Using Technology and Industry Best Practices to Achieve Real-time Progressing

March 30th, 2021
1:00 PM-2:00 PM, EST

Agenda

- Introductions, Opening Remarks
- Topics for Today's session
  1. Project Progressing Definitions
  2. Project Progressing Pre-Requisites
  3. Project Workface Data Collection Process
  4. Progress Reporting
  5. Benefits and Summary
- Question and Answers

Introductions, Opening Remarks

Bob Brown

Mr. Brown is a project management and technology business executive with 35+ years of significant results in improving overall corporate and/or project performance in the Industrial Industry in North America and Internationally.

He has been responsible for developing and implementing project management information systems and business processes to improve project success rates for some of the world's largest owners and EPCs. Bob has led the development and set-up of procedures, workflows, tools, to complete project management information systems on projects from small to mega projects in excess of $15B.

Objectives

1. Collecting Construction Progressing Data at the workface
2. Discuss the pre-requisites required to make this data useful and valid
3. Define work management processes and controls in the field
4. How to employ technology to support field construction progressing and required data
5. Highlight approaches to minimize the impact of force majeure issues like COVID using daily progressing
6. How to provide timely, structured data for analyzing and making informed project decisions

Progressing – An Integrated Solution

Single Source of Truth: Project Monitoring & Reporting

Out of the box cost control and EVM functionality

Integrated with Corporate ERP and Maintenance Systems

Change & Progress Management

Complete set of real time metrics including Safety, Quality, Schedule and CPI&SPI

Mobile platform in the field can report project progress in real time

Progressing – terminology and language

Construction Progress Monitoring is an inspection process that ensures that actual construction achieved is consistent with the planned construction. Construction Progress Monitoring verifies that work completed is consistent with plans and specifications.

Construction Schedule means the schedule for performance of the Contract; showing the time for completing the Work Activities within the Contract Times; the planned sequence for performing the various components of the Work; and the interrelationship between the activities.

Progressing – terminology and language

Work Breakdown Structure (WBS) is a visual, task-oriented breakdown of a project into executable work packages.

Construction Estimate is the material, equipment and labor quantities required to construct a project. The Construction Estimate contains both direct and indirect costs.

Progressing – terminology and language

Field Data Collection is the collection of construction data in the field. Field data is collected typically at the workface for the purpose of recording task completion against the planned schedule and is used to analyze and calculate progress, % complete, and productivity.

Progressing - Project Pre-requisites

1. Final Engineering FEL3 Design
2. Construction Contracting Strategy
3. Project Work Breakdown Structure
4. Estimate (including manhours)
5. Schedule and Work Plan
6. Contract Rules of Credit
7. Technology

Project Delivery and Contracting Strategy

Generic Group	Typical Objectives
Cost-related	Meet cost performance targets
Schedule-related	Meet schedule performance targets
Safety-related	Meet recordable targets
Quality-related	Achieve customer satisfaction Attain high quality of constructed facility Minimize contractor scope changes Maximize plant reliability
General	Minimize risk Optimize risk/return Ensure confidentiality Minimize interference with existing operations Meet business requirements

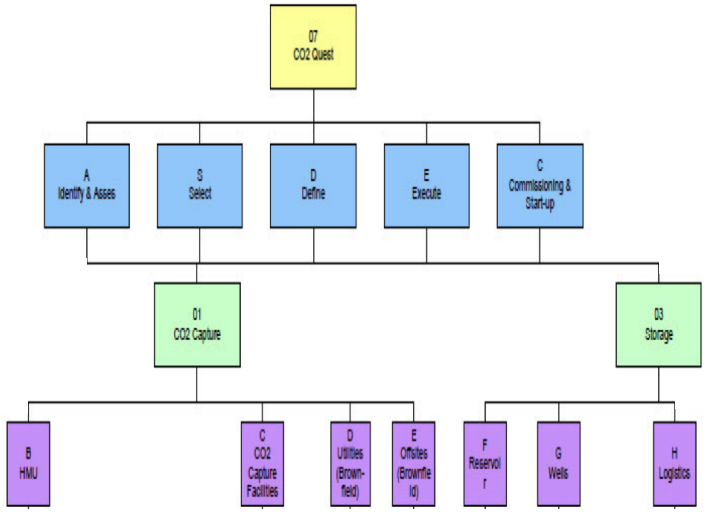
Industry has learned that selecting the Project Delivery and Contracting Strategy that best meets the objectives of the business and the project – **improves project success rates**

Progressing - Contract Strategies

- Time and Materials
- Fixed Price to a maximum
- Fixed Price
- Lump Sum
- Fixed Price plus fee
- Milestone driven
- Combination of above
- Defined in a contract Rules of Credit

