Path of Construction
Enhancing the Best Practice for Engineering & Supply Chain to Support AWP Implementation

Presenters
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Joe Hobbs – Worley Parsons, Committee Member
Agenda

• Background
• Definition of Path of Construction (COAA)
• Key Concepts of Path of Construction (POC)
• What is a Procurement Work Package (PWP)?
• Rules of Credit for EWPs
• Enhancing the Best Practice (BP)
• Summary
• Q & A
Background

Attack the Real Issues
Improving Projects in Alberta

Ed Merrow
May 12, 2015
Engineering Drives Labour Productivity

Drivers of Field Labour Productivity:

- The availability of engineered materials
- The availability of accurate design

Design and materials
are made available

Successful projects
(even with some of the world’s poorest labour)

Design and materials
are not made available

World’s best labour using the best workforce planning will generate pathetic labour productivity
When Engineering Slips

Materials procurement is late and out of sequence for construction

Insufficient IFC Design

IFC design is insufficient to start work in the field, but field start occurs anyway, especially with EPC contracting

Deficient Design Quality

Design quality starts to plummet as the review cycle and QC are under stress

Poor Labour Productivity

Labour productivity is very poor

The project collapses
What Is the Problem?

• The problem with schedule-driven projects is that the practices used, especially on the front-end, were the poorest of any strategy.

• This is because the speed of FEL is outrunning the resources committed and sometimes even the Basic Data development as well.

• The bigger the schedule-driven project, the poorer key practices become.

• Unfortunately, schedule-driven projects are more sensitive to practices than any other group of projects.

• Because there is no slack in time, mistakes are brutally punished; there is no time for work-around.
In Alberta, All Mistakes Are Punished

- Even with down oil prices and contractors currently hungry for work, Alberta has more projects than its population can easily support over the long term
  - Engineering markets are thin
  - Craft labour markets are thin
  - Projects are often remote
- In this environment, any deviations from Best Practice result in outsized penalties—about twice the negative consequences of the same deviation on the US Gulf Coast
- Yes, labour productivity is not good
- But when practices are best, productivity is excellent

*Trying to fix productivity at the workface without fixing the business and project practices first will be an utter failure*
What We Would Do Differently:

• Did not understand the significance of defining EWPs and PWPs based on construction before developing the engineering schedule

• Progress engineering by EWP completions, not ISO issues

• Progress procurement by PWP completions
What is Path of Construction?
WorkFace Planning Project Integration

Phase 1 - Pre-Project

Owner
- Assign sponsors and champions including data
- Review and integrate WFP processes and support functions

Project Management
- Develop WorkFace Planning (WFP) strategy
- Determine WFP requirements for all participants
- Ensure WFP requirements are in practices
- Establish internal WFP requirements
- System high level definition and support
- Develop Project Level 1 Schedule
- Develop Project Level 2 Schedule
- Approve Level 2 Schedule

Construction Management
- Demonstrate capacity to support WFP
- WFP execution plan
- Turnover Plan
- Construction Execution Plan
- Construction impact into layout and project sequence
- Early start of construction development
- Completeness and early WFP, PWP, and MIP definition
- Early procurement process with WorkFace Planning

Supply Chain Management
- Request for proposal
- Contract formation for engineering
- Management of procurement strategy
- Management of contracting strategy

Note: For a contractor to be considered WorkFace Planning Champions and procedures need to be in place prior to project commencement.

