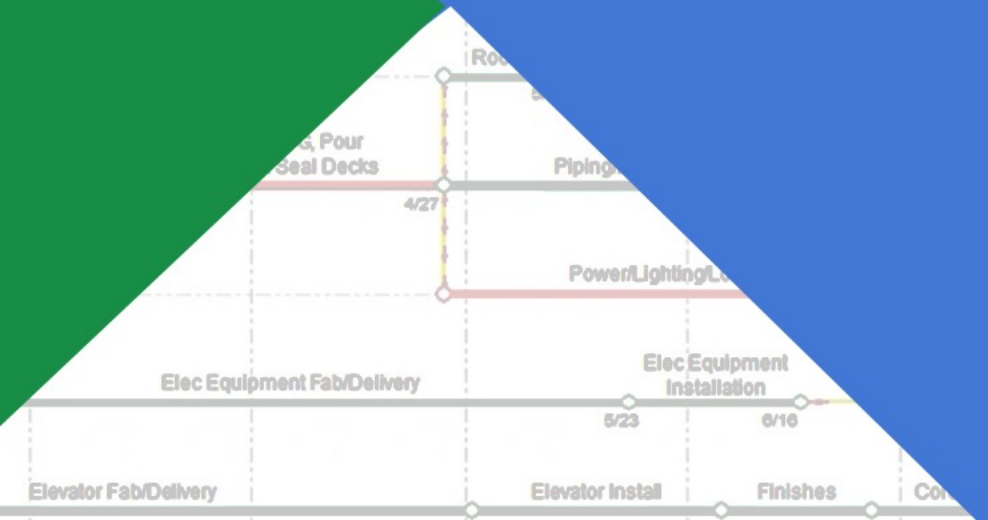


NetPoint+GPM
CONFERENCE
May 12 & 13, 2022

Solving Critical Schedule & Risk Issues on Major Public Infrastructure Projects



Presented by:
Jeffrey Plant

Meet The Presenter

Jeffrey Plant

MBA, P.Eng., ING., PMP

Managing Director, PMA Canada

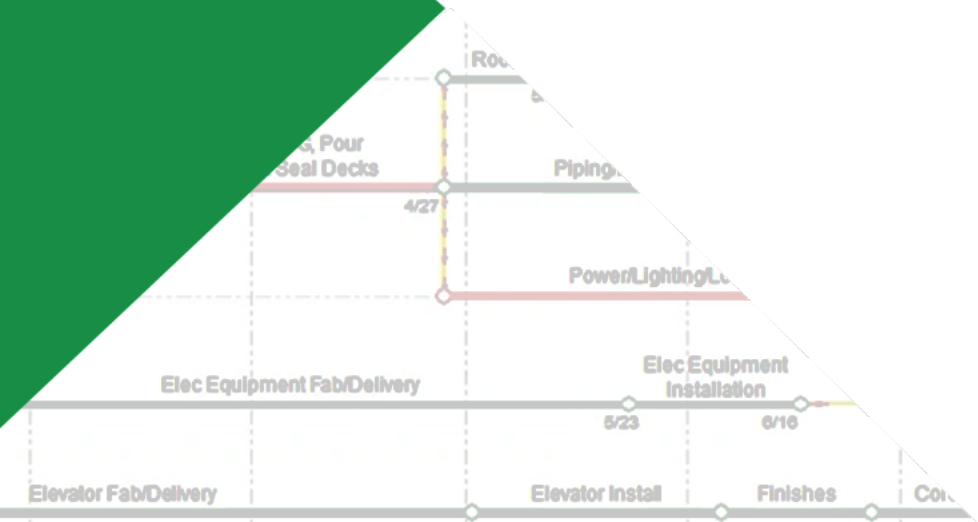
Accomplished infrastructure delivery professional; extensive transportation, environmental, and building project experience including:

- LA Metro G-Line BRT Improvements
- Austin ATP - Project Connect (LRT)
- Metro Vancouver Iona Island WWTP
- Samuel de Champlain Bridge (Montreal)
- VivaNext Highway 7 BRT (York Region, Ontario)
- Gardiner Expressway Rehabilitation (Toronto)
- NW Bulk Transmission Line (Ontario)
- Port of Miami Tunnel
- Dulles Corridor Metrorail Phase 2





Agenda

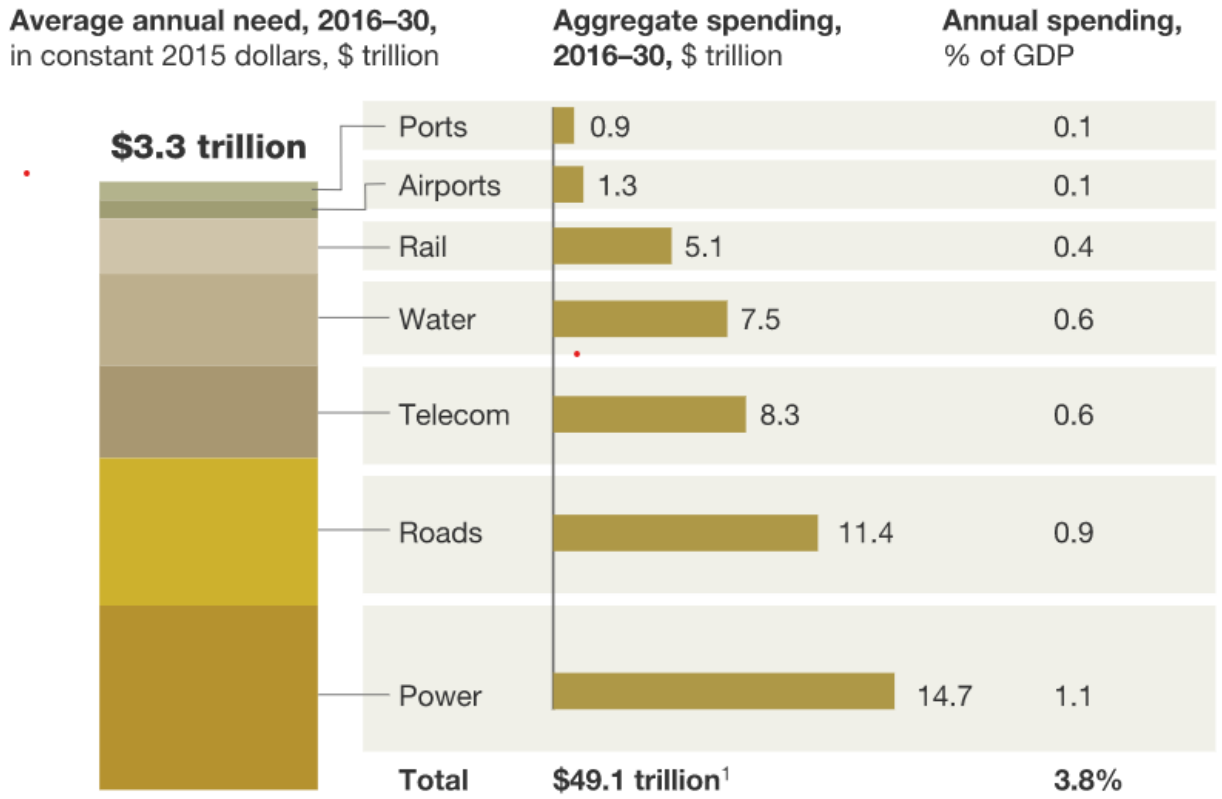


- The Infrastructure Challenge
- What Owner's Want
- The Project Delivery Challenge
- Scheduling Tools
- Use of NetPoint for Project Planning
- Managing a Schedule or a Project?
- Use of NetPoint for Project Management
- Highlighting Potential Risks using Netpoint
- The Risk Transfer Process
- Preparing a Risk Register
- Quantifying Risks Using Monte Carlo Analysis
- A new Paradigm for Schedule management

The Infrastructure Challenge

What was the annual Global Infrastructure Spending Deficit in 2015 dollars?

