AGENDA

1. Scalability of AWP for Smaller Projects: Lloyd (Yogesh)
2. Return on Investment of AWP Implementation: Ryan P & Yonus
3. EWP Readiness Assessment Tool: Joe Hobbs
4. PWP – The Procurement Work Process: Yogesh
5. Path of Construction: Glen
6. Mindfulness: Yogesh

Special Note: Revised edition of Schedule for Sale
1. SCALABILITY OF AWP

Presented by: Yogesh

Note – actual scalability presentation is being done at same time
Committees and Chairs

The committees are composed of over 40 professionals from the owner, and engineering, supply chain and construction communities from both sides of the border.

<table>
<thead>
<tr>
<th>Committee</th>
<th>Chair</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steering Committee</td>
<td>Lloyd Rankin (Group ASI)</td>
</tr>
<tr>
<td>Owners</td>
<td>Jeremy Furzer (Enbridge)</td>
</tr>
<tr>
<td>Engineering and Supply Chain</td>
<td>Randy Friesen (Fluor)</td>
</tr>
<tr>
<td>Front-End Construction (FEC)</td>
<td>Kirk Harris (Black &amp; Veatch)</td>
</tr>
<tr>
<td>WorkFace Planning (WFP)</td>
<td>Ben Swan (Element Industrial)</td>
</tr>
<tr>
<td>Editor</td>
<td>Narjis Shahzad (Teknobuilt)</td>
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</tbody>
</table>
Our Mandate

• Improving smaller projects’ ($100 million and under) outcomes through the application of Advanced Work Packaging principles.
• The objective is... maximize value through the right planning at the right time to improve project performance as measured by:
  o Productivity
  o Cost
  o Safety
  o Schedule
  o Quality
  o Predictability
AWP Principles: Never Changing

1. Determine how you will build the project (POC)
2. Determine how to package the project
3. Determine how to manage the packages
4. Identify and supply the necessary information
5. Identify and supply the necessary materials requirements
6. Identify and supply the necessary equipment requirements
7. Identify and supply the necessary labor requirements
AWP Practices: Must Change
## Project Classification Tool

**Ready Now**

### COAA AWP - SCALABLE

#### Construction Familiarity & Complexity Screening Tool

<table>
<thead>
<tr>
<th>No</th>
<th>Question</th>
<th>Complexities (Risks)</th>
<th>Description</th>
<th>Type of Complexity</th>
<th>Screening General Comments</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Project Familiarity</td>
<td>Scope similarity</td>
<td>Outright project with scope of work similar to previously executed projects and has &gt;50% scope change</td>
<td>Type 1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Project Execution</td>
<td>Efficiency</td>
<td>Managed as a portfolio, Program</td>
<td>Type 1</td>
<td></td>
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<tr>
<td>3</td>
<td>General design and execution package management</td>
<td>Efficiency</td>
<td>Standardized design or EPC engineering and construction packages are replicated from previous projects</td>
<td>Type 1</td>
<td></td>
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<tr>
<td>4</td>
<td>Regulatory and permitting requirements</td>
<td>Efficiency</td>
<td>Operation requires successful completion of project-specific regulatory permitting requirements</td>
<td>Type 1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Project execution</td>
<td>Efficiency</td>
<td>Owner of EPC has partnerships with select general contractors and assigns construction in multiple stages</td>
<td>Type 1</td>
<td></td>
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<tr>
<td>6</td>
<td>Project execution</td>
<td>Efficiency</td>
<td>Owner of EPC provides equipment and material from an approved vendor</td>
<td>Type 1</td>
<td></td>
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</tbody>
</table>

#### Complexity Level (Constructability)

<table>
<thead>
<tr>
<th>No</th>
<th>Question</th>
<th>Complexity</th>
<th>Description</th>
<th>Complexity Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Project execution</td>
<td>Low</td>
<td>1 or 2 adjacent areas, shared resources can be utilized</td>
<td>LOW</td>
</tr>
<tr>
<td>2</td>
<td>Project execution</td>
<td>Low</td>
<td>Coordination, shared services, utilities</td>
<td>LOW</td>
</tr>
</tbody>
</table>