Application of WorkFace Planning
Standard Project Procedure
Integration of WFP and Standard Procedure
• How POC works?
• What inputs are?
• What outputs are?
• Deliverables coming out of POC etc.
Path of Construction (POC) – COAA “2017”

The Path of Construction is a description of the work sequencing for the project which becomes progressively elaborated as the project progresses. It may also be in the form of a list or diagram (or combination of all three) that documents the optimum construction execution logic / installation sequence of the physical components for a project. It should reside within the Project Execution Plan and other Plans throughout the lifecycle of the project.
Developing POC

• POC develops from identifying CWPs with sequence, content and durations
• Once Construction Schedule developed, Engineering and Supply Chain (Procurement) need to confirm that they can support the proposed schedule.
• How does that look? – Example of a Piping EWP
Typical Piping EWP
Details required for POC

Vendor Data for Other Disciplines

Material Requisition

BOM

Vendor Data

Vendor Data for Piping

Ready for Shipment

Delivered prior to start of CWP

PWP for Long Lead Eqpt

Piping EWP

PWP for Bulks & Eng Eqpt

Piping CWP

EWP IFC
Procurement Work Package

The concept and discussion on its relevance for material certainty in AWP
What is a PWP?

• Complete list of all supplied material and equipment for an EWP/CWP
  – Engineered equipment
  – Bulk
  – Field supply (to be supplied by contractor)
• Who is requesting, buying, expediting, receiving, holding it
• Listing of all important dates that have to be met

• Provides link for all material/equipment to POs
• Provides link to latest logistics / expediting

• PWP could have an element of providing leading indicators
Who, Where and What in SCM?

Who
• Owner buying it
• EP
• Contractor

Where
• From home office
• Site
• Global supply chain

What: Depends on what you are buying
  – Engineered item
  – Bulk
  – Field buy
PWP: Life Cycle

Engineering
- Buying
- Expediting
- Inspection
- & Delivery

Procurement
- Receiving
- Storage
- Preservation
- Tracking
- Issuing

Materials Management
- Procure
- Manage
- Install

Contractor

PWP

MTO / MR

PO

Traceability

Field materials

EWP

CWP

Installed / Part of System

Procurement cycle - ends at “Port of Entry”
Transfer of custody
Material management
Who is holding the PWP?

• PWP changes ownership through the lifecycle
• Decide early on the Project the hand-offs: Procurement to Materials Manager to Contractor
Value Proposition of PWP

• Visibility to supply chain on how project will be executed
• Visibility to Construction on how the material is being bought and level of confidence in having it at site before opening work front
• Material Management not chasing individual POs
• Early alignment with Materials Manager during POC development
• Use as a leading indicator of how material/equipment is available to site
WORK PACKAGES / COMPLETION / TURNOVER

- EWP: Engineering deliverables
- CWP: EWP + Construction
- IWPs: Foreman level work execution package
  - FIWP: Field installation work packages
  - MIWP: Module Installation work package
- Sub systems
- System Packages

PWP in the AWP Work Process

EWPs
CWP
IWP
Sub Systems
System Packages
What schedule points are tracked?

- Long Lead Item
- Material Requisition
- Engineering
- Vendor Data for Other Disciplines
- BOM
- Vendor Data for EWP
- Vendor Data
- Ready for Shipment
- Delivered prior to start of CWP
- EWP IFC

Long Lead Eqpt
- EWP
- Bulks & Eng Eqpt
- CWP
Why are we packaging?

- PWP is the bridge that gets us from how we buy to how we build
- AWP in PWP: Early involvement to influence procurement upstream and have strategy for site materials
- Can start during the POC for Material planning by CWAs
- Scope clarity and alignment
- Relevance of how construction is going to do the work with SCM
- Three tie points are: EWP, PWP and POs
- PWPs may have direct correlation to POs or multiple POs
Supply Chain

AWP/WFP

Design

Materials

Planned Resources

CWP

EWP

PWP

Supply Chain
EWP: Rules of Credit

EWP Refresher
What is an EWP?

**Engineering Deliverable**
- Scope of Work
- Drawings
- Engineering specifications & standards
- Procurement information
- Vendor documents
- Quality requirements

**Engineering/Construction Deliverable**
- Construction Scope of Work
- Engineering Information
- Craft / Manpower
- Direct Field Equip / Mat’l
- Safety
- Quality (QA / QC)
- Special Permits / Regulatory
- Subcontractors
- Vendor support data
- Rigging studies
- Scaffold
- Special equip / tools/ consum.
- Waste management
- Risk register
- WFP
- Project Controls
- Turn-over documents
- Contact List

**Construction Deliverable**
- Scope Deliverable
- Activities
- Resources: equipment, tools
- materials, labour, work instructions, safety equipment, drawings, vendor data, ...
- Special Conditions
- Quality Control
- Interdependencies
- Risk Planning
- Error Proofing

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**Diagram**

- **EWP**
- **CWP**
- **IWP**
Construction Work Package
Engineering Work Package
Installation Work Package
Why is progressing important?

