# Manufacturing Problem: Downtime

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

Control System

Weekly

Weekly

A0010 — Atlas — 1

| Activity Lead Time | 0 | Day |
|---|---|---|

A0020 — 1

| Transport Frequency | 1 | Trip / Week |
|---|---|---|
| Transport Time | 2 | Hr |

0.14 Day

A0030 — Blanks — 1

| Inventory | 7500 | Item |
|---|---|---|

A0040 — Mold Handles — 1

1.00

| Cycle Time | 3 | Min |
|---|---|---|
| Qty Per Cycle | 5 | Item |
| Capacity | 1400.00 | Item / Day |

Station experiencing the unplanned downtime

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 |

7.50 Day — 180.00 Sec — 3.85 Day — 240.00 Sec

A0080 — Make Box — 2

1.00

| Cycle Time | 3 | Min |
|---|---|---|
| Qty Per Cycle | 4 | Item |
| Capacity | 1120.00 | Item / Day |

A0090 — Boxes — 2

| Inventory | 7000 | Item |
|---|---|---|

7.00 Day — 180.00 Sec

A0070 — Drilled Blanks — 1

| Inventory | 3100 | Item |
|---|---|---|

A0100 — Assemble — #2

2.00

| Cycle Time | 6 | Min |
|---|---|---|
| Qty Per Cycle | 10 | Item |
| Capacity | 1400.00 | Item / Day |

3.10 Day — 360.00 Sec — 9.00 Day

A0110 — Scissors — #2

| Inventory | 9000 | Item |
|---|---|---|

A0130 — Customer — all

| Customer Demand | 1000 | Item / Day |
|---|---|---|
| Share % | 100 | % |
| Effective Demand | 1000.00 | Item / Day |

A0120 — #2

| Transport Frequency | 1 | Trip / Week |
|---|---|---|
| Transport Time | 4 | Hr |

0.29 Day

Z0010 — Time Summary — 1

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

| Units | Year | Week | Week |
|---|---|---|---|
| | 52 | 70 | 5 |
| | Week | Hr | day |

# Manufacturing Solution: Downtime

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

Control System

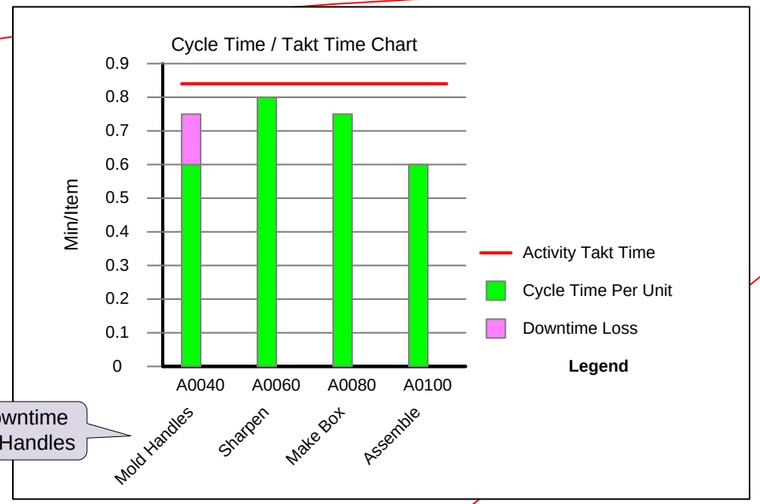
Weekly

Weekly

A0010 | 1

Atlas

| Activity Lead Time | 0 | Day |
|---|---|---|




20% downtime at Mold Handles

A0080 | 2

Make Box

1.00

| Cycle Time | 3 | Min |
|---|---|---|
| Qty Per Cycle | 4 | Item |
| Capacity | 1120.00 | Item / Day |
| Pre OEE Capacity | 1120.00 | Item / Day |
| OEE Percent | 100.00 | % |

A0090 | 2

Boxes

| Inventory | 7000 | Item |
|---|---|---|

A0130 | all

Customer

| Customer Demand | 1000 | Item / Day |
|---|---|---|
| Share % | 100 | % |
| Effective Demand | 1000.00 | Item / Day |

A0020 | 1

| Transport Frequency | 1 | Trip / Week |
|---|---|---|
| Transport Time | 2 | Hr |

A0120 | #2

| Transport Frequency | 1 | Trip / Week |
|---|---|---|
| Transport Time | 4 | Hr |

0.14 Day

180.00 Sec

7.00 Day

0.29 Day

## Answer:

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

A0030 | 1

Blanks

| Inventory | 7500 | Item |
|---|---|---|

A0040 | 1

Mold Handles

1.00

| Cycle Time | 3 | Min |
|---|---|---|
| Qty Per Cycle | 5 | Item |
| Capacity | 1120.00 | Item / Day |
| Pre OEE Capacity | 1400.00 | Item / Day |
| OEE Percent | 80.00 | % |
| Uptime Percent | 80 | % |

A0050 | 1

Molded Blanks

| Inventory | 3850 | Item |
|---|---|---|

A0060 | 1

Sharpen

1.00

| Cycle Time | 4 | Min |
|---|---|---|
| Qty Per Cycle | 5 | Item |
| Capacity | 1050.00 | Item / Day |
| Pre OEE Capacity | 1050.00 | Item / Day |
| OEE Percent | 100.00 | % |

A0070 | 1

Drilled Blanks

| Inventory | 3100 | Item |
|---|---|---|

A0100 | #2

Assemble

2.00

| Cycle Time | 6 | Min |
|---|---|---|
| Qty Per Cycle | 10 | Item |
| Capacity | 1400.00 | Item / Day |
| Pre OEE Capacity | 1400.00 | Item / Day |
| OEE Percent | 100.00 | % |

A0110 | #2

Scissors

| Inventory | 9000 | Item |
|---|---|---|

7.50 Day

180.00 Sec

3.85 Day

240.00 Sec

3.10 Day

360.00 Sec

9.00 Day

Z0010 | 1

Time Summary

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

| Units | Year | Week | Week |
|---|---|---|---|
| | 52 | 70 | 5 |
| | Week | Hr | day |



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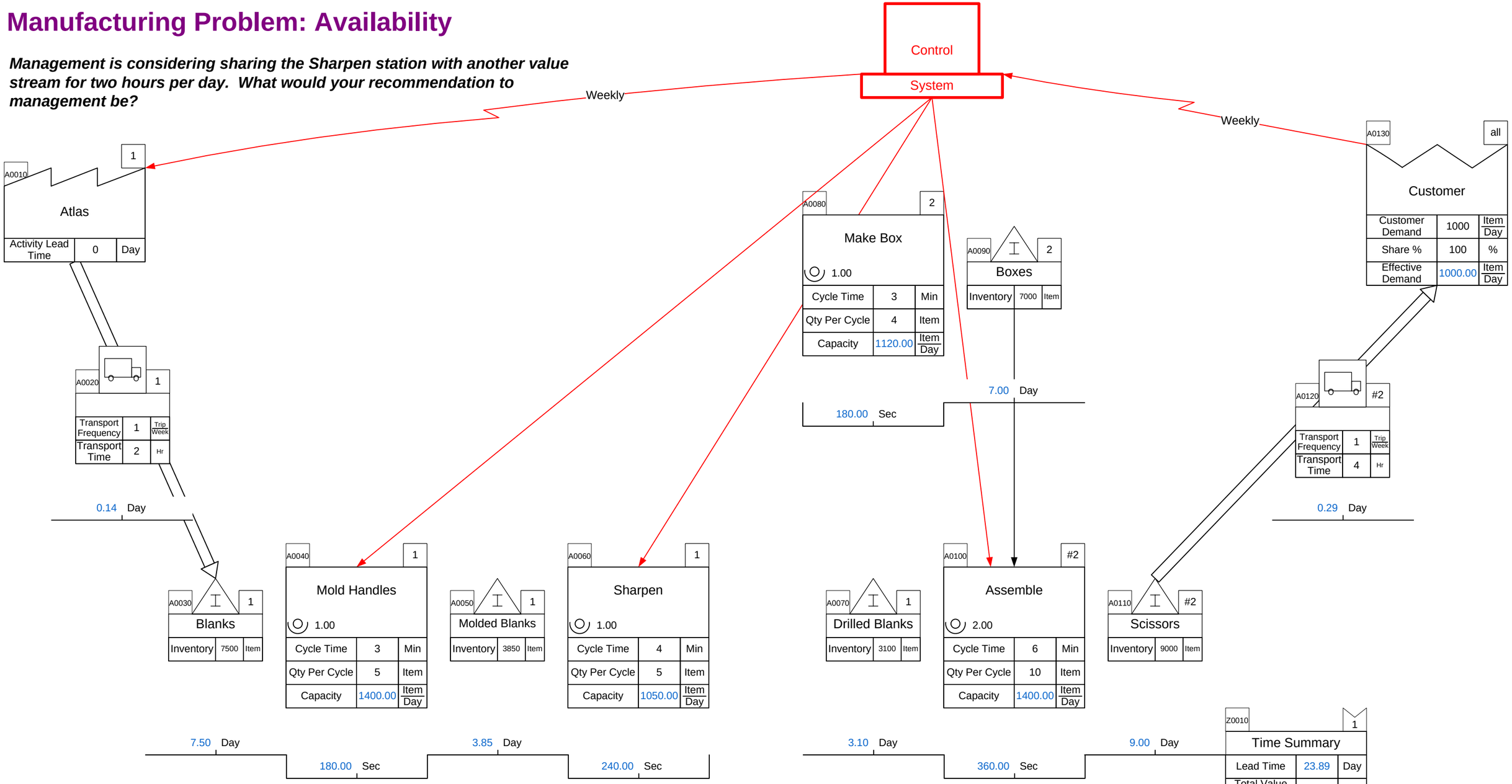
# Manufacturing Problem: Availability

