which is ensuring cost effective and efficient delivery, using an integrated, digital team approach with estimating, project controls and risk management.

(IND-4186) (Presentation Only) Industry Showcase - Hexagon: Measuring Performance with Digital Progress Management

Author(s)/Presenters(s): Cynthia Gomes

Skill Level:

TCM Sections:

Time & Room: MON 11:30-12:30 (Salon C5-6/Lower Level)

Abstract:

(IND-4187) (Presentation Only) Industry Showcase - Riskonnect, Inc.: Why Projects Fail – and What to Do About It

Author(s)/Presenters(s): David Emanuel

Skill Level:

TCM Sections:



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Time & Room: MON 11:30-12:30 (Salon C3-4/Lower Level)

Abstract: Experienced project managers, risk experts, and executives all recognize that projects can fail – but why do projects fail? The answer to that question, however, can be very elusive.

This session will explain how a well-executed risk management process can help you get to the bottom of issues at all levels from project to program to enterprise and beyond. You'll learn how to anticipate threats by improving your risk assumptions, how to recognize gaps and evolve your risk process, and how to leverage lessons learned to prevent future projects from failing.

(IND-4188) (Presentation Only) Industry Showcase - Contruent: The Future of Construction Technology

Author(s)/Presenters(s): TBD

Skill Level:

TCM Sections:

Time & Room: MON 10:15-11:15 (Salon C5-6/Lower Level)

Abstract:

(IND-4189) (Presentation Only) Industry Showcase - Safran

Author(s)/Presenters(s): TBD

Skill Level:

TCM Sections:

Time & Room: MON 2:00-3:00 (Salon C5-6/Lower Level)

Abstract:

(IND-4193) (Presentation Only) Industry Showcase - ARETE: Simplifying Risk Management through Artificial Intelligence



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Author(s)/Presenters(s): Carlos Mendizabal

Skill Level:

TCM Sections:

Time & Room: SUN 1:15-2:15 (Salon A1/Lower Level)

Abstract:

(IND-4194) (Presentation Only) Industry Showcase - TBD

Author(s)/Presenters(s): TBD

Skill Level:

TCM Sections:

Time & Room: TUE 2:00-3:00 (Salon A4/Lower Level)

Abstract:

(INT-4030) Logistic Challenges in Large-Sized Theme Park Projects in China and An Appropriate Management Model

Author(s)/Presenters(s): Lan Zhang; Tianqi Xiong; Renjun Luo

Skill Level: Basic

TCM Sections: 7.1. Project Scope and Execution Strategy Development
4.1. Project Implementation

Time & Room: SUN 4:15-5:15 (Salon C1-2/Lower Level)

Abstract: For a large-sized theme park project, the logistics plan and management are critical for its construction, where the pedestrians and equipment need to move efficiently as well as materials. According to the literature review, there are different methods to address this issue. However, traffic jams, road reworks, and staging areas still occur, resulting in schedule delays and increased costs. Therefore, a logistic management model that considers the life cycle of a project is required. This study



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

analyzes the challenges of the current study and practice in the market. After identifying the problems, this study develops a model based on the current logistics content and phases considering the characteristics of the major construction phases, that is, underground work, structure work, building fit-out, and final landscape work, to establish a logistics plan that accommodates construction activities. In the case study, the proposed model further illustrates how the logistic model works during the structural construction stage. This model contains the major logistics elements, such as space, shelter, service, and route, which are planned for individual construction activities that are needed to support the actual work and flow of materials as well as people sequence. The logistics model connects the major construction activities at different stages to the transferred material loading and frequency that meet the construction needs and enrich the current knowledge on logistics management. However, the model may be further adjusted according to the project characteristics and other constraints encountered by the project.

(INT-4035) Challenges of Contractor's Management Organization for a Large Semiconductor Project in China

Author(s)/Presenters(s): Lan Zhang; Jian Chen; Jiang Lu

Skill Level: Intermediate

TCM Sections: 7.1. Project Scope and Execution Strategy Development
8.1. Project Control Plan Implementation

Time & Room: SUN 5:30-6:30 (Salon C1-2/Lower Level)

Abstract: The contractor is responsible for project delivery through the management team. An effective general contractor (GC) project organization is the key to a successful project. Methods for choosing the appropriate structure and adequately qualified personnel for project requirements are essential. This study first analyzes the challenges of previous GCs' project organization using a literature review. Based on the project scope of the work, project deliverables, and identified challenges, a project organization model structure with key staff was developed. In the case study, an initial organization chart was presented and adjusted with the progress of the project to illustrate how the team performs and addresses challenges. A core team composed of the project manager, technical engineer, construction manager, and common function manager might be the key to meeting the identified challenges. The study connects the scope of work of a project with a project team by a structural organization with hierarchy and qualifications that are required by the project with minimum resource consumption. However, owing to the different sizes and complexities of each project, the exact number of key staff and their qualification levels might be adjusted.



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

(IT-4095) Bidding Process Budget and Proposals Comparative Analysis

Author(s)/Presenters(s): Leandro André; Vitor dos Santos Borré

Skill Level: Advanced
TCM Sections: 7.3. Cost Estimating and Budgeting
 3.3. Investment Decision Making
Time & Room: SUN 3:00-4:00 (Salon C1-2/Lower Level)

Abstract: RAPCO is Python based algorithm which provides bidding reports making comparative analysis of goods and services unit prices procurements proposals. Bidding committee members, cost estimators as well as auditors will benefit from the comparative analysis provided by the tool, allowing to identify deviations that might indicate overprices, underprices, and possible price unbalancing. Other benefits like the prioritization of the most likely items for negotiation, including negotiation limits are provided. The results include savings due to work automation, productivity increase as well as better calculations, graphics, and communication between users, so as to provide deeper analysis, more assertive questioning to all decision makers in the bidding process. Recently, this tool has been updated to analyze budget consumption progress and provide support in negotiating eventual contractual amendments, indicating possible bidding ranking inversions. In the near future, these analysis will allow, by means of machine learning, for a better understanding the market and suppliers' dynamics.

(OWN-3987) Main Considerations for Design and Implementation of Project Management Guidelines for Owner Companies

Author(s)/Presenters(s): Reza Shahrán; Abbas Shakourifar, PSP

Skill Level: Intermediate
TCM Sections: 11.4. Quality and Quality Management
 11.2. People and Performance Management
Time & Room: TUE 11:30-12:30 (Salon C1-2/Lower Level)

Abstract: Large organizations are required to have a coherent and intelligent program, project and contract management system that provides a standard method for the collection, processing and results for all projects to ensure that they make complex decisions with quality and reliable data. To achieve



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

this goal, they generate guidelines as an overarching document which could enable different functions to work collaboratively and improve existing processes and systems. For a guideline document to be useful and successfully used by different stakeholders, it is necessary to have a clear framework before preparing such documents so that nothing is missed.

For this purpose, the following principles should be considered:

- The principle of system approach
- The principle of comprehensiveness
- The principle of strategic approach
- The principle of stakeholder interaction and engagement
- The principle of ethical approach
- The principles of digital approach
- The principle of continuous improvement

(OWN-3989) Benchmarking with Big Data

Author(s)/Presenters(s): Micah J. Meads

Skill Level:

TCM Sections: 10.4. Project Historical Database Management
11.3. Information Management

Time & Room: TUE 3:45-4:45 (Salon C1-2/Lower Level)

Abstract: Owners face daunting challenges in the age of "big data" to use the volume, diversity, and variability of accessible data to make predictable and competitive project decisions. The magnitude and pace of project data have never been larger. Owner organizations digitize all aspects of their business internally to capture and retain vital information on project performance. Externally, data consultancies and data clearinghouses constantly increase their footprint and develop new ways to make their data available to clients. The disadvantage of this amount of access is an inability to focus and discern which data will assist a business in succeeding. Owner companies may underutilize external data or misapply external benchmarks because of the challenges associated with a plethora of data, resulting in uncompetitive initiatives.

