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Philosophy of Engineering and Construction Risks in Project Management

Addressing Risk in Construction Projects



Mark Herbert

Faithful+Gould

Senior Project Controls Manager



Member of the SNC-Lavalin Group



Greg Franzen

Faithful+Gould

Director - Agrifood



Member of the SNC-Lavalin Group



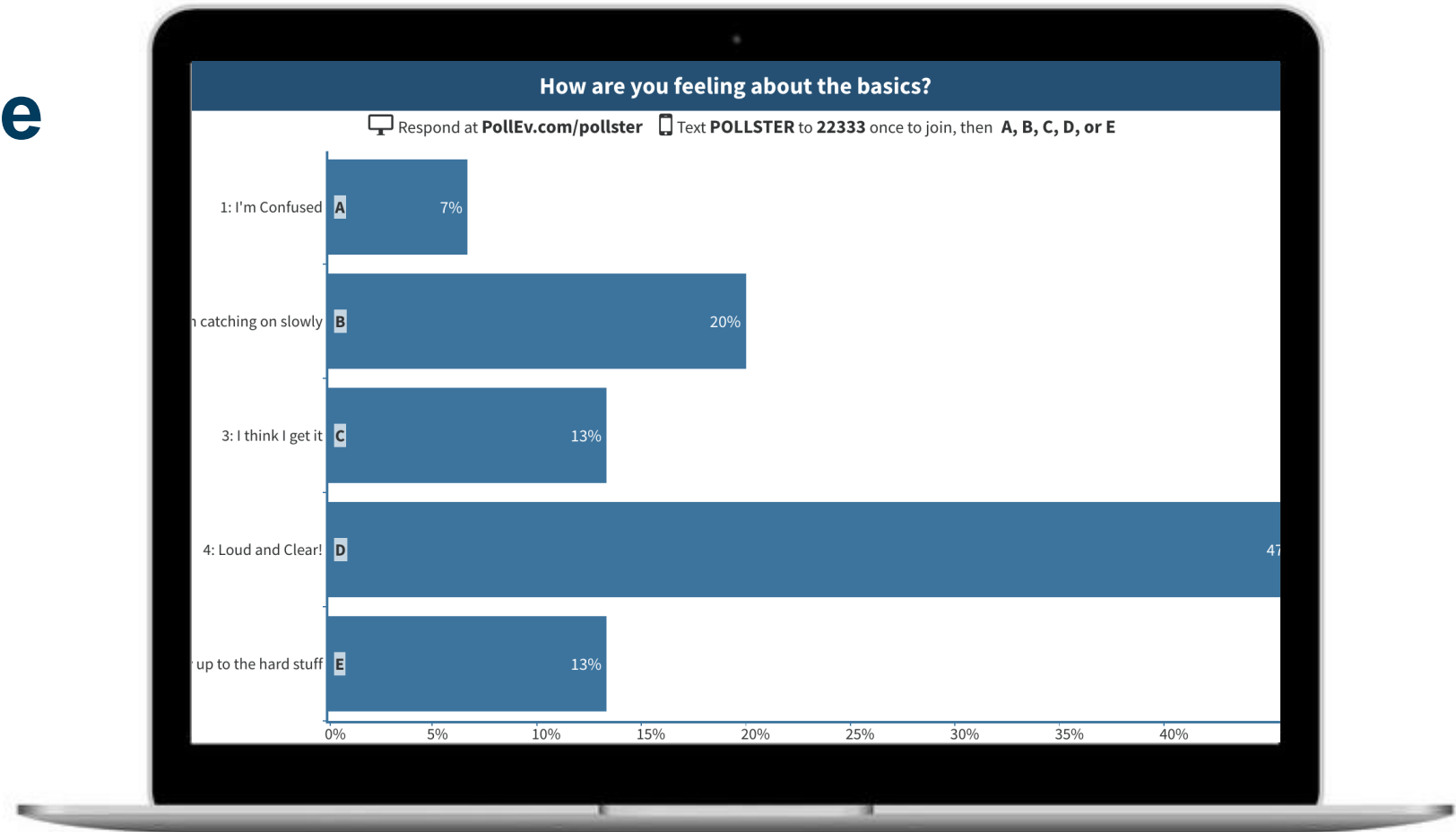
Philosophy of Engineering and Construction Risks in Project Management

Addressing Risk in Construction Projects

Agenda

1. Philosophy of Risk
2. Definition of Risk
3. Examples of Risk
4. Where and What Form does Risk Appear?
5. Risk Mitigation
6. Risk Prevention

Informal Audience Survey



Philosophy of Risk

Definition of Risk

› Philosophy

The study of the theoretical basis of a particular branch of knowledge or experience



› Risk

A situation involving exposure to danger



› Philosophy of risk

The study of the theoretical basis of dangerous situations

Tasks are Never 100% Complete



Being Human is a Source of Risk

Error

A Mistake

Omission

A person or thing that has been left out or excluded

Blunder

A Careless Mistake

Lie

An untruthful statement or purposeful omission of a truthful statement



Examples of Risk



Insufficient Time

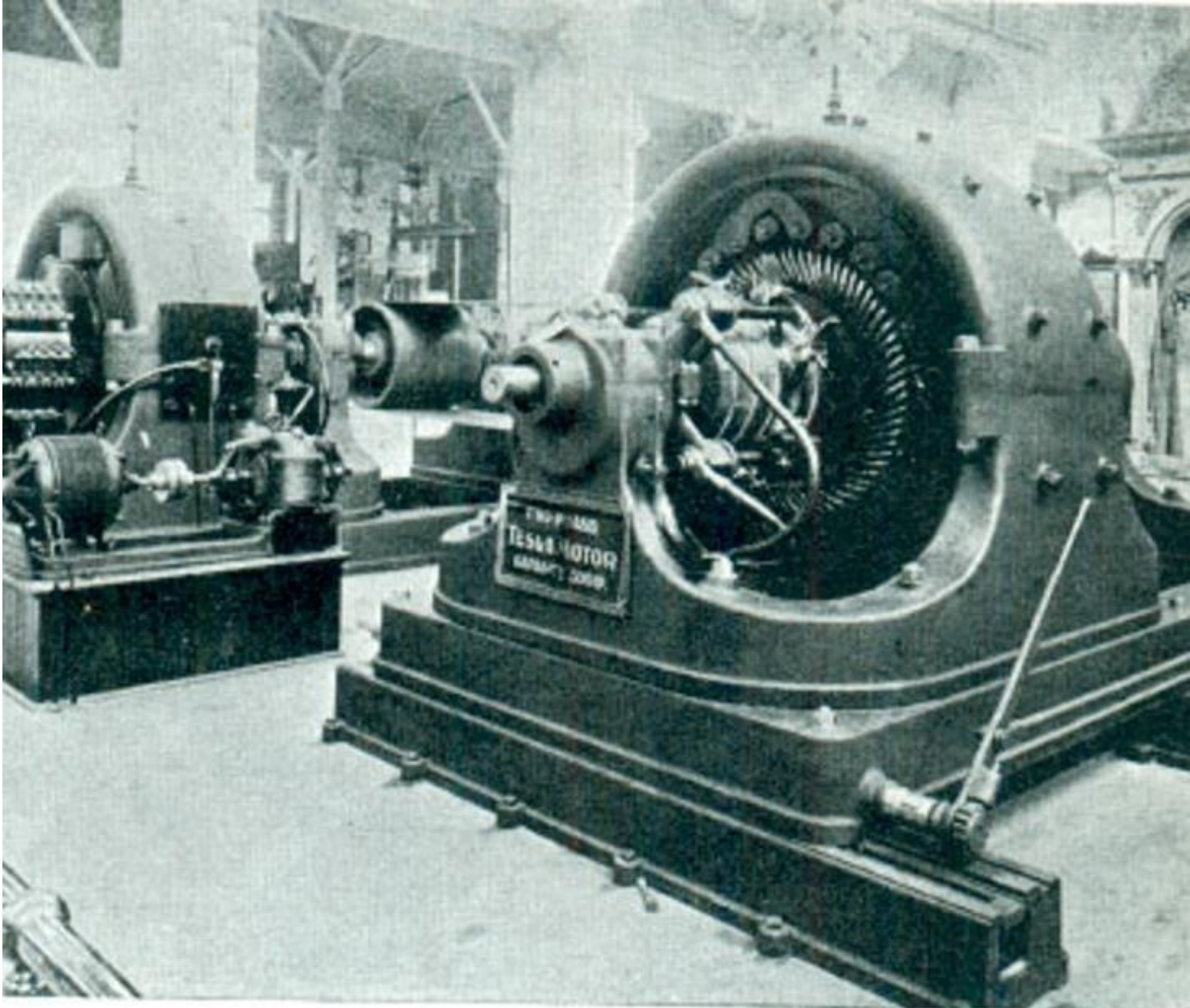
Chicago World's Fair



GRAND BASIN AND COURT OF HONOR



Chicago World's Fair



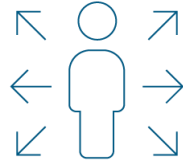
Chicago World's Fair



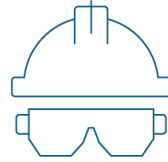


Incomplete Work Scope / Inexperienced Team Members

Project Management Services



Project Manager



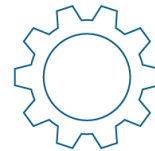
Construction
Manager



Cost
Manager



Operations Manager



Project
controls Manager



Schedule Manager

Together we **create a more valuable contribution** that leads to effective and successful outcomes for our clients – protecting their assets and maximising value.

