

Developing Risk-Adjusted Schedules

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Risk-Adjusted Scheduling

Traditional Planning Philosophy

- Plan from 'left to right'
- Focus on critical path
- Compounding delay effect
- Completion highly uncertain
- Best-case not most-likely scenario
- Separate cost & schedule models

Risk-Adjusted Scheduling

- Plan from 'right to left'
- Focus on constraint free execution
- Embed risk within plan
- Plan to at least the 'most likely'
- 3rd dimension – **confidence**
- Tie cost & schedule risk together

A traditional CPM schedule is base case.

A risk-adjusted schedule is most likely.

Full Project Lifecycle Risk Analysis

Pre-Bid

- Alternate scenario analysis

Bid

- Contractor contingency & margin

Planning

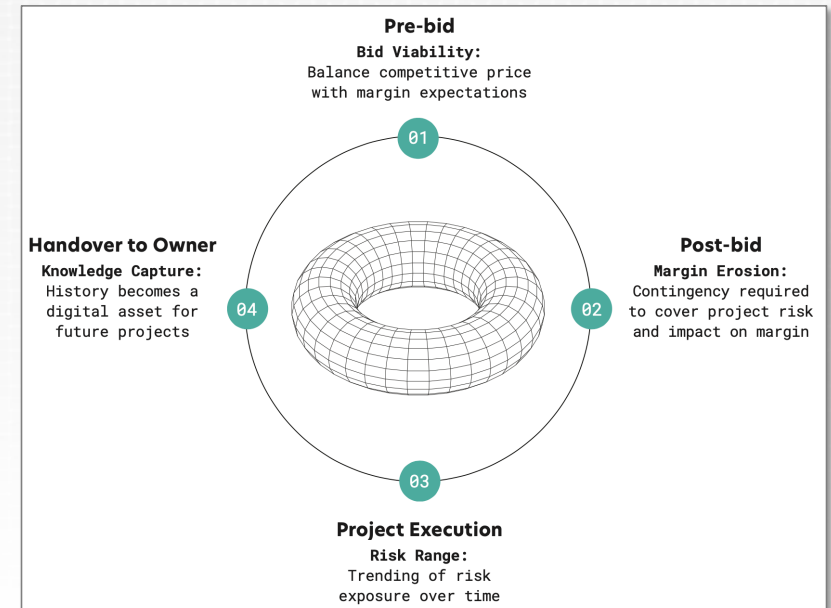
- Achievable forecast determination

Execution

- Continuous de-risking & remediation

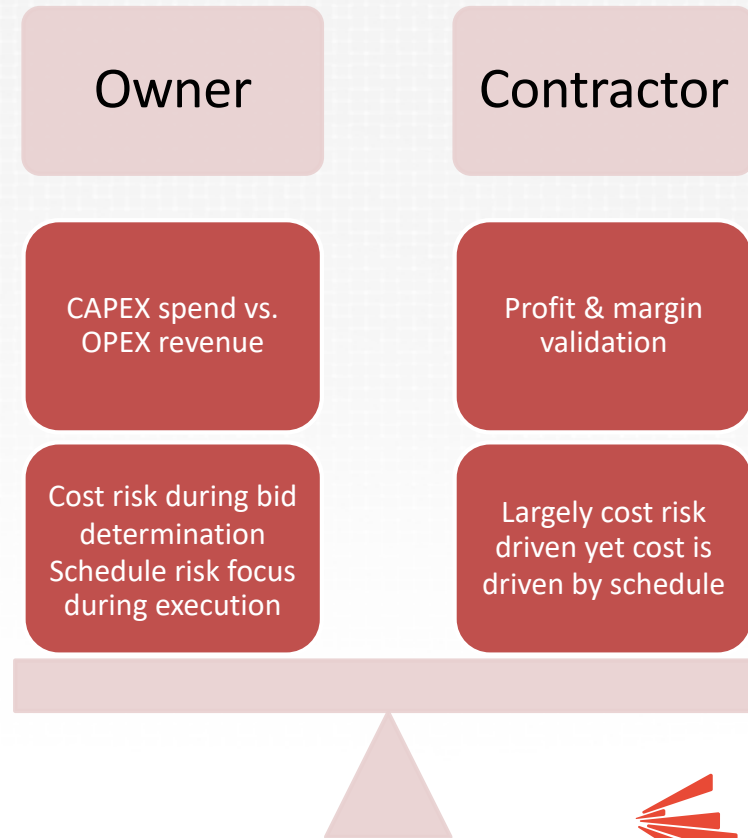
Closeout

- Capture lessons learned/risk register



Differing Perceptions of Risk

- It's typical (and OK) for an owner & contractor to have different risk profiles & tolerances
- Owner risk maturity higher than contractor
- Arguably better to award higher bid with higher confidence



