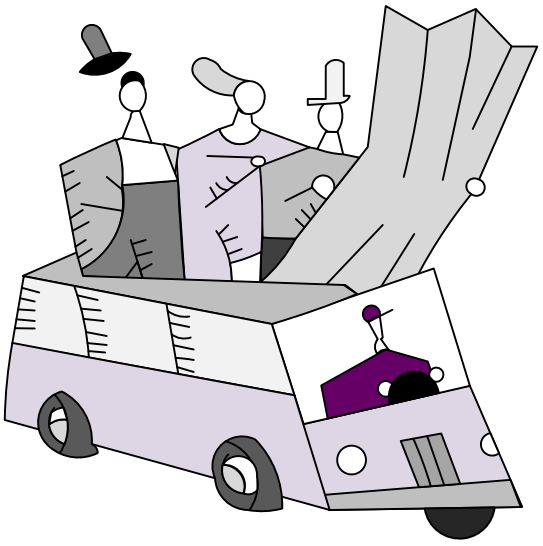
eVSM Value Stream Mapping Workshop for Discrete Parts



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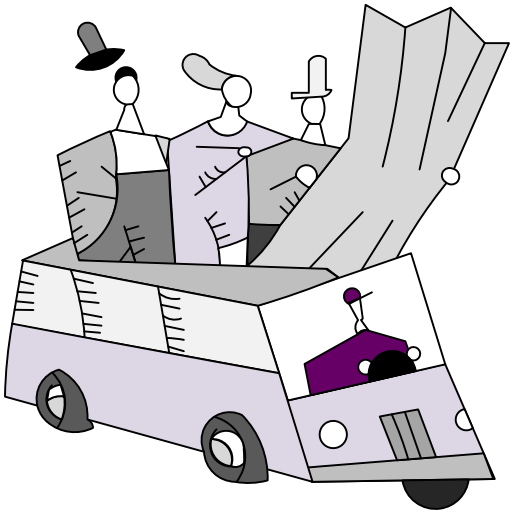
Lean, VSM, & eVSM



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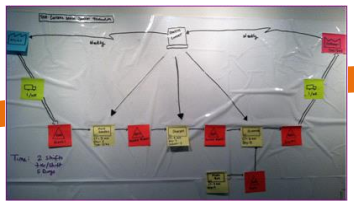
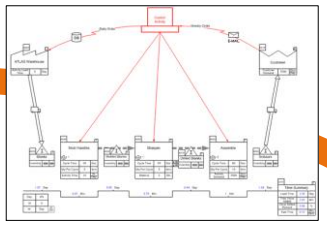
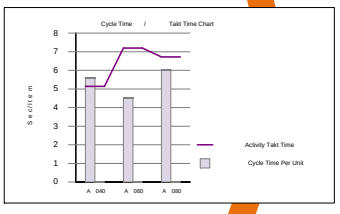
eVSM / Supporting Process Improvement



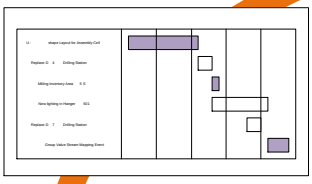
Wall Map



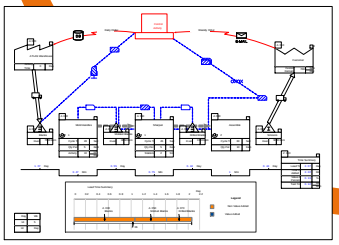
Capture



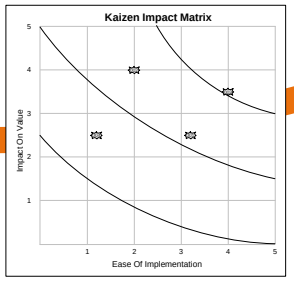
Analyze

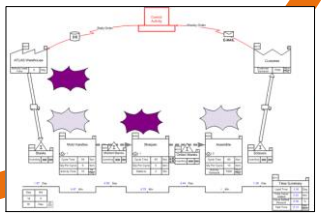


Improve



Prioritize





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What is eVSM?

Best Practice Maps

Applying the standard

Company specific Best Practice Maps

---

eVSM

Standardized mapping & analysis

Application Specific Stencils

Use maps for calculations

Excel Integration

Capture wall maps

VSM Icons for Visio

Collaborative Tools

Group Interaction	Diagramming	Data
Brown Paper & Post-Its	Visio	Excel

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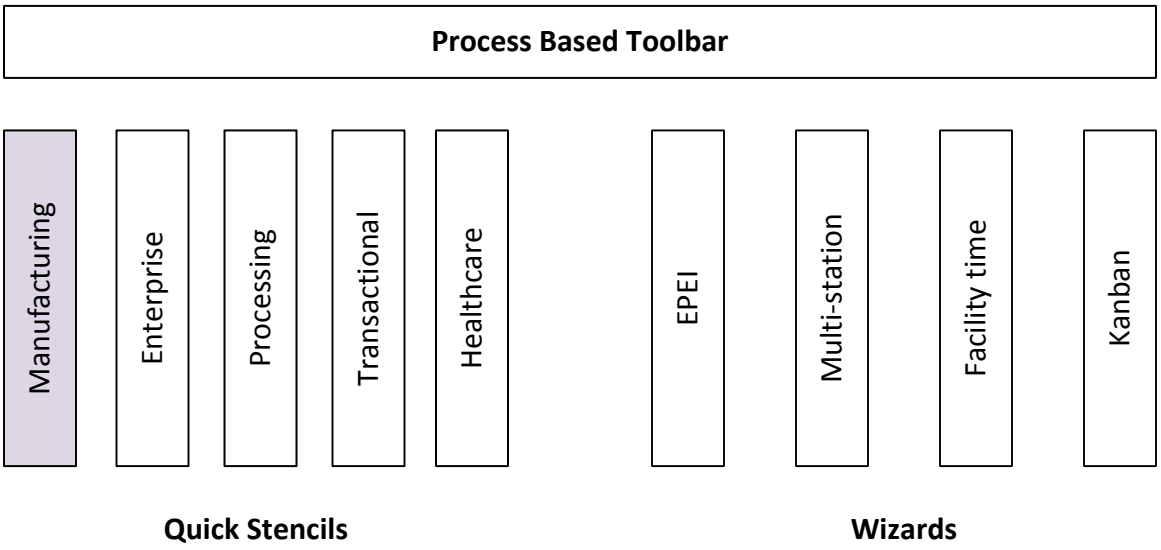
eVSM Architecture



Drag and Drop Core

Sketcher (wall maps)	Standard Variables	Built-in Equations	Kaizen Impact
Multi-path Maps	Production Units	Built-in Charts	Kaizen Risk
Multi-level Maps	Data Variation	What-If Studies	Kaizen Report

Visio + Excel Integration (32 bit + 64 bit)

Windows 7 + 8 Support (32 bit + 64 bit)

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Manufacturing Concepts

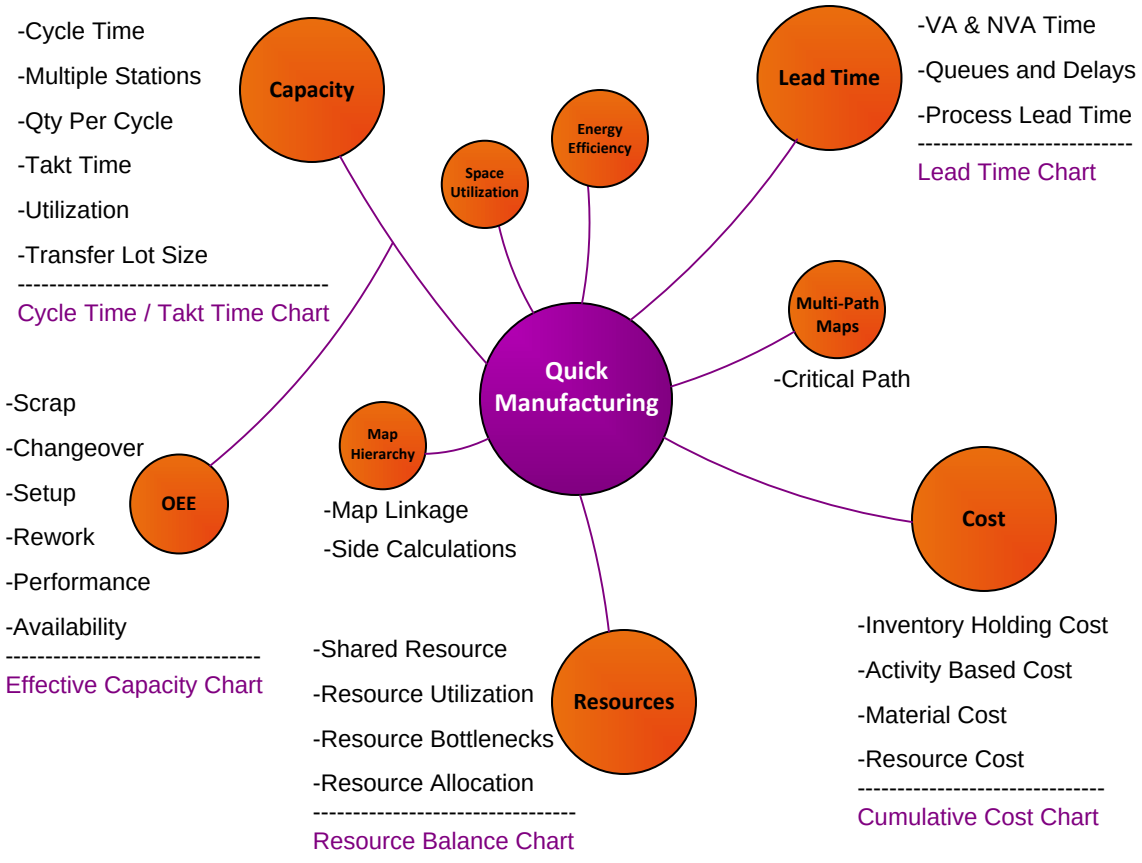
Standard Variables

Design Macro Shapes

Built-in Equations

Built-in Charts

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



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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

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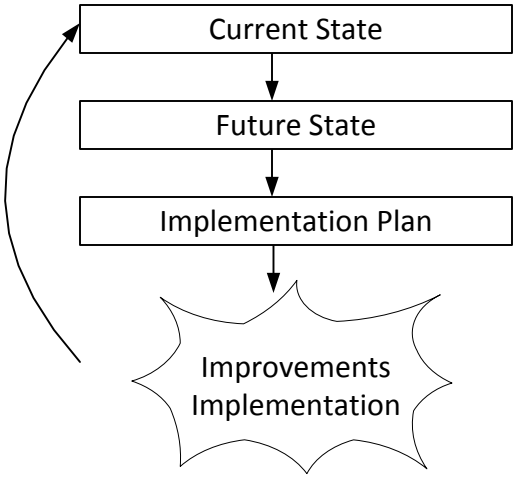
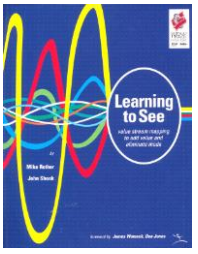
Lean Means...

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

The Lean Process





...Learning to See, LEI

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What is a Value Stream?

All steps, both Value Added and Non Value Added, required to complete a product or service from beginning to end

What is a Value Stream Map?

A simple tool that visually represents what's going on in a value stream

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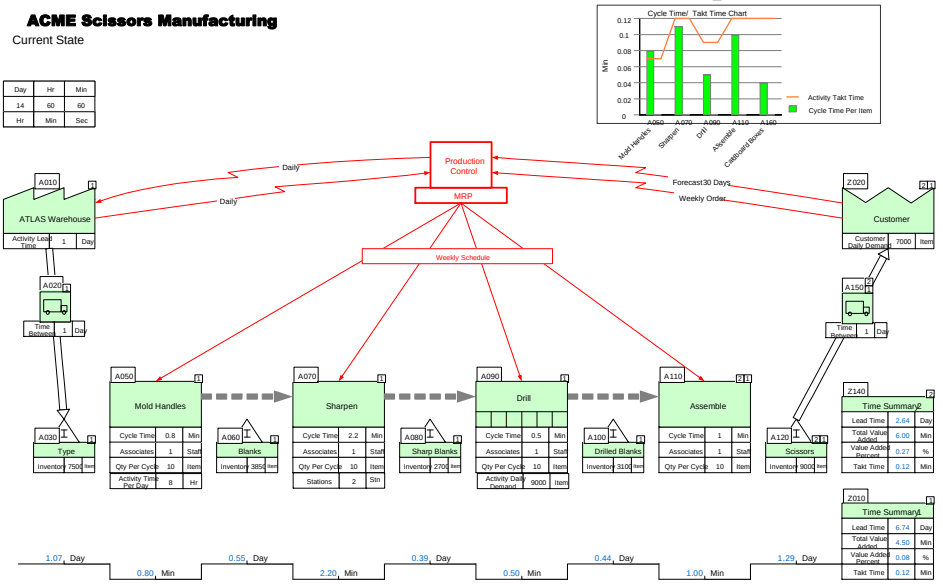
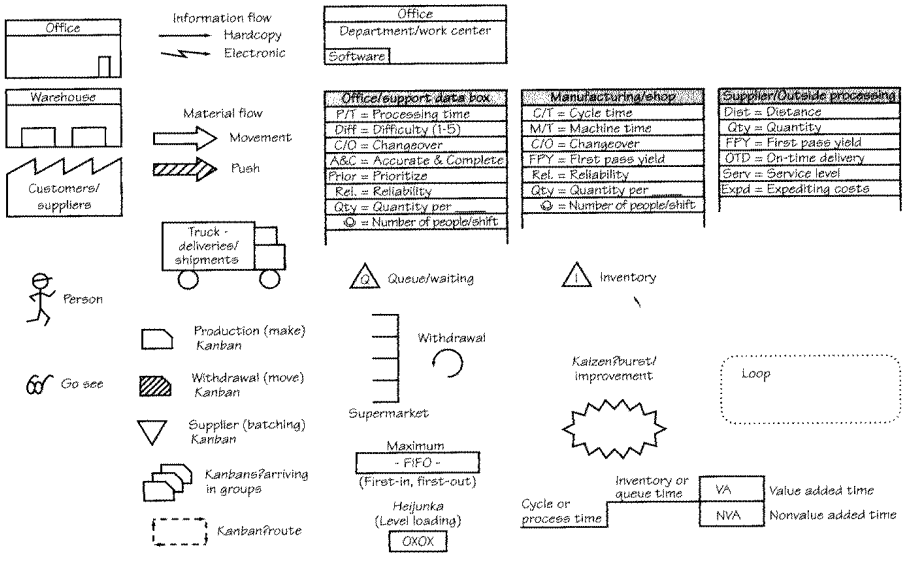
What is a Value Stream Map?



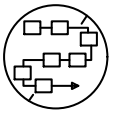
VSM – Learning to See



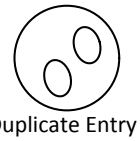
Types of Waste

Transportation

Excess Inventory



Over Processing

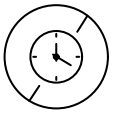


Duplicate Entry

Over Production

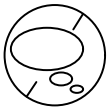
Excess Motion

Confusion



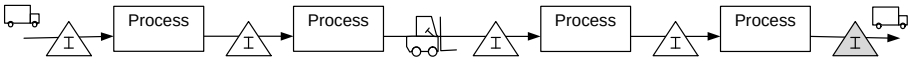
Waiting

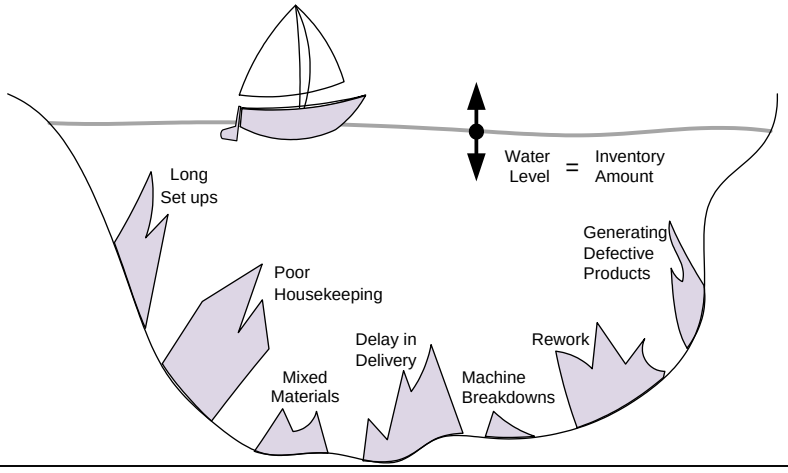
Defects



Knowledge

Hiding the Waste





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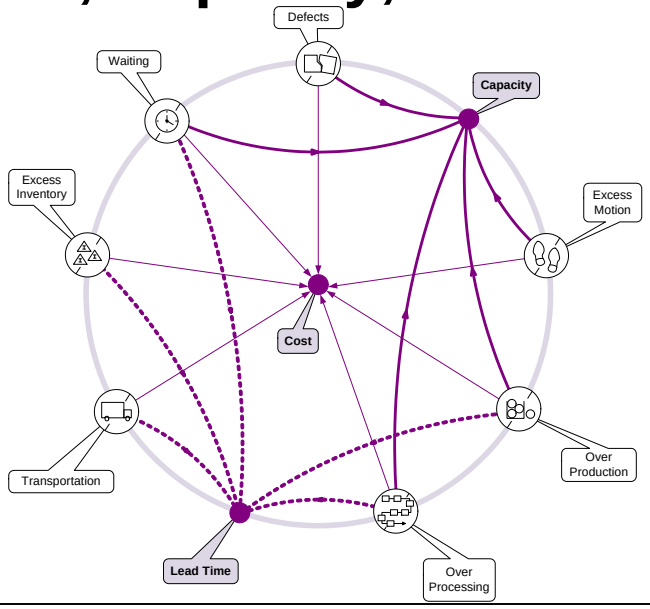
What is a LEAN Value Stream?

- Define value from the customer's perspective
- **Map the value stream**
- Create flow and eliminate waste
- Create pull where flow is difficult
- Seek perfection

- Minimize the LEAD TIME
- Adequate & Efficient CAPACITY
- Minimum COST for QUALITY

Lead Time, Capacity, Cost



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What is eVSM?

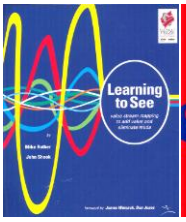
- Software Tool:

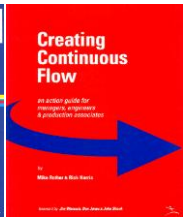
  -VSM, A3 Reports, Spaghetti Reports, Communication Circles

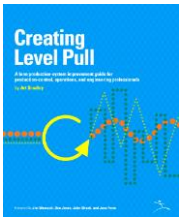
  -Analyze VSM Data

  -Manage Lean Transformation
- Built on Visio and Excel
- Based on Publications from Lean Enterprise Institute

Lean Workbooks

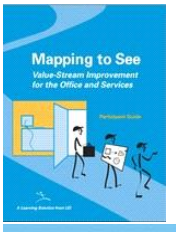




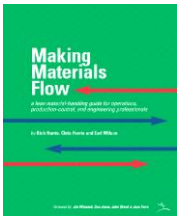


Process Level

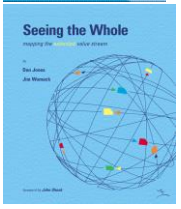
Plant Level

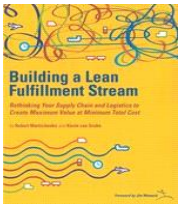


Office Services



Materials





Multiple Plants Across Companies

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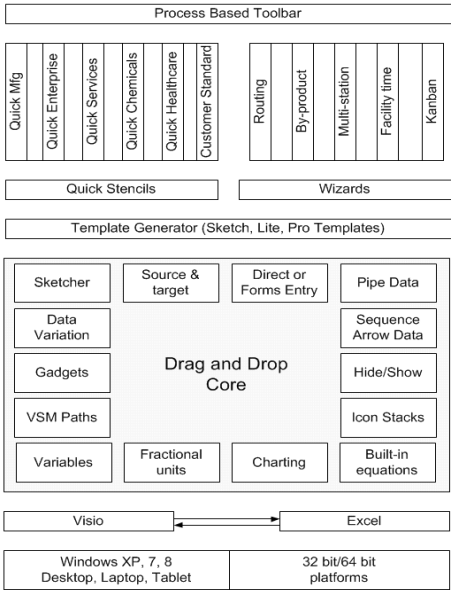
eVSM v8 Platform

Tablet

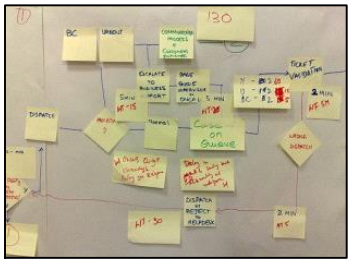
Laptop

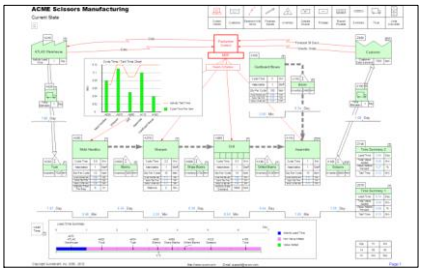
Large Wall-Mounted Touchscreen



Wall Maps/Digital Pictures/eVSM

Value Stream Mapping is a Paper & Pencil tool





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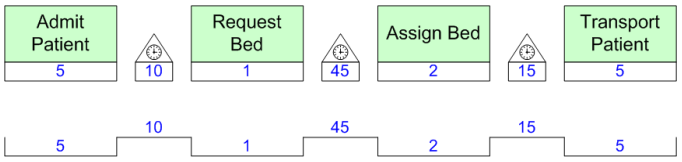
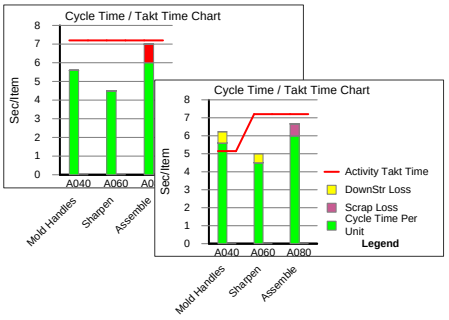
What is a Quick Stencil?

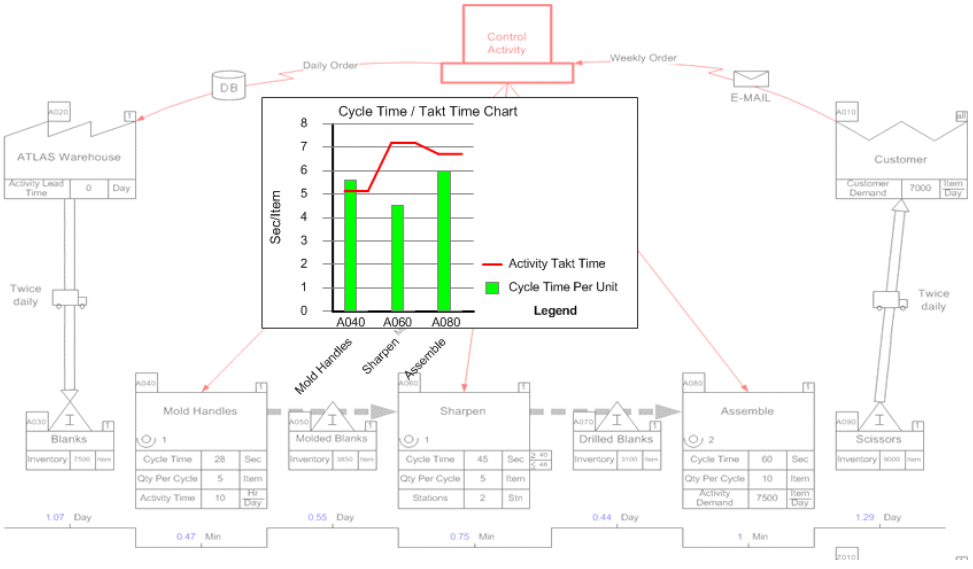
- Very fast way to map
- Drag, Drop & Enter Values
- Automated Calculation & Charts



Total Time=VA + NVA
=(5+1+2+5) + (10+45+15)
=13+70
=83 Min's



Visualizing Capacity



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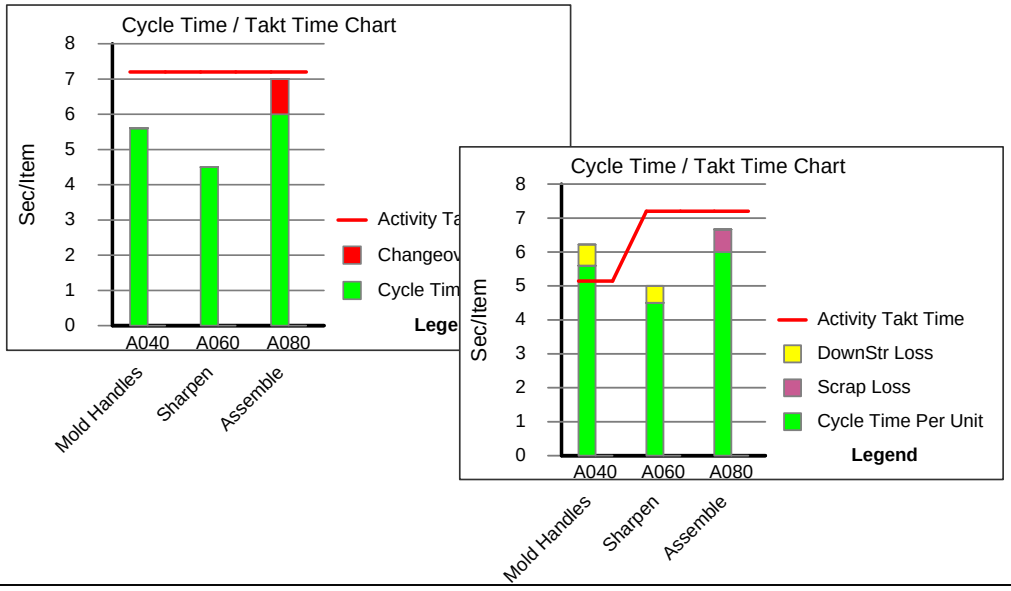
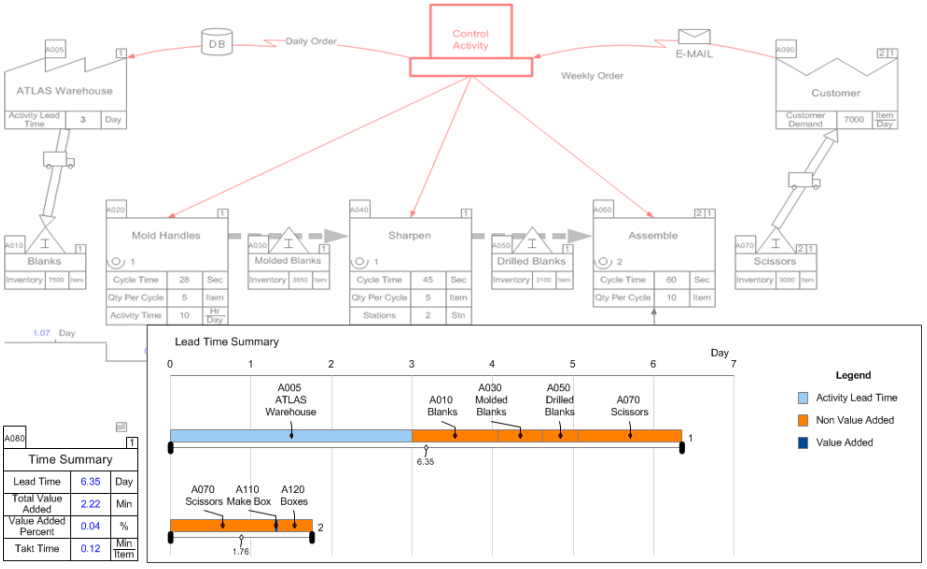
Capacity Losses



Visualizing Lead Time



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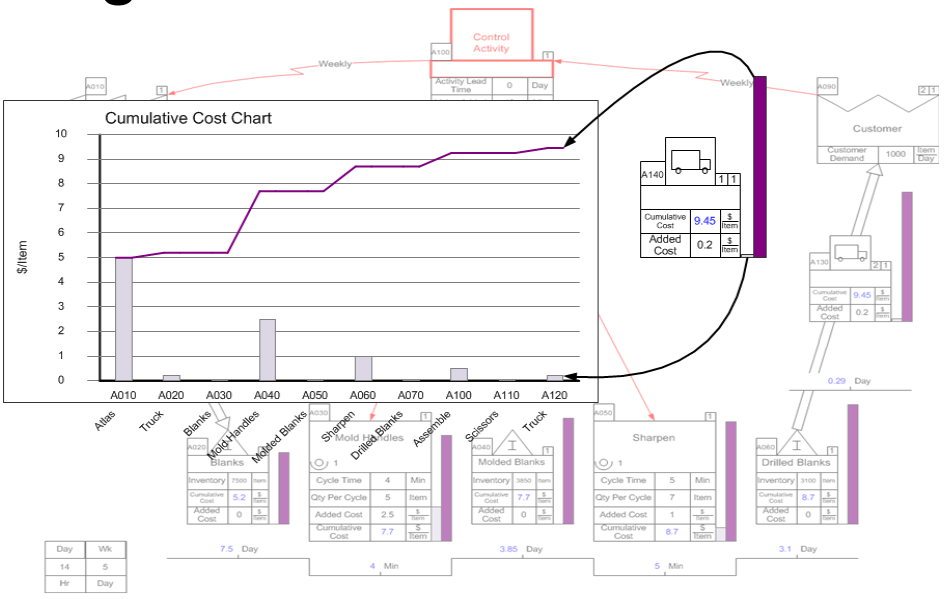
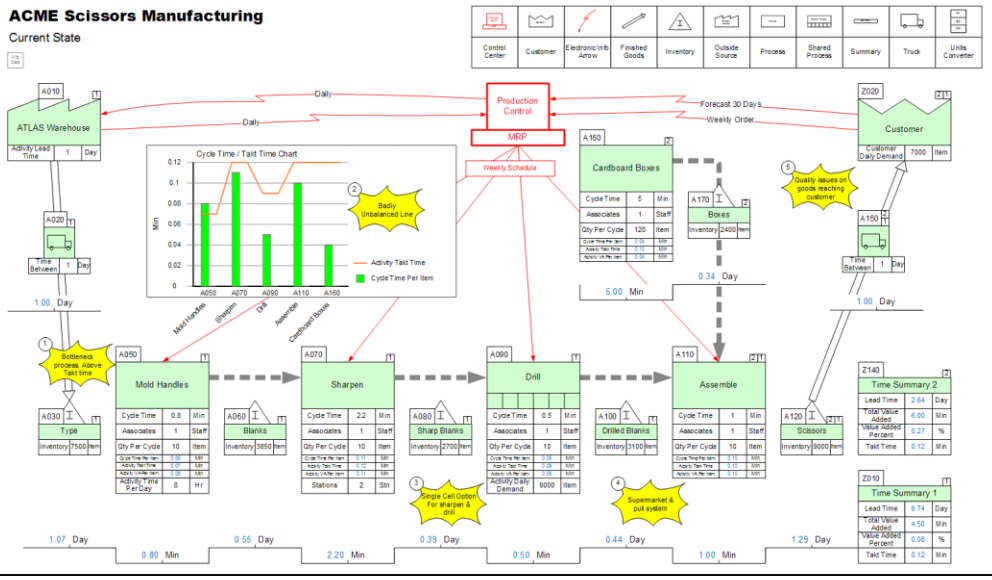
Visualizing Cost



Kaizen – Ideas in Context



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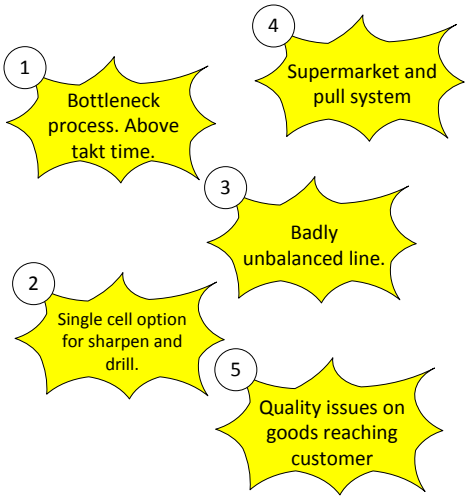
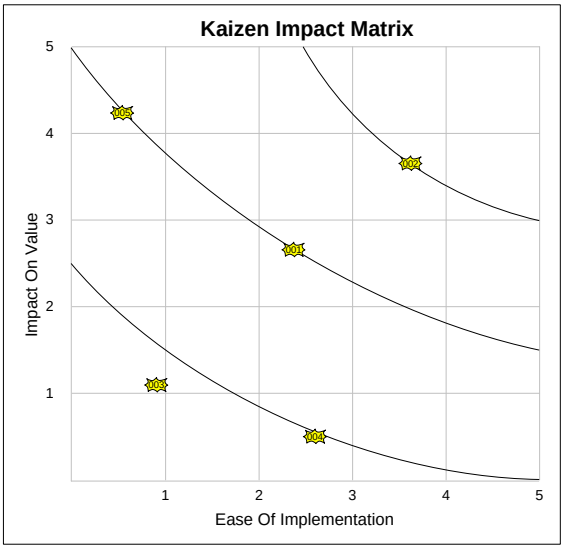
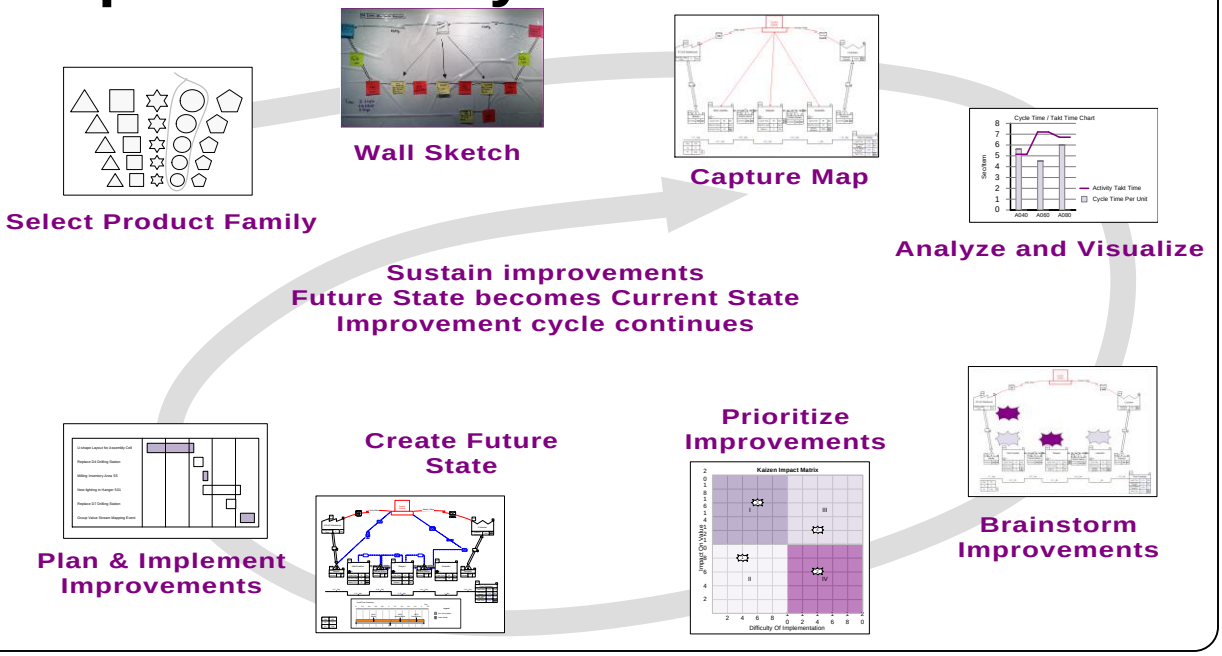
Kaizen Impact Matrix

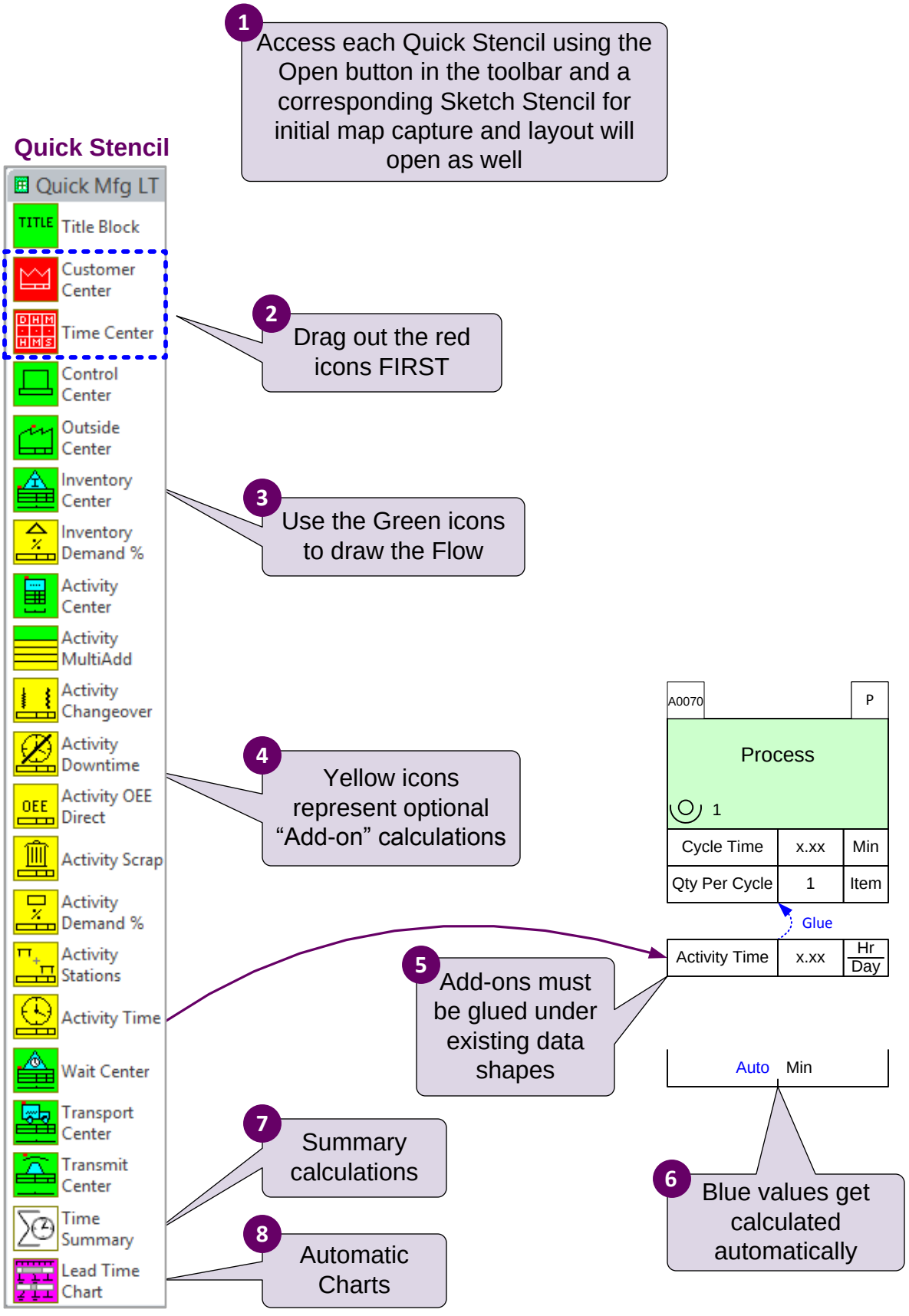




Improvement Cycle



Working with Quick Stencils in eVSM v8



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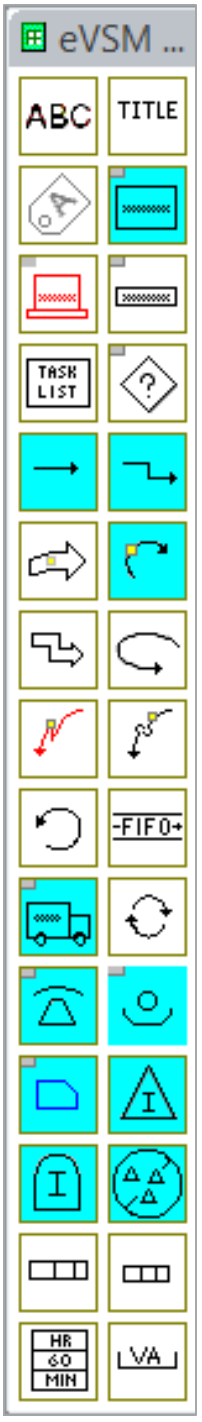
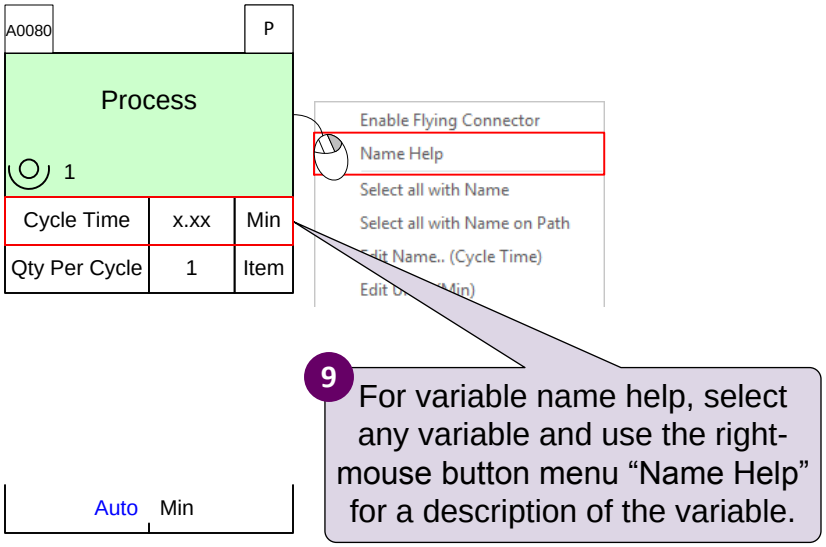
Main Stencil





9 For variable name help, select any variable and use the right-mouse button menu “Name Help” for a description of the variable.

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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?

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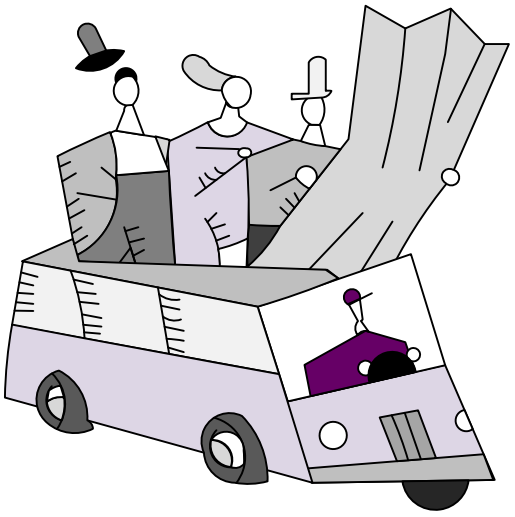
Plant Level Mapping



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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

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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.

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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

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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

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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

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

$$\text{Activity Capacity} = \frac{\text{Activity Time}}{\text{Cycle Time Per Item}} \times \text{OEE}$$

$$= \frac{10 \times 60}{1.25} \times 0.8 = 384 \text{ Item/Day}$$

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.

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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,

$$\text{Resource Capacity} = \frac{\text{Resource Time} \times \text{Resource Qty}}{\text{Resource PT}}$$

$$= \frac{8 \times 60 \times 2}{10}$$

$$= 96 \text{ Item/Day}$$

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.

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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

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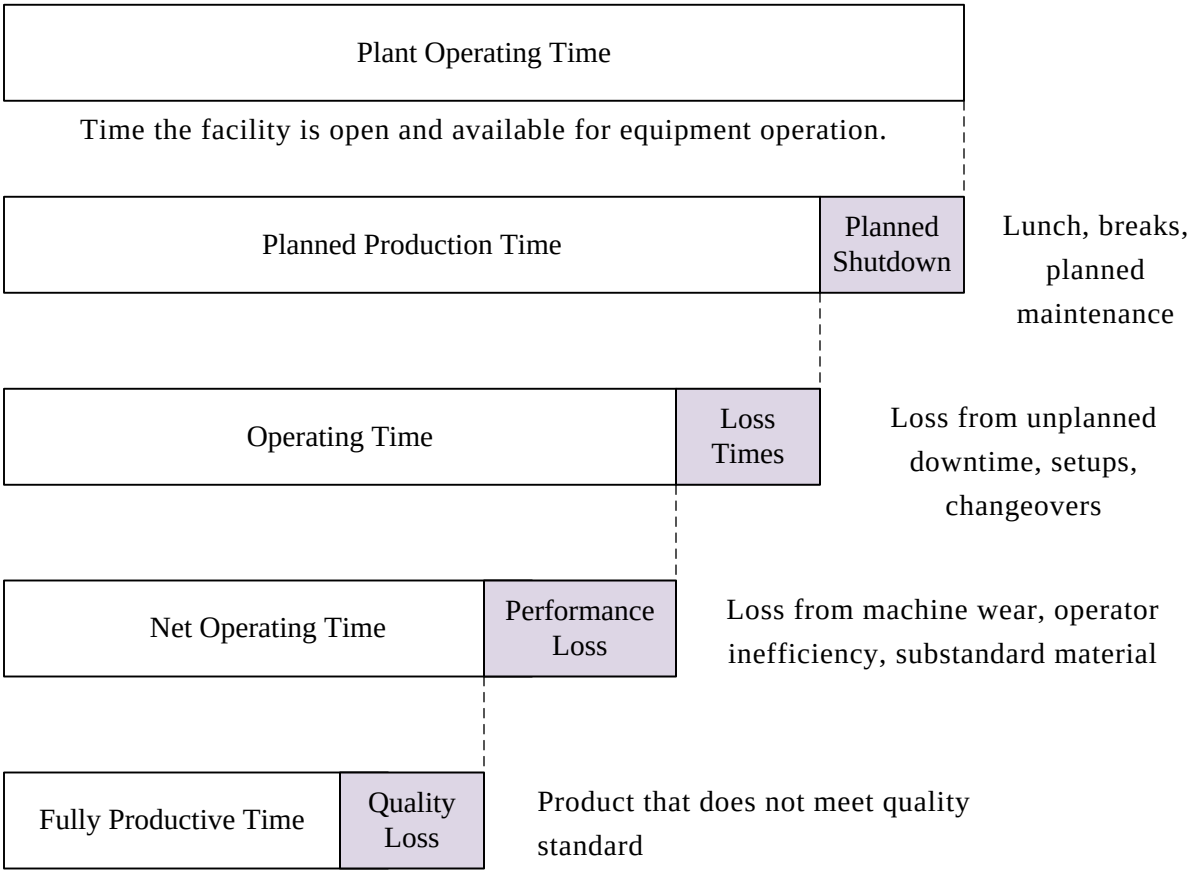
Facility Time Related Terms



- 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 = $\text{Availability Rate} \times \text{Quality Rate} \times \text{Performance Rate}$
- OEE Availability Rate = $\dfrac{\text{Operating time}}{\text{Planned production Time}}$
- OEE Quality Rate = $\dfrac{\text{Fully productive time}}{\text{Net Operating Time}}$
- OEE Performance Rate = $\dfrac{\text{Net Operating Time}}{\text{Operating Time}}$

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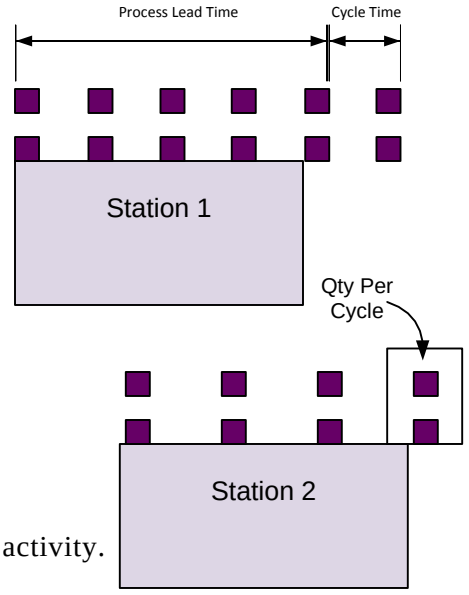
Activity Time Related Terms



- 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.

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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.

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Resource Terms

- Efficiency: Efficiency rating for a resource to allow for auxiliary activities (walking, interruptions..)
- Effective Resource Time: Resource Time * Resource Qty * Efficiency
- NVA Utilization: Resource Time Used for Non Value Added Activity / 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: Total Time Spent / 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: Time Used for Value Added Activity / Effective Resource Time

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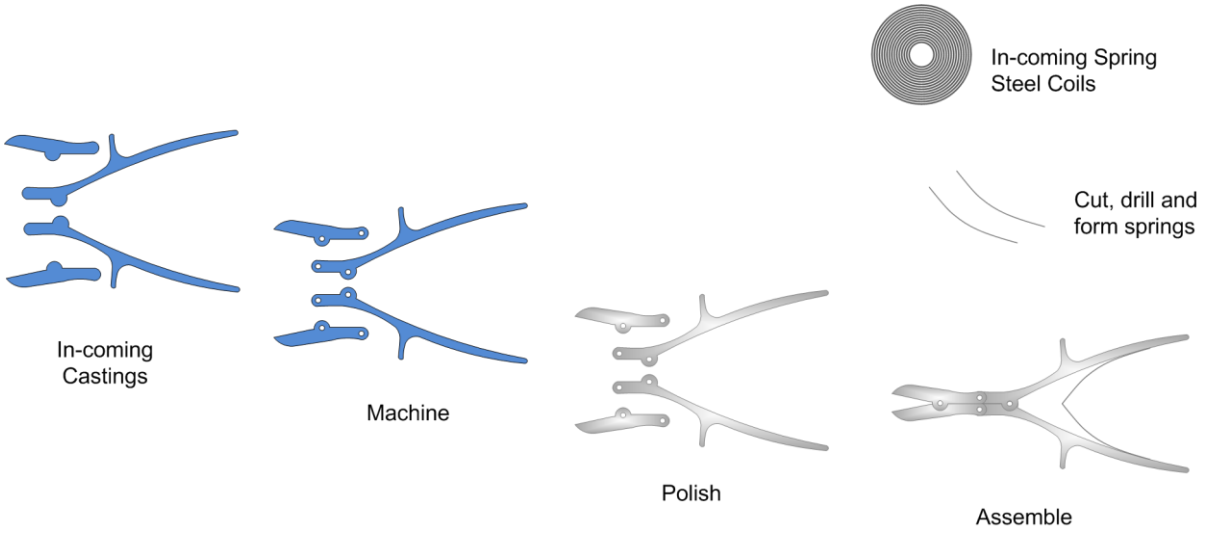
ACME Case Study – Plant

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.

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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%.

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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.

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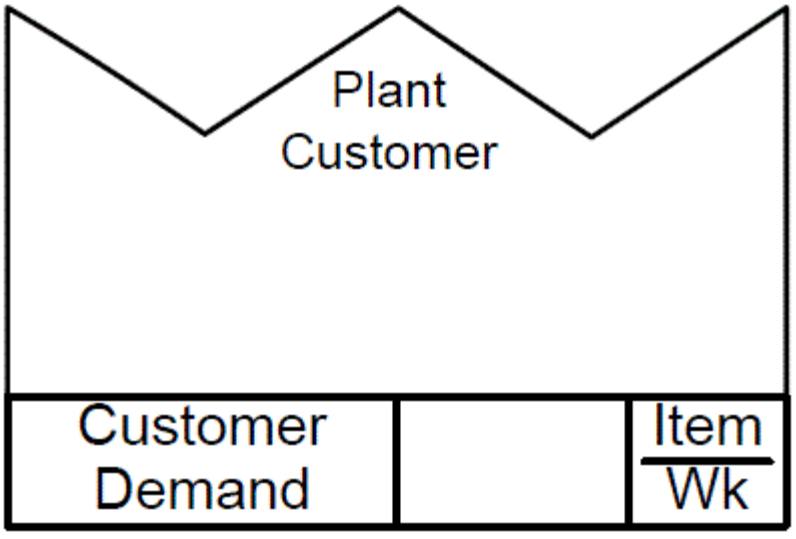
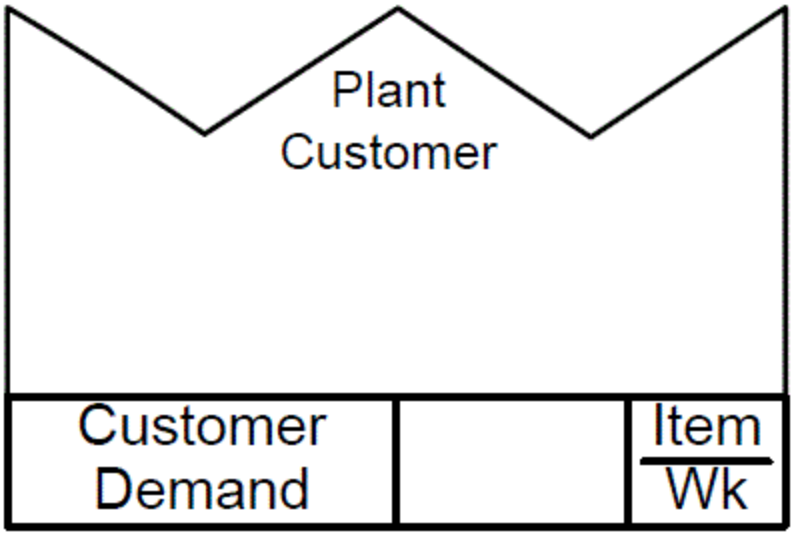
Quick Manufacturing Templates





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Plant Activity		
Cycle Time		
Qty Per Cycle		
Added Cost		
OEE Input Percent		%
Stations		Stn
Scrap Percent		%
Activity Time		Hr / Day

Plant Activity		
Cycle Time		
Qty Per Cycle		
Added Cost		
OEE Input Percent		%
Stations		Stn
Scrap Percent		%
Activity Time		Hr / Day

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Plant Activity		
Cycle Time		
Qty Per Cycle		
Added Cost		
OEE Input Percent		%
Stations		Stn
Scrap Percent		%
Activity Time		Hr / Day

Plant Activity		
Cycle Time		
Qty Per Cycle		
Added Cost		
OEE Input Percent		%
Stations		Stn
Scrap Percent		%
Activity Time		Hr / Day

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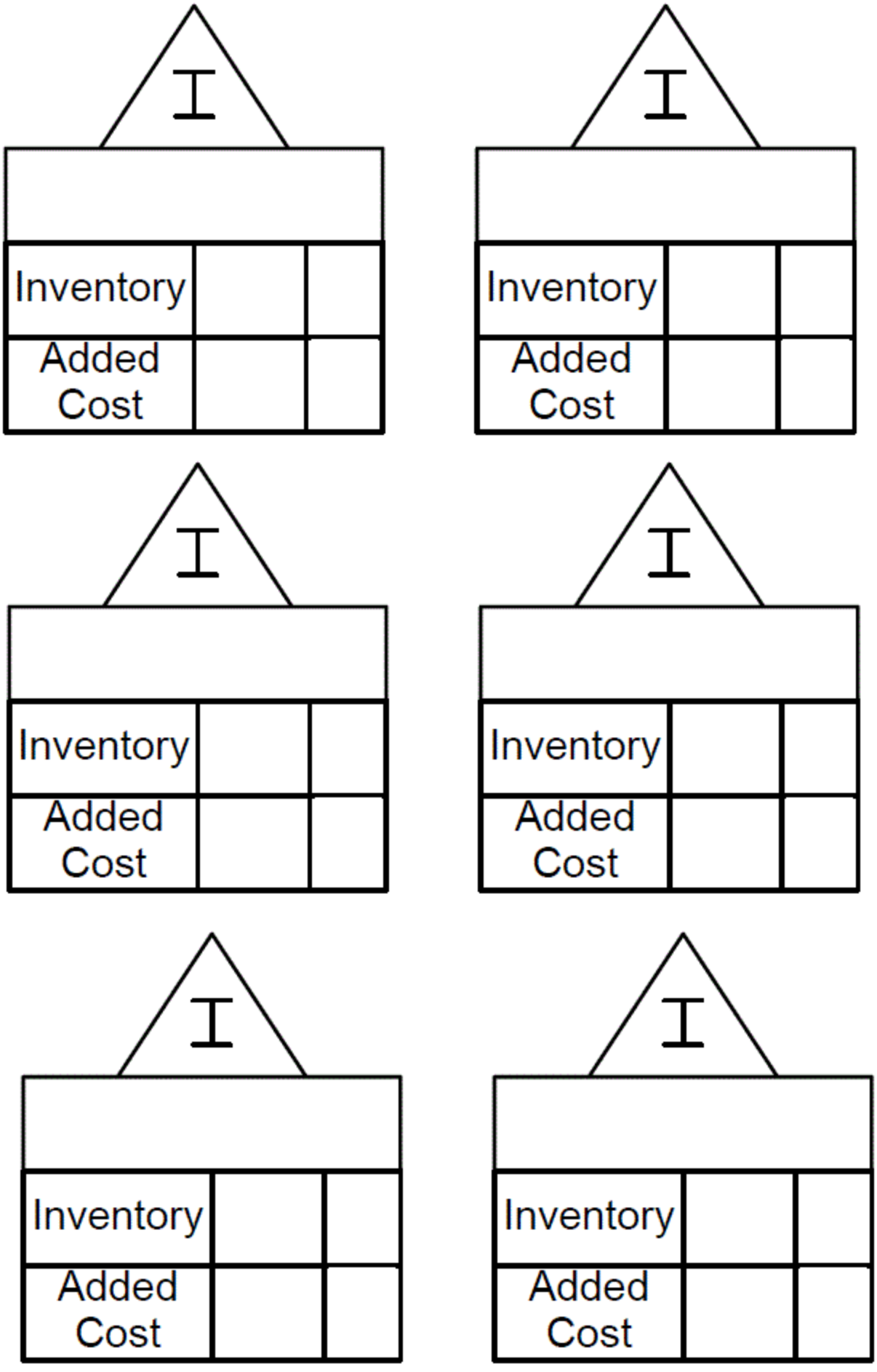

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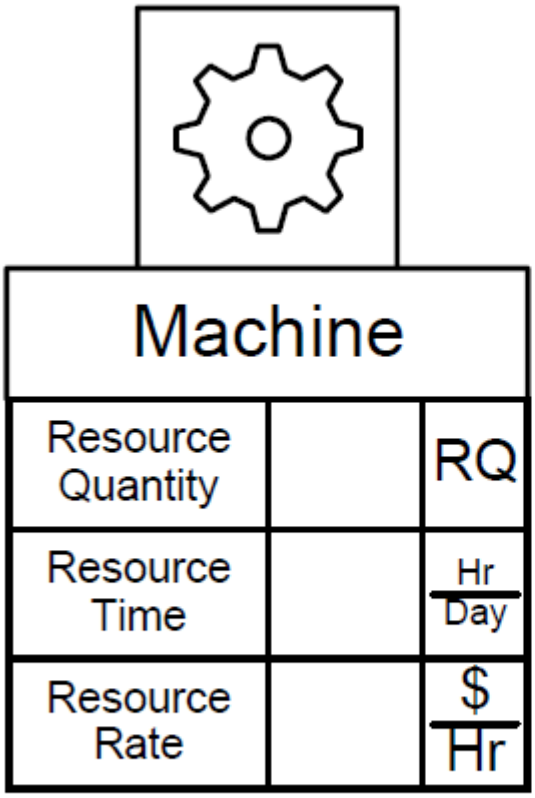

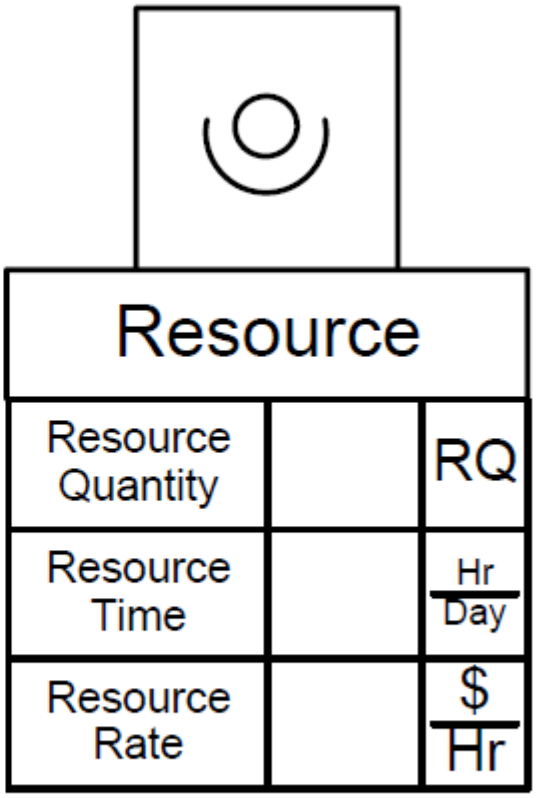

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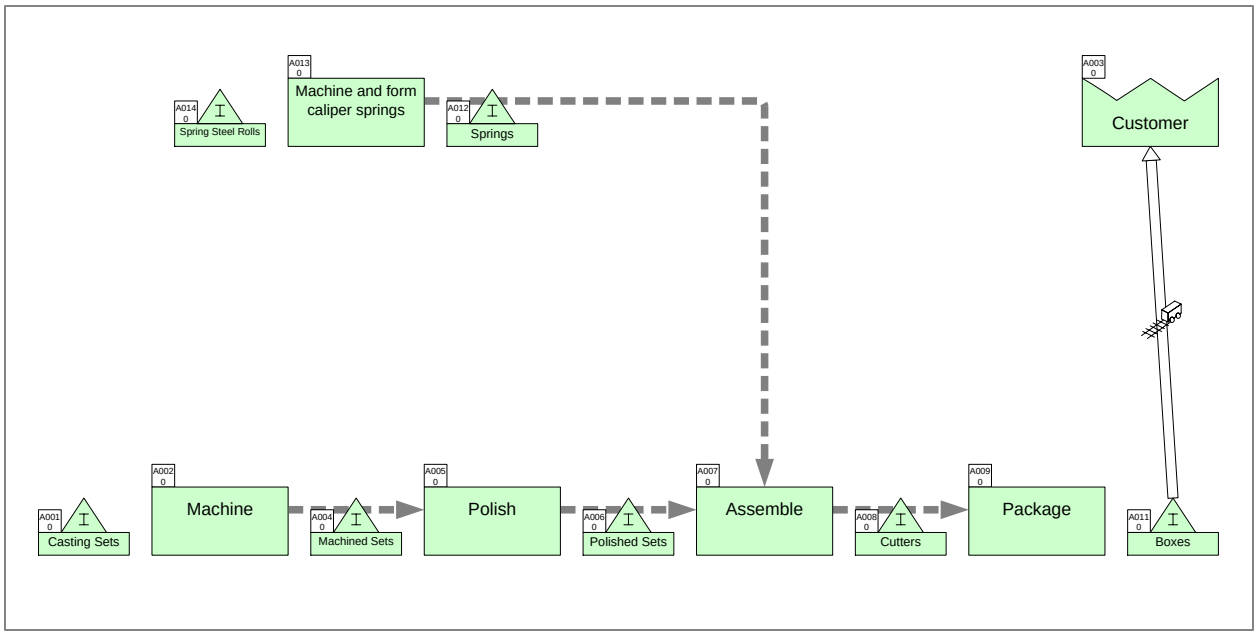
Quick Manufacturing Tutorial

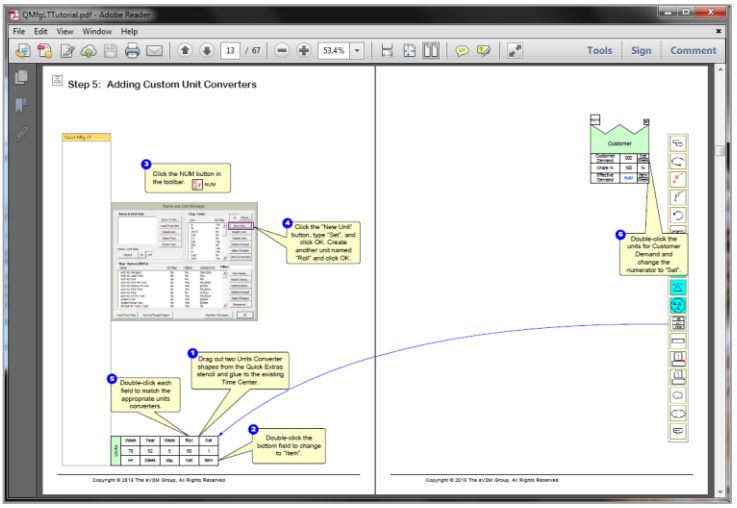
This tutorial will guide you through the steps to draw a simple map, perform common calculations, and plot charts using the Quick Manufacturing stencil.



