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Path of Construction

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

Presenters

Glen Warren – COAA Co-Chair, Industry Expert Emeritus

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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

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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 workface planning will generate pathetic labour productivity**

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When Engineering Slips

Late Procurement — 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

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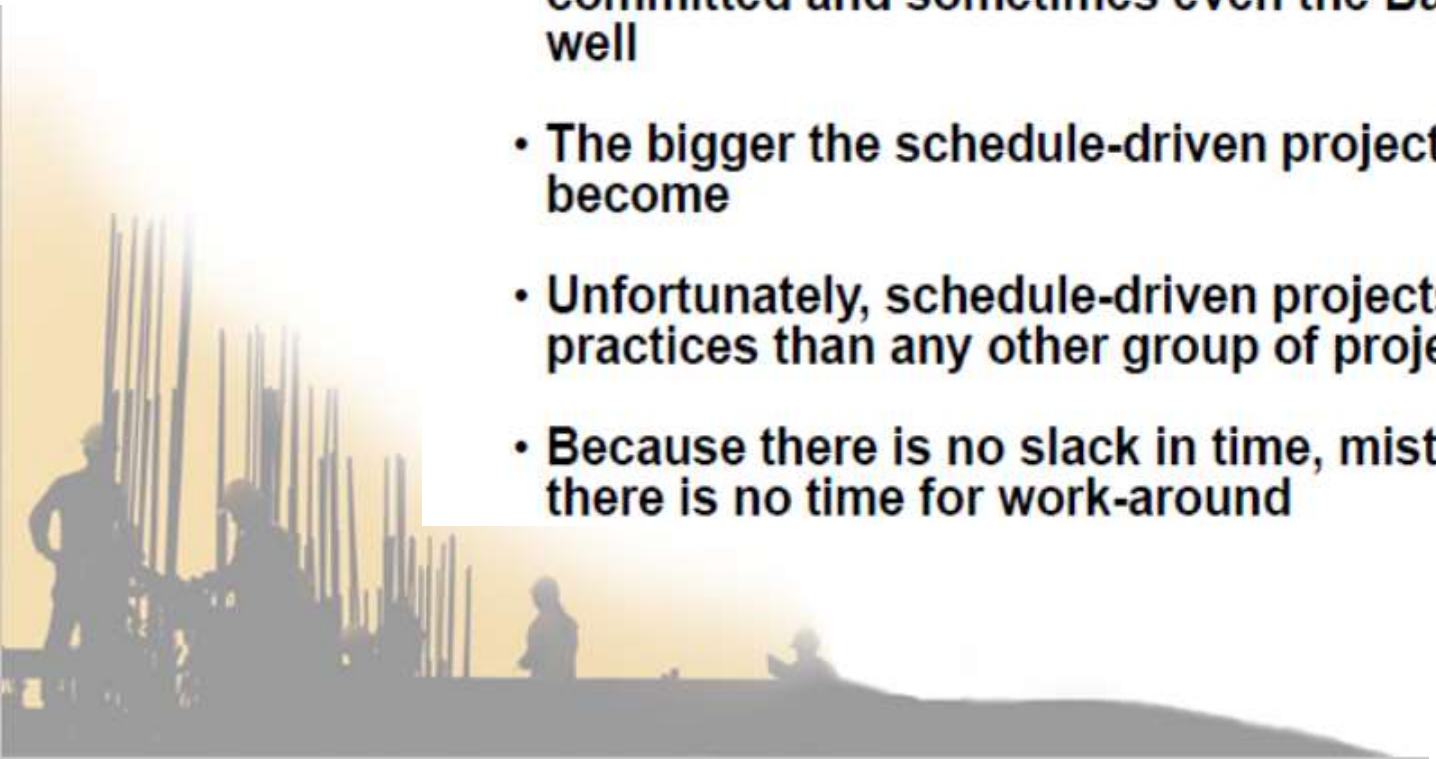
What Is the Problem?

- 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



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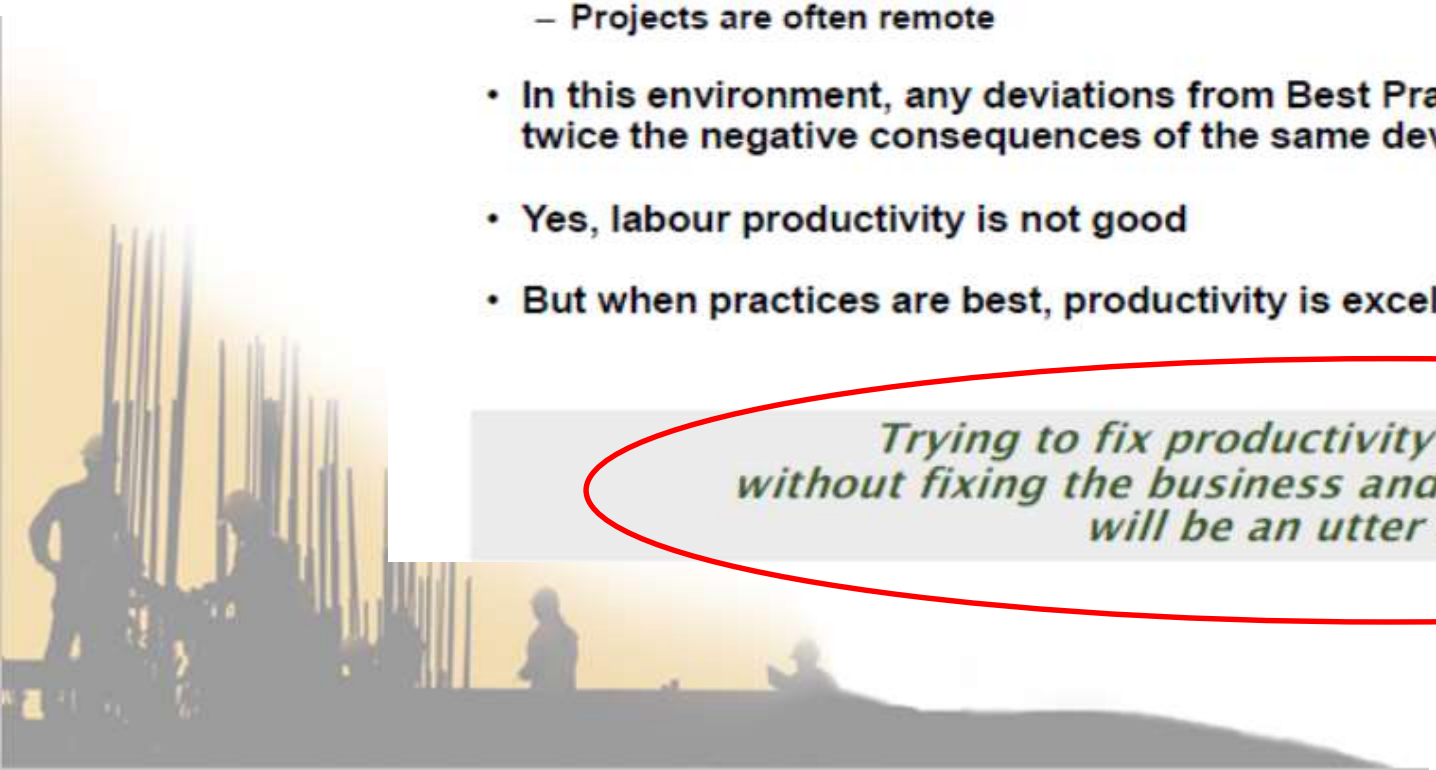
In Alberta, All Mistakes Are Punished

