PREFABRICATION AND ASSEMBLY AND OPEN BUILDING

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Definition of the Championship Area

The term "prefabrication" refers to fabricating and assembling components prior to final installation. Some prefabrication occurs at the site, but most occurs off site.

“Assembly” refers to all site management functions, and is detailed below.

"Open Building" is a strategy to design, construct and operate the built environment the user can relate to and is willing to maintain and defend. Therefore the built environment needs to reflect the way it is controlled. In order to prevent serious misfits it needs to be adaptable to changing needs. Open Building advocates a layering of the built environment along the lines of control: who decides about what? Suggested levels of decision-making are the urban fabric, base building and fit out. Strategies have been developed to coordinate yet decouple decisions allocated to different levels. This can be a key to coordinating and decoupling the work of trades on the building site and to making buildings demountable without waste. Since all decisions about the built environment substantiate where and when building parts connect, call it the last planner's domain, Open Building and Lean Construction meet in this championship.

Prefabrication

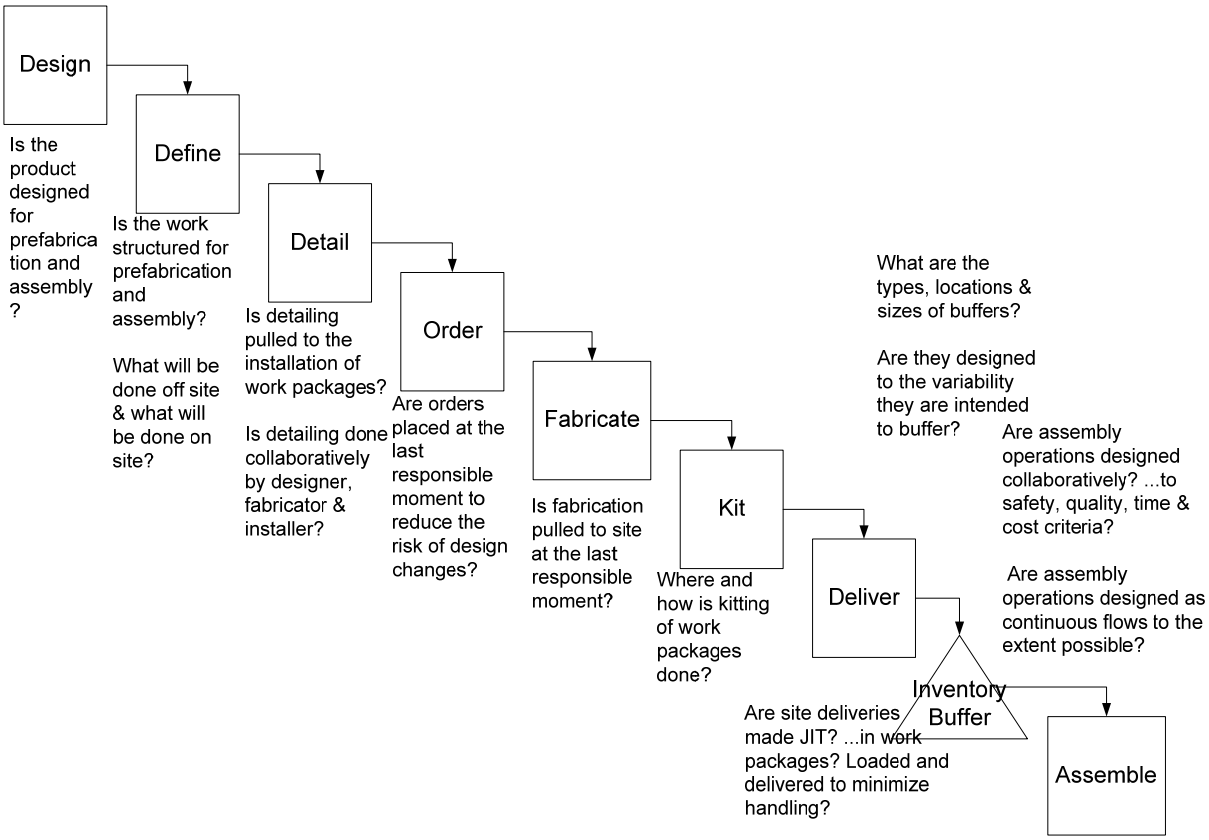
Lean Ideal -- A lean ideal appropriate for this championship is "Simplify site installation to final assembly and commissioning".

Pursuit of this ideal involves every phase in project delivery and in the life of the products that are components of the facility being constructed (see process chart below).

