INEIGHT

INEIGHT WHITE PAPER:

WHY PLANNING FOR UNCERTAINTY WILL SAVE YOUR PROJECT

INTRODUCTION

The science of project planning has somewhat of a shaky reputation at best. Sure, change is inevitable but how often do projects really come in per the plan? Almost never. Even during this era of big data and digital transformation, project schedule and cost overruns are still more the norm than they are the exception.

Arguably, the reason for this is less about poor execution and more about the fact, that as an industry, we still struggle with accurately forecasting how long capital expenditure projects will actually take to complete. The root cause being less to do with the likes of CPM-based techniques not being fit for purpose but instead simply due to inaccurate data being fed into such plans. Feed overly optimistic durations into a CPM schedule and guess what? The forecasted completion date for the project will in turn be overly optimistic and rarely achievable.

To improve our forecasting capability, we need to do a better job of defining how long work really takes. This can be inherently challenging when building a construction schedule as the scope of work, quantities and specific deliverables are often not 100% defined during the time at which the plan is developed.

With the advent of technologies such as Artificial Intelligence (AI) and the simple realization that it takes the expertise of a team to build a plan, rather than a siloed effort, the tide is finally turning with regard to better forecasting.

CPM PLANNING STILL WORKS

Critical Path Method (CPM) is based on a very simple premise: break down the scope of a project into activities; estimate how long these activities will take; link these into a sequence and from this we can calculate the total duration of all work leading to project completion.

Of course, there are some additional layers of complexity involved such as working calendars, critical and non-critical path(s) and associated float etc. But at the end of the day, the CPM-forecasted project completion is entirely driven by sequence of work and how long this work will take.

DETERMINING SEQUENCE OF WORK

In a CPM schedule, sequence of work is modeled by linking activities together using logic ties. These ties establish a relationship between activities and define hard rules as to the order of operations e.g., “we can’t lay the decking before we have completed the underlying structure.”

In many ways, defining such a sequence is easier than determining durations as it is a simple, logical definition of when scope may be built. Knowledge of such sequencing typically resides with the expertise of the field execution team through their experience on prior projects. Historically, modeling sequence has not been the biggest bottleneck in planning — that falls under “Forecasting Durations.”

ACCURATELY FORECASTING HOW LONG WORK WILL TAKE (DURATIONS)

Accurately forecasting activity durations is just plain difficult — period. Why? Well, the problem lies with the fact there are multiple influencers on duration:

- *Productivity rates*
- *Number of personnel/crews working*
- *How much work is there to do & what are the quantities involved?*
- *External factors such as weather or availability of materials*

All of these drive uncertainty and variability of duration. It's no wonder, then, that CPM plans suffer from poor accuracy. It's easier for us to forecast by not taking into account these variables and simply assume everything will work out fine. The downside to this, though, is that we then end up with a best-case forecast rather than a most-likely forecast. If we march our project to a best-case target, we are much more likely to fail as we are unfairly benchmarking against a highly unlikely outcome.

HOW RISK ANALYSIS HELPS

In the past decade, risk analysis, specifically in the form of Monte Carlo simulation, has become widely accepted as a means of moving from 'best-case' planning to 'most-likely.' In simple terms, the Monte Carlo analysis simulates a very high number of potential project outcomes accounting for the huge number of possible variations in activity durations. The mathematics behind Monte Carlo is simple and defendable. What has been an ongoing challenge, though, is how best to capture and model the inputs needed for a Monte Carlo simulation.

In each simulation iteration, a given duration is selected from a range of values and applied to activities in the CPM schedule. This range is typically defined using what is known as a 3-point estimate comprising a minimum, most likely and maximum value. Again, while this is mathematically sound, getting a team member or discipline lead to define such a range in the form of, say, a 3-point triangular or 2-point uniform distribution quickly leads to you being marched out of the room under a cloud of ridicule!

To date, the problem hasn't been in the mathematical modeling, but more with software solutions not making the risk and uncertainty capturing process more meaningful to the project team.

