

Critique of Advanced Work Packaging

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Overview

- Topic of our research: Advanced Work Packaging
- Objective of our research: to assess the effectiveness of this practice recommended by the **Construction Industry Institute** and the **Construction Owners Association of Alberta**.
- How we will carry out the research:
 - through analysis of the recommended practice described in the literature
 - through measurement of its effectiveness at the workplace

What is Advanced Work Packaging?

- Work packaging breaks the complete project scope of work into pieces so they can be planned and made ready to be designed, procured, and constructed, and so these processes can be monitored and controlled.
- The pieces in AWP are Construction Work Areas (CWAs), which consist of discipline-specific Construction Work Packages (CWPs), each of which are fed by one or more Engineering Work Packages (EWPs). CWPs are divided into Installation Work Packages (IWPs) consisting of the work a construction crew of the relevant craft can do in one or two weeks.

EWP → CWP → IWP

- “Advanced Work Packaging” appears to signify the explicit link between engineering and construction work, and the specification of the process of defining and assembling the work package documents.



Primary References

O'Brien, Leite & Meeks (2013). *Advanced Work Packaging: Design through Workface Execution*. Construction Industry Institute, Research Report 272-11, The University of Texas, Austin.

Research Team 272 (2013). *Advanced Work Packaging: Design through Workface Execution*. Construction Industry Institute, Implementation Resource 272-2, Vols. 1-3, The University of Texas, Austin.

Why Question Claims for AWP's Effectiveness?

AWP is a production system. As such, it must be well designed in order to be effective.

Hypothesis: AWP is not a well-designed system and will not consistently perform to achieve its objective—to provide everything needed to craft crews when needed, and thereby to reduce project cost and duration.

Finding:

The AWP system is under-designed

- The focus is on creating work package documents.
- Purchasing, physical acquisition, handling, kitting, delivery of the information, materials, equipment, tools, labor, etc., is decidedly secondary and mostly ignored.
- No mention is made of uncertainty and variation in the system (merge bias, matching problems, etc.)

Consequently, it's not clear how the AWP system is supposed to work.

Unexplained System Design Choices

1. Sizing IWPs to one or more weeks' work for a crew; as opposed to one day's work or one unit of trade installation such as one piping isometric.

... as was done by DuPont using farm wagons long ago—introduced in the '60s

2. Crediting an IWP completion to project progress without requiring QC sign off.

... opposite the practice H.B. Zachry introduced 20 years ago

Unexplained System Design Choices

3. Maintaining a backlog of IWPs to avoid loss of capacity should the scheduled IWP be unsound.
 - No guidelines regarding buffer size
 - No explicit assumptions about delivery variation
4. No justification of the choice of an inventory buffer vs capacity or time.

If the objective is to reduce total cost, capacity utilization could be sacrificed rather than be the focus of optimization.

Unexplained System Design Choices

5. CWPs appear to be the transfer batch between disciplines. No explanation is provided why the IWP (or sets of IWPs; e.g., constructed around natural units such as process equipment) was not selected as the transfer batch.

The likely underlying assumption is that providing work packages will improve labor utilization and hence labor productivity and thereby reduce labor cost and time. This is the traditional project management assumption that doing every bit of work as fast as possible completes the project as quickly as possible—which is only true if the different bits of work are independent one from another. If they were independent, there would be no need to structure the work for release between trades; indeed, all trades could do their work concurrently.

Articulating this presupposition is sufficient to reveal its falseness.

Unexplained System Design Choices

6. Sizing of CWPs is not explicit, but they are said to usually correspond to contracts, and so can be assumed to be quite large. No justification for this apparent choice to sacrifice speed of delivery—presumably for labor cost savings, but schedule reductions are also claimed.

What We Expect to Find

1. Failure to specify pull in AWP design, naturally results in push.
We expect to see huge inventory growth on projects using AWP.
2. The larger the transfer batch, the longer the duration of the process.
We expect to see projects taking longer rather than being done more quickly.
3. Having defined work packages, coordinated between engineering and construction, does not reduce the challenge of coordinating massive flows of materials, information and resources to construction sites when needed.
We expect labor utilization to get worse rather than better.
4. Inventory growth, longer project durations, and higher labor costs—plus increased costs for expediting and firefighting—
... are expected to result in projects well over budget and time.

Next Steps

1. Identify projects to study.
2. Describe & characterize their production system in detail (mapping, simulation, ...).
3. Collect production data, such as inventory data, lead times, uncertainties, variation, etc.
4. Test our expectations.