Work Breakdown Structure (WBS)

- Work Breakdown Structure (WBS) is the heart of the project management and control and integrates the scope of work to the cost, schedule and progress measurement
- Streamlines information flow, improves communications, reduces redundancy and improves visibility
- The WBS work breakdown/cost codes
- Provides multi-view of the project scope –allows analysis and view of project costs from different perspectives
- Helps define the project scope of work
- Sub-divides the project scope into manageable pieces
- Integrates cost and schedule
- Establishes cost and schedule baselines
- Supports scheduling, cost control and the management of change processes
- Checklist for the Estimate



WBS Example

Progressing - Estimate

Association for the Advancement of Cost Engineering (AACE) recognizes five (5) classes of estimate:

Class of Cost Estimate	Class 5	Class 4	Class 3	Class 2	Class 1
Typical Cost Estimate Methodology	Capacity Factored, Parametric Models, Judgment, or Analogy	Equipment Factored or Parametric Models	Semi-Detailed Unit Costs with Assembly Level Line Items	Detailed Unit Cost with Forced Detail Takeoff	Detailed Unit Cost with Detailed Take-off
Expected Range Boundaries (Variation in Estimate to Compete - $)	H: +30% to +100% L: -20% to -50%	H: +30% to +100% L: -20% to -50%	H: +30% to +100% L: -20% to -50%	H: +30% to +100% L: -20% to -50%	H: +30% to +100% L: -20% to -50%