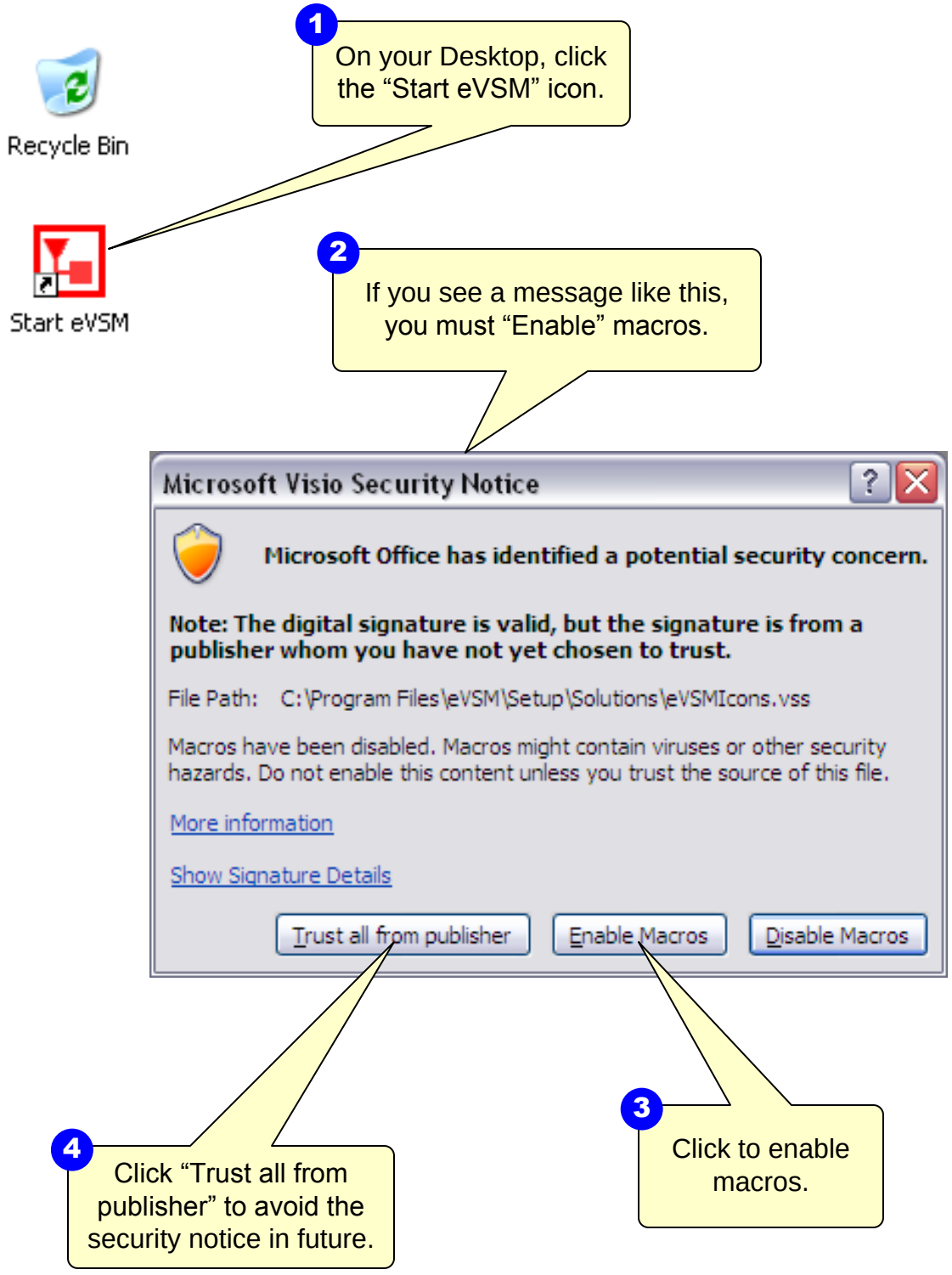
Viewing/printing eVSM Tutorial:

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



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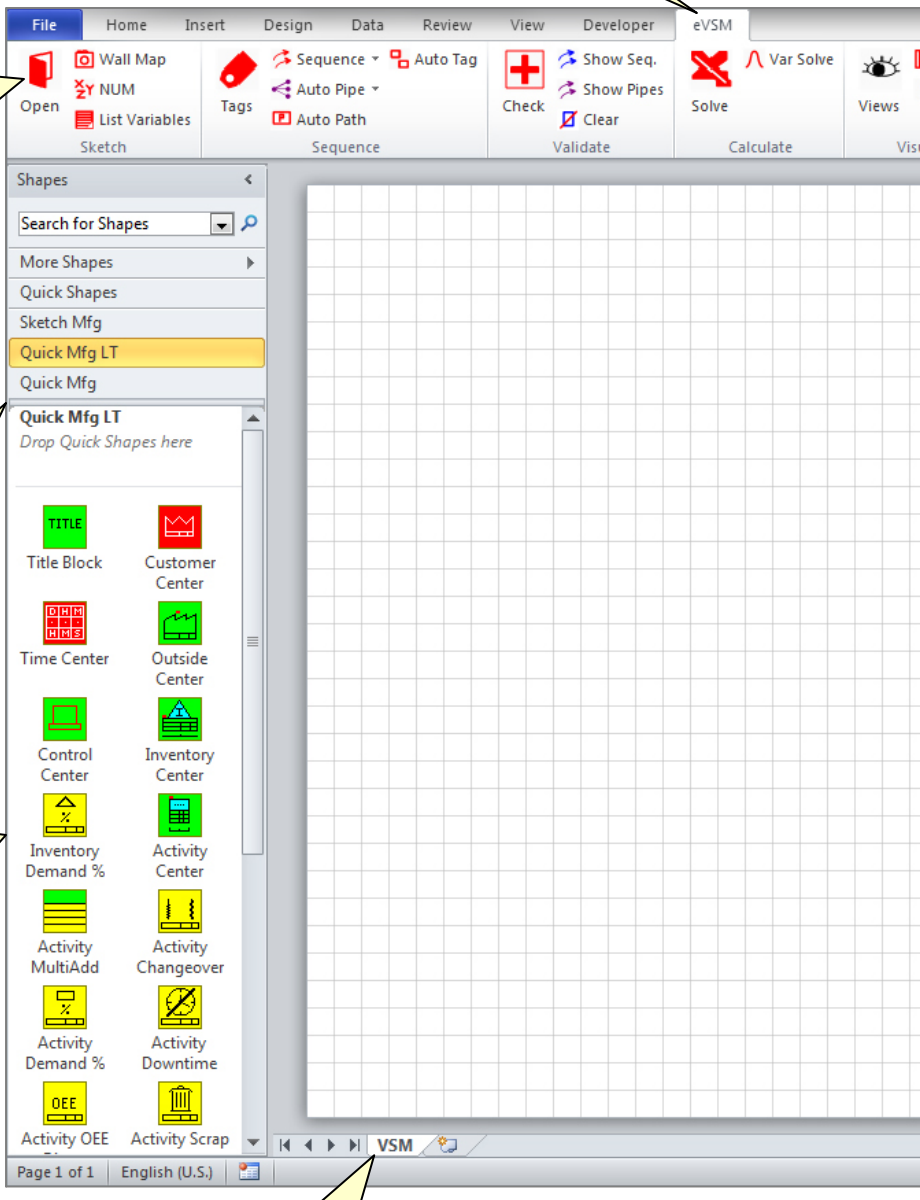
The eVSM Environment

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 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.

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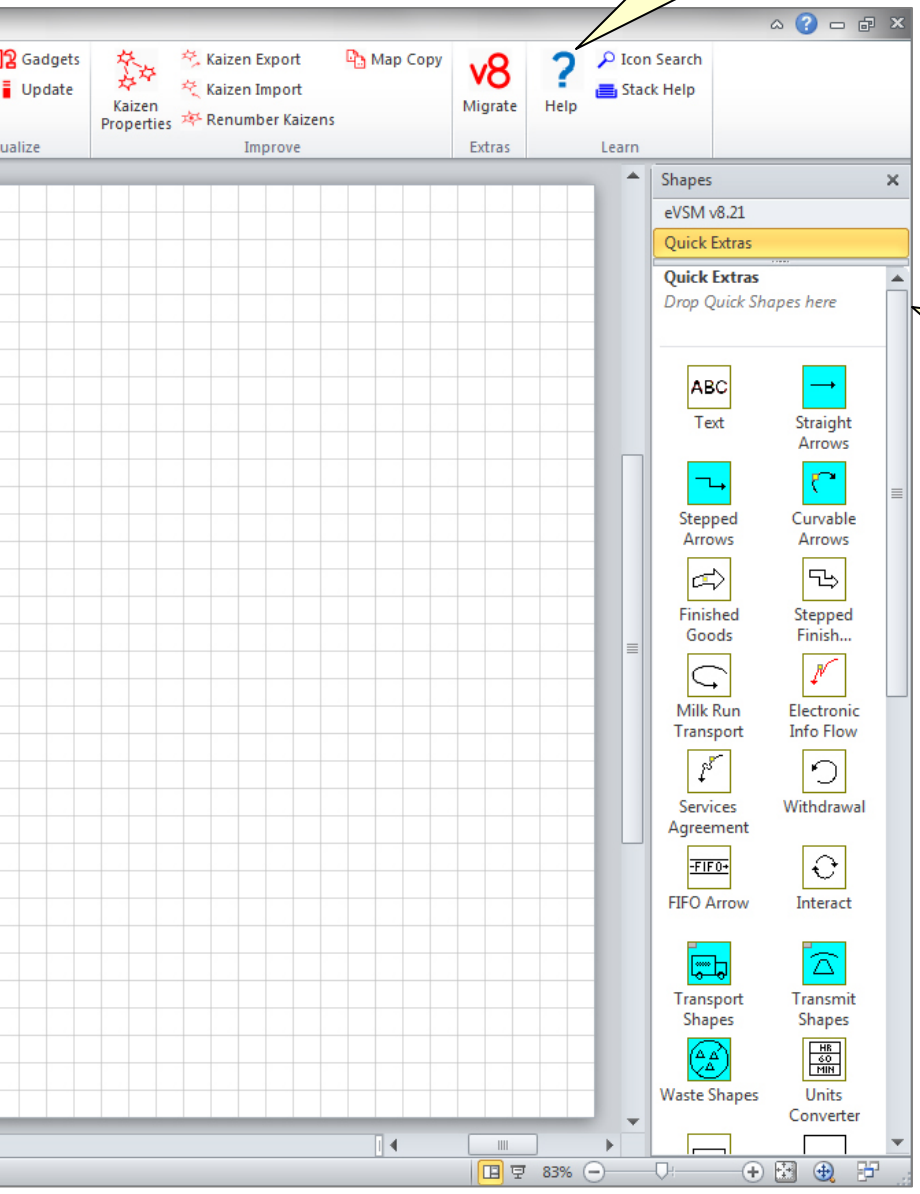
Hover over each button in the eVSM Toolbar to learn what it does. Detailed help and tutorials are available at the eVSM help site which can be accessed via this button.



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.

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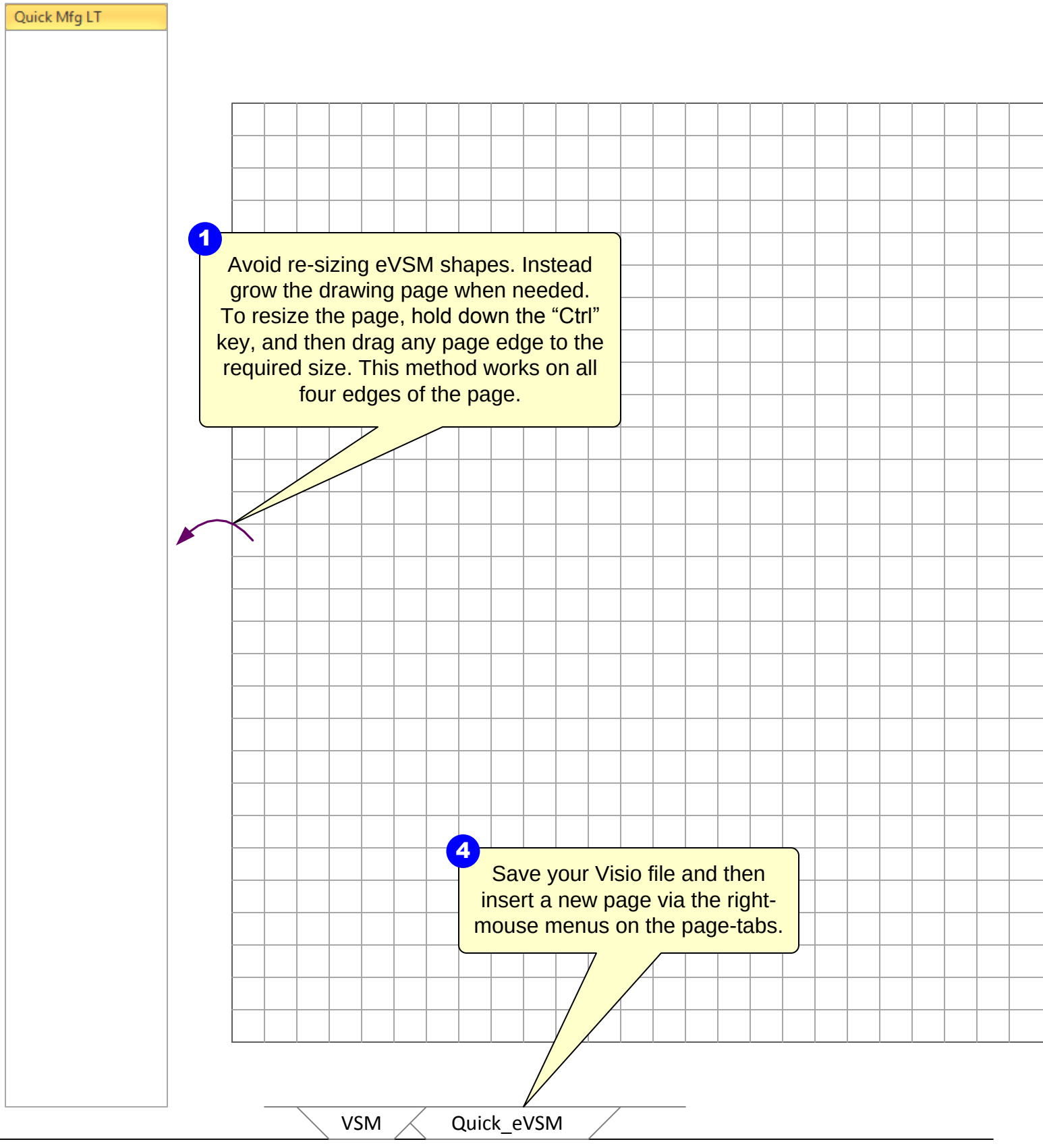
Step 2: Learn eVSM Basics



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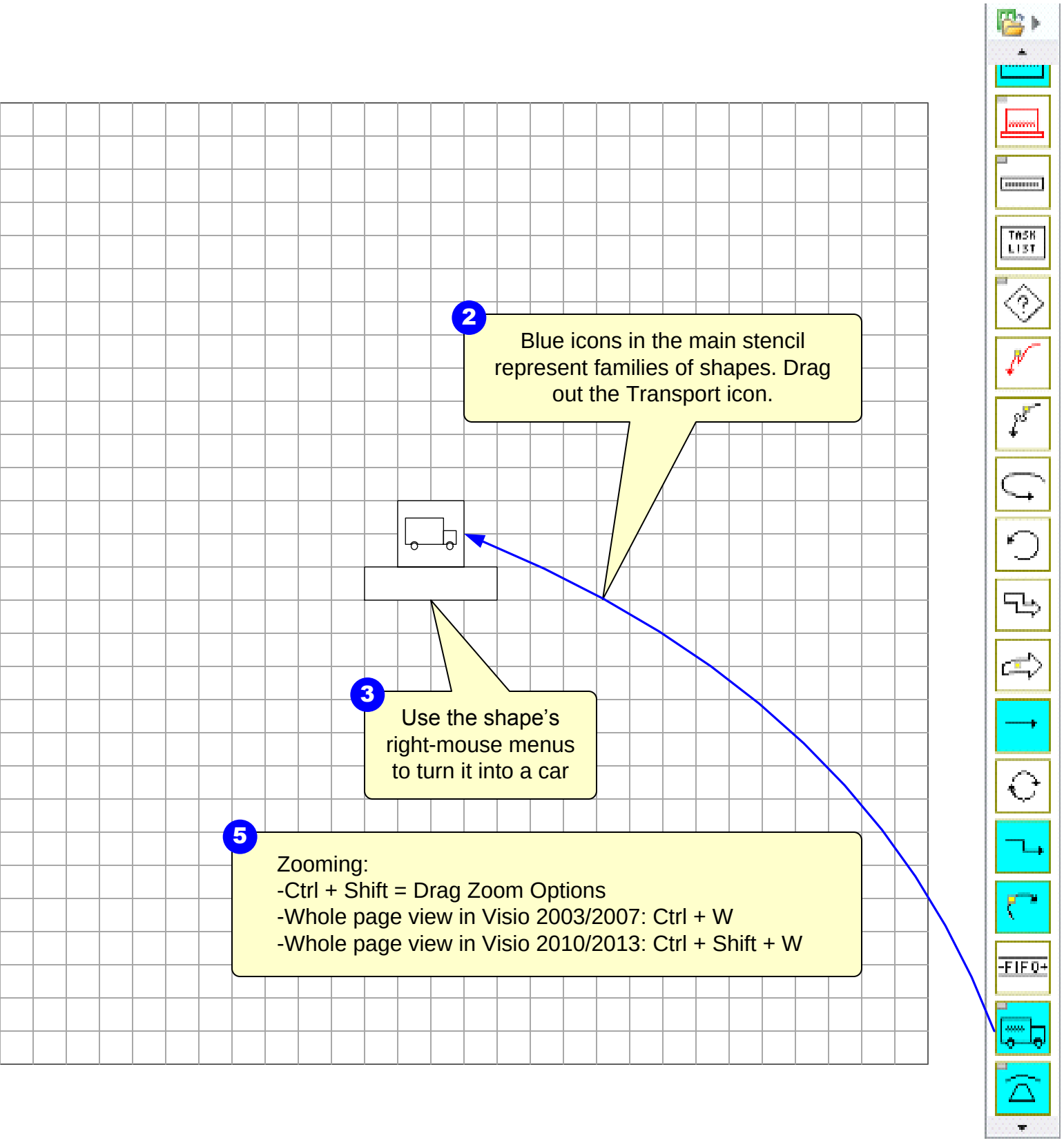

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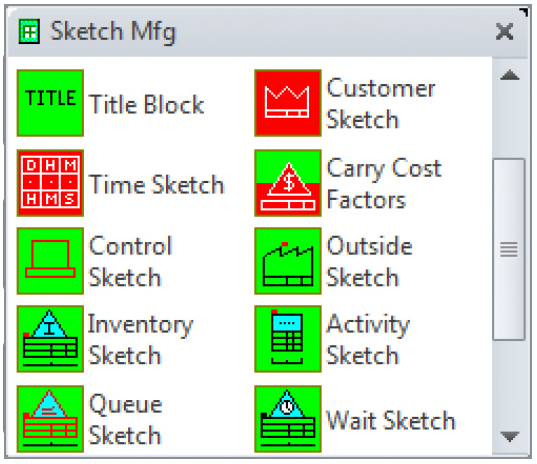
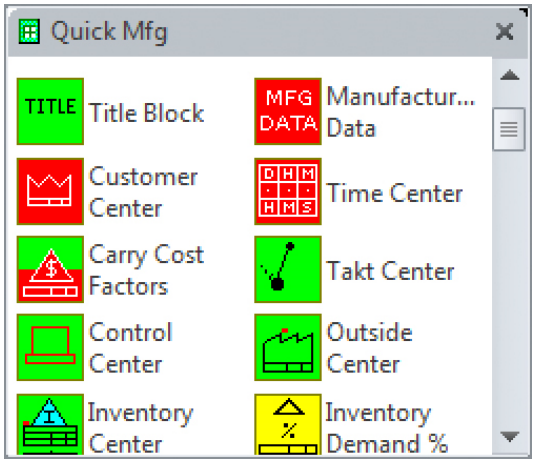
Quick Mfg Stencils Overview

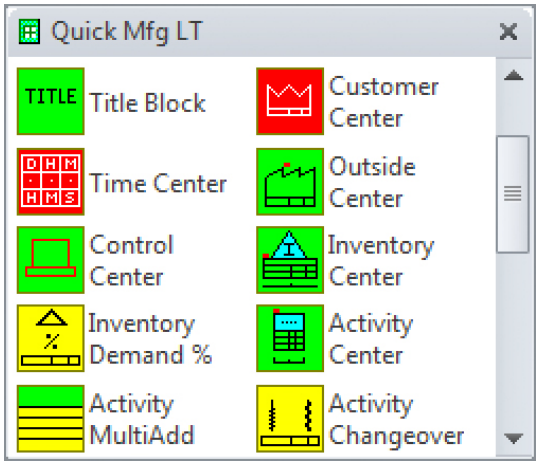
Quick Manufacturing has three stencils.



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.

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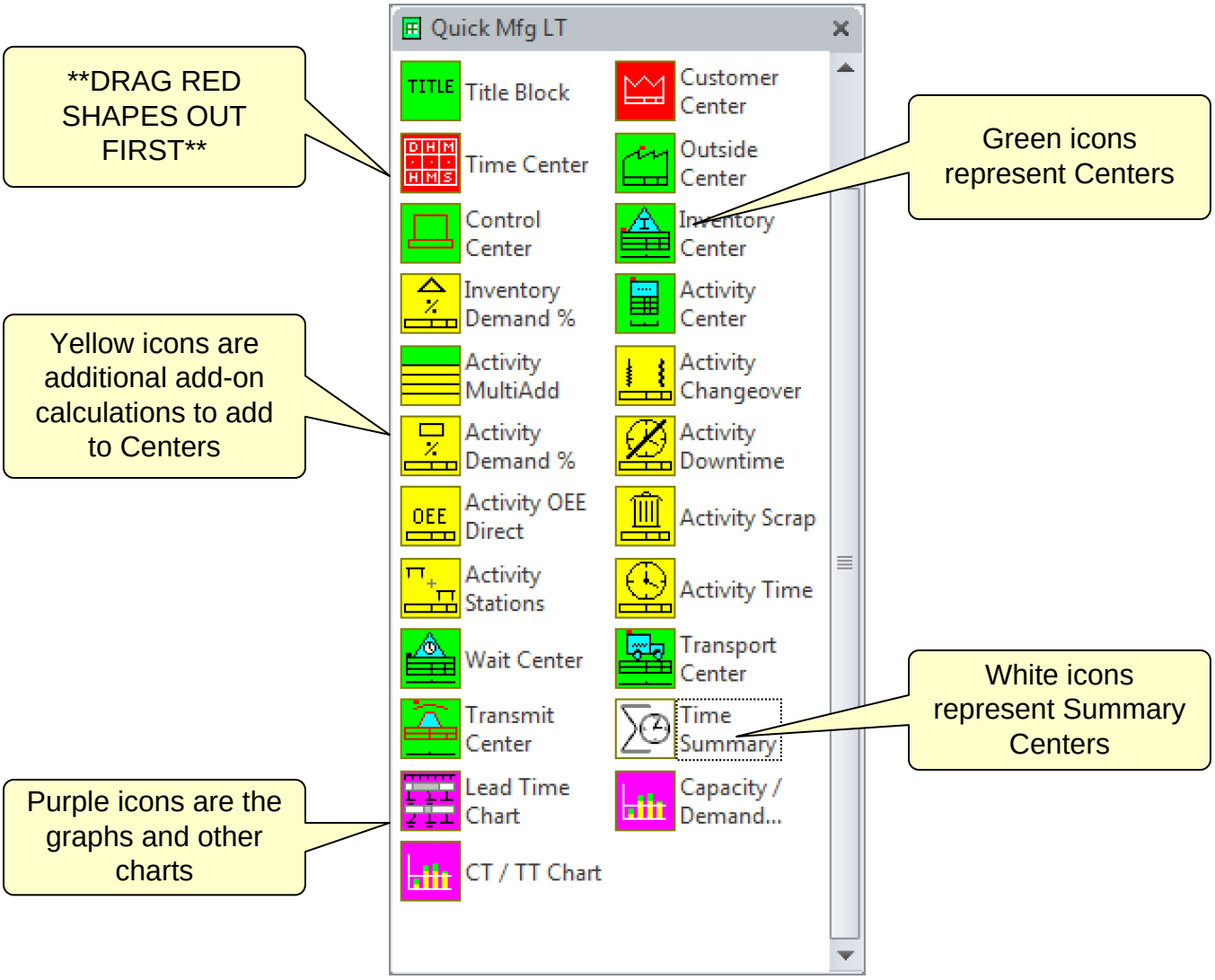
Quick Stencil Icon Colors

Below is an overview of the Quick Mfg stencil shapes.



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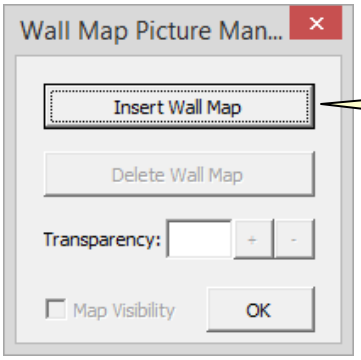
Step 3: Using the wall map sketcher

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 to 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:

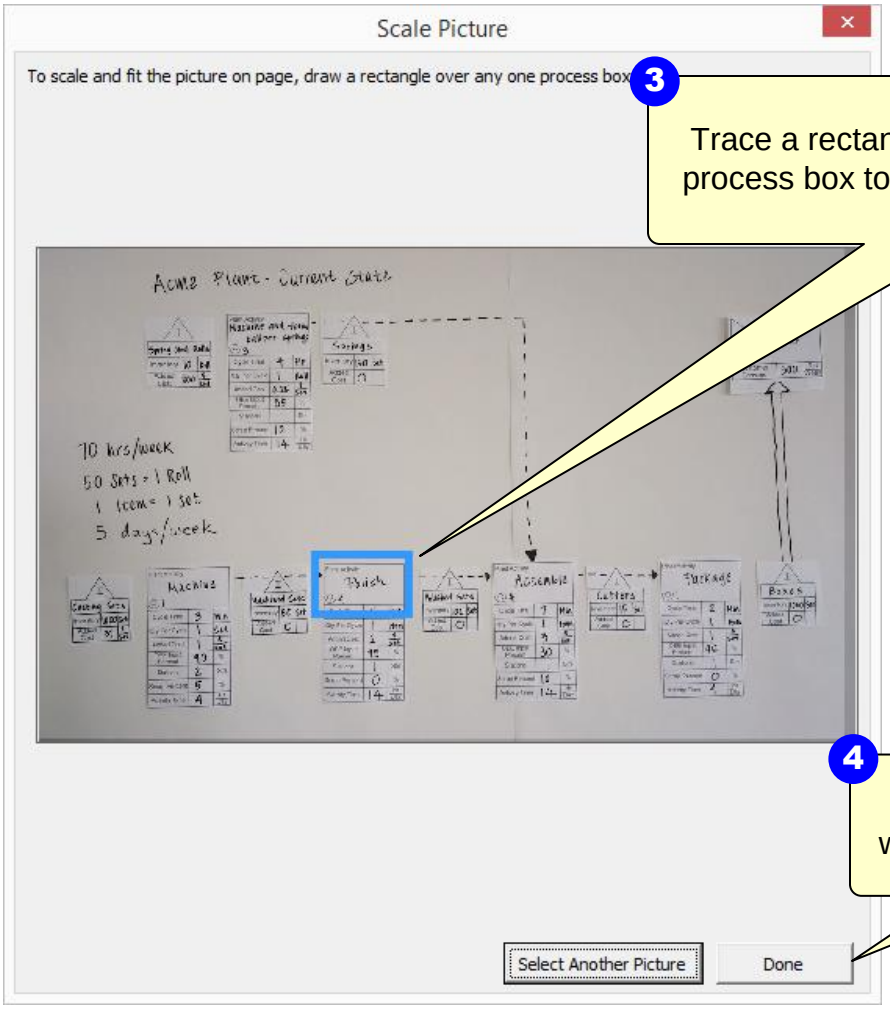
http://www.evsm.com/wallmap

Quick Mfg LT

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



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



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

4 Click Done when finished.

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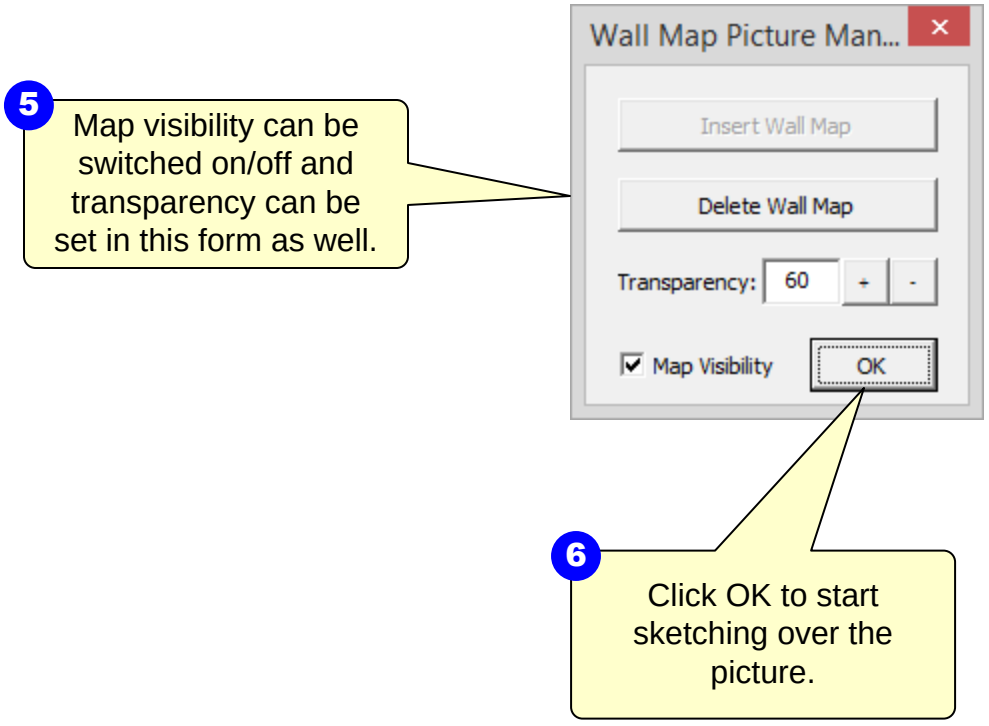

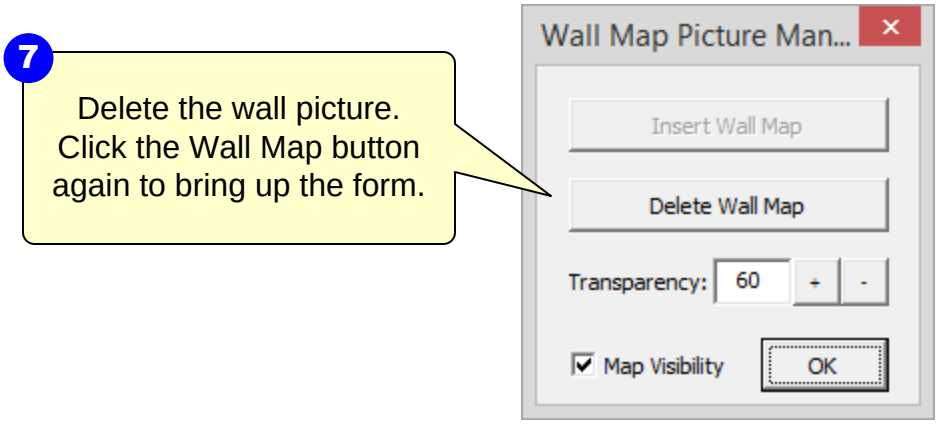

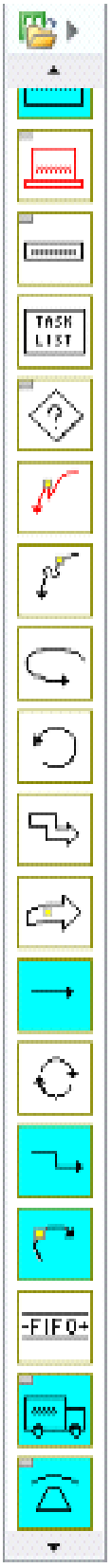

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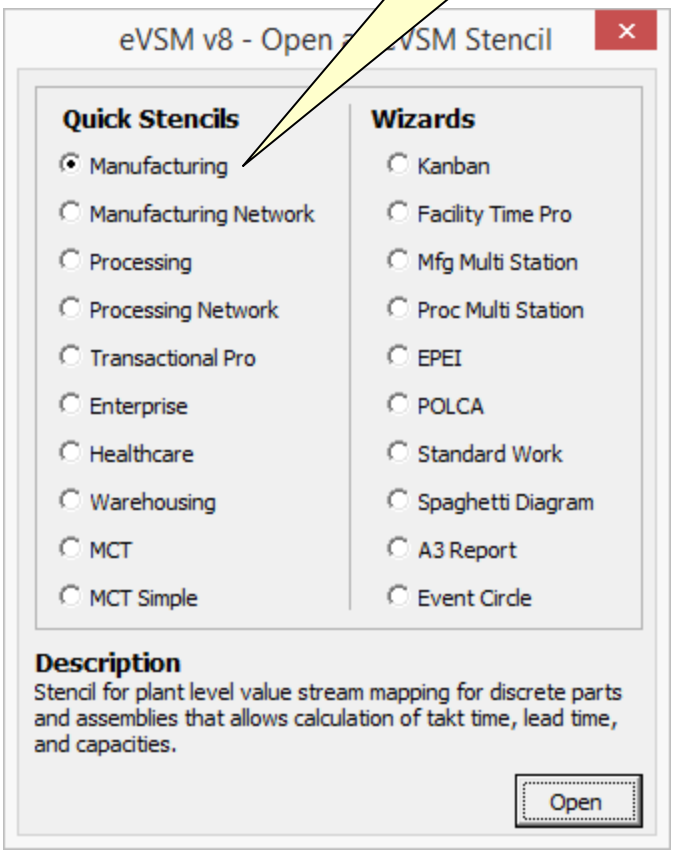
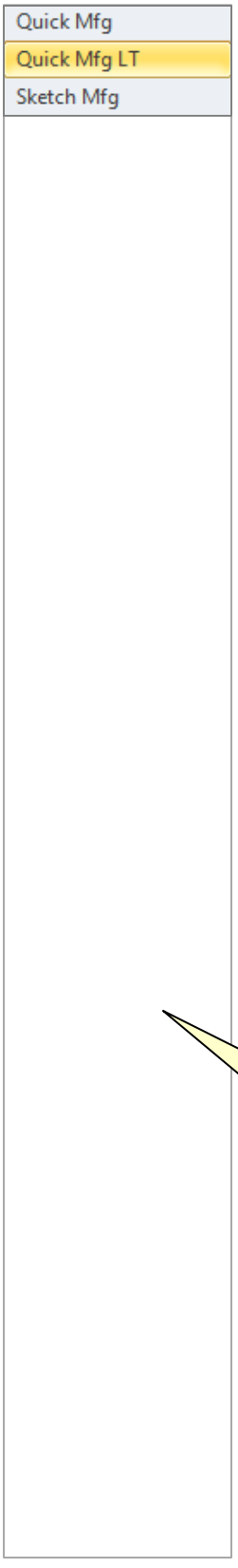
Step 4: Initiate the map for Quick Manufacturing LT

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.

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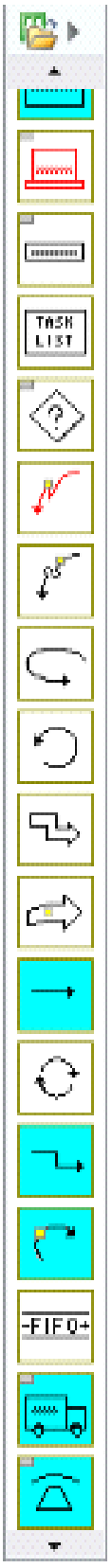

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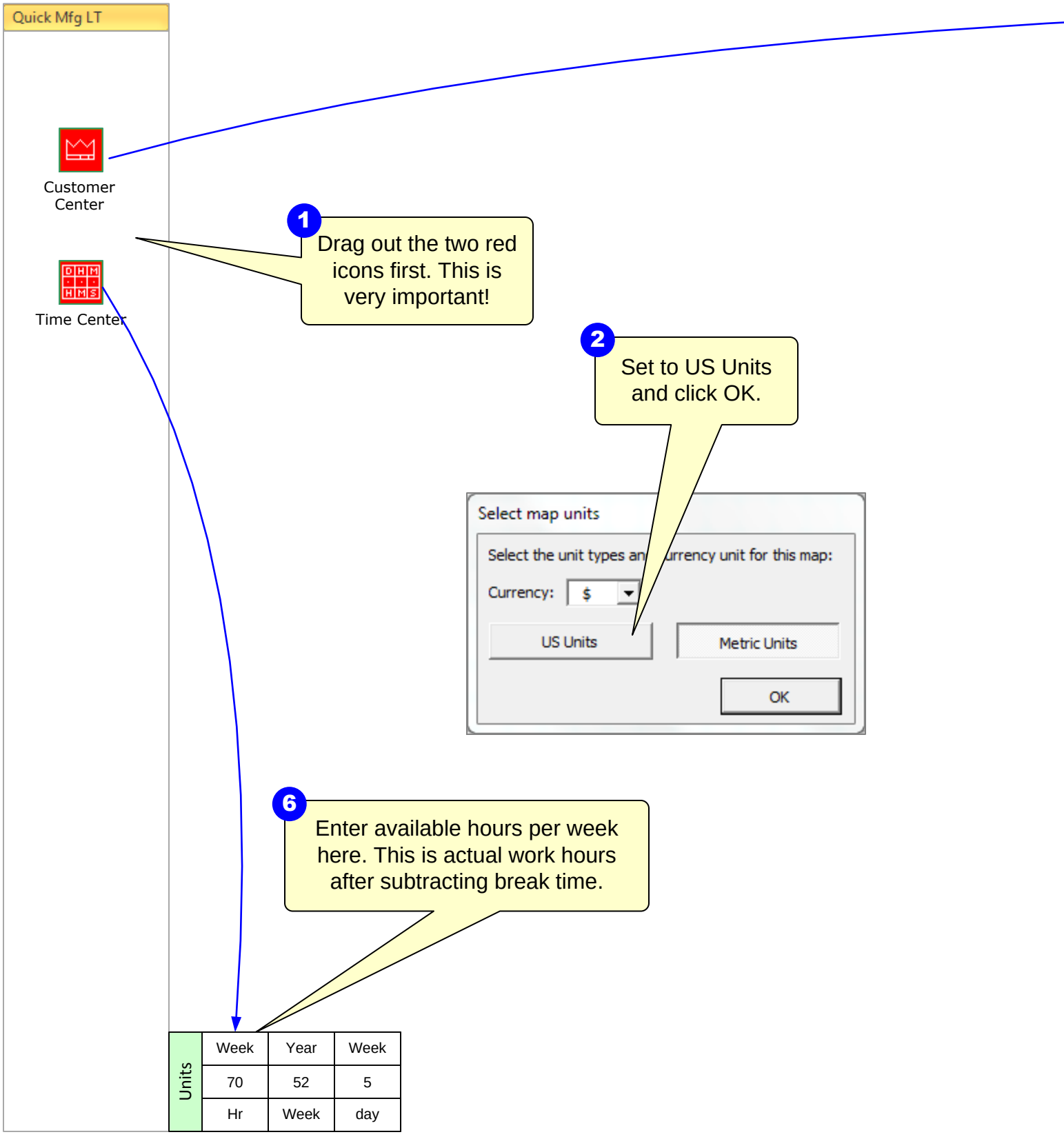
Step 4B: Initiate the map for Quick Manufacturing LT



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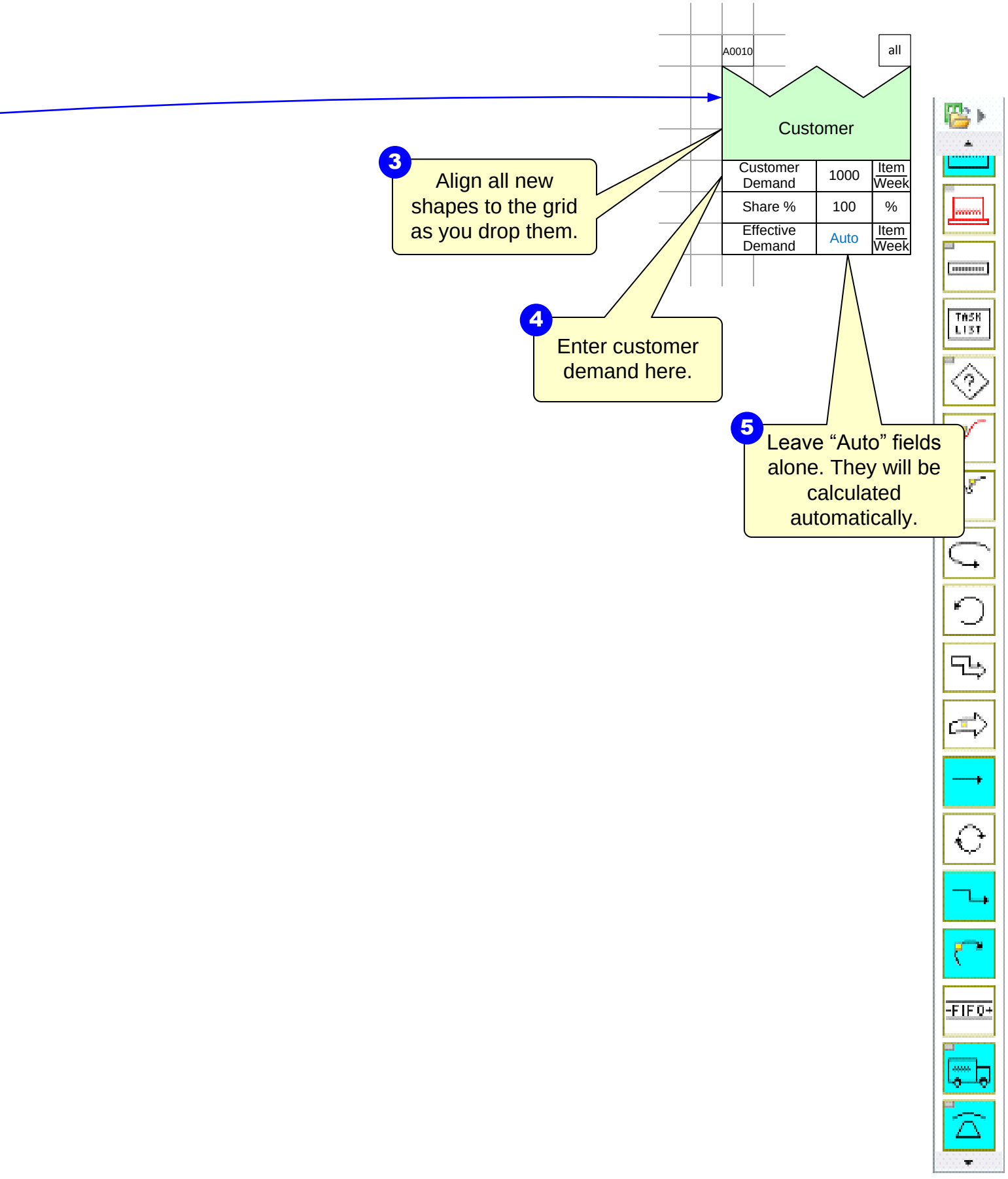

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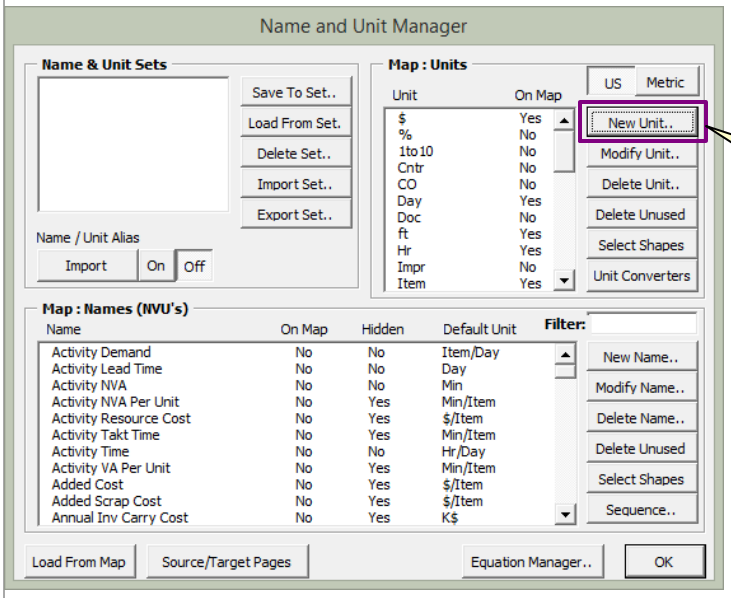
Step 5: Adding Custom Unit Converters

Quick Mfg LT

3 Click the NUM button in the toolbar. NUM



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.

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

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

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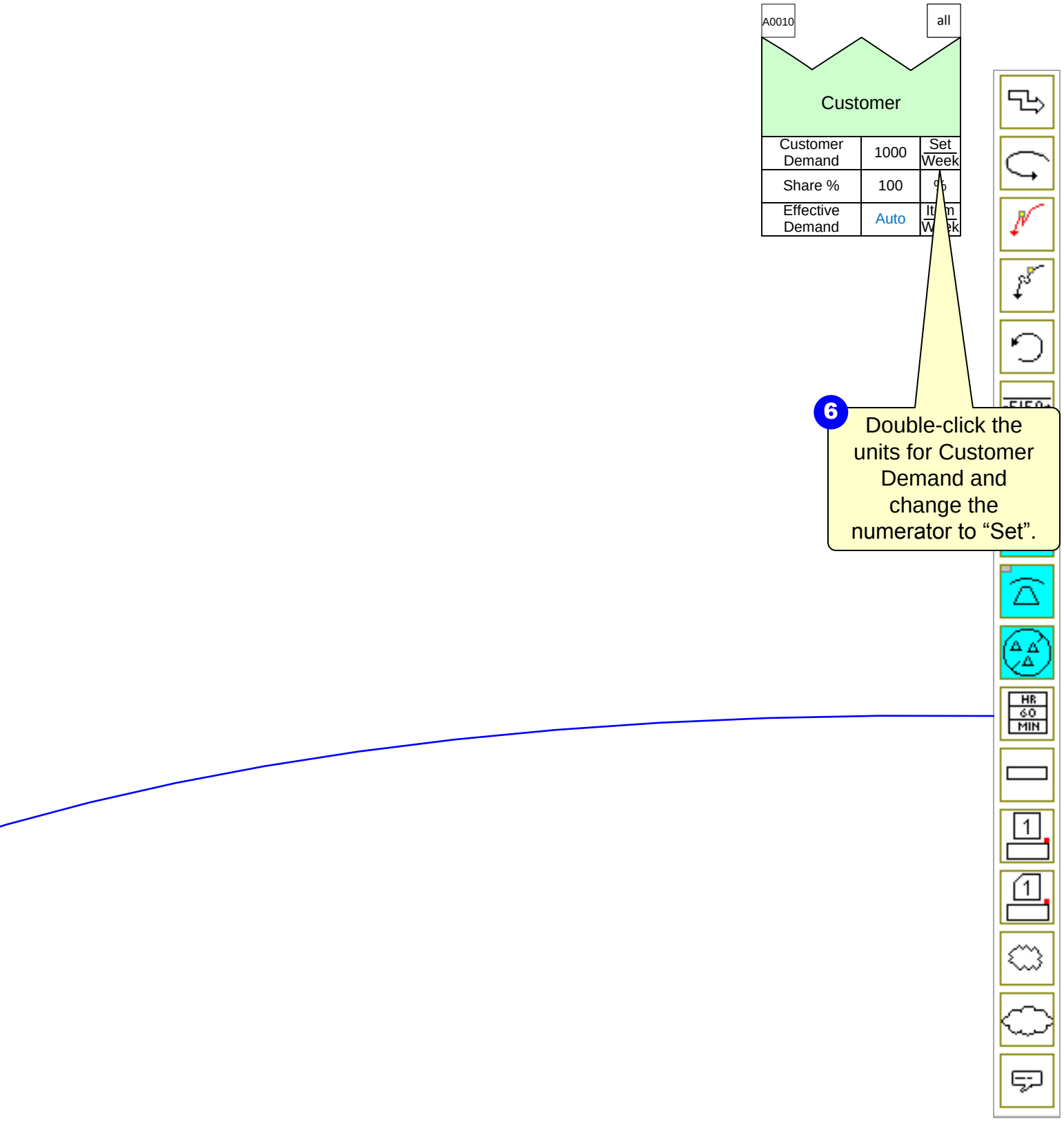

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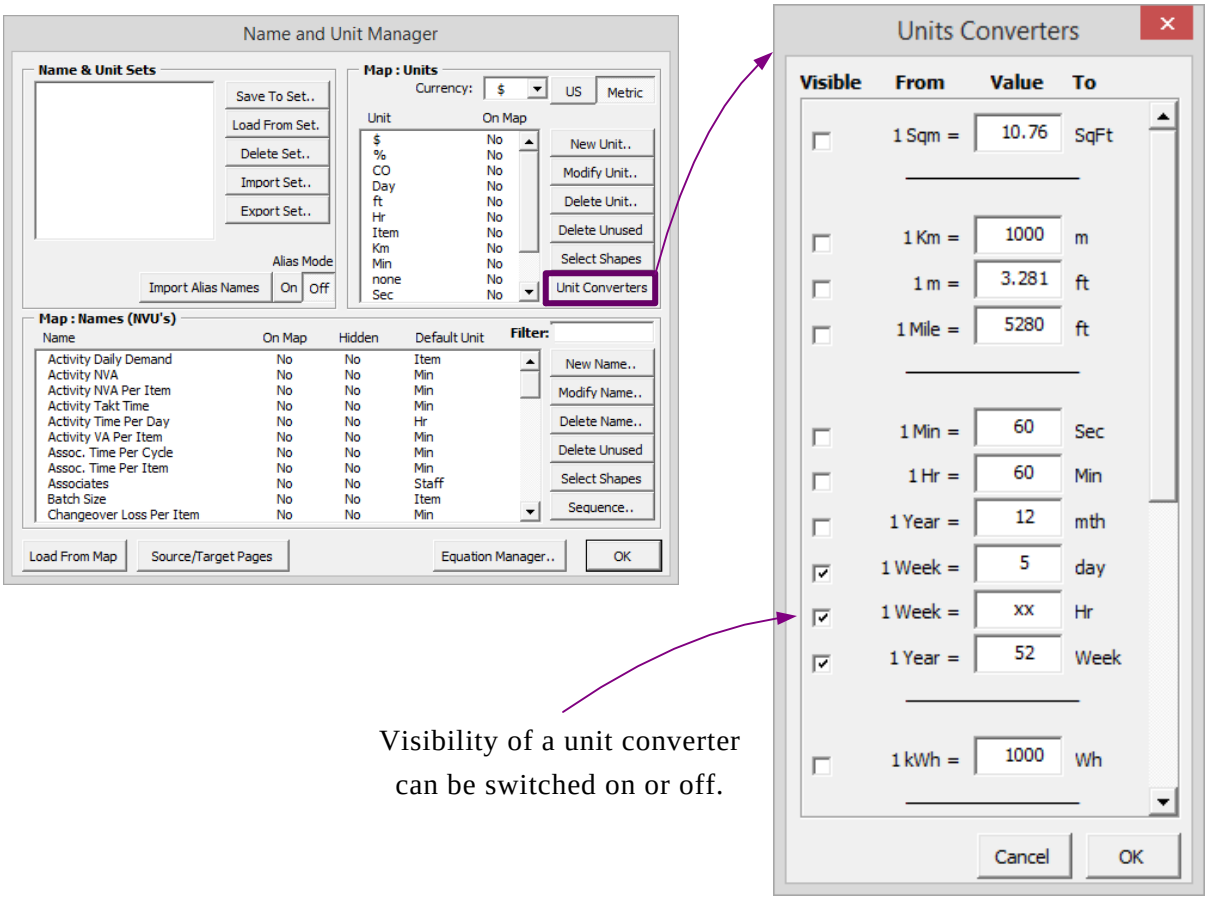
Unit Converters Usage

- 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.

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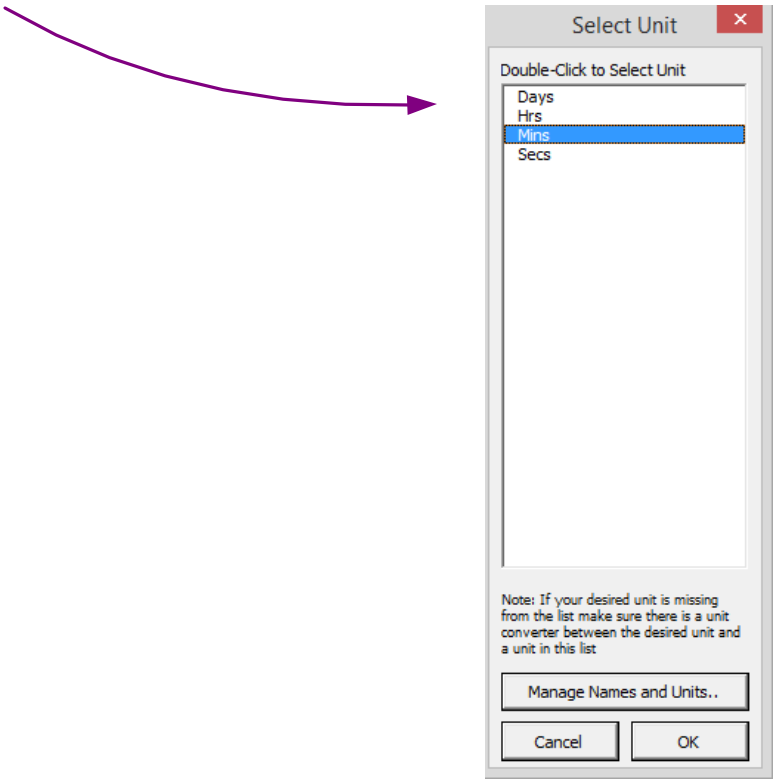
- Unit families eliminate errors when changing units
- Only Time units will appear when double-clicking on Mins to change to Hrs



- 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

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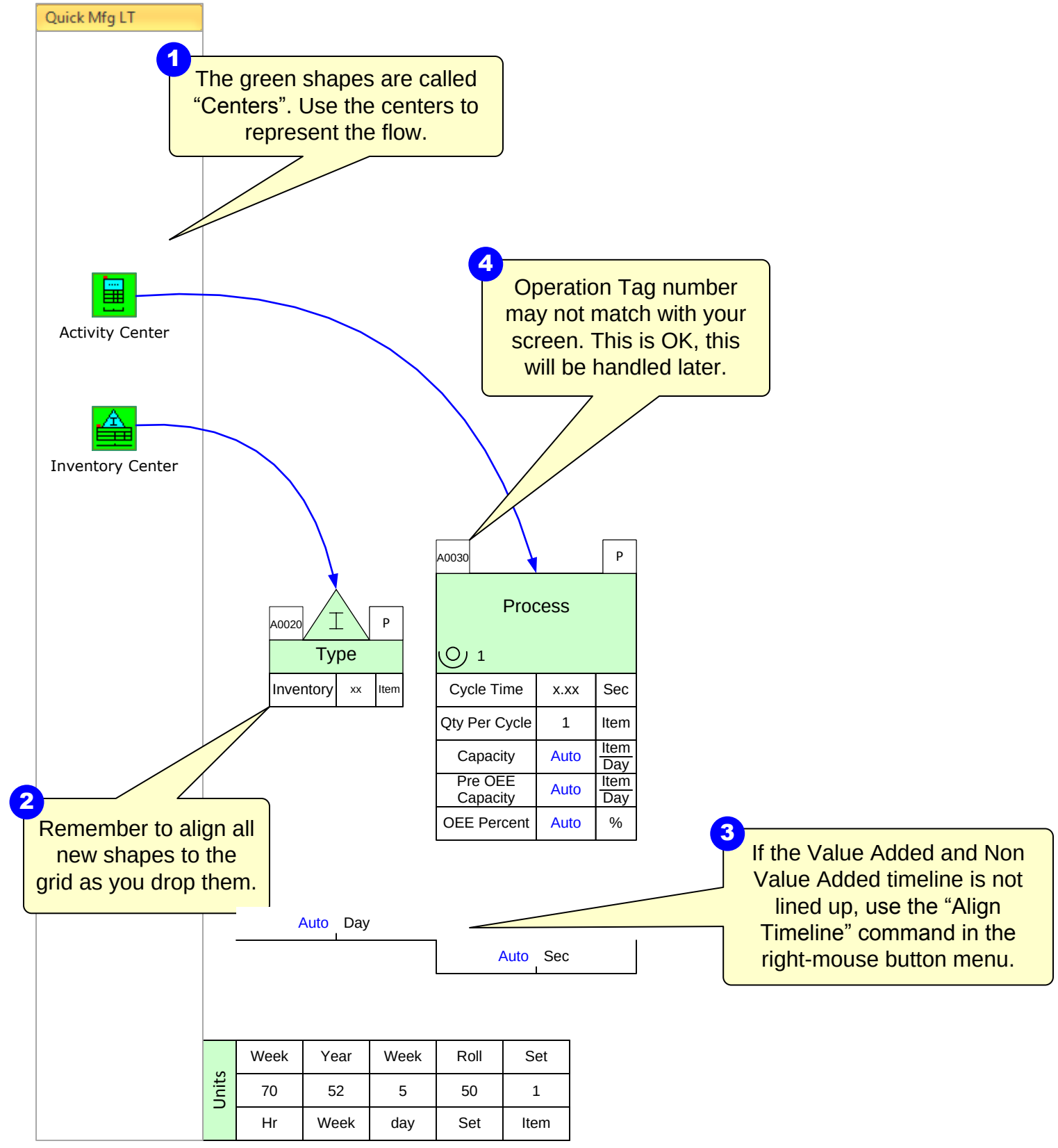
Step 6: Draw the flow



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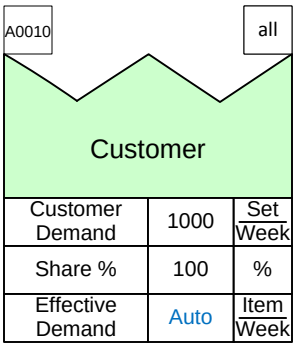

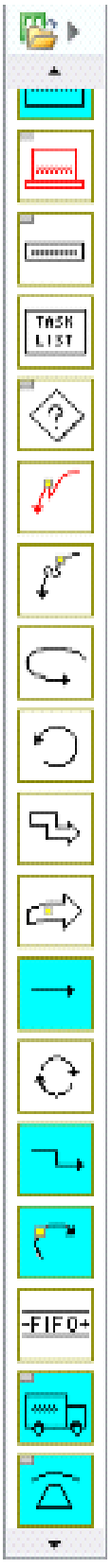

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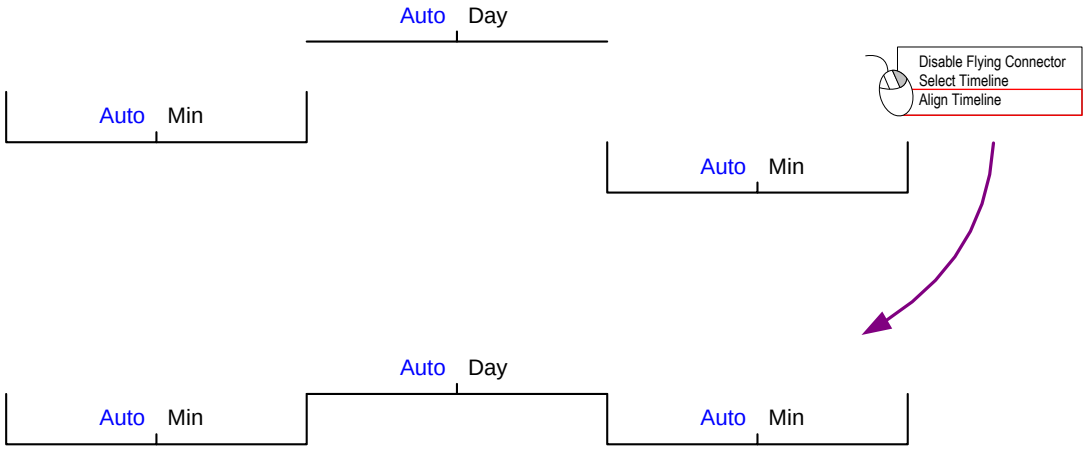
Working with the timeline

- 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



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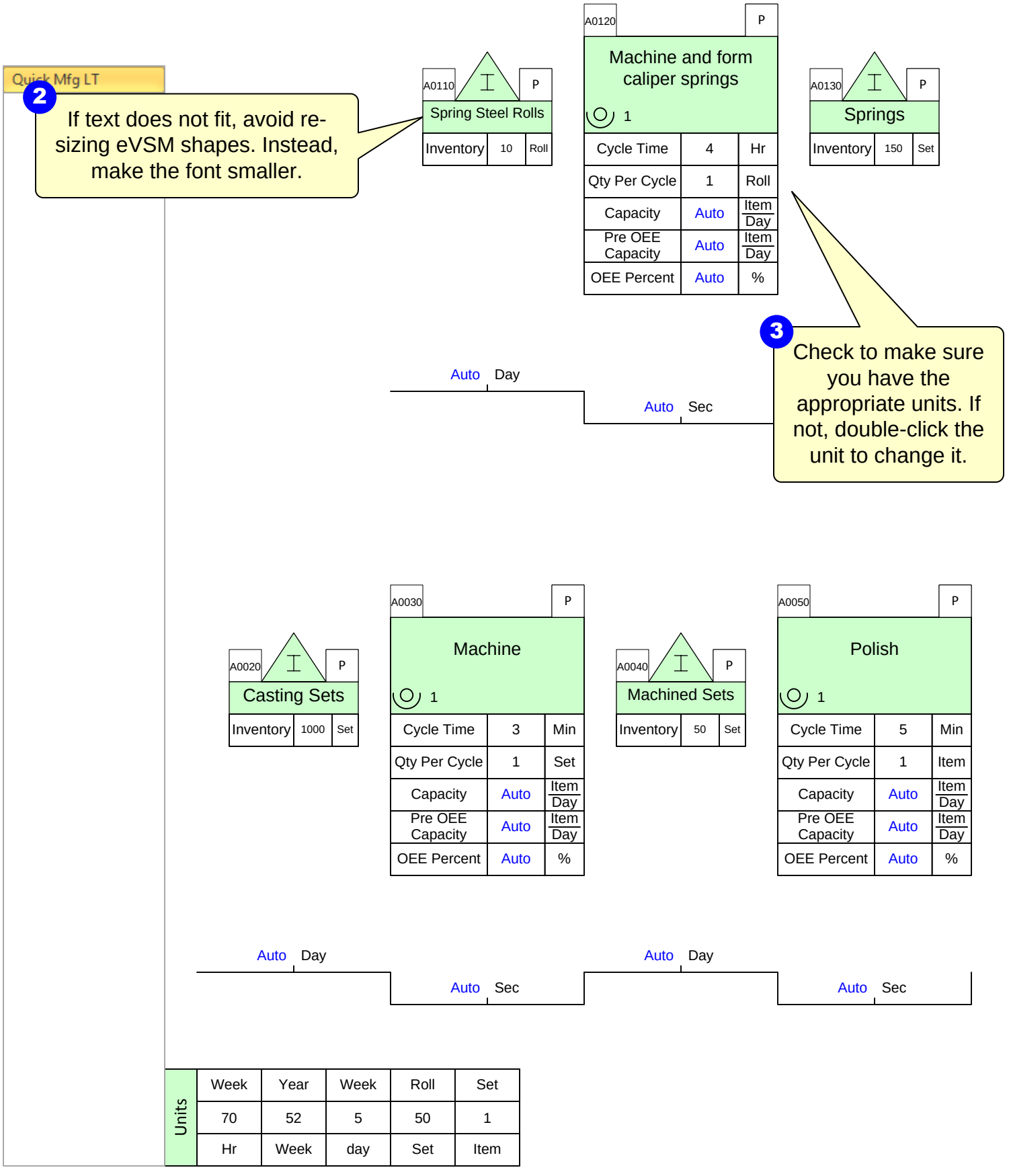
Step 7: Complete the flow and enter data



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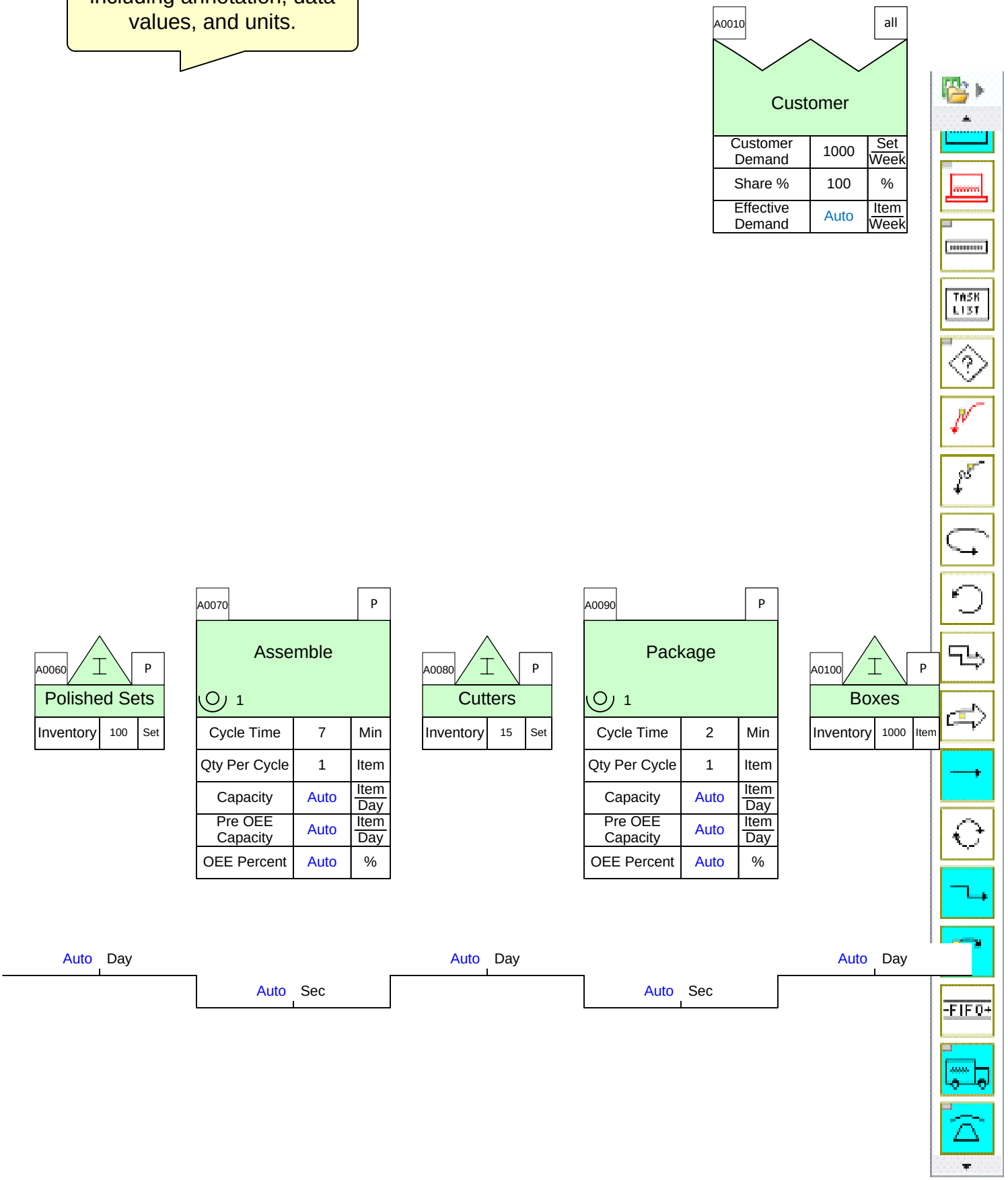
1 Complete as shown below, including annotation, data values, and units.



