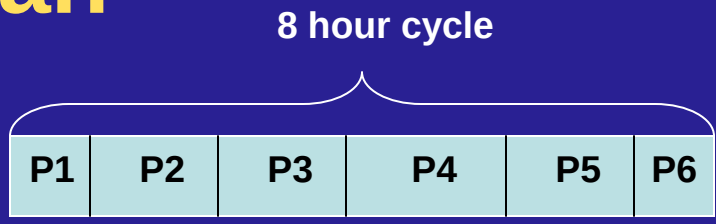
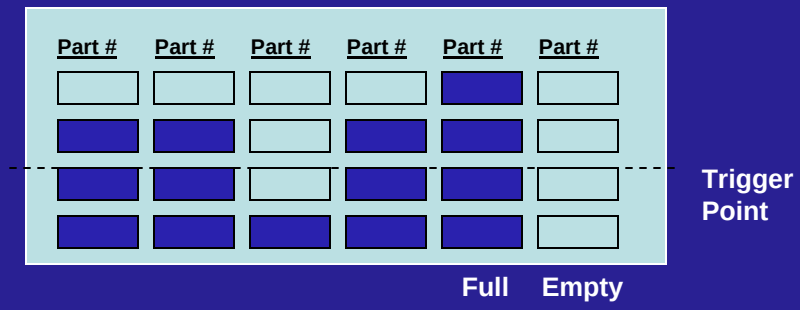
Ways to schedule batch processes with kanban

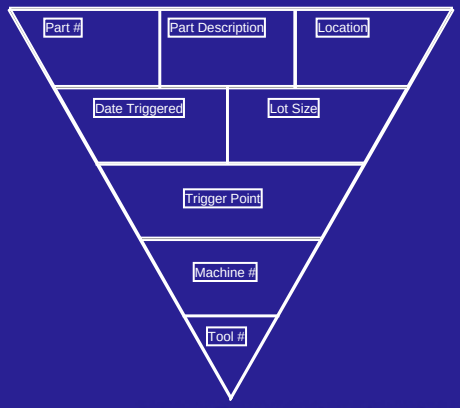
- **Pattern production**
  - +Predictable sequence, stability
  - -Inflexible to changes during shift



- **Lot making with batch board**
  - +Visual control, shorter lots possible, info
  - -Many cards per part #, requires discipline



- **Triangle kanban**
  - +Single kanban to control, pressure to reduce C/O time
  - -Fixed quantity unfixed time cases only



