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Project Management & Project Controls

The Importance of Front-End Planning "Leveraging Industry Best Practices to Improve Front-End Planning"

Session 2 - September 29, 2020
1:00 PM-2:00 PM, EST

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Introducing the Participants

Jeremy Rasmussen – Chief Technology Officer

Jeremy is a leading thinker in information and communications technology (ICT), mobile software, and open source intelligence. With both **strategic and hands-on experience** ranging from software development architecture and networking system design for the project management sector. Jeremy is consistently on the leading edge of the role of technology in business and capital projects. He co-published and presented numerous papers on the role of mobile technology in complex industrial environments at industry conferences in Canada, the United States, and China. Jeremy is also a member of the Canadian Nuclear Associations Executive Committee and Board of Directors.

Feroz Ashraf, Global Executive Advisor – Capital Projects, P.Eng (Ontario and Quebec)

Mr. Ashraf has extensive **experience** in the resource sector, including mining and metallurgy, oil and gas, infrastructure, power and related downstream industries. He is currently an Executive Advisor, Capital projects at PTAG Inc. He has **35+ years of EPC/EPC experience,** on over **300+ projects** ranging from **$10million to over $5 billion** across Canada and globally in over 25 countries. He was the Senior Project Officer, then COO and then CEO of an operating company with plants / projects in USA, Kazakhstan, Australia, and Tanzania. He is member of OIQ and PEO and is a guest lecturer on Project Management at York University- Schulich School of Mining (MBA program).

Michael Dubreuil, Managing Director, B.Math (Computer Science)

Mr. Dubreuil is the **Managing Director** for PTAG Inc., a leading global capital project/program management firm. He has 35 years of experience leading Projects and Organizations through significant development, restructuring, and process improvement. He currently serves as the **Chairman of the Sector Leadership Team of the Construction Industry Institute**. He is an Advisor to organizations on Project Contracting Strategies including - Industrial Integrated Project Delivery (I2PD).

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Session 1 Recap

Session 1 Agenda

1.	Top reasons why projects go off-track	-- Lack of planning is the biggest one
2.	Failure as an Industry to Perform & Deliver Projects	-- Systemic Cost, Schedule and Performance issues
3.	Front-End Planning – what, why, how ?	-- Phased approach using CII defined phases
4.	Leveraging Industry Best Practices	-- To Improve Front-End Planning
5.	Why a Disciplined Stage-Gate Process is Critical	-- Right sized to the Projects Complexity and Priority
6.	Project Set-up / Project Management using and Integrated Project Controls Handbook	-- Providing the Team with an easy to use procedures, methods and tools
7.	Project Complexity Model drives the Project Delivery Model Requirements	-- Right sized to the Project's Complexity and Priority
8.	Why Defining Proper List of Project Management Deliverables is Important	– Ensures Appropriate Project Management elements are being used based on project priorities and complexities

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Agenda for Today's Session #2

1. **Value Engineering (Value Planning)** a FEP **Best Practice**
2. Project Delivery and Contracting Strategy (PDCS) – Selected in FEP
3. **Integrated Project Execution Plan** (IPEP) – a roadmap to success
4. Rigorous **Project Controls** are Critical
5. **Risk Analysis Methodology** a key part of Front-End Planning
6. More about, Interactive **Project Management & Controls Handbook** – a key to Project Management and Delivery Success

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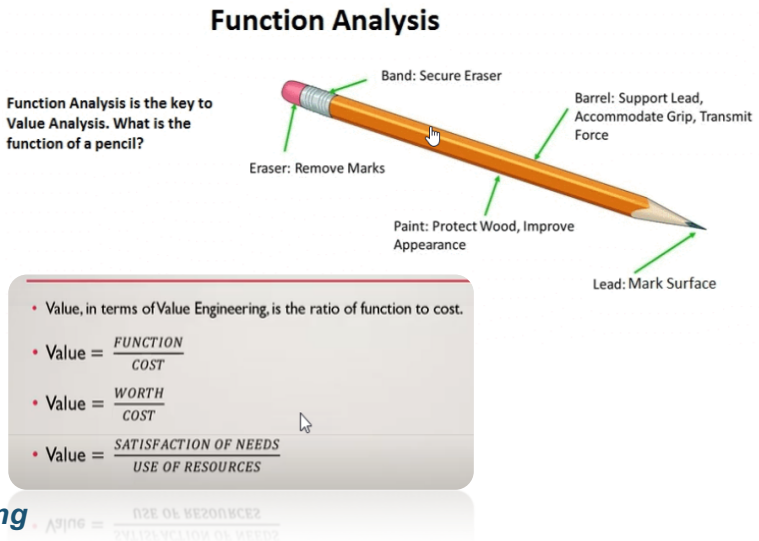
1. Value Engineering – FEP Best Practice

