



# The LeanMan

Lean Factory Simulation Kits

## Lean Principles

2-Event Facilitator Instructions and  
Participant Placemats

## Learning to See the Waste

# Calculations

Measure and Calculate the results:

	Total Cars Completed	Number Reworked	Number In WIP	Rate Cars/Minute	1st PC to FGI in SEC
Batch 'n Queue "A"	_____	_____	_____	( total # cars / sim run time) _____	(time in sec) _____
Lean "B"	_____	_____	_____	( total # cars / sim run time) _____	(time in sec) _____
	=B/A*100	=A/B*100	=A/B*100	=B/A*100	=A/B*100
Improvement	%	%	%	%	%

## Timekeeper:

Exercise #A: Place the participant instruction placemats with the Batch 'n Queue steps face up.

Call START and run the simulation for 10 minutes, then call STOP. Overtime up to 4 minutes may be permitted to deliver at least one batch to finished goods. Record the time the 1st car reaches finished goods. Complete the metrics calculation form for each exercise.

Exercise #B: Turn the participant placemats over so the Lean Flow instructions are face up.

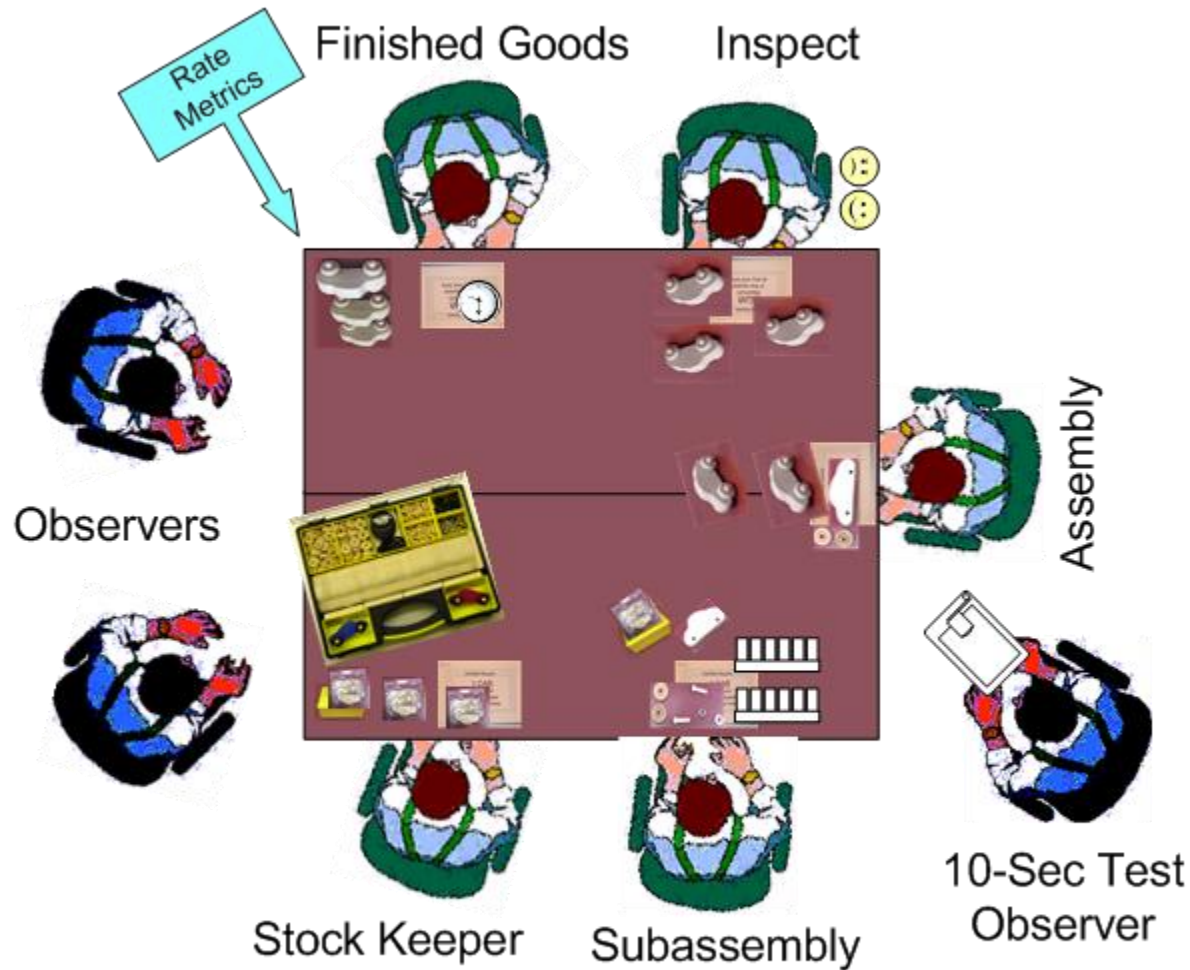
Call START and run the lean flow simulation for 10 minutes, call STOP. Record the time the 1st car reaches finished goods. Complete the metrics calculation form for each exercise