- Progressing is best performed with at least Class 3 or better

Progressing - Estimating: Construction

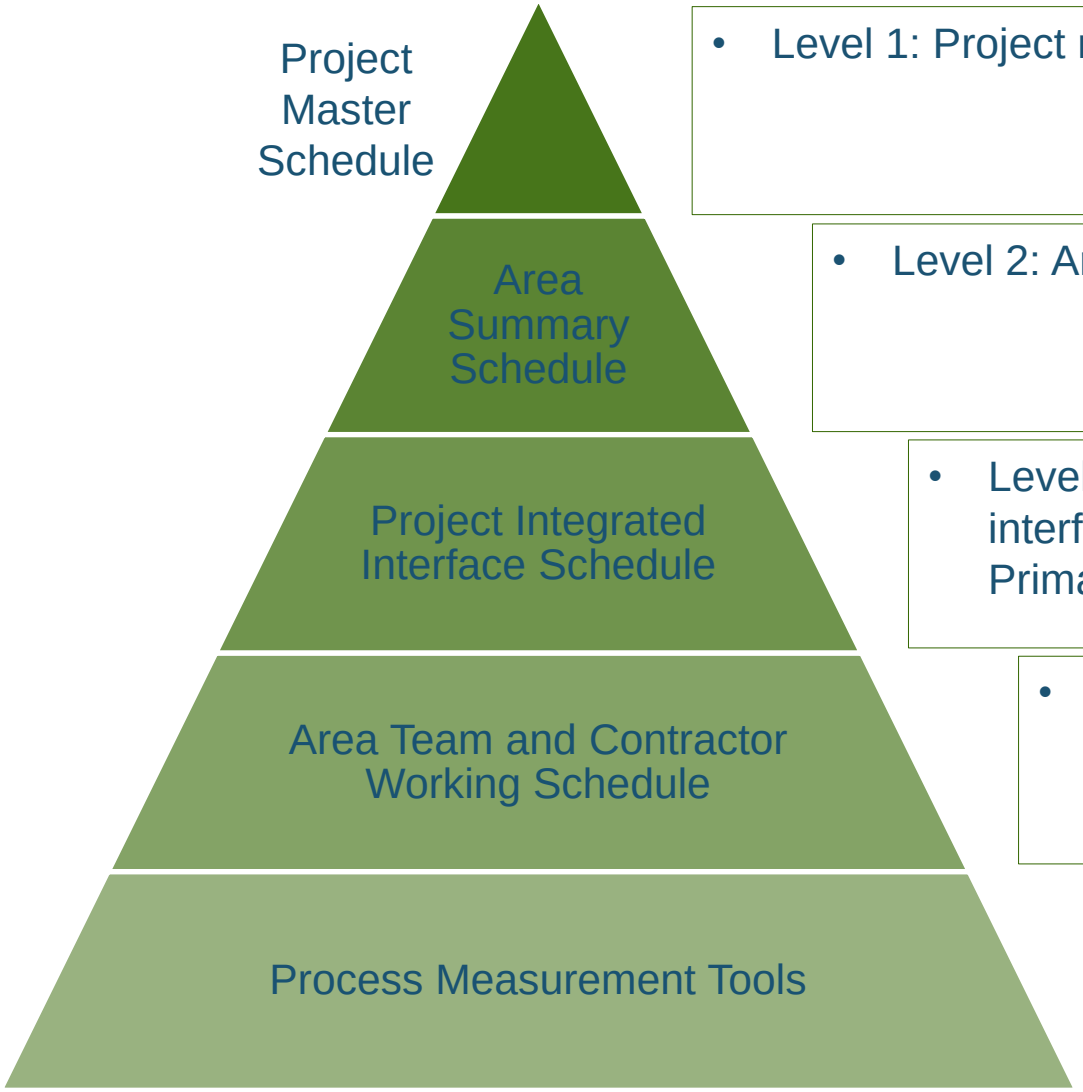
Facilities

- Contractor Supplied Material
- Quantities to install
- Workweek & travel time
- Weather assumptions
- Productivity Assumptions – unit man-hours
- Man-hours
- All-in-Labor Rates including In-directs
- Living Out Allowance (LOA) assumptions
- Rotation Assumptions

Pipelines

- Baselay
- Quantities to install
- Work week & travel Time
- Weather assumptions
- Production Rates -meters per day
- Crew sizes
- Construction Equipment
- Labour Rates
- LOA & Rotation Assumption