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*Note: Screened low/high description from Drop Box Box Tab. Record key decisions and actions.*
WorkFace Planning System
Ready Now

6/13/2018

© COAA or respective owners
To be Reviewed
By CII and
Ready for
October 2018

6/13/2018
2. ROI OF AWP IMPLEMENTATION

Presented by:
Ryan Posnikoff – Bentley Systems
&
Yonas Halala – University of Alberta
Working with University of Alberta NSERC Industrial Research Chair to:

1. Develop tools and a framework to assess AWP costs and benefits
2. Assess impact of maturity of AWP practices on project performance
3. Assess impact of characteristics of workface planners, foremen, and crew on performance
4. Develop a method to calculate ROI of AWP on projects
2. ROI Committee

Co-Chair: Ryan Posnikoff – Bentley Systems
Co-Chair: Tannis Liviniuk – Pull Plan
Andrew Foy – Team Builder Solutions
Doug Hill – Team Builder Solutions
Barry Tymchuck – Pathfinder Project Services
Bobby Patterson – Zachry Group
Petra Polster – AECOM
Stephen Atkinson – Accenture
Committee Formed

• Charter
• Draft Methodology

Work begins with UoA

Data Collection Methodology
• Call for participants
2. ROI OF AWP IMPLEMENTATION

- **Summer 2017**
  - Data collection begins

- **Fall 2017**
  - Research continues
  - Collection methodology validated

- **COAA BP 2018**
  - Masters Thesis complete
  - Publishing Review

- **Upcoming**
  - ROI calculation tools for COAA members
  - More participants required
Data Collection Forms

- Performance metrics
- Problem Sources
- Foreman/Crew characterization
- AWP Additional costs
- AWP maturity assessment
- WorkFace planner qualification characterization
ROI Calculation Framework

Determine

- AWP additional costs: $C_{awp}$
- Cost KPIs: $B_{awp}$
- Productivity KPIs: $B_{awp}$
- Schedule KPIs: $B_{awp}$

ROI

$$\frac{\sum B_{awp} - C_{awp}}{C_{awp}}$$
Context characterization and correlation analysis framework

Characterize Projects
- Workface planner qualification characterization
- Problem Sources
- Foreman characterization
- Crew Characterization

Correlation Analysis
- Independent Variable
  - AWP maturity assessment
  - $M_{awp}$
- Dependent Variables
  - ROI
  - Work Package KPIs
    - Cost KPIs
    - Productivity KPIs
    - Safety KPIs
    - Schedule KPIs
    - Quality KPIs
    - Predictability KPIs
  - Project KPIs
    - Detailed Design KPIs
    - Construction KPIs

• Cost KPIs
• Productivity KPIs
• Safety KPIs
• Schedule KPIs
• Quality KPIs
• Predictability KPIs
Progress to Date:

1. Developed data collection instruments and methodology
2. Tested data collection and analysis on pilot project
3. Developed a report of findings
4. Currently soliciting additional projects for data collection
Need for further AWP Research

1. Lack of sufficient quantitative data to verify benefits of AWP utilization.
2. Cost of implementing AWP is not quantified and compared to benefits in order to determine ROI.
3. Impact of crew, foreman, and workforce planners on AWP implementation has not been addressed.
3. EWP READINESS ASSESSMENT TOOL

Presented by: Joe Hobbs

To provide latest update and how the tool has changed from ROC for EWP to an EWP Readiness Assessment tool. New narrative available to explain the tool as well as now having developed guidelines for most engineering disciplines.
Why do we need a readiness assessment tool?