- 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

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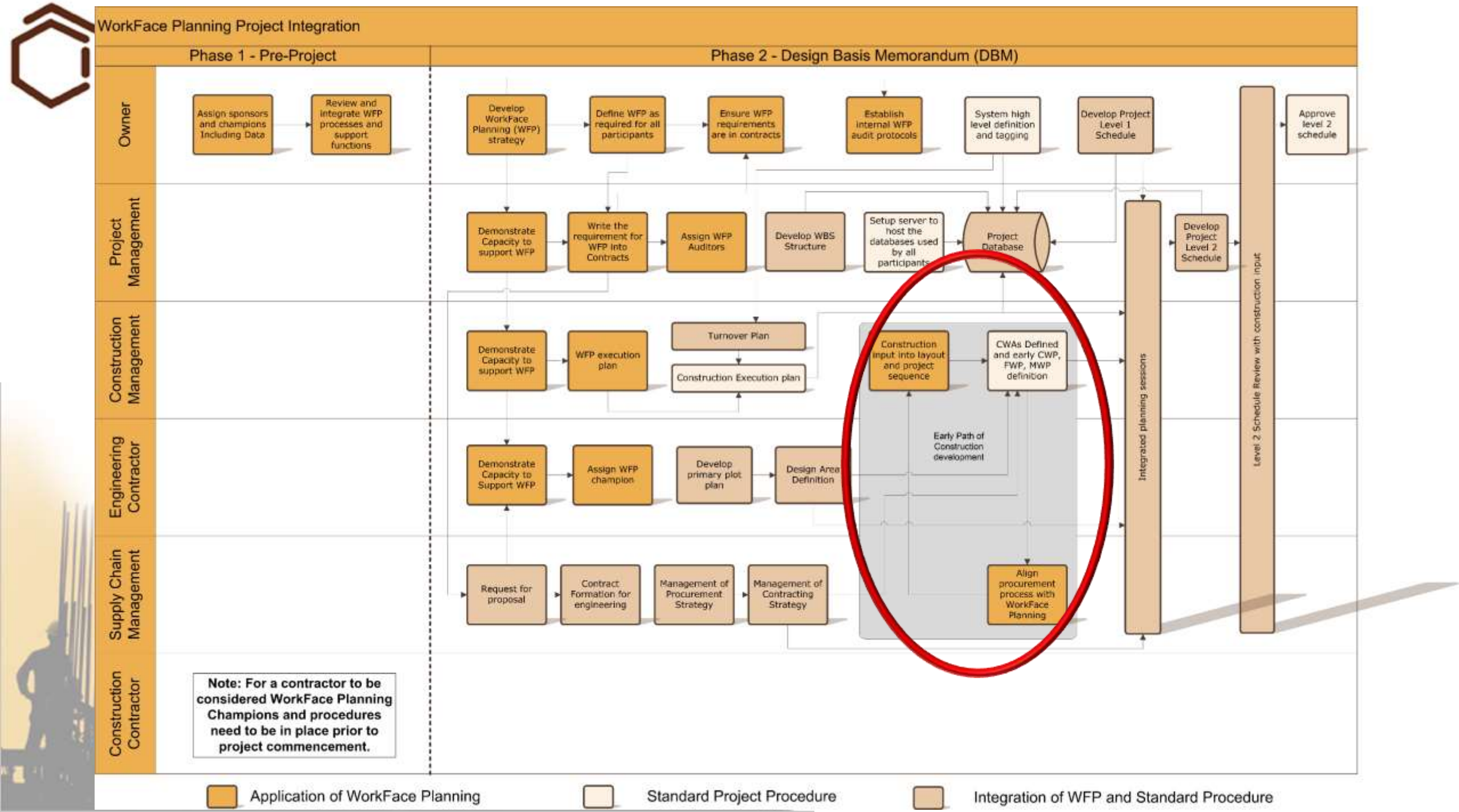
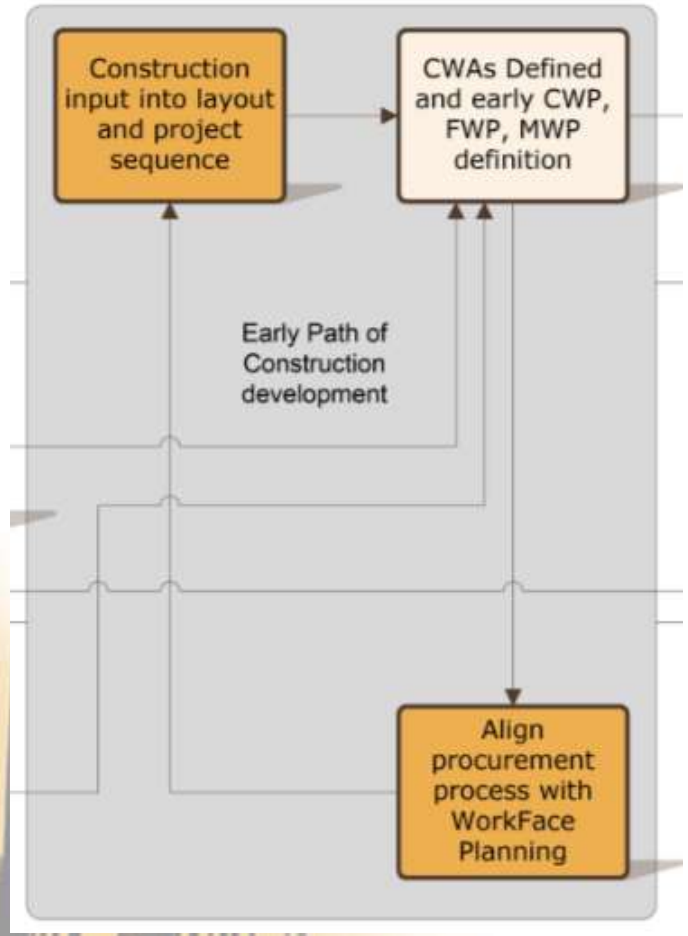
What is Path of Construction?


WorkFace Planning Project Integration
Phase 1 - Pre-Project
Phase 2 - Design Basis Memorandum (DBM)
Owner
Project Management
Construction Management
Engineering Contractor
Supply Chain Management
Construction Contractor
Assign sponsors and champions Including Data
Review and integrate WFP processes and support functions
Develop WorkFace Planning (WFP) strategy
Define WFP as required for all participants
Ensure WFP requirements are in contracts
Establish internal WFP audit protocols
System high level definition and tagging
Develop Project Level 1 Schedule
Approve level 2 schedule
Demonstrate Capacity to support WFP
Write the requirement for WFP into Contracts
Assign WFP Auditors
Develop WBS Structure
Setup server to host the databases used by all participants
Project Database
Develop Project Level 2 Schedule
Level 2 Schedule Review with construction input
Demonstrate Capacity to support WFP
WFP execution plan
Turnover Plan
Construction Execution plan
Construction input into layout and project sequence
CWAs Defined and early CWP, FWP, MWP definition
Integrated planning sessions
Early Path of Construction development
Demonstrate Capacity to Support WFP
Assign WFP champion
Develop primary plot plan
Design Area Definition
Request for proposal
Contract Formation for engineering
Management of Procurement Strategy
Management of Contracting Strategy
Align procurement process with WorkFace Planning
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

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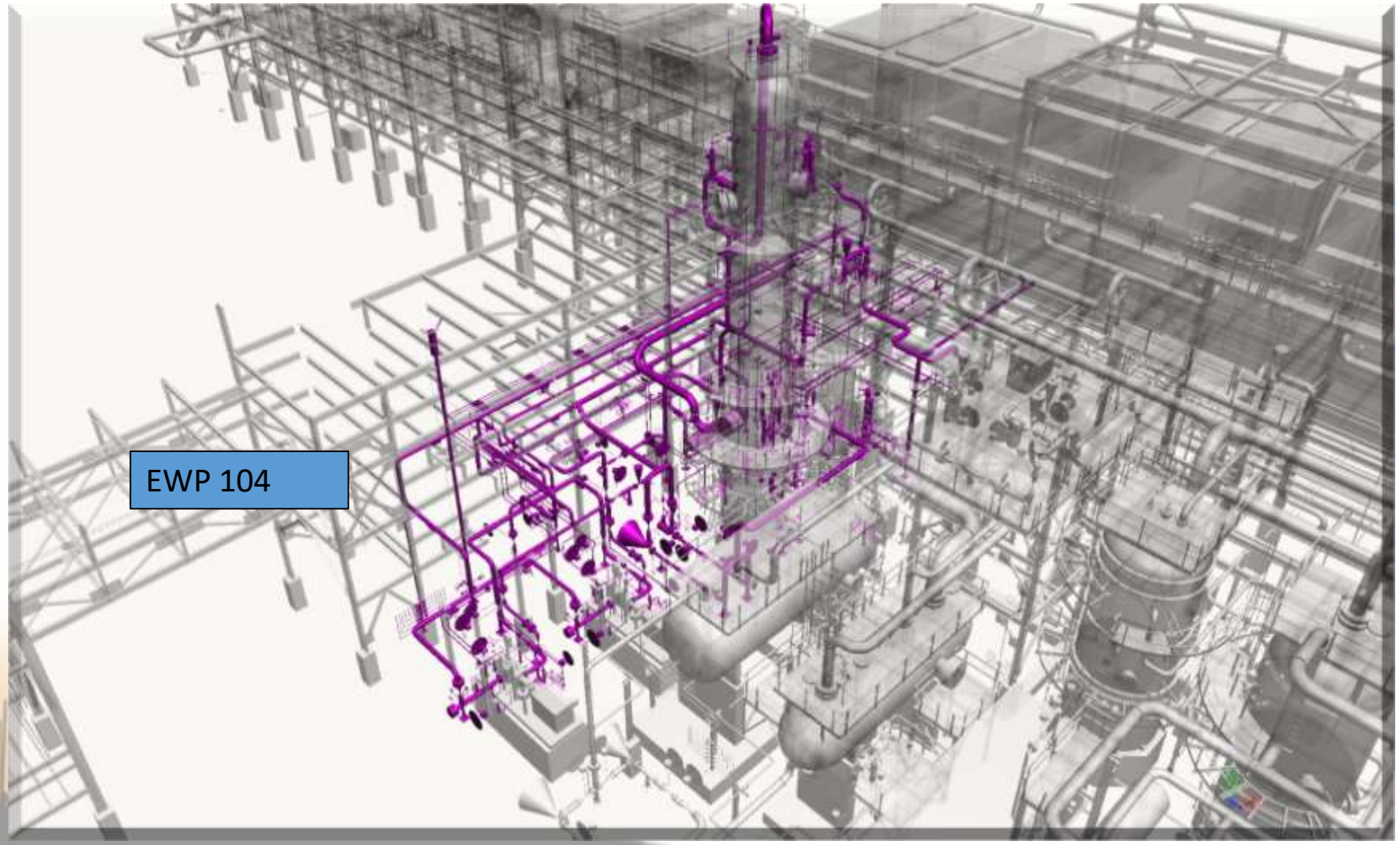
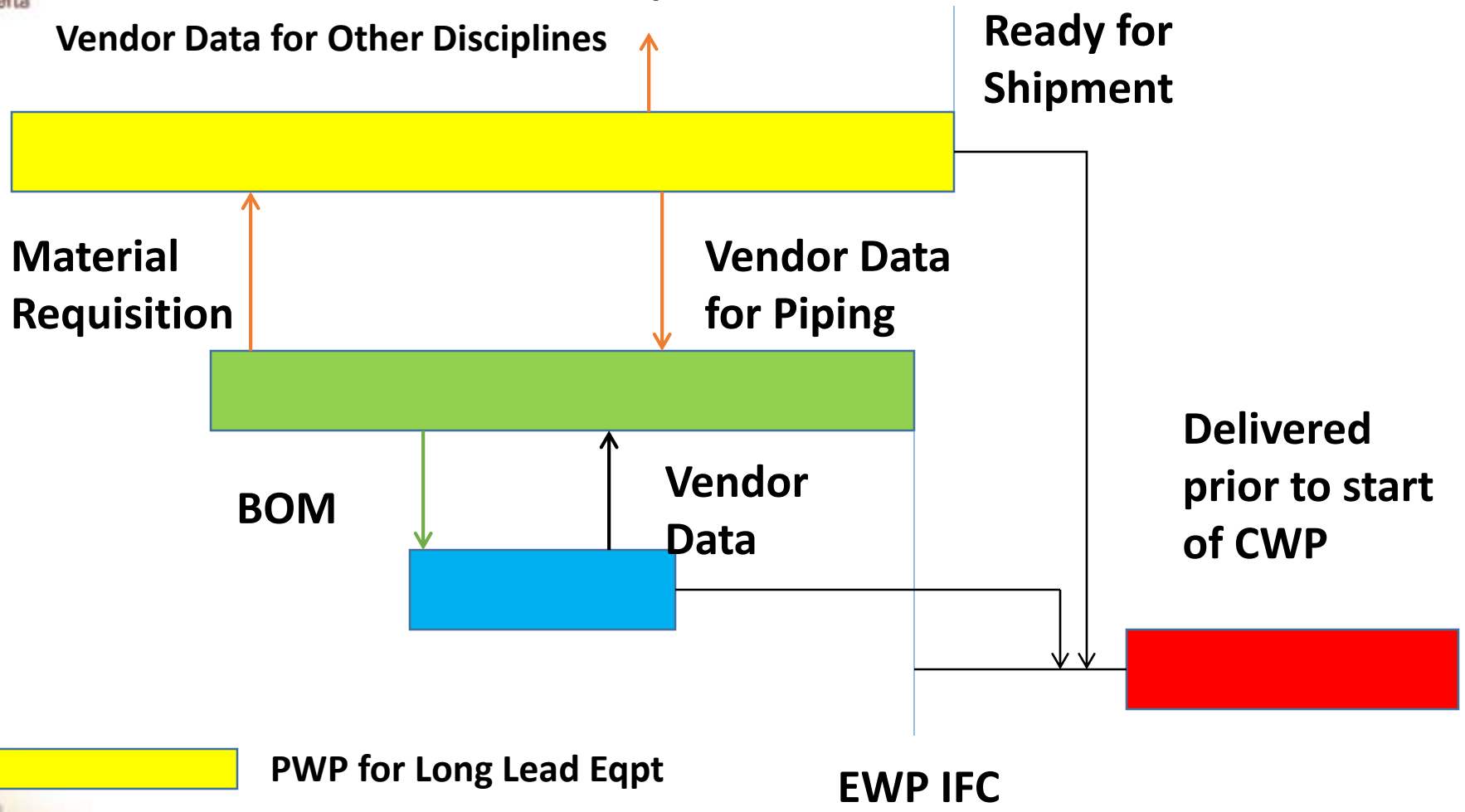
Typical Piping EWP



