The LeanMan

Lean Factory Simulation Kits

Lean Principles

4-Event Placemat Instructions

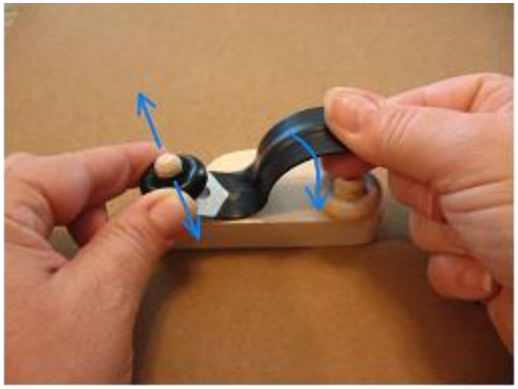
Lean Factory Simulation

A word about safety and ergonomics:

- The simulation exercises use small components to produce toy cars. They are attractive to small children, therefore use caution when storing the components and keep them away from small children to prevent choking.
- The wooden pegs used to mount the wheels are made of a hard wood and should provide stable use over a long time. However, all wood will absorb moisture in high humidity conditions causing a slight swelling of the fibers and resulting is a tight fit of the wheel assembly. If this happens, the pegs may be baked in a 300º F oven for 10 minutes to remove the excess moisture.
- If a tight peg / wheel assembly is difficult to remove, use the wheel extraction tool provided. Follow the instructions as shown.

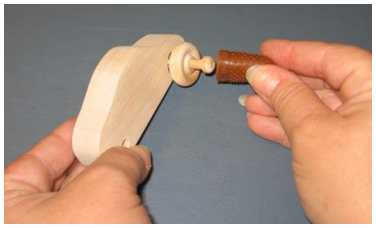
To remove a tight wheel assembly, gently slide the wheel extraction tool under the wheel and around the axle peg.

Slowly pry up against the underside of the wheel or disk, with the tip of the tool centered with the peg, to bring the peg straight out of the hole.



Gently rock the axle back and forth while pressing downward on the extraction tool handle. Use care not to flip the wheel and disk into the air. Do not bend the tool – press slowly and rock the peg loose.

- When inserting the wheel / peg assembly onto the car body, use a slight clockwise twist of the peg to ease insertion. Use the ergonomic tool provided to grip the peg and prevent finger soreness over the duration of the simulation event.



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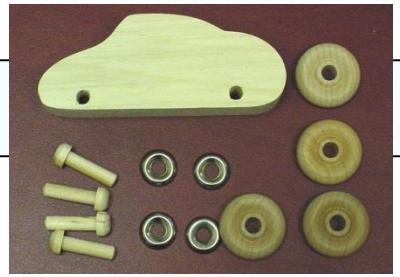
Exercise #1 Batch ‘n Queue

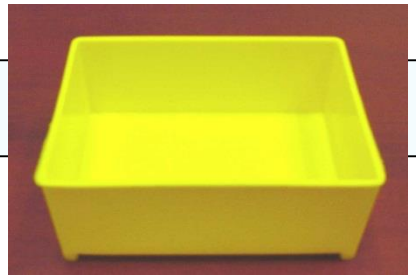
Batch ‘n Queue - Step 1

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 <u>one</u> of the kits in each batch of three until told to stop by the inspection person.

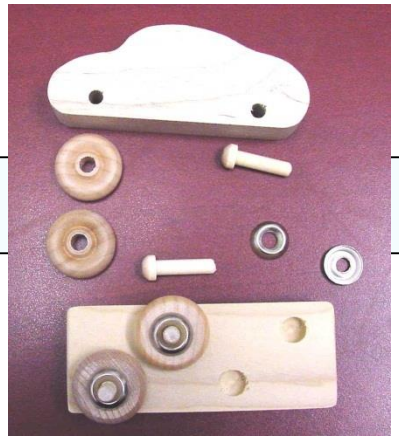




Batch ‘n Queue - Step 2

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.



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.