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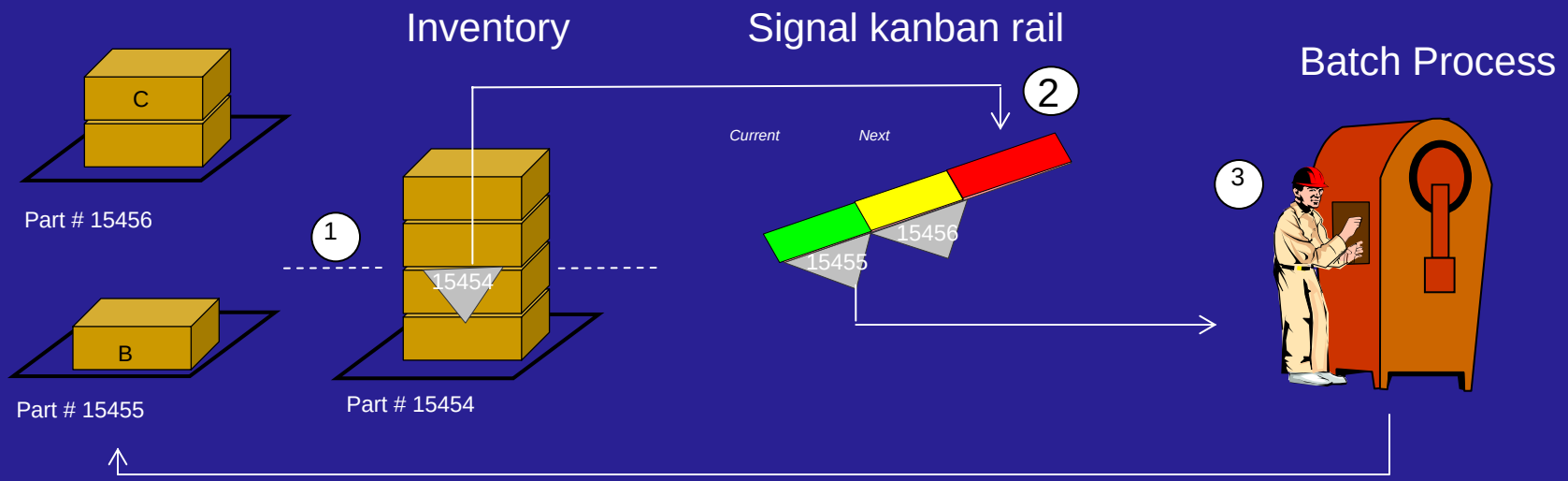
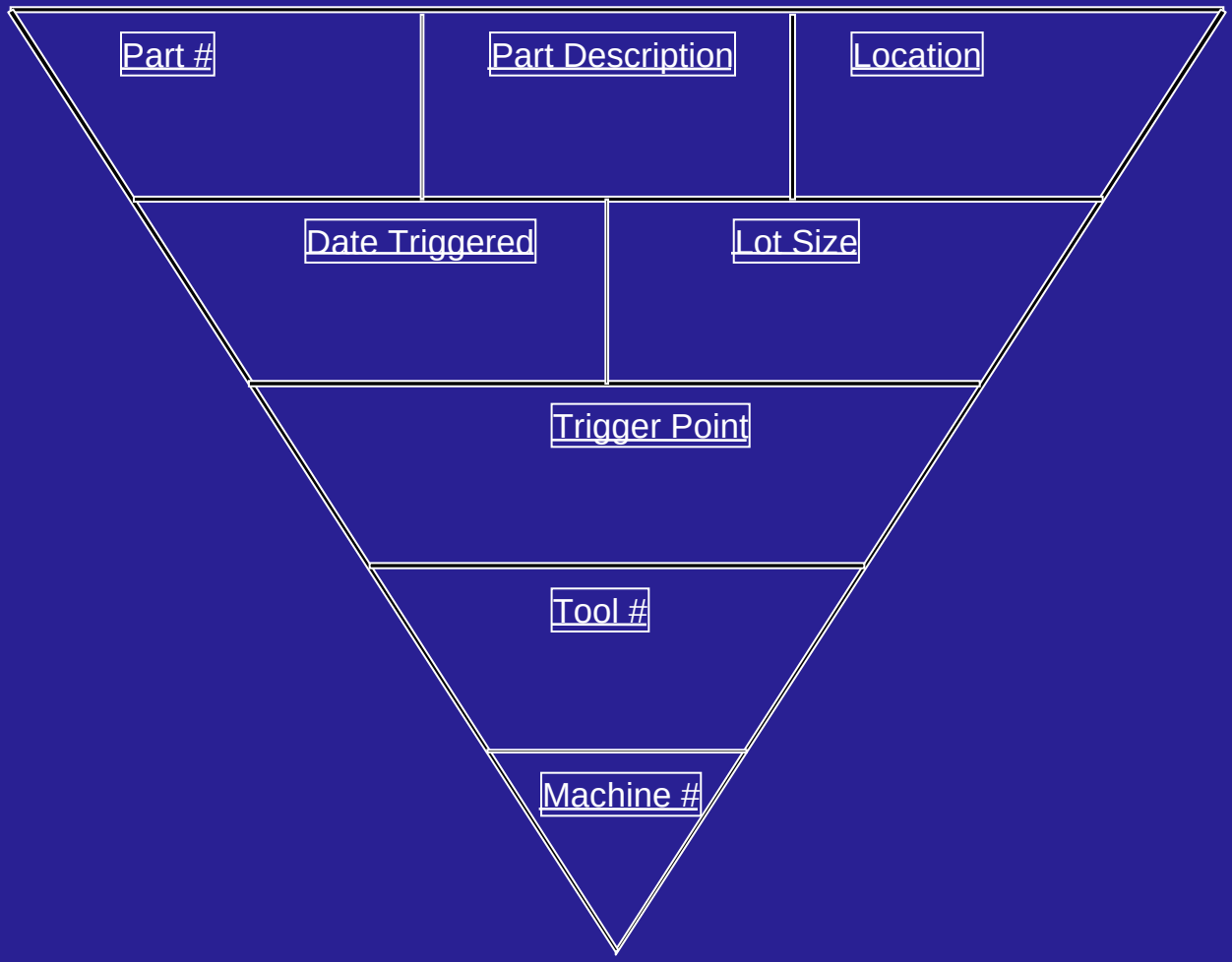
Sample triangle kanban flow