- ❑ 10%
- ❑ 25%
- ☑ 33% ($1.1 trillion)
- ❑ 50%
- ❑ 75%



[1]The estimate of total demand is lower than the $57 trillion projection in previous MGI research. It has been adjusted for the following reasons: this projection covers a 15-year period (2016–30) rather than an 18-year period (2013–30); water numbers have been reduced by 40%, as Global Water Intelligence adjusted its water capital-expenditure definition to exclude equipment spending; base-year prices have been revised from 2010 to 2015; and GDP growth forecasts have been revised downward by IHS.

Credit: McKinsey Global institute: "Bridging Global Infrastructure Gaps, June 14, 2016, Report

The Infrastructure Challenge

$1.2 Trillion
US infrastructure bill signed into law on November 15, 2021

$550 Billion over 5 years[1] including…

- $110 Billion for roads, bridges and major infrastructure
- $105 Billion for water infrastructure
- $66 Billion for passenger and freight rail
- $65 Billion for broadband infrastructure
- $65 Billion to improve the power grid
- $39 Billion for public transit
- $25 Billion for airports
- $17 Billion for ports
- $7.5 Billion for electric vehicle chargers

1. Here's what's in the bipartisan infrastructure package, CNN November 15, 2021

What Owners Want…

- Well-conceived projects
- Strong public support
- A predictable and streamlined funding and approval process
- Efficient design and delivery
- Realistic Schedules
- On-time and on-budget projects
- Excellent project quality
- No claims

The Project Delivery Challenge

- Many large projects simultaneously
- Unprecedented cost escalation
- Limited construction industry resources
- Supply chain issues
- Declining contractor profitability
- Construction Industry consolidation

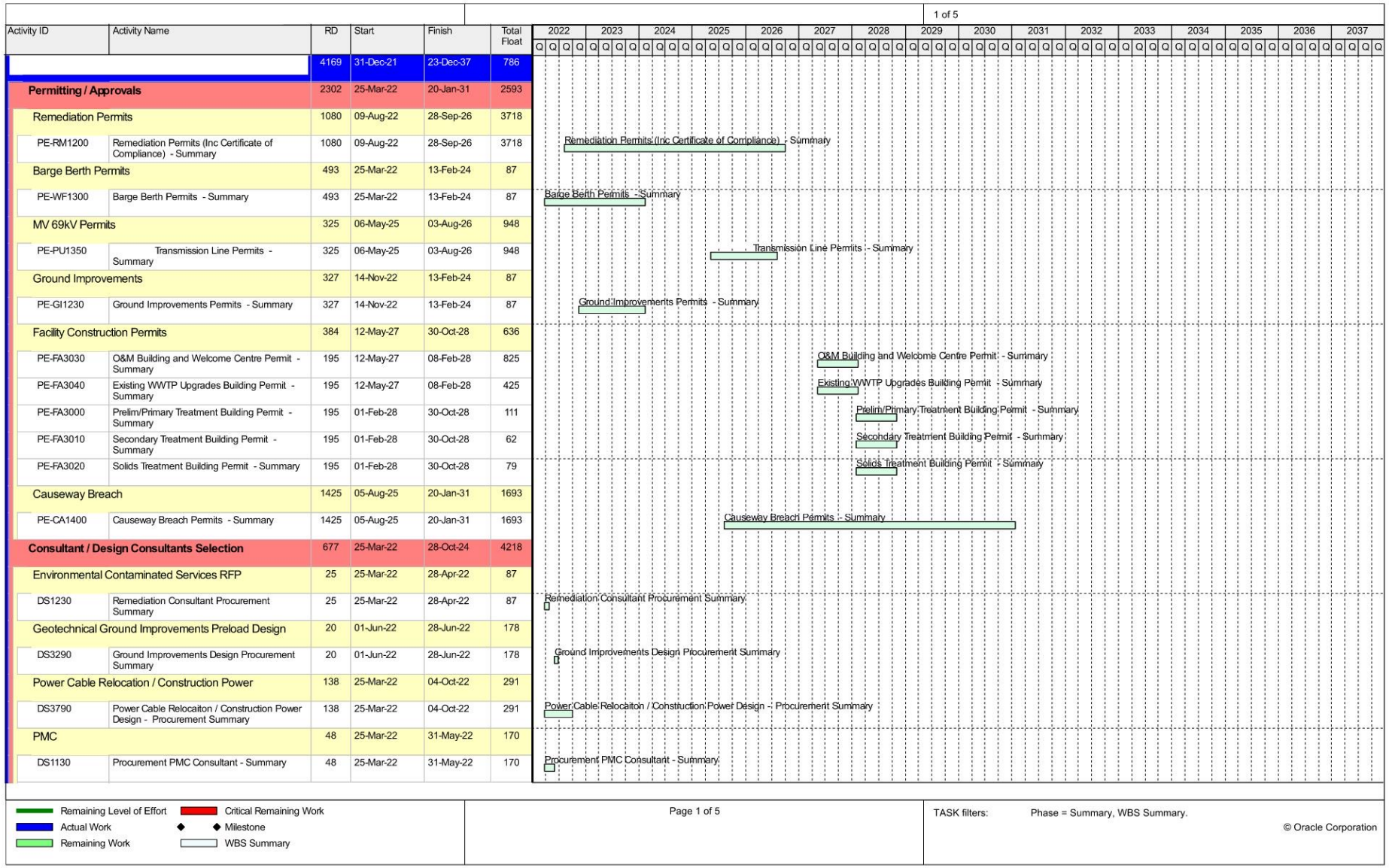
The Project Delivery Challenge

We are moving from a “Buyer’s Market” to a “Seller’s Market”

Projects need to be better planned to be attractive to potential bidders

Better planning starts with a realistic schedule, an understanding of project risks and a realistic budget