Details required for POC



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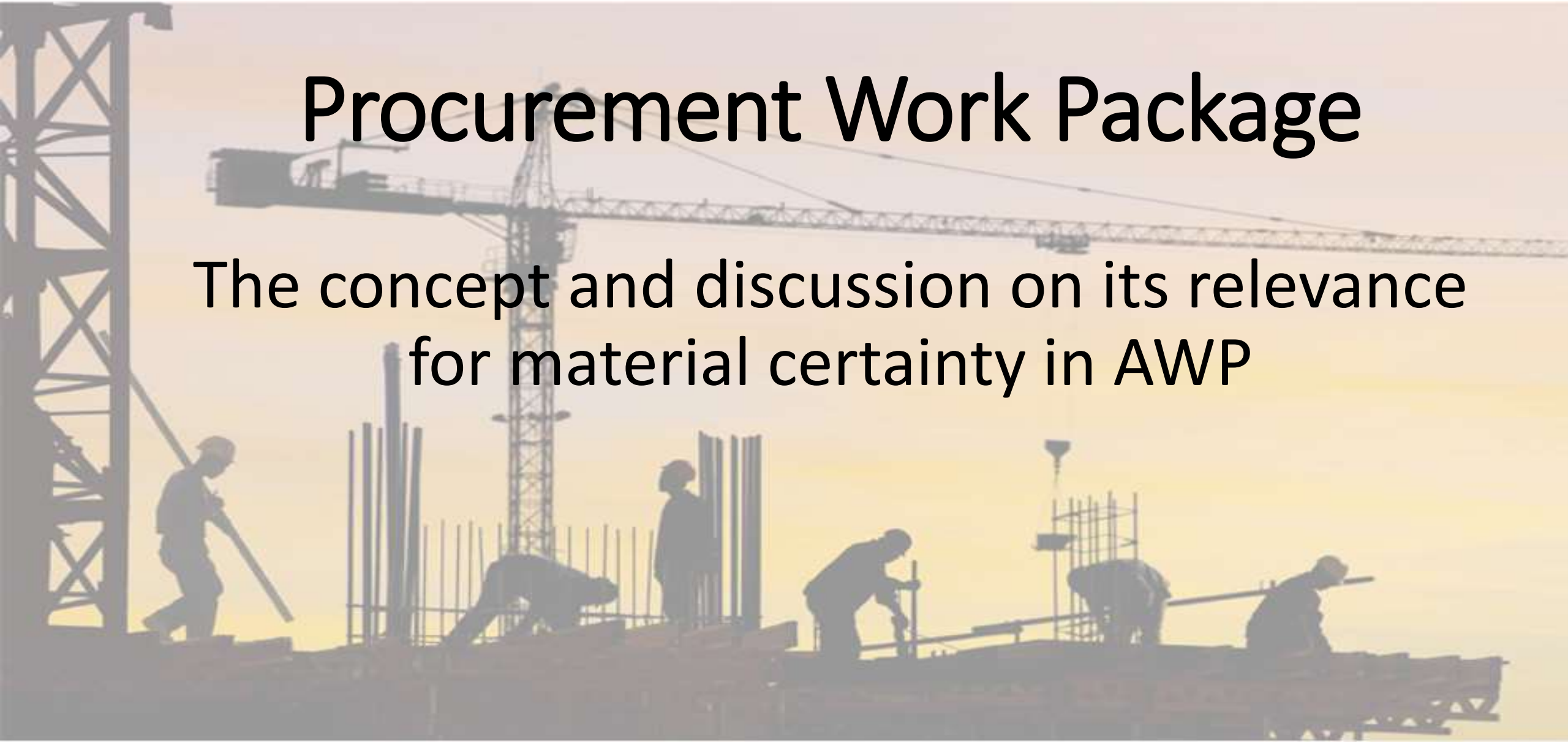


Procurement Work Package

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

PWP

MTO / MR

PO

Traceability

Field materials

Engineering → Procurement → Materials Management → Contractor

EWP

- Buying
- Expediting
- Inspection
- & Delivery

- Receiving
- Storage
- Preservation
- Tracking
- Issuing

- Procure
- Manage
- Install

CWP

Installed / Part of System

Procurement cycle - ends at
"Port of Entry"
Transfer of custody
Material management

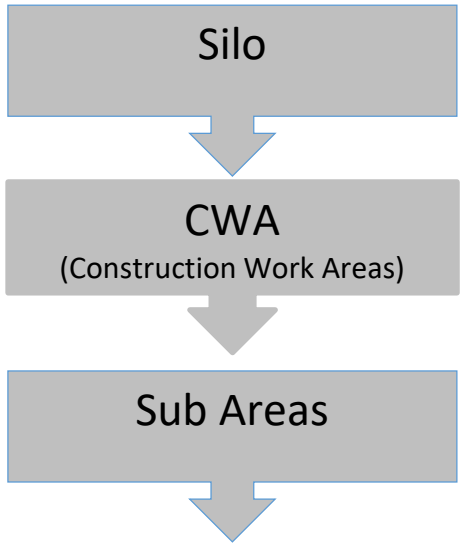
Who is holding the PWP?

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

Value Proposition of PWP

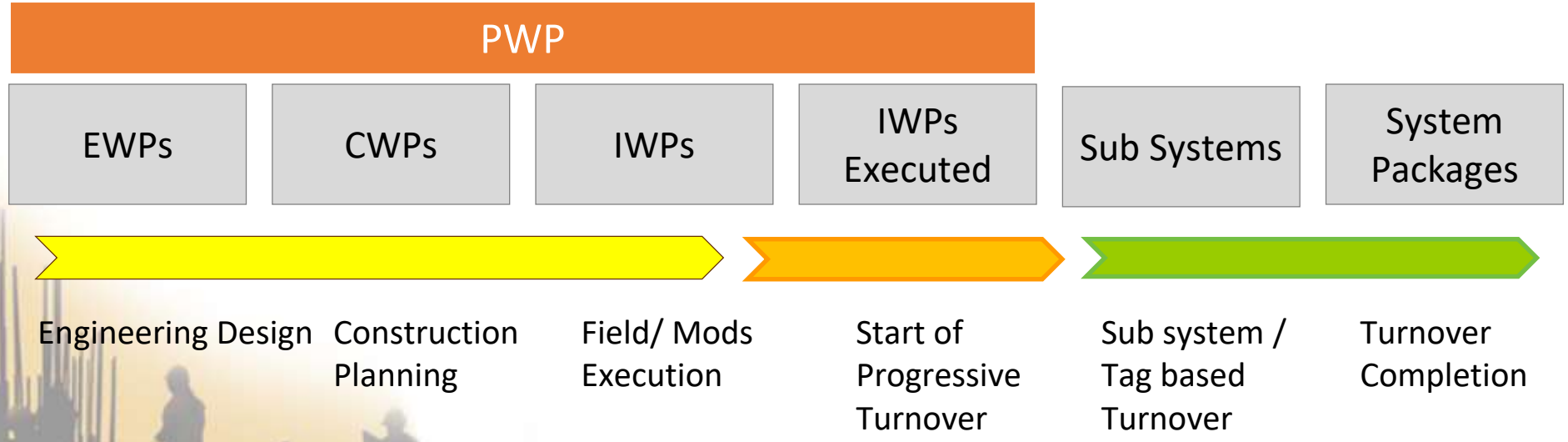
- **Visibility to supply chain on how project will be executed**
- **Visibility to Construction on how the material is being bought and level of confidence in having it at site before opening work front**
- **Material Management not chasing individual POs**
- **Early alignment with Materials Manager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