• The entire AWP/WFP strategy is dependent on Engineering and Procurement providing their deliverables to meet Path of Construction

• Contractor mobilizes and plans execution based on Engineering forecast of IFC EWPs

• Contractor depends on information being accurate and timely for all Procurement Updates and ensuring all material and equipment will be available before scheduled start date of each specific IWP
Conventional EWP Progressing

• Deliverable based

• Gated progression

• Unclear how each individual deliverable progress contributes (relates) to the overall EWP Progress, especially if sub-EWP components are not progressed (i.e. quality requirements)
Proposed EWP Progressing

• Package progress

• Gated progression

• Deliverables may be indicated as milestones where needed
## Generic EWP progress

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<thead>
<tr>
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<th>%</th>
<th>CUM</th>
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<tbody>
<tr>
<td>Initial Scope Identified</td>
<td>5</td>
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<tr>
<td>Initial Design (Modelling)</td>
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<td>40</td>
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<tr>
<td>Preliminary Vendor Data Received (Where Applicable)</td>
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<td>45</td>
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<tr>
<td>Preliminary MTO/BOM (Bulks) to Supply Chain</td>
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<tr>
<td>Final Vendor Data Received / Checks (Where Applicable)</td>
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<tr>
<td>Model Finalized (90%)</td>
<td>15</td>
<td>70</td>
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<tr>
<td>Deliverables (incl. final MTOs, etc)</td>
<td>15</td>
<td>85</td>
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<tr>
<td>EWP Reviews (Including: Eng Checking / Squad Check / IFR, etc)</td>
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<td>90</td>
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<tr>
<td>EWP c/w Drawing/Spec/MTOs Issued IFC</td>
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<td>95</td>
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<tr>
<td>EWP Accepted by Construction</td>
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Example – discipline progressing

• Piping deliverables
  – Development of 3D Model
  – Drawings (Isometrics, plans, etc.)
  – P & IDs
  – Requisitions
  – Specifications
  – Pipe Stress Analysis
  – Calculations
  – Scope write-up
  – ...

[Image of construction site]
# Piping EWP progressing

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Applicability

• Generic template applied to all disciplines (your process may differ slightly)
  - Tied to vendor data
  - Tied to construction acceptance

• Milestones are added as required for internal control

• Traditional progressing can be used to assess individual deliverables
Enhancing AWP

POC, PWP & ROC
Why enhance the best practice?

• **THE KEY** to successful WFP within AWP Implementation is to have Engineering Work Packages (EWPs) / and Procurement Work Packages (PWPs) provided complete and on time to support the Path of Construction on your project.

• The BP should be applicable to **ALL** contracting strategies.
What does WFP Planner need?

• EWP/PWP deliverables that provide all engineering and procurement information needed to produce IWPs to execute the scope of work are complete and delivered to meet the Path of Construction.

• Confidence that forecasted EWP/PWP deliverables will be met

• Ability to easily find material status / location
Enhancing procurement

• Equipment and material in range of 50% of TIC.
• Surveys show Vendor Data requirements are not clear (if even specified at all) on over 50% of Quotations (RFQs) and over 35% of Purchase Orders
• Ability to quickly find material status
• Vendor alignment is being overlooked
Basics of AWP
Summary

• BP to incorporate Path of Construction
• EWPs and PWPs are mapped to CWPs
• Tie PWP into the AWP Process
• Use formats / templates in IR 272 as guidelines
• Incorporate Rules of Credit into BP
Thank You For Attending

Q & A