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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

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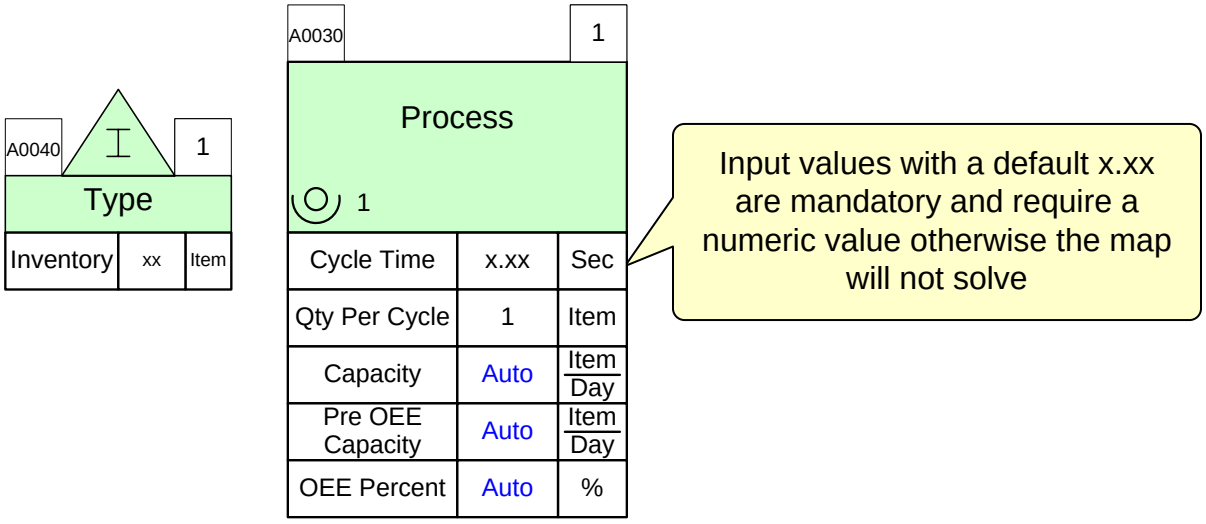
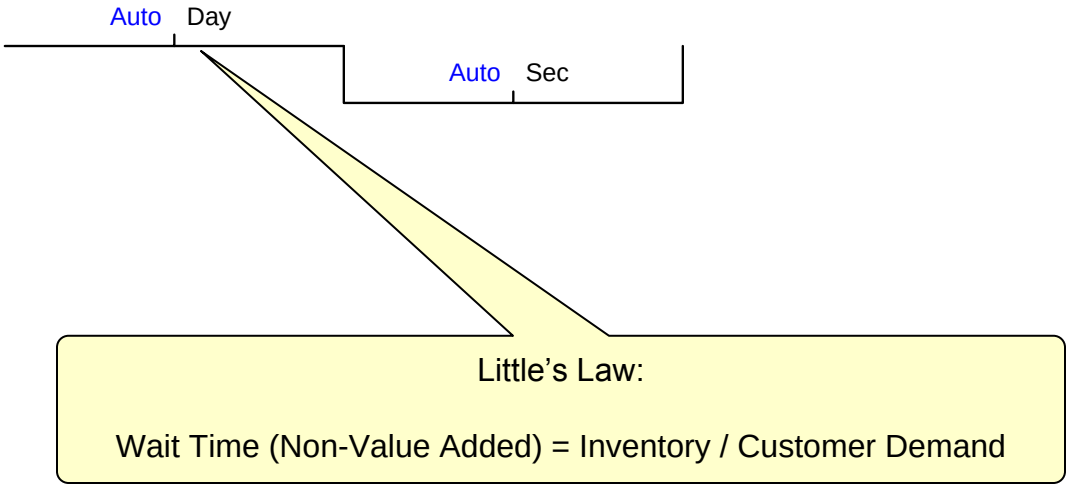
Data Entry Hints





- 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

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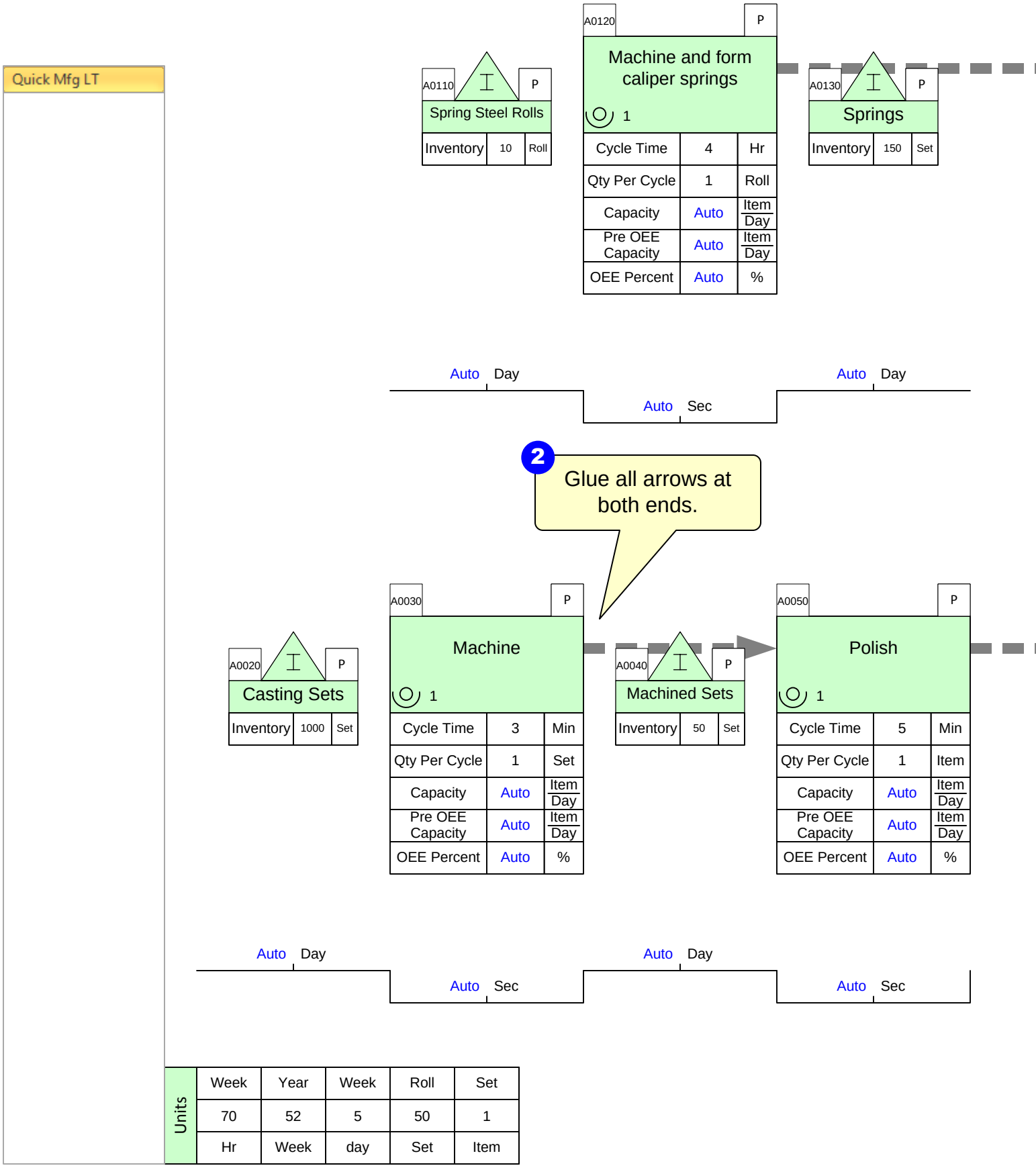
Step 8: Add Arrows from Main Stencil



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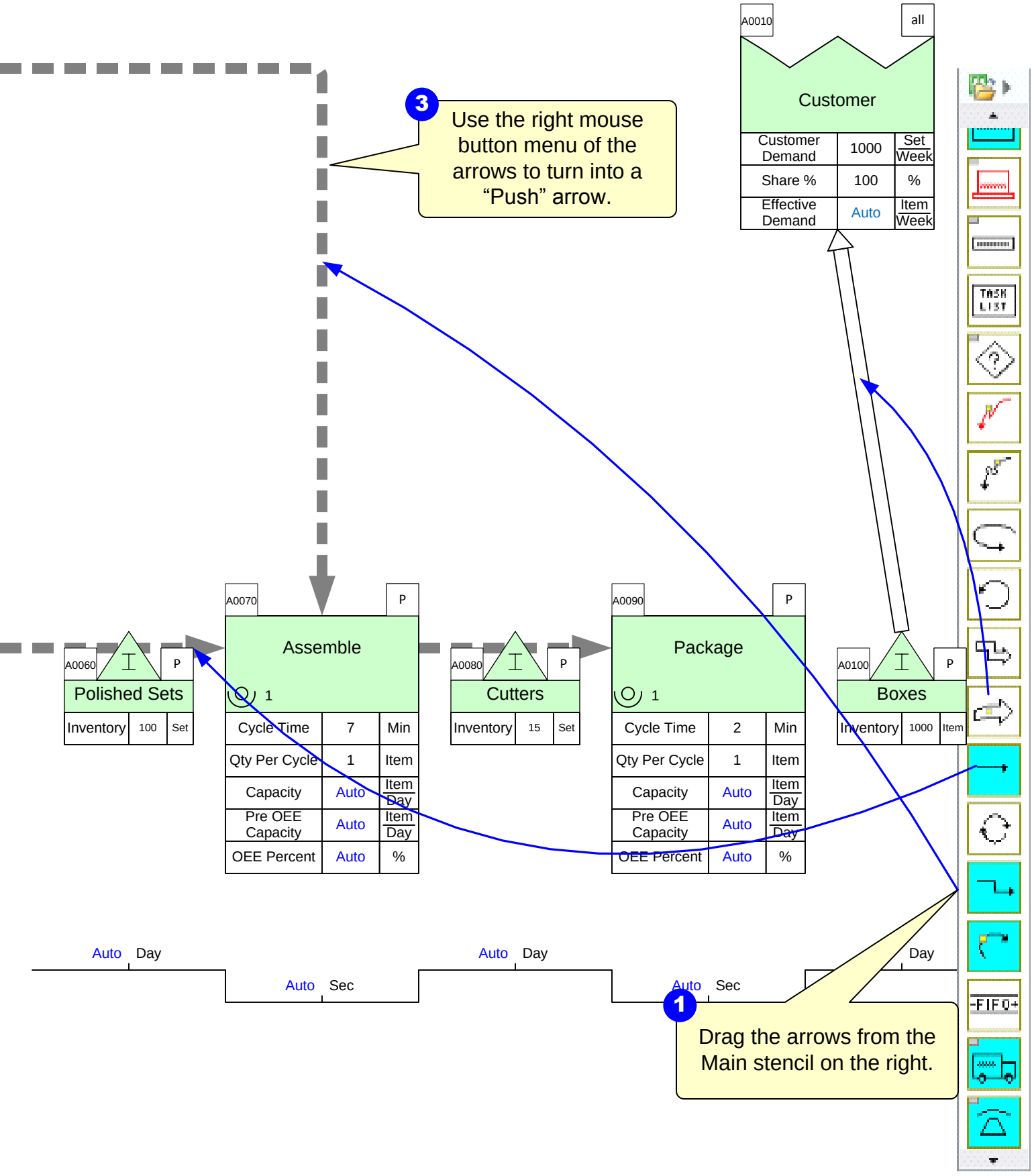

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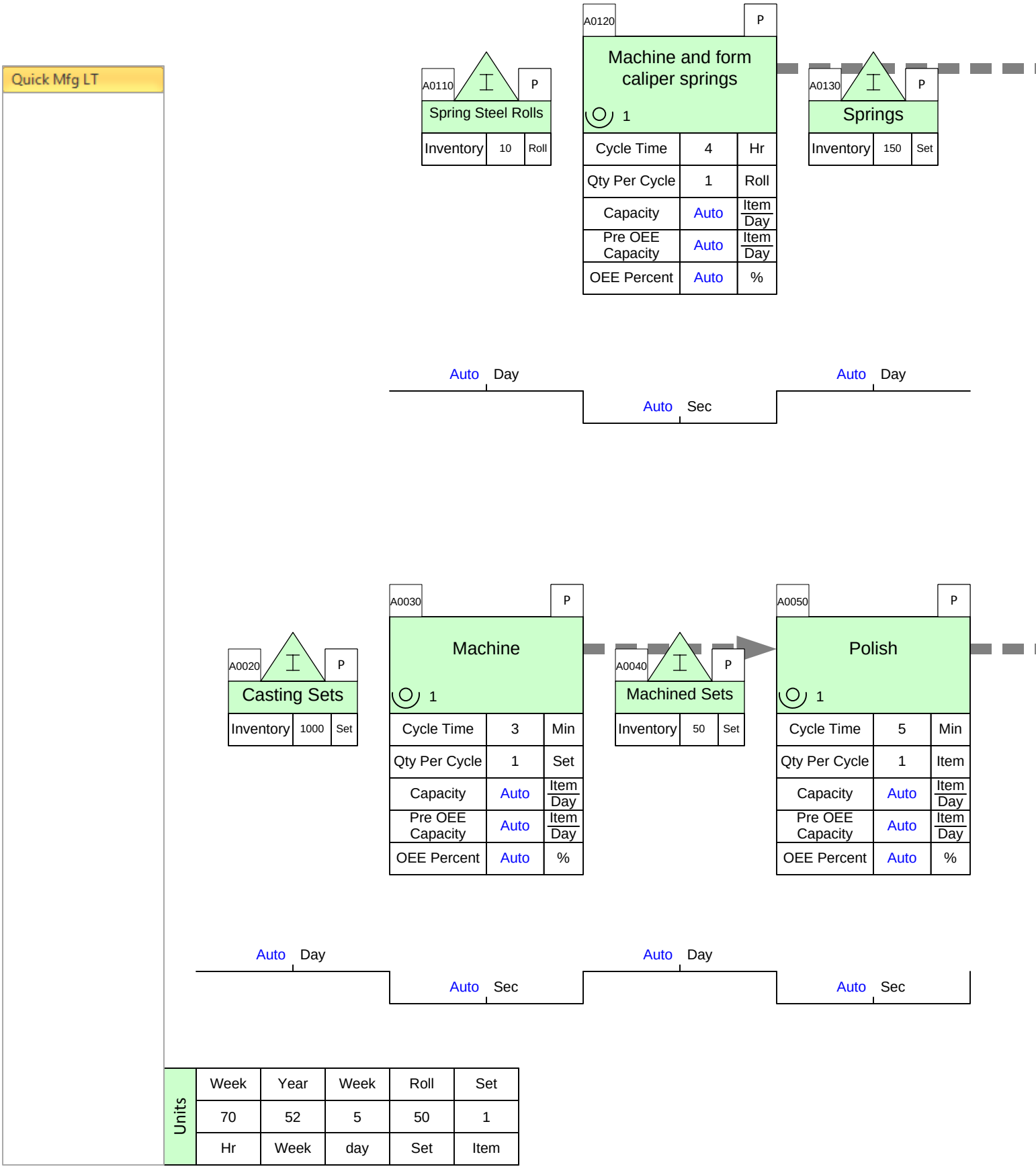
Step 9: Add Transport shapes



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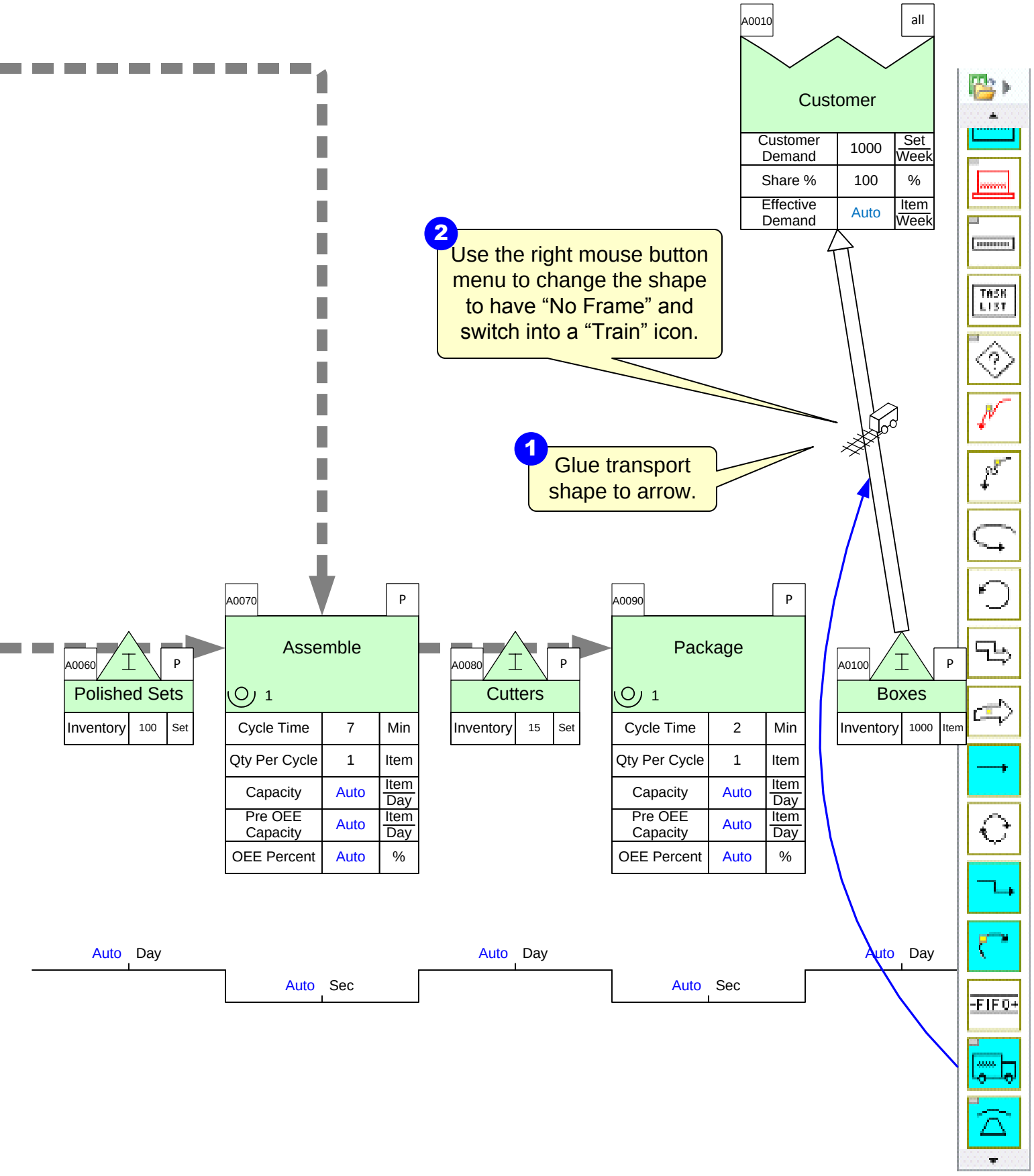

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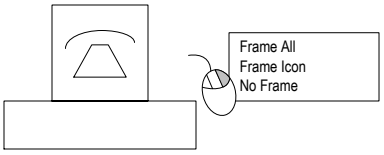
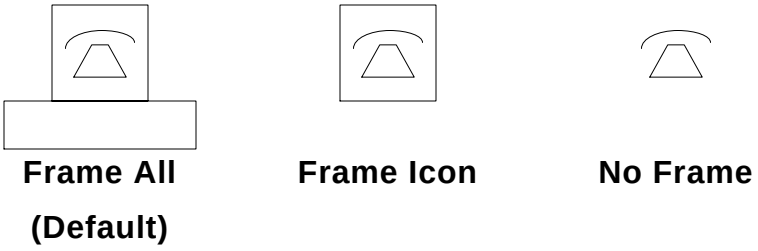
Transport, Transmit, and Flow Shapes

- 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

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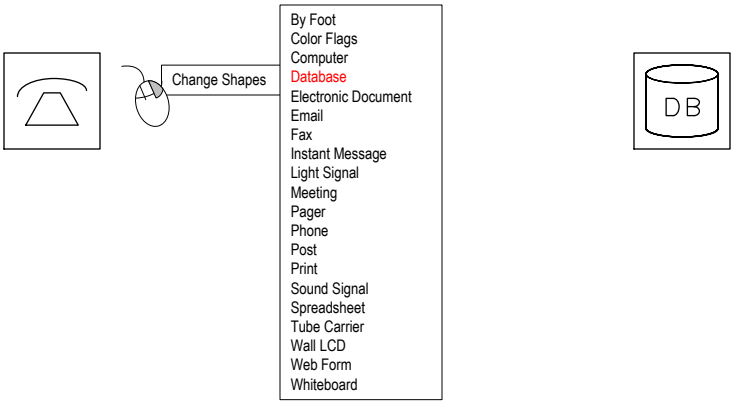
Blue Stack Shapes

- 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



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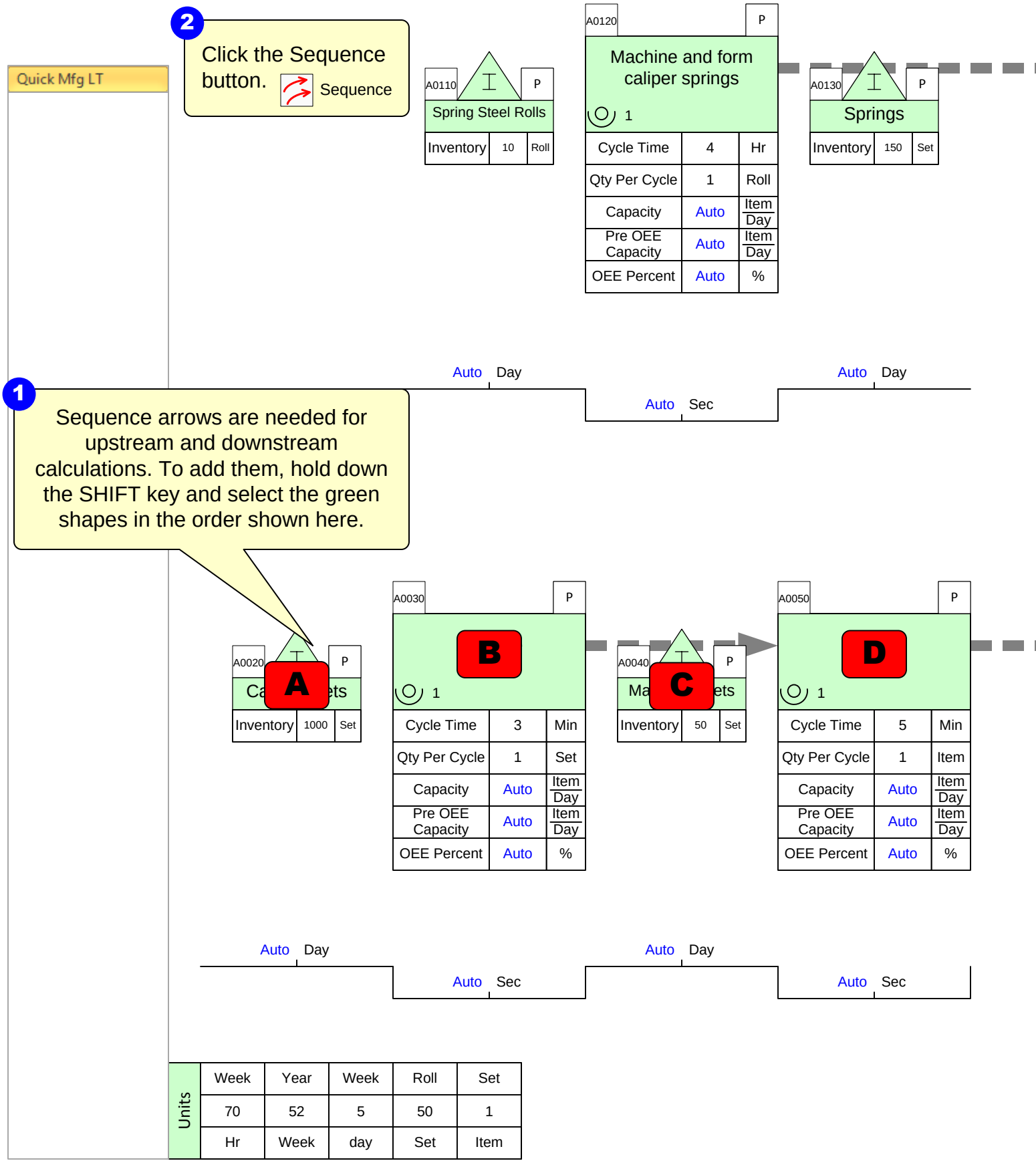
Step 10: Sequence Arrows



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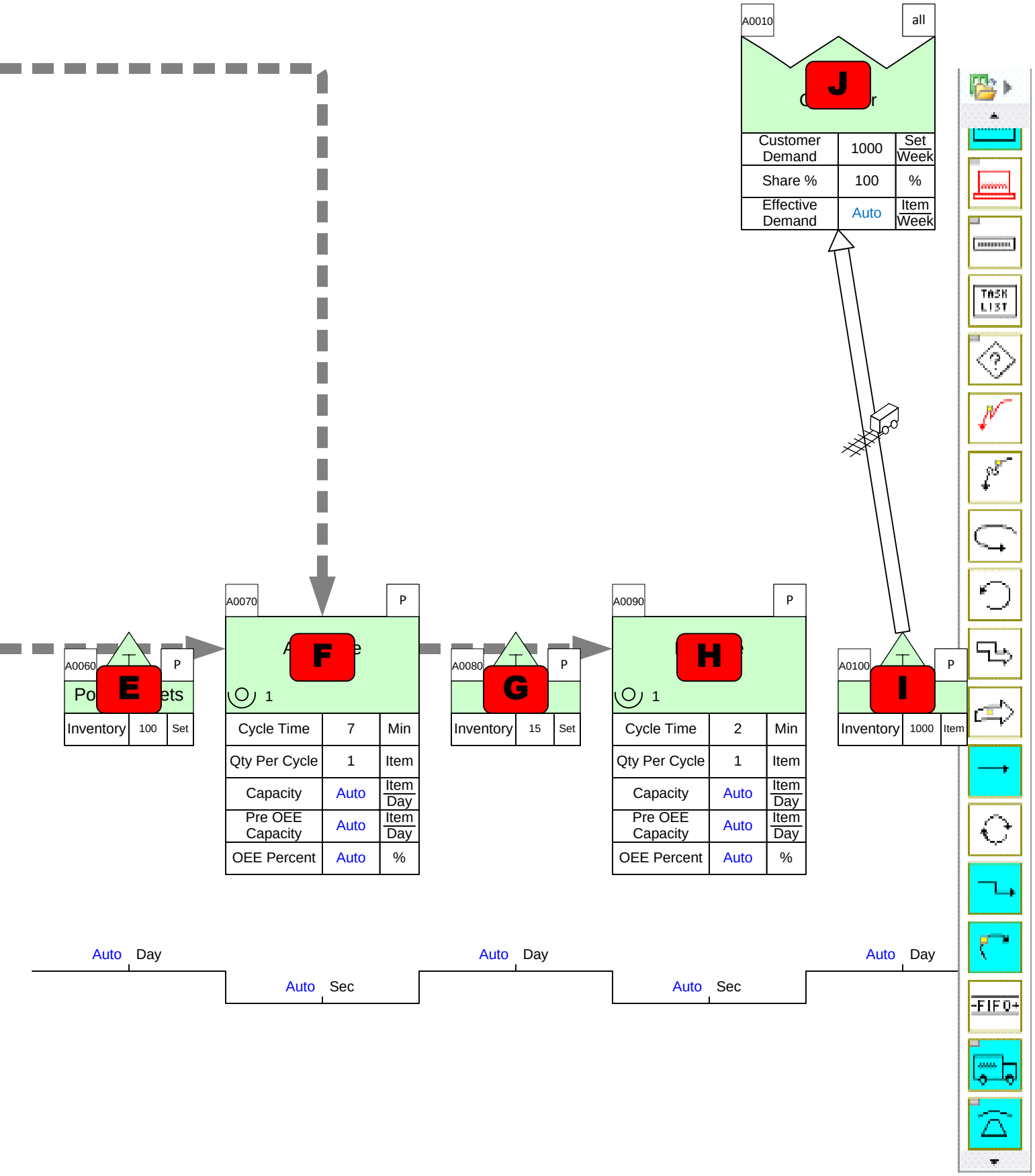

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Sequence Arrows

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.

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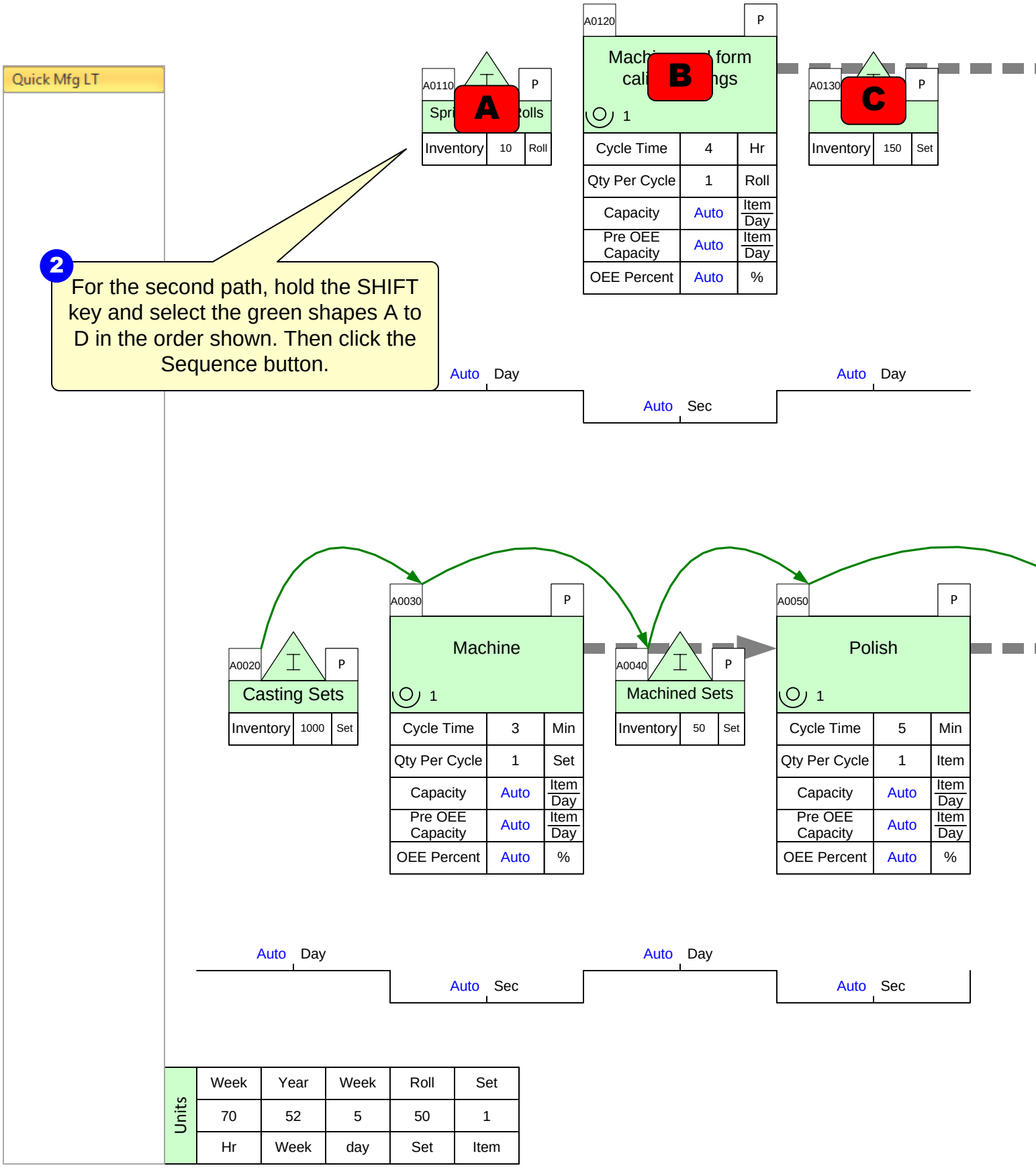
Step 11: Sequence Path 2



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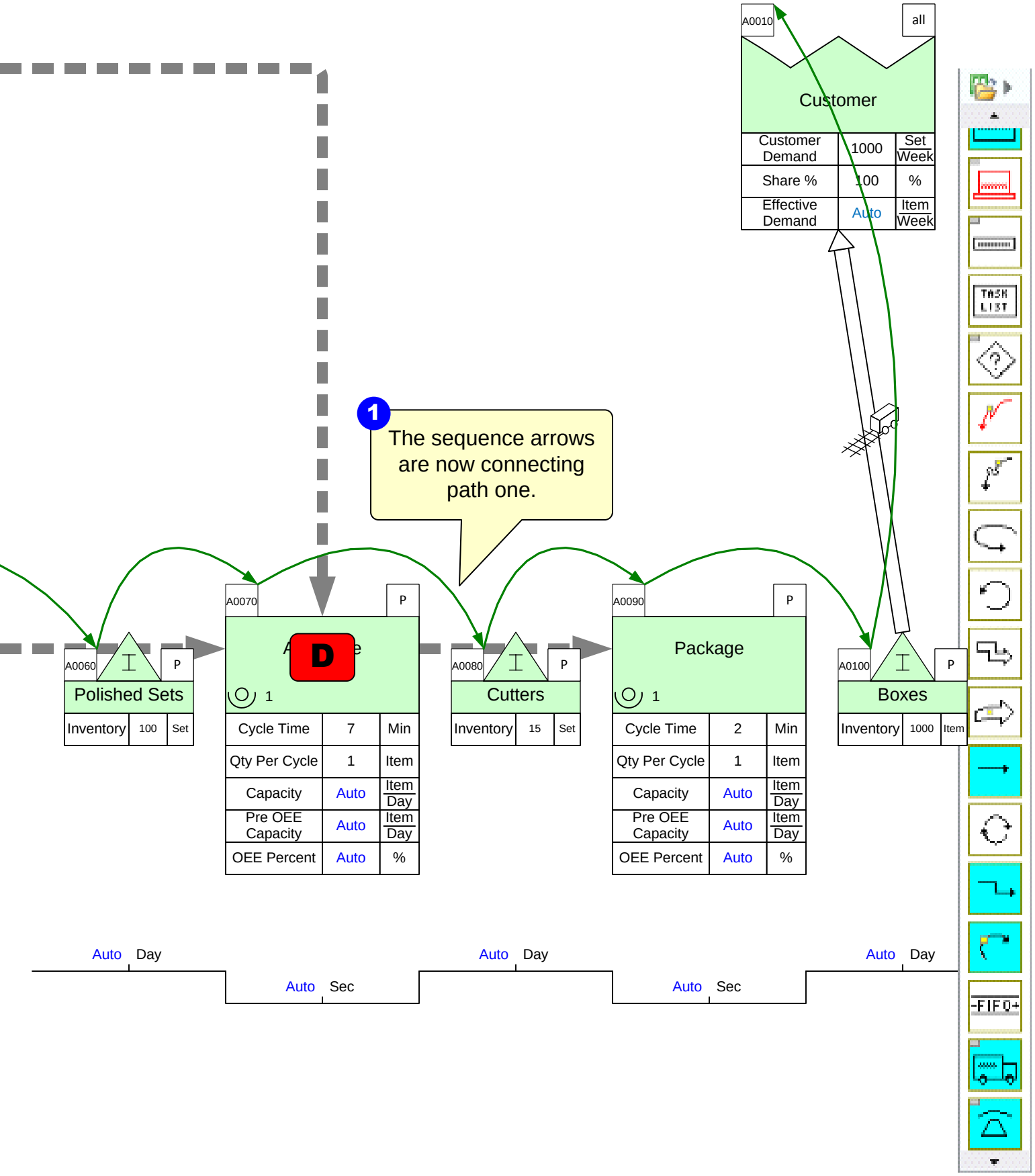

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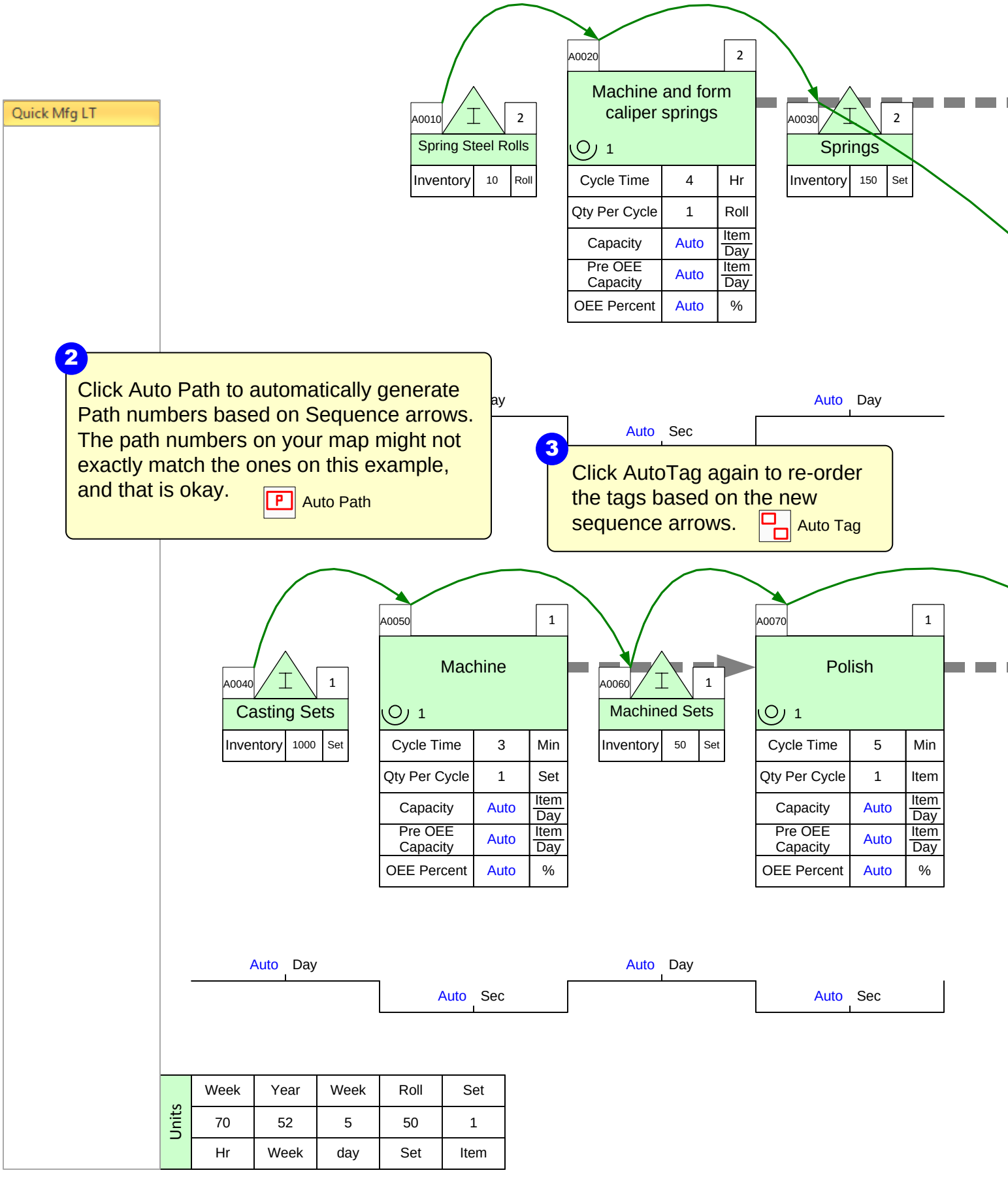
Step 12: Use Auto Path to Generate Path ID's based on Sequence Arrows



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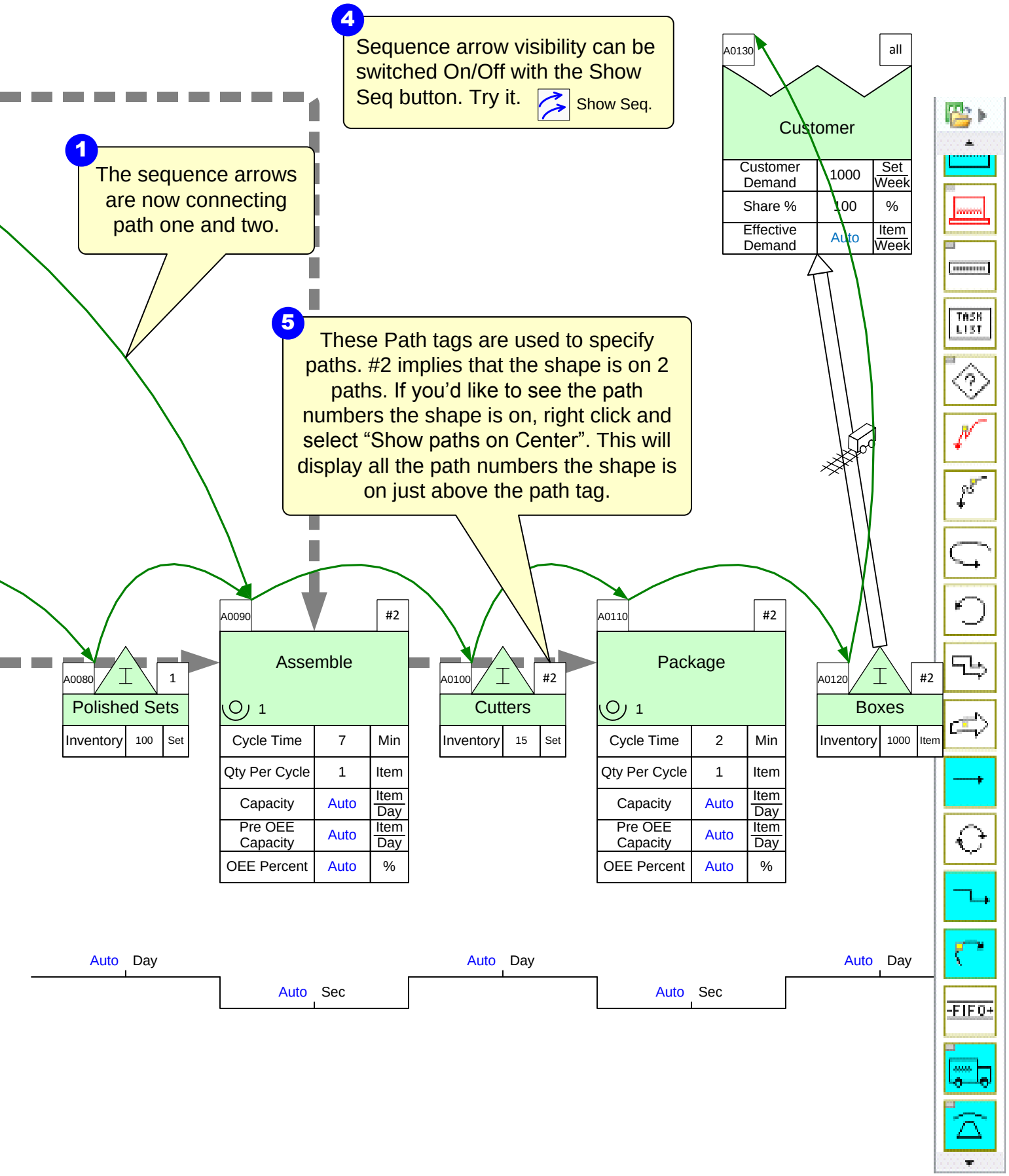

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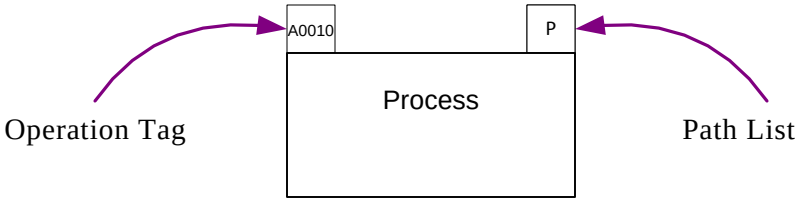
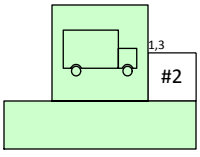
Path List



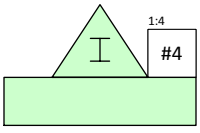
- Path List: The Path List is used to identify a path that an activity (or other shape able to be tagged) belongs to. The shape is glued above the top right corner of the shape.
- An activity can belong to no paths, one or more, or all paths. The benefit of assigning path numbers to activities is that 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

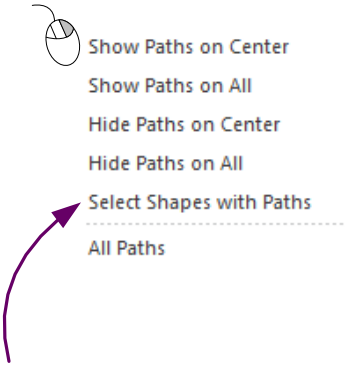
Right clicking on the Path List shape will pull up a menu to display all the path numbers on each center/page, or to hide all paths on each center or for the whole page.



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.

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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

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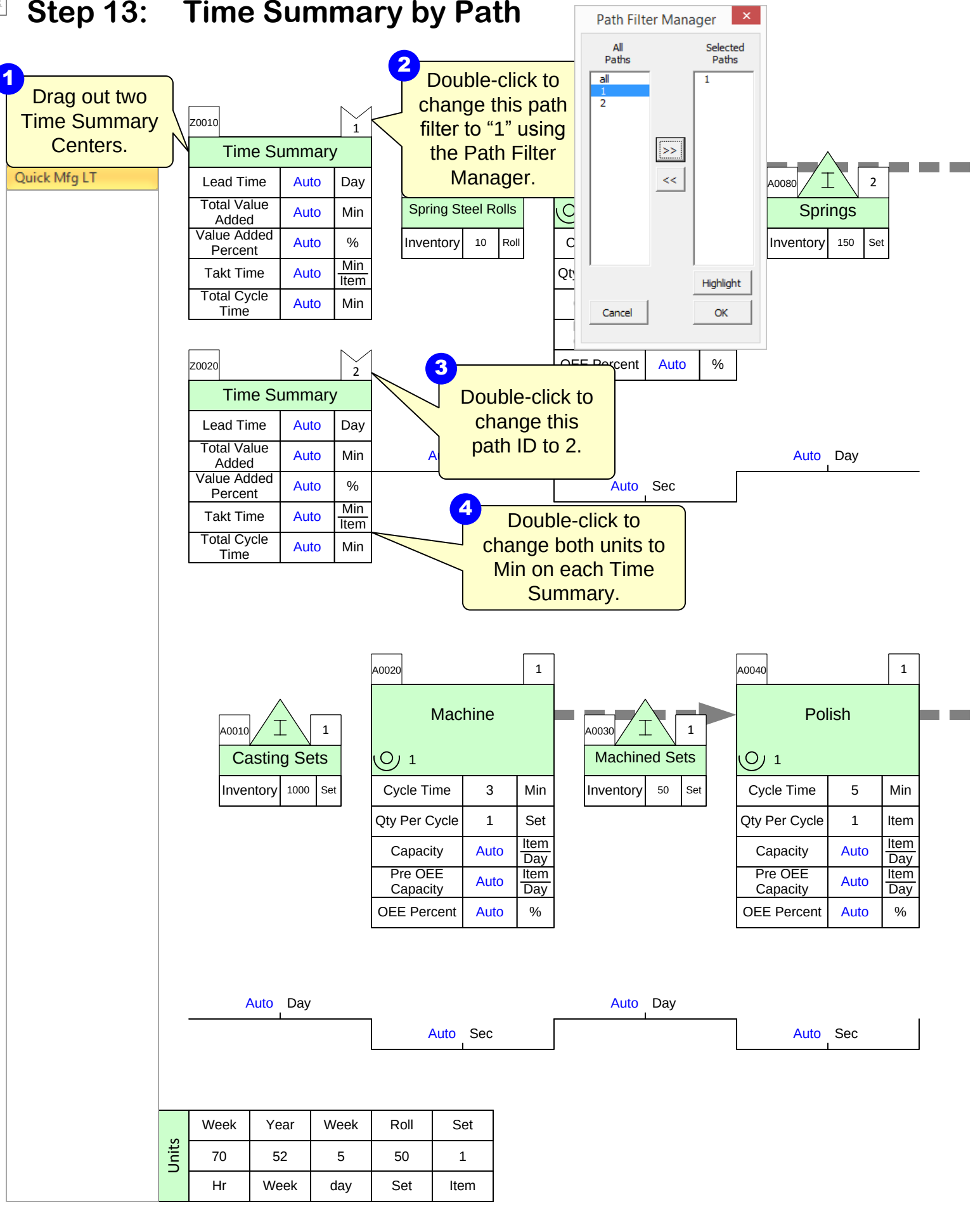
Step 13: Time Summary by Path



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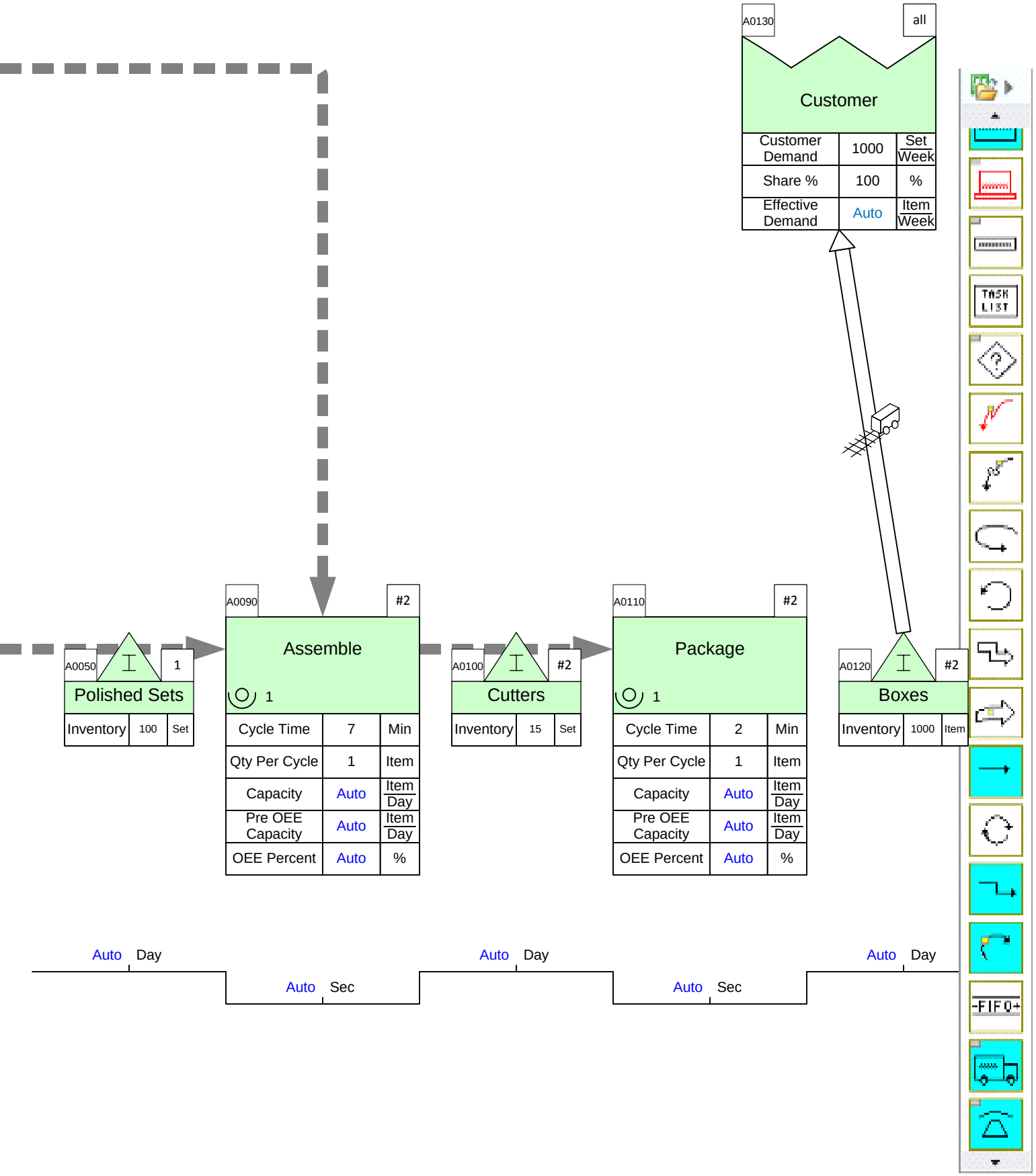

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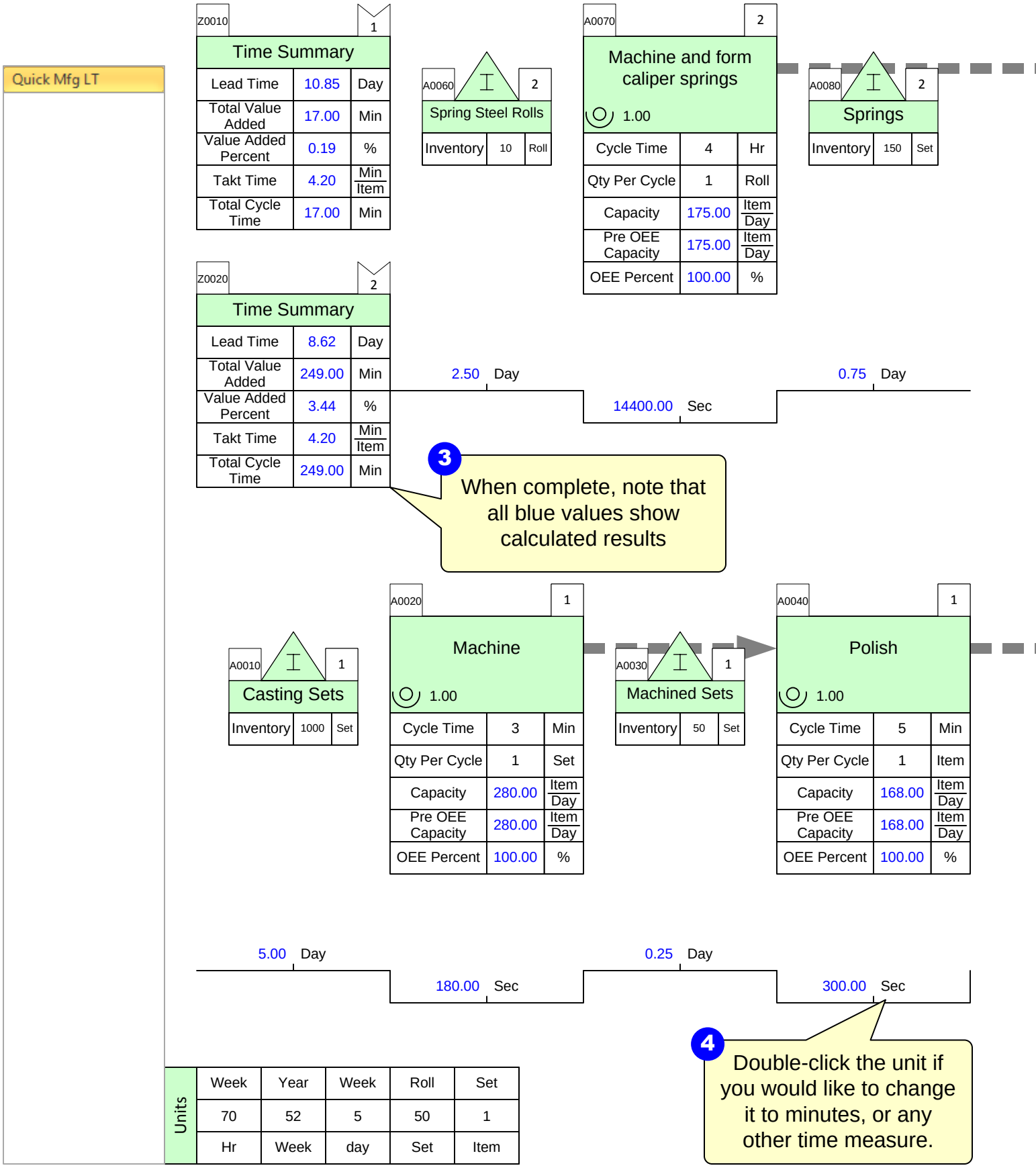
Step 14: Perform Calculations



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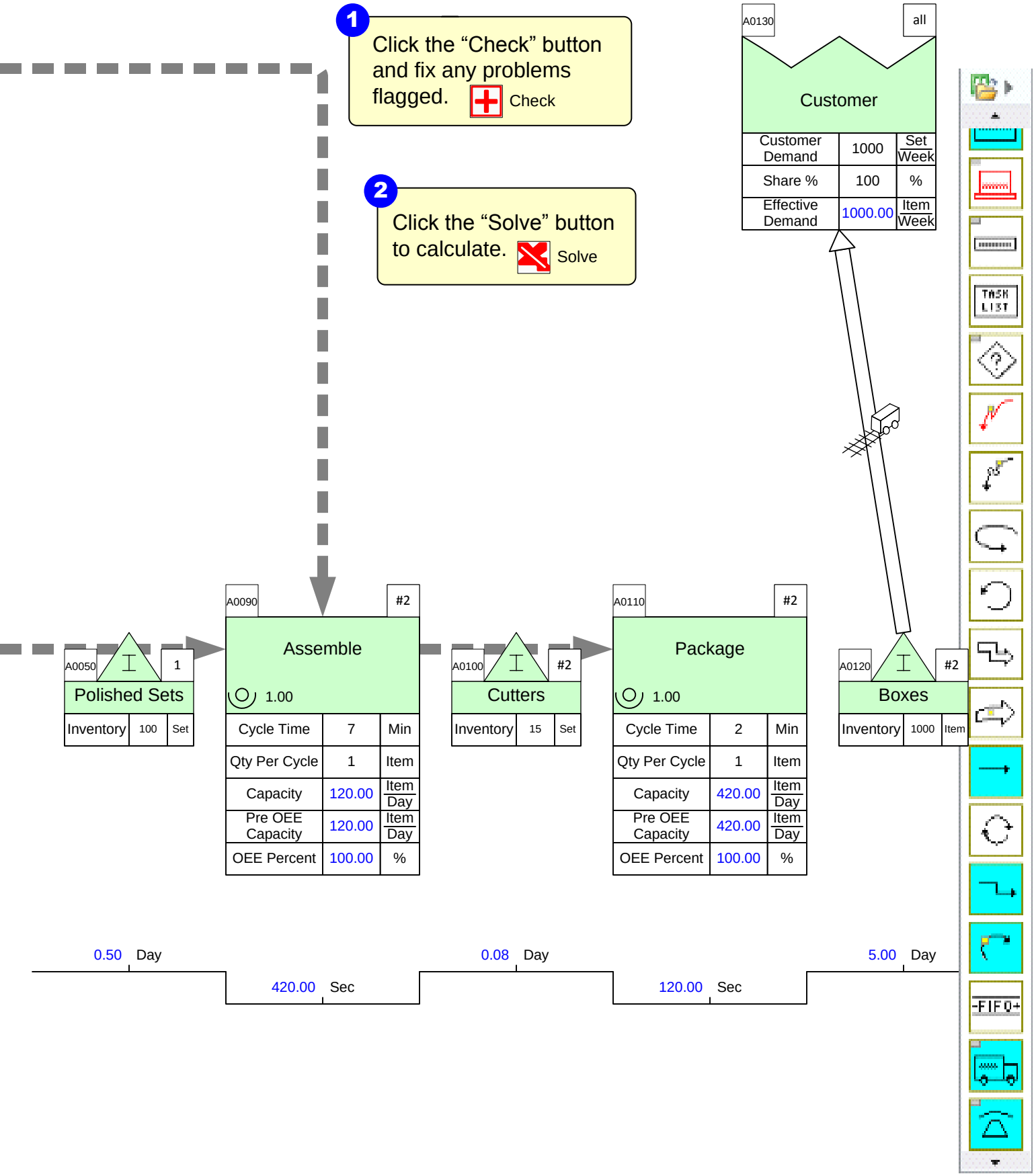

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First Check then Solve

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

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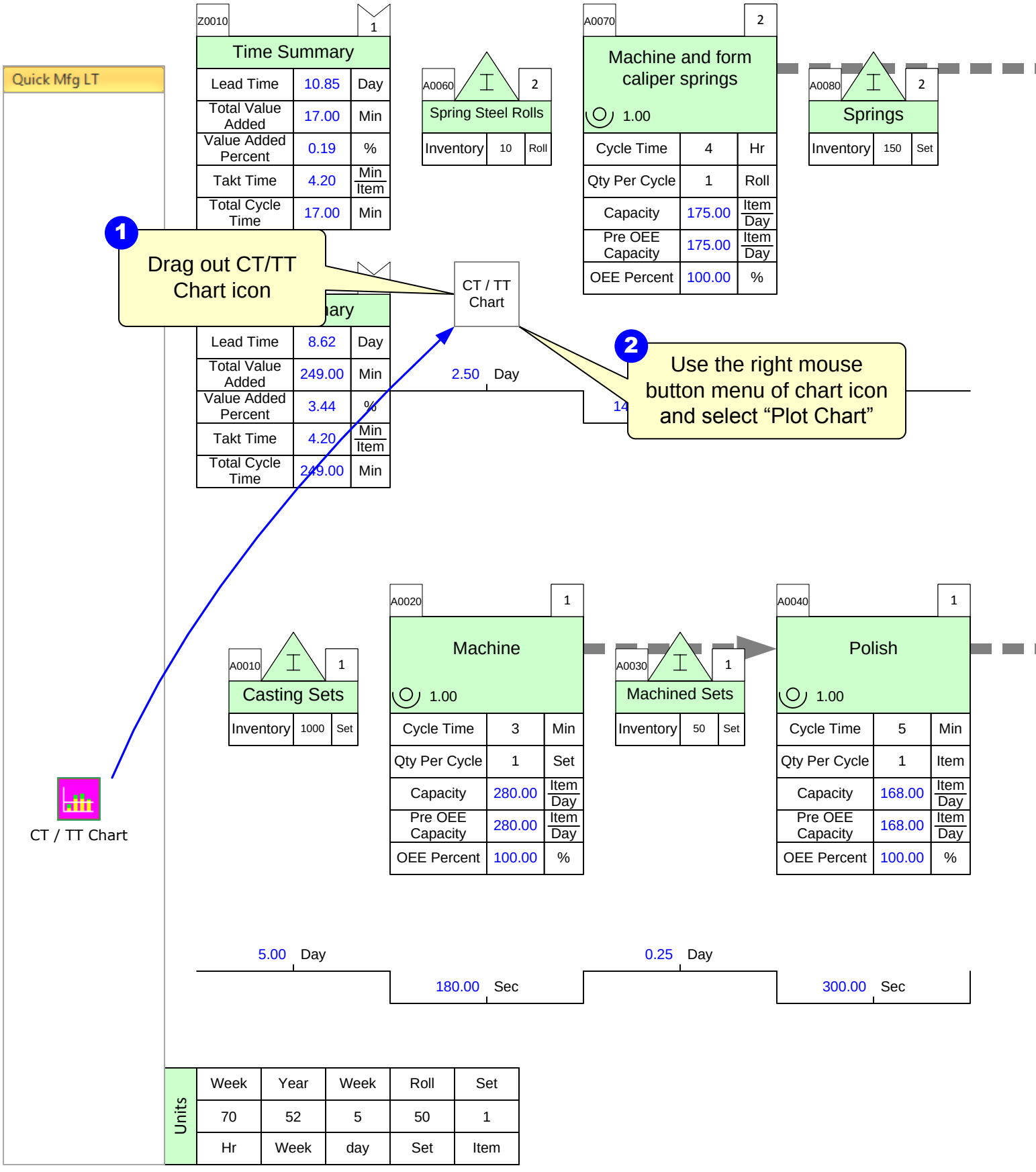
Step 15: Add Cycle Time Takt Time Chart



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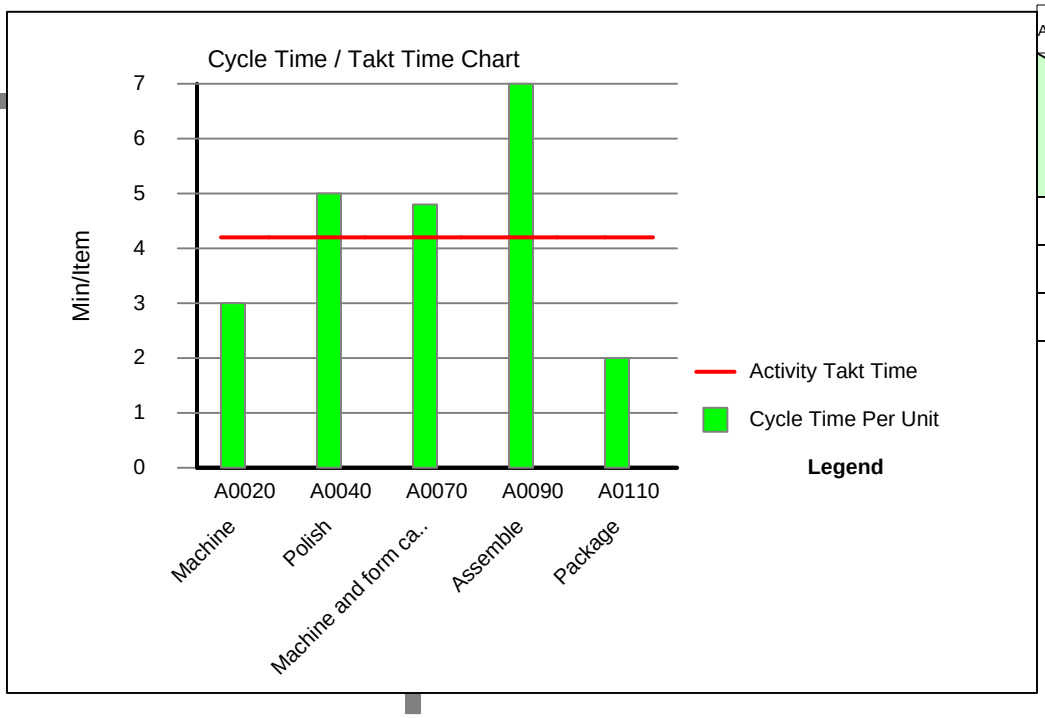

A0130	all
Customer	
Customer Demand	1000 Set/Week
Share %	100 %
Effective Demand	1000.00 Item/Week

A0050	1
Polished Sets	
Inventory	100 Set

A0090	#2
Assemble	
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
Cutters	
Inventory	15 Set

A0110	#2
Package	
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
Boxes	
Inventory	1000 Item