- Engineering Rules-of-Credit
- EWP readiness versus RoC
- EWP readiness assessment tool
Engineering Rules-of-Credit

Gates
- Drawing initiated
- Checking
- Internal Discipline review
- Issued For Review
- Comments incorporated
- Authentication
- Issued For Construction

Milestones
- Issued Preliminary
- Issued Final
Engineering Rules-of-Credit

- **Model**: RoC = Gated Progress RoC
- **M.R.**: RoC = Gated Progress
- **EWP**: RoC = Gated → Avg’d Σ Deliverable
- **Stress**: RoC = Milestone Progression
- **P&ID**: RoC = Gated Progress
<table>
<thead>
<tr>
<th>EWP</th>
<th>Avg’d Σ Deliverable (Gated RoC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawing 1</td>
<td>Gated RoC</td>
</tr>
<tr>
<td>Deliverable 2</td>
<td>Gated RoC</td>
</tr>
</tbody>
</table>

- Drawing initiated
- Checking
- Internal Discipline review
- Issued For Review
- Comments incorporated
- Authentication
- Issued For Construction
Engineering Rules-of-Credit

\[
\text{EWP} \rightarrow \text{Avg’d } \sum \text{ Deliverable (Gated RoC)}
\]

\[
\text{Drawing 1} \rightarrow \text{Gated RoC} = \% \text{ complete}
\]

\[
\text{Deliverable 2} \rightarrow \text{Gated RoC} = \% \text{ complete}
\]

\[
\text{Deliverable } N \rightarrow \text{Gated RoC} = \% \text{ complete}
\]

\[
\sum \text{ deliverable progress}
\]

\[
\text{EWP}_{\text{progress}} = \sum \text{ deliverable progress} / ‘N’ \text{ deliverables}
\]
Engineering Rules-of-Credit

EWP → Avg’d ∑ Deliverable (Gated RoC)

EWP = ∑ deliverable progress / ‘N’ deliverables

The BIG Question

EWP progress = 95% it has been for 4 months!

ANSWER

The 95% progress = completeness ≠ readiness
Engineering Rules-of-Credit

- Model → Gated Progressed RoC
- M.R. → Gated Progressed RoC
- EWP → Avg’d Σ Deliverable (Gated RoC)
- Stress → Milestone Progression
- P&ID → Gated RoC
Engineering Rules-of-Credit

Materials
- MR
- RFQ

Purchase Order
- Vendor Data

Constructability

Detail Design

60% Model Review

Final Model Review

Constructability Review

Create drawings & EWP

Initial MTO

Final MTO

Construct

Engineering by System

Engineering by System

Procurement by Commodity

Fabricate

PWP

Ship

CWP

IWP

IWP

IWP

IWP

IWP

IWP

PWP By Area

100% Engineering

100% Materials
# Engineering Work Package Readiness

<table>
<thead>
<tr>
<th>GENERAL</th>
<th>%</th>
<th>CUM</th>
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</thead>
<tbody>
<tr>
<td>Initial Scope Identified</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Initial Design (60% Model)</td>
<td>35</td>
<td>40</td>
</tr>
<tr>
<td>Preliminary Vendor Data Received (Where Applicable)</td>
<td>5</td>
<td>45</td>
</tr>
<tr>
<td>Preliminary MTO/BOM (Bulks) to Supply Chain</td>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>Final Vendor Data Received / Checks (Where Applicable)</td>
<td>5</td>
<td>55</td>
</tr>
<tr>
<td>Model Finalized (90%)</td>
<td>15</td>
<td>70</td>
</tr>
<tr>
<td>Deliverables (incl. final MTOs, etc)</td>
<td>15</td>
<td>85</td>
</tr>
<tr>
<td>EWP Reviews (Incl Eng Checking / IDR(SQK) / IFR, etc)</td>
<td>5</td>
<td>90</td>
</tr>
<tr>
<td>EWP c/w Drawing/Spec/MTOs Issued IFC</td>
<td>5</td>
<td>95</td>
</tr>
<tr>
<td>EWP Accepted by Construction</td>
<td>5</td>
<td>100</td>
</tr>
</tbody>
</table>
## EWP Readiness – Mechanical/Piping

