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Cycle Time *vs.* Processing Time *vs.* Lead Time

When developing a process map, a fundamental objective is to illustrate clearly the usually dramatic difference between overall door-to-door Lead Time (which is a direct indication of flexibility and responsiveness) and Value-Added time, or processing time. Then we analyze the situation for causes of waste and develop a plan to minimize that waste.

While cycle time and processing time of course are directly related, they pertain to different parameters of interest. Processing time is a measure of the total "hands-on" value-added time invested in a production unit in order to get it to the customer. Cycle time is simply a measure of the unit production rate given the resources applied along the line. When designing/balancing a line or cell, one focus is to achieve a cycle time slightly less than the "takt" time, or demand rate. Based upon that, we then strive to set up the series of processes/cells so that individual cycle times are roughly the same. That is what allows flow.

As the Operator Balance chart suggests, what determines cycle time is the combination of total work content (processing time) and the resources available. In the highly-simplified example of Acme Stamping we dealt with a series of four manual processes in the Current State, each with one full-time dedicated operator. In that case, cycle time and processing time *(within any given process)* are the same. However, by referring to Page 72 in the course book, we see that in Acme's Future State the new cell's cycle time is 55 seconds -- by design, just under the takt time of 60 seconds. Since three full-time operators are involved, processing time for the cell then is 55 x 3 = 165 seconds.

A Slight Academic Detour

It is possible (and highly desireable) for overall lead time to be shortened to the point where it approaches total processing time, ***if*** the operation is highly efficient. In fact, it even could be possible -- by committing enough resources, and if some processes can be run in parallel -- to attain a lead time that is *less* than total processing time.

As an extreme example, let's say we have 100 single-operator processes running in parallel to produce a final product. Assume that each one makes a subassembly, all of which then feed together into one single-operator final-assembly process that takes 5 minutes. If each of these subassembly processes also requires 5 minutes of processing time by a single resource (we would design our line that way to keep cycle times similar throughout), the results are:

Cycle Time = 5 minutes

Processing Time = (5 min. x 100) + 5 min. final assembly = 505 minutes

Lead Time = 5 min. + 5 min. = 10 minutes (plus any non-value-added time)

But if those same processes all had to occur in series, then the results would have been:

Cycle Time = 5 minutes

Processing Time = (5 min. x 101) = 505 minutes

Lead Time = (5 min. x 101) = 505 minutes (plus any non-value-added time)

For a given product, processing time always stays essentially the same; that is the work content required to make the product. However, cycle time and lead time can be driven to a minimum given the various constraints of a product's manufacture; available resources; company priorities; etc. The objective is to optimize the system overall.