0.50 Day | 420.00 Sec | 0.08 Day | 120.00 Sec | 5.00 Day

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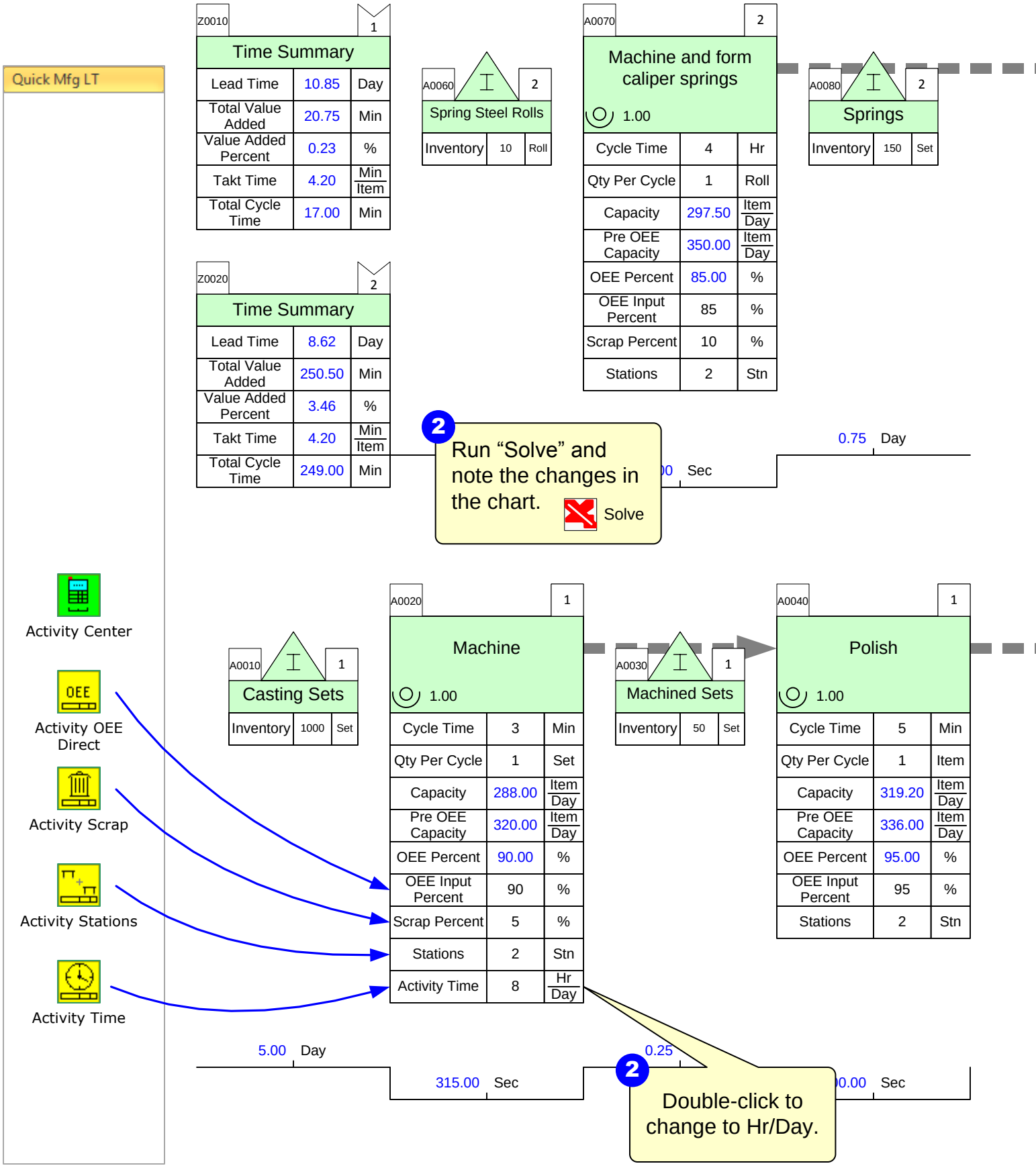
Step 16: Try Add-on Calculations: OEE, Scrap, Activity Time



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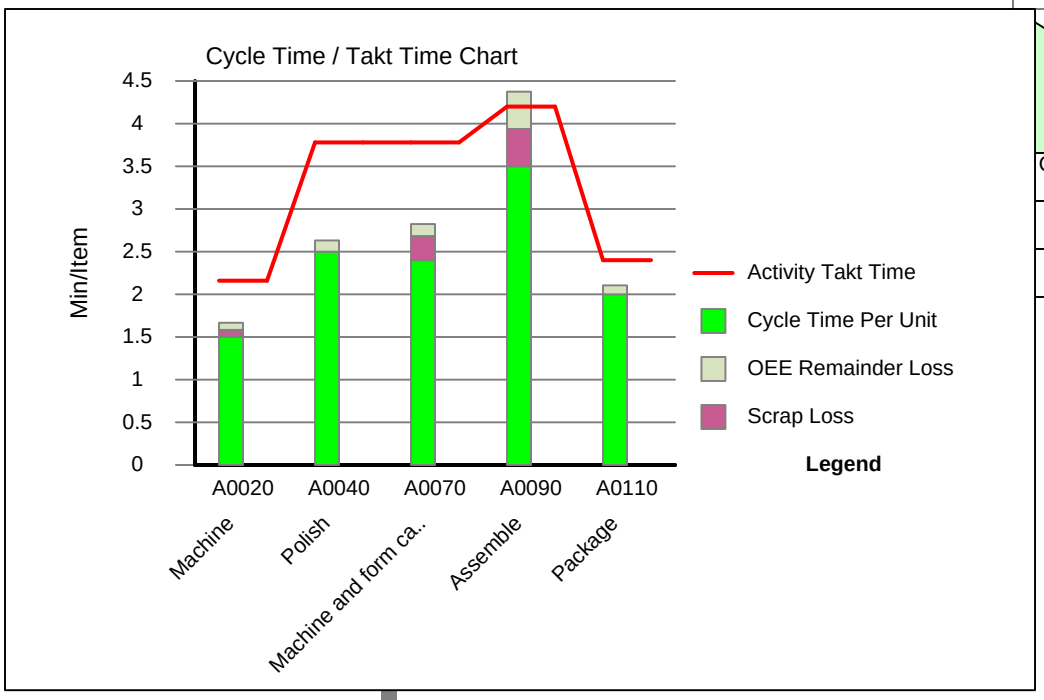
Units	Week	Year	Week	Roll	Set
	70	52	5	50	1
	Hr	Week	day	Set	Item



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

A0050	1
Polished Sets	
Inventory	100 Set

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 %
OEE Input Percent	80 %
Scrap Percent	10 %
Stations	2 Stn

A0100	#2
Cutters	
Inventory	15 Set

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 %
OEE Input Percent	95 %
Activity Time	8 Hr/Day

A0120	#2
Boxes	
Inventory	1000 Item

0.50 Day

420.00 Sec

5.00 Day

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

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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

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	
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 %

5.00 Day — 315.00 Sec — 0.25 Day — 300.00 Sec

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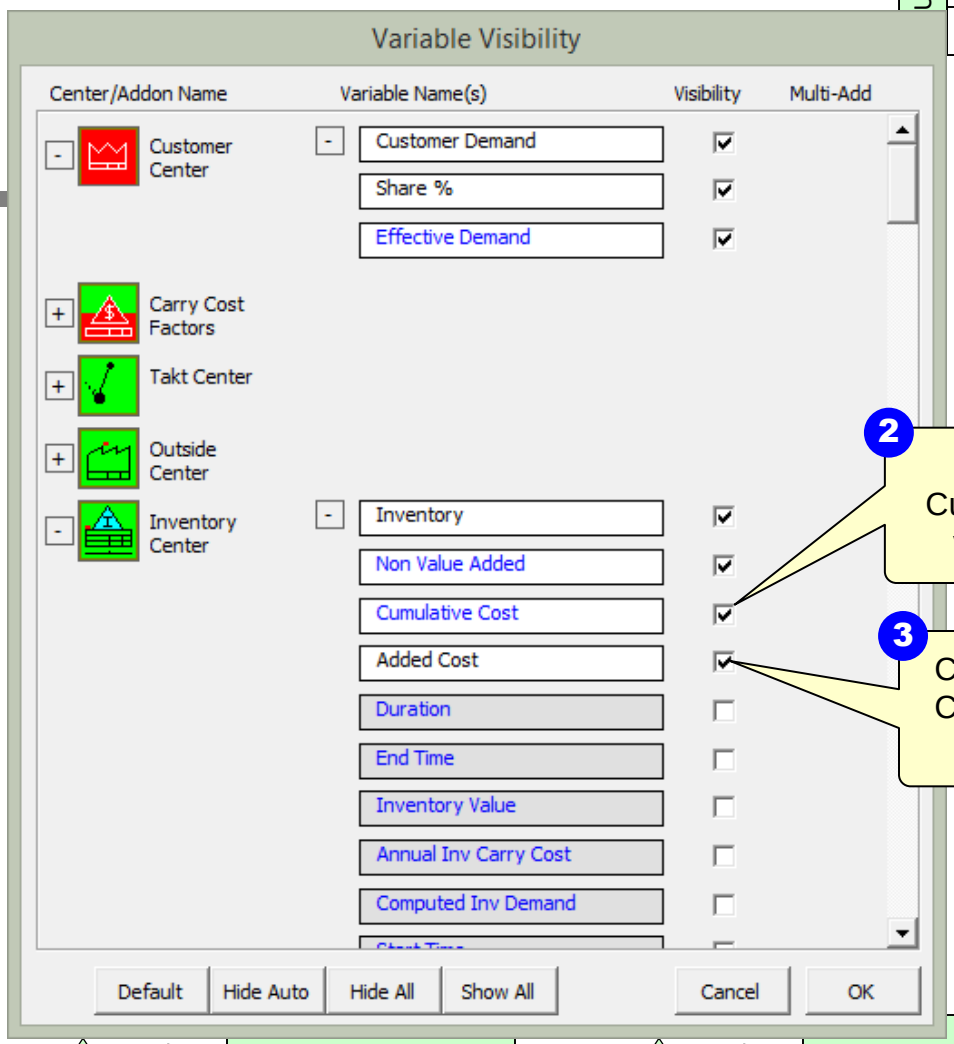
Units	Week	Year	Week	Roll	Set
	70	52	5	50	1
	Hr	Week	day	Set	Item



2 Check the Cumulative Cost visibility box.

3 Check the Added Cost visibility box and click OK.

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

A0050	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	#2
Cutters	
Inventory	15 Set
Cumulative Cost	57.72 $/Item
Added Cost	0.00 $/Item

Package	#2
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
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. Solve

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

0.50 Day | 420.00 | 210.00 Sec | 5.00 Day

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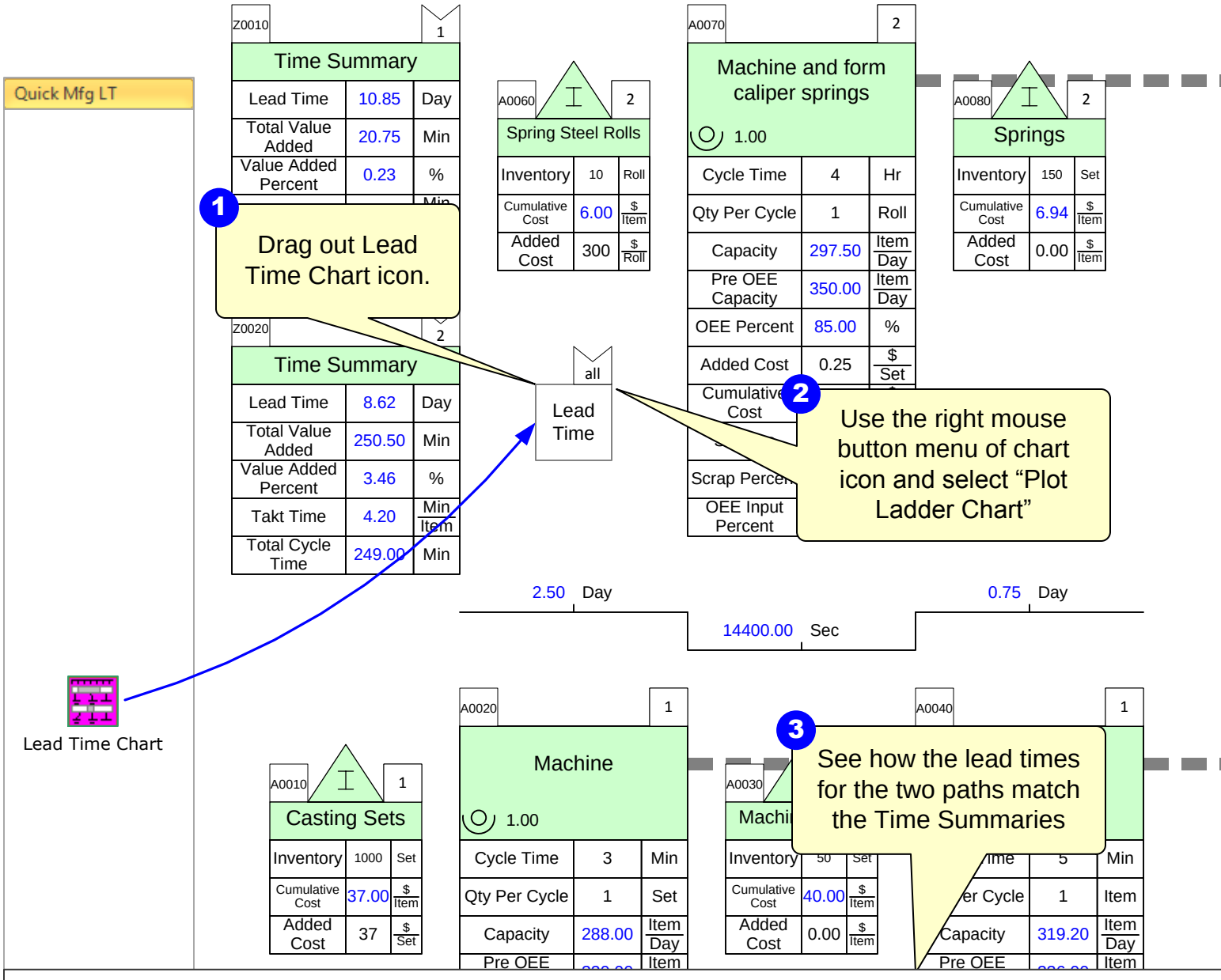
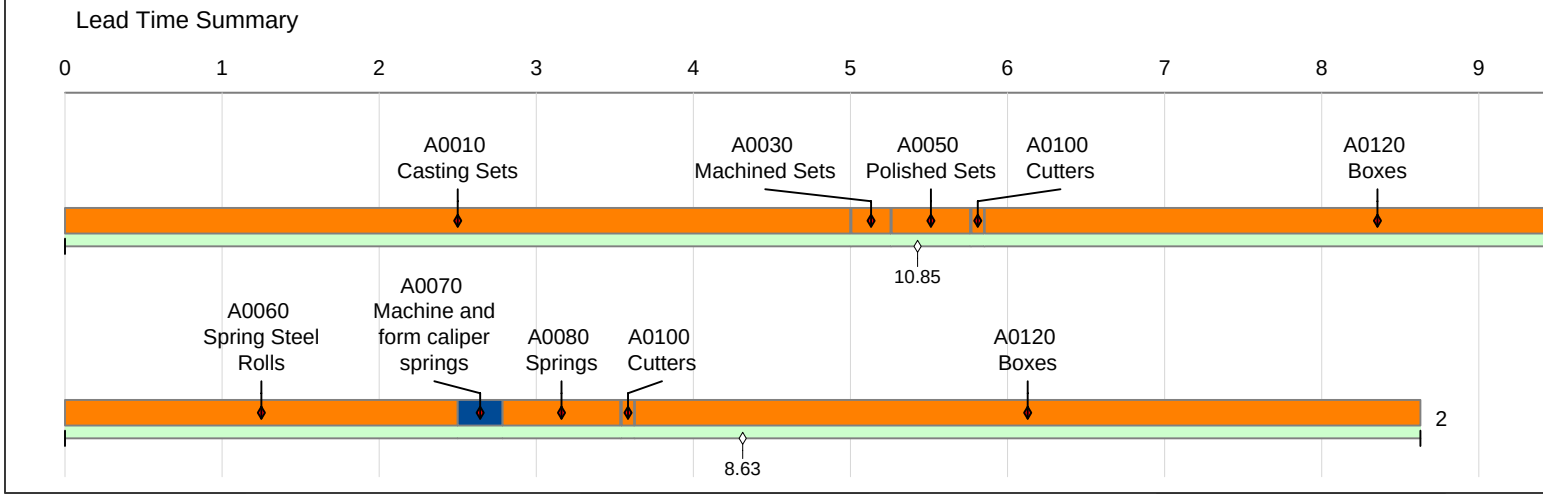
Step 18: Plot Lead Time Chart





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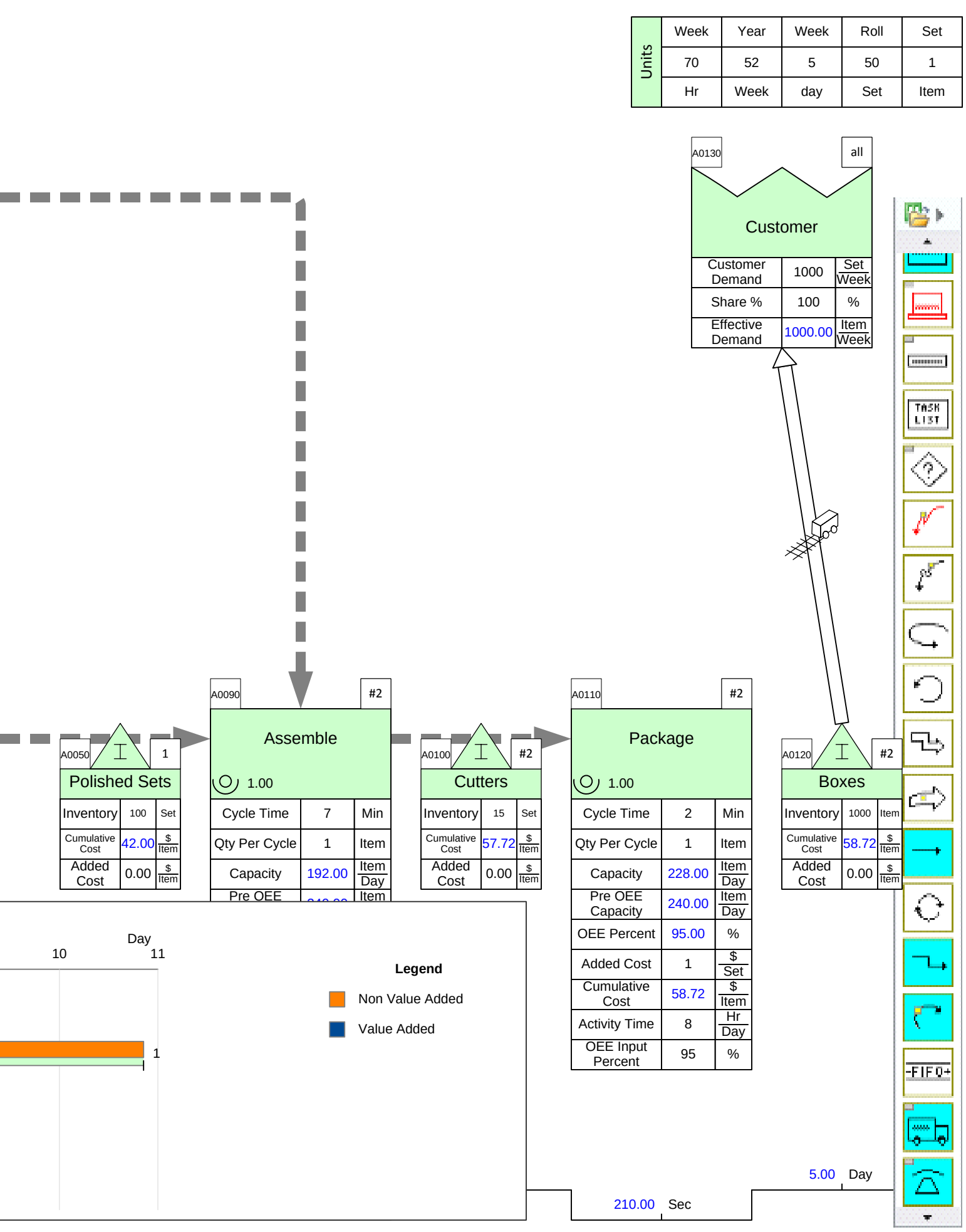

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ACME – Resource Modeling

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.

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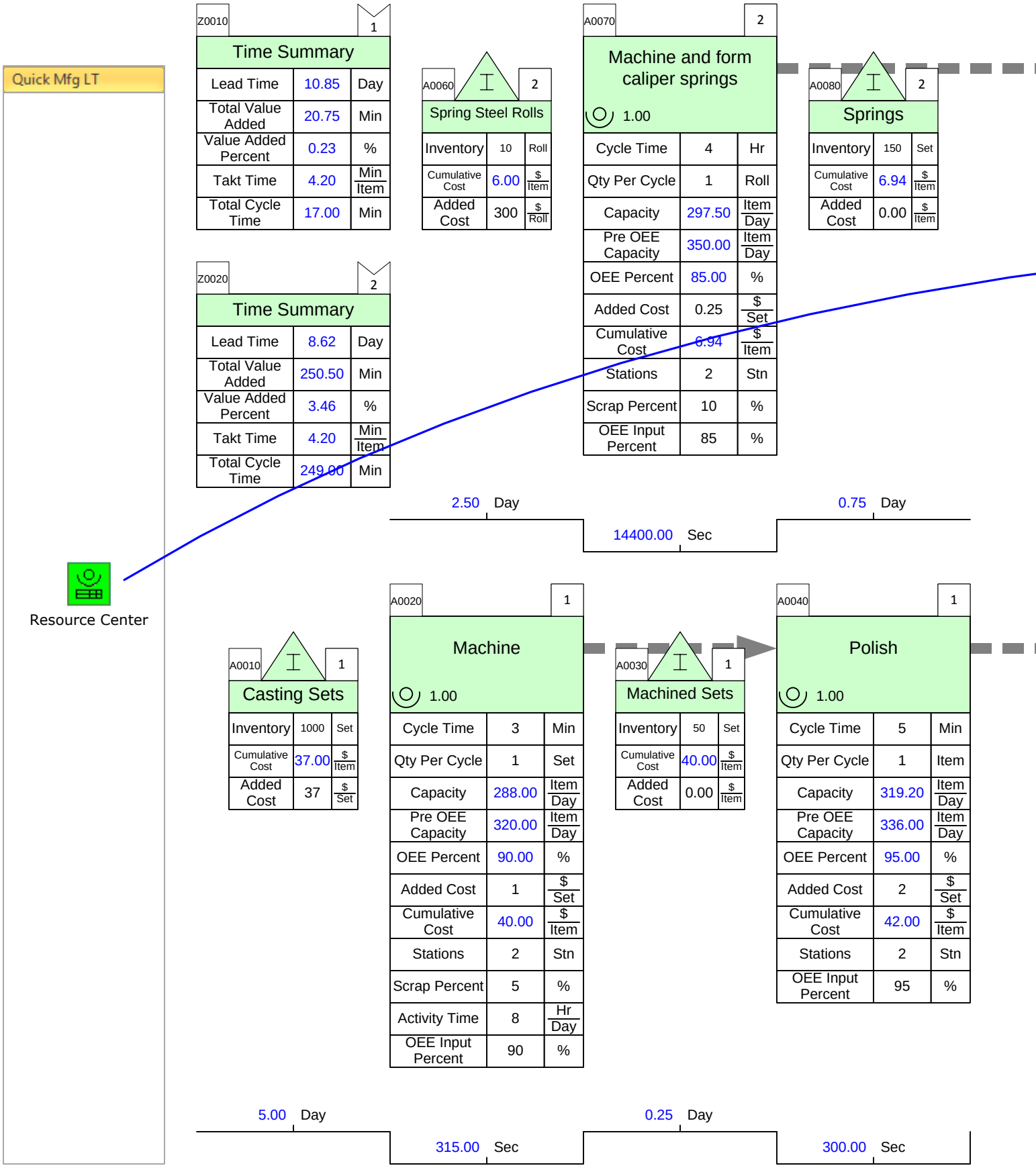
Step 19: Resource Modeling



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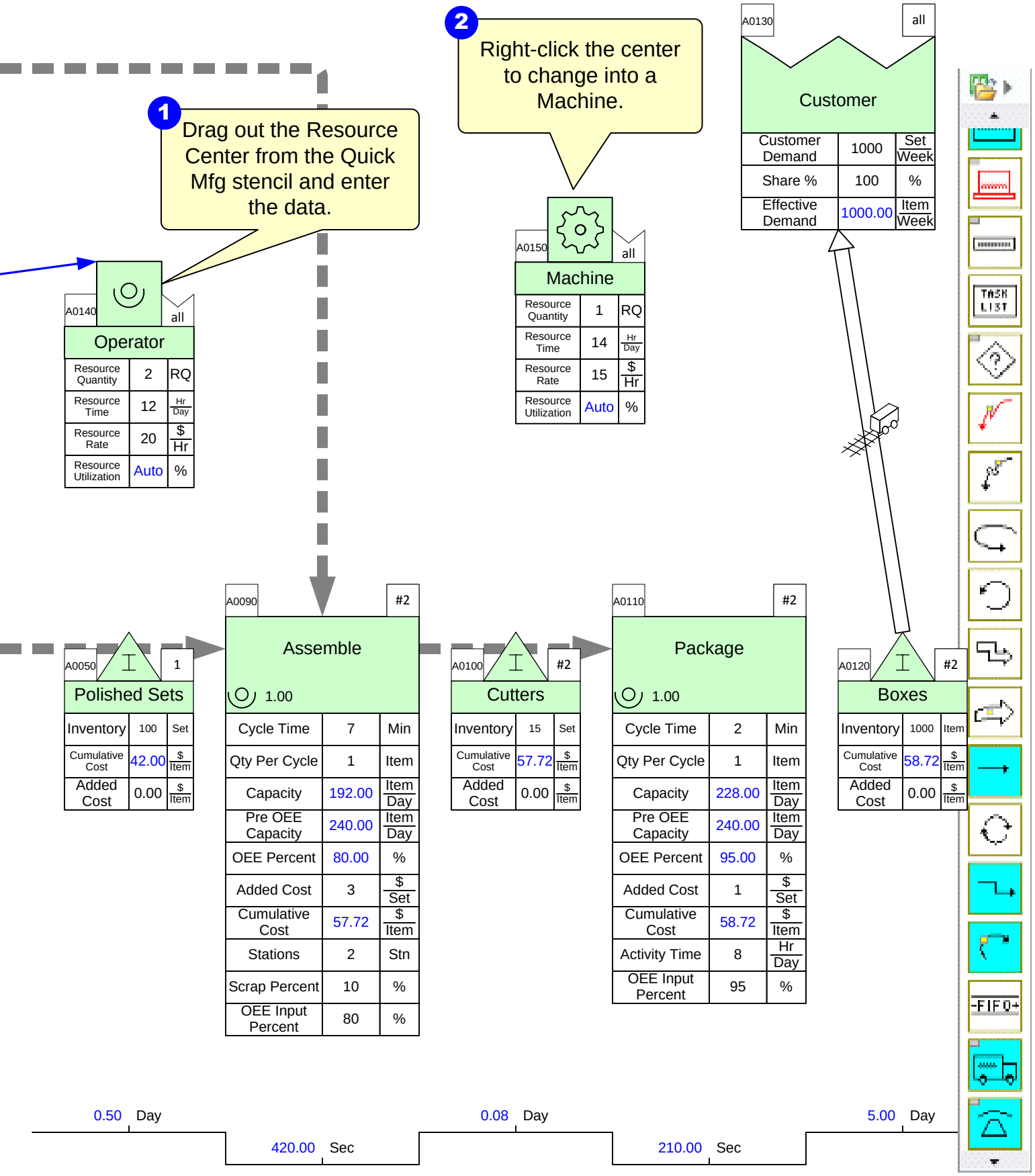
Units	Week	Year	Week	Roll	Set
	70	52	5	50	1
	Hr	Week	day	Set	Item

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

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



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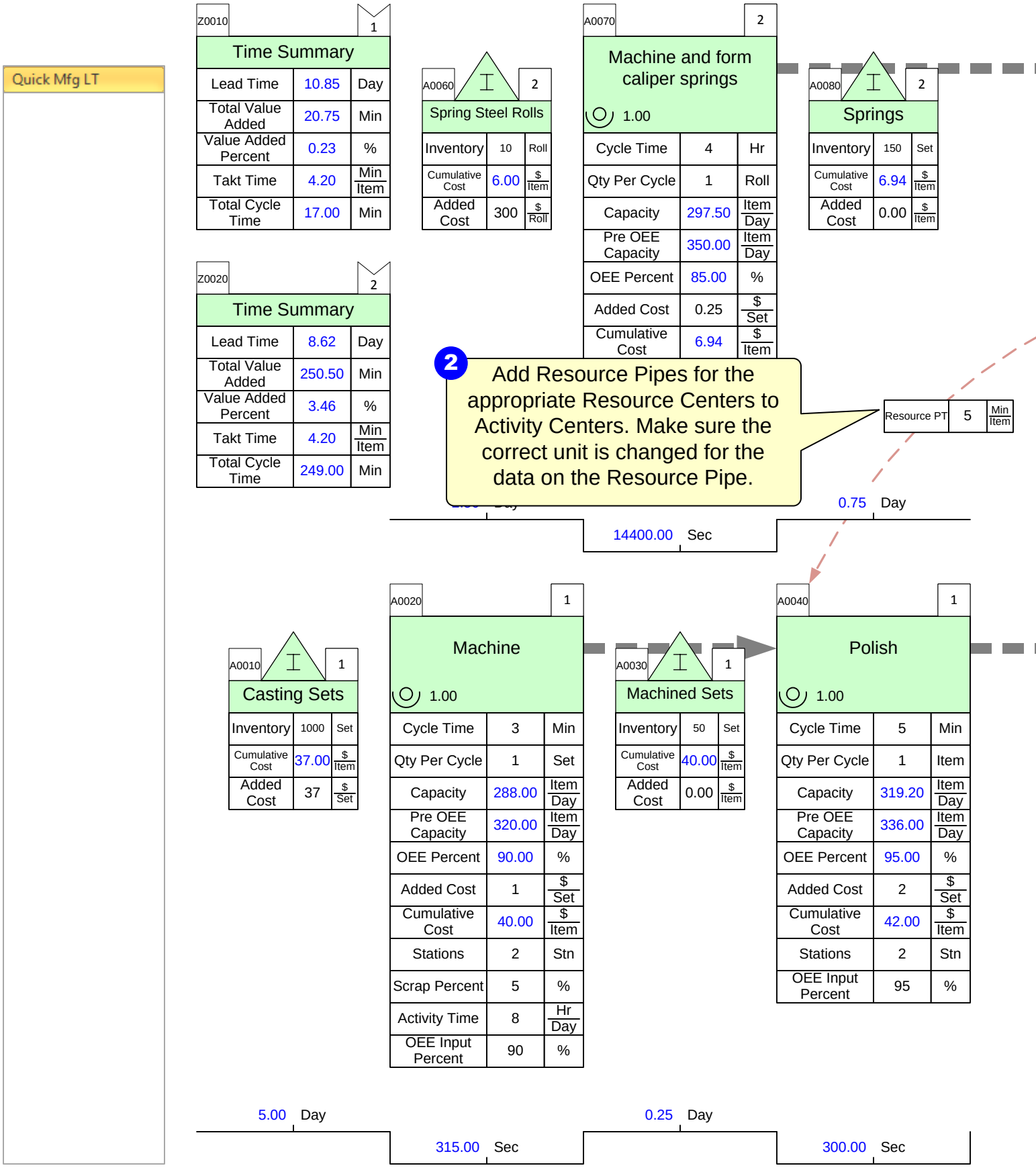
Step 20: Adding Resource Pipes



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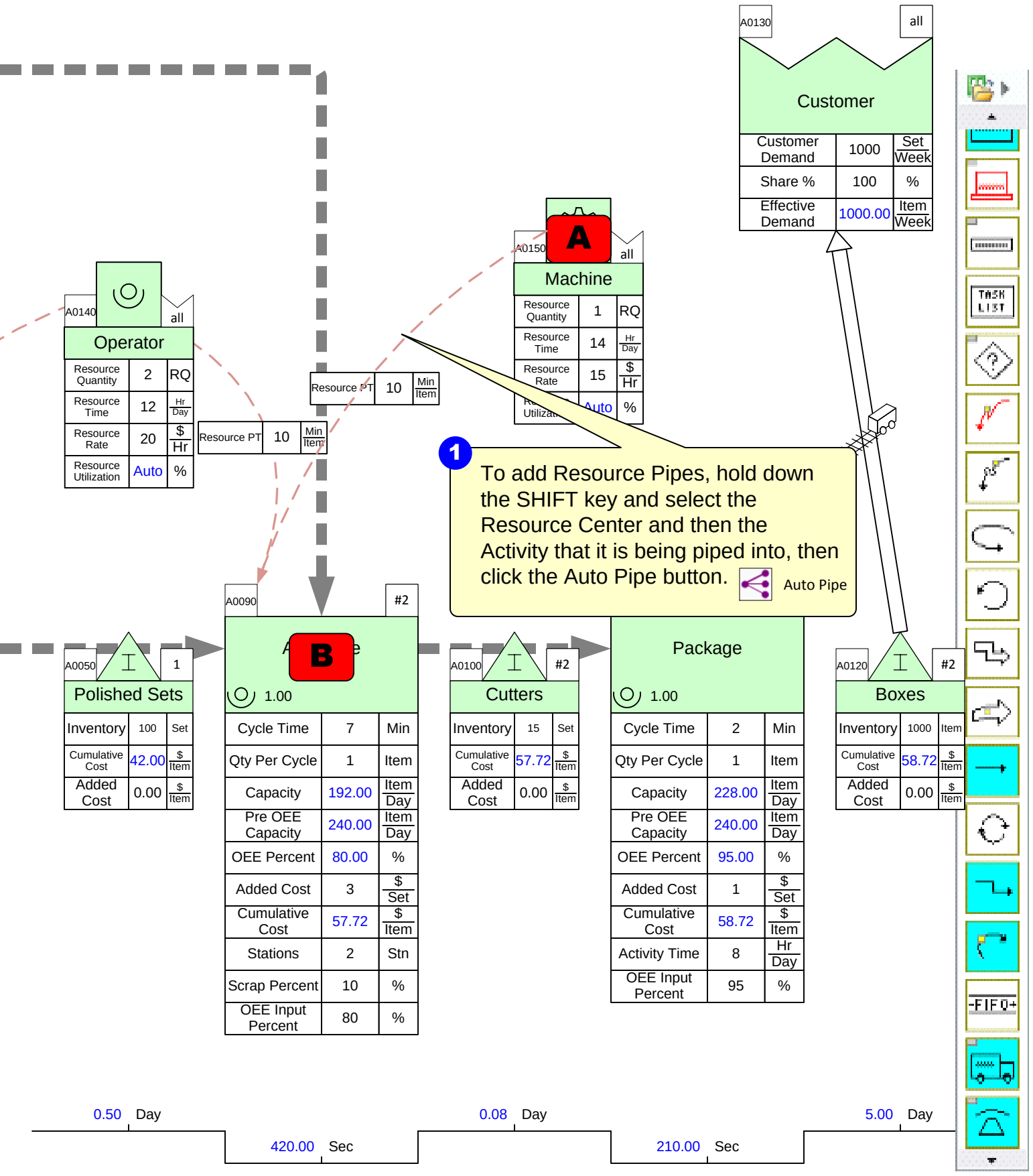
Units	Week	Year	Week	Roll	Set
	70	52	5	50	1
	Hr	Week	day	Set	Item



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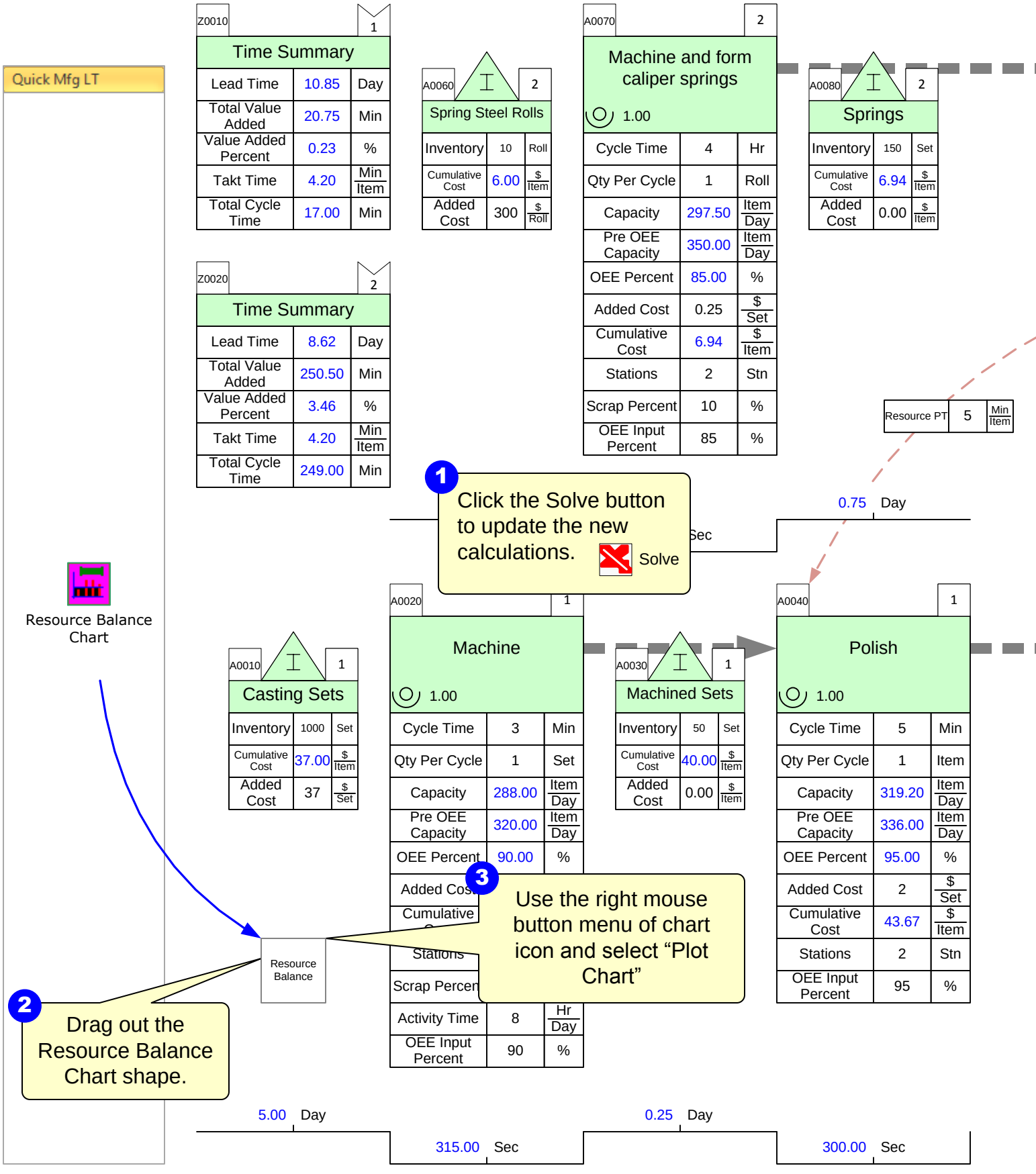
Step 21: Resource Balance Chart



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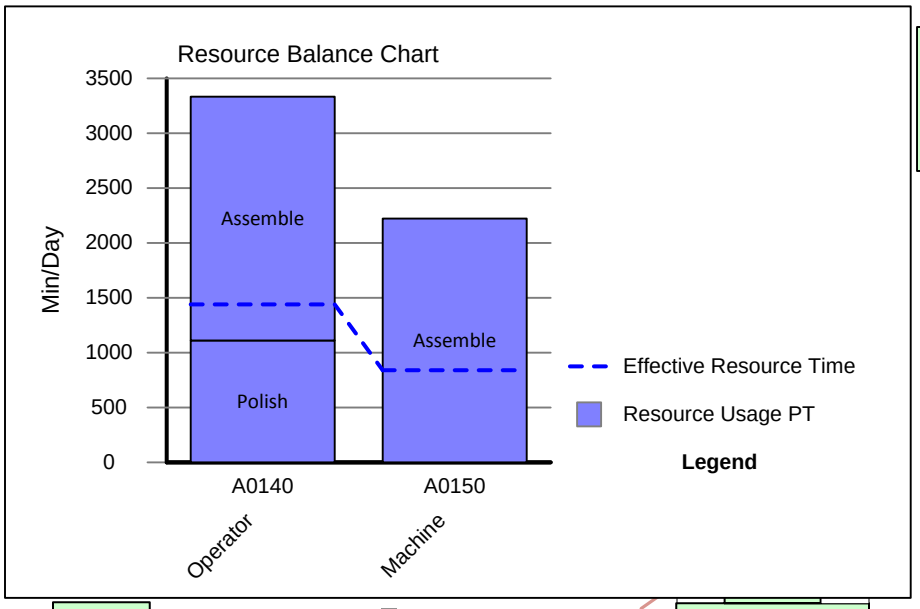

Units	Week	Year	Week	Roll	Set
	70	52	5	50	1
	Hr	Week	day	Set	Item

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	%

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	%

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 — 420.00 Sec — 0.08 Day — 210.00 Sec — 5.00 Day

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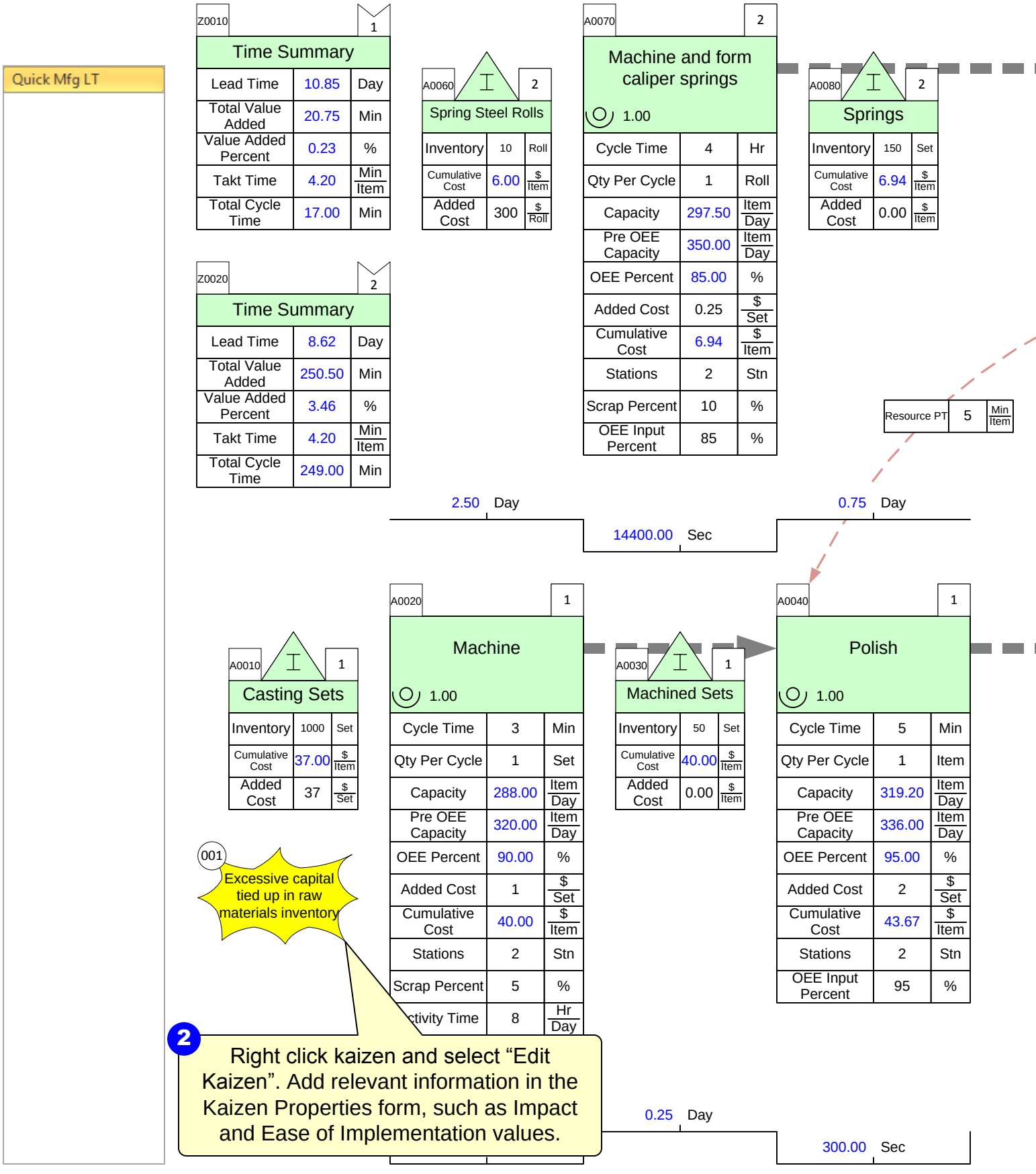
Step 22: Kaizen Improvements



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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

A0130 all

Customer

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

A0150 all

Machine

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

A0140 all

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

002

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

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

1 Drag out Kaizen starbursts from the Quick Extras stencil.

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	%

#2

Boxes

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

0.50 Day — 420.00 Sec — 0.08 Day — 210.00 Sec — 5.00 Day

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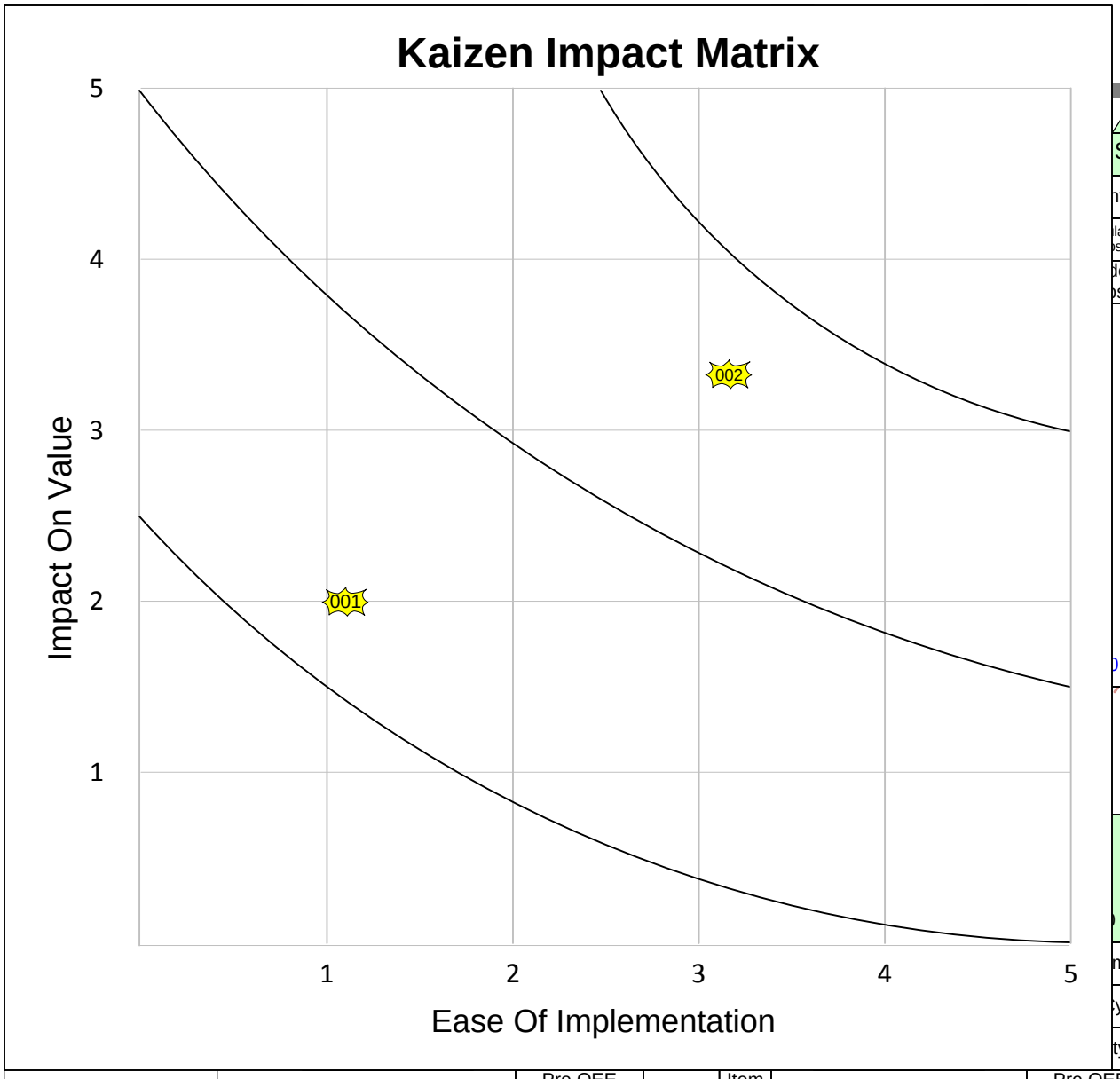
Step 23: Kaizen Impact Matrix



2

Springs

ntory	150	Set
lative st	6.94	$ / Item
ded st	0.00	$ / Item

Resource PT | 5 | Min / Item

0.75 Day

1

Polish

me	5	Min
ycle	1	Item
ty	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

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	%

5.00 Day

315.00 Sec

0.25 Day

300.00 Sec

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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

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

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

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 — 420.00 Sec — 0.08 Day — 210.00 Sec — 5.00 Day

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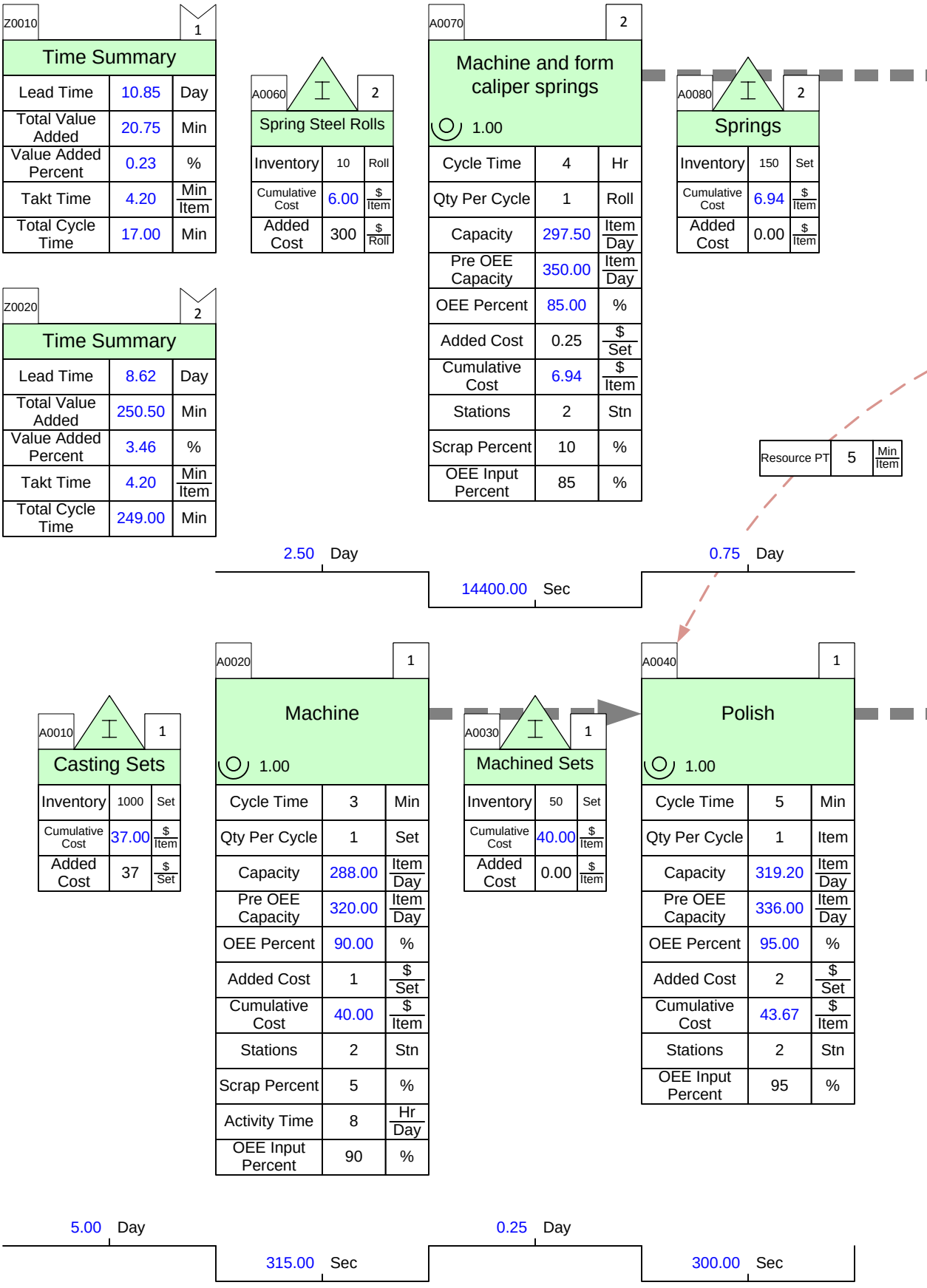
ACME Plant – Current State



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

Z0030 all

Scrap Costs

Total Scrap Cost	1919.75	$ / Day

Z0130 all

Inventory Summary

Total Inventory Value	115.45	K$

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

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	%

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	%

A0050 1

Polished Sets

Inventory	100	Set
Cumulative Cost	43.67	$ / Item
Added Cost	0.00	$ / Item

A0100 #2

Cutters

Inventory	15	Set
Cumulative Cost	66.05	$ / Item
Added Cost	0.00	$ / Item

A0120 #2

Boxes

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

0.50 Day — 420.00 Sec — 0.08 Day — 210.00 Sec — 5.00 Day

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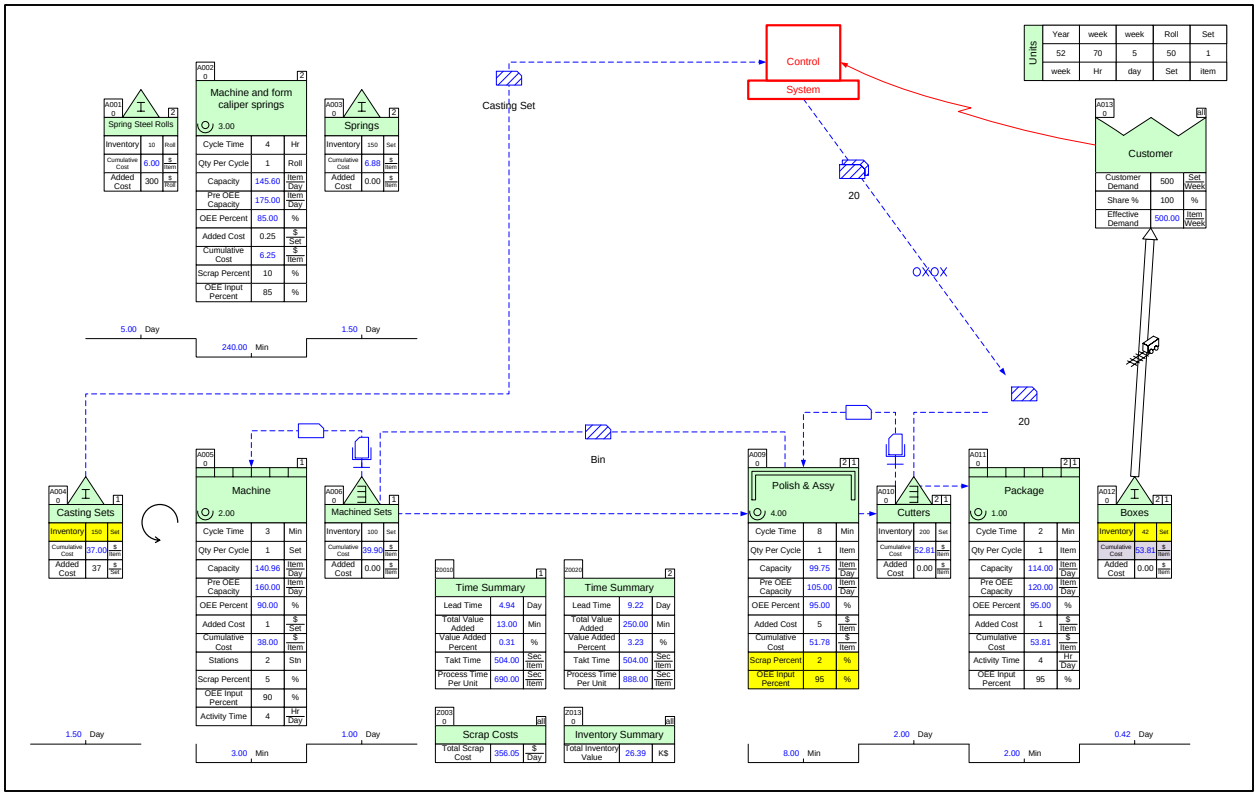
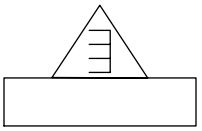
Future State



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

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Kanban - continued

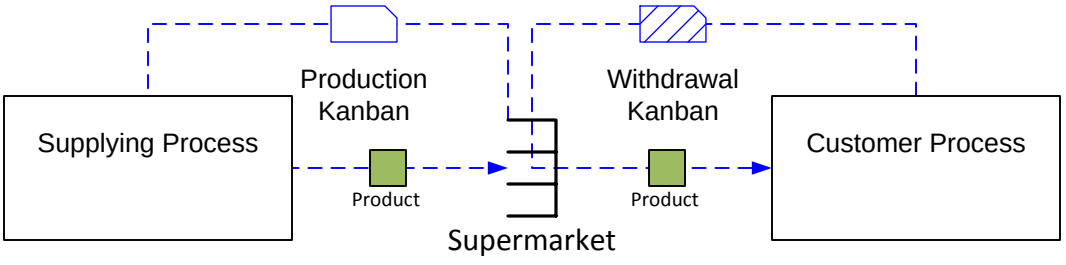
- Signal Kanban – signals when a reorder point is reached and another batch needs to be produced. Used when the supplying process must produce in batches because changeover is required

- 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

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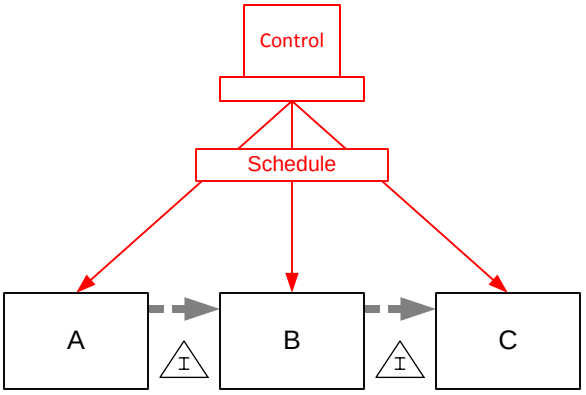
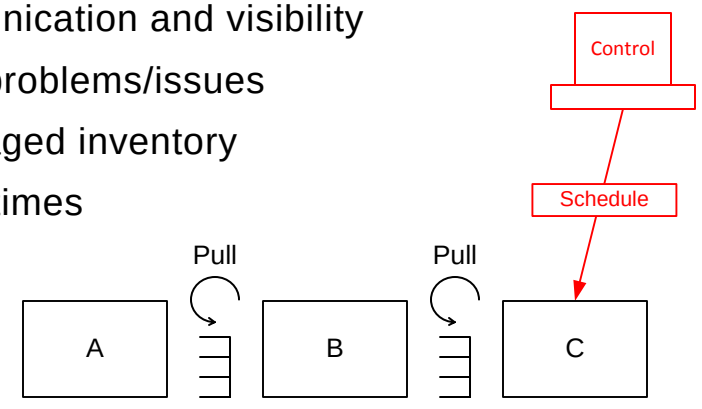
Push Process



- 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



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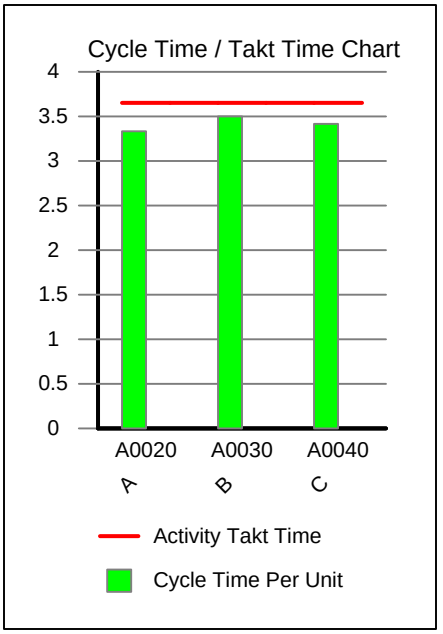
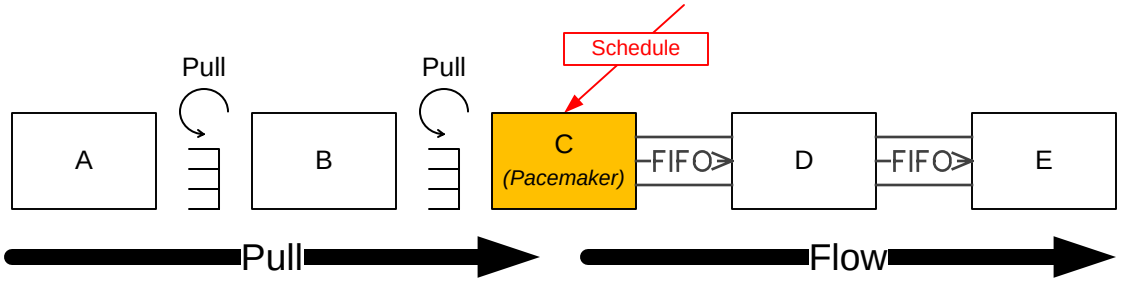
Continuous Flow

- 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



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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 cell

    Goal: 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 delivery

    Goal: Only 1.5 days of casting sets inventory

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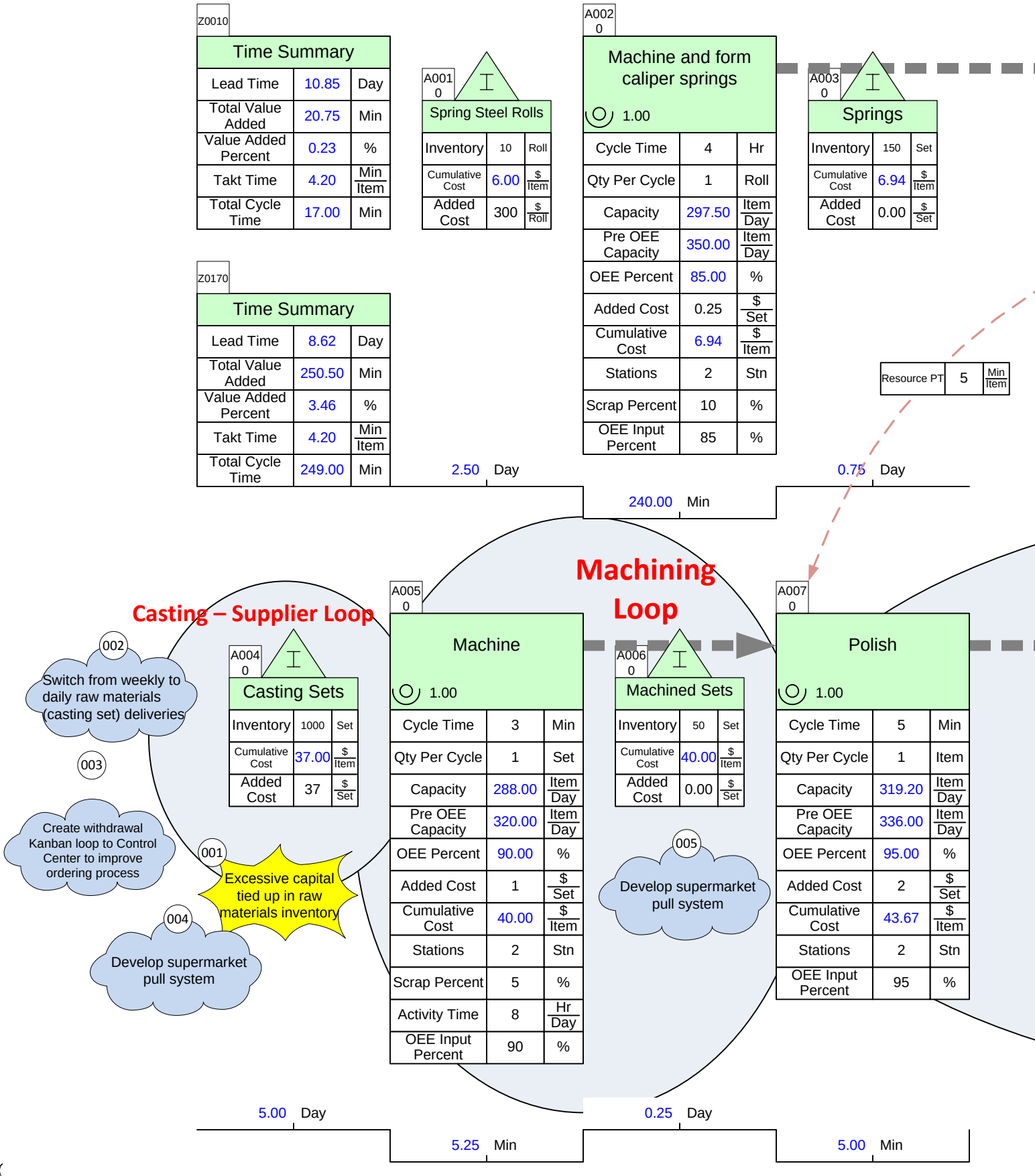
ACME Plant – Current State