<table>
<thead>
<tr>
<th>PIPING / MECHANICAL</th>
<th>%</th>
<th>CUM</th>
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</thead>
<tbody>
<tr>
<td>Initial Scope Identified</td>
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<td>5</td>
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<tr>
<td>P&amp;IDs / LDTs IFC</td>
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</tr>
<tr>
<td>Preliminary Stress</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial Design (Modelling)</td>
<td>35</td>
<td>40</td>
</tr>
<tr>
<td>Preliminary Vendor Data Received (Where Applicable)</td>
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<tr>
<td>Final Stress</td>
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</table>
Engineering Work Package Readiness

• Readiness is workflow based (It relies on the activities and contributors to the EWP (not just produced deliverables within it))

• The readiness assessment tool can be easily modified to suit differing workflows

• The tools can be applied in a generic form (all disciplines are the same) or be discipline specific

• Readiness can be assessed by anyone

• Meant to help facilitate dialogue not to police or punish
Presented by: Yogesh Srivastava
Presentation to provide guidance as to changing from a PWPackage to PWProcess. Guidelines for database attributes to support. Guidelines to how to use this as Material Readiness Assessment for any specific CWP.
4. PWP

Presented by: Yogesh Srivastava
Presentation to provide guidance as to changing from a PWPackage to PWProcess. Guidelines for database attributes to support. Guidelines to how to use this as Material Readiness Assessment for any specific CWP.
The PWP
Procurement Work Process
Procurement Work Package
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  CWPs  IWPs  IWP Executed  Sub Systems  System Packages

Engineering Design  Construction Planning  Field/ Mods Execution  Start of Progressive Turnover  Sub system / Tag based Turnover  Turnover Completion
4. PWP Life Cycle

PWP Life Cycle:
- **Engineering**
  - Buying
  - Expediting
  - Inspection
  - & Delivery

- **Procurement**
  - Receiving
  - Storage
  - Preservation
  - Tracking
  - Issuing

- **Materials Management**
  - Procurement cycle - ends at “Port of Entry”
  - Transfer of custody
  - Material management

- **Contractor**
  - Procure
  - Manage
  - Install

**Installed / Part of System**
Why PWP?

- 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

- PWP may have direct correlation to POs or multiple POs
What schedule points are tracked?

- Material Requisition
- Vendor Data
- Vendor Data for EWP
- BOM
- EWP IFC
- Ready for Shipment
- Delivered prior to start of CWP
- Long Lead Eqpt
- EWP
- Bulks & Eng Eqpt
- CWP

Long Lead Item

Engineering
5. Path of Construction

Presented by: Glen Warren
The POC has changed as AWP has been adopted. Provides new procedure, new checklist and new guidelines for database attributes to support POC.
5. Path of Construction

- Construction Risks
- Site/Facilities Plan
- Construction Expertise
- Construction Execution Plan
- Review Constructability Log
- Path of Construction
- Modularization, Pre-assembly Strategy
- Construction Risk Register
- Heavy Lift Plan
- CWP / EWP Plan
- Contracting Plan
- DBM Construction Execution Plan
- FIWP Release Plan
- DBM Plot Plan
- EWP Development
- Preliminary Plot Plan
- PFDs

Continued on Page 2 - EDS
Path of Construction

WorkFace Planning Project Integration

Phase 1 - Pre-Project
- 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 logging
- Develop business level schedule

Phase 2 - Design Basis Memorandum (DBM)
- Develop Project: Level 2 Schedule

Owner
- Assign sponsors and champions including tasks
- 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 logging
- Develop Project: Level 1 Schedule

Project Management
- 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

Construction Management
- Demonstrate Capacity to support WFP
- WFP execution plan
- Construction Execution plan

Early Path of Construction development

Engineering Contractor
- Demonstrate Capacity to Support WFP
- Assign WFP champion
- Develop primary plan
- Design Area Definition
- Construction input into layout and project sequence
- CWAs Defined and early CWP, FWP, MWP definition

Supply Chain Management
- Request for proposal
- Contract Formation for engineering
- Management of Procurement Strategy
- Management of Contracting Strategy
- Align procurement process with WorkFace Planning

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

Legend:
- Application of WorkFace Planning
- Standard Project Procedure
- Integration of WFP and Standard Procedure
## The Details