PWP in the AWP Work Process

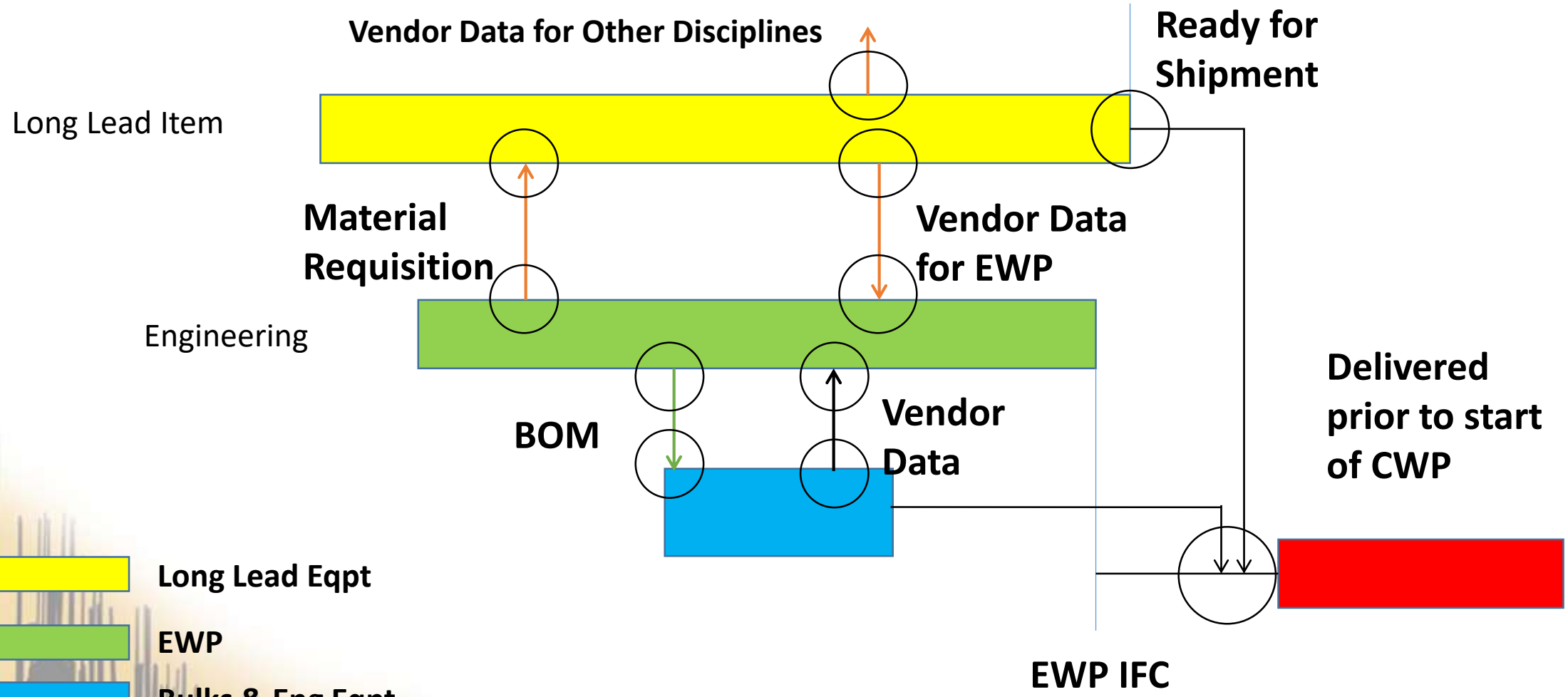


WORK PACKAGES / COMPLETION / TURNOVER

- 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



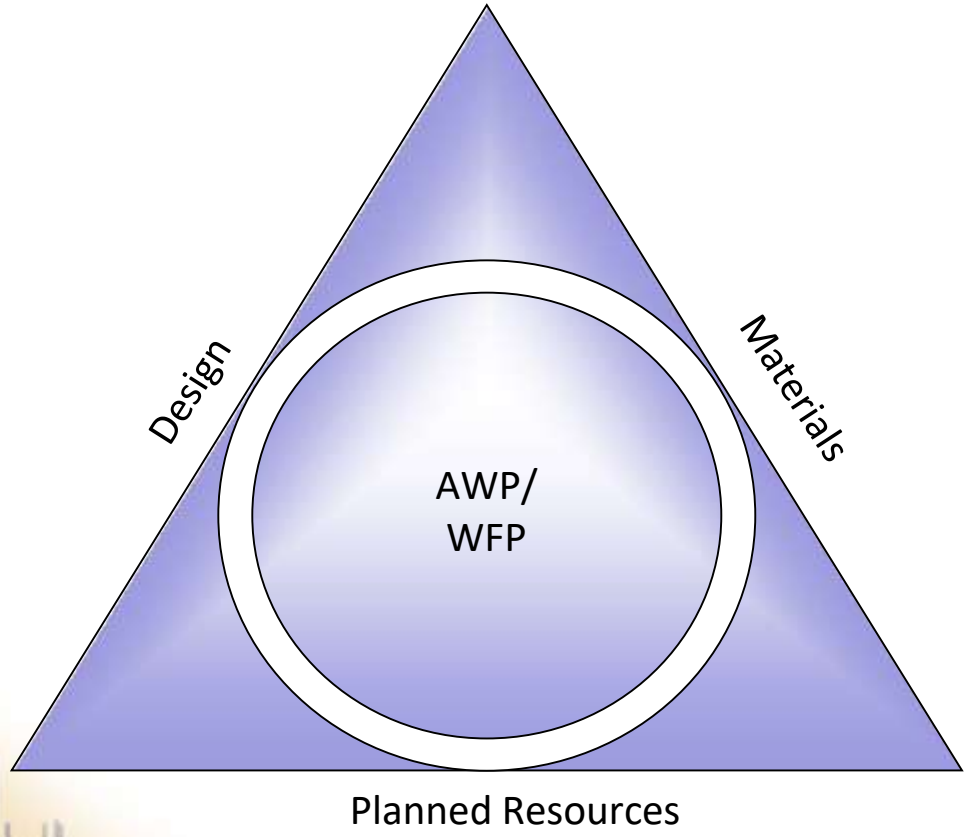
What schedule points are tracked?



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

AWP/WFP



EWP

PWP

Supply Chain

CWP

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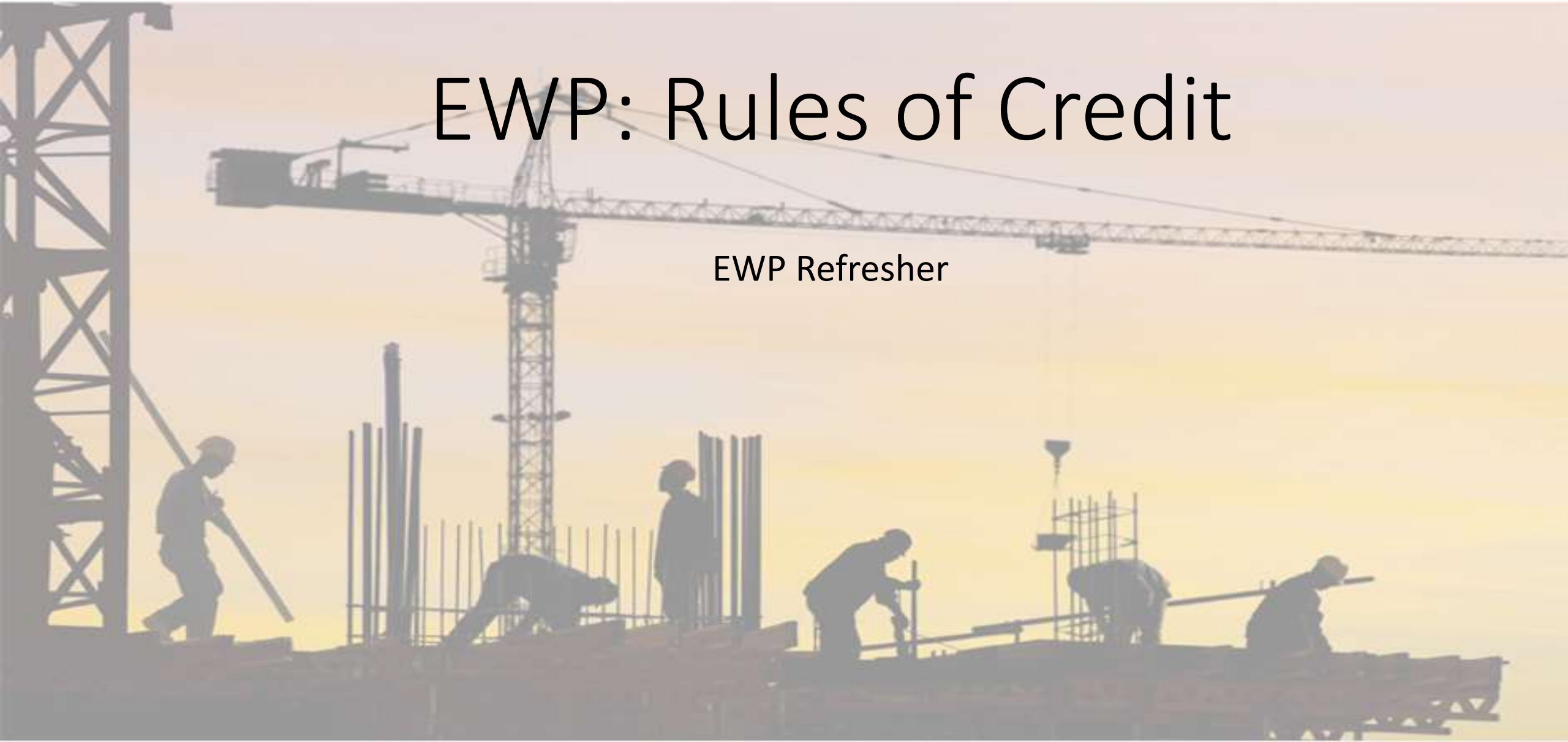

EWP: Rules of Credit

EWP Refresher

What is an EWP?

