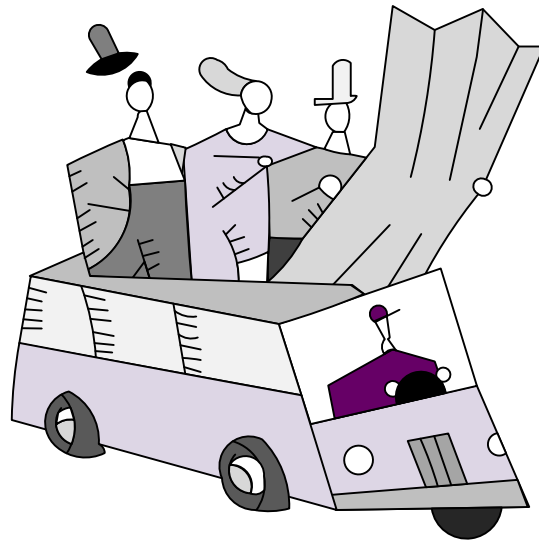


# eVSM Value Stream Mapping Workshop for Discrete Parts



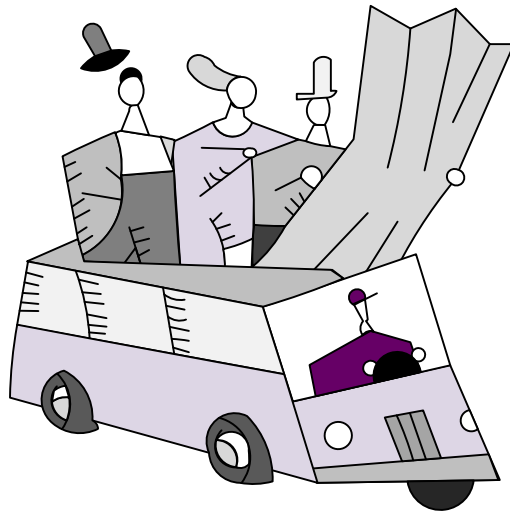


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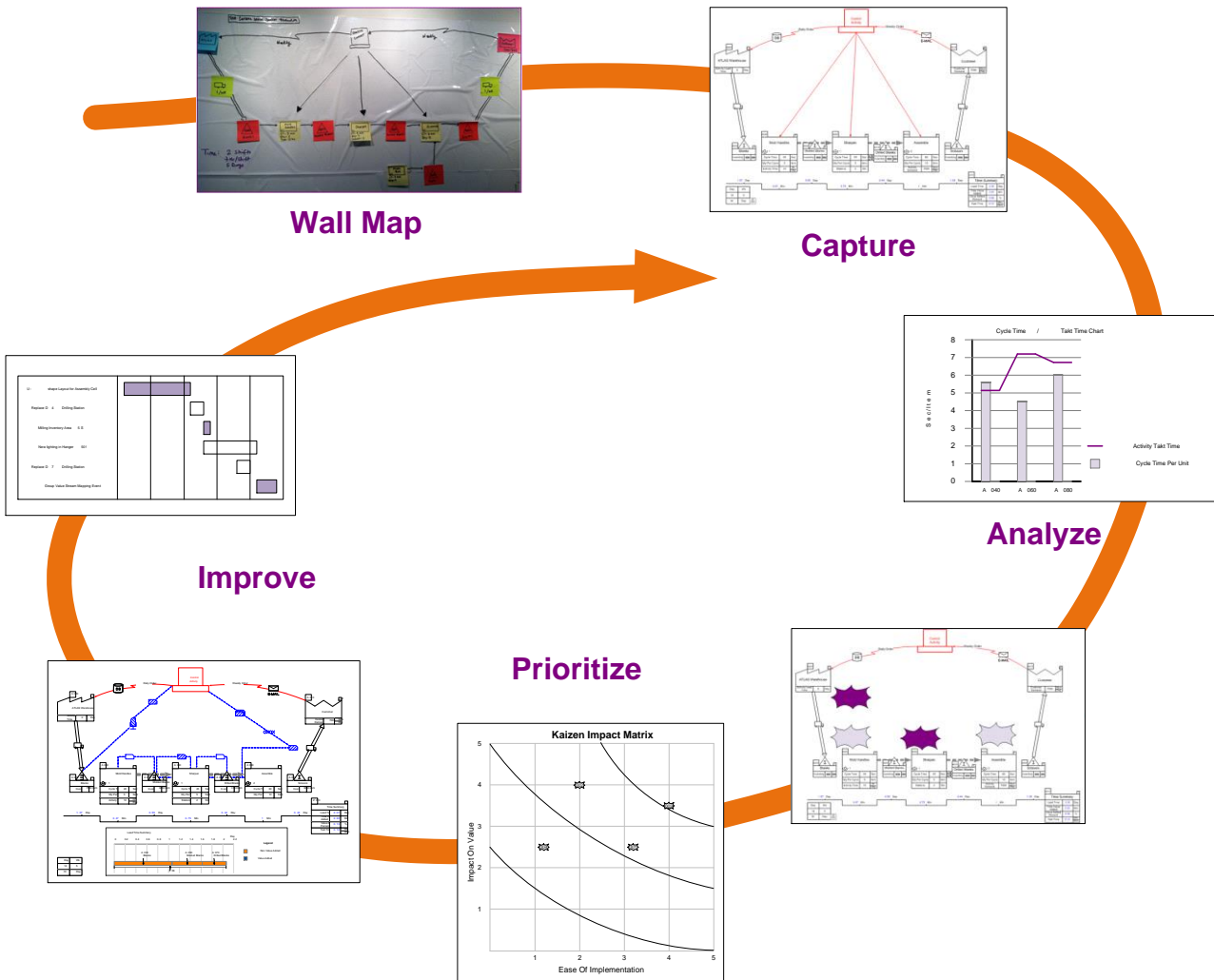


# Lean, VSM, & eVSM

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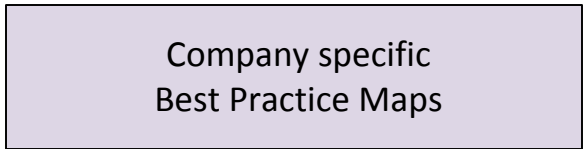
# eVSM / Supporting Process Improvement



# What is eVSM?

## Best Practice Maps

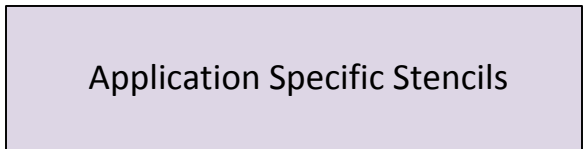
Applying the standard



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## eVSM

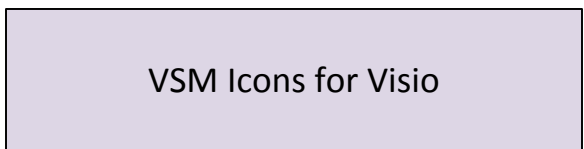
Standardized mapping & analysis



Use maps for calculations



Capture wall maps



---

## Collaborative Tools

Group Interaction



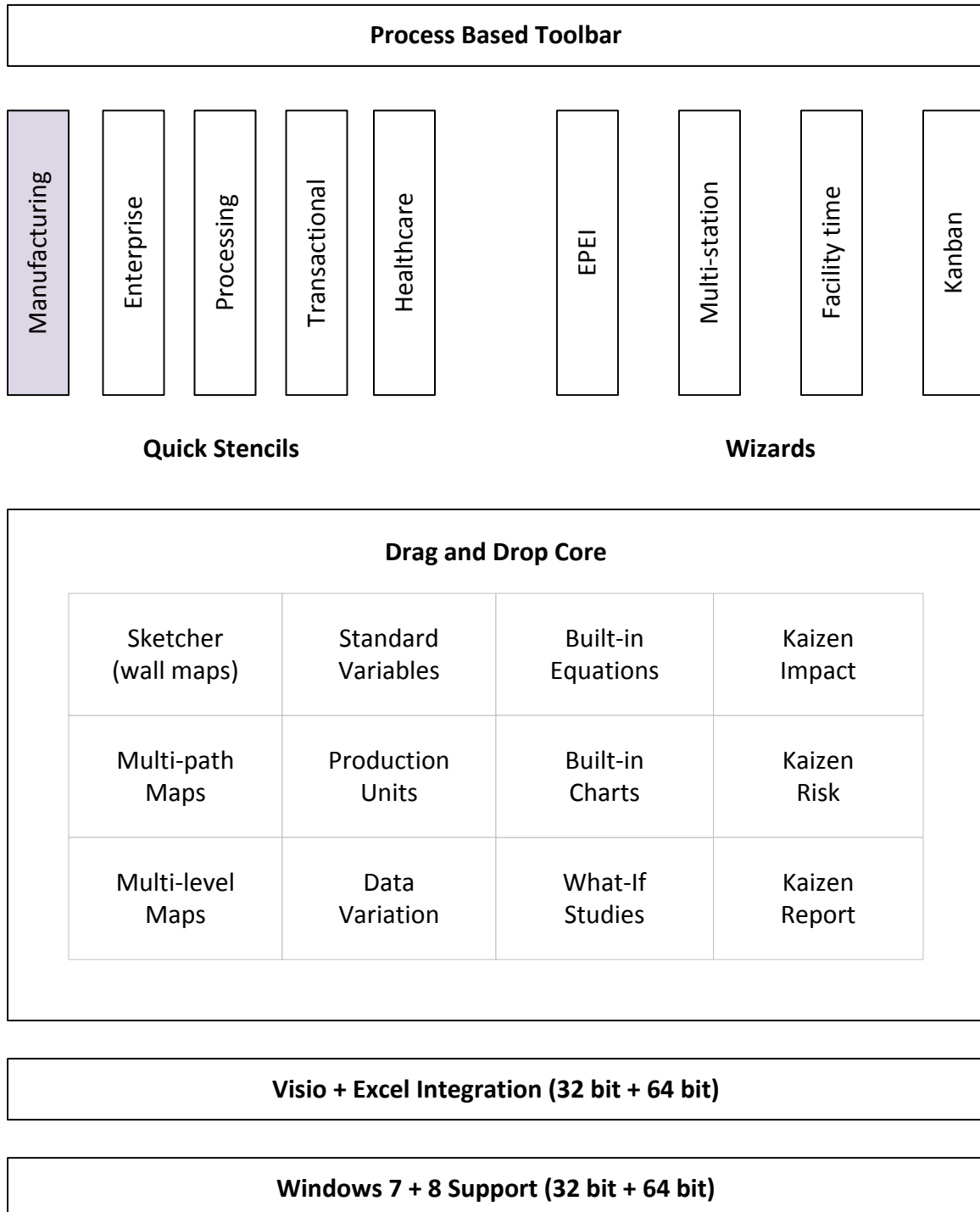
Diagramming



Data



# eVSM Architecture





# Manufacturing Concepts



Standard Variables



Design Macro Shapes

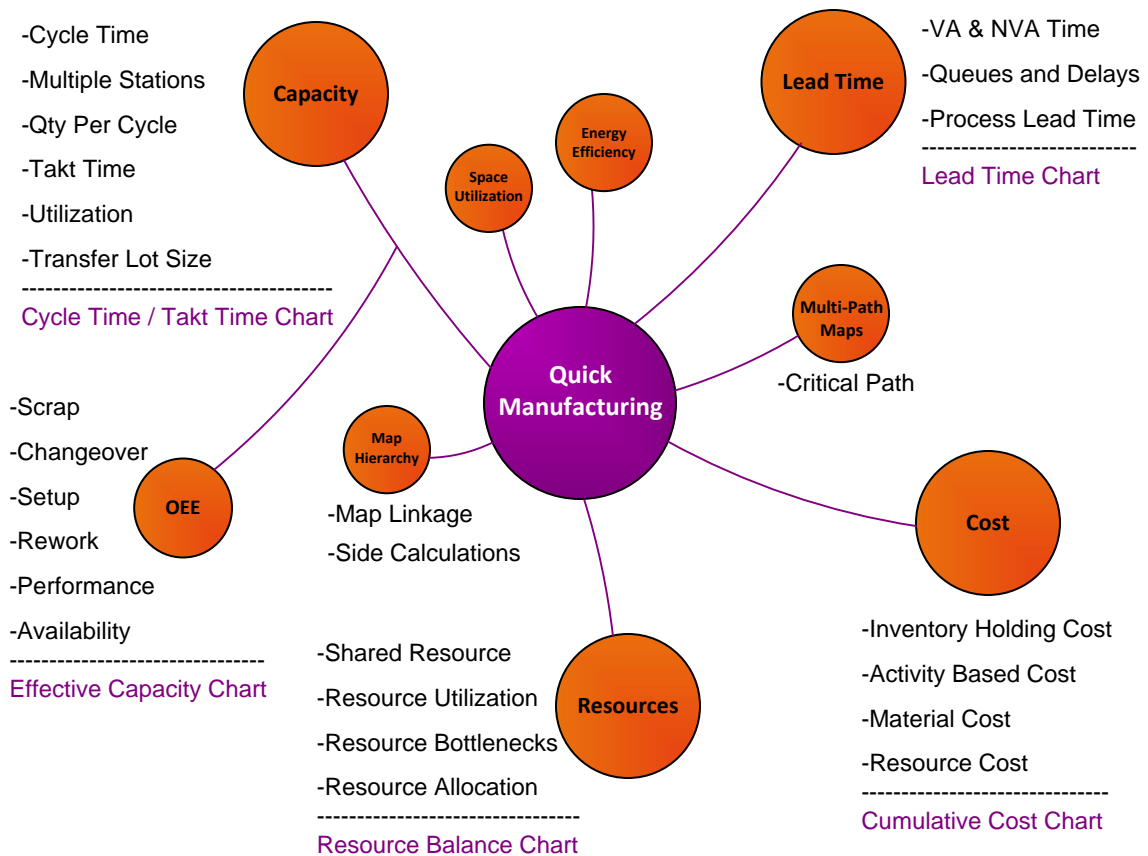


Built-in Equations



Built-in Charts

The technical concepts addressed by the Quick Manufacturing stencil are shown below.



## What is Lean?

Lean is a set of concepts, principles, and tools used to create and deliver the **most value** from the **customer's perspective** while consuming the **fewest resources**.

*...Lean Enterprise Institute*

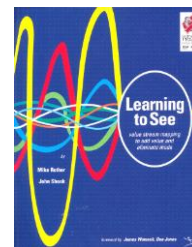
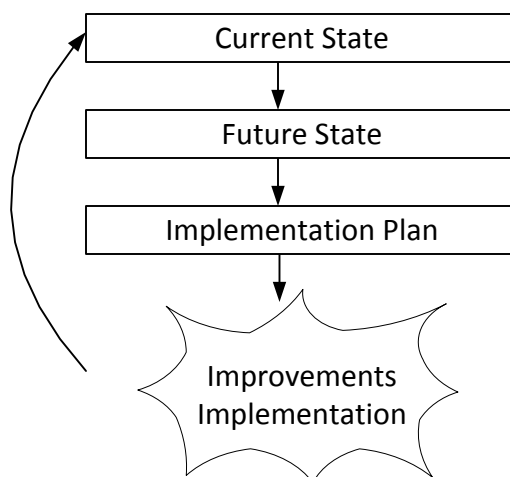
## Lean Principles

- Value is defined from the Customer's perspective
- Map the Value Stream
- Create flow & eliminate waste
- Create pull where flow is difficult
- Seek perfection

## Lean Means...

- Lower cost
- Less inventory
- Less space
- Shorter lead-time
- Fewer people

## The Lean Process



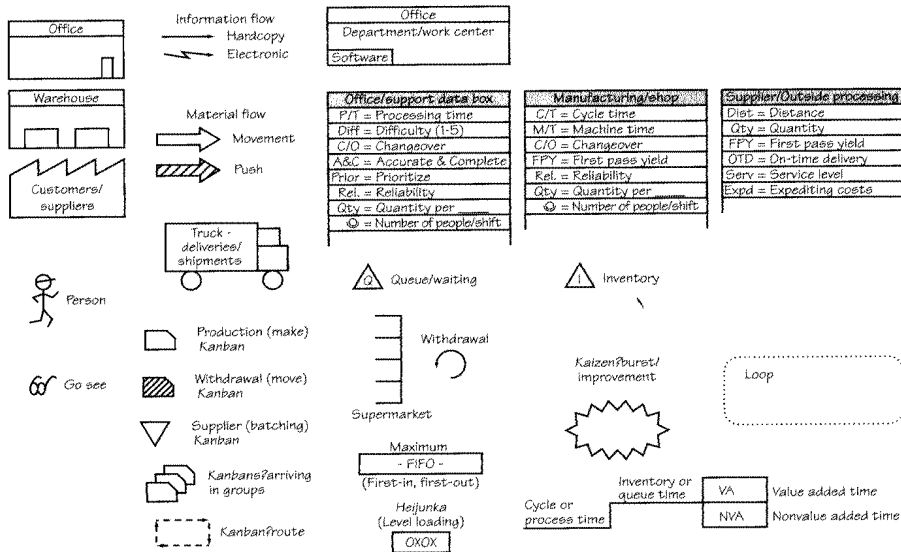
...Learning to See, LEI



# What is a Value Stream Map?



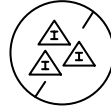
# VSM – Learning to See



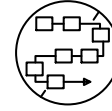
# Types of Waste



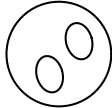
Transportation



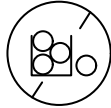
Excess Inventory



Over Processing



Duplicate Entry



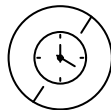
Over Production



Excess Motion



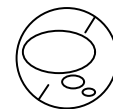
Confusion



Waiting

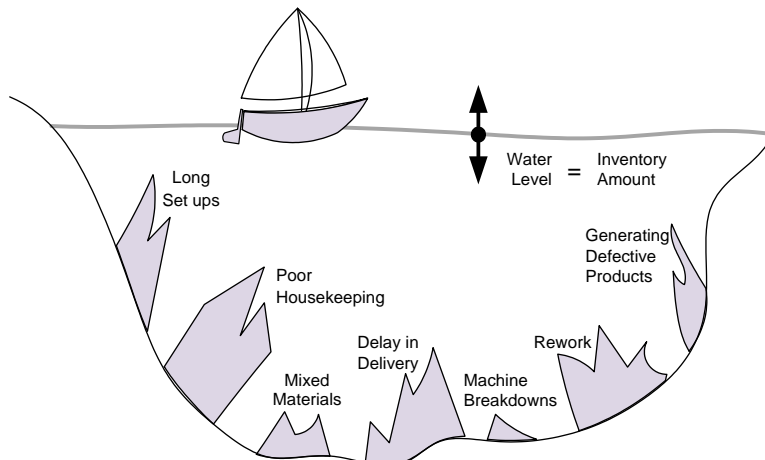


Defects



Knowledge

# Hiding the Waste





# What is eVSM?

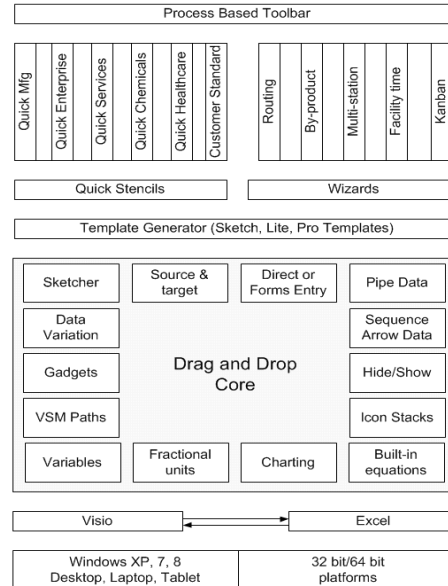
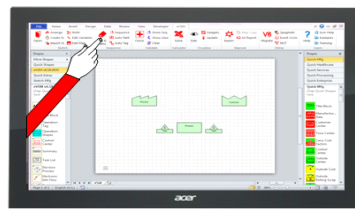
- Software Tool:
  - VSM, A3 Reports, Spaghetti Reports, Communication Circles
  - Analyze VSM Data
  - Manage Lean Transformation
- Built on Visio and Excel
- Based on Publications from Lean Enterprise Institute

# Lean Workbooks



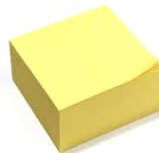
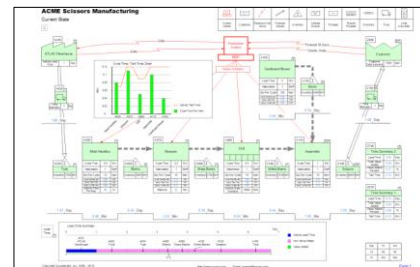
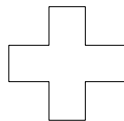
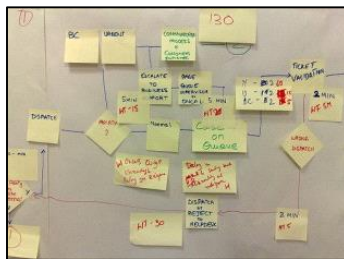


# eVSM v8 Platform



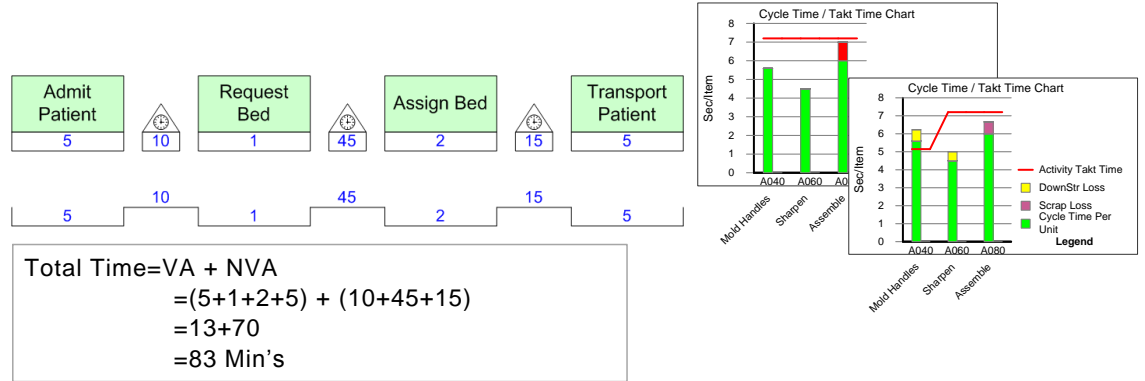
# Wall Maps/Digital Pictures/eVSM

Value Stream Mapping is a Paper & Pencil tool

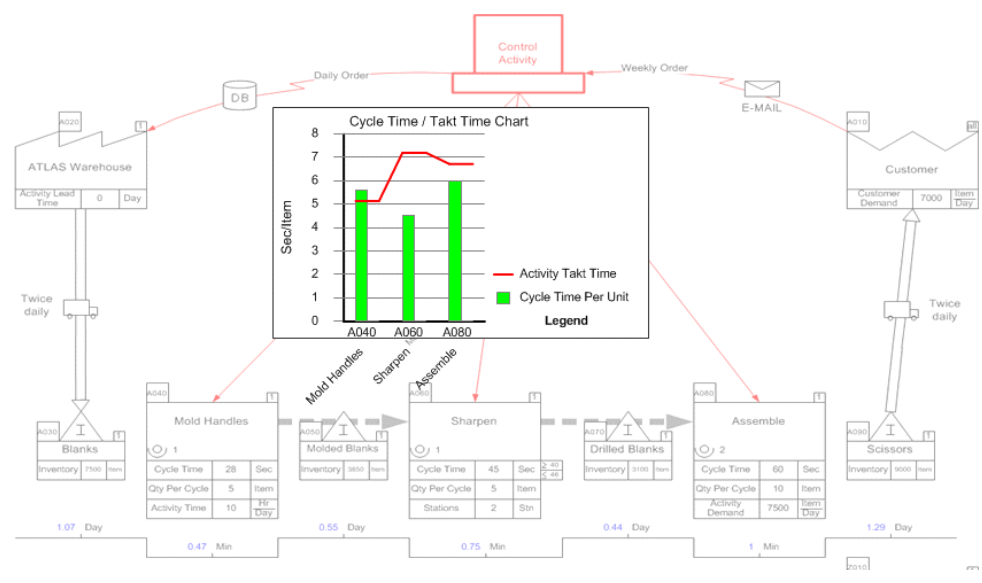


# What is a Quick Stencil?

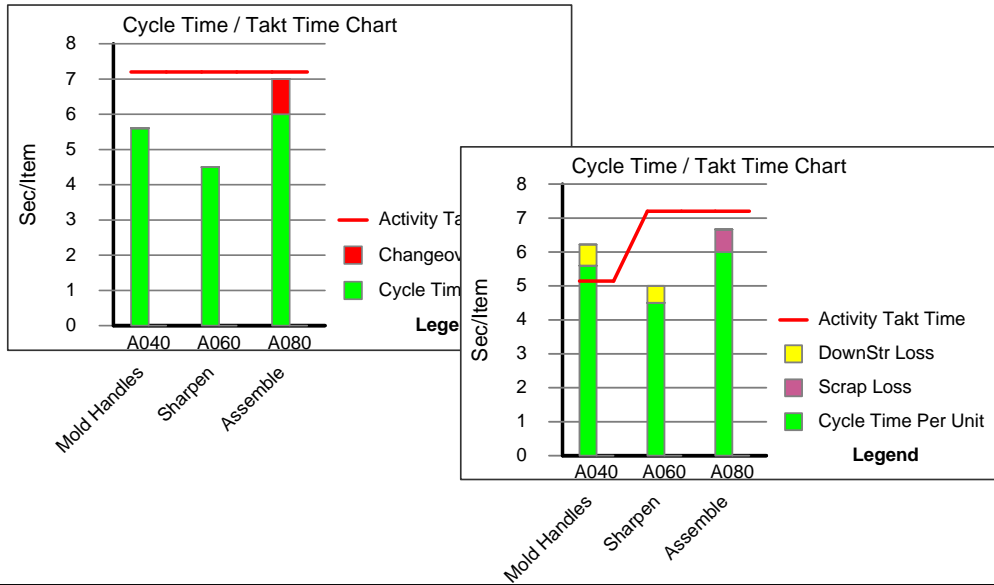
- Very fast way to map
- Drag, Drop & Enter Values
- Automated Calculation & Charts



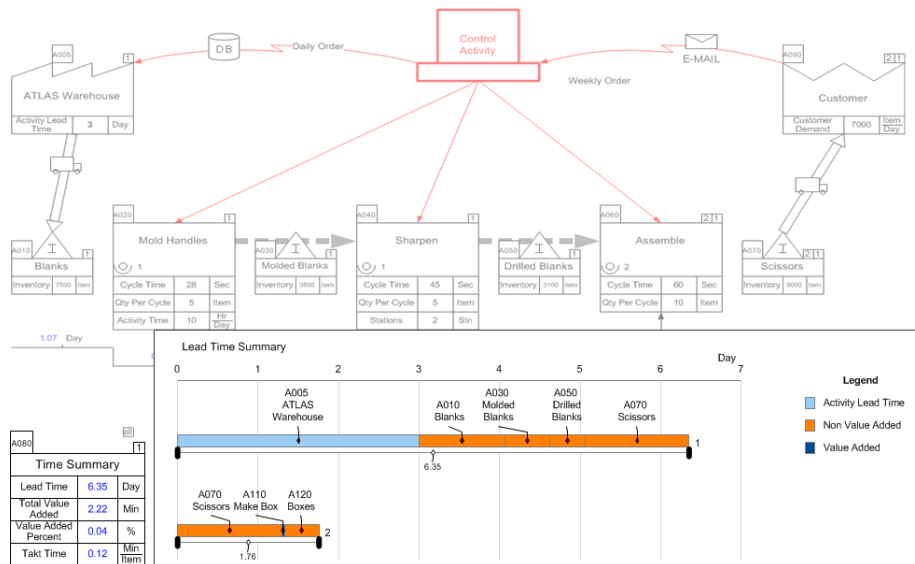
# Visualizing Capacity



# Capacity Losses

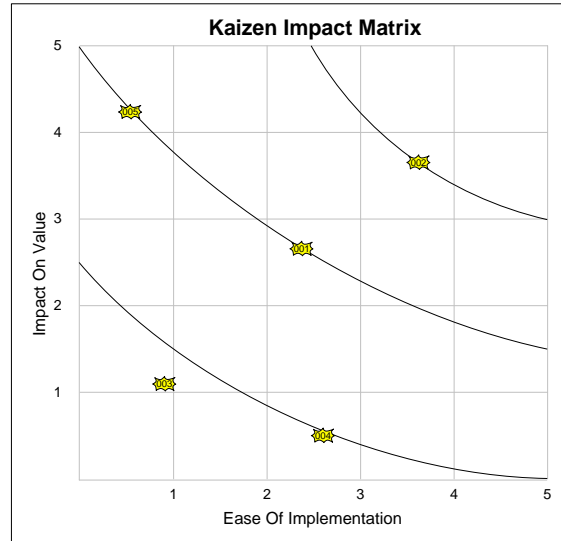
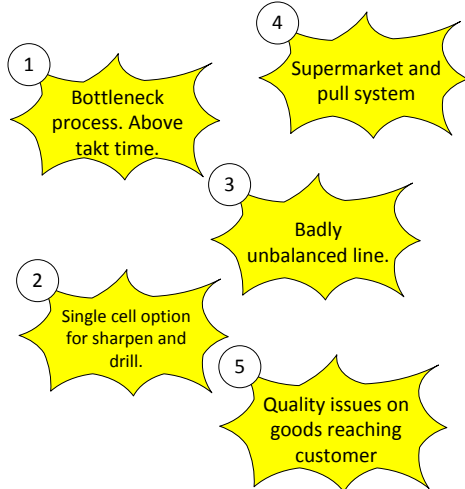


# Visualizing Lead Time

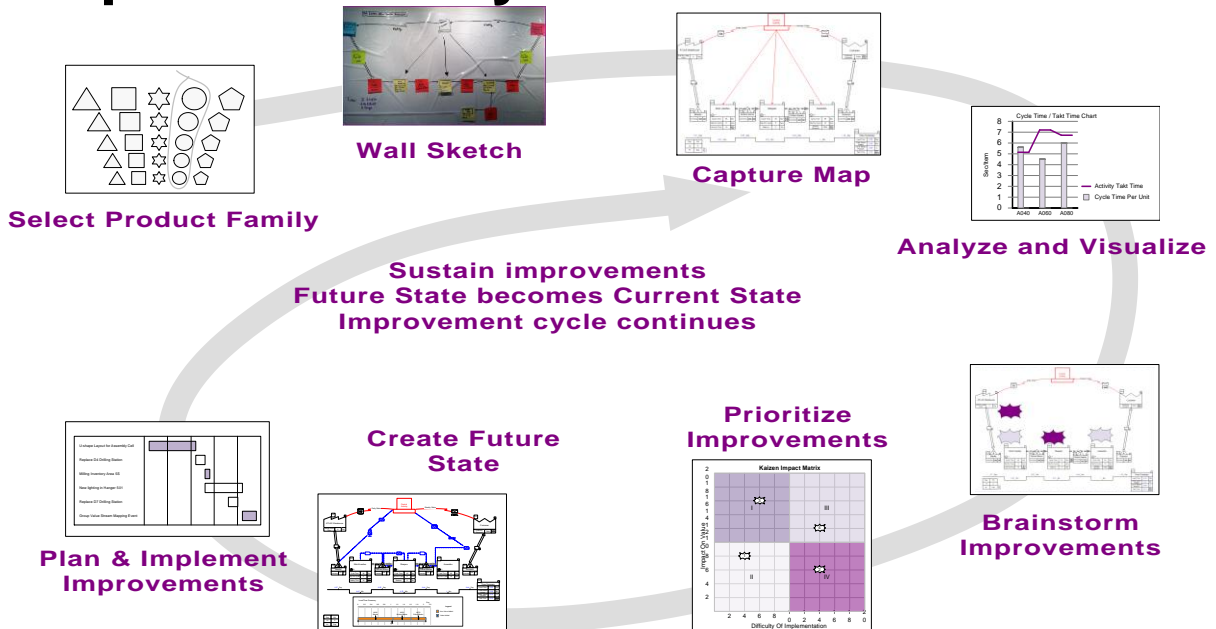




# Kaizen Impact Matrix



# Improvement Cycle



# Working with Quick Stencils in eVSM v8

**Quick Stencil**

- Quick Mfg LT
- TITLE Title Block
- Customer Center
- Time Center
- Control Center
- Outside Center
- Inventory Center
- Inventory Demand %
- Activity Center
- Activity MultiAdd
- Activity Changeover
- Activity Downtime
- Activity OEE Direct
- Activity Scrap
- Activity Demand %
- Activity Stations
- Activity Time
- Wait Center
- Transport Center
- Transmit Center
- Time Summary
- Lead Time Chart

**1** Access each Quick Stencil using the Open button in the toolbar and a corresponding Sketch Stencil for initial map capture and layout will open as well

**2** Drag out the red icons FIRST

**3** Use the Green icons to draw the Flow

**4** Yellow icons represent optional "Add-on" calculations

**5** Add-ons must be glued under existing data shapes

**6** Blue values get calculated automatically

**7** Summary calculations

**8** Automatic Charts

A0070	P
Process	
1	
Cycle Time	x.xx Min
Qty Per Cycle	1 Item
Glue	
Activity Time	x.xx Hr Day
Auto Min	



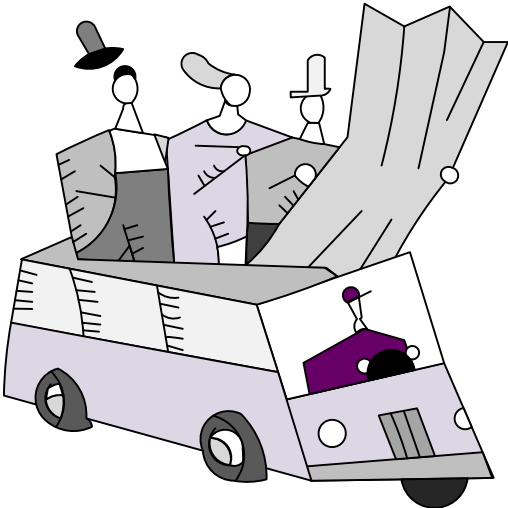
## Quick Stencil – Try This:

1. Go to a new page and use the “Open” command to access the Quick Mfg stencil.
2. Which icons from the stencil must be put on the map first?
3. How do you get quick help on the icons in the stencil?
4. Drag out an Activity Center from the stencil. How do you get a quick description of the “Qty Per Cycle” variable in the center?
5. What is the meaning of the blue “Auto” value in the Activity Center?



# Plant Level Mapping

---



## Activity Available Time

- Available Time = Planned Production Time after breaks
- Plant Available Time = Default Available Time for all activities
- Activity Time: Overrides the Plant Available Time at an activity
- Facility Time Wizard: Allows off-page calculation of Available Time for different shift patterns

## Activity Sequence

- Sequence arrows to explicitly establish upstream/downstream connectivity
- Rolling scrap calculation based on connectivity
- Cumulative Cost calculation based on connectivity
- Value stream path generation for multi-lane maps based on connectivity

## **OEE – Overall Equipment Effectiveness**

- Availability
  - Changeover, unplanned downtime, setup
- Quality
  - Scrap (and rolling scrap)
- Performance
  - Machine, material, or operator inefficiency

## **Resource Modeling**

- Resources (Manpower) are now modeled explicitly within the value stream map.
- Resources can be connected to multiple activities.
- Resource VA and NVA times can be captured to help identify improvement areas.
- Resource cost handling.
- Bottleneck resources are identified (Resource Utilization).
- Resource usage (balancing) chart.

## Carrying Cost

- Based on Inventory Cost
  - Calculated using Activity Based Costing

### Carry Cost Factors

- Cost of Capital
- Damage
- Obsolescence
- Shrinkage
- Insurance

## Customer Demand

- Multiple Customers
- Path-based demand
- Demand override (Activity Demand or Demand %)
  - Production for other value streams
  - Product family routing
  - Rework situation

## **Kaizen Report, Impact & Risk**

- Kaizen burst for improvement opportunities
- Association of bursts with activities
- Improvement prioritization via impact, difficulty, and risk
- Charting with impact and risk matrices
- Kaizen reporting to spreadsheet

## Capacity Modeling

Capacity analysis in Quick Mfg requires consideration of both activity capacity and resource capacity. Let's see it works.

### Activity Capacity

So let's say that an activity has:

- Cycle Time = 5 mins
- Qty Per Cycle = 2 Item
- Activity Time = 10 Hrs/Day
- OEE = 80%
- Number of Stations = 2

Then Cycle Time Per Item

$$= \frac{\text{Cycle Time}}{\text{Qty Per Cycle} \times \text{Number of Stations}} = \frac{5}{2 \times 2} = 1.25 \text{ Min/Item}$$

$$\begin{aligned} \text{Activity Capacity} &= \frac{\text{Activity Time}}{\text{Cycle Time Per Item}} \times \text{OEE} \\ &= \frac{10 \times 60}{1.25} \times 0.8 = 384 \text{ Item/Day} \end{aligned}$$

This capacity calculation assumes that a station has all of the resources it needs over its activity time period to process items within the cycle time stated. If this is a concern, then explicit resources can be modeled and a resource capacity calculation can be done in addition.

## Resource Capacity

Let's say that for a particular resource used by an activity, (could be a person or a machine) it has the following characteristics:

- Resource Qty = 2
- Resource Time = 8 Hrs/Day
- Resource PT (Resource Process Time) = 10 Min/Item

then,

$$\begin{aligned}\text{Resource Capacity} &= \frac{\text{Resource Time} \times \text{Resource Qty}}{\text{Resource PT}} \\ &= \frac{8 \times 60 \times 2}{10} \\ &= 96 \text{ Item/Day}\end{aligned}$$

So in this example, while the Activity Capacity (independent of Resource consideration) is 384 Item/Day, the resource would actually limit the capacity to 96 Item/Day.

The Quick Mfg stencil reports both the Activity Capacity and the Resource Capacity associated with each resource used by the activity. It also handles the issue of shared resources between activities.

## Discrete Parts VSM Terms

For a full glossary of lean terminology, we recommend the “Lean Lexicon”.

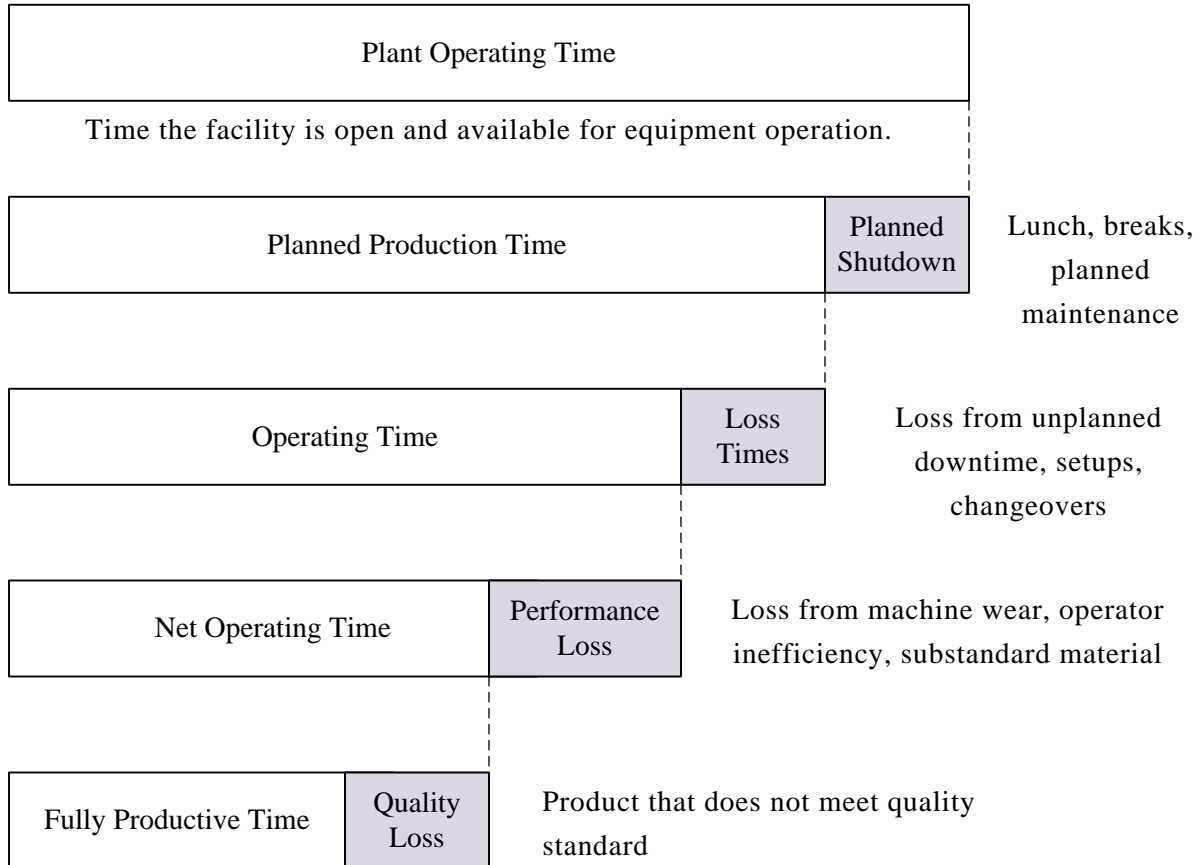
The terminology described here is specific to discrete parts and assemblies and we propose that you use it to “standardize” your variables on these types of maps.

### Acronyms

- OEE – Overall Equipment Effectiveness
- NVA – Non-Value Added
- VA – Value-Added
- VSM – Value Stream Map
- WACT – Weighted Average Cycle Time
- WIP – Work In Process



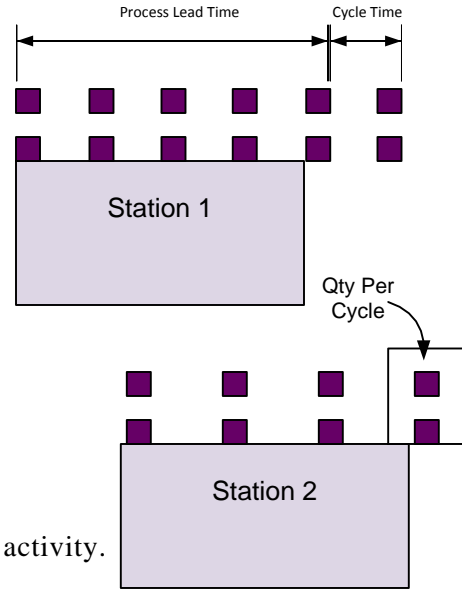
## Facility Time Related Terms



- Takt Time: Time interval of planned production time at which the value stream needs to produce an item to meet demand.
- Lead Time: The time it takes for an item to move between two designated points in the process.
- OEE Rate = Availability Rate  $\times$  Quality Rate  $\times$  Performance Rate
- OEE Availability Rate =  $\frac{\text{Operating time}}{\text{Planned production Time}}$
- OEE Quality Rate =  $\frac{\text{Fully productive time}}{\text{Net Operating Time}}$
- OEE Performance Rate =  $\frac{\text{Net Operating Time}}{\text{Operating Time}}$

## Activity Time Related Terms

- Stations: Number of identical stations of an activity. Each additional station reduces the Cycle Time Per Unit.
- Cycle Time: The time interval between a set of items exiting an activity and the next set.
- Qty Per Cycle: The number of items produced during one cycle at one station.
- Cycle Time Per Unit = 
$$\frac{\text{Cycle Time}}{\text{Qty Per Cycle} \times \text{Stations}}$$
- Activity Time: Planned Production Time specific to an activity.
- Activity Takt Time: Takt Time specific to an activity.
- Value-Added Time: Time of those work elements that transform the product in a way that adds value for the customer.
- Non-Value Added Time: Time of those work elements that adds Cost but no value to the product or service as seen by the customer.
- Uptime: The percent of Activity Time that is actually available for production work after unplanned downtime.
- Time Per Changeover: Time required to switch a station from producing one type of item to another.
- Process Lead Time: Time from when an item enter an activity to when it leaves the activity.



## Cumulative Cost Terms

- **Added Cost:** Additional cost “put into” an item by an activity. This is an addition to cost of any explicit resources modeled on the map (see Resource Terms).
- **Cumulative Cost:** The total cost put into an item to get it to a particular point in the value stream.

## Carrying Cost Terms

- **Cost of Capital:** This is the annual interest rate associated with borrowing money to finance inventory.
- **Inventory Damages:** The percentage of inventory damaged each year.
- **Insurance on Inventory:** The annual insurance premium as a percent of the inventory value.
- **Inventory Obsolescence:** The percentage of inventory that becomes obsolete each year.
- **Inventory Shrinkage:** The percentage of inventory that is “lost” each year.
- **Total Carrying Cost Factors:** The overall Carrying Cost factors calculated from the detailed factors above.
- **Total Annual Inventory Carry Cost:** This is the annual cost associated with carrying a value of inventory. It is calculated by multiplying the Inventory Value and the Total Carrying Cost Factors.

## Resource Terms

- Efficiency: Efficiency rating for a resource to allow for auxiliary activities (walking, interruptions..)
- Effective Resource Time:  $\text{Resource Time} * \text{Resource Qty} * \text{Efficiency}$
- NVA Utilization:  $\text{Resource Time Used for Non Value Added Activity} / \text{Effective Resource Time}$
- Resource Cost: Cost of this resource to process an item
- Resource NVA Cost: Resource cost for NVA activity per item
- Resource PT: Resource time to process an item
- Resource PT NVA: The NVA portion of the resource time to process an item
- Resource Quantity: Quantity of resource available
- Resource Query Cost: Resource cost to service queries in a time period
- Resource Rate: Cost rate for a resource
- Resource Time: Resource available time after subtracting planned breaks.
- Resource Usage: Total resource usage per period via this pipe
- Resource Usage NVA: The NVA portion of the Total resource usage per period via this pipe
- Resource Utilization:  $\text{Total Time Spent} / \text{Effective Resource Time}$
- Resource VA Cost: Resource cost for VA activity per item
- Total Resource Cost: Cost per time period for this resource
- Total Time Spent: Total time used of this resource
- VA Utilization:  $\text{Time Used for Value Added Activity} / \text{Effective Resource Time}$



# ACME Case Study – Plant

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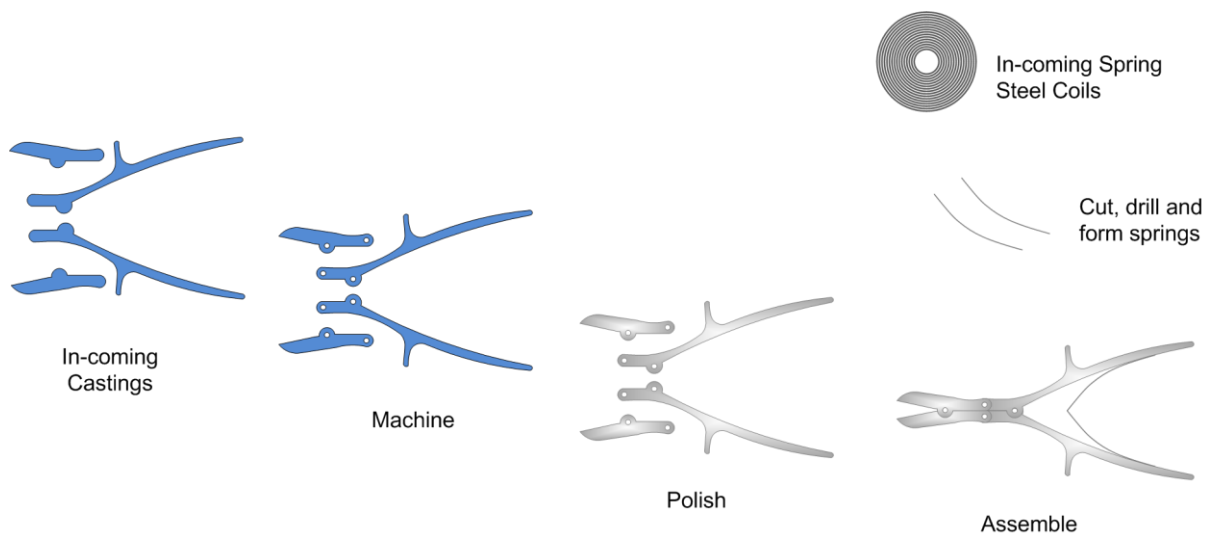
## Introduction

You will be using this case study to create a value stream map on the wall. With your group, read through the information below then complete the exercises at the end.



## Background and Overview

ACME, founded in 1965, specializes in high-quality surgical instruments and has recently added surgical, re-usable, double-action cutters to its catalog, retailing at \$90 per set. Each set consists of four cast pieces which are supplied by Tower Hills Foundry. At ACME, the castings are machined, polished, and sent to the final assembly line. The metal for the springs is supplied by Fornost Quality steelworks in steel rolls which are cut down into springs and assembled with the castings. One casting set and one spring set makes one final Surgical Cutter. Finally, the finished product is individually packaged for shipping.



The assembled cutters are sent to packaging where they are individually boxed and then stored for shipping.

## Value Stream Walk

To capture the current state value stream, you meet the plant supervisor in the finished goods shipping area on Monday afternoon. You learn that the plant line works 2 shifts per day, 5 days a week. Each shift is 8 hours including a 30 min break and two 15 min breaks. Shipment quantity to customers is 1000 surgical cutter sets per week.

You had previously asked the supervisor to collect inventory and time metrics for the line. Here is the inventory summary.

Inventory	Totals	Units
Incoming Casting Sets	1000	set
Machined Sets awaiting Polishing	50	set
Polished Sets ready for Assembly	100	set
Rolls of Spring Steel	10	roll
Spring sets ready for Assembly	150	set
Cutters ready for packaging	15	set
Boxes ready for shipping	1000	set

The Packaging area has 1 operator and is available just 1 shift per day. Packing involves boxing the cutters, and labeling the boxes ready for shipping. Packing takes 2 minutes and adds \$1 to cost per cutter set. The OEE for the packaging process is 95%.

As you walk upstream you arrive at the Assembly area which has 2 assembly stations, 1 operator each. Assembly takes 7 minutes per set and adds \$3 to the cost. The scrap rate here is 10% and the OEE is 80%.

You follow the castings supply upstream to the Polishing area which also has 2 stations, 1 operator each. Polishing takes 5 minutes, and adds \$2 per set. The OEE is 95%.

The Machine shop has 2 machines available to the cutters value stream, but only for 1 shift per day. Each machine has 1 operator. The machining operation takes the castings (\$37 per set of raw castings) and adds \$1 per set for machining, has a scrap rate of 5% and OEE of 90%. Cycle Time for machining is 3 minutes.

You walk back to the Assembly area and make your way to the spring production room. Spring production has two stations with 1 operator each. The spring sets are cut and formed from rolls of spring steel. Each roll costs \$300 and yields 50 sets of springs. The process takes 4 hours per roll and adds \$0.25 per set to the total cost. OEE is 85% and scrap rate is 10%.





## Exercises

### Part A

1. Draw a wall value stream map using the template cut outs for the product showing the customer, inventories, and processes.
2. Show the data associated with the inventory, activities, and any costs.