Risk Insight & Modeling

Insight & Outputs

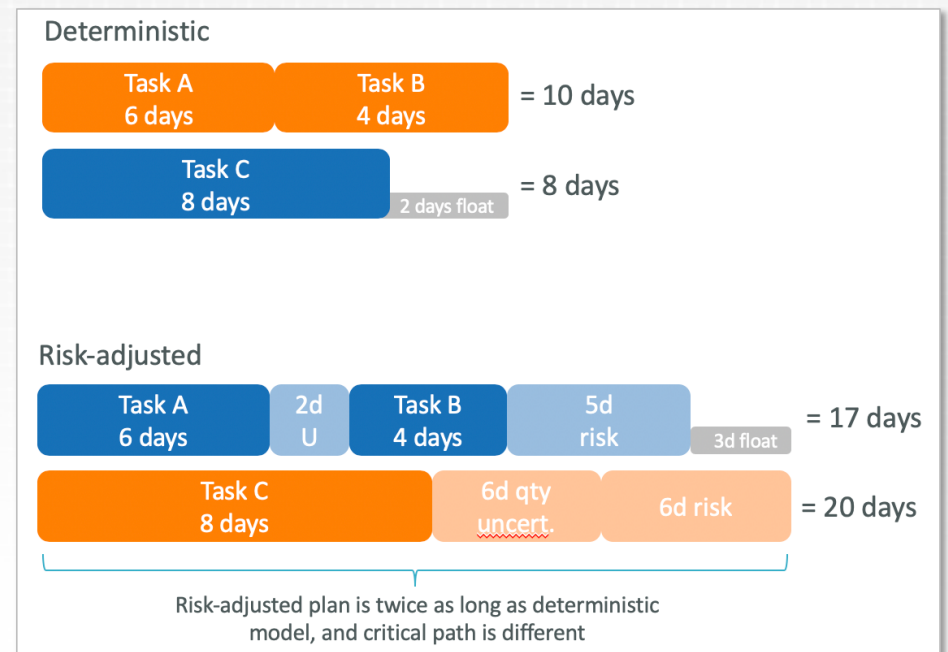
- Risk-adjusted forecast
- Certainty e.g. 75%
- Contingency & range of outcomes
- Drivers: uncertainty or events?
- Time/cost correlation

Inputs

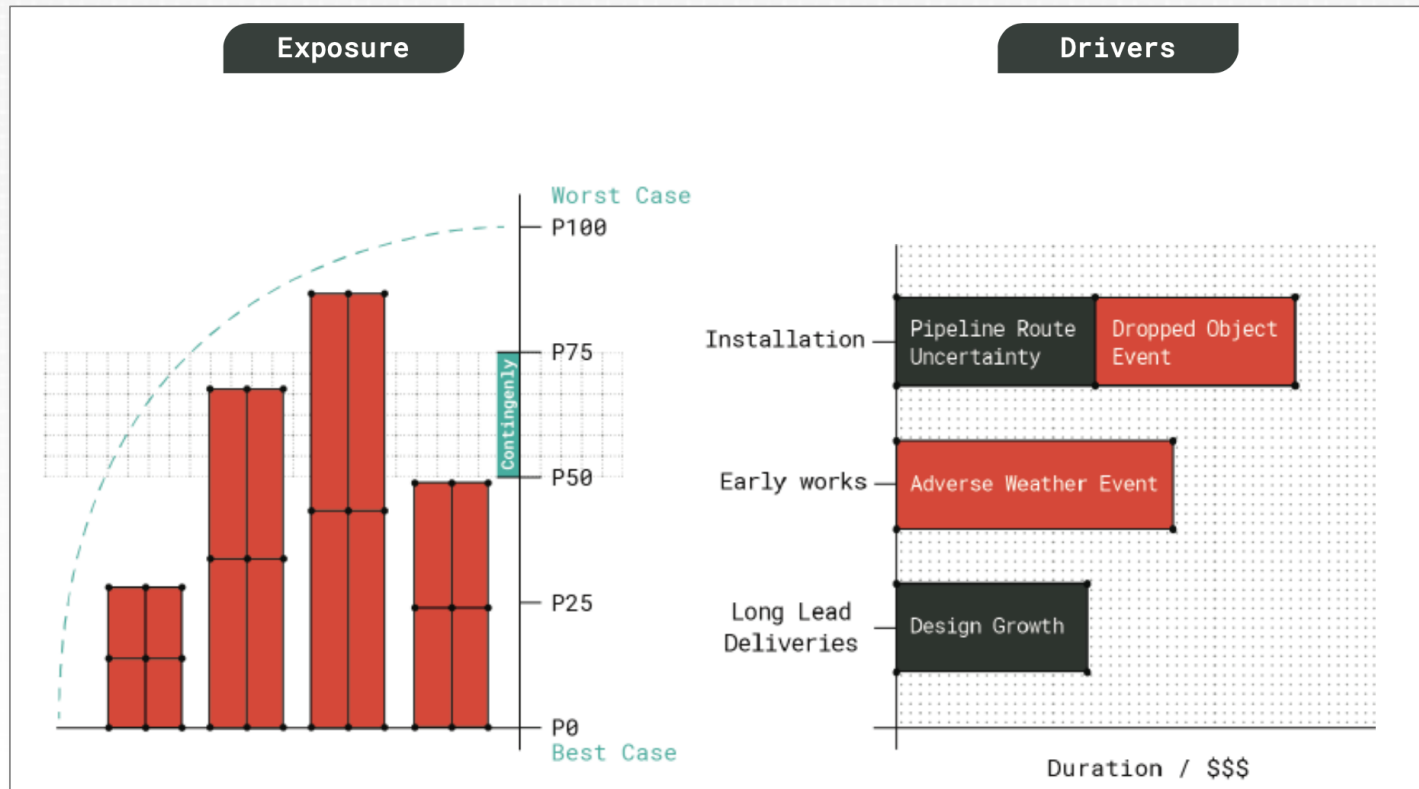
- Internal factors – uncertainty
- External factors – risk events