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

Z0030

Scrap Costs

Total Scrap Cost	1919.75	$/Day

Z0020

Inventory Summary

Total Inventory Value	115.45	K$

A0130

Customer

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

A0150

Machine

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

A0140

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

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

Pacemaker Loop

008 Develop supermarket pull system for cutters

A0080

Polished Sets

Inventory	100	Set
Cumulative Cost	43.67	$/Item
Added Cost	0.00	$/Set

A0090

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

Cutters

Inventory	15	Set
Cumulative Cost	66.05	$/Item
Added Cost	0.00	$/Set

A0110

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

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

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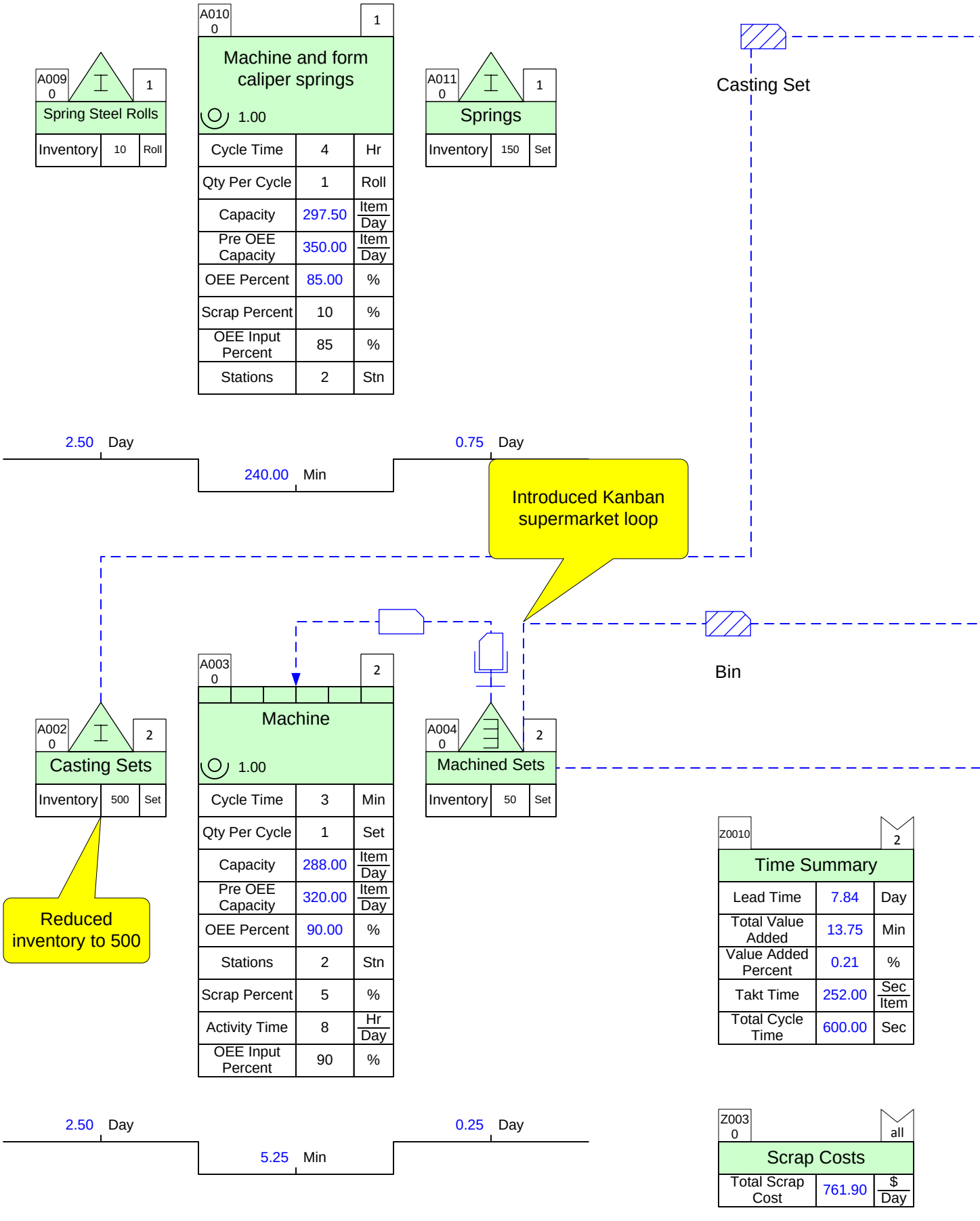
ACME Plant – Future State



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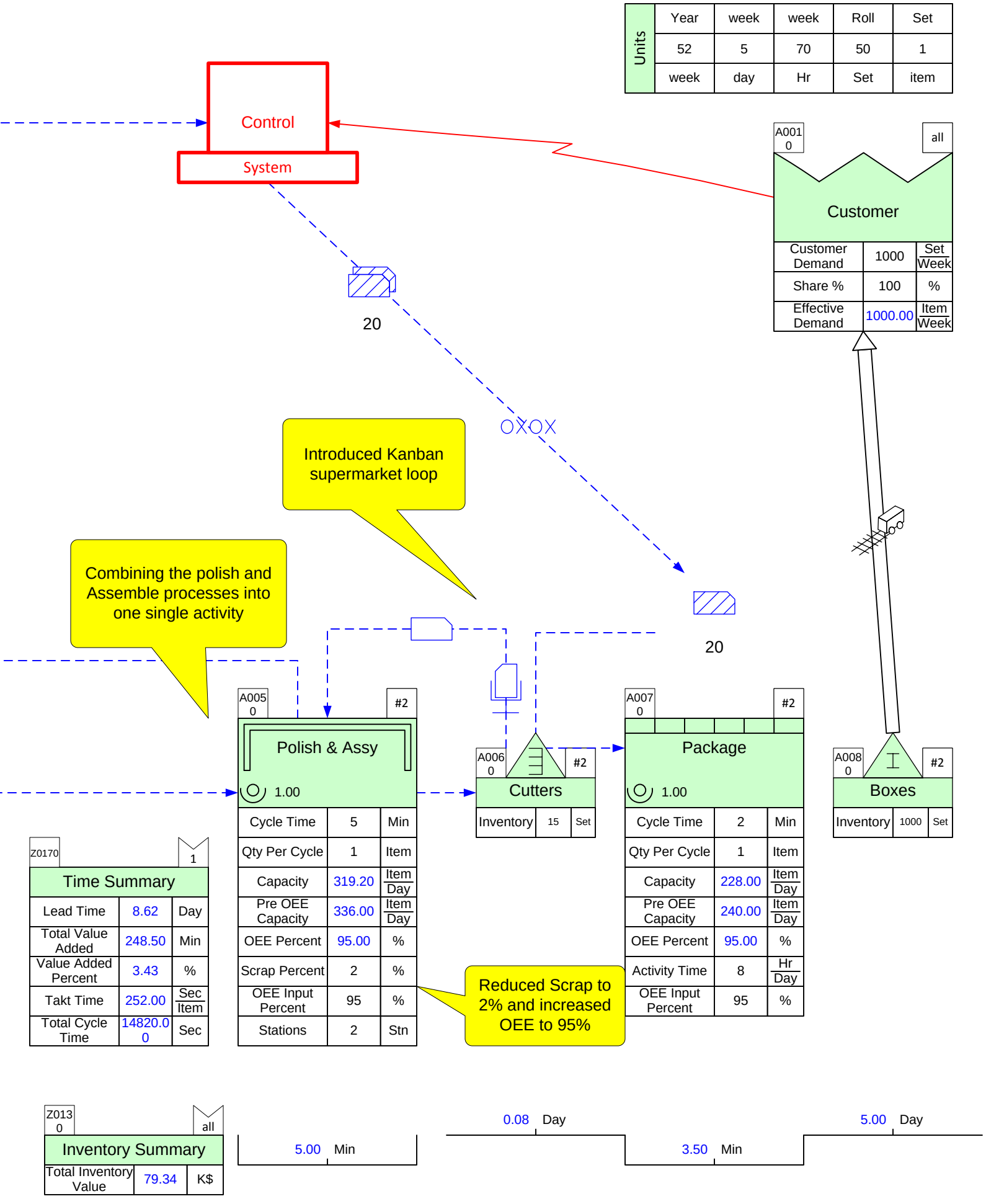

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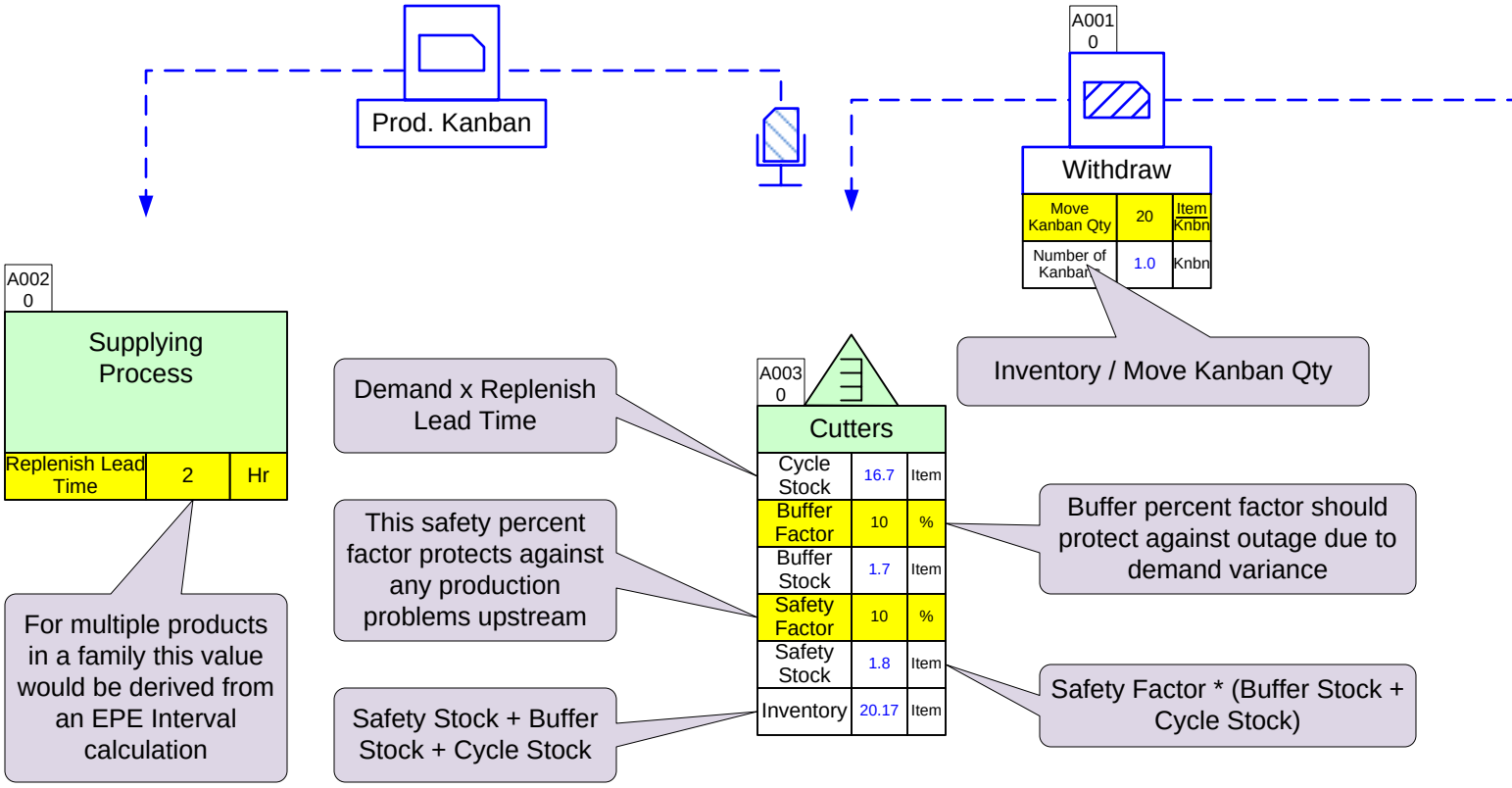
ACME Plant – Cutters Supermarket Kanban Loop

Adapted from “Creating Level Pull”



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A004
0

Consuming
Process

Demand	100	Item / Day

Units	Day	Hr
	12	60
	Hr	Min

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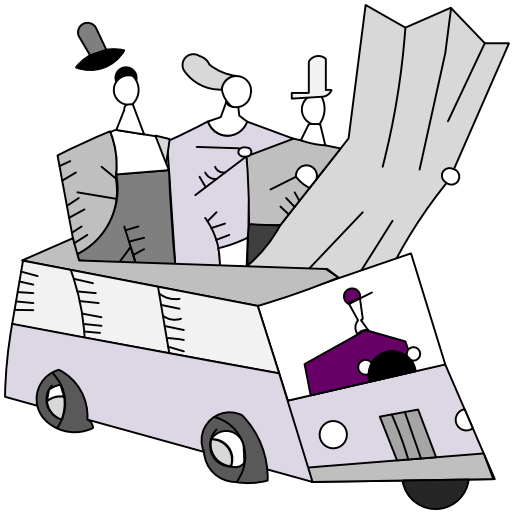
Quick Mfg Problem & Solution Maps

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.



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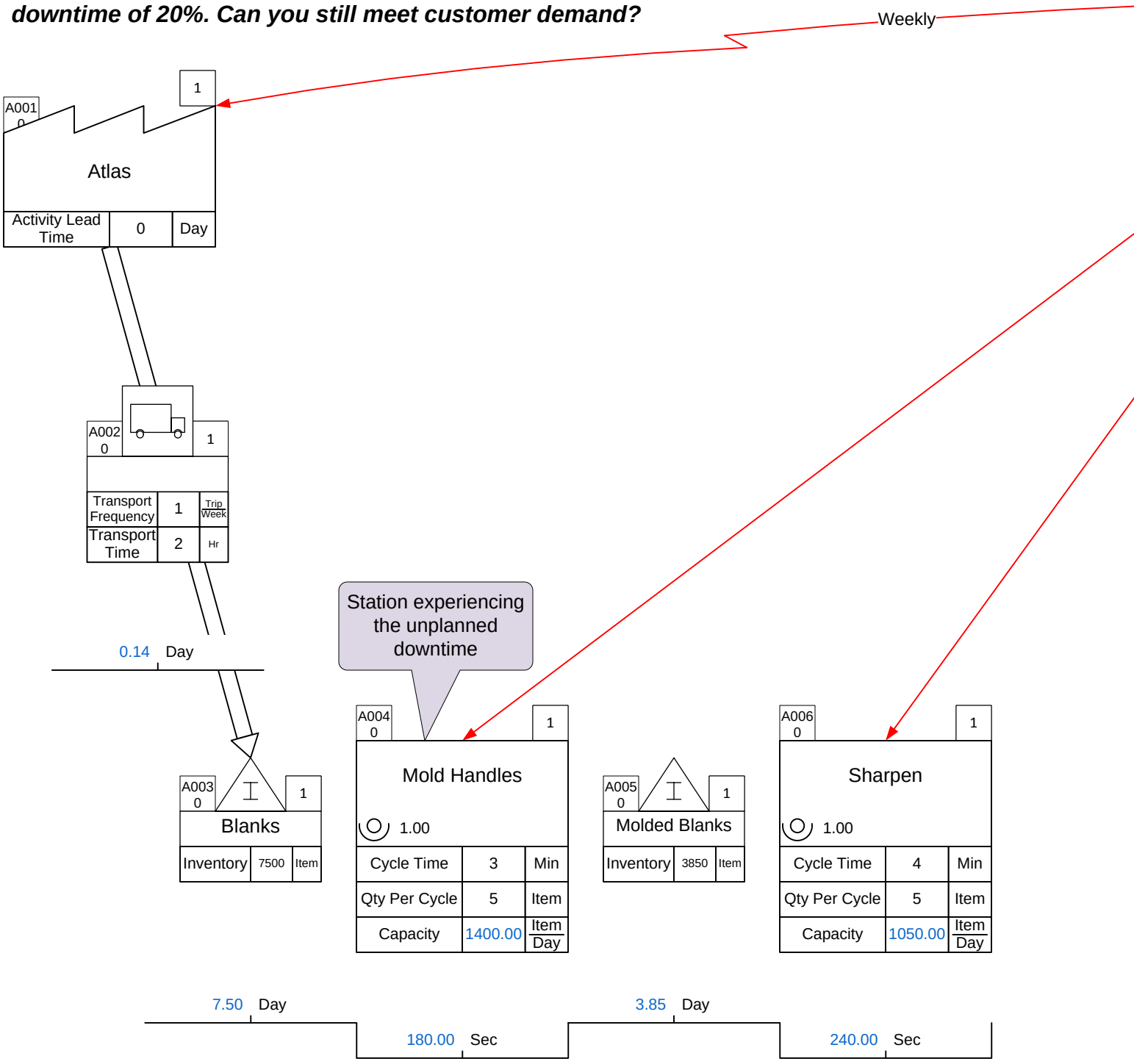
Manufacturing Problem: Downtime

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



Units	Year	Week	Week
	52	70	5
	Week	Hr	day

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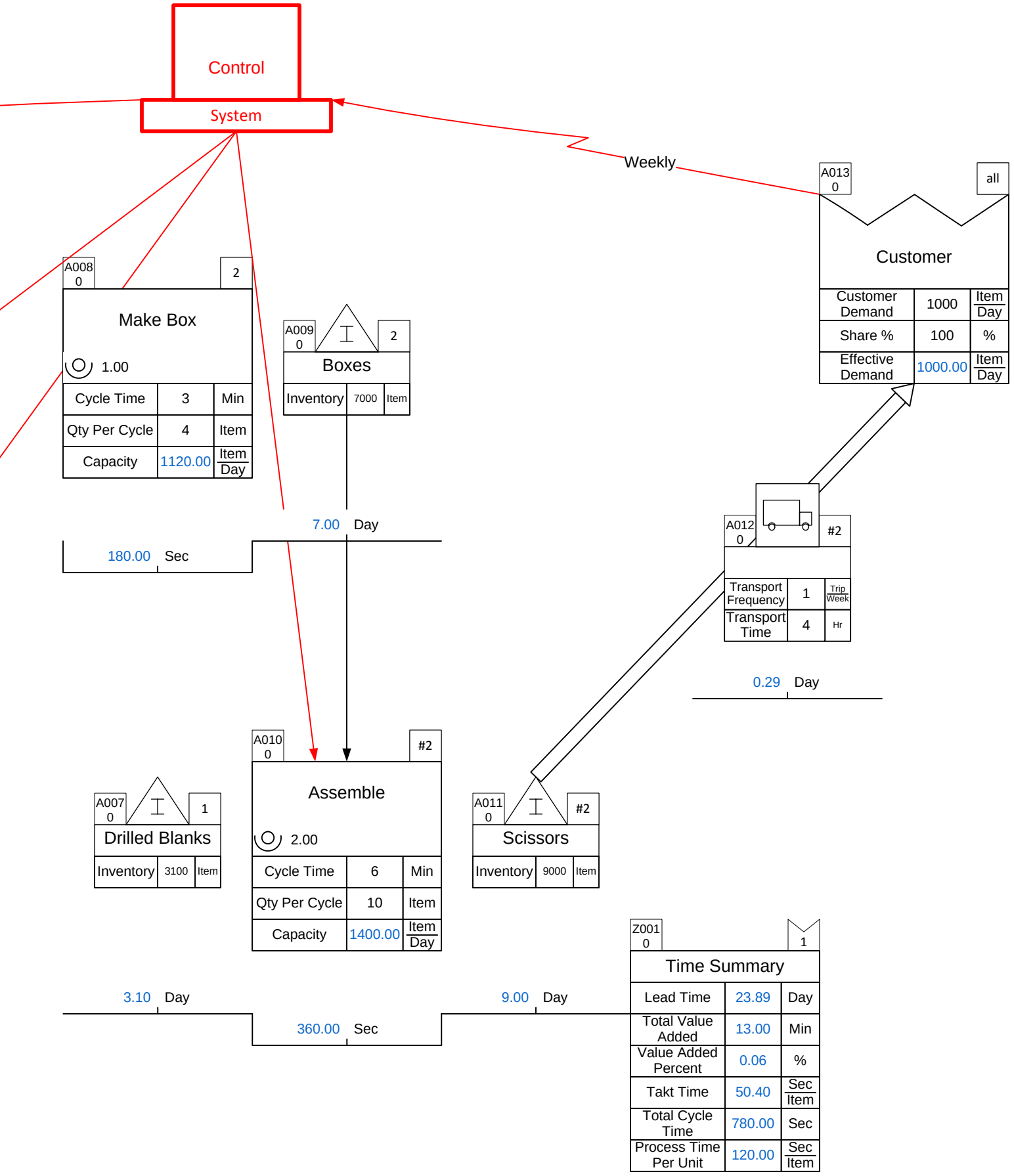

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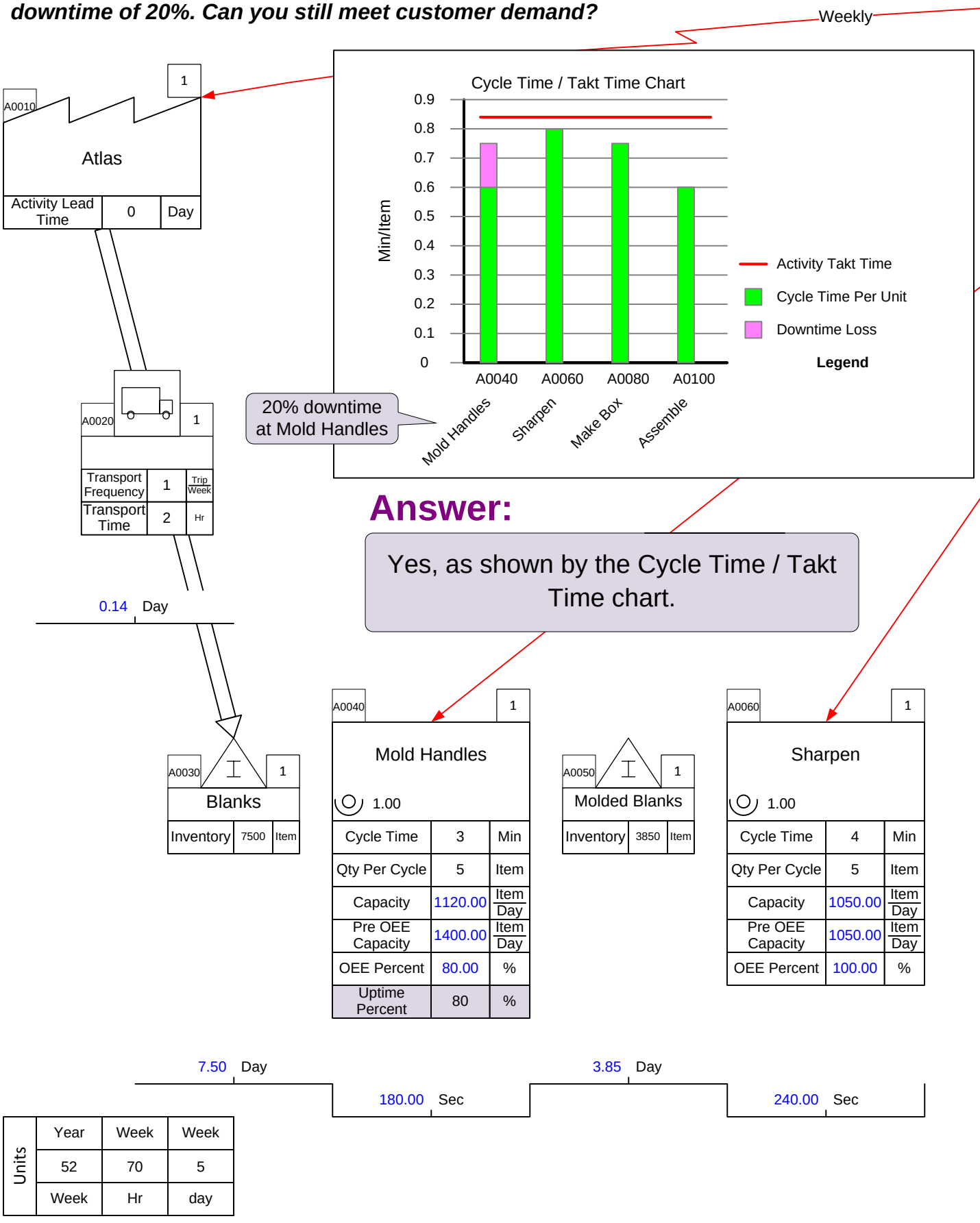
Manufacturing Solution: Downtime

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



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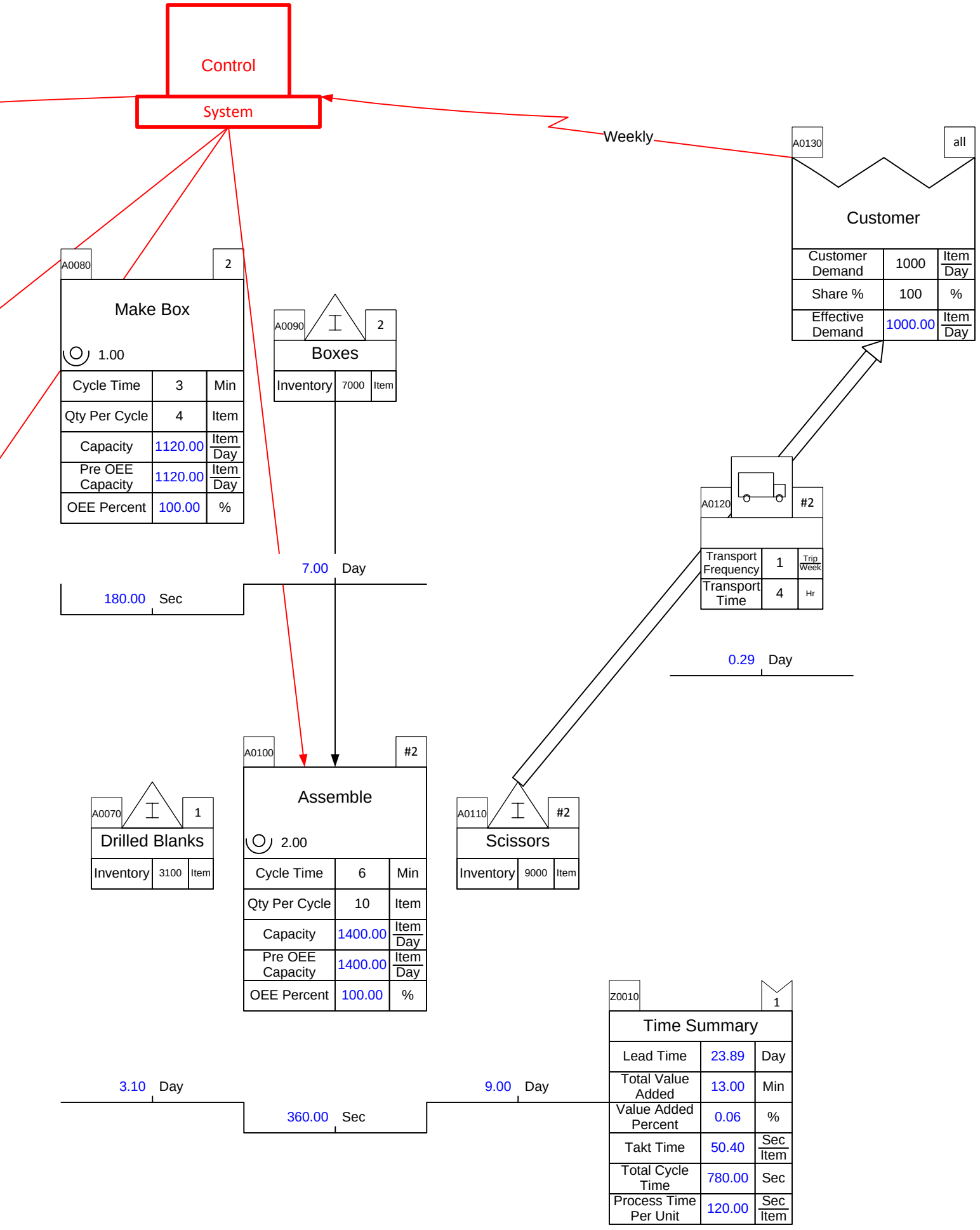

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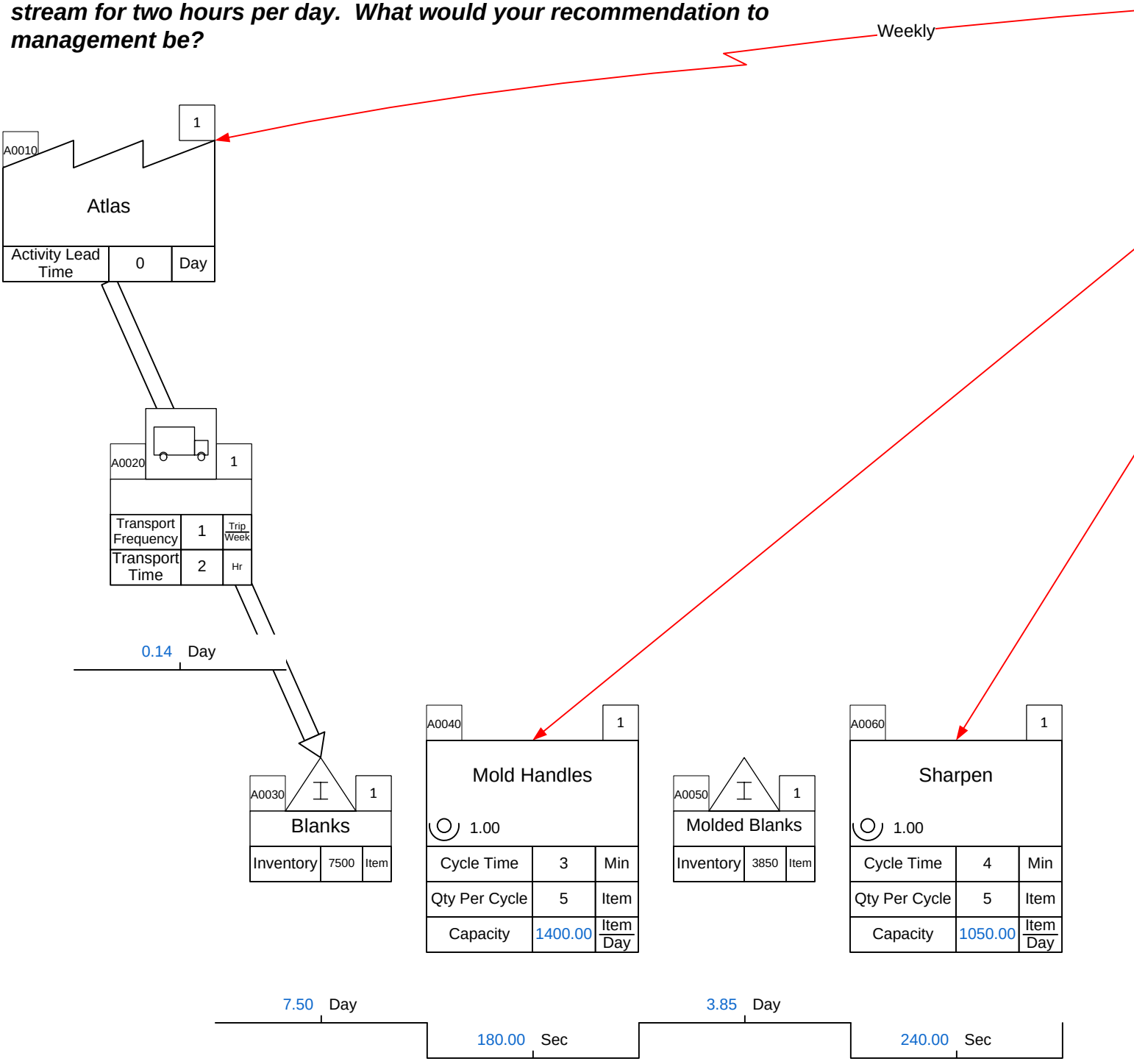
Manufacturing Problem: Availability

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



Units	Year	Week	Week
	52	70	5
	Week	Hr	day

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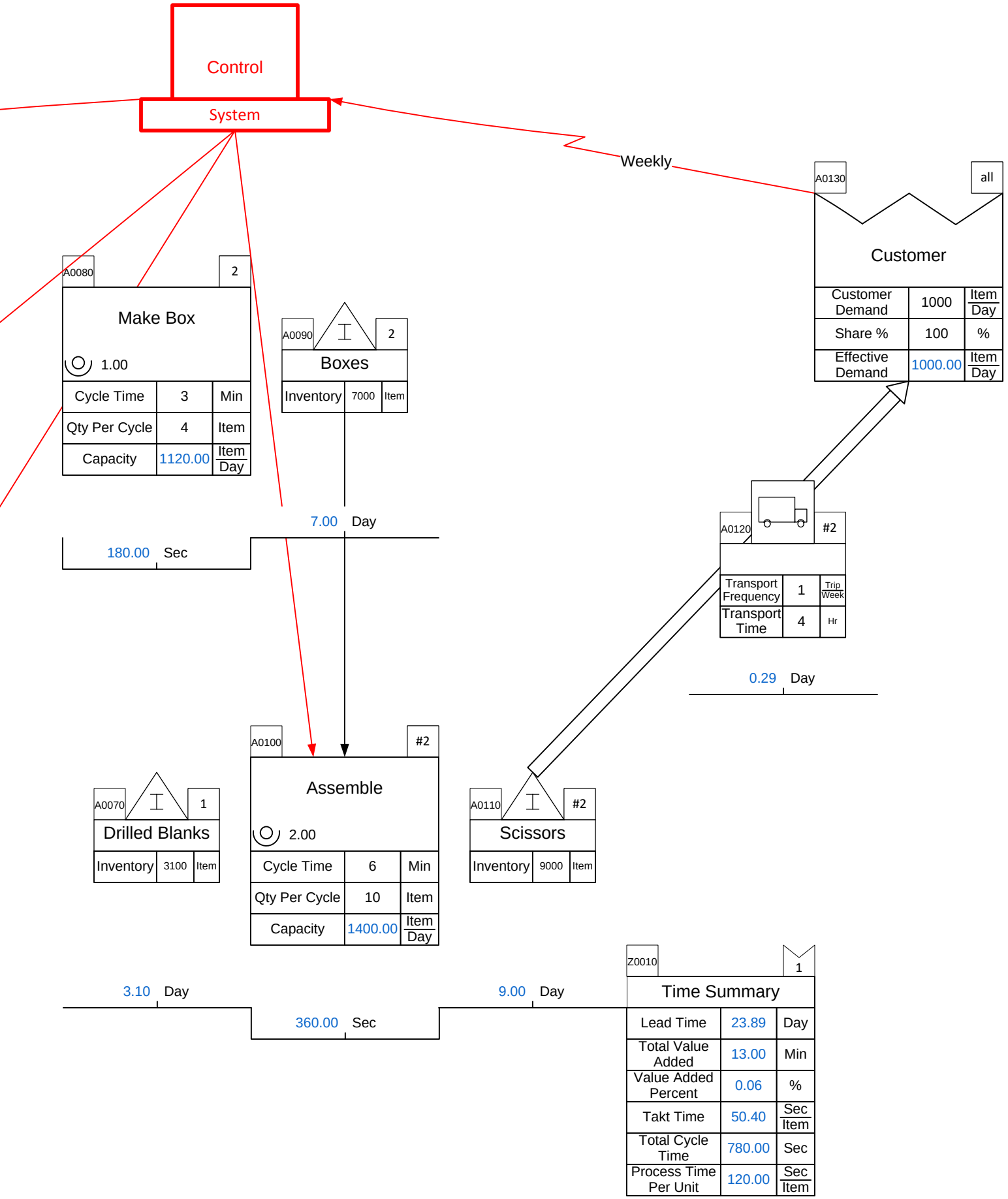

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Manufacturing Solution: Availability

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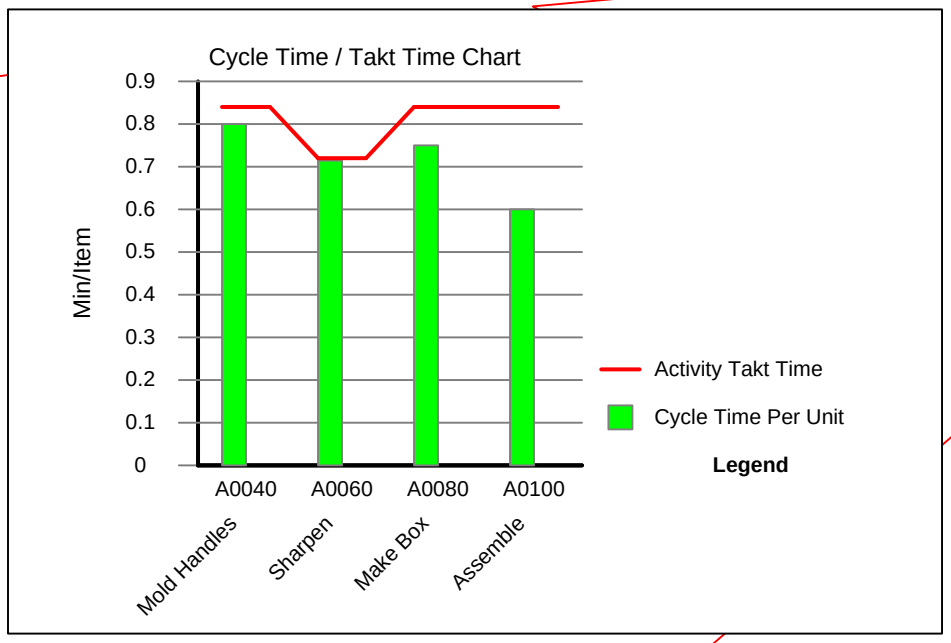
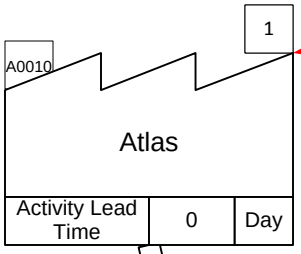
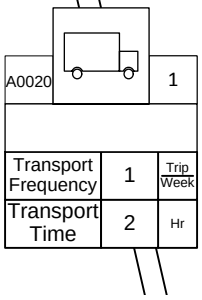


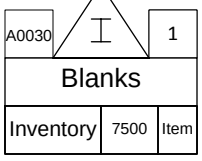


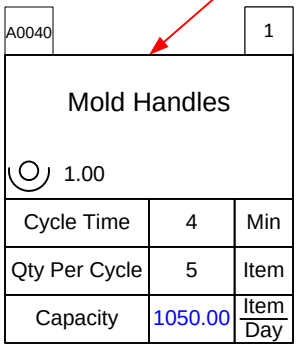


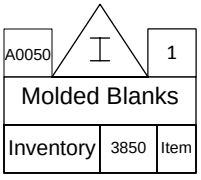
0.14 Day

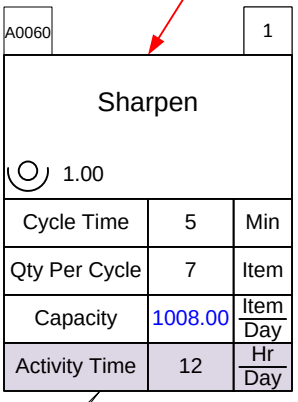
Answer:

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

240.00 Sec

3.85 Day

350.00 Sec

Availability change – two hours less than other stations

Units	Year	Week	Week
	52	70	5
	Week	Hr	day

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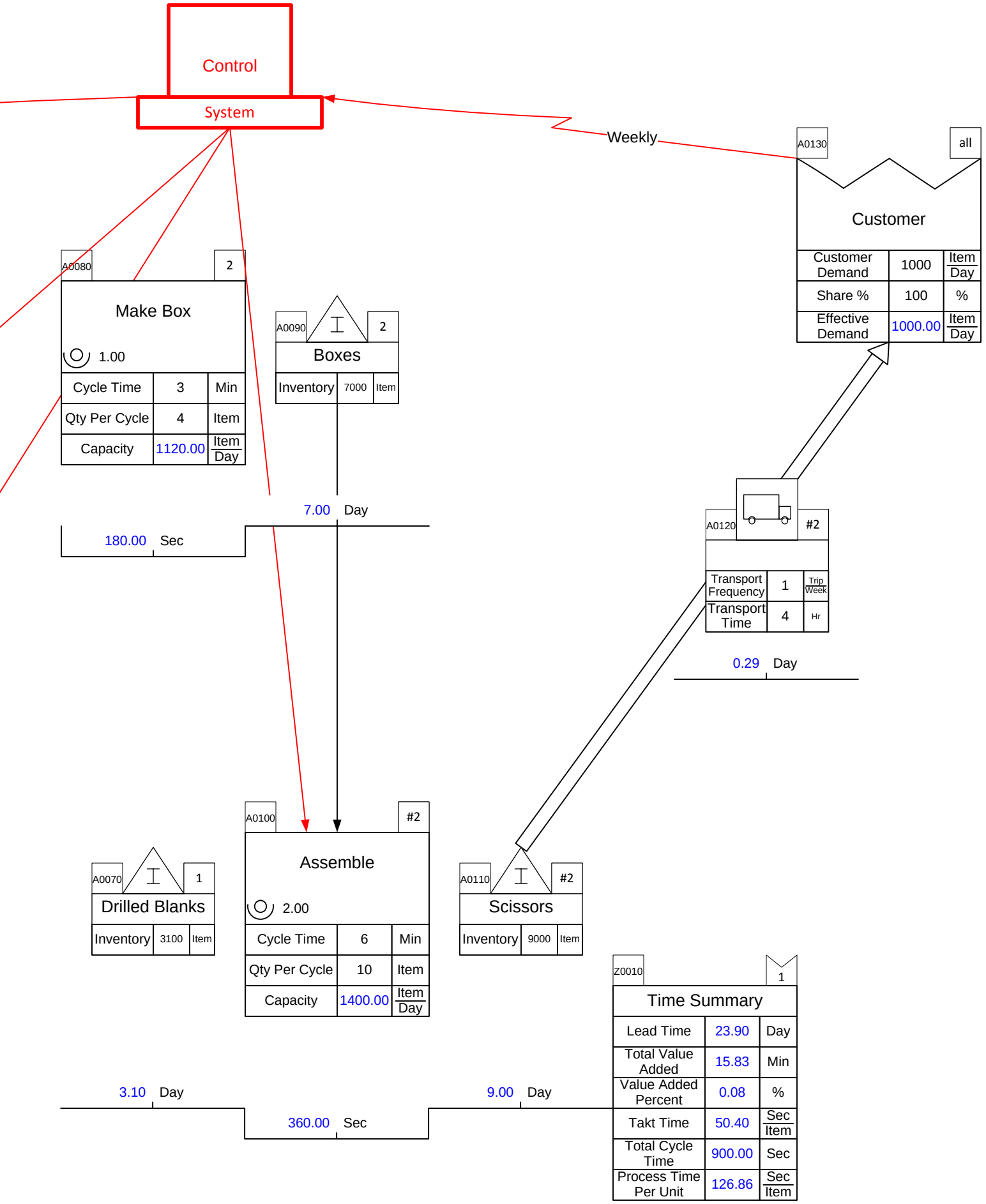

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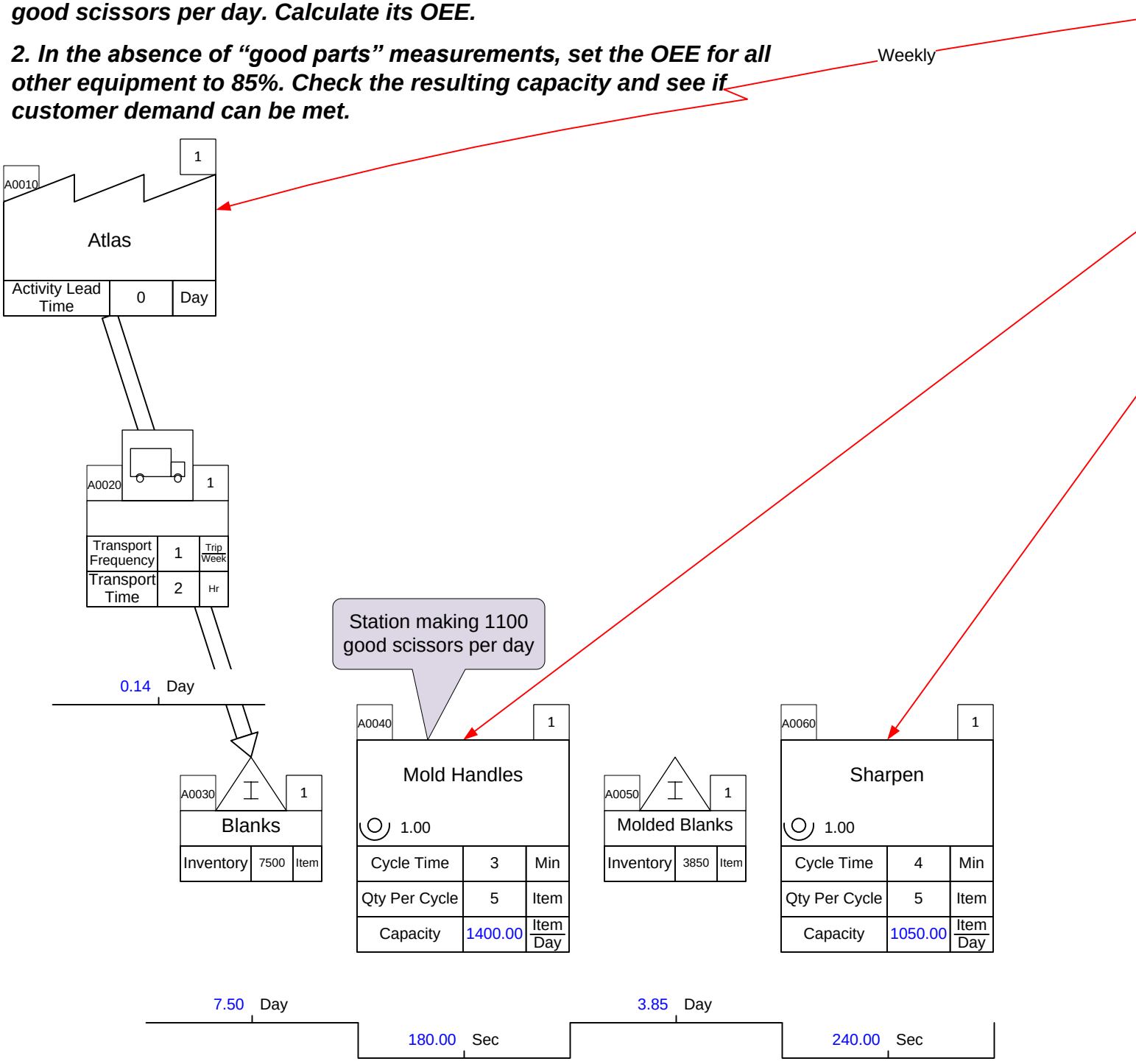
Manufacturing Problem: OEE

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.



Units	Year	Week	Week
	52	70	5
	Week	Hr	day

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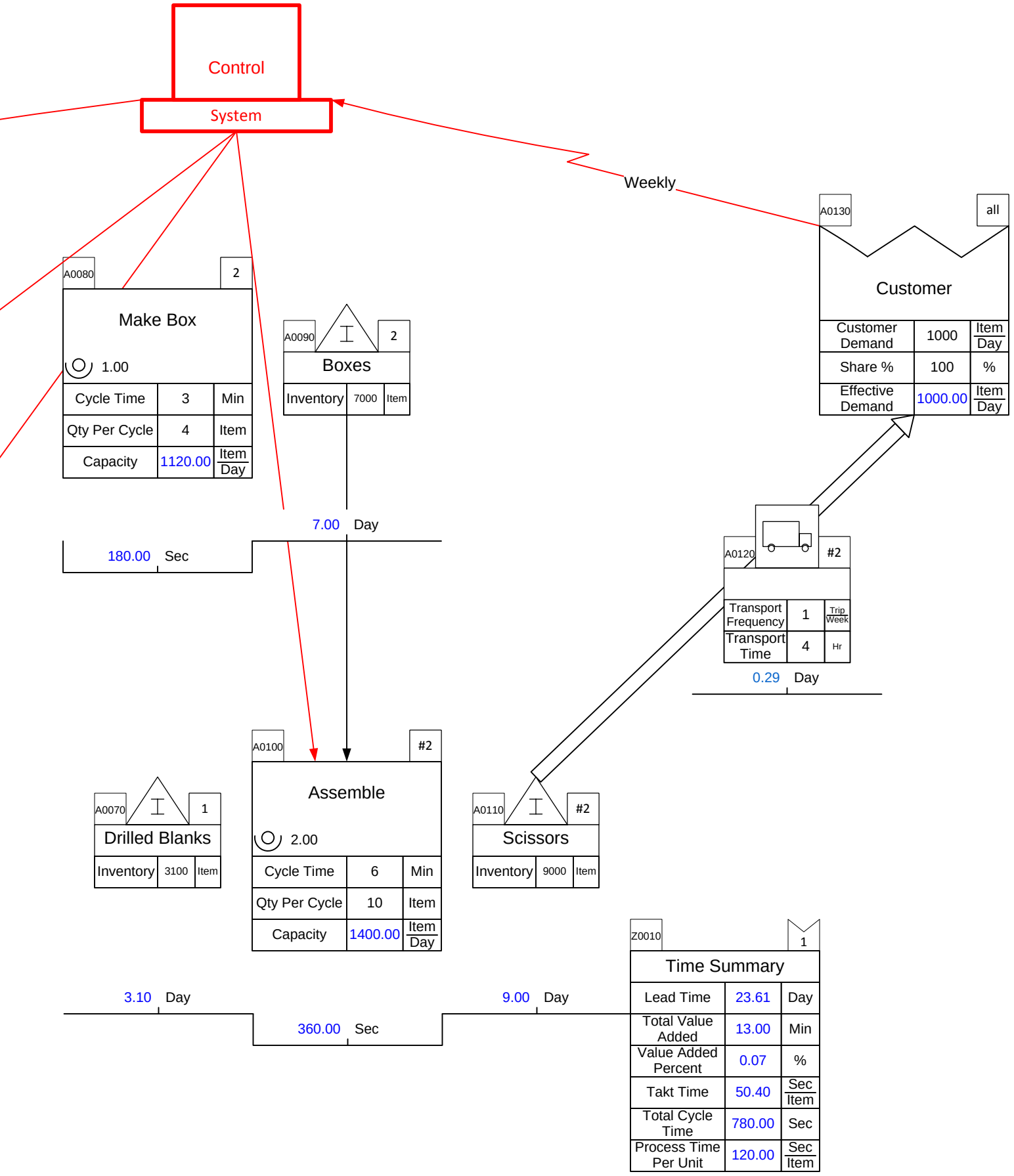

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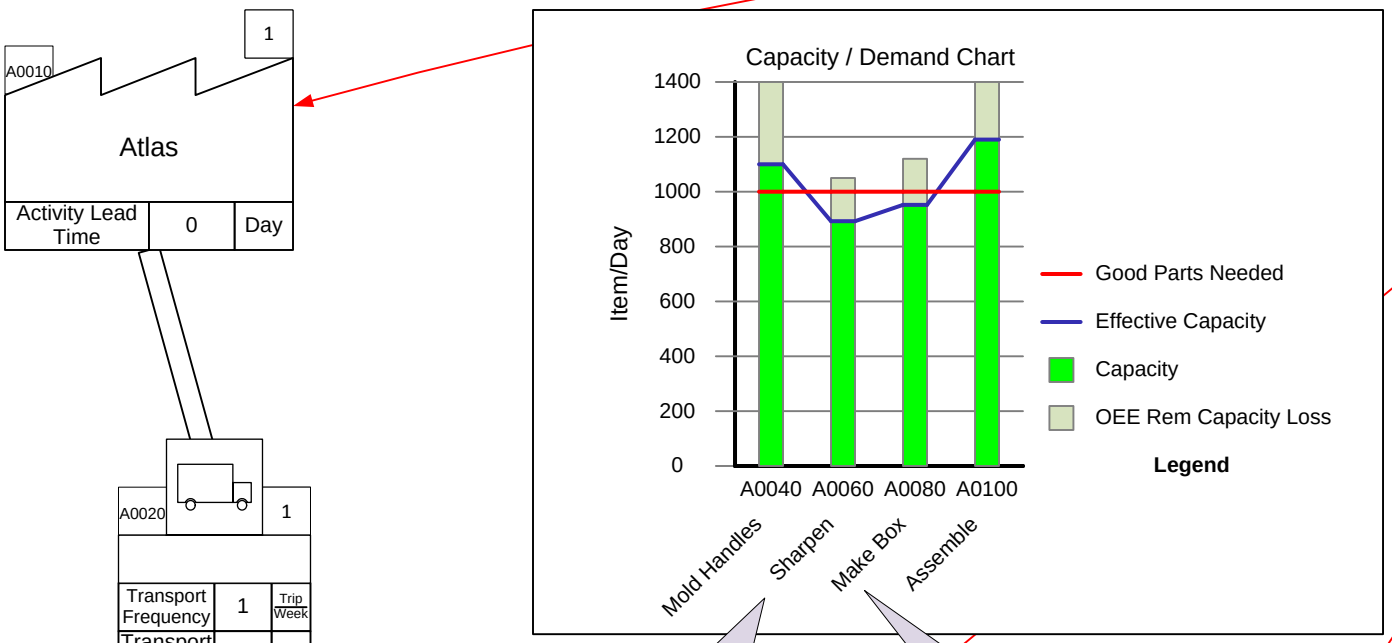
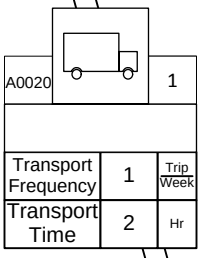
Manufacturing Solution: OEE

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

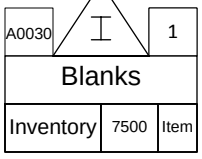


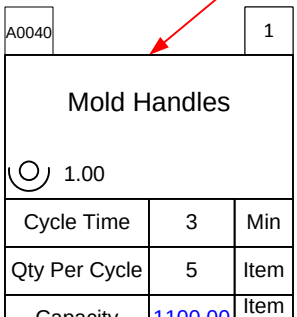


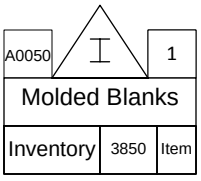
0.14 Day

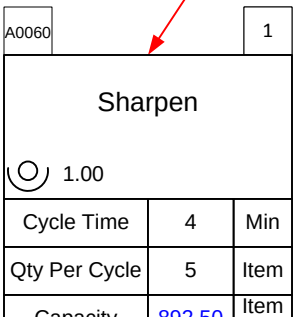
This activity is not meeting customer demand

This activity is not meeting customer demand









7.50 Day

180.00 Sec

3.85 Day

240.00 Sec

Units	Year	Week	Week
	52	70	5
	Week	Hr	day

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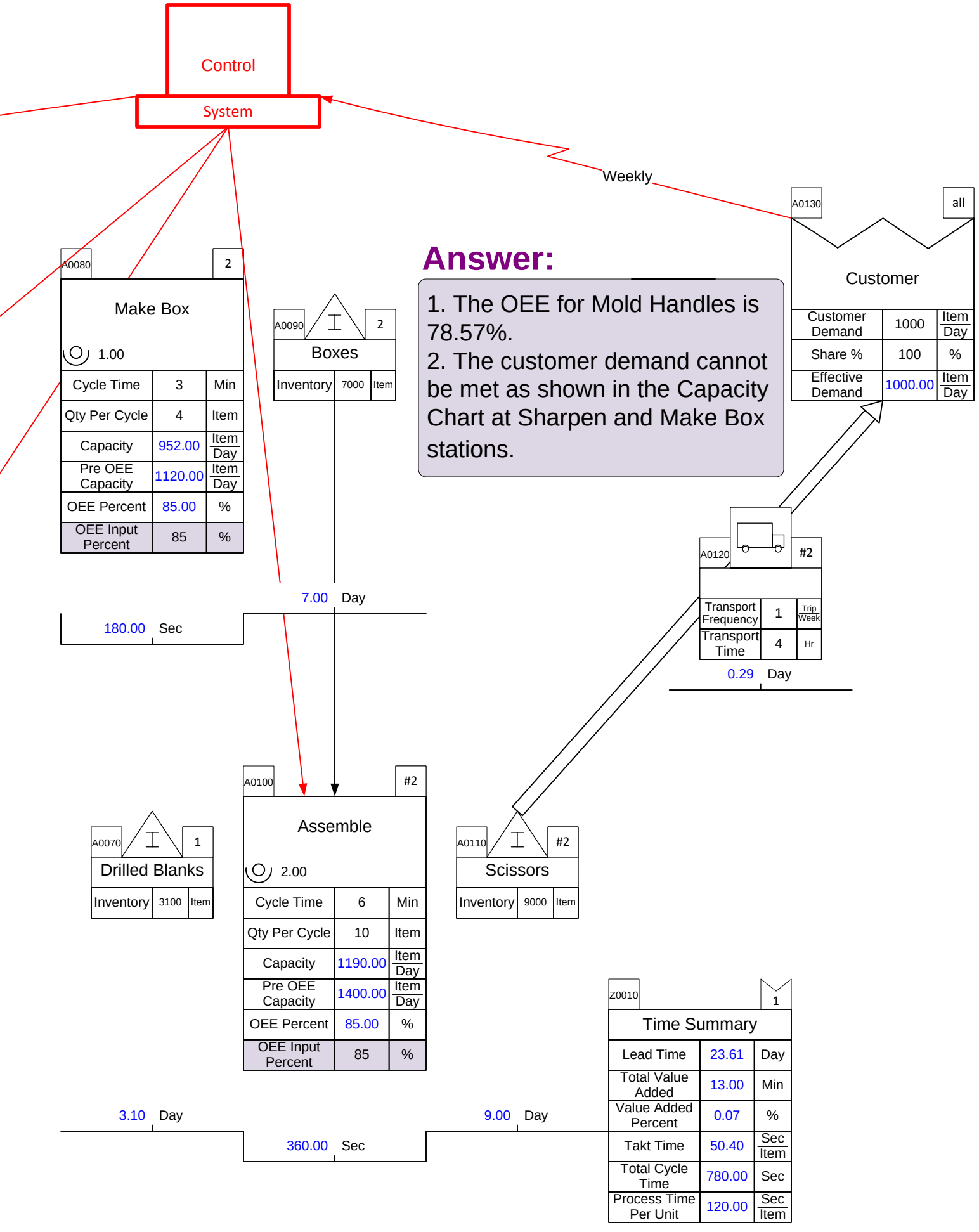

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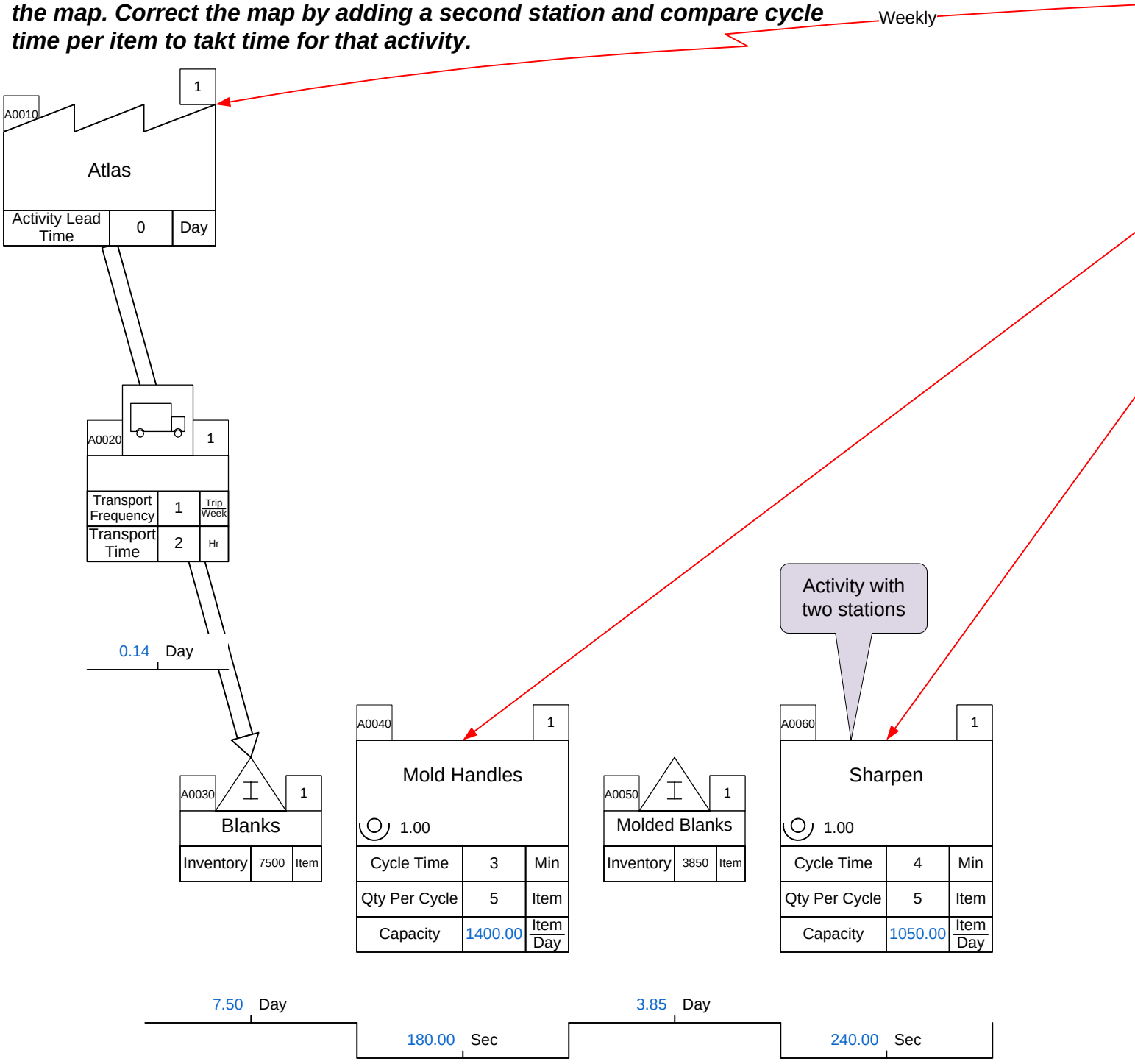
Manufacturing Problem: Stations

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.



Units	Year	Week	Week
	52	70	5
	Week	Hr	day

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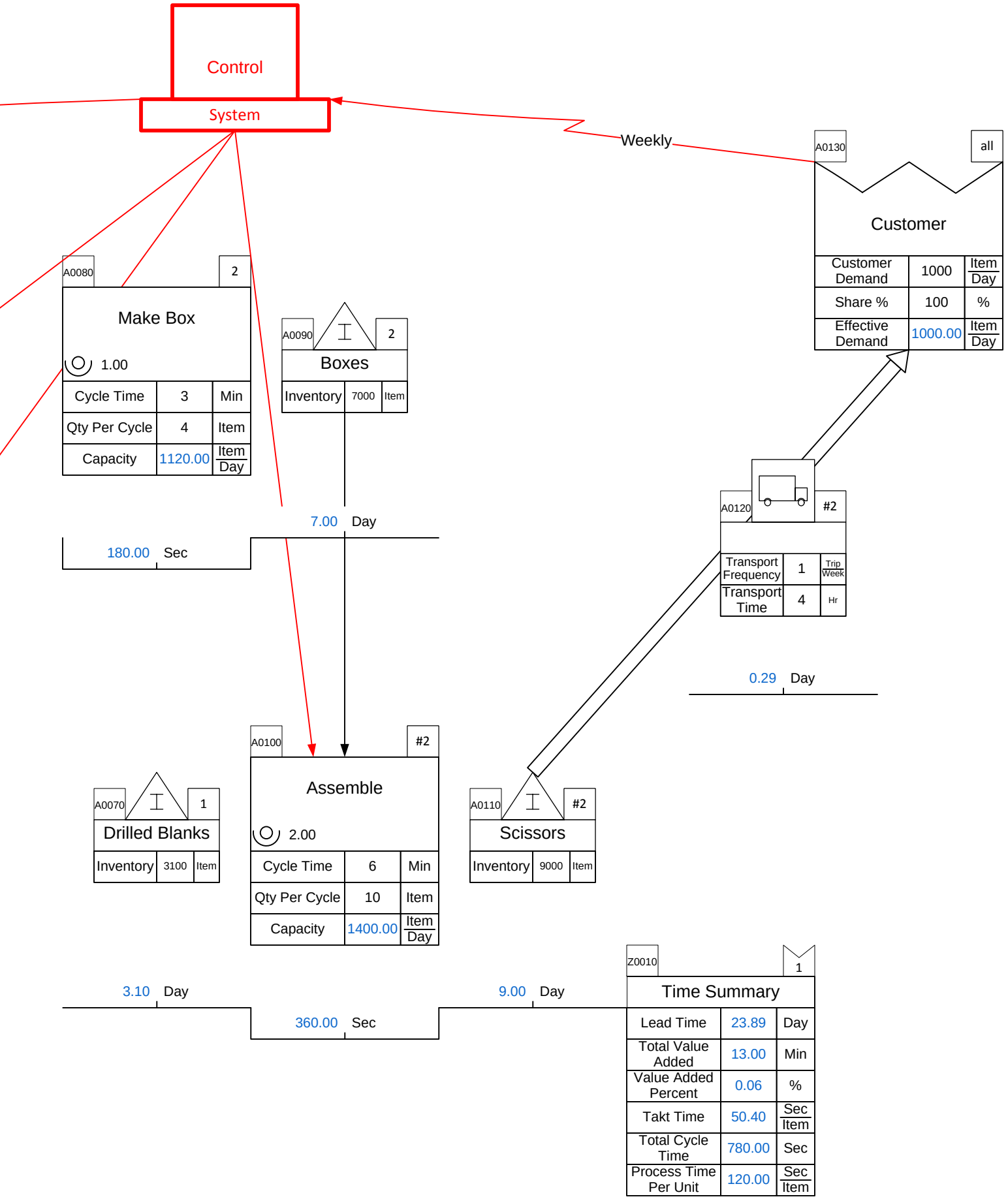

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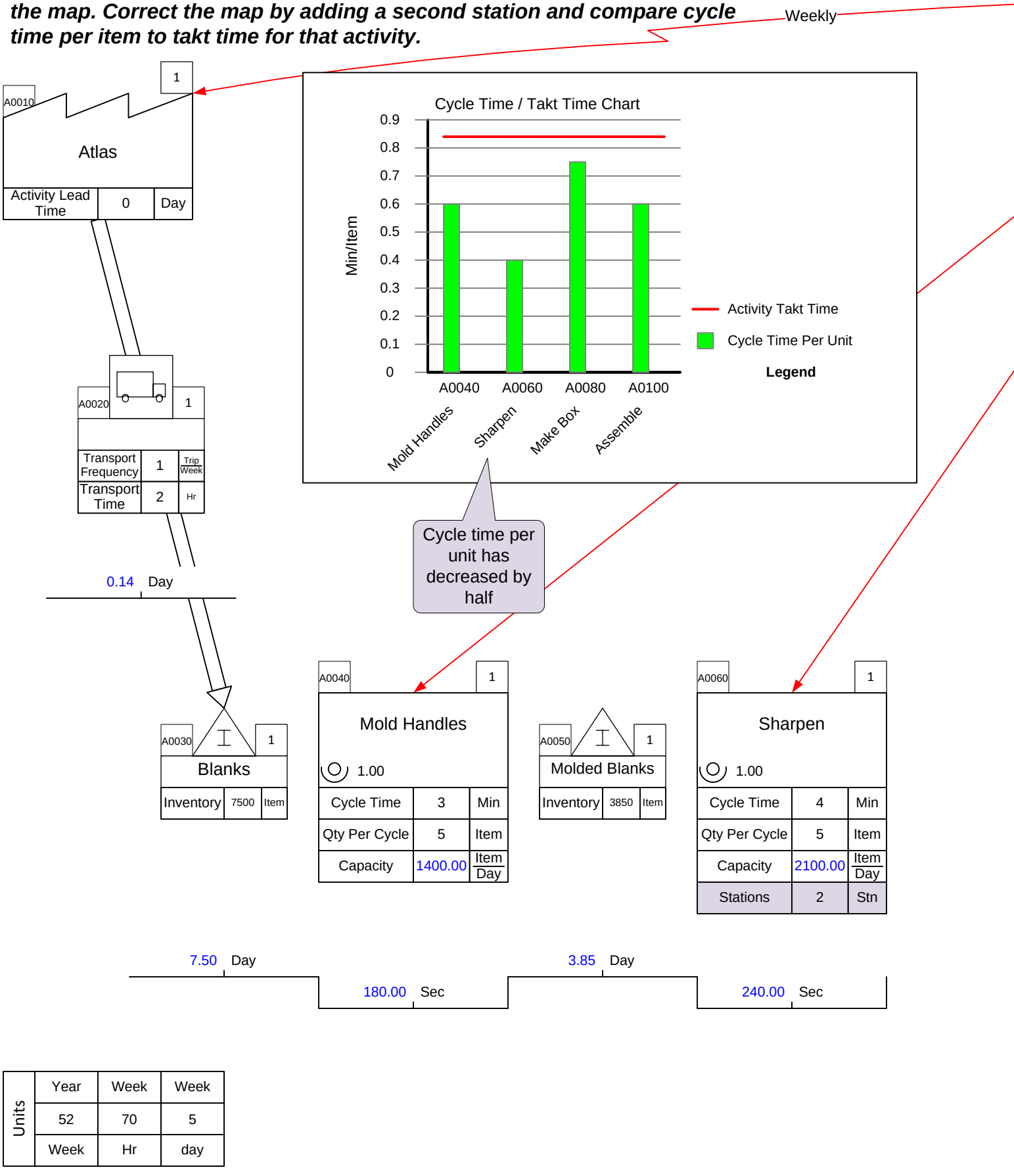
Manufacturing Solution: Stations

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.