Let’s start with a schedule at the planning stage…

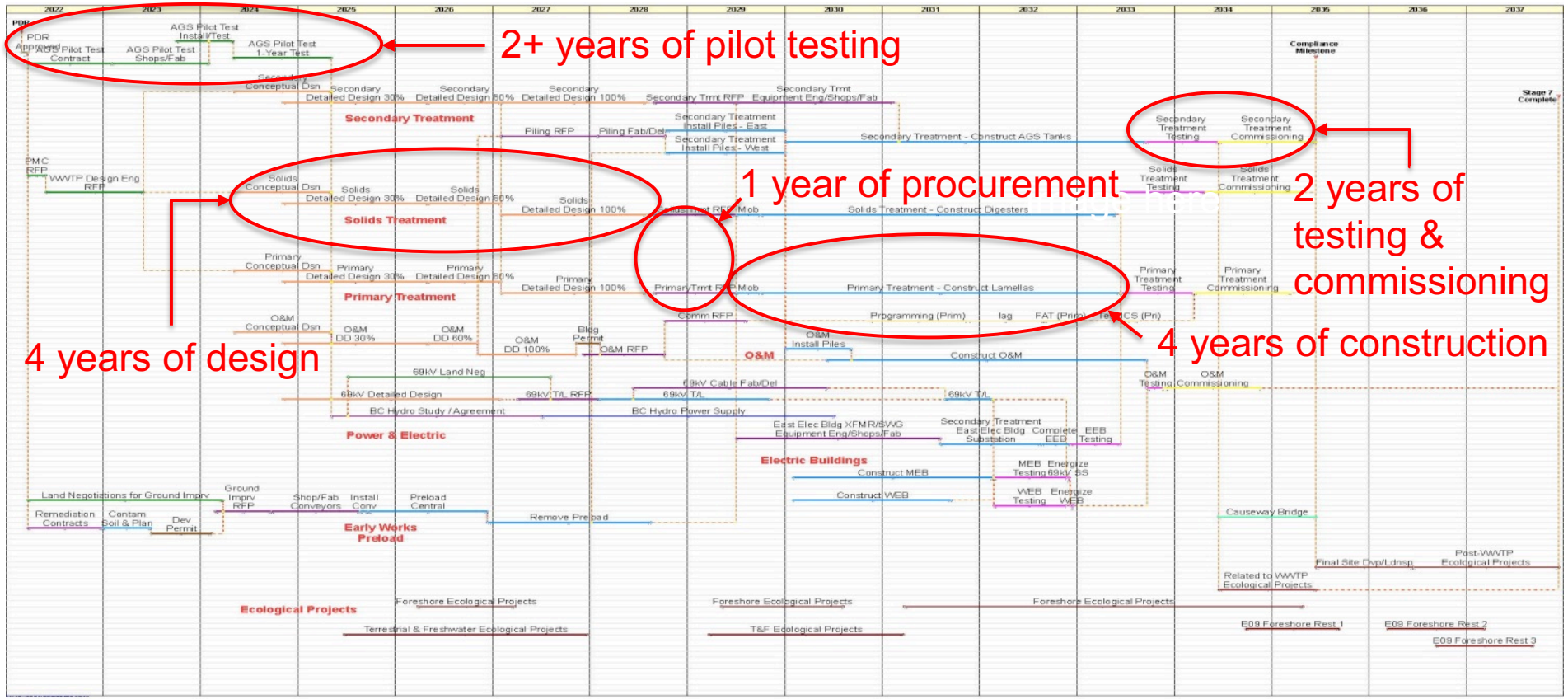


1 of 5

Activity ID	Activity Name	RD	Start	Finish	Total Float
		4169	31-Dec-21	23-Dec-37	786
Permitting / Approvals		2302	25-Mar-22	20-Jan-31	2593
Remediation Permits		1080	09-Aug-22	28-Sep-26	3718
PE-RM1200	Remediation Permits (Inc Certificate of Compliance) - Summary	1080	09-Aug-22	28-Sep-26	3718
Barge Berth Permits		493	25-Mar-22	13-Feb-24	87
PE-WF1300	Barge Berth Permits - Summary	493	25-Mar-22	13-Feb-24	87
MV 69kV Permits		325	06-May-25	03-Aug-26	948
PE-PU1350	Transmission Line Permits - Summary	325	06-May-25	03-Aug-26	948
Ground Improvements		327	14-Nov-22	13-Feb-24	87
PE-GI1230	Ground Improvements Permits - Summary	327	14-Nov-22	13-Feb-24	87
Facility Construction Permits		384	12-May-27	30-Oct-28	636
PE-FA3030	O&M Building and Welcome Centre Permit - Summary	195	12-May-27	08-Feb-28	825
PE-FA3040	Existing WWTP Upgrades Building Permit - Summary	195	12-May-27	08-Feb-28	425
PE-FA3000	Prelim/Primary Treatment Building Permit - Summary	195	01-Feb-28	30-Oct-28	111
PE-FA3010	Secondary Treatment Building Permit - Summary	195	01-Feb-28	30-Oct-28	62
PE-FA3020	Solids Treatment Building Permit - Summary	195	01-Feb-28	30-Oct-28	79
Causeway Breach		1425	05-Aug-25	20-Jan-31	1693
PE-CA1400	Causeway Breach Permits - Summary	1425	05-Aug-25	20-Jan-31	1693
Consultant / Design Consultants Selection		677	25-Mar-22	28-Oct-24	4218
Environmental Contaminated Services RFP		25	25-Mar-22	28-Apr-22	87
DS1230	Remediation Consultant Procurement Summary	25	25-Mar-22	28-Apr-22	87
Geotechnical Ground Improvements Preload Design		20	01-Jun-22	28-Jun-22	178
DS3290	Ground Improvements Design Procurement Summary	20	01-Jun-22	28-Jun-22	178
Power Cable Relocation / Construction Power		138	25-Mar-22	04-Oct-22	291
DS3790	Power Cable Relocaiton / Construction Power Design - Procurement Summary	138	25-Mar-22	04-Oct-22	291
PMC		48	25-Mar-22	31-May-22	170
DS1130	Procurement PMC Consultant - Summary	48	25-Mar-22	31-May-22	170

- 16-year program summarized on 5 pages
- Many decision-makers have difficulty following Critical Path Method GANTT Charts

The NetPoint Alternative



- 16-year program on 1 page…
- Real-time Interactive Planning Tool
- Helps decision-makers to better understand the project challenges

Complex Scheduling Specifications have become the Norm

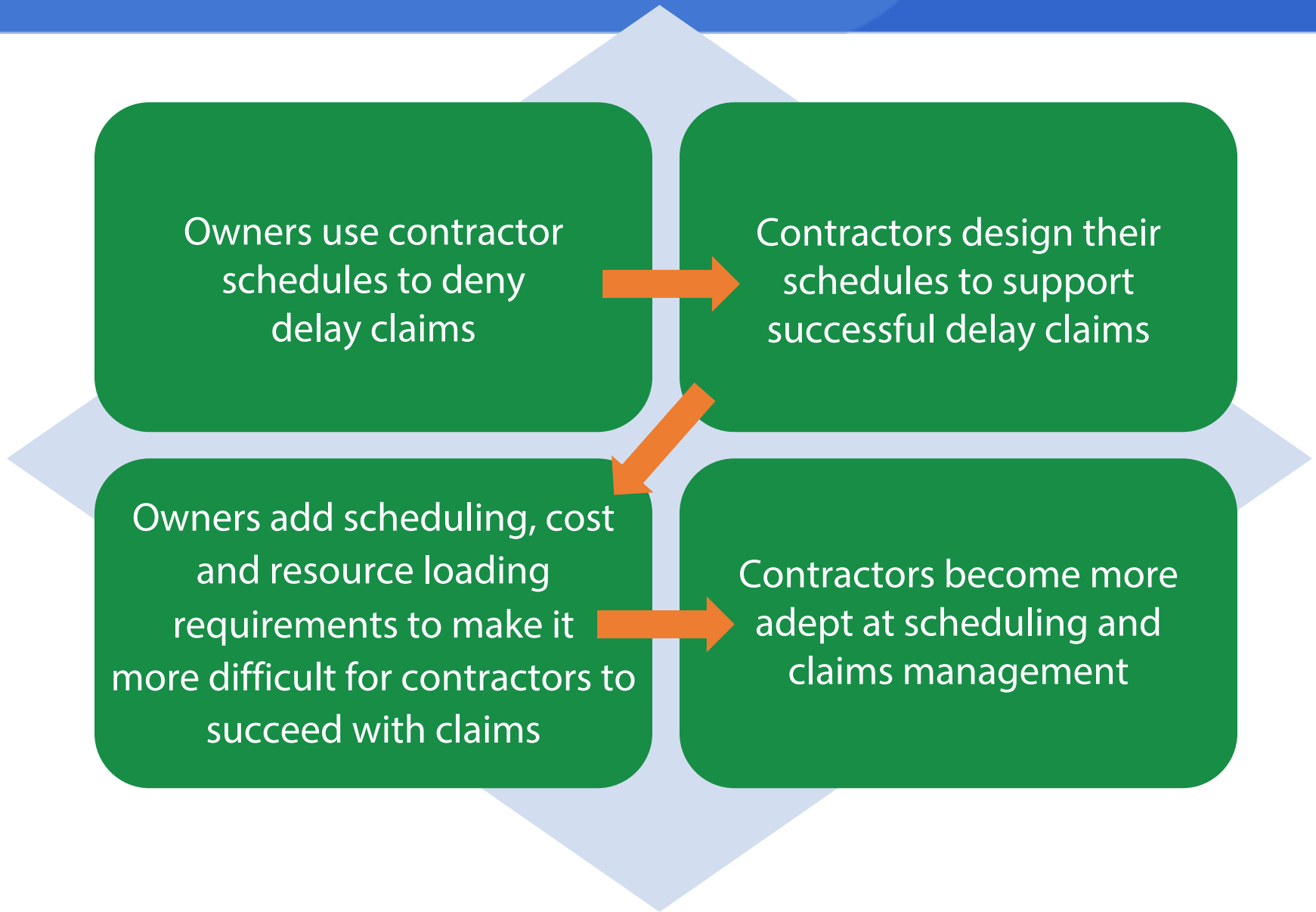


Owners want assurance that the project delivery contractor can deliver the planned schedule



Are Complex Scheduling Specifications providing owners with the assurance they crave?

