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Professional Spotlight

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Mr. McCue has over 40 years of engineering experience with a focus on project and construction management, consulting engineering, design, contract administration, and construction claims resolution. He has testified as an expert in mediation, arbitration, and various courts on engineering issues, including scheduling, estimating, design deficiencies, and construction defects. As an arbitrator for the American Arbitration Association, he has participated in numerous construction arbitration panels.

His professional background includes designing commercial and institutional facilities, inspecting nuclear power plants, and managing projects in petrochemical and pharmaceutical industries. Mr. McCue's expertise spans mechanical and environmental engineering, HVAC, electrical systems, and regulatory standards. He has taught project management courses at Pennsylvania State University and the University of Pennsylvania, and presents seminars and speaks at national and international conferences.

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In this edition of the MDCAdvisor® Expert Newsletter:

Once Upon a Time in the Future: Understanding the Risks & Uncertainties of Artificial Intelligence (AI) Development In Complex MEGA Construction Project Environments)

By: Robert C. McCue, P.E., EUR ING, CEng MIEI, MCIArb.

With the recent announcement of extensive construction projects for artificial intelligence development, there is a growing demand for essential materials like steel, cement, and lumber, alongside concerns about resource availability and logistics. These MEGA projects will also need significant infrastructure for utilities, housing, and transportation. Project teams face various risks categorized as known-knowns (clear estimating challenges), known-unknowns (uncertainties related to labor and competition), and unknown-unknowns (unpredictable events like natural disasters). Through examples such as the impact of an earthquake on a refinery project, this article explores the complexities of estimating and managing construction within this uncertain environment.

More Than Just Counting Rainy Days: Documenting Weather Delays

By Michelle N. Delehanty, PE, PMP

With predictions of a particularly harsh winter from the Farmer's Almanac, construction projects across the U.S. may face significant challenges due to increased storms and extreme cold. These conditions can lead to closures, resulting in schedule delays, change orders, and potential claims from contractors. To justify weather-related delays, contractors must meet specific criteria concerning contract terms, project timelines, abnormal weather conditions, and documentation of affected activities. This article explores the implications of weather on construction schedules, the necessity for clear contract clauses regarding weather delays, and the importance of establishing a solid baseline schedule to accurately assess and manage delays, ensuring projects remain on track despite unpredictable winter weather.

Once Upon a Time in the Future: Understanding the Risks & Uncertainties of Artificial Intelligence (AI) Development In Complex MEGA Construction Project Environments)

By: Robert C. McCue, P.E., EUR ING, CEng MIEI, MCIArb.

Recently, significant construction projects have been announced for extensive AI development, necessitating vast amounts of construction resources. These MEGA projects will require substantial quantities of steel, cement, lumber, electrical equipment, and miles of wiring. What potential challenges could arise during the delivery process? Where will this increased demand find reliable and stocked suppliers? Beyond the estimated material quantities needed for these identified projects, there will also be a tremendous need for utility, housing, and transportation infrastructure to support the construction of these MEGA projects.
When examining the common challenges faced by the project team and estimators, we identify three main categories of risk and understanding that guide the estimates for quantities and costs needed to complete the work:

Known-Knowns

This category includes the most straightforward estimating challenges, such as the tonnage of steel, cubic yards of concrete, volume of lumber, cost of transformers, amount of switchgear, and miles of wiring required. Develops plans and specifications into quantities and Costs.

Known-Unknowns

These include uncertainties regarding the location and availability of the labor force, utility expansions needed to support power, water, sewage requirements, as well as permitting and environmental issues. Additionally, there is the competition from other MEGA projects that may also be vying for the same critical materials and labor resources. This is experienced based and is percentages of identified hard costs.

Unknown-Unknowns

This most challenging category, is often referred to as Force Majeure events, and poses significant difficulties in estimation and management for project success. This is the realm of predicting future events and probability risk analysis.

The following three illustrative examples are based on our consulting experience and provide some context for consideration of Unknown – Unknowns:

- A large refinery in the Middle East had just begun construction when Japan experienced the Kobe earthquake. This disaster caused a sudden shortage in the global steel supply as Japan switched from being a major exporter to a net importer. Consequently, construction on the refinery was severely hindered, as design work had been completed without any procurement yet taking place. Recovery from the steel disruption required redesigning key structures and sourcing alternative steel dimensions that did not meet the original design specifications. This unforeseen impact could not be accounted for within the original budget or timeline. Recovery required extraordinary efforts to accomplish.