Benchmarking stands as an important component of cost engineering to develop and evaluate project estimates. When project benchmarking combines with 'big data' to make better project decisions - and not simply at funding assessments - the value of project benchmarking increases. This paper will focus on project benchmarking utilizing external big data with a "cost engineering mindset" as well as why



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

organizations should leverage external benchmarking across the entire life cycle of a project, enabling capital projects to better compete and deliver.

(OWN-4031) Implementing a Data-Driven Method to Reduce Deferred Maintenance and Repair

Author(s)/Presenters(s): Avi Schwartz; Jodie Kim, PE; Eric Dembert; Yue Ou; Brandon Billy; Brendan Hurley

Skill Level:

TCM Sections:

Time & Room: TUE 3:45-4:45 (Salon A1/Lower Level)

Abstract: In the current era of booming technology, hybrid work models, and unprecedented inflation, many companies and agencies may prefer to invest their money in newer, more technologically advanced buildings rather than in the upkeep of their aging infrastructure, leading to fewer available resources to reduce their deferred maintenance and repair (DM&R). While capital budgets often include funding for maintenance and repair, rarely is the funding enough to cover annual growth in DM&R. Lack of sound DM&R reduction strategies could lead to premature deterioration, space usage limitation, and even greater lifetime costs. As buildings age and the funding gap increases, it is more important than ever to have a simple strategy to reduce and manage DM&R.

This paper discusses a DM&R-reducing framework that a portfolio or program manager can easily adapt to their specific circumstances and implement with an agile model for processing DM&R data and automating the multidisciplinary project generation process. Implementing such a framework can help keep facilities in an enduring, sustainable condition and raise leadership's confidence in their organization's long-term planning and budget management ability. To illustrate some preliminary benefits and how these can be used, a case study explains how these DM&R reduction strategies are being used for a federal agency.

(OWN-4056) Project Control for Owners' Small Project Portfolios

Author(s)/Presenters(s): Stephen L. Cabano, FAACE



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Skill Level: Intermediate
TCM Sections: 8.1. Project Control Plan Implementation
Time & Room: TUE 10:15-11:15 (Salon C1-2/Lower Level)

Abstract: Effective project control has immense value in keeping large projects on track to achieve cost and/or schedule objectives. With that said, many project management practitioners believe that large project tools and techniques are overkill in the multiple small project environment. The consensus is that extensive project control is unnecessary for small project portfolios not requiring the size and depth of coverage applied for large projects. However, it is also generally accepted that there are adaptations of these tools and techniques that can provide the transparency required to keep small projects and overall portfolios on target. This paper will begin by outlining the need for effective baselines established in small project portfolios and continue with the control means and methods that are applicable. Lessons learned will be shared, along with successful organizational structures, control tools and processes that result in small project solutions suitable for the plant/site-based project environment.

(OWN-4146) Project Controls Plan - Owner's Perspective

Author(s)/Presenters(s): Syd Daneshyar, P.Eng. CCP

Skill Level: Intermediate
TCM Sections: 8.1. Project Control Plan Implementation
Time & Room: TUE 2:00-3:00 (Salon C1-2/Lower Level)

Abstract: The project controls plan (PCP) is a combined cost, schedule and staff management plan which should be implemented during the life of the project. Like other stakeholders, the owners have different objectives and level of involvement on the project, so they plan their works in a different approach.

The owners encounter some issues to plan and implement total cost management framework. For example, the earned value management system cannot be implemented correctly because of using improper tools and systems to process and pay the invoices, the owner's summary schedule does not show the critical path of the project because of the utilized method to roll-up the contractor's schedule with the master schedule, or the contingency drawdown is not properly defined.

In this paper, the project controls plan from owner's perspective will be discussed. This paper recommends that owners provide the project controls plan to optimize the cost and required resources



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

based on selected contracting strategy, risk allocation and selected tools and systems. In general, if the owners take more risk on the project, they should have more involvement and resources to manage the risks.

(OWN-4166) Project Contingency Forecasting – Owner’s Perspective

Author(s)/Presenters(s): Rajmohan Mishra

Skill Level: Intermediate
TCM Sections: 7.6. Risk Management
8.1. Project Control Plan Implementation
Time & Room: MON 10:15-11:15 (Salon C1-2/Lower Level)

Abstract: Project execution and management in today’s world is vastly different from few years ago. The traditional approach to project development, estimating and submission for approval of final investment has transformed into business mandated delivery windows and other constraints that make project execution more critical and sensitive to cost and schedule impacts. Various aspects of project management such as contracting strategy, early EPC involvement, design completion incentives, witness points for procurement to ensure quality, oversees sourcing of critical material etc. have seen significant improvements to ensure project execution success.

However, one of significant requirements from an owner’s perspective is the predictability of the end, which greatly relies of project risk management and contingency management. This paper addresses some of the issues in project contingency management and provides solutions and insight for owner organizations to revisit the strategy and ensure contingency management is effective and brings predictability to project end results (cost and schedule).

(OWN-4168) Enhancing the Control and Quality of Process Piping Manufacturing

Author(s)/Presenters(s): Ghassan Al-Dossary, CCP; Abdullah Y. Saleh; Mohammed S. Alghamdi; Hussain A. Al-Omani, CCP CEP DRMP EVP PSP

Skill Level: Advanced
TCM Sections: 11.4. Quality and Quality Management
11.2. People and Performance Management



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Time & Room: TUE 11:30-12:30 (Salon A1/Lower Level)

Abstract: An accelerated oil and gas project, which is the first of its kind with respect to design and schedule execution for the owner, had a critical construction issue which was a high welding rejection rate. This issue, if not resolved, would have impacted the project execution schedule negatively, resulting in project completion delays. The project process pipe welding scope was approximately 250,000 dia-inch in the shop and field. The scope also included 52 mm walled pipes, which was a first experience for the owner. Looking to this complexity of pipe welding and the accelerated project completion schedule, the lump sum turn-key (LSTK) contractor had a challenge to balance the targeted completion schedule and the project quality index (PQI). This study will look at the major impacts to the PQI and the initiatives taken by the project team to overcome them.

(PM-4045) Applying Influential Behaviors on Non-Operated Joint Venture Projects

Author(s)/Presenters(s): Claudette Richard-Smith

Skill Level: Basic

TCM Sections: 7.1. Project Scope and Execution Strategy Development

Time & Room: TUE 2:00-3:00 (Salon C5-6/Lower Level)

Abstract: As much as 71% of upstream investment is spent through alliance or joint venture relationships. [9, p.1] An oil and gas JV in its most basic form is fairly simple. A company will take on the operator role by managing the infrastructure in a given area, and another company will assume a non-operator role by providing capital so that each player is mutually benefited. [10,p.1] Non-operating partners are in the business to protect their investment. They have the expertise to challenge and assist the operator in making the project a success. This paper will delve into how companies can effectively use influential behaviors and strategies when a joint operating agreement can limit non-operating partners to few legal rights.