Scheduling Specifications



Scheduling Specifications

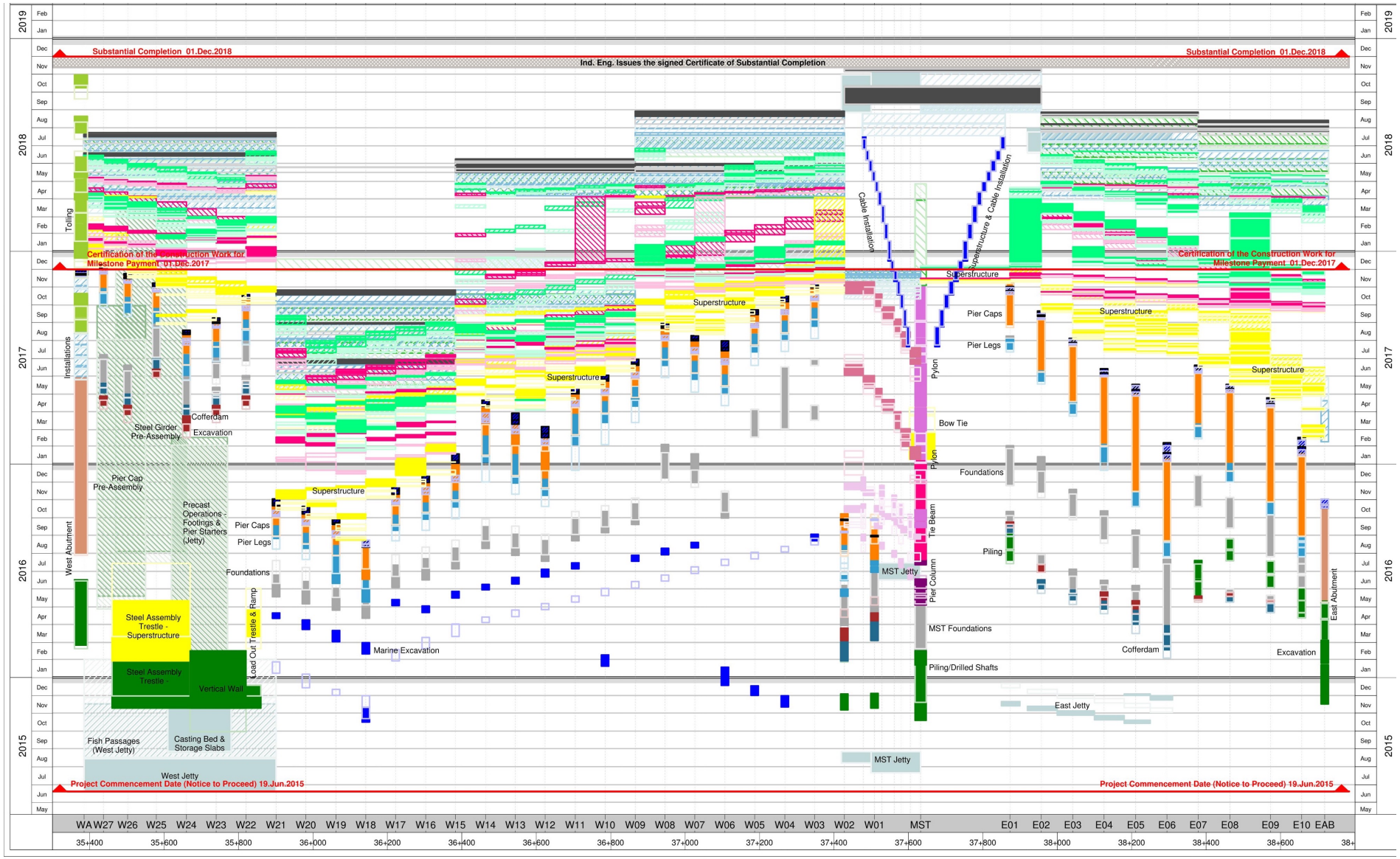
Managing the schedule becomes a project in itself…

- Consumes management resources
- Adds little value to the construction management process
- Results in multiple versions of the schedule:
  - The "Official" schedule (what the owner wants to hear and which the project team generally ignores)
  - The Contractor's schedule (which the area managers know is usually optimistic but possibly achievable)
  - The actual schedule (which too often resides in the heads of the area managers)

