VSM
Made Easy

Value Stream Mapping

The Current State Map

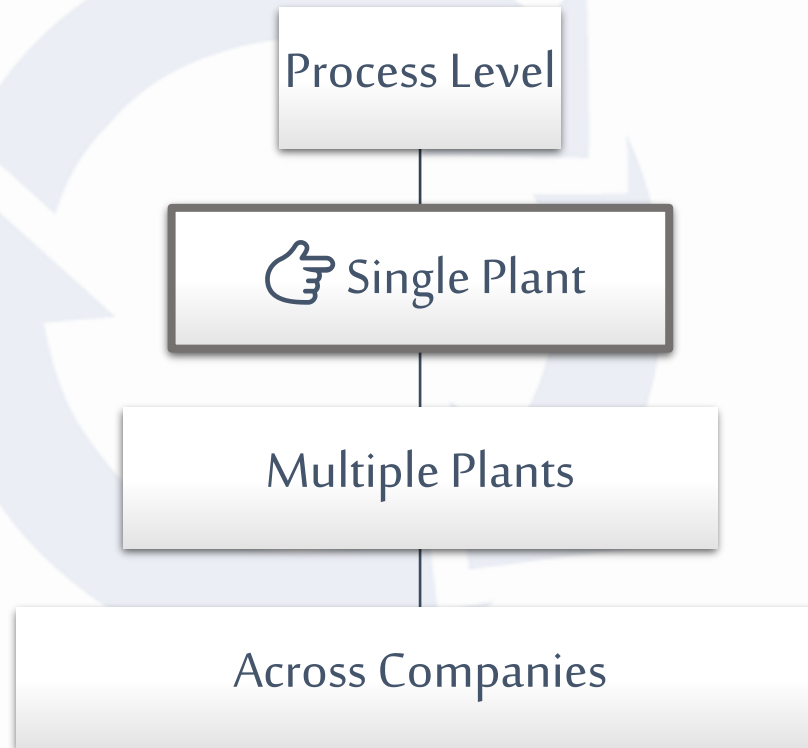| Product Family | → | **Current State Drawing** | → | Future State Drawing | → | Work Plan & Implementation |

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The Current State Map

Getting started with the Current State Map

- Developing a future state begins with an analysis of the current production situation

- This Module shows you how to create a "current state map" using a simple example factory.

- We use a set of symbols, or "icons," to represent processes and flows.

Process Level

👉 Single Plant

Multiple Plants

Across Companies

- You can develop additional icons of your own, but keep them consistent within your company so that everyone will know how to draw and understand the maps that you need to institute lean manufacturing.
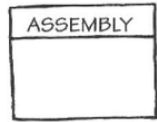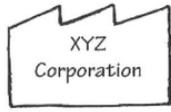
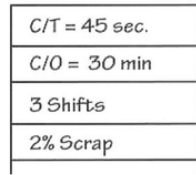# Value Stream Map Symbols – Material Flow & General Icons

MATERIAL FLOW ICONS

ASSEMBLY	XYZ Corporation	C/T = 45 sec. / C/O = 30 min / 3 Shifts / 2% Scrap	I / 300 pieces 1 Day
Manufacturing Process	Outside Sources	Data Box	Inventory

Supermarket
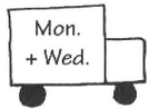
Mon. + Wed.			max. 20 pieces / —FIFO→
Truck Shipment	PUSH Arrow	Finished Goods to Customer	First-In-First-Out Sequence Flow
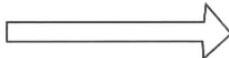
Withdrawal

GENERAL ICONS

UPTIME

CHANGEOVER

Kaizen Lightening Burst	Buffer or Safety Stock	Operator
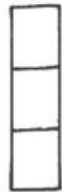
- You can develop additional icons of your own, but keep them consistent within your company so that everyone will know how to draw and understand the maps that you need to institute lean manufacturing.

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Value Stream Map Symbols – Information Flow Icons

Content

INFORMATION FLOW ICONS

Manual Information Flow

Electronic Information Flow

Weekly Schedule — Schedule

OXOX — Load Leveling

Signal Kanban

Kanban Post

Withdrawal Kanban

Production Kanban

Sequenced-Pull Ball

"Go See" Scheduling

Kanban Arriving in Batches

Source: Rother and Shook (1999)

Good to Know

- You can develop additional icons of your own, but keep them consistent within your company so that everyone will know how to draw and understand the maps that you need to institute lean manufacturing.