Units	Year	Week	Week
	52	70	5
	Week	Hr	day

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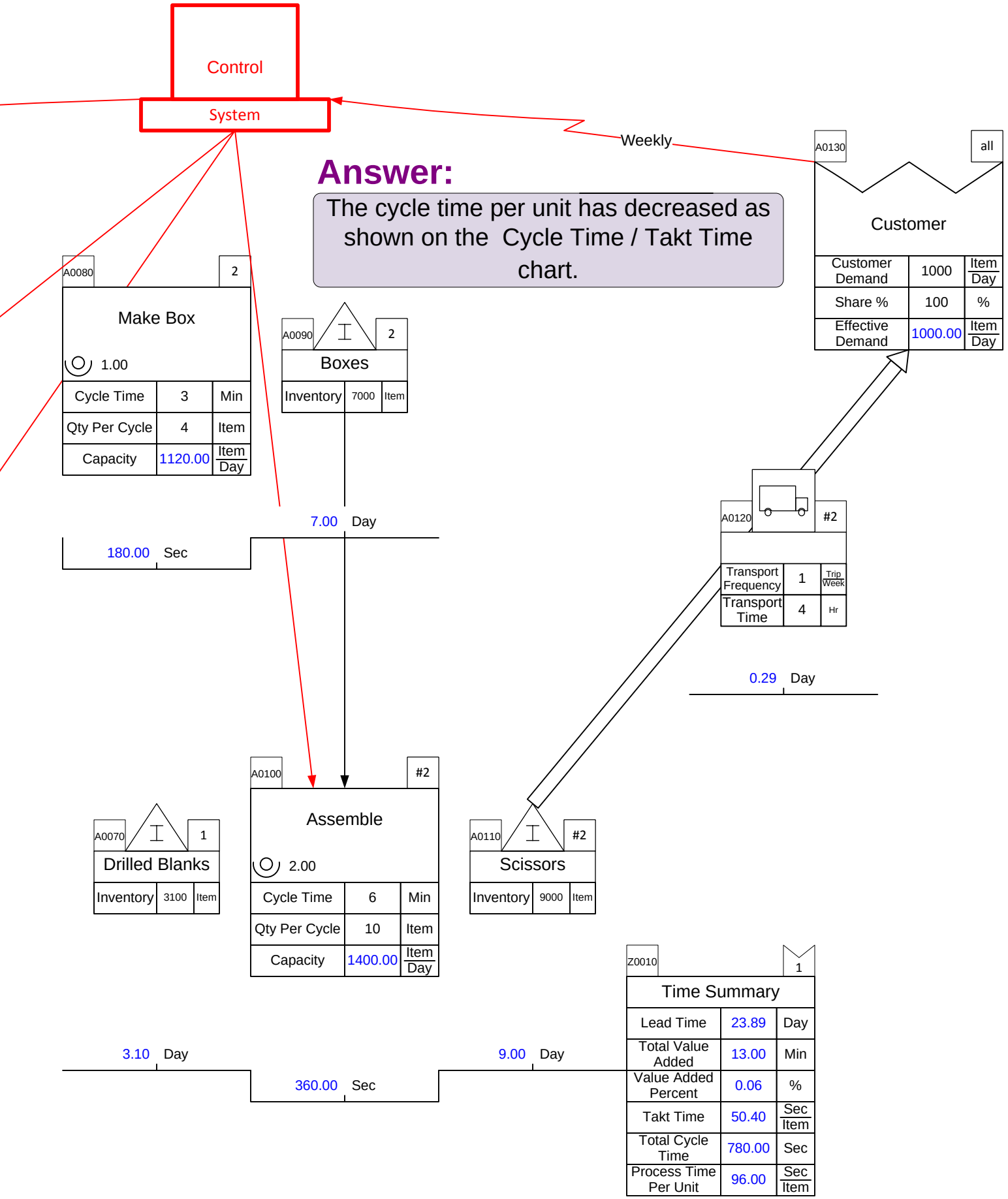

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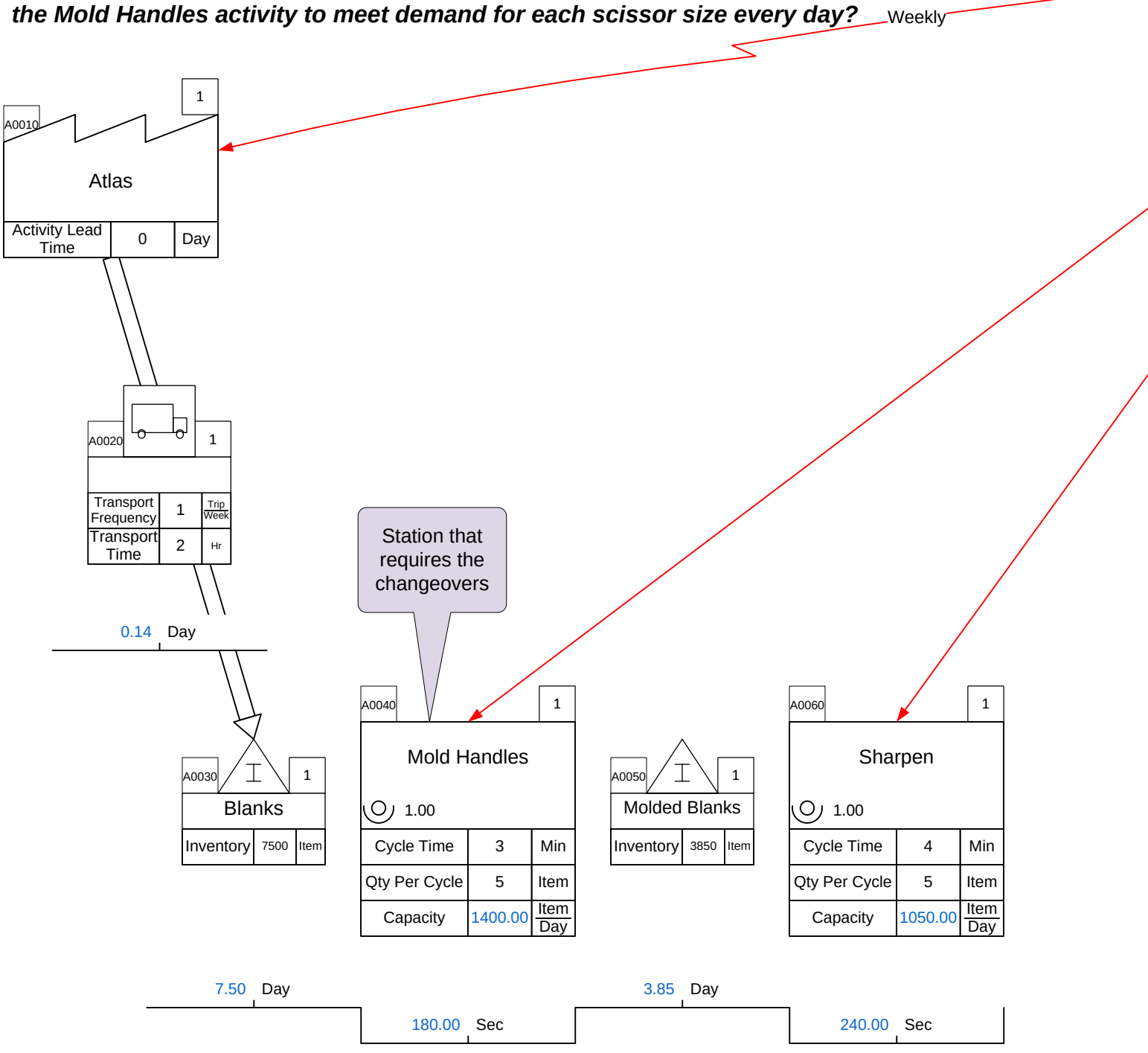
Manufacturing Problem: Changeover

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?



Units	Year	Week	Week
	52	70	5
	Week	Hr	day

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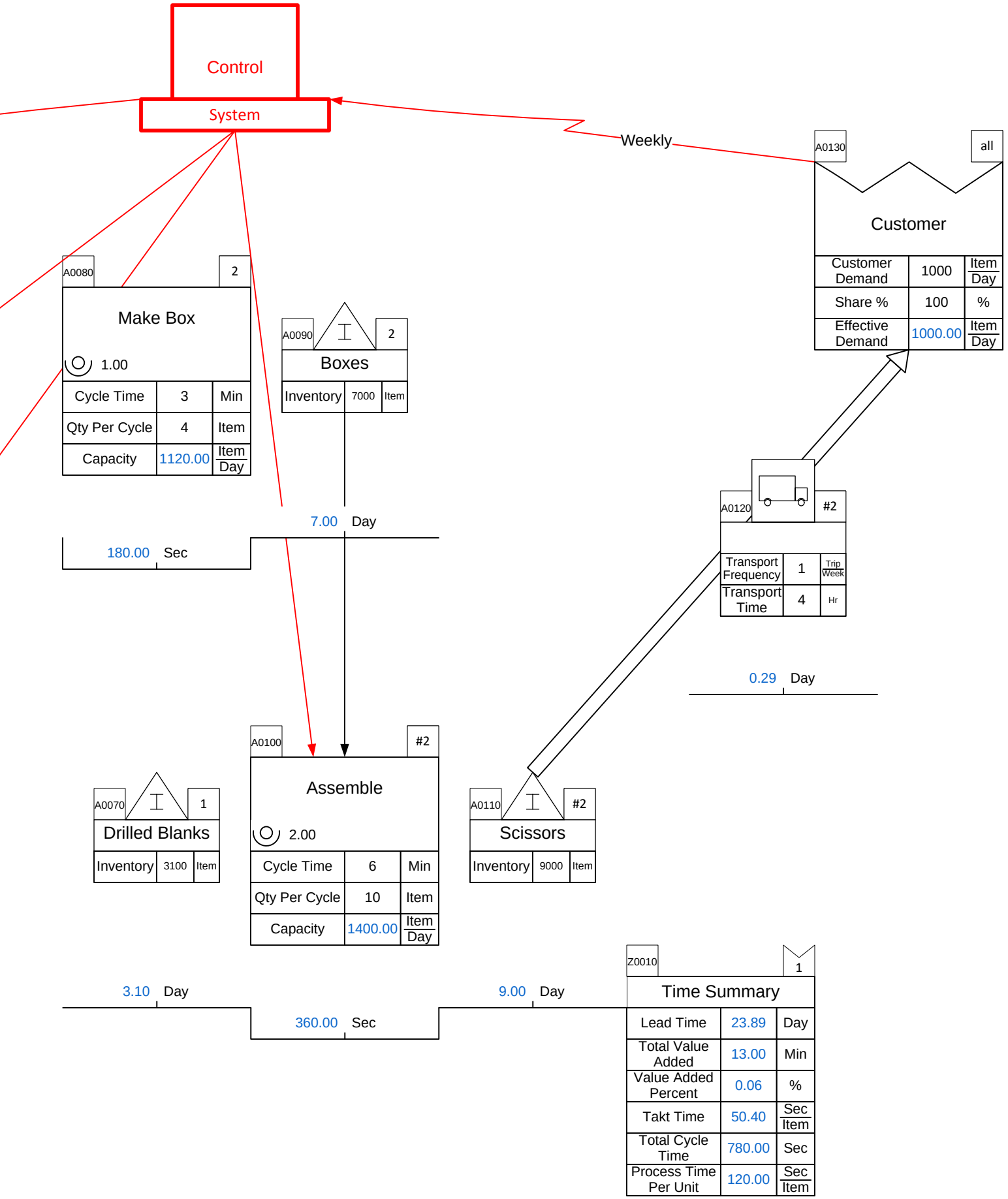

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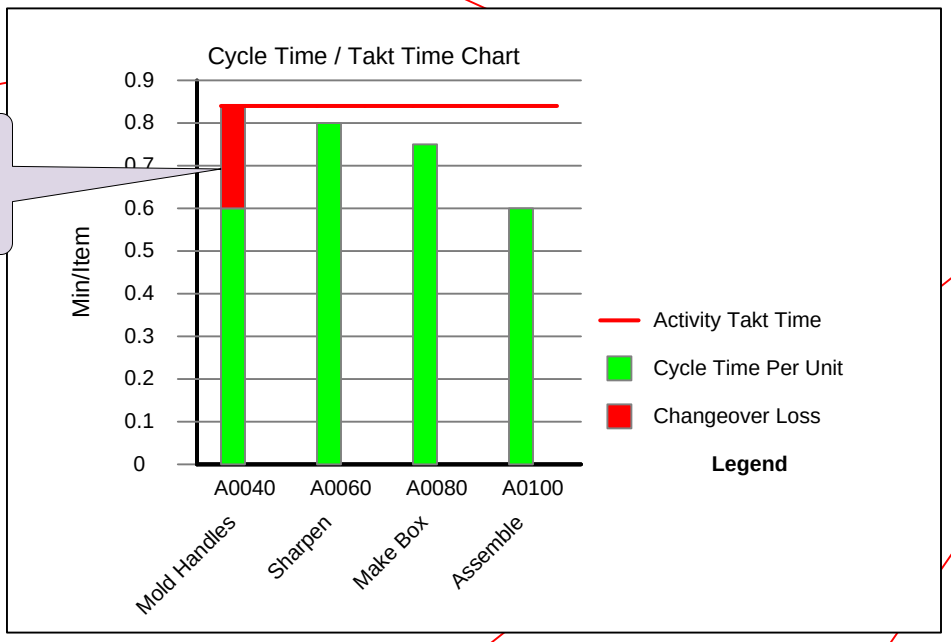
Manufacturing Solution: Changeover

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



Changeover loss for Mold Handles

A0010	Atlas	1
Activity Lead Time	0	Day

A0020		1
Transport Frequency	1	Trip / Week
Transport Time	2	Hr

0.14 Day

Answer:

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

A0030	Blanks	1
Inventory	7500	Item

A0040	Mold Handles	1
	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	Molded Blanks	1
Inventory	3850	Item

A0060	Sharpen	1
	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 — 180.00 Sec — 3.85 Day — 240.00 Sec

Units	Year	Week	Week
	52	70	5
	Week	Hr	day

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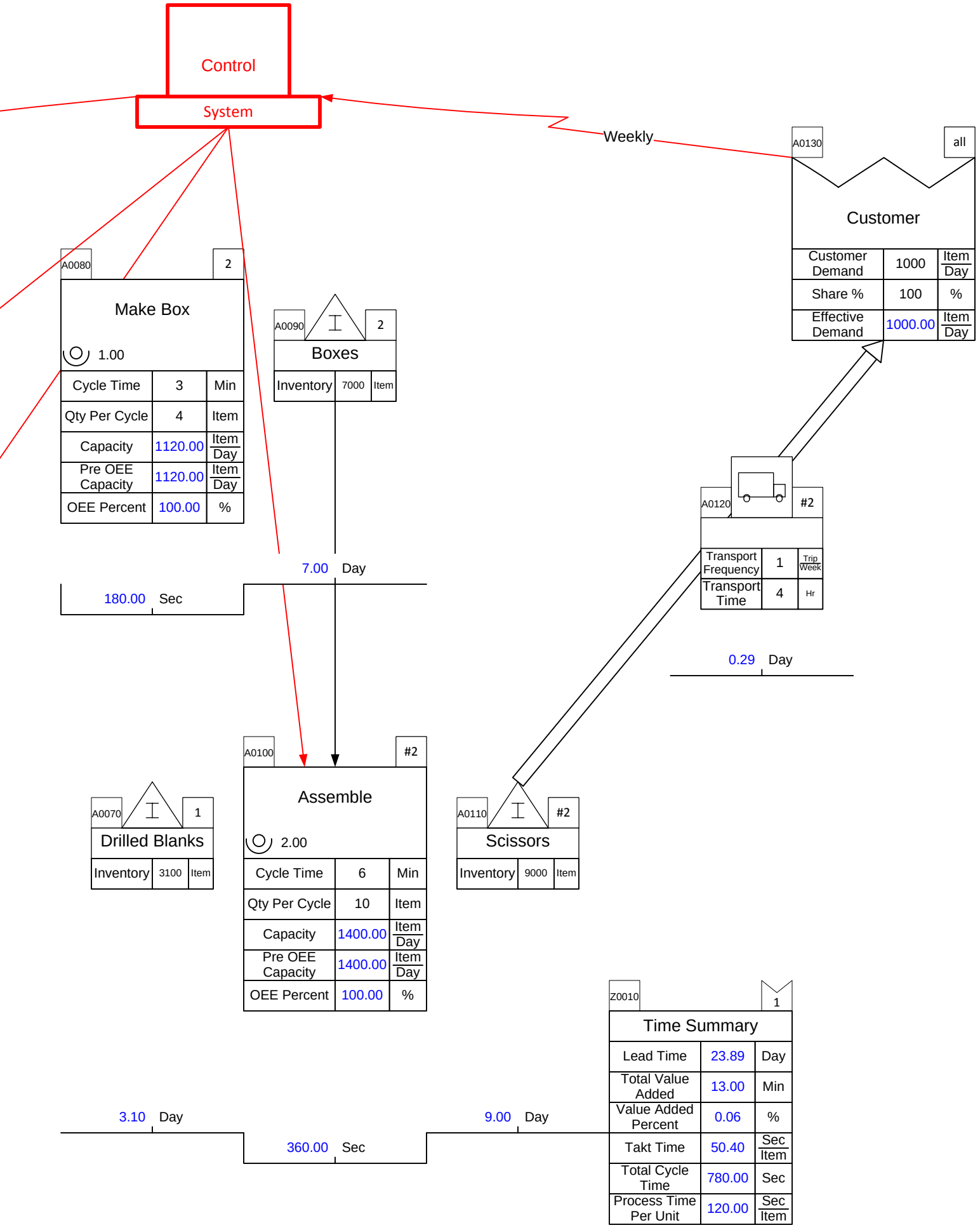

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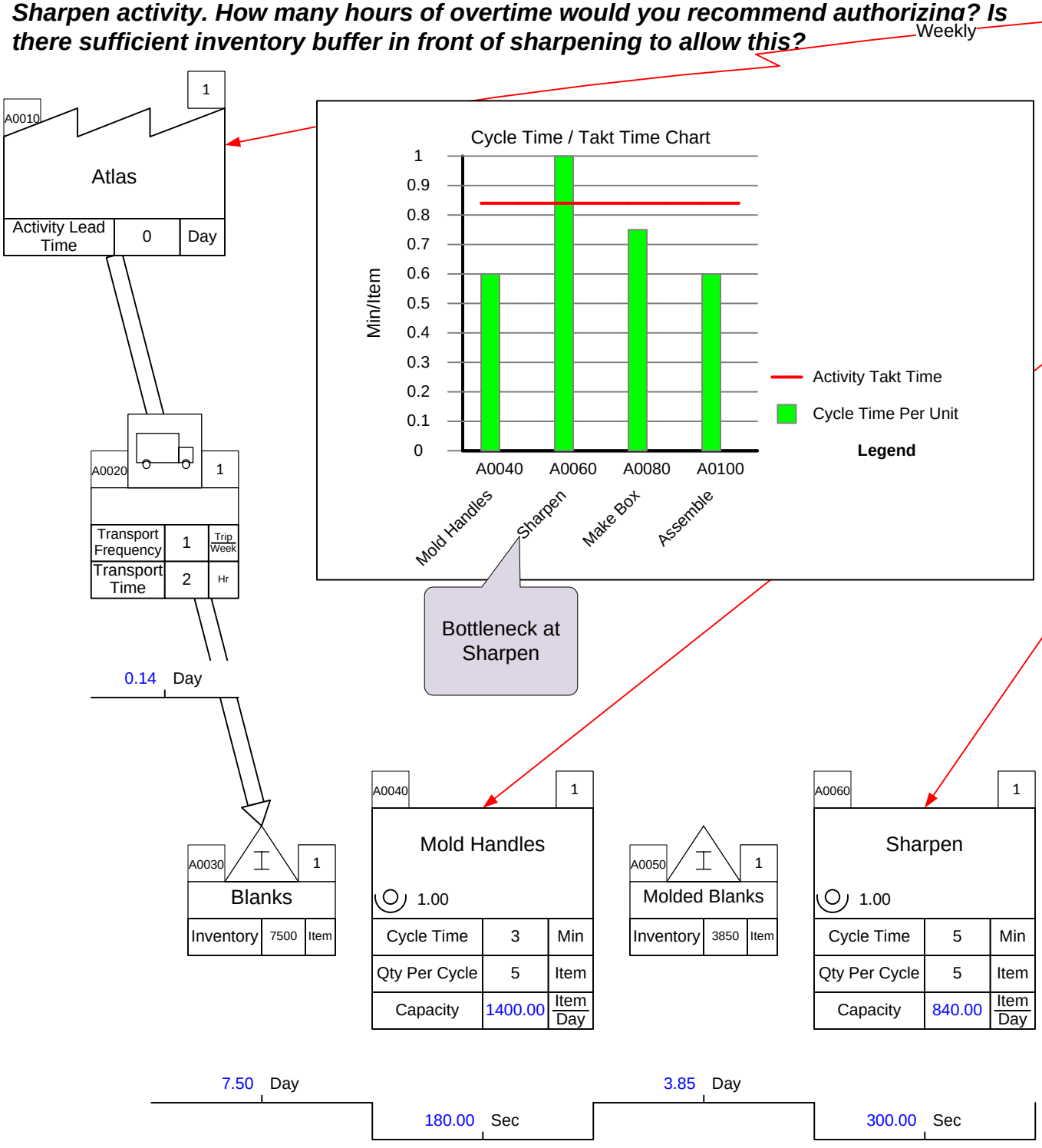
Manufacturing Problem: Activity Time

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?



Units	Year	Week	Week
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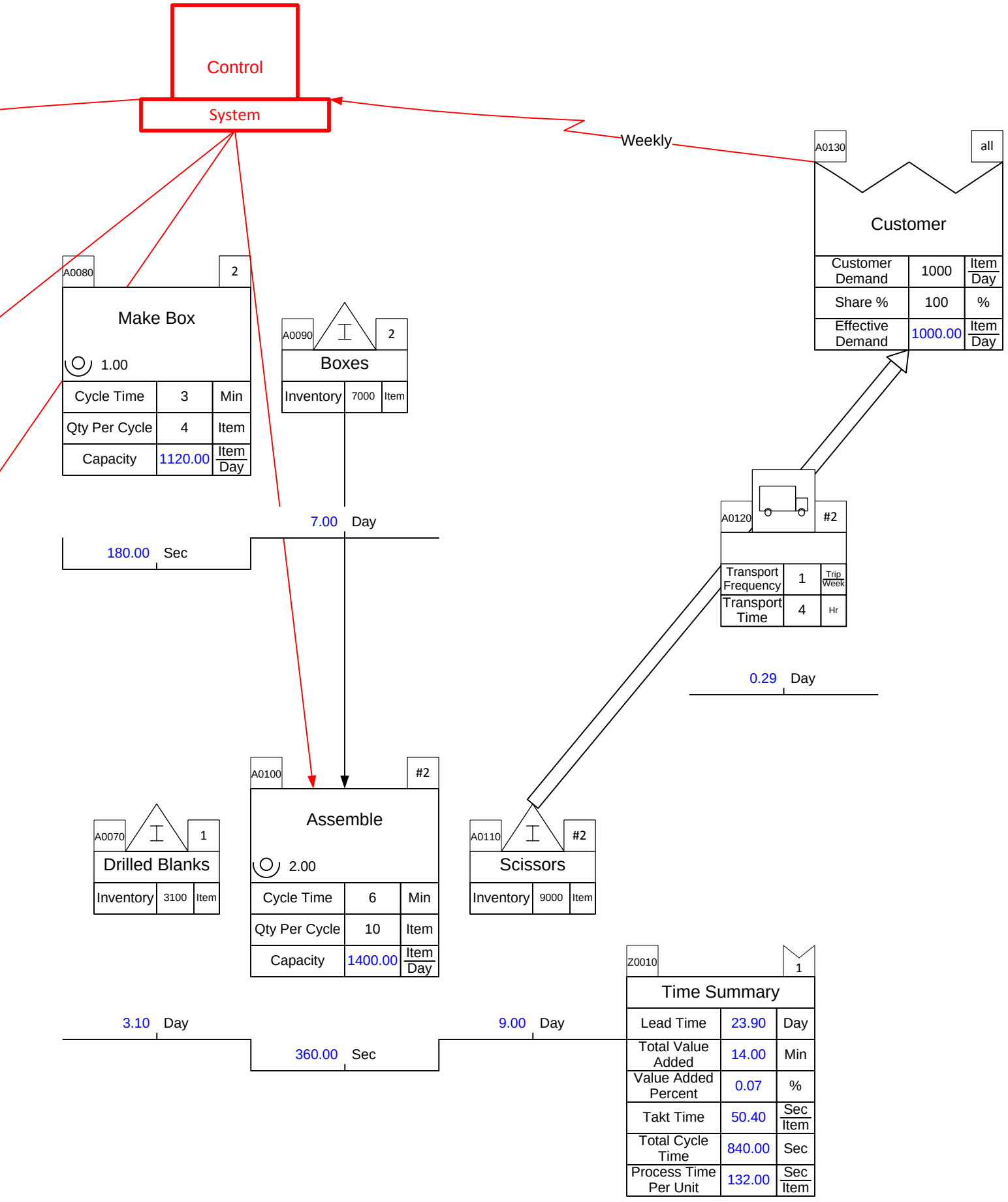

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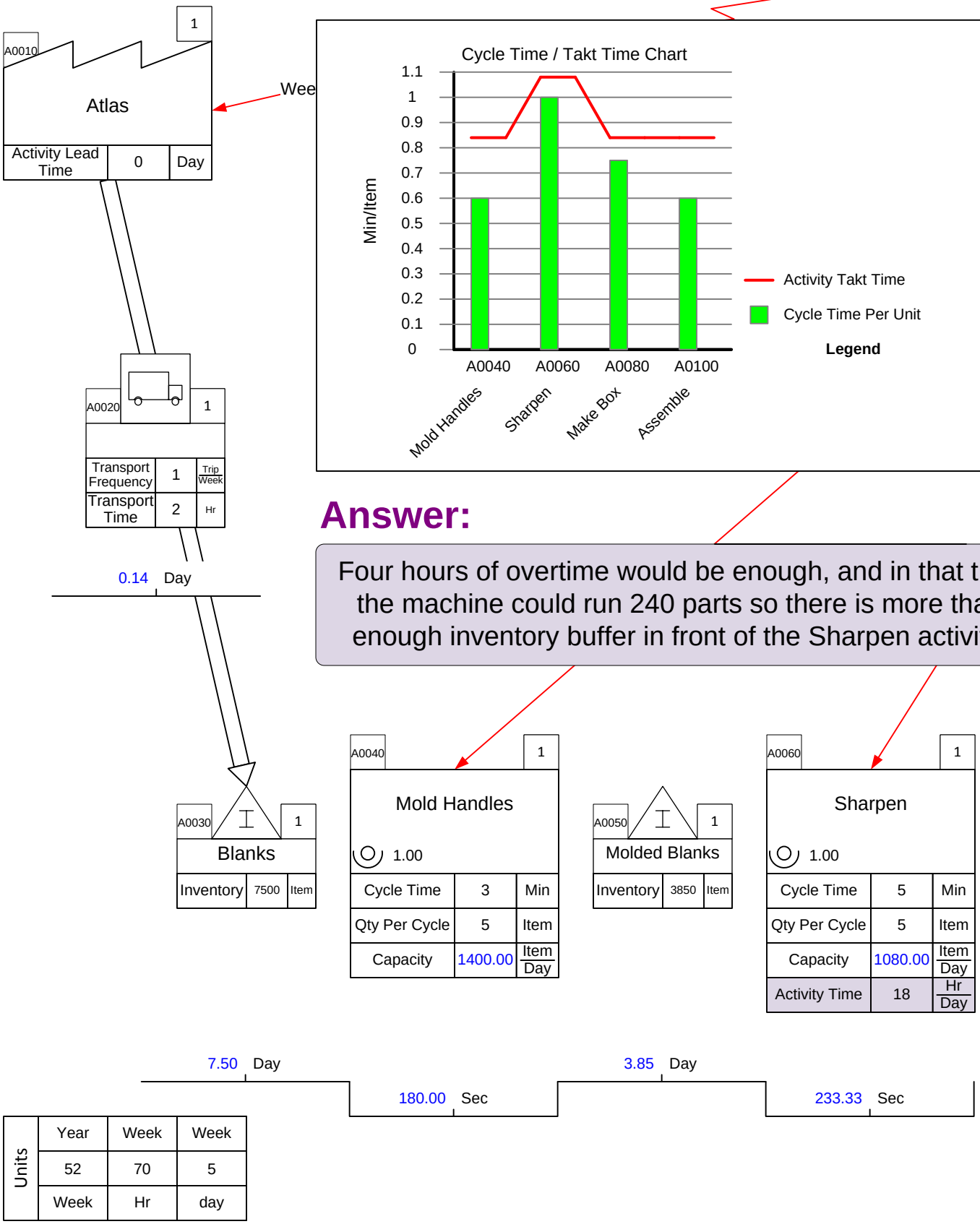
Manufacturing Solution: Activity Time

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.



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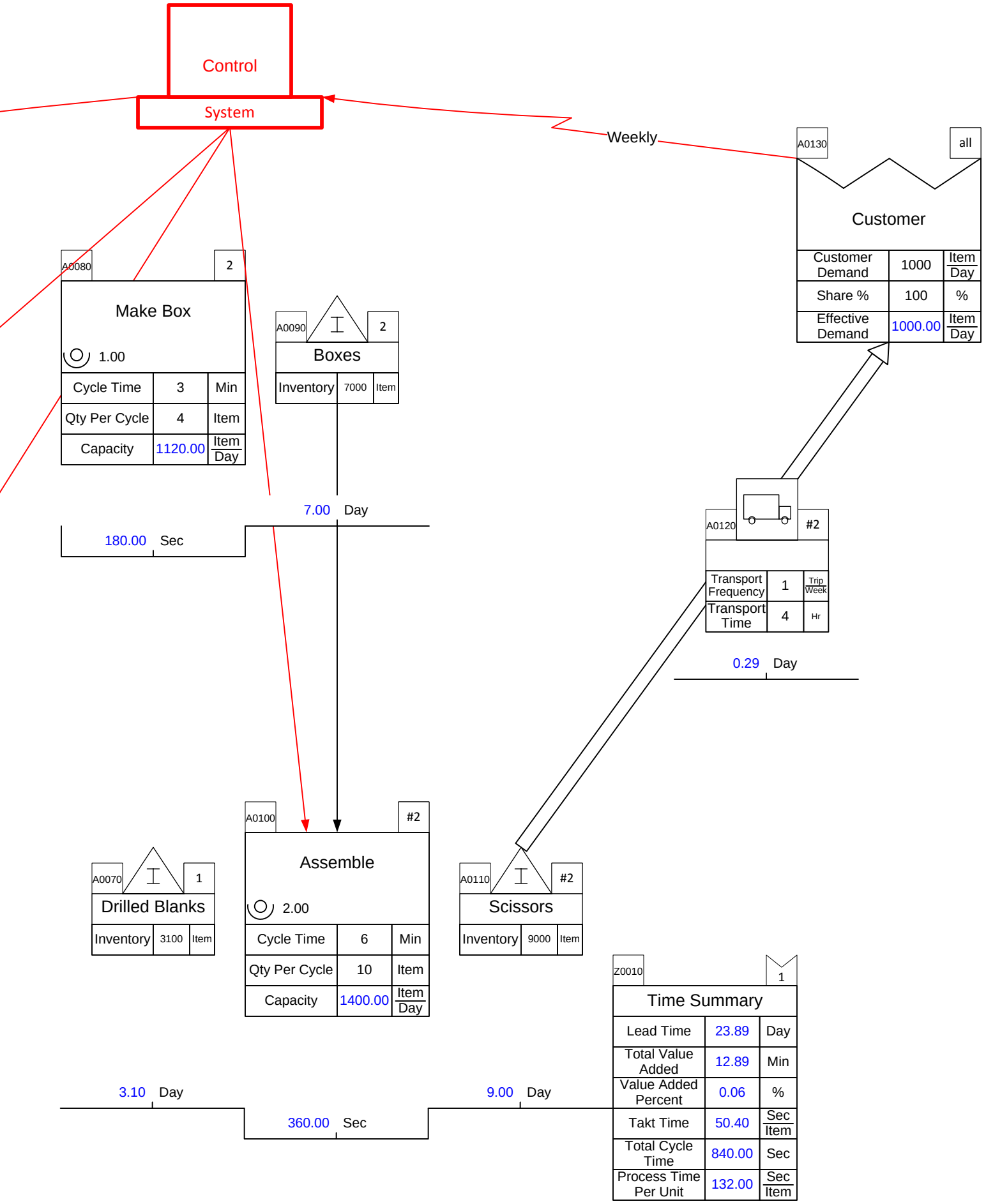

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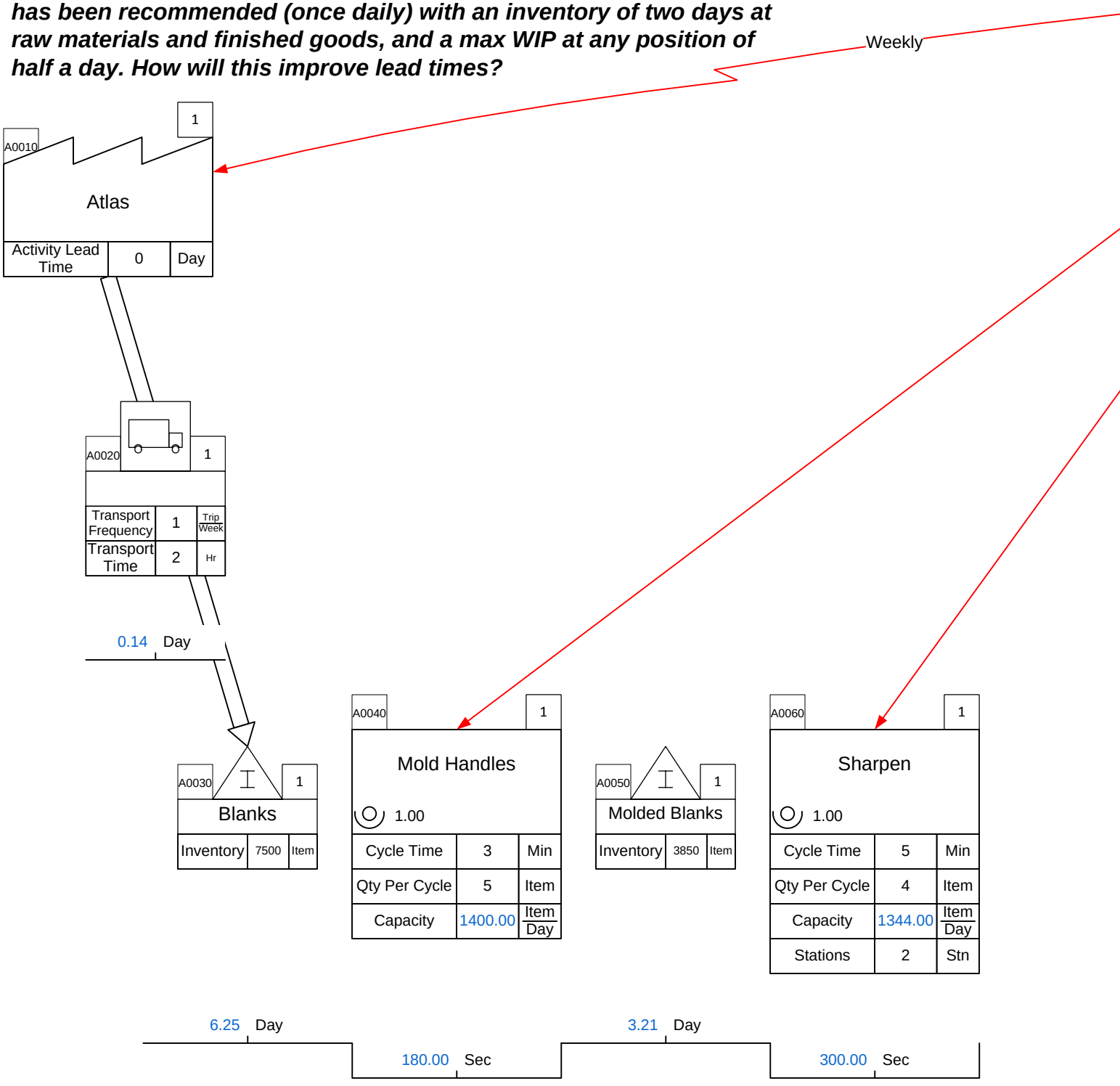
Manufacturing Problem: Lead Time

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?



Units	Year	Week	Week
	52	70	5
	Week	Hr	day

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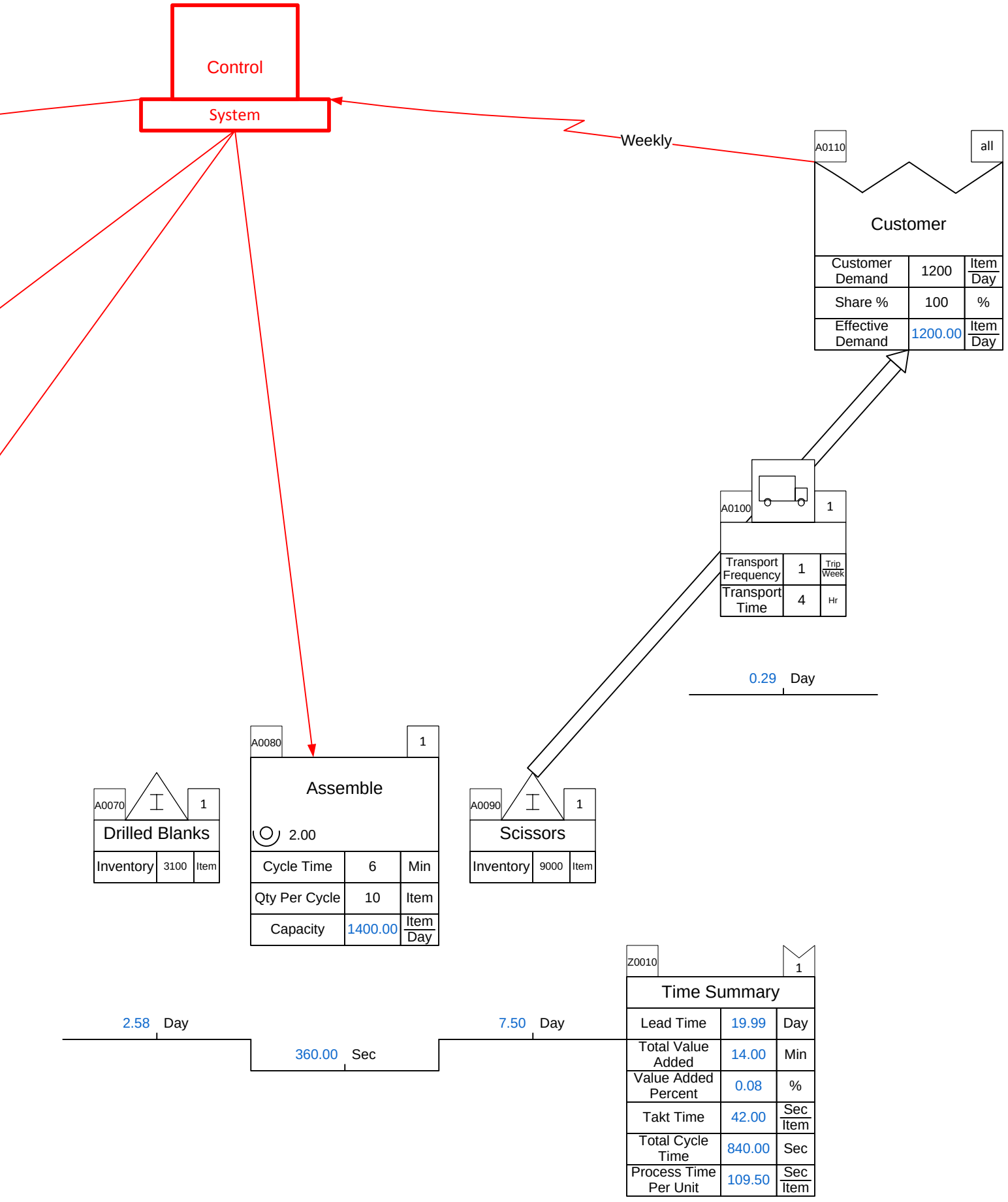

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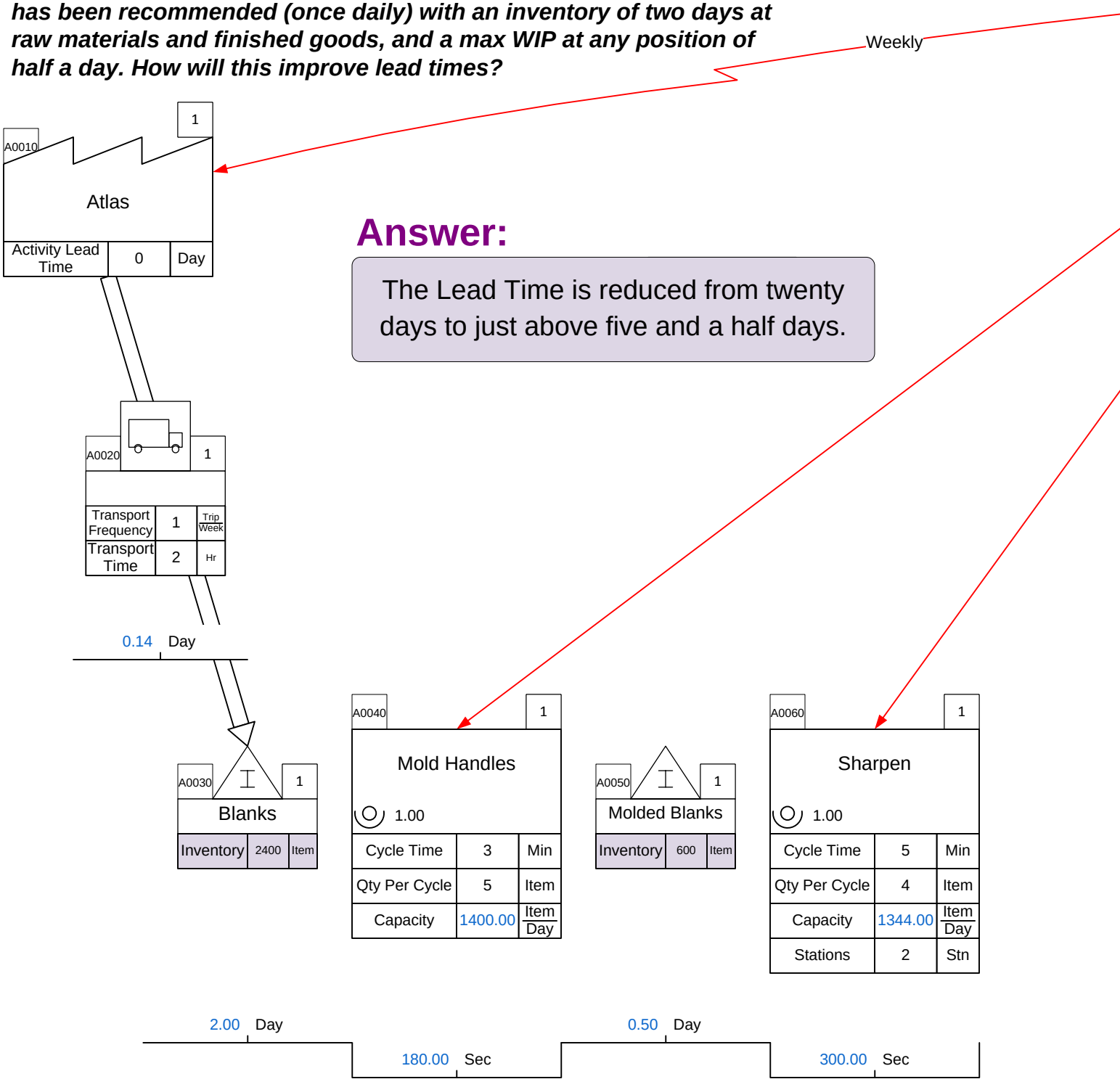

Answer:

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

Units	Year	Week	Week
	52	70	5
	Week	Hr	day

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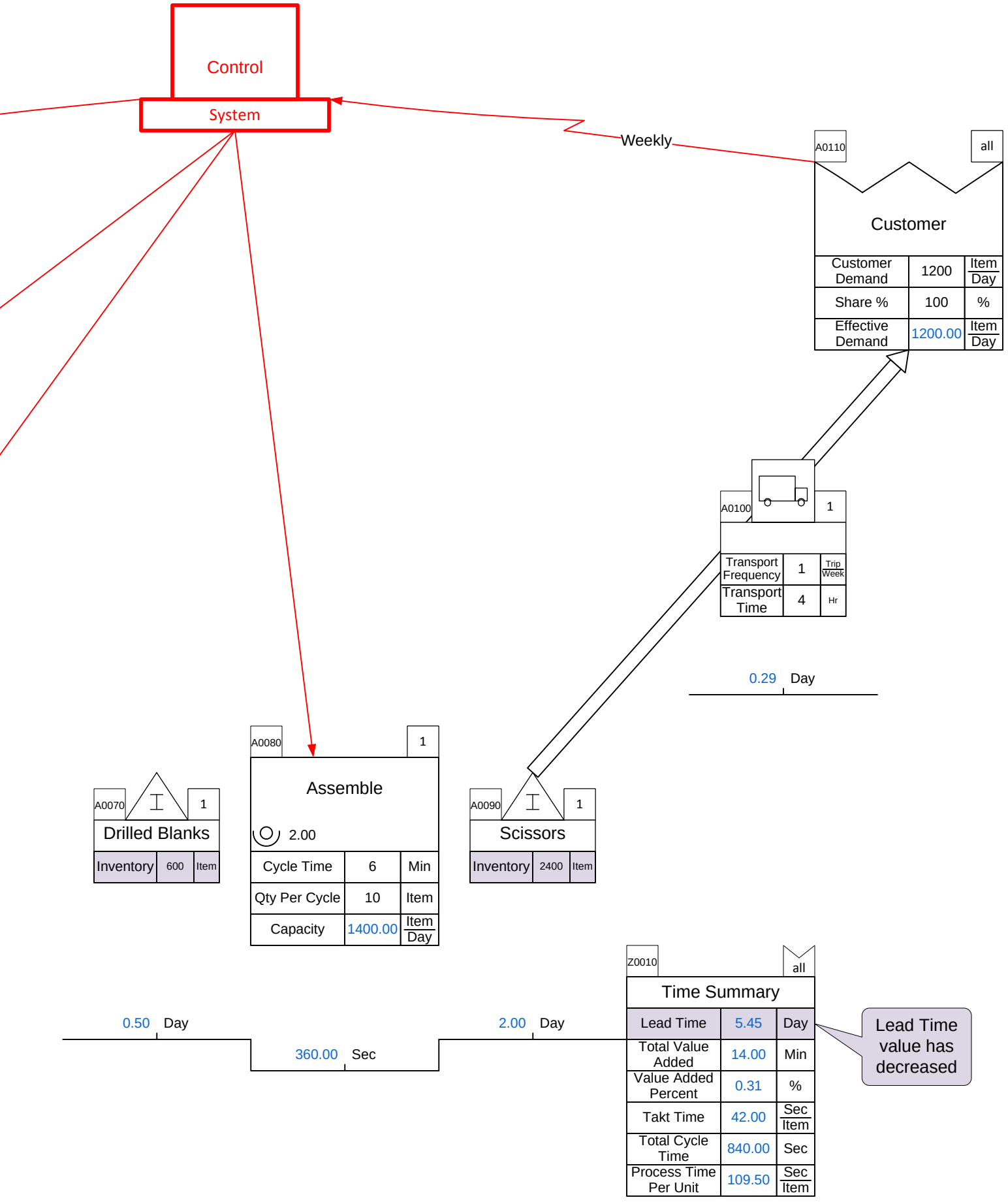

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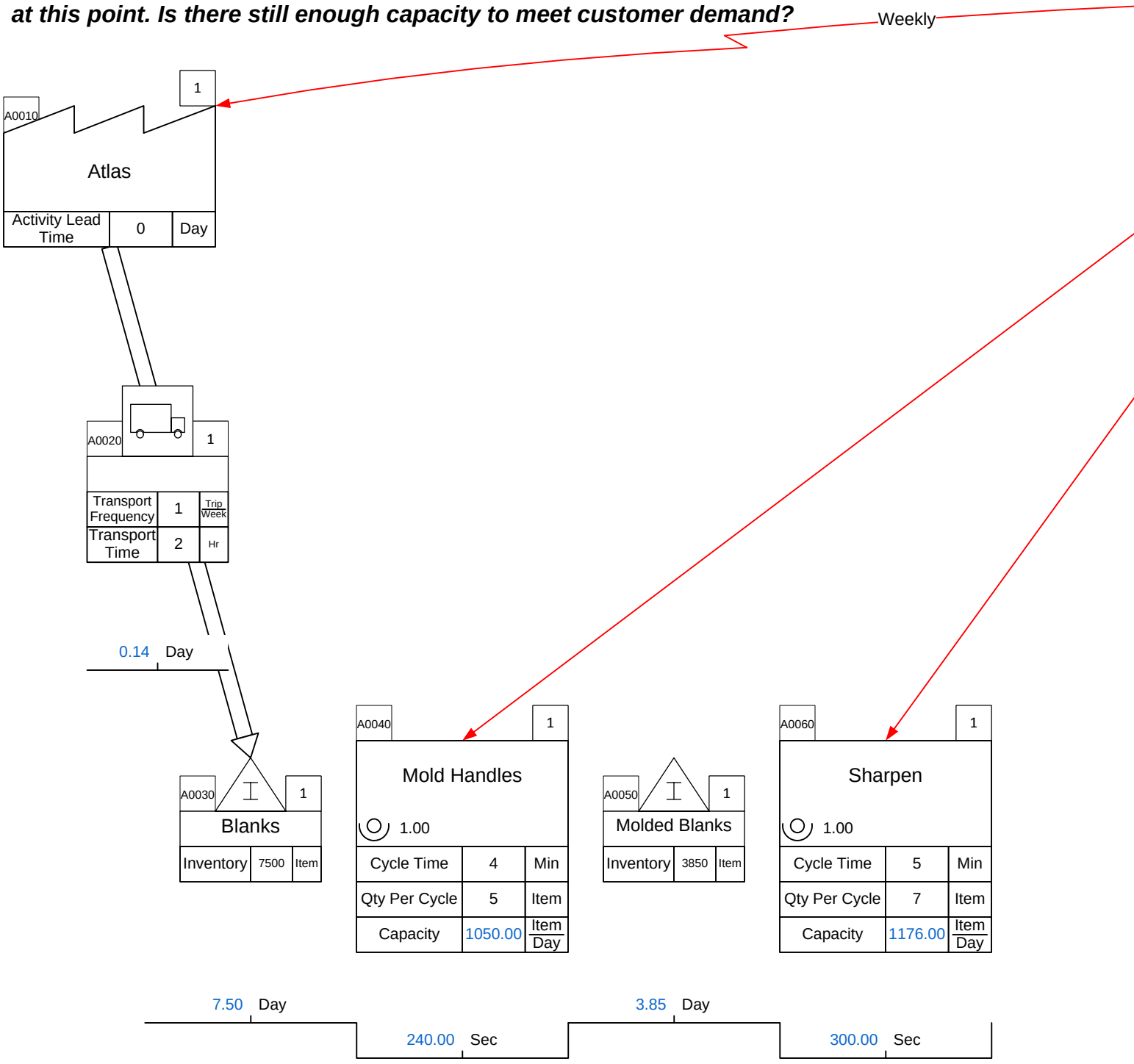
Manufacturing Problem: Scrap

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



Units	Year	Week	Week
	52	70	5
	Week	Hr	day

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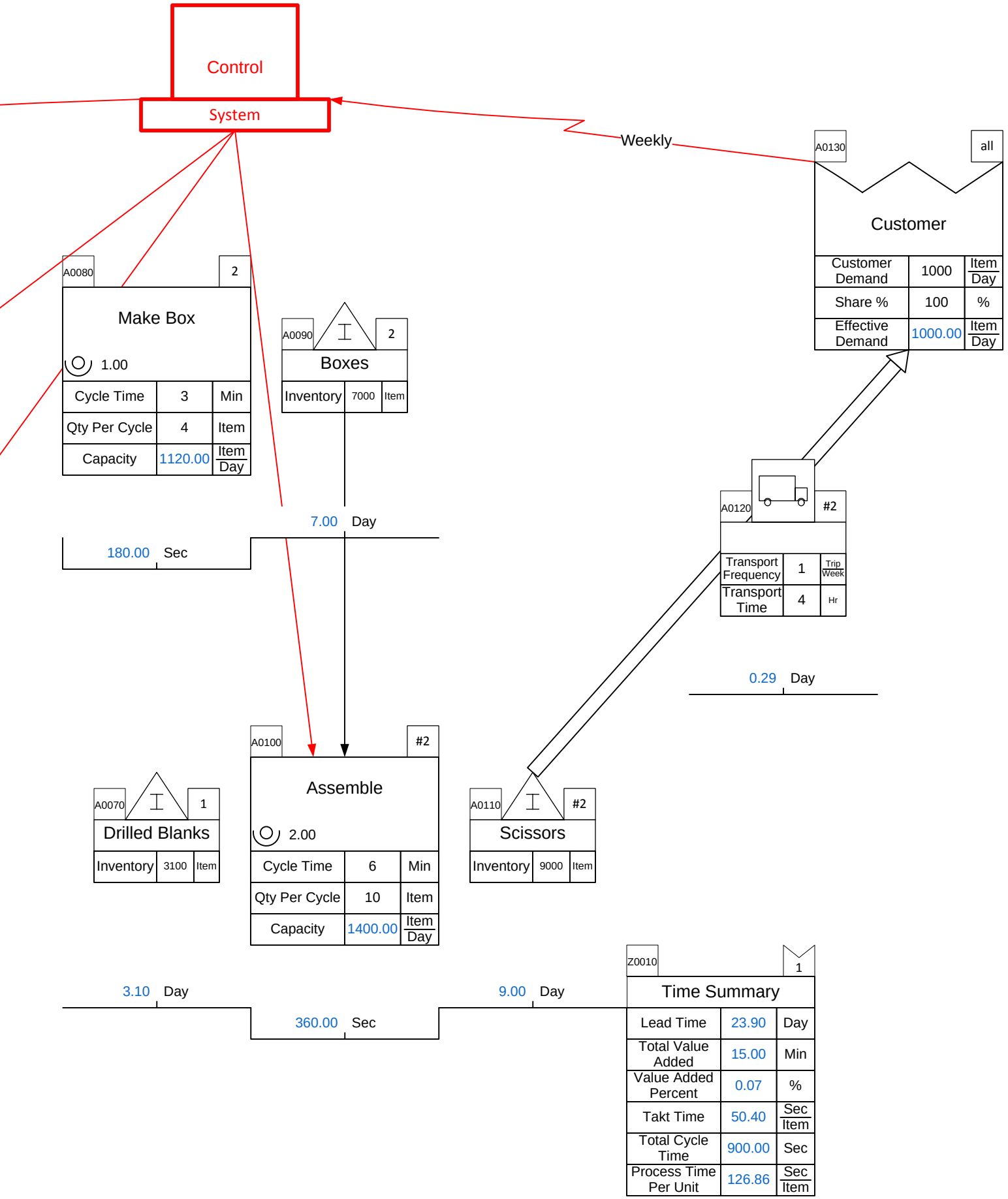

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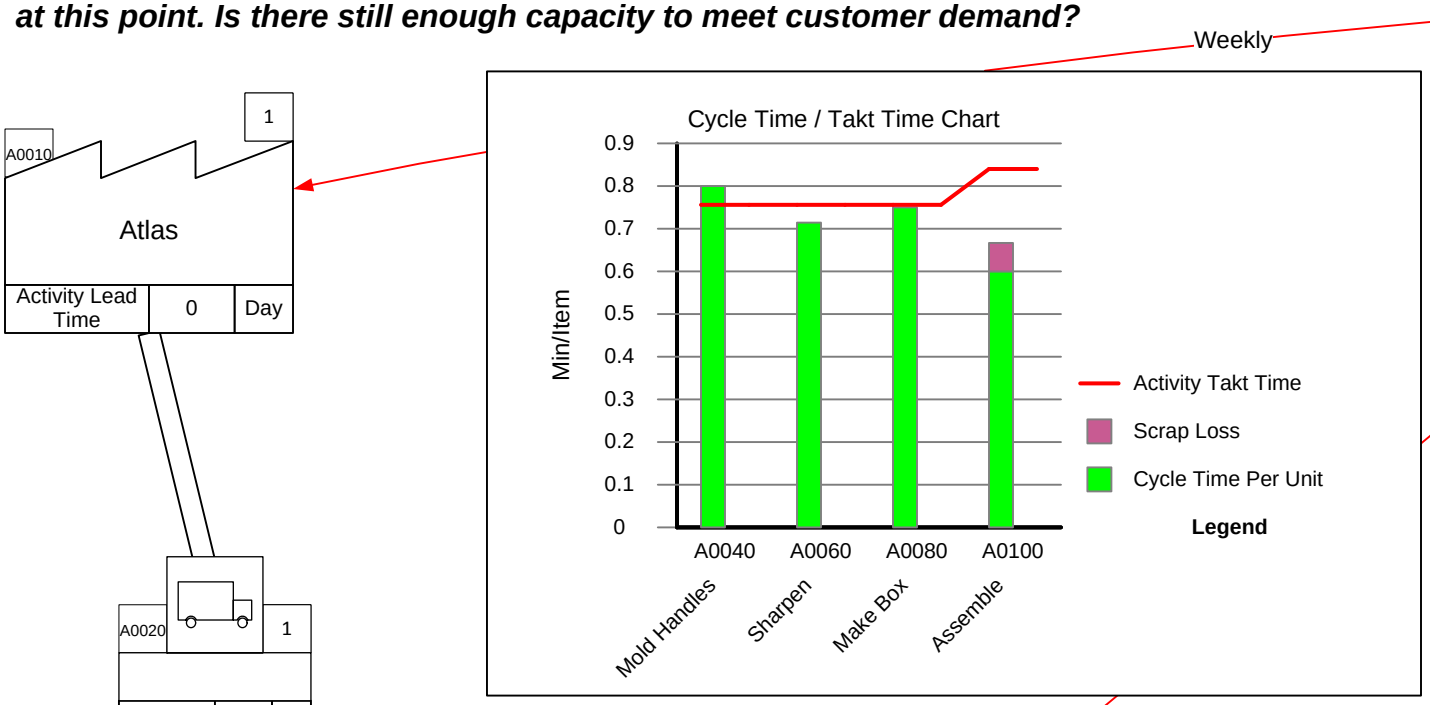
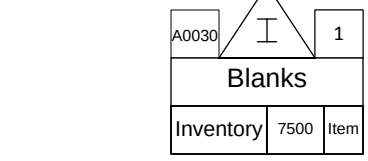


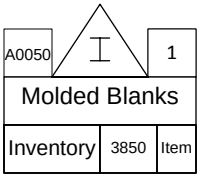
Answer:

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



A0040	1
Mold Handles	
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
Sharpen	
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

240.00 Sec

3.85 Day

300.00 Sec

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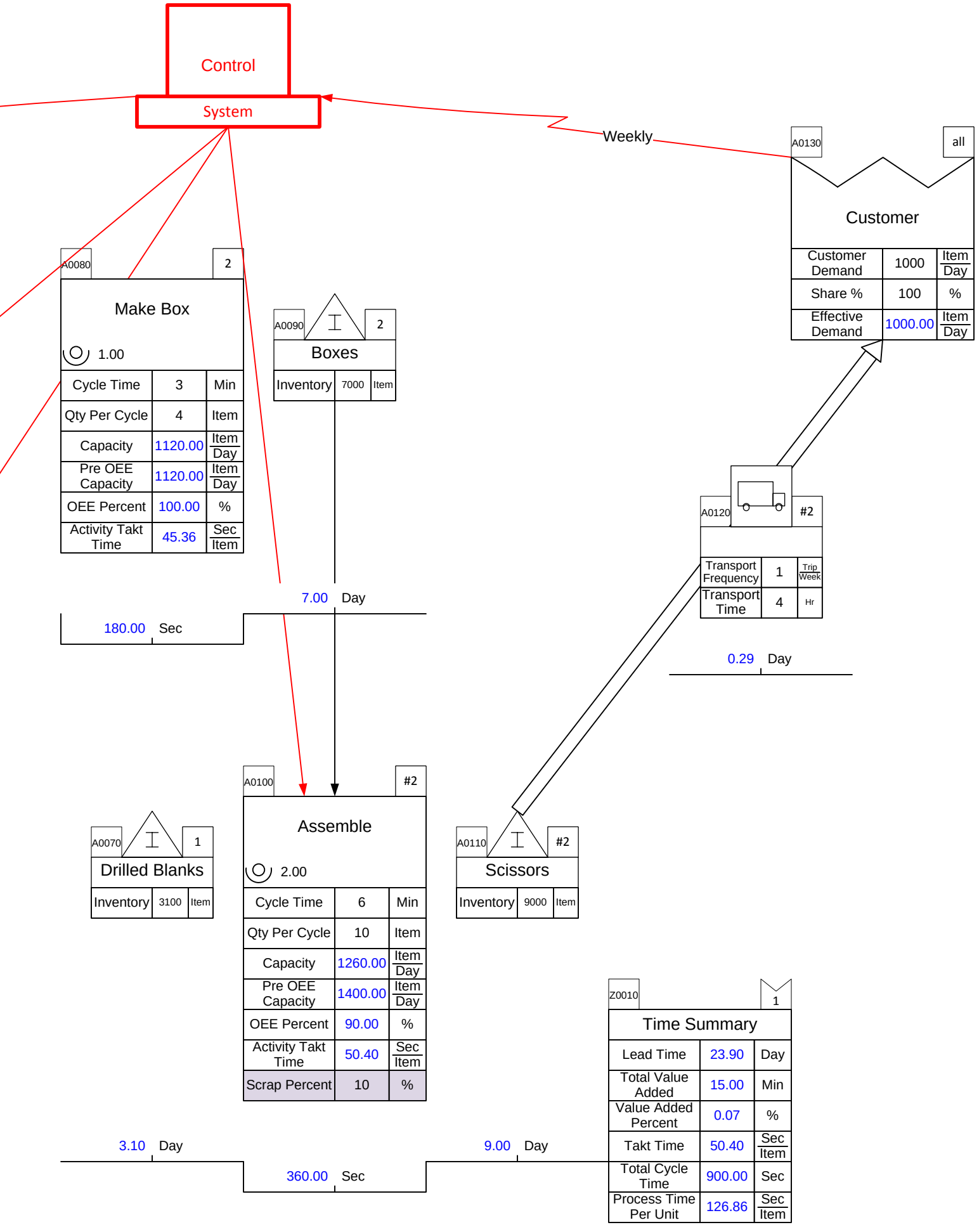