Note: the alternate Financial Metric Sheet may be used in place of this format.

## Facilitator Instructions:

### ■ Exercise Number 1 - Batch 'n Queue

- Requires 5 participants to run the exercise and any number of participants in the observation team.
- Place the five placemats in numbered order Batch 'n Queue side face up around a table with five chairs.
  - Position #1. STOCKKEEPER Place the kit of materials in front of this person with the lid open. Get out the five plastic zip lock bags from under the car bodies, and use one large yellow plastic container as a tote box.
  - Position #2. SUBASSEMBLY Place the five subassembly fixtures at this position
  - Position #3. ASSEMBLY - no set up req'd
  - Position #4. INSPECTION - no set up req'd
  - Position #5. TIMEKEEPER Place the metric sheet here, along with the stopwatch (or other method of marking 10 minutes)
- Have the five participants sit and read the process on their place mat, and tell the observer team to stand behind the participants and watch the action. Tell the timekeeper to call start when ready and start the timer. Tell everyone to follow their process. **NOTE: if no cars reach finished goods at the end of ten minutes continue to run on overtime for up to 4 minutes or until at least one delivery is made.**
- Hand out one of the 10-Second Test forms to the observer team and ask them to perform the 10-Second Test about every two minutes and record the results (use a wet-erase marker on the laminated sheet).
- NOTE: don't take up time explaining the exercise in detail - just get them started. The initial confusion will quickly settle out as activities become obvious.
- As the exercise progresses, point out non-value added activities as they occur (examples)
  - Everyone except the stock keeper starts out the "day" idle, even though the 3-piece batch may be optimum for someone picking kits, it's not optimum for the value stream (everyone else).
  - Upstream processes stop when waiting for totes and bags to return from downstream
  - Picking kits into bags and then into totes and then de-kiting right away at the next step is a lot of double handling of material
  - Quality nonconforming material (black wheels) isn't "found" until the inspector catches it at the tail end, allowing a lot more quality defects to flow into the WIP.
  - Returning a defective car back upstream for rework causes a lot of confusion and uses up time. If your company uses one, discuss the impact of having to complete a non conforming material report.
  - Even though each person read the process, point out anyone not following the process. There's always one!
  - How many batches of cars were delivered in the 10 minutes? Was OT needed to satisfy the customer?
  - Complete the alternate Financial Metric Sheet to see the Waste impact to the bottom line. Discuss the influence of WIP, Flow and Batch Size on the cost of operations.