- **A Creative**, structured method of reaching an outcome of the **highest value** at the lowest cost
- **The process** of reducing the cost of developing a product, facility or asset without reducing its value, quality or function
- **The Systematic** application of recognized techniques that identifies the **elements** of a facility/product, establishing the worth of these functions, to meet the required performance of the facility at the lowest overall cost
- **Value** is the Ratio of Element Function to Cost

*Value Engineering is **Not Cost Cutting***



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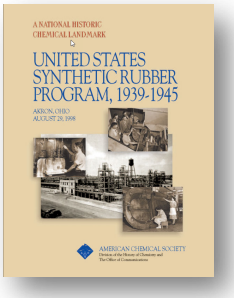
1. Value Engineering – FEP Best Practice

History

- World War II created shortages of parts, labour and raw materials
- Engineers and Project Managers at G. E. facing shortages were forced to find alternatives to **unavailable or cost-prohibitive "standard" choices**
- Born out of necessity, the success of the **process of analyzing alternatives** led to a change in the structure of design
- **Lawrence Miles** formalized this process following the war

Why Use Value Engineering

- The original or conventional method, design or idea is not always the most functional or the most cost effective
- Construction costs accounts for only a small fraction of the life cycle costs of major facilities (as little as 11%)
- Manufacturing investment costs account for only a fraction of the production costs. Labor, maintenance, downtime, and production rates account for much more



- Natural rubber supply from Southeast Asia was cut off at the beginning of World War II
- The United States and its allies faced the loss of a strategic material
- With U.S. government sponsorship, a consortium of companies involved in rubber research and production united in a unique spirit of technical cooperation
- They produced a synthetic rubber, GR-S (Government Rubber-Styrene), on a commercial scale.

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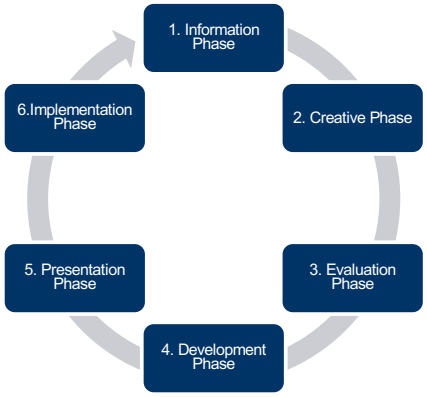
1. Value Engineering – FEP Best Practice

Value Engineering is a Process



Use a 3rd party facilitator and SME's from multiple organizations to prevent group think and biases

1. **Information Phase**
   Identifies the main elements of a project and an understanding of the functions and benefits of those elements
2. **Creative Phase**
   A brainstorming exercise to identify alternatives to the major elements of a project
3. **Evaluation Phase**
   Analyzes the functions/benefits and costs of the alternative elements and ranks the alternatives based on value improvement
4. **Development Phase**
   Select the most viable alternatives and develop enough details to perform a comparative analyses to original major elements
5. **Presentation Phase**
   Present the alternatives that provide the most value to the project
6. **Implementation Phase**
   Select the alternative for each element with the highest value for the detailed design phase

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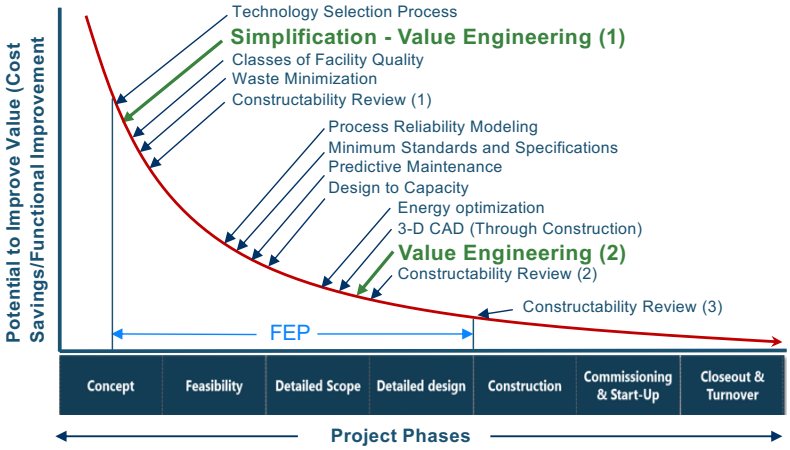
1. Value Engineering – FEP Best Practice



- Value Engineering can be performed at all phases of the project
- The earlier in the project value engineering is performed the better
- Potential cost savings and functional improvement impact - decreases with each progressive phase of a project

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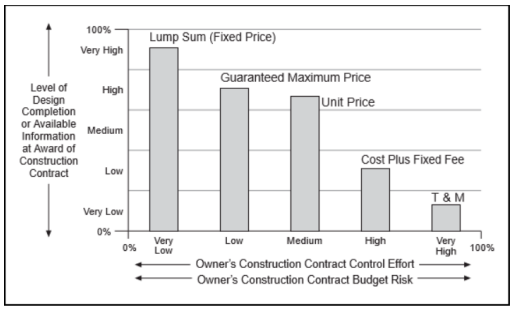
2. Project Delivery and Contracting Strategy