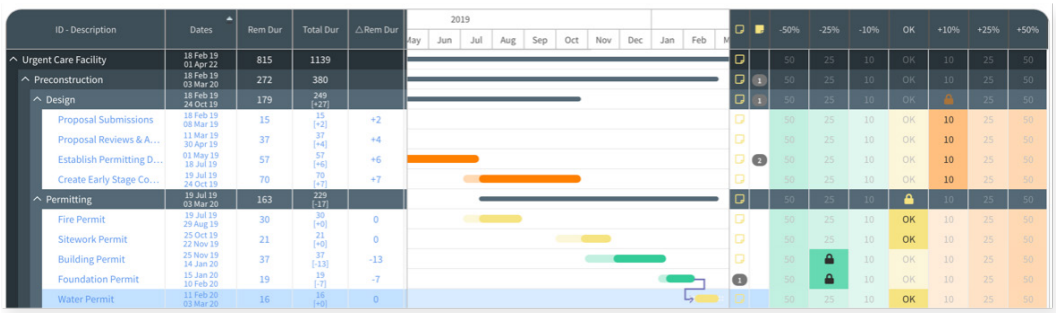
NEXT GENERATION RISK ANALYSIS

To help address the challenge of developing a meaningful risk model, a more team-centric and collaborative avenue of capturing risk and uncertainty inputs has been developed along with more easily consumable and actionable risk reports.

LET THE SOFTWARE GENERATE UNCERTAINTY RANGES FOR YOU

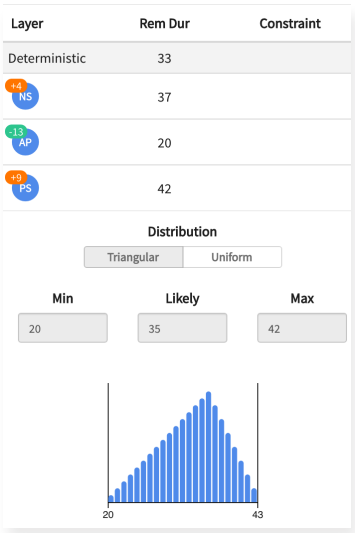
Rather than force team members down the “describe the range of outcomes as a distribution approach,” why not capture such expert opinion through a simple scorecard? Simply ask team members to either buy-in or push back on the proposed durations.

As multiple team members provide similar or even differing opinions, each of these inputs can be pooled together to automatically generate the uncertainty distribution. This distribution can then be fed into the Monte Carlo model for analysis.



TEAM MEMBER “BUY-IN SCORECARD”

This approach carries the massive benefit of making the expert opinion and knowledge capture process very fast and easy for contributors while still retaining the underlying modeling methodology. It also better ensures that the total consensus of the team is accounted for in the risk model rather than ‘loudest in the room wins.’