Planning and Scheduling

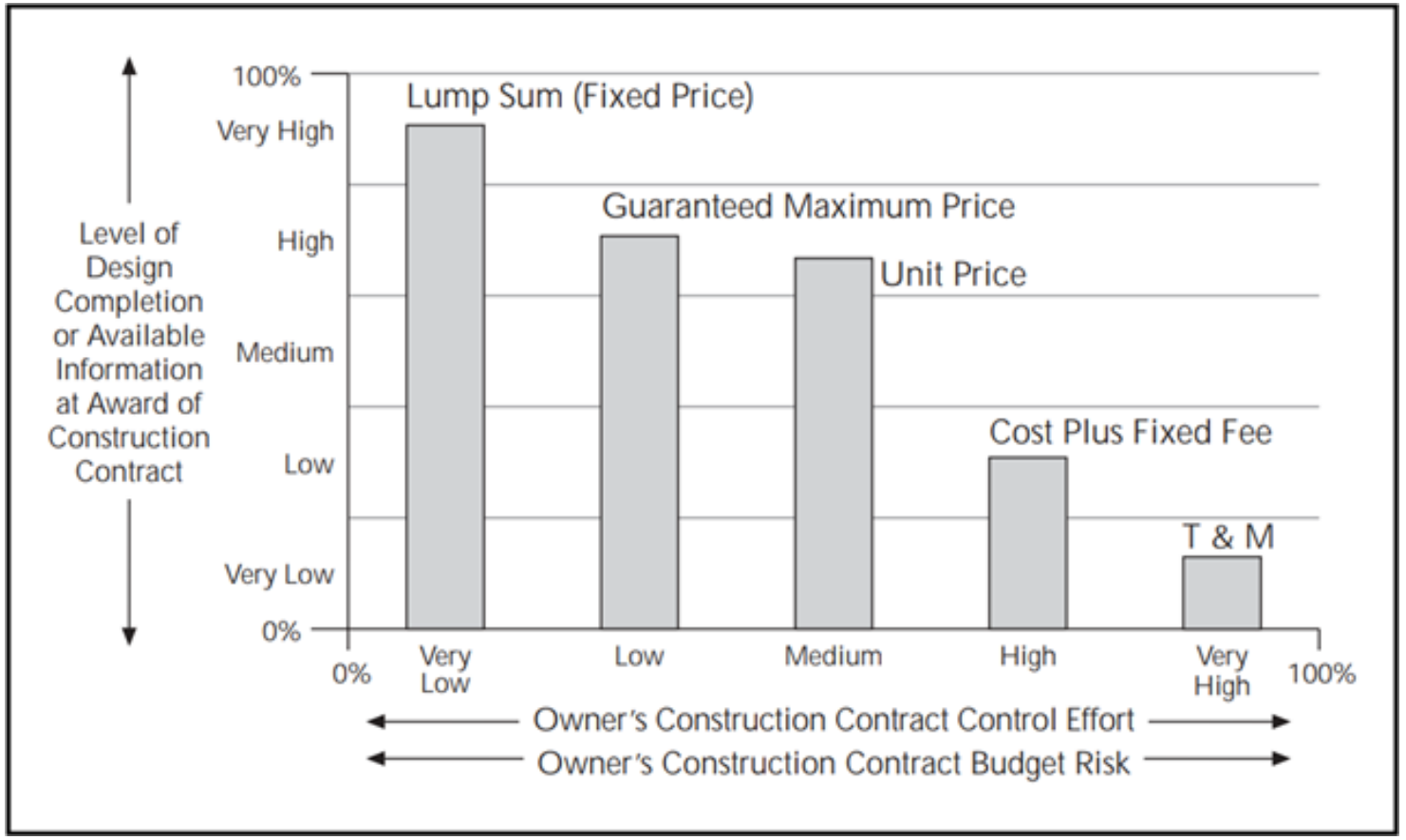


- Level 1: Project milestone and overview of execution
- Level 2: Area summary and overview of execution and key dates
- Level 3: Logic network schedule for total project showing interfaces and key dates between execution packages in Primavera
- Level 4: Logic network schedule, MR lists contractor construction schedules, lists of checklist of the deliverables to ensure all work in the area is well defined