Contract Language

1. Risk of Generic, Unclear, and Typical Contract Language
2. Develop the project budget and schedule with progressive detail
3. Ensure Engineering Design Service hours/costs definition can be tracked
4. Assist the project team to quantify cost and schedule risks for contingency
5. Work with project team to institute the Change Management



Incomplete Project Work Scope

1. Develop the project budget and schedule with progressive detail
2. Track Engineering Design Service hours/costs by definitions
3. Quantify cost and schedule risks for contingency
4. Institute the Change Management Program

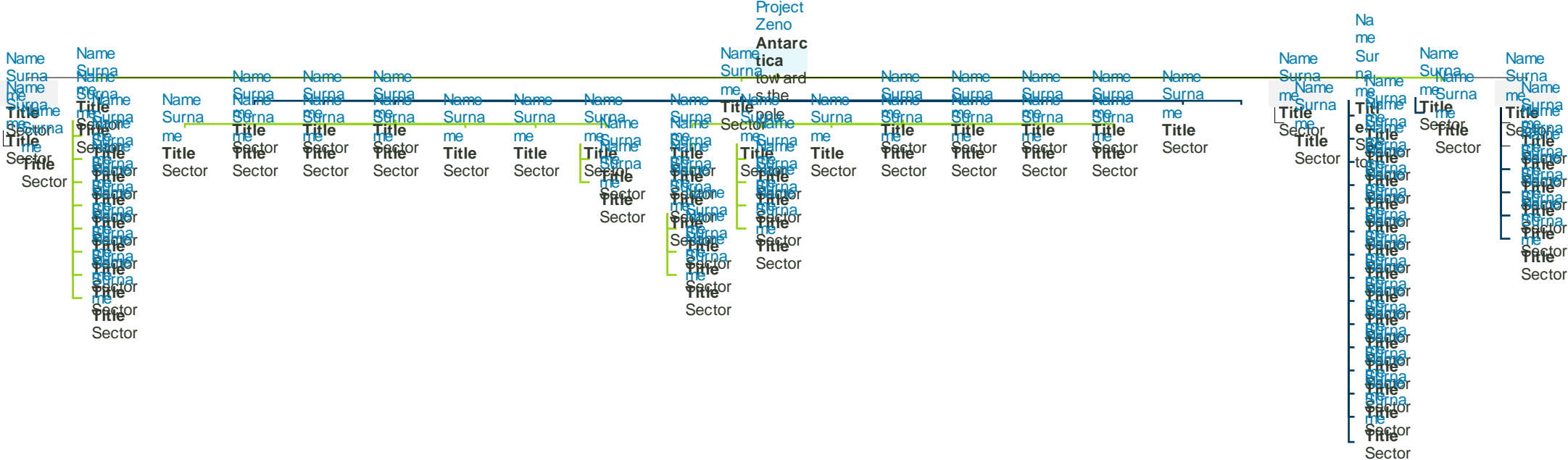


The Risk of Hierarchical Data...Assigning Technical Task to the Non-Technical Person

“Hierarchical DBMSs were popular from the late 1960s, with the introduction of IBM's Information Management System (IMS) DBMS, through the 1970s.” – Unixspace.com

WBS Code	WBS Name	Total Activities
0041259-4.PR.01	Interchange Justification Reports	115
0041259-4.PR.01.A	Segment A - Sta 100+00 to 1035+00	64
0041259-4.PR.01.A.A	Area 1 - Sta 100+00 to Sta 183+00	12
0041259-4.PR.01.A.B	Area 2 - Sta 183+00 to Sta 489+00	13
0041259-4.PR.01.A.C	Area 3 - Sta 489+00 to Sta 740+00	13
0041259-4.PR.01.A.D	Area 4 - Sta 740+00 to Sta 1035+00	26
0041259-4.PR.01.B	Segment B - Sta 1035+00 to 1967+00	26
0041259-4.PR.01.B.G	Area 7 - Sta 1410+00 to Sta 1626+00	13
0041259-4.PR.01.B.H	Area 8 - Sta 1626+00 to Sta 1967+00	13
0041259-4.PR.01.C	Segment C - Sta 1967+00 to Sta 2902+50	25
0041259-4.PR.01.C.J	Area 10 - Sta 2214+00 to Sta 2502+00	13
0041259-4.PR.01.C.L	Area 12 - Sta 2855+00 to 2902+50	12
0041259-4.PR.02	NEPA Re-evaluation Assessment	60
0041259-4.PR.02.A	Segment A - Sta 100+00 to 1035+00	18
0041259-4.PR.02.A.B	Area 2 - Sta 183+00 to Sta 489+00	6
0041259-4.PR.02.A.C	Area 3 - Sta 489+00 to Sta 740+00	6
0041259-4.PR.02.A.D	Area 4 - Sta 740+00 to Sta 1035+00	6
0041259-4.PR.02.B	Segment B - Sta 1035+00 to 1967+00	24
0041259-4.PR.02.B.E	Area 5 - Sta 1035+00 to Sta 1212+00	6
0041259-4.PR.02.B.F	Area 6 - Sta 1212+00 to Sta 1410+00	6
0041259-4.PR.02.B.G	Area 7 - Sta 1410+00 to Sta 1626+00	6
0041259-4.PR.02.B.H	Area 8 - Sta 1626+00 to Sta 1967+00	6
0041259-4.PR.02.C	Segment C - Sta 1967+00 to Sta 2902+50	18
0041259-4.PR.02.C.I	Area 9 - Sta 1967+00 to Sta 2214+00	6
0041259-4.PR.02.C.J	Area 10 - Sta 2214+00 to Sta 2502+00	6
0041259-4.PR.02.C.K	Area 11 - Sta 2502+00 to Sta 2855+00	6
0041259-4.PR.03	Protected Species	119
0041259-4.PR.03.0	General	2
0041259-4.PR.03.A	Segment A - Sta 100+00 to 1035+00	39
0041259-4.PR.03.A.A	Area 1 - Sta 100+00 to Sta 183+00	3
0041259-4.PR.03.A.A.1	Habitat Assessments	3
0041259-4.PR.03.A.B	Area 2 - Sta 183+00 to Sta 489+00	3
0041259-4.PR.03.A.B.1	Habitat Assessments	3
0041259-4.PR.03.A.C	Area 3 - Sta 489+00 to Sta 740+00	3
0041259-4.PR.03.A.C.1	Habitat Assessments	3