***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 |

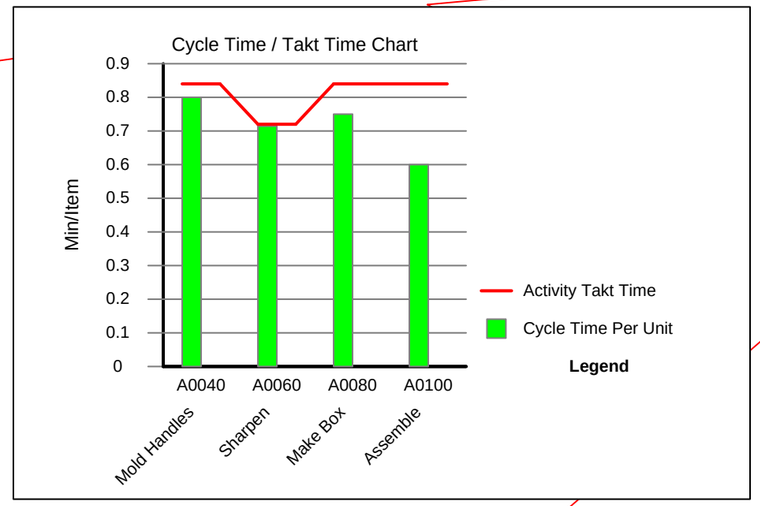
# Manufacturing Solution: Availability

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

Control System

Weekly

Weekly




A0010 — 1
Atlas
Activity Lead Time | 0 | Day

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

0.14 Day

A0030 — 1
Blanks
Inventory | 7500 | Item

7.50 Day

240.00 Sec

A0040 — 1
Mold Handles
1.00
Cycle Time | 4 | Min
Qty Per Cycle | 5 | Item
Capacity | 1050.00 | Item/Day

A0050 — 1
Molded Blanks
Inventory | 3850 | Item

3.85 Day

A0060 — 1
Sharpen
1.00
Cycle Time | 5 | Min
Qty Per Cycle | 7 | Item
Capacity | 1008.00 | Item/Day
Activity Time | 12 | Hr/Day

350.00 Sec

Availability change – two hours less than other stations

| Units | | | |
|---|---|---|---|
| | Year | Week | Week |
| | 52 | 70 | 5 |
| | Week | Hr | 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.

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

180.00 Sec

A0090 — 2
Boxes
Inventory | 7000 | Item

7.00 Day

3.10 Day

360.00 Sec

A0070 — 1
Drilled Blanks
Inventory | 3100 | Item

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

9.00 Day

A0110 — #2
Scissors
Inventory | 9000 | Item

A0120 — #2
Transport Frequency | 1 | Trip/Week
Transport Time | 4 | Hr

0.29 Day

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

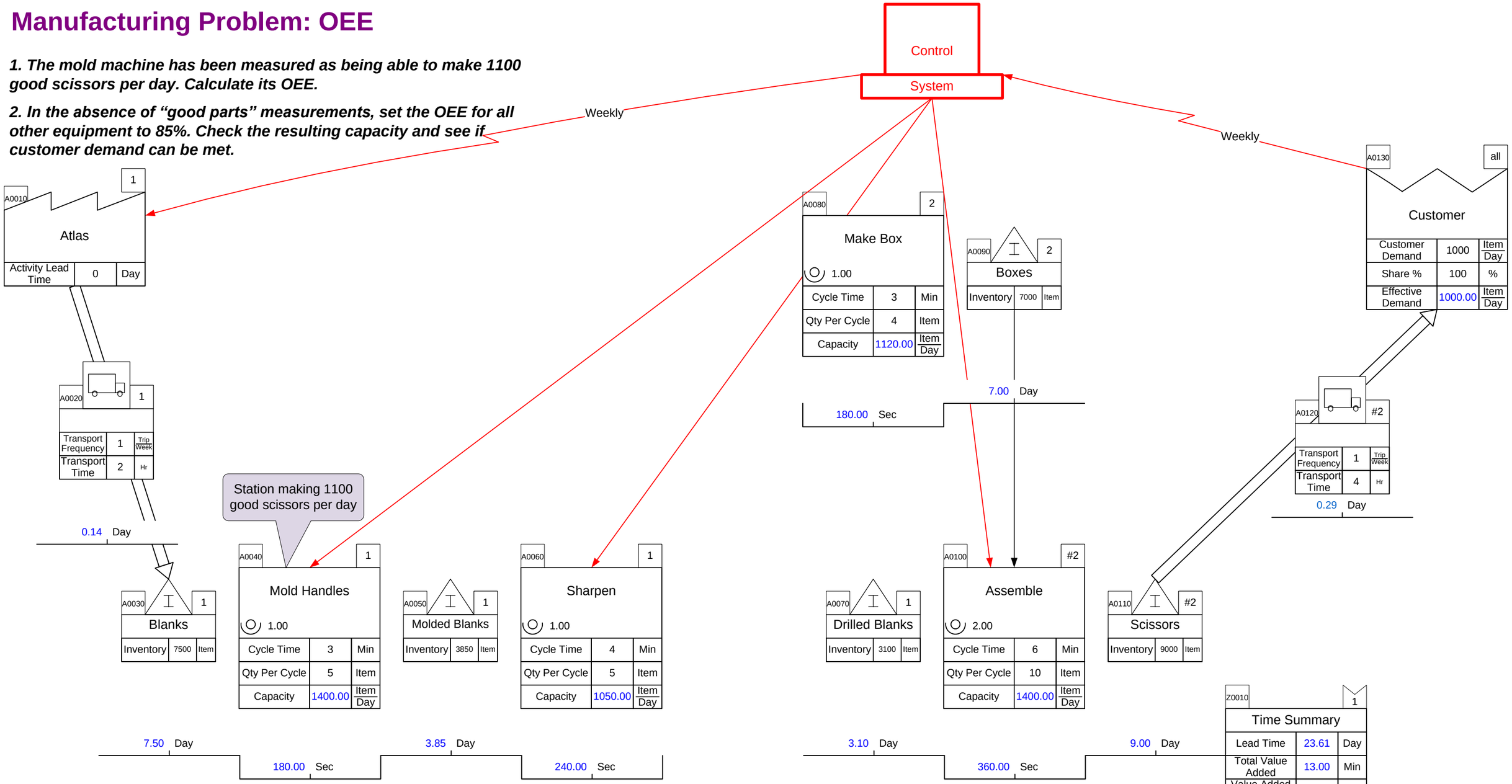
Z0010 — 1
Time Summary

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

# Manufacturing Problem: OEE

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

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

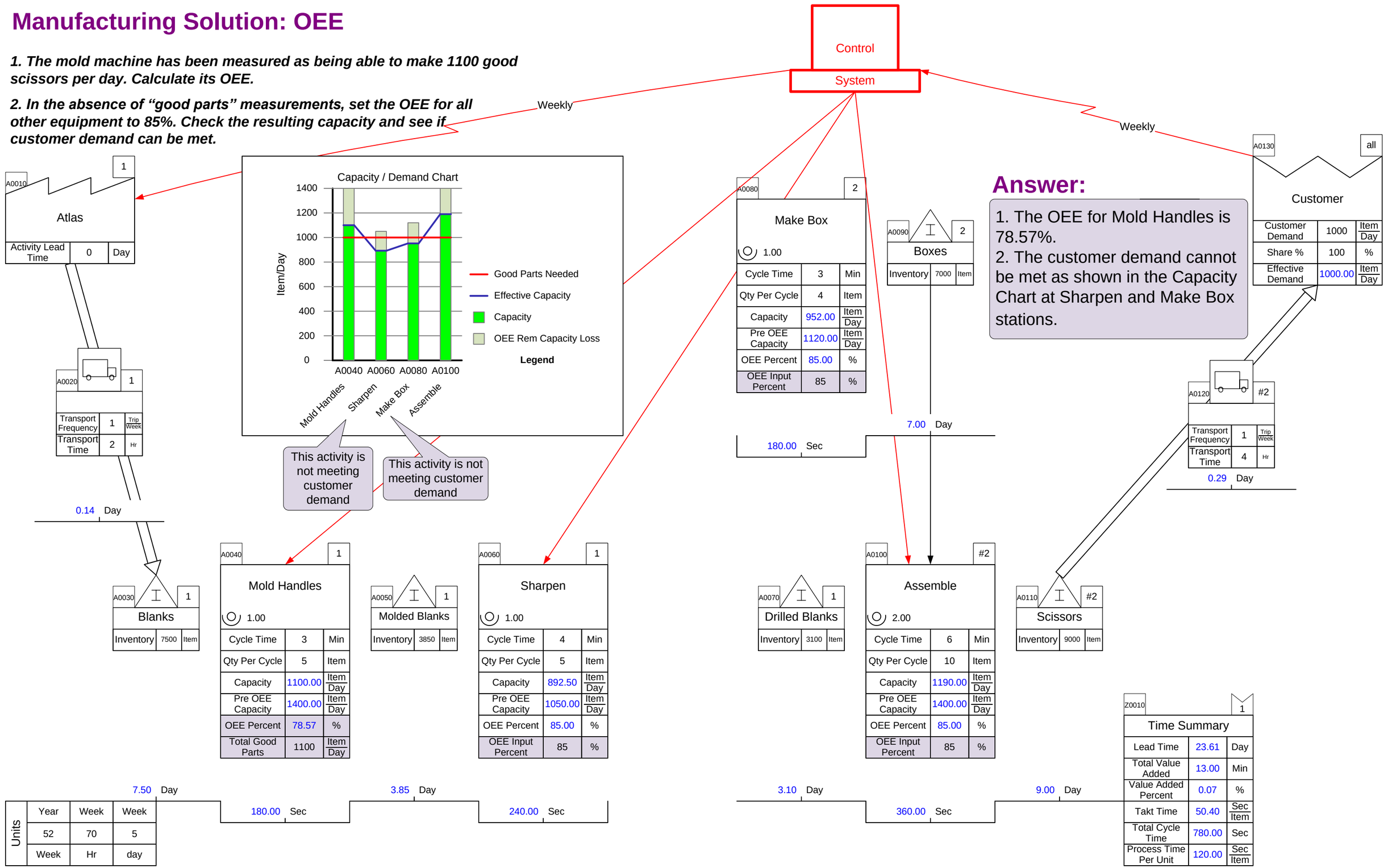



| Units | Year | Week | Week |
|---|---|---|---|
| | 52 | 70 | 5 |
| | Week | Hr | day |

# 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.***

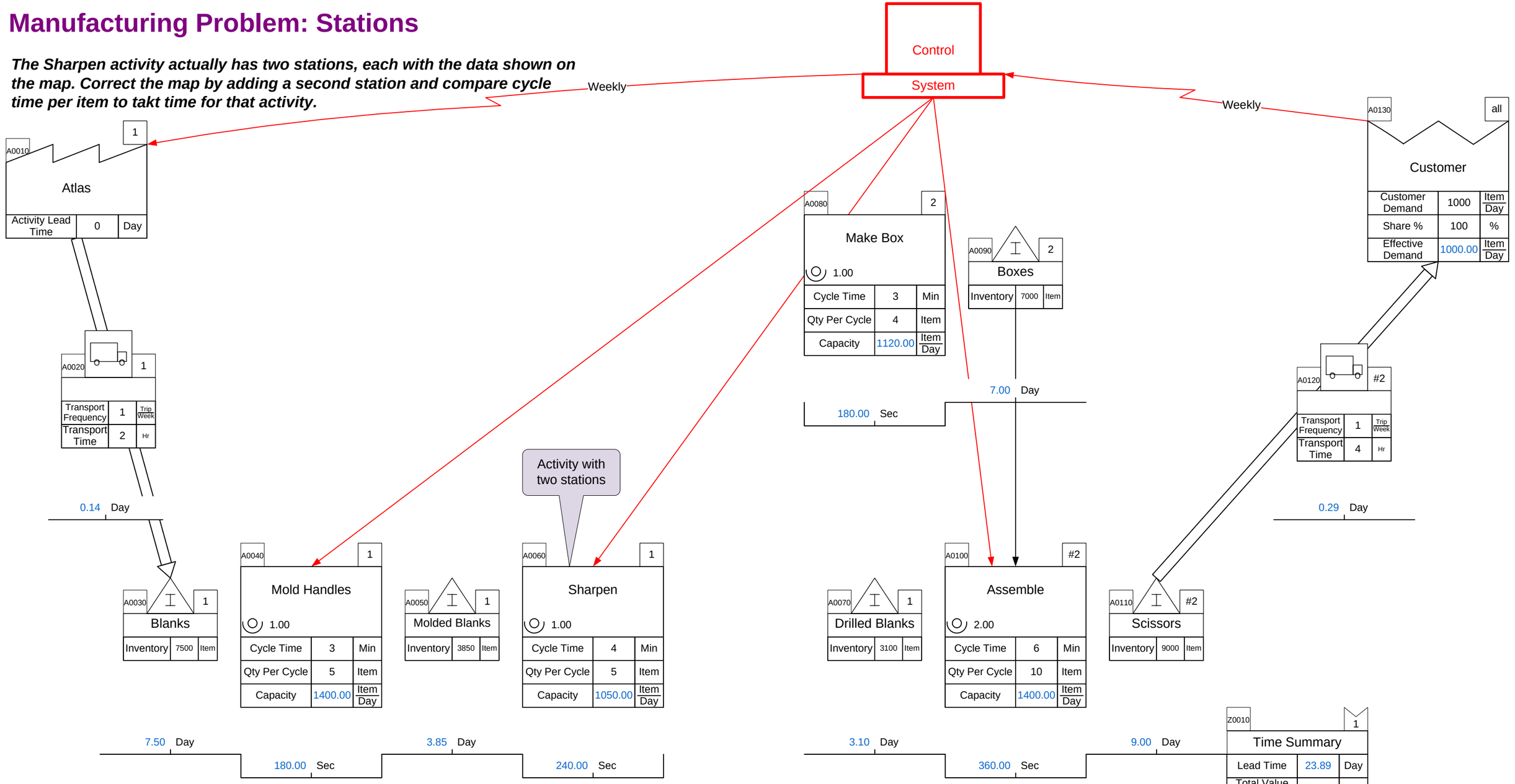



## Answer:

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

# 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 |

# 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.***

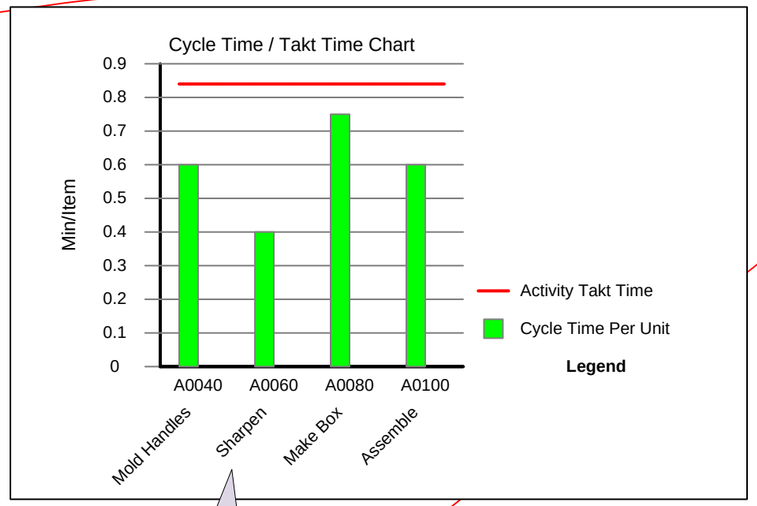
Control System

Weekly

Weekly

## Answer:

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




Cycle time per unit has decreased by half

A0010 — 1
Atlas
Activity Lead Time | 0 | Day

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

0.14 Day

A0030 — 1
Blanks
Inventory | 7500 | Item

A0040 — 1
Mold Handles
1.00
Cycle Time | 3 | Min
Qty Per Cycle | 5 | Item
Capacity | 1400.00 | Item/Day

A0050 — 1
Molded Blanks
Inventory | 3850 | Item

A0060 — 1
Sharpen
1.00
Cycle Time | 4 | Min
Qty Per Cycle | 5 | Item
Capacity | 2100.00 | Item/Day
Stations | 2 | Stn

7.50 Day — 180.00 Sec — 3.85 Day — 240.00 Sec

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

A0090 — 2
Boxes
Inventory | 7000 | Item

7.00 Day — 180.00 Sec

A0070 — 1
Drilled Blanks
Inventory | 3100 | Item

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

3.10 Day — 360.00 Sec — 9.00 Day

A0110 — #2
Scissors
Inventory | 9000 | Item

A0120 — #2
Transport Frequency | 1 | Trip/Week
Transport Time | 4 | Hr

0.29 Day

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

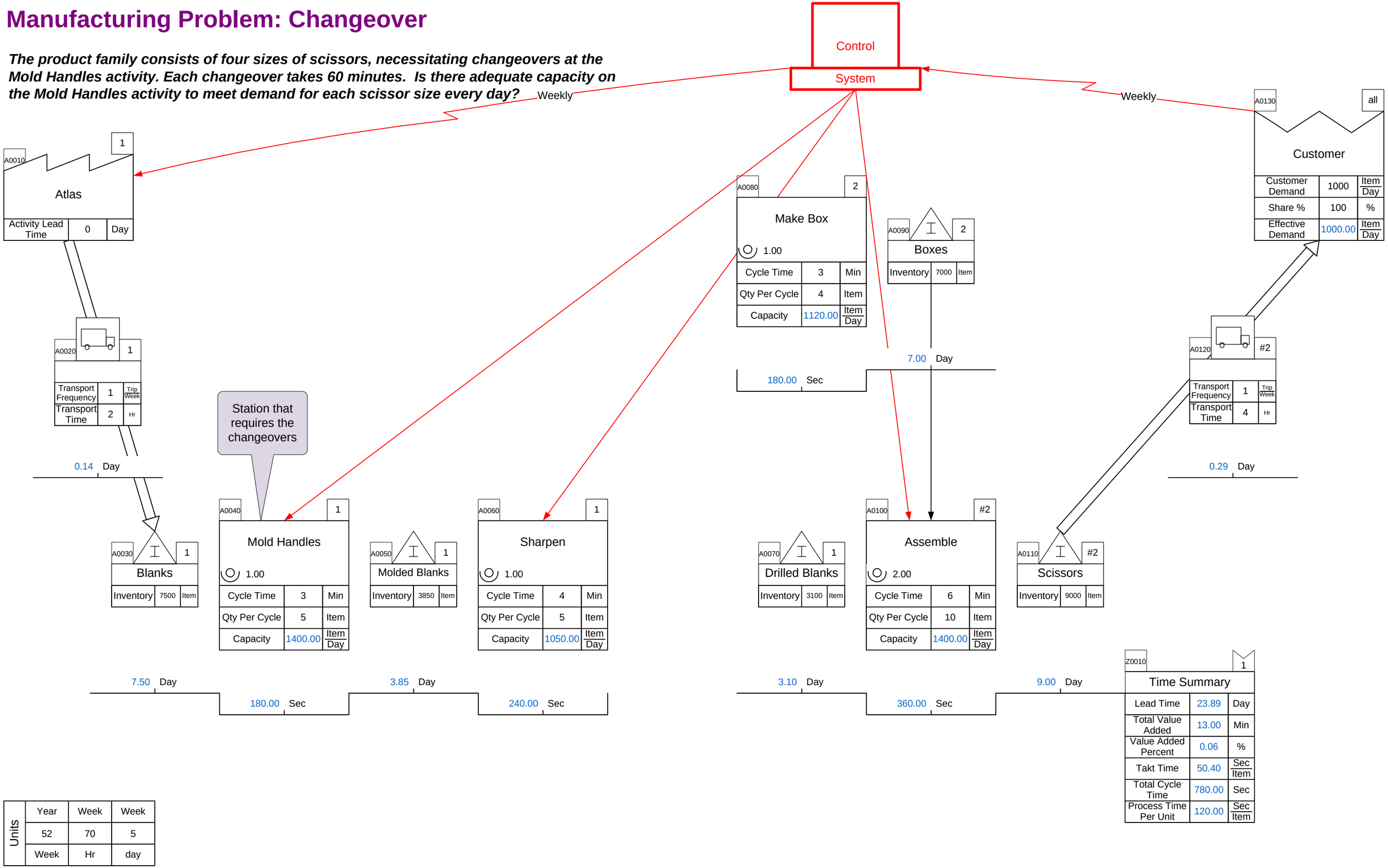
Z0010 — 1
Time Summary

| | | |
|---|---|---|
| Lead Time | 23.89 | Day |
| Total Value Added | 13.00 | Min |
| Value Added Percent | 0.06 | % |
| Takt Time | 50.40 | Sec/Item |
| Total Cycle Time | 780.00 | Sec |
| Process Time Per Unit | 96.00 | Sec/Item |

| Units | Year | Week | Week |
|---|---|---|---|
| | 52 | 70 | 5 |
| | Week | Hr | day |

# Manufacturing Problem: Changeover

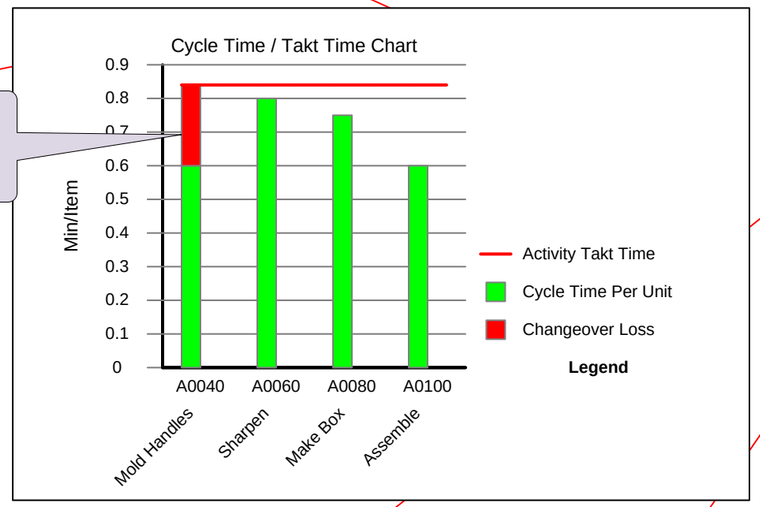
***The product family consists of four sizes of scissors, necessitating changeovers at the Mold Handles activity. Each changeover takes 60 minutes. Is there adequate capacity on the Mold Handles activity to meet demand for each scissor size every day?***




| Units | Year | Week | Week |
|---|---|---|---|
| | 52 | 70 | 5 |
| | Week | Hr | day |

# 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?***




Changeover loss for Mold Handles

## Answer:

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

Control System

Weekly

Weekly

A0010 — 1 — Atlas

| Activity Lead Time | 0 | Day |
|---|---|---|

A0020 — 1

| Transport Frequency | 1 | Trip / Week |
|---|---|---|
| Transport Time | 2 | Hr |

0.14 Day

A0030 — 1 — Blanks

| Inventory | 7500 | Item |
|---|---|---|

A0040 — 1 — Mold Handles — 1.00

| Cycle Time | 3 | Min |
|---|---|---|
| Qty Per Cycle | 5 | Item |
| Capacity | 1000.00 | Item / Day |
| Pre OEE Capacity | 1400.00 | Item / Day |
| OEE Percent | 71.43 | % |
| Changeovers | 4 | CO / Day |
| Time Per Changeover | 60 | Min / CO |

A0050 — 1 — Molded Blanks

| Inventory | 3850 | Item |
|---|---|---|

A0060 — 1 — Sharpen — 1.00

| Cycle Time | 4 | Min |
|---|---|---|
| Qty Per Cycle | 5 | Item |
| Capacity | 1050.00 | Item / Day |
| Pre OEE Capacity | 1050.00 | Item / Day |
| OEE Percent | 100.00 | % |

A0080 — 2 — Make Box — 1.00

| Cycle Time | 3 | Min |
|---|---|---|
| Qty Per Cycle | 4 | Item |
| Capacity | 1120.00 | Item / Day |
| Pre OEE Capacity | 1120.00 | Item / Day |
| OEE Percent | 100.00 | % |

A0090 — 2 — Boxes

| Inventory | 7000 | Item |
|---|---|---|

7.00 Day

180.00 Sec

A0070 — 1 — Drilled Blanks

| Inventory | 3100 | Item |
|---|---|---|

A0100 — #2 — Assemble — 2.00

| Cycle Time | 6 | Min |
|---|---|---|
| Qty Per Cycle | 10 | Item |
| Capacity | 1400.00 | Item / Day |
| Pre OEE Capacity | 1400.00 | Item / Day |
| OEE Percent | 100.00 | % |

A0110 — #2 — Scissors

| Inventory | 9000 | Item |
|---|---|---|

A0120 — #2

| Transport Frequency | 1 | Trip / Week |
|---|---|---|
| Transport Time | 4 | Hr |

0.29 Day

A0130 — all — Customer

| Customer Demand | 1000 | Item / Day |
|---|---|---|
| Share % | 100 | % |
| Effective Demand | 1000.00 | Item / Day |

| Units | Year | Week | Week |
|---|---|---|---|
| | 52 | 70 | 5 |
| | Week | Hr | day |

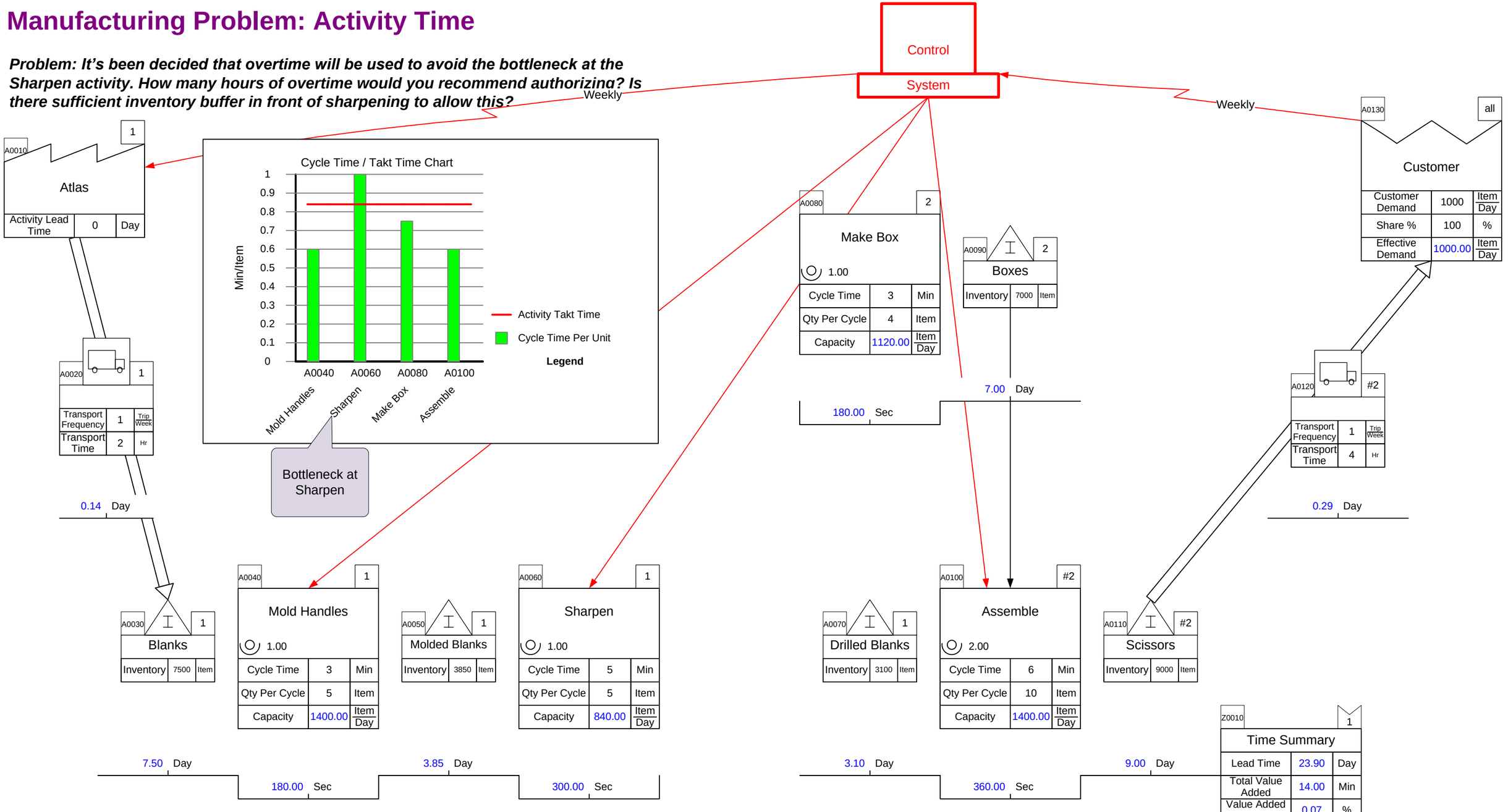
7.50 Day — 180.00 Sec — 3.85 Day — 240.00 Sec — 3.10 Day — 360.00 Sec — 9.00 Day

Z0010 — 1 — Time Summary

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

# Manufacturing Problem: Activity Time

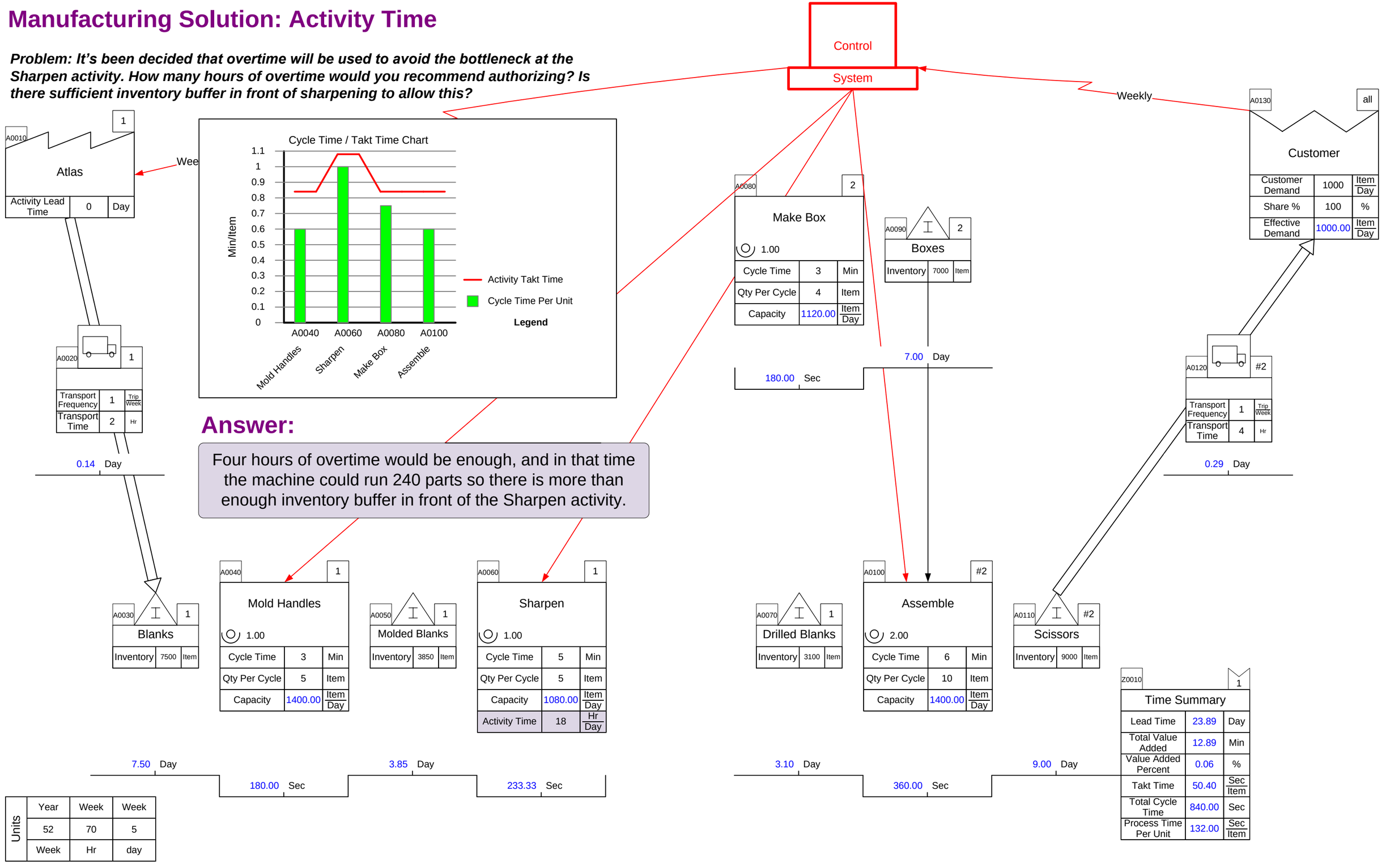
***Problem: It's been decided that overtime will be used to avoid the bottleneck at the Sharpen activity. How many hours of overtime would you recommend authorizing? Is there sufficient inventory buffer in front of sharpening to allow this?***




| Units | Year | Week | Week |
|---|---|---|---|
| | 52 | 70 | 5 |
| | Week | Hr | day |

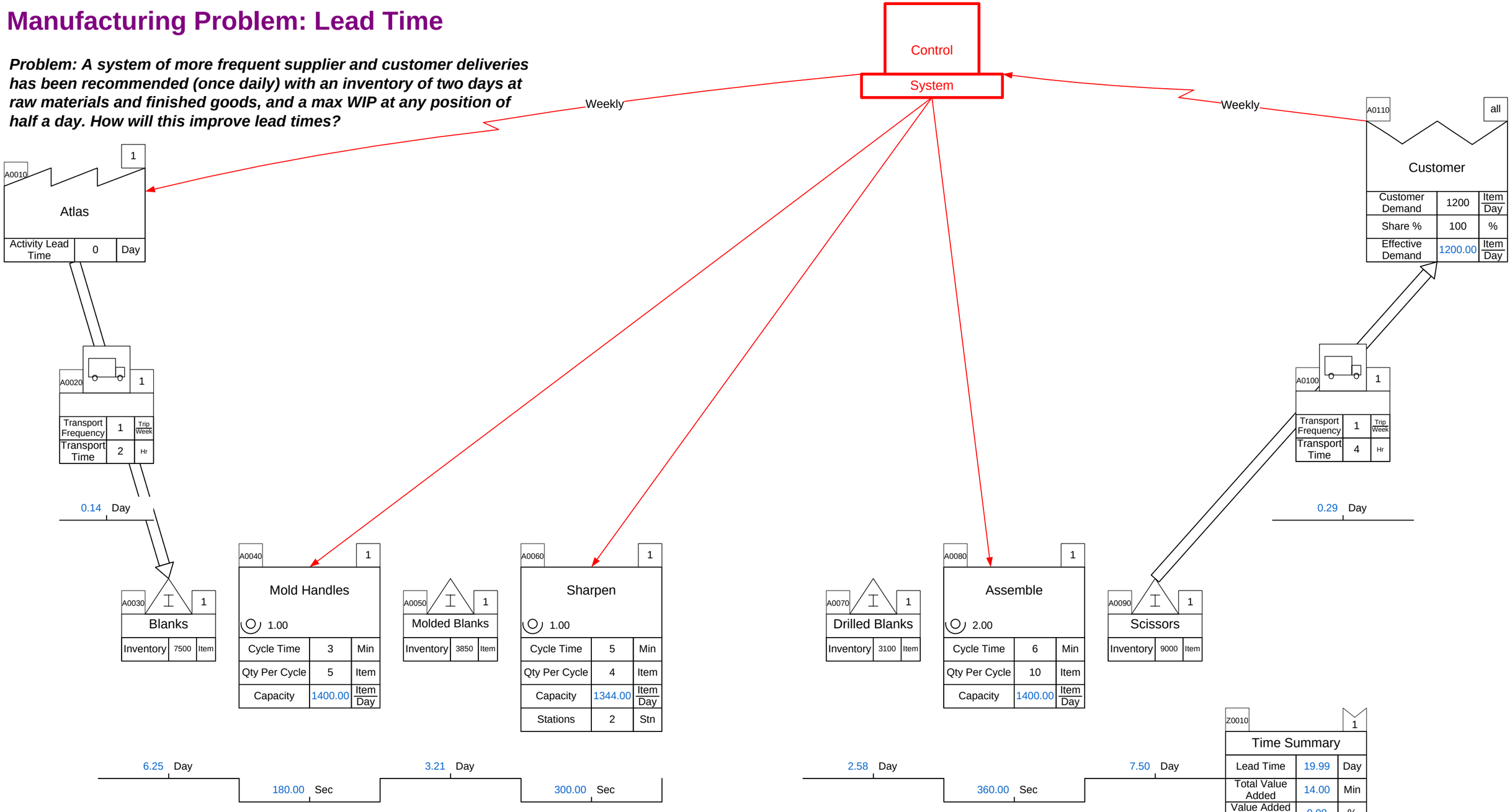
# Manufacturing Solution: Activity Time

***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?***



# 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?***



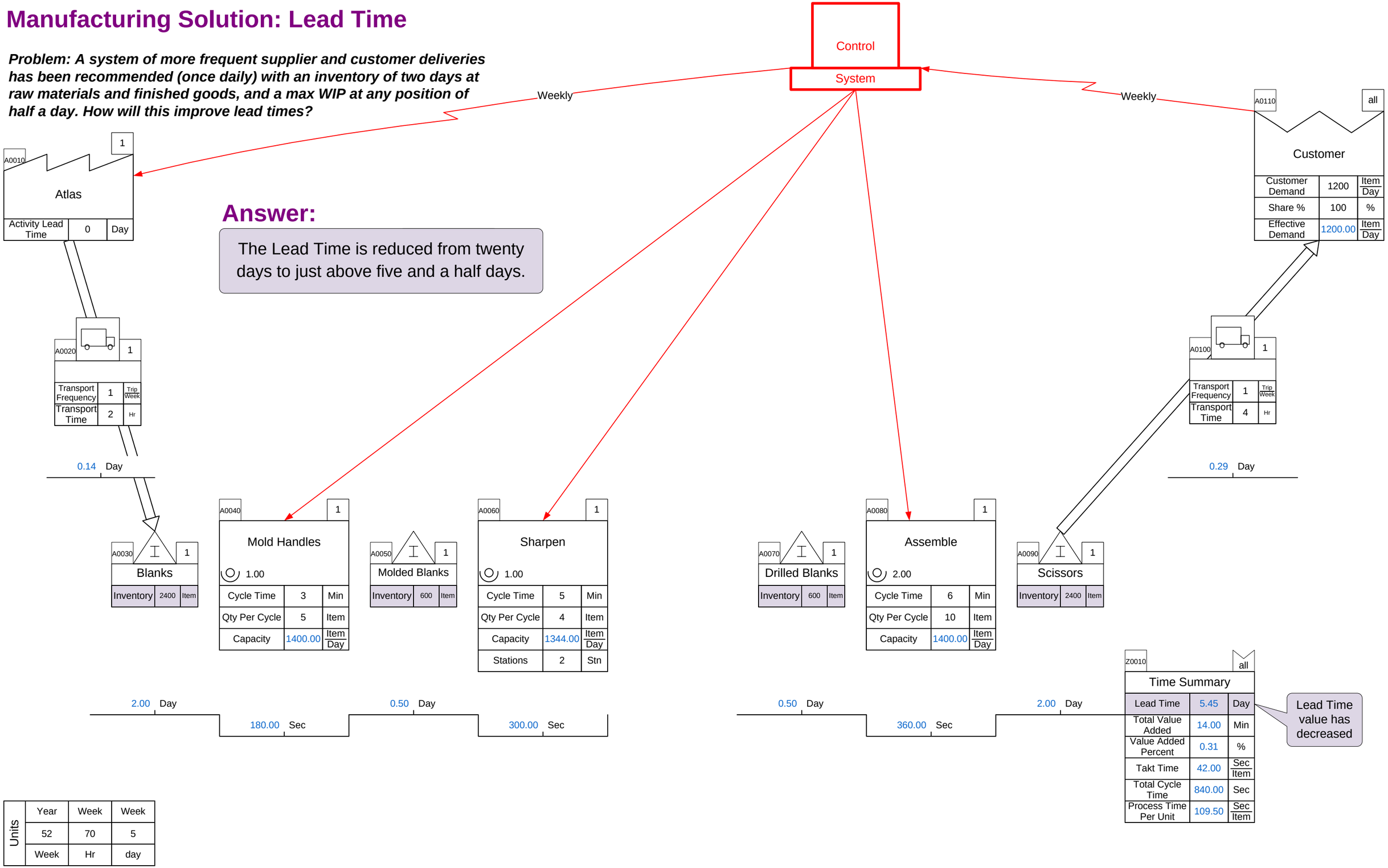

| Units | Year | Week | Week |
|---|---|---|---|
| | 52 | 70 | 5 |
| | Week | Hr | day |

# Manufacturing Solution: Lead Time

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

## Answer:

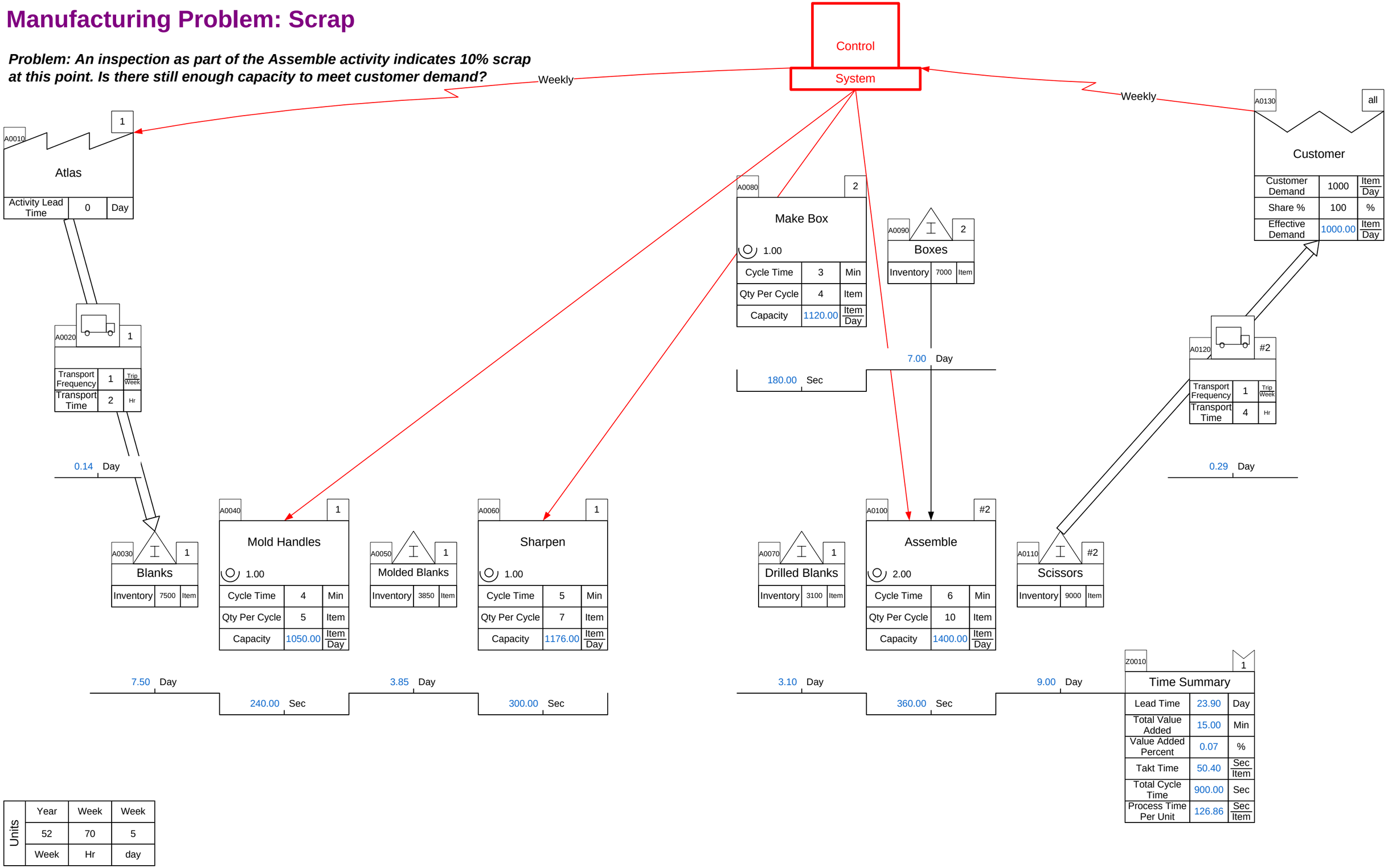
The Lead Time is reduced from twenty days to just above five and a half days.




| Units | Year | Week | Week |
|---|---|---|---|
| | 52 | 70 | 5 |
| | Week | Hr | day |

# 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 |

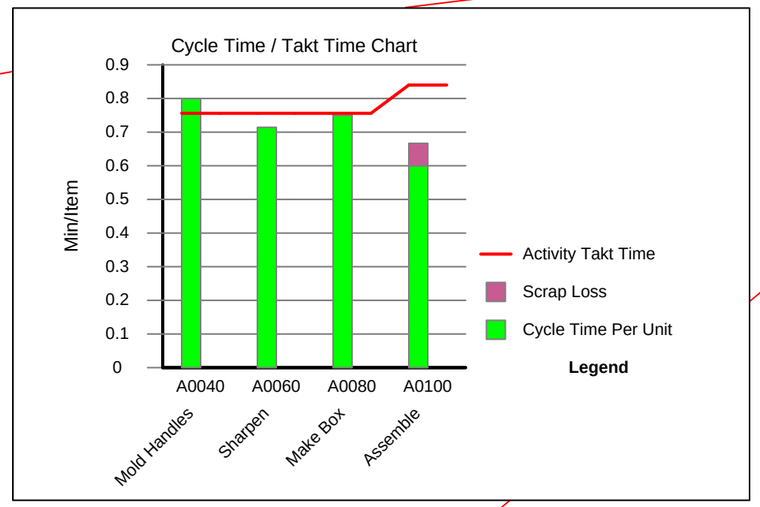
# Manufacturing Solution: Scrap

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

Control System

Weekly

Weekly




## Answer:

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

A0010 — 1
Atlas
Activity Lead Time | 0 | Day

0.14 Day

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

A0030 — 1
Blanks
Inventory | 7500 | Item

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 |

240.00 Sec

A0050 — 1
Molded Blanks
Inventory | 3850 | Item

3.85 Day

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 |

300.00 Sec

| Units | | | |
|---|---|---|---|
| | Year | We | |
| | 52 | 70 | 5 |
| | Week | Hr | day |

7.50 Day

A0080 — 2
Make Box
1.00

| | | |
|---|---|---|
| Cycle Time | 3 | Min |
| Qty Per Cycle | 4 | Item |
| Capacity | 1120.00 | Item/Day |
| Pre OEE Capacity | 1120.00 | Item/Day |
| OEE Percent | 100.00 | % |
| Activity Takt Time | 45.36 | Sec/Item |

180.00 Sec

A0090 — 2
Boxes
Inventory | 7000 | Item

7.00 Day

A0070 — 1
Drilled Blanks
Inventory | 3100 | Item

3.10 Day

A0100 — #2
Assemble
2.00

| | | |
|---|---|---|
| Cycle Time | 6 | Min |
| Qty Per Cycle | 10 | Item |
| Capacity | 1260.00 | Item/Day |
| Pre OEE Capacity | 1400.00 | Item/Day |
| OEE Percent | 90.00 | % |
| Activity Takt Time | 50.40 | Sec/Item |
| Scrap Percent | 10 | % |

360.00 Sec

A0110 — #2
Scissors
Inventory | 9000 | Item

9.00 Day

A0130 — all
Customer

| | | |
|---|---|---|
| Customer Demand | 1000 | Item/Day |
| Share % | 100 | % |
| Effective Demand | 1000.00 | Item/Day |

A0120 — #2
Transport Frequency | 1 | Trip/Week
Transport Time | 4 | Hr

0.29 Day

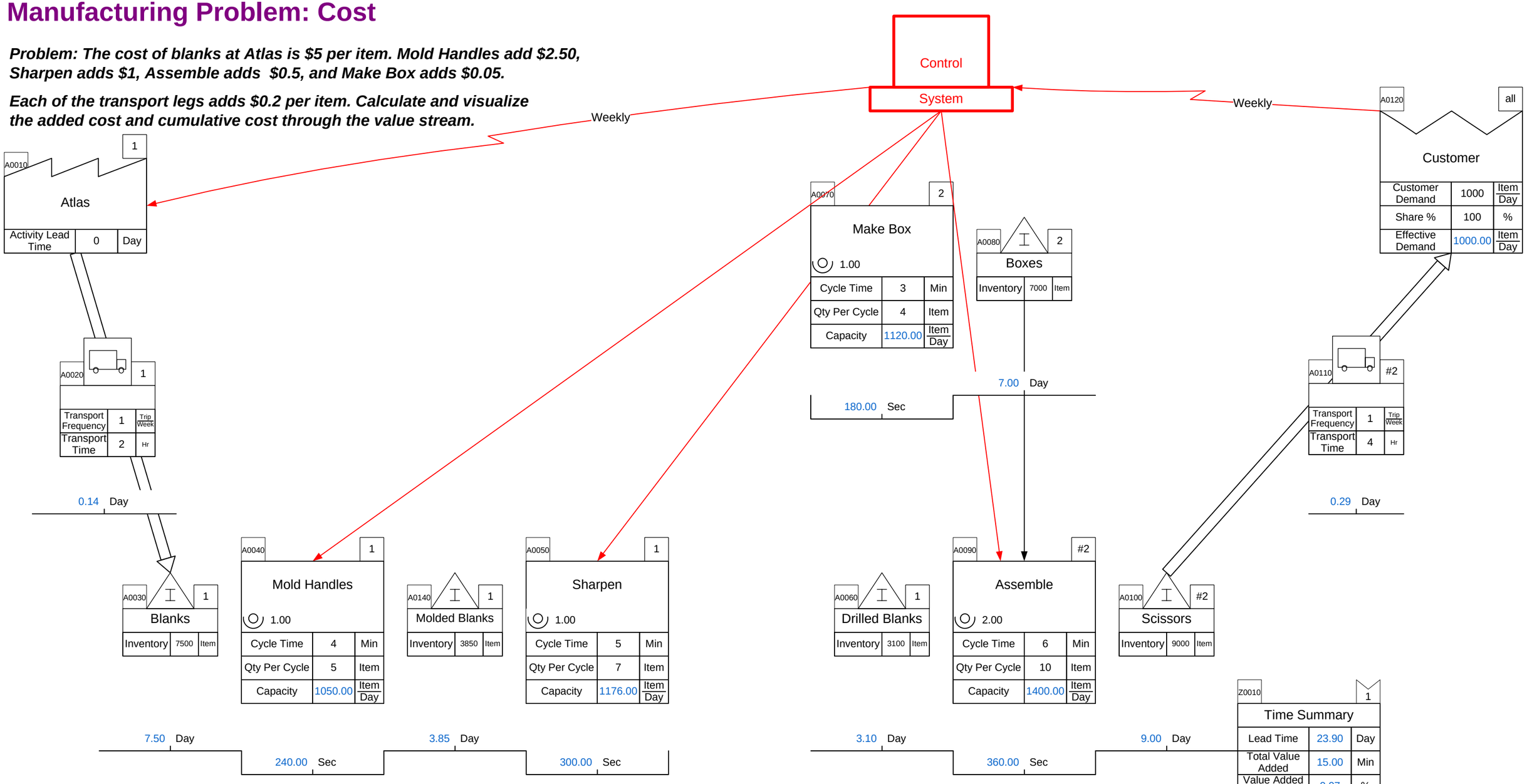
Z0010 — 1
Time Summary

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

# Manufacturing Problem: Cost

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

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

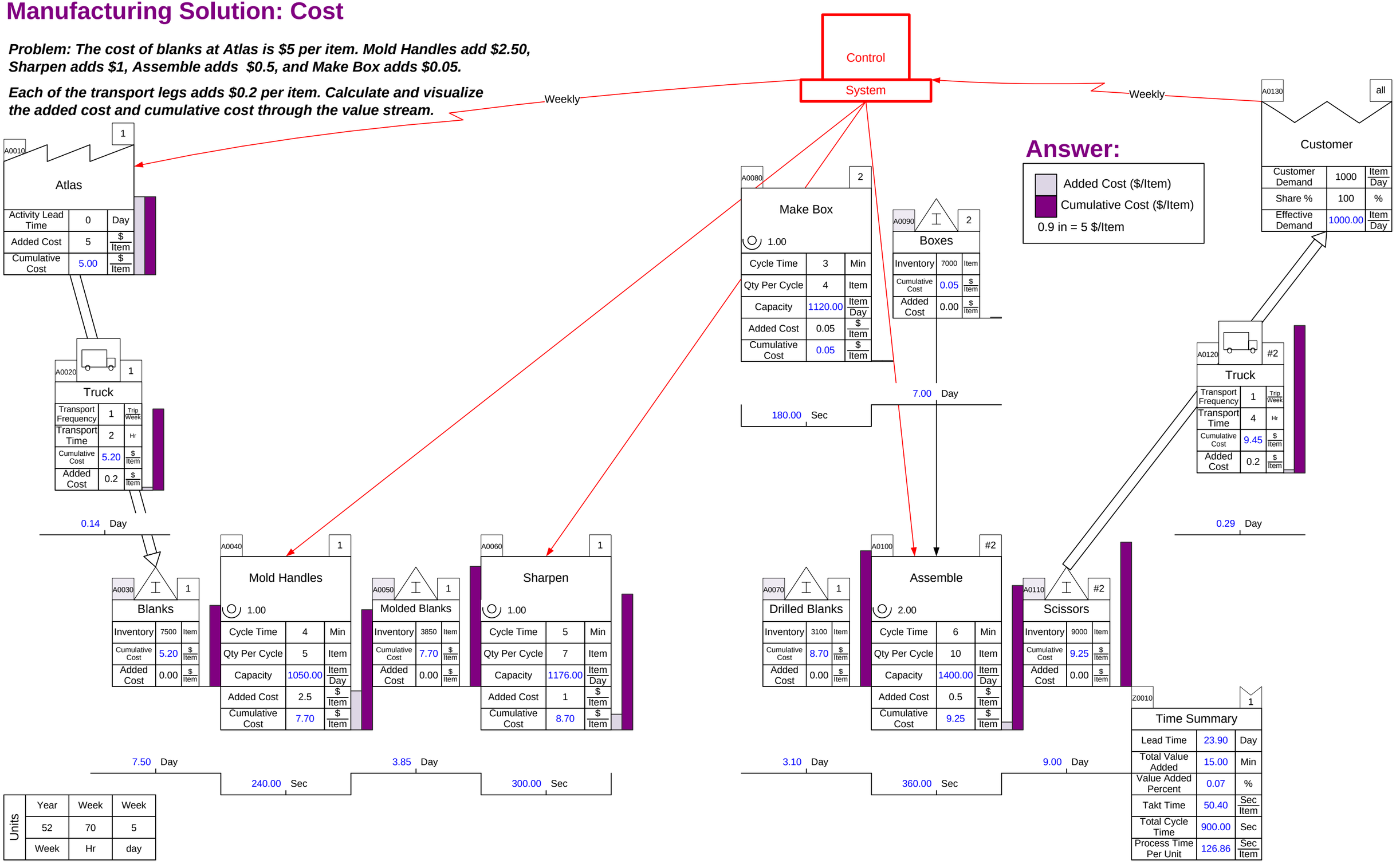



| Units | Year | Week | Week |
|---|---|---|---|
| | 52 | 70 | 5 |
| | Week | Hr | day |

# Manufacturing Solution: Cost

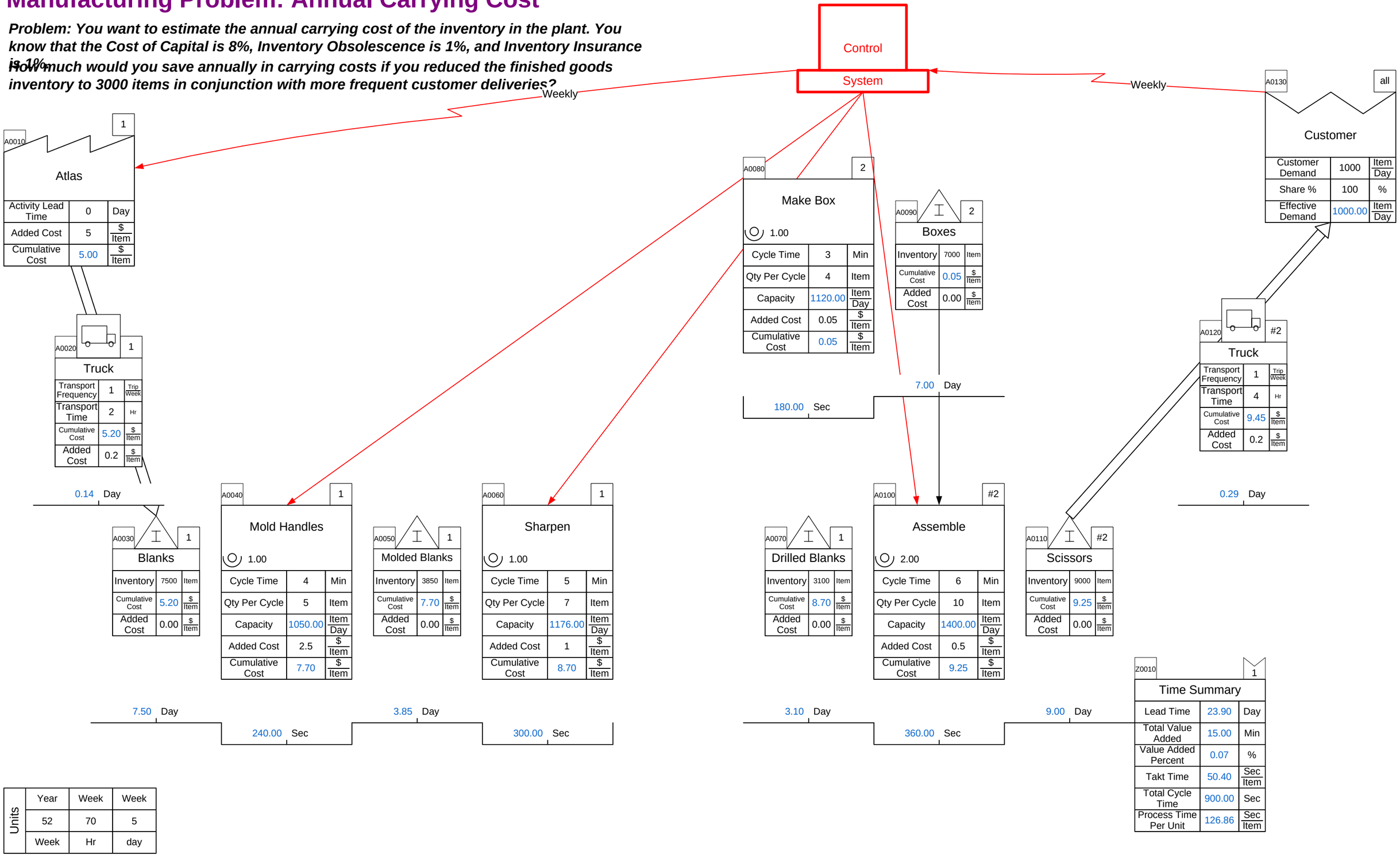
***Problem: The cost of blanks at Atlas is $5 per item. Mold Handles add $2.50, Sharpen adds $1, Assemble adds $0.5, and Make Box adds $0.05.***

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



# 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 |
|---|---|---|---|
| | 52 | 70 | 5 |
| | Week | Hr | day |

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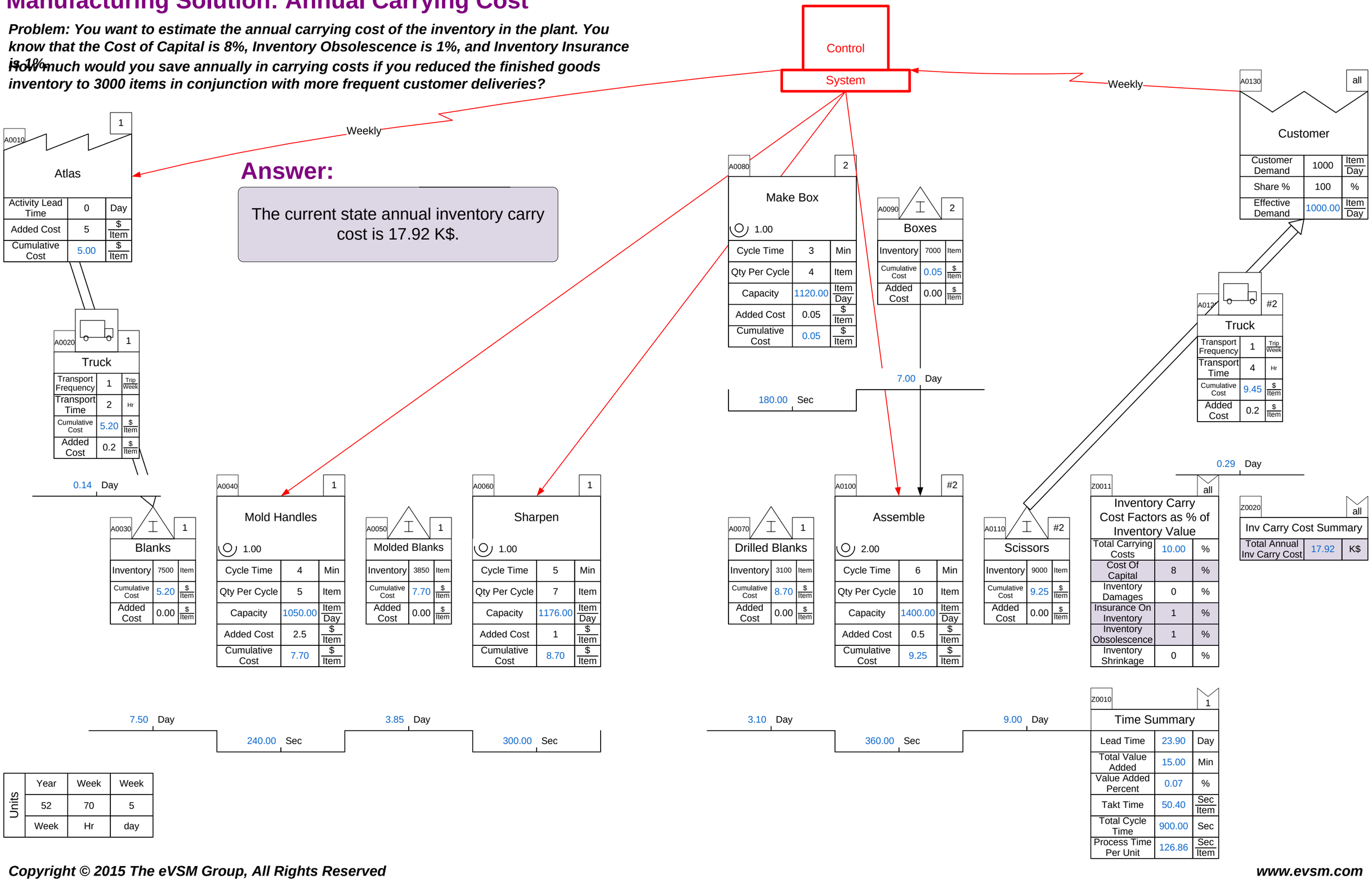
## Answer:

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



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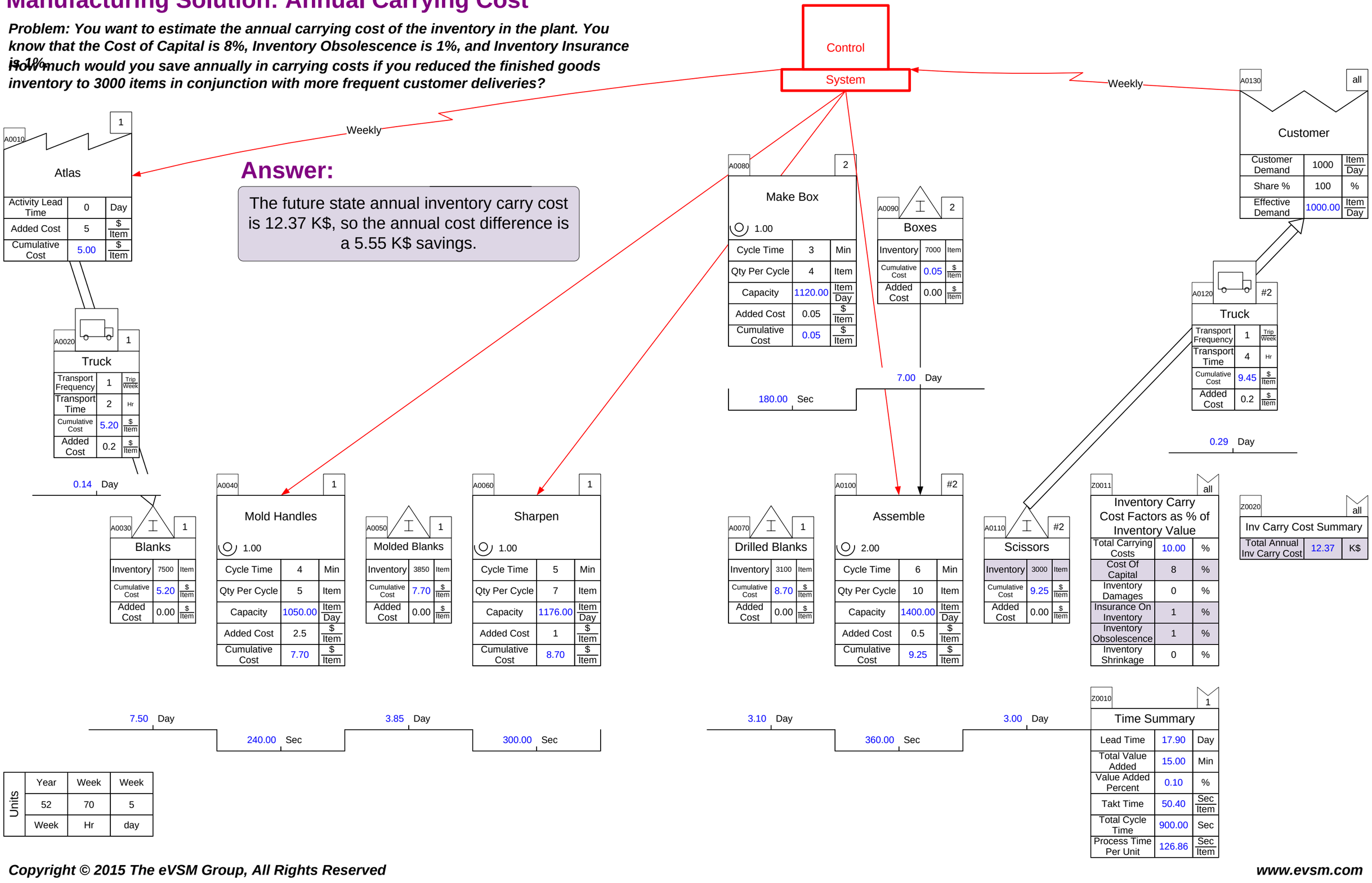
## Answer:

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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