Note: Only 1 triangle kanban per part # is needed in this flow

Triangle Kanban



Short exercise - Steps for setting up triangle kanban*

Step 1: Determine time available for changeover work.

Step 2: Set the number of changeovers per day.

Step 3: Establish a lot size for production.

Step 4: Establish a trigger point for reorder.

*Assumes part numbers have already been dedicated to run on certain machines

Step 1: Determine time available for non-production work (1 machine*)

Part #	Average demand per day (pieces)	Cycle time Per piece	Required run time per day	Average changeover time	Average scrap rate
15487	200	40 sec.	136 min.	55 min.	1.5%
15488	300	45 sec.	228 min.	55 min.	1.3%
15489	500	40 sec.	339 min.	55 min.	1.5%
	1,000		703 min.		

Total 1-shift production time available (net breaks and lunch)		450 min.
Number of shifts	x	2
Time available for production on 1 machine 1 day	=	900 min.
Time required per day to meet average demand*	-	703 min.
Net time available for set up and changeovers per day	=	197 min.
* Taken from above chart on basic machine data		

***The three part numbers dedicated to this molding machine**

Step 2: Set the number of change over events per day

Non-production time available		197 min.
Average downtime (not including set-up and changeover times)	-	30 min.
Time available for changeover work on 1 machine 1 day	=	167 min.
Average changeover time	÷	55 min.
Desirable number of changeovers per day	=	3.04

Step 3a: Establish the batch factor

$$\textbf{Batch Factor} = \frac{\text{Number of part numbers on the machine}}{\text{Number of C/O's per day}}$$

In this molding machine example

$$\frac{3 \text{ part numbers}}{3 \text{ C/O's}} = \textbf{1}$$

Lot Size = 1 day of production per part number

Step 3b: Establish the lot size

Part #	Batch factor		Demand per day (pieces)		Lot size (pieces)
15487	1	x	200	=	200
15488	1	x	300	=	300
15489	1	x	500	=	500

Total 1000 pieces

Step 4: Establish the trigger point for reorder

$$\text{Trigger point} = \frac{\text{Total lead-time to replenish}}{\text{Part takt time}}$$

Part #	Daily run time	C/O time	First container	Average down time*	Total LT (min)
15487	136	55	10	4.4%	210
15488	228	55	10	4.4%	306
15489	339	55	10	4.4%	421

***Inclusive of scrap loss**

Step 4: Establish the trigger point for reorder (continued)

Part #	Lot size (Pieces)	Total LT (Min)	Longest lead-time* (min)	Takt time (27,000*2/ Daily demand)	Trigger Point**
15487	200	210	421	4.5 min	100
15488	300	306	421	3.0 min	140
15489	500	421	306	1.8 min	170

*Assumes longest run time item at front of queue for the three part numbers.
**Rounded to the nearest 10 (box quantity)