Ergonomic Assembly Tool

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

Batch ‘n Queue - Step 4

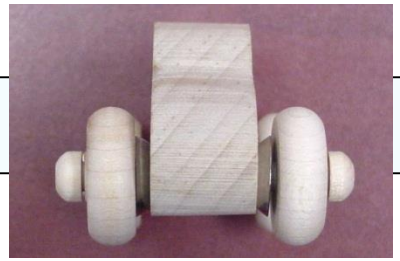
Inspection Criteria:

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***

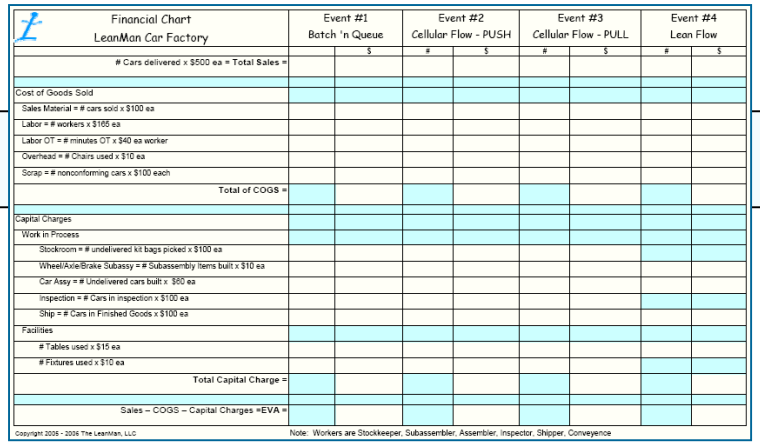
3 If acceptable, pass completed cars in a batch of three pieces to Finished Goods



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 1. 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. Complete the metrics by recording the number of cars in WIP, Quality Defects, etc.



Financial Chart LeanMan Car Factory	Event #1 Batch 'n Queue		Event #2 Cellular Flow - PUSH		Event #3 Cellular Flow - PULL		Event #4 Lean Flow	
	#	$	#	$	#	$	#	$
# Cars delivered x $500 ea = Total Sales =								
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								
Total of COGS =								
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								
Total Capital Charge =								
Sales – COGS – Capital Charges =EVA =								

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Note: Workers are Stockkeeper, Subassembler, Assembler, Inspector, Shipper, Conveyence

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Lean Factory Simulation

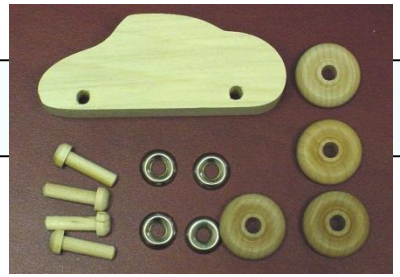
Exercise #2 Continuous Flow (push)

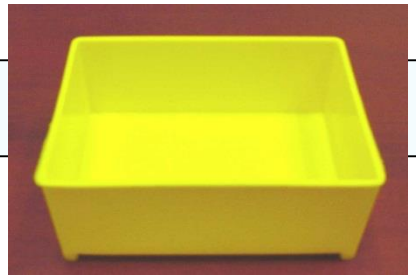
Continuous 1-Piece Flow - MRP Push Method
Step 1

Stockroom:

1 Pick 1 kit, placing material for the car into a plastic bag, zip lock the bag and place into large yellow container.
2 Move the 1-piece job to the next operation
3 Repeat operation when the empty container is returned from the next op.

NOTE: insert a painted wheel into every third kit until told to stop by the inspection person.

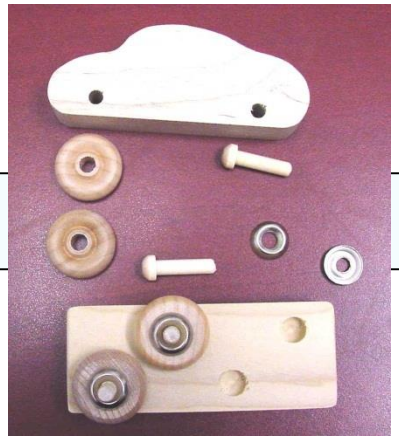




Continuous 1-Piece Flow - MRP Push Method
Step 2

Wheel / Axle / Brake subassembly:

1 Remove material from plastic container. *Return empty container and bag 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 the fixture and car body to next operation when complete.