EWP → CWP → IWP

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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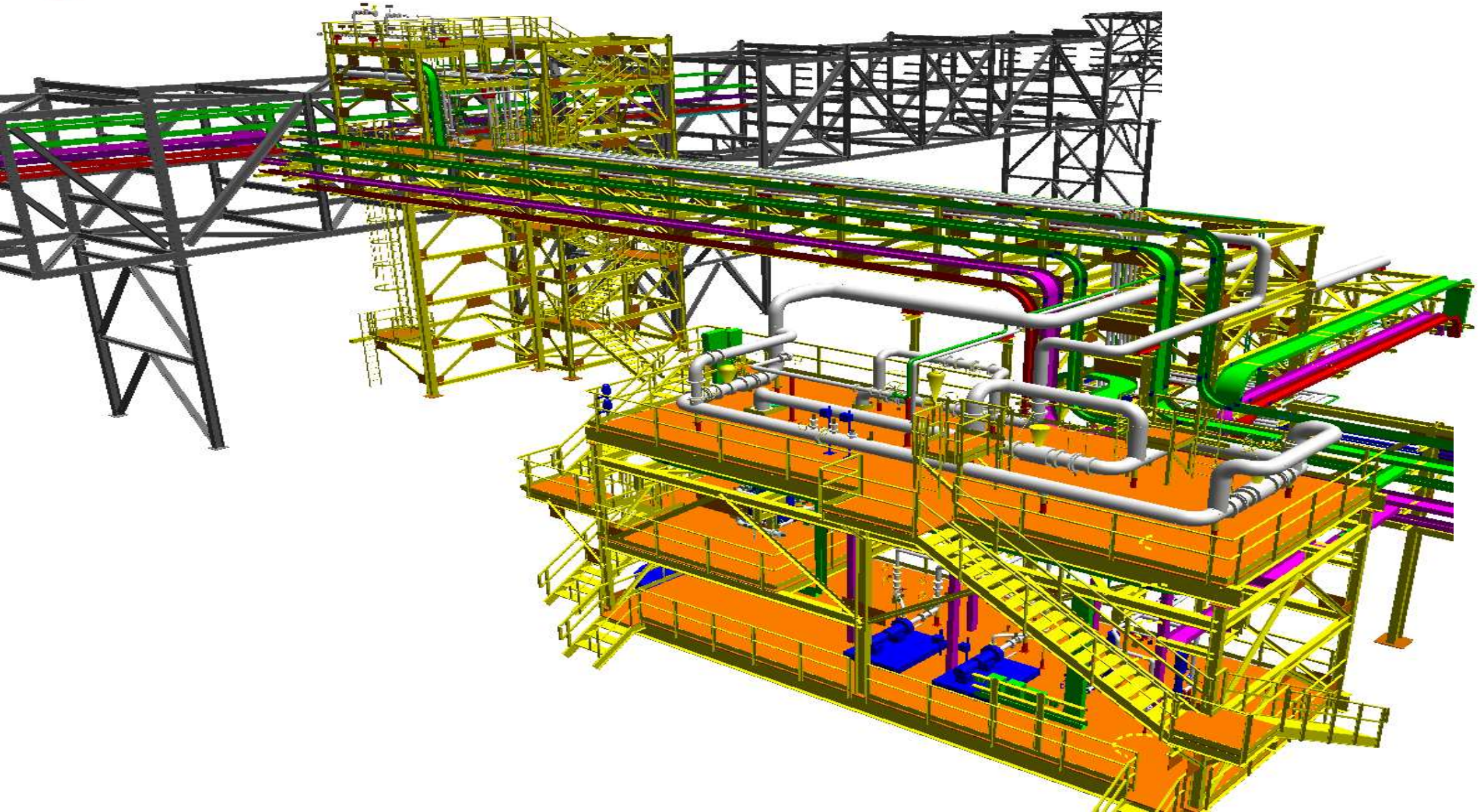

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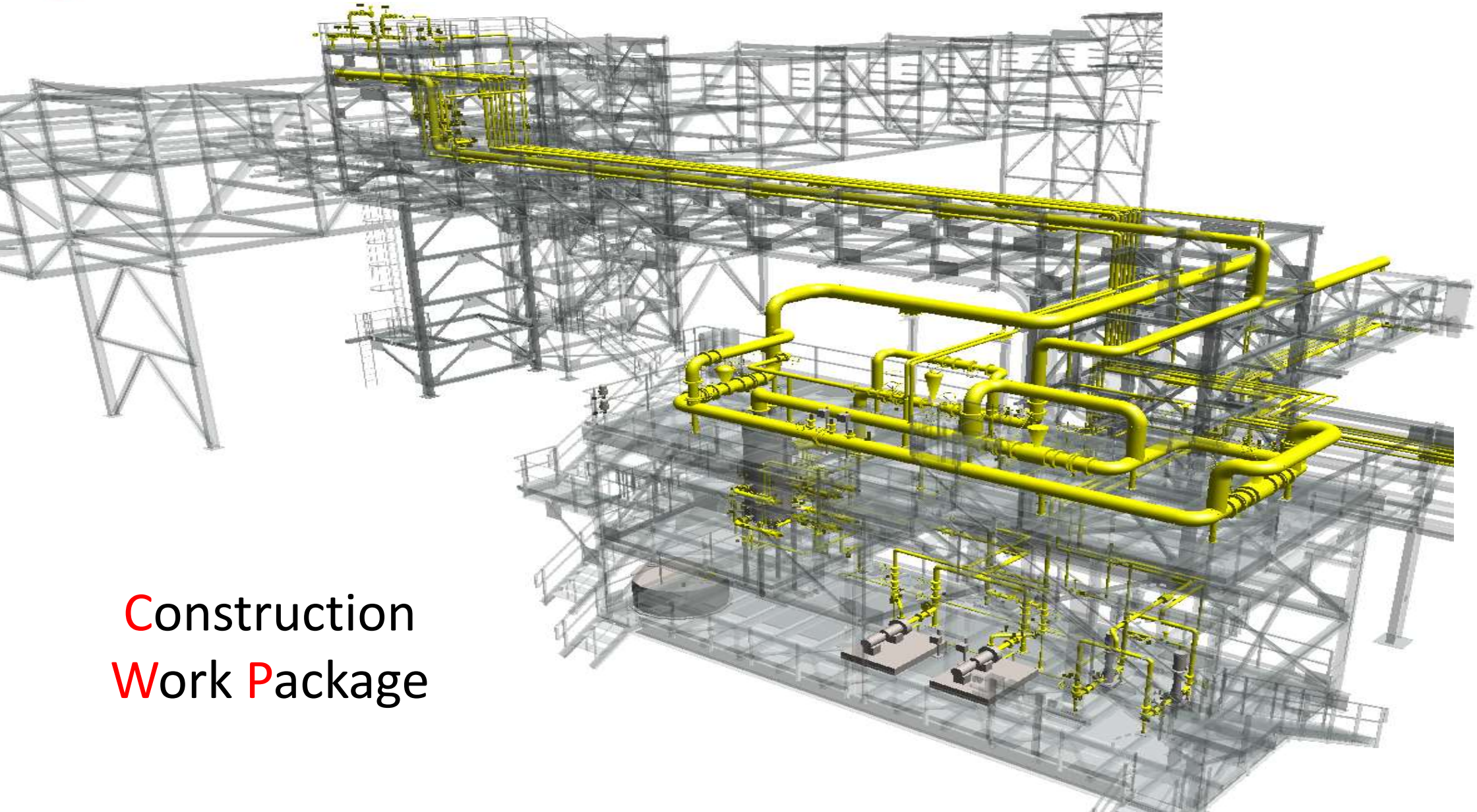

Construction Work Package

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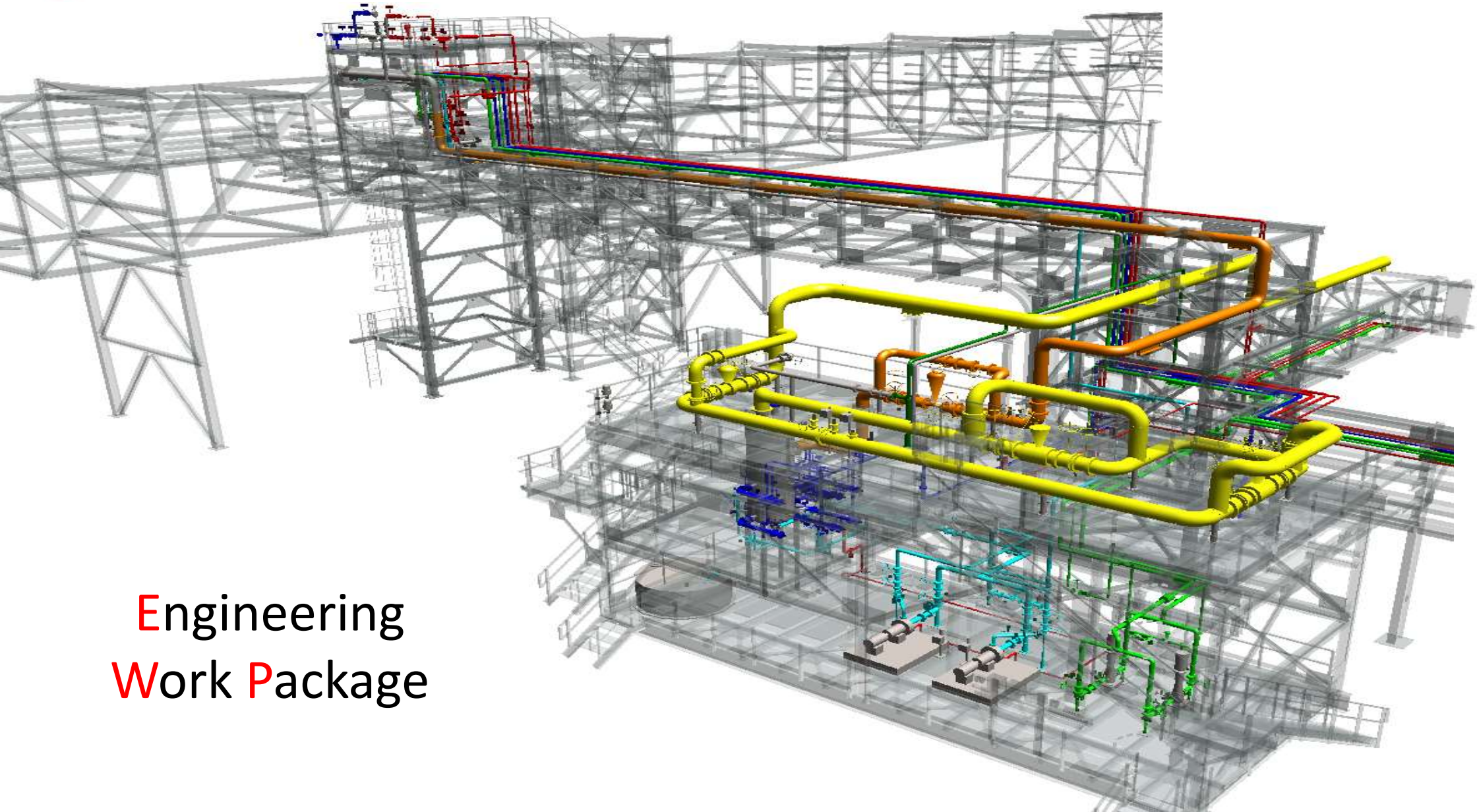