MTS and MTO Products -- Products used in the building process can be divided into made-to-stock (MTS) and made-to-order (MTO). This championship deals with both types of products.

Made-to-stock products are best handled through inventory replenishment strategies, whereas made-to-order products are best pulled forward through their supply process to arrive at the site just when needed; or as we like to say, at the last responsible moment. Standardizing product catalogs to reduce the number of products required in inventory is one of the first steps needed to make inventory replenishment feasible. Supplier managed inventory has proven successful for some companies and projects, where suppliers take on the job of determining material requirements, maintaining and distributing materials. Where that is not feasible, current best practice is to use kanban techniques and milk runs as described in Robert Arbulu's IGLC11 paper. We invite research and papers on these and other issues involving the management of made-to-stock products.

Made-to-order products can be further divided into those that are engineered-to-order and those that are fabricated- or assembled-to-order to a previously produced design, as in standard products like modular air handling units. Obviously the most complex and demanding are engineered-to-order products. The process chart below shows the steps involved in the delivery of an engineered-to-order product.



We invite research and papers on issues involved in the management of MTO products, including but not limited to:

* Designing for fabrication: product and process

* Designing for assembly: product and process.

DFM and DFA rules have been developed in the manufacturing sector. The challenge is to develop rules to guide design-for-manufacturing and design-for-assembly in the construction world.

* Integration of designing/engineering and detailing in both 2D and 3D environments. Lean construction advocates have long called for shifting detailed engineering to fabricators and installers, but the best solution is to co-produce design in a single step; something 3D models facilitate enormously.

* Linking orders for prefabricated/preassembled products to the installation activities so the products are pulled to the site at the last responsible moment.

* Modularization; i.e., designing and making parts of the facility in larger, more comprehensive chunks, thus shifting more making off site.

* Structuring supply chains for flow; e.g., increasing the probability of timely delivery of subassembly components by reducing the number of intersecting flows (the matching or merge bias problem).

Assembly

Turning now to "assembly", this refers to all site installation activities and issues and includes operations design, labor supply, crew management, shared resource management, site materials management and commissioning.

Site Management -- As previously stated, we have interpreted "assembly" to mean all elements of site management not assigned to other championships. Here are brief notes on some key elements in site management. We invite ideas and papers on all of these topics.

Operations Design -- The installation of materials and products is done through operations; e.g., pulling electrical wire, erecting pipe, installing formwork, placing concrete. The types of operations that benefit from detailed planning include those that are new, hazardous, critical or repetitive—in other words, pretty much everything. Relevant topics from the literature are discrete event simulation, cell manufacturing, continuous flow processes and first run studies. A connected issue is the design and acquisition of temporary structures, which are perhaps the most acute intersection of product and process design.

Labor Supply -- Should the industry pursue a strategy of deskilling? Is deskilling a necessary consequence of simplifying site installation to final assembly and commissioning? Will labor unions embrace lean concepts and techniques such as Last Planner and train supervisors accordingly? What is an appropriate approach to multiskilling that accomplishes the purpose of smoothing work flow and will be supported by labor?

Shared Resources -- One of the challenges of site management is coordinating the use of shared resources such as space, cranes, scaffolding and lifts. What are current best practices regarding each of these? 2D and 3D models seem clearly necessary for effective allocation of space. Are cranes and lifts best allocated through schedules or through requests for service? How are these managed by the crafts themselves on successful projects?

Site Materials Management -- How best to provide workers what they need when they need it (provide value), while minimizing waste? Kanban techniques and supplier managed inventories appear to be part of the answer. If work is best organized around providing work packages, a 'day's' work for each crew, then what should be delivered with the made-to-order products? Is it best to 'bag and tag' or kit all materials together needed for that day's work, or is it best to deliver just-in-time only the made-to-order products, while maintaining right-sized inventories of made-to-stock products easily available to site operatives? Or, should final kitting be done on site by special crews who combine MTO and MTS products with the tools and information needed by the installation crews, with the crew foreman coordinating between them?

Commissioning -- It seems right to measure project completion from that point in time when the client has beneficial use of the facility; in other words, after testing, occupancy and start up. That is the point in time when it can be determined if the facility can do what was promised and if it is fit for purpose. It is the time when the customer begins to get value from their investment. It has long been standard practice to commission manufacturing facilities and the practice of commissioning has in recent years been extended to buildings as well. Commissioning involves testing and integrating the functional systems of a facility. It begins in early planning and involves systematic prevention and elimination of defects from design onwards. Provider and customer work together first in defining the project, then have another major intersection in the final commissioning of a facility.