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# Takt Time Grouping: implementing kanban-flow manufacturing in an unbalanced, high variation cycle-time process with moving constraints

Mitchell A. Millstein & Joseph S. Martinich

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## Abstract

One-piece flow and kanban/pull methods have been used to reduce work-in-process (WIP) and flowtime in manufacturing flow processes; however, these methods have limitations. For example, one-piece flow does not work well when there are relatively large set-up times required between different components. One-piece flow also requires operations to be well balanced with a minimum of variability in processing times at each operation. Unfortunately, these conditions often do not exist. The theory of constraints drum-buffer-rope (DBR) method is designed for unbalanced processes, and it has been shown to be effective for products with large operation time variation. However, DBR does not generally optimise flowtime and cannot handle a process with moving constraints (bottlenecks). We have developed a method called Takt Time

Grouping (TTG) for implementing kanban-flow manufacturing, when one-piece flow or DBR do not provide good results. TTG combines one-piece flow manufacturing, transfer-batch sizing and DBR concepts through the use of a constraints-based transfer-batch sizing formula. Using a discrete event simulation model, it is shown that TTG increases throughput rate as compared to one-piece flow, CONWIP and DBR approaches, with much lower WIP inventory and faster flowtime than CONWIP and DBR.

Keywords:

flow manufacturing | kanban | theory of constraints | drum-buffer-rope | cycle time variation | mixed model | transfer-batch sizing | CONWIP

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