### Part B

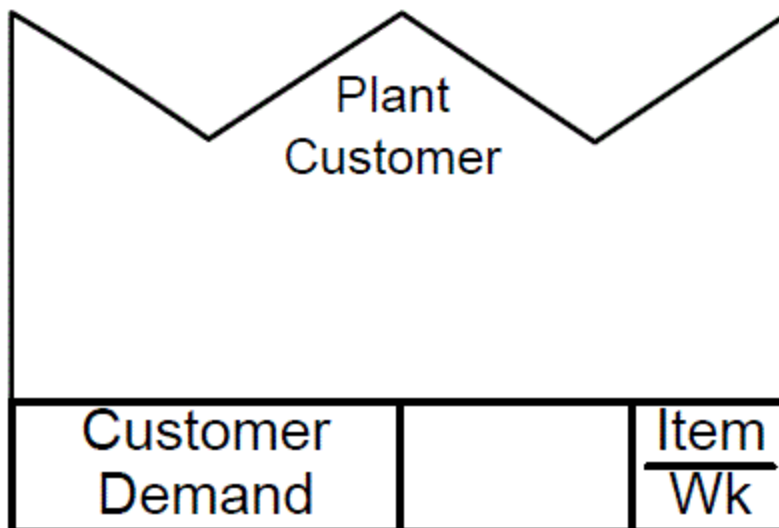
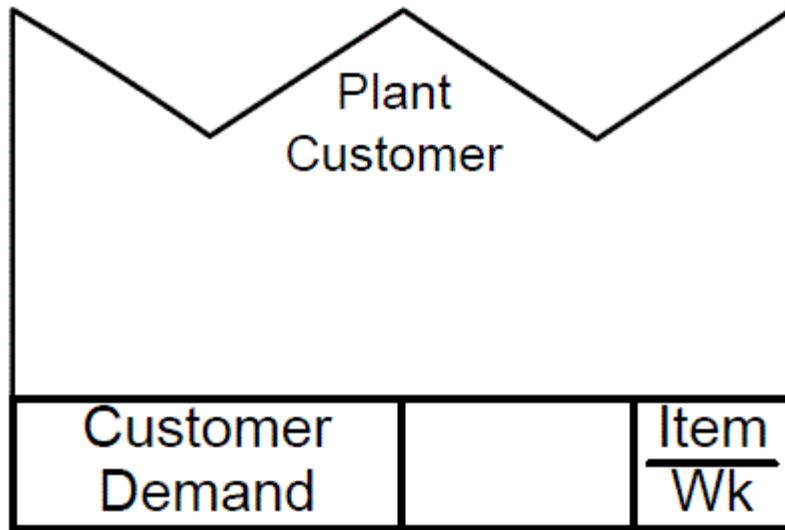
1. Calculate how many days of inventory you have at each point.
2. Identify useful summary metrics for the map.
3. Identify what charts would be useful to visualize the value stream and mark these up.

### Part C


1. Follow the step by step tutorial on the following pages to bring the wall map into eVSM and create the map electronically.




## Quick Manufacturing Templates







Plant Activity		
		
Cycle Time		
Qty Per Cycle		
Added Cost		
OEE Input Percent		%
Stations		Stn
Scrap Percent		%
Activity Time		$\frac{\text{Hr}}{\text{Day}}$

Plant Activity		
		
Cycle Time		
Qty Per Cycle		
Added Cost		
OEE Input Percent		%
Stations		Stn
Scrap Percent		%
Activity Time		$\frac{\text{Hr}}{\text{Day}}$

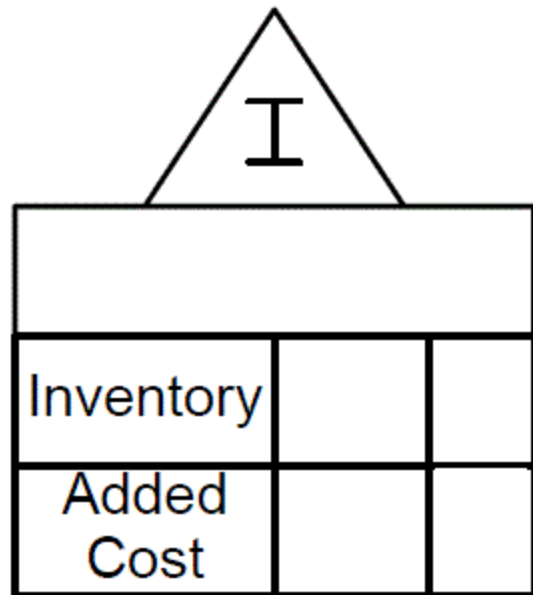
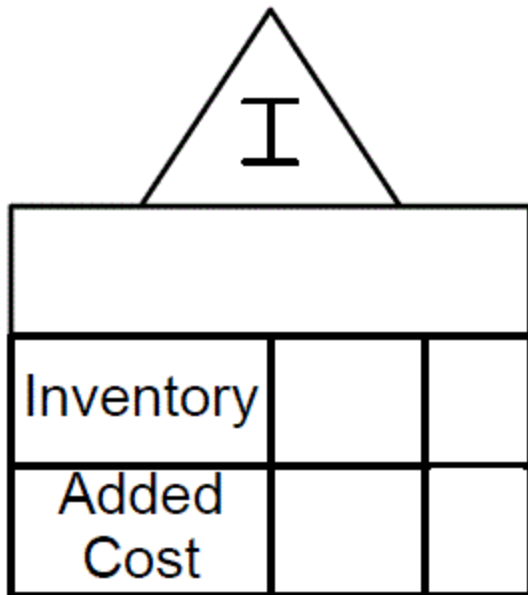
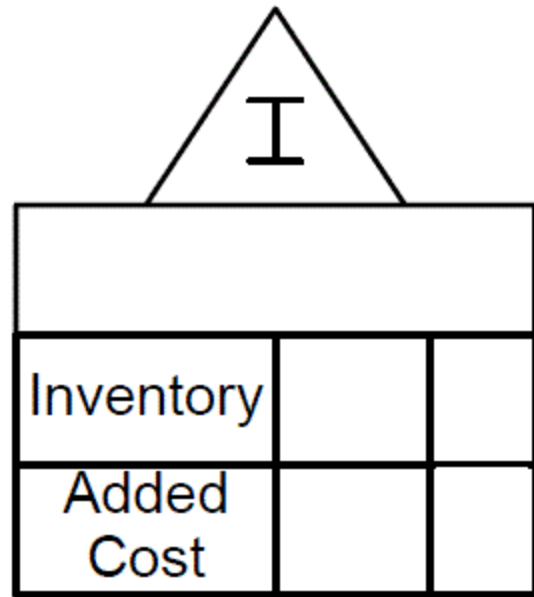
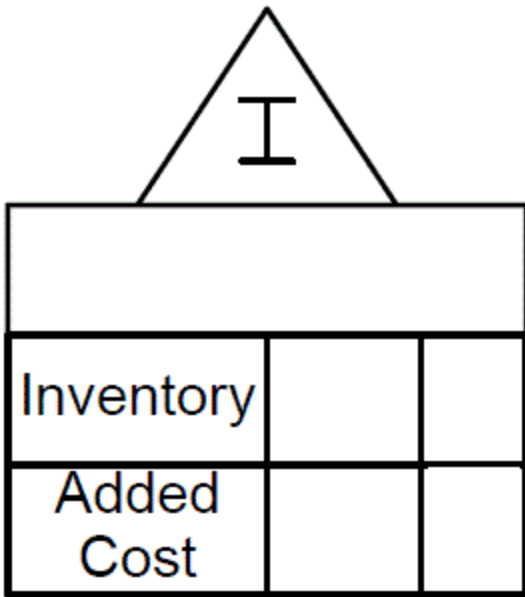
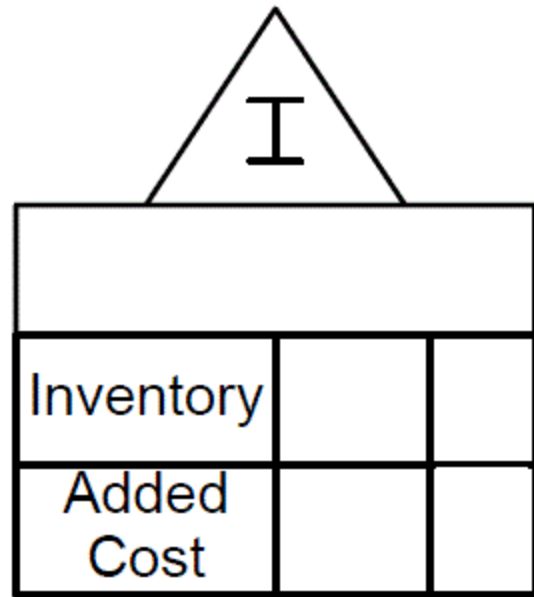
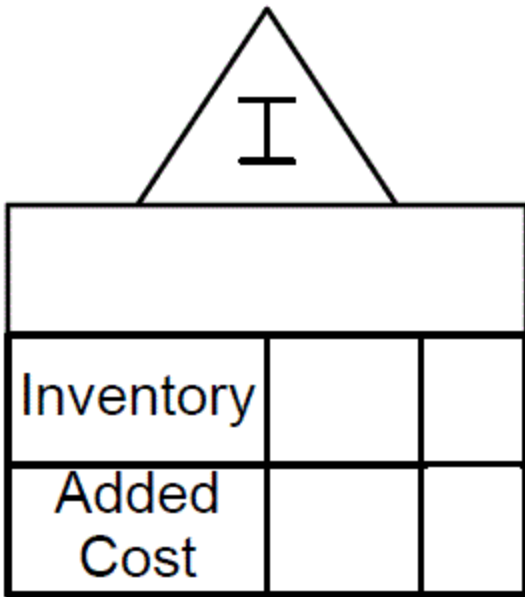


Plant Activity		
		
Cycle Time		
Qty Per Cycle		
Added Cost		
OEE Input Percent		%
Stations		Stn
Scrap Percent		%
Activity Time		$\frac{\text{Hr}}{\text{Day}}$

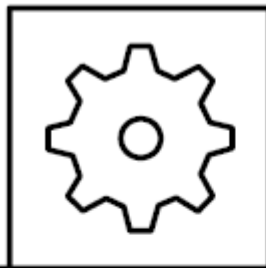
Plant Activity		
		
Cycle Time		
Qty Per Cycle		
Added Cost		
OEE Input Percent		%
Stations		Stn
Scrap Percent		%
Activity Time		$\frac{\text{Hr}}{\text{Day}}$



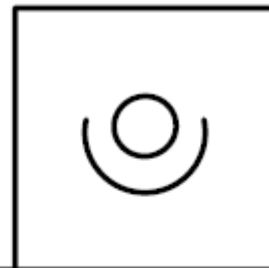








Machine		
Resource Quantity		RQ
Resource Time		$\frac{\text{Hr}}{\text{Day}}$
Resource Rate		$\frac{\$}{\text{Hr}}$

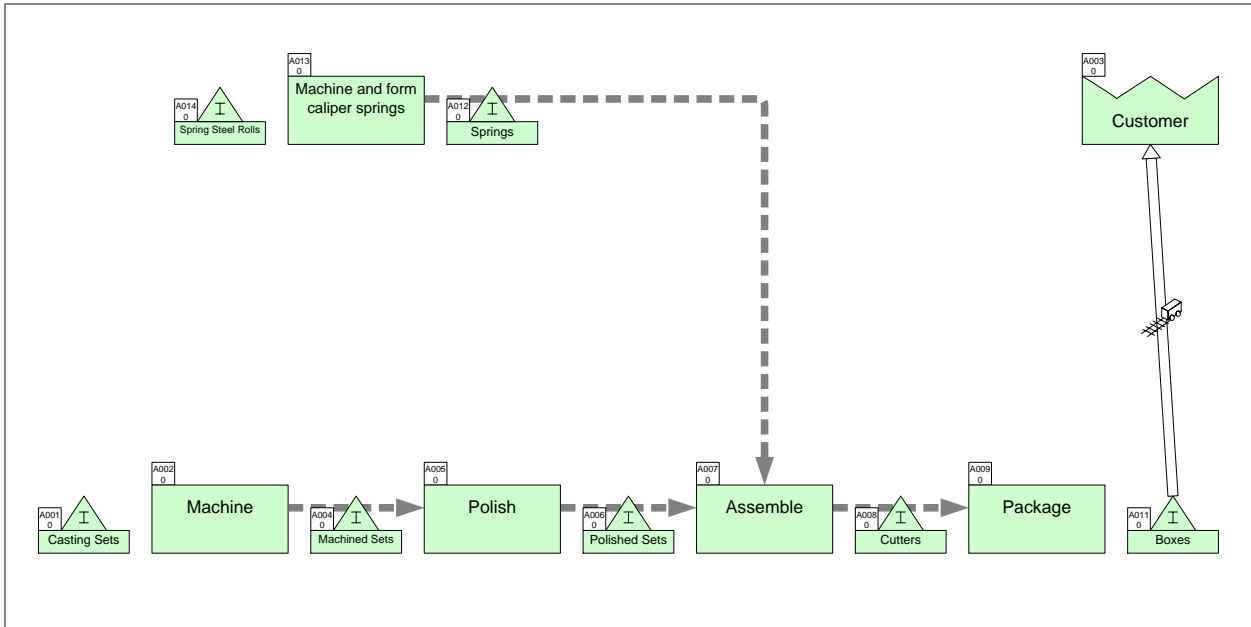


Resource		
Resource Quantity		RQ
Resource Time		$\frac{\text{Hr}}{\text{Day}}$
Resource Rate		$\frac{\$}{\text{Hr}}$



# Quick Manufacturing Tutorial

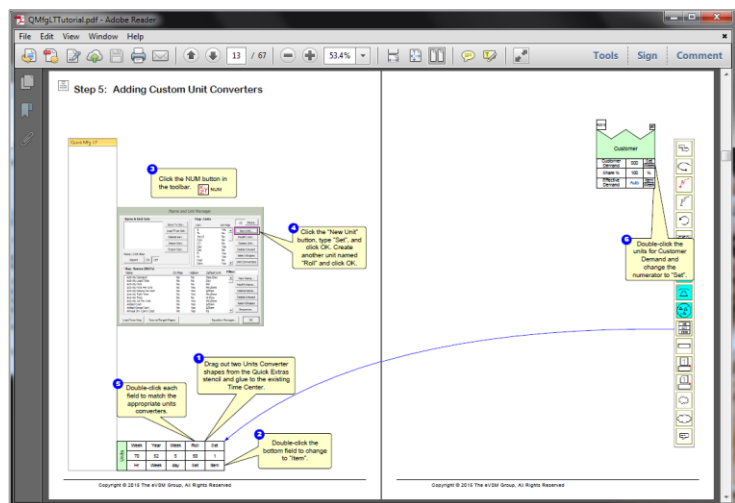
This tutorial will guide you through the steps to draw a simple map, perform common calculations, and plot charts using the Quick Manufacturing stencil.



## Viewing/printing eVSM Tutorial:

This tutorial is designed for two page layout. If printing, you will need double-sided print.

For on-screen viewing, save the PDF file to your PC and then open it in Acrobat Reader (not in a web browser). In the Acrobat menus, click “View>Page Display”, make sure “Show Cover Page in Two Page View” is checked and then select “Two Page View”.



# Step 1: Start eVSM

1 On your Desktop, click the "Start eVSM" icon.

2 If you see a message like this, you must "Enable" macros.

3 Click to enable macros.

4 Click "Trust all from publisher" to avoid the security notice in future.

Recycle Bin

Start eVSM

Microsoft Visio Security Notice

Microsoft Office has identified a potential security concern.

Note: The digital signature is valid, but the signature is from a publisher whom you have not yet chosen to trust.

File Path: C:\Program Files\evsm\Setup\Solutions\evsmIcons.vss

Macros have been disabled. Macros might contain viruses or other security hazards. Do not enable this content unless you trust the source of this file.

[More information](#)

[Show Signature Details](#)

Trust all from publisher Enable Macros Disable Macros

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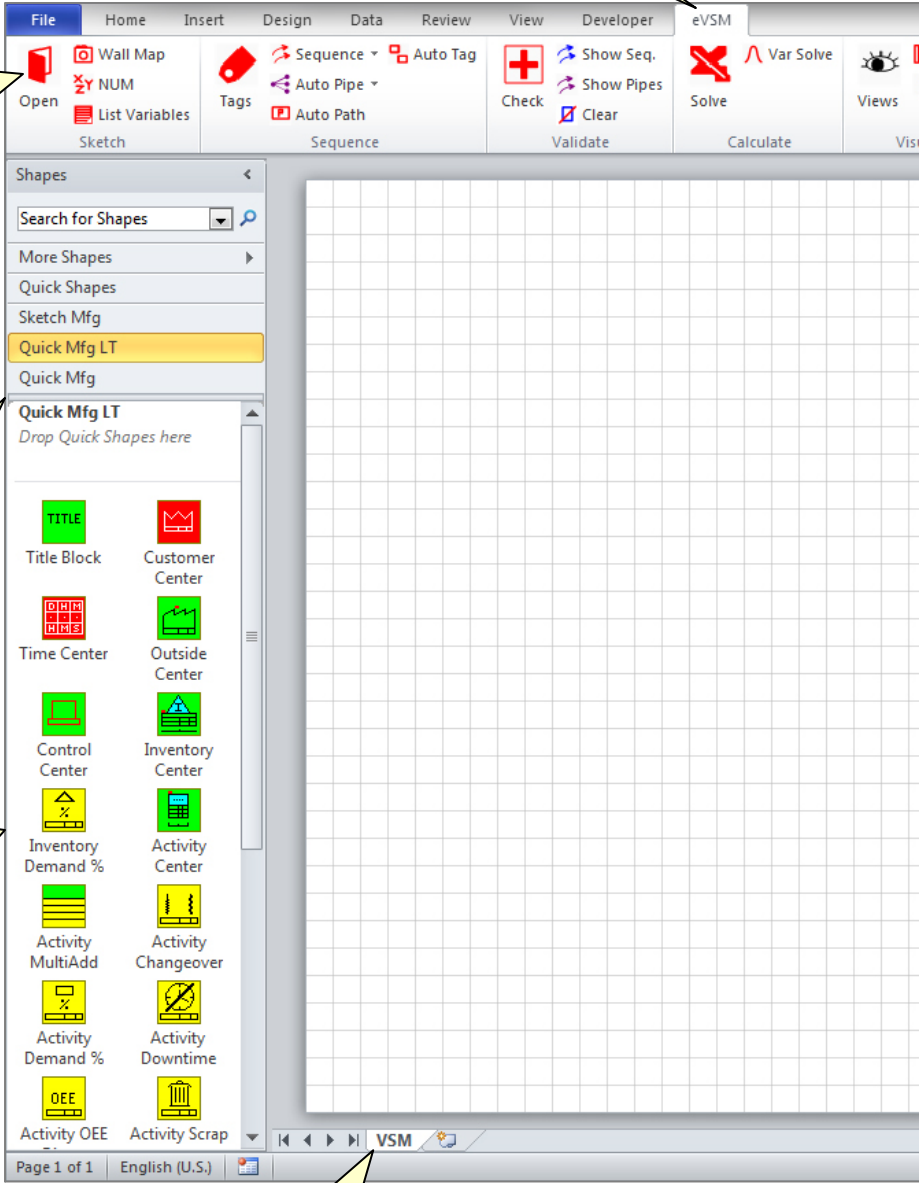
# The eVSM Environment

eVSM adds this toolbar to Visio as well as the stencils on the left and right. If the eVSM toolbar disconnects, click File>Save As and save the file, close the file, then re-open it. This tip can be used for other crashes in eVSM.

A new map is initiated by selecting your application area from the "Open" button. Only the stencils required for your selected application area will open on the left side.

The left hand side has the Quick eVSM stencils which are optimized for specific application areas such as manufacturing vs office vs healthcare.

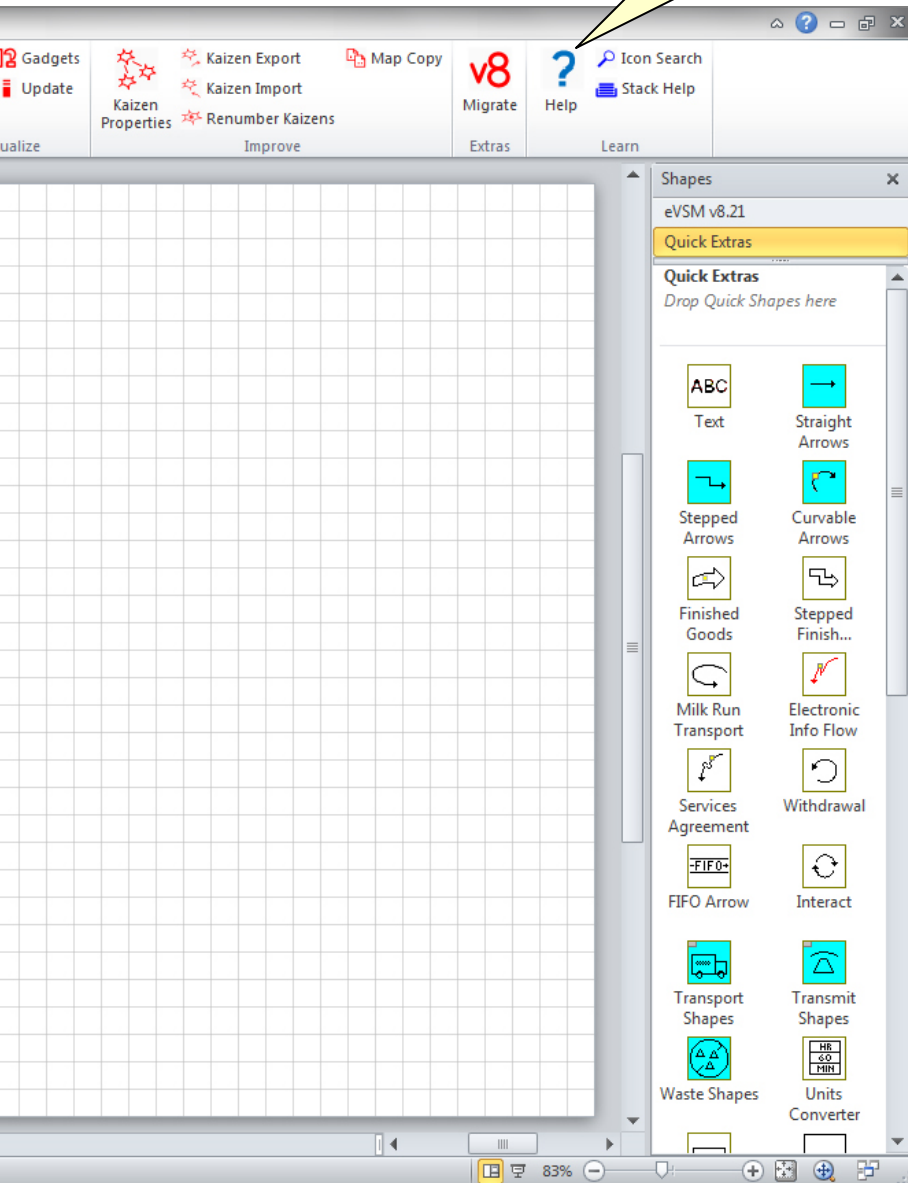
The Quick stencils contain macro shapes which are often collections of individual eVSM shapes with pre-built names, units, equations, and other properties.



A Visio file can have multiple pages which are accessed with these tabs. Each page gets locked to a chosen eVSM application and then not be used for other applications.



Hover over each button in the eVSM Toolbar to learn what it does. Detailed help and tutorials are available at the eVSM help site which can be accessed via this button.



The right side has two stencils. The main eVSM stencil, showing the eVSM version number, and the eVSM Extras stencil which is just a subset of the main stencil to help new users.

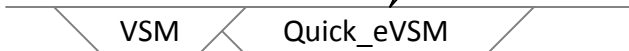
## Step 2: Learn eVSM Basics

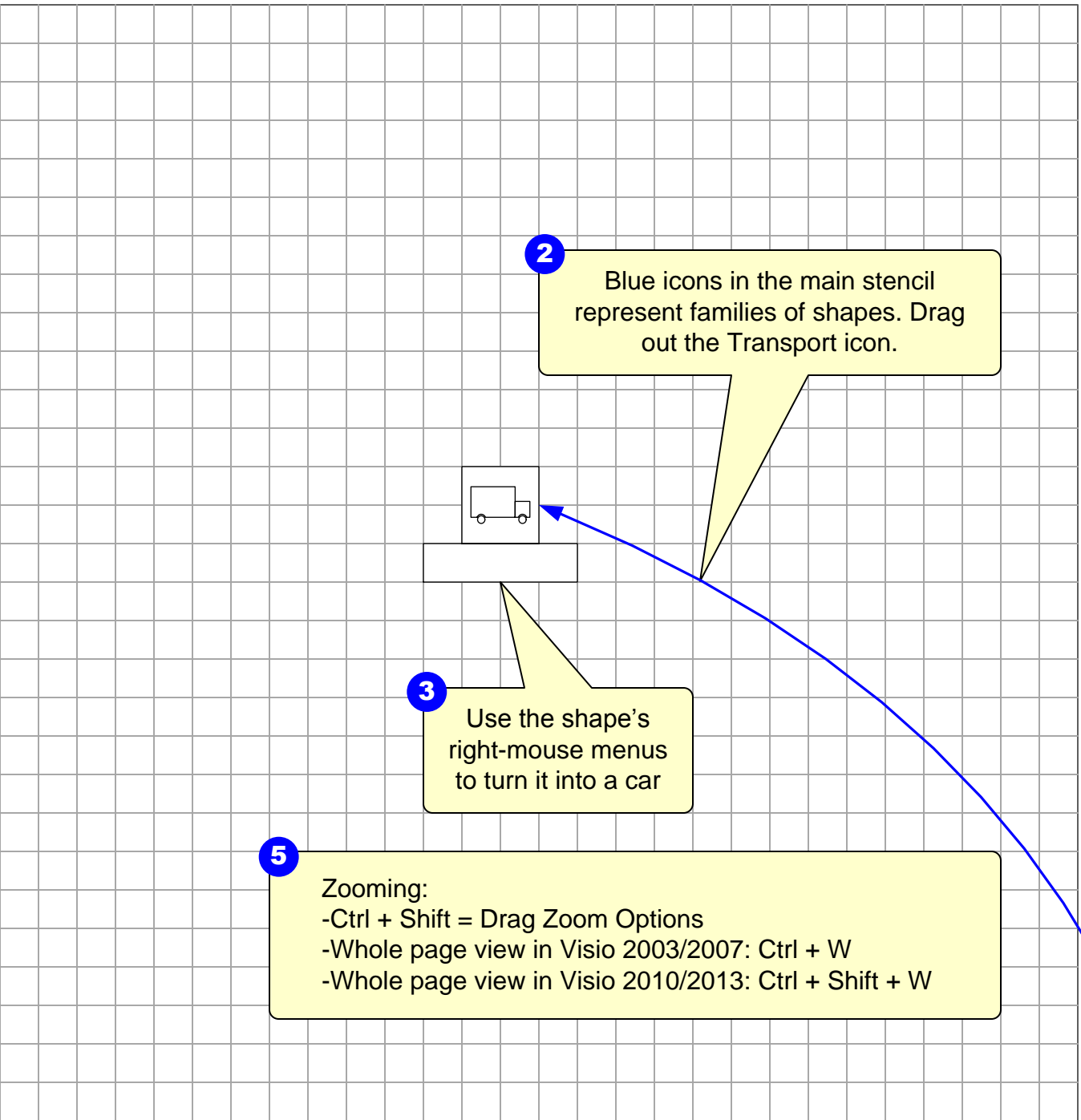


**1** Avoid re-sizing eVSM shapes. Instead grow the drawing page when needed. To resize the page, hold down the “Ctrl” key, and then drag any page edge to the required size. This method works on all four edges of the page.



**4** Save your Visio file and then insert a new page via the right-mouse menus on the page-tabs.

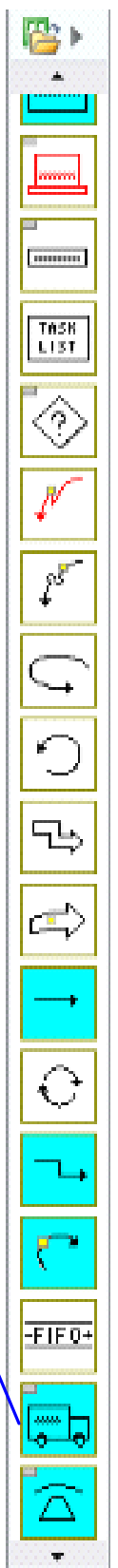




**2** Blue icons in the main stencil represent families of shapes. Drag out the Transport icon.

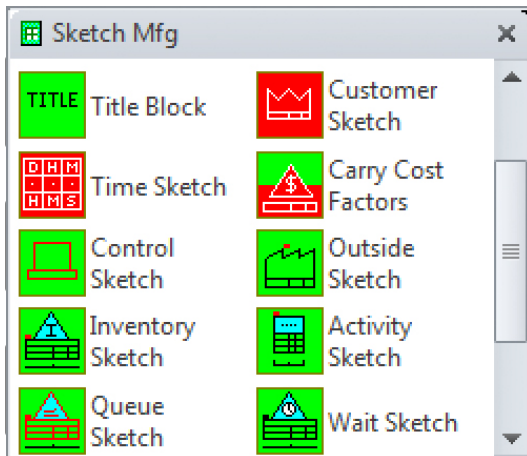
**3** Use the shape's right-mouse menus to turn it into a car

**5** Zooming:  
-Ctrl + Shift = Drag Zoom Options  
-Whole page view in Visio 2003/2007: Ctrl + W  
-Whole page view in Visio 2010/2013: Ctrl + Shift + W

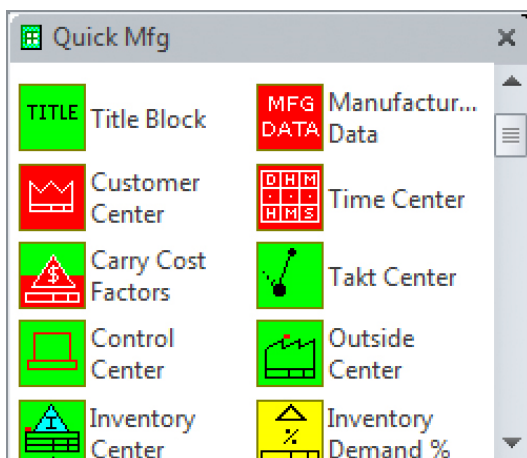


## Quick Mfg Stencils Overview

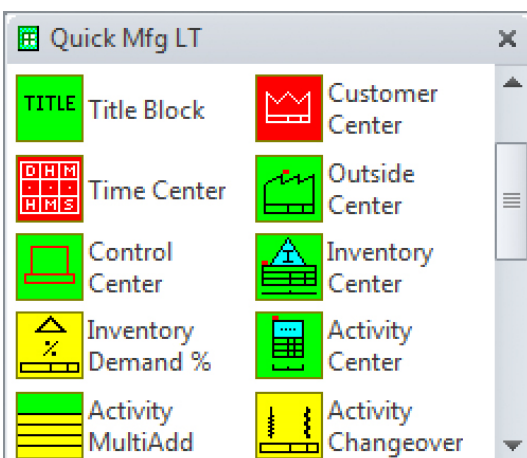
Quick Manufacturing has three stencils.



The Sketch stencil allows you to capture the value stream flow with no data shapes. Data shapes can later be added automatically via right mouse button menus.



The full Quick stencil contains all of the macro shapes available in Quick manufacturing. Includes the full set of add-on (yellow icons) calculations.



The LT stencil contains all the flow shapes but only a small subset of the add-on (yellow icons) calculations. Great for new users and for users who don't need the advanced calculations.

## Quick Stencil Icon Colors

Below is an overview of the Quick Mfg stencil shapes.

The image shows a software window titled "Quick Mfg LT" containing a grid of 20 icons. Each icon is accompanied by a text label. The icons are color-coded as follows:

- Green icons (Centers):** Title Block, Time Center, Control Center, Inventory Center, Activity Center, Activity Changeover, Activity Downtime, Activity Scrap, Activity Time, Transport Center.
- Yellow icons (Additional add-on calculations):** Inventory Demand %, Activity MultiAdd, Activity Demand %, Activity OEE Direct, Activity Stations.
- Purple icons (Graphs and other charts):** Lead Time Chart, CT / TT Chart.
- White icons (Summary Centers):** Time Summary.
- Red icon (Customer Center):** Customer Center.

Callouts provide additional instructions:


- "\*\*DRAG RED SHAPES OUT FIRST\*\*" points to the Customer Center icon.
- "Green icons represent Centers" points to the Inventory Center icon.
- "Yellow icons are additional add-on calculations to add to Centers" points to the Activity MultiAdd icon.
- "White icons represent Summary Centers" points to the Time Summary icon.
- "Purple icons are the graphs and other charts" points to the Lead Time Chart icon.

## Step 3: Using the wall map sketcher

Often value stream maps are started on walls or paper. Converting a hand-drawn map can be tedious and error prone. An easy way to handle this is to take a clear picture of the map, import it into eVSM and then draw the electronic map, directly on top of the picture. This page shows how the eVSM Wall Map function can help with this. You can use a picture of any map to learn this step, if you don't have one, download a copy from:

<http://www.evsm.com/wallmap>



**1** Click the Wall Map button in the toolbar to import a wall map picture into eVSM.  Wall Map

Wall Map Picture Man... ✕

**2** Click the Insert Wall Map button to browse for the image on your computer.

Insert Wall Map

Delete Wall Map

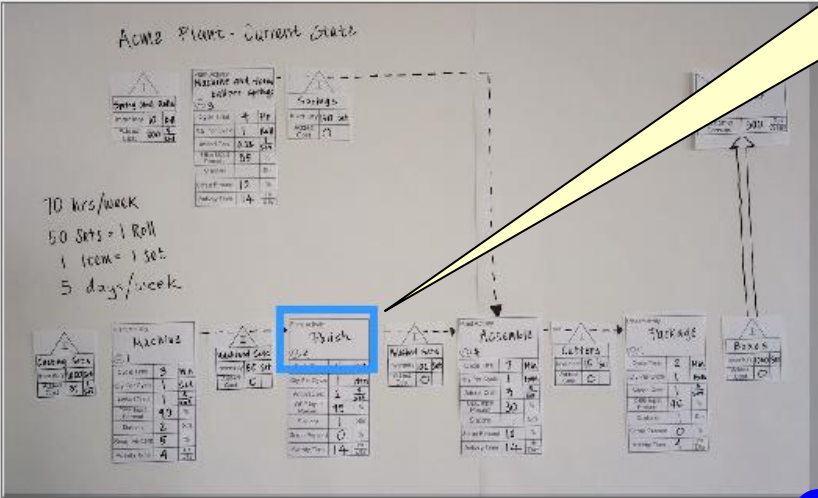
Transparency:  + -

Map Visibility OK

Scale Picture ✕

To scale and fit the picture on page, draw a rectangle over any one process box **3**

Trace a rectangle over any one process box to scale the picture.




**4** Click Done when finished.

Select Another Picture Done



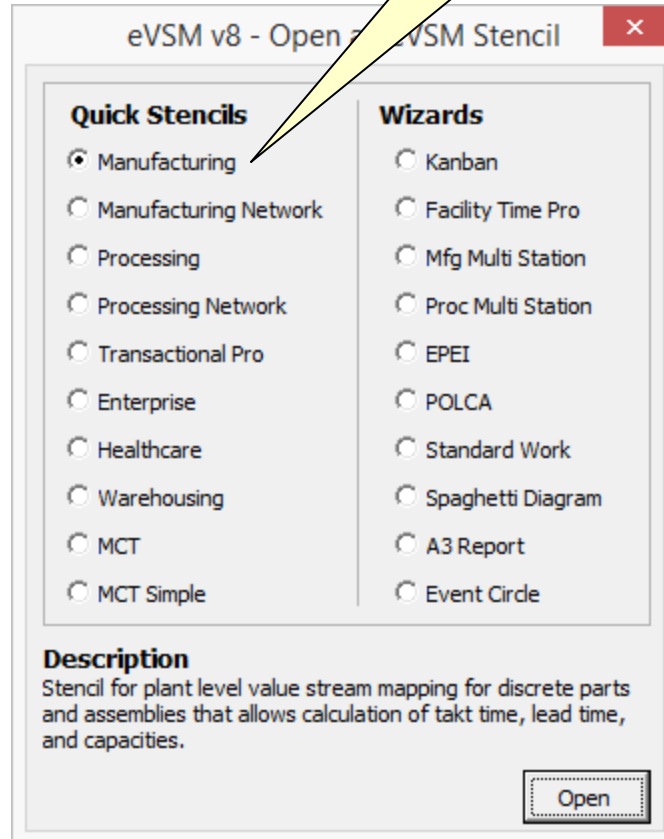
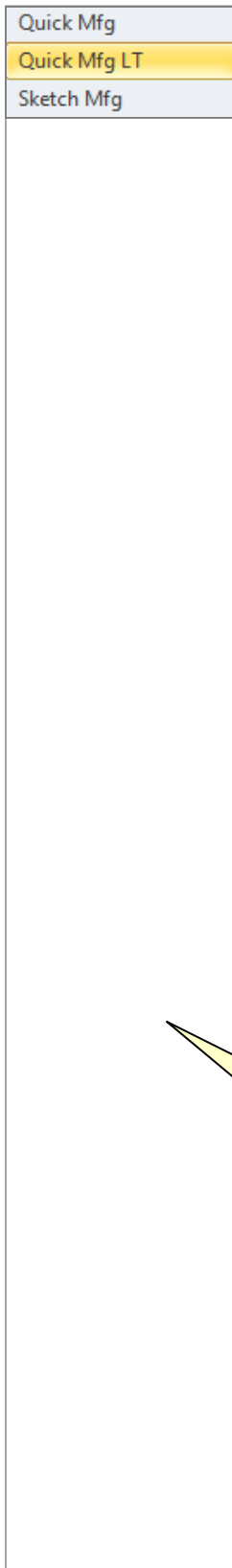
## Step 4: Initiate the map for Quick Manufacturing LT

1

Click the  Open button in the eVSM toolbar.

2

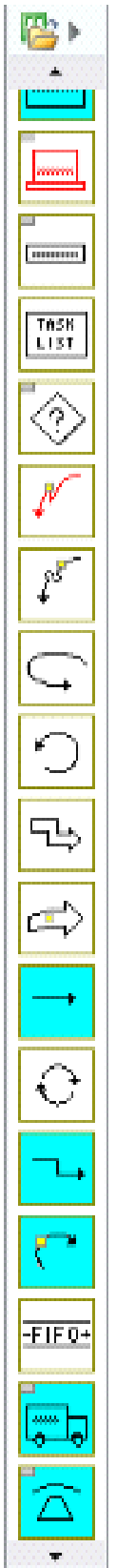
Select Manufacturing, and click Open.



3


The Manufacturing stencils will open on the left. For this tutorial, use the Quick Mfg LT.






# Step 4B: Initiate the map for Quick Manufacturing LT

Quick Mfg LT



Customer Center



Time Center

**1** Drag out the two red icons first. This is very important!

**2** Set to US Units and click OK.

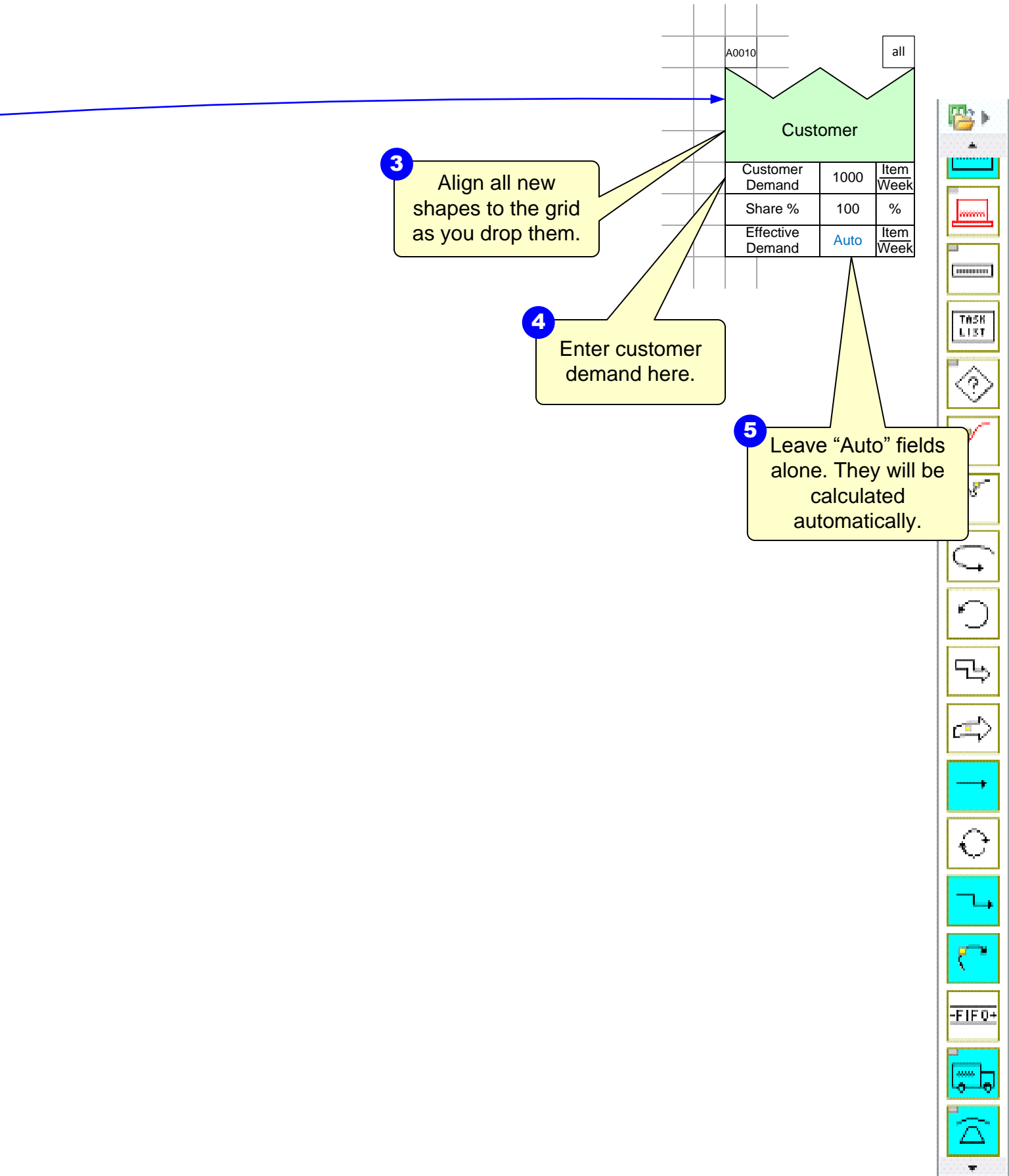
Select map units

Select the unit types and currency unit for this map:

Currency:


**6** Enter available hours per week here. This is actual work hours after subtracting break time.

Units	Week	Year	Week
	70	52	5
	Hr	Week	day



# Step 5: Adding Custom Unit Converters

Quick Mfg LT

**3** Click the NUM button in the toolbar.  NUM

Name and Unit Manager

**Name & Unit Sets**

Save To Set..  
Load From Set..  
Delete Set..  
Import Set..  
Export Set..

Name / Unit Alias  
Import On Off

**Map : Units**

Unit	On Map	US	Metric
\$	Yes		
%	No		
1to10	No		
Cntr	No		
CO	No		
Day	Yes		
Doc	No		
ft	Yes		
Hr	Yes		
Impr	No		
Item	Yes		

New Unit..  
Modify Unit..  
Delete Unit..  
Delete Unused  
Select Shapes  
Unit Converters

**Map : Names (NVU's)**

Name	On Map	Hidden	Default Unit	Filter:
Activity Demand	No	No	Item/Day	
Activity Lead Time	No	No	Day	
Activity NVA	No	No	Min	
Activity NVA Per Unit	No	Yes	Min/Item	
Activity Resource Cost	No	Yes	\$/Item	
Activity Takt Time	No	Yes	Min/Item	
Activity Time	No	No	Hr/Day	
Activity VA Per Unit	No	Yes	Min/Item	
Added Cost	No	Yes	\$/Item	
Added Scrap Cost	No	Yes	\$/Item	
Annual Inv Carry Cost	No	Yes	K\$	

Load From Map Source/Target Pages Equation Manager.. OK

**4** Click the "New Unit" button, type "Set", and click OK. Create another unit named "Roll" and click OK.

**1** Drag out two Units Converter shapes from the Quick Extras stencil and glue to the existing Time Center.

**5** Double-click each field to match the appropriate units converters.

**2** Double-click the bottom field to change to "Item".


Units	Week	Year	Week	Roll	Set
	70	52	5	50	1
	Hr	Week	day	Set	Item

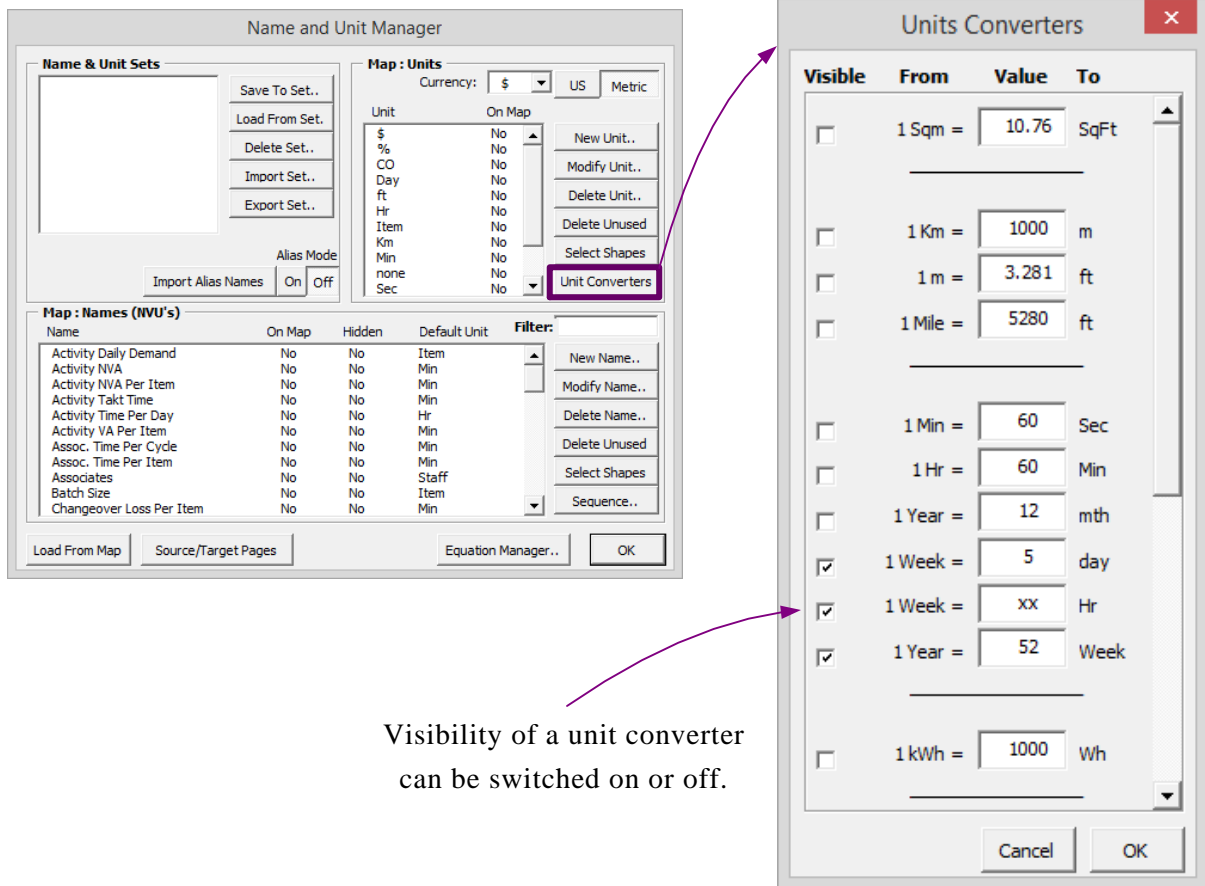
A0010			all
Customer			
Customer Demand	1000	Set	Week
Share %	100	%	
Effective Demand	Auto	Item	Week



**6** Double-click the units for Customer Demand and change the numerator to "Set".

## Unit Converters Usage

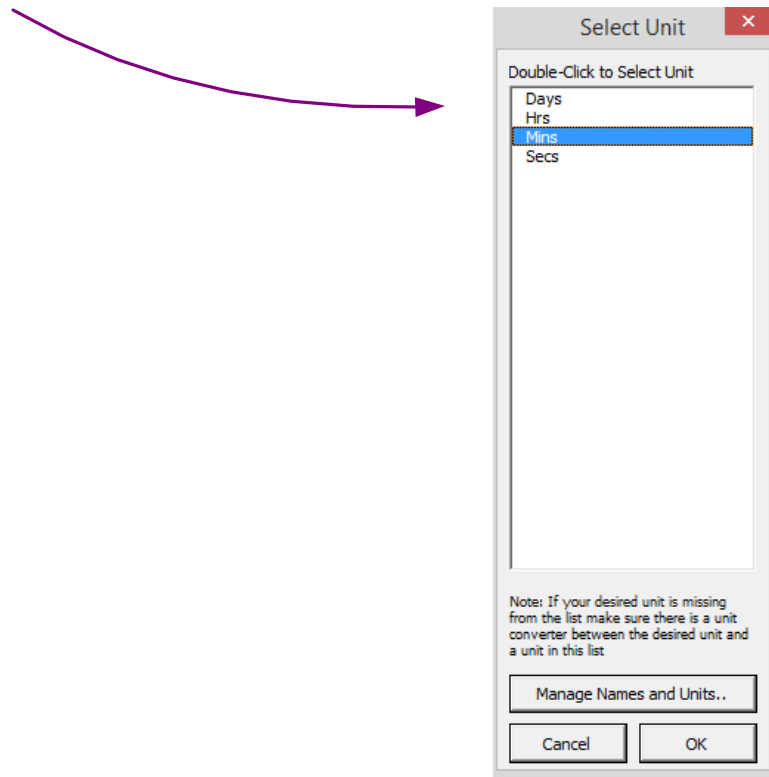
- Secs/Mins, Mins/Hrs units converters are hidden
- Made visible through NUM button in the toolbar  NUM



Visibility of a unit converter can be switched on or off.

Visible	From	Value	To
<input type="checkbox"/>	1 Sqm =	10.76	SqFt
<input type="checkbox"/>	1 Km =	1000	m
<input type="checkbox"/>	1 m =	3.281	ft
<input type="checkbox"/>	1 Mile =	5280	ft
<input type="checkbox"/>	1 Min =	60	Sec
<input type="checkbox"/>	1 Hr =	60	Min
<input type="checkbox"/>	1 Year =	12	moth
<input checked="" type="checkbox"/>	1 Week =	5	day
<input checked="" type="checkbox"/>	1 Week =	xx	Hr
<input checked="" type="checkbox"/>	1 Year =	52	Week
<input type="checkbox"/>	1 kWh =	1000	wh


- Unit families eliminate errors when changing units
- Only Time units will appear when double-clicking on Mins to change to Hrs



- If desired unit does not appear:
  - Create a new unit -- OR --
  - Place a units converter on map

- Use NUM button in toolbar to create the new unit
- New unit will require units converter to connect default unit to new unit

Hr
60
Min

- New unit will appear in “Select Unit” window when double-click unit (family)  NUM
- If desired unit was in the NUM, add a units converter to the map
- Built-in error proofing to prevent incompatible units

# Step 6: Draw the flow

## Quick Mfg LT

**1** The green shapes are called "Centers". Use the centers to represent the flow.



Activity Center



Inventory Center

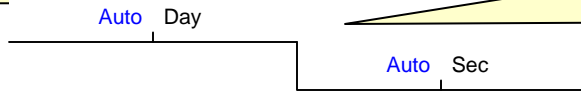
**4** Operation Tag number may not match with your screen. This is OK, this will be handled later.

A0020	I	P
Type		
Inventory	xx	Item

A0030		P
Process		
1		
Cycle Time	x.xx	Sec
Qty Per Cycle	1	Item
Capacity	Auto	Item Day
Pre OEE Capacity	Auto	Item Day
OEE Percent	Auto	%

**2** Remember to align all new shapes to the grid as you drop them.

**3** If the Value Added and Non Value Added timeline is not lined up, use the "Align Timeline" command in the right-mouse button menu.