Engineering
Work Package

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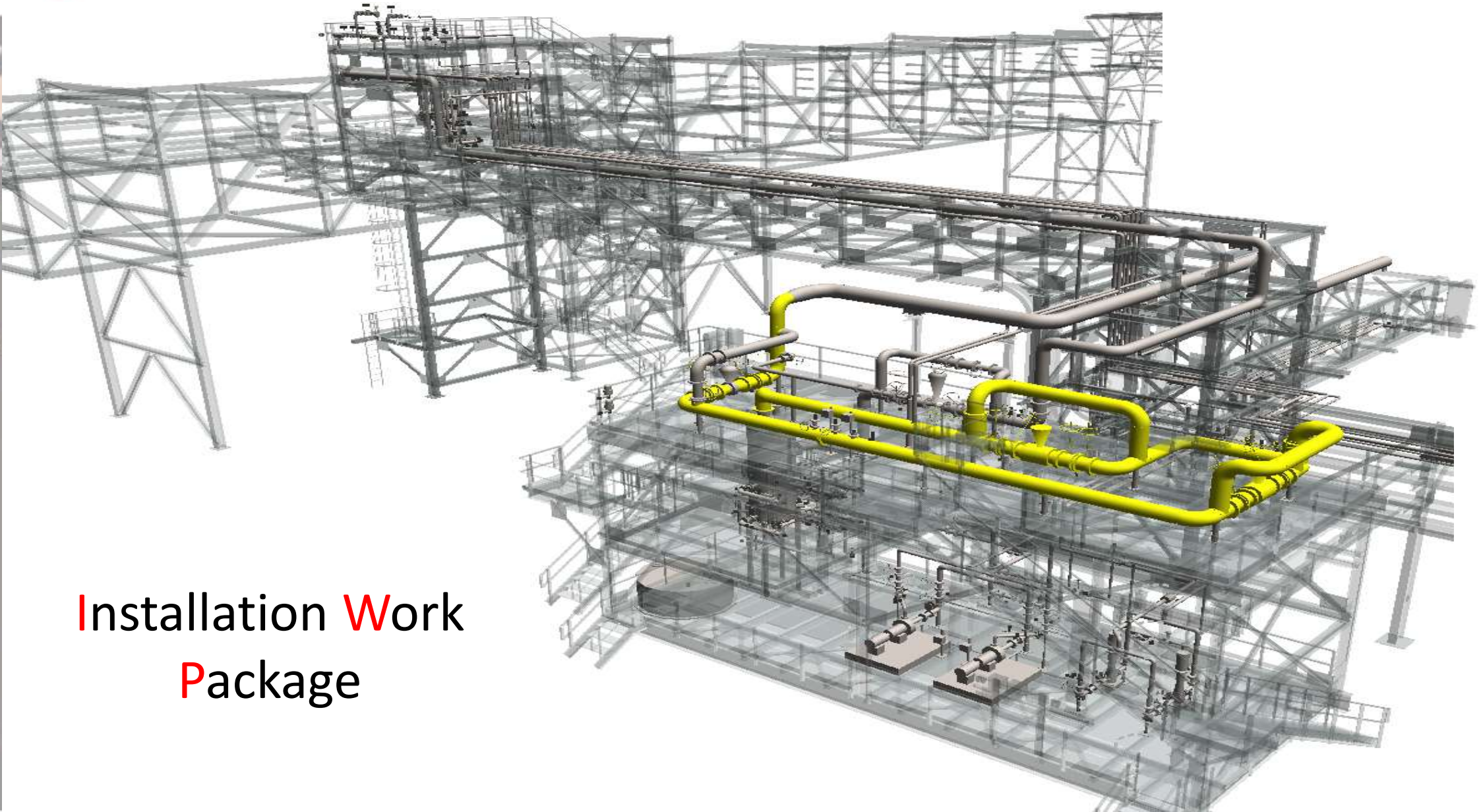


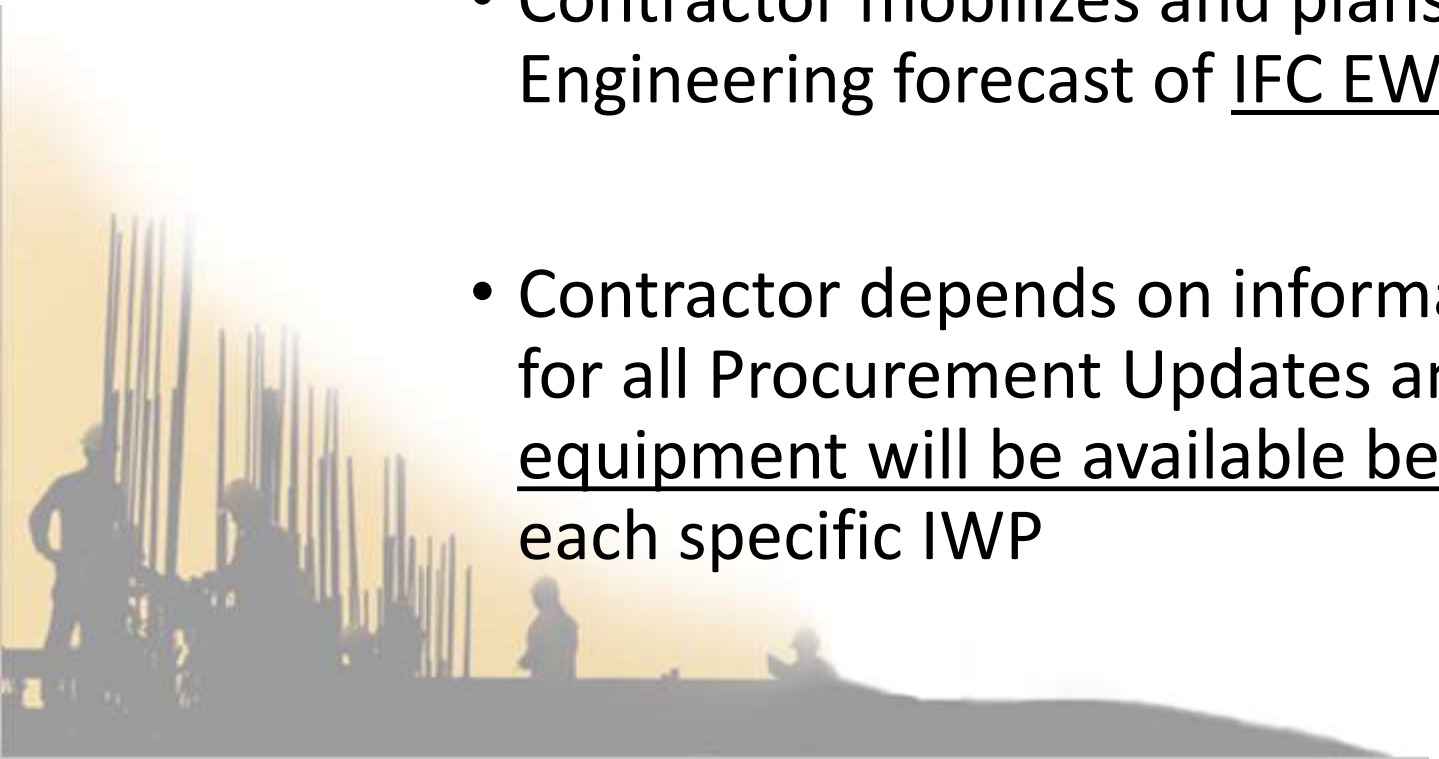
Installation Work Package

Why is progressing important?

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

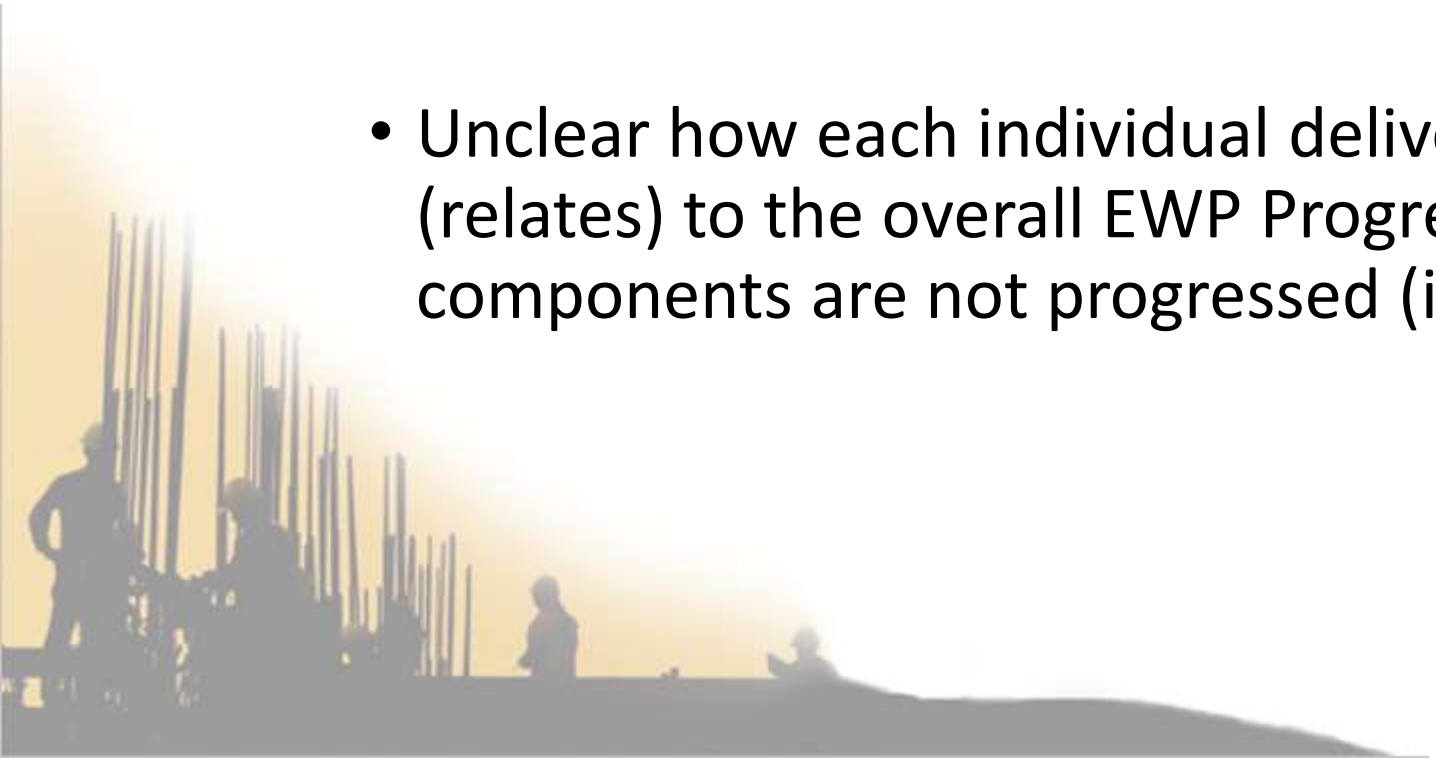
- Contractor mobilizes and plans execution based on Engineering forecast of IFC EWPs