Developing an influential training plan is a critical strategy that a non-operating joint venture can incorporate. Many partners have realized that influence is the only real currency of a non-operator. Recommendations will be made throughout this paper to identify training and development opportunities for team members assigned to joint venture projects. A discussion will be had on designing the informal alliance by determining what kind of casual communication with the operator outside of formal platforms can be incorporated into the project team. There will be points made in



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

building trust in relationships and behaviors that need to change to improve the level of trust. Another topic that will be covered is the strengths and weaknesses of a non-operator team and how to leverage their skills with the venture partners for optimum performance. The last topic explored in the paper is work styles and expectations. This will include a deep dive into behavioral personality styles and how they affect interactions.

(PM-4071) An Overview of Hydropower Construction Projects in Canada and Lessons Learned

Author(s)/Presenters(s): Ali Montaser, P.Eng. CCP EVP PSP; Ahmed Montaser, EVP

Skill Level: Basic

TCM Sections: 0.0. General Reference
7.2. Schedule Planning and Development

Time & Room: TUE 11:30-12:30 (Salon C5-6/Lower Level)

Abstract: Canada is the world's fourth largest generator of electrical hydropower with facilities that have been around for more than one hundred years. Hydropower projects are inherently complex projects since these types of projects are structurally massive, technically complicated, and often involve many stakeholders. Building hydropower projects in Canada brings its own challenges due to remoteness, as well as freezing conditions that could reach as low as -50 oC degrees. As a summary of lessons learned, this paper provides an overview of hydropower construction and reviews the overall scope including land acquisition, camp, and river management. The benefits and unique characteristics of a hydropower project are reviewed, along with the additional challenges of these projects when located in remote locations in Canada. This paper discusses the main components of the principle and supporting infrastructure from an engineering and construction perspective and provides a high-level 1 schedule for the construction sequence of the main components of the principle and supporting infrastructure. Lastly, this paper includes lessons learned from hydropower projects.

(PM-4076) Maturity Gain With the Application of PEP in Mining and Steel Projects

Author(s)/Presenters(s): Jéssica Chequer dos Santos



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Skill Level: Basic
TCM Sections: 3.1. Requirements Elicitation and Analysis
3.3. Investment Decision Making
Time & Room: MON 5:00-6:00 (Salon C3-4/Lower Level)

Abstract: The warming-up projections with the recovery of the world economy in the post COVID-19 era boost the demand forecasts in the steel and mining sector. Inserted in this global scenario, the companies in these sectors in Brazil have several sustainability and competitiveness projects in their portfolio planned for the coming years.

In this context, the capital project market has been evolving at a fast pace, and theories with little applicability have given way to tools and processes that can be systematically adopted, accelerating the degree of maturity and management of projects.

This paper describes the use of the front-end loading (FEL) methodology in steel and mining projects that involves the development of definitions for decision-makers to identify and control risks, minimize threats, make investment decisions, and maximize the potential for success. In this context, the execution of the project execution plan - PEP, is the guide used by the project team intending to deliver the agreed results of the enterprise. This paper seeks to prove, through Monte Carlo simulation, the gain in project maturity with the elaboration of the PEP and the consequent reduction of contingency between the approval gates of FEL 2 and FEL 3.

(PM-4090) Last Line of Defense: Integration of Quality Control Initiatives With Project Controls for More Predictable Outcomes

Author(s)/Presenters(s): Sedat Akkaya; Krishan Mittal, P.Eng.; Noor Al-Shaikh

Skill Level: Intermediate
TCM Sections: 11.4. Quality and Quality Management
8.1. Project Control Plan Implementation
Time & Room: TUE 3:45-4:45 (Salon C5-6/Lower Level)

Abstract: With the new age of rapidly evolving data analytics, the focus of project controls activities has shifted more to the information as an outcome of data. Project controls quality is a true measure of the effectiveness of the project controls in providing reliable, actionable, and timely information to empower senior/project management's decision making. It is important to recognize that there is also a



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

cost to having poor quality such as bad decisions, chaos resulting in poor morale, and client/stakeholders dissatisfaction. Considering the reliability of the data's direct correlation with quality control, it is more important than ever to build robust integrated quality control processes in project controls. The five basic project controls quality control pillars can be defined as: purpose (why is the data required?), accuracy (is information sufficiently accurate?), information content (does it add value?), communication (is the information and communication clear and unambiguous?), final checks and balances (is the information checked, reviewed, and approved?).

With this paper, the authors will demonstrate methodologies:

- to integrate quality control five pillars within project controls activities throughout project life cycle- from planning to execution, and close out of the project.
- to measure the effectiveness of the project control quality control (PCQC) initiatives with creation of the key performance indicators for the five pillars of project controls quality control.

(PM-4141) New Payment Provision for Win-Win Negotiations Between Contractor and Subcontractors Using Genetic Algorithms

Author(s)/Presenters(s): Ashraf El Azouni; Ali Fares

Skill Level: Advanced

TCM Sections:

Time & Room: TUE 10:15-11:15 (Salon C5-6/Lower Level)

Abstract: Contractors frequently outsource their work to subcontractors. Because of the intense competition in the construction industry, contractors are constantly looking for ways to reduce bid prices. This paper outlines a negotiation strategy whereby the contractor requests lower prices from subcontractors in exchange for shorter payment lags. Even before receiving payment from the owner, the contractor agrees to pay subcontractors. While prompt payments lessen the financing costs for subcontractors, lower subcontractor prices lower the contractor's bid price. In contrast to the industry standard of "pay-when-paid," this new payment offer of "pay-before-paid" signifies a paradigm change. In order to assign project work packages to prospective subcontractors based on their provided prices for specific payment-lag alternatives, a genetic algorithm (GA) optimization model is developed. The GA model's objective is to decrease the contractor's bid price. The scalability of the GA model was established through solving large-size problems.



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

(PM-4150) (Presentation Only) How to Create a World Class Project Management Organization?

Author(s)/Presenters(s): Dr. Nick J. Lavingia, PE

Skill Level:

TCM Sections:

Time & Room: MON 3:45-4:45 (Salon C3-4/Lower Level)

Abstract: In today's competitive business environment, companies that do not excel in capital stewardship can become takeover target. This practical presentation is based on how a company created an organization that delivered pacesetter project performance and achieved its goal of being number1 in return on capital employed (ROCE) and total shareholder return (TSR).

The 5 steps to success are:

1. Understand project management's impact on the bottom line of the company by improving ROCE And TSR.
2. Implement a structured project development and execution process which enables effective communication between decision makers, multifunctional project team and stakeholders.
3. Demand use of project management best practices that optimize safety, cost, schedule, and operability of a project.
4. Insist on use of total cost management tools to plan, schedule, estimate, monitor and report project progress.
5. Require training and certification of executives, managers and project professionals.

(PM-4155) Interface Management Performance Framework for Brownfield Construction Projects using Construction Simulation Language

Author(s)/Presenters(s): Dr. Wael El Ghandour

Skill Level: Advanced

TCM Sections: 4.1. Project Implementation

6.1. Asset Performance Assessment

Time & Room: TUE 5:00-6:00 (Salon C5-6/Lower Level)



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Abstract: The success of brownfield construction projects largely depends on interface management (IM), which is one of the fundamental challenges for their execution. Failure to appropriately manage brownfield construction project interfaces can cause rework and wasted time that increases the cost and delays the target schedule of the projects. It also influences the project's teamwork, quality, scope changes control, and safety performance. The variety of interactions between projects, the current infrastructure, the facilities, and the third parties they both depend on and affect have all greatly expanded. This could be external and/or internal. One of the main challenges facing the brownfield construction project is the insufficient project interface management performance control and measurement tools. Generally, there is no agreed-upon method for assessing the success of project interface management. This research presents an overview of interface management, discussing its definition and its effect on the success of brownfield construction projects. To improve project performance, a new method of figuring out how IM output affects brownfield construction projects is introduced. The framework used interfaces work breakdown structure (IWBS), interface points network (IPN), interface performance index (IPI), and construction simulation language.

