Flow Driver - A System For Reducing Fabricator Lead Time

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Introduction

The superiority of pull-based production systems over traditional batch and queue (mass) is evident and resulting in the transformation of several industries. In White Paper-1 we presented the benefits of pull-based production for AEC projects. In that paper we proposed that in order to use pull-based systems on AEC projects, a window of reliability greater than supplier lead-time must be obtained. The Last Planner system of production control was created to increase the window of reliability, which subsequently will exceed the lead time for acquiring most commodity materials; i.e., those available off-the-shelf. However, a large number of components are fabricated to order and typically have lead times of 4-12 weeks; far exceeding current reliability windows. Consequently, it will be necessary to reduce those lead times. This paper presents the conceptual framework for Flow Driver, a process for reducing fabricator lead time.

Background

Over the past year, members of LCI's staff have visited several fabrication facilities (fabricators) to better understand current production practice amongst those supplying finished goods (materials) to the AEC industry. All but one, Trane Manufacturing, are using some form of traditional batch and queue (mass) production. During these visits Glenn Ballard is often heard stating "We only have seen one type of fabricator regardless of the goods being produced." Almost always the obligatory presentation of the firm's history indicates that their present production process has evolved over the years with little or no attention paid to systems development. When asked if they have considered the application of lean production, each of them has proven to be unfamiliar with the topic. It seems at this point safe to say that many, if not most, of those producing materials for the AEC industry have had little if any exposure to contemporary production theory.

Initial performance metrics derived from these visits are as follows:

- Queue time far exceeds processing time
- Batches are processed in the largest size possible
- An effort is made to locally suboptimizing process or work station

Hypothesized reductions in lead time are:

- Fabricated steel reduced from ten weeks to two weeks

- Air-Handler units from sixteen weeks to five
- Industrial piping from six weeks to two

Discussion - Why are we where we are?

If such performance improvement is obtainable one must inquire as to why lead times are so long and what keeps us from reducing them. It seems that several issues are at hand. The most apparent are the "throw it over the wall" work flow mentality, purchasing on low price without considering supplier performance, and poor plan reliability at the assembly site. These issues, coupled with evolution of distribution channels[1], form what Jim Womack termed "The lack of a social basis for collective analysis of the overall industry value stream."

Prior to addressing business models and distribution channel evolution we must first however develop the necessary processes to improve performance. Once the processes are developed and tested we will be better able to identify the business model issues that need to be addressed.

Improving Performance Through Flow Driver

Based on our observations to date we are of the opinion that opportunity for improvement abounds at the majority of fabricators serving the AEC industry. Through the application of four simple tools; work mapping, analysis, compression and prototyping we can begin to move closer to our goal of a window of reliability greater than material lead time. The following is a step by step guide for the improvement of a fabrication process.

Step One - Work Mapping

Describe the current state of the fabricator's process through the application of LCI's Work Mapping language. Draft the overall facility layout, routing of information and materials and location of suppliers providing raw materials to the facility. Include the fabricator's order acquisition and order forecasting processes. Confirm the accuracy of your map with fabricator personnel. {ADD A SCHEMATIC WORKMAP AS AN EXAMPLE}

Step Two - Analysis

Enter performance metrics. Determine the dominant products or product families. Record processing times, queue times, work-in-process (WIP), defect rates, rework durations, set-up times, transfer batch sizes, process batch sizes, cycle times for key items or types of fabrication, throughput rates and capacities. Identify bottlenecks and their utilization rates. Document the directives or goals that govern batch sizing. Supplement quantitative measurement data with

[1] During our visit to a steel fabricator our host explained that in the early half of the century structural steel was rolled and fabricated by the same firm. He stated that the standard in-process time from rolling to erection for a large structural member averaged forty eight hours. He went on to state that over capacity of mills resulted in fabrication only firms. After awhile the distribution channels evolved to reflect the current state. (mill, fabricator and erector)

interviews of facility personnel. Note quality performance (defect rates), lead time, and on-time performance of vendors providing raw materials to the facility.

Step Three - Compression

Develop a future state map by considering the application of the following actionable items.

1. Clean and clear.
2. Expand bottleneck capacities to increase system capacity.
3. Establish decoupling buffers before and after bottleneck processes to take best advantage of available system capacity.
4. Implement pull techniques such as kanban or conwip to reduce work-in-process (WIP); e.g., reduce the space between machines to limit intermediate inventories and reduce material handling time.
5. Reduce rework by implementing poka-yoke (mistake proofing) techniques.
6. Reduce set-up time through the application of SMED (single minute exchange of die) techniques.
7. Reduce transfer batch sizes.
8. Reduce process batch sizes where appropriate.
9. Organize production in cells using group technology and multi-skilled workers.
10. Improve supplier quality and delivery performance.
11. Increase the accuracy of the demand forecasting system.

Step Four - Prototyping

Though the compression strategies will result in improved profitability and cash flow for the fabricator, the actual cost of the implementation is such that mistakes must be avoided. This can be done through the use of several prototyping tools such as future state Work Maps, mathematical models and discrete event simulation. {EXPAND-add Iris' pull model as an example of discrete event simulation}

Conclusion

In order to use pull-based systems on AEC projects a window of reliability greater than supplier lead-time must be obtained. This is achieved by improving plan reliability and reducing lead time for supply. This paper presents the conceptual model for Flow Driver, a technique for reducing fabricator lead time based on four tools: work mapping, analysis, compression and prototyping. As with the implementation of any lean production based process the current business drivers must be understood and altered. This is the topic of future white papers. In the meantime your thoughts and ideas are appreciated.