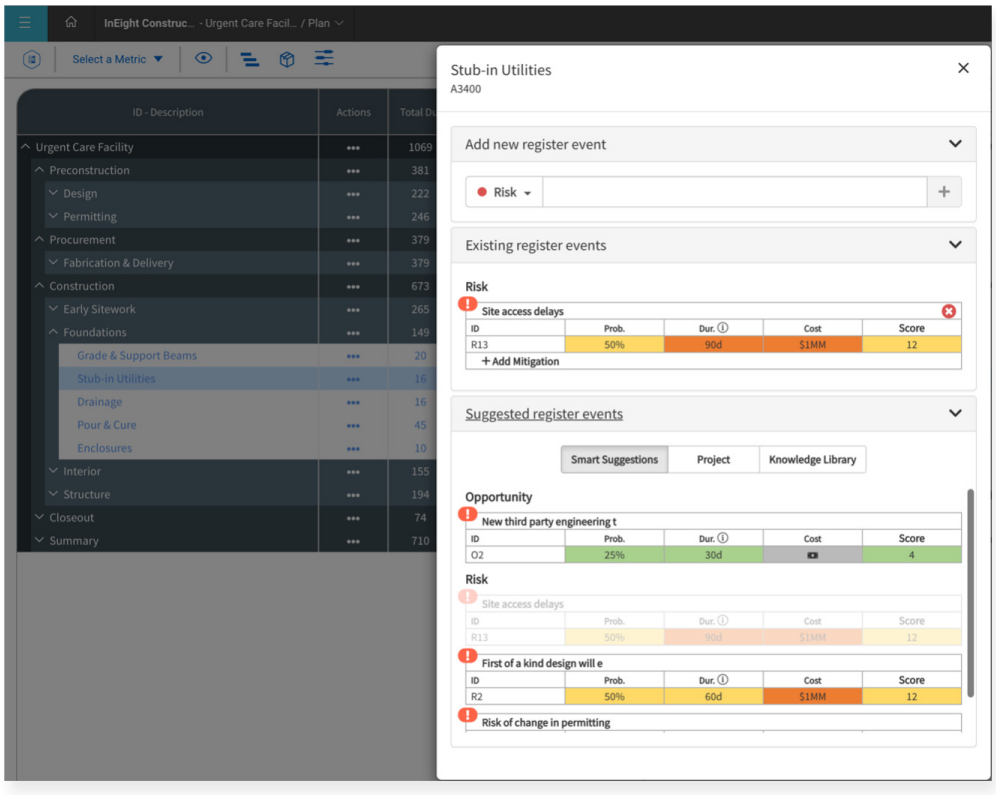
COMPUTER GENERATED

USE AI TO HELP ESTABLISH YOUR RISK REGISTER

In addition to more efficiently capturing duration ranges through the approach described above, the second step in the risk model building process is to capture and quantify risk events.

Traditionally, risk events have been tracked in what is known as a project risk register. Risk registers themselves are fundamentally sound and well proven in the field. Where the modeling challenge arises is in the mapping of those identified risks from the register into the schedule risk model. Without overstating, this process is treacherous at best and one that causes huge challenges in project risk workshops.

So instead of identifying risks in isolation of the schedule and then trying to embed them back in, why not provide an environment where risks are both identified and scored directly in context of the schedule itself?



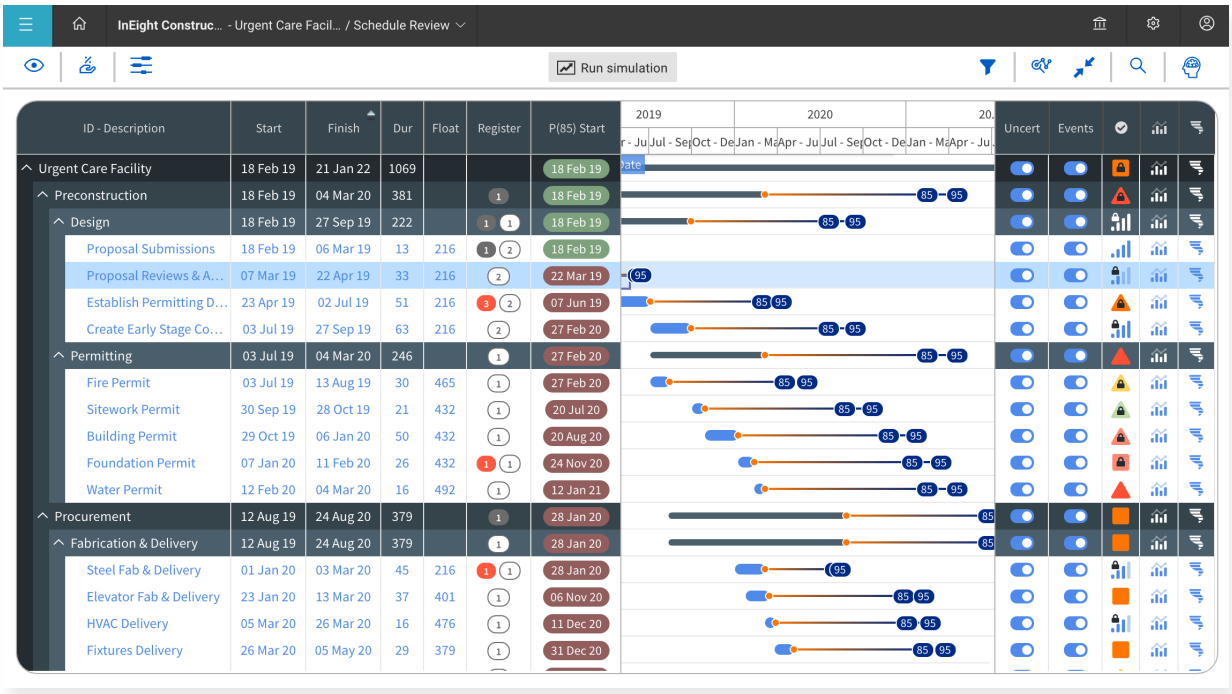
AI-DRIVEN GUIDANCE ON RISK EVENT IDENTIFICATION

To fully capitalize from the benefits of AI, team members are provided a list of suggested risks from the company's knowledge library repository.