(PS-3964) (Panel Discussion) Two Truths and a Lie Game - Fellows Edition

Author(s)/Presenters(s): Christopher W. Carson, CEP DRMP PSP FAACE; Ronald M. Winter, PSP FAACE; Glen R. Palmer, CFCC PSP FAACE; Kenji P. Hoshino, CFCC PSP FAACE; John J. Ciccarelli, PE CCP PSP FAACE

Skill Level:

TCM Sections:

Time & Room: SUN 5:30-6:30 (Salon A1/Lower Level)

Abstract: The AACE Fellows have hundreds of years' worth of experience in all the cost engineering/project controls disciplines, and this session is an opportunity for Fellows to give back to the community. This year the war stories will all follow a theme of "Projects Pulled Back from the Brink of Disaster". •

The session will include a Moderator (Carson), three Storytellers (Palmer, Hoshino, Ciccarelli), and a Doubter (Winter), all AACE Fellows. The three Storytellers will each provide three short war stories from their past projects, each of which will include two truths and one lie in their mix of stories, and the Doubter will question each Storyteller and provide challenges and objections in an effort to prove the stories to be lies while the Storytellers defend their story. Then the audience will get a chance to ask follow-up questions and subsequently vote on whether the story is a Truth or a Lie.



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

(PS-3986) A Proposal for a Standardized Set of Definitions of Work Availability

Author(s)/Presenters(s): Michael A. Mac Guinness, C.Eng.

Skill Level: Intermediate
TCM Sections: 10.1. Project Performance Assessment
10.2. Forecasting
Time & Room: TUE 5:00-6:00 (Salon A3/Lower Level)

Abstract: Work availability is a frequent topic of discussion when it becomes necessary to resolve challenges resulting from unforeseen events. Nevertheless, there is no agreed definition of it, and without definition, there is no way to consistently quantify it. In practice, concepts of work availability are remarkably fluid. They vary according to the time scale considered, the effect of work sequence, and the assessment of multiple other factors.

In its most expansive definition, work availability can be considered “all work for which IFC drawings have been issued minus completed work.” At the other extreme, this definition could be limited to “work for which all necessary prerequisites including but not limited to labor, material, permits, etc., are complete and ready at site for installation.” It is not unusual for owners and contractors to have heated disagreements regarding work availability due to unrecognized differences in their concept of it.

A set of definitions is proposed that reflects the stages of preparation of work as its prerequisites are completed before its scheduled dates, and as it progresses through the medium- and short-term planning process.

A simple system dynamics model is used to dynamically quantify and to illustrate graphically the quantity of work in each stage, how that changes over time, and how expectations for work availability influence manpower planning and mobilization.

(PS-3990) Managing the Master Schedule for Multi-Prime Contracts

Author(s)/Presenters(s): Pirouz Bozorgnia, PSP; Ibrahim Odeh; Weijia Chen

Skill Level: Basic
TCM Sections: 4.1. Project Implementation



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

7.2. Schedule Planning and Development

Time & Room: SUN 12:00-1:00 (Salon A3/Lower Level)

Abstract: Multi-prime contract is a procurement model where the owner is directly entering into a contract with a number of different trades to complete a program. The model allows the owner more control over each work element but places an additional burden on the owner to manage and coordinate all of its trades. This would require a sophisticated master schedule aligned with each trade's plan to complete the work and identification of potential risks as the project develops.

This paper provides recommendations on developing a baseline master schedule, utilizing project documents to analyze resources and identify risks, as well as recommendations regarding the contract schedule language that will not be overly burdensome on the trade and would still protect the owner from coordination claims as they arise throughout the project.

(PS-4018) Benefits and Applications of Half-Step Scheduling

Author(s)/Presenters(s): Joao Paulo Matos Dias, PSP; Loami Cabral

Skill Level: Intermediate

TCM Sections: 7.2. Schedule Planning and Development

9.2. Progress and Performance Measurement

Time & Room: TUE 10:15-11:15 (Salon A4/Lower Level)

Abstract: With the increased demand and complexity of construction projects, where the investments and risks are high and deadlines are tight, there is a need for innovative and accurate project planning and scheduling approaches and processes to be adopted. Having these processes well-structured and implemented throughout the project life cycle will guarantee feasible and transparent information, and will act as a mechanism of predictability with a direct impact on the contractual management and delivery performance.

Through an accurate study of the application of half-step scheduling techniques, this technical paper aims to suggest alternatives to optimize the periodical prospective schedule updates and management of risks associated with the creation of half-step schedules, in addition to presenting the direct benefits of their tailoring, both in adherence to the AACE International's Recommended Practice for Forensic Schedule Analysis (RP 29R-03) and in possible reductions in implicit limitations, such as concurrency and performance problems.



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

(PS-4021) How to Save a Troubled Project: Case Studies of Transitioning to Takt Planning

Author(s)/Presenters(s): A. Keith Rines, PE PSP

Skill Level: Intermediate
TCM Sections: 7.2. Schedule Planning and Development
7.4. Resource Planning
Time & Room: MON 2:00-3:00 (Salon A3/Lower Level)

Abstract: How does one shift the culture of a troubled construction project to complete on time when the project schedule is forecasting late completion? Takt planning is a scheduling tool which can do just that by paying careful attention to balancing workflow and utilizing space as a resource. The purpose of this paper is to identify schedule variances and minimize impacts by focusing on flow. This paper will explore challenges from implementing a workforce management plan during construction when the project was delayed and executed with poor original planning and an incomplete critical path method schedule. This paper will apply the multiple lessons learned from one case study to a second case study. Takt planning is a practical application of executing a collaborative endeavor involving owner, contractor, and subcontractors to switch everyone's thinking from push to pull planning for better project outcomes. Construction is dynamic and the project planning needs continuous adjustment to mitigate delay and avoid chaos.

(PS-4042) Extending Your CPM Schedules to Embrace the Power of Linear Scheduling

Author(s)/Presenters(s): Santosh Bhat, PSP; Christopher W. Carson, CEP DRMP PSP FAACE

Skill Level:
TCM Sections:
Time & Room: SUN 4:15-5:15 (Salon A3/Lower Level)



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Abstract: Linear projects, such as tunnels, railways, highways, pipelines, and transmission networks are becoming increasingly complex and face greater constraints in achieving their desired delivery outcomes.

The planning and scheduling of such projects is also increasing in complexity and whilst most of these projects rely on CPM schedules for time management, the benefits of improved schedule communication, analysis, and stakeholder buy-in offered by linear schedules are still relatively under-utilized.

Linear Schedules are a visual method of representing schedules for such projects, that offer additional benefits beyond traditional Gantt chart outputs and can be easily understood by a wider audience of project stakeholders. By using a real-world example from a linear infrastructure project, this paper will provide and examine an overview of linear schedules, the benefits offered by using them on linear projects, techniques and considerations of appending additional data to CPM schedules to produce linear schedules and discuss further use in cases such as delay and disruption analyses of project schedules.