The Official Schedule…



The Contractor's Schedule…

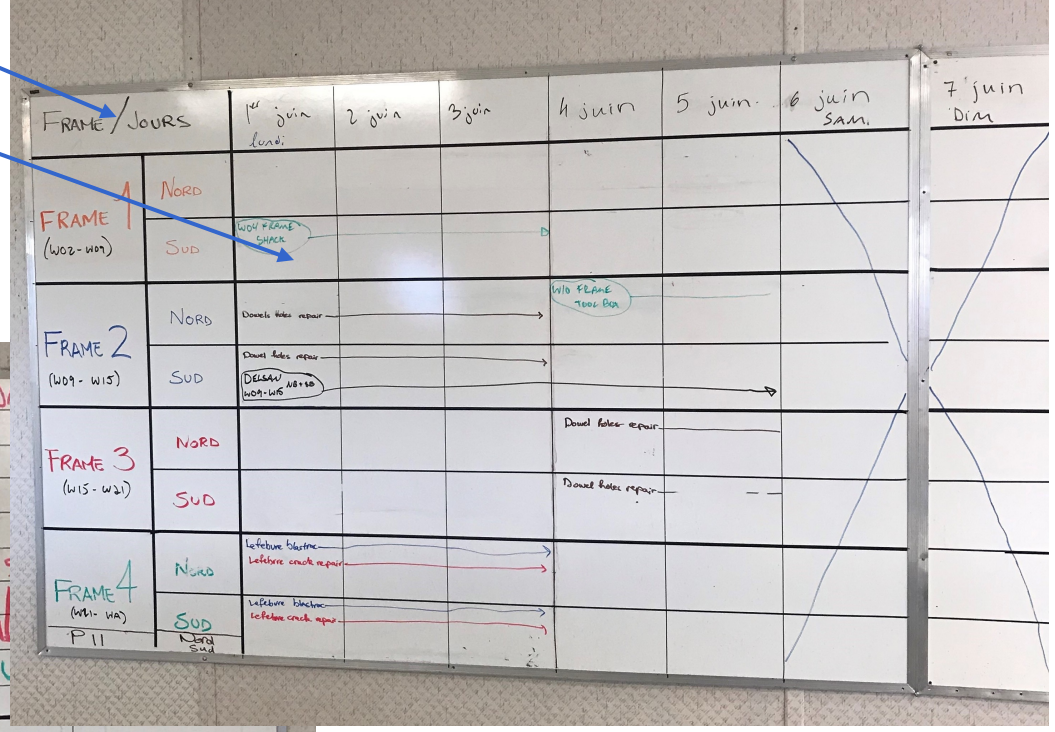


1 Page
TILOS Schedule

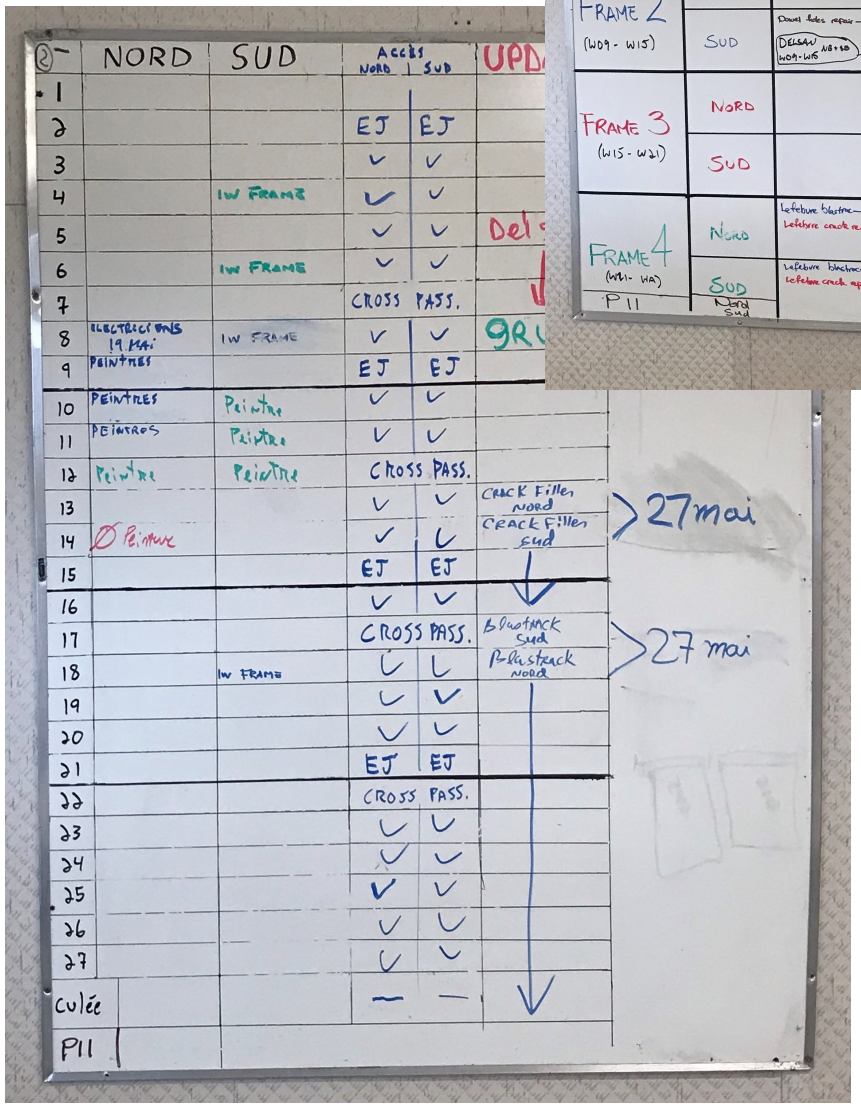
The Area Manager's Schedule…

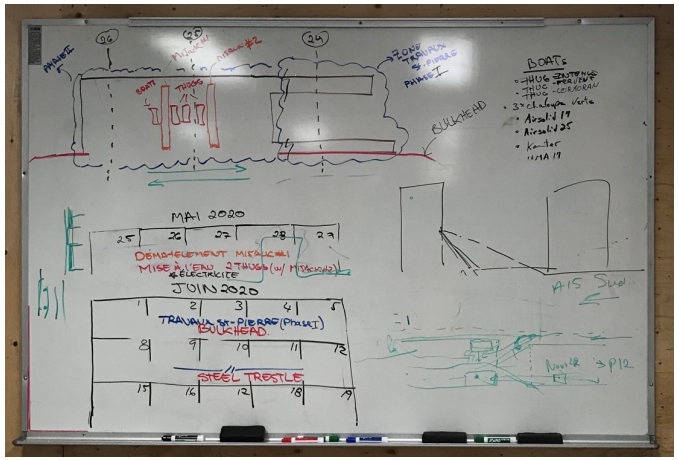
Location/Date

Scheduled Work



Restricted Work Areas

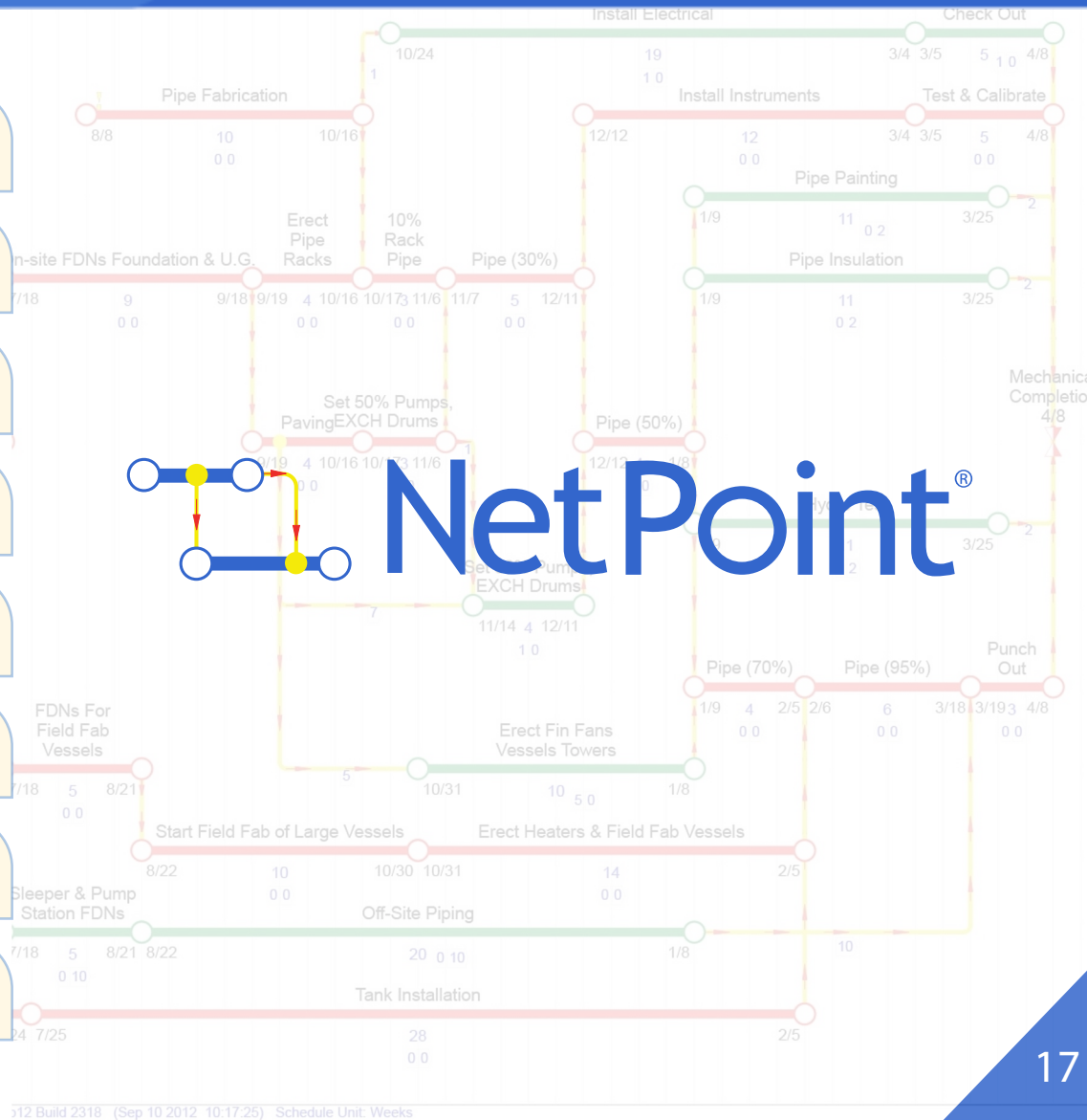




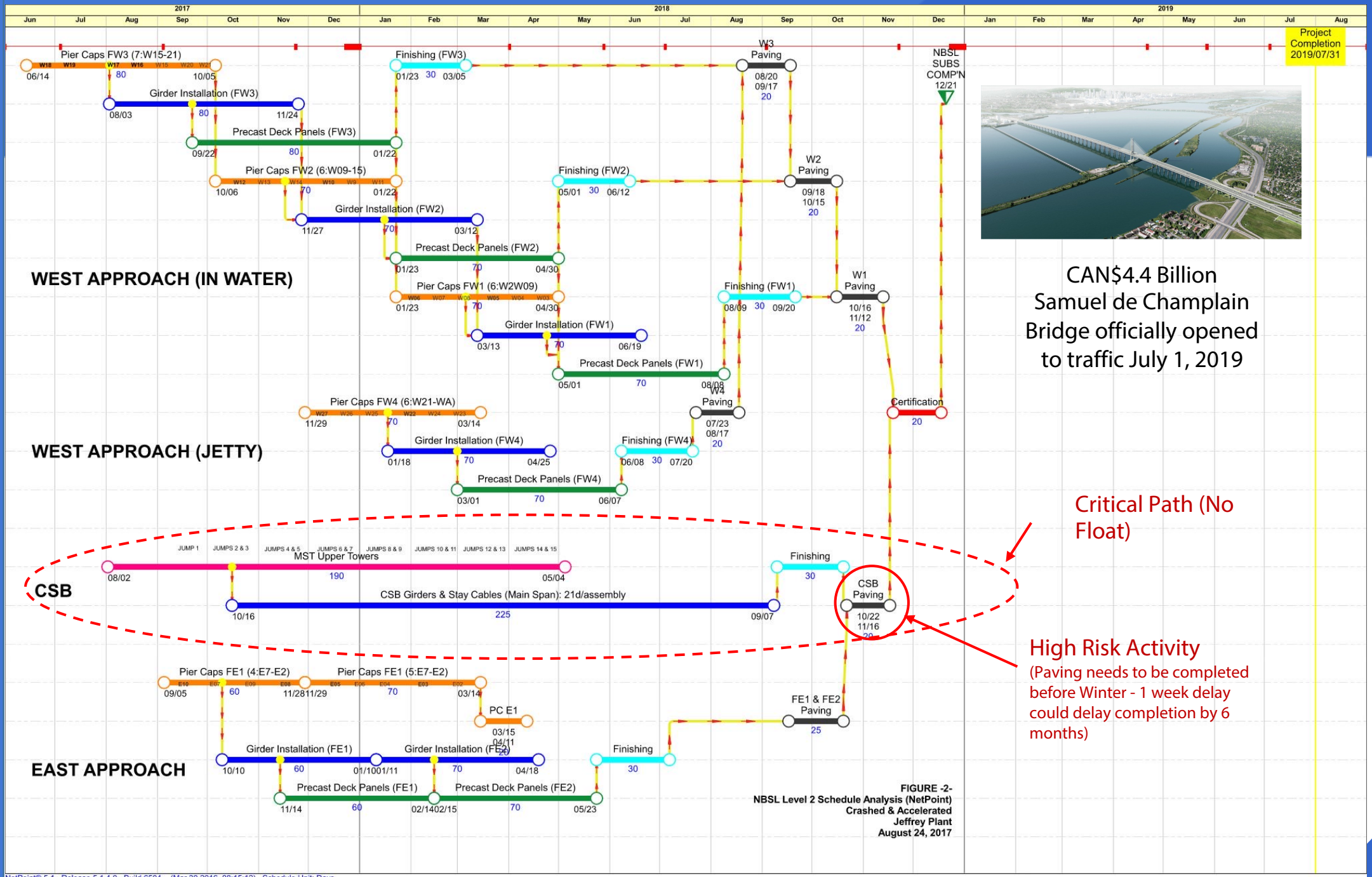
Work Sequence

Using NetPoint for Project Management

- Focus on key activities while seeing the whole project
- Intuitive
- Visual
- Dynamic
- Easy to use
- Facilitates “what-if” analyses
- Supports “drift” and “float”
- Compatible with P6



NetPoint for Project Management



CAN$4.4 Billion Samuel de Champlain Bridge officially opened to traffic July 1, 2019

Critical Path (No Float)

High Risk Activity
(Paving needs to be completed before Winter - 1 week delay could delay completion by 6 months)

Identifying Project Risks

1. Policy & Strategic (Political) Risks
2. Transaction Risks (Client/Contractor)
3. Project Agreement Risks
4. Design Risks
5. Site Condition/Environmental Risks
6. Construction Risks
7. Resource Risks
8. Permit & Approval Risks
9. Commissioning Risks (Def'n of Done)
10. Maintenance & Residual Risks

Credit: Infrastructure Ontario – MMM Group; Value for Money, Civil Infrastructure Projects, April 2015

Developing a Risk Register

	LOWER GREATER				
Factor	1	2	3	4	5
Probability	<10%	10%-30%	30%-50%	50%-70%	>70%