- Level 5: Progress Measurement system for contractors, drawing, registers, MC checklist, etc.

Rules of Credit Methods

Compensation should be related to the levels of information available at contract award, based on equitable allocation of financial risks among parties to the contract.

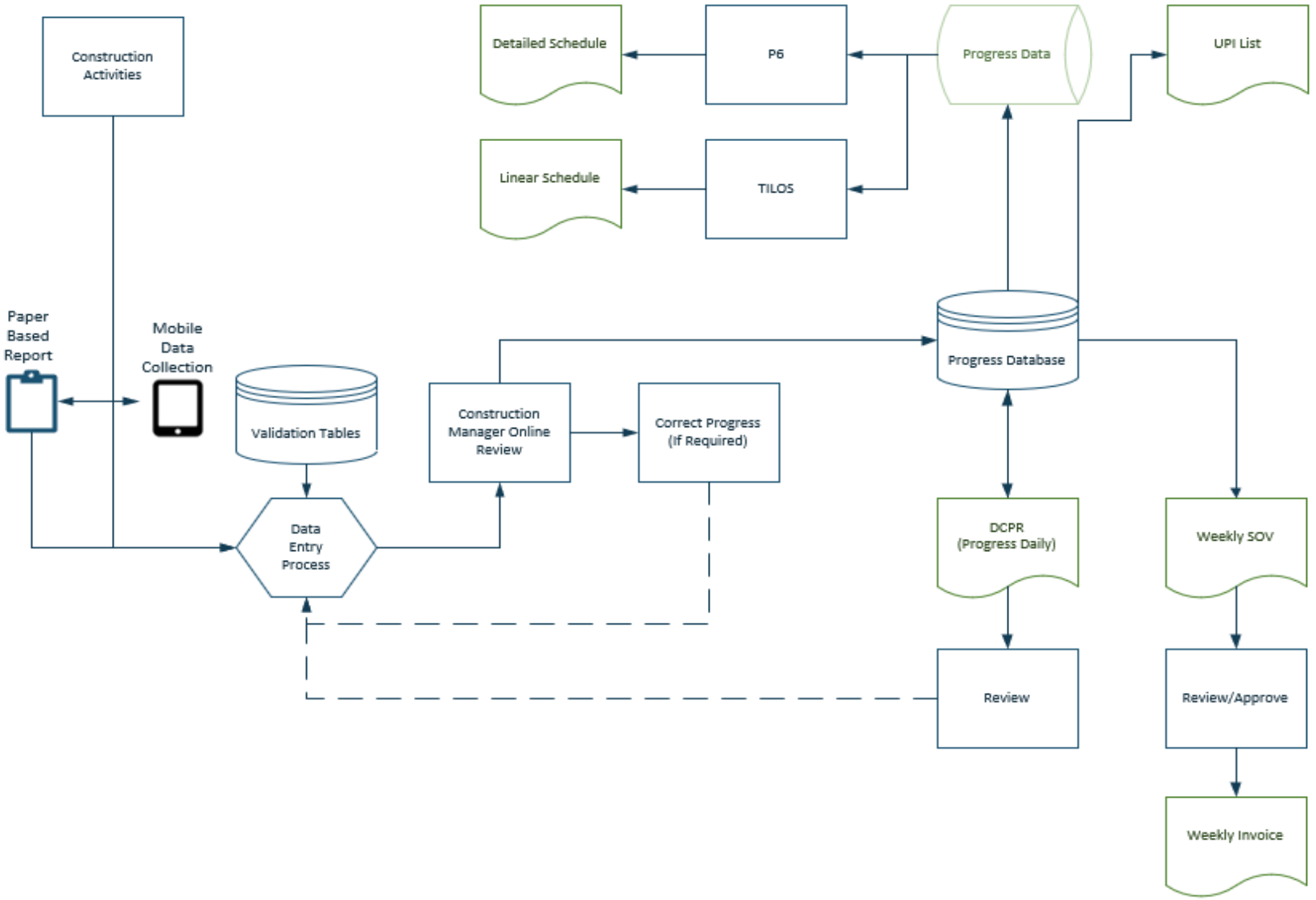
Each compensation approach has a corresponding level of owner's financial risk and owner's level of contract control effort that is associated with it.