(PS-4044) Integrating Sustainability Metrics with CPM Schedules: A Novel Approach with Applications in the Construction Industry

Author(s)/Presenters(s): Dr. Achintyamugha S. Sharma; Dr. Priyanka Deka; Goutam Jois, Esq.; Umesh K. Jois

Skill Level: Intermediate

TCM Sections: 7.2. Schedule Planning and Development

11.6. Environment, Health, and Safety Management

Time & Room: SUN 5:30-6:30 (Salon A3/Lower Level)

Abstract: This paper describes a novel way to integrate sustainability metrics into a Critical Path Method (CPM) based project schedule. To date, common industry practices of project controls do not include quantification and monitoring of environmental emissions associated with projects. This research team has addressed this gap by developing a method of estimating 100-year Global Warming Potential (GWP) CO₂-equivalent emissions associated with each activity of a CPM schedule. This methodology will transform a CPM schedule into a holistic tool, which can be used by project owners, contractors, construction managers, and other stakeholders to make meaningful decisions on the basis of duration, resources, cost and GWP emissions. This novel technique can be applied on virtually any type of project,



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

including residential and commercial buildings, special purpose construction (such as data centers), power/utilities, infrastructure projects (highways/railways, bridges, aviation, transit facility buildings, etc.), signals and communication systems, and more, as exemplified through a few fictitious examples in this paper. Additionally, the paper describes (1) potential relationships between GWP, and resources and cost as well as (2) the impacts of delays and Change Orders on GWP emissions.

(PS-4061) Past Performance Can Be a Good Indicator of Future Results

Author(s)/Presenters(s): Tara L. Hannebaum; William C. Schwartzkopf

Skill Level: Basic

TCM Sections: 7.2. Schedule Planning and Development

Time & Room: SUN 1:15-2:15 (Salon A3/Lower Level)

Abstract: Normal scheduling practice on construction projects to determine if a project has gained or lost time during the update period is to update the schedule with actual progress, calculate the schedule and compare the forecast completion date to both the forecast completion date in the prior update and the required completion date. That process can—and often does—provide misleading information.

Looking only at the forecast work to the right of the data date ignores an important source of critical information. Comparing actual progress to planned progress during the update period provides significant insight into whether the project is actually gaining or losing compared to the schedule. When actual losses during a schedule update are immediately “offset” or mitigated by changes to durations or logic of future work, the project end date does not move, and no loss is assigned in the period. Mitigating delays to maintain and achieve on-time performance is a worthy goal, but when it simply makes a project appear to be on schedule when it may not be, it can:

- Cause problems for the owner who discovers after it is too late to adjust that the project will finish later than planned
- Require the contractor at the end of the project to accelerate work at great cost to meet the unrealistic end date created by the mitigation

This paper discusses an analysis method that addresses this situation and allows for a proper analysis of actual critical path delay and realized mitigation independent of predicted future critical path performance.



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

(PS-4070) Identifying and Understanding Schedule Revisions using Basic Primavera Software

Author(s)/Presenters(s): Matthew Marzilli, PSP; Michael P. Ryan, PE PSP

Skill Level: Basic
TCM Sections: 7.2. Schedule Planning and Development
9.2. Progress and Performance Measurement
Time & Room: SUN 3:00-4:00 (Salon A3/Lower Level)

Abstract: Identifying and understanding impacts due to revisions is an important part of the schedule review or forensic analysis process. Especially on larger projects, it can be a struggle just to organize and tabulate the hundreds of revisions made to each update without the use of external software.

This paper will first explain how to find and organize schedule revisions using the tools available in Primavera P6. Next, it will examine some of the lessons learned during the analysis of revisions on dozens of previous projects. Finally, using case studies from past projects, it will illustrate how identification of the impacts due to these revisions improved the schedule review or forensic analysis process.

(PS-4097) Float Enabled Resource Envelope: A New Tool for Resource Management

Author(s)/Presenters(s): Kenji P. Hoshino, CFCC PSP FAACE; Richard J. Wood; Steinar Dalva

Skill Level: Advanced
TCM Sections: 7.4. Resource Planning
7.6. Risk Management
Time & Room: TUE 3:45-4:45 (Salon A3/Lower Level)

Abstract: Standard CPM calculation provides two extreme performance scenarios: the early start, which uses no float, and the late start which uses all the float.

Most real-world implementations use some float. The use of float and the extent of its use is unpredictable because it is subject to the circumstances and the conditions of the project, which are



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

driven by many factors. Therefore, the supply of necessary resources for implementing the schedule must anticipate all the possibilities of float usage.

A resource histogram that reflects this reality must be based on an adequate sampling of many float-usage scenarios and be composited from data-points gathered from the scenarios for each period on the histogram timescale.

The paper will introduce a new computational tool that seeks to explore this relatively untapped reserve of resource management.

(PS-4126) Changing Schedule Performance Index Methodology

Author(s)/Presenters(s): Kareem M. Khattab, PSP

Skill Level: Intermediate

TCM Sections: 7.2. Schedule Planning and Development

9.2. Progress and Performance Measurement

Time & Room: TUE 2:00-3:00 (Salon A3/Lower Level)

Abstract: One of the frequently used indexes in the industry is the schedule performance index (SPI), which is calculated by dividing the earned value (EV) over the planned value (PV). As the total earned value equals to the total planned value so the SPI will always tend to 1 at the project completion regardless of the schedule status. The schedule may be delayed and still the SPI is showing tendency to 1. Moreover, SPI can show a value greater than 1, while the schedule is delayed. This happens when the non-critical activities are ahead the planned dates, and its' value exceeds the values of the critical activities values which are delayed so earned value exceeds the planned value and SPI is greater than 1. SPI may also show a value of less than 1, and the schedule is ahead, this would be the case if the critical activities are ahead, and the non-critical activities values exceed the critical activities and are behind.

To overcome these main SPI fallbacks, this paper and presentation introduces new terminologies, metrics, equations, and indexes for measuring the schedule performance which can be utilized and used for corrective actions for the delayed activities and preventive actions for the future activities.

(PS-4127) Application of Linear Schedules in Project Validation and Forensic Analysis



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Author(s)/Presenters(s): Aldo D. Mattos, CCP PSP FAACE

Skill Level: Basic
TCM Sections: 7.2. Schedule Planning and Development
6.4. Forensic Performance Assessment
Time & Room: TUE 11:30-12:30 (Salon A3/Lower Level)

Abstract: Time-location schedules, also known as linear schedules, have been regularly used to plan repetitive and/or rectilinear projects, due to their ability to show the activities along the time in a more visual and concise way. However, many planners don't exploit the full capacity of time-location schedules. In this paper the author shows some applications and benefits of time-location schedules in project validation and forensic analysis: (i) consolidation of information; (ii) schedule validation; (iii) progress monitoring; and (iv) tool for forensic schedule analysis.

(PS-4131) The Value of Total Float Values in Schedule Analysis: Ensuring and Restoring the Integrity of Schedule Float Values

Author(s)/Presenters(s): Saeid Khademagha, P.Eng. PSP

Skill Level: Intermediate
TCM Sections: 7.2. Schedule Planning and Development
9.2. Progress and Performance Measurement
Time & Room: TUE 5:00-6:00 (Salon A5/Lower Level)

Abstract: From the moment a project is scheduled until it is finished, one phrase—"critical path", is consistently conveyed in all project meetings at various levels. This phrase is the essence of the critical path method (CPM) as the most widely used and accepted planning and scheduling method. Since the total float values define the criticality and near-criticality of the activities, or in other words, the flexibility within a schedule, any action that has a detrimental impact on the validity of the total float values may cause some activities to mistakenly appear critical.