Analysis

- Monte Carlo simulation



Reporting the What & the Why



Next-Gen Risk Workshop Facilitation

AUGMENTED INTELLIGENCE (AI) + HUMAN INTELLIGENCE (HI) + RISK INTELLIGENCE (RI)



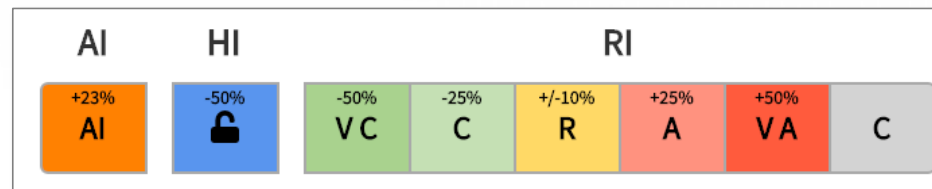
Adding a third expert opinion into the mix – **the computer**



Overcoming the misunderstanding of **Risk Events vs. Uncertainty**



Real Time Analysis & Modified Monte Carlo Simulation

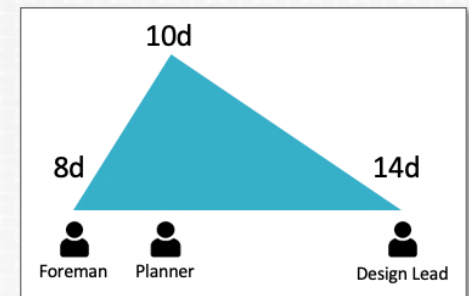


PMFocus Risk Methodology

PMFocus Risk Assessment Methodology



Uncertainty:
e.g. Qty Growth,
Productivity rates,
buy-in

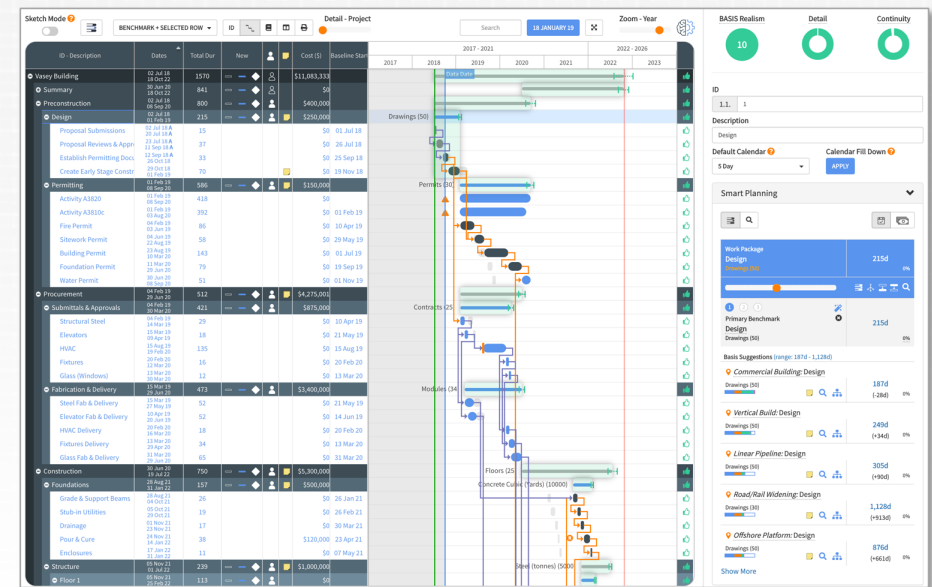


Risk Events:
e.g. Discrete &
Measurable

Active	ID	Type	Description	Mitigation	Probability	Schedule Impact	Cost Impact	Score
<input checked="" type="checkbox"/>	R14	Risk	Expansion joints not designed for local temp fluctua		75%	60 days	\$10,000	10
<input checked="" type="checkbox"/>	R6	Risk	Expansion joints not designed for local temp fluctua		75%	60 days	\$1,000,000	10
<input checked="" type="checkbox"/>	R13	Risk	Laydown constraints		75%	60 days	\$100,000	10
<input checked="" type="checkbox"/>	R4	Risk	Weld issues causing rework		50%	90 days	\$100,000	10
<input checked="" type="checkbox"/>	O1	Opportu	Order new COTS modules		50%	60 days		10
<input checked="" type="checkbox"/>	R11	Risk	Risk of delay due to lack of designers resulting in ne		50%	60 days	\$100,000	10