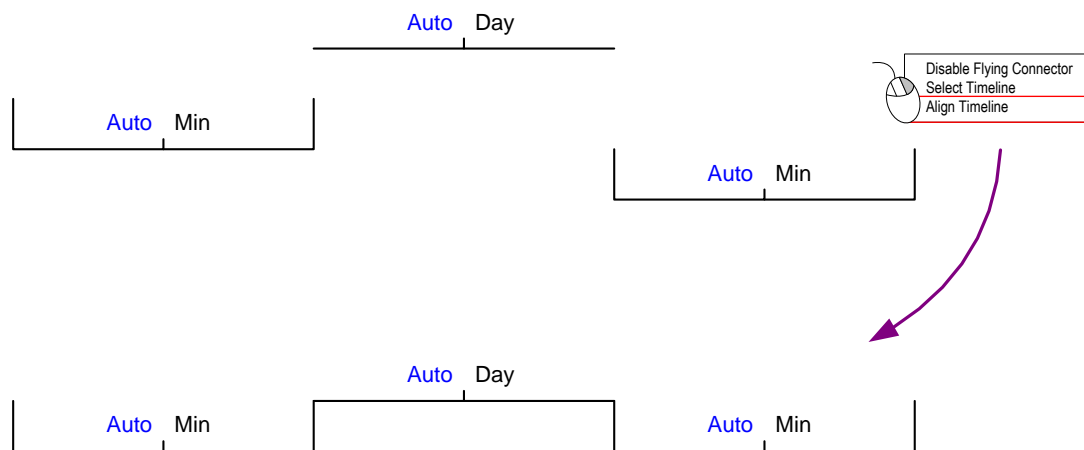
Units	Week	Year	Week	Roll	Set
	70	52	5	50	1
	Hr	Week	day	Set	Item





## Working with the timeline

- Shift the entire timeline up or down, use “Select Timeline” in the right-mouse menu
- If that option doesn’t appear in the menu, make sure you have the entire VA or NVA shape selected and try again
- “Align Timeline” function also in the right-mouse menu will create the ladder timeline for you if the VA and NVA shapes are not correctly aligned, as shown below



This area intentionally left blank

# Step 7: Complete the flow and enter data

Quick Mfg LT

2

If text does not fit, avoid re-sizing eVSM shapes. Instead, make the font smaller.

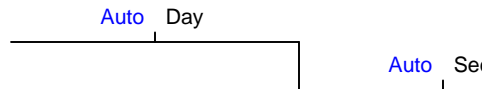
A0110	I	P
Spring Steel Rolls		
Inventory	10	Roll

A0120		P
Machine and form caliper springs		
	1	
Cycle Time	4	Hr
Qty Per Cycle	1	Roll
Capacity	Auto	Item Day
Pre OEE Capacity	Auto	Item Day
OEE Percent	Auto	%

A0130	I	P
Springs		
Inventory	150	Set

3

Check to make sure you have the appropriate units. If not, double-click the unit to change it.

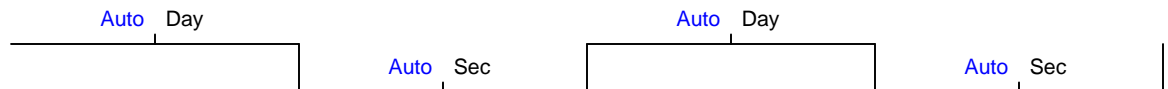


A0020	I	P
Casting Sets		
Inventory	1000	Set

A0030		P
Machine		
	1	
Cycle Time	3	Min
Qty Per Cycle	1	Set
Capacity	Auto	Item Day
Pre OEE Capacity	Auto	Item Day
OEE Percent	Auto	%

A0040	I	P
Machined Sets		
Inventory	50	Set

A0050		P
Polish		
	1	
Cycle Time	5	Min
Qty Per Cycle	1	Item
Capacity	Auto	Item Day
Pre OEE Capacity	Auto	Item Day
OEE Percent	Auto	%



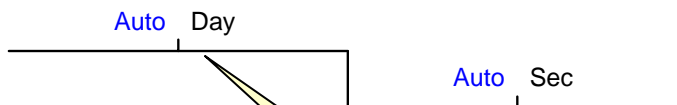
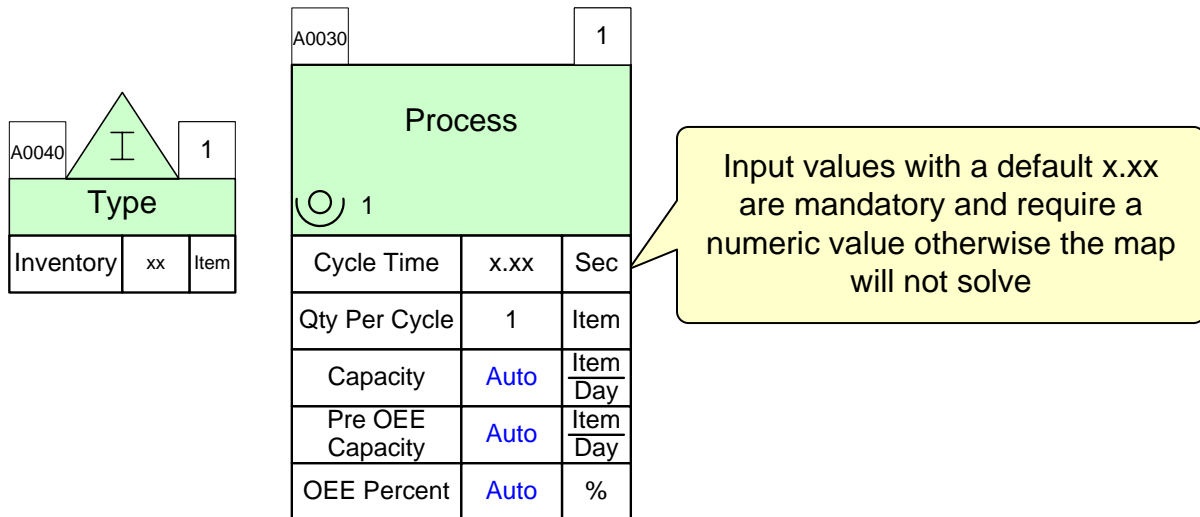
Units	Week	Year	Week	Roll	Set
	70	52	5	50	1
	Hr	Week	day	Set	Item



## Fractional Units

- Fractional units makes specifying and computing demand quantities or production times easier
- Provides better control of data entry and display
- Fractional units changed like any other unit on map using the NUM button in the toolbar

## Data Entry Hints



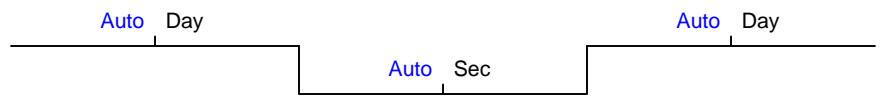
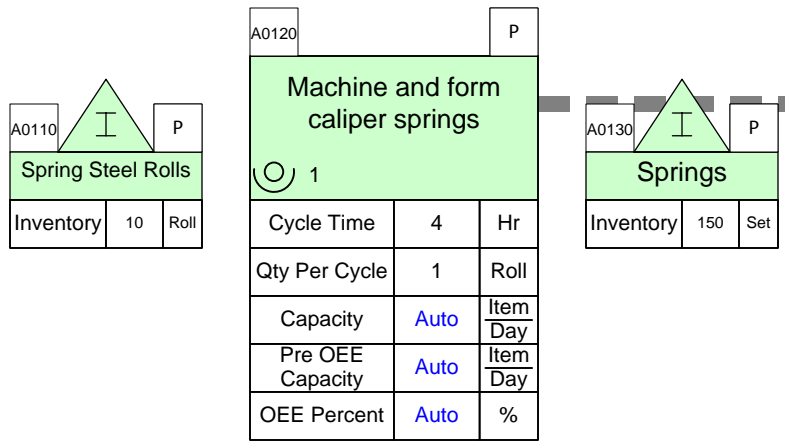
Little's Law:

$$\text{Wait Time (Non-Value Added)} = \text{Inventory} / \text{Customer Demand}$$

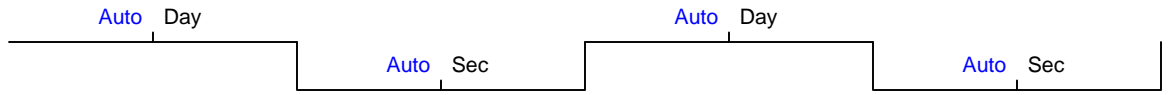
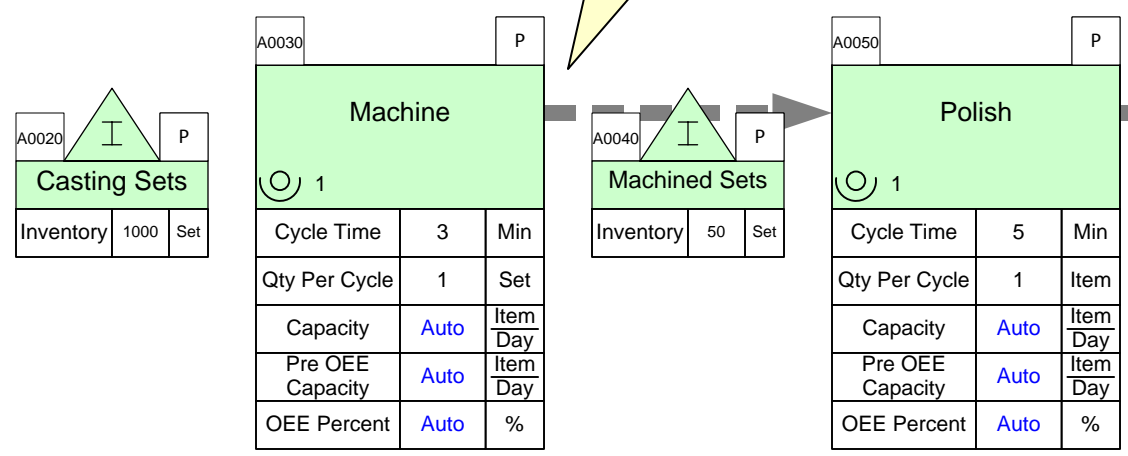
- When entering data use tab key to go to next NVU
- Non-Value Added and Value Added ladders are already glued to Activity Center and Inventory Center, respectively
- The standard NVUs on an Activity Center are required for calculations and MUST NOT be deleted

# Step 8: Add Arrows from Main Stencil

Quick Mfg LT

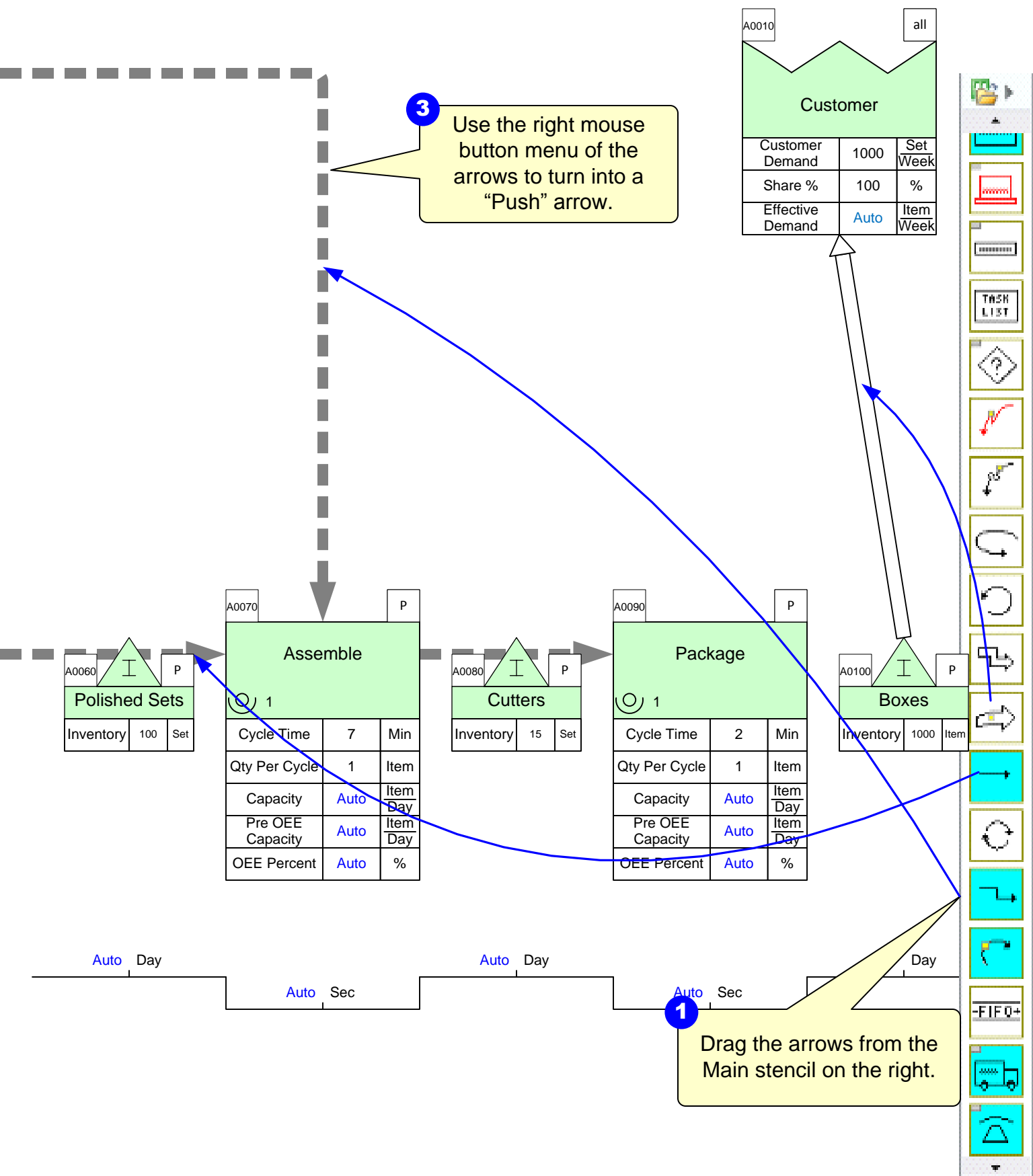


**2** Glue all arrows at both ends.



Units	Week	Year	Week	Roll	Set
	70	52	5	50	1
	Hr	Week	day	Set	Item





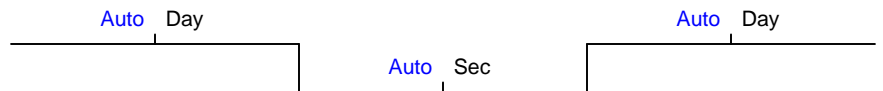
# Step 9: Add Transport shapes

Quick Mfg LT

A0110	I	P
Spring Steel Rolls		
Inventory	10	Roll

A0120		P
Machine and form caliper springs		
⊙ 1		
Cycle Time	4	Hr
Qty Per Cycle	1	Roll
Capacity	Auto	Item Day
Pre OEE Capacity	Auto	Item Day
OEE Percent	Auto	%

A0130	I	P
Springs		
Inventory	150	Set

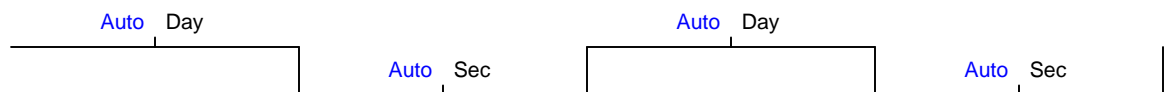


A0020	I	P
Casting Sets		
Inventory	1000	Set

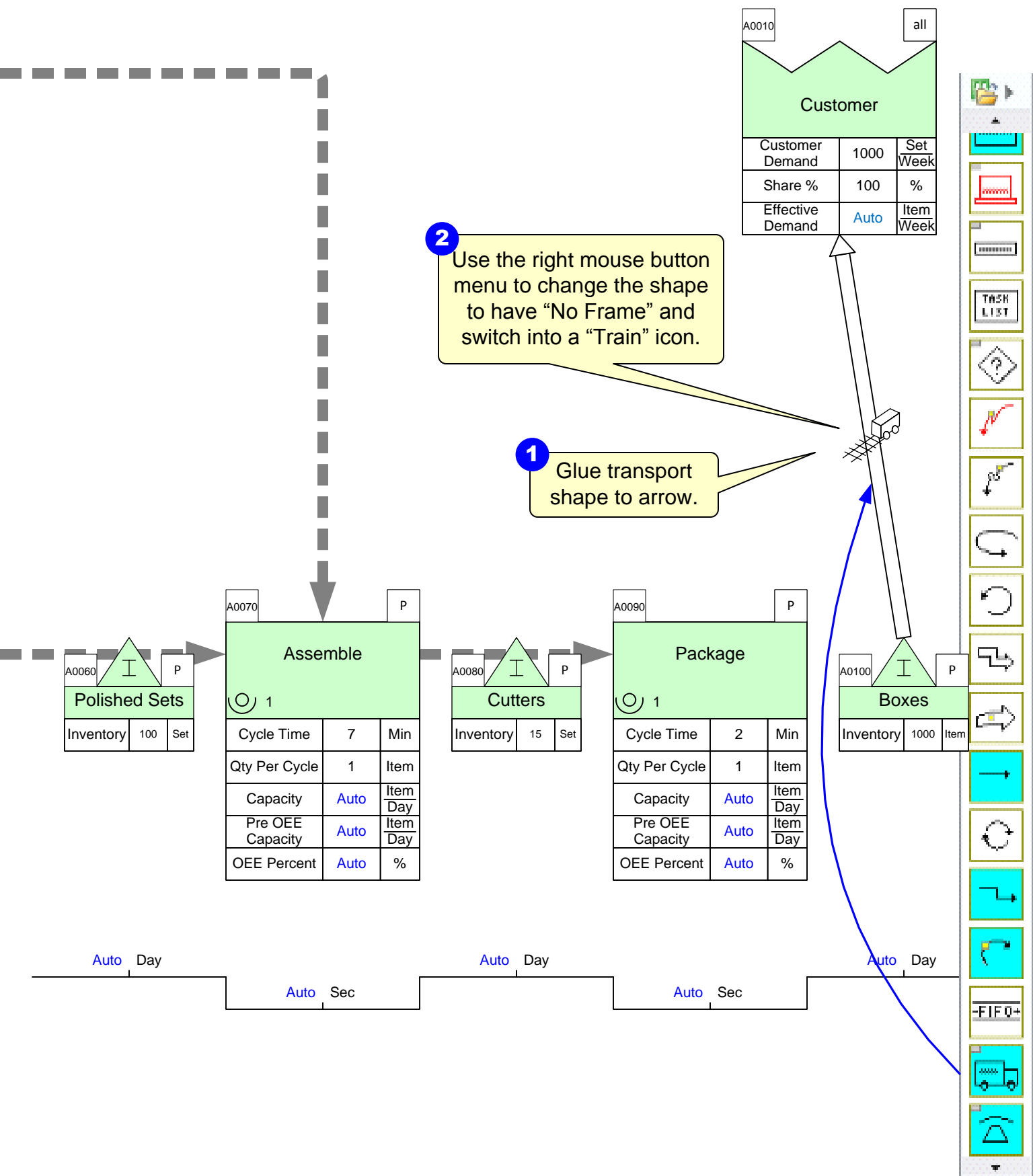
A0030		P
Machine		
⊙ 1		
Cycle Time	3	Min
Qty Per Cycle	1	Set
Capacity	Auto	Item Day
Pre OEE Capacity	Auto	Item Day
OEE Percent	Auto	%

A0040	I	P
Machined Sets		
Inventory	50	Set

A0050		P
Polish		
⊙ 1		
Cycle Time	5	Min
Qty Per Cycle	1	Item
Capacity	Auto	Item Day
Pre OEE Capacity	Auto	Item Day
OEE Percent	Auto	%

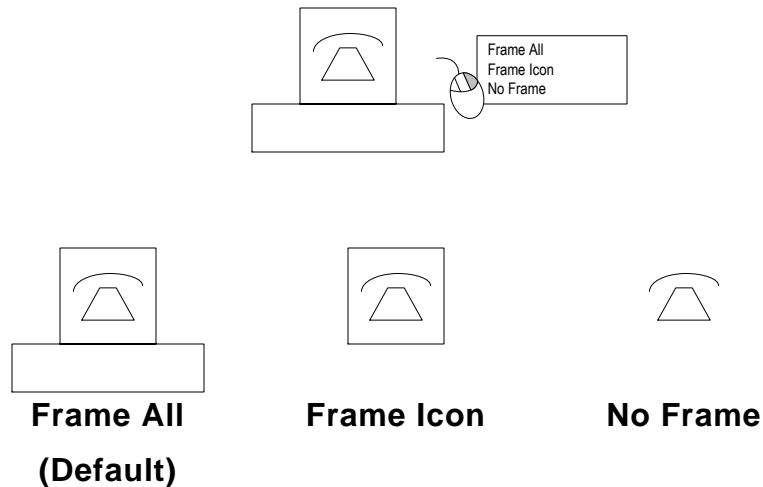


Units	Week	Year	Week	Roll	Set
	70	52	5	50	1
	Hr	Week	day	Set	Item



## Transport, Transmit, and Flow Shapes

- Transport, Transmit, and Flow Shapes now have text box framed to allow data values to be added if needed
  - If data is added to shape, an Operation Tag and Path Locator needs to be added
- To remove frame, right-click on shape and select “Frame Icon”

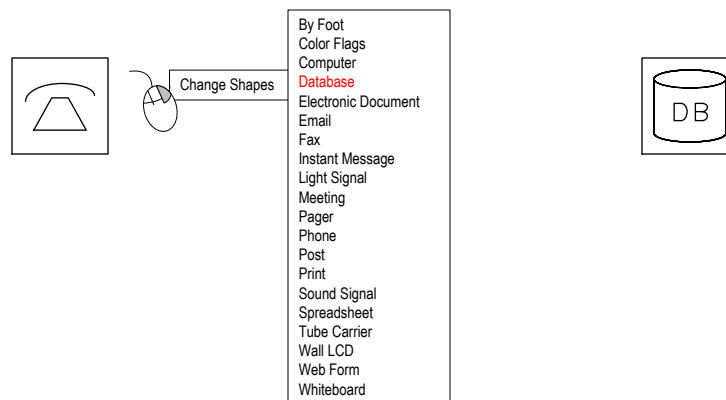


- Use Text Block tool to move text



## Blue Stack Shapes

- Blue icon stack has other shapes to choose
- Right-click on shape and select desired shapes
- Use the **Stack Help** button in the toolbar to see complete list of shapes in a stack after selecting a blue or green stack icon from a stencil



# Step 10: Sequence Arrows

Quick Mfg LT

**1** Sequence arrows are needed for upstream and downstream calculations. To add them, hold down the SHIFT key and select the green shapes in the order shown here.

**2** Click the Sequence button. Sequence

A0110	I		P				
Spring Steel Rolls							
Inventory	10		Roll				

A0120			P				
Machine and form caliper springs							
1							
Cycle Time	4		Hr				
Qty Per Cycle	1		Roll				
Capacity	Auto		Item Day				
Pre OEE Capacity	Auto		Item Day				
OEE Percent	Auto		%				

A0130	I		P				
Springs							
Inventory	150		Set				

Auto Day

---

Auto Sec

---

Auto Day

---

A0020	I		P				
Ca A							
Inventory	1000		Set				

**A**

A0030			P				
B							
1							
Cycle Time	3		Min				
Qty Per Cycle	1		Set				
Capacity	Auto		Item Day				
Pre OEE Capacity	Auto		Item Day				
OEE Percent	Auto		%				

**B**

A0040	I		P				
Ma C							
Inventory	50		Set				

**C**

A0050			P				
D							
1							
Cycle Time	5		Min				
Qty Per Cycle	1		Item				
Capacity	Auto		Item Day				
Pre OEE Capacity	Auto		Item Day				
OEE Percent	Auto		%				

**D**

Auto Day

---

Auto Sec

---

Auto Day

---

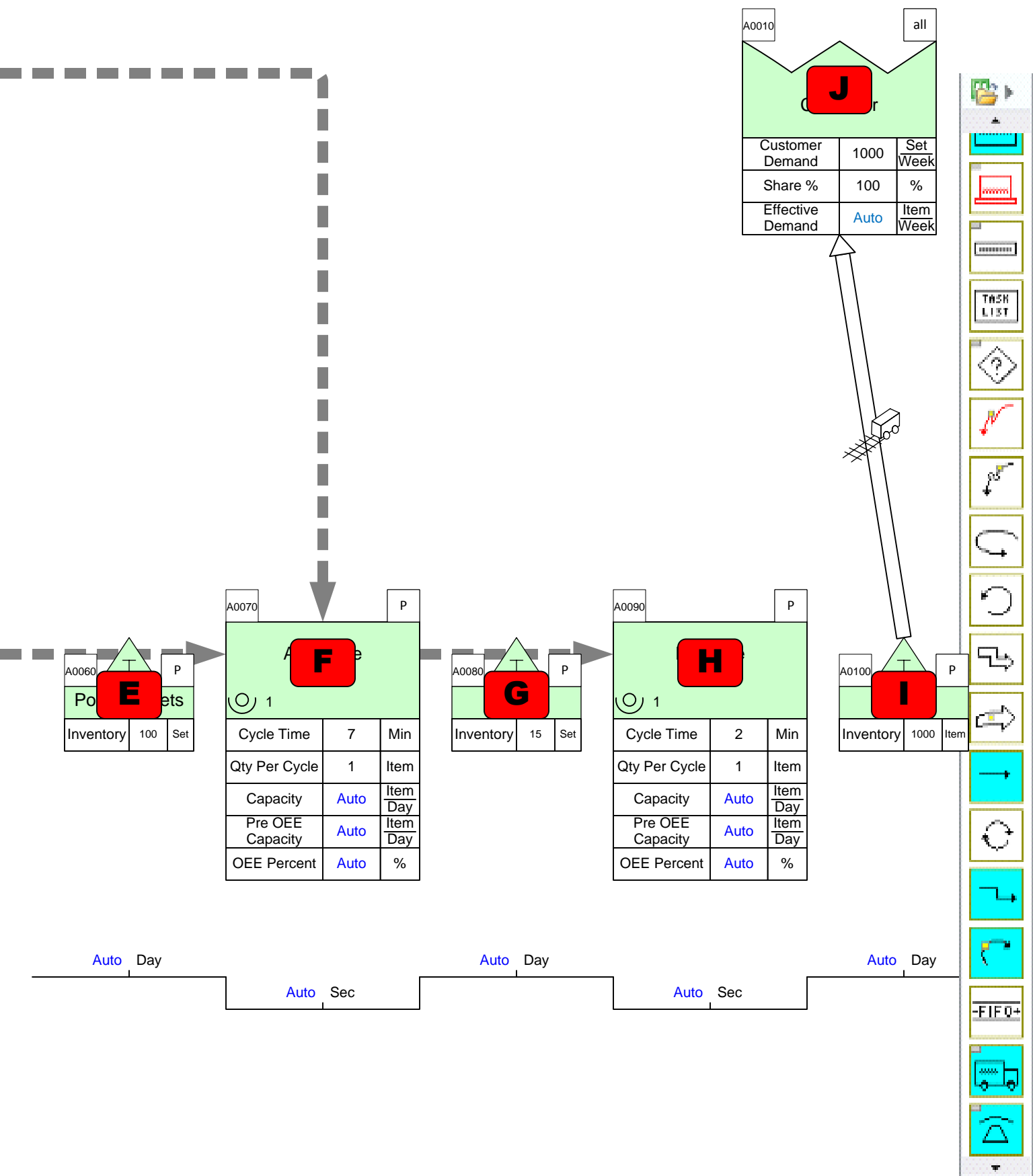
Auto Sec

---



  

Units	Week	Year	Week	Roll	Set
	70	52	5	50	1
	Hr	Week	day	Set	Item

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## Sequence Arrows Sequence

- Provide a means of generating tag numbers in upstream to downstream sequence (using the **AutoTag** button)  Auto Tag
- Provide a means of generating path numbers that comprehend all of the paths on the map (using the **Auto Path** button)  Auto Path
- Are the basis for upstream/downstream calculations in the built-in eVSM equations
- Sequence arrows can be added for a few centers at a time or in a continuous path.



This area intentionally left blank

# Step 11: Sequence Path 2

Quick Mfg LT

A0110		P
Springs		
Inventory	10	Roll

A0120		P
Machine Form calibrations		
Cycle Time	4	Hr
Qty Per Cycle	1	Roll
Capacity	Auto	Item Day
Pre OEE Capacity	Auto	Item Day
OEE Percent	Auto	%

A0130		P
Inventory		
Inventory	150	Set

**2** For the second path, hold the SHIFT key and select the green shapes A to D in the order shown. Then click the Sequence button.

Auto Day

Auto Sec

Auto Day

A0020		P
Casting Sets		
Inventory	1000	Set

A0030		P
Machine		
Cycle Time	3	Min
Qty Per Cycle	1	Set
Capacity	Auto	Item Day
Pre OEE Capacity	Auto	Item Day
OEE Percent	Auto	%

A0040		P
Machined Sets		
Inventory	50	Set

A0050		P
Polish		
Cycle Time	5	Min
Qty Per Cycle	1	Item
Capacity	Auto	Item Day
Pre OEE Capacity	Auto	Item Day
OEE Percent	Auto	%

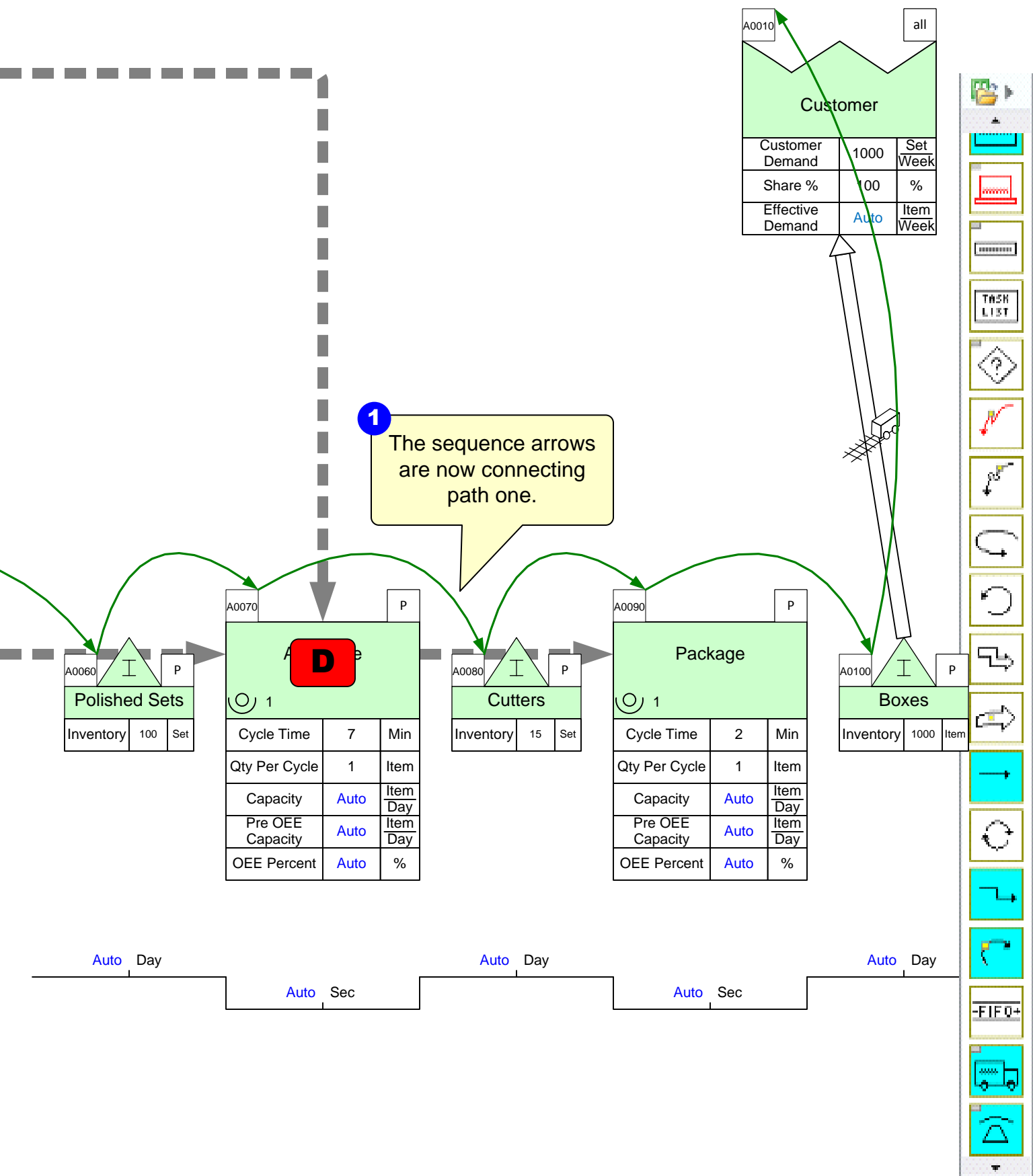
Auto Day

Auto Sec

Auto Day

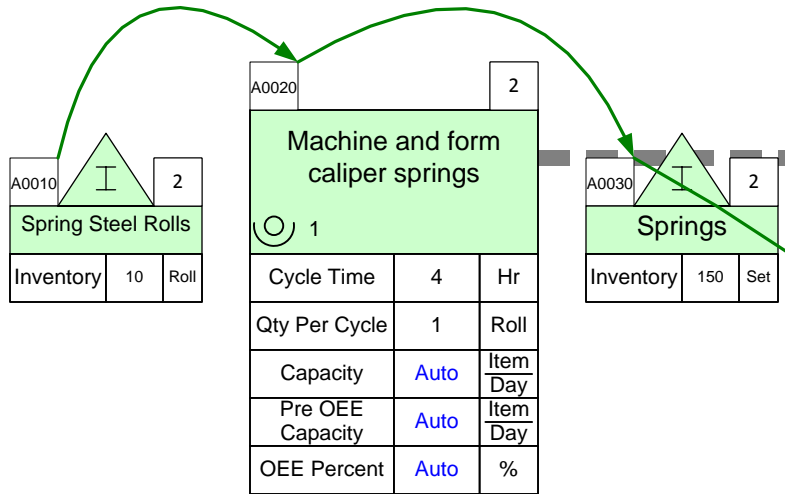
Auto Sec

Units	Week	Year	Week	Roll	Set
	70	52	5	50	1
	Hr	Week	day	Set	Item




# Step 12: Use Auto Path to Generate Path ID's based on Sequence Arrows


Quick Mfg LT

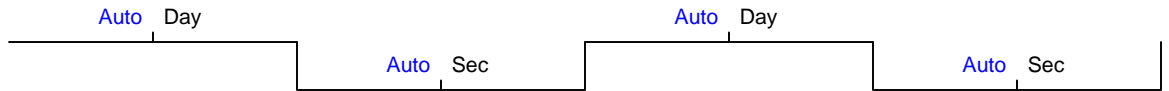
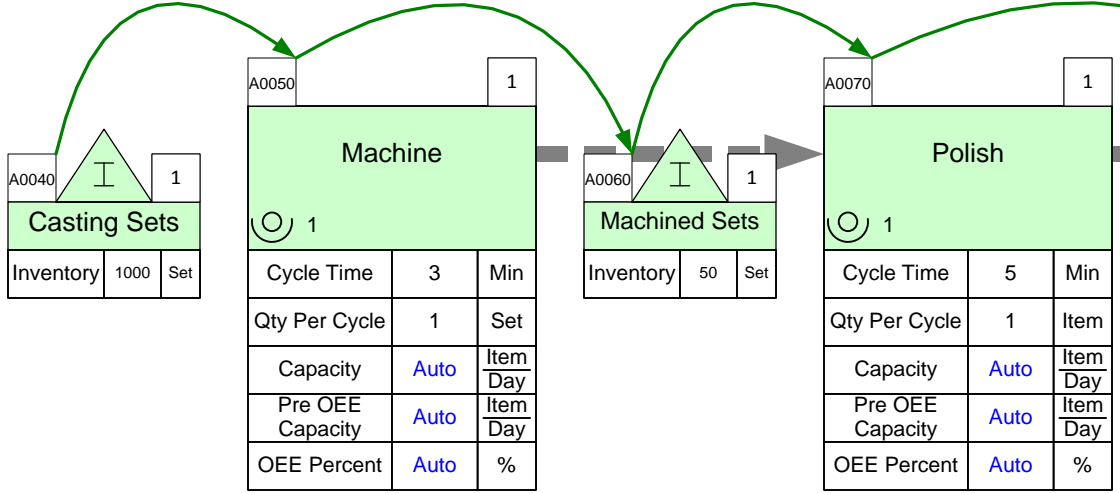


**2** Click Auto Path to automatically generate Path numbers based on Sequence arrows. The path numbers on your map might not exactly match the ones on this example, and that is okay.


 Auto Path

**3** Click AutoTag again to re-order the tags based on the new sequence arrows.

 Auto Tag



Units	Week	Year	Week	Roll	Set
	70	52	5	50	1
	Hr	Week	day	Set	Item


**4** Sequence arrow visibility can be switched On/Off with the Show Seq. button. Try it.  Show Seq.

**1** The sequence arrows are now connecting path one and two.


**5** These Path tags are used to specify paths. #2 implies that the shape is on 2 paths. If you'd like to see the path numbers the shape is on, right click and select "Show paths on Center". This will display all the path numbers the shape is on just above the path tag.

A0130		all
Customer		
Customer Demand	1000	Set Week
Share %	100	%
Effective Demand	Auto	Item Week

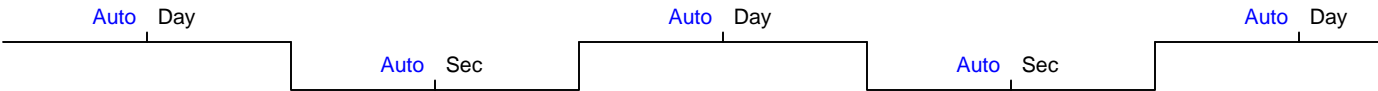
A0080		1
Polished Sets		
Inventory	100	Set

A0090		#2
Assemble		
 1		
Cycle Time	7	Min
Qty Per Cycle	1	Item
Capacity	Auto	Item Day
Pre OEE Capacity	Auto	Item Day
OEE Percent	Auto	%

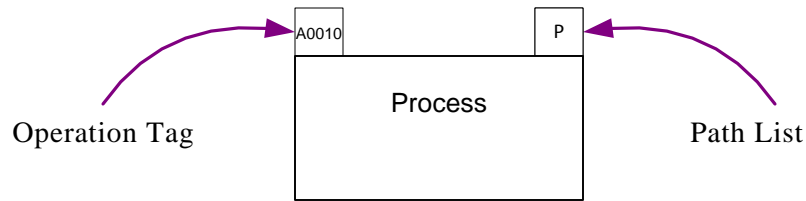
A0100		#2
Cutters		
Inventory	15	Set

A0110		#2
Package		
 1		
Cycle Time	2	Min
Qty Per Cycle	1	Item
Capacity	Auto	Item Day
Pre OEE Capacity	Auto	Item Day
OEE Percent	Auto	%

A0120		#2
Boxes		
Inventory	1000	Item



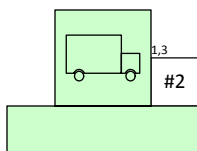
## Path List



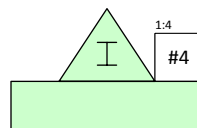
- Path List: The Path List is used to identify a path that an activity (or other shape able to be tagged) belongs to. The shape is glued above the top right corner of the shape.
- An activity can belong to no paths, one or more, or all paths. The benefit of assigning path numbers to activities is that the associated activity variables (like NVA time) can be summed up across the map in a path specific sense.
- After you have used the Auto Path function, the Path List will appear as either of the following:

- All    The center is on all paths
- 6    The center is only on path 6
- #4    The center is on 4 different paths

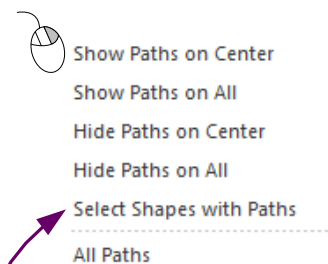
Right clicking on the Path List shape will pull up a menu to display all the path numbers on each center/page, or to hide all paths on each center or for the whole page.



The "1,3" indicates that this center is on paths 1 and 3



The "1:4" indicates that this center is on paths 1 through 4 (1, 2, 3, 4)



Using the "Select Shapes with Paths" option will highlight all shapes on the map that have those specific path numbers.

## Operation Tags

- Operation Tags:
  - Provides short name for process step
  - Identifies process step to Excel for calculations
  - Defines the order in which data is plotted on charts
  - Operation Tags MUST be 1-alpha and 4-numeric characters (ie: A0200)
  - Are typically assigned using the [Auto Tag](#) button and AFTER sequence arrows have been applied

# Step 13: Time Summary by Path

**1** Drag out two Time Summary Centers.

Z0010 1

Time Summary		
Lead Time	Auto	Day
Total Value Added	Auto	Min
Value Added Percent	Auto	%
Takt Time	Auto	Min Item
Total Cycle Time	Auto	Min

**2** Double-click to change this path filter to "1" using the Path Filter Manager.

Path Filter Manager

All Paths	Selected Paths
all	1
1	
2	

Highlight OK Cancel

A0080 2

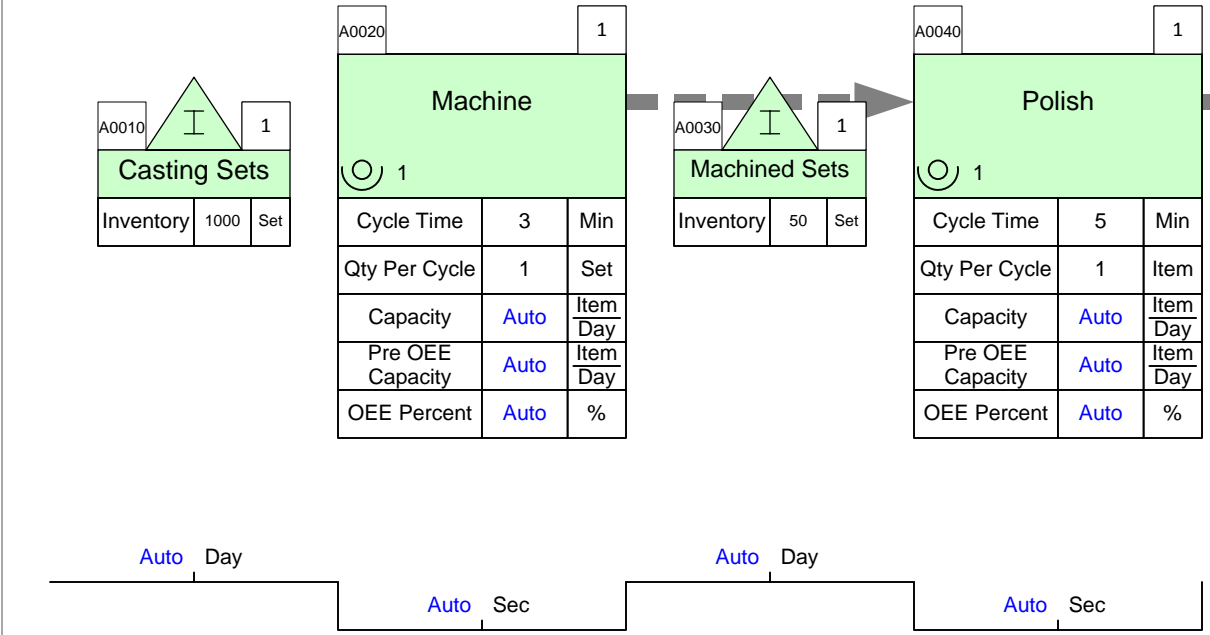
Springs		
Inventory	150	Set

Z0020 2

Time Summary		
Lead Time	Auto	Day
Total Value Added	Auto	Min
Value Added Percent	Auto	%
Takt Time	Auto	Min Item
Total Cycle Time	Auto	Min

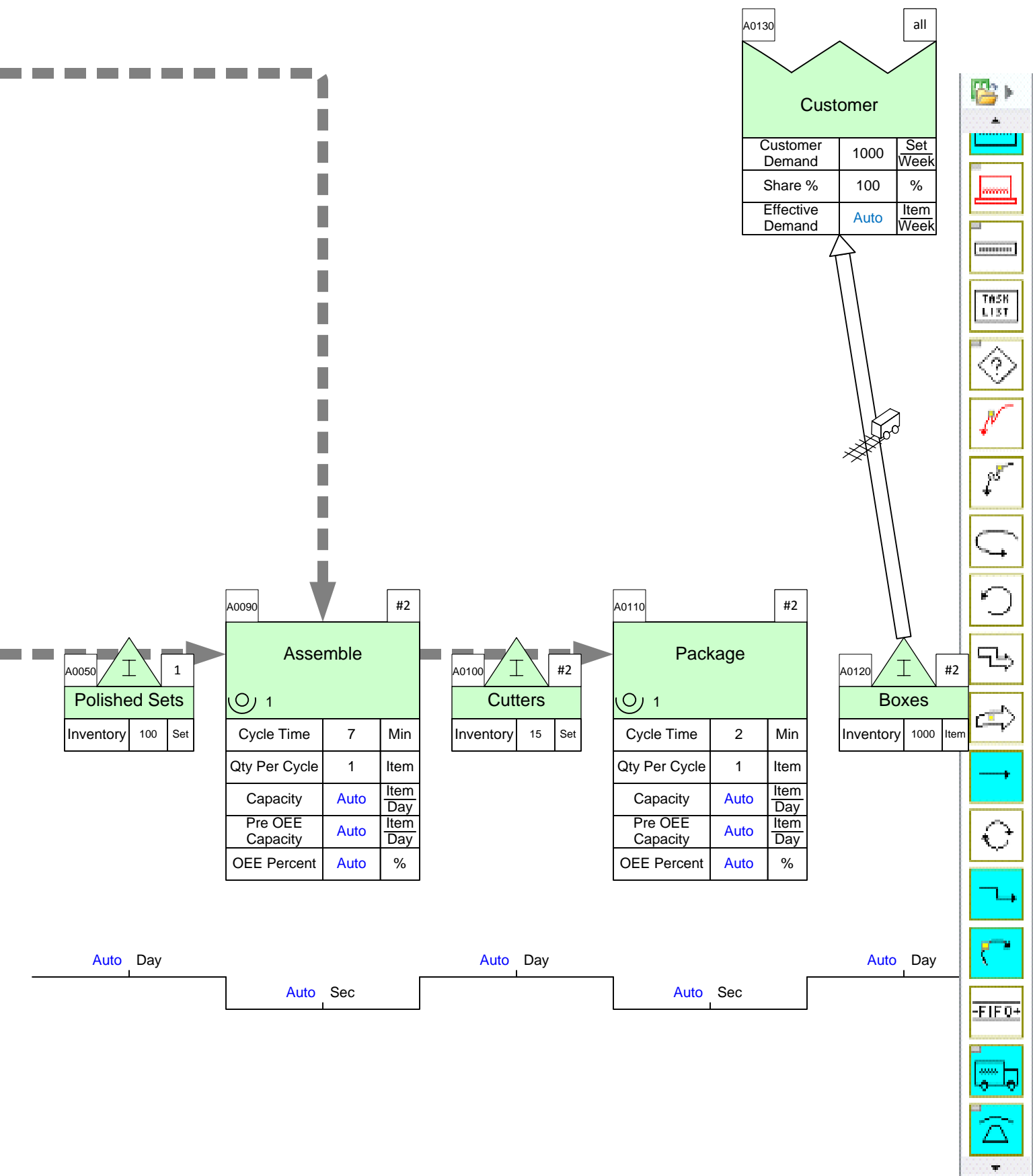
**3** Double-click to change this path ID to 2.

**4** Double-click to change both units to Min on each Time Summary.



Units	Week	Year	Week	Roll	Set
	70	52	5	50	1
	Hr	Week	day	Set	Item





# Step 14: Perform Calculations

**Quick Mfg LT**

Z0010	1
<b>Time Summary</b>	
Lead Time	10.85 Day
Total Value Added	17.00 Min
Value Added Percent	0.19 %
Takt Time	4.20 Min Item
Total Cycle Time	17.00 Min

A0060	2
<b>Spring Steel Rolls</b>	
Inventory	10 Roll

A0070	2
<b>Machine and form caliper springs</b>	
1.00	
Cycle Time	4 Hr
Qty Per Cycle	1 Roll
Capacity	175.00 Item Day
Pre OEE Capacity	175.00 Item Day
OEE Percent	100.00 %

A0080	2
<b>Springs</b>	
Inventory	150 Set

Z0020	2
<b>Time Summary</b>	
Lead Time	8.62 Day
Total Value Added	249.00 Min
Value Added Percent	3.44 %
Takt Time	4.20 Min Item
Total Cycle Time	249.00 Min

2.50 Day

14400.00 Sec

0.75 Day

**3** When complete, note that all blue values show calculated results

A0010	1
<b>Casting Sets</b>	
Inventory	1000 Set

A0020	1
<b>Machine</b>	
1.00	
Cycle Time	3 Min
Qty Per Cycle	1 Set
Capacity	280.00 Item Day
Pre OEE Capacity	280.00 Item Day
OEE Percent	100.00 %

A0030	1
<b>Machined Sets</b>	
Inventory	50 Set

A0040	1
<b>Polish</b>	
1.00	
Cycle Time	5 Min
Qty Per Cycle	1 Item
Capacity	168.00 Item Day
Pre OEE Capacity	168.00 Item Day
OEE Percent	100.00 %

5.00 Day


180.00 Sec


0.25 Day

300.00 Sec

**4** Double-click the unit if you would like to change it to minutes, or any other time measure.

<b>Units</b>	Week	Year	Week	Roll	Set
	70	52	5	50	1
	Hr	Week	day	Set	Item

**1** Click the "Check" button and fix any problems flagged.  Check

**2** Click the "Solve" button to calculate.  Solve

A0130	all	
<b>Customer</b>		
Customer Demand	1000	Set Week
Share %	100	%
Effective Demand	1000.00	Item Week

A0050	1	
<b>Polished Sets</b>		
Inventory	100	Set

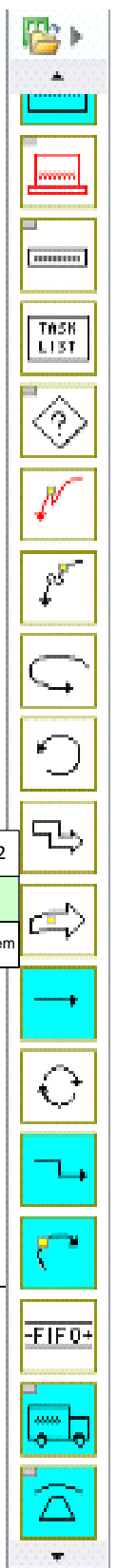
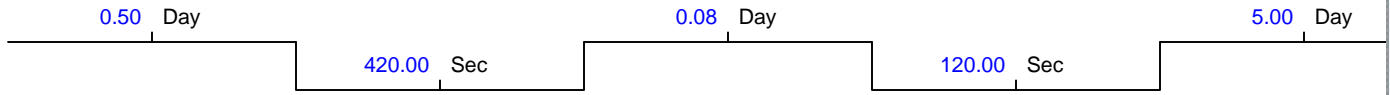
A0090	#2	
<b>Assemble</b>		
1.00		
Cycle Time	7	Min
Qty Per Cycle	1	Item
Capacity	120.00	Item Day
Pre OEE Capacity	120.00	Item Day
OEE Percent	100.00	%

A0100	#2	
<b>Cutters</b>		
Inventory	15	Set

A0110	#2	
<b>Package</b>		
1.00		
Cycle Time	2	Min
Qty Per Cycle	1	Item
Capacity	420.00	Item Day
Pre OEE Capacity	420.00	Item Day
OEE Percent	100.00	%

A0120	#2	
<b>Boxes</b>		
Inventory	1000	Item

## First Check then Solve

Users should first Check and then Solve the map.