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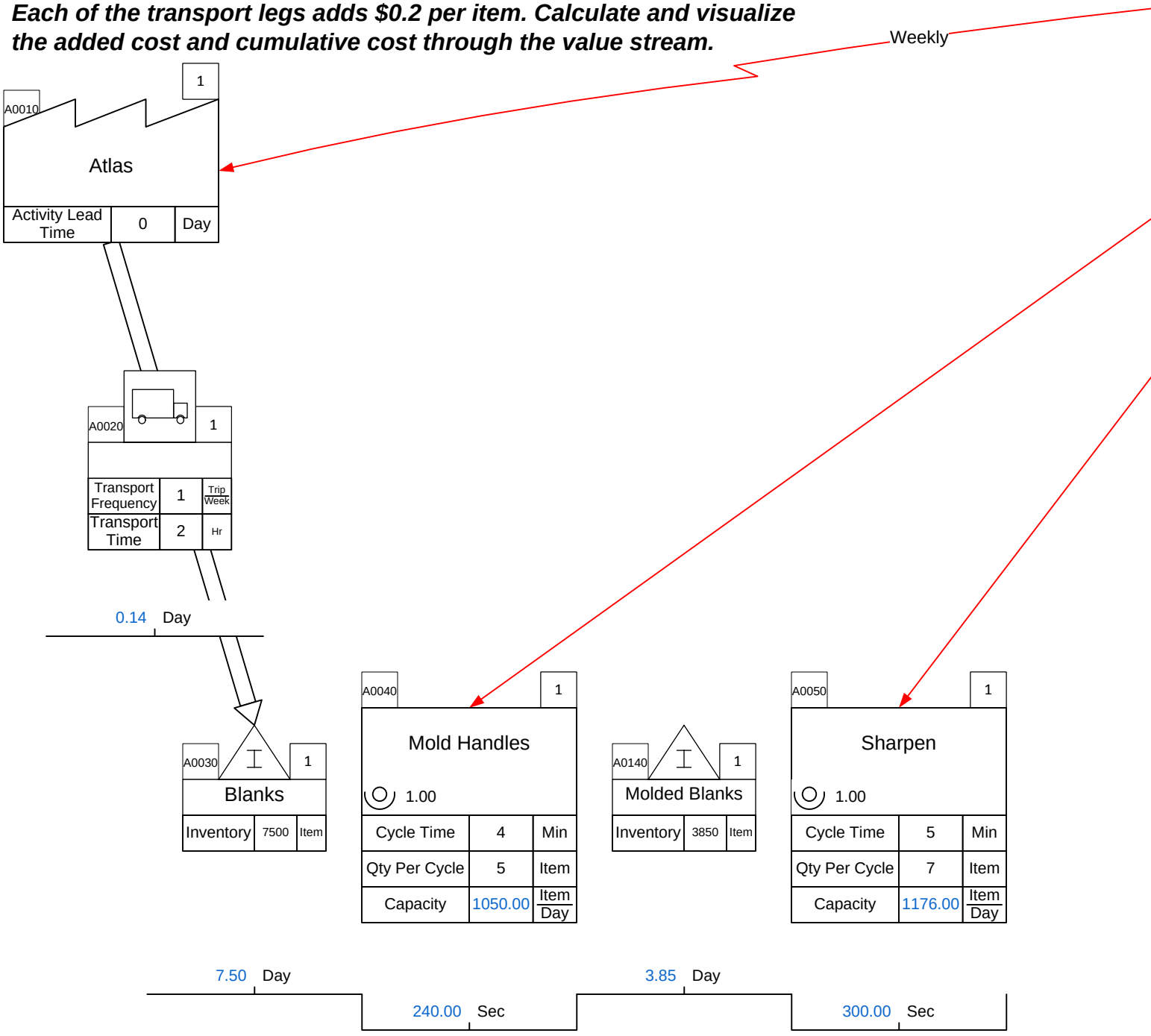
Manufacturing Problem: Cost

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
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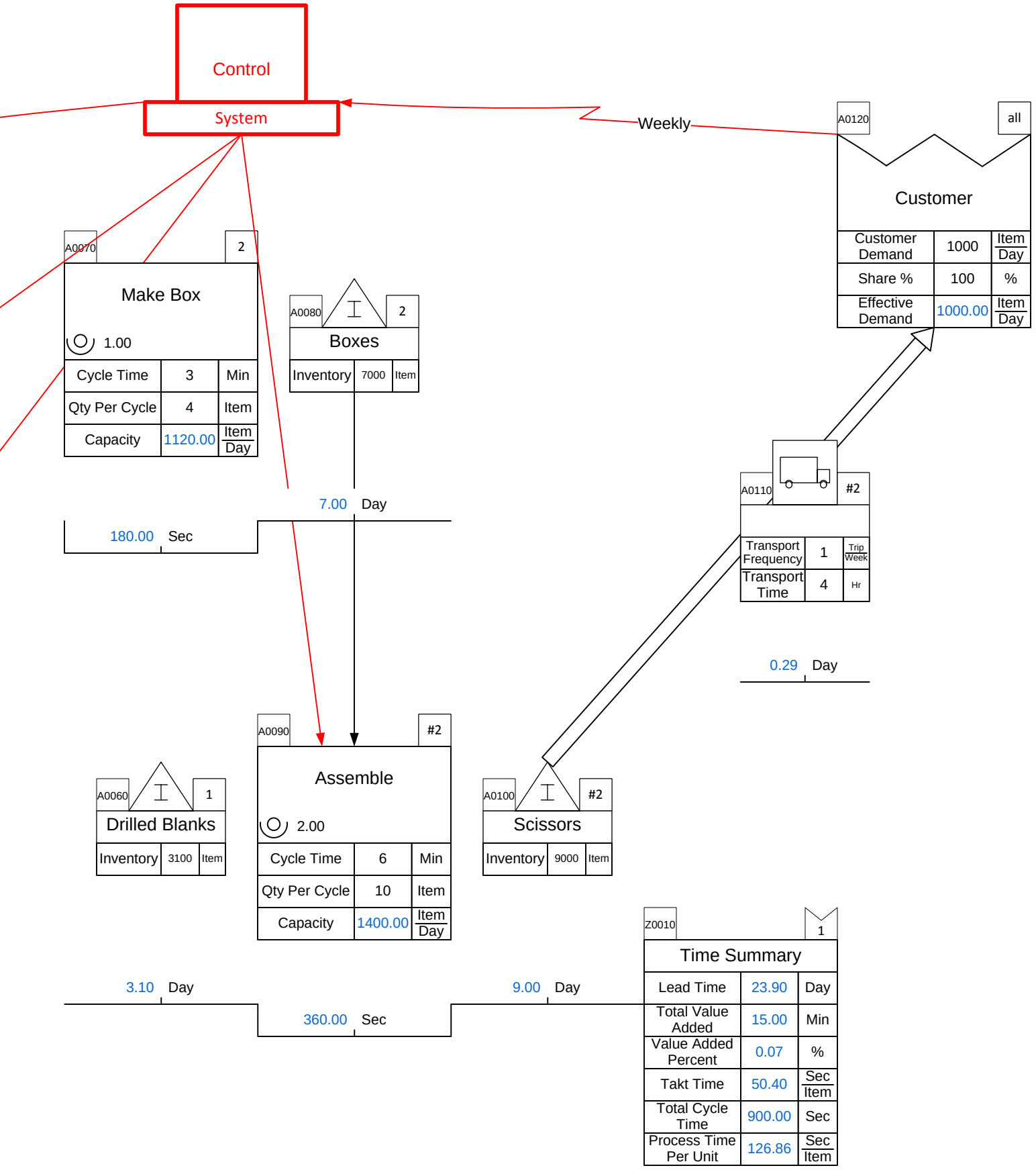

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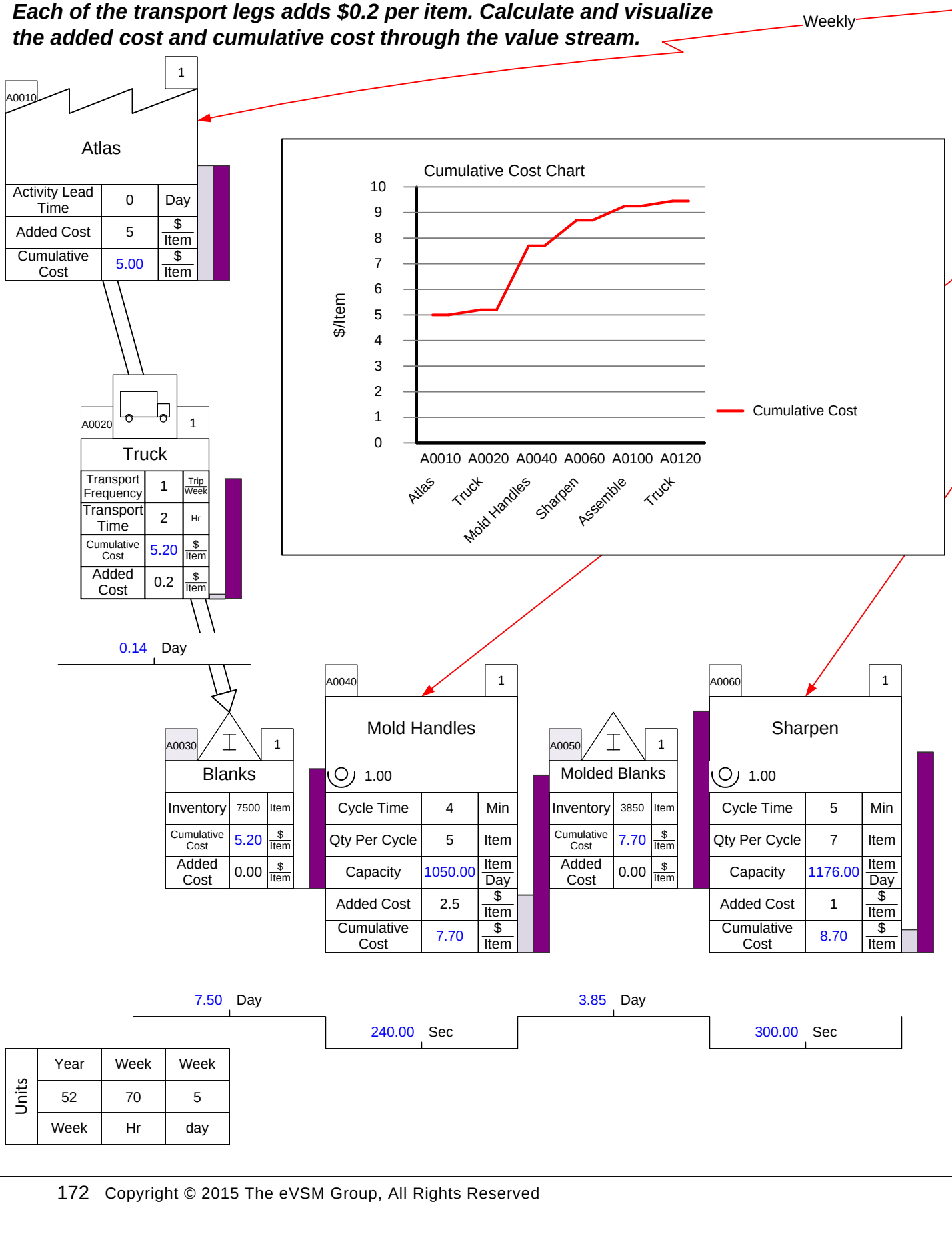

Units	Year	Week	Week
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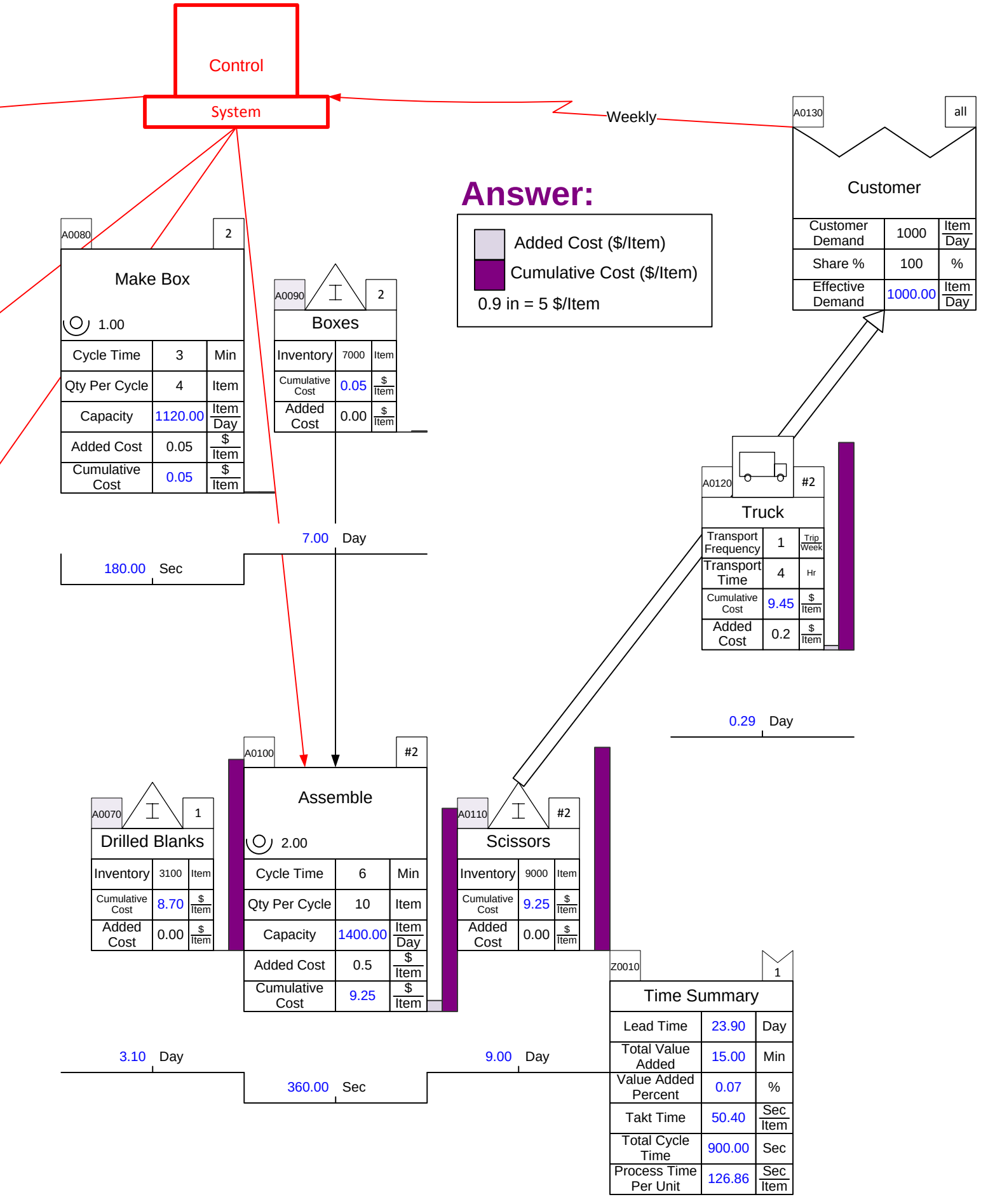

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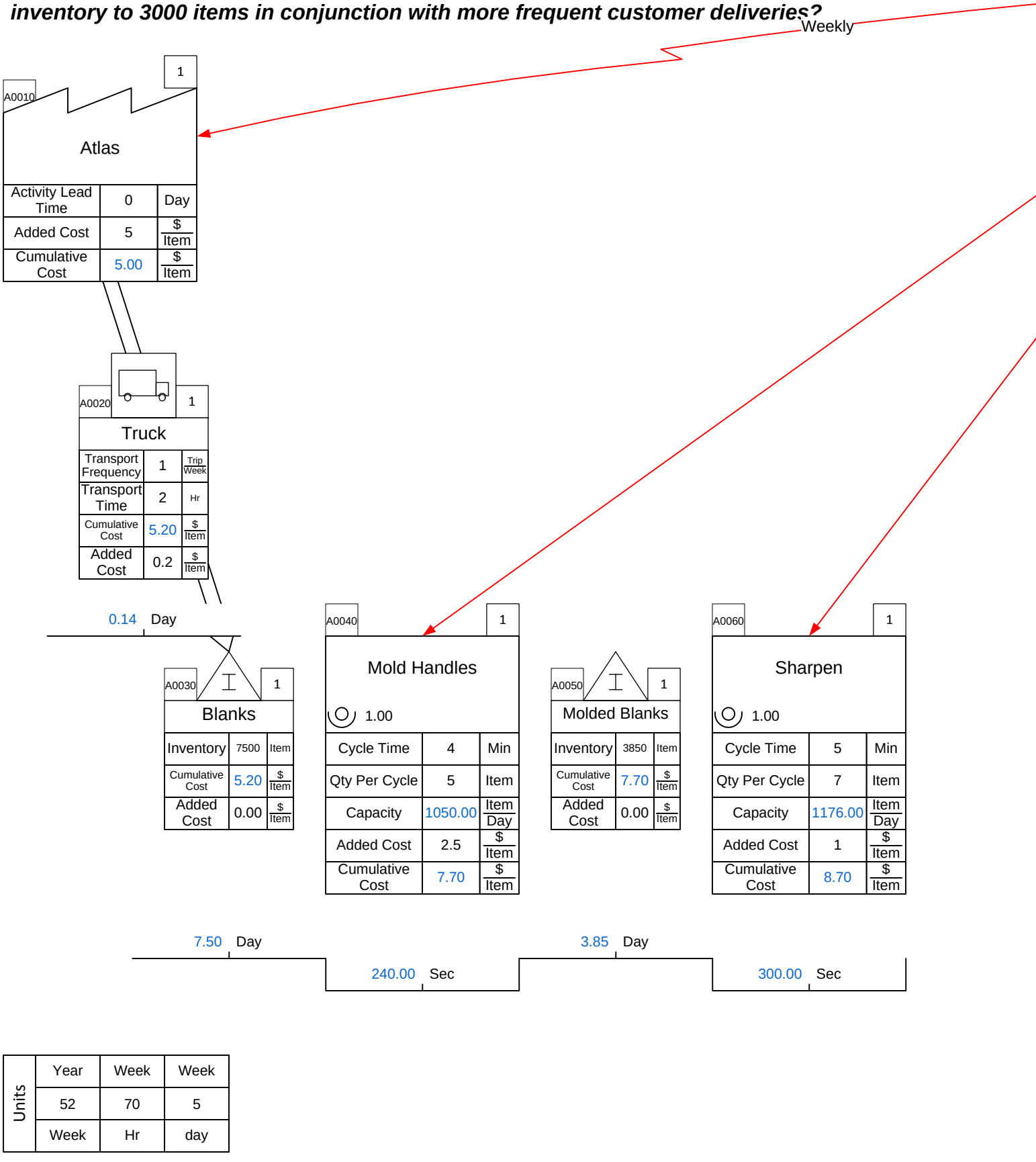
Manufacturing Problem: Annual Carrying Cost

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?



Units	Year	Week	Week
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	Week	Hr	day

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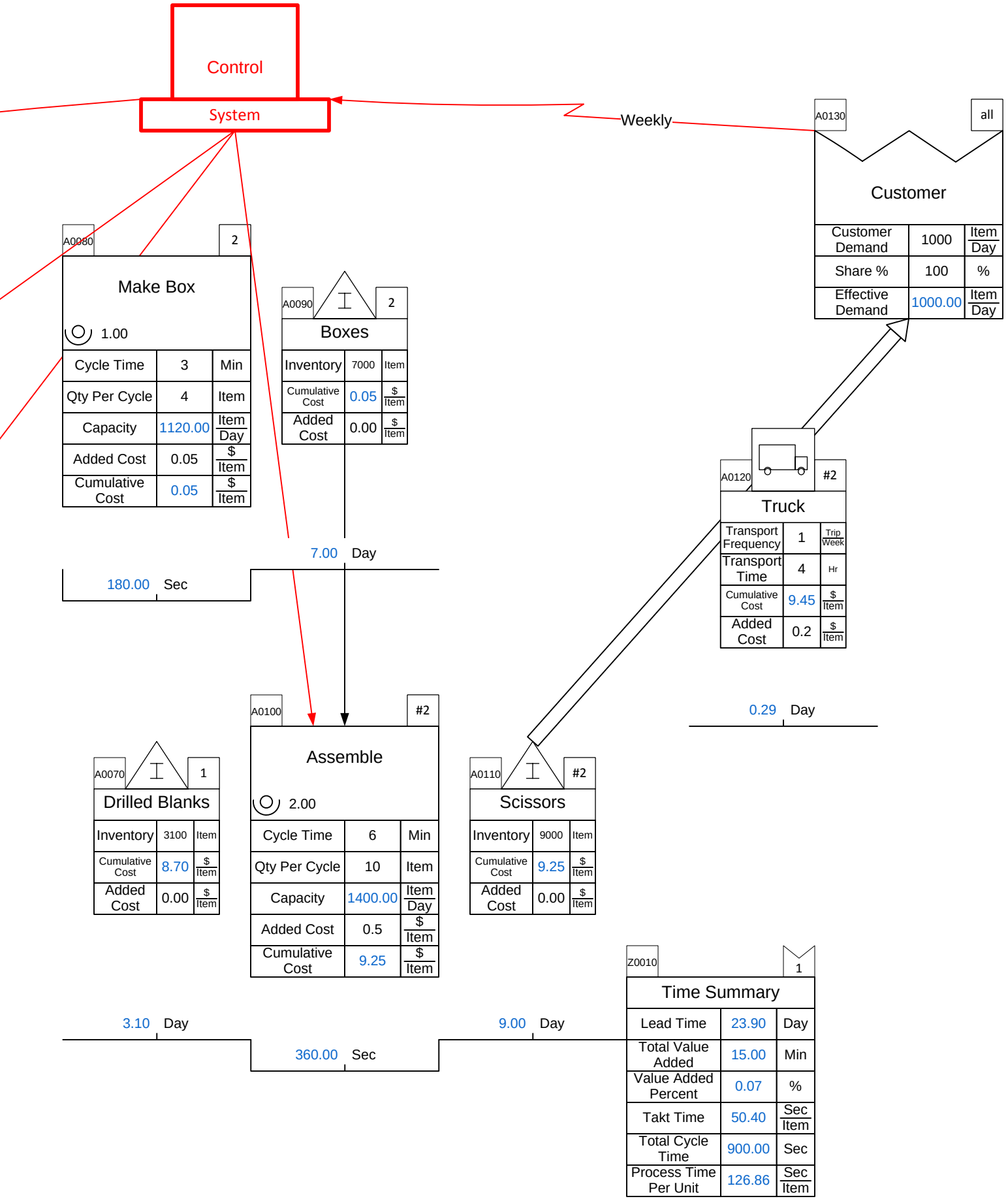

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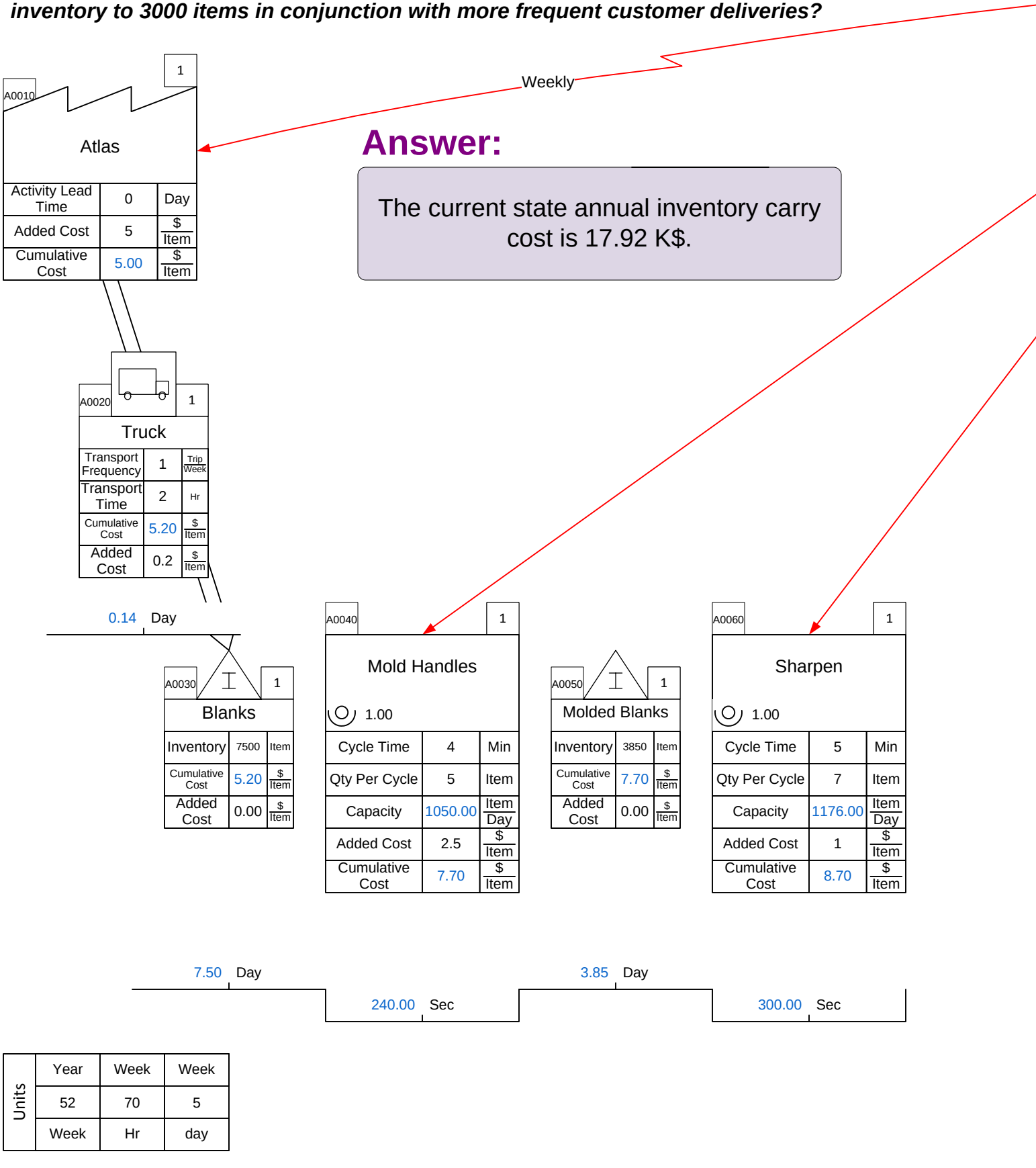

Answer:

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

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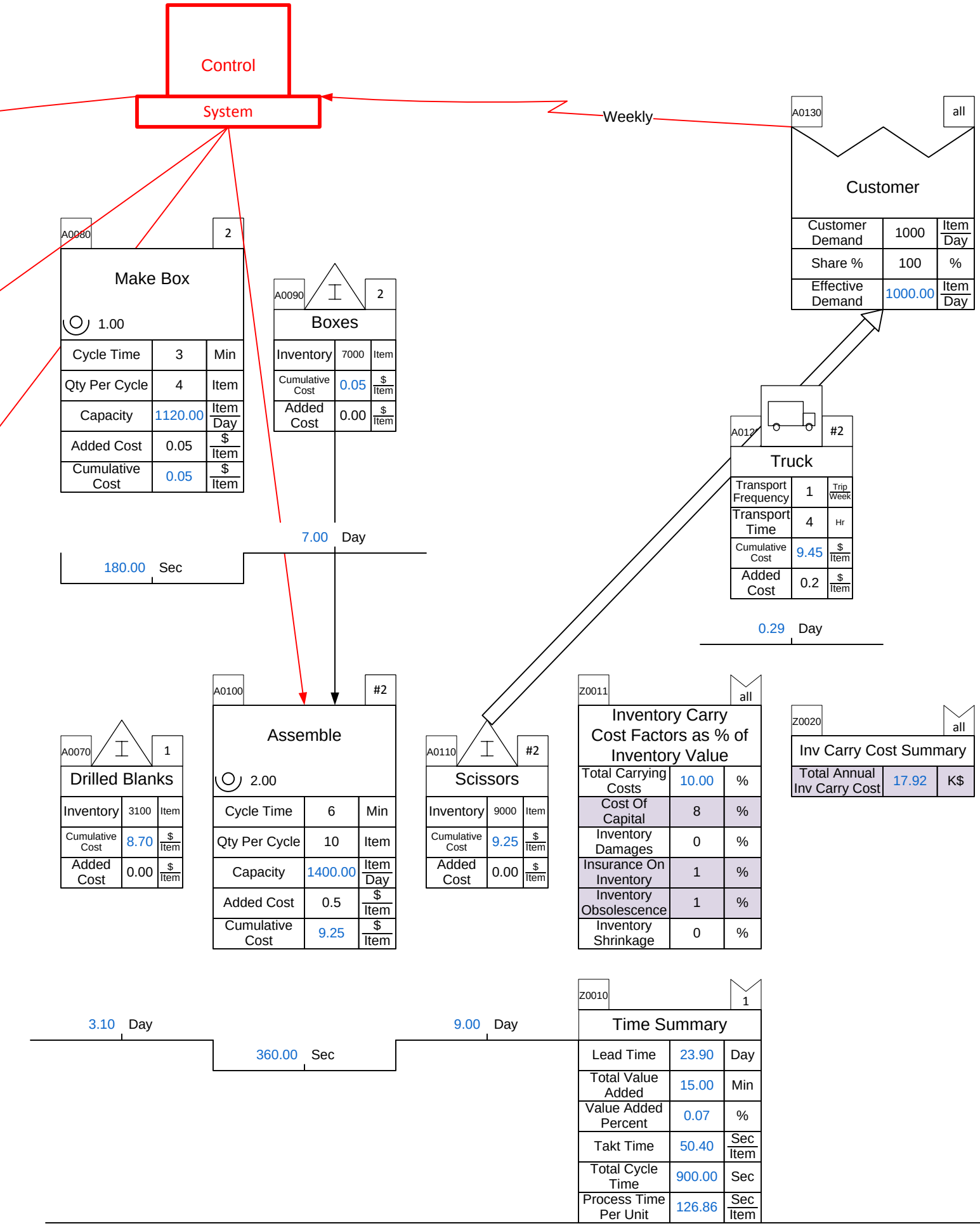

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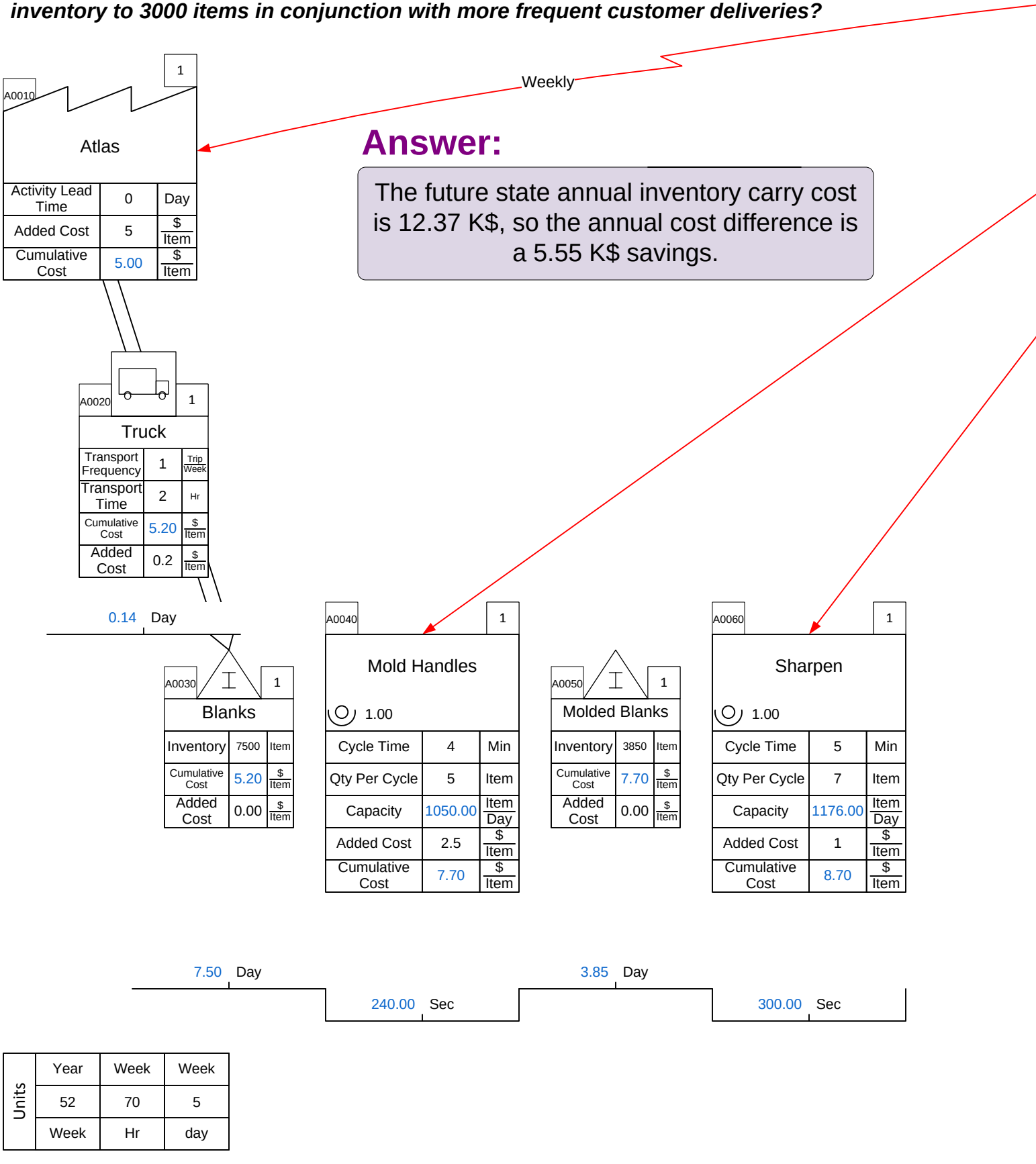

Answer:

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

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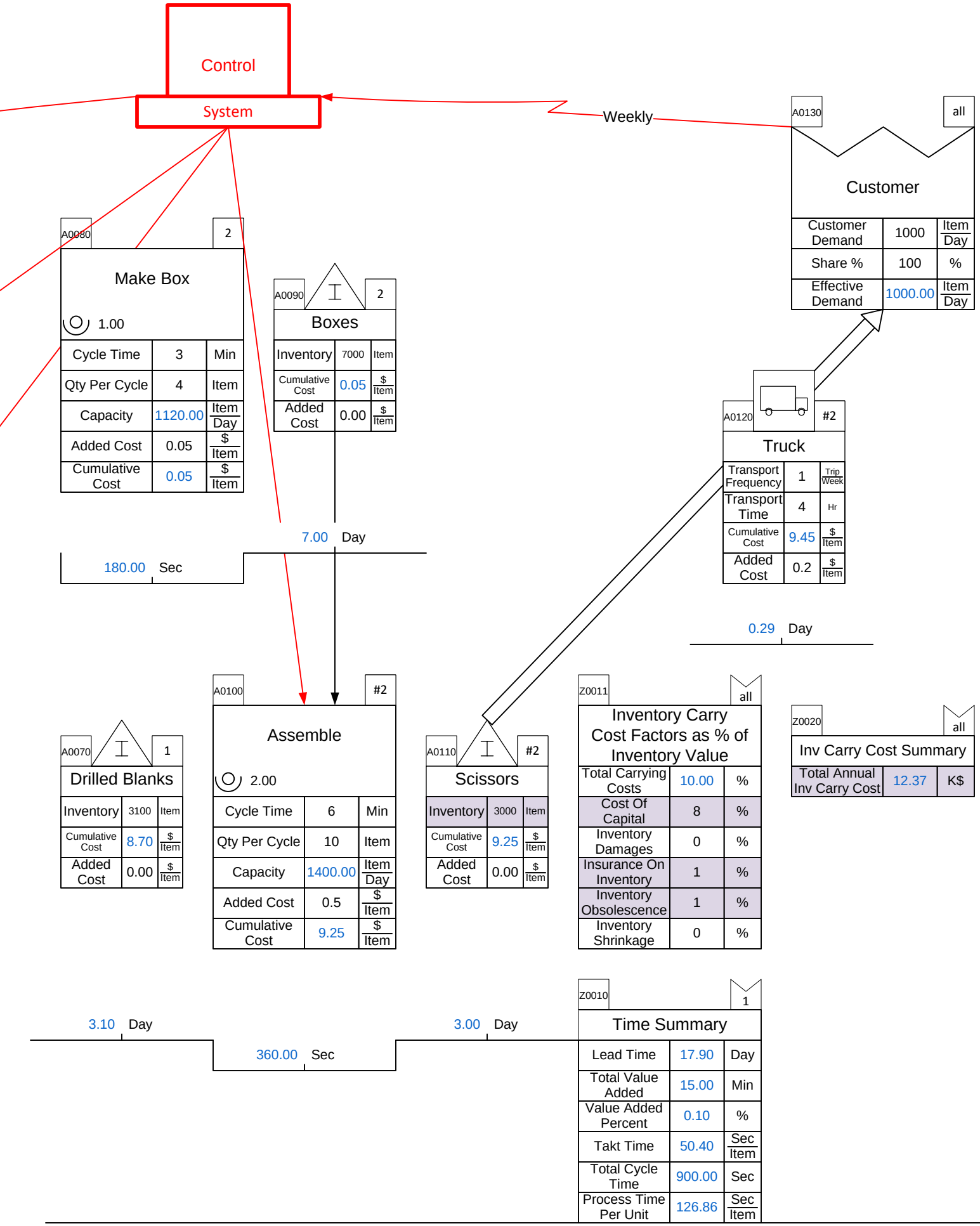

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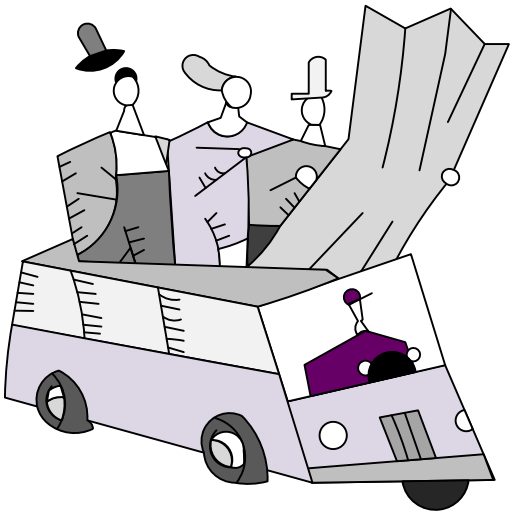
Inbound and Outbound Maps



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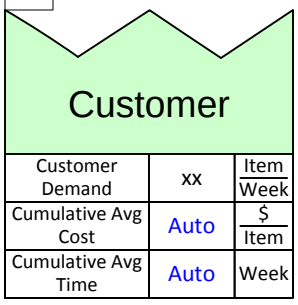
Manufacturing Network Shapes

A0010



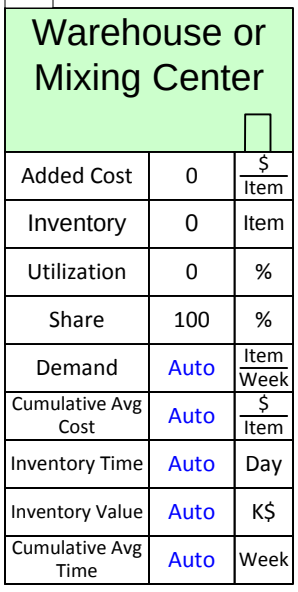
The Customer Center is used at the end of a map to show the demand for each product.

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



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.

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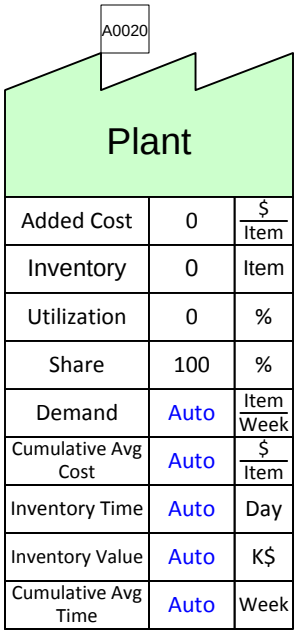

The Plant Center shows the amount of inventory held and the costs and data associated with that inventory.

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.

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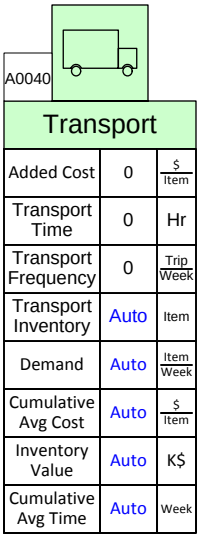

The Transport Center tracks shipments and the associated times and costs with each shipment.

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.

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ACME Case Study – Inbound

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.

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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.

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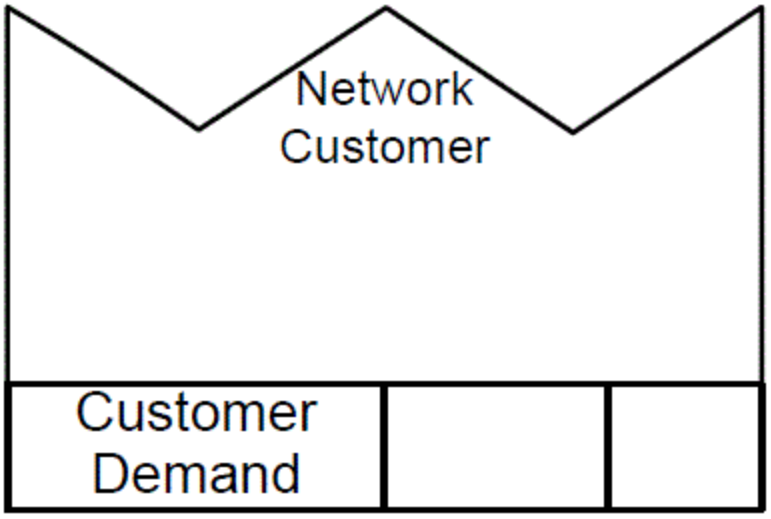

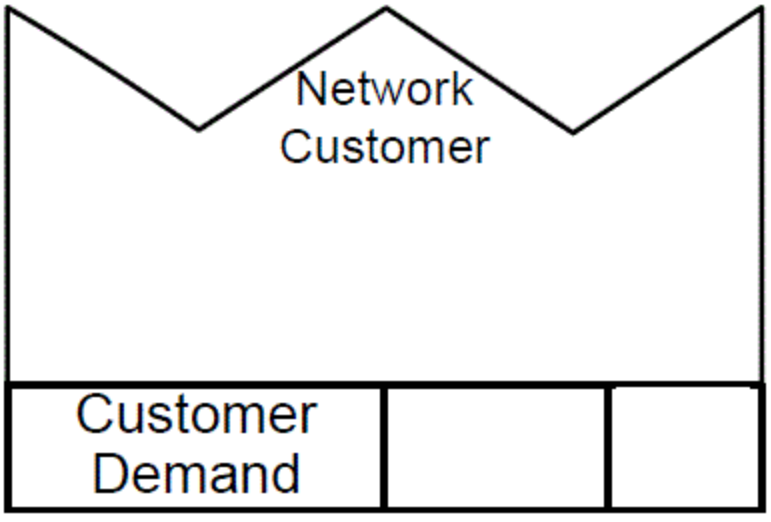

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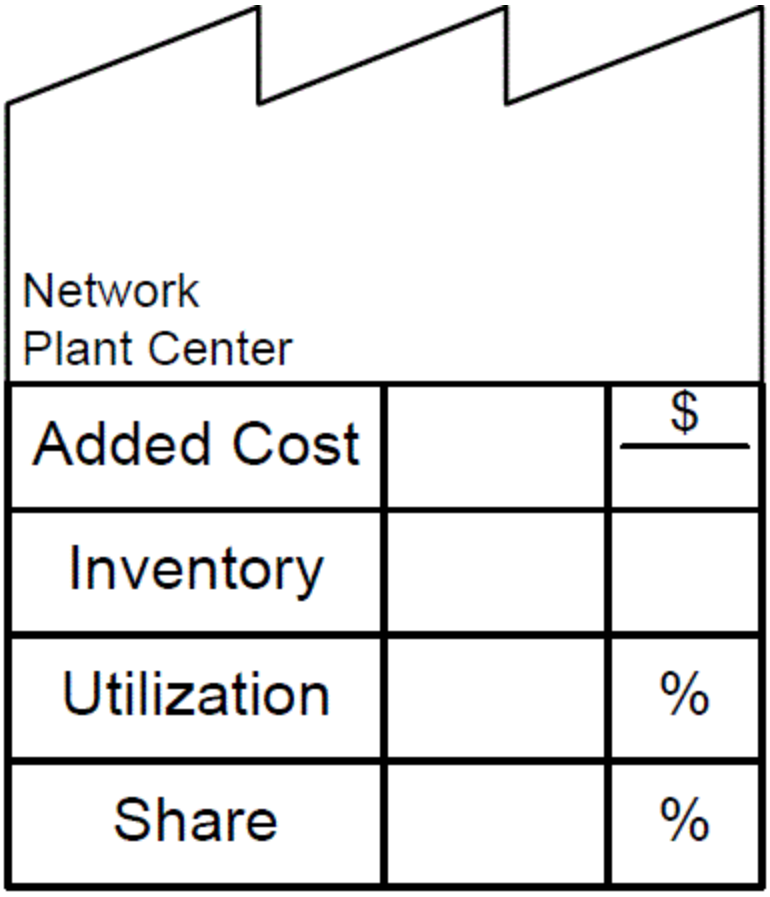

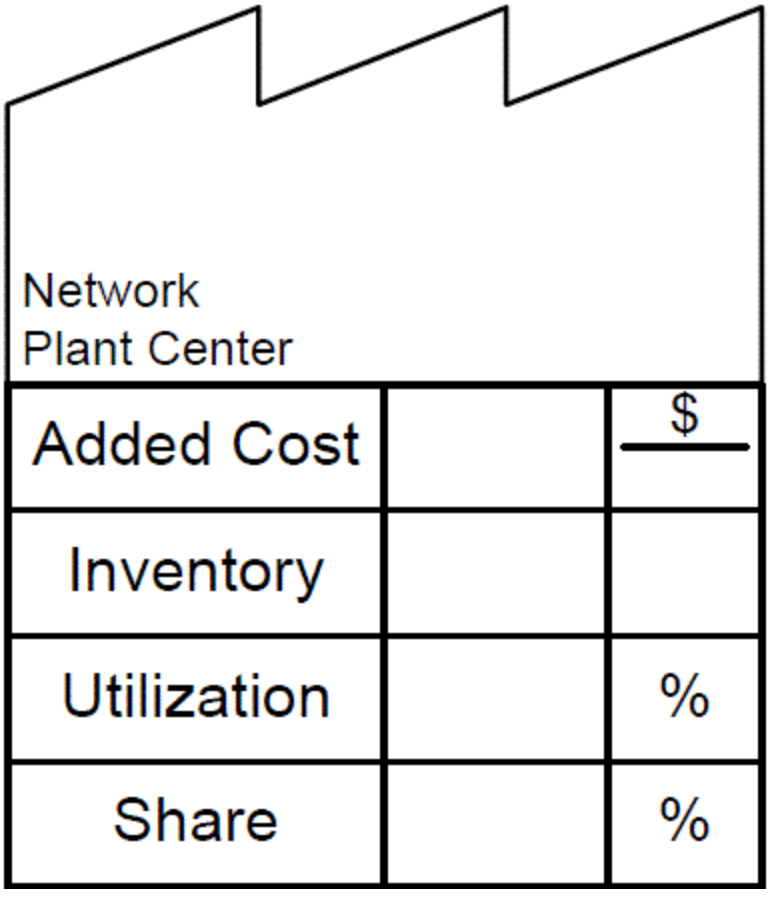

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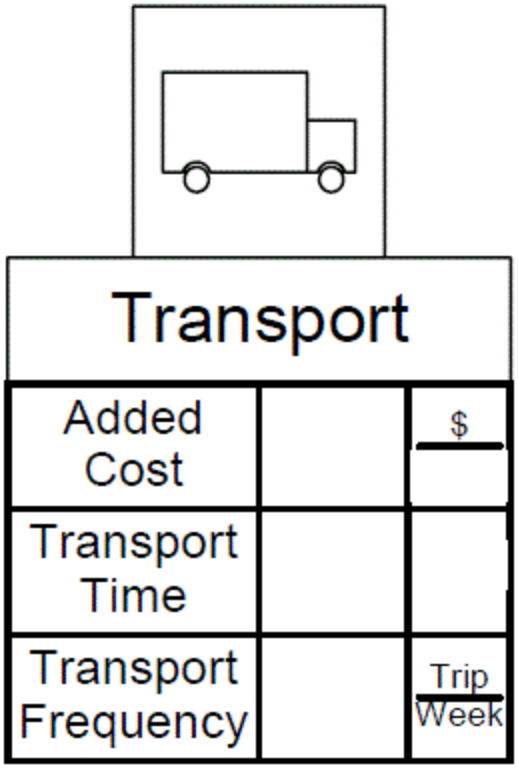

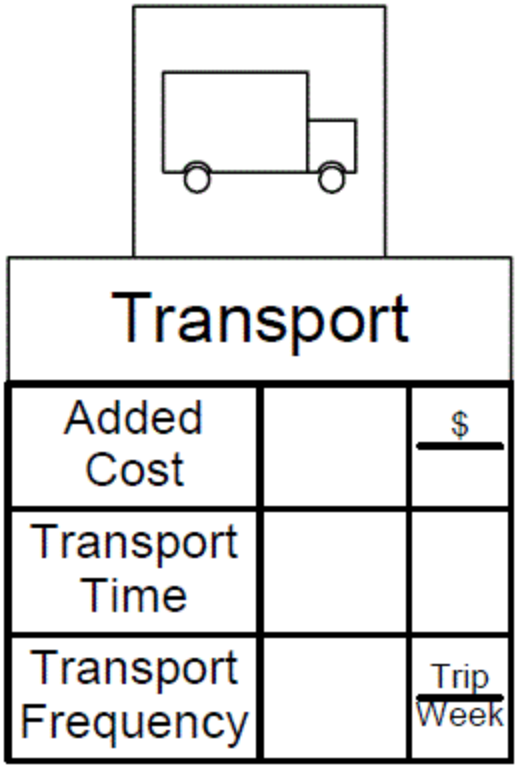

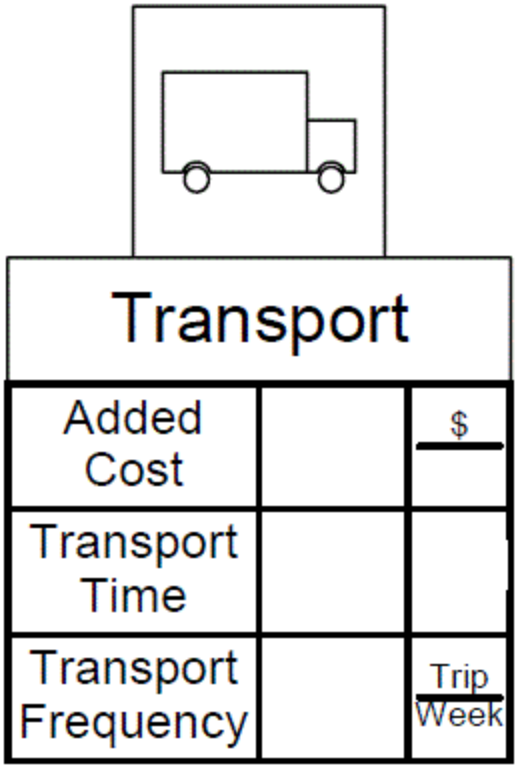

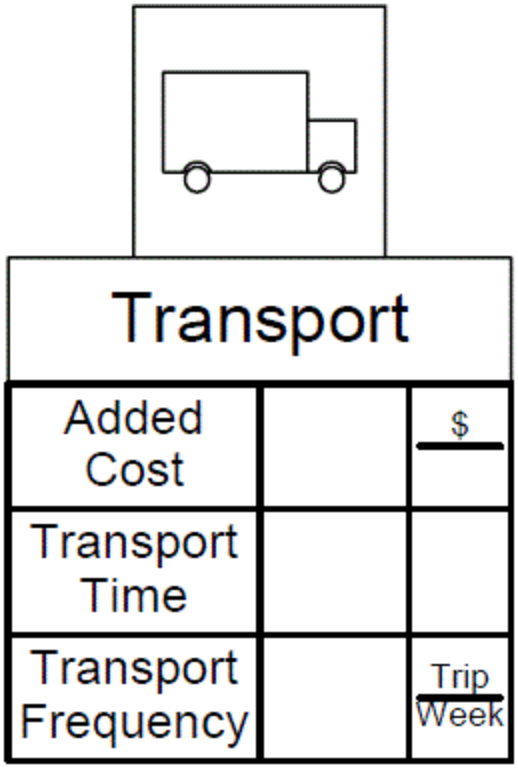

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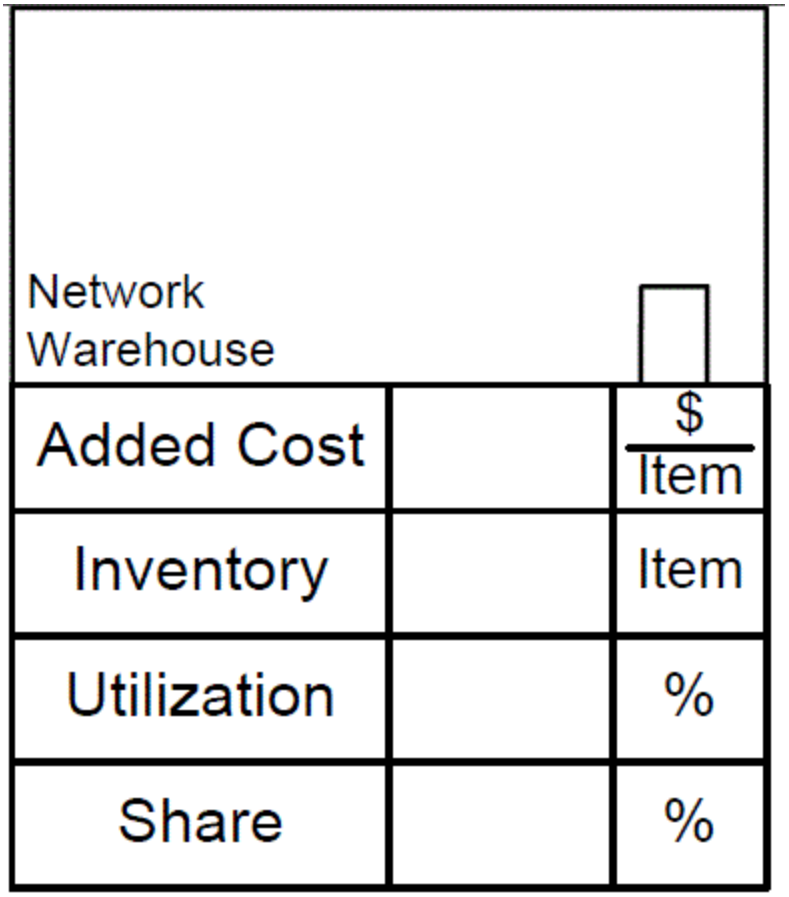

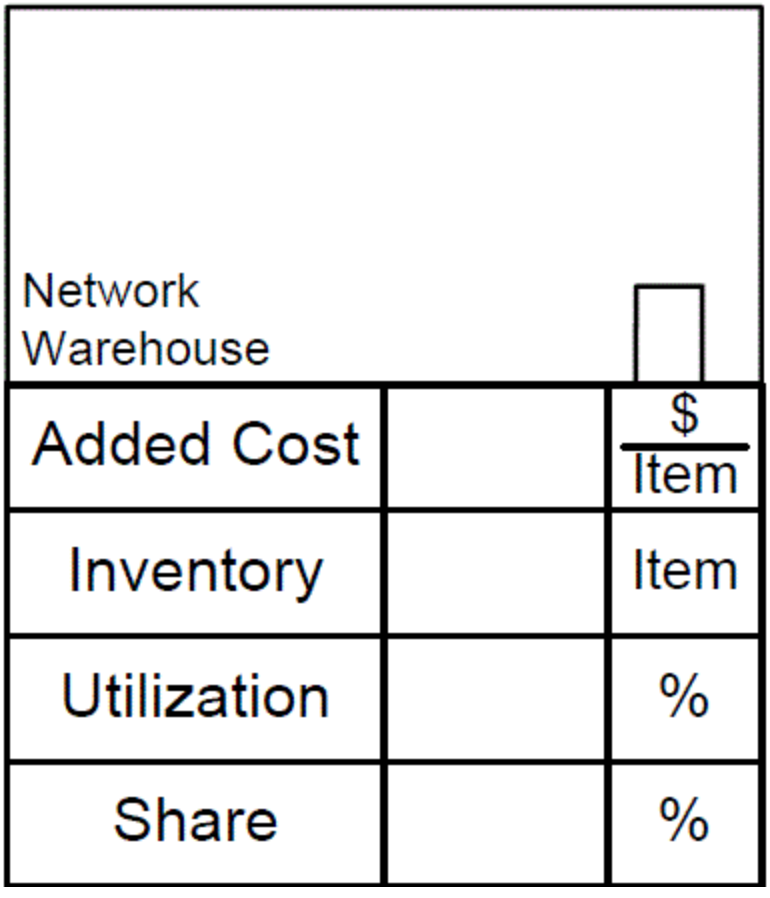

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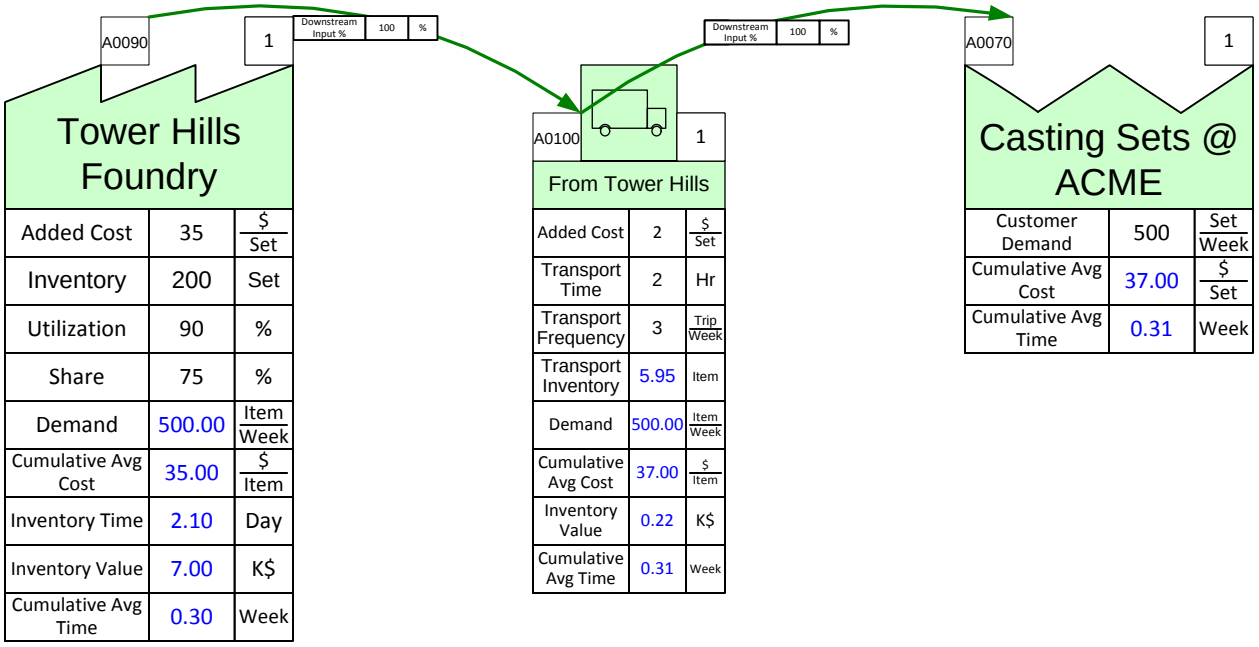
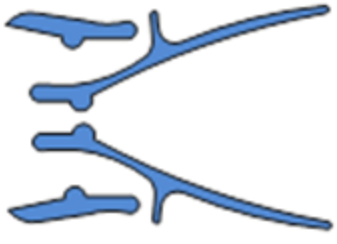
Inbound – Casting Sets





In-coming Castings

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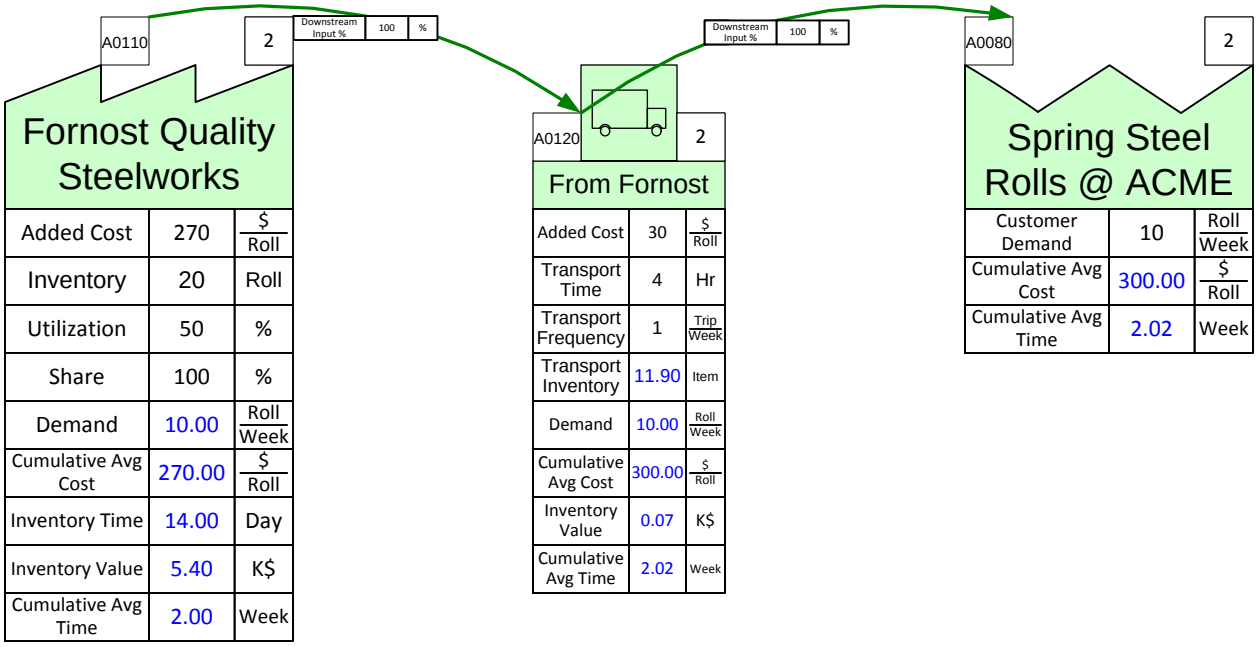
Inbound – Spring Steel Rolls



In-coming Spring Steel Coils

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

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ACME Case Study – Outbound

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.

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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.