Selecting a Project's Delivery and Contracting Strategy ("PDCS") is a core deliverable of Front-End Planning - ideally done during the Concept Phase to allow for early participation of key suppliers

- Tools such as CII's PDCS provides a list of contracting alternatives for consideration
- The PDCS encourages decision makers to identify and focus on the project objectives and other critical success factors early in project planning phase
- Enhances insight into PDCS selection through systematic consideration of all decision variables
- Provides a defensible rationale for PDCS selection based on quantification of alternatives
- The PDCS selection procedure and tool should be used as a standard. The procedure and tool are easy to use and ultimately align owner project objectives with the PDCS selected for capital projects



The level of Engineering is one method to help select the Contract Strategy

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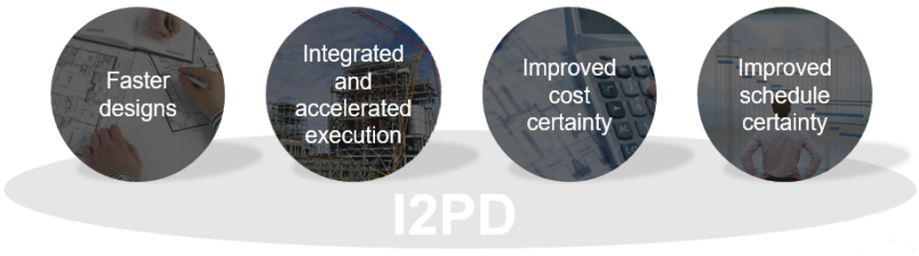
2. Industrial Integrated Project Delivery ("I2PD")

Where **Early Cost and Schedule Certainty** are paramount business objectives on Complex Multi-Supplier Industrial projects – Industrial Integrated Project Delivery ("I2PD") is an ideal Project Delivery Contracting Strategy

> **I2PD increases speed, trust and transparency as a contracting strategy – it delivers project outcome certainty**



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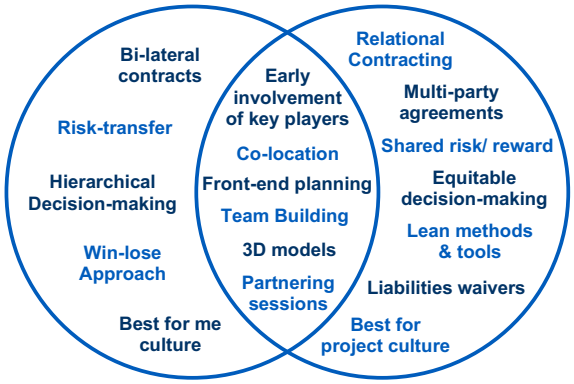
What is I2PD?

Trust, Collaboration, Integration, Open Communication

EPC, EPCM, DB, CMR

DBB



I2PD

Improved Safety, Earlier Cost and Schedule Certainty, Optimized Design

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What Types of Projects Can I2PD Deliver?

Downstream and Chemicals
- ✓ Refining facilities
- ✓ Petrochemical facilities
- ✓ Specialty chemical facilities

Manufacturing and Life Sciences
- ✓ Pharmaceuticals
- ✓ Automotive
- ✓ Processing

I2PD

Fast Tracking Projects with Certainty

Power, Utilities, and Infrastructure
- ✓ Power Generation
- ✓ Transmission & distribution
- ✓ Pipelines, water, waste water
- ✓ Dams, bridges, tunnels & rail
- ✓ Port & harbor upgrades

Upstream, Midstream and Mining
- ✓ Offshore terminals
- ✓ Oil and gas production

Facilities and Healthcare Buildings
- ✓ Museums,
- ✓ Public buildings
- ✓ Hospitals

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3. Integrated Project Execution Plan

Using a Highly Collaborative an Integrated Project Delivery and Contracting Strategy allows for the development of an **Integrated Project Execution Plan ("IPEP")** during the Front-End Planning phases

- **Project Execution Plan (PEP)** is the project baseline and governing document for the project
- **Establishes in appropriate terms** what will be done to meet the project scope and contractual requirements
- Describes the project plan in **both a strategic and tactical way**
- Developed by key project **internal participants** led by the project manager
- **Approved** by company management prior to publishing
- **Live document** and should be updated with current and future project details as developed through project phases

An IPEP involves all key **(Internal and External)** participants (the "Project Team") in its development led by the Project Managers of the Key Project Stakeholders

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3. Integrated Project Execution Plan