Rather than team members having to brainstorm from a blank sheet of paper, they can take into account previously realized risks and opportunities from similar historical projects. Not only that, but as new risks are identified, they can be published to the enterprise risk register ready for subsequent consumption the next time around. This self-perpetuating risk management loop is an entirely new and more effective way for an organization to become more risk mature.

MEANINGFUL RISK EXPOSURE INSIGHT

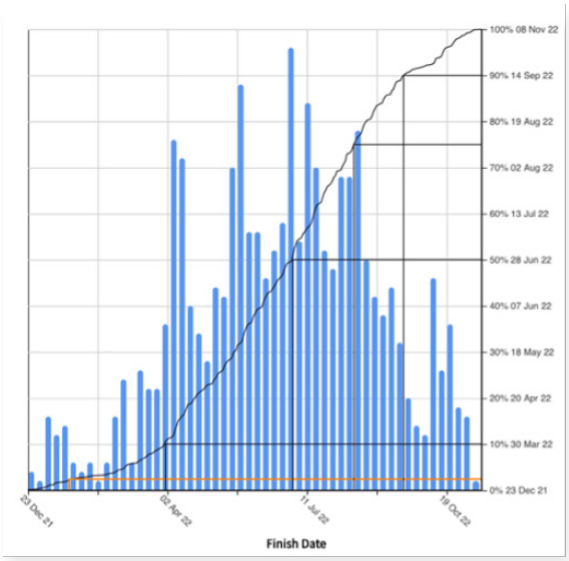
Overcoming the complexity of the risk data capture process has been addressed above. Once analysis is complete, reporting the meaning of the results is key. Traditional risk reports have tended to be statistical in nature referring back to the likes of probabilities and correlations — all very interesting but in reality, how useful? Wouldn't it be more useful to simply understand "what is our risk exposure on this project?", "why are we exposed?" and "what can be done to mitigate?"



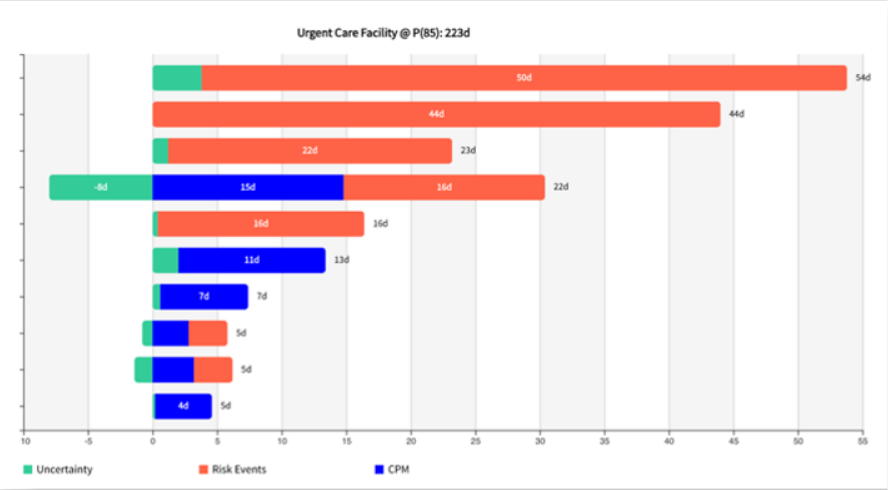
EXAMPLE OF A RISK-ADJUSTED SCHEDULE ACCOUNTING FOR UNCERTAINTY AND IDENTIFIED RISK EVENTS

One of the biggest drawbacks of traditional project risk management has been that risk analysis has been conducted not only as a separate exercise to the planning process, but worse, it is conducted in a separate software tool. This makes little sense. Instead, the processes of building a CPM schedule and risk analysis should be combined into one. By accounting for risk and uncertainty during the schedule development itself, we start to move toward true risk adjusted forecasting — we can make more informed decisions if we have an up-front understanding of risk hot spots.