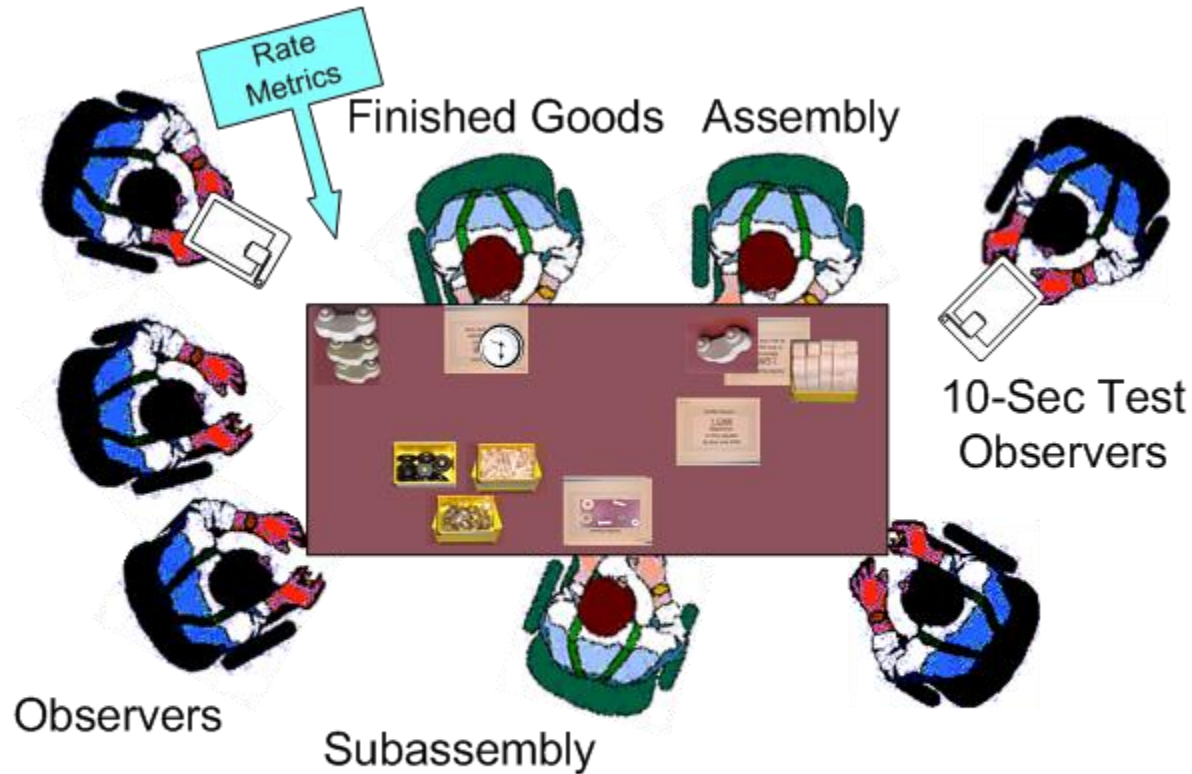


**Learning to See the Waste – Exercise #1 Batch 'n Queue**  
**3-pc Batch, Picked Kits, Quality Inspector**

## Facilitator Instructions:

### ■ Exercise Number 2 - Lean Flow.

- Requires 3 participants to run the exercise and any number of participants in the observation team.
- Flip the placemats over with the Lean Flow face side up in numbered order around a table. Note that the KANBAN Square placemat goes between the two assembly positions.
  - Note the switch in jobs. The stock keeper and Inspector positions are eliminated, and material is placed at the point of use.
  - Position #1. SUBASSEMBLY Place the yellow containers of wheels, axle pegs and break disks into a Point of Use inventory area in front of this person. Mix the painted wheels into the containers with the plain wheels. Note: Fixtures are not used.
  - Position #2. ASSEMBLY Place the car bodies into a POU inventory area in front of this person.
  - Position #3. TIMEKEEPER Place the metric sheet here, along with the stopwatch (or other method of marking 10 minutes)
- Have the three participants sit and read the process on their placemat, and tell the observer team to stand behind the participants and watch the action. Tell the timekeeper to call start when ready and start the timer. Tell everyone to follow their process. **NOTE: if no cars reach finished goods at the end of ten minutes continue to run on overtime for up to 4 minutes or until at least one delivery is made.**
- Hand out one of the 10-Second Test forms to the observer team and ask them to perform the 10-Second Test about every two minutes and record the results (use a wet-erase marker on the laminated sheet).
- NOTE: don't take up time explaining the exercise in detail - just get them started. The initial confusion will quickly settle out as activities become obvious.
- As the exercise progresses, point out differences observed between the first exercise and the lean method. Point out the non-value added activities that have disappeared, and any that remain (give examples)
  - Everyone in this lean flow begins to work almost at once, and work develops a balance. Notice how difficult it is to keep four subassemblies in the KANBAN square as they are quickly used by the final assembly stage.
  - Notice nothing travels back upstream to interfere with the flow (no fixtures or material totes, and rework if necessary is performed at the point of discovery)
  - Picking material from the POU inventory eliminates the double handling of parts
  - Quality nonconforming material (black wheels) are found and removed from the flow immediately. Quality mistakes still happen - but now they are a function of workmanship and more easily resolved.
  - Notice the increase in frequency of repetitive motions - discuss ergonomics and safety in a lean flow
  - How many cars were delivered in the 10 minutes? All 20? Was any OT required?
  - Compare the metrics and discuss the observations of the 10 Second Test team for both simulations.
  - Complete the alternate Financial Metric Sheet to see the lean impact to the bottom line. Discuss the influence of WIP, Flow and Batch Size on the cost of operations.