- 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

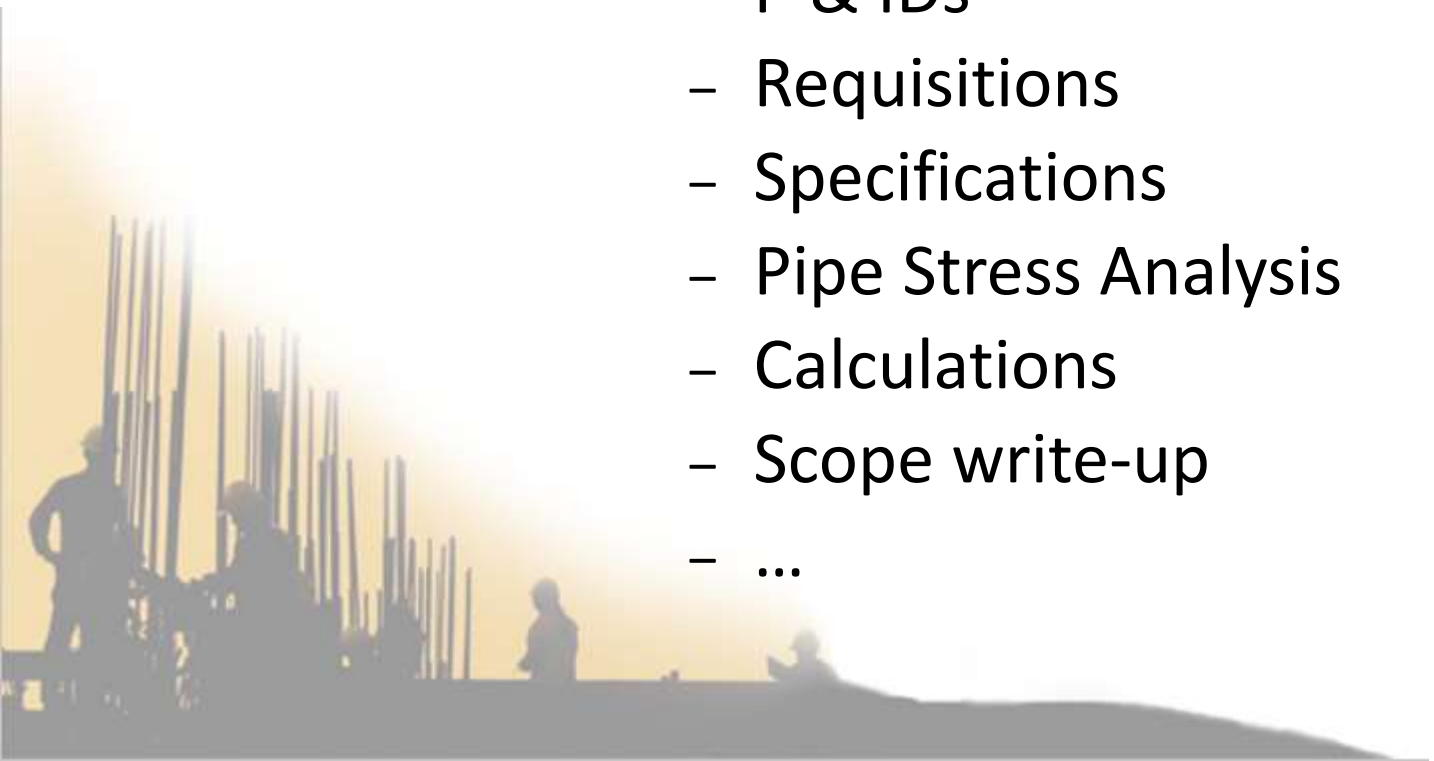
- Package progress
- Gated progression
- Deliverables may be indicated as milestones where needed

Generic EWP progress

GENERAL	%	CUM
Initial Scope Identified	5	5
Initial Design (Modelling)	35	40
Preliminary Vendor Data Received (Where Applicable)	5	45
Preliminary MTO/BOM (Bulks) to Supply Chain	5	50
Final Vendor Data Received / Checks (Where Applicable)	5	55
Model Finalized (90%)	15	70
Deliverables (incl. final MTOs, etc)	15	85
EWP Reviews (Including: Eng Checking / Squad Check / IFR, etc)	5	90
EWP c/w Drawing/Spec/MTOs Issued IFC	5	95
EWP Accepted by Construction	5	100

Example – discipline progressing

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



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Piping EWP progressing

PIPING / MECHANICAL		%	CUM
Initial Scope Identified		5	5
P&IDs / LDTs IFC	Milestone		20
Preliminary Stress	Milestone		35
Initial Design (Modelling)		35	40
Preliminary Vendor Data Received (Where Applicable)		5	45
Preliminary MTO/BOM (Bulks) to Supply Chain		5	50
Final Vendor Data Received / Checks (Where Applicable)		5	55
Final Stress	Milestone		65
Model Finalized (90%)		15	70
Deliverables (incl. final MTOs, etc)		15	85
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EWP c/w Drawing/Spec/MTOs Issued IFC		5	95
EWP Accepted by Construction		5	100

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

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Enhancing AWP

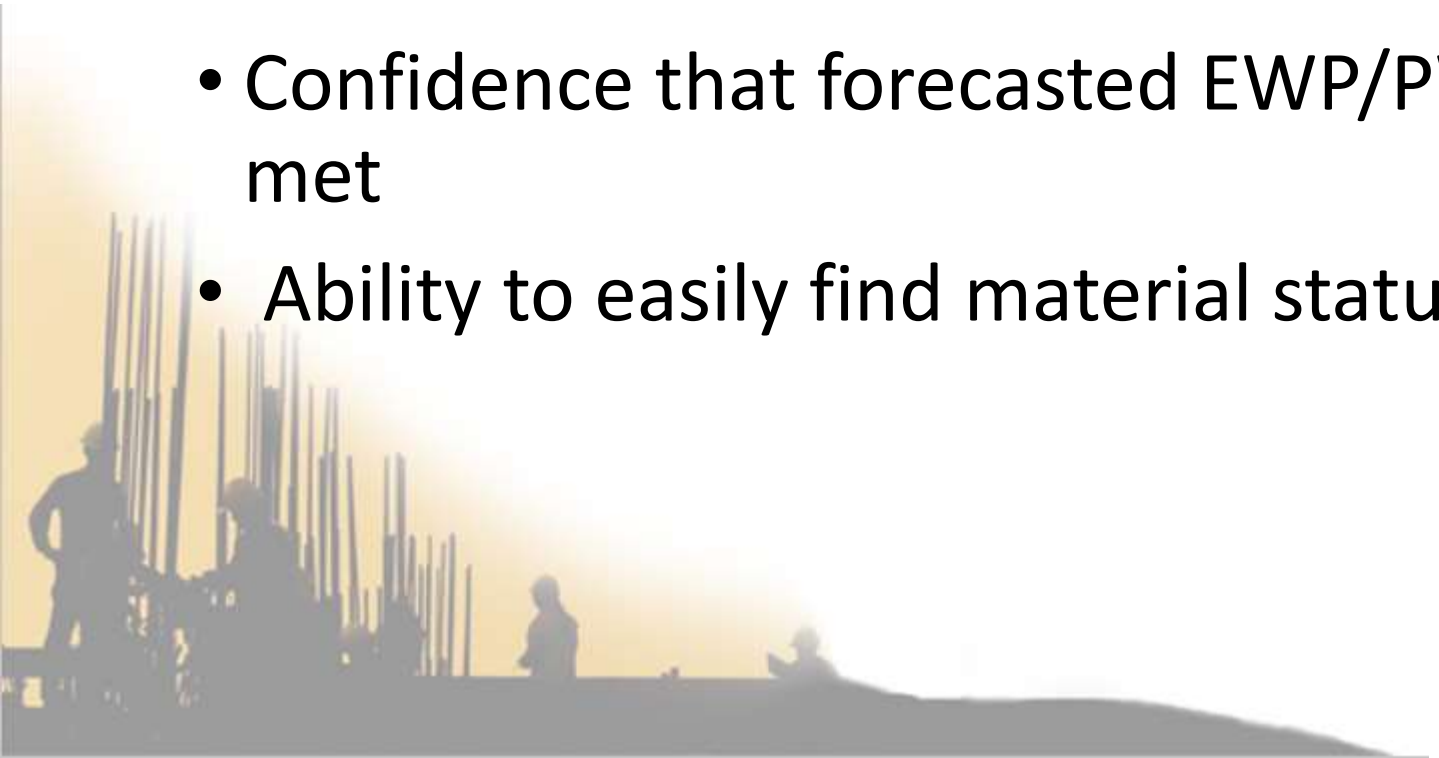
POC, PWP & ROC

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 projec
- The BP should be applicable to ALL contracting strategies