Elaborating on smarter risk reporting, focusing on required contingency to overcome risk exposure as well as highlighting whether specific risk events or areas of schedule aggressiveness are driving on-time completion exposure, is a much more meaningful way to report risk than has previously been possible.



WHAT IS MY RISK EXPOSURE?



WHAT IS DRIVING MY EXPOSURE?

Active	EventId	Title	Description	%	Dur	$	Score
	R9	Risk #1	Risk #1	Medium (...	High (90d)	High ($1M...	12
	R7	Risk of delay due to permitti	Risk of delay due to permitting authority resulting in rework	Medium (...	High (90d)	Medium (...	12
	R11	Local regulatory authority ch	Local regulatory authority changing requirements	Medium (...	High (90d)	High ($1M...	12
	R4	Risk of late delivery	Risk of late delivery	Medium (...	High (90d)	Low ($10K)	12
	R2	First of a kind design will e	First of a kind design will extend engineering timeframe	Medium (...	Medium (...	High ($1M...	12
	R23	Risk of change in permitting	Risk of change in permitting authority due to civil unrest resulting in rework of design	Medium (...	High (90d)	High ($1M...	12
	R12	Lack of specs leads to re-des	Lack of specs leads to re-design	High (75%)	Medium (...	Medium (...	12
	R17	Competing work in fabyard	Competing work in fabyard	High (75%)	Medium (...	Medium (...	12
	R10	Scope poorly defined	Scope poorly defined	High (75%)	Medium (...	Medium (...	12
	R1	Weld issues causing rework	Weld issues causing rework	Low (25%)	Very High ...	Very Low (...	10
	R6	Weather delay	Weather delay	Low (25%)	High (90d)	Very High ...	10
	R15	Unknown Utilities	Unknown Utilities	Medium (...	Medium (...	Low ($10K)	9
	R3	Risk of schedule delay due to	Risk of schedule delay due to engineering drawings resulting in extended	Medium (...	Medium (...	Very Low (...	9
	R18	Unknown Utilities - Bad Geote	Unknown Utilities - Bad Geotech	High (75%)	Low (30d)	Low ($10K)	8
	R8	Risk of Lack of permitting sc	Risk of Lack of permitting scope	Low (25%)	High (90d)	High ($1M...	8
	R5	Risk of Lake of permitting co	Risk of Lake of permitting contract language	Low (25%)	High (90d)	High ($1M...	8

ENTERPRISE RISK REGISTER

RISK-ADJUSTED FORECASTING FOR ALL

Historically, project risk analysis has been a luxury available to only the larger project organizations and typically embraced more by owner organizations than contractors. The advent of next-generation risk-adjusted forecasting software is opening up the benefits of risk insight to the masses. By combining the data mining power of AI with a mindset change with regard to incorporating team member expert opinion, risk modeling is making huge strides forward.

Contractor organizations can now benefit from determining applicable contingency along with appropriate margin when developing their commercial bids. In short, contractors can ensure they are more competitive by following this risk adjusted forecasting approach.

Likewise, owners now get more insight into the realism and achievability of contractor schedules and so can react and remediate faster if contingency burn-down starts to accelerate beyond an acceptable tolerance.

In all instances, the benefit of providing a much easier means of capturing risk inputs, applying them to a proven approach using Monte Carlo simulation plus deeper and more meaningful insight through next - generation risk reporting is hard to argue against.

The long overdue marriage between CPM project planning and Monte Carlo-based risk analysis is finally becoming a reality. By helping more accurately forecast project schedules as well as drive more on-time project completion, this culmination of proven practices becomes a match made in heaven.

To learn more about next-generation planning, scheduling and risk solutions visit **InEight.com**.

ABOUT INEIGHT

InEight provides field-tested project management software for the owners, contractors, engineers and architects who are building the world around us. Over 400,000 users and more than 850 customers worldwide rely on InEight for real-time insights that help manage risk and keep projects on schedule and under budget across the entire life cycle. From pre-planning to design, from estimating to scheduling, and from field execution to turnover, InEight has powered more than $400 billion in projects globally across infrastructure, public sector, energy and power, oil, gas and chemical, mining, and commercial. **For more information visit InEight.com.**