**Learning to See the Waste – Exercise #2 Lean Flow  
1x1 Flow, Point of Use Mtl, Certified Assemblers**



## Batch 'n Queue - Step 1

### Stockroom:

- 1 Pick 3 kits, placing material for each car into a plastic bag, zip lock the bag and place into large yellow container.
- 2 Move the batch of 3 cars to the next operation
- 3 Repeat operation when the empty containers are returned from next op.

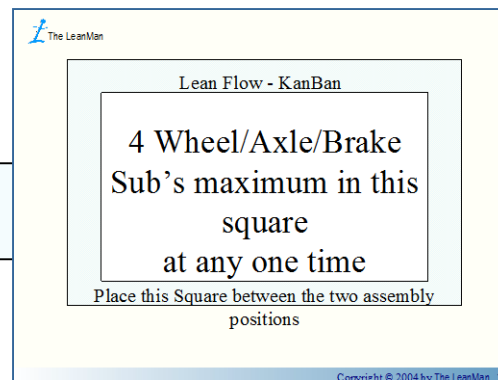
**NOTE: randomly insert a painted wheel into just one of the kits in each batch of three until told to stop by the inspection person.**



## Lean Flow - Step 1

### Wheel / Axle / Brake subassembly:

- 1 Pick material from the POU bins, inspecting for nonconforming material (discard and do not use and painted wheel)
- 2 Assemble wheel onto axle, curved side of wheel toward axle hub.
- 3 Slip disk brake onto axle, flat side to wheel's flat side. Place sub assembly into the KANBAN square. *No more than 4 at any one time*





## Batch 'n Queue - Step 2

### Wheel / Axle / Brake subassembly:

- 1 Remove material from plastic container. *Return empty containers to previous op.*
- 2 Assemble wheel onto axle, curved side of wheel toward axle hub.
- 3 Slip disk brake onto axle, flat side to wheel's flat side. Place sub assembly onto fixture by pressing the rounded hub into the fixtures recessed hole.
- 4 Place 4 subassemblies onto each fixture.
- 5 Pass entire batch to next operation when all three are complete.



## Lean Flow - KanBan

**4 Wheel/Axle/Brake Sub's  
maximum in this square  
at any one time**

Place this Square between the two assembly positions

## Batch 'n Queue - Step 3

### Car assembly:

- 1 Remove each wheel subassembly from holding fixture and attach to car body, use clockwise twist as you insert the axle peg. *Return empty holding fixture to previous op.*
- 2 Move the completed batch of 3 cars to the next operation when all 3 are complete.



Use of the tool is highly encouraged to prevent sore fingers over the duration of the simulation event.

## Lean Flow - Step 2

### Car assembly:

- 1 Pick the car body from the POU material and pick each wheel subassembly from the KanBan square as needed, inspecting for (and rejecting) any with a painted wheel.
- 2 Attach each wheel subassembly to the car body, use clockwise twist as you insert the axle peg, and inspect for freely rotating wheel. Adjust as required.
- 3 Move the car to the Finished Goods area when complete.