### Check Button Check

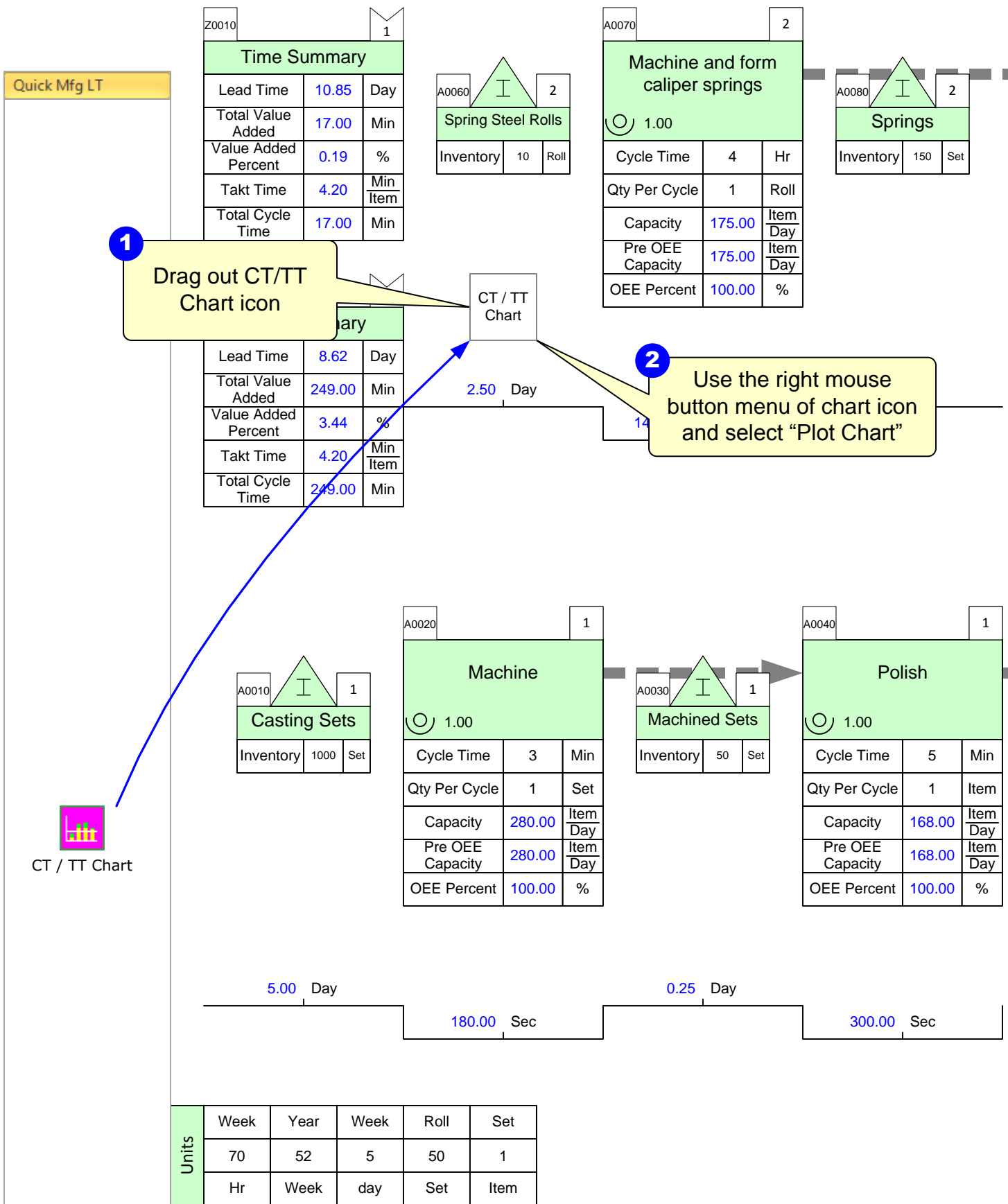
- Performs comprehensive model checking
- Fixes obvious problem
- Provides list of outstanding issues

### Solve Button Solve

- Performs basic model checking
- Stops if there is any obvious issues like missing data values
- Solves the built-in equations and puts the results on the map
- Exports data to an Excel spreadsheet

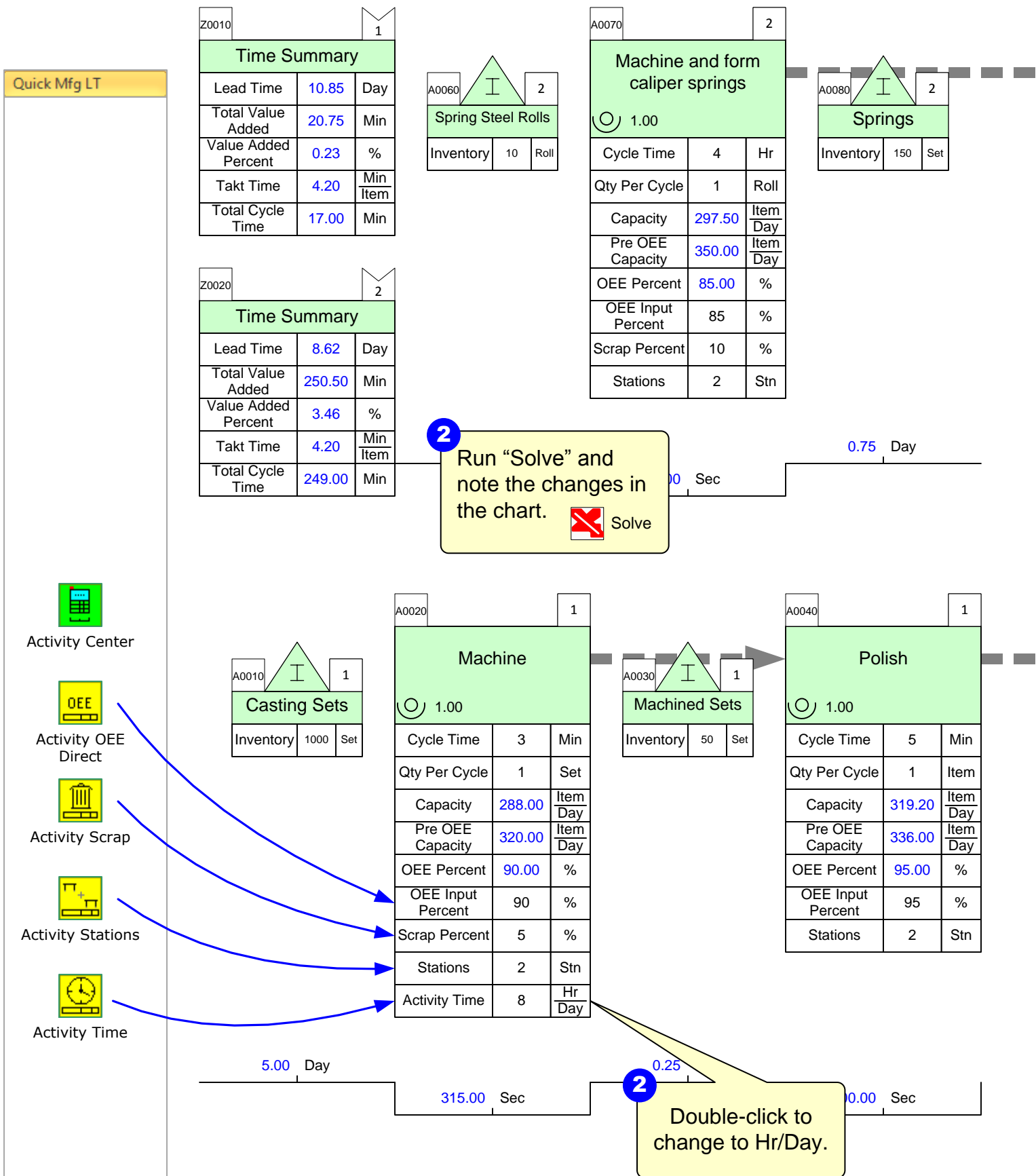
This area intentionally left blank

# Step 15: Add Cycle Time Takt Time Chart



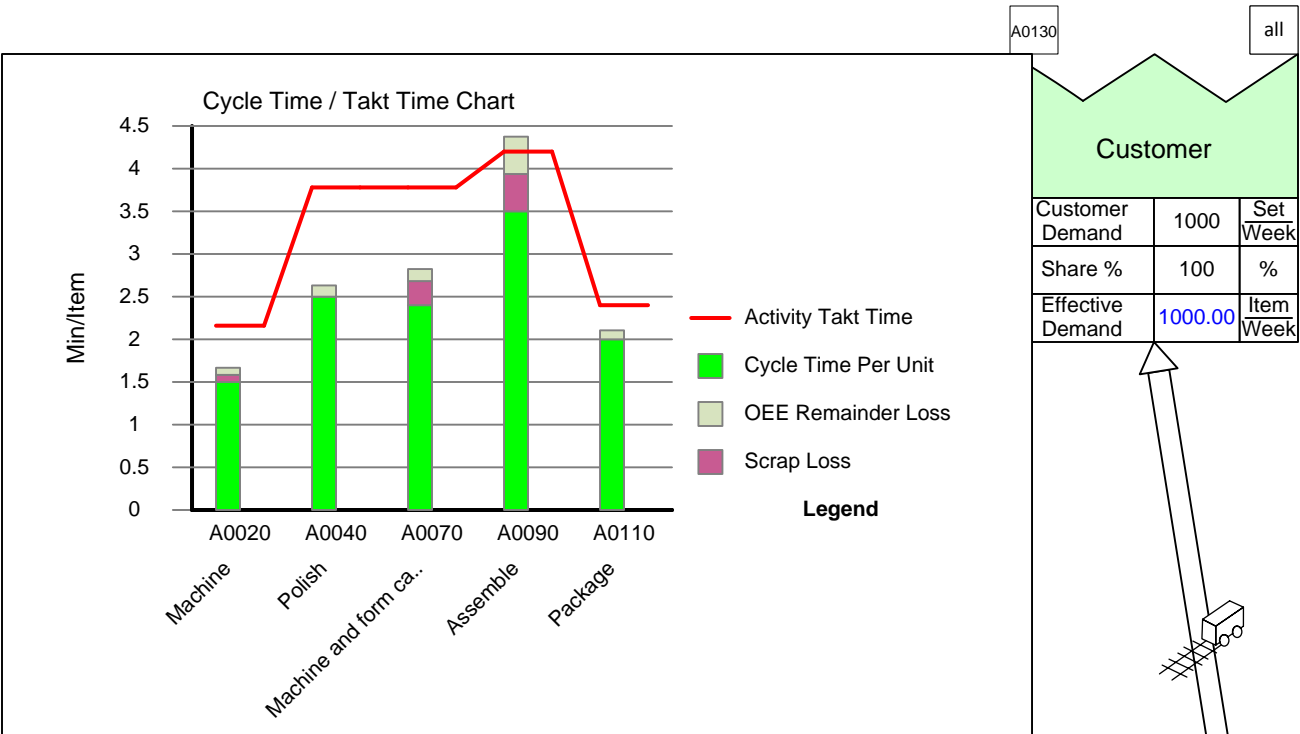


# Step 16: Try Add-on Calculations: OEE, Scrap, Activity Time

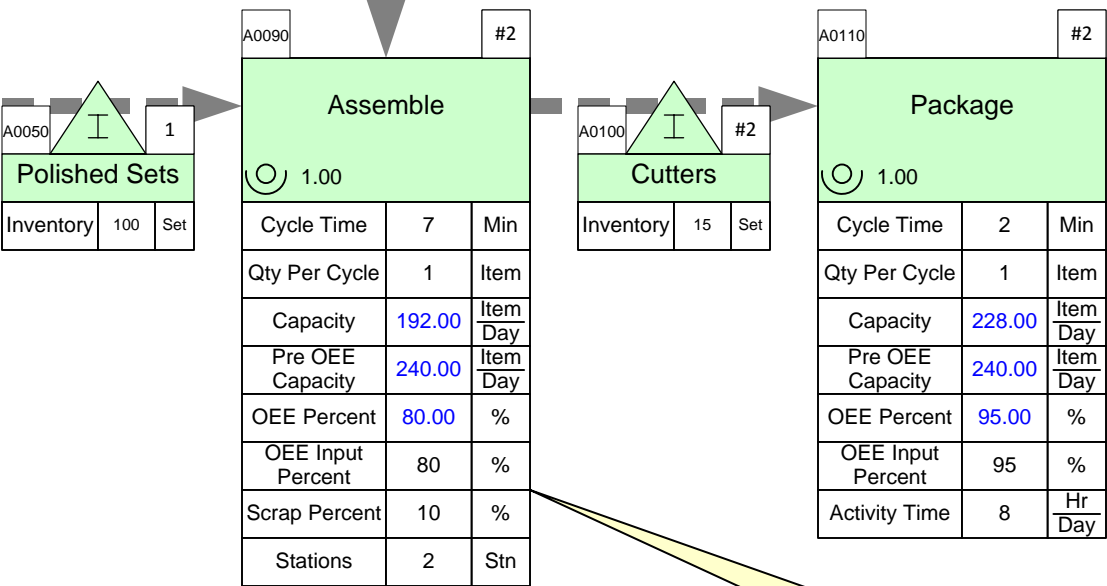




Units	Week	Year	Week	Roll	Set
	70	52	5	50	1
	Hr	Week	day	Set	Item



Customer		
Customer Demand	1000	Set Week
Share %	100	%
Effective Demand	1000.00	Item Week




**1** Drag out the appropriate add-ons for each center. Be sure to glue the add-ons to the center.

Vertical toolbar containing icons for:
 

- Simulation Start/Stop
- Inventory
- Trash List
- Help
- Simulation Control (Pause, Play, Step)
- Simulation Settings (Clock, Refresh)
- Simulation Tools (Arrow, Magnifying Glass)
- Simulation Modes (FIFO+, etc.)
- Simulation Views (3D, 2D)

# Step 17: Hide/Show Cost Variables

**1** Click the Views button in the toolbar.  Views

**Quick Mfg LT**

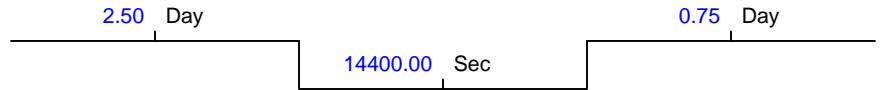
Z0010	1	
Time Summary		
Lead Time	10.85	Day
Total Value Added	20.75	Min
Value Added Percent	0.23	%
Takt Time	4.20	Min Item
Total Cycle Time	17.00	Min

A0060	2	
Spring Steel Rolls		
Inventory	10	Roll
Cumulative Cost	6.00	\$ Item
Added Cost	300	\$ Roll

A0070	2	
Machine and form caliper springs		
1.00		
Cycle Time	4	Hr
Qty Per Cycle	1	Roll
Capacity	297.50	Item Day
Pre OEE Capacity	350.00	Item Day
OEE Percent	85.00	%
Added Cost	0.25	\$ Set
Cumulative Cost	6.94	\$ Item
Stations	2	Stn
Scrap Percent	10	%
OEE Input Percent	85	%

A0080	2	
Springs		
Inventory	150	Set
Cumulative Cost	6.94	\$ Item
Added Cost	0.00	\$ Item

Z0020	2	
Time Summary		
Lead Time	8.62	Day
Total Value Added	250.50	Min
Value Added Percent	3.46	%
Takt Time	4.20	Min Item
Total Cycle Time	249.00	Min

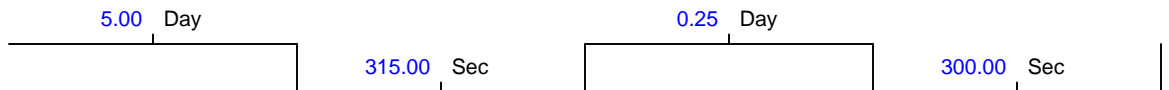


A0010	1	
Casting Sets		
Inventory	1000	Set
Cumulative Cost	37.00	\$ Item
Added Cost	37	\$ Set

A0020	1	
Machine		
1.00		
Cycle Time	3	Min
Qty Per Cycle	1	Set
Capacity	288.00	Item Day
Pre OEE Capacity	320.00	Item Day
OEE Percent	90.00	%
Added Cost	1	\$ Set
Cumulative Cost	40.00	\$ Item
Stations	2	Stn
Scrap Percent	5	%
Activity Time	8	Hr Day
OEE Input Percent	90	%

A0030	1	
Machined Sets		
Inventory	50	Set
Cumulative Cost	40.00	\$ Item
Added Cost	0.00	\$ Item

A0040	1	
Polish		
1.00		
Cycle Time	5	Min
Qty Per Cycle	1	Item
Capacity	319.20	Item Day
Pre OEE Capacity	336.00	Item Day
OEE Percent	95.00	%
Added Cost	2	\$ Set
Cumulative Cost	42.00	\$ Item
Stations	2	Stn
OEE Input Percent	95	%



Units	Week	Year	Week	Roll	Set
	70	52	5	50	1
	Hr	Week	day	Set	Item

### Variable Visibility

Center/Addon Name	Variable Name(s)	Visibility	Multi-Add
Customer Center	Customer Demand	<input checked="" type="checkbox"/>	
	Share %	<input checked="" type="checkbox"/>	
	Effective Demand	<input checked="" type="checkbox"/>	
Inventory Center	Inventory	<input checked="" type="checkbox"/>	
	Non Value Added	<input checked="" type="checkbox"/>	
	Cumulative Cost	<input checked="" type="checkbox"/>	
	Added Cost	<input checked="" type="checkbox"/>	
	Duration	<input type="checkbox"/>	
	End Time	<input type="checkbox"/>	
	Inventory Value	<input type="checkbox"/>	
	Annual Inv Carry Cost	<input type="checkbox"/>	
	Computed Inv Demand	<input type="checkbox"/>	
	Check Time	<input type="checkbox"/>	

Buttons: Default, Hide Auto, Hide All, Show All, Cancel, OK

Customer		
Customer Demand	1000	Set Week
Share %	100	%
Effective Demand	1000.00	Item Week

**2** Check the Cumulative Cost visibility box.

**3** Check the Added Cost visibility box and click OK.

A0050	I	1
Polished Sets		
Inventory	100	Set
Cumulative Cost	42.00	\$/Item
Added Cost	0.00	\$/Item

Assemble			
1.00			
Cycle Time	7	Min	
Qty Per Cycle	1	Item	
Capacity	192.00	Item Day	
Pre OEE Capacity	240.00	Item Day	
OEE Percent	80.00	%	
Added Cost	3	\$/Set	
Cumulative Cost	57.72	\$/Item	
Stations	2	Stn	
Scrap Percent	10	%	
OEE Input Percent		%	

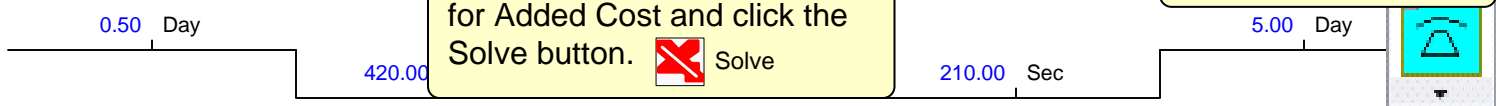
A0100	I	#2
Cutters		
Inventory	15	Set
Cumulative Cost	57.72	\$/Item
Added Cost	0.00	\$/Item

Package			
1.00			
Cycle Time	2	Min	
Qty Per Cycle	1	Item	
Capacity	228.00	Item Day	
Pre OEE Capacity	240.00	Item Day	
OEE Percent	95.00	%	
Added Cost	1	\$/Set	
Cumulative Cost	58.72	\$/Item	
Activity Time	8	Hr Day	
OEE Input Percent	95	%	

A0120	I	#2
Boxes		
Inventory	1000	Item
Cumulative Cost	58.72	\$/Item
Added Cost	0.00	\$/Item


**4** Now that the Added Cost and Cumulative Cost variables are visible, fill in the data values for Added Cost and click the Solve button.

**5** Make sure the correct unit is selected for each center.



# Step 18: Plot Lead Time Chart

**Quick Mfg LT**



Lead Time Chart

Z0010	1	
Time Summary		
Lead Time	10.85	Day
Total Value Added	20.75	Min
Value Added Percent	0.23	%

A0060	2	
Spring Steel Rolls		
Inventory	10	Roll
Cumulative Cost	6.00	\$/Item
Added Cost	300	\$/Roll

A0070	2	
Machine and form caliper springs		
Cycle Time	4	Hr
Qty Per Cycle	1	Roll
Capacity	297.50	Item/Day
Pre OEE Capacity	350.00	Item/Day
OEE Percent	85.00	%
Added Cost	0.25	\$/Set
Cumulative Cost		
Scrap Percent		
OEE Input Percent		

A0080	2	
Springs		
Inventory	150	Set
Cumulative Cost	6.94	\$/Item
Added Cost	0.00	\$/Item

Z0020	2	
Time Summary		
Lead Time	8.62	Day
Total Value Added	250.50	Min
Value Added Percent	3.46	%
Takt Time	4.20	Min/Item
Total Cycle Time	249.00	Min

all		
Lead Time		
2.50	Day	
14400.00	Sec	
0.75	Day	

A0010	1	
Casting Sets		
Inventory	1000	Set
Cumulative Cost	37.00	\$/Item
Added Cost	37	\$/Set

A0020	1	
Machine		
Cycle Time	3	Min
Qty Per Cycle	1	Set
Capacity	288.00	Item/Day
Pre OEE		Item

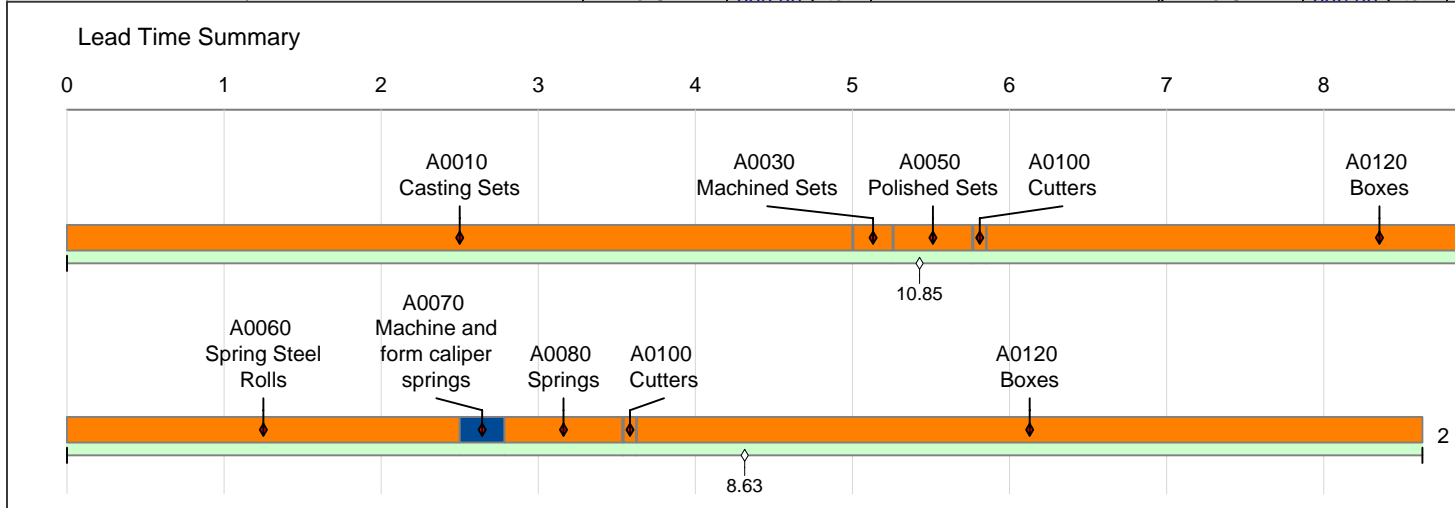
A0030	1	
Machined Sets		
Inventory	50	Set
Cumulative Cost	40.00	\$/Item
Added Cost	0.00	\$/Item

A0040	1	
Polished Sets		
Inventory	5	Min
Qty Per Cycle	1	Item
Capacity	319.20	Item/Day
Pre OEE		Item

**1** Drag out Lead Time Chart icon.

**2** Use the right mouse button menu of chart icon and select "Plot Ladder Chart"

**3** See how the lead times for the two paths match the Time Summaries





## ACME – Resource Modeling

---

### Exercise

With your group, read the information below and then:

1. Model the resources for the activity.
2. Show the data associated with the resource handling as well as resource pipe data.
3. Calculate the map.
4. Identify what charts would be useful to visualize the value stream and mark these up.
5. Identify where there is a bottleneck.

### Background and Overview

ACME sells Surgical Cutters which are made from a combination of springs and kits. The plant line first creates the polished kits from the casting sets and then joins the springs in the Assemble step. You take a second value stream walk with the plant supervisor to model the resource allocation for the activity processes.


### Value Stream Walk

The plant supervisor explains how resources are coming from technicians as well as machines. You first notice that the Assemble activity has two different resources being piped into it. The first is a machine that runs 14 hours a day with a resource quantity of 1 at a cost of \$15 an hour. The second resource is an operator that works 12 hours a days with a resource quantity of 2 at \$20 an hour. Both have a resource process time of 10 minutes. The operator is also shared at the Polish activity with a resource process time of 5 minutes.



# Step 19: Resource Modeling

**Quick Mfg LT**



Resource Center

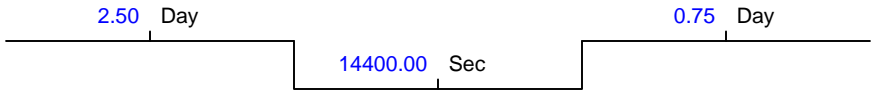
Z0010	1	
Time Summary		
Lead Time	10.85	Day
Total Value Added	20.75	Min
Value Added Percent	0.23	%
Takt Time	4.20	Min/Item
Total Cycle Time	17.00	Min

A0060	2	
Spring Steel Rolls		
Inventory	10	Roll
Cumulative Cost	6.00	\$/Item
Added Cost	300	\$/Roll

A0070	2	
Machine and form caliper springs		
1.00		
Cycle Time	4	Hr
Qty Per Cycle	1	Roll
Capacity	297.50	Item/Day
Pre OEE Capacity	350.00	Item/Day
OEE Percent	85.00	%
Added Cost	0.25	\$/Set
Cumulative Cost	6.94	\$/Item
Stations	2	Stn
Scrap Percent	10	%
OEE Input Percent	85	%

A0080	2	
Springs		
Inventory	150	Set
Cumulative Cost	6.94	\$/Item
Added Cost	0.00	\$/Item

Z0020	2	
Time Summary		
Lead Time	8.62	Day
Total Value Added	250.50	Min
Value Added Percent	3.46	%
Takt Time	4.20	Min/Item
Total Cycle Time	249.00	Min

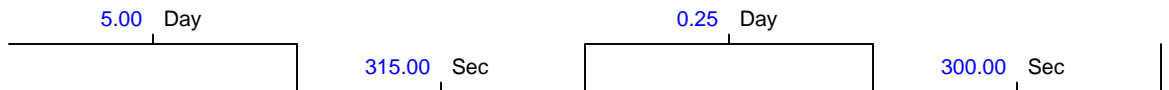


A0010	1	
Casting Sets		
Inventory	1000	Set
Cumulative Cost	37.00	\$/Item
Added Cost	37	\$/Set

A0020	1	
Machine		
1.00		
Cycle Time	3	Min
Qty Per Cycle	1	Set
Capacity	288.00	Item/Day
Pre OEE Capacity	320.00	Item/Day
OEE Percent	90.00	%
Added Cost	1	\$/Set
Cumulative Cost	40.00	\$/Item
Stations	2	Stn
Scrap Percent	5	%
Activity Time	8	Hr/Day
OEE Input Percent	90	%

A0030	1	
Machined Sets		
Inventory	50	Set
Cumulative Cost	40.00	\$/Item
Added Cost	0.00	\$/Item

A0040	1	
Polish		
1.00		
Cycle Time	5	Min
Qty Per Cycle	1	Item
Capacity	319.20	Item/Day
Pre OEE Capacity	336.00	Item/Day
OEE Percent	95.00	%
Added Cost	2	\$/Set
Cumulative Cost	42.00	\$/Item
Stations	2	Stn
OEE Input Percent	95	%





Units	Week	Year	Week	Roll	Set
	70	52	5	50	1
	Hr	Week	day	Set	Item

**1** Drag out the Resource Center from the Quick Mfg stencil and enter the data.

A0140		all
<b>Operator</b>		
Resource Quantity	2	RQ
Resource Time	12	Hr Day
Resource Rate	20	\$ Hr
Resource Utilization	Auto	%

**2** Right-click the center to change into a Machine.

A0150		all
<b>Machine</b>		
Resource Quantity	1	RQ
Resource Time	14	Hr Day
Resource Rate	15	\$ Hr
Resource Utilization	Auto	%

A0130		all
<b>Customer</b>		
Customer Demand	1000	Set Week
Share %	100	%
Effective Demand	1000.00	Item Week

A0050		1
<b>Polished Sets</b>		
Inventory	100	Set
Cumulative Cost	42.00	\$ Item
Added Cost	0.00	\$ Item

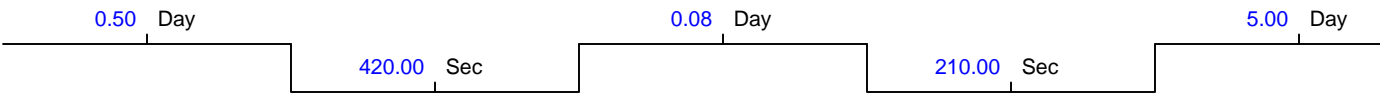
A0090		#2
<b>Assemble</b>		
	1.00	
Cycle Time	7	Min
Qty Per Cycle	1	Item
Capacity	192.00	Item Day
Pre OEE Capacity	240.00	Item Day
OEE Percent	80.00	%
Added Cost	3	\$ Set
Cumulative Cost	57.72	\$ Item
Stations	2	Stn
Scrap Percent	10	%
OEE Input Percent	80	%

A0100		#2
<b>Cutters</b>		
Inventory	15	Set
Cumulative Cost	57.72	\$ Item
Added Cost	0.00	\$ Item

A0110		#2
<b>Package</b>		
	1.00	
Cycle Time	2	Min
Qty Per Cycle	1	Item
Capacity	228.00	Item Day
Pre OEE Capacity	240.00	Item Day
OEE Percent	95.00	%
Added Cost	1	\$ Set
Cumulative Cost	58.72	\$ Item
Activity Time	8	Hr Day
OEE Input Percent	95	%

A0120		#2
<b>Boxes</b>		
Inventory	1000	Item
Cumulative Cost	58.72	\$ Item
Added Cost	0.00	\$ Item



# Step 20: Adding Resource Pipes

**Quick Mfg LT**

Z0010	1	
<b>Time Summary</b>		
Lead Time	10.85	Day
Total Value Added	20.75	Min
Value Added Percent	0.23	%
Takt Time	4.20	Min/Item
Total Cycle Time	17.00	Min

A0060	2	
<b>Spring Steel Rolls</b>		
Inventory	10	Roll
Cumulative Cost	6.00	\$/Item
Added Cost	300	\$/Roll

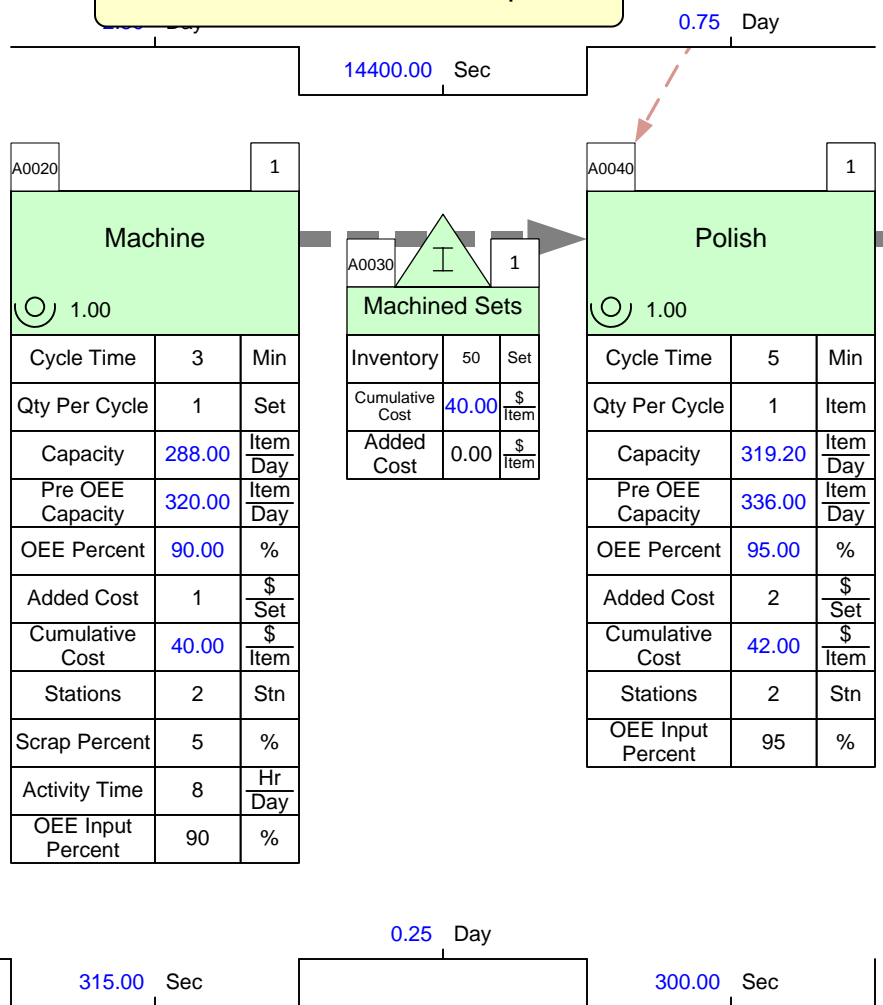
A0070	2	
<b>Machine and form caliper springs</b>		
Cycle Time	4	Hr
Qty Per Cycle	1	Roll
Capacity	297.50	Item/Day
Pre OEE Capacity	350.00	Item/Day
OEE Percent	85.00	%
Added Cost	0.25	\$/Set
Cumulative Cost	6.94	\$/Item

A0080	2	
<b>Springs</b>		
Inventory	150	Set
Cumulative Cost	6.94	\$/Item
Added Cost	0.00	\$/Item

Z0020	2	
<b>Time Summary</b>		
Lead Time	8.62	Day
Total Value Added	250.50	Min
Value Added Percent	3.46	%
Takt Time	4.20	Min/Item
Total Cycle Time	249.00	Min

**2** Add Resource Pipes for the appropriate Resource Centers to Activity Centers. Make sure the correct unit is changed for the data on the Resource Pipe.

Resource PT	5	Min/Item
-------------	---	----------



Units	Week	Year	Week	Roll	Set
	70	52	5	50	1
	Hr	Week	day	Set	Item

Operator		
Resource Quantity	2	RQ
Resource Time	12	Hr Day
Resource Rate	20	\$ Hr
Resource Utilization	Auto	%

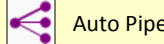
Machine		
Resource Quantity	1	RQ
Resource Time	14	Hr Day
Resource Rate	15	\$ Hr
Resource Utilization	Auto	%

Customer		
Customer Demand	1000	Set Week
Share %	100	%
Effective Demand	1000.00	Item Week

Resource PT	10	Min Item
-------------	----	----------

Resource PT	10	Min Item
-------------	----	----------

**1** To add Resource Pipes, hold down the SHIFT key and select the Resource Center and then the Activity that it is being piped into, then click the Auto Pipe button.



Polished Sets		
Inventory	100	Set
Cumulative Cost	42.00	\$ Item
Added Cost	0.00	\$ Item

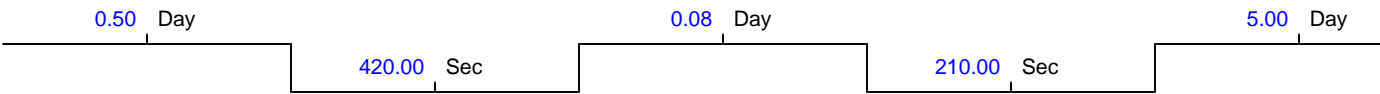
Activity B		
Cycle Time	7	Min
Qty Per Cycle	1	Item
Capacity	192.00	Item Day
Pre OEE Capacity	240.00	Item Day
OEE Percent	80.00	%
Added Cost	3	\$ Set
Cumulative Cost	57.72	\$ Item
Stations	2	Stn
Scrap Percent	10	%
OEE Input Percent	80	%

Cutters		
Inventory	15	Set
Cumulative Cost	57.72	\$ Item
Added Cost	0.00	\$ Item

Package		
Cycle Time	2	Min
Qty Per Cycle	1	Item
Capacity	228.00	Item Day
Pre OEE Capacity	240.00	Item Day
OEE Percent	95.00	%
Added Cost	1	\$ Set
Cumulative Cost	58.72	\$ Item
Activity Time	8	Hr Day
OEE Input Percent	95	%


Boxes		
Inventory	1000	Item
Cumulative Cost	58.72	\$ Item
Added Cost	0.00	\$ Item

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# Step 21: Resource Balance Chart

**Quick Mfg LT**



Resource Balance Chart


Z0010	1	
Time Summary		
Lead Time	10.85	Day
Total Value Added	20.75	Min
Value Added Percent	0.23	%
Takt Time	4.20	Min Item
Total Cycle Time	17.00	Min

A0060	2	
Spring Steel Rolls		
Inventory	10	Roll
Cumulative Cost	6.00	\$/Item
Added Cost	300	\$/Roll

A0070	2	
Machine and form caliper springs		
1.00		
Cycle Time	4	Hr
Qty Per Cycle	1	Roll
Capacity	297.50	Item Day
Pre OEE Capacity	350.00	Item Day
OEE Percent	85.00	%
Added Cost	0.25	\$/Set
Cumulative Cost	6.94	\$/Item
Stations	2	Stn
Scrap Percent	10	%
OEE Input Percent	85	%

A0080	2	
Springs		
Inventory	150	Set
Cumulative Cost	6.94	\$/Item
Added Cost	0.00	\$/Item

Z0020	2	
Time Summary		
Lead Time	8.62	Day
Total Value Added	250.50	Min
Value Added Percent	3.46	%
Takt Time	4.20	Min Item
Total Cycle Time	249.00	Min

**1** Click the Solve button to update the new calculations.  Solve

A0010	1	
Casting Sets		
Inventory	1000	Set
Cumulative Cost	37.00	\$/Item
Added Cost	37	\$/Set

A0020	1	
Machine		
1.00		
Cycle Time	3	Min
Qty Per Cycle	1	Set
Capacity	288.00	Item Day
Pre OEE Capacity	320.00	Item Day
OEE Percent	90.00	%
Added Cost		\$/Set
Cumulative Cost		\$/Item
Stations		Stn
Scrap Percent		%
Activity Time	8	Hr Day
OEE Input Percent	90	%

A0030	1	
Machined Sets		
Inventory	50	Set
Cumulative Cost	40.00	\$/Item
Added Cost	0.00	\$/Item

A0040	1	
Polish		
1.00		
Cycle Time	5	Min
Qty Per Cycle	1	Item
Capacity	319.20	Item Day
Pre OEE Capacity	336.00	Item Day
OEE Percent	95.00	%
Added Cost	2	\$/Set
Cumulative Cost	43.67	\$/Item
Stations	2	Stn
OEE Input Percent	95	%

5.00 Day

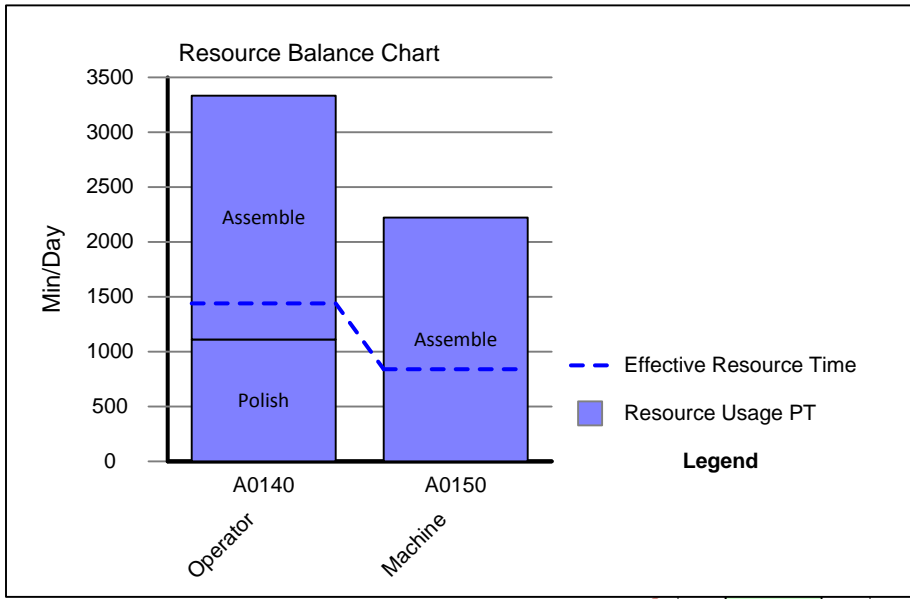
315.00 Sec

0.25 Day

300.00 Sec

**2** Drag out the Resource Balance Chart shape.

**3** Use the right mouse button menu of chart icon and select "Plot Chart"



Units	Week	Year	Week	Roll	Set
	70	52	5	50	1
	Hr	Week	day	Set	Item

Customer		
Customer Demand	1000	Set Week
Share %	100	%
Effective Demand	1000.00	Item Week

Operator		
Resource Quantity	2	RQ
Resource Time	12	Hr Day
Resource Rate	20	\$ Hr
Resource Utilization	231.48	%

Machine		
Resource Quantity	1	RQ
Resource Time	14	Hr Day
Resource Rate	15	\$ Hr
Resource Utilization	264.55	%

Resource PT	10	Min Item
-------------	----	----------

Resource PT	10	Min Item
-------------	----	----------

Polished Sets		
Inventory	100	Set
Cumulative Cost	43.67	\$ Item
Added Cost	0.00	\$ Item

Assemble		
Cycle Time	7	Min
Qty Per Cycle	1	Item
Capacity	192.00	Item Day
Pre OEE Capacity	240.00	Item Day
OEE Percent	80.00	%
Added Cost	3	\$ Set
Cumulative Cost	66.05	\$ Item
Stations	2	Stn
Scrap Percent	10	%
OEE Input Percent	80	%

Cutters		
Inventory	15	Set
Cumulative Cost	66.05	\$ Item
Added Cost	0.00	\$ Item

Package		
Cycle Time	2	Min
Qty Per Cycle	1	Item
Capacity	228.00	Item Day
Pre OEE Capacity	240.00	Item Day
OEE Percent	95.00	%
Added Cost	1	\$ Set
Cumulative Cost	67.05	\$ Item
Activity Time	8	Hr Day
OEE Input Percent	95	%

Boxes		
Inventory	1000	Item
Cumulative Cost	67.05	\$ Item
Added Cost	0.00	\$ Item

**TRASH LIST**

**FIFO+**

0.50 Day

0.08 Day

5.00 Day

420.00 Sec

210.00 Sec

# Step 22: Kaizen Improvements

**Quick Mfg LT**

Z0010	1	
Time Summary		
Lead Time	10.85	Day
Total Value Added	20.75	Min
Value Added Percent	0.23	%
Takt Time	4.20	Min/Item
Total Cycle Time	17.00	Min

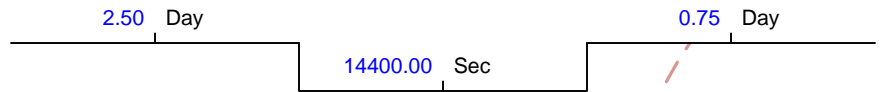
A0060	2	
Spring Steel Rolls		
Inventory	10	Roll
Cumulative Cost	6.00	\$/Item
Added Cost	300	\$/Roll

A0070	2	
Machine and form caliper springs		
⊙ 1.00		
Cycle Time	4	Hr
Qty Per Cycle	1	Roll
Capacity	297.50	Item/Day
Pre OEE Capacity	350.00	Item/Day
OEE Percent	85.00	%
Added Cost	0.25	\$/Set
Cumulative Cost	6.94	\$/Item
Stations	2	Stn
Scrap Percent	10	%
OEE Input Percent	85	%

A0080	2	
Springs		
Inventory	150	Set
Cumulative Cost	6.94	\$/Item
Added Cost	0.00	\$/Item

Z0020	2	
Time Summary		
Lead Time	8.62	Day
Total Value Added	250.50	Min
Value Added Percent	3.46	%
Takt Time	4.20	Min/Item
Total Cycle Time	249.00	Min

Resource PT	5	Min/Item
-------------	---	----------



A0010	1	
Casting Sets		
Inventory	1000	Set
Cumulative Cost	37.00	\$/Item
Added Cost	37	\$/Set

A0020	1	
Machine		
⊙ 1.00		
Cycle Time	3	Min
Qty Per Cycle	1	Set
Capacity	288.00	Item/Day
Pre OEE Capacity	320.00	Item/Day
OEE Percent	90.00	%
Added Cost	1	\$/Set
Cumulative Cost	40.00	\$/Item
Stations	2	Stn
Scrap Percent	5	%
Activity Time	8	Hr/Day

A0030	1	
Machined Sets		
Inventory	50	Set
Cumulative Cost	40.00	\$/Item
Added Cost	0.00	\$/Item


A0040	1	
Polish		
⊙ 1.00		
Cycle Time	5	Min
Qty Per Cycle	1	Item
Capacity	319.20	Item/Day
Pre OEE Capacity	336.00	Item/Day
OEE Percent	95.00	%
Added Cost	2	\$/Set
Cumulative Cost	43.67	\$/Item
Stations	2	Stn
OEE Input Percent	95	%

001 Excessive capital tied up in raw materials inventory

**2** Right click kaizen and select "Edit Kaizen". Add relevant information in the Kaizen Properties form, such as Impact and Ease of Implementation values.