Overthinking...Assigning NON-Technical Tasks to the Technical Person



Overlapping Responsibilities / Poor Time Management



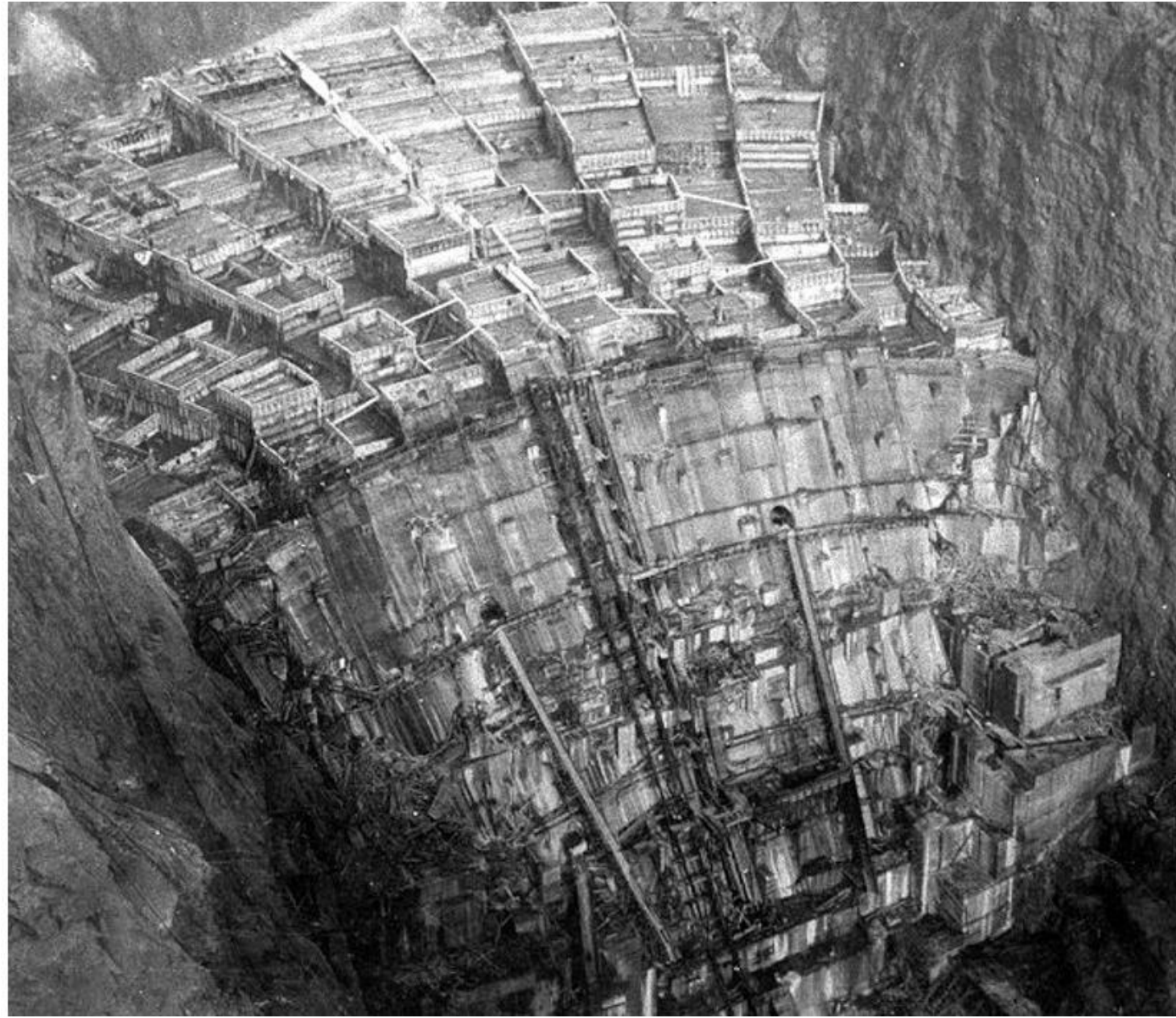


Insufficient Leadership

The Hoover Dam



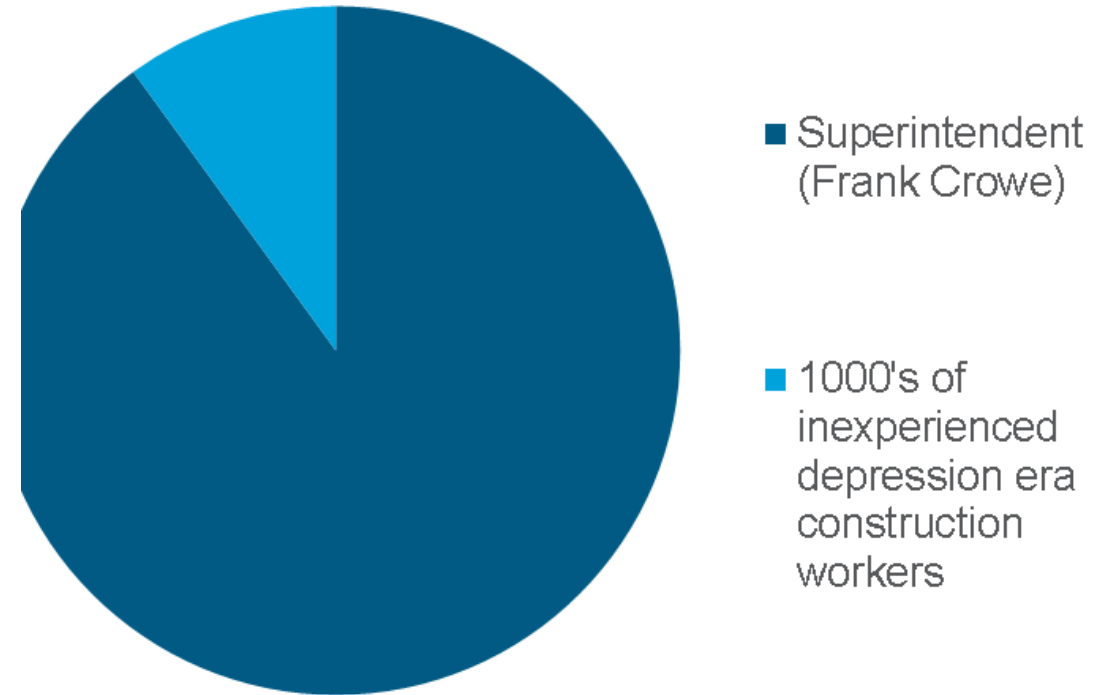
The Hoover Dam



Insufficient Leadership

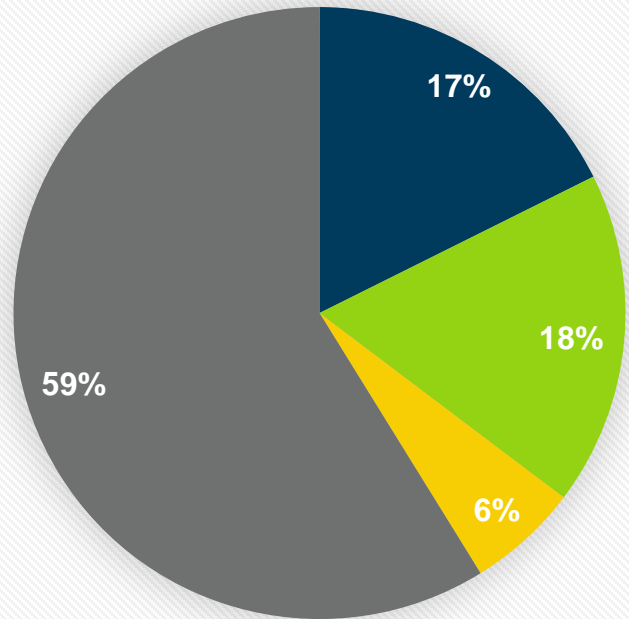


Hoover Dam Construction Team Ability



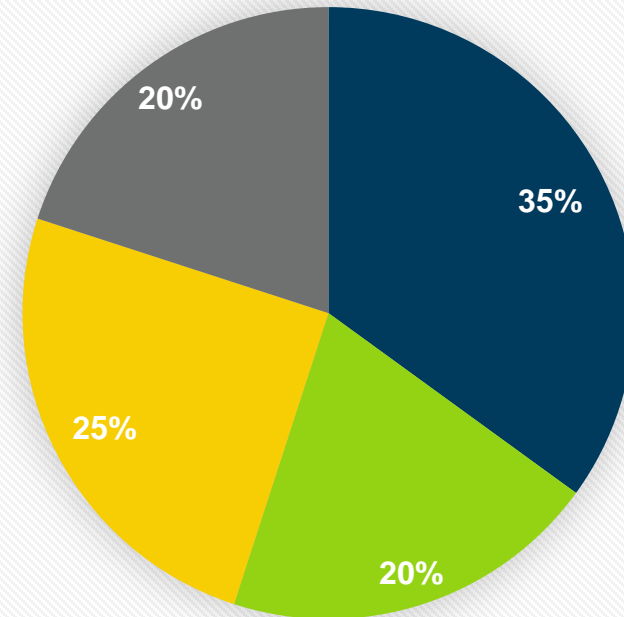
Team Matters

Team 1 Ability



■ Construction Manager ■ Scheduler
■ Cost Manager ■ Project Manager

Team 2 Ability



■ Construction Manager ■ Scheduler
■ Cost Manager ■ Project Manager



Legal Considerations

An Example and Questions

City in the USA vs. Engineering Firm



1. “Architects, doctors, engineers, attorneys, and others deal in somewhat inexact sciences and are continually called upon to exercise their skilled judgement in order to anticipate and provide for random factors which are incapable of precise measurement”
2. “The indeterminate nature of these factors makes it impossible for professional service people to gauge them with complete accuracy in every instance”
3. “Because of the inescapable possibility of error which adheres in these services, the law has traditionally required, not perfect results, but rather the exercise of the skill and judgement which can be reasonably expected from similar situated professionals.”