This inaccurate result may mislead the project management team into making wrong decisions for the remainder of the project, which could violate the contractual completion date of the project.



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Incorrect logic, missing activities, multiple calendars, out-of-sequence progress, and time constraints all may result in discordance and confusion in total float values, and consequently, a meaningless critical path.

In addition to resulting in inaccurate time management for the remainder of the project, these flaws in total float values can also undermine the accuracy of resource management, risk management, and delay analysis.

It is essential for the project management team, including the planner and schedulers, to professionally know how to identify inaccurate and meaningless total float values and to fix them in a proper and professional way. The negative impacts and recommended resolving practices will be described in this article through the discussion of several actual case study large-scale schedules.

(PS-4151) Advanced CPM Milestone Review

Author(s)/Presenters(s): Ronald M. Winter, PSP FAACE

Skill Level: Basic
TCM Sections: 7.2. Schedule Planning and Development
10.1. Project Performance Assessment
Time & Room: MON 5:00-6:00 (Salon A3/Lower Level)

Abstract: Several AACE recommended practices (RP) mention that the scheduler should specifically consider milestones in the creation and review of the typical construction schedule. These RPs do not detail what should be considered when reviewing milestones. It is not enough for the scheduler to look at them and hope that something ‘pops-out’. Advanced schedulers should focus on a list of specific topics.

This paper discusses the hows and whys of the proper use of milestones in CPM schedules and how to make better schedules. From baseline schedules to schedule updates, this handy guide gives advanced schedulers more tools to ensure that they have better schedules and better run projects.

(PS-4157) Scheduling Requirements Across the U.S. Federal Government: Summary and Recommendations



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Author(s)/Presenters(s): Michael R. Nosbisch, CCP PSP FAACE; Diane Bragoni, PSP

Skill Level: Intermediate
TCM Sections: 7.2. Schedule Planning and Development
10.1. Project Performance Assessment
Time & Room: MON 10:15-11:15 (Salon A3/Lower Level)

Abstract: This paper will summarize and advise on the practical applications of current scheduling requirements across the federal government of the United States of America, encompassing both construction projects and aerospace programs.

Federal projects/programs have their own unique project management and controls requirements compared to the private sector. These requirements may catch contractors off-guard if they were not fully reviewed or understood prior to contract award. For example, on large aerospace programs, usually developed under cost reimbursable contracts, control account-level detail is often required to roll up to an overall integrated master schedule (IMS) as a key element of an earned value management system (EVMS). Additionally, federal construction projects administered under the standard Unified Facilities Guide Specifications (UFGS) 01 32 01.00 10 scheduling specifications require schedules to be cost loaded, balanced per the contract line item numbers (CLINs), and converted into a Standard Data Exchange Format (SDEF) file that can be uploaded into the government's system for review and payment processing.

This paper will provide an understanding and awareness of the unique scheduling specifications/guides and associated requirements across multiple federal agencies. The authors will also leverage their own personal experience in providing recommendations to better prepare readers to successfully navigate them in support of their projects/programs, regardless of scope.

(RISK-3965) Perceptions and Use of Building Price Data in Australia

Author(s)/Presenters(s): Dr. Anthony J. Mills; Dr. Argaw Gurmu; Dr. Citra Ongkowijoyo; Dr. Wenying Yao; Dr. Alexia A. Nalewaik, CCP FAACE; Anthony Lieberman

Skill Level: Advanced
TCM Sections: 7.3. Cost Estimating and Budgeting
7.6. Risk Management
Time & Room: SUN 5:30-6:30 (Salon A5/Lower Level)



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Abstract: Recently, the Australian Institute of Quantity Surveyors (AIQS) commissioned a study of construction price data published by the Institute. The goal of the study was to gain a deeper comprehension of how the published data was used, and perceptions of its accuracy and value. This building price data has been published periodically by the Institute since the 1970's, but there was not previously much effort expended to understand how useful the data was to members, and whether it was suitable for their purposes.

In order to conduct the research, cost data was gathered from *The Built Environment Economist*, a quarterly magazine published by the AIQS. The research itself was conducted in stages. A survey of users of the cost data (magazine subscribers) was conducted, the published one-year cost index forecasts were compared to the reliability of other trusted published statistics, and the one-year forecasted data accuracy was checked by building forecast models. The models used were based on commonly used forecast techniques (specifically, vector error correction (VEC) and exponential smoothing (ES)). Based on the study results, the research team identified key benefits and drawbacks of the published cost data, and identified for the AIQS several options for improving the published data product.

This research provides insight into the methods used to generate building price forecasts and is useful to individuals involved or interested in generating and improving the usability of published building price information. In particular, the study sought to understand what building price data end-users value most, and how cost engineers perceive the price forecast accuracy. The study also provides a fresh perspective on how building price data providers and their member/customers interact.

(RISK-4038) Lessons Learned from the US Department of State, Bureau of Overseas Buildings Operations, Office of Construction Management on its Enterprise-wide Implementation of Project Risk Management

Author(s)/Presenters(s): Sholeh Lee, PE; Benjamin R. Hodel; Justin Jacobsen, PRMP PSP; Michael T. Siburt, PE CCP PRMP PSP

Skill Level: Basic

TCM Sections: 7.6. Risk Management

Time & Room: SUN 3:00-4:00 (Salon A1/Lower Level)

Abstract: Project risk management has for decades been recognized by the US GAO as a project best practice who has urged federal agencies to conduct cost and schedule risk analyses to evaluate,



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

quantify, and mitigate risks that can lead to cost increases and schedule delays. This paper will highlight the efforts at advancement and implementation of project risk management policies and supporting processes within the US Department of State, Bureau of Overseas Buildings Operations (OBO), Office of Construction Management in alignment with this GAO guidance. Initially launched as a pilot program, OBO recognized the value of enterprise-wide implementation of project risk management, expanding use beyond just the largest or most complex projects. OBO is driving a cultural shift within its respective project management structure with the implementation of these project risk management fundamentals, which has and will continue to reap rewards in improved project outcomes. Through lessons learned, this paper will explore the challenges and opportunities of these enterprise-wide efforts, including examining the way in which OBO is achieving team commitment, utilizing champions, establishing a proactive risk management culture, using defined requirements, and offering and updating training for their teams.

(RISK-4073) (Presentation Only) Managing Coefficient of Variation in Monte Carlo Based Cost Models

Author(s)/Presenters(s): Stephen Koellner

Skill Level:

TCM Sections:

Time & Room: TUE 3:45-4:45 (Salon C3-4/Lower Level)

Abstract: Effective estimators develop risk-adjusted models that account for statistical uncertainty to calculate a range of possible cost outcomes for a project. The coefficient of variation (CV) of a risk-adjusted model is a statistic that normalizes uncertainty to determine if appropriate bounds have been captured in the estimate. The bottom-up application of cost uncertainty requires the use of Monte Carlo simulations. Despite many benefits, this approach is susceptible to underestimation of uncertainty for top-level work breakdown structure (WBS) elements. Failure to understand the causes of this underestimation could prevent realistic generation of bounding estimates. Unreasonable upper bounds for potential costs may present false flags while assessing performance as part of the PDCA cycle of TCM, as reasonable cost growth exceeds variance from the underestimated plan.