Cost Impact	<0.03%	0.03% - 0.1%	0.1% - 0.15%	0.15% - 0.33%	>0.33%
Schedule Impact	<2%	2%-6%	6%-12%	12% - 18%	>18%

Consider a $3 Billion, 60 month project:

	LOWER GREATER				
Factor	1	2	3	4	5
Probability	<10%	10%-30%	30%-50%	50%-70%	>70%
Cost Impact	<$1M	$1M - $3M	$3M - $5M	$5M - $10M	>$10M
Schedule Impact	<1m	1m - 3m	3m - 6m	6m - 9m	>9m

Developing a Risk Register

Start with a "Qualitative" Risk Register…

ID	Type	Updated	Owner	Risk Description	Probability of Occurrence	Cost Impact	Schedule Impact	Cost RISK Score	Schedule RISK Score	Proposed Mitigation
1.01	P&S	22-May-2	FJB	Project may be cancelled if bids exceed budget	1	1	1	1	1	Go/No Go estimate review
2.01	Trans	22-May-2	FJB	Bid Period too short	4	3	2	12	8	Increase contingency
3.01	PA	22-May-2	FJB	Ambiguous clauses in PA	4	4	4	16	16	Request clarity. Increase contingency
4.01	Design	22-May-2	FJB	Potential for scope changes	2	2	4	4	8	Claims management
5.01	Site	22-May-2	FJB	Unknown Contamination	3	3	5	9	15	Claims management
6.01	Const	22-May-2	FJB	Utility relocation delays	5	3	5	15	25	Utility management. Increase contingency.
7.01	Res	22-May-2	FJB	Labor shortages	4	3	5	12	20	Project Labor Agreement
8.01	Permit	22-May-2	FJB	Municipal permits delayed	4	2	4	8	16	Increase contingency.
9.01	DD	22-May-2	FJB	Ambiguous clauses in PA	4	2	5	8	20	Seek clarity early
10.01	O&M	22-May-2	FJB	Performance sub-standard	2	5	1	10	2	Increase design effort

Who should own the risks?