### Path Of Construction - Stakeholder Inputs

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Input</th>
<th>Type</th>
<th>Prerequisite for POC</th>
<th>Project Phase</th>
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</thead>
<tbody>
<tr>
<td>Owner</td>
<td>Enterprise Objectives</td>
<td>Doc</td>
<td></td>
<td>PREFEED FEED Det Engineering Construction</td>
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<td>Schedule Milestones</td>
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<td>Project Scope</td>
<td>Doc</td>
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<td>Project Management Team (PMT)</td>
<td>Project Execution Strategy</td>
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<td>AWP / WFP Strategy</td>
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<td>Establish Path of Construction Procedure</td>
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<td>High-level Scope Summary</td>
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<td>Project Charter</td>
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<td>Project Objectives/Strategy Summary</td>
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<td>Project Delivery System</td>
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<td>Project Key Milestone/Deadlines</td>
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</tbody>
</table>
6. MINDFULNESS

Presented by: Yogesh

Provide a high level summary of what the Mindfulness presentation during the next track will be providing.

COAA is trying to determine whether another committee should be struck to further develop guidelines to implement best practices using the “soft skills”.
• On an average we have 50,000 thoughts each day
• 98% of the thoughts are the same as yesterday
• 80% of those are negative.
• And the things we repeatedly do become automatic and our second nature.

On an average, 47% of the time, we are distracted – HBR Study

Operating in Error!
Distractions: Twice as more in 10 years!

As humans we are no longer cognitively alert as we were 10 years ago

AVERAGE ATTENTION SPAN

10 years ago: 20 seconds
Now: 10 Seconds

SHEER VOLUME OF DATA EXPLOSION

Human- and machine- generated data are already experiencing a growth rate that is 10 times faster than that of traditional business data, while machine data is increasing at 50 times the growth rate.

Source: Dr. Cindy Gordon, CEO SalesChoice Inc
We are constantly DISTRACTED....

This decrease in human cognitive focus has been fueled by mobile connectivity. While we are plugged in 24/7, our productivity is being severely impacted by our cognitive dissonance.
Current Applications

**MBSR**
Mindfulness-Based Stress Reduction

Benefit psychologically and physically from extended time spent pinning their attention to the present

**MBCT**
Mindfulness-Based Cognitive Therapy

Emerged as a popular therapeutic intervention to treat depression
Projects & Construction Situation

High momentum of man, materials & machinery
Introducing the Lean Mind: An Inside-Out Practice
The Lean Mind for Personal Practice

15 Minute Personal Practice

- Based on traditional mindfulness concepts from Vipassana & Mitta Bhavna
- **It’s an inside-out practice of the Self**, starts with settling down at your core and
- Three dimensional expansion: of your self to include others, extension in time beyond present moment and expand spatially outside your vicinity.
- Clear and well defined intent built around minimizing waste
The Lean Mind™ at Construction Site

2.5 Minute Practice at Site Example

- Based on traditional mindfulness concepts
- Going inside-out, it is the expansion of self to include others, extension in time beyond present moment and the work area.
- Clear and well defined intent built around minimizing waste
- Combined with cultural facets of the organization, leadership and employee
Apprenticeship & Mentoring

Next Shift / Trade
Efficient Handover

Orderly &
Safe Job Site
The Corporate HSE Benefit

Bill 30 – Passed 15 Dec’ 2017, coming in force – 30 Jun’ 2018 (most parts)

Promotion and maintenance of the highest degree of:
- Physical
- Psychological
- Social well-being of workers
People bring Mindfulness

HSE: Safety ➔ Mindfulness ➔ Productivity

Existing HSE Orientation and Training Programs

A LEAN Mind (Mottainai) culture for every worker orientation

Complete & aligned package based execution: AWP/WFP fundamentals

Leverage by Enhanced Onboarding Program
Productivity Problem: Work vs. Waste Equation

- Waiting for resources
- Waiting for services
- Waiting for equipment
- Waiting for permits
- Waiting for issues to be resolved (RFIs)
- Waiting for decisions
- Waiting for information
- Waiting at integration points

COAA Benchmark data