Progressing - Field Rules of Credit

1. Quantities Installed
2. Lump Sum – Fixed Price Activities
3. Milestone completion
4. T & M – Time and Materials
5. Unit Priced Items installed (UPI)

Progressing – Workflow



Progressing - Paper vs Technology

Traditional paper documents – In today's construction projects, paper documents are often used to collect and manage field data as many foreman are more comfortable with this approach:

- Provides foreman with the comfort of documenting progress - on a paper document that can be adjusted
- Many times, these documents are not filled in until later in the day – which means that the actuals they record are dependent on their memory
- Foreman handwriting is quite often unreadable
- Recoding techniques are foreman specific rather than project driven
- These Forms have to be entered later into the progressing and costing system (extra chance for errors)
- Cannot easily attach additional documents such as pictures, reference

Progressing - Paper vs Technology

Digital Documents – With advance of today's technology paper documents can be duplicated on mobile digital screens

- Data integrity rules are applied immediately (drop down menus and data verification)
- Handwriting is not an issue
- Additional documents can be added (specs., pictures, drawings, maps, etc.)
- No back-office data entry required
- Data is up-loaded directly to progressing and costing systems

Progressing - Mobile Features and Benefits

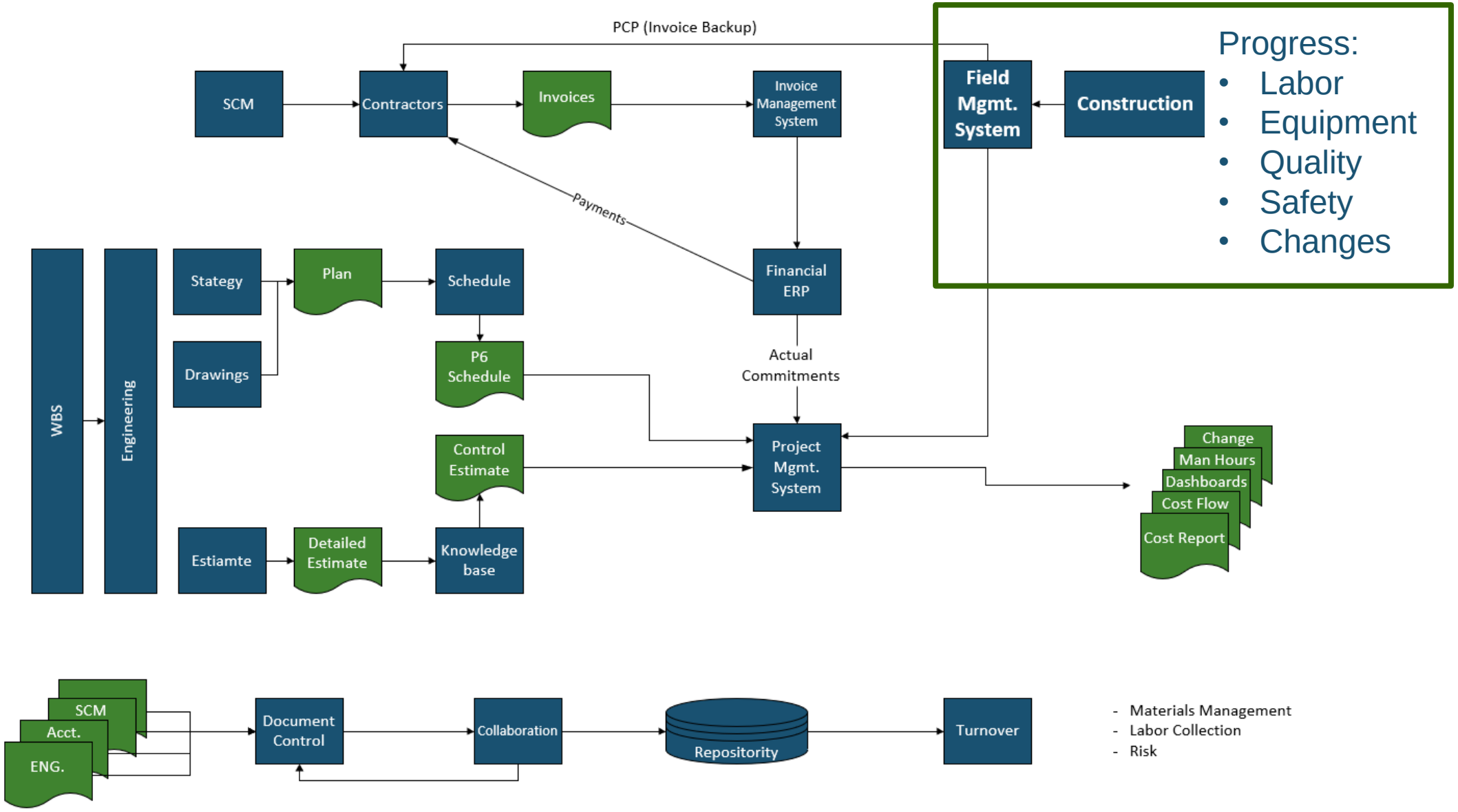
- Ensures critical data is collected in real time, with a user-friendly mobile interface that provides instant validation
- Use modern digital tools to empower personnel to collect additional data such as: pictures, sound recordings, videos, instrumentation data, etc.
- Ensures that the data collected is accurate, timely, geo tagged, and meets contractual requirements
- Improved transparency, record storage, retention & accessibility (Stored on SQL database)
- Is secure and auditable (CICA 5025, SOC 1 and 2 standards; ISO 27001 and COBIT 4.1)
- Interconnects additional applications (GIS, SAP etc..)