Units	Week	Year	Week	Roll	Set
	70	52	5	50	1
	Hr	Week	day	Set	Item

**3** Click the Kaizen Export button in the toolbar to create a kaizen report in Excel.  Kaizen Export

Operator		
Resource Quantity	2	RQ
Resource Time	12	Hr Day
Resource Rate	20	\$ Hr
Resource Utilization	231.48	%

Resource PT	10	Min Item
-------------	----	----------

Resource PT	10	Min Item
-------------	----	----------

Machine		
Resource Quantity	1	RQ
Resource Time	14	Hr Day
Resource Rate	15	\$ Hr
Resource Utilization	264.55	%

Customer		
Customer Demand	1000	Set Week
Share %	100	%
Effective Demand	1000.00	Item Week

002 Assemble process is a bottleneck because of low OEE and high scrap

Polished Sets		
Inventory	100	Set
Cumulative Cost	43.67	\$ Item
Added Cost	0.00	\$ Item

Assemble		
Cycle Time	7	Min
Qty Per Cycle	1	Item
Capacity	192.00	Item Day
Pre OEE Capacity	240.00	Item Day
OEE Percent	80.00	%
Added Cost	3	\$ Set
Cumulative Cost	66.05	\$ Item
Stations	2	Stn
Scrap Percent	10	%
OEE Input Percent	80	%

Cutters		
Inventory	15	Set
Cumulative Cost	66.05	\$ Item
Added Cost	0.00	\$ Item

Boxes		
Cycle Time	2	Min
Qty Per Cycle	1	Item
Capacity	228.00	Item Day
Pre OEE Capacity	240.00	Item Day
OEE Percent	95.00	%
Added Cost	1	\$ Set
Cumulative Cost	67.05	\$ Item
Activity Time	8	Hr Day
OEE Input Percent	95	%

Inventory	1000	Item
Cumulative Cost	67.05	\$ Item
Added Cost	0.00	\$ Item

**1** Drag out Kaizen starbursts from the Quick Extras stencil.

0.50 Day

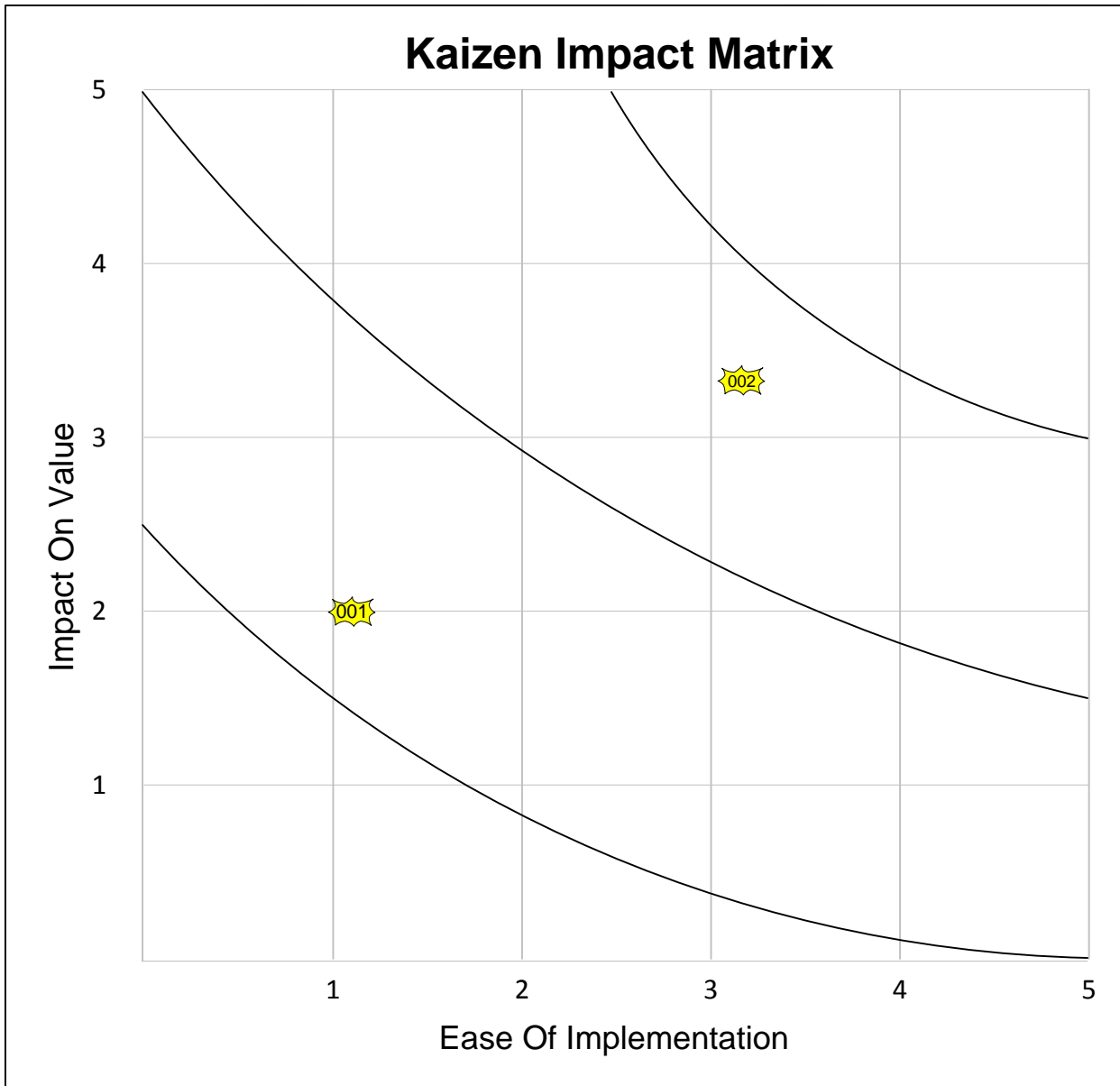
0.08 Day

5.00 Day

420.00 Sec

210.00 Sec

# Step 23: Kaizen Impact Matrix



I 2		
Springs		
Inventory	150	Set
Relative Cost	6.94	\$/Item
Fixed Cost	0.00	\$/Item

Resource PT	5	Min/Item
-------------	---	----------

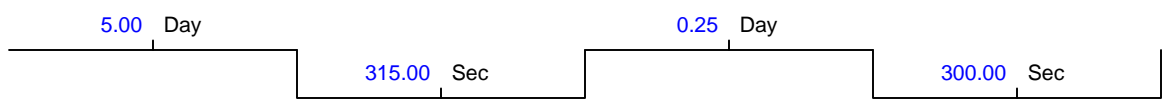
0.75 Day

1		
Polish		
Time	5	Min
Cycle	1	Item
Quantity	319.20	Item/Day

001  
 Excessive capital tied up in raw materials inventory

Pre OEE Capacity	320.00	Item/Day
OEE Percent	90.00	%
Added Cost	1	\$/Set
Cumulative Cost	40.00	\$/Item
Stations	2	Stn
Scrap Percent	5	%
Activity Time	8	Hr/Day
OEE Input Percent	90	%

Pre OEE Capacity	336.00	Item/Day
OEE Percent	95.00	%
Added Cost	2	\$/Set
Cumulative Cost	43.67	\$/Item
Stations	2	Stn
OEE Input Percent	95	%





Units	Week	Year	Week	Roll	Set
	70	52	5	50	1
	Hr	Week	day	Set	Item

**1** Drag out the Kaizen Impact Matrix and right-click to plot.

Kaizen Impact Matrix

Customer		
Customer Demand	1000	Set Week
Share %	100	%
Effective Demand	1000.00	Item Week

Machine		
Resource Quantity	1	RQ
Resource Time	14	Hr Day
Resource Rate	15	\$ Hr
Resource Utilization	264.5	5 %

Operator		
Resource Quantity	2	RQ
Resource Time	12	Hr Day
Resource Rate	20	\$ Hr
Resource Utilization	231.4	8 %

Resource PT	10	Min Item
-------------	----	----------

Resource PT	10	Min Item
-------------	----	----------

002 Assemble process is a bottleneck because of low OEE and high scrap

Polished Sets		
Inventory	100	Set
Cumulative Cost	43.67	\$ Item
Added Cost	0.00	\$ Item

Assemble		
Cycle Time	7	Min
Qty Per Cycle	1	Item
Capacity	192.00	Item Day
Pre OEE Capacity	240.00	Item Day
OEE Percent	80.00	%
Added Cost	3	\$ Set
Cumulative Cost	66.05	\$ Item
Stations	2	Stn
Scrap Percent	10	%
OEE Input Percent	80	%

Cutters		
Inventory	15	Set
Cumulative Cost	66.05	\$ Item
Added Cost	0.00	\$ Item

Package		
Cycle Time	2	Min
Qty Per Cycle	1	Item
Capacity	228.00	Item Day
Pre OEE Capacity	240.00	Item Day
OEE Percent	95.00	%
Added Cost	1	\$ Set
Cumulative Cost	67.05	\$ Item
Activity Time	8	Hr Day
OEE Input Percent	95	%

Boxes		
Inventory	1000	Item
Cumulative Cost	67.05	\$ Item
Added Cost	0.00	\$ Item

0.50 Day

0.08 Day

5.00 Day

420.00 Sec

210.00 Sec

# ACME Plant – Current State

Z0010	1	
Time Summary		
Lead Time	10.85	Day
Total Value Added	20.75	Min
Value Added Percent	0.23	%
Takt Time	4.20	Min Item
Total Cycle Time	17.00	Min

A0060	I	2
Spring Steel Rolls		
Inventory	10	Roll
Cumulative Cost	6.00	\$ Item
Added Cost	300	\$ Roll

A0070	2	
Machine and form caliper springs		
⊙ 1.00		
Cycle Time	4	Hr
Qty Per Cycle	1	Roll
Capacity	297.50	Item Day
Pre OEE Capacity	350.00	Item Day
OEE Percent	85.00	%
Added Cost	0.25	\$ Set
Cumulative Cost	6.94	\$ Item
Stations	2	Stn
Scrap Percent	10	%
OEE Input Percent	85	%

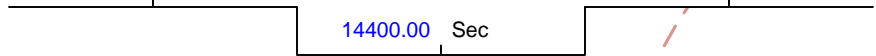
A0080	I	2
Springs		
Inventory	150	Set
Cumulative Cost	6.94	\$ Item
Added Cost	0.00	\$ Item

Z0020	2	
Time Summary		
Lead Time	8.62	Day
Total Value Added	250.50	Min
Value Added Percent	3.46	%
Takt Time	4.20	Min Item
Total Cycle Time	249.00	Min

Resource PT	5	Min Item
-------------	---	----------

2.50 Day

0.75 Day



A0010	I	1
Casting Sets		
Inventory	1000	Set
Cumulative Cost	37.00	\$ Item
Added Cost	37	\$ Set

A0020	1	
Machine		
⊙ 1.00		
Cycle Time	3	Min
Qty Per Cycle	1	Set
Capacity	288.00	Item Day
Pre OEE Capacity	320.00	Item Day
OEE Percent	90.00	%
Added Cost	1	\$ Set
Cumulative Cost	40.00	\$ Item
Stations	2	Stn
Scrap Percent	5	%
Activity Time	8	Hr Day
OEE Input Percent	90	%

A0030	I	1
Machined Sets		
Inventory	50	Set
Cumulative Cost	40.00	\$ Item
Added Cost	0.00	\$ Item

A0040	1	
Polish		
⊙ 1.00		
Cycle Time	5	Min
Qty Per Cycle	1	Item
Capacity	319.20	Item Day
Pre OEE Capacity	336.00	Item Day
OEE Percent	95.00	%
Added Cost	2	\$ Set
Cumulative Cost	43.67	\$ Item
Stations	2	Stn
OEE Input Percent	95	%

5.00 Day

0.25 Day



Z0030	all	
Scrap Costs		
Total Scrap Cost	1919.75	\$/Day

Z0130	all	
Inventory Summary		
Total Inventory Value	115.45	K\$

Units	Week	Year	Week	Roll	Set
	70	52	5	50	1
	Hr	Week	day	Set	Item

A0130	all	
Customer		
Customer Demand	1000	Set/Week
Share %	100	%
Effective Demand	1000.00	Item/Week

A0140	all	
Operator		
Resource Quantity	2	RQ
Resource Time	12	Hr/Day
Resource Rate	20	\$/Hr
Resource Utilization	231.48	%

A0150	all	
Machine		
Resource Quantity	1	RQ
Resource Time	14	Hr/Day
Resource Rate	15	\$/Hr
Resource Utilization	264.55	%

Resource PT	10	Min/Item
-------------	----	----------

Resource PT	10	Min/Item
-------------	----	----------

A0050	1	
Polished Sets		
Inventory	100	Set
Cumulative Cost	43.67	\$/Item
Added Cost	0.00	\$/Item

A0090	#2	
Assemble		
☉ 1.00		
Cycle Time	7	Min
Qty Per Cycle	1	Item
Capacity	192.00	Item/Day
Pre OEE Capacity	240.00	Item/Day
OEE Percent	80.00	%
Added Cost	3	\$/Set
Cumulative Cost	66.05	\$/Item
Stations	2	Stn
Scrap Percent	10	%
OEE Input Percent	80	%

A0100	#2	
Cutters		
Inventory	15	Set
Cumulative Cost	66.05	\$/Item
Added Cost	0.00	\$/Item

A0110	#2	
Package		
☉ 1.00		
Cycle Time	2	Min
Qty Per Cycle	1	Item
Capacity	228.00	Item/Day
Pre OEE Capacity	240.00	Item/Day
OEE Percent	95.00	%
Added Cost	1	\$/Set
Cumulative Cost	67.05	\$/Item
Activity Time	8	Hr/Day
OEE Input Percent	95	%

A0120	#2	
Boxes		
Inventory	1000	Item
Cumulative Cost	67.05	\$/Item
Added Cost	0.00	\$/Item

0.50 Day

0.08 Day

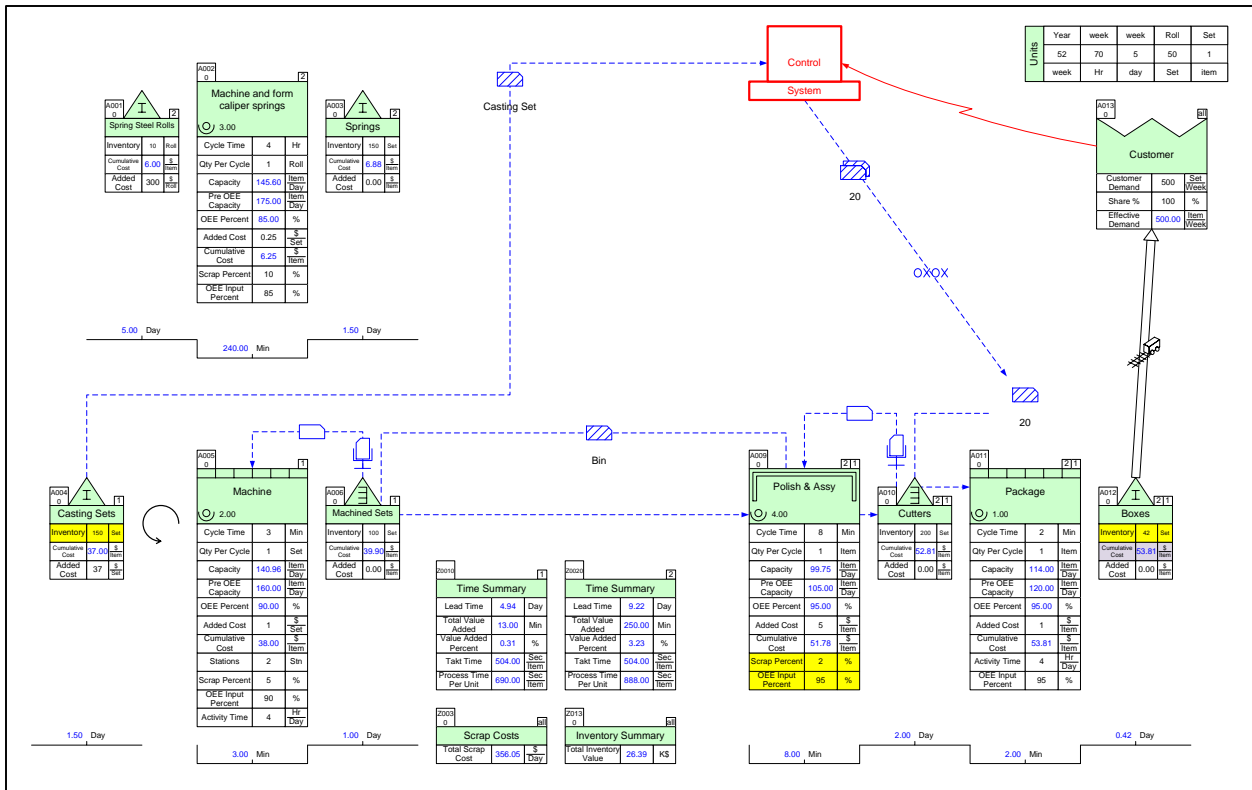
5.00 Day

420.00 Sec

210.00 Sec

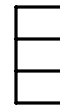
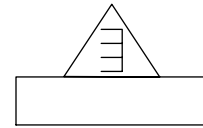


# Future State






## Inventory Supermarket

- An inventory facility that is used if continuous flow does not extend upstream in a process; in other words, if batching is necessary, then supermarkets are used to regulate process flows
- Buffer or Safety Stock
- Withdrawal – represents a pull of material, usually from a supermarket



## Kanban

- Visual “pull” system that controls production & inventory
-  • Withdrawal Kanban – instructs material handler to get and transfer parts (i.e. from a supermarket to the consuming process)
-  • Production Kanban – gives permission for a process to produce a specified quantity
-  • Load Leveling – intercepts batches of Kanban and level the mix and volume of them over a period of time

## Kanban - continued



- Signal Kanban – signals when a reorder point is reached and another batch needs to be produced. Used when the supplying process must produce in batches because changeover is required



- Kanban Post – Place where Kanban are collected and held for conveyance

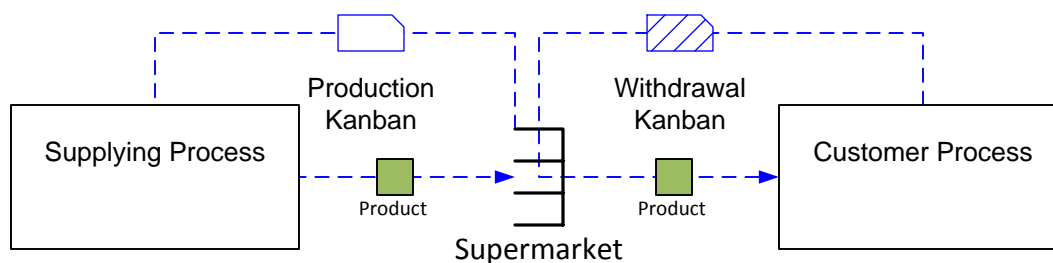


- Kanban arriving in batches



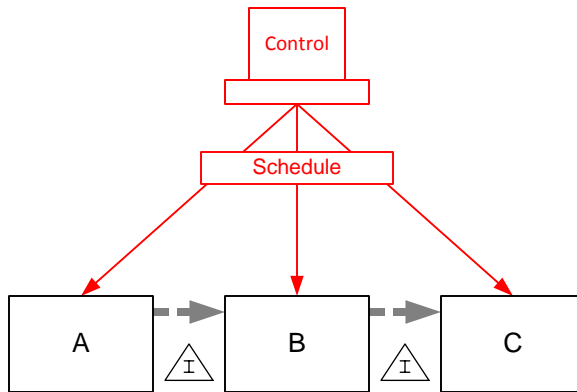
- Sequenced Ball Pull – Pull system for subassembly processes without using a supermarket

## Supermarket Pull System



- Customer Process withdraws what it needs when it needs it
- Supplying Process produces to replenish what was withdrawn

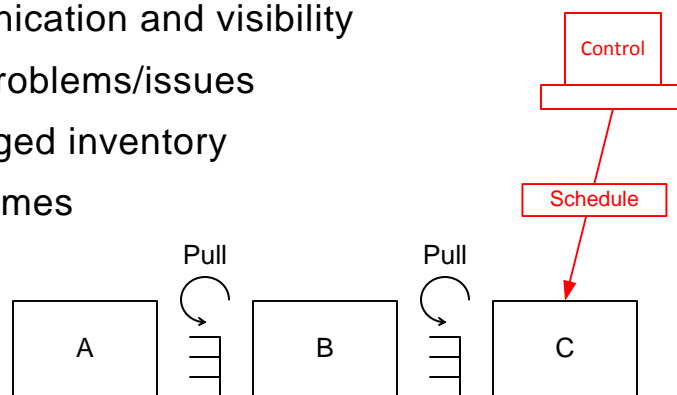
## Push Process



- Make to plan/schedule
- Work centers independent
- Poor linkage and communications
- More inventory
- Longer lead times
- Waste not visible (hidden in inventory)

## Pull Process

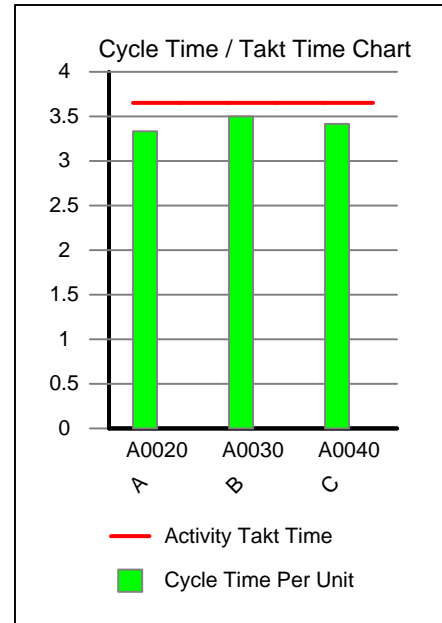
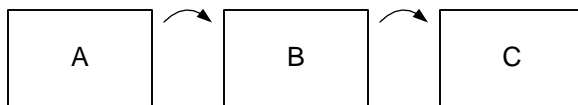
- Make to customer demand
- Work centers linked together
- Close communication and visibility
- Smokes out problems/issues
- Less or managed inventory
- Shorter lead times





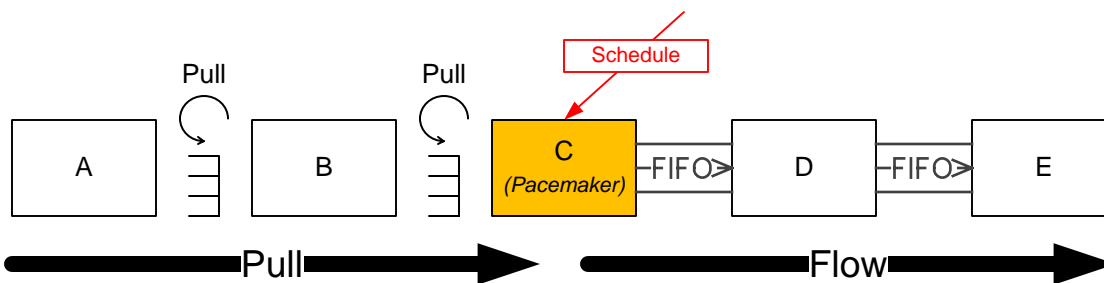
## Continuous Flow

- Cycle Times near Takt
- Processes that are sequential and can be placed adjacent to each other
- Operators that can be cross-trained to perform all the operations (optional)
- Low WIP, shortest lead times



## Pacemaker Process

- The single point where a production process is scheduled.
- Upstream processes produce to pull signal originating from the pacemaker.
- Continuous flow downstream of pacemaker



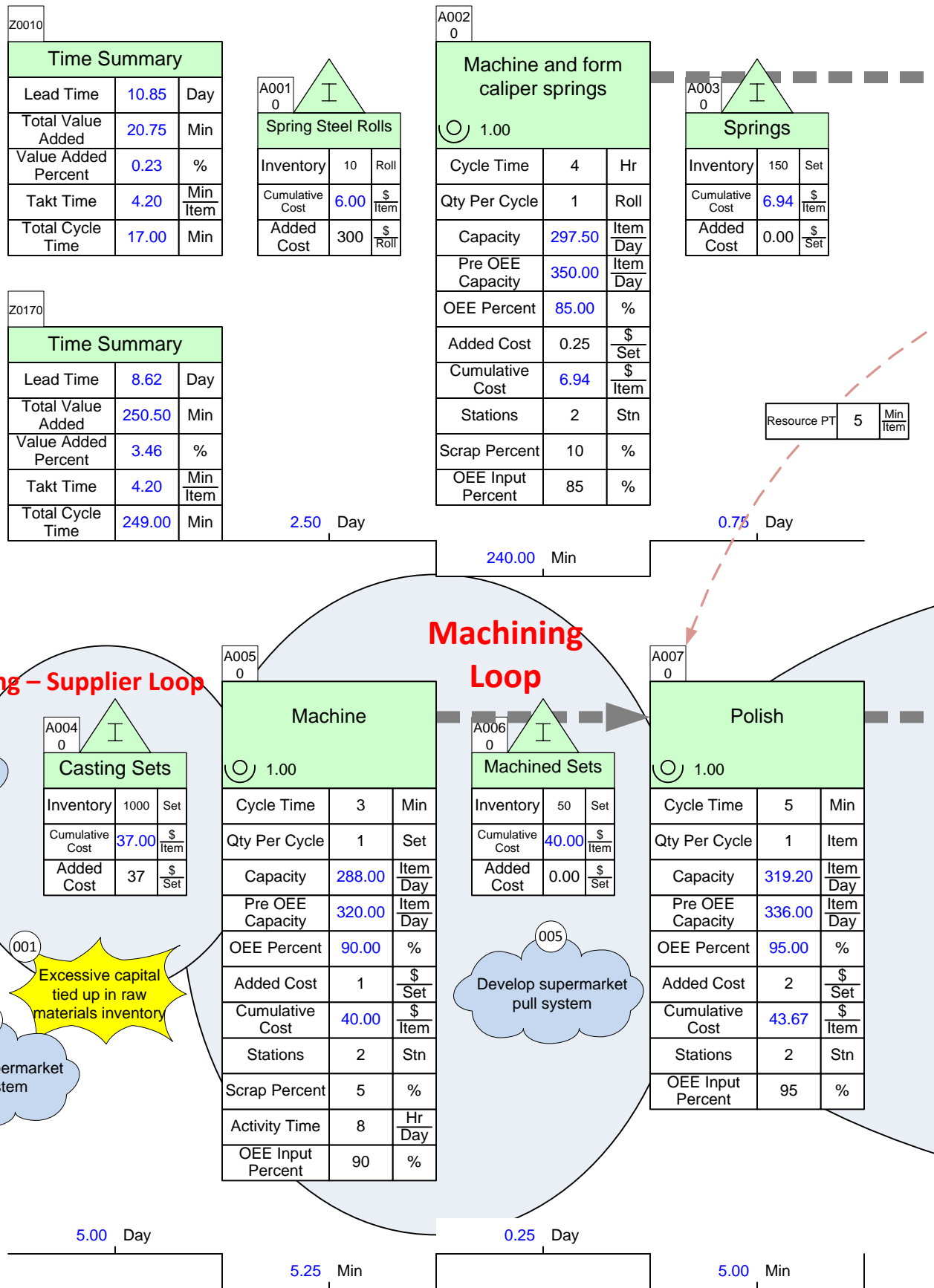


# Improvement Workshop

## Part C

1. Identify any improvements that can be made to the process.
2. Use kaizen bursts on the map, to capture and prioritize all the improvements you identified.
3. Using Map Copy as a starting point, design a future state map for ACME Surgical Cutter production.
4. Pacemaker Loop
  - a. Develop continuous flow from Polish to Assemble
  - b. Kaizen work elements to increase OEE to 95% and reduce scrap to 2% and reduce total cycle time to under 8 mins
  - c. Develop pull system with finished goods supermarket
  - d. Develop material handler routes between supermarket and cellGoal: Use Kanban wizard to size the finished goods supermarket
5. Machining Loop
  - a. Establish pull system with machined sets supermarket (eliminate schedules)Goal: Only 1 day of machined sets inventory
6. Casting Set – Supplier Loop
  - a. Develop pull system with Casting Set supermarket
  - b. Introduce daily coil deliveryGoal: Only 1.5 days of casting sets inventory

# ACME Plant – Current State



Units	Week	Year	Week	Roll	set
	70	52	5	50	1
	Hr	Week	day	set	item

Z003 0	Scrap Costs		
Total Scrap Cost	1919.75	\$	Day

Z002 0	Inventory Summary		
Total Inventory Value	115.45	K\$	

A013 0	Customer		
Customer Demand	1000	Set	Week
Share %	100	%	
Effective Demand	1000.00	Item	Week

A014 0	Operator		
Resource Quantity	2	RQ	
Resource Time	12	Hr	Day
Resource Rate	20	\$	Hr
Resource Utilization	231.48	%	

Resource PT	10	Min	Item
-------------	----	-----	------

A015 0	Machine		
Resource Quantity	1	RQ	
Resource Time	14	Hr	Day
Resource Rate	15	\$	Hr
Resource Utilization	264.55	%	

007 Assemble process is a bottleneck because of low OEE and high scrap

### Pacemaker Loop

008 Develop supermarket pull system for cutters

A008 0	Polished Sets		
Inventory	100	Set	
Cumulative Cost	43.67	\$	Item
Added Cost	0.00	\$	Set

A009 0	Assemble		
Cycle Time	7	Min	
Qty Per Cycle	1	Item	
Capacity	192.00	Item	Day
Pre OEE Capacity	240.00	Item	Day
OEE Percent	80.00	%	
Added Cost	3	\$	Set
Cumulative Cost	66.05	\$	Item
Stations	2	Stn	
Scrap Percent	10	%	
OEE Input Percent	80	%	

A010 0	Cutters		
Inventory	15	Set	
Cumulative Cost	66.05	\$	Item
Added Cost	0.00	\$	Set

A011 0	Package		
Cycle Time	2	Min	
Qty Per Cycle	1	Item	
Capacity	228.00	Item	Day
Pre OEE Capacity	240.00	Item	Day
OEE Percent	95.00	%	
Added Cost	1	\$	Set
Cumulative Cost	67.05	\$	Item
Activity Time	8	Hr	Day
OEE Input Percent	95	%	

A012 0	Boxes		
Inventory	1000	Set	
Cumulative Cost	67.05	\$	Item
Added Cost	0.00	\$	Set

006 Create continuous flow between Polish and Assemble, and turn into a cell

0.50 Day

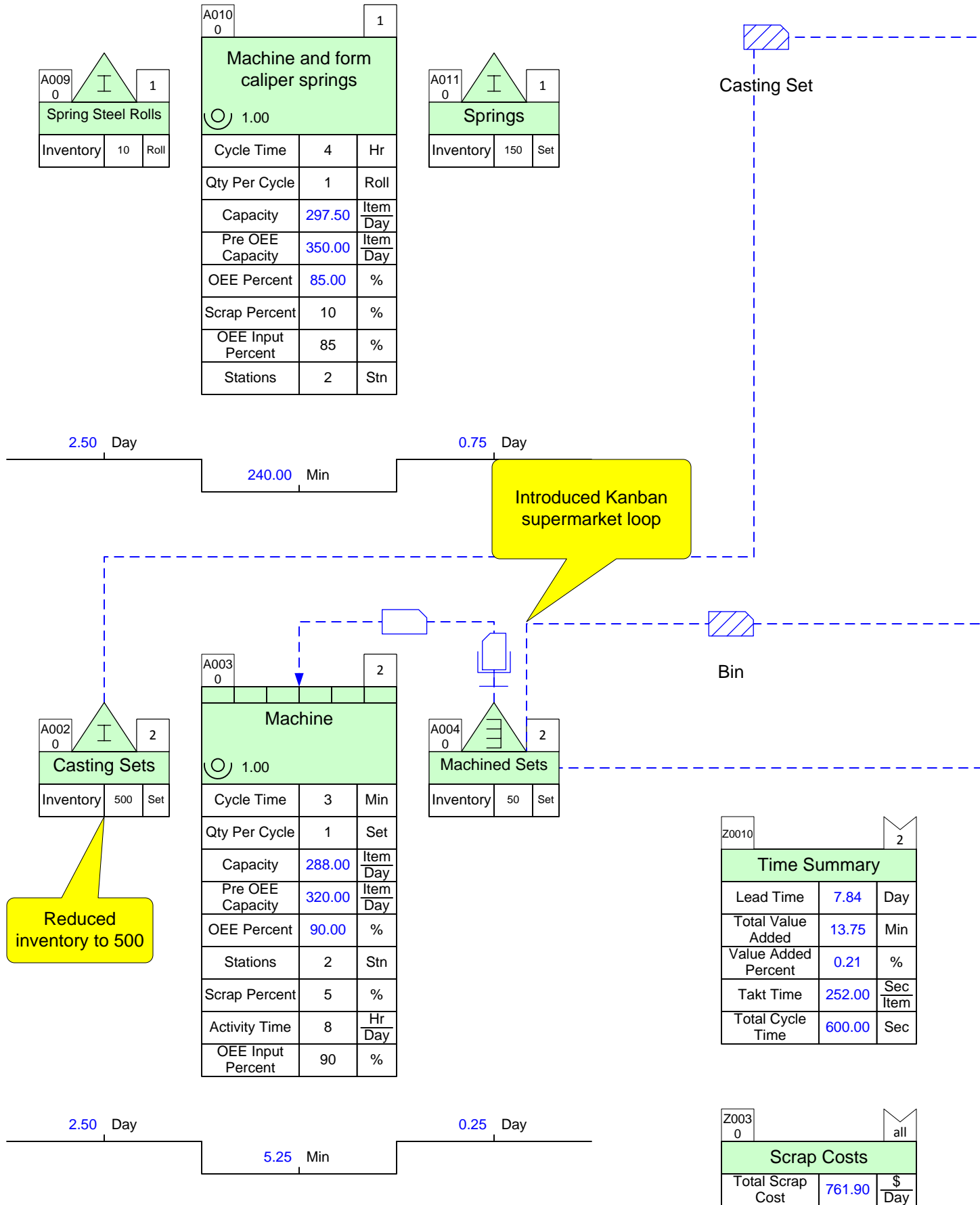
7.00 Min

0.08 Day

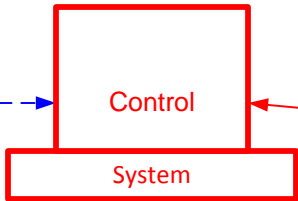
3.50 Min

5.00 Day

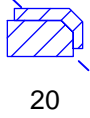
# ACME Plant – Future State



Units	Year	week	week	Roll	Set
	52	5	70	50	1
	week	day	Hr	Set	item



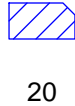
A001 0		all
<b>Customer</b>		
Customer Demand	1000	Set Week
Share %	100	%
Effective Demand	1000.00	Item Week



OXOX

Introduced Kanban supermarket loop

Combining the polish and Assemble processes into one single activity



A005 0		#2
<b>Polish &amp; Assy</b>		
1.00		
Cycle Time	5	Min
Qty Per Cycle	1	Item
Capacity	319.20	Item Day
Pre OEE Capacity	336.00	Item Day
OEE Percent	95.00	%
Scrap Percent	2	%
OEE Input Percent	95	%
Stations	2	Stn

Reduced Scrap to 2% and increased OEE to 95%

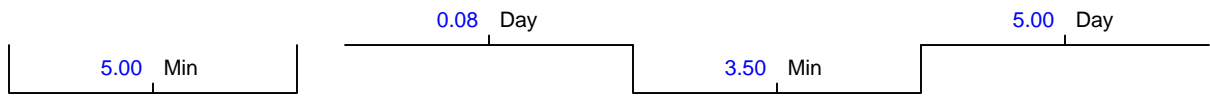
A006 0		#2
<b>Cutters</b>		
Inventory	15	Set

A007 0		#2
<b>Package</b>		
1.00		
Cycle Time	2	Min
Qty Per Cycle	1	Item
Capacity	228.00	Item Day
Pre OEE Capacity	240.00	Item Day
OEE Percent	95.00	%
Activity Time	8	Hr Day
OEE Input Percent	95	%

A008 0		#2
<b>Boxes</b>		
Inventory	1000	Set

Z0170		1
<b>Time Summary</b>		
Lead Time	8.62	Day
Total Value Added	248.50	Min
Value Added Percent	3.43	%
Takt Time	252.00	Sec Item
Total Cycle Time	14820.00	Sec

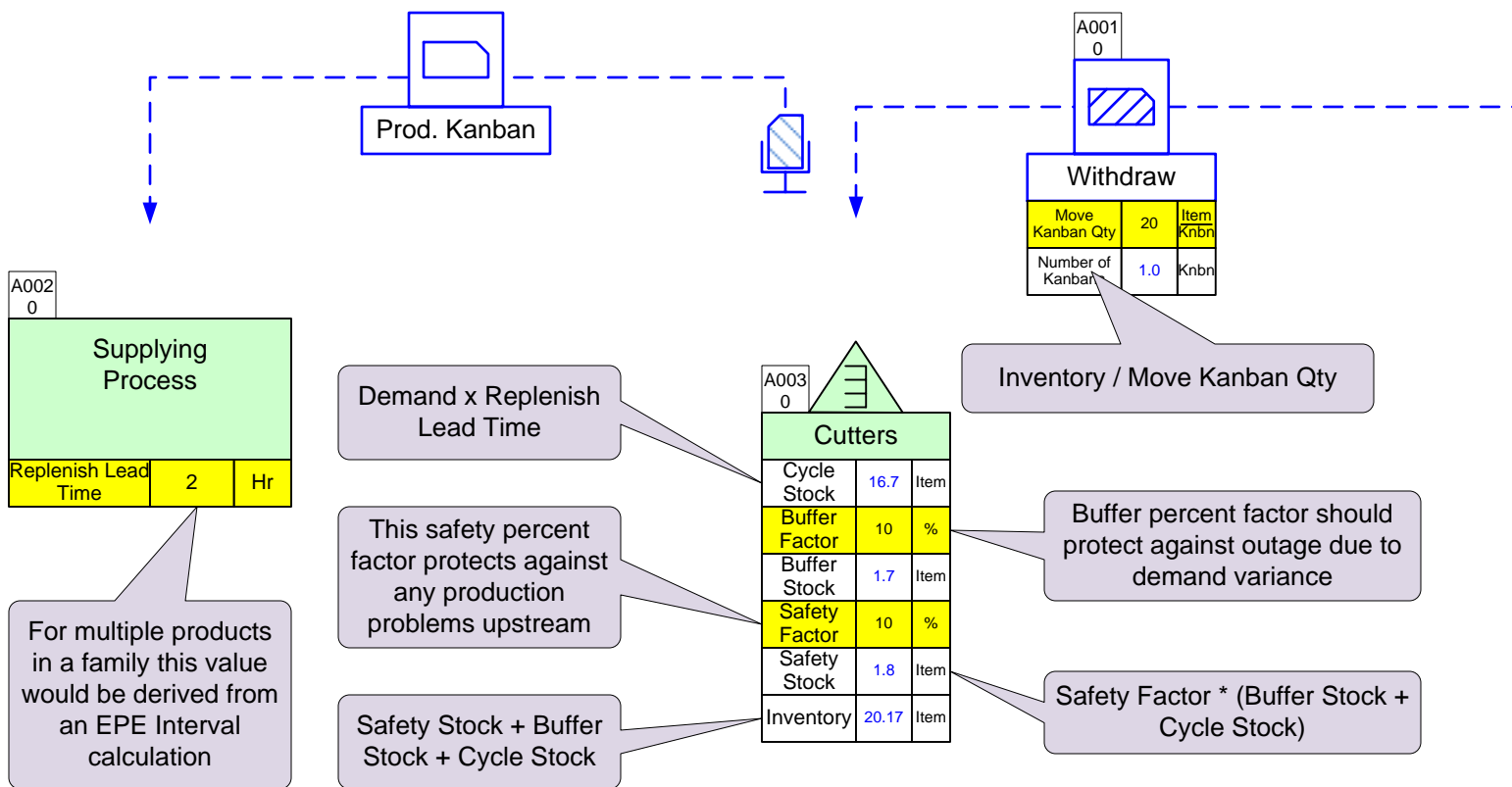
Z013 0		all
<b>Inventory Summary</b>		
Total Inventory Value	79.34	K\$



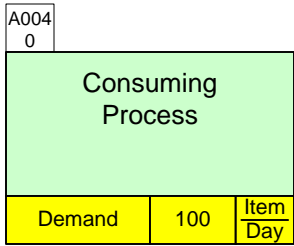
# ACME Plant – Cutters

## Supermarket Kanban Loop

Adapted from “Creating Level Pull”







Units	Day	Hr
	12	60
	Hr	Min

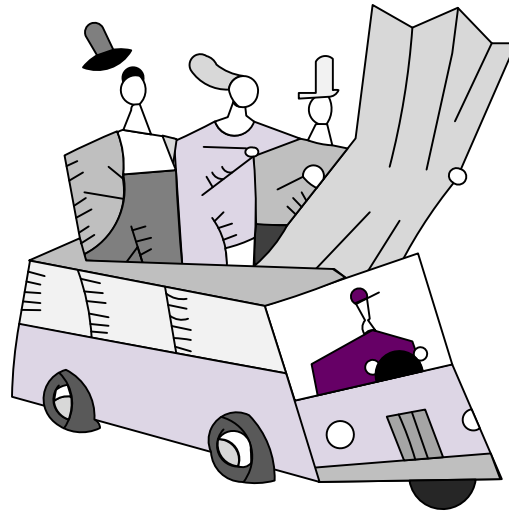


## Quick Mfg Problem & Solution Maps

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The following VSM exercises test your ability to make simple changes to a map, similar to those you might need to make as you design the future state for your process.

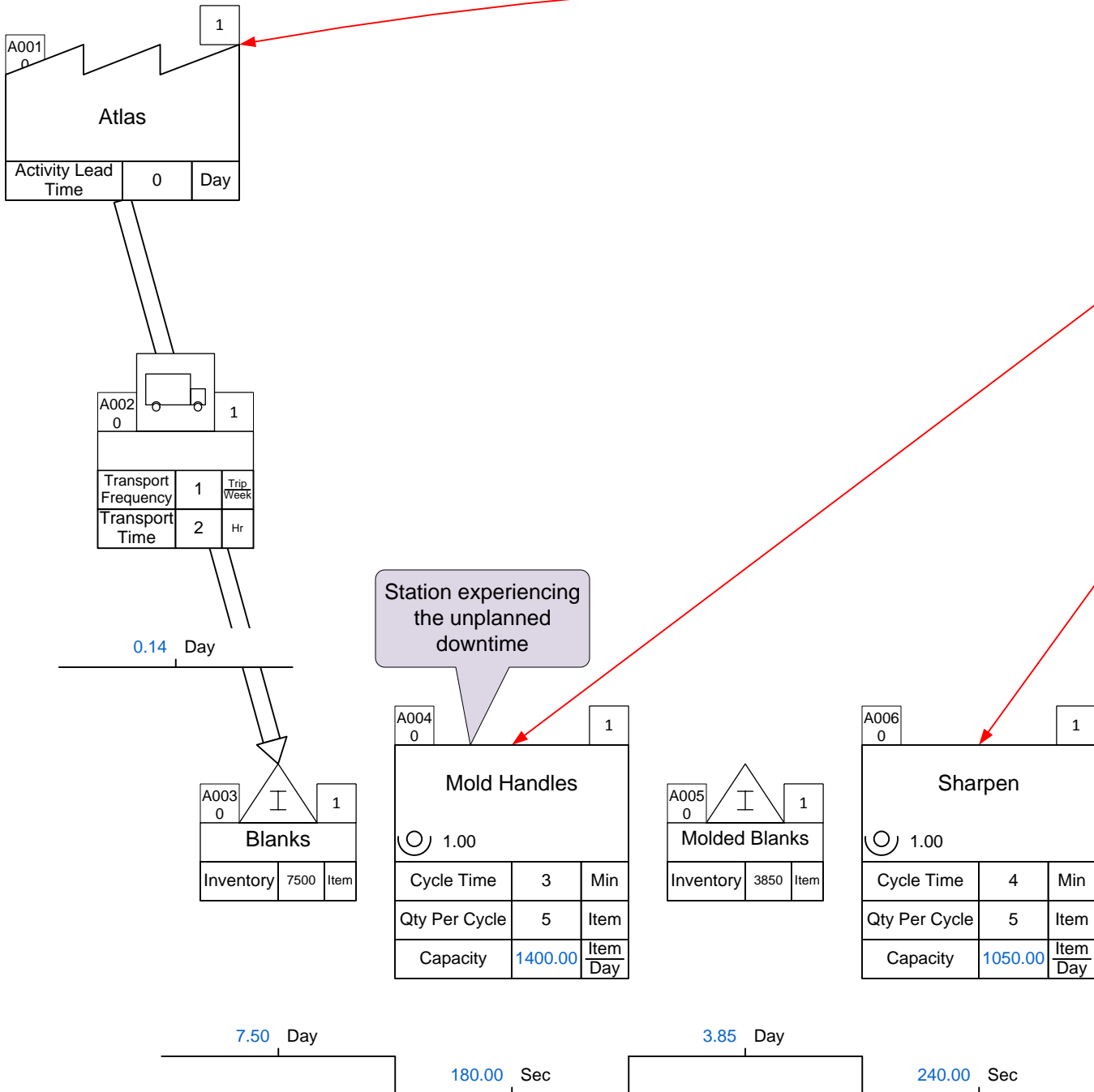
Each problem map is followed by a solution map. Our suggestion is to first think through the problem by marking up the problem map and completing the calculations where possible before you look at the solution map. All of the solution maps have been created by making small changes using the eVSM software.



# Manufacturing Problem: Downtime

The mold handles station experiences an unplanned downtime of 20%. Can you still meet customer demand?

Weekly



Units	Year	Week	Week
	52	70	5
	Week	Hr	day

Control

System

Weekly

A008 0			2
<b>Make Box</b>			
1.00			
Cycle Time	3	Min	
Qty Per Cycle	4	Item	
Capacity	1120.00	Item Day	

A009 0			2
<b>Boxes</b>			
I			
Inventory	7000	Item	

A013 0			all
<b>Customer</b>			
Customer Demand	1000	Item Day	
Share %	100	%	
Effective Demand	1000.00	Item Day	

180.00 Sec

7.00 Day

A012 0			#2
<b>Transport</b>			
I			
Transport Frequency	1	Trip Week	
Transport Time	4	Hr	

0.29 Day

A007 0			1
<b>Drilled Blanks</b>			
I			
Inventory	3100	Item	

A010 0			#2
<b>Assemble</b>			
2.00			
Cycle Time	6	Min	
Qty Per Cycle	10	Item	
Capacity	1400.00	Item Day	

A011 0			#2
<b>Scissors</b>			
I			
Inventory	9000	Item	

3.10 Day

360.00 Sec

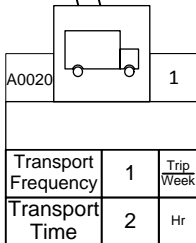
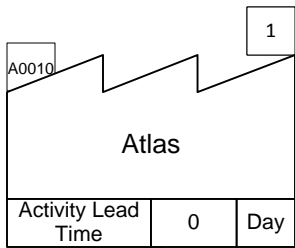
9.00 Day

Z001 0			1
<b>Time Summary</b>			
Lead Time	23.89	Day	
Total Value Added	13.00	Min	
Value Added Percent	0.06	%	
Takt Time	50.40	Sec Item	
Total Cycle Time	780.00	Sec	
Process Time Per Unit	120.00	Sec Item	

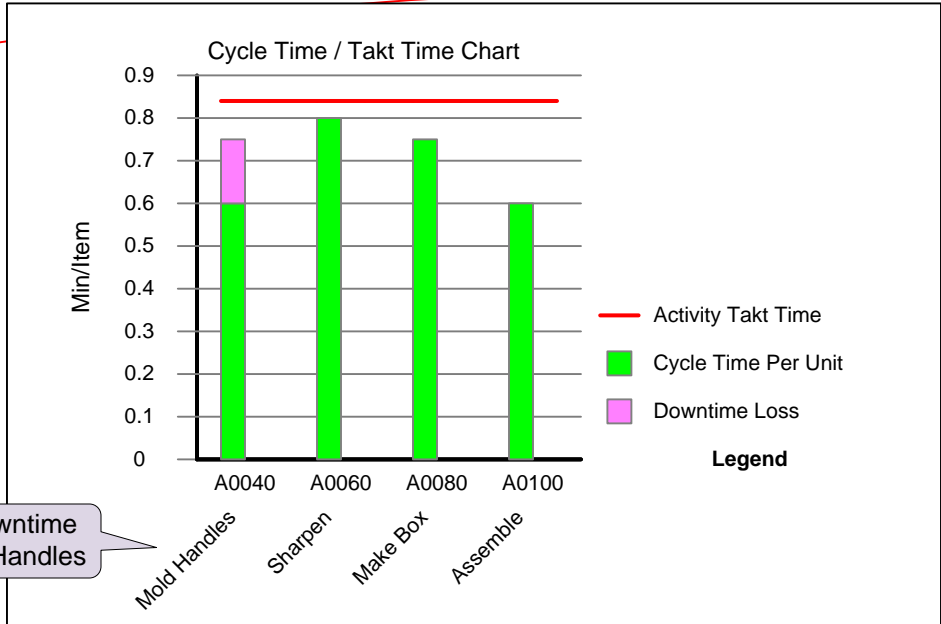
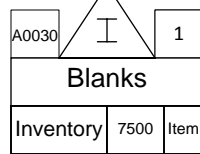
# Manufacturing Solution: Downtime

The mold handles station experiences an unplanned downtime of 20%. Can you still meet customer demand?

Weekly



0.14 Day

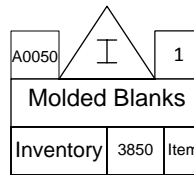


20% downtime at Mold Handles

## Answer:

Yes, as shown by the Cycle Time / Takt Time chart.

A0040			1
Mold Handles			
⊙ 1.00			
Cycle Time	3	Min	
Qty Per Cycle	5	Item	
Capacity	1120.00	Item Day	
Pre OEE Capacity	1400.00	Item Day	
OEE Percent	80.00	%	
Uptime Percent	80	%	



A0060			1
Sharpen			
⊙ 1.00			
Cycle Time	4	Min	
Qty Per Cycle	5	Item	
Capacity	1050.00	Item Day	
Pre OEE Capacity	1050.00	Item Day	
OEE Percent	100.00	%	

7.50 Day

3.85 Day

180.00 Sec

240.00 Sec

Units	Year	Week	Week
	52	70	5
	Week	Hr	day

Control

System

Weekly

A0080 2

Make Box		
☉ 1.00		
Cycle Time	3	Min
Qty Per Cycle	4	Item
Capacity	1120.00	Item Day
Pre OEE Capacity	1120.00	Item Day
OEE Percent	100.00	%

A0090 2

Boxes		
Inventory	7000	Item

A0130 all

Customer		
Customer Demand	1000	Item Day
Share %	100	%
Effective Demand	1000.00	Item Day

A0120 #2

Transport		
Frequency	1	Trip Week
Time	4	Hr

7.00 Day

180.00 Sec

0.29 Day

A0070 1

Drilled Blanks		
Inventory	3100	Item

A0100 #2

Assemble		
☉ 2.00		
Cycle Time	6	Min
Qty Per Cycle	10	Item
Capacity	1400.00	Item Day
Pre OEE Capacity	1400.00	Item Day
OEE Percent	100.00	%

A0110 #2

Scissors		
Inventory	9000	Item

3.10 Day

360.00 Sec

9.00 Day

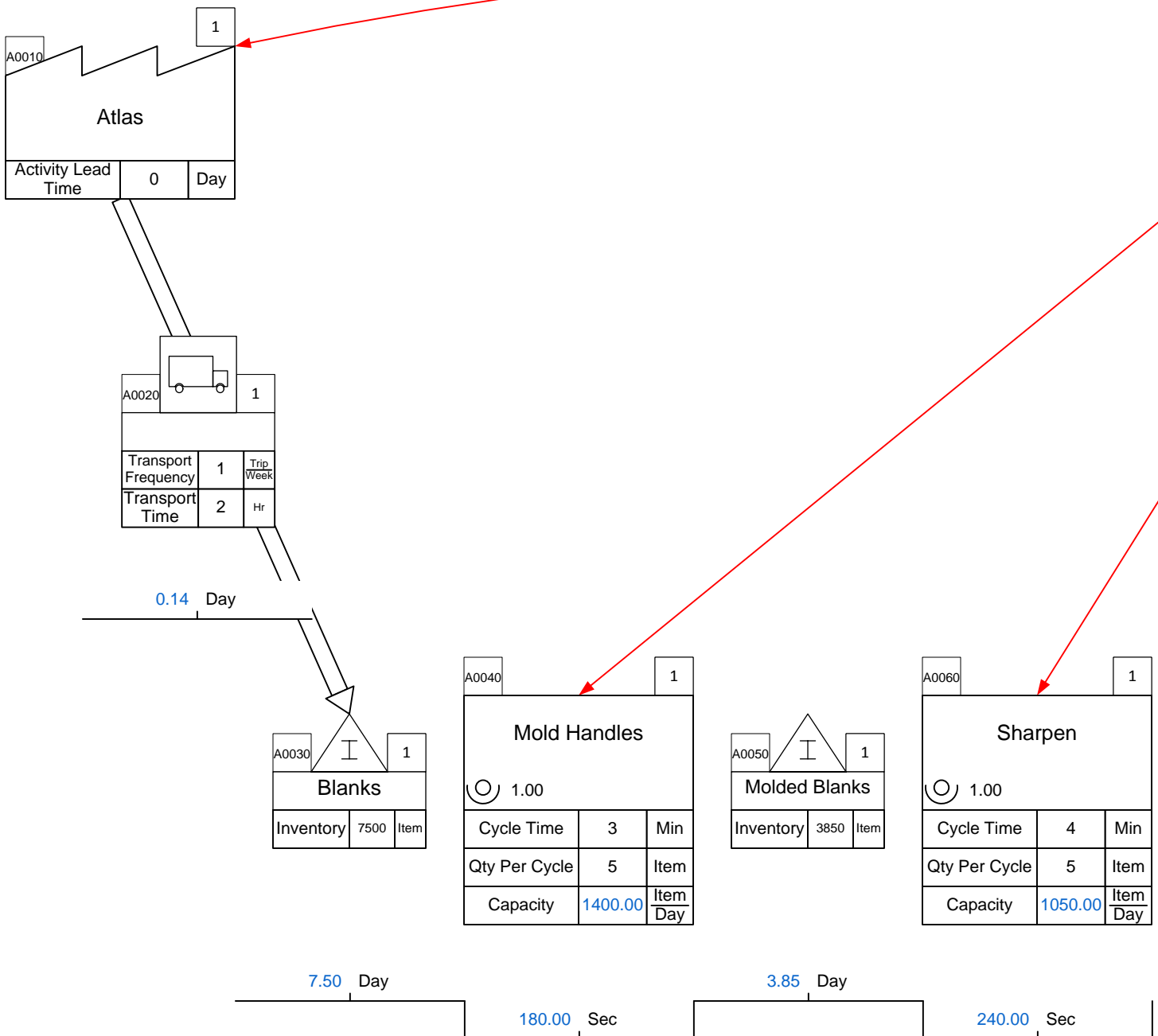
Z0010 1

Time Summary		
Lead Time	23.89	Day
Total Value Added	13.00	Min
Value Added Percent	0.06	%
Takt Time	50.40	Sec Item
Total Cycle Time	780.00	Sec
Process Time Per Unit	120.00	Sec Item

# Manufacturing Problem: Availability

Management is considering sharing the Sharpen station with another value stream for two hours per day. What would your recommendation to management be?

Weekly



Units	Year	Week	Week
	52	70	5
	Week	Hr	day



Control

System

Weekly

A0080	2	
Make Box		
☉ 1.00		
Cycle Time	3	Min
Qty Per Cycle	4	Item
Capacity	1120.00	Item Day

A0090	2	
Boxes		
Inventory	7000	Item

A0130	all	
Customer		
Customer Demand	1000	Item Day
Share %	100	%
Effective Demand	1000.00	Item Day

180.00 Sec

7.00 Day

A0120	#2	
Transport		
Transport Frequency	1	Trip Week
Transport Time	4	Hr

0.29 Day

A0070	1	
Drilled Blanks		
Inventory	3100	Item

A0100	#2	
Assemble		
☉ 2.00		
Cycle Time	6	Min
Qty Per Cycle	10	Item
Capacity	1400.00	Item Day

A0110	#2	
Scissors		
Inventory	9000	Item

3.10 Day

360.00 Sec

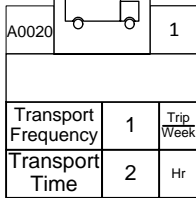
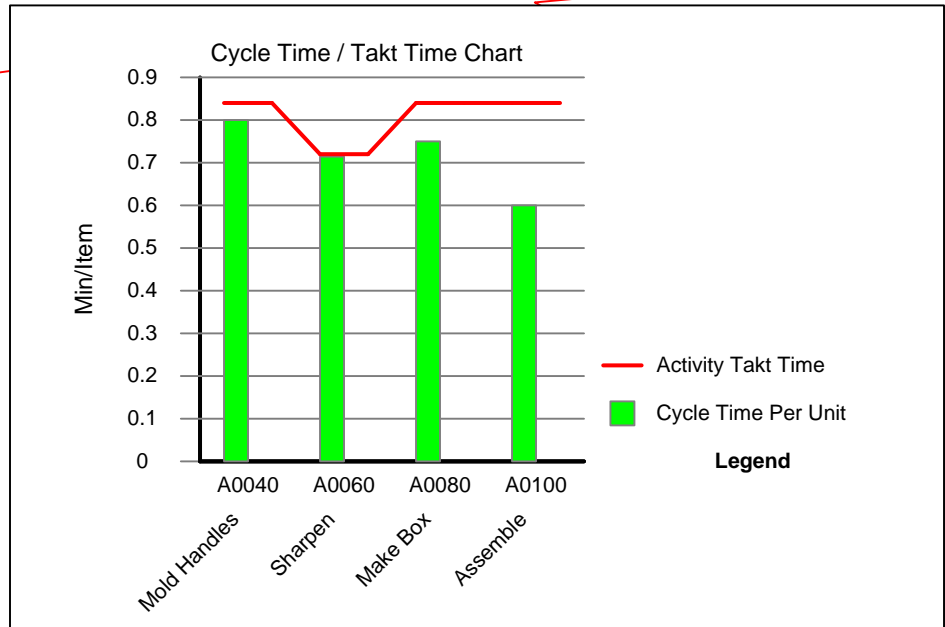
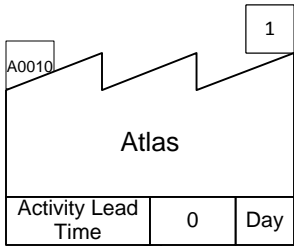
9.00 Day

Z0010	1	
Time Summary		
Lead Time	23.89	Day
Total Value Added	13.00	Min
Value Added Percent	0.06	%
Takt Time	50.40	Sec Item
Total Cycle Time	780.00	Sec
Process Time Per Unit	120.00	Sec Item

# Manufacturing Solution: Availability

Management is considering sharing the Sharpen station with another value stream for two hours per day. What would your recommendation to management be?

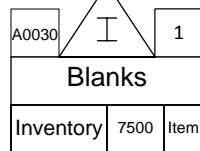
Weekly



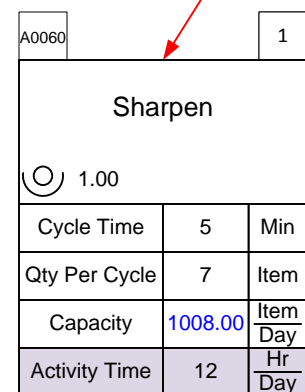
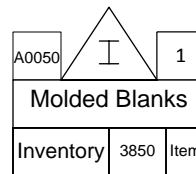
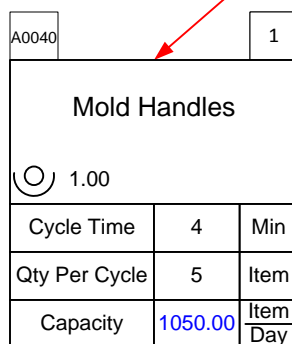
0.14 Day

## Answer:

Sharing the Sharpen station brings its availability very close to Takt Time, leaving little to no room for planned/unplanned downtime. It would be best to not share the Sharpen station as it's currently configured.