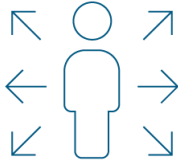
Standard of Care

1. Professionals are recognized through education, experience, and ongoing dedication
2. Professionals may be regulated by licensure, registrations, and certifications
3. Professionals exhibit responsibility through moral behavior and competent practice
4. Perfection, or even satisfactory result is not guaranteed
5. Ordinary skill and ability is expected

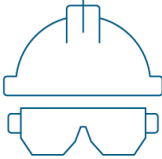


Risk Prevention

Early Involvement of the Entire Project Team



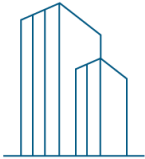
Project Manager



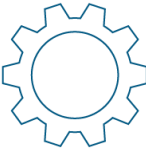
Construction Manager



Cost Manager



Operations Manager

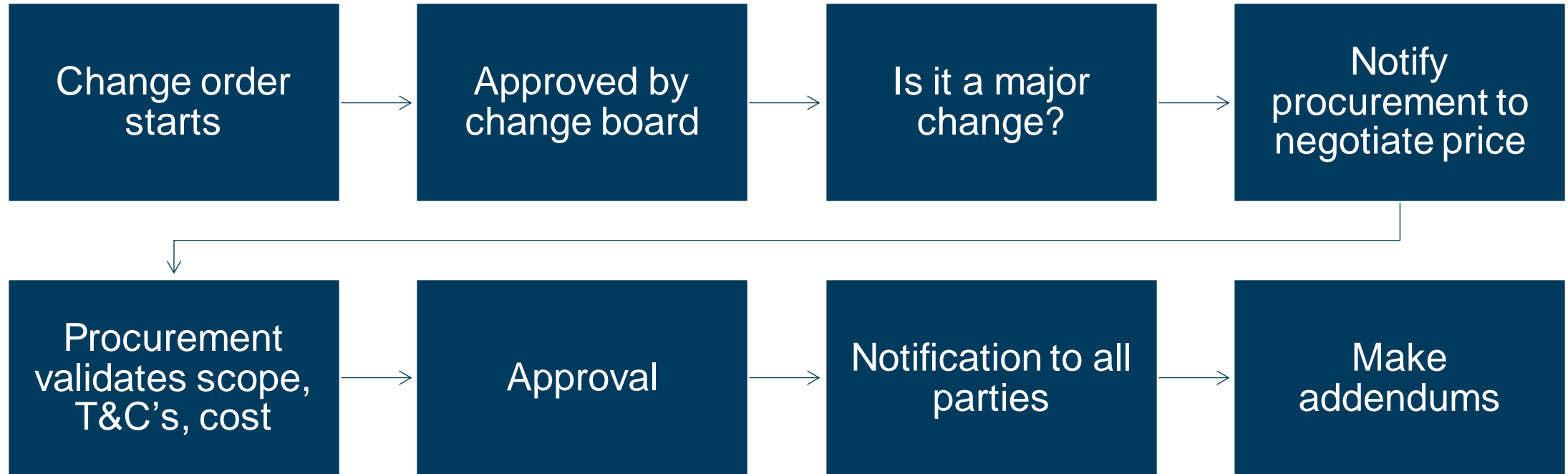


Project controls Manager



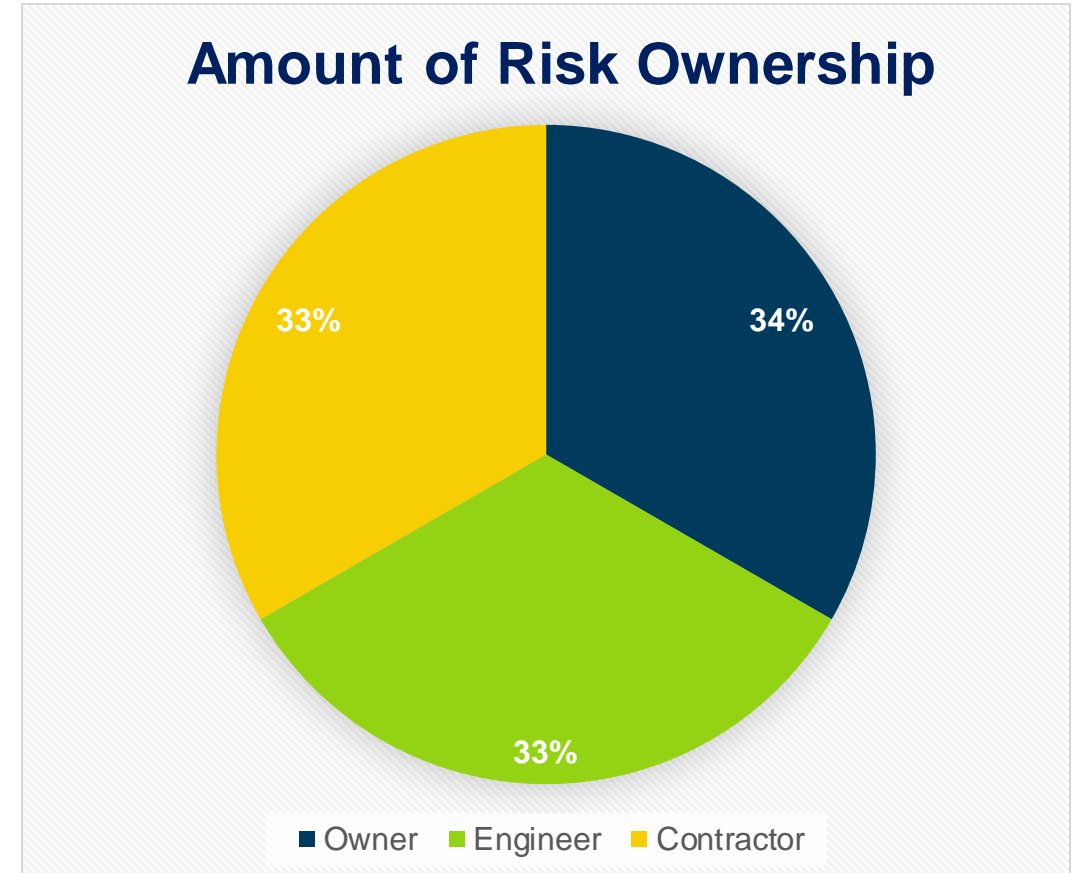
Schedule Manager

Have a Clear Change Process

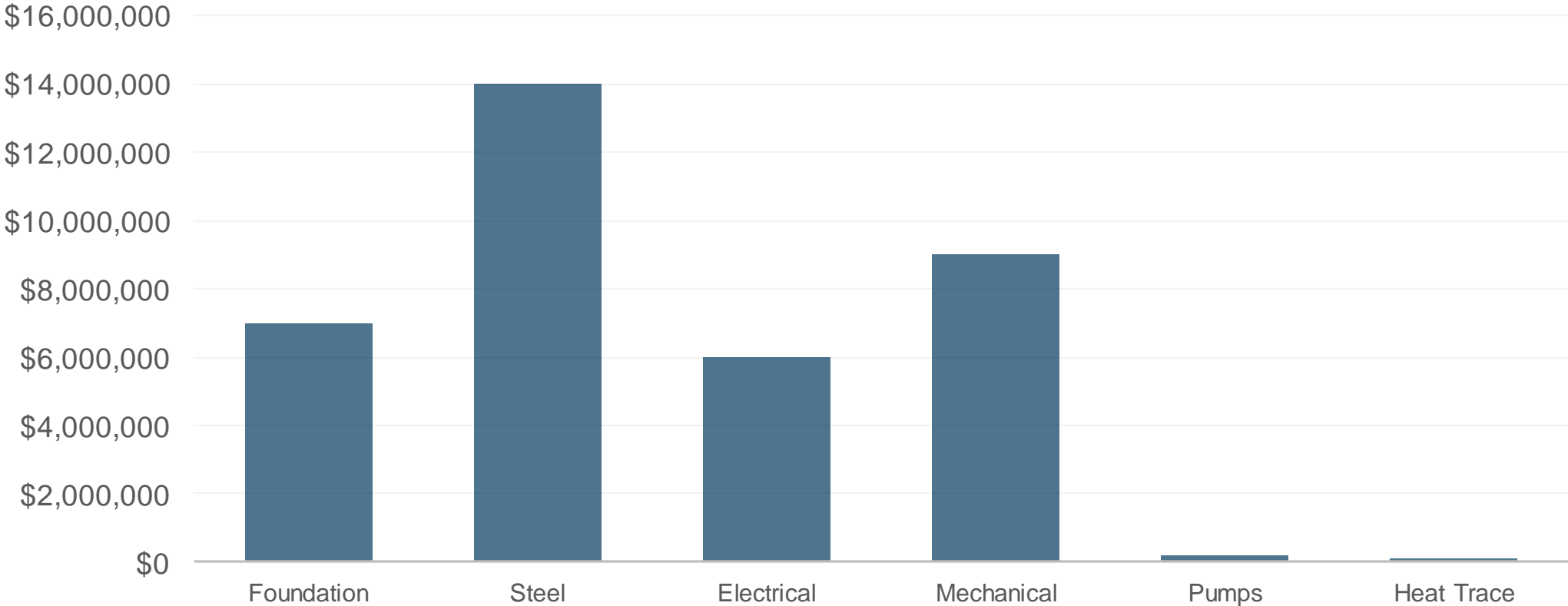


Collaborative Approach to Shared Liability

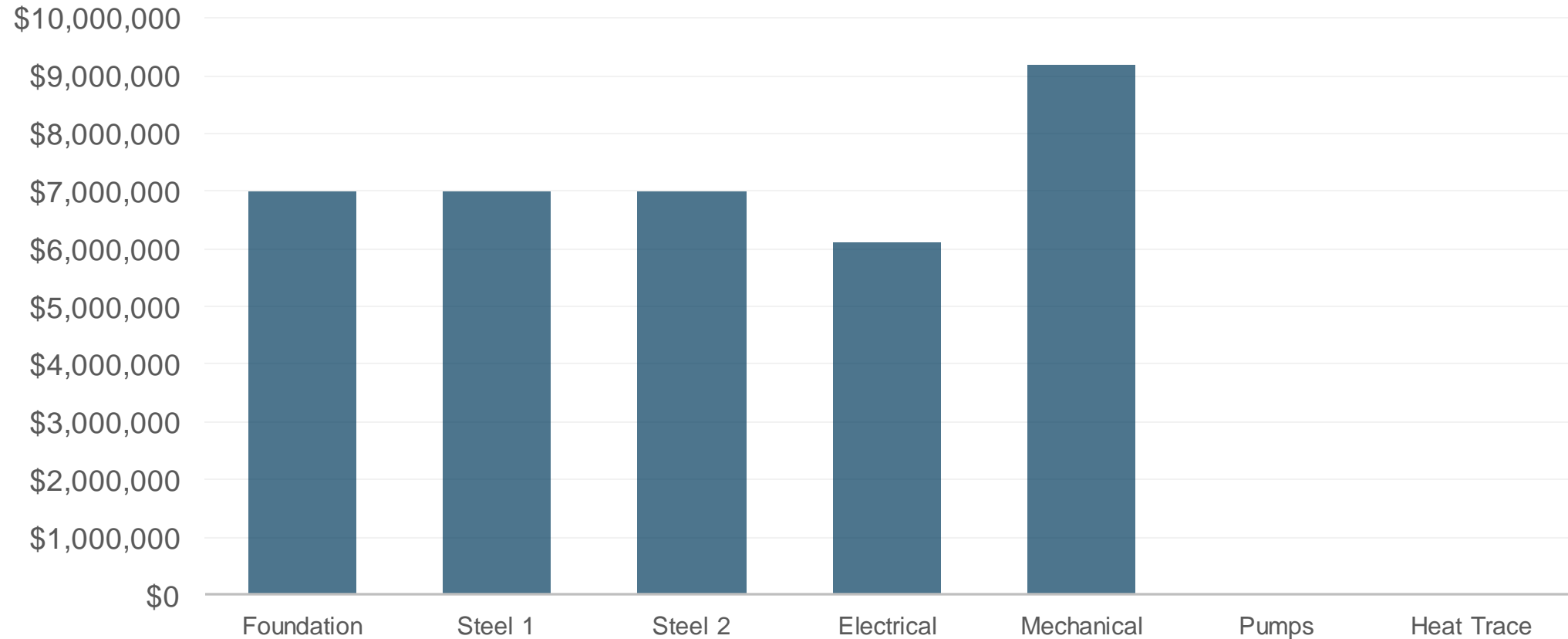
1. Liquidated Damages
2. Early completion bonuses
3. Value engineering incentives
4. Return on investment incentives
5. Excusable delay sharing programs
6. Not to exceed clauses
7. Decision time frames with penalties / rewards