1.0 PROJECT OVERVIEW
- 1.1 Client and Project Information
- 1.2 Contract Basis and Terms
- 1.3 Integrated Scope of Work Description
- 1.4 Project Objective and Goal
- 1.5 Project Execution Strategy
- 1.6 Project Cost and Schedule

2.0 PROJECT MANAGEMENT
- 2.1 Integrated Organization and Responsibilities
- 2.2 Kick-Off and Alignment
- 2.3 Integrated Initial Planning
- 2.4 Project Baseline Development
- 2.5 Project Study and Review

3.0 INTEGRATED PROJECT ADMINISTRATION AND INFORMATION MANAGEMENT
- 3.1 Integrated Project Communications
- 3.2 Project Plan and Procedure
- 3.3 Project Meeting and Report
- 3.4 Network Requirement
- 3.5 Knowledge Management

4.0 PROJECT CONTROLS / ESTIMATING
- 4.1 Integrated Estimating
- 4.2 Scheduling and Schedule Control
- 4.3 Integrated Cost Control
- 4.4 Integrated Progress Measurement
- 4.5 Review and Approval

5.0 ENGINEERING / DESIGN
- 5.1 Design Basis
- 5.2 Design Deliverables
- 5.3 Design Control
- 5.4 Project Document & Data Management

6.0 CONTRACT MANAGEMENT
- 6.1 Risk/Reward Plan
- 6.1 Project Sub-contracting Plan
- 6.2 Claim Avoidance Plan

7.0 PROCUREMENT
- 7.1 Material Management Plan
- 7.2 Purchasing
- 7.3 Expediting
- 7.4 Inspection
- 7.5 Logistic Management

8.0 CONSTRUCTION
- 8.1 Construction Planning
- 8.2 Labor Management
- 8.3 Temporary Facility Plan
- 8.4 Construction Execution Planning
- 8.5 Construction Organization
- 8.6 Construction Administration
- 8.7 Field Engineering
- 8.8 Field Material Control
- 8.9 Mechanical Completion/ Pre-commissioning

9.0 OPERATION
- 9.1 Commissioning
- 9.2 Start-up
- 9.3 Performance Test

10.0 CHANGE MANAGEMENT
- 10.1 Integrated Change Management Basis
- 10.2 Change Work-Flow

11.0 RISK MANAGEMENT
- 11.0 Project Risk Identification
- 11.1 Integrated Risk Workshop

12.0 QUALITY MANAGEMENT
- 12.1 Audit Plan and Programme
- 12.2 Corrective Action/ Preventive Action Programme

13.0 HEALTH, SAFETY, ENVIRONMENTAL AND SECURITY
- 13.1 HSE Philosophy
- 13.2 Design HSE
- 13.3 Site HSE
- 13.4 Security Plan

14.0 TURNOVER
- 14.1 Facility Hand Over
- 14.2 Document Hand Over

15.0 PROJECT CLOSE-OUT
- 15.1 Contracts Close-out
- 15.2 Certificates
- 15.3 Close-out Book

In yellow are the key changes between a PEP and an IPEP
- integrating the expertise and best ideas from the participants

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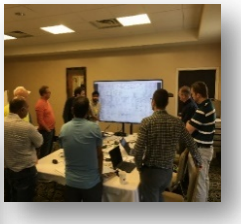
3. Integrated Project Execution Plan

IPEP Benefits

- Thorough and consistent understanding of Scope
- Alignment on all Project Objectives
- Improved Project Value (Capital Competitiveness)
- Understanding of Risk
- Enhanced Communications
- Improved Craft Productivity
- Reduced Changes and Claims
- Lower Project Contingency
- Improved HSE Outcomes



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4. Project Controls

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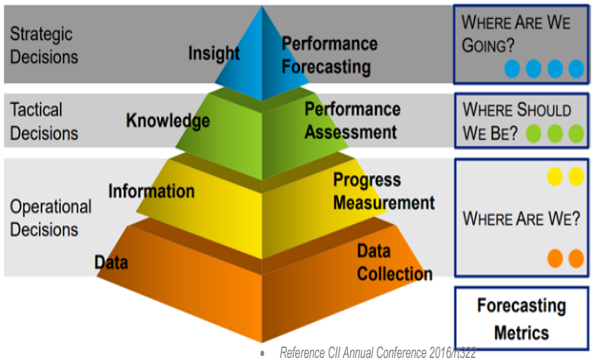
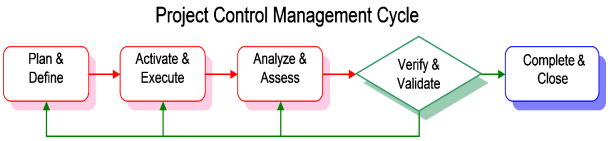
Project Controls & PMIS Requirements in FEP



To achieve this, we need to plan the Project Controls Cycle



Inter-relationship Between Data Collection, Progress Measurement and Performance Assessment