Use of the tool is highly encouraged to prevent sore fingers over the duration of the simulation event.

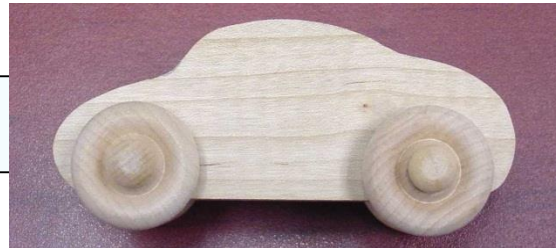
## Batch 'n Queue - Step 4

### Inspection Criteria:

- 1 All 4 wheels rotate freely.
- 2 All 4 wheels unpainted.

Return any reject to previous operation for repair, ***and tell the stock keeper to stop using painted wheels***

- 3 If acceptable, pass completed cars in a batch of three pieces to Finished Goods



## Lean Flow - Step 3

### Finished Goods / Timekeeper

- 1 Start the exercise by starting the stopwatch and calling go.
- 2 Record the metrics in the spaces provided on the metric sheet for exercise "B". Pay attention to the time when the first car reaches Finished Goods and record it.
- 3 When ten minutes are up - call stop. If no cars have reached Finished Goods, call "OVERTIME" and allow up to 4 additional minutes. Stop when a delivery is made. Complete the metrics by recording the number of cars in WIP, Quality Defects, etc.

	Total Cars Completed	Number Reworked	Number In WIP	Rate Cars/Minute	1st PC to FGI in SEC
Batch 'n Queue "A"				( total # cars / sim run time)	(time in sec)
Lean "B"				( total # cars / sim run time)	(time in sec)
	=B/A*100	=A/B*100	=A/B*100	=B/A*100	=A/B*100
Improvement	%	%	%	%	%



## Batch 'n Queue - Step 5

### Finished Goods / Timekeeper

- 1 Start the exercise by starting the stopwatch and calling go.
- 2 Record the metrics in the spaces provided on the metric sheet for exercise "A". Pay attention to the time when the first set of cars reaches Finished Goods and record the time.
- 3 When ten minutes are up - call stop. If no cars have reached Finished Goods, call "OVERTIME" and allow up to 4 additional minutes. Stop when a delivery is made. Complete the metrics by recording the number of cars in WIP, Quality Defects, etc.

	Total Cars Completed	Number Reworked	Number In WIP	Rate Cars/Minute	1st PC to FGI in SEC
Batch 'n Queue "A"				( total # cars / sim run time)	(time in sec)
Lean "B"				( total # cars / sim run time)	(time in sec)
	=B/A*100	=A/B*100	=A/B*100	=B/A*100	=A/B*100
Improvement	%	%	%	%	%

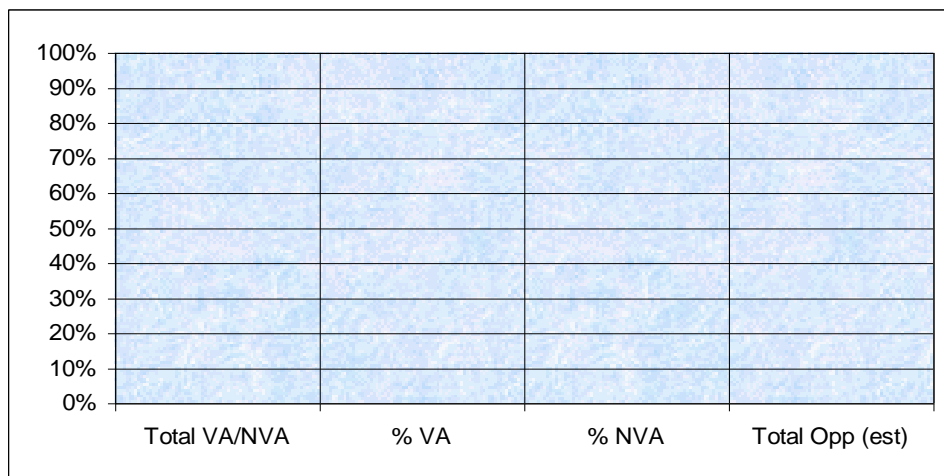
Lean Flow

Finished Goods



Area	Input No. of Persons Observed ↓		Input No. of Persons Doing VA Work ↓				
Test #	# Observed		VA (qty)		NVA (qty)		Running % NVA
1							
2							
3							
4							
5							
<b>Totals</b>							