This topic illustrates how elements such as WBS size, correlation, and uncertainty of lower-level elements can impact top-level spread in a WBS using a derived equation and randomly generated WBSs. The discussion will identify root causes of risk underestimation in Monte Carlo based models along with mitigation steps for addressing the underlying issues. Program management professionals and cost



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

estimators can apply these insights and guidelines to manage cost-growth risks more effectively by more accurately quantifying cost uncertainty to enable data-driven decision making.

(RISK-4091) Reducing Subjectivity of Qualitative Risk Scoring and Analysis

Author(s)/Presenters(s): Dr. Ashraf Salem, P.Eng.; Dr. Emad Elwakil, PE CCP

Skill Level: Intermediate
TCM Sections: 7.6. Risk Management
Time & Room: SUN 1:15-2:15 (Salon C1-2/Lower Level)

Abstract: Probability, impact, and risk scoring are usually encountered with significant subjectivity during risk identification and qualitative assessment process. This subjectivity is severely reliant on personal bias and level of expertise of the participants in risk workshops. This paper introduces a novel method to reduce such subjectivity using fuzzy-set theory. The developed method accounts for the variation in assessing the probability of occurrence and the potential impacts on the project objectives and interests. The method converts the stakeholders' linguistic evaluation to a fuzzy number and hence to a crisp number that provides an objective representation of probability, impact, and risk scoring for each identified risk. Finally, results are discussed, and conclusions are drawn highlighting the applications of the developed model and how it can assist owners, contractors and project managers for efficient risk identification, scoring, and analysis process.

(RISK-4118) A Causal Approach to Integrated Risk Analysis Using Time Performance Factors

Author(s)/Presenters(s): J. Gerard Boyle, CFCC

Skill Level: Intermediate
TCM Sections: 7.6. Risk Management
Time & Room: TUE 10:15-11:15 (Salon A5/Lower Level)

Abstract: A survey of current literature pertaining to risk analysis reveals consensus that integration of cost and schedule is essential to reliable assessment of the risk to the time and cost objectives on construction projects.



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

There are, however, major differences of opinion regarding how cost and schedule should be integrated into risk analysis. At one extreme, it is argued that statistical or parametric techniques are superior to CPM schedule analysis. Adherents of a more “traditional” approach do use a CPM schedule, but insist the contractor’s detailed execution schedule is unnecessary. Instead, a summary level schedule is validated by “plenary stakeholders”. Acknowledging that the methods both have advantages and disadvantages, risk analysts are counseled to use two or more methods (a hybrid approach).

This paper identifies fundamental flaws in risk theory and practice. A worked example is used to critique the integrated cost and schedule risk analysis method using risk drivers and Monte Carlo (“MC”) CPM simulation. A primary problem is that the analysis is not causal; it doesn’t account for the deterministic connection between output (effect) and input (the causal productivity and resource supply factors). Moreover, assumptions about the connection of labor cost and time are incorrect.

As a corrective, new performance formulas and analytical approaches successfully used on major construction programs are introduced. Ideas are proposed for future research and development pursuant to improving the reliability of risk and schedule analysis.

(RISK-4119) (Presentation Only) Quantitative Schedule Risk Analysis For Revitalization Project at Early Stages

Author(s)/Presenters(s): Adalberto Marques da Costa; Rodrigo Maia Francisco da Costa

Skill Level: Basic

TCM Sections: 7.6. Risk Management

Time & Room: TUE 5:00-6:00 (Salon A4/Lower Level)

Abstract: The purpose of this presentation is to present a case study about a quantitative schedule risk analysis applied to revitalization projects focused on early stages, in the Petrobras Exploration & Production Area. A revitalization project, in Petrobras, is defined by the deployment of a new floating production system in replacement of one or more existing production systems, partially reusing subsea equipment and wells.

These kinds of megaprojects, especially in FEL 2, present some unusual challenges: even though more mature reservoir information is available compared to a greenfield project, there are a lot of wells (25 to 80) involved and some technical alternatives available to apply. In this stage at Petrobras, it is required



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

to run quantitative schedule risk analysis in two separate times: (1) to support the procurement strategy and (2) to get a predictability schedule at the decision gate of the conceptual design.

The authors want to share these findings, the internal process, and issues to achieve the outcomes.

(RISK-4124) Risk Management Lessons Learned

Author(s)/Presenters(s): Christopher P. Caddell, PE CCP DRMP FAACE

Skill Level: Basic
TCM Sections: 7.6. Risk Management
Time & Room: TUE 2:00-3:00 (Salon A5/Lower Level)

Abstract: Many organizations have implemented formal risk management practices at either the individual project level or as a part of management of an overall capital program. However, often those organizations are not seeing the anticipated benefit from implementing those practices. They continue to have projects fail by going significantly over budget, experiencing pronounced delays, or suffering major disputes between parties. Having reviewed a large number of projects in these programs over the past twenty years, the author has identified many lessons learned that have impacted the value an organization receives from implementing risk management. The lessons learned cover all facets of a risk management program, including risk management planning, identification, qualitative and quantitative assessments, response, and monitoring. The issues include mistakes in implementation, tool utilization, poor understanding, lack of collaboration, and lack of commitment. The author has witnessed issues in each of these areas that reduce the effectiveness of the risk management program. By highlighting these issues and how to address them, other organizations can benefit from these lessons learned and maximize the value of a strong risk management program.

(RISK-4144) A Risk-Based Approach to Construction Management

Author(s)/Presenters(s): Chloe E. Edwards; Yasaman Shahtaheri

Skill Level: Intermediate
TCM Sections: 7.6. Risk Management
4.1. Project Implementation
Time & Room: SUN 4:15-5:15 (Salon A5/Lower Level)



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Abstract: Risk management plays a fundamental role in project controls and delivery. The purpose of incorporating risk management into project management practices is to identify and address uncertainties related to key project-related activities. The uncertainties, known as risk events, can relate to project deliverables that are quantifiable and are often measured by impact to project schedule, cost, or environmental impact. Risk management should be incorporated as an iterative practice throughout the planning, execution, and commissioning phases of a project. This paper specifically examines how risk management contributes to effective project controls and delivery through a case study of a transportation project. The case study covers a 12-kilometer heavy rail design and construction project through multiple municipalities and natural environment. A risk-based approach was implemented to evaluate the risk-based contingency for construction and design costs, evaluate project duration, and prepare and implement mitigation strategies to increase the likelihood of project success.

(RISK-4170) Risk Identification and Assessment of Facility Engineering for International Oil and Gas Projects

Author(s)/Presenters(s): Li Huaiyin; Xuebo Dang; Lei Zhang; Jiayin Wang

Skill Level: Basic

TCM Sections: 7.6. Risk Management

Time & Room: SUN 12:00-1:00 (Salon C1-2/Lower Level)

Abstract: International oil and gas exploration and development projects face many risks, mainly from three aspects: political and economic taxation risks, exploration and development technology risks, petroleum engineering (facility, drilling, etc.) design and construction risks.

Facility engineering is a major aspect of international oil and gas projects. It is the key link to production targets, investment control, and on-time production. Risk factors, risk identification and risk assessment are very complicated.

The methods used in the identification of facility engineering risks in international oil and gas projects include: expert survey, fault tree analysis, HAZOP, scenario analysis, flow chart, work-risk decomposition, policy comparison and SWOT analysis method, etc.

The basis of facility engineering risk assessment is project classification, which generally could be divided into different project types from three dimensions: oil properties, surface environment and



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

development methods. Risk factors might be identified by the principle of 2 stages and 3 levels. The identified risk factors are qualitatively and quantitatively classified, and the probability and impact scores are determined by specific conditions of each factor in the project, and the risk level is classified. For complex facility engineering systems, Analytic Hierarchy Process (AHP) method could be used for risk factor assessment.