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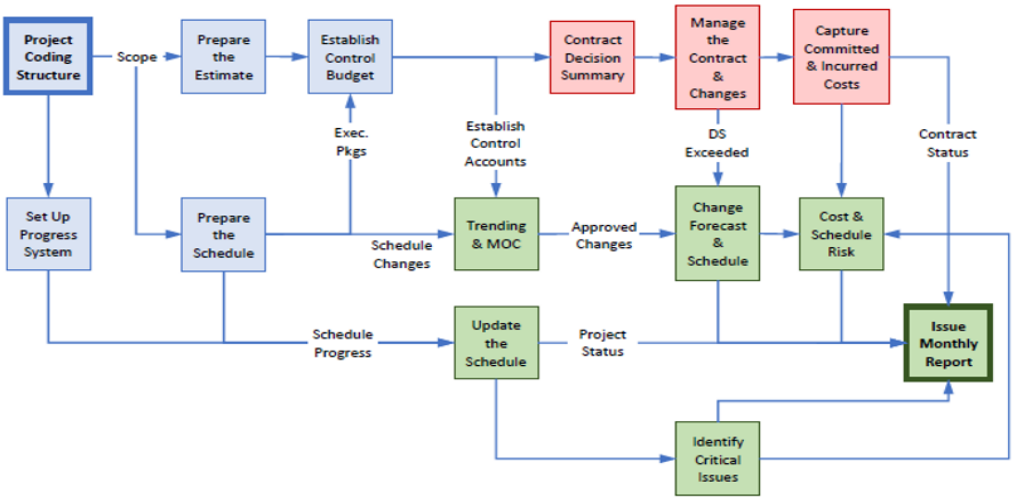
Developing Your Workflow during FEP



PM and PC processes are typically not well defined in FEP

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Estimate Development and Breakdown Structures

1.1.1.1 *Estimate Request Checklist*

It is recommended to fill in and complete the Estimate Request Checklist by the Project Manager and Cost Estimator to ensure uniformity, clarity and consistency on the project.

ESTIMATE REQUEST CHECKLIST

Project # and Title	< ..... # and Description .....>
Project Manager	< ..... Name and Signature .....>
Cost Estimator	< ..... Name and Signature .....>
Checklist Date	< ..... Checklist Date .....>

SECTION 1 (To be filled in by Project Manager)

1.0 PREREQUISITES

a) Project Information availability
- ☐ Project #, title and description
- ☐ Project scope statement
- ☐ Project charter
- ☐ Other documents (Please specify)

COMMENTS:

b) Estimate expectations and timelines
- ☐ Type of Estimate [☐ - Order of Magnitude, ☐ - Prefeasibility, ☐ - Feasibility]
- ☐ Agreement with project manager on estimate due date [----------]
- ☐ Specific estimate review requirements:

COMMENTS:

c) Project technical scope completeness for detailed estimate
- ☐ Process/Utility Flow Diagrams (PFDs)
- ☐ Piping/ Instrumentation Diagrams (P&IDs)
- ☐ Equipment Data Sheets
- ☐ Motor Lists
- ☐ Electrical Single Line Diagram
- ☐ Equipment Layout Drawings
- ☐ Vendor Quotations
- ☐ Grading Drawings, Building Layouts and Specifications
- ☐ Other details (Specify)
- ☐ Underground Piping and Electrical Layouts
- ☐ Subcontractor quotations
- ☐ Concrete foundation layouts
- ☐ Piping Isometrics
- ☐ Plot Plans
- ☐ Engineering Specifications
- ☐ Environment / Government Requirements

Estimate Development Check List

Requirements (R) & Deliverables (D)	Project Stage: Order of Magnitude	Pre-Feasibility	Feasibility
R - Recommended methodology	Use of capacity factoring, scaling, historical data	Use of equipment factor, parametric models, historical data	Engineering estimates, firm quotes, detailed estimate
R - Estimate alignment with WBS and Control Accounts	Optional	Required	Required
R - Estimate review requirements	Internal review	Internal review + peer group review	Internal review + peer group review + optional third party review
R - Expected accuracy range	-50% to +50%	-15% to +25%	-10% to +15%
R - Expected level of project contingency	Up to 30%	15% to 25%	10% to 15%
R - Recommended contingency calculation approach	Contingency % allocation based upon	Contingency allocation at WBS/CBS Level	Contingency allocation at WBS/CBS Level
R - Cost Estimate Tool - "Project Cost Estimates"	Optional	Required	Required
D - Cost Estimate Plan	Optional	Optional	Mandatory
D - Basis of Estimate	High Level	1-2 Pager	Detailed
D - Cost Estimate	Required	Required	Required
D - Estimate Presentation	Not Required	Optional	Optional