Total Observed \_\_\_\_\_  
 Total Observed VA \_\_\_\_\_  
 Total Observed NVA \_\_\_\_\_  
 % Activity NVA \_\_\_\_\_  
**Est Opportunity (%)** \_\_\_\_\_  
 (Shown in Red - 25% of NVA)



*Lean Thinking - developing an "eye for waste"*





Area

Input No. of  
Persons  
Observed

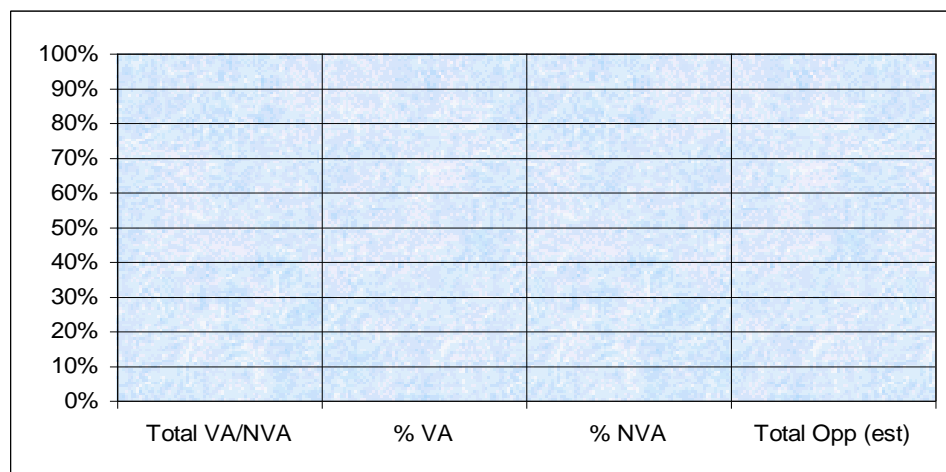


Input No. of  
Persons Doing  
VA Work




Test #	# Observed		VA (qty)		NVA (qty)		Running % NVA
1							
2							
3							
4							
5							
<b>Totals</b>							

Total Observed \_\_\_\_\_  
 Total Observed VA \_\_\_\_\_  
 Total Observed NVA \_\_\_\_\_  
 % Activity NVA \_\_\_\_\_  
**Est Opportunity (%)** \_\_\_\_\_  
 (Shown in Red - 25% of NVA)



*Lean Thinking - developing an "eye for waste"*

## Alternate Metric Sheet for Learning to See The Waste

 <b>Financial Chart</b> <b>Learning to See the Waste</b>	Run 'A'		Run 'B'	
	Batch 'n Queue		Lean Flow	
		\$	#	\$
# Cars delivered x \$500 ea = <b>Total Sales</b> =				
Cost of Goods Sold				
Sales Material = # cars sold x \$100 ea				
Labor = # workers x \$165 ea				
Labor OT = # minutes OT x \$40 ea worker				
Overhead = # Chairs used x \$10 ea				
Scrap = # nonconforming cars x \$100 each				
<b>Total of COGS</b> =				
Capital Charges				
Work in Process				
Stockroom = # undelivered kit bags picked x \$100 ea				
Wheel/Axle/Brake Subassy = # Subassembly Items built x \$10 ea				
Car Assy = # Undelivered cars built x \$60 ea				
Inspection = # Cars in inspection x \$100 ea				
Ship = # Cars in Finished Goods x \$100 ea				
Facilities				
# Tables used x \$15 ea				
# Fixtures used x \$10 ea				
<b>Total Capital Charge</b> =				
<b>Sales – COGS – Capital Charges =EVA</b> =				

also available as an Excel file on the CD