- A Multi-Fuel power plant in Asia was close to completion when delays in the transmission system due to poor planning, material shortages, and construction holdups halted its operation at commissioning. The plant remained unused for years while the power grid was extended and expanded. The expected revenue to cover construction costs did not materialize, rendering the project uneconomical.

- A high-rise condominium project that seemed poised for early and lucrative occupancy faced issues after residents moved in, citing persistent ammonia odors in their units. Investigations initially failed to find a source for the smell until forensic analysis revealed that changes to the environmental control system (Selective Catalytic Reduction) from a power plant that was providing fly ash additives to a concrete batch plant had contaminated the concrete. Ammonia carryover in the concrete was evolving during curing resulting in elevated ammonia levels in the building. Compounding the problem, the building's energy-efficient ventilation system inadvertently intensified the issue by recirculating the ammonia. This was an instance of a true Unknown-Unknown that arose from unique unforeseen environmental conditions.

As teams prepare for the impending influx of AI projects, they must take into account all three levels of estimating and environmental challenges. Once projects commence, Construction Managers must remain vigilant for "Black Swan"[1] events beyond their control that could significantly impact the project's success. Employing the best practices from Systems Thinking[2] and Complexity Theory[3] can provide project teams with the tools needed to detect, respond to, and navigate the Unknown-Unknowns that may arise to challenging the project.

1. The Black Swan – Nassim Nicholas Taleb, The Impact of the Highly Improbable. Random House ISBN 978-1-4000-6351-
2. Ackoff Center Weblog: SYSTEMS THINKER Russell Ackoff
3. Complexity: A Transient Condition Precedent to Project Failure; Understanding and Surviving Project Complexity: MDC Advisor – www.mdcsystems.com

Project Highlight

Indiana Manufacturing Plant Project

Construction Claims | Client: Sun Oil Company

MDCSystems® was retained to review engineering, procurement and construction issues concerning the development of a coke (coal) manufacturing plant in Indiana. Our client's damages stemmed from the differential movement of the sub-grade beneath the coke oven battery foundations and the failure of the coke ovens' exhaust gas system to maintain adequate negative process pressures.
The contractor entered an agreement to engineer, procure and construct 1,330,000 tons per year coke making plant. This plant was to employ a proprietary coke making process that had been developed over the course of 30 years while in use at a similar plant in Virginia. The Indiana plant was constructed on land that was reclaimed during the course of 25 years by placing fill material consisting of slag, fly ash and other miscellaneous materials in an enclosure that extended into Lake Michigan.

After an extensive analysis and review of information, visiting the site and conducting research, MDCSystems® concluded that the Contractor failed to perform its contractual obligations under the Contract; failed to engineer, procure, and construct the facility in accordance with the contract, the specifications, and the custom and practice of the industry. MDCSystems® concluded that the Owner was entitled to be reimbursed by the Contractor and a settlement favorable to our client was reached.

More Than Just Counting Rainy Days: Documenting Weather Delays

By: Michelle N. Delehanty, PE, PMP

According to the farmer's almanac, this upcoming winter is predicted to be more severe than last year, which already seems as if it were one for the record books. For many regions throughout the United States, that means a multitude of storms, extreme cold, and potential closings to schools, offices, and, most problematic, construction sites. These closings of construction projects can lead to schedule delays, change order requests, and ultimately claims. In order for a contractor to justify to the owner that there is indeed a weather-related construction delay, they must demonstrate four specific things: (1) that the delay is within the terms of the contract (2) that the activity delayed had a direct effect on the project end date (was on the critical path), (3) the weather event occurred in excess of the "normal" weather for the season, and (4) there is documentation of which specific activities were delayed on each weather occurrence.

Contract Weather Delay, Notice, and Recovery

Every construction contract is unique, but most projects will experience a weather event of some sort, and accommodations should be made in the contract to outline just what to do when this occurs. It is customary for the delay clause in the contract to define two things. First, exactly what a contractor will get if a weather delay occurs – a time extension only (noncompensable delay), time and monetary damages (compensable delay), or a combination of the two after a certain number of days. The compensability of the delays will be laid out in the contract, and will depend on the importance of the completion date, liquidated damages, or other factors. There will also be a requirement in the contract for the contractor to provide notice of the delay within a certain time period of the delay occurring. This requirement also varies with the contract; however, it is always in the contractor's best interest to provide formal notice of a weather delay as soon as there is potential to be one, even if the length of time or cost of the recovery is unknown. The contractor should also work to provide a recovery schedule to get the project back on track to finish on the agreed upon project end date.