<input checked="" type="checkbox"/>	R17	Risk	Scope poorly defined		50%	30 days	\$100,000	10
<input checked="" type="checkbox"/>	R2	Risk	Laydown constraints	Procure additional acreage adjacent to	50%	60 days	\$100,000	10
<input checked="" type="checkbox"/>	R1	Risk	Delays due to UXB		25%	60 days	\$100,000	10
<input checked="" type="checkbox"/>	R3	Risk	Unknown soil conditions		50%	30 days	\$10,000	10
<input checked="" type="checkbox"/>	R5	Risk	Local regulatory authority changing requirements		50%	30 days	\$10,000	10
<input checked="" type="checkbox"/>	R7	Risk	Site Access constraints		25%	60 days	\$100,000	10
<input checked="" type="checkbox"/>	R8	Risk	Risk of clashes due to pipe sizing resulting in rework		25%	60 days	\$10,000	10
<input checked="" type="checkbox"/>	R9	Risk	Risk of Quantity Growth due to late takeoff		25%	60 days	\$10,000	10

Rapid Schedule Development & Critique using Augmented Intelligence

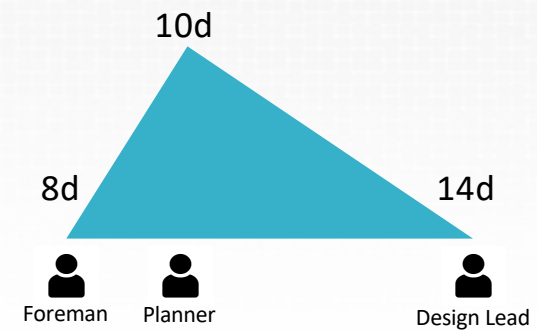
- Planner shares **context** with computer
- Computer suggests **durations, costs, risks, sub-nets & sequence**
- **Benchmark & Schedule critique**
- Suggested **productivity rates**
- Inference engine gets smarter through **machine learning**



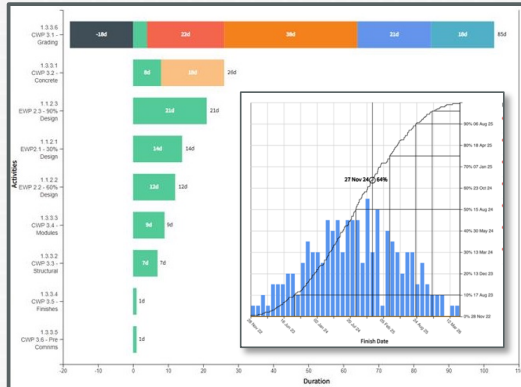
Obtaining Buy In through Human Intelligence

- Why force experts to translate their expertise into statistical distributions?
- Capture buy-in and pushback through scorecard
- Driven by expert opinion