Continuous 1-Piece Flow - MRP Push Method
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 car to the next operation when complete.

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

Continuous 1-Piece Flow - MRP Push Method
Step 4

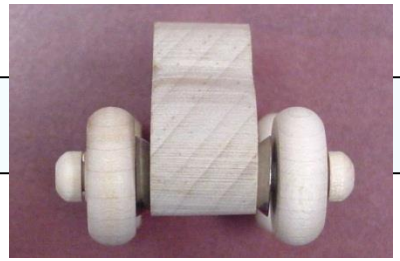
Inspection Criteria:

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***

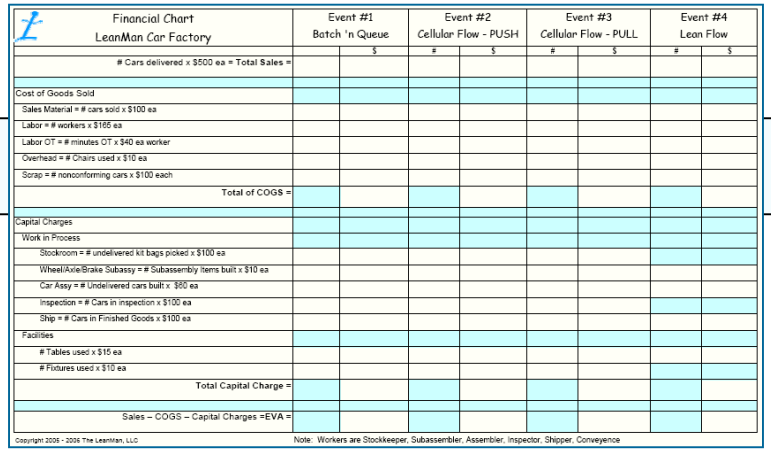
3 If acceptable, pass completed car to Finished Goods



Continuous 1-Piece Flow - MRP Push Method
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 2. Pay attention to the time when the first car reaches Finished Goods and record the time.
3 When 4 minutes are up - call stop. (Allow up to 4 minutes OT to achieve a delivery) Complete the Financial Metrics sheet



Financial Chart LeanMan Car Factory	Event #1 Batch 'n Queue		Event #2 Cellular Flow - PUSH		Event #3 Cellular Flow - PULL		Event #4 Lean Flow	
	#	$	#	$	#	$	#	$
# Cars delivered x $500 ea = Total Sales =								
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Overhead = # Chairs used x $10 ea								
Scrap = # nonconforming cars x $100 each								
Total of COGS =								
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								
Total Capital Charge =								
Sales – COGS – Capital Charges =EVA =								

Note: Workers are Stockkeeper, Subassembler, Assembler, Inspector, Shipper, Conveyence

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Lean Factory Simulation

Exercise #3 Continuous Flow (pull system)

Continuous 1-Piece Flow - Pull System
Step 1

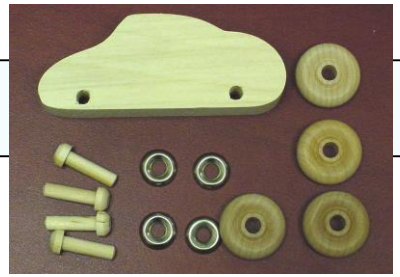
Stockroom:

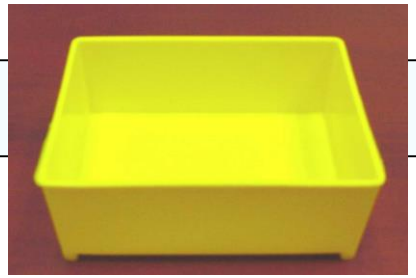
1 Pick 1 kit, placing material for the car into a plastic bag, zip lock the bag and place into large yellow container.