Establishing a solid baseline and knowing the critical path

First, in order for a schedule to show a delay that can be pinpointed to a specific weather event, the baseline schedule has to be established, approved, and updated on a regular basis prior to the event occurring. In order for the delay to be applicable, it must affect the end date of the project. Primarily, the delayed activity must be on the critical path of the latest schedule update at the time of the weather event. For example, if the critical path showed concrete-steel-decking with finish-start relationships, and a storm occurred on a day when the steel was 50% complete causing steel work for two days, then the contractor would get a two day delay (assuming the terms of the contract and abnormal weather clauses allowed it). Conversely, using that same schedule, if the concrete was 95% complete and delayed for two days because of the storm but steel work was able to continue uninterrupted, there is no delay to the critical path; therefore the contractor shouldn't get any days.

Additionally, if the delayed activity is not shown to be a critical item at the time the weather event occurs, the contractor must demonstrate that the weather caused a delay long enough to use up all of that activity's float. Essentially, the weather event would change the critical path of the schedule to include the delayed activity. The number of days that can be claimed as weather delays will be those days the activity is delayed less the amount of float the activity had prior to the weather event. For example, using the critical path discussed above, if concurrent activity landscaping had three days of float but was delayed five while the original critical path activities continued as scheduled, the landscaping would then become critical and add a two day delay to the end date, granting the contractor two days.

Normal Weather

Typically, the contract will aver that weather delays can only be claimed when the weather is in excess of "normal" weather. For example, if the average rainfall for your region in the month of April is four inches and a delay is claimed during an April that only had two inches of rainfall the entire month, an extension would typically not be granted. This is because "normal" weather should be accommodated for when the project is baselined. The same logic can be taken when scheduling certain weather-restricted activities in the winter season. If the average temperature for the region is always below freezing in January, the durations of concrete related activities should adapt to the amount of work one could reasonably achieve given the low temperatures.

Documentation of the Weather Delay

The golden rule of any change order or claim is to document, document, document. The only way to make a valid weather delay claim is to record what is happening on the construction site before, during, and after the occurrence of the weather event. As noted above, it is always best to approach a potential weather event (or any part of a construction project) with an established baseline schedule and progress schedules constantly updated. Weekly and daily site reports should be kept, noting progress of critical and sub-critical activities on each report. When the weather event occurs, the daily report should note exactly which activities do not progress and why. The contractor should notify the owner as soon as they think a delay might be occurring, and the project schedule should be updated for progress to see if changes have been made to either the critical path or the end date. After the number of delay days has been established based on the field records and it is confirmed that the critical path has been affected, it is the contractor's obligation to establish that the weather during the delay period was abnormal. Once all three of these things are met, the contractor can move ahead with a request for additional days. If a change order is presented to the owner with one of these items missing, the owner should request additional information from the contractor before obliging them with additional time or money. During the time the delays and contract extensions are being resolved, the contractor should establish a recovery schedule and continue work in order to keep the project from delaying any further.

How Can I Prepare for a Weather Event

With a few months remaining until the uncertainty of the upcoming winter, there is still time for contractors and owners to be proactive. They should make sure that all parties understand the approach to delay claims on weather event, work together to get a baseline schedule approved with a conclusive critical path, and establish procedures on how to approach a weather event by documenting all potential delays.

As an Owner:

- Review the contract clauses related to weather delay. If there is no contract clause, establish an approach for delays and potential compensation due to weather.
- Review the project schedule regarding how many weather days are built in, and require regular updating.
- Review contractor daily reports concerning weather; confirm the reports are providing enough detail about the ongoing work.
- Communicate your expectations and reiterate contract requirements with the contractor at meetings.

As a contractor:

- Review the contract clauses related to weather delay. If there is no contract clause, seek out the owner's expectations regarding notice, schedule extension, and compensation.
- Provide notice to the owner of any potential weather delays.
- Maintain accurate field records, daily reports, and updated schedules for future reference if a weather delay claim should arise.

If both parties have an understanding of what to expect when a weather event occurs, know which activities are directly affected, and follow the contractual requirements for schedule extension and compensation, dealing with weather delays will be easier and help the rest of the project run smoother.