ID	Description	Dates	Rem Dur	Total Dur	Δ Rem Dur	Δ End	Completed
Chinery Pipeline							
		02 Jul 18 - 22 Sep 19	1103	1543			
		02 Jul 18 - 02 Jul 18	332	464			
		02 Jul 18 - 02 Jul 18	143	199			
		02 Jul 18 - 02 Jul 18	125	125			
Design							
		02 Jul 18 - 02 Jul 18	30	30	-1	-3	OK
		20 Aug 18 - 13 Aug 18	44	44	+2	+1	OK
		12 Oct 18 - 12 Oct 18	69	69	-6	-7	OK
Terminal							
		31 Jul 18 - 31 Oct 19	262	366			
		31 Jul 18 - 31 Jul 18	39	39	+4	+4	OK
		21 Sep 18 - 12 Jan 19	57	146	+6	+1	OK
		08 Apr 19 - 08 Apr 19	83	83	+8	+13	OK
Pump Station							
		03 Sep 18 - 03 Oct 19	287	403			
		03 Sep 18 - 03 Sep 18	44	44	+9	+13	OK
		04 Apr 19 - 20 May 19	36	130	-13	-16	OK
		30 May 19 - 30 May 19	94	94	+18	+11	OK
Construction							
		22 Jan 20 - 20 Jan 22	519	725			
		07 Aug 20 - 07 Aug 20	401	563			
North Spread							
		12 Aug 20 - 12 Aug 20	32	32	0	-7	OK
		10 Mar 20 - 10 Mar 20	32	32	0	-7	OK
		23 Apr 20 - 23 Apr 20	32	32	0	-7	OK
		06 Jan 20 - 06 Jan 20	40	40	+8	+5	OK
		03 Aug 20 - 03 Aug 20	32	32	0	+5	OK
		16 Sep 20 - 16 Sep 20	32	32	0	+3	OK
		17 Sep 20 - 17 Sep 20	40	40	+8	+15	OK
		25 Dec 20 - 25 Dec 20	16	16	-7	-7	OK
		18 Jan 21 - 18 Jan 21	32	32	0	-7	OK
		10 Jan 21 - 10 Jan 21	32	32	0	-7	OK



Real-Time Risk Adjusted Forecasting using Risk Intelligence



Chinery Pipeline (50% Confidence Scenario) - Review

Projects Knowledge Library Settings Dan Patterson MorgCon Inc

Detail - Project 26%

Zoom - Year

ID - Description	Start Date	Finish Date	Dur	Float	Uncert	Risk	2017	2018	2019	2020	2021	2022	2023	2024	2025
Chinery Pipeline	02 Jul 18	06 Jan 23	1650												
Design	02 Jul 18	10 Jan 20	558												
Contracting & Fabrication	01 Oct 18	20 Apr 21	933												
Construction	13 May 20	09 May 22	727												
North Spread	13 May 20	24 Nov 21	561												
NS 1	13 May 20	25 Jun 20	32	0											
NS 2	21 Jul 21	09 Sep 21	37	0											
NS 3	25 Jun 20	10 Aug 20	32	0											
NS 4	10 Sep 21	01 Nov 21	37	0											
NS 5	11 Aug 20	23 Sep 20	32	0											
NS 6	02 Nov 21	22 Dec 21	37	0											
NS 7	23 Sep 20	06 Nov 20	32	0											
NS 8	23 Dec 20	04 Feb 21	32	0											
NS 9	05 Feb 21	22 Mar 21	32	0											
NS 10	21 Jun 21	26 Aug 21	49	0											
NS 11	12 Oct 21	24 Nov 21	32	118											
Chinery Terminal	24 Sep 20	04 Jun 21	254												
Site Prep	24 Sep 20	11 Nov 20	35	241											
Foundations	12 Nov 20	07 Dec 20	18	241											
Steel Structure	08 Dec 20	16 Feb 21	51	241											
Exterior	18 Mar 22	07 Jun 22	58	308											
Module Installation	17 Feb 21	02 Jun 21	76	243											
Comms	08 Jun 22	06 Oct 22	87	310											
South Spread	23 Dec 20	21 Sep 21	278												

Duration Uncertainty

Uncertainty Type: Markup Manual

Distribution: Triangular Uniform

Min: 32, Likely: 32, Max: 48

Rem Dur (P50): 37

Constraint: None

Register

ID	Prob.	Dur.	Cost	SCORE DP
R13	75%	60d	\$100K	12



P75 Certainty is the New Normal

Pre-COVID

- ⚡ 1 in 5 projects view schedule through “risk lens”
- ⚡ Risk registers little more than checklists
- ⚡ Fixed amount contingency

New World

- ⚡ Non-risked forecasts will be the exception
- ⚡ Risk quantification will become as important as the forecast itself

Confidence in our forecasts is more important than ever.

Thank You

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