Progressing - Change Management

Given that progress data has been collected in a timely and structured manner, and that the data is approved by all parties on a daily basis:

1. Any changes can be easily verified, and the owner acceptance or rejection of the change is obvious
2. Changes can be managed weekly and not delayed until the end of the project
3. Changes are managed to the contract terms and rules of credit

Technology Systems Integration



Progressing – Reporting

Reporting: Starts with the gathering structuring and verifying field progress data is fundamental to the enabling the provision of meaningful project reports

- For project management staff and executives to measure performance.
- To analyze and be able to ask informed questions which leads to effective timely decision making.

Standard Progress Reporting

- Daily Construction Progress Reports
- Weekly Performance Reports (Earned Value)
- Unit Priced Item Reports
- Specialized Reporting
  - Lost Time / Delays
  - Gap and overlap/interference reporting
- Progress Payment Certificates
- Dash Boards
  - Progress Curve - Hours
  - Progress S Curve - Planned versus Actual
  - Bar Chart - Progress % Complete by Control Account
  - Bar Chart - Progress Planned versus Actual

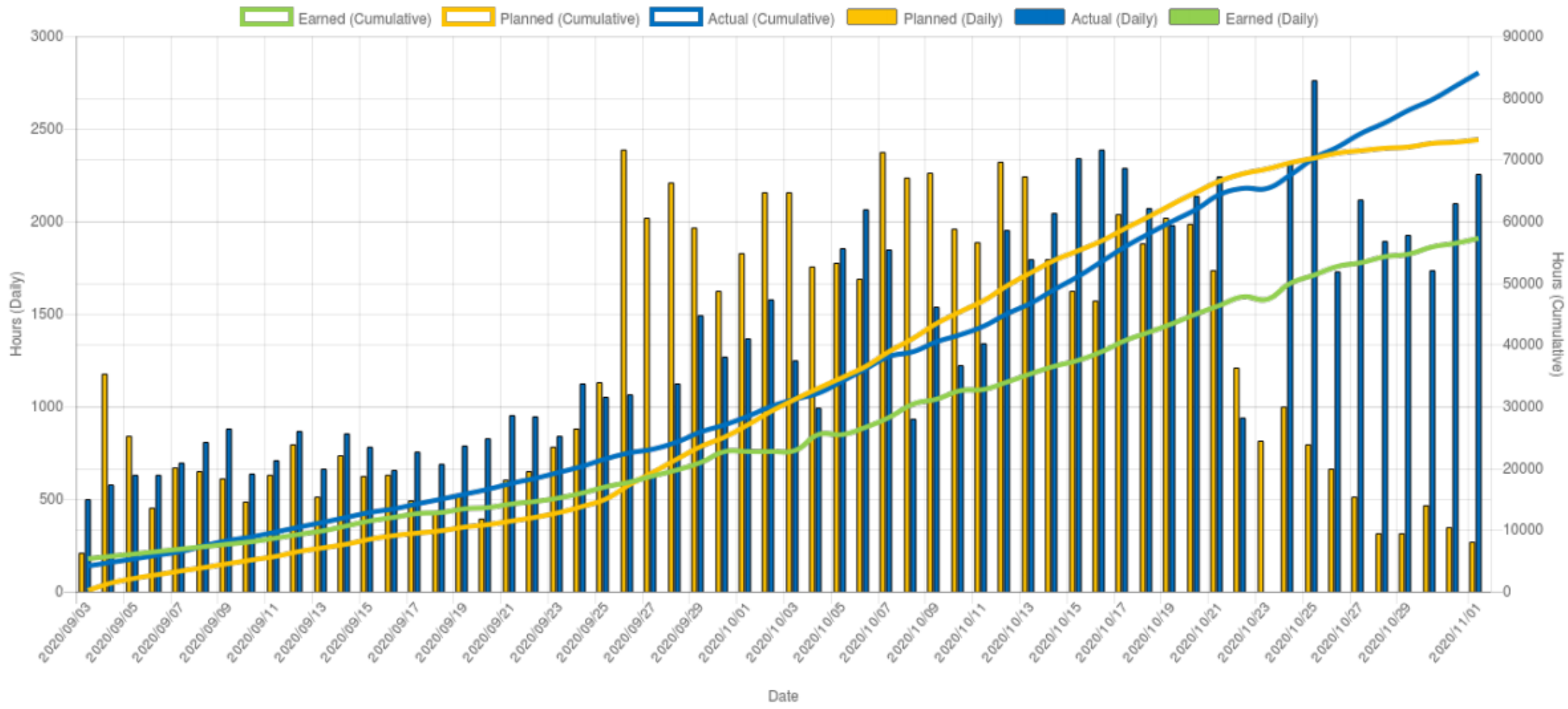
Report samples - Progress Report

WBS		Activity Description	Forecast Start	Forecast Finish	Budget to Install	Forecast to Install	UOM	Today			Cumulative to Date					Remaining
								Actual	Plan	Variance	Actual	Actual % Total	Plan	Plan % Total	Variance	
	130	Support to Camp Contractors	2020/08/12	2020/11/28								29.99%		0.00%		
	136	P2	2020/09/22	2020/12/19								20.80%		0.00%		
200	K030	Platform Preparation/Grading	2020/09/23	2020/12/19	100	100	%	0	0	0	41	41.60%	60	60.29%	-19	58
	140	East Access Roads, Shooflies and Bridges	2019/12/02 A	2021/09/13								47.90%		0.00%		
	141	East Access Roads and Bridges	2019/12/02 A	2021/09/13								60.12%		0.00%		
250	A041	RW-230.0	2021/03/09	2021/04/20	900	900	LM	0	0	0	0	0.00%	0	0.00%	0	900
250	A061	RW-250.0	2021/03/05	2021/04/06	1,400	1,400	LM	0	0	0	0	0.00%	0	0.00%	0	1,400
260	A212	Clore Bridge BR616	2020/09/22	2020/10/20	1	1	EA	0	0	0	0	98.00%	0	0.00%	1	0
250	A221	RW-1616.5	2020/10/31 A	2020/11/04	600	600	LM	0	0	0	510	85.00%	600	100.00%	-90	90
	150	Central Access Roads, Shooflies and Bridges	2019/04/29 A	2021/09/01								53.67%		0.00%		
	151	Central Access Roads and Bridges	2019/04/29 A	2020/12/15								68.38%		0.00%		
250	B031	RW-160.2	2020/10/20	2020/11/12	11,234	11,234	LM	0	0	0	10,785	96.00%	11,234	100.00%	-449	449
250	B061	RW-160.3.B	2020/10/26	2021/06/03								18.65%		0.00%		
250	2	Access RW160.3 B Grubbing / Access Trail	2020/10/26	2021/05/01	1,850	1,850	LM	0	0	0	1,500	81.08%	376	20.32%	1,124	350
250	3	Access RW160.3 B Subgrade/Ballast/Temporary Crossings	2020/10/28	2021/05/25	1,850	1,850	LM	0	0	0	800	43.24%	270	14.59%	530	1,050
250	B131	RW-160.5	2019/04/29 A	2020/10/13	1,000	1,000	LM	0	0	0	950	95.00%	1,000	100.00%	-50	50