7.50 Day



3.85 Day

240.00 Sec

Availability change – two hours less than other stations

350.00 Sec

Units	Year	Week	Week
	52	70	5
	Week	Hr	day

Control

System

Weekly

A0080 2

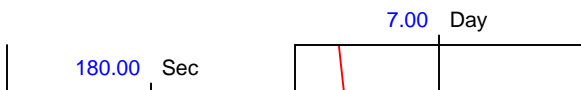
Make Box		
☉ 1.00		
Cycle Time	3	Min
Qty Per Cycle	4	Item
Capacity	1120.00	Item Day

A0090 2

Boxes		
Inventory	7000	Item

A0130 all

Customer		
Customer Demand	1000	Item Day
Share %	100	%
Effective Demand	1000.00	Item Day



A0120 #2

Transport		
Transport Frequency	1	Trip Week
Transport Time	4	Hr

0.29 Day

A0070 1

Drilled Blanks		
Inventory	3100	Item

A0100 #2

Assemble		
☉ 2.00		
Cycle Time	6	Min
Qty Per Cycle	10	Item
Capacity	1400.00	Item Day

A0110 #2

Scissors		
Inventory	9000	Item



Z0010 1

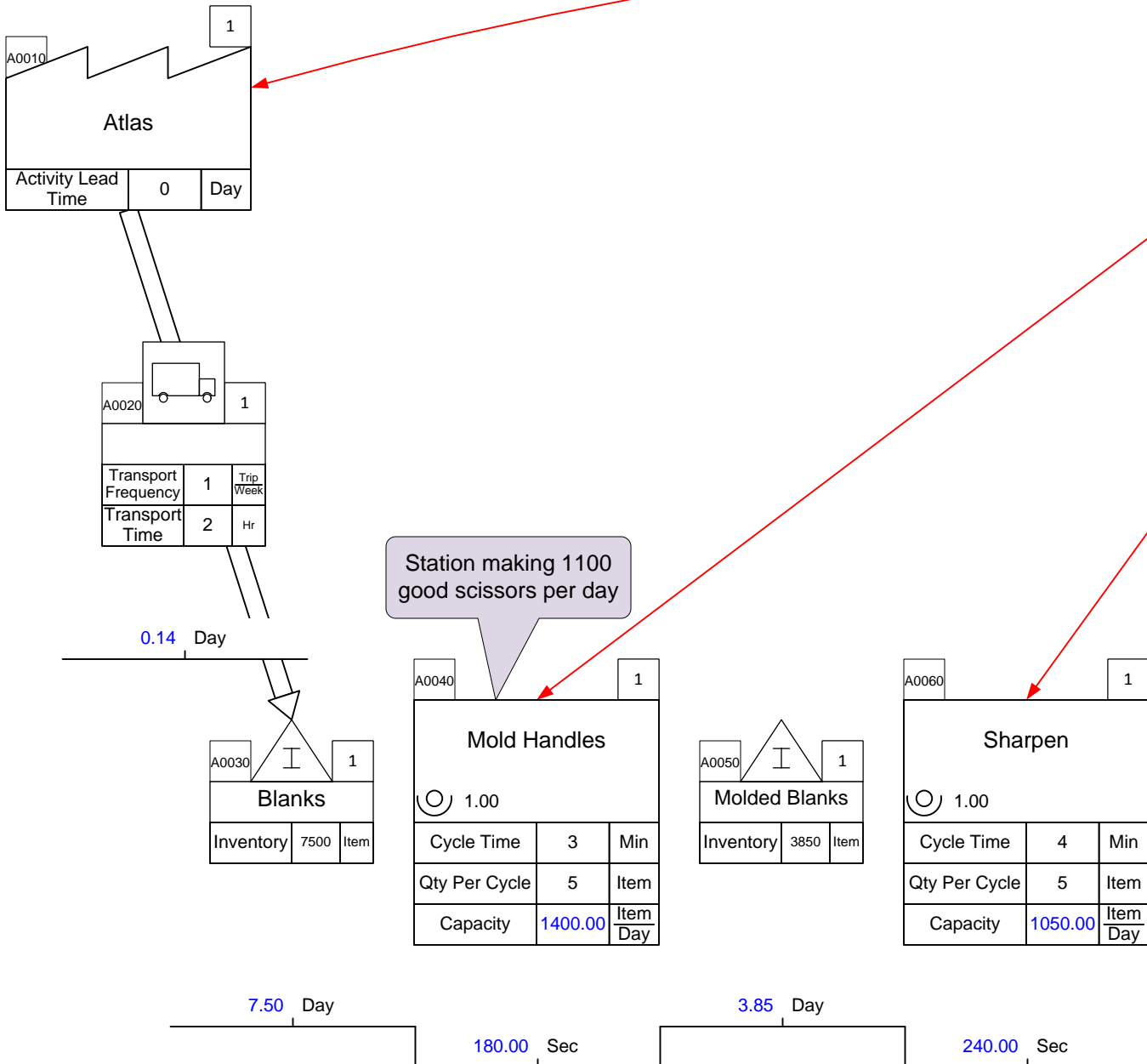
Time Summary		
Lead Time	23.90	Day
Total Value Added	15.83	Min
Value Added Percent	0.08	%
Takt Time	50.40	Sec Item
Total Cycle Time	900.00	Sec
Process Time Per Unit	126.86	Sec Item

# Manufacturing Problem: OEE

1. The mold machine has been measured as being able to make 1100 good scissors per day. Calculate its OEE.

2. In the absence of "good parts" measurements, set the OEE for all other equipment to 85%. Check the resulting capacity and see if customer demand can be met.

Weekly



Units	Year	Week	Week
	52	70	5
	Week	Hr	day

Control

System

Weekly

A0080		2
<b>Make Box</b>		
☉ 1.00		
Cycle Time	3	Min
Qty Per Cycle	4	Item
Capacity	1120.00	Item Day

A0090	I	2
<b>Boxes</b>		
Inventory	7000	Item

A0130		all
<b>Customer</b>		
Customer Demand	1000	Item Day
Share %	100	%
Effective Demand	1000.00	Item Day

180.00 Sec

7.00 Day

A0120		#2
<b>Transport</b>		
Transport Frequency	1	Trip Week
Transport Time	4	Hr

0.29 Day

A0070	I	1
<b>Drilled Blanks</b>		
Inventory	3100	Item

A0100		#2
<b>Assemble</b>		
☉ 2.00		
Cycle Time	6	Min
Qty Per Cycle	10	Item
Capacity	1400.00	Item Day

A0110	I	#2
<b>Scissors</b>		
Inventory	9000	Item

3.10 Day

360.00 Sec

9.00 Day

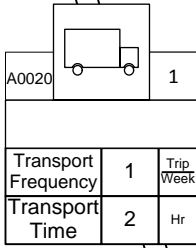
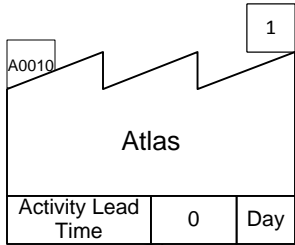
Z0010		1
<b>Time Summary</b>		
Lead Time	23.61	Day
Total Value Added	13.00	Min
Value Added Percent	0.07	%
Takt Time	50.40	Sec Item
Total Cycle Time	780.00	Sec
Process Time Per Unit	120.00	Sec Item

# Manufacturing Solution: OEE

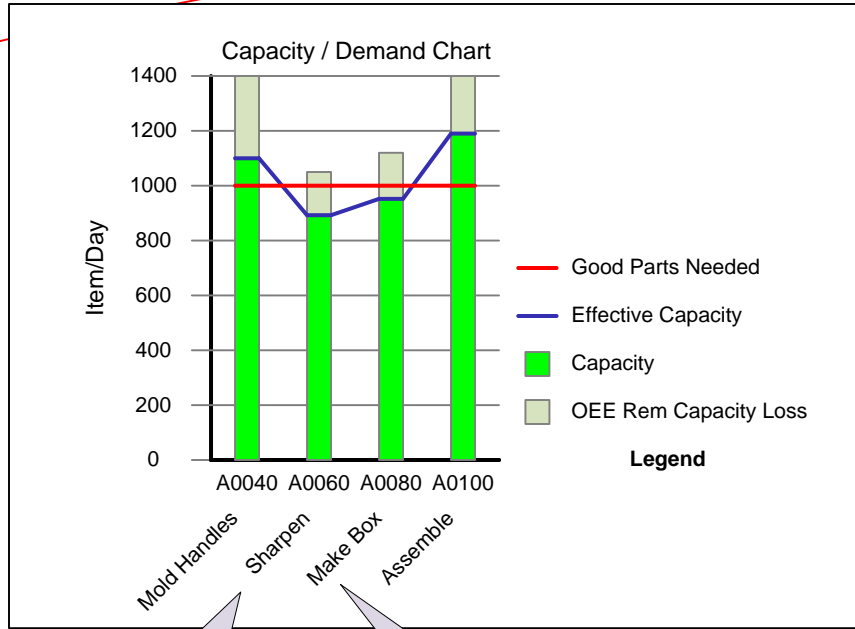
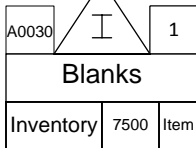
1. The mold machine has been measured as being able to make 1100 good scissors per day. Calculate its OEE.

2. In the absence of "good parts" measurements, set the OEE for all other equipment to 85%. Check the resulting capacity and see if customer demand can be met.

Weekly



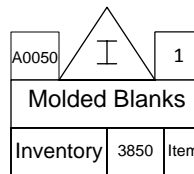
0.14 Day



This activity is not meeting customer demand

This activity is not meeting customer demand

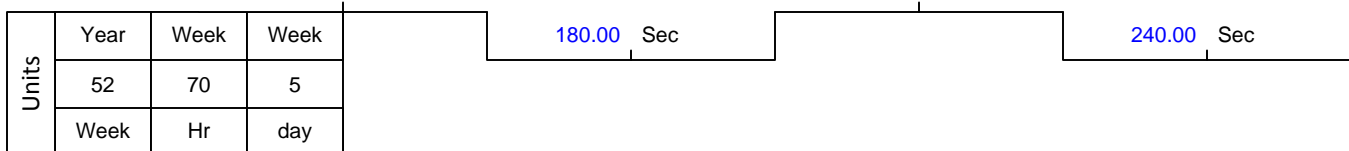
A0040	1
<b>Mold Handles</b>	
☉ 1.00	
Cycle Time	3 Min
Qty Per Cycle	5 Item
Capacity	1100.00 Item/Day
Pre OEE Capacity	1400.00 Item/Day
OEE Percent	78.57 %
Total Good Parts	1100 Item/Day



A0060	1
<b>Sharpen</b>	
☉ 1.00	
Cycle Time	4 Min
Qty Per Cycle	5 Item
Capacity	892.50 Item/Day
Pre OEE Capacity	1050.00 Item/Day
OEE Percent	85.00 %
OEE Input Percent	85 %

7.50 Day

3.85 Day



Control

System

Weekly

A0080		2
Make Box		
☉ 1.00		
Cycle Time	3	Min
Qty Per Cycle	4	Item
Capacity	952.00	Item Day
Pre OEE Capacity	1120.00	Item Day
OEE Percent	85.00	%
OEE Input Percent	85	%

A0090	I	2
Boxes		
Inventory	7000	Item

A0130		all
Customer		
Customer Demand	1000	Item Day
Share %	100	%
Effective Demand	1000.00	Item Day

### Answer:

1. The OEE for Mold Handles is 78.57%.
2. The customer demand cannot be met as shown in the Capacity Chart at Sharpen and Make Box stations.

180.00	Sec
--------	-----

7.00 Day

A0120		#2
Transport		
Transport Frequency	1	Trip Week
Transport Time	4	Hr

0.29 Day

A0070	I	1
Drilled Blanks		
Inventory	3100	Item

A0100		#2
Assemble		
☉ 2.00		
Cycle Time	6	Min
Qty Per Cycle	10	Item
Capacity	1190.00	Item Day
Pre OEE Capacity	1400.00	Item Day
OEE Percent	85.00	%
OEE Input Percent	85	%

A0110	I	#2
Scissors		
Inventory	9000	Item

3.10 Day

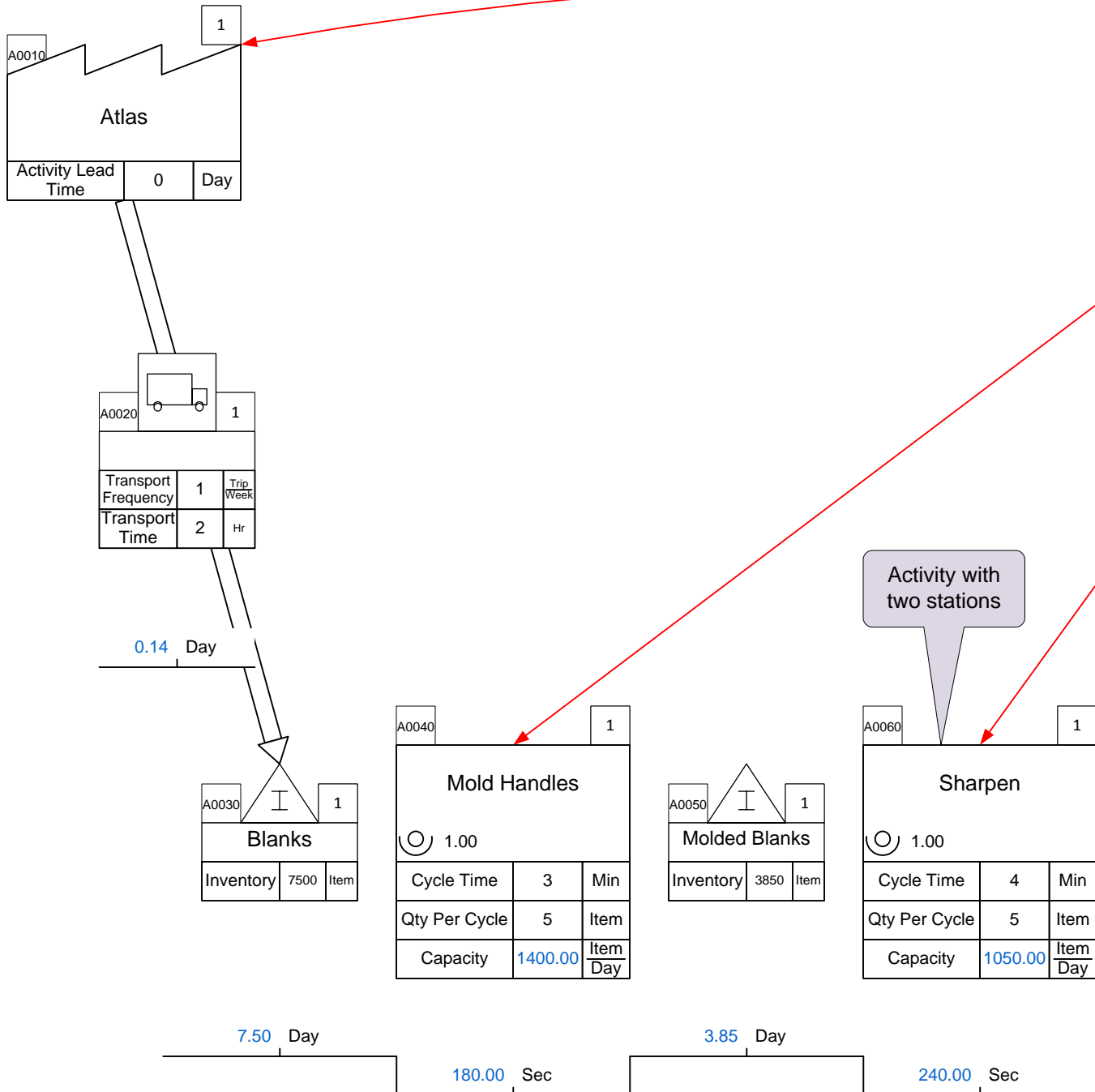
360.00 Sec

9.00 Day

Z0010		1
Time Summary		
Lead Time	23.61	Day
Total Value Added	13.00	Min
Value Added Percent	0.07	%
Takt Time	50.40	Sec Item
Total Cycle Time	780.00	Sec
Process Time Per Unit	120.00	Sec Item

# Manufacturing Problem: Stations

The Sharpen activity actually has two stations, each with the data shown on the map. Correct the map by adding a second station and compare cycle time per item to takt time for that activity. Weekly



Units	Year	Week	Week
	52	70	5
	Week	Hr	day



Control

System

Weekly

A0080 2

Make Box		
☉ 1.00		
Cycle Time	3	Min
Qty Per Cycle	4	Item
Capacity	1120.00	Item Day

A0090 2

Boxes		
Inventory	7000	Item

A0130 all

Customer		
Customer Demand	1000	Item Day
Share %	100	%
Effective Demand	1000.00	Item Day

180.00 Sec

7.00 Day

A0120 #2

Transport		
Transport Frequency	1	Trip Week
Transport Time	4	Hr

0.29 Day

A0070 1

Drilled Blanks		
Inventory	3100	Item

A0100 #2

Assemble		
☉ 2.00		
Cycle Time	6	Min
Qty Per Cycle	10	Item
Capacity	1400.00	Item Day

A0110 #2

Scissors		
Inventory	9000	Item

3.10 Day

360.00 Sec

9.00 Day

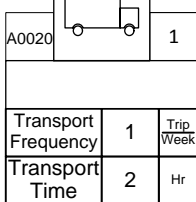
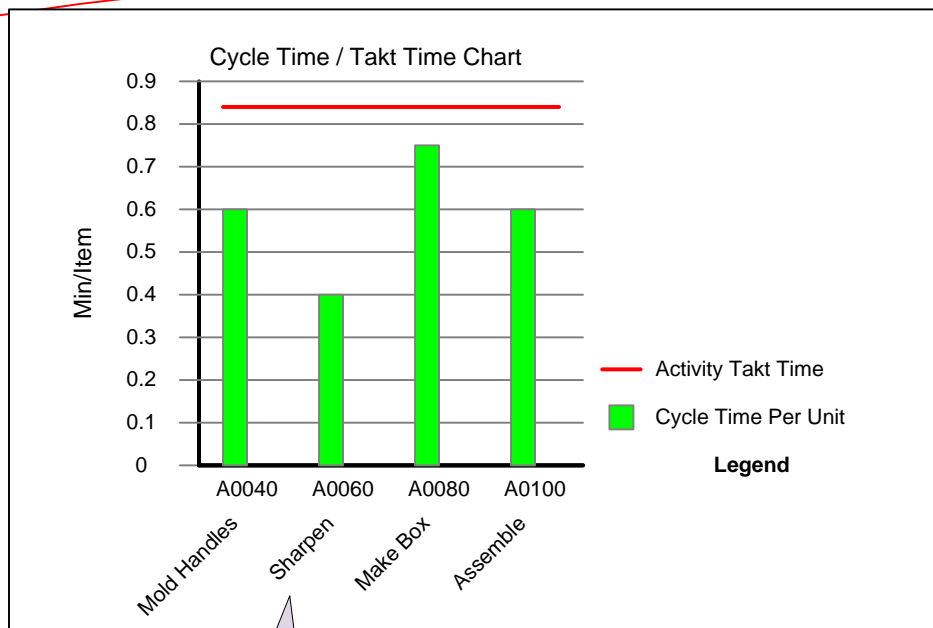
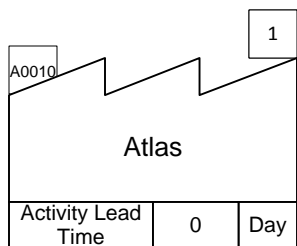
Z0010 1

Time Summary		
Lead Time	23.89	Day
Total Value Added	13.00	Min
Value Added Percent	0.06	%
Takt Time	50.40	Sec Item
Total Cycle Time	780.00	Sec
Process Time Per Unit	120.00	Sec Item

# Manufacturing Solution: Stations

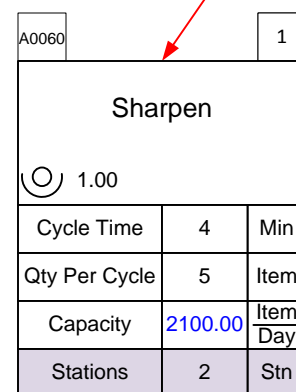
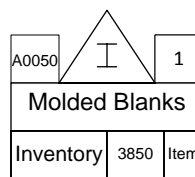
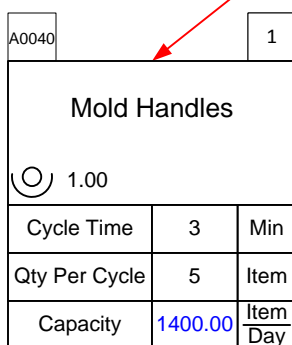
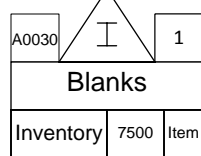
The Sharpen activity actually has two stations, each with the data shown on the map. Correct the map by adding a second station and compare cycle time per item to takt time for that activity.

Weekly



0.14 Day

Cycle time per unit has decreased by half



7.50 Day

3.85 Day

180.00 Sec

240.00 Sec

Units	Year	Week	Week
	52	70	5
	Week	Hr	day

Control

System

Weekly

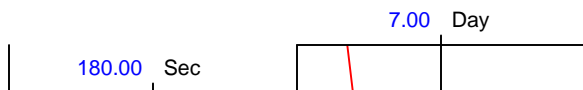
### Answer:

The cycle time per unit has decreased as shown on the Cycle Time / Takt Time chart.

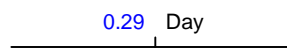
A0080	2	
Make Box		
☉ 1.00		
Cycle Time	3	Min
Qty Per Cycle	4	Item
Capacity	1120.00	Item Day

A0090	2	
Boxes		
Inventory	7000	Item

A0130	all	
Customer		
Customer Demand	1000	Item Day
Share %	100	%
Effective Demand	1000.00	Item Day



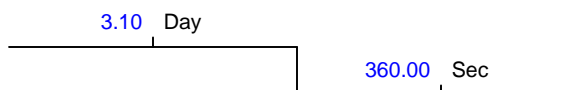
A0120	#2	
Transport		
Transport Frequency	1	Trip Week
Transport Time	4	Hr



A0070	1	
Drilled Blanks		
Inventory	3100	Item

A0100	#2	
Assemble		
☉ 2.00		
Cycle Time	6	Min
Qty Per Cycle	10	Item
Capacity	1400.00	Item Day

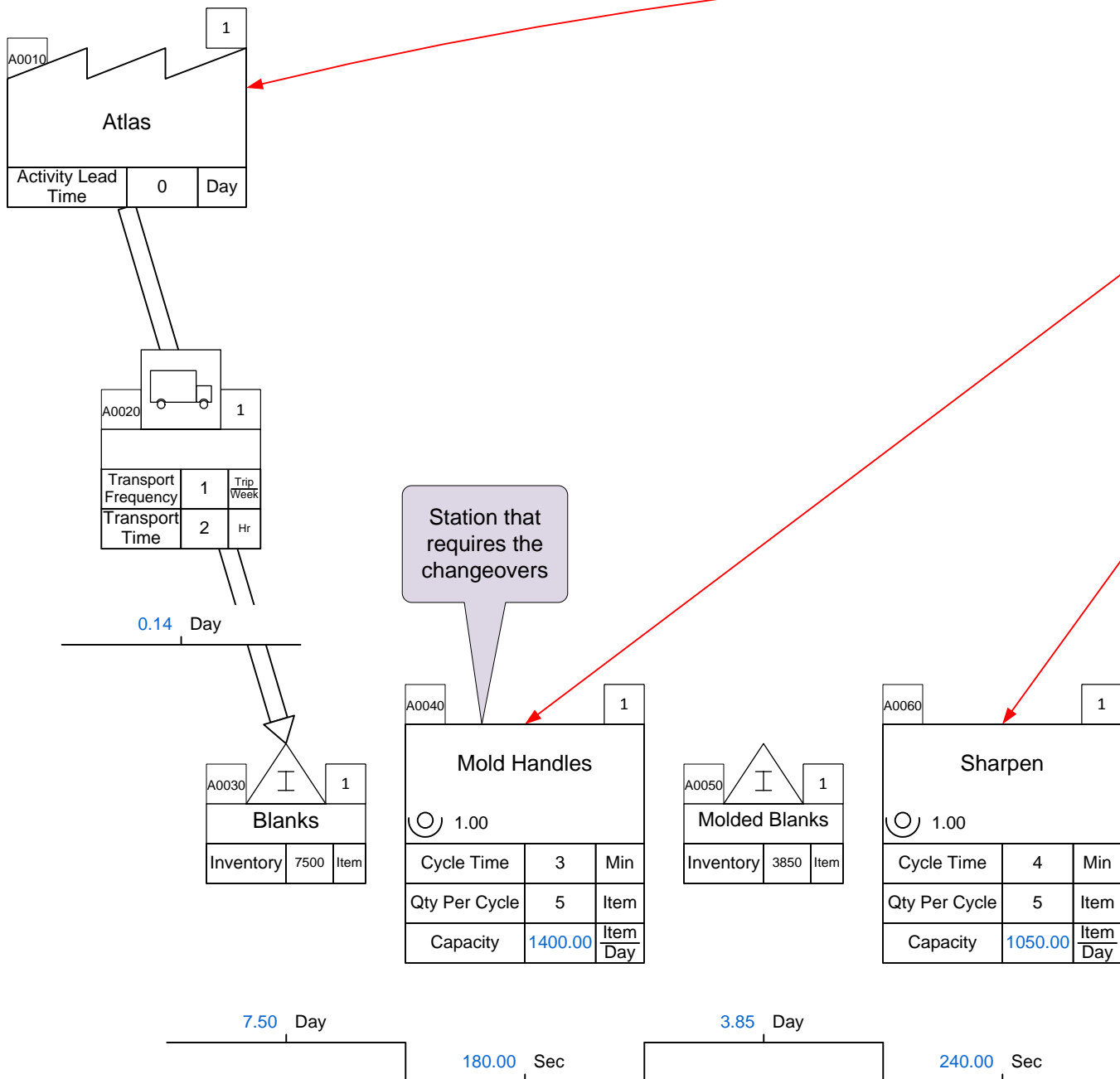
A0110	#2	
Scissors		
Inventory	9000	Item



Z0010	1	
Time Summary		
Lead Time	23.89	Day
Total Value Added	13.00	Min
Value Added Percent	0.06	%
Takt Time	50.40	Sec Item
Total Cycle Time	780.00	Sec
Process Time Per Unit	96.00	Sec Item

# Manufacturing Problem: Changeover

The product family consists of four sizes of scissors, necessitating changeovers at the Mold Handles activity. Each changeover takes 60 minutes. Is there adequate capacity on the Mold Handles activity to meet demand for each scissor size every day? Weekly



Units	Year	Week	Week
	52	70	5
	Week	Hr	day

Control

System

Weekly

A0080 2

Make Box		
☉ 1.00		
Cycle Time	3	Min
Qty Per Cycle	4	Item
Capacity	1120.00	Item Day

A0090 2

Boxes		
Inventory	7000	Item

A0130 all

Customer		
Customer Demand	1000	Item Day
Share %	100	%
Effective Demand	1000.00	Item Day

180.00 Sec

7.00 Day

A0120 #2

Transport		
Transport Frequency	1	Trip Week
Transport Time	4	Hr

0.29 Day

A0070 1

Drilled Blanks		
Inventory	3100	Item

A0100 #2

Assemble		
☉ 2.00		
Cycle Time	6	Min
Qty Per Cycle	10	Item
Capacity	1400.00	Item Day

A0110 #2

Scissors		
Inventory	9000	Item

3.10 Day

360.00 Sec

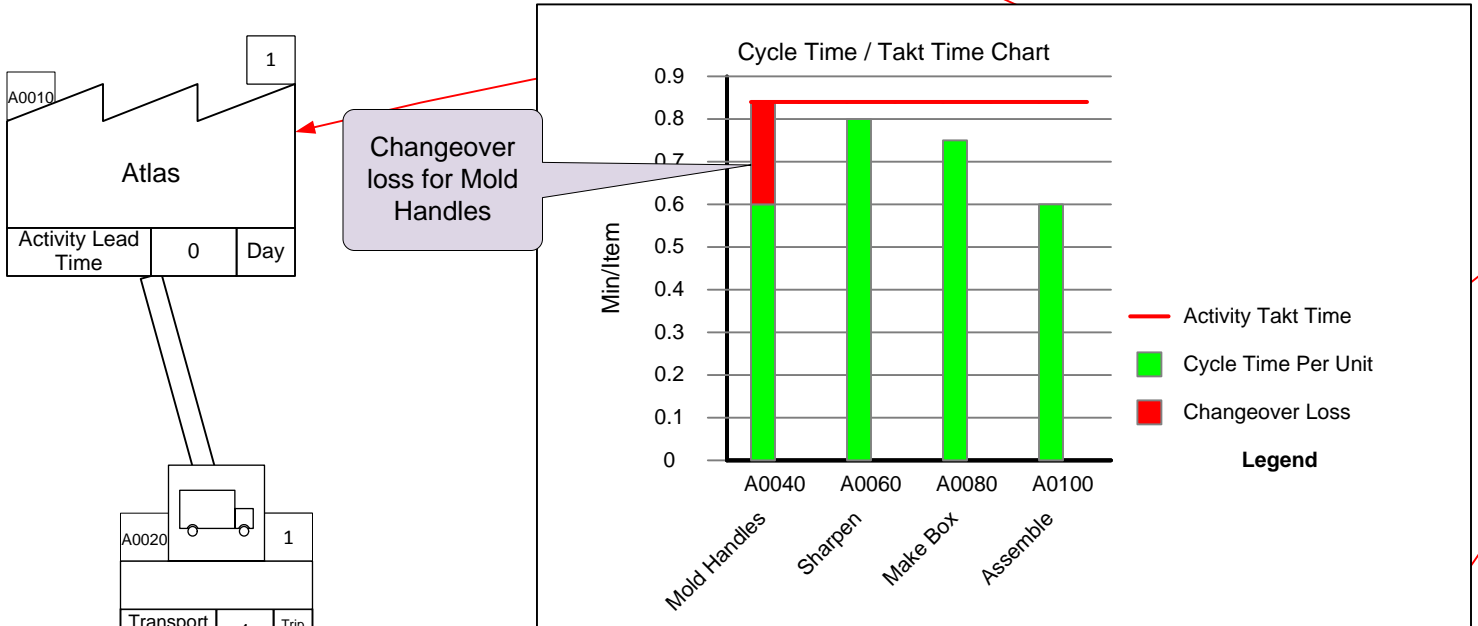
9.00 Day

Z0010 1

Time Summary		
Lead Time	23.89	Day
Total Value Added	13.00	Min
Value Added Percent	0.06	%
Takt Time	50.40	Sec Item
Total Cycle Time	780.00	Sec
Process Time Per Unit	120.00	Sec Item

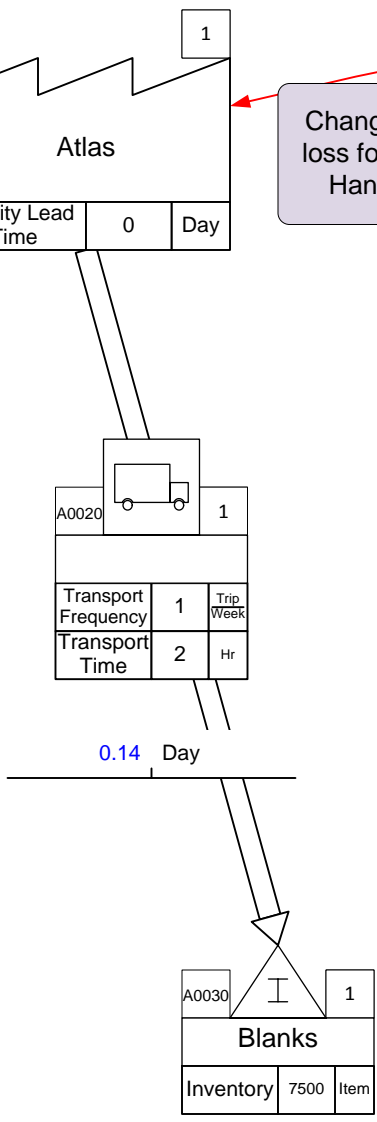
# Manufacturing Solution: Changeover

The product family consists of four sizes of scissors, necessitating changeovers at the Mold Handles activity. Each changeover takes 60 minutes. Is there adequate capacity on the Mold Handles activity to meet demand for each scissor size every day? Weekly



**Answer:**

Just barely, as shown on the Cycle Time / Takt Time chart.



A0040			1
<b>Mold Handles</b>			
☉ 1.00			
Cycle Time	3	Min	
Qty Per Cycle	5	Item	
Capacity	1000.00	Item Day	
Pre OEE Capacity	1400.00	Item Day	
OEE Percent	71.43	%	
Changeovers	4	CO Day	
Time Per Changeover	60	Min CO	

A0050			1
<b>Molded Blanks</b>			
☉ 1.00			
Inventory	3850	Item	

A0060			1
<b>Sharpen</b>			
☉ 1.00			
Cycle Time	4	Min	
Qty Per Cycle	5	Item	
Capacity	1050.00	Item Day	
Pre OEE Capacity	1050.00	Item Day	
OEE Percent	100.00	%	

Units	Year	Week	Week	7.50 Day	180.00 Sec	3.85 Day	240.00 Sec
	52	70	5				
	Week	Hr	day				

Control

System

Weekly

A0080	2	
<b>Make Box</b>		
☉ 1.00		
Cycle Time	3	Min
Qty Per Cycle	4	Item
Capacity	1120.00	Item Day
Pre OEE Capacity	1120.00	Item Day
OEE Percent	100.00	%

A0090	2	
<b>Boxes</b>		
Inventory	7000	Item

A0130	all	
<b>Customer</b>		
Customer Demand	1000	Item Day
Share %	100	%
Effective Demand	1000.00	Item Day

A0120	#2	
<b>Transport</b>		
Transport Frequency	1	Trip Week
Transport Time	4	Hr

7.00 Day

0.29 Day

180.00 Sec

A0070	1	
<b>Drilled Blanks</b>		
Inventory	3100	Item

A0100	#2	
<b>Assemble</b>		
☉ 2.00		
Cycle Time	6	Min
Qty Per Cycle	10	Item
Capacity	1400.00	Item Day
Pre OEE Capacity	1400.00	Item Day
OEE Percent	100.00	%

A0110	#2	
<b>Scissors</b>		
Inventory	9000	Item

3.10 Day

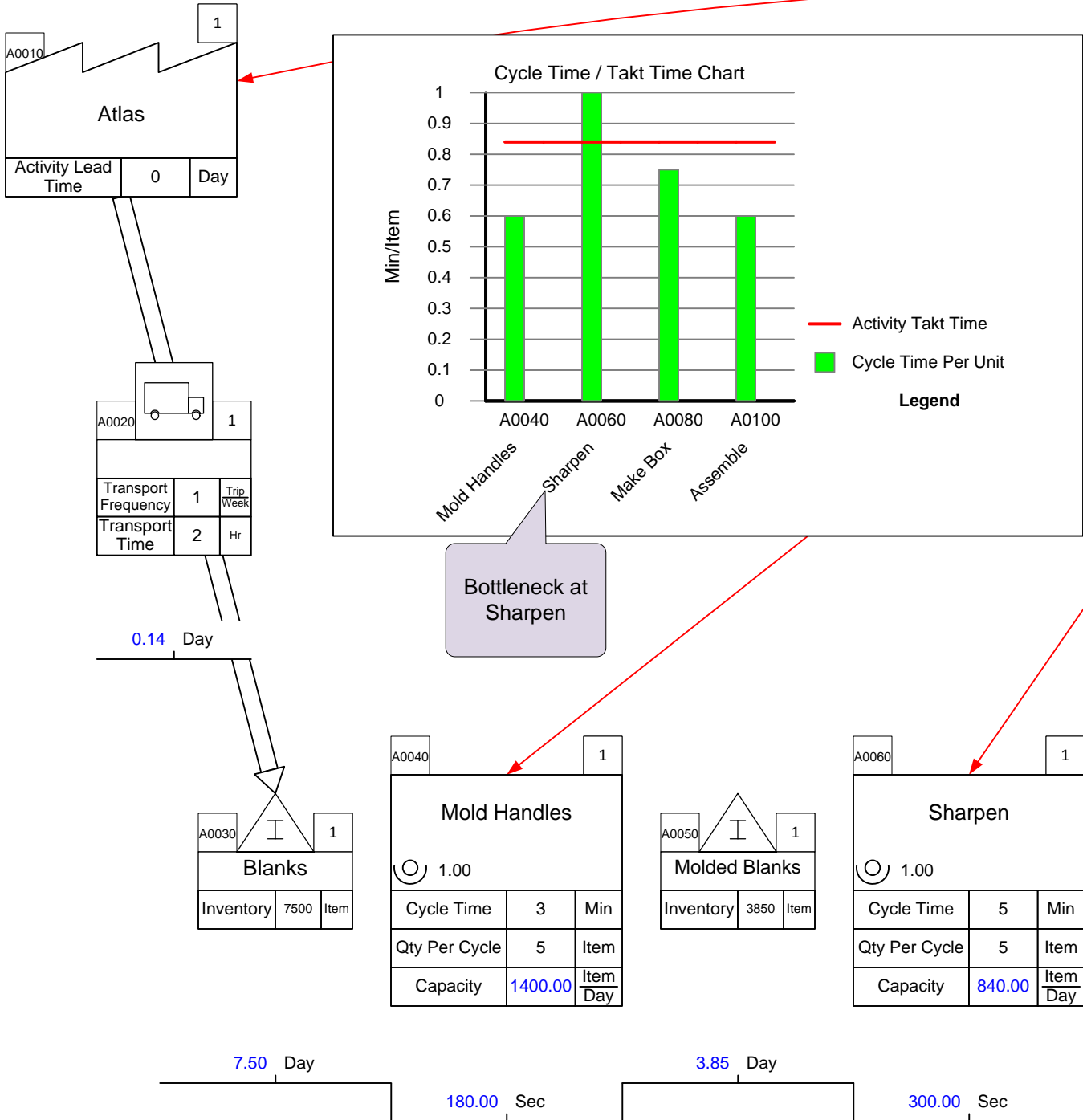
360.00 Sec

9.00 Day

Z0010	1	
<b>Time Summary</b>		
Lead Time	23.89	Day
Total Value Added	13.00	Min
Value Added Percent	0.06	%
Takt Time	50.40	Sec Item
Total Cycle Time	780.00	Sec
Process Time Per Unit	120.00	Sec Item

# Manufacturing Problem: Activity Time

**Problem:** It's been decided that overtime will be used to avoid the bottleneck at the Sharpen activity. How many hours of overtime would you recommend authorizing? Is there sufficient inventory buffer in front of sharpening to allow this? Weekly



Units	Year	Week	Week
	52	70	5
	Week	Hr	day



Control

System

Weekly

A0080 2

Make Box		
☉ 1.00		
Cycle Time	3	Min
Qty Per Cycle	4	Item
Capacity	1120.00	Item Day

A0090 2

Boxes		
Inventory	7000	Item

A0130 all

Customer		
Customer Demand	1000	Item Day
Share %	100	%
Effective Demand	1000.00	Item Day

180.00 Sec

7.00 Day

A0120 #2

Transport		
Frequency	1	Trip Week
Time	4	Hr

0.29 Day

A0070 1

Drilled Blanks		
Inventory	3100	Item

A0100 #2

Assemble		
☉ 2.00		
Cycle Time	6	Min
Qty Per Cycle	10	Item
Capacity	1400.00	Item Day

A0110 #2

Scissors		
Inventory	9000	Item

3.10 Day

360.00 Sec

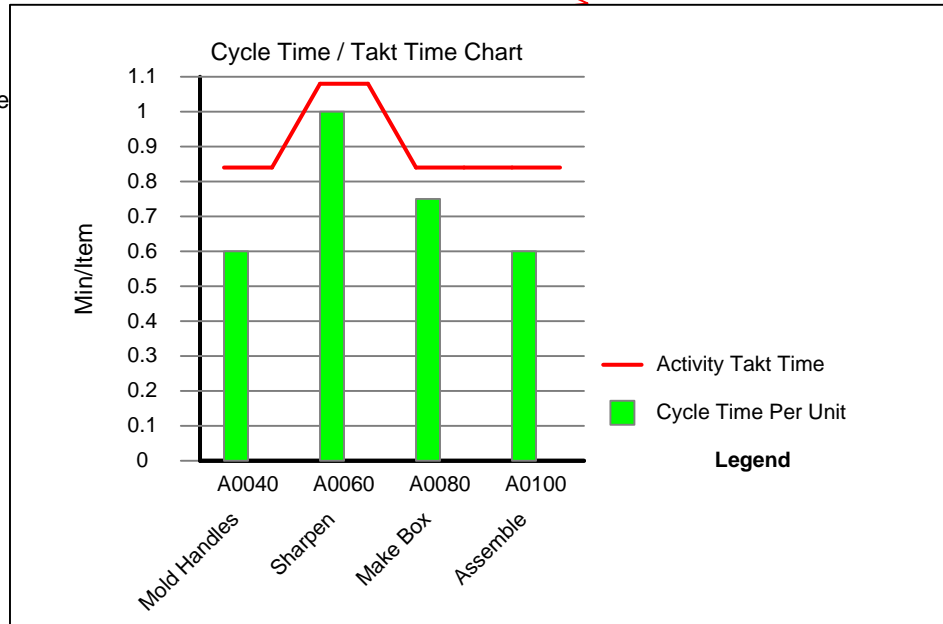
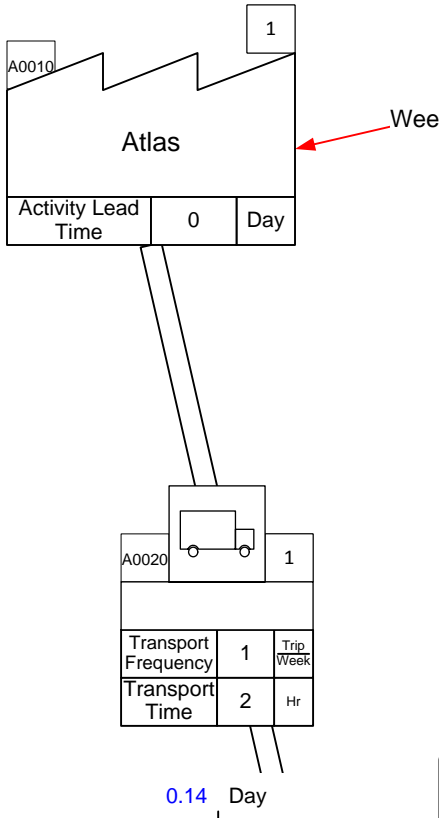
9.00 Day

Z0010 1

Time Summary		
Lead Time	23.90	Day
Total Value Added	14.00	Min
Value Added Percent	0.07	%
Takt Time	50.40	Sec Item
Total Cycle Time	840.00	Sec
Process Time Per Unit	132.00	Sec Item

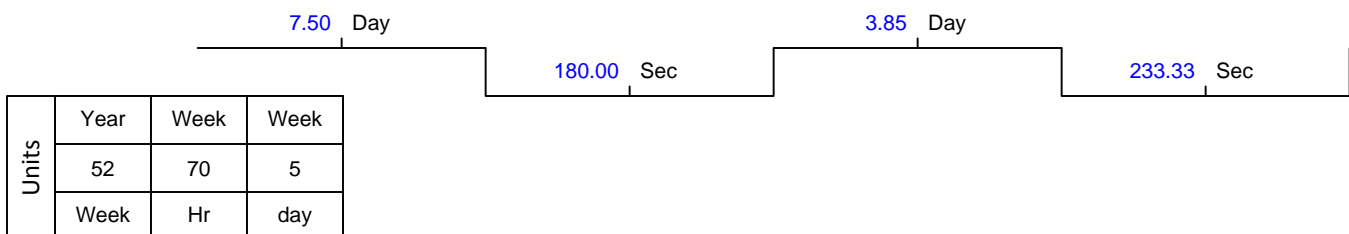
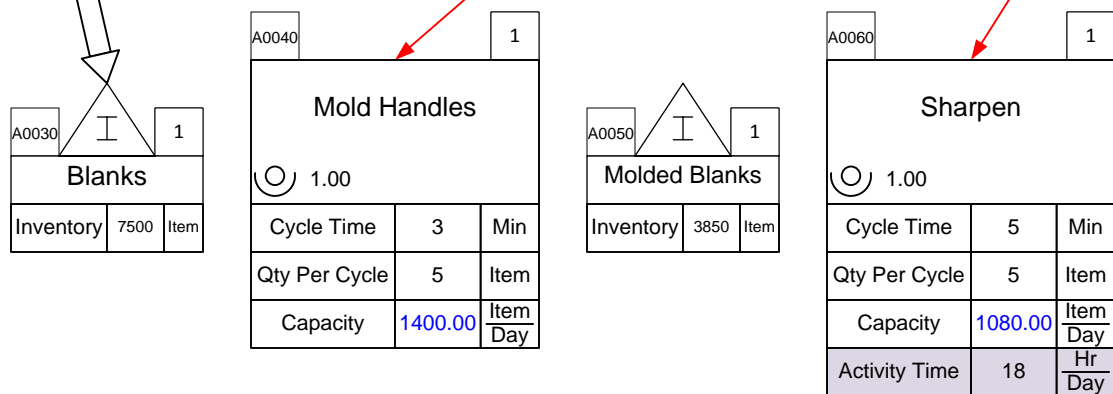
# Manufacturing Solution: Activity Time

**Problem:** It's been decided that overtime will be used to avoid the bottleneck at the Sharpen activity. How many hours of overtime would you recommend authorizing? Is there sufficient inventory buffer in front of sharpening to allow this?



## Answer:

Four hours of overtime would be enough, and in that time the machine could run 240 parts so there is more than enough inventory buffer in front of the Sharpen activity.



Units	Year	Week	Week
	52	70	5
	Week	Hr	day

Control

System

Weekly

A0080 2

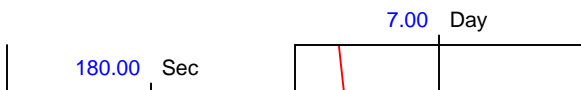
Make Box		
☉ 1.00		
Cycle Time	3	Min
Qty Per Cycle	4	Item
Capacity	1120.00	Item Day

A0090 2

Boxes		
Inventory	7000	Item

A0130 all

Customer		
Customer Demand	1000	Item Day
Share %	100	%
Effective Demand	1000.00	Item Day



A0120 #2

Transport		
Transport Frequency	1	Trip Week
Transport Time	4	Hr

0.29 Day

A0070 1

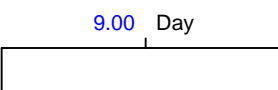
Drilled Blanks		
Inventory	3100	Item

A0100 #2

Assemble		
☉ 2.00		
Cycle Time	6	Min
Qty Per Cycle	10	Item
Capacity	1400.00	Item Day

A0110 #2

Scissors		
Inventory	9000	Item



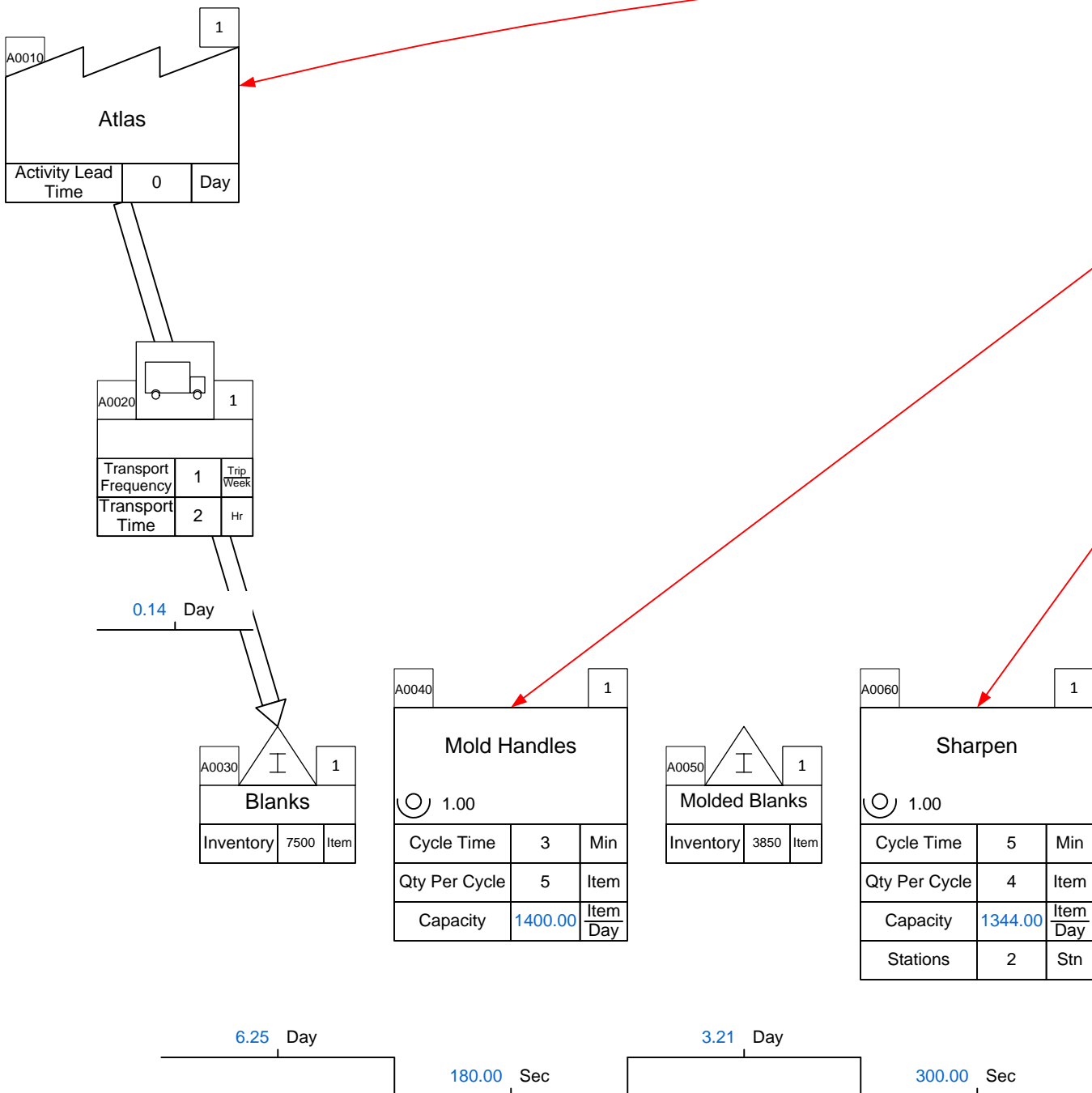
Z0010 1

Time Summary		
Lead Time	23.89	Day
Total Value Added	12.89	Min
Value Added Percent	0.06	%
Takt Time	50.40	Sec Item
Total Cycle Time	840.00	Sec
Process Time Per Unit	132.00	Sec Item

# Manufacturing Problem: Lead Time

**Problem:** A system of more frequent supplier and customer deliveries has been recommended (once daily) with an inventory of two days at raw materials and finished goods, and a max WIP at any position of half a day. How will this improve lead times?