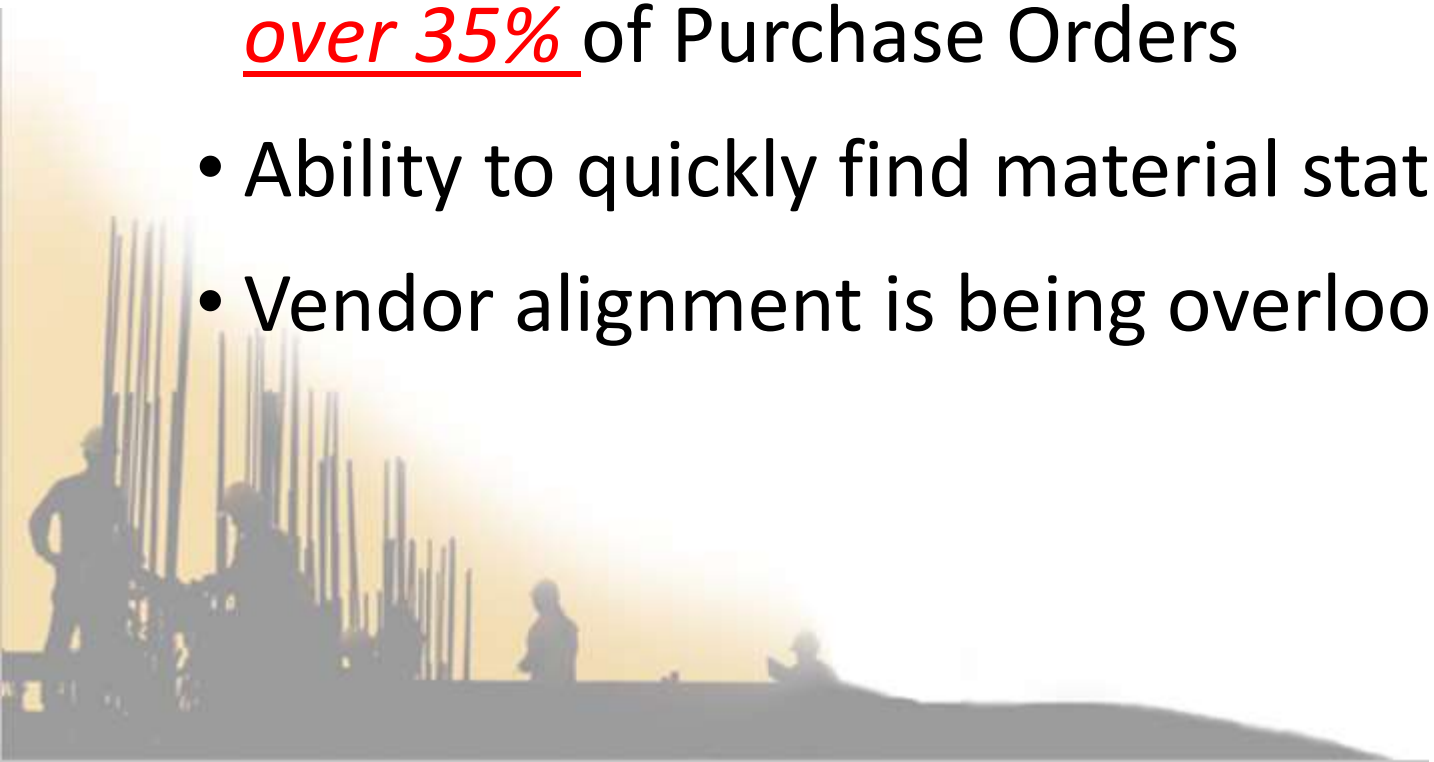
What does WFP Planner need?

- 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

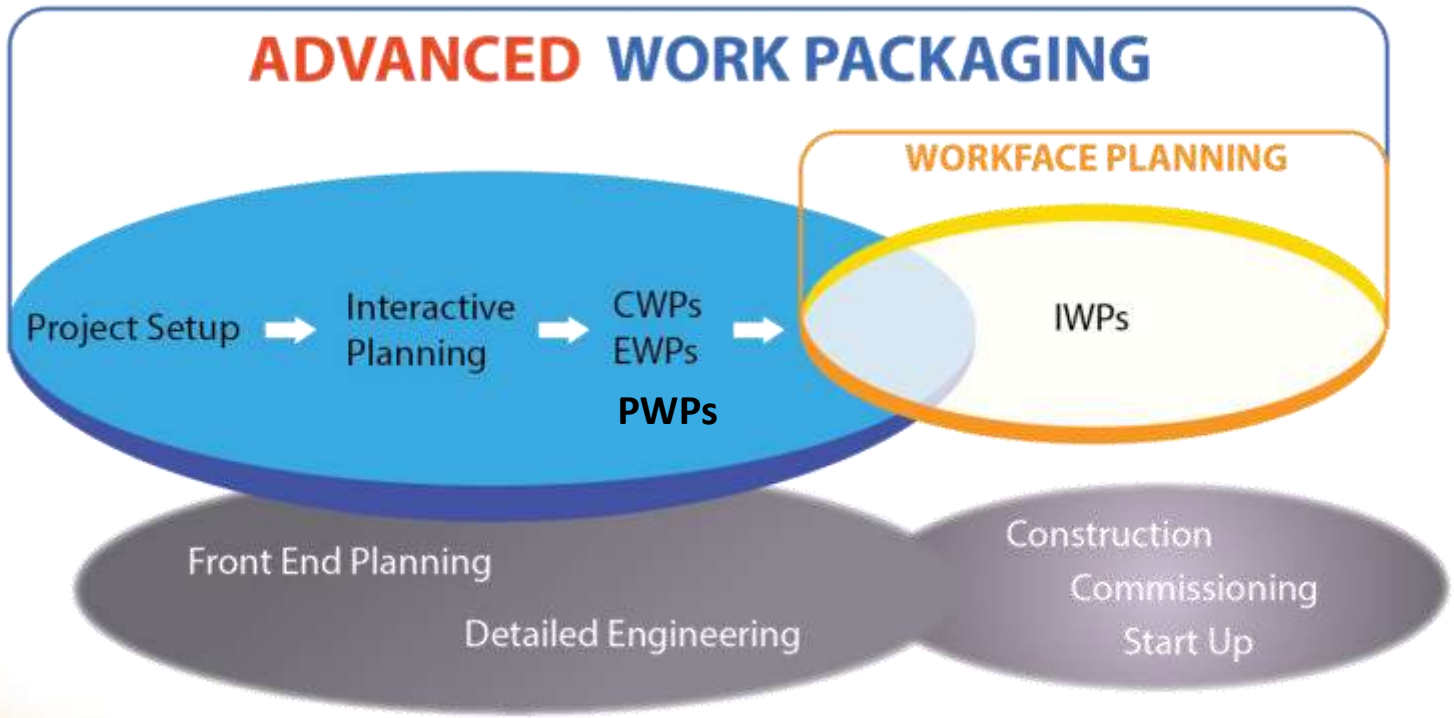


Enhancing procurement

- 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

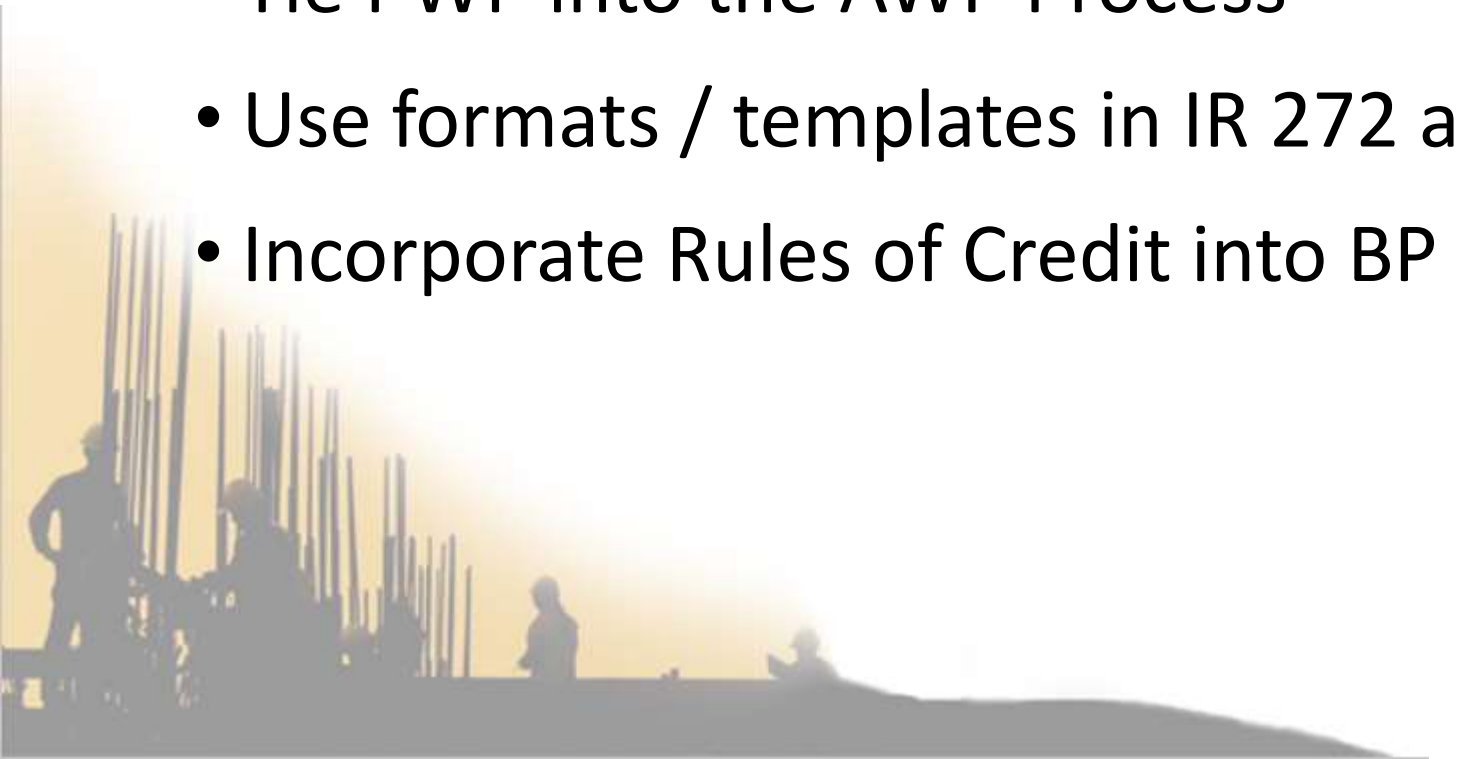


Basics of AWP



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



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Q & A