This paper describes the identification and evaluation methods of facility engineering risk factors for international oil and gas projects. Facility engineering risk identification and assessment application of 5 typical oil and gas projects are provided based on the authors' experience. In the last section, some risk response methods are given for facility risk assessment.

(TCM-4048) Implementation of an Integrated Phase-Gate Project Controls Process

Author(s)/Presenters(s): Christopher W. Carson, CEP DRMP PSP FAACE; Leo Carson-Penalosa

Skill Level:

TCM Sections:

Time & Room: SUN 12:00-1:00 (Salon C5-6/Lower Level)

Abstract: The path to successful project delivery starts in the pre-design phase and is linked to four disciplines of the cost engineering or project controls effort of; cost estimating and management, planning and scheduling, risk management, and claims avoidance/forensic analysis/dispute resolution. Integrating these four disciplines into the design and construction process improves the benchmark plans, ensures adequate budget and schedule, and provides a consistent set of deliverables to improve the quality of the effort. The authors have found that this process greatly improves the deliverables and analysis results.

This effort is based on seven phases of a project; pre-design, schematic design, detailed design, design for construction, bid/tender document development, construction, and post-construction. These align with front-end loading and the front-end engineering design commonly used in the process world but also with any project design effort. The authors have previously written about the importance of design scheduling and this process aligns with that paper and brings in the full cost engineering/project controls support.

This paper will explain the authors' process in detail, providing the reader additional insight and guidance to successfully implement a fully integrated phase-gate project controls and design/construction effort.



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

(TCM-4079) Aligning Organizational Drivers with the Benefit of Projects Controls for Aviation Government Entities

Author(s)/Presenters(s): Dana N. Rutledge; Stuart B. Wood; Steven Andersen

Skill Level: Intermediate
TCM Sections: 8.1. Project Control Plan Implementation
11.2. People and Performance Management
Time & Room: MON 10:15-11:15 (Salon A5/Lower Level)

Abstract: Project controls is becoming more widely adopted and deemed vital in effective project delivery, especially in large complex programs and projects. This is more prevalent in the private sector, as it has been proven to increase repeated success in project execution and thereby increase profitability for businesses – both owners and contractors alike. However, the value of project controls to drive profits or benefits for public sector owners in the aviation industry does not always carry the same importance as it does in private and for-profit industries. When profit or delivering on time is not a driver for performance by an organization (public or private), many project controls principles will appear irrelevant or not required. These principles appear at face value to cost more than the added benefit. As a result, many organizations, including government-controlled aviation organizations, may benefit from further development and implementation of integrated project controls, especially for large projects and programs (including the implementation of project management offices).

This paper will discuss the benefits of project controls utilizing a method to determine organizational drivers to help influence the use of project controls, provide information on project controls solutions that are available, and how applying the right tool at the right time can affect positive project outcomes as a result of organizational acceptance of robust project controls. The purpose of this methodology is to create value for owners and increase the implementation of integrated project controls and thereby project success.

(TCM-4106) Developing Cost-Models from a Contractor's Cost-Loaded Schedule

Author(s)/Presenters(s): John B. Newman, CCP CEP

Skill Level: Intermediate



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

TCM Sections: 7.3. Cost Estimating and Budgeting
10.4. Project Historical Database Management
Time & Room: MON 2:00-3:00 (Salon C3-4/Lower Level)

Abstract: The Central Puget Sound Regional Transit Authority (RTA), aka Sound Transit (ST), which services Pierce, King, and Snohomish Counties in Washington State, is undertaking one of the most ambitious transit expansions in the country including a network of 116 miles of link light rail construction. Sound Transit's portfolio has been broken down into several alignments with multiple construction contracts. The most common project delivery methods at Sound Transit are DBB (design-bid-build), DB (design-build), and GC/CM (general contractor / construction manager). These methods often yield only lump sum bids/proposals or high-level bid packages, which are not conducive to developing historical cost-models. This poses a challenge to Sound Transit cost engineers and cost consultants that are tasked to establish accurate budgets for guideway, track, stations, garages, etc. This paper presents a solution for developing a cost-model that is derived from a contractor's cost-loaded construction schedule by cross-coding it with Sound Transit's hierarchical estimate breakdown structure (EBS). A comprehensive look at the benefits and challenges of this method are explained.

(TCM-4139) Performing Under Pressure – Implementing TCM Principles in an Evolving Project Environment

Author(s)/Presenters(s): Courtney J. Gosewisch, CCP

Skill Level: Intermediate
TCM Sections: 2.4. Project Control Process Map
8.1. Project Control Plan Implementation
Time & Room: MON 3:45-4:45 (Salon A3/Lower Level)

Abstract: This paper will highlight the project controls challenges and lessons learned when a steam pipe unexpectedly failed inside a 310,000 square foot historical and functional building in Milwaukee, Wisconsin.

The building was hit by a superheated steam release during a storm in May 2020. This event cause flooding, which knocked out steam service to the buildings in the downtown Milwaukee area. Water flooded the basement and steam permeated through the HVAC system, causing damage to elevators, electrical equipment, carpeting, furniture, light fixtures, historical marble, ornate woodworking, and more. The sudden event required extensive cost tracking to support the submittal of an insurance claim.



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

In addition to the physical damage endured, the team had to secure funding, meet an aggressive schedule to repair an essential building in a timely manner, handle supply chain issues, and keep workers safe during a global pandemic.

The project team used cost management principles, detailed cost tracking and reporting, change management, and cost forecasting to restore this historic building. The project would not have been successful without a major focus on communication, collaboration, and soft skills.

This paper and presentation will highlight the project controls challenges, successes, and lessons learned that ultimately led to implementing team process improvements.

(TCM-4163) (Presentation Only) Improving Project Delivery and Project Controls at Amtrak

Author(s)/Presenters(s): Laura Mason; Jim W. Short

Skill Level:

TCM Sections:

Time & Room: TUE 3:45-4:45 (Salon A4/Lower Level)

Abstract: On November 15, 2021, the Infrastructure and Investment Act (IIJA) a.k.a., the Bipartisan infrastructure Law, was signed into law. The IIJA provides a larger level of investment in passenger and freight rail than Amtrak received in the over 50 years since it was created.

This presentation will explain the improved project delivery models and project controls Amtrak is deploying to ensure we maximize the value of this historic funding. The IIJA provides \$66 billion (USD) for investments in freight and passenger rail - \$22 billion to improve and upgrade existing Amtrak assets and \$44 billion to flow through the U.S. Department of Transportation, via Federal Railroad Administration's discretionary grant programs dedicated to safety, infrastructure, and new and improved passenger rail service.

Amtrak works hard every day to deliver safe, high quality, on-time rail passenger service that exceeds customer expectations. Over the next five years, the IIJA funding, combined with our other annual and discretionary grant funding, will be dedicated to modernizing and upgrading critical infrastructure across the Amtrak network including tunnels, bridges, stations, fleet, and more.



(The following sessions are scheduled for the technical program. Subject to change. Rev. 2023-05-25@12:10PM)

Using our progress through a number of key planned projects, this presentation will describe alternate contracting models we are evaluating to improve project delivery and enhanced project controls (including cost estimating, planning & scheduling, cost management, and cost & schedule risk assessment/risk management), leveraging a number of AACE recommended practices.