Weekly




Units	Year	Week	Week
	52	70	5
	Week	Hr	day

Control


System

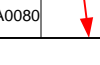
Weekly

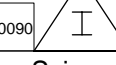
A0110			all		
<b>Customer</b>					
Customer Demand	1200	Item	Day		
Share %	100	%			
Effective Demand	1200.00	Item	Day		

A0100			1		
					
Transport Frequency	1	Trip	Week		
Transport Time	4	Hr			

0.29 Day

A0070			1		
					
<b>Drilled Blanks</b>					
Inventory	3100	Item			

A0080			1		
					
<b>Assemble</b>					
2.00					
Cycle Time	6	Min			
Qty Per Cycle	10	Item			
Capacity	1400.00	Item	Day		

A0090			1		
					
<b>Scissors</b>					
Inventory	9000	Item			

Z0010			1		
<b>Time Summary</b>					
Lead Time	19.99	Day			
Total Value Added	14.00	Min			
Value Added Percent	0.08	%			
Takt Time	42.00	Sec	Item		
Total Cycle Time	840.00	Sec			
Process Time Per Unit	109.50	Sec	Item		

2.58 Day

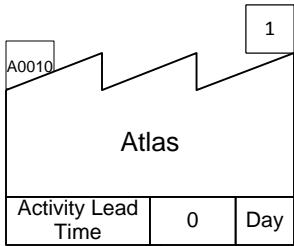
360.00 Sec

7.50 Day

# Manufacturing Solution: Lead Time

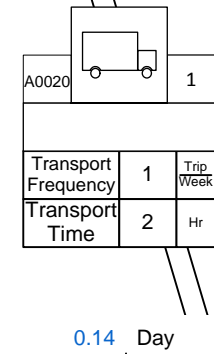
**Problem:** A system of more frequent supplier and customer deliveries has been recommended (once daily) with an inventory of two days at raw materials and finished goods, and a max WIP at any position of half a day. How will this improve lead times?

Weekly

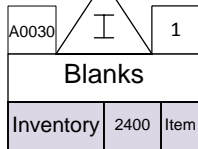


## Answer:

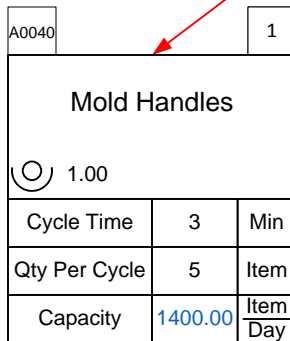
The Lead Time is reduced from twenty days to just above five and a half days.



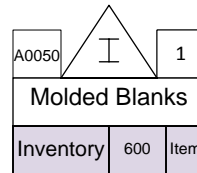
0.14 Day



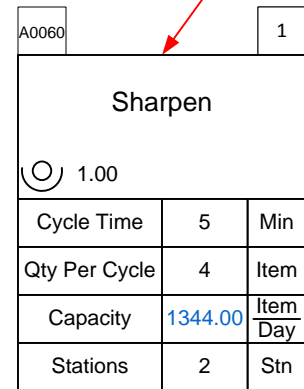
2.00 Day



180.00 Sec



0.50 Day



300.00 Sec

Units	Year	Week	Week
	52	70	5
	Week	Hr	day

Control

System

Weekly

A0110		all
Customer		
Customer Demand	1200	Item Day
Share %	100	%
Effective Demand	1200.00	Item Day

A0100		1
Transport		
Transport Frequency	1	Trip Week
Transport Time	4	Hr

0.29 Day

A0080		1
Assemble		
	2.00	
Cycle Time	6	Min
Qty Per Cycle	10	Item
Capacity	1400.00	Item Day

A0070		1
Drilled Blanks		
Inventory	600	Item

A0090		1
Scissors		
Inventory	2400	Item

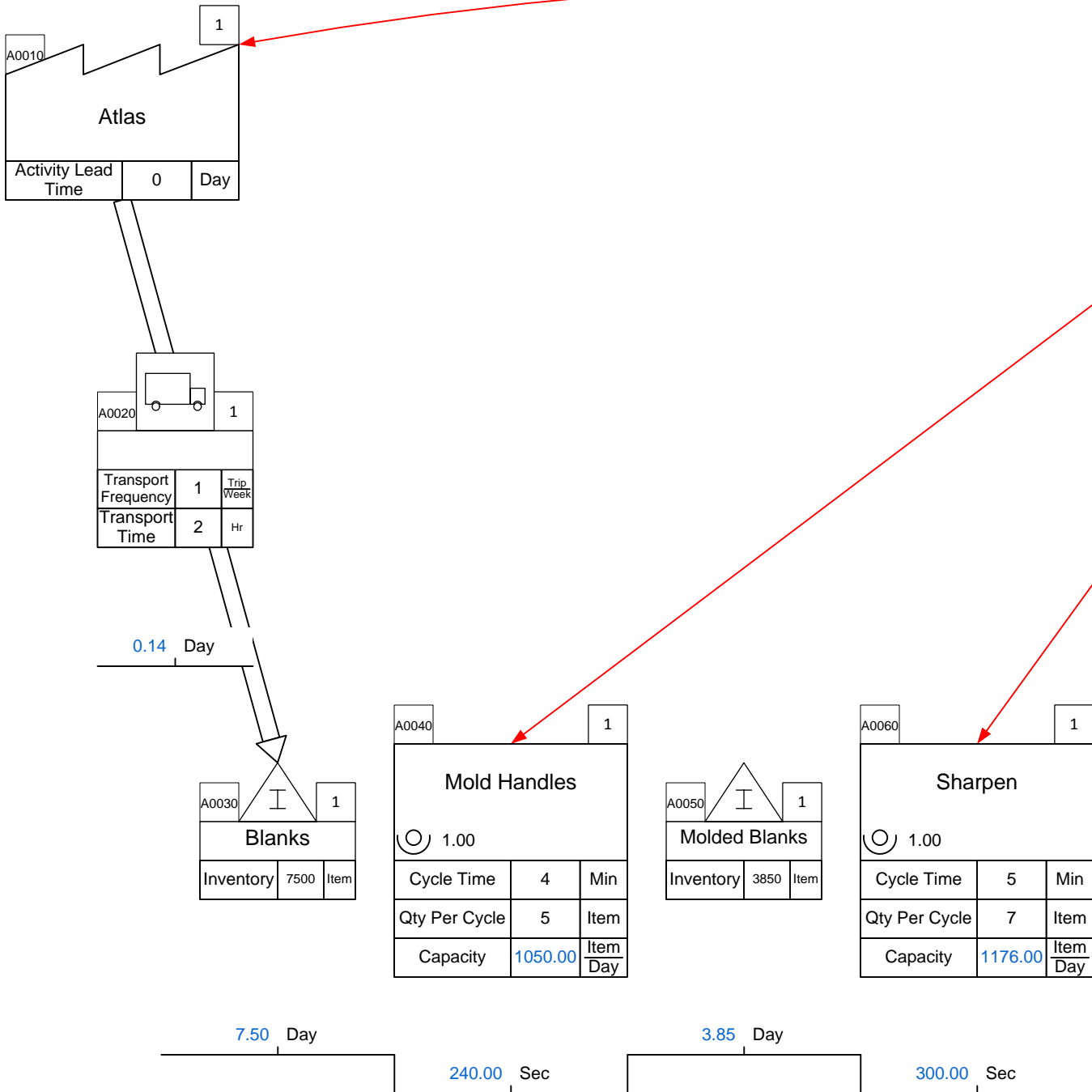
Z0010		all
Time Summary		
Lead Time	5.45	Day
Total Value Added	14.00	Min
Value Added Percent	0.31	%
Takt Time	42.00	Sec Item
Total Cycle Time	840.00	Sec
Process Time Per Unit	109.50	Sec Item

Lead Time value has decreased

# Manufacturing Problem: Scrap

**Problem: An inspection as part of the Assemble activity indicates 10% scrap at this point. Is there still enough capacity to meet customer demand?**

Weekly



Units	Year	Week	Week
	52	70	5
	Week	Hr	day



Control

System

Weekly

A0080 2

Make Box		
☉ 1.00		
Cycle Time	3	Min
Qty Per Cycle	4	Item
Capacity	1120.00	Item Day

A0090 2

Boxes		
Inventory	7000	Item

A0130 all

Customer		
Customer Demand	1000	Item Day
Share %	100	%
Effective Demand	1000.00	Item Day

180.00 Sec

7.00 Day

A0120 #2

Transport		
Transport Frequency	1	Trip Week
Transport Time	4	Hr

0.29 Day

A0070 1

Drilled Blanks		
Inventory	3100	Item

A0100 #2

Assemble		
☉ 2.00		
Cycle Time	6	Min
Qty Per Cycle	10	Item
Capacity	1400.00	Item Day

A0110 #2

Scissors		
Inventory	9000	Item

3.10 Day

360.00 Sec

9.00 Day

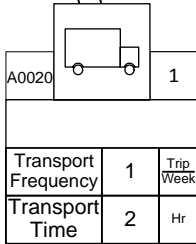
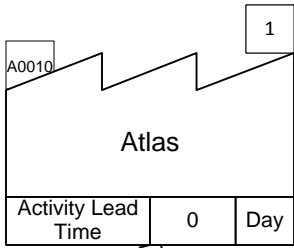
Z0010 1

Time Summary		
Lead Time	23.90	Day
Total Value Added	15.00	Min
Value Added Percent	0.07	%
Takt Time	50.40	Sec Item
Total Cycle Time	900.00	Sec
Process Time Per Unit	126.86	Sec Item

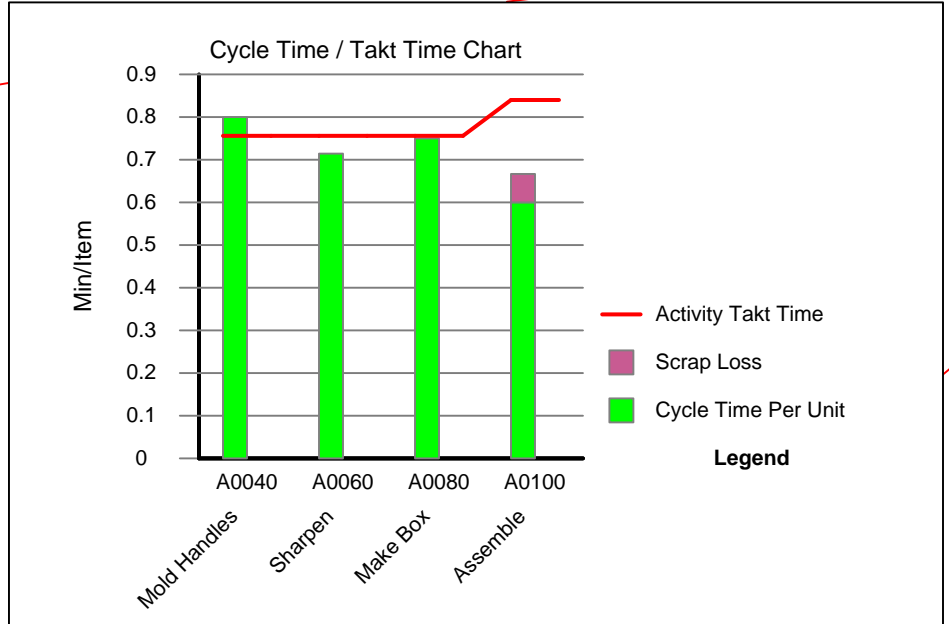
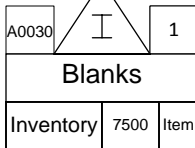
# Manufacturing Solution: Scrap

**Problem:** An inspection as part of the Assemble activity indicates 10% scrap at this point. Is there still enough capacity to meet customer demand?

Weekly



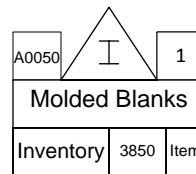
0.14 Day



## Answer:

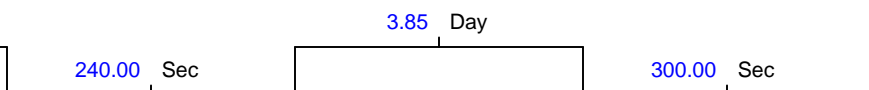
The Scrap loss at the Mold Handles activity reduces Takt Times upstream such that there is inadequate Capacity.

A0040	1
<b>Mold Handles</b>	
⊙ 1.00	
Cycle Time	4 Min
Qty Per Cycle	5 Item
Capacity	1050.00 Item/Day
Pre OEE Capacity	1050.00 Item/Day
OEE Percent	100.00 %
Activity Takt Time	45.36 Sec/Item



A0060	1
<b>Sharpen</b>	
⊙ 1.00	
Cycle Time	5 Min
Qty Per Cycle	7 Item
Capacity	1176.00 Item/Day
Pre OEE Capacity	1176.00 Item/Day
OEE Percent	100.00 %
Activity Takt Time	45.36 Sec/Item

Units	Year	We	7.50 Day
	52	70	5
	Week	Hr	day



Control

System

Weekly

A0080	2	
<b>Make Box</b>		
☉ 1.00		
Cycle Time	3	Min
Qty Per Cycle	4	Item
Capacity	1120.00	Item Day
Pre OEE Capacity	1120.00	Item Day
OEE Percent	100.00	%
Activity Takt Time	45.36	Sec Item

A0090	I	2
<b>Boxes</b>		
Inventory	7000	Item

A0130	all	
<b>Customer</b>		
Customer Demand	1000	Item Day
Share %	100	%
Effective Demand	1000.00	Item Day

A0120	#2	
<b>Transport</b>		
Transport Frequency	1	Trip Week
Transport Time	4	Hr

180.00	Sec
--------	-----

7.00 Day

0.29 Day

A0070	I	1
<b>Drilled Blanks</b>		
Inventory	3100	Item

A0100	#2	
<b>Assemble</b>		
☉ 2.00		
Cycle Time	6	Min
Qty Per Cycle	10	Item
Capacity	1260.00	Item Day
Pre OEE Capacity	1400.00	Item Day
OEE Percent	90.00	%
Activity Takt Time	50.40	Sec Item
Scrap Percent	10	%

A0110	I	#2
<b>Scissors</b>		
Inventory	9000	Item

Z0010	1	
<b>Time Summary</b>		
Lead Time	23.90	Day
Total Value Added	15.00	Min
Value Added Percent	0.07	%
Takt Time	50.40	Sec Item
Total Cycle Time	900.00	Sec
Process Time Per Unit	126.86	Sec Item

3.10 Day

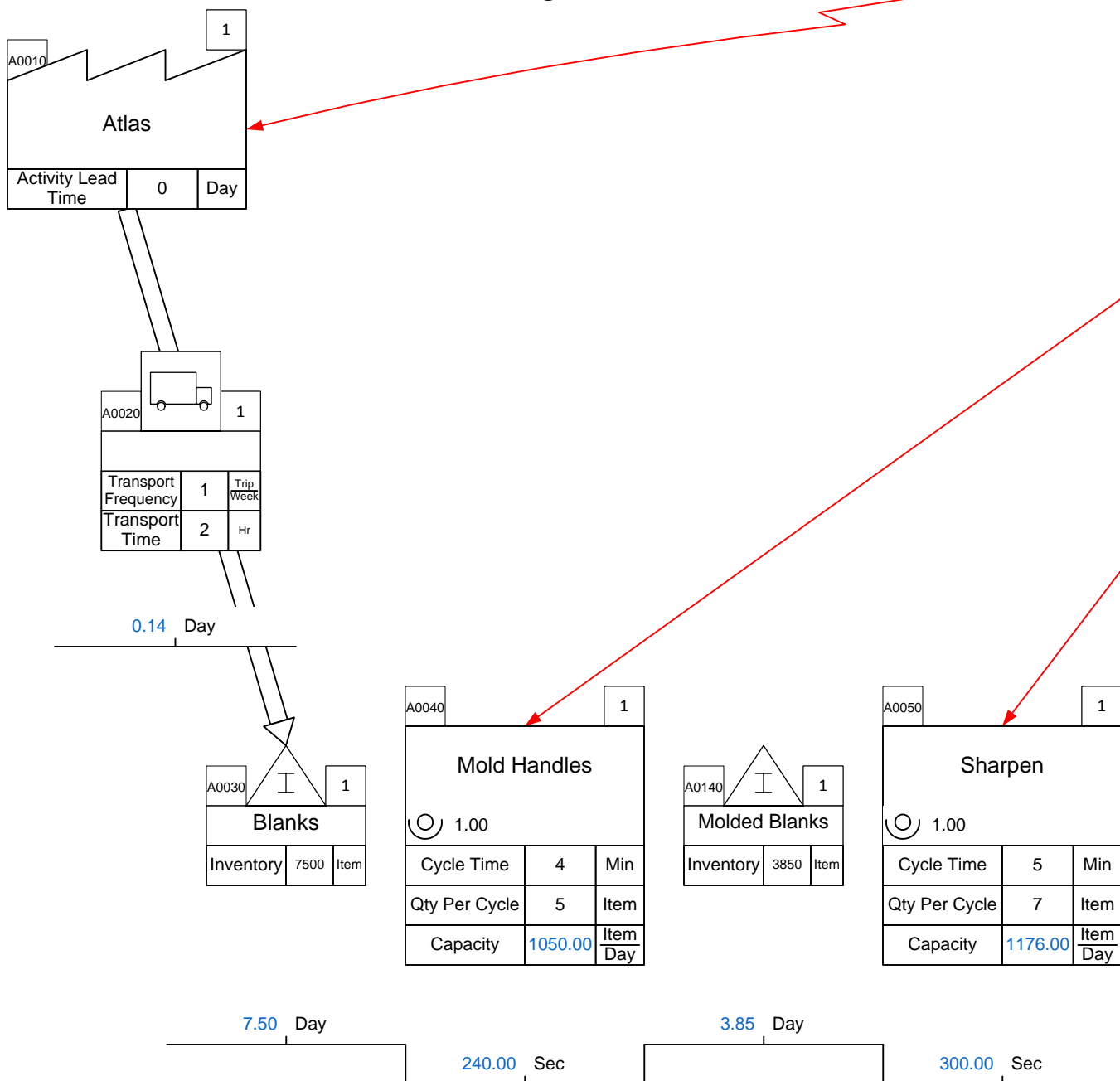
360.00 Sec

9.00 Day

# Manufacturing Problem: Cost

**Problem:** The cost of blanks at Atlas is \$5 per item. Mold Handles add \$2.50, Sharpen adds \$1, Assemble adds \$0.5, and Make Box adds \$0.05.

Each of the transport legs adds \$0.2 per item. Calculate and visualize the added cost and cumulative cost through the value stream.



Units	Year	Week	Week
	52	70	5
	Week	Hr	day



Weekly

Customer		
Customer Demand	1000	Item Day
Share %	100	%
Effective Demand	1000.00	Item Day

Make Box		
1.00		
Cycle Time	3	Min
Qty Per Cycle	4	Item
Capacity	1120.00	Item Day

Boxes		
Inventory	7000	Item

180.00 Sec

7.00 Day

Transport		
Transport Frequency	1	Trip Week
Transport Time	4	Hr

0.29 Day

Drilled Blanks		
Inventory	3100	Item

Assemble		
2.00		
Cycle Time	6	Min
Qty Per Cycle	10	Item
Capacity	1400.00	Item Day

Scissors		
Inventory	9000	Item

3.10 Day

360.00 Sec

9.00 Day

Time Summary		
Lead Time	23.90	Day
Total Value Added	15.00	Min
Value Added Percent	0.07	%
Takt Time	50.40	Sec Item
Total Cycle Time	900.00	Sec
Process Time Per Unit	126.86	Sec Item

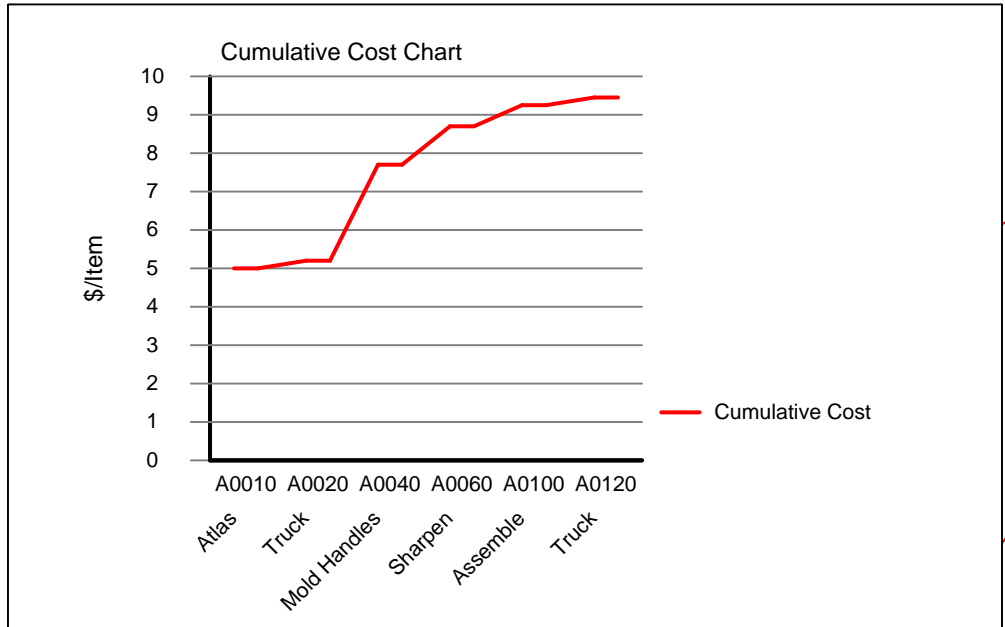
# Manufacturing Solution: Cost

**Problem:** The cost of blanks at Atlas is \$5 per item. Mold Handles add \$2.50, Sharpen adds \$1, Assemble adds \$0.5, and Make Box adds \$0.05.

Each of the transport legs adds \$0.2 per item. Calculate and visualize the added cost and cumulative cost through the value stream.

Weekly

A0010 Atlas		
Activity Lead Time	0	Day
Added Cost	5	\$/Item
Cumulative Cost	5.00	\$/Item



A0020 Truck		
Transport Frequency	1	Trip/Week
Transport Time	2	Hr
Cumulative Cost	5.20	\$/Item
Added Cost	0.2	\$/Item

0.14 Day

A0030 Blanks		
Inventory	7500	Item
Cumulative Cost	5.20	\$/Item
Added Cost	0.00	\$/Item

A0040 Mold Handles		
☉ 1.00		
Cycle Time	4	Min
Qty Per Cycle	5	Item
Capacity	1050.00	Item/Day
Added Cost	2.5	\$/Item
Cumulative Cost	7.70	\$/Item

A0050 Molded Blanks		
Inventory	3850	Item
Cumulative Cost	7.70	\$/Item
Added Cost	0.00	\$/Item

A0060 Sharpen		
☉ 1.00		
Cycle Time	5	Min
Qty Per Cycle	7	Item
Capacity	1176.00	Item/Day
Added Cost	1	\$/Item
Cumulative Cost	8.70	\$/Item

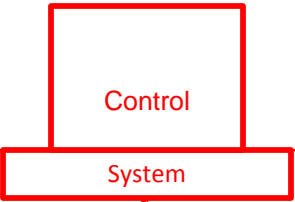
7.50 Day

3.85 Day

240.00 Sec

300.00 Sec

Units	Year	Week	Week
	52	70	5
	Week	Hr	day



Weekly

### Answer:

	Added Cost (\$/Item)
	Cumulative Cost (\$/Item)
0.9 in = 5 \$/Item	

Customer		
Customer Demand	1000	Item Day
Share %	100	%
Effective Demand	1000.00	Item Day

Make Box		
Cycle Time	3	Min
Qty Per Cycle	4	Item
Capacity	1120.00	Item Day
Added Cost	0.05	\$/Item
Cumulative Cost	0.05	\$/Item

Boxes		
Inventory	7000	Item
Cumulative Cost	0.05	\$/Item
Added Cost	0.00	\$/Item

Truck		
Transport Frequency	1	Trip Week
Transport Time	4	Hr
Cumulative Cost	9.45	\$/Item
Added Cost	0.2	\$/Item

7.00 Day

0.29 Day

Drilled Blanks		
Inventory	3100	Item
Cumulative Cost	8.70	\$/Item
Added Cost	0.00	\$/Item

Assemble		
Cycle Time	6	Min
Qty Per Cycle	10	Item
Capacity	1400.00	Item Day
Added Cost	0.5	\$/Item
Cumulative Cost	9.25	\$/Item

Scissors		
Inventory	9000	Item
Cumulative Cost	9.25	\$/Item
Added Cost	0.00	\$/Item

Time Summary		
Lead Time	23.90	Day
Total Value Added	15.00	Min
Value Added Percent	0.07	%
Takt Time	50.40	Sec Item
Total Cycle Time	900.00	Sec
Process Time Per Unit	126.86	Sec Item

3.10 Day

9.00 Day

360.00 Sec

# Manufacturing Problem: Annual Carrying Cost

**Problem:** You want to estimate the annual carrying cost of the inventory in the plant. You know that the Cost of Capital is 8%, Inventory Obsolescence is 1%, and Inventory Insurance is 1%. How much would you save annually in carrying costs if you reduced the finished goods inventory to 3000 items in conjunction with more frequent customer deliveries?

Weekly

A0010			1
Atlas			
Activity Lead Time	0	Day	
Added Cost	5	\$	Item
Cumulative Cost	5.00	\$	Item

A0020			1
Truck			
Transport Frequency	1	Trip	Week
Transport Time	2	Hr	
Cumulative Cost	5.20	\$	Item
Added Cost	0.2	\$	Item

0.14 Day

A0030			1
Blanks			
Inventory	7500	Item	
Cumulative Cost	5.20	\$	Item
Added Cost	0.00	\$	Item

A0040			1
Mold Handles			
Inventory	1.00	Item	
Cycle Time	4	Min	
Qty Per Cycle	5	Item	
Capacity	1050.00	Item	Day
Added Cost	2.5	\$	Item
Cumulative Cost	7.70	\$	Item

A0050			1
Molded Blanks			
Inventory	3850	Item	
Cumulative Cost	7.70	\$	Item
Added Cost	0.00	\$	Item

A0060			1
Sharpen			
Inventory	1.00	Item	
Cycle Time	5	Min	
Qty Per Cycle	7	Item	
Capacity	1176.00	Item	Day
Added Cost	1	\$	Item
Cumulative Cost	8.70	\$	Item

7.50 Day

3.85 Day

240.00 Sec

300.00 Sec

Units	Year	Week	Week
	52	70	5
	Week	Hr	day





Weekly

Customer		
Customer Demand	1000	Item Day
Share %	100	%
Effective Demand	1000.00	Item Day

Make Box		
Cycle Time	3	Min
Qty Per Cycle	4	Item
Capacity	1120.00	Item Day
Added Cost	0.05	\$ Item
Cumulative Cost	0.05	\$ Item

Boxes		
Inventory	7000	Item
Cumulative Cost	0.05	\$ Item
Added Cost	0.00	\$ Item

Truck		
Transport Frequency	1	Trip Week
Transport Time	4	Hr
Cumulative Cost	9.45	\$ Item
Added Cost	0.2	\$ Item

180.00	Sec
--------	-----

7.00 Day

0.29 Day

Drilled Blanks		
Inventory	3100	Item
Cumulative Cost	8.70	\$ Item
Added Cost	0.00	\$ Item

Assemble		
Cycle Time	6	Min
Qty Per Cycle	10	Item
Capacity	1400.00	Item Day
Added Cost	0.5	\$ Item
Cumulative Cost	9.25	\$ Item

Scissors		
Inventory	9000	Item
Cumulative Cost	9.25	\$ Item
Added Cost	0.00	\$ Item

3.10 Day

360.00 Sec

9.00 Day

Time Summary		
Lead Time	23.90	Day
Total Value Added	15.00	Min
Value Added Percent	0.07	%
Takt Time	50.40	Sec Item
Total Cycle Time	900.00	Sec
Process Time Per Unit	126.86	Sec Item

# Manufacturing Solution: Annual Carrying Cost

**Problem:** You want to estimate the annual carrying cost of the inventory in the plant. You know that the Cost of Capital is 8%, Inventory Obsolescence is 1%, and Inventory Insurance is 1%. How much would you save annually in carrying costs if you reduced the finished goods inventory to 3000 items in conjunction with more frequent customer deliveries?

A0010			1		
Atlas					
Activity Lead Time	0	Day			
Added Cost	5	\$/Item			
Cumulative Cost	5.00	\$/Item			

Weekly

**Answer:**

The current state annual inventory carry cost is 17.92 K\$.

A0020			1		
Truck					
Transport Frequency	1	Trip/Week			
Transport Time	2	Hr			
Cumulative Cost	5.20	\$/Item			
Added Cost	0.2	\$/Item			

0.14 Day

A0030			1		
Blanks					
Inventory	7500	Item			
Cumulative Cost	5.20	\$/Item			
Added Cost	0.00	\$/Item			

A0040			1		
Mold Handles					
Inventory	1.00	Item			
Cycle Time	4	Min			
Qty Per Cycle	5	Item			
Capacity	1050.00	Item/Day			
Added Cost	2.5	\$/Item			
Cumulative Cost	7.70	\$/Item			

A0050			1		
Molded Blanks					
Inventory	3850	Item			
Cumulative Cost	7.70	\$/Item			
Added Cost	0.00	\$/Item			

A0060			1		
Sharpen					
Inventory	1.00	Item			
Cycle Time	5	Min			
Qty Per Cycle	7	Item			
Capacity	1176.00	Item/Day			
Added Cost	1	\$/Item			
Cumulative Cost	8.70	\$/Item			

7.50 Day

3.85 Day

240.00 Sec

300.00 Sec

Units	Year	Week	Week
	52	70	5
	Week	Hr	day

Control

System

Weekly

A0080	2	
<b>Make Box</b>		
⊙ 1.00		
Cycle Time	3	Min
Qty Per Cycle	4	Item
Capacity	1120.00	Item Day
Added Cost	0.05	\$ Item
Cumulative Cost	0.05	\$ Item

A0090	2	
<b>Boxes</b>		
Inventory	7000	Item
Cumulative Cost	0.05	\$ Item
Added Cost	0.00	\$ Item

A0130	all	
<b>Customer</b>		
Customer Demand	1000	Item Day
Share %	100	%
Effective Demand	1000.00	Item Day

A012	#2	
<b>Truck</b>		
Transport Frequency	1	Trip Week
Transport Time	4	Hr
Cumulative Cost	9.45	\$ Item
Added Cost	0.2	\$ Item

7.00 Day

180.00 Sec

0.29 Day

A0070	1	
<b>Drilled Blanks</b>		
Inventory	3100	Item
Cumulative Cost	8.70	\$ Item
Added Cost	0.00	\$ Item

A0100	#2	
<b>Assemble</b>		
⊙ 2.00		
Cycle Time	6	Min
Qty Per Cycle	10	Item
Capacity	1400.00	Item Day
Added Cost	0.5	\$ Item
Cumulative Cost	9.25	\$ Item

A0110	#2	
<b>Scissors</b>		
Inventory	9000	Item
Cumulative Cost	9.25	\$ Item
Added Cost	0.00	\$ Item

Z0011	all	
<b>Inventory Carry Cost Factors as % of Inventory Value</b>		
Total Carrying Costs	10.00	%
Cost Of Capital	8	%
Inventory Damages	0	%
Insurance On Inventory	1	%
Inventory Obsolescence	1	%
Inventory Shrinkage	0	%

Z0020	all	
<b>Inv Carry Cost Summary</b>		
Total Annual Inv Carry Cost	17.92	K\$

3.10 Day

360.00 Sec

9.00 Day

Z0010	1	
<b>Time Summary</b>		
Lead Time	23.90	Day
Total Value Added	15.00	Min
Value Added Percent	0.07	%
Takt Time	50.40	Sec Item
Total Cycle Time	900.00	Sec
Process Time Per Unit	126.86	Sec Item

# Manufacturing Solution: Annual Carrying Cost

**Problem:** You want to estimate the annual carrying cost of the inventory in the plant. You know that the Cost of Capital is 8%, Inventory Obsolescence is 1%, and Inventory Insurance is 1%. How much would you save annually in carrying costs if you reduced the finished goods inventory to 3000 items in conjunction with more frequent customer deliveries?

A0010			1		
Atlas					
Activity Lead Time	0	Day			
Added Cost	5	\$/Item			
Cumulative Cost	5.00	\$/Item			

Weekly

## Answer:

The future state annual inventory carry cost is 12.37 K\$, so the annual cost difference is a 5.55 K\$ savings.

A0020			1		
Truck					
Transport Frequency	1	Trip/Week			
Transport Time	2	Hr			
Cumulative Cost	5.20	\$/Item			
Added Cost	0.2	\$/Item			

0.14 Day

A0030			1		
Blanks					
Inventory	7500	Item			
Cumulative Cost	5.20	\$/Item			
Added Cost	0.00	\$/Item			

A0040			1		
Mold Handles					
Inventory	1.00	Item			
Cycle Time	4	Min			
Qty Per Cycle	5	Item			
Capacity	1050.00	Item/Day			
Added Cost	2.5	\$/Item			
Cumulative Cost	7.70	\$/Item			

A0050			1		
Molded Blanks					
Inventory	3850	Item			
Cumulative Cost	7.70	\$/Item			
Added Cost	0.00	\$/Item			

A0060			1		
Sharpen					
Inventory	1.00	Item			
Cycle Time	5	Min			
Qty Per Cycle	7	Item			
Capacity	1176.00	Item/Day			
Added Cost	1	\$/Item			
Cumulative Cost	8.70	\$/Item			

7.50 Day

3.85 Day

240.00 Sec

300.00 Sec

Units	Year	Week	Week
	52	70	5
	Week	Hr	day



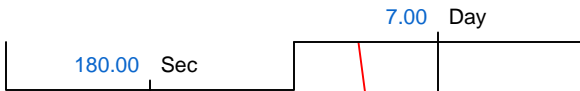
Weekly

Customer		
Customer Demand	1000	Item Day
Share %	100	%
Effective Demand	1000.00	Item Day

Make Box		
1.00		
Cycle Time	3	Min
Qty Per Cycle	4	Item
Capacity	1120.00	Item Day
Added Cost	0.05	\$ Item
Cumulative Cost	0.05	\$ Item

Boxes		
Inventory 7000 Item		
Cumulative Cost	0.05	\$ Item
Added Cost	0.00	\$ Item

Truck		
Transport Frequency	1	Trip Week
Transport Time	4	Hr
Cumulative Cost	9.45	\$ Item
Added Cost	0.2	\$ Item



Assemble		
2.00		
Cycle Time	6	Min
Qty Per Cycle	10	Item
Capacity	1400.00	Item Day
Added Cost	0.5	\$ Item
Cumulative Cost	9.25	\$ Item

Scissors		
Inventory 3000 Item		
Cumulative Cost	9.25	\$ Item
Added Cost	0.00	\$ Item

Inventory Carry Cost Factors as % of Inventory Value		
Total Carrying Costs	10.00	%
Cost Of Capital	8	%
Inventory Damages	0	%
Insurance On Inventory	1	%
Inventory Obsolescence	1	%
Inventory Shrinkage	0	%

Inv Carry Cost Summary		
Total Annual Inv Carry Cost	12.37	K\$

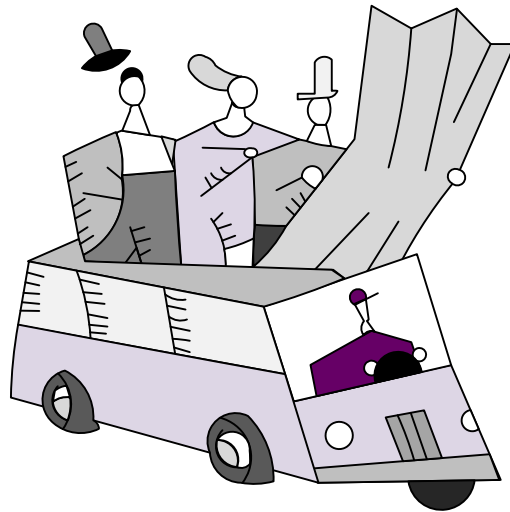


Time Summary		
Lead Time	17.90	Day
Total Value Added	15.00	Min
Value Added Percent	0.10	%
Takt Time	50.40	Sec Item
Total Cycle Time	900.00	Sec
Process Time Per Unit	126.86	Sec Item



# Inbound and Outbound Maps

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## Manufacturing Network Shapes

A0010		
<b>Customer</b>		
Customer Demand	xx	Item Week
Cumulative Avg Cost	Auto	\$ Item
Cumulative Avg Time	Auto	Week

**The Customer Center is used at the end of a map to show the demand for each product.**

Customer Demand: The periodic demand for goods produced by this value stream.

Cumulative Average Cost: Cumulative average cost of items at this point in the value stream.

Cumulative Average Time: Cumulative average time at this point in the value stream.

A0030		
<b>Warehouse or Mixing Center</b>		
Added Cost	0	\$ Item
Inventory	0	Item
Utilization	0	%
Share	100	%
Demand	Auto	Item Week
Cumulative Avg Cost	Auto	\$ Item
Inventory Time	Auto	Day
Inventory Value	Auto	K\$
Cumulative Avg Time	Auto	Week

**The Warehouse or Mixing Center shows where multiple shipments are sent, mixed, and then re-shipped.**

Added Cost: Added cost due to this step in the value stream.

Inventory: The number of items waiting to be worked upon.

Utilization: Percent of this facilities capacity that is currently utilized.

Share: Percent of output or inventory attributable to this value stream

Demand: The demand for product at this point.

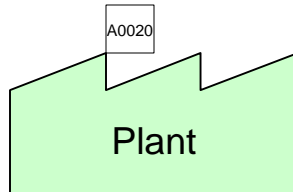
Cumulative Average Cost: Cumulative average cost of items at this point in the value stream

Inventory Time: The time value associated with this inventory.

Inventory Value: The total value of inventory at this location.

Cumulative Average Time: Cumulative average time at this point in the value stream.



 <b>Plant</b>		
Added Cost	0	\$ Item
Inventory	0	Item
Utilization	0	%
Share	100	%
Demand	Auto	Item Week
Cumulative Avg Cost	Auto	\$ Item
Inventory Time	Auto	Day
Inventory Value	Auto	K\$
Cumulative Avg Time	Auto	Week

**The Plant Center shows the amount of inventory held and the costs and data associated with that inventory.**

Added Cost: Added cost due to this step in the value stream.

Inventory: The number of items waiting to be worked upon.

Utilization: Percent of this facilities capacity that is currently utilized.

Share: Percent of output or inventory attributable to this value stream

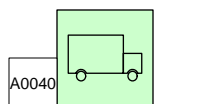
Demand: The demand for product at this point.

Cumulative Average Cost: Cumulative average cost of items at this point in the value stream

Inventory Time: The time value associated with this inventory.

Inventory Value: The total value of inventory at this location.

Cumulative Average Time: Cumulative average time at this point in the value stream.

 <b>Transport</b>		
Added Cost	0	\$ Item
Transport Time	0	Hr
Transport Frequency	0	Trip Week
Transport Inventory	Auto	Item
Demand	Auto	Item Week
Cumulative Avg Cost	Auto	\$ Item
Inventory Value	Auto	K\$
Cumulative Avg Time	Auto	Week

**The Transport Center tracks shipments and the associated times and costs with each shipment.**

Added Cost: Added cost due to this step in the value stream.

Transport Time: The time taken to deliver items.

Transport Frequency: Trips per time period

Transport Inventory: The quantity of inventory on this transport.

Demand: The demand for product at this point.

Cumulative Average Cost: Cumulative average cost of items at this point in the value stream

Inventory Value: The total value of inventory at this location.

Cumulative Average Time: Cumulative average time at this point in the value stream.

# ACME Case Study – Inbound

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## Exercise

With your group, read the information below and then:

1. Draw a wall value stream map for the inbound shipments to the plant.
2. Show the data associated with the supplier, transportation, and any costs.
3. Calculate the cumulative costs per step to determine the final cost of the materials when they reach the plant.
4. Calculate the demand for the castings and steel rolls and then the demand for each of the suppliers.
5. Identify useful summary metrics for the map.
6. Identify what charts would be useful to visualize the value stream and mark these up.

## Background and Overview

ACME, founded in 1965, specializes in high-quality surgical instruments and has recently added surgical, re-usable, double-action cutters to its catalog, retailing at \$90 per set. Each set consists of four cast pieces which are outsourced to Tower Hills Foundry. The castings are machined, polished, and sent to the final assembly line. The metal for the springs is supplied by Fornost Quality steelworks in steel rolls which are broken down into springs and assembled with the castings. One casting set and one spring set makes one final Surgical Cutter. Finally, the finished product is sent to two warehouses then shipped to the two customers.

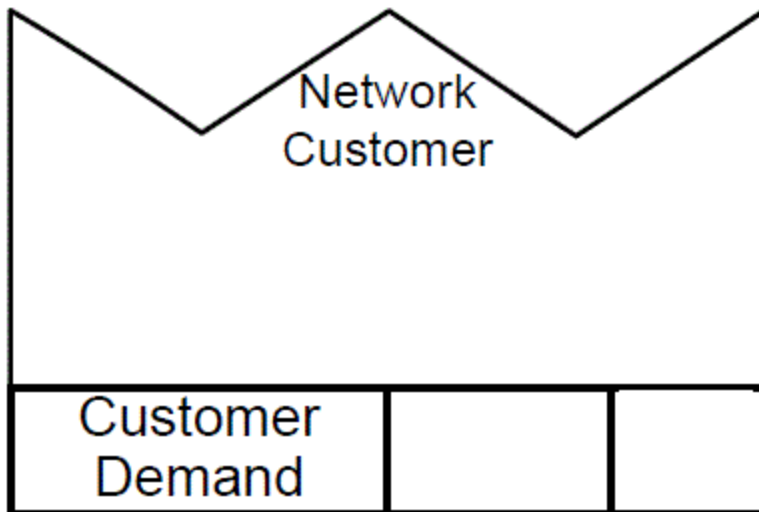
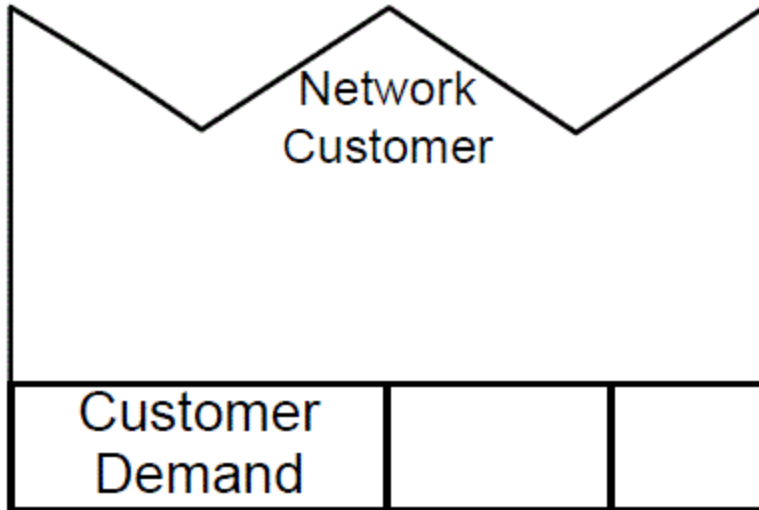
The inbound value stream shows how ACME buys the casting sets and spring steel rolls from Tower Hills Foundry and Fornost Quality Steelworks and has the materials shipped to the plant.

## Value Stream Walk

To capture the current state value stream, you meet the purchasing supervisor on Monday morning. The casting sets are supplied by Tower Hills Foundry, who charge \$35 per set and have an inventory of 200 sets. They have a utilization of 90% and ACME purchases 75% of their casting sets. ACME gets 3 shipments from Tower Hills Foundry each week with each shipment taking 2 hours and adding an additional \$2.00 in shipping costs per set. ACME needs 500 casting sets each week.

The spring steel rolls are supplied by Fornost Quality Steelworks. ACME will eventually break down the steel rolls to springs, with each roll yielding 100 spring sets. Fornost Quality Steelworks has a utilization of 50% and ACME is their only customer. This supplier charges \$270 per steel roll and currently holds 20 rolls at their warehouse. Fornost sends 1 shipment per week, which takes 4 hours and adds an additional cost of \$30 per roll. ACME needs 10 spring steel rolls per week, which creates 1000 spring sets.





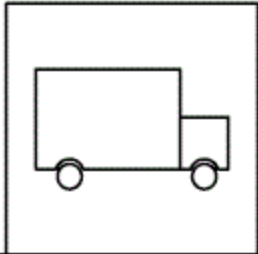


Network Plant Center		
Added Cost		<u>\$</u>
Inventory		
Utilization		%
Share		%

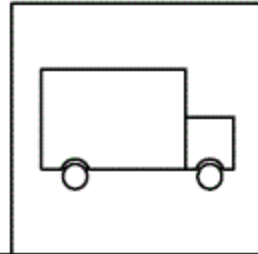
Network Plant Center		
Added Cost		<u>\$</u>
Inventory		
Utilization		%
Share		%



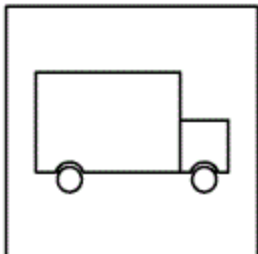




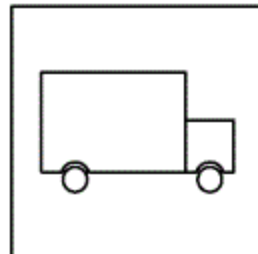
Transport		
Added Cost		\$
Transport Time		
Transport Frequency		<u>Trip</u> Week



Transport		
Added Cost		\$
Transport Time		
Transport Frequency		<u>Trip</u> Week



Transport		
Added Cost		\$
Transport Time		
Transport Frequency		<u>Trip</u> Week



Transport		
Added Cost		\$
Transport Time		
Transport Frequency		<u>Trip</u> Week



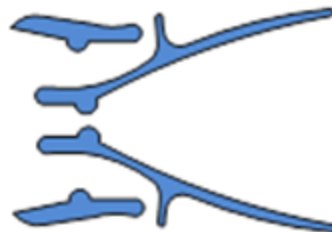
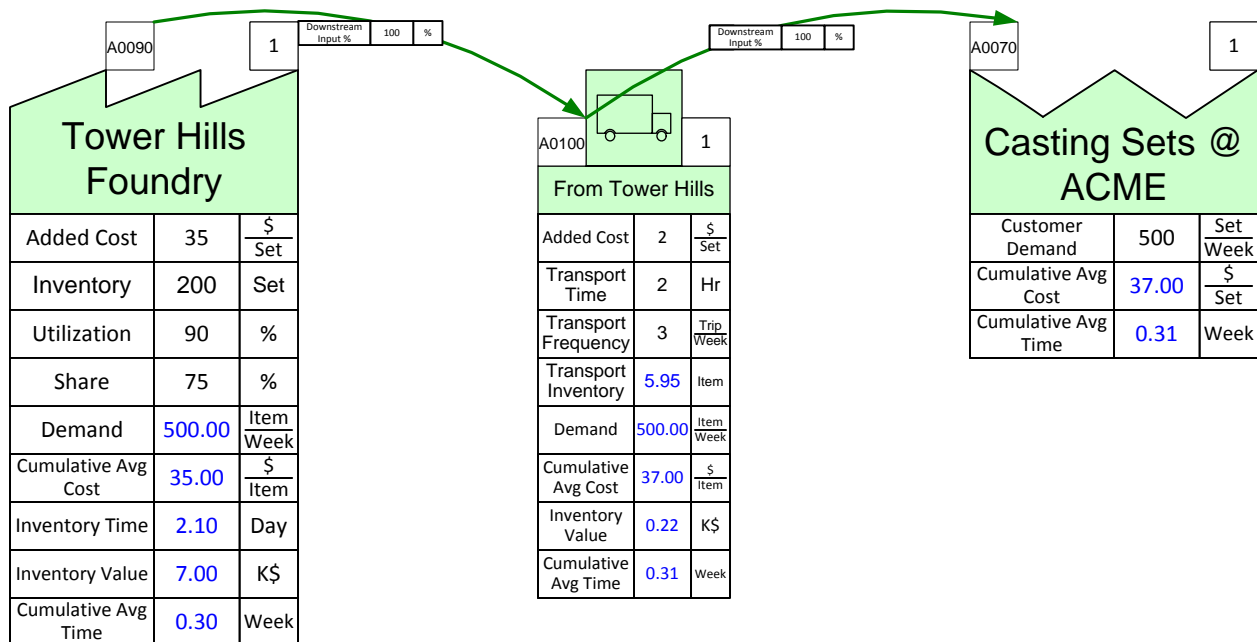
Network Warehouse <input type="checkbox"/>		
Added Cost		$\frac{\$}{\text{Item}}$
Inventory		Item
Utilization		%
Share		%

Network Warehouse <input type="checkbox"/>		
Added Cost		$\frac{\$}{\text{Item}}$
Inventory		Item
Utilization		%
Share		%



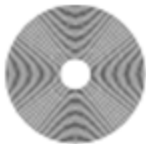
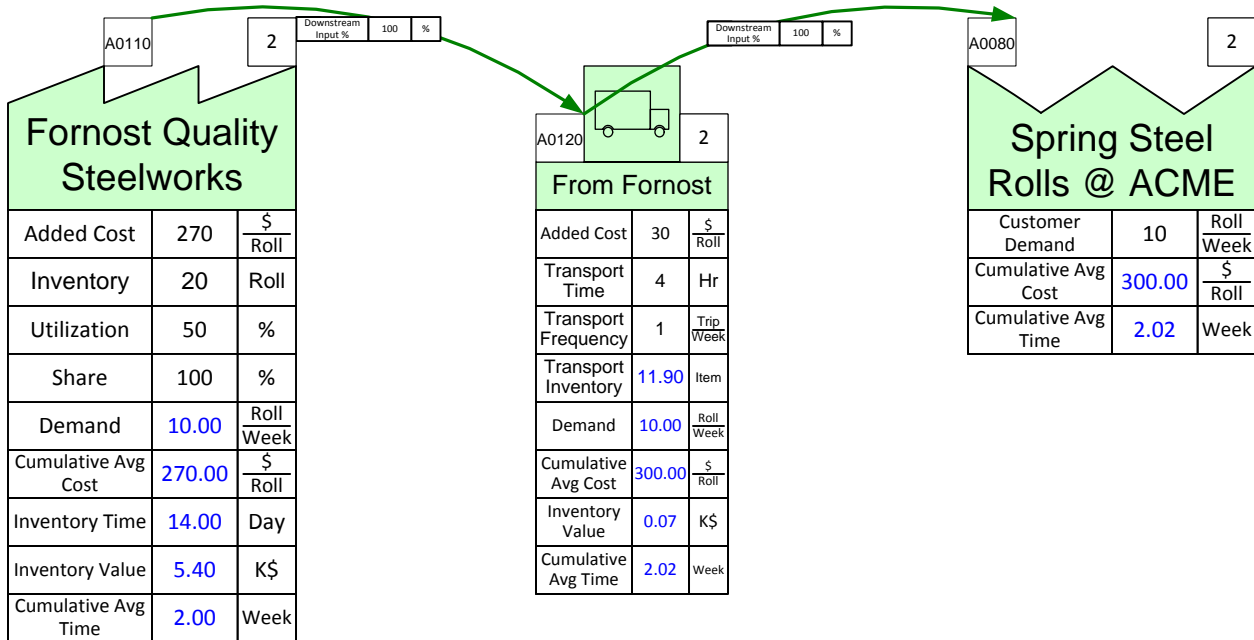
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# Inbound – Casting Sets



In-coming Castings

# Inbound – Spring Steel Rolls



In-coming Spring Steel Coils

Units	Day	Week	Roll	Set	Item
	24	7	100	1	2
	Hr	Day	Spring	Item	Spring

# ACME Case Study – Outbound

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## Exercise

With your group, read the information below and then:

1. Draw a wall value stream map for the product showing the supplier, warehouses, transportation, and customers.
2. Show the data associated with the warehouses, transportation, and customers.
3. Calculate how many days of inventory you have at the plant and warehouses.
4. Calculate the demand at each warehouse and at the ACME plant based on the customer demand.
5. Identify useful summary metrics for the map.
6. Identify what charts would be useful to visualize the value stream and mark these up.

## Background and Overview

ACME, founded in 1965, specializes in high-quality surgical instruments and has recently added surgical, re-usable, double-action cutters to its catalog, retailing at \$90 per set. Each set consists of four cast pieces which are outsourced to Tower Hills Foundry. The castings are machined, polished, and sent to the final assembly line. The metal for the springs is supplied by Fornost Quality steelworks in steel rolls which are broken down into springs and assembled with the castings. One casting set and one spring set makes one final Surgical Cutter. Finally, the finished product is sent to two warehouses then shipped to the two customers.

The outbound operations transport the Surgical Cutters to mixing centers and then to the two customers, Medical Supplies Inc. and USA Surgical Tools.