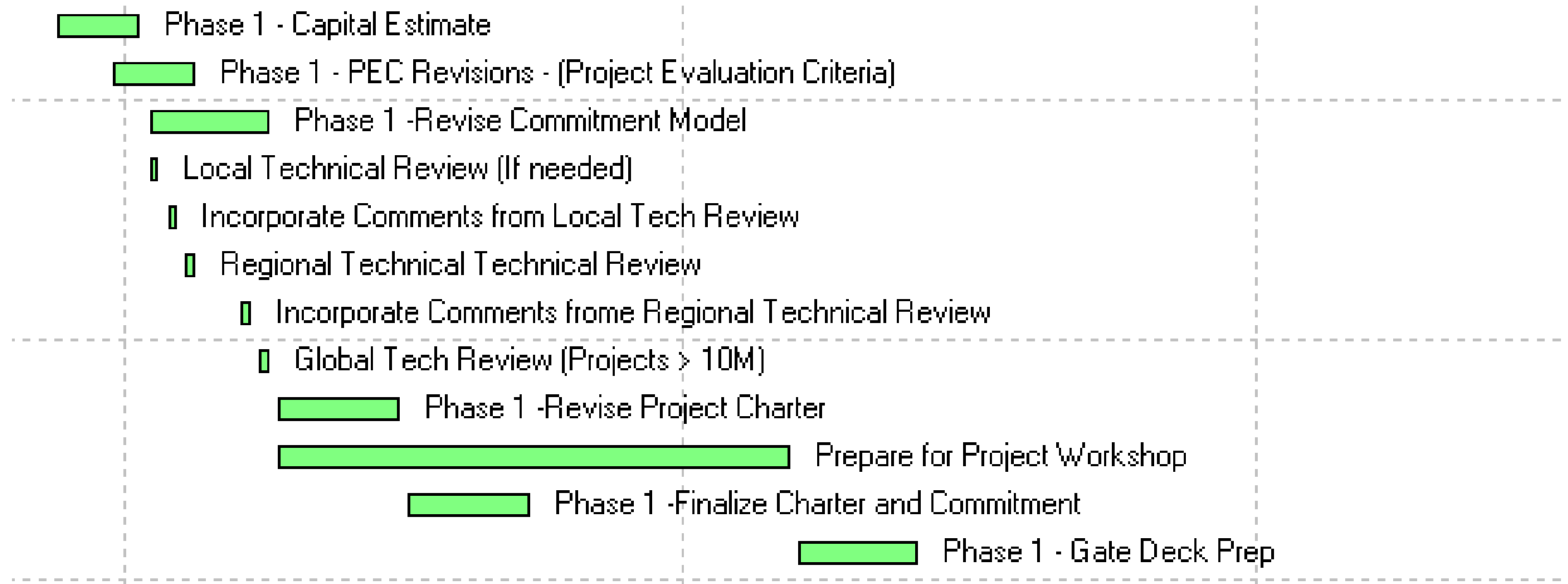
Construction Delivery Method



Construction Delivery Method



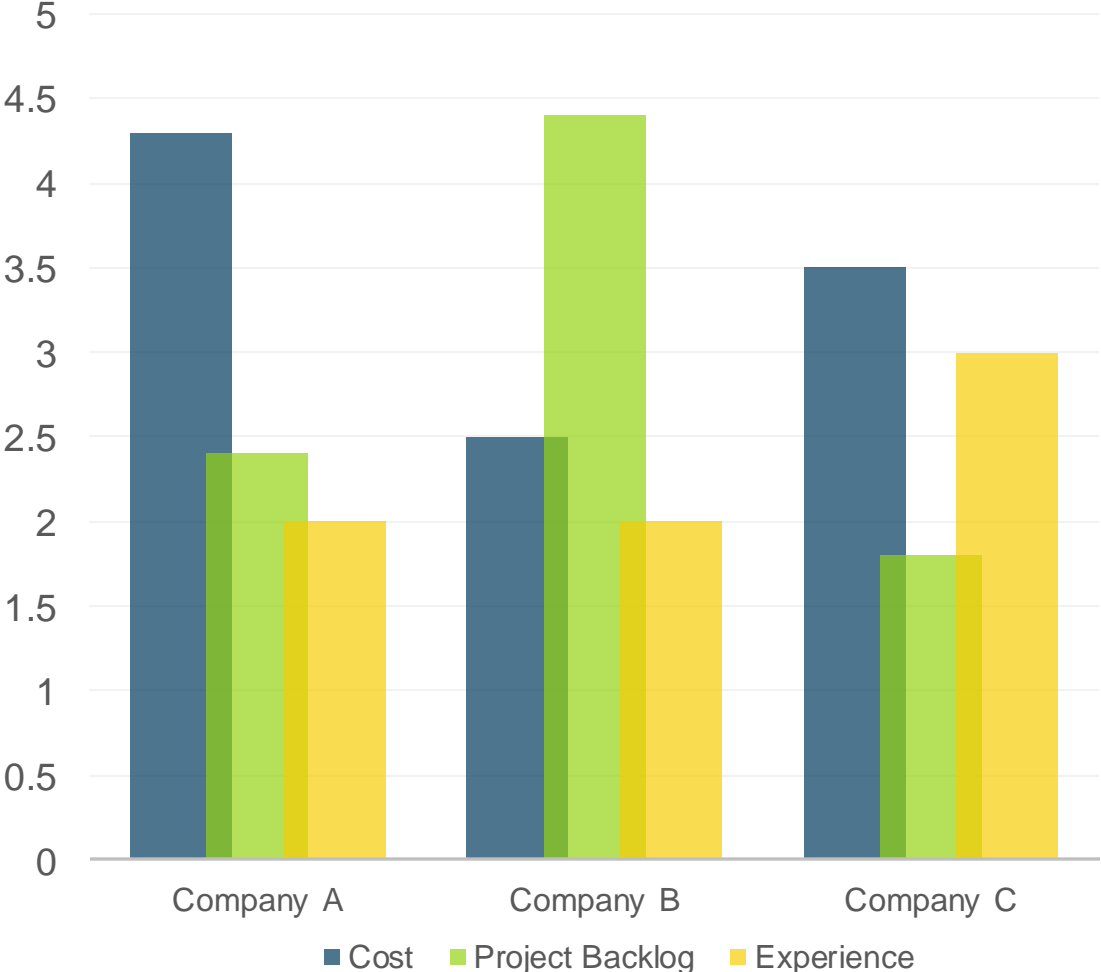
Team Input on Construction Schedule



Lowest Cost May not be Best

Consider more than just fees. Don't go with the lowest price for the sake of saving money.

A high score is good. EX. Company A high cost score means they are the least expensive. EX. Company B has completed the most similar projects



Allow Sufficient Time for Work Activities

Coordination now will provide savings in the future.

Not everything is a rush.



Risk Mitigation

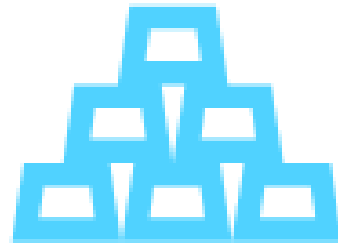
What Information Already Exists?

1. Project Charter
2. Previous Scope Descriptions
3. Similar Completed Projects
4. Existing Project Execution plan?
5. Existing Roles and Responsibilities Chart

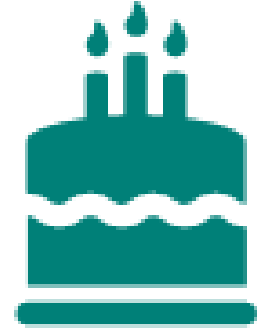
Time and Cost Contingency and/or Value Engineering



Time



Cost



Options

Project Team Based Risk/Opportunity Management

1. Owners and Contractors should consider working as partners to collaborate
2. Develop a risk log and monetize it
3. Rank the likelihood of the event occurring (Low, Medium, High)
4. Meet regularly to review the status of risks/opportunities

Risk Log - SAMPLE													
Project		Probability Classification				Definition							
Job no.	62330-01-00	1	2	3									
		Highly likely	Possible but with cost reduction	Highly unlikely									
PCO No.	Risk No.	Probability Classification	PCO Approved in Procure	Date submitted	Requested by	Title	Amount	Revised Estimate	Pulled from Contingency	Final PCO Amount	Status	Physical Work Completed	Owner Review Comments
'001	AA-P1	3	No	10/23/2019	Client	Provide Fencing for CPBA	\$47,662.91	-	\$0.00	\$47,662.91	Rejected	No	Notes about the risk item
'002	AA-P2	2	Yes	10/23/2019	Contractor	Laydown Area & Road Extension into Pullet Site	\$105,937.46	-	(\$100,770.93)	\$0.00	Pending - Proceeding	Yes	Notes about the risk item
'003	AA-P3	1	Yes	11/5/2019	Engineer	Cost to Bury Overhead Power Line due to Building Encroachment	\$23,880.27	-	(\$22,715.64)	\$0.00	Approved	Yes	Notes about the risk item
'004	AA-P4	2	Yes	11/5/2019	Client	Mort's Water - Water Line Repair and Septic Line Location	\$1,875.88	-	(\$1,784.39)	\$0.00	Pending - In Review	Yes	Notes about the risk item
'005	AA-P5	1	Yes	11/8/2019	Contractor	Drew Brandt Winter Conditions Cost on Pullet #1 Slab	\$14,860.54	-	(\$14,135.80)	\$0.00	Approved	No	Notes about the risk item

Invest in Communication Tools

1. 3D digital models
2. Building Information Modeling
3. Enterprise scheduling platforms
4. Enterprise cost management platforms
5. Laptops for individuals or other means of access to project data
6. Project analysis tools like acumen fuse
7. Microsoft office suite
8. Skype or MS teams



Project Team Relationships



Authorities Having Jurisdiction (AHJ's)