Breaking the Scope using WBS and establishing Budget and Schedule baselines

Activity Planning and Scheduling during FEP

• Project Scope (scope statement)	• Project Execution Plan (as required)
• Engineering Deliverables (if any)	• Key Contracts / POs (if any)
• Work Breakdown Structure (WBS)	• Key Milestones and / or Dates
• Cost Breakdown Structure (CBS)	• Logic Relationship (Start to Finish, etc.)
• Activity Durations and / or Estimates of Time	• Project Calendar (start to finish)
• Resource Requirements & Availability	• Constraints (Max Days of shutdown)
• Key Risks (Risk Register)	• Assumptions or Stakeholder Requirements
• Scheduling Tools (Primavera P6)	

The perquisites above are required to plan and schedule key project activities at ever increasing levels of detail (Levels 1 through 3)

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Establishing the Basis of the Schedule During FEP

Typical items to be included in the Basis of Project Schedule, are listed below:

- Project scope, description / summary
- Schedule development methodology
- Critical path(s), near critical path
- Constraints
- Project and resource availability / calendar (if any)
- Opportunities, if any (e.g. alignment with other major equipment rentals)
- WBS (Work Breakdown Structure)
- Key milestones and / or dates
- Assumptions
- Risks, issues, if any
- Exclusions and Exceptions

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What is Required at Each FEP Phase?

Requirements (R) & Deliverables (D)	Order of Magnitude	Pre-Feasibility	Feasibility	Execution
R - Application of standard WBS, CBS, activity code and resources code	Optional	Required	Required	Required
R - Critical Path requirements	Not Required	Optional	Required	Required
R - Schedule Baseline requirements	Not Required	Optional	Required	Required
R - Resource loading using man-hours	Not Required	Optional	Required	Required
R - Commodity / Quantity tracking requirements	Not Required	Not Required	Not Required	Recommended
R - Specific Schedule Scenario Analysis	Not Required	Not Required	Not Required	As required
R - Scheduling Tool	Excel / P6	P6	P6	P6
D - Schedule Level	Level 1 / Level 2	Level 2	Level 3	Level 3 / Level 4
D - Schedule Management Plan	Not Required	Not Required	Optional	Maintained from FS
D - Schedule Basis Requirements	Not Required	Optional	High Level (1-2 Pages)	Maintained from FS
D - Schedule Risk Analysis	Not Required	Not Required	Optional	Optional
D - Schedule Health Analysis	Not Required	Not Required	Optional	Optional

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5. Risk Analysis Methodology

- a key part of Front-End Planning

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Risk Analysis – Quantifying Uncertainty

- **Risk** is an uncertain event that can have a positive or negative effect on the project
- **Opportunity**: A risk that would have a positive impact on one or more objectives of the project
- **Threat**: A risk that would have a negative impact on one or more objectives of the project

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Opportunity Register

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Company:	
Project:	
Project Manager:	

OPPORTUNITY REGISTER

Opportunity Name	Detailed Opportunity Description	Expected Outcome Narrative	Owner	Project Division (WBS)	Opportunity Chance		Outcome Chance		Savings ($)	Associated Task (per schedule)	Cause	Trigger	Management Strategy	Response Plan	Cost of Response Plan ($)
					Cost (%)	Schedule (%)	Cost improvement (%)	Schedule improvement (%)							

Owner	Project Division (WBS)	Opportunity Chance		Outcome Chance		Savings ($)
		Cost (%)	Schedule (%)	Cost improvement (%)	Schedule improvement (%)	

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Threat Register

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Company:	
Project:	
Project Manager:	

THREAT REGISTER

Threat Name	Detailed Threat Description	Expected Outcome Narrative	Owner	Project Division (WBS)	Threat Chance		Outcome Chance		Cost ($)	Associated Task (per checklist)	Cause	Trigger	Management Strategy	Mitigation Plan	Cost of Mitigation Plan	Response Plan	Cost of Response Plan	Response Plan Outcome		Residual Threat	Cost of Residual Threat ($)
					Cost (%)	Schedule (%)	Cost (%)	Schedule (%)										Cost increase (%)	Schedule increase (%)		

Owner	Project Division (WBS)	Threat Chance		Outcome Chance		Cost ($)
		Cost (%)	Schedule (%)	Cost (%)	Schedule (%)	

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Ranking the Opportunities and Threats

Consequence	1-Minor	2-Medium	3-Serious	4-Major	5-Catastrophic
Likelihood					
A-Almost certain	Moderate	High	Critical	Critical	Critical
B-Likely	Moderate	High	High	Critical	Critical
C-Possible	Low	Moderate	High	Critical	Critical
D-Unlikely	Low	Low	Moderate	High	Critical
E-Rare	Low	Low	Moderate	High	High

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Risk Evaluation – Multiple Methods

A) Using Expected Monetary Value (EMV)

- This Expected Monetary Value (EMV) is calculated for each risk / uncertainty by multiplying probability of occurrence (likelihood) and expected impact (consequence).