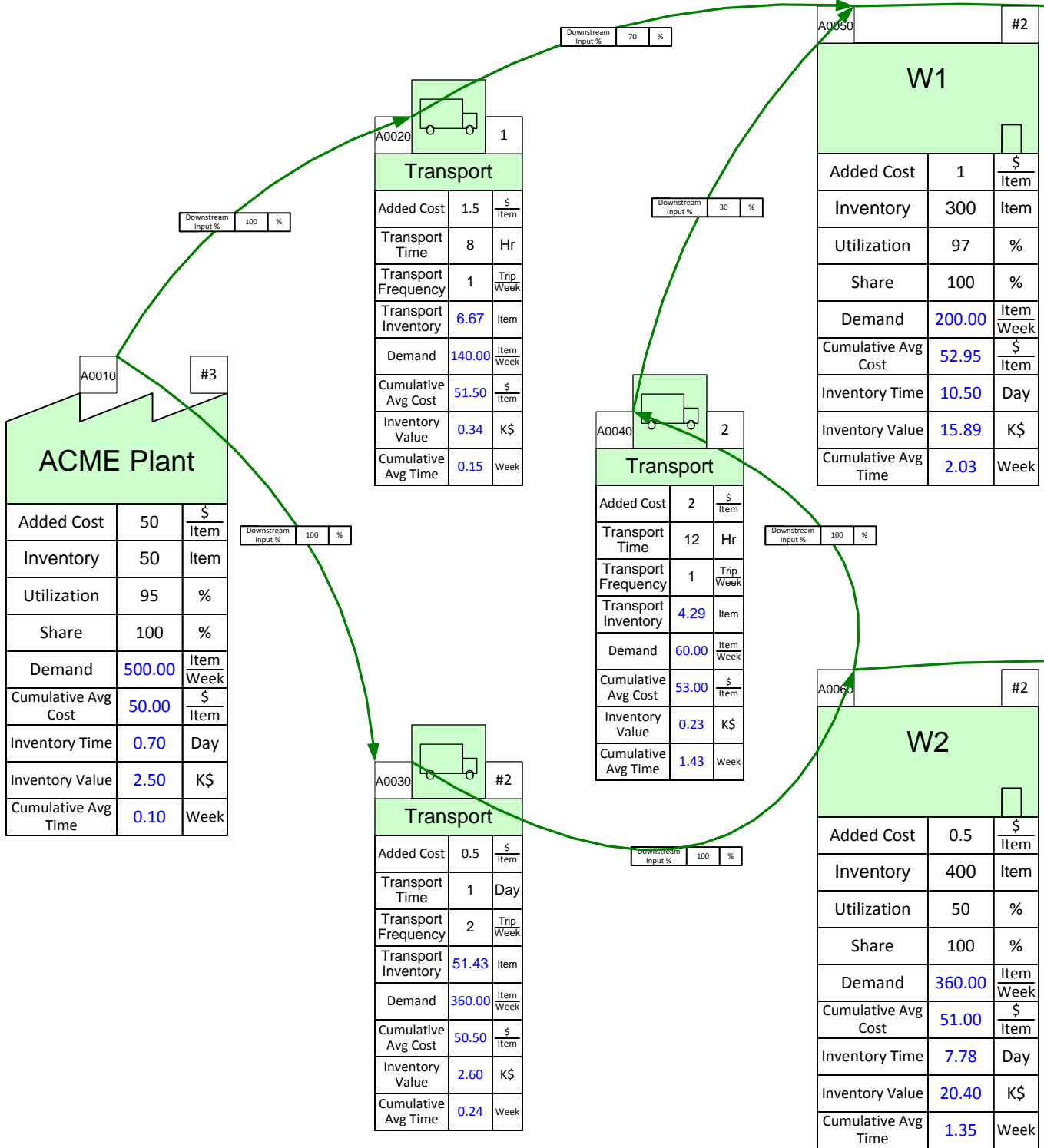
## Value Stream Walk

To capture the current state value stream, you meet the logistics supervisor on Monday afternoon. You learn that the outbound operations transport the Surgical Cutters to two different warehouses. From there, trucks take the product to Medical Supplies Inc. and USA Surgical Tools. Occasionally some cutters have to be shipped from warehouse 2 to warehouse 1.

The logistics supervisor explains how the cutters start at our ACME plant, which currently holds 50 items and has a utilization of 95%. At this point in the value stream, the cutters have incurred a cost of around \$50 each. USA Surgical Tools has a customer demand of 200 cutters per week and is located close to Warehouse 1, which has a utilization of 97%. ACME ships 70% of USA Surgical Tools' demand to Warehouse 1 once per week with the transportation taking 8 hours and costing an additional \$1.50 per item. Warehouse 1 currently holds 300 cutters and incurs an added cost of \$1 per item. The remaining 30% of USA Surgical Tools' demand is sent in a shipment from Warehouse 2 to Warehouse 1 that occurs once per week. The shipping takes 12 hours and adds a cost of \$2 per cutter. Finally, Warehouse 1 ships to USA Surgical Tools 3 times per week, with each trip lasting 2 hours and adding a cost of \$1 per cutter.

Medical Supplies Inc. has a customer demand of 400 Surgical Cutters per week. They receive their product from Warehouse 2, which has a utilization of 50%. Warehouse 2 gets all of its supply directly from the ACME plant. The warehouse currently has 300 cutters and has an additional storage cost of \$0.50 per item. The shipment from the ACME plant to the warehouse takes 1 day and occurs twice per week. Additional transportation costs are \$0.50 per cutter. Medical Supplies Inc. then receives a shipment from Warehouse 2 once per week. The transportation takes 6 hours and adds a cost of \$1.50 per item.

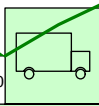
Units	Day	Week
	24	7
	Hr	Day



# Outbound – ACME

Downstream  
Input % 100 %

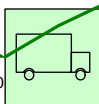
Downstream  
Input % 100 %

A0090		#2
<b>Transport</b>		
Added Cost	1	\$ Item
Transport Time	2	Hr
Transport Frequency	3	Trip Week
Transport Inventory	2.38	Item
Demand	200.00	Item Week
Cumulative Avg Cost	53.95	\$ Item
Inventory Value	0.13	K\$
Cumulative Avg Time	2.04	Week

A0070			#2
<b>USA Surgical Tools</b>			
Customer Demand	200	Item Week	
Cumulative Avg Cost	53.95	\$ Item	
Cumulative Avg Time	2.04	Week	

Downstream  
Input % 100 %

Downstream  
Input % 100 %

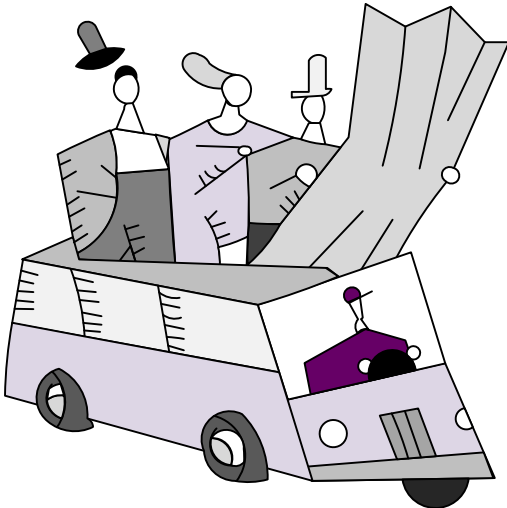
A0100		3
<b>Transport</b>		
Added Cost	1.5	\$ Item
Transport Time	6	Hr
Transport Frequency	1	Trip Week
Transport Inventory	10.71	Item
Demand	300.00	Item Week
Cumulative Avg Cost	52.50	\$ Item
Inventory Value	0.56	K\$
Cumulative Avg Time	1.39	Week

A0080			3
<b>Medical Supplies Inc.</b>			
Customer Demand	300	Item Week	
Cumulative Avg Cost	52.50	\$ Item	
Cumulative Avg Time	1.39	Week	



# Linking Maps Together

---



# Source and Target

## What is it?

- A way to link values on one or more maps
- All of the linked maps must be in the same file
- A means to write simple equations (sum, min, max, average) visually and to link multiple source values to a target value
- Source values get updated on every “Solve”.

## How does it work?

- Connect source shapes from the Quick Extras stencil to the source variables and give them an ID (like “SI”)
- Connect target shape from the Quick Extras stencil to the target variable and select one of sum, avg, min, or max as the operator
- If the source and target shapes are on separate pages, then point the source page to the target page
  - Via “Source/Target Pages” button in the Name and Unit Manager
- Use the “Solve” button to update source variables

The ACME Plant is part of an extended value stream. The demand and cost flow through the extended stream such that changes in the end customer demand ripple through the whole stream.

## Linking Demand

Demand starts at the customer shape on the outbound map and must be linked back to a demand on the plant and via that to demand on the suppliers.

## Linking Cost

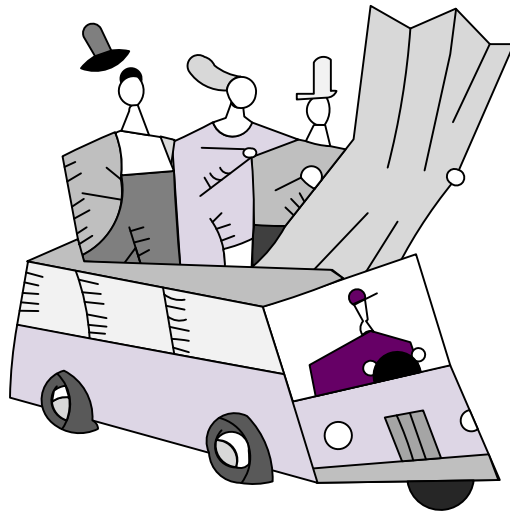
Cost starts accumulating at the suppliers and must be linked forward so that cumulative cost is visible at all points in the value stream and leading to a delivered cost at each customer.

## eVSM Workshop

1. Open the file with the 3 maps (Inbound, Plant, Outbound).
2. From the Quick Extras stencil, glue a “Source Shape” called “OD” to the ACME Plant “Demand” value on the Outbound map. We want to use this value for the demand on the plant map.
3. Add a “Target Shape” called “OD” to the Customer Demand variable on the Plant map. Click on the “Name and Unit Manager” button in the toolbar and use the “Source/Target” pages to select the “Outbound” page.
4. Solve the Plant map.
5. Add a “Source Shape” called “CSD” to the “Inventory” variable in the “Casting Sets” inventory on the Plant map.
6. Add a “Source Shape” called “SD” to the “Inventory” variable in the “Springs” inventory on the Plant map.
7. Add “Target Shapes” called “CSD” and “SD” to the appropriate “Customer Demand” values on the Inbound map, and use the Name and Unit Manager to access the “Source/Target Pages” button and select the “Plant” page.
8. Solve the Inbound map.
9. Do a “What-If” study where you change the demand for Medical Supplies Inc. to 325 Items/Week and need to understand the resulting weekly demand for Casting Sets.



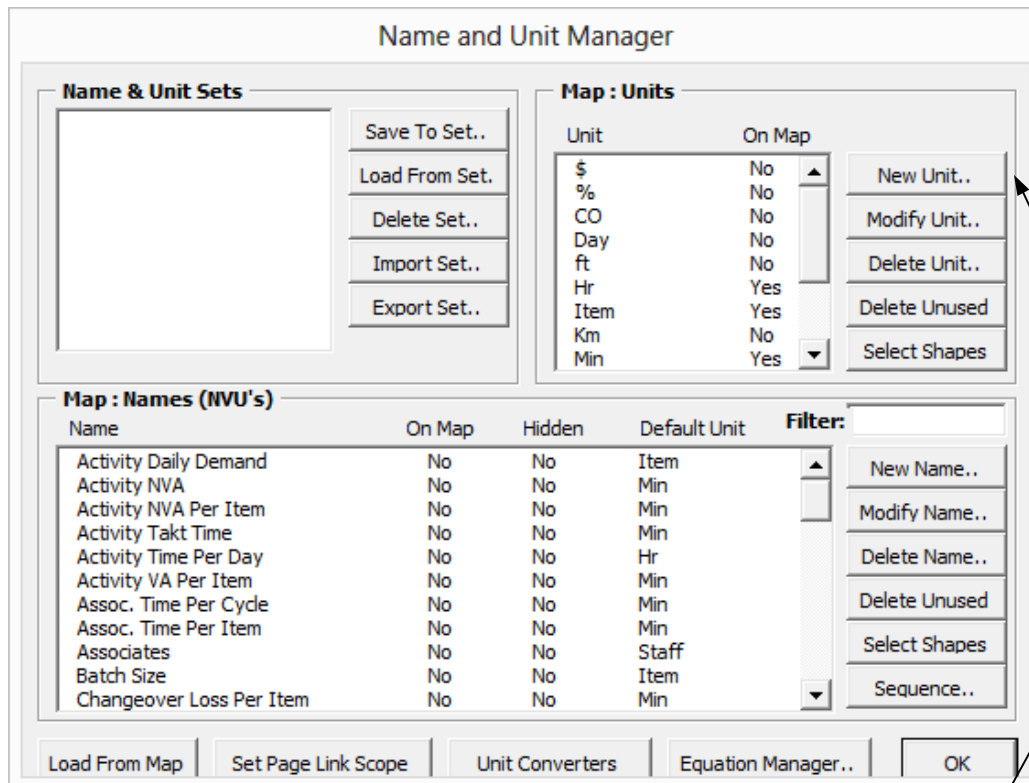




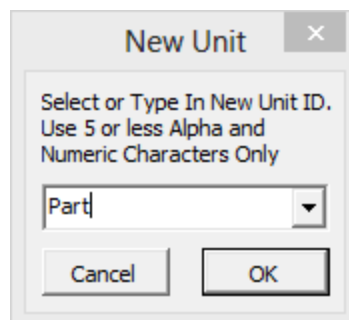
## Units Handling

If you want to create a custom unit that you would like to use throughout the map, start with the Name and Unit Manager. If you want to use a built-in unit but need to convert it, such as Weeks to Days, start with Step 3.

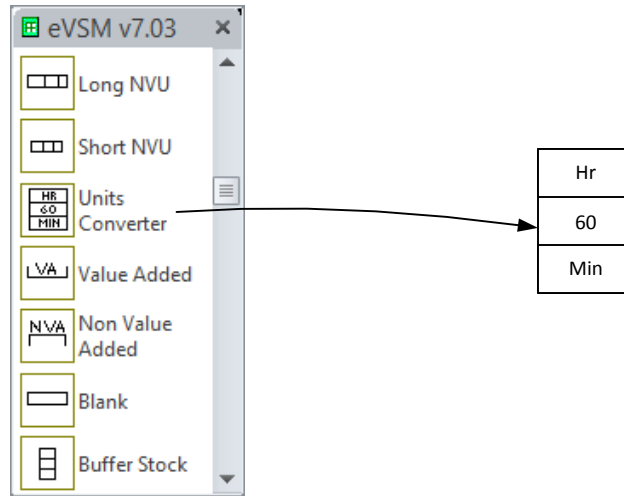
1. Click the Name and Unit Manager button in the eVSM toolbar.



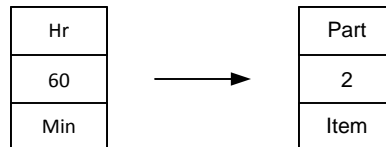
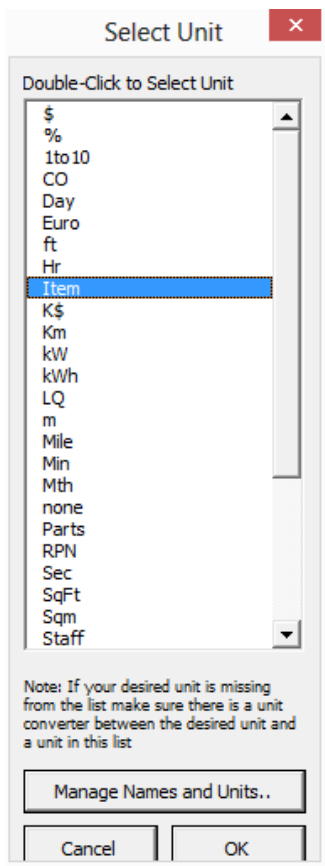
2. Add a new unit called “Part” by clicking on “New Unit...”



3. Drag out a Units Converter shape from the eVSM stencil.



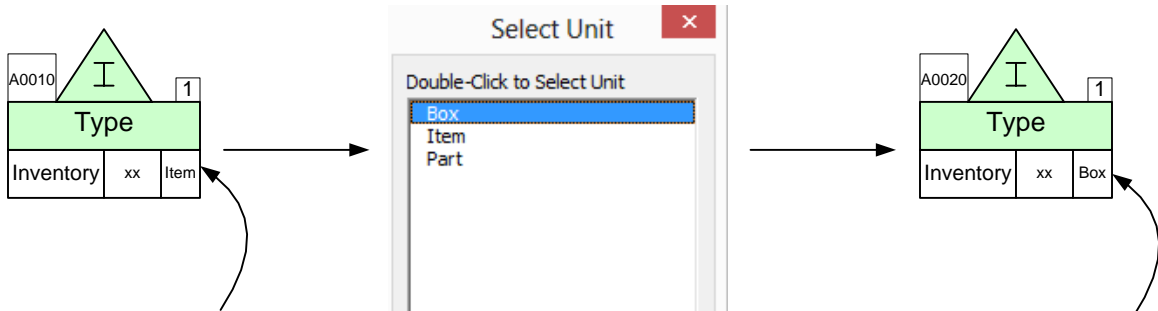
4. Double click on the default unit “Hr” to change the top unit to “Part” and the default unit “Min” to change the bottom unit to “Item.” This allows the calculator to account for the new unit. The top unit is the original unit, while the number specifies how many of the bottom unit makes up one of the top unit.



5. If you have more than one custom unit, repeat step two and three.

Part	Box
2	60
Item	Part

Note: Only the custom units that you created via a unit converter(s) will appear in the form when trying to change a variable unit on a center. This is to avoid (for example) people converting quantity units to time units for a center, like the Inventory Center. To ensure that the units you want to change appear in the form, create the converters first between any units you plan to use.



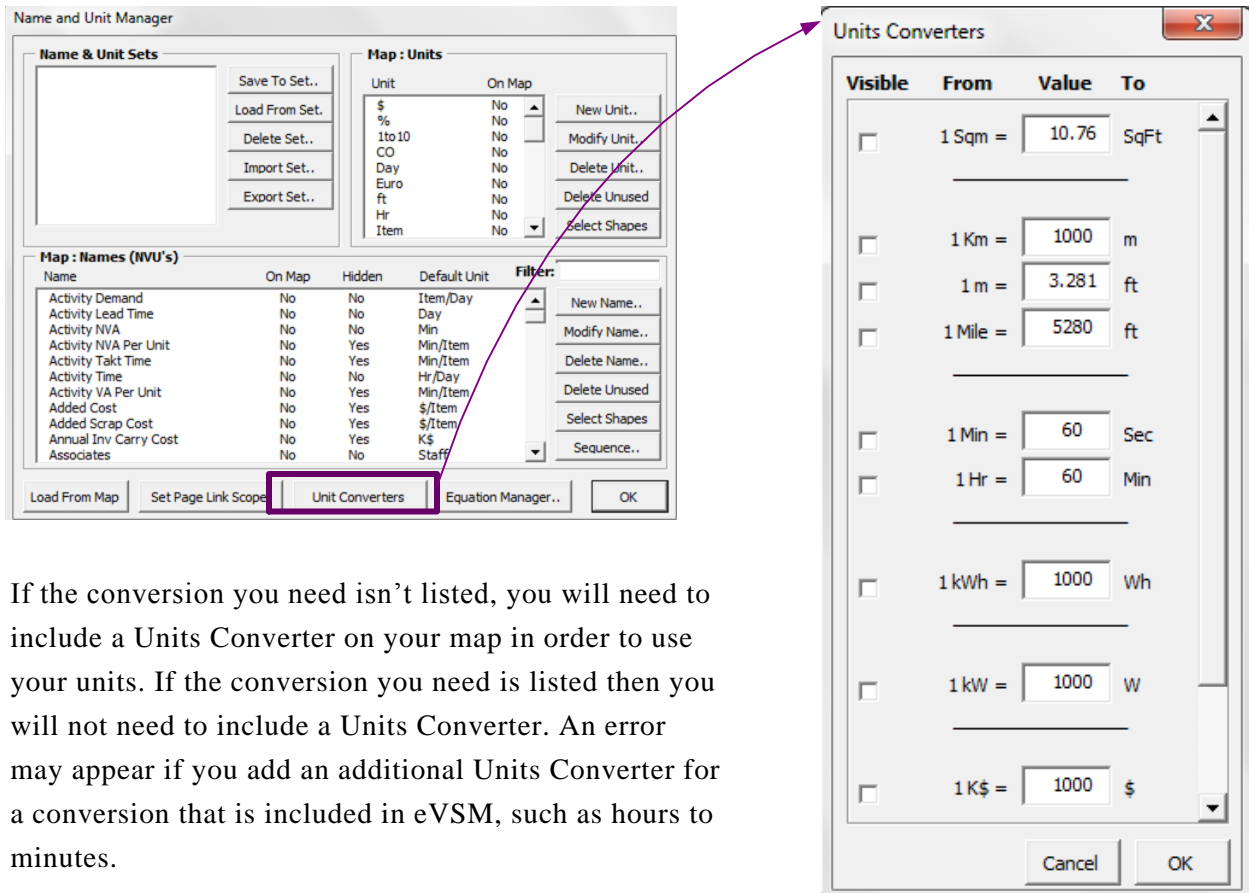
6. Double-click on the unit.

7. This form appears showing that it is “legal” to convert “Item” to “Box” or “Part” because unit converters exist between these three.

8. Selection of “Box” in the form causes the unit to be replaced in the databox.

## Miscellaneous Tips








eVSM comes with built-in basic unit conversions that don't require a Units Converter. To check and see which unit conversions are included, open the NUM and click "Unit Converters."



If the conversion you need isn't listed, you will need to include a Units Converter on your map in order to use your units. If the conversion you need is listed then you will not need to include a Units Converter. An error may appear if you add an additional Units Converter for a conversion that is included in eVSM, such as hours to minutes.

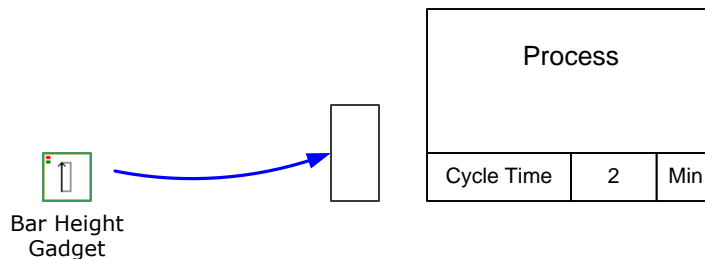
## Using Gadgets to Visualize Data

Any data on the map can be linked to visual gadgets that change in size and color with change in the data. Some gadget types are shown below:

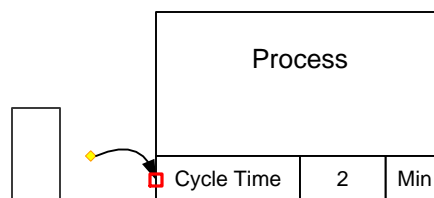
						
Bar Height Gadget	Sq. Area Gadget	Tr. Area Gadget	Slider Percent Gadget	Arc Angle Gadget	Line Tk Gadget	Curve Tk Gadget

Each gadget has exactly one size parameter that can be tied to a data value on the map. Here's the typical means used to apply and manipulate gadgets:

1. Drag out the gadget from the main eVSM stencil and position it near the data value with which it will be associated (in this case the "Cycle Time"). In this example the Bar Height Gadget is being used.

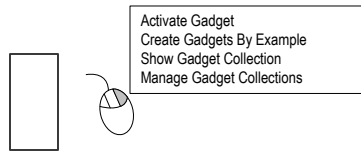


2. This system shape will be automatically dropped on the page the first time a gadget is used. If you copy a map to a new page make sure you also copy this shape because it is used to hold gadget data for the map.
3. Select the gadget, drag and glue the gadget's yellow flying connector to the side of the NVU data shape (avoid gluing to the top or bottom of the data shape).

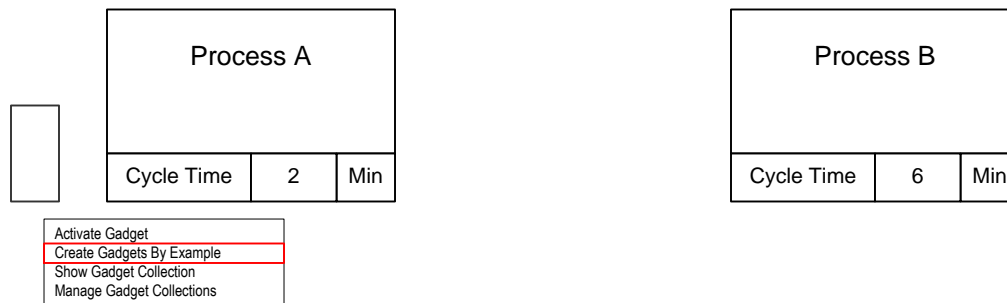


- Right click on the gadget and use the “Activate Gadget” option to create a new gadget collection. The collection name will be “Bar\_Cycle Time”. The name is created from the gadget type and the data variable name.

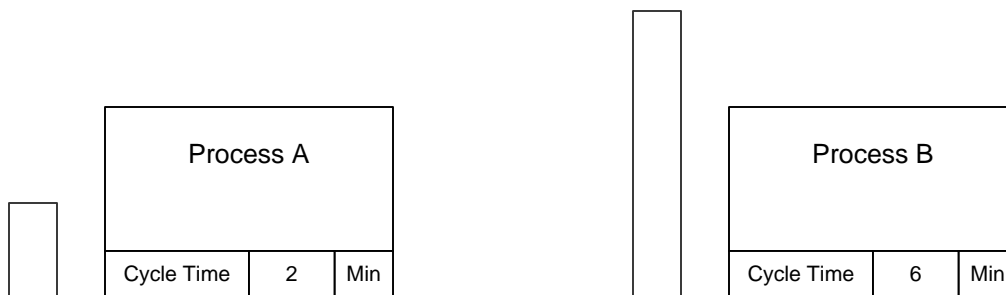
A gadget can only belong to one collection. Each collection can only have a single type (eg. “Bar”) of gadget.



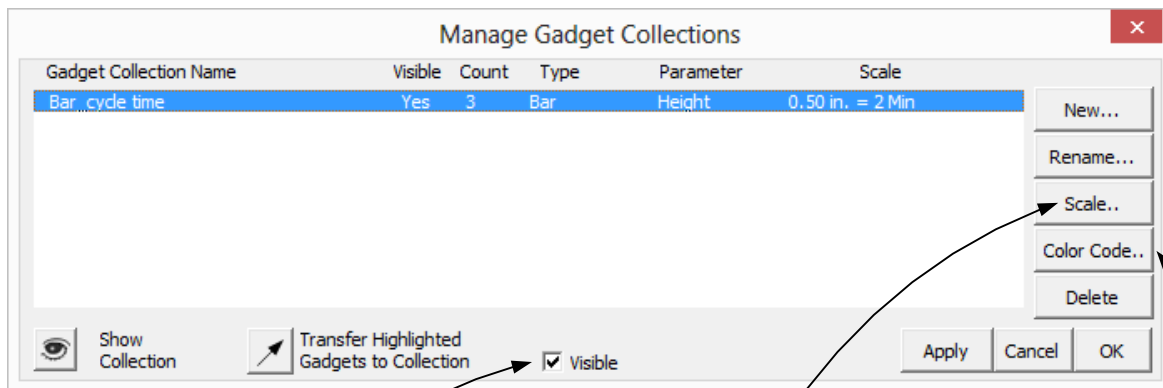
- You can change gadget scale factors and color code them by modifying the properties of the associated Gadget Collection. You can easily create additional gadgets tied to other instances of the same data on the map. Just click on the gadget and use the right mouse button to select “Create Gadgets By Example” to create the gadget for Process B below.



- Note that the new gadget is automatically positioned, scaled and put into the same “Bar\_Cycle Time” collection. If you do not wish to have new gadgets created for the whole map than select the original gadget, then sub-select an area of the map before using the “Create Gadgets By Example” menu.



- To modify a gadgets scale factor or to color code it, you need to change the properties of its associated collection. Right mouse click on the gadget and select “Manage Gadget Collections,” or click the Gadgets button in the toolbar.



To hide or show gadgets in a collection, first select the collection from a list, then click this button.

Note: the collection list has a column indicating visibility status.

You can modify the scale factor for a collection that controls gadget size in relation to data value. Use the Apply button to see the new gadget sizes on the map before exiting the form.

You can color code the gadget fill and font colors based on the value of the data to which the gadget is glued. You can also simply “inherit” the color from the data shape or assign a color to a gadget manually.



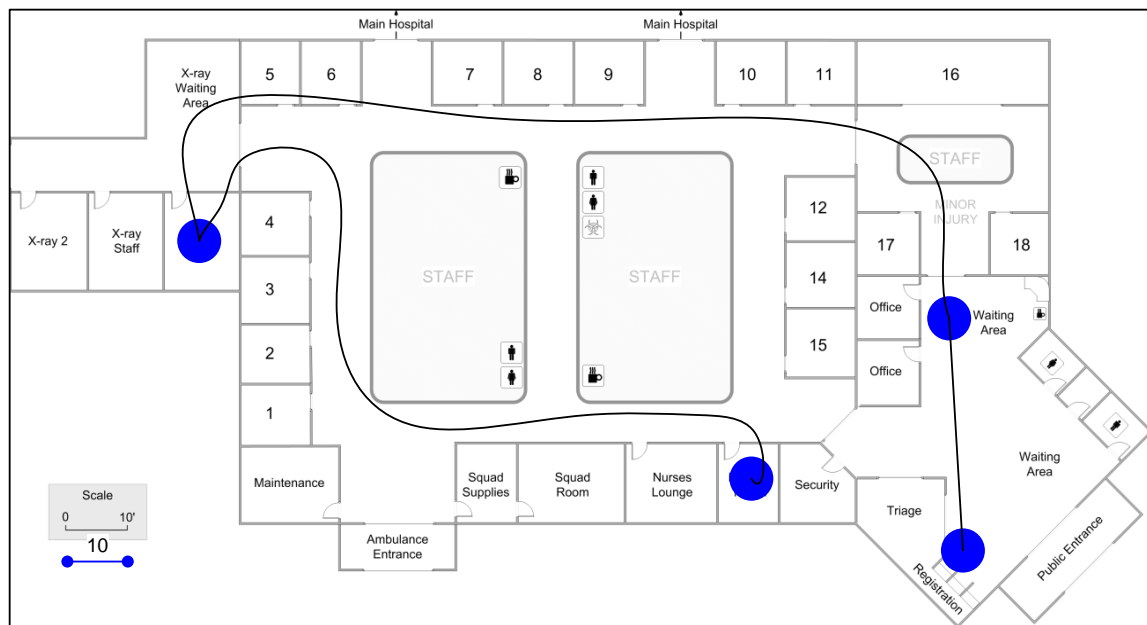
## Gadget Tips

- Gadgets have a single size parameter that will scale to the data value in which a gadget is glued via the flying yellow connector.
- Gadgets are typically glued to NVU, VA or NVA shapes. When gadgets in a collection are glued to data shapes with different units, Units Converters are needed on the map to compute the correct scale factors.
- Gadgets have to belong to a collection. They can be put in a collection using the Activate Gadget command or by transferring them into a collection via the Manage Gadgets form.
- Gadget scale factors and color coding can be controlled via the Manage Gadgets form.
- An easy way to create a gadget “set” after creating a first gadget is to use the Create Gadgets By Example in the right mouse button menu.
- The Visible switch on the Manage Gadgets form is very useful in showing different metrics on the map in a presentation environment.
- See the “Examples” section on the eVSM help site ([www.evsm.com/help](http://www.evsm.com/help)) for usage examples of the different gadget types.
- A starter set of gadgets is provided with eVSM. Additional gadgets can be requested by contacting [support@evsm.com](mailto:support@evsm.com).



## Spaghetti Wizard Tutorial

This tutorial will guide you through the steps to generate a spaghetti layout using the Spaghetti Wizard.





# Step 1: Start eVSM

1 On your Desktop, click the "Start eVSM" icon.

2 If you see a message like this, you must "Enable" macros.

3 Click to enable macros.

4 Click "Trust all from publisher" to avoid the security notice in future.

Recycle Bin

Start eVSM

Microsoft Visio Security Notice

Microsoft Office has identified a potential security concern.

Note: The digital signature is valid, but the signature is from a publisher whom you have not yet chosen to trust.

File Path: C:\Program Files\evsm\Setup\Solutions\evsmIcons.vss

Macros have been disabled. Macros might contain viruses or other security hazards. Do not enable this content unless you trust the source of this file.

[More information](#)

[Show Signature Details](#)

Trust all from publisher Enable Macros Disable Macros

## Step 2: Learn eVSM Basics

**2** Avoid re-sizing eVSM shapes. Instead grow the drawing page when needed. To resize the page, hold down the “Ctrl” key, and then drag any page edge to the required size. This method works on all four edges of the page.

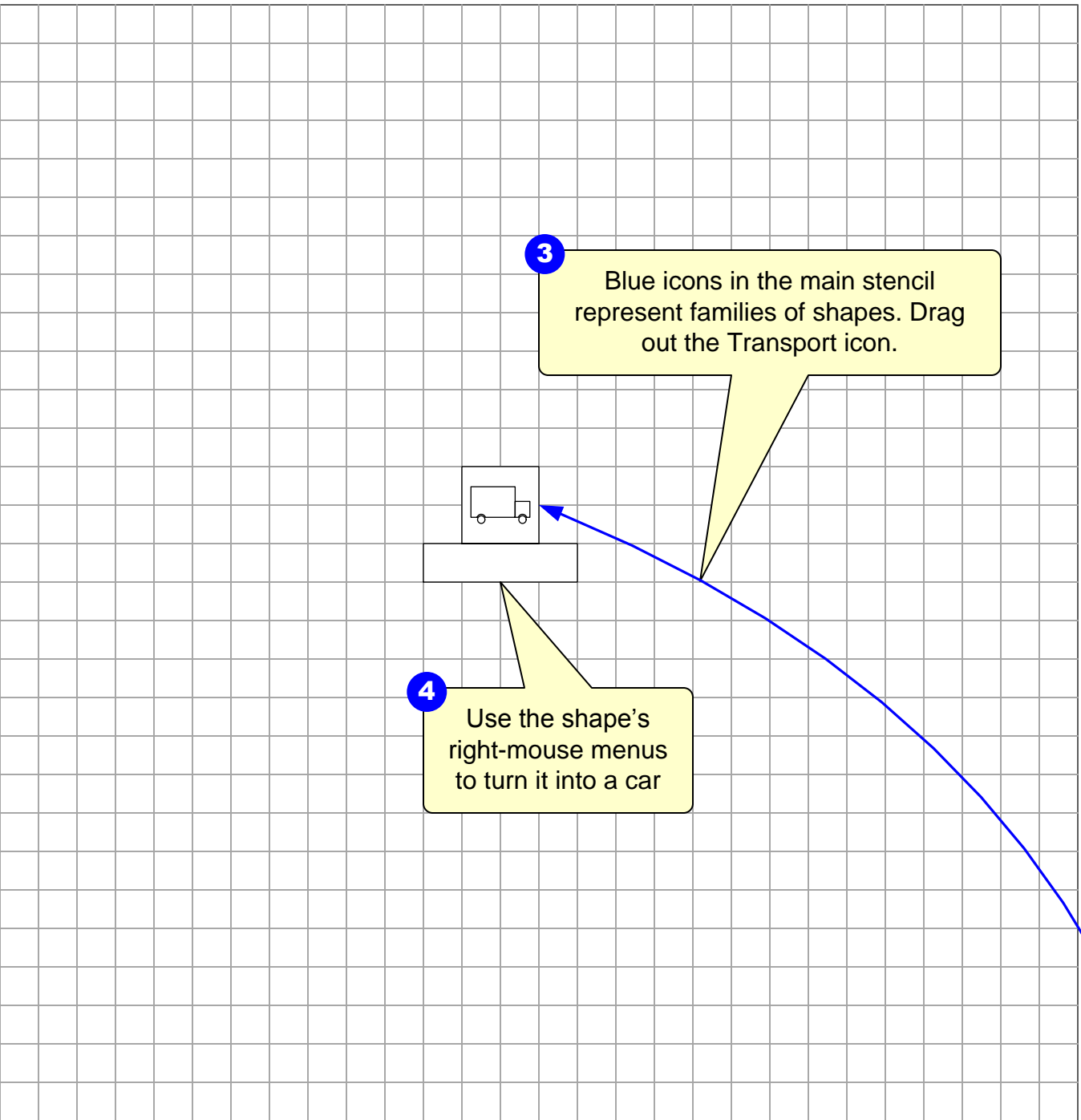


**5** Save your Visio file and then insert a new page via the right-mouse menus on the page-tabs.

VSM

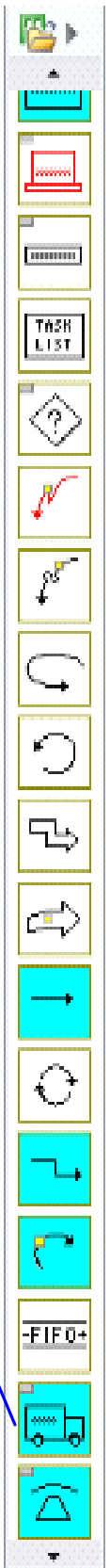
Quick\_eVSM

**1** eVSM Help resources are available in the Learn module of the toolbar. Hover over each one to see what they do.

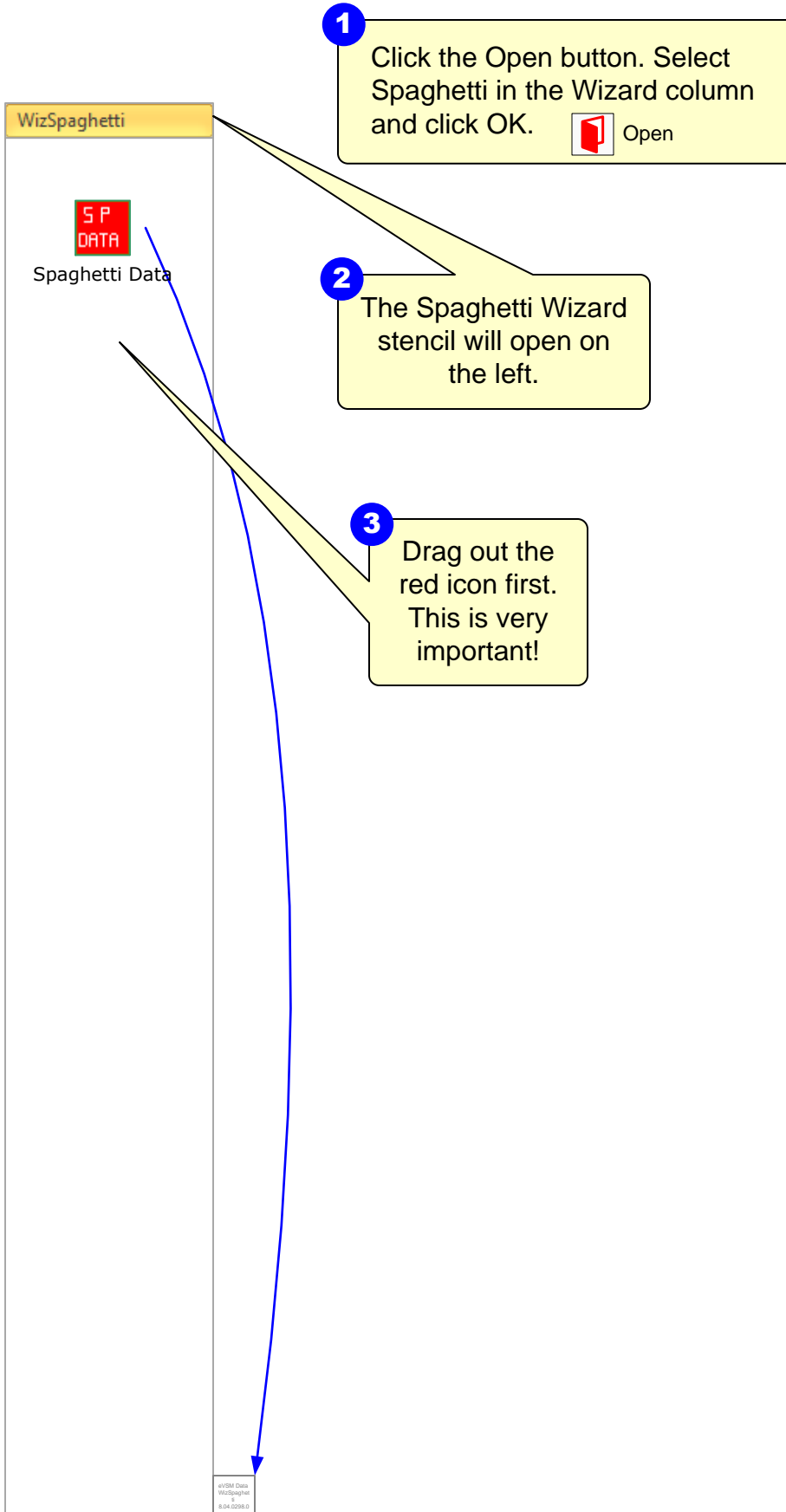


**3** Blue icons in the main stencil represent families of shapes. Drag out the Transport icon.

**4** Use the shape's right-mouse menus to turn it into a car



## Step 3: Initiate the map for the Spaghetti Wizard

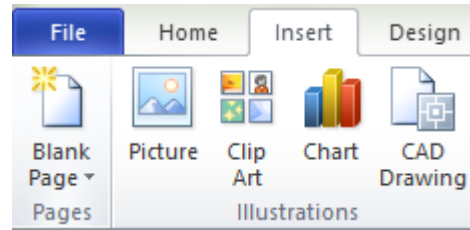
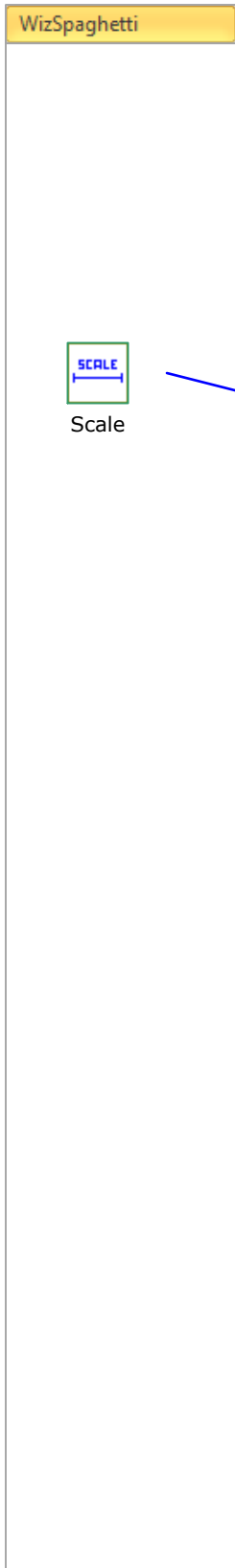






# Step 4: Draw/Import Floor Map

**1** Draw or import a floor map. Visio can import most bitmap formats as well as AutoCAD drawings. Either use the "Insert" tab in Visio or simply copy and paste the picture into a new drawing.





# Step 5: Add Spaghetti Places

WizSpaghetti



Place

eVSM Data  
WizSpaghetti  
v. 1.0  
8/24/2015



# Step 6: Draw Spaghetti Paths

The image shows a Visio workspace with a yellow header labeled "WizSpaghetti". A callout box with a blue circle containing the number "1" points to the workspace. To the right, two toolbars are shown: the "Drawing" toolbar from Visio 2003/2007 and the "Tools" ribbon from Visio 2010. The "Drawing" toolbar contains icons for a straight line, a curved line, a wavy line, and a pencil. The "Tools" ribbon lists various drawing tools, with a sub-menu for "Line" tools containing icons for a straight line, a wavy line, a curved line, and a pencil. A callout box points to these line tools in the 2010 ribbon.

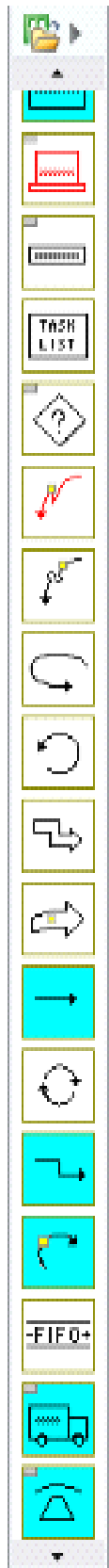
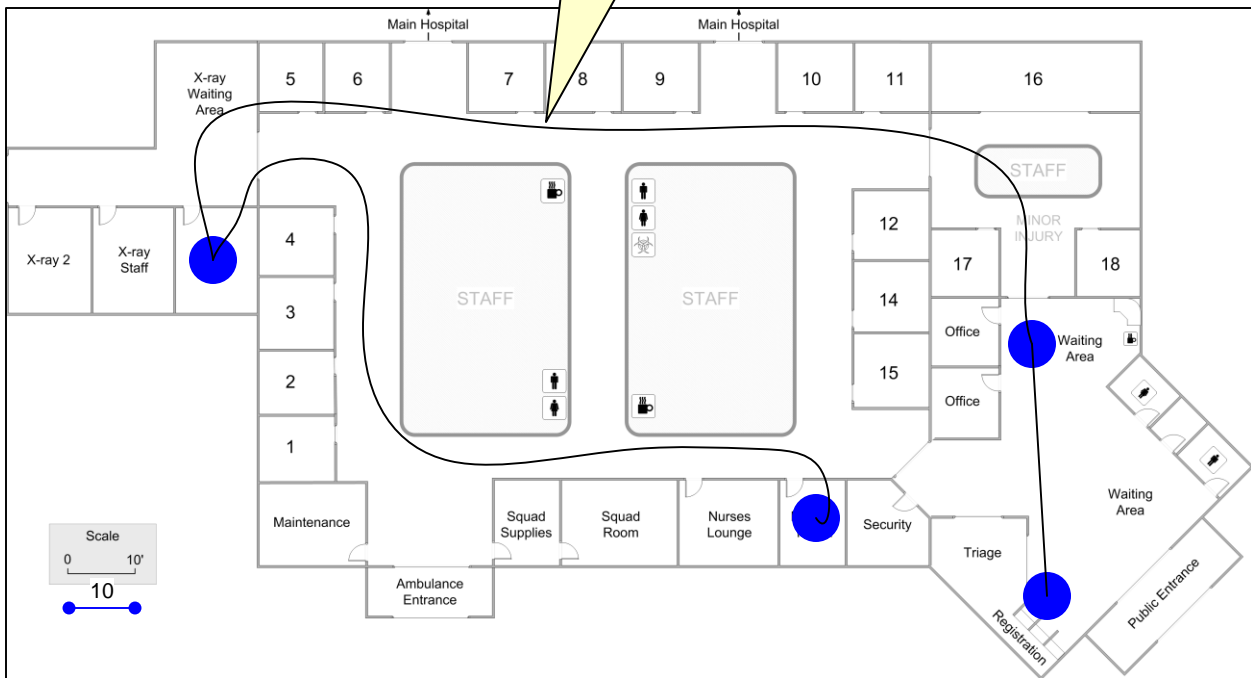
Any of the line tools in the Drawing toolbar can be used in Visio 2003/2007

Line tools in Visio 2010

**1** In Visio 2003/2007, the line drawing tools are in the Drawing Toolbar. This can be opened via the right-mouse menus on the Visio Toolbars. In Visio 2010, the drawing tools are near the center of the "Home" ribbon.

eVSM Data  
WizSpagheti  
v. 1.0  
8/24/2015

**2** Use the Visio line drawing tools to map the paths. You must ensure that each path starts and ends in a Spaghetti Place icon. You can set color and line thickness of the paths using standard Visio formatting.




# Step 7: Create Spaghetti Report

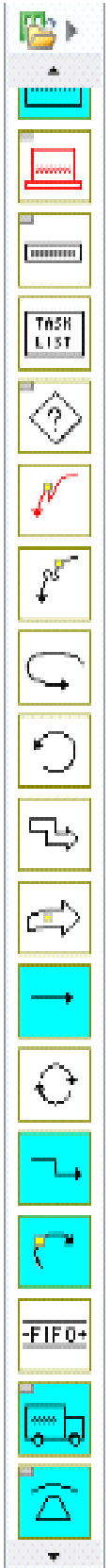
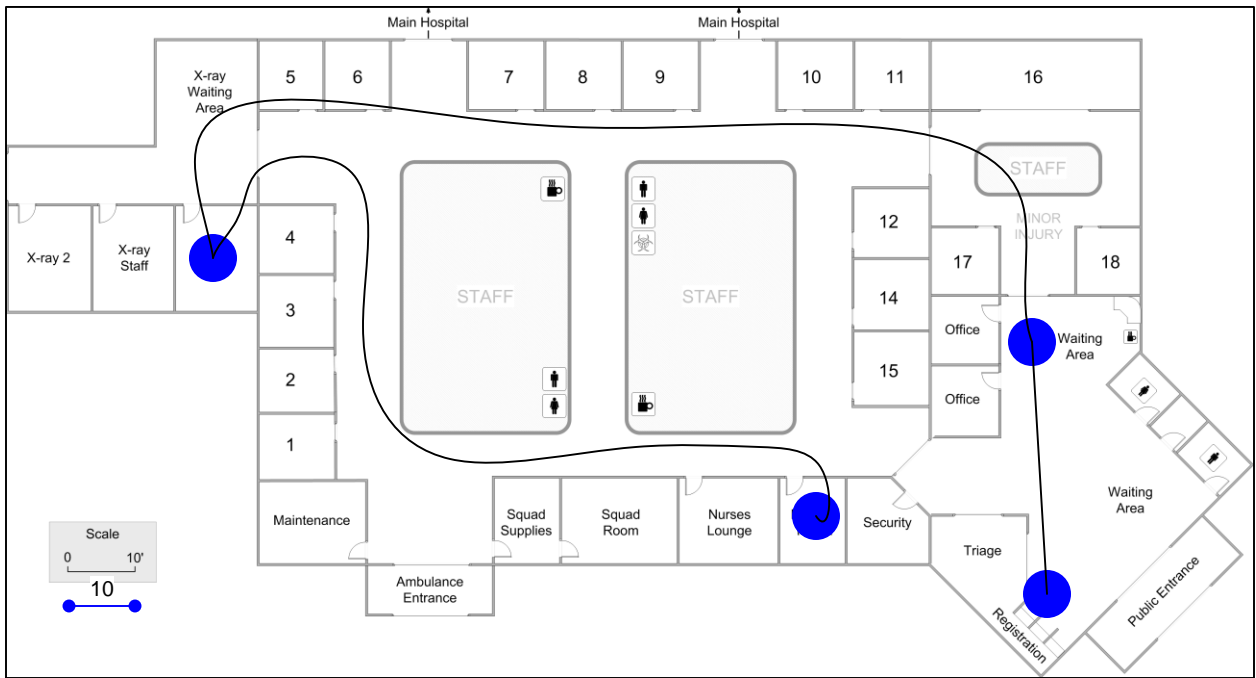
WizSpaghetti



eVSM Data  
WizSpaghetti  
v. 1.0  
8/24/2015



**1** Click the Solve button. eVSM will create a spreadsheet report of the paths. Note that the Solve button recreates the Excel report, it DOES NOT update it.  Solve





# eVSM Training Evaluation Form

Name: \_\_\_\_\_

Title/Role: \_\_\_\_\_

Email: \_\_\_\_\_

Please indicate your impressions of the items listed below.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. The training met my expectations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I will be able to apply the knowledge learned.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. The training objectives for each topic were identified and followed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. The content was organized and easy to follow.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. The materials distributed were pertinent and useful.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. The trainer was knowledgeable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. The quality of instruction was good.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. The trainer met the training objectives.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Class participation and interaction were encouraged.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Adequate time was provided for questions and discussion.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

11. How do you rate the training overall?

Excellent	Good	Average	Poor	Very Poor
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

12. What aspects of the training could be improved?

## eVSM Training Evaluation Form

1. Describe the next VSM activity you are involved in. (Role, Training, Purpose, Team, Sponsor)

2. Do you plan to use the tools you have learned about in the workshop? If so, how?

3. What challenges do you envisage in applying these tools?

4. What advantages will you realize in applying these tools?

5. Other Comments?

**THANK YOU FOR YOUR FEEDBACK!**