Permits /
Public Polls

Regulations

Inspections

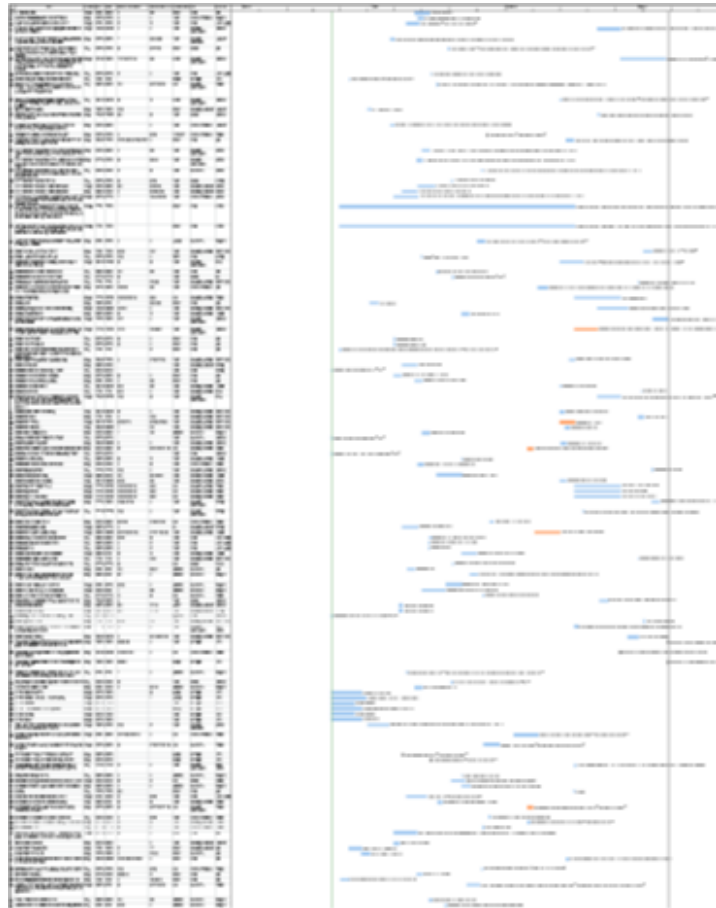
Drawing
Approvals

Council
Meetings

OSHA

Taxes

Understand the Project Stakeholders



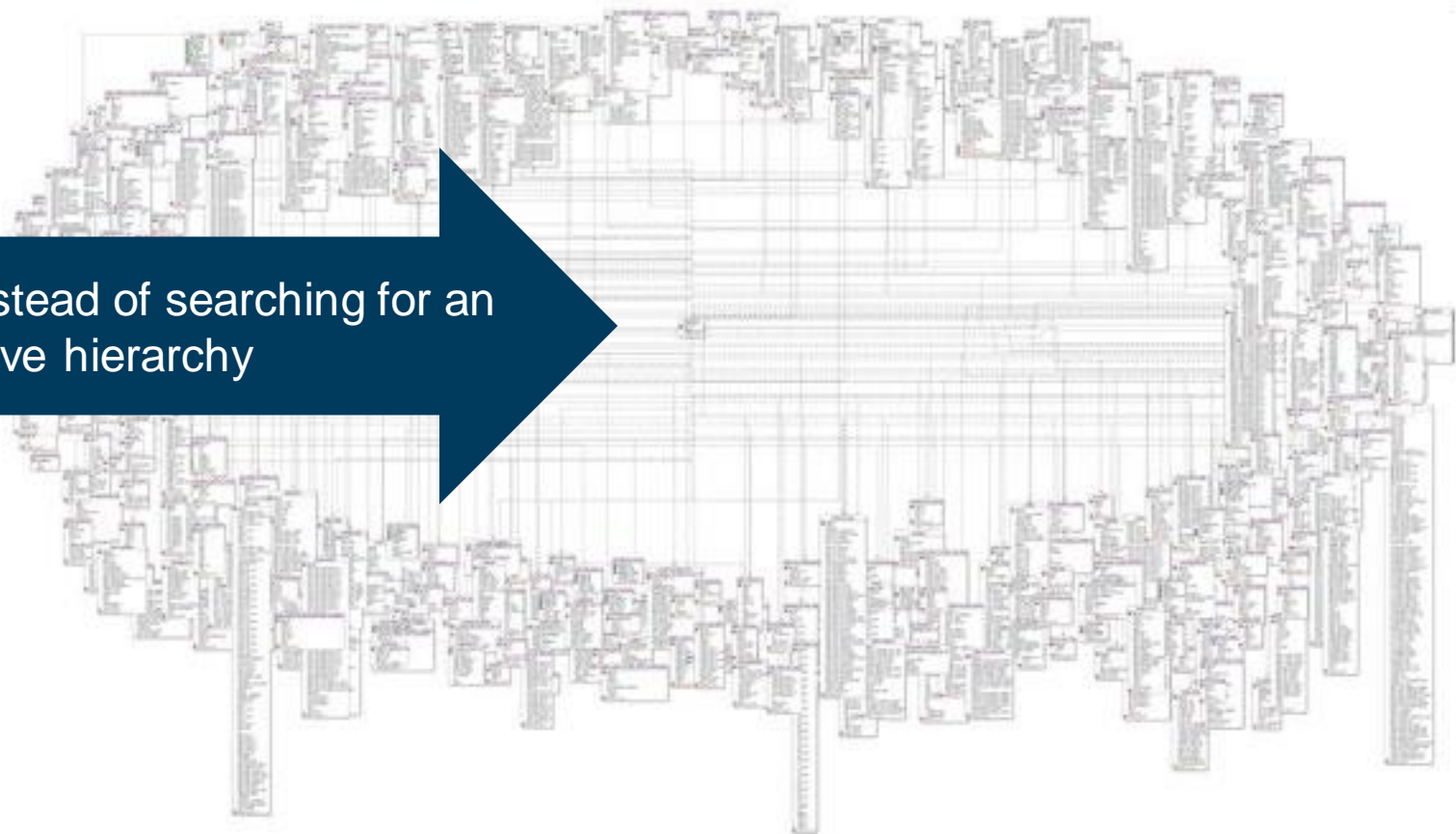
Build Relationships with People



Who is Doing What? When are They Available?



Relational Data Management



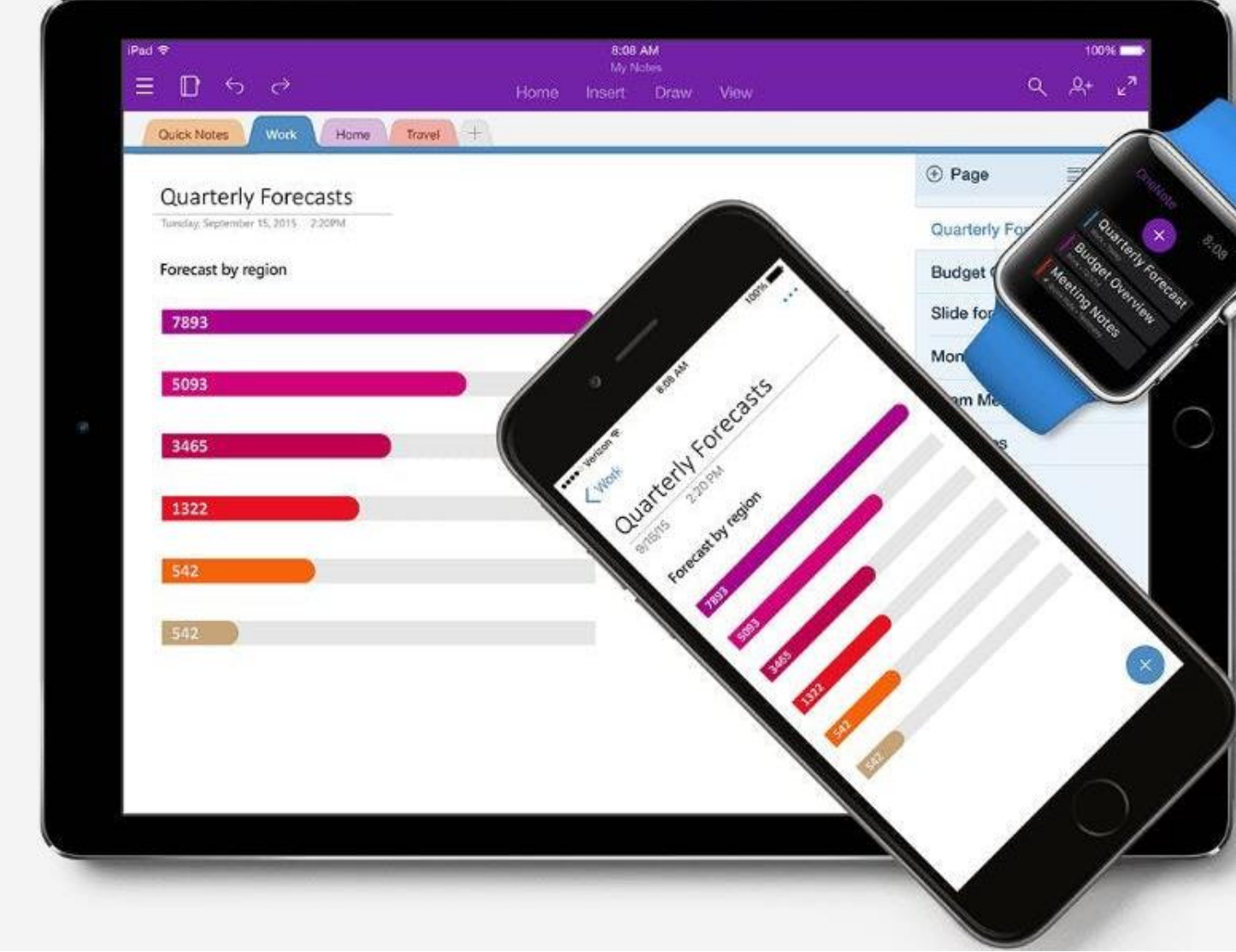
Ask a question and get an answer instead of searching for an answer in a single, massive hierarchy