- The party best able to manage them…

Why Perform Quantitative Risk Analyses?

For the Owner

- To establish realistic contingency allowances for budgeting purposes
- To avoid overpromising on delivery dates
- To establish “value for money” in assessing project delivery models

For the Contractor

- To understand the probable combined effect of multiple risks on various activities

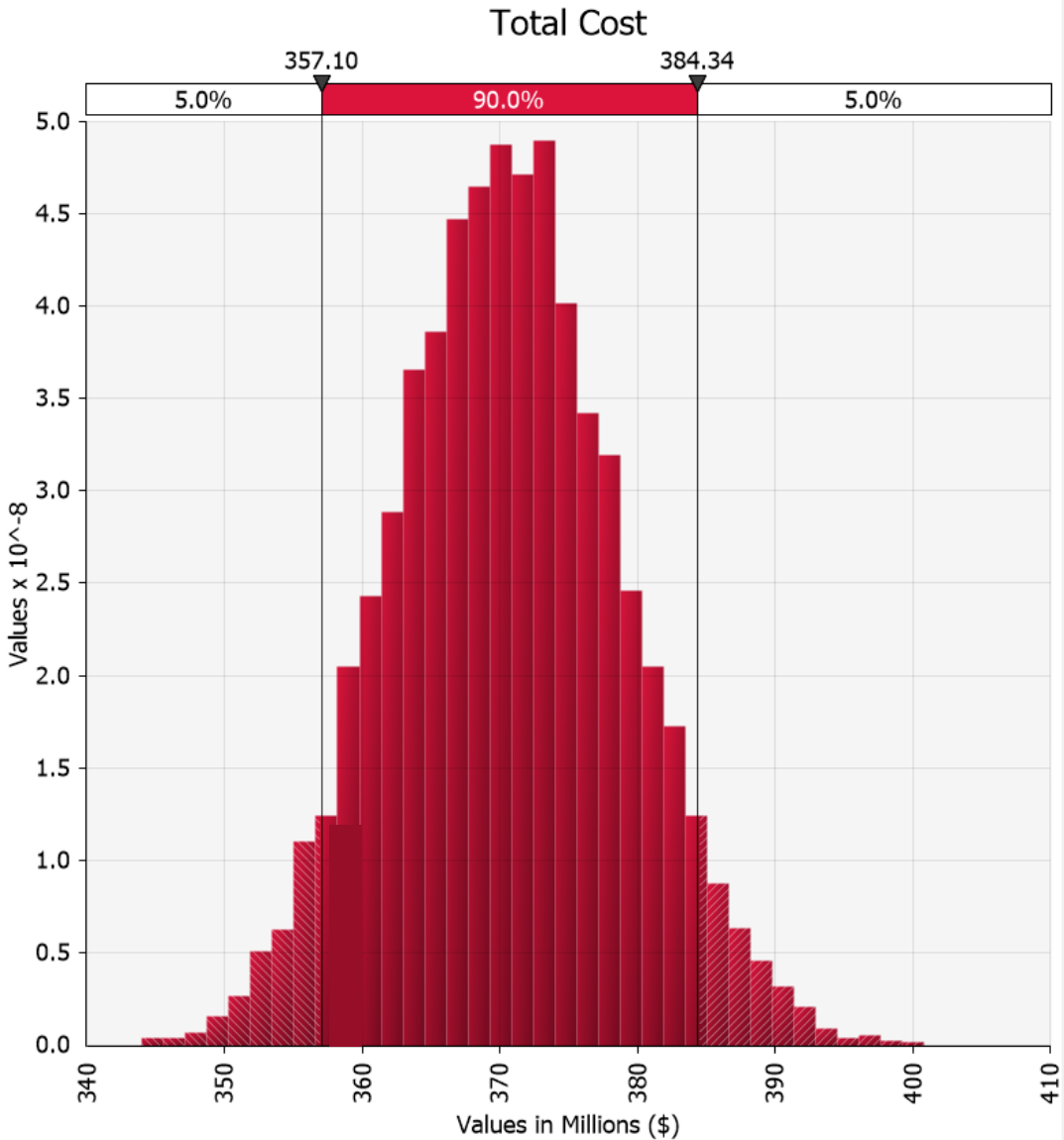
For Both

- More realistic forecast of completion
- More credible and defensible contingencies
- Encourages forward thinking
- Adds discipline to the scheduling process
- Can improve project team collaboration

Performing Quantitative Cost & Schedule Analyses

Process	Cost Risk Analysis	Schedule Risk Analysis
Review	Review estimate and estimate basis document to ensure it is credible and reflects Project Execution Plan.	Review project schedule and schedule basis document to ensure it is comprehensive , has CPM integrity and reflects Project Execution Plan.
Identify	Interact with project team to identify and prioritize risks that could affect the project's cost outcome.	Interact with project team to identify and prioritize risks that could affect the project's schedule outcome.
Model	Develop a cost model. Usually, the model is a summarization of the estimate with cost variables added to simulate effects of risks.	Develop CPM schedule model – usually it is a summary schedule of 75-250 activities containing the project's critical, near-critical or "risk sensitive" sequences.
Range	Determine probabilistic distribution for cost risk variables. Determine "range" inputs to the variables.	Develop the probabilistic parameters for the CPM model: ranges to activity durations, use of risk events, and use of risk factors.
Simulate	Use simulation tool, such as @RISK™ or NetRisk, to perform Monte Carlo risk simulation	Use simulation tool, such as NetRisk, to perform Monte Carlo risk simulation.
Report	Interpret the results of the simulation for the project team's use. Key item: Probability Distribution of overall cost.	Interpret the results of the simulation for the project team's use. Key items: Probability Distribution of key project milestone events and probabilistic critical path.

The Quantitative Cost Analysis Output…



Statistics	Total Cost
Cell	'AtRisk Output'!K1
Minimum	$343,974,967.16
Maximum	$400,832,667.45
Mean	$370,517,803.81
90% CI	± $191,897.65
Mode	$371,094,690.66
Median	$370,366,302.46
Std Dev	$8,247,967.30
Skewness	0.1019
Kurtosis	2.9150
Values	5000
Errors	0
Filtered	0
Left X	$357,096,837.64
Left P	5.0%
Right X	$384,341,113.46
Right P	95.0%
Dif. X	$27,244,275.82
Dif. P	90.0%
1%	$352,111,322.08
2.5%	$354,813,608.02
5%	$357,096,837.64
10%	$359,953,666.65
20%	$363,486,165.05
25%	$364,825,670.04
30%	$366,109,470.81
35%	$367,235,347.32
40%	$368,338,221.02
45%	$369,404,513.39
50%	$370,366,302.46
55%	$371,397,770.29
60%	$372,530,486.39
65%	$373,536,005.40
70%	$374,697,128.47
75%	$376,013,499.26
80%	$377,386,819.79
90%	$381,296,863.02
95%	$384,341,113.46
97.5%	$387,251,269.61
99%	$390,003,303.92