EMV = Probability x Impact

- The EMV is calculated for each of the risks and it provides the overall risk exposure for the project.

$$EMV = \sum_{i=1}^{n} P_i V_i$$

B) Using Simulation Model (Monte Carlo or PertMaster)

- This method requires specialized software to run the model and expertise to develop and interpret the risk model. The model development involves calculation of optimistic, most likely and pessimistic values (cost and schedule impact) for each risk and other uncertainties and these values are then fed into the model using specific distribution such as triangular distribution or PERT distribution.

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Accuracy is Improved as Project is Better Defined

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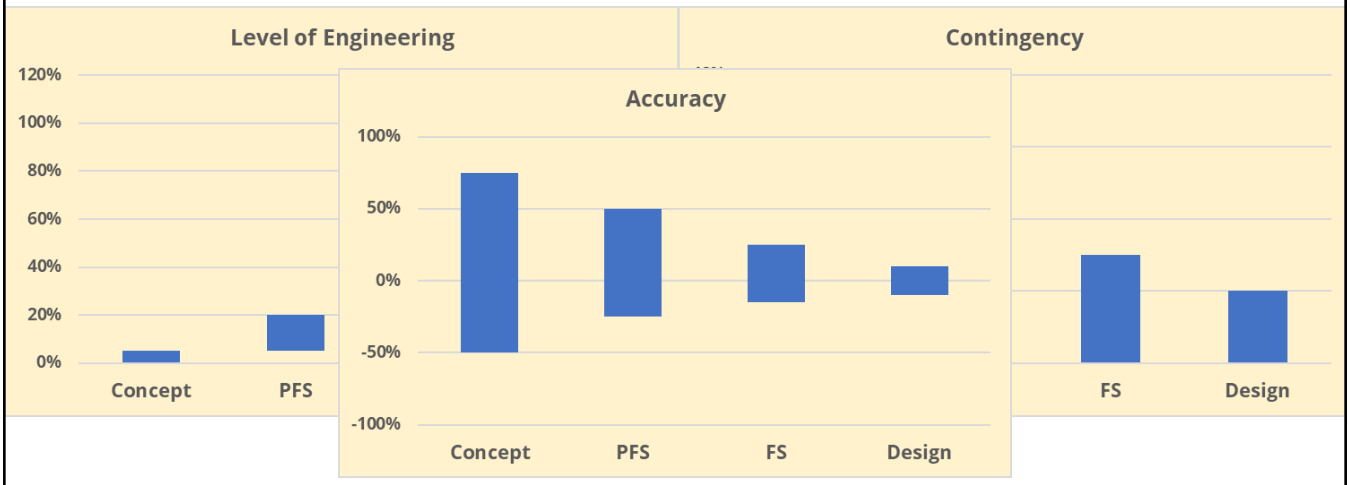

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Risk Profile Improves as Front-End Planning Progresses

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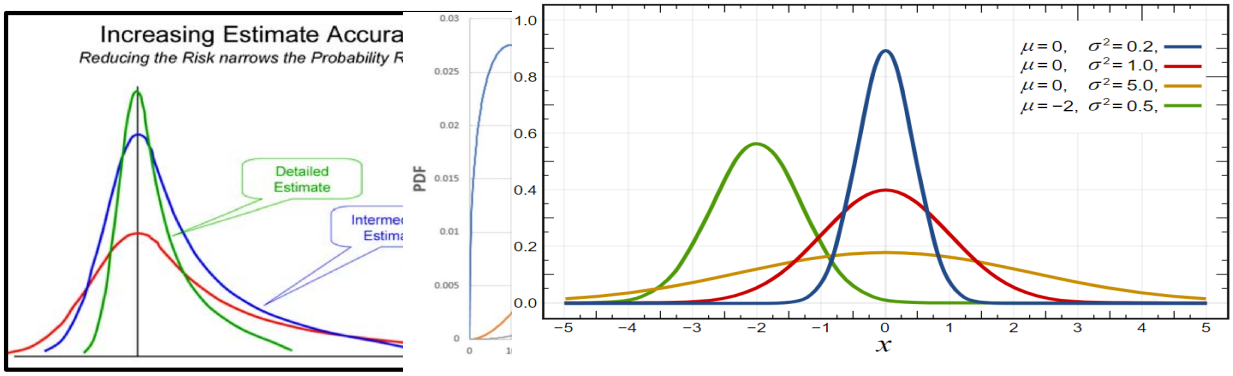
Its all about Management Philosophy & Risk Tolerance

It can be a skewed curve with low probability (skewed to left) or high probability (skewed to the right) !!