Report samples - Weekly Report

Mainline Footage Progress											Mainline Hours Progress												Metrics	
			Progress This Period				Progress To Date						Progress This Period					Progress To Date						
Crew	UOM	Current Scope	Plan	Actual	Plnd % Compl.	Earned % Compl.	Plan	Actual	Plnd % Compl.	Earned % Compl.	UOM	Total Budget	Plan	Earned	Actual	Plnd % Compl.	Earned % Compl.	Plan	Earned	Actual	Plnd % Compl.	Earned % Compl.	PF	SCI
Clearing	LF	99,500	0	1,081	0.0%	1.1%	99,500	99,500	100.0%	100.0%	Hour	30,000	0	325	325	0.0%	1.1%	30,000	30,000	30,000	100.0%	100.0%	1.00	1.00
Grading	LF	99,500	5,853	5,967	5.9%	6.0%	98,525	98,422	99.0%	98.9%	Hour	48,000	1,800	2,878	1,803	3.8%	6.0%	47,720	47,480	48,625	99.4%	98.9%	0.98	0.99
Ditching	LF	66,500	3,167	2,708	4.8%	4.1%	50,139	51,145	75.4%	76.9%	Hour	49,776	2,490	2,026	2,421	5.0%	4.1%	40,148	38,283	40,736	80.7%	76.9%	0.94	0.95
Stringing	LF	66,500	3,912	4,963	5.9%	7.5%	58,025	57,270	87.3%	86.1%	Hour	30,260	1,866	2,258	2,258	6.2%	7.5%	28,142	26,060	26,060	93.0%	86.1%	1.00	0.93
Bending	LF	99,500	3,827	4,256	3.8%	4.3%	56,766	56,945	57.1%	57.2%	Hour	38,500	1,839	1,646	1,966	4.8%	4.3%	25,016	22,034	25,680	65.0%	57.2%	0.86	0.88
Welding	LF	66,500	3,167	3,441	4.8%	5.2%	40,639	38,604	61.1%	58.1%	Hour	105,120	5,782	5,439	5,856	5.5%	5.2%	65,788	61,023	67,217	62.6%	58.1%	0.91	0.93
Coating	LF	66,500	3,167	4,603	4.8%	6.9%	37,472	36,285	56.3%	54.6%	Hour	18,720	1,030	1,295	1,063	5.5%	6.9%	10,686	10,214	10,828	57.1%	54.6%	0.94	0.96
Lowering-in	LF	66,500	3,023	2,000	4.5%	3.0%	35,769	32,832	53.8%	49.4%	Hour	119,232	6,558	3,585	6,884	5.5%	3.0%	65,081	58,867	67,065	54.6%	49.4%	0.88	0.90
Backfilling	LF	66,500	3,023	2,068	4.5%	3.1%	35,769	33,632	53.8%	50.6%	Hour	19,320	1,063	600	1,099	5.5%	3.1%	10,546	9,771	10,719	54.6%	50.6%	0.91	0.93
Testing	LF	99,500	0	0	0.0%	0.0%	0	0	0.0%	0.0%	Hour	4,536												
Clean-up	LF	99,500	4,326	5,789	4.3%	5.8%	20,909	20,995	21.0%	21.1%	Hour	26,400	1,320	1,535	1,267	5.0%	5.8%	4,928	5,571	4,999	18.7%	21.1%		
											Total	**489,864**	**23,748**	**21,587**	**24,942**	**4.8%**	**4.4%**	**328,055**	**309,303**	**331,929**	**67.0%**	**63.1%**	**0.93**	**0.94**

Report samples – Construction Daily Progress



Progressing - Other Online Field Applications

- **Quality**
  - Non-conformance report (NCR) reporting and closure
  - Observation from Inspection (OFI)
  - Root Cause Analysis
  - Corrective Actions
- **Safety**
  - Near Miss
  - Incident
- **Environmental**
  - Pre-construction, Construction and post Construction records
  - Incidents (Spills, Gas leaks, Natural Disasters, etc.)
- **Project Technical Reference Library**

Progressing - Summary

1. Project construction execution strategy is fundamental to success

2. Part of the execution strategy is the contracting strategy - including complete rules of credit

3. The prerequisites for effective progressing are:

    a) Work Breakdown Structure that emulates the work execution process
    b) Approved Class 3 or better estimate
    c) Man-hour estimate
    d) Approved schedule and work plan
    e) Rules of credit broken into measurable elements

4. Use technology to assist with all aspects of the project where feasible

Progressing – Summary Continued

5. Strong field management team and processes - that enforce field staff adhering to the field data collection requirements
    - Do not let the construction foremen or superintendents drive the data requirements
6. Make sure all data is entered daily and any discrepancies between contractors and owner being resolved daily
    - Make sure the all changes are discussed and resolved as they happen and not at the end of the project
7. Daily Progressing ensures that bad news is reported as quickly as good news

Questions and Answers

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