Expected profit (5%) at P10 = $18 million

P10 = $360 million

P50 = $370 million

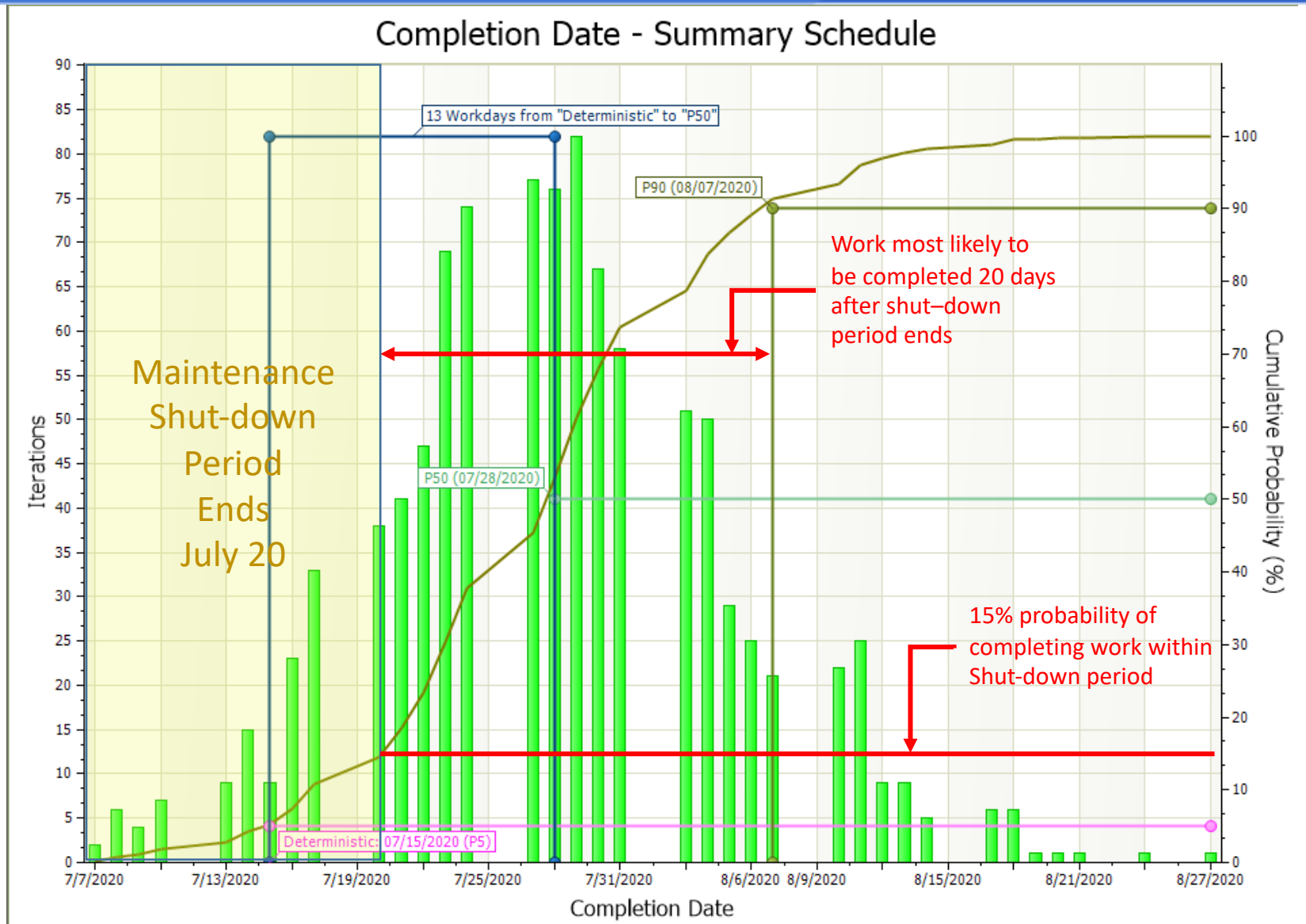
P90 = $381 million

The Quantitative Schedule Analysis Output…

Imagine this is a schedule for a 30-day maintenance shutdown…

Contractor said he could do the work in 25 days…

Quantitative schedule risk analysis suggested 5% probability of success…



CONSEQUENCES

$100,000/d shut-down cost

20d delay in completion would cost owner $2 million

A new paradigm for project management

NetPoint is an effective tool to manage a project at high level

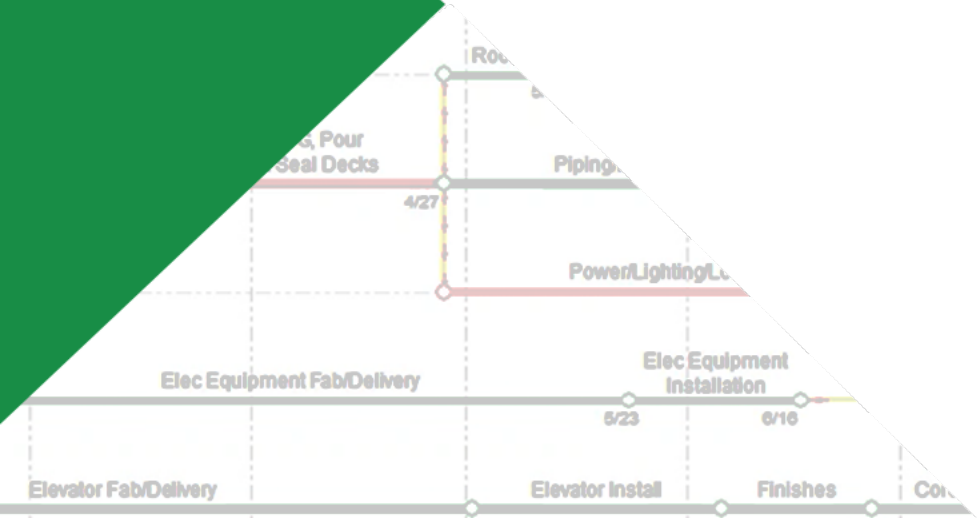
NetRisk is an effective tool for quantitative schedule (and cost) risk analysis

Used together, these tools can provide readily understandable, near real-time, actionable information

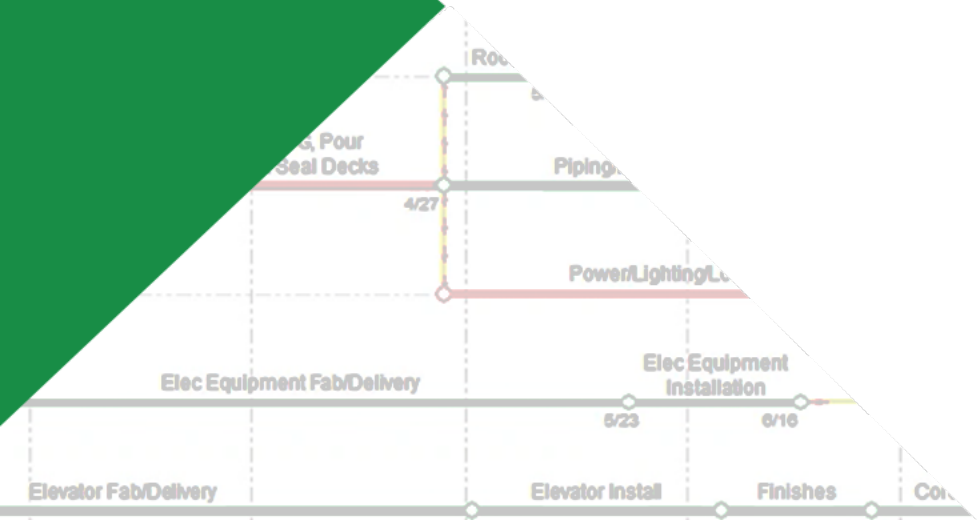
Let’s meet the infrastructure challenge by providing better forecasts of costs and schedules by better understanding project risks



Q & A


Elec Equipment Fab/Delivery
Elec Equipment Installation
5/23
6/16
Elevator Fab/Delivery
Elevator Install
Finishes





Thank you!

Jeffrey Plant, PMP, P.Eng., Ing.

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