The Less Deviation the Better



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As FEP Increases Certainty of Success Increases

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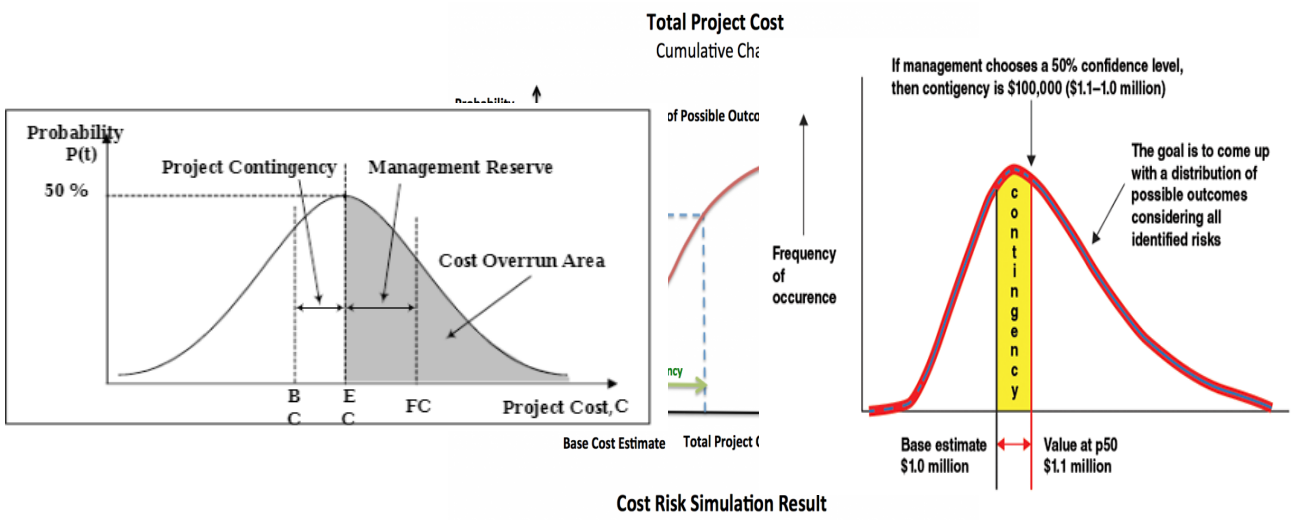

Contingency Levels Decrease as Risk Maturity Increases

Accuracy and Probability of Cost Outcomes are Linked

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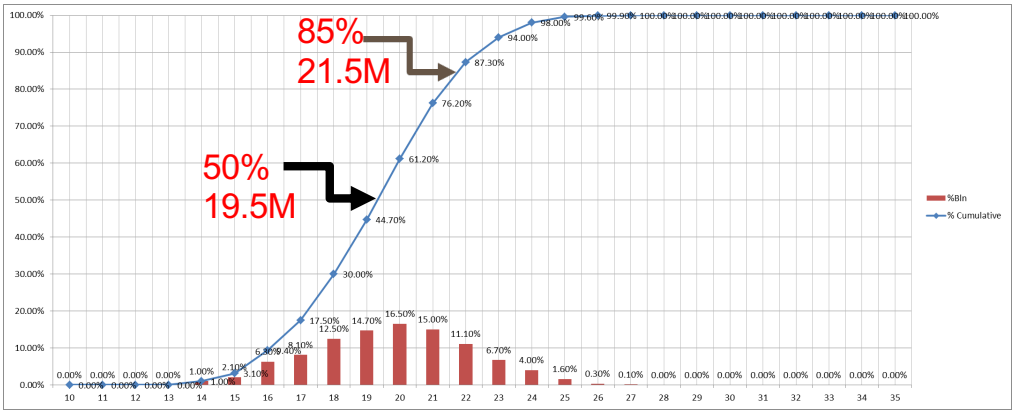

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6. Interactive Project Management and Control Handbook

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10 Step Approach to Planning and Setting up the Project

1. Project Set-up, Initiation, Kick-off, and Alignment
2. Stage Gate Reviews, Project Audit & Assurance
3. Team Structure & Composition (Owners Team and Contractors)
4. Governance / Policies and Procedures + Deploy & Invest in Industry Best Practices (&Tools)
5. Prioritization with the Operational / Sustaining Capital Objectives
6. Project Risk Analyses Realization and Mitigation Strategies
7. Project Management Information Management, Set-up & Integration
8. QA/QC Reviews, Permits and Stakeholder Management Plan (CSR Plan)
9. Site Planning and Logistics, Technical Issues, Operational Input & Reviews, and Handover
10. Look Ahead Plan with Project Execution Strategy and Resource Loaded Schedule with "pull planning process"

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Handbook – A simple guide to success

1. Project Excellence and Best Practices
2. Stage Gate Process & Project Framework
3. Project Set-u
4. Cost Managen (Estimation and C
5. Planning and Sch
6. Procuremer & Contracts Administration

7. Progress, Measurements and Metrics
8. Project Change Management
9. Project Quality Management
10. Project Risk Management
11. Project Analyses and Reporting
12. Construction, Operational Readiness, Handover and Closeouts

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Questions and Answers

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