RT319
Validating Advanced Work Packaging as a Best Practice – A Game Changer

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With thanks to Stan Stasek, DTE Energy
Mining Case Study

Characteristics:

- **TIC:** $1 billion CAD.
- **Construction hours:** 4 million.
- **Sector:** Mining (relocation of equipment).
- **Contract:** Lump Sum (construction).

- Aggressive use of AWP planning during FEED.
- **TRIR lower than company’s average** (Zero Lost Time Injuries after > 4 million hours).
- **25% Productivity Improvement.**
- **10% savings in TIC.**
- 2 months **Ahead of Schedule** (schedule driven).
- Construction **Rework** was **below 5%** and progressively diminished during project execution.
Modularization Case Study

Characteristics:

- TIC: $30 million USD.
- Construction hours: 16,000
- Sector: Oil & Gas (water treatment).
- Contract: Lump Sum.

- 30% On-site Productivity improvement.
- 5% Off-site Productivity improvement.
- **10% savings in TIC.**
- Completed **On Time.**
- **Less Rework** (on-site **AND** in the mod-yard).
- **Zero lost-time accident:** off-site safety performance aligned with company’s average.
Plant Expansion Case Study

Characteristics:

TIC: $1 billion CAD.

Construction hours: 2.7 million.

Sector: Oil & Gas (plant expansion).


• **TRIR lower than company’s average** (Zero Lost Time Injuries after > 4 million hours).

• Not all areas of this project used AWP, those areas used a disproportionate amount of contingency.

• **12% Productivity Improvement** overall; higher on AWP activities.

• **>>$20 M Under Budget.**

• 3 months **Ahead of Schedule** (schedule-driven).

• **Rework** was **below 1%** (in comparison to a target of 3%).
Agenda

- Case Studies
- Research Validation Review
- An Owner’s Story
- Resources
Triangulation of Evidence

RT 319 Objective

1. Identify AWP Maturity Levels
2. Validate AWP Benefits

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

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
Chemical 3
Power 5
Infrastructure 2
Oil&Gas 10

Size*
Small 5
Medium 2
Mega 6
Large 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
## 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>On/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>
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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.
Implementation Maturity vs Performance (15 cases)

S-Curve pattern:

- High Correlation between AWP Maturity and Project Performance.
  (Spearman rho = 0.959, significant at 99% conf. level)

- AWP Maturity level can be used to set Project Performance expectations.
  ($R^2 = 0.923$, significant at 99% conf. level)

- High Ratings Reliability and Distribution Validity, confirming the S-curve pattern.
Maturity Model

Three AWP Maturity Stages (CII IR272 – Volume II).

Objectives:

1. Provide empirical evidence of the 3 stages.
2. Investigate the relationship between AWP Maturity and Project Performance.
3. Deliver practical recommendations to obtain higher levels of AWP maturity.
AWP Maturity Model

- AWP Early Stages
- AWP Effectiveness
- AWP Business Transformation

PROJECT PERFORMANCE vs. AWP MATURITY
## (1) AWP Early Stages

### Performance Breakout

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<th>2 – AWP Effectiveness</th>
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<td><strong>Quality</strong></td>
<td>Rework in line with previous quality performance</td>
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(2) AWP Effectiveness

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Performance Breakout

- Productivity
- Quality
- Predictability
- Schedule
- Cost
- Safety
# AWP Business Transformation

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Survey

Objective:
Achieve Generalizable Results on AWP Benefits.
• 92 Responses (Houston + Alberta Data).
• Unit of Analysis = Project.
• Strong Statistical Robustness.

AWP Assessment

Process Adherence
Organization Alignment
Contract Integration

Engineering Deliverable

AWP explains 25% of Timely and Complete Eng. Deliverables

AWP is a large contributor to Project Predictability
• Assess a Causal Relationship (SEM approach)
• Confirm case studies results

Project Predictability

AWP explains 30% of Project Predictability (time, schedule, and rework)
Expert Interviews

Objective:
Provide Confirmatory Results to Case Study Analysis.
• 25 Expert Interviews.
• Explore AWP in different sectors (e.g. building).
• Focus on specific implementation areas.
One Owner’s Story – DTE Energy

- **DTE Energy** is a Detroit based diversified energy provider involved in the development and management of energy related businesses and services nationwide.
DTE Energy – Major Enterprise Projects

• **Major Enterprise Projects** is responsible for managing large capital and strategic projects for DTE Energy.

• Portfolio is large and very diverse.
Case for Change – Why Advanced Work Packaging?

- DTE-MEP exists to deliver enterprise projects in a **predictable** and **repeatable** manner.
- Client expectations focus on **safety, schedule, cost, quality**.
  - Sounds like AWP might help to achieve.
- DTE-MEP has been very successful in delivering projects.
  - Experienced variability in **productivity, constructability, and rework rates**.
- Significant contractor variability in using work packaging.
  - From zero use of work packages to full use of AWP.
- DTE-MEP has focus on **process orientation** for all project activities.
Approach - Embedding AWP Into DTE-MEP Work

- Establish a core team (including an AWP implementation lead with prior experience).
- Benchmark AWP techniques/insights/lessons learned (RT272).
- Plan and execute WP/AWP on targeted pilot projects (large repeating project, small repeating project).
- Conduct After Action Reviews.
- Apply lessons learned and “finalize” governance procedure controls.
- Roll out to all “new” DTE-MEP projects.
- Check and adjust, coach and mentor (ongoing).
Benefits Realized So Far

• Early wins:
  
  – Productivity improvements (less crew downtime).
  
  – Improved tracking of work progress.
  
  – Improved visibility of issues.
    • Improved communication between contractor(s) and owner.
    • Worker feedback used to improve downstream work.
    • Increased contractor ownership of issues and their resolution.
  
  – Better constructability planning embedded into design phase.
Challenges So Far

• Early learnings:

  – Contract language needs to clearly define AWP expectations upfront.

  – Some contractors were new to AWP – wanting to add AWP costs as contingency risk to bids (felt it was potentially added work).

  – Need to educate all project stakeholders on AWP (owner’s staff, contractors, client representatives).

  – Very difficult to initially implement AWP on in-flight, in-progress projects.
One Owner’s Conclusions

DTE Energy has concluded that:

- AWP improved project **productivity** and **predictability**.

- AWP can be **scalable**, adjusted and applied to smaller projects as well as larger projects.

- Contractors will embrace AWP once they gain experience in its use.

- The **Owner** needs to drive use of AWP in the early stages.

- Early adopters of AWP can see a payback even if their maturity level is low.

- Need only use technology/software necessary to do the job.
Initial Misperceptions of AWP

• True or False?
Initial Misperceptions of AWP

• True or False?

– Costs of AWP implementation outweigh the benefits
Initial Misperceptions of AWP

• True or False?

  – Costs of AWP implementation outweigh the benefits - **FALSE**
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– Expensive new technology and software are required to implement AWP
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– AWP requires large additional staffs to implement
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Agenda

- Case Studies
- Research Validation Review
- An Owner’s Story
- Resources
Volume I: Recommended Process

Volume II: Implementation Guidance

Volume III: Case Studies and Expert Interviews
Narrative & Templates

• Narrative description of the overall AWP Process
• CWP, EWP, IWP templates
• Contract considerations
• Functional Roles & Job Descriptions
• Vendor prequalification
• Maturity model
• Audit & assessment tools
Detailed Project Example

Example: Overall Project (ISBL)

Example: Construction Work Area (CWA)

Example: Engineering Work Package (EWP)

Example: Installation Work Package (IWP)
THANK YOU AND QUESTIONS?