Advanced Work Packaging (AWP) as emerging planning approach to improve project performance

Case studies from the industrial construction sector

Simone Ponticelli, University of Texas at Austin
William J. O’Brien, University of Texas at Austin
Fernanda Leite, University of Texas at Austin

June 9, 2015
Vancouver, BC
Agenda

AWP Concepts
Research Gap and Objective
Methodology: Multiple Case Studies
Findings: AWP and Project Performance
Conclusions
Background

70% of industrial projects exceed 10% variation from expected cost and schedule values (CII, 2012).

Traditional planning processes are not reliable to deal with current projects complexity and uncertainty (e.g. Gibson et al., 2006).

Among them, Work-Packaging concepts are extensively used, but:
 – Obsolete to manage current projects (Choo, 1999).
 – Lack of focus on initial project planning (Kim and Ibbs, 1995).

Since 2009, CII RT272 and RT319 aimed at re-collecting and defining current work-packaging best practices.
A Long Research Journey!

**RT272 Phase I (09-11)**
- Process

**RT272 Phase II (11-13)**
- Implementation

**RT319 (14-15)**
- Validation

**Contributors:**
- Steve Autry, ConocoPhillips
- Michael Bankes, Fluor
- Jim Blevins, Pathfinder
- Dan Childers, Zachry Industrial Inc.
- Roy Burnette, CH2M Hill
- Mark James, Laidlaw Engineers & Constructors
- Keith Critzer, ExxonMobil
- Jim Dyan, Coreworx
- Olfa Hamdi, The University of Texas at Austin
- Ken Kohl, GE Power & Water
- Fernanda Leite, The University of Texas at Austin
- Jose LaRota, Southern Company
- Fernanda Leite, Texas A&M University
- William Milias, Bentley Systems
- Bill O’Brien, The University of Texas at Austin
- Sean Allegretti, Bentley Systems, Inc
- Bryan Parsons, KBR
- Simone Poncelli, The University of Texas at Austin
- Sean Pellegrino, Chevron
- Bryan Parsons, KBR
- Sean Pellegrino, Chevron
- Jim Rammell, Wood Group Mustang
- Lloyd Rankin, Ascension Systems
- Yogesh Srivastava, North West Redwater Partnership
- Glen Warren, Redwater Partnership
- Stan Stasek, DTE Energy
- Jim Rammell, Mustang
- Jim Vicknair, WorleyParsons
- Glen Warren, COAA

5th ICSC – Vancouver, 09 June 2015
What is Advanced Work Packaging?
CWP- Construction Work Packages  
EWP- Engineering Work Packages  
IWP- Installation Work Packages
Research Gap & Objective

Various scholars advocated a closer connection between theory and practice in project management (e.g. Howell and Koskela, 2002).

→ AWP still requires further analysis and empirical validation.

Research Objectives:
• Provide in-depth insights on the AWP implementation process.
• Explore the impact of AWP on key project performance dimensions (cost, schedule, quality, safety).
Triangulation of Evidence

1. Identify AWP Maturity Levels
   - Case Studies
     - Methods of AWP Implementation
     - AWP Benefits & Lessons Learned
   - Expert Interviews
     - Support Case Study Analysis
     - Focus on Specific AWP Processes
   - Survey
     - Statistical Validation
     - AWP and Project Predictability

2. Validate AWP Benefits

Cross-Validated Results!
Case Studies

Objective:
In-depth Results on AWP Benefits
- 20 Case Studies and 52 Interviewees.
- Different industrial sectors and project sizes.
- Documented AWP benefits, challenges, and lessons learned.

*Size (million USD):
Small: < 5
Medium: btw. 5 and 50
Big: btw. 50 and 500
Mega: > 500

Sector
- Power, 5
- Chemical, 3
- Infrastructure, 2
- Oil&Gas, 10

Size*
- Small, 5
- Medium, 2
- Mega, 6
- Big, 7

Location
- Canada, 8
- US, 12
Research Methodology

Two case studies selected to **isolate** the impact of AWP on project performance:

- **Project 1**
  - With AWP
  - Without AWP

- **Project 2**
  - With AWP
  - Without AWP

Same Project Scope
Same Companies
Contiguous Sites
Performed in parallel

**AWP is the main difference!**

To enhance results validity and reliability:

- Consult multiple informants to achieve triangulation (Gibbert et al., 2008).
- Obtain feedback from each interviewee (Creswell and Miller, 2000).
Case Study 1 – Description

Characteristics:
- TIC: $8 million USD
- Construction hours: 80,000
- Sector: Oil & Gas (wells expansion)
- Contract: Time and Materials

Owner, Engineering, and Contractor are integrated since FEED:
- Include constructability principles
- Define AWP procedures, role, and responsibilities

<table>
<thead>
<tr>
<th>CWP Area</th>
<th>EWPs Discipline</th>
<th>IWPs CON + TURNOVER</th>
</tr>
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</table>
Case Study 1 – Findings

<table>
<thead>
<tr>
<th>Performance</th>
<th>Without AWP</th>
<th>With AWP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>On-budget</td>
<td>$750,000 below budget</td>
</tr>
<tr>
<td>Schedule</td>
<td>On schedule</td>
<td>5 days early</td>
</tr>
<tr>
<td>Quality</td>
<td>2% weld reject rate</td>
<td>0% weld reject rate</td>
</tr>
<tr>
<td>Safety</td>
<td>1 lost time incident</td>
<td>0 lost time incident</td>
</tr>
</tbody>
</table>

Project Control:

- Held weekly meeting based on IWP progress
- Incorporate lessons learned after IWPs completion
Case Study 2 – Description

Characteristics:
- TIC: $400 million CAD
- Construction hours: 1 million
- Sector: Infrastructure (dykes and disposal area)
- Contract: Time and Materials

Early engagement resulted in effective constraint minimization
IT integration based on AWP (planning, procurement, execution processes)
Case Study 2 – Findings

<table>
<thead>
<tr>
<th>Performance</th>
<th>Without-AWP</th>
<th>With-AWP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>$100.000 over budget</td>
<td>$40 million savings (10% TIC)</td>
</tr>
<tr>
<td>Schedule</td>
<td>3 months delay</td>
<td>On schedule</td>
</tr>
<tr>
<td>Quality</td>
<td>RFIs paralyzing operations</td>
<td>RFIs solved before operations</td>
</tr>
<tr>
<td>Safety</td>
<td>12 lost time incidents</td>
<td>0 lost time incident</td>
</tr>
<tr>
<td>Productivity</td>
<td>n/a</td>
<td>25% higher</td>
</tr>
</tbody>
</table>

Process Control:
- Update plans on a daily basis
- Payment structure aligned with AWP deliverable
Common Implementation Traits

“Ancillary” Benefits:

• Project Predictability (in terms of cost, time, and quality).
• Integration between Disciplines (CON, ENG, PRO).
• Accountability of construction crews.

Challenges:

• Achieve Buy-in and Commitment (from top-management to crews).
• Reduce Change Inertia (systematic training & change mgmt process).
• Project control based on AWP deliverable.
Further Evidence: AWP Maturity Results

High Correlation between AWP Maturity and Project Performance (Spearman rho = 0.959, significant at 99% confidence level)
Overall Findings

The projects adopting AWP performed better (safety, cost, schedule, quality).

- 25% improvement in productivity
- 10% reduction in TIC
- Improved rework, quality, safety
- Improved alignment
- Improved contractor profitability

However… AWP requires hard-work and commitment!

- Deploy systematic and integrated planning since FEED.
- Identify and solve project constraints before mobilization.
- Deliver plans to support construction activities.
Thank you!