Lessons Learned

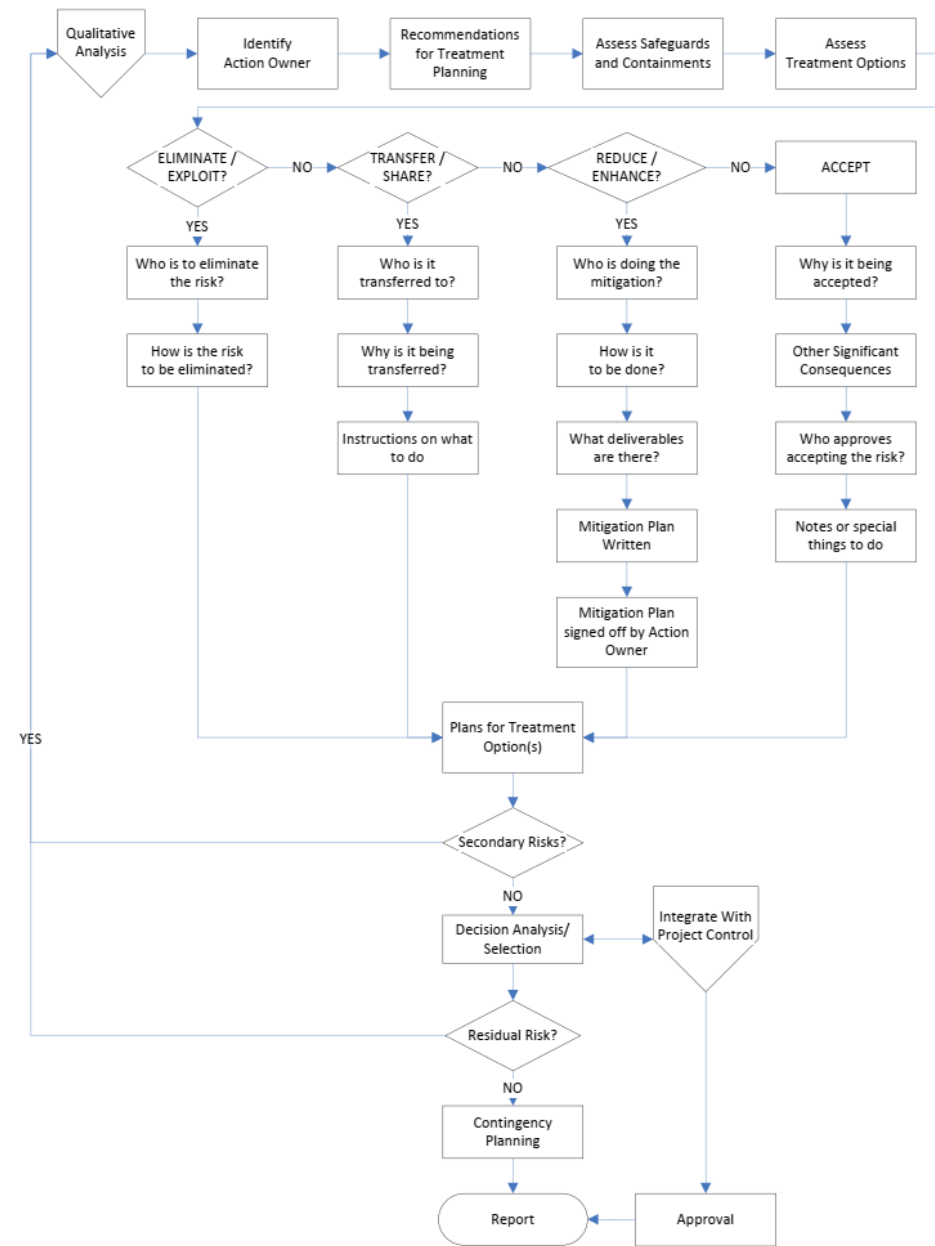
Prevent Future Risks / Employ Savings Opportunities

How Do We Continually Improve?



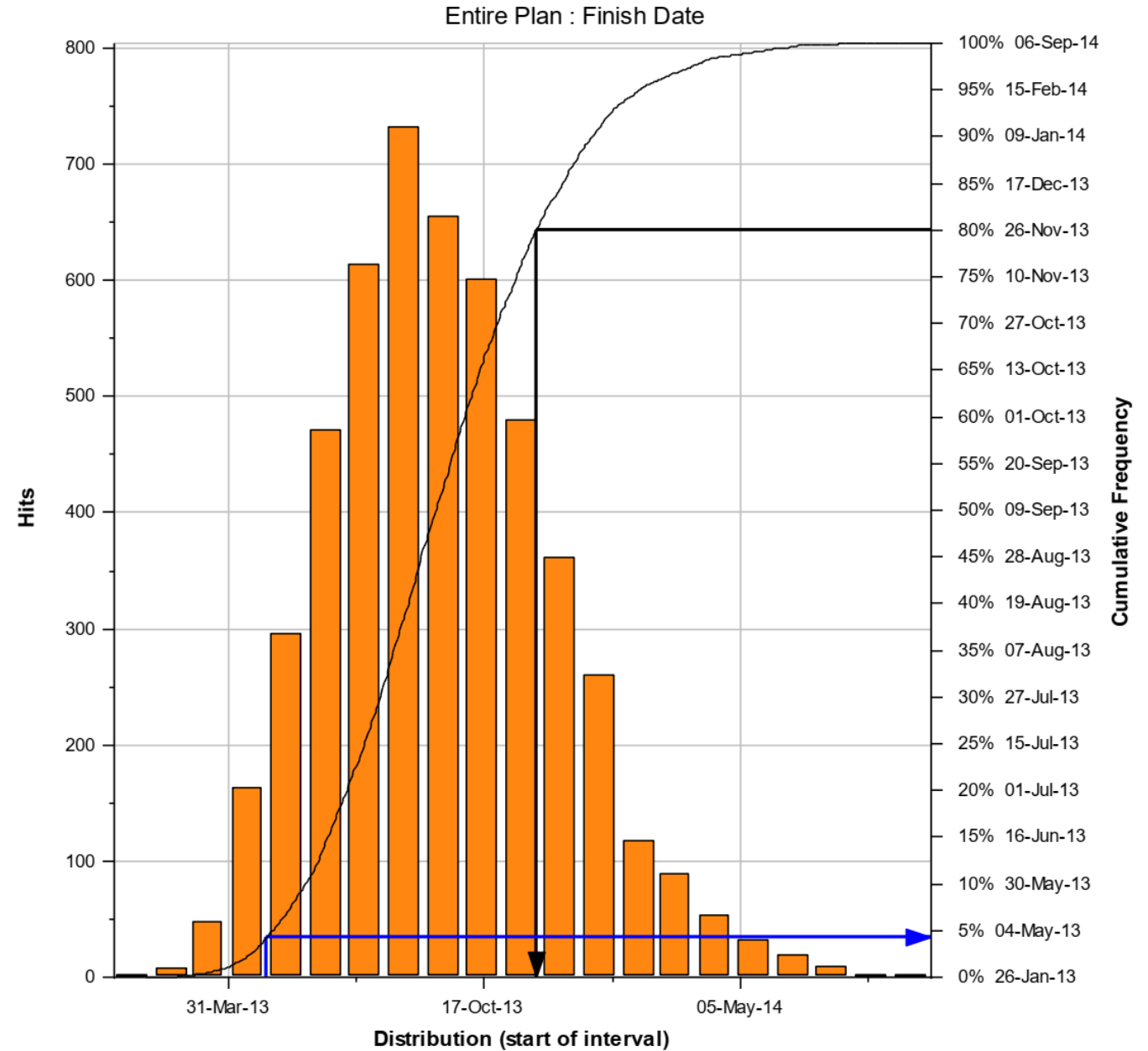
How Do We Continually Improve?

Risk Treatment Mapping and Decision Making



How Do We Continually Improve?

Risk Registers and Monte Carlo Simulations



Include Contingency

- Design contingency
- Construction Contingency
- Management reserve



It Takes a Village



Life is Hard

Take a personal interest in others

Perspective is important

Be a servant leader



Final Wrap Up

1. Early involvement and collaboration of a project team
2. Establish Change Management Process
3. Project Team Relationships
4. Lessons Learned
5. Include Contingency
6. It Takes a Village





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