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Externalizing Work® through Prefabrication Measuring Progress

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Prefabrication tasks are activities that can be productively transferred away from the installation site or even away from the jobsite entirely. One issue* associated with transferring work from a jobsite to prefabrication is **how to measure the progress of work in the prefabrication process** as this measurement is a direct factor in the measurement of the overall job progress.

Every construction installation task may be viewed as having 3 separate phases:

- **Prepare:**
 - Transport/distribution of labor, tools, materials, and plans to the jobsite
 - Preparation of the labor (understanding the plans and schedule), tools (setting and powering up), and material (receiving, unpacking, fabrication, assembly, etc)
 - Movement of materials to the final installation site
- **Install:** the actual installation task
- **Put Away:** return workers, tools, and leftover material to location(s) appropriate for the next task

When prefabrication is done away from the point of installation, many of the activities associated with preparation and put away may be streamlined, simplified or even entirely eliminated from the burden on the jobsite.

Prefabrication tasks still consist of the same 3 general phases, replacing “Install” with “Make”, “Prep” or “Assemble”; however, due to the process layout in a prefabrication area, several advantages exist.

Among them:

- Savings from reduced **cost and effort (labor hours)** associated with:
 - Less material handling
 - Fewer material returns
 - Less wasted material
 - Improved labor efficiency
 - Improved labor productivity
- Consistency of production
- Increased reliability
- Improved safety
- Manpower flexibility or buffer
- Decoupling of sequence of work from sequence of time on the project

* Additional aspects with respect to tracking prefabrication for a project include factors affecting the budget and budgeting process, the impact of prefabrication on overall Job Productivity, and the productivity of prefabrication itself as a production process will be addressed in future sessions.



Prefabrication – Measuring Progress

The current question is **how to measure the progress of prefabrication activities** with an appropriate metric. This metric will be based on the ASTM Standard E2691 for measuring construction productivity as commercialized in the form of Job Productivity Assurance and Control (JPAC®). Assume for now that an allotment of hours from the job has been identified for prefabrication activities.* This “budget” will exist for baseline tracking of completion within the overall job.

The prefabrication itself will be tracked as a separate Prefab Project in JPAC® with only the progress (percent complete) needing to be transferred. Since the tasks in JPAC® are ideally established according to the way the work is done, the prefab tasks may need to use different cost codes than the labor codes for the purpose of tracking productivity in prefab, for example:

- Planning
- Assembly
- Design/CAD
- Kitting / Packaging
- Materials (Ordering, receiving, etc)
- Delivery

These can be translated to task items in corresponding labor cost codes and transferred directly as below:

Task	Cost Code	Labor Hour Budget	% Work for Cost Code	% Work for Job	Observed % Complete
Planning	01-11	120	13.33%	5.7%	75%
CAD/design	01-11	40	4.44%	1.9%	50%
Receiving	02-11	20	2.22%	0.95%	50%
Assembly of A units (50)	03-11	100	11.11%	4.75%	80%
Assembly of B units (100)	03-11	200	22.22%	9.5%	40%
Assembly of C units (400)	03-11	100	11.11%	4.75%	0%
Kitting (80)	04-11	200	22.22%	9.5%	10%
Packing	04-11	40	4.44%	1.9%	0%
Delivery	05-11	80	8.89%	3.8%	0%
Cable Prefab	11	900	100%	42.7	33.3%

Task	Cost Code	Labor Hours Budget	% Work for Cost Code	% Work for Job	Observed % Complete
Cable Installation	11	6500	87.84%	22.49%	15%
Cable Prefab	11	900	12.16%	3.11%	33.3%
Total		7400	100%	25.6%	17.2%

While it could be daunting to have to individually break down the fabrication hours out of every job task, certain patterns exist that will simplify the process as most tasks will follow one of three basic forms that differ in how the effort is allocated in the WBS in order to be measured.

- **Common across all jobs:**
 - Standard materials, always on hand, occur on almost every jobsite
 - Examples: boxes, wall mounts, MC whips, fixture kits
 - **Tracked by quantity**; assembly effort is very predictable by unit and correlates with quantity produced
- **Common within job categories:**
 - Assemblies and applications specific to a type of work, for example: schools, hospitals, airports, hotels, water treatment plants, etc.
 - Examples: racks, plumbing fixture carriers, high-bay light assemblies, hospital headwalls
 - **Tracked by: one time arrangement for basic planning/setup/layout within the job, then ongoing production**



Prefabrication – Measuring Progress

- **Job specific**

- One-of-a-kind or high-risk elements of a project
 - Examples: specialty lighting or décor, underground utilities, material handling equipment

Tracked with a specific WBS of all elements involved

- For tasks that encompass more than one labor code, the effort can be allocated to the appropriate multiple job cost codes through an “automatic unbundling” when translating to the job. For example, “Assembly of B-units” above might be 40% cable, 60% wire, and the percent completion to the job codes would be distributed accordingly.