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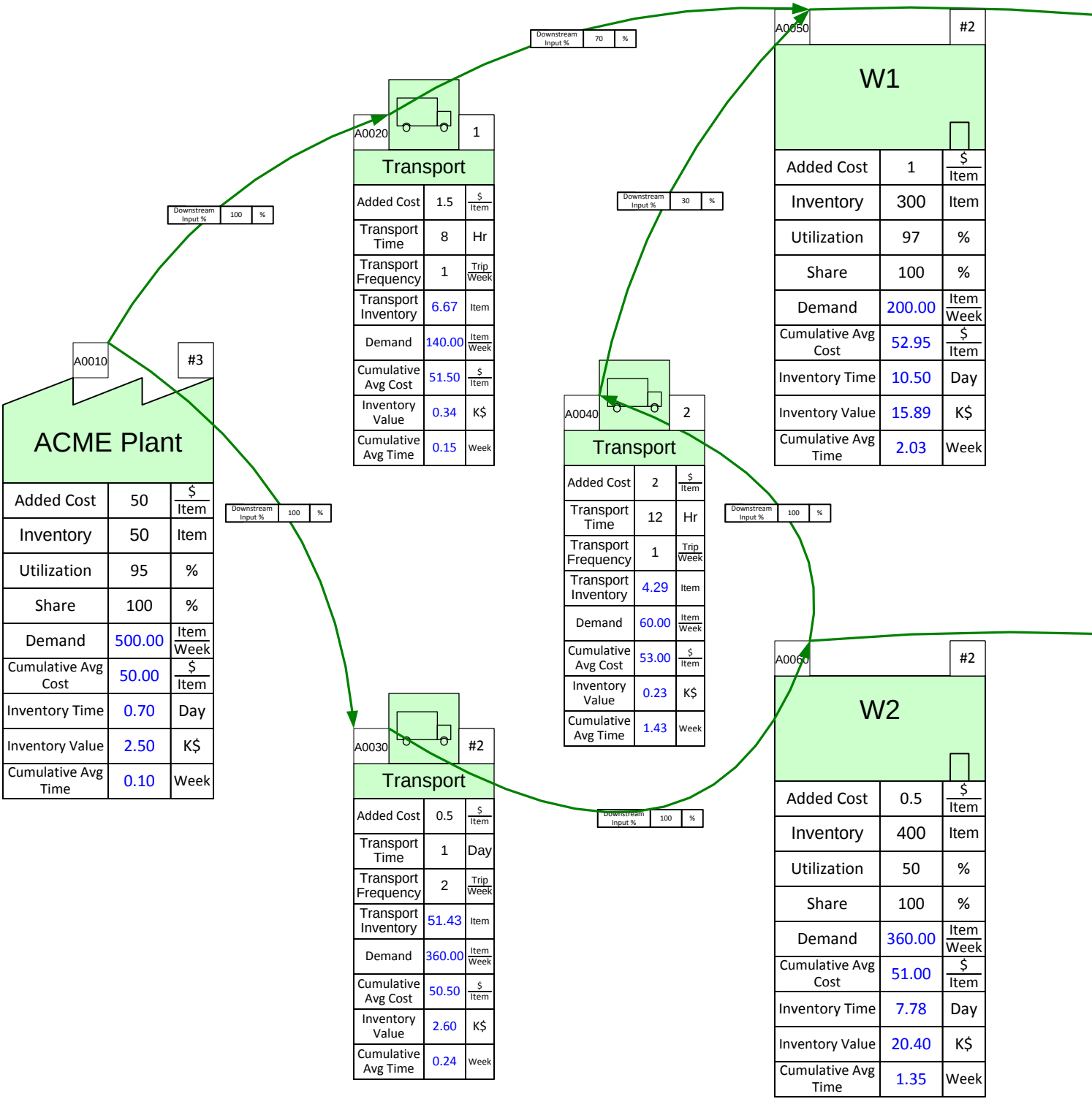
Units	Day	Week
	24	7
	Hr	Day



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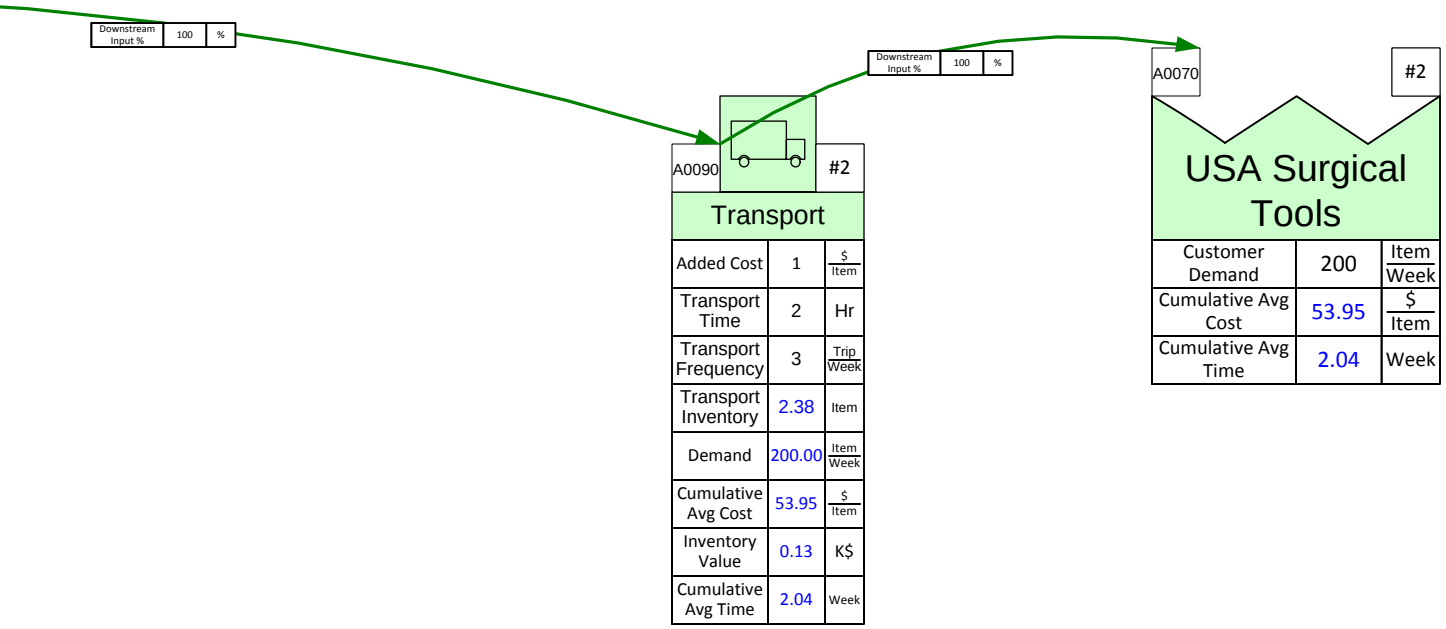
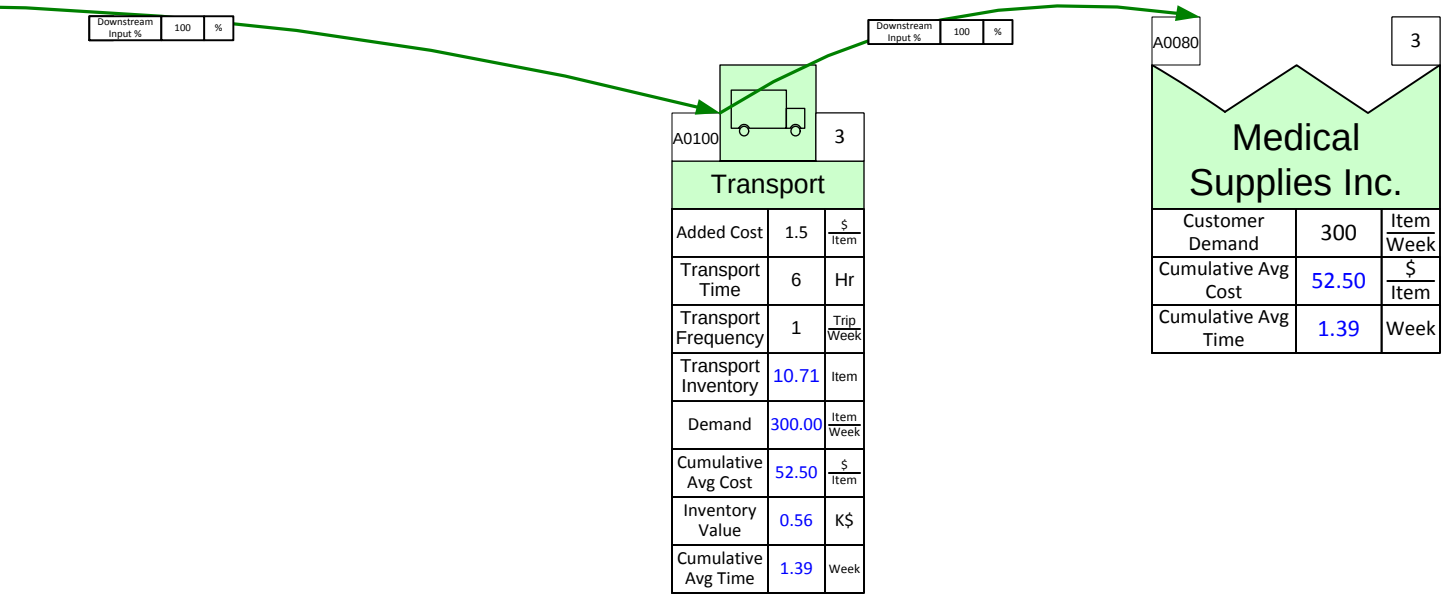
Outbound – ACME





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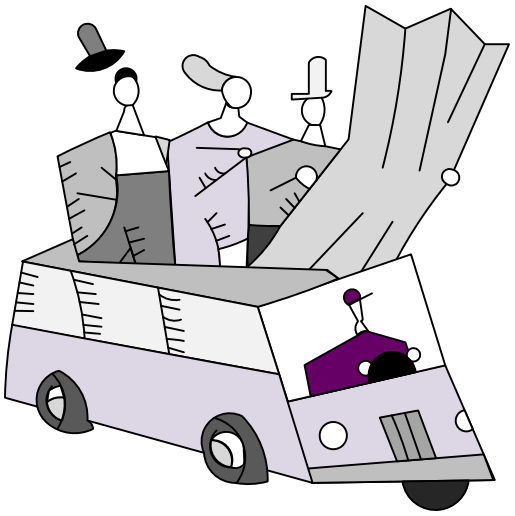
Linking Maps Together



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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

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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.

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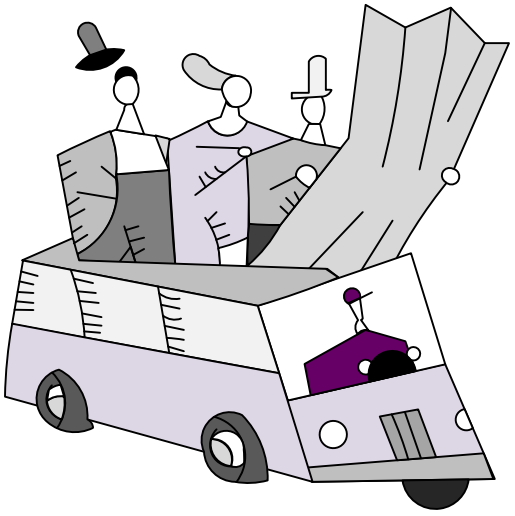
eVSM Extras



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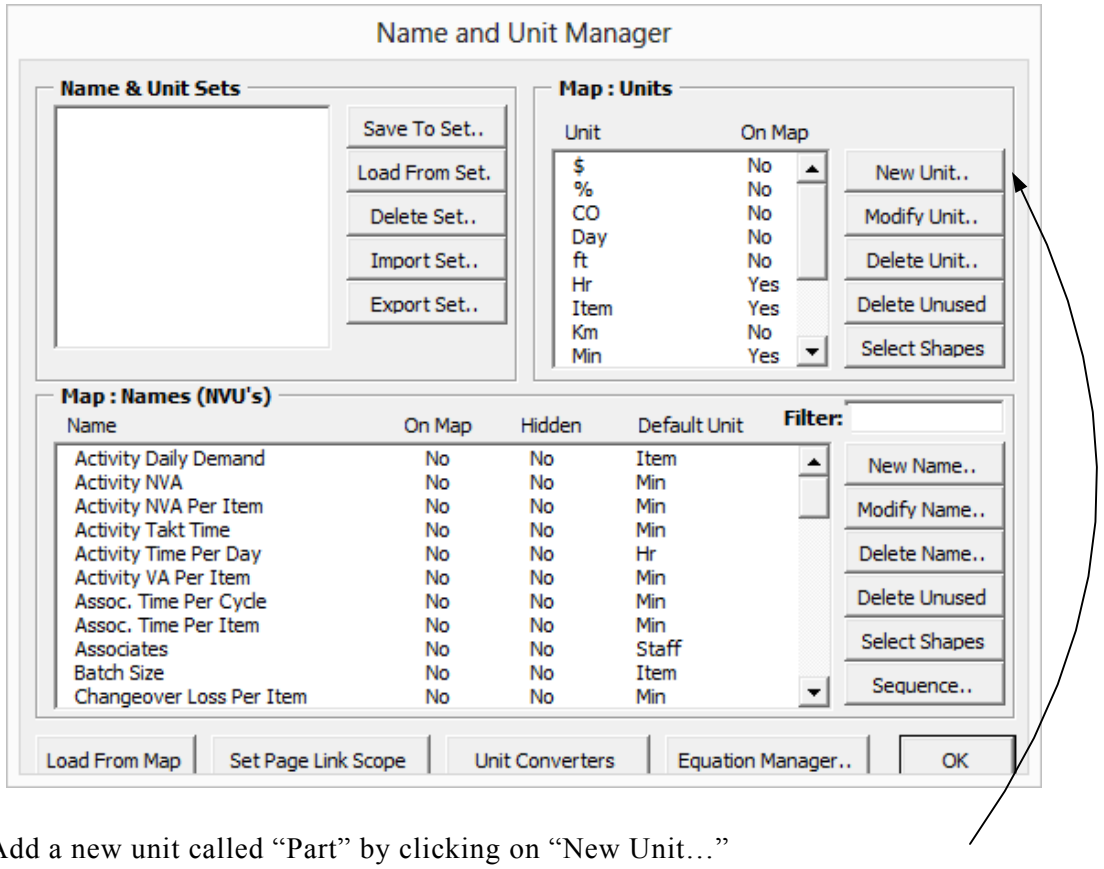
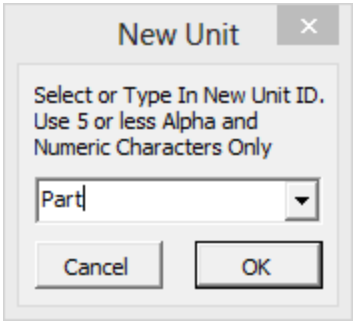
Units Handling

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…”



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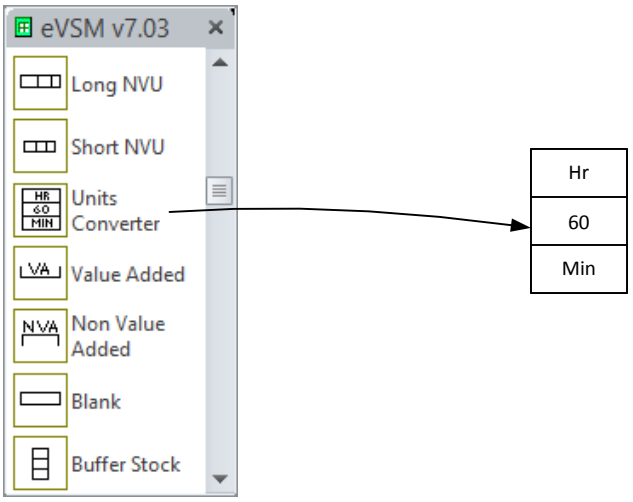
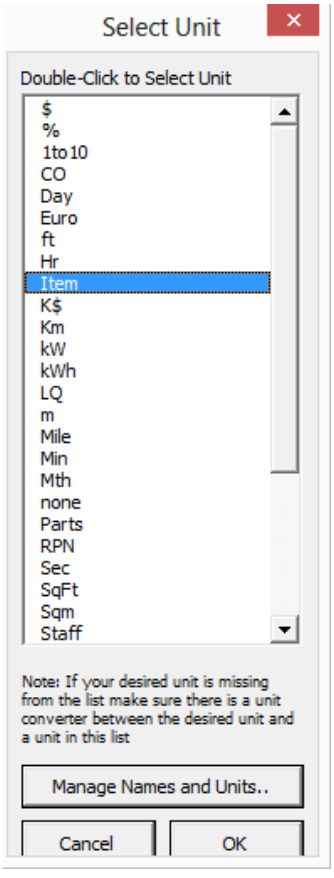
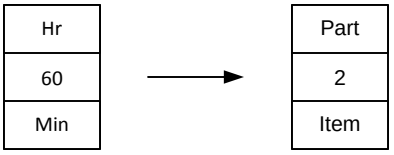
3. Drag out a Units Converter shape from the eVSM stencil.





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.



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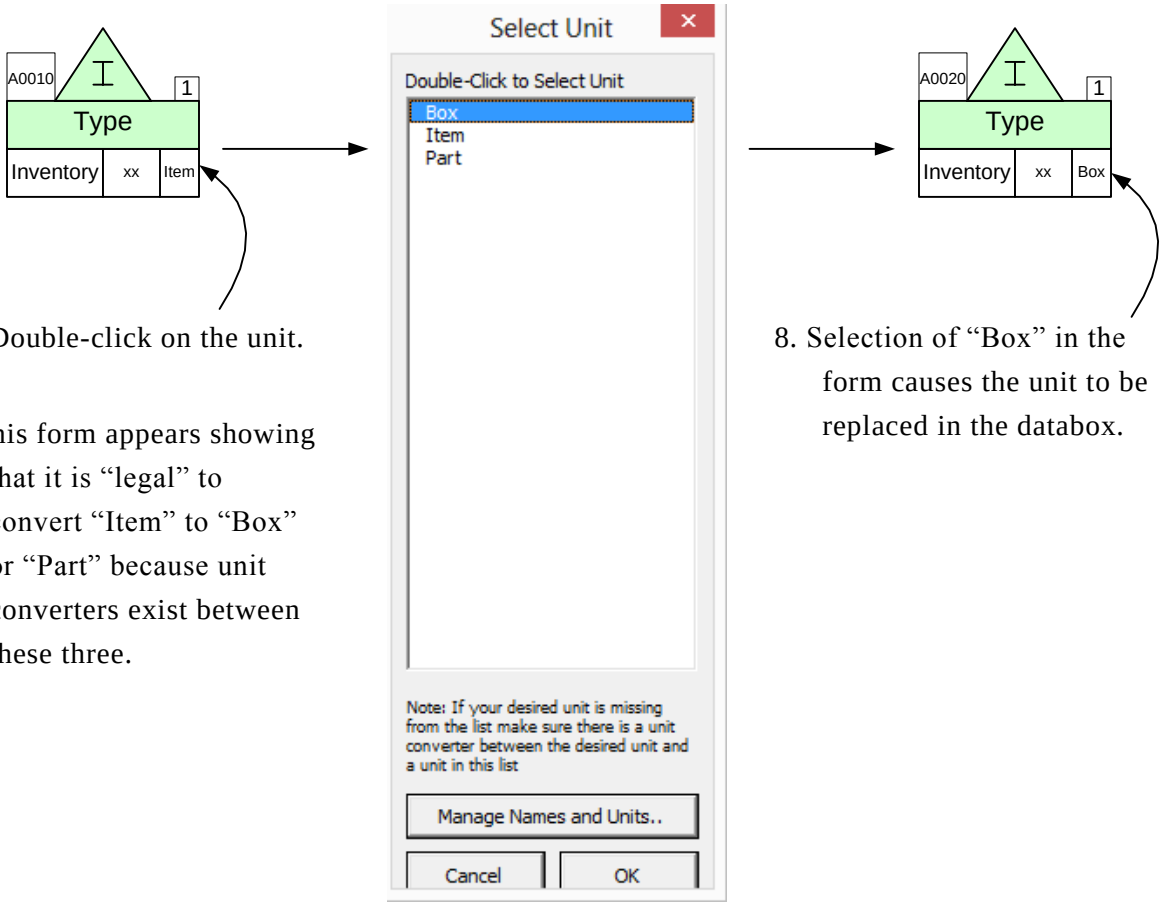
5. If you have more than one custom unit, repeat step two and three.

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.

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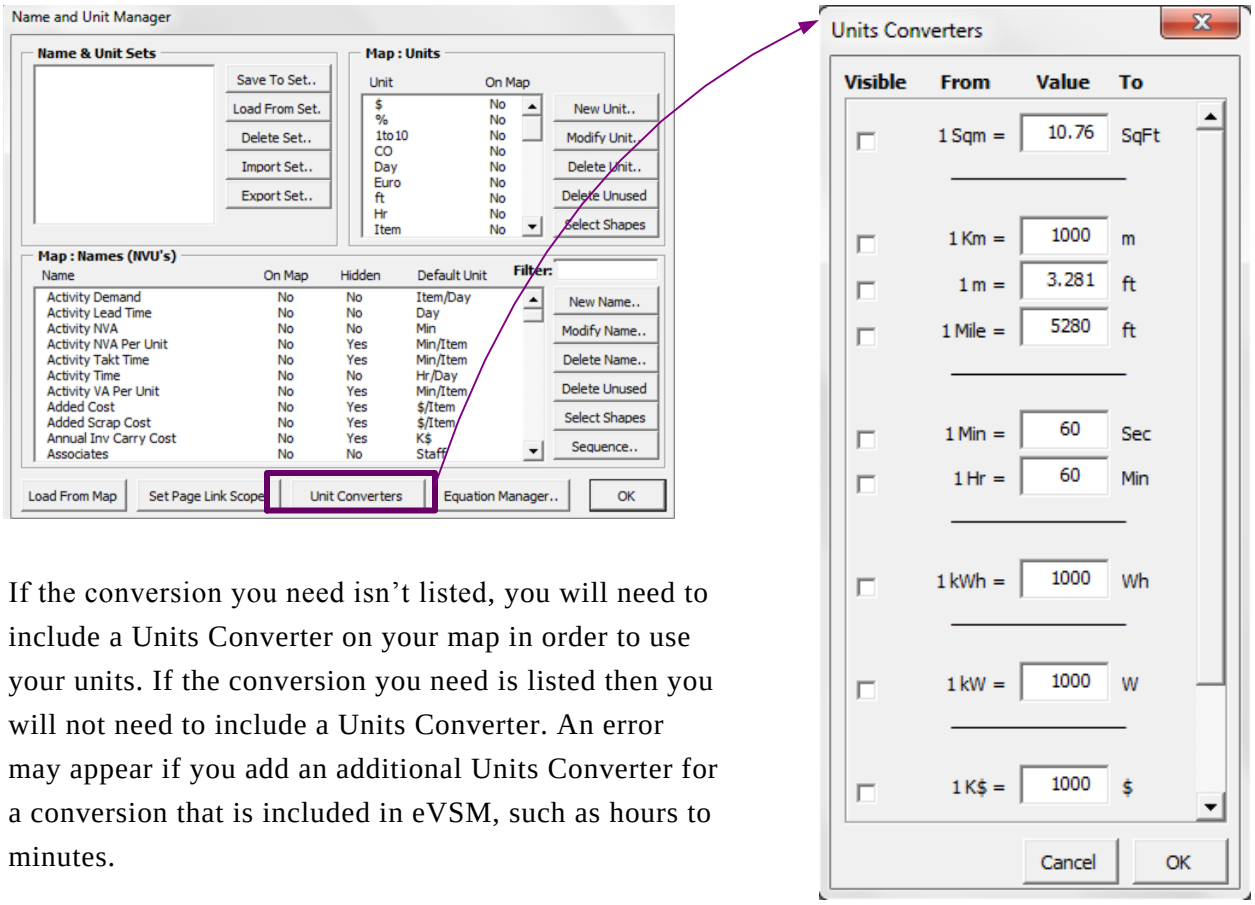
Miscellaneous Tips

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.

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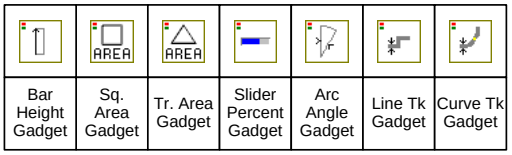
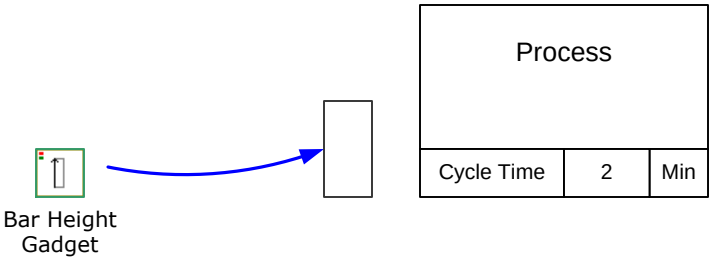
Using Gadgets to Visualize Data

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:



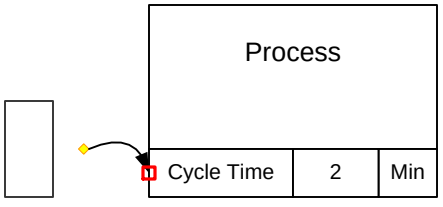
Each gadget has exactly one size parameter that can be tied to a data value on the map. Here's the typical means used to apply and manipulate gadgets:

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).



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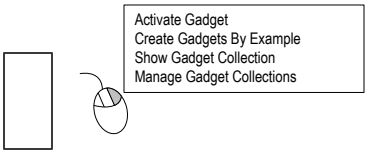
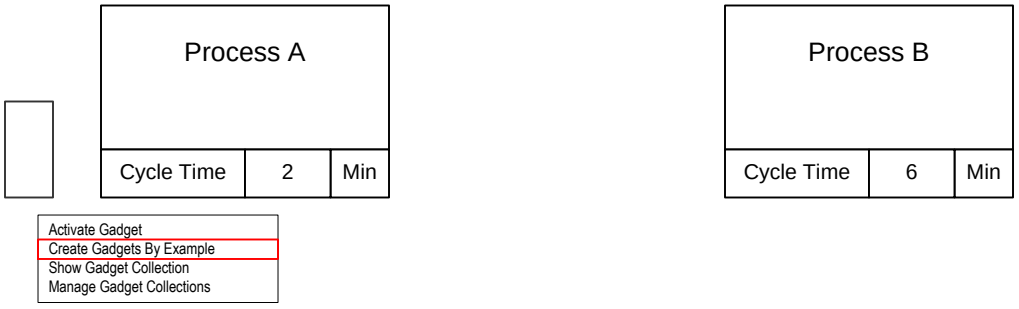
4. Right click on the gadget and use the “Activate Gadget” option to create a new gadget collection. The collection name will be “Bar_Cycle Time”. The name is created from the gadget type and the data variable name.

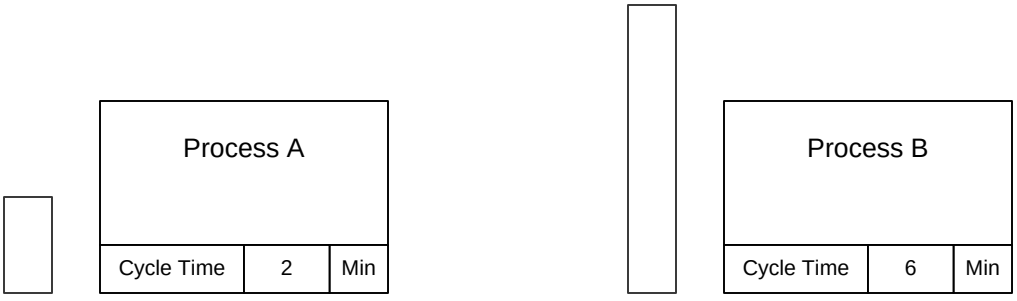
   A gadget can only belong to one collection. Each collection can only have a single type (eg. “Bar”) of gadget.



5. 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.



6. 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.



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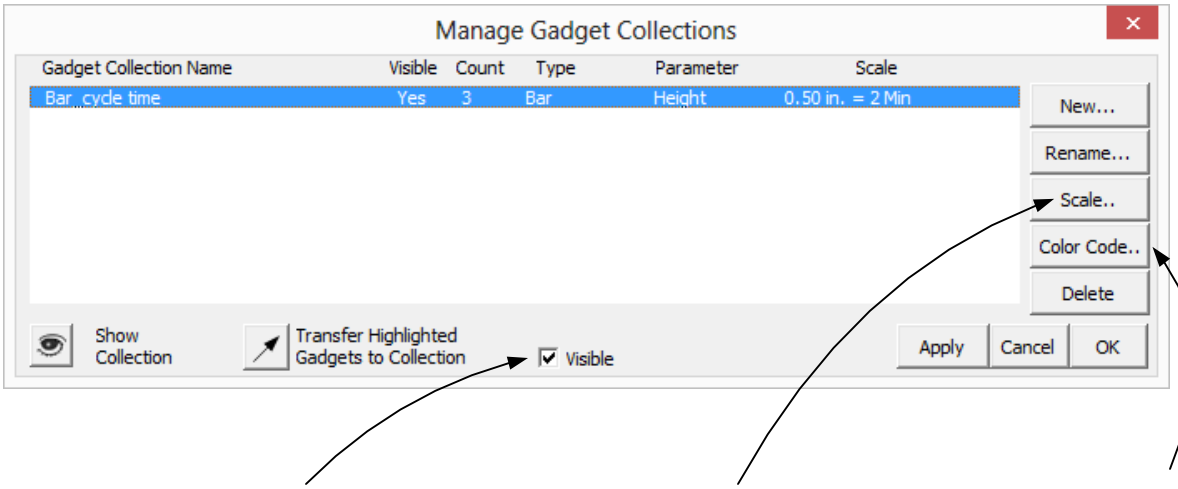
7. To modify a gadgets scale factor or to color code it, you need to change the properties of its associated collection. Right mouse click on the gadget and select "Manage Gadget Collections," or click the Gadgets button in the toolbar.



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.

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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) 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.

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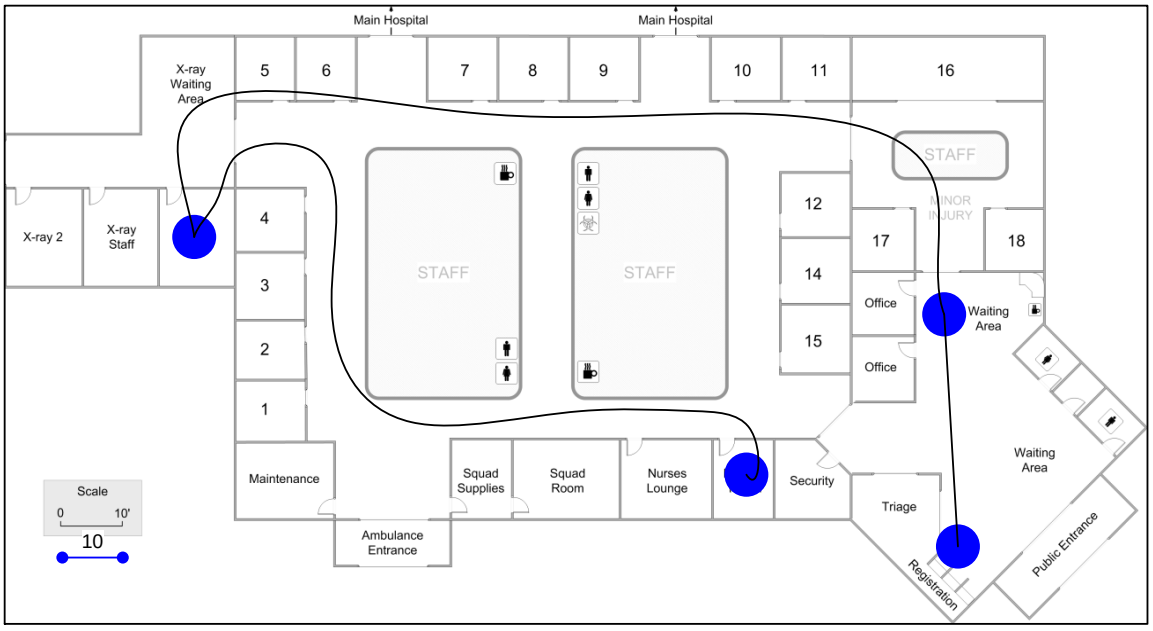
Spaghetti Wizard Tutorial

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



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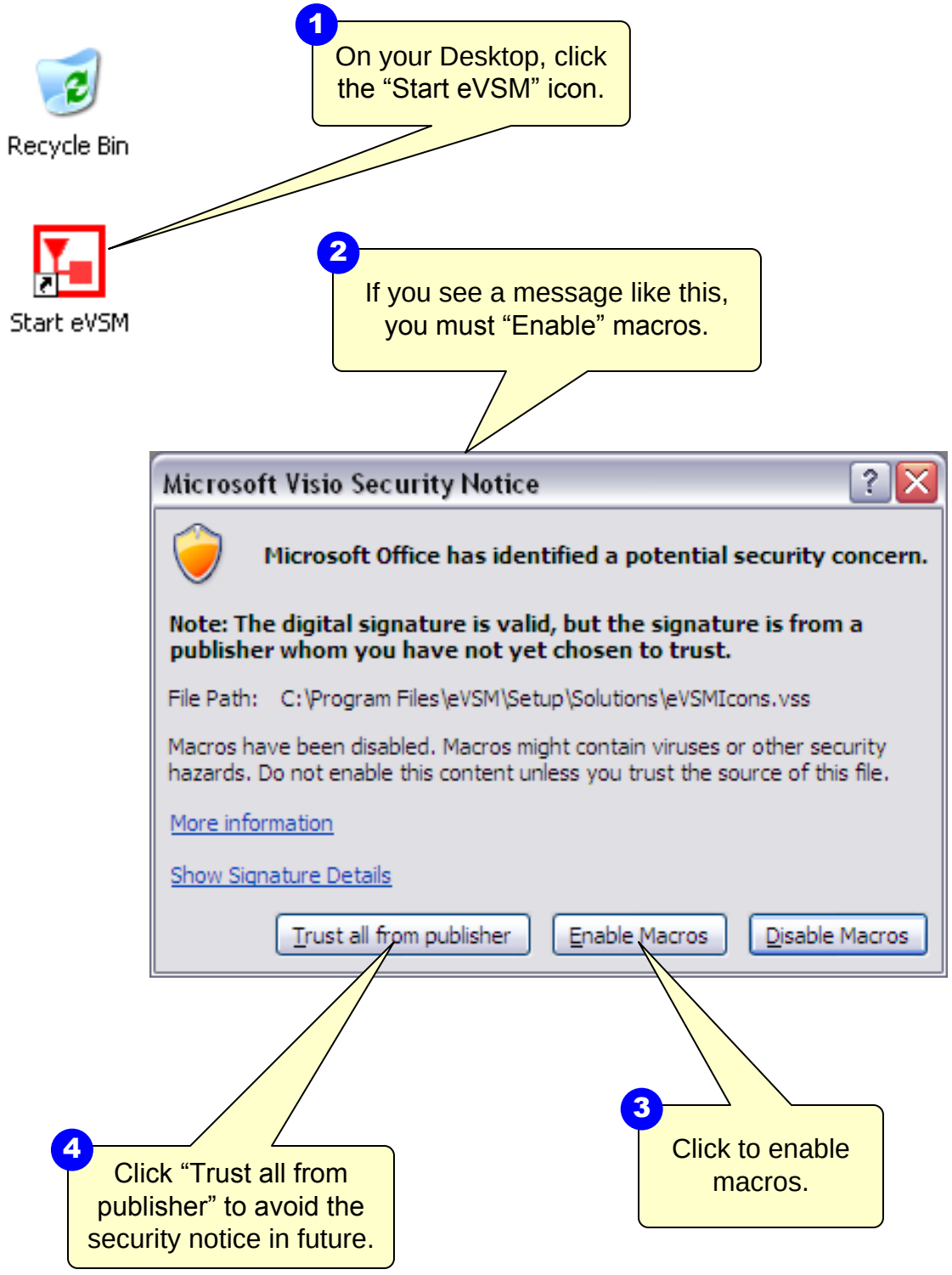
Step 1: Start eVSM



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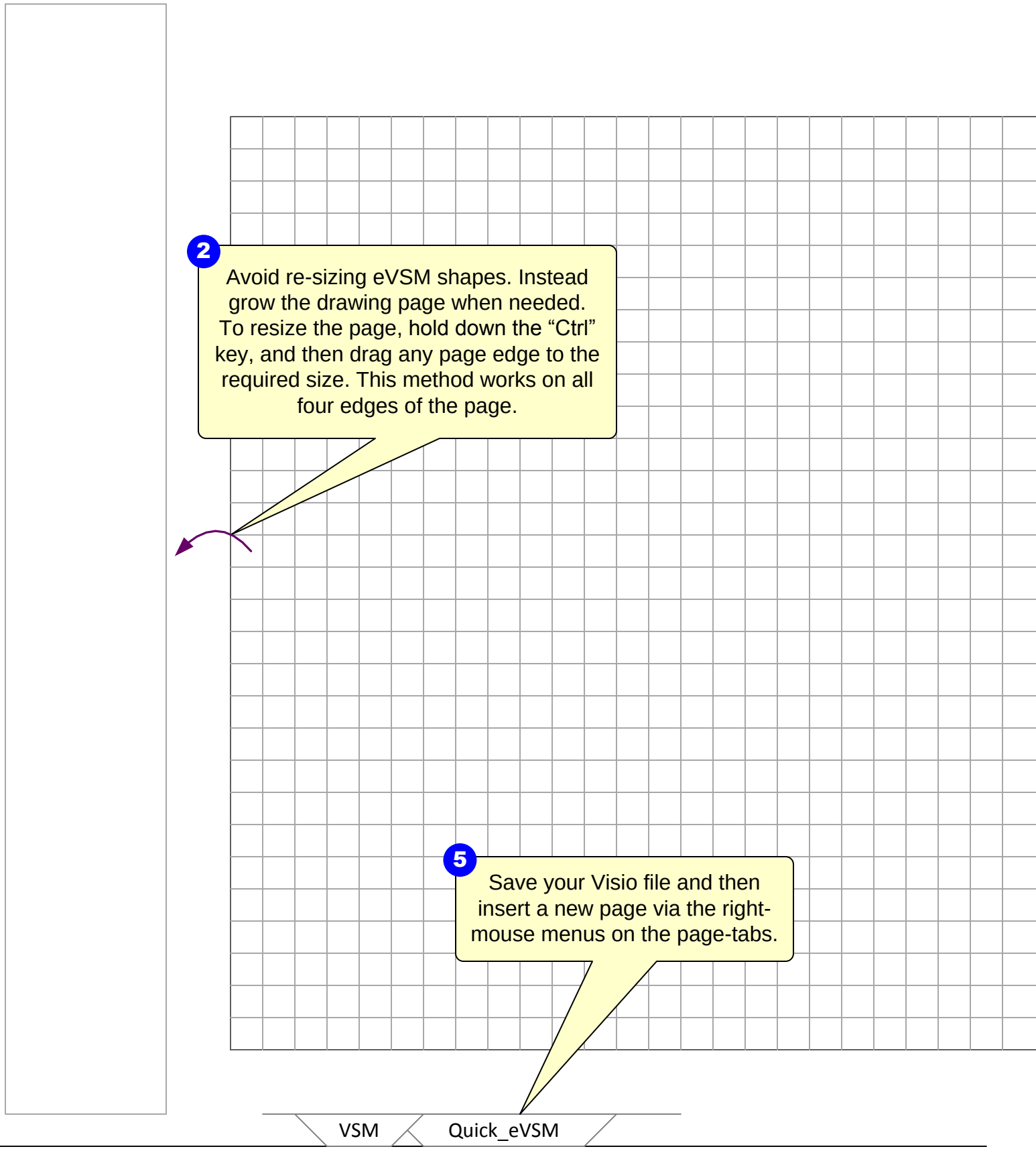
Step 2: Learn eVSM Basics



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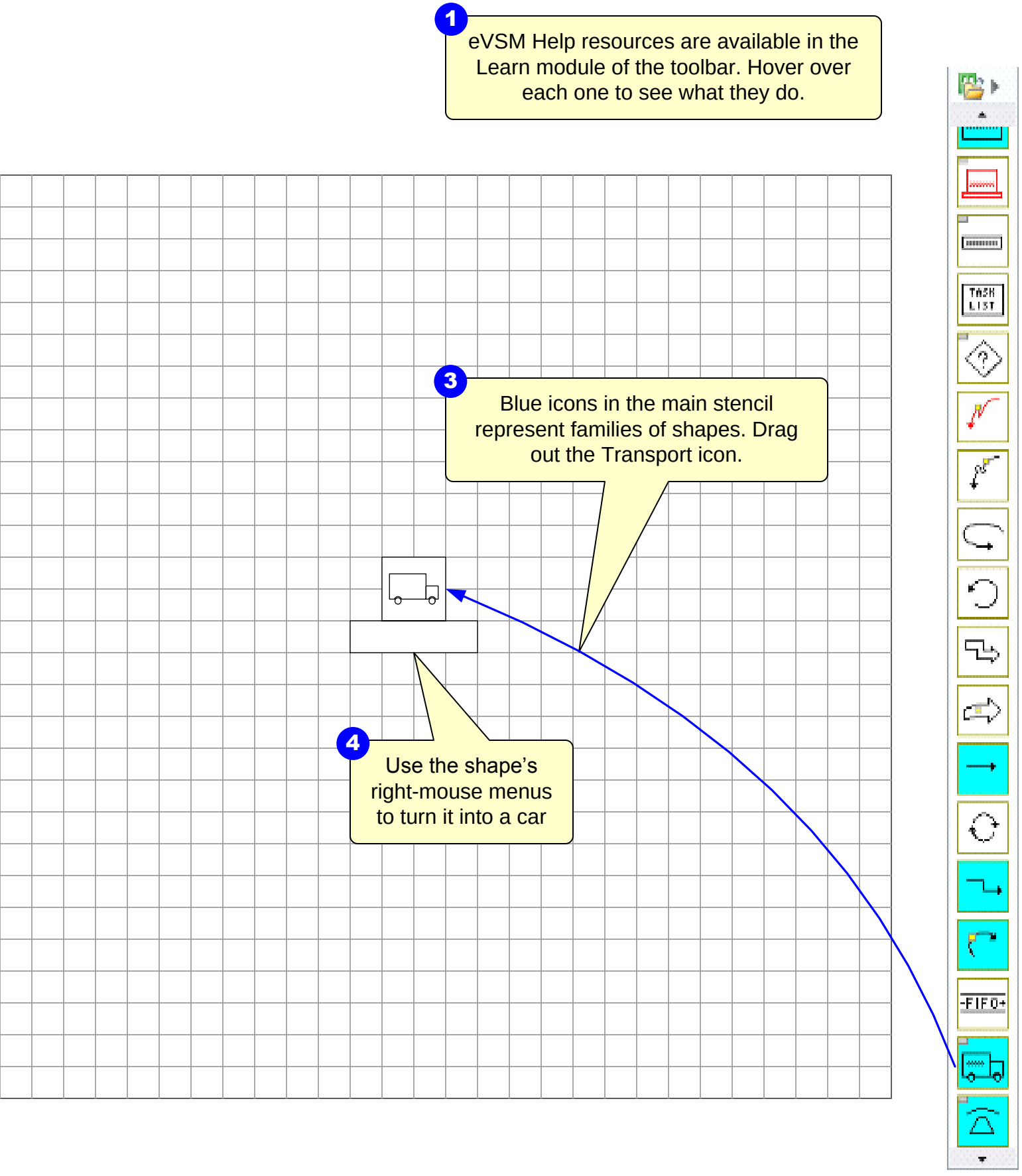

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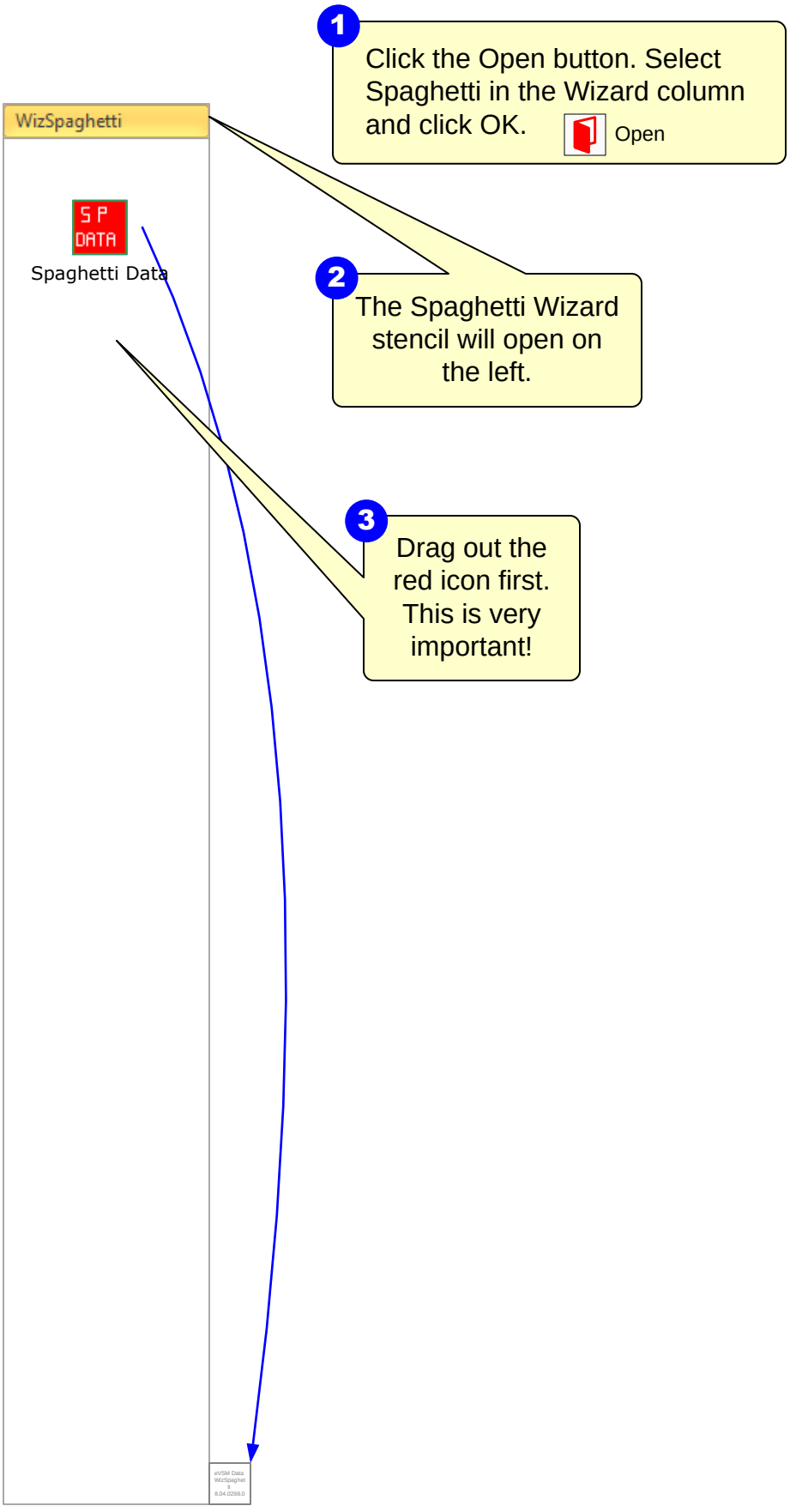
Step 3: Initiate the map for the Spaghetti Wizard



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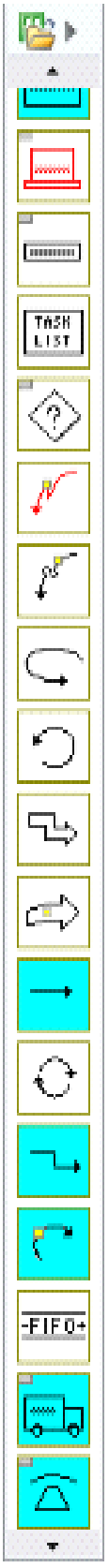

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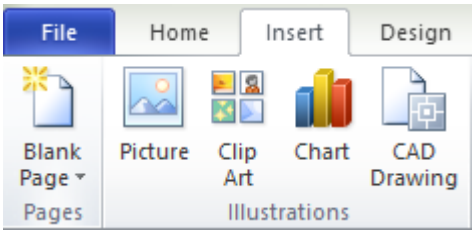
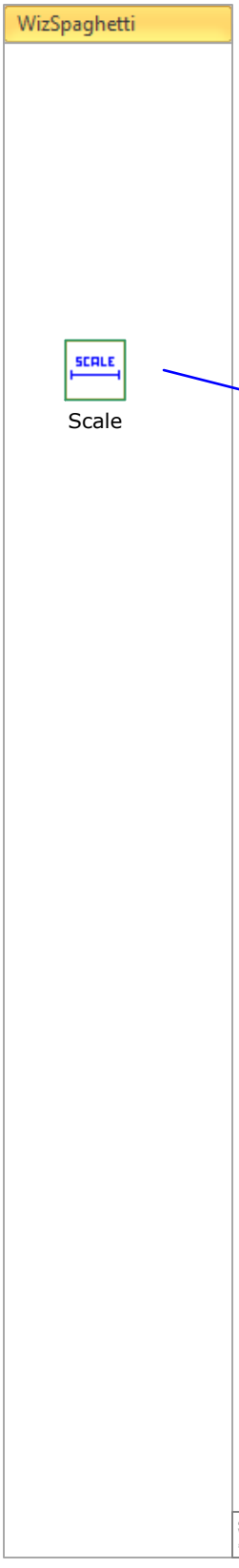
Step 4: Draw/Import Floor Map

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.





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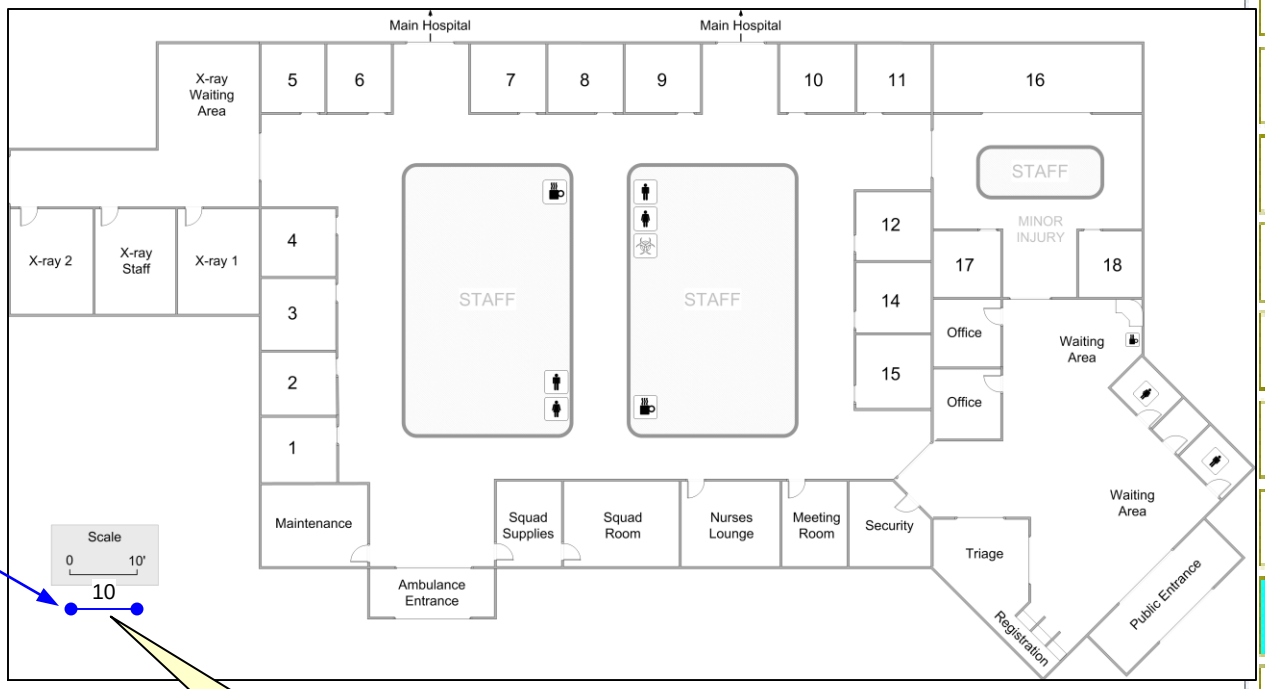

2

Drag out a Spaghetti Scale shape and stretch it out to exactly fit a known dimension on the map. The known dimension could be a map scale if available, or a floor dimension you have measured. Enter the actual dimension value on the scale shape by double-clicking it.

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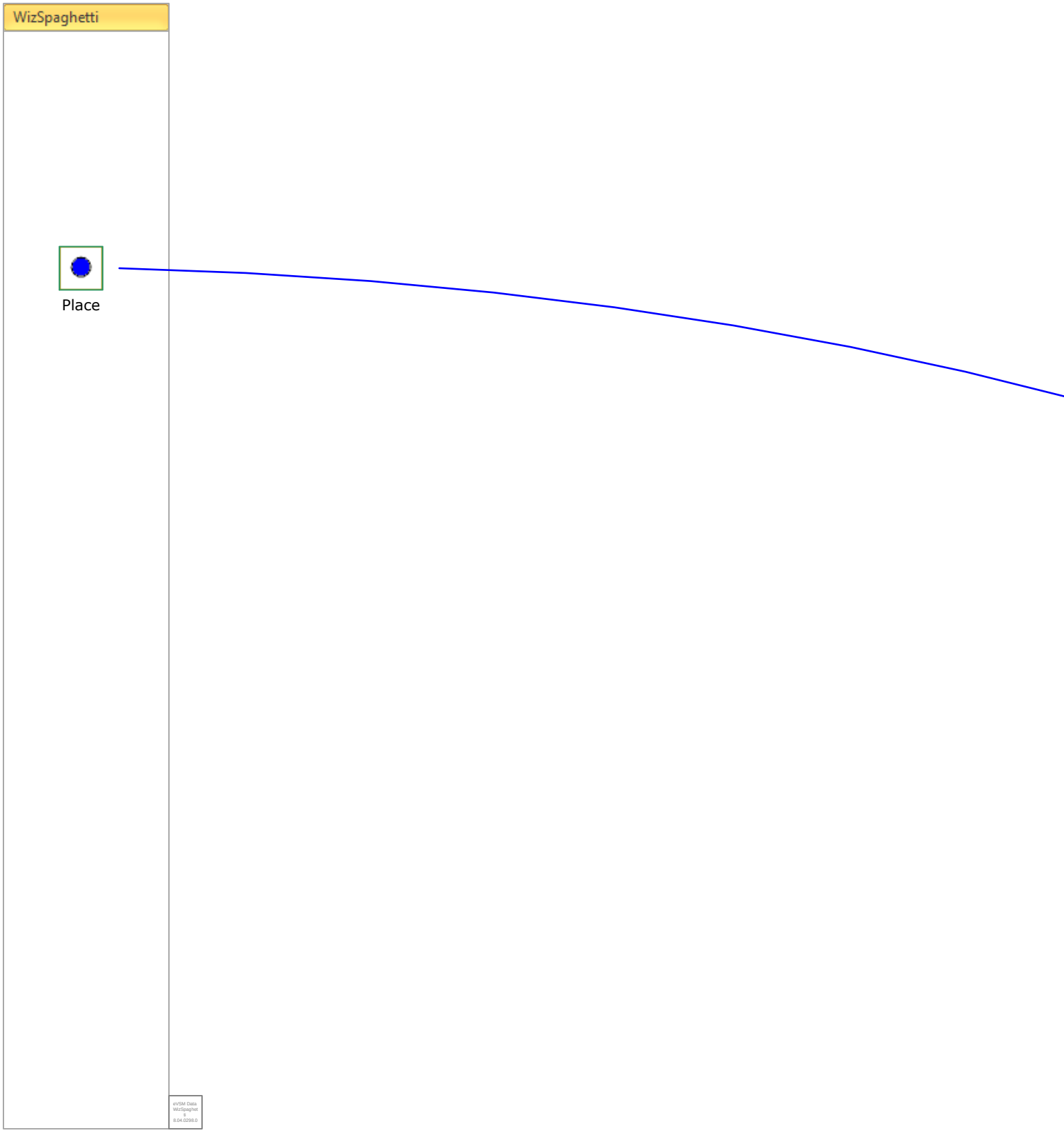
Step 5: Add Spaghetti Places



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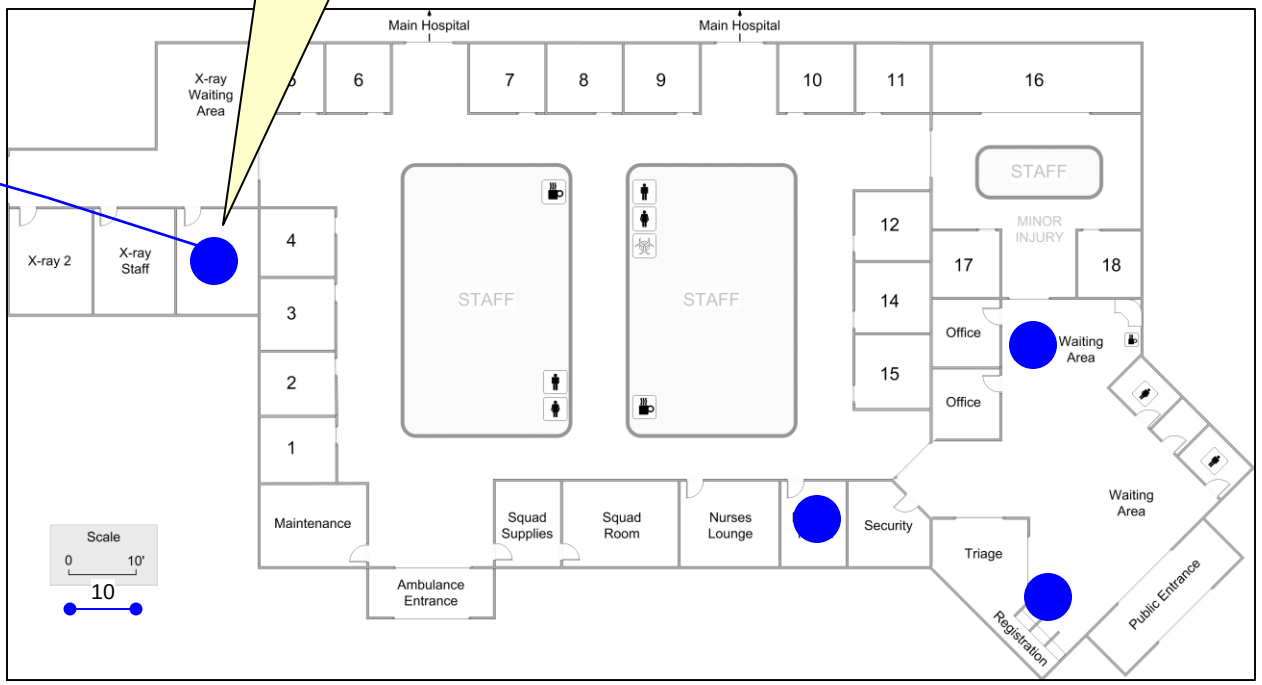
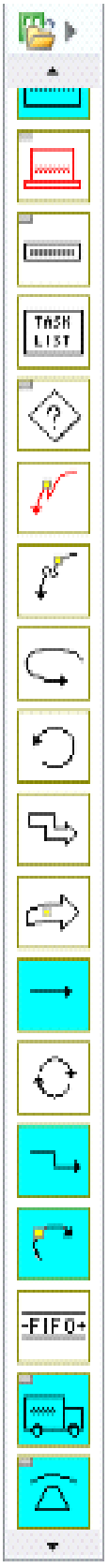
1

Define Activity Centers by dropping a Spaghetti Place icon onto the diagram for each place, then double-clicking each one to name the Place.





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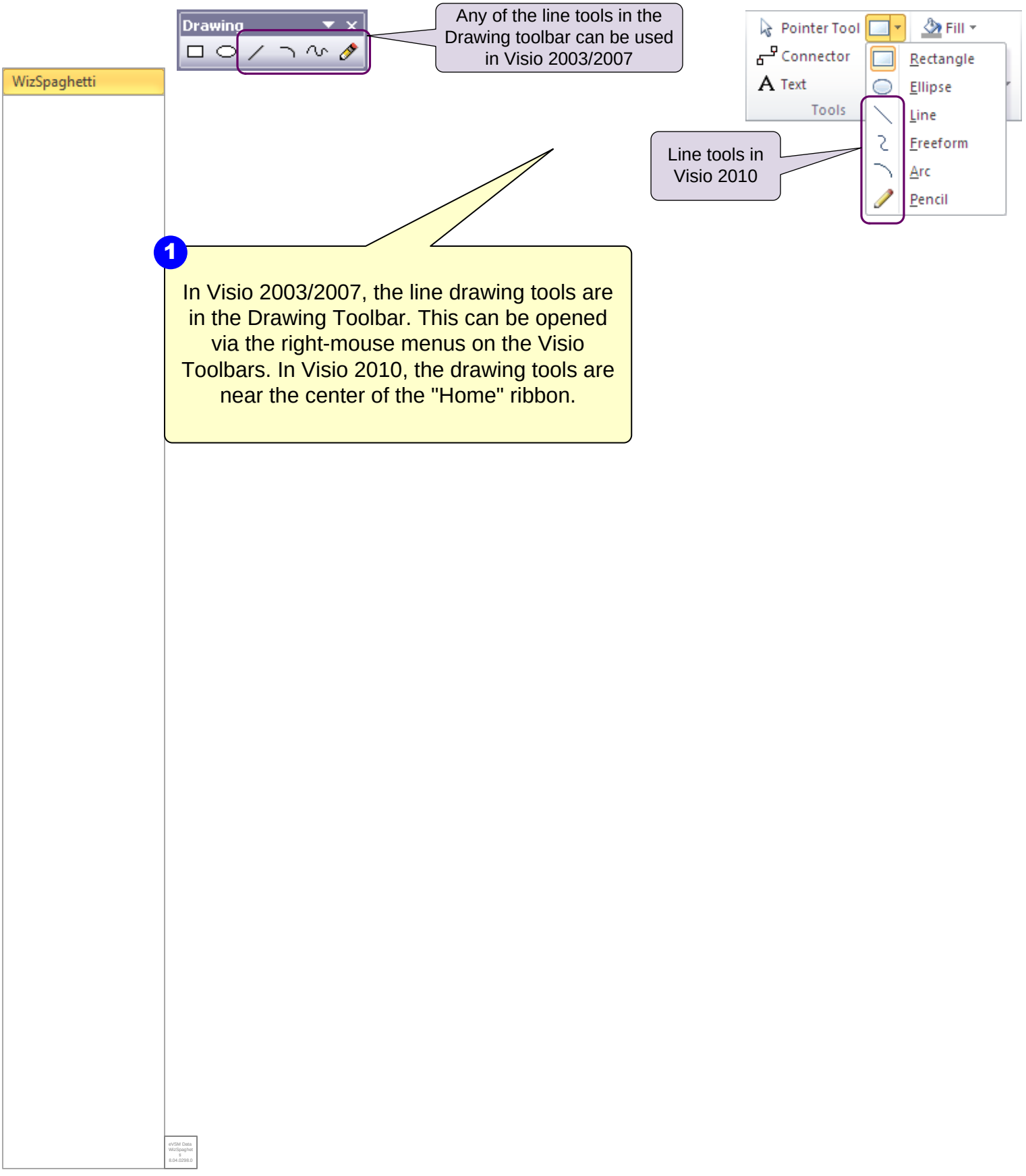
Step 6: Draw Spaghetti Paths



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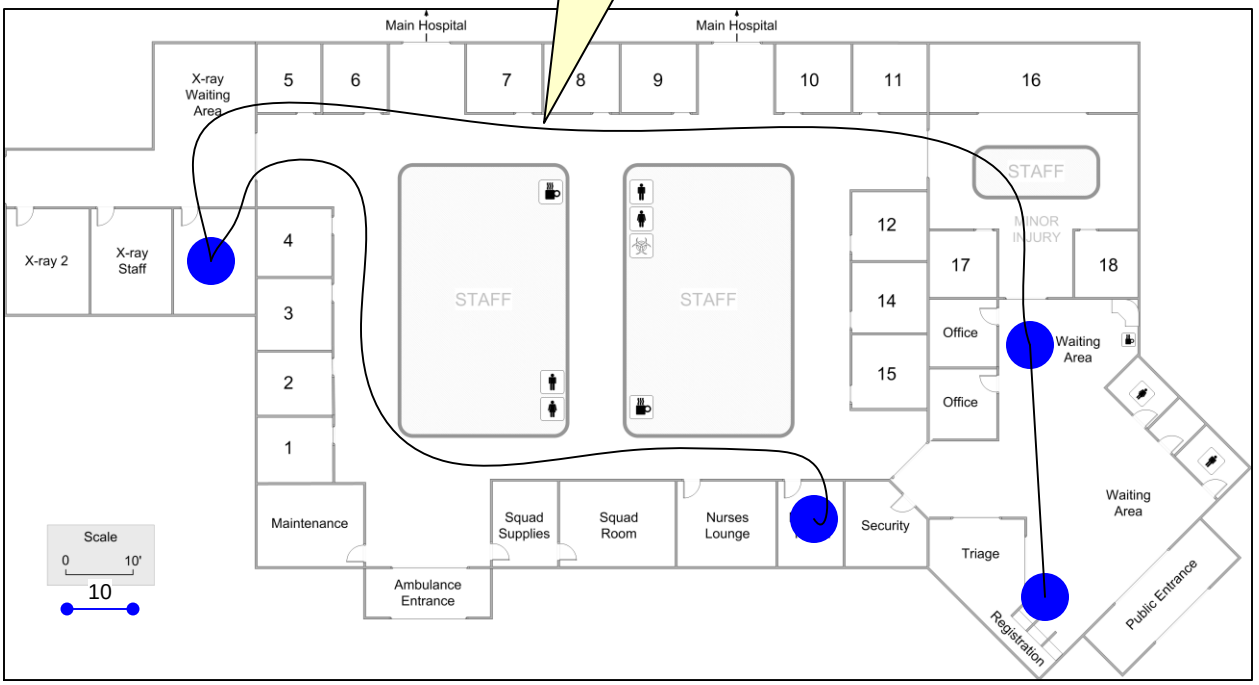
2

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.



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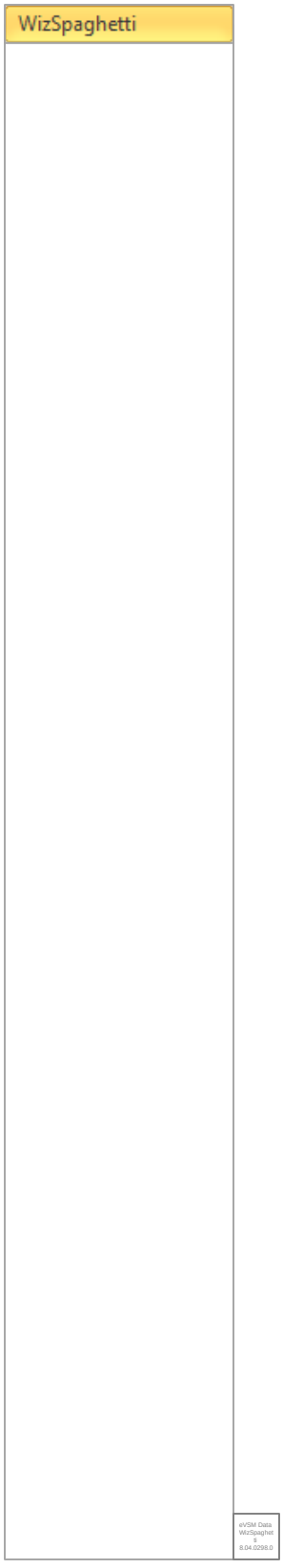
Step 7: Create Spaghetti Report



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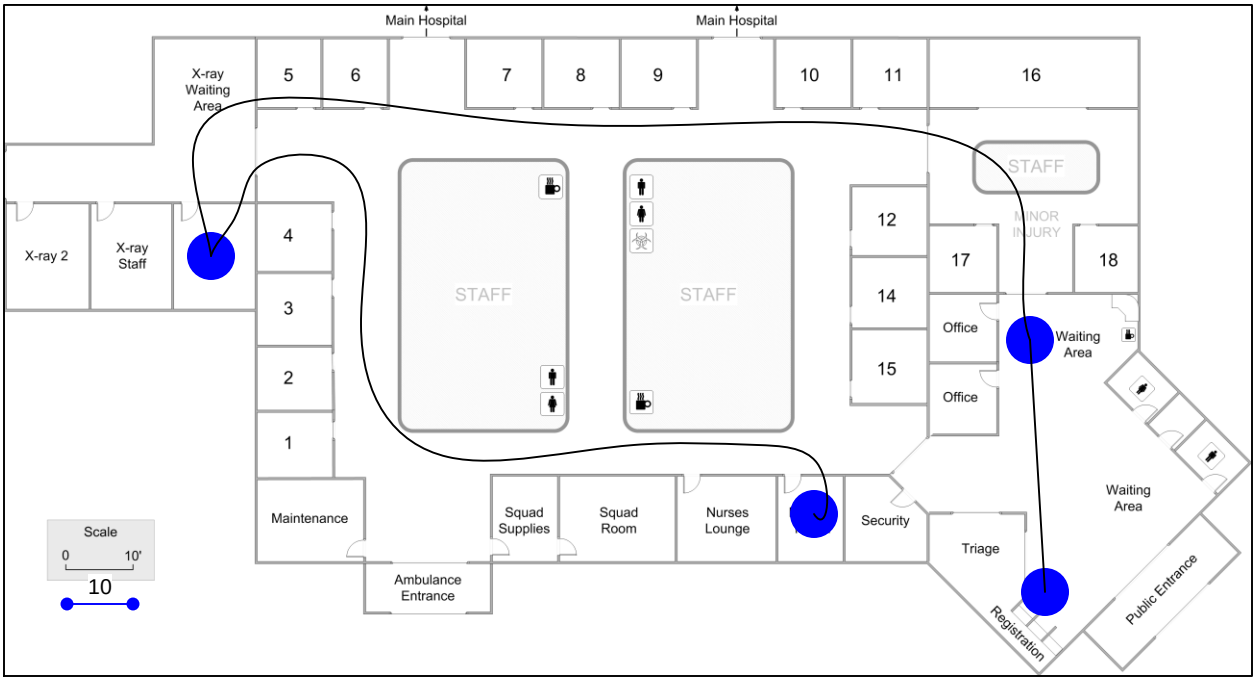
1

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



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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	❑	❑	❑	❑	❑
2. I will be able to apply the knowledge learned.	❑	❑	❑	❑	❑
3. The training objectives for each topic were identified and followed.	❑	❑	❑	❑	❑
4. The content was organized and easy to follow.	❑	❑	❑	❑	❑
5. The materials distributed were pertinent and useful.	❑	❑	❑	❑	❑
6. The trainer was knowledgeable.	❑	❑	❑	❑	❑
7. The quality of instruction was good.	❑	❑	❑	❑	❑
8. The trainer met the training objectives.	❑	❑	❑	❑	❑
9. Class participation and interaction were encouraged.	❑	❑	❑	❑	❑
10. Adequate time was provided for questions and discussion.	❑	❑	❑	❑	❑

11. How do you rate the training overall?

Excellent	Good	Average	Poor	Very Poor
❑	❑	❑	❑	❑

12. What aspects of the training could be improved?

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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!

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