2 Move the 1-piece job into step 1's KanBan Square, but *only* if it is empty.

3 Repeat operation when the empty container is returned from the next op.

NOTE: insert a painted wheel into every third kit until told to stop by the inspection person.





Continuous 1-Piece Flow - Pull System

Step 2 Input Kanban

Maximum:
1 Car kit

Place this Square between the Stockroom and Subassembly positions

Continuous 1-Piece Flow - Pull System
Step 2

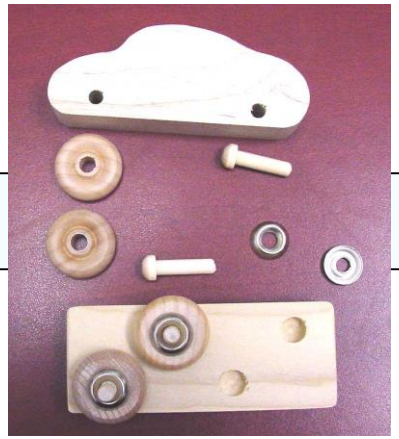
Wheel / Axle / Brake subassembly:

1 Pull the kit from the KanBan Square, remove bag from plastic container empty bag. *Return the empty container and bag to previous op.*

2 Assemble wheel onto axle, curved side of wheel toward axle hub. Slip disk brake onto axle, flat side to wheel's flat side. Place sub assembly onto fixture by pressing the rounded hub into the recessed hole.

4 Place 4 subassemblies onto each fixture.

5 Pass the fixture and car body into step 3's KanBan Square, but only if it is empty.



Continuous 1-Piece Flow - Pull System

Step 3 Input Kanban

Maximum:
1 subassembly fixture
and 1 Car Body

Place this Square between the Subassembly & Car Assembly positions

Continuous 1-Piece Flow - Pull System
Step 3

Car assembly:

1 Pull the fixture and car body from the KanBan Square, 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 car into step 4's KanBan Square when complete, but only if it is empty.

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

Continuous 1-Piece Flow - Pull System

Step 4 Input Kanban

Maximum:
1 completed Car
(or 1 repaired car)

Place this Square between the Car Assembly and Inspection positions

Continuous 1-Piece Flow - Pull System
Step 4

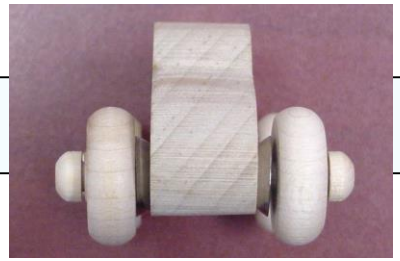
Inspection Criteria:

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***

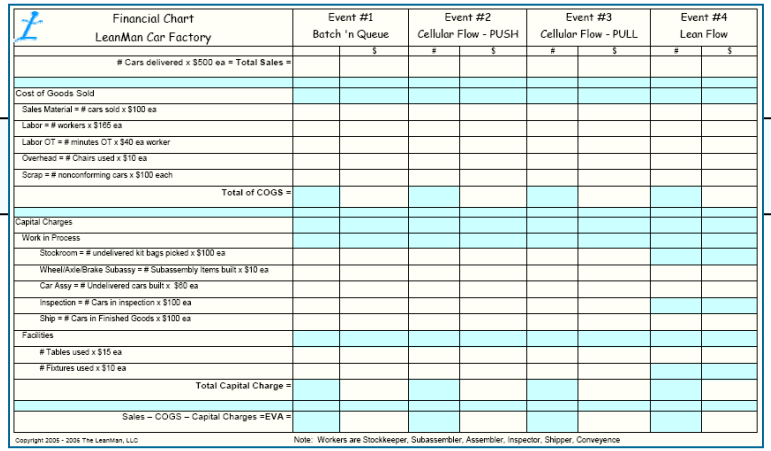
3 If acceptable, pass completed car to Finished Goods



Continuous 1-Piece Flow - Pull System
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 3. Pay attention to the time when the first car reaches Finished Goods and record the time.
3 When 4 minutes are up - call stop. (Allow up to 4 minutes OT to achieve a delivery) Complete the Financial Metrics sheet



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Note: Workers are Stockkeeper, Subassembler, Assembler, Inspector, Shipper, Conveyence

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Lean Factory Simulation

Exercise #4 Lean Flow

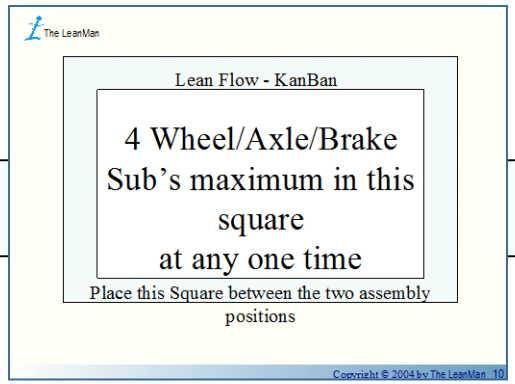
Lean Flow
Step 1

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 then 4 at any one time*



Lean Flow
KanBan

Maximum:
4 Wheel/Axle/Brake Sub's in this square at any one time

Place this Square between the Subassembly & Car Assembly positions

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.

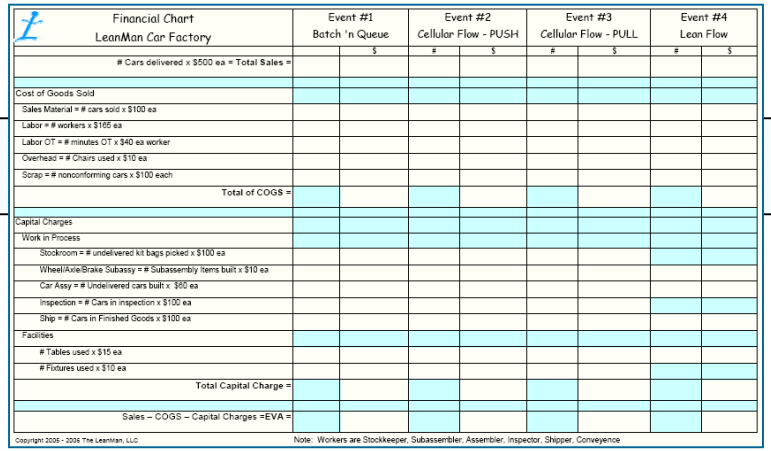
Lean Flow
Step 3

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 4. Pay attention to the time when the first car reaches Finished Goods and record it.

3 When 4 minutes are up - call stop. (Allow up to 4 minutes OT to achieve a delivery) Complete the Financial Metrics sheet



Financial Chart LeanMan Car Factory	Event #1 Batch 'n Queue		Event #2 Cellular Flow - PUSH		Event #3 Cellular Flow - PULL		Event #4 Lean Flow	
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Ship = # Cars in Finished Goods x $100 ea								
Facilities								
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# Fixtures used x $10 ea								
Total Capital Charge =								
Sales – COGS – Capital Charges =EVA =								

Note: Workers are Stockkeeper, Subassembler, Assembler, Inspector, Shipper, Conveyence

Financial Chart LeanMan Car Factory	Event #1 Batch 'n Queue		Event #2 Cellular Flow - PUSH		Event #3 Cellular Flow - PULL		Event #4 Lean Flow	
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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								
Total Capital Charge =								
Sales – COGS – Capital Charges =**EVA =**								
Production Velocity (4 minute run plus OT)								
Number of Minutes Worked plus OT								
Number of Cars Produced (sold + FG Inv)								
Production Rate =								

Note: Workers are Stockkeeper, Subassembler, Assembler, Inspector, Shipper, Conveyence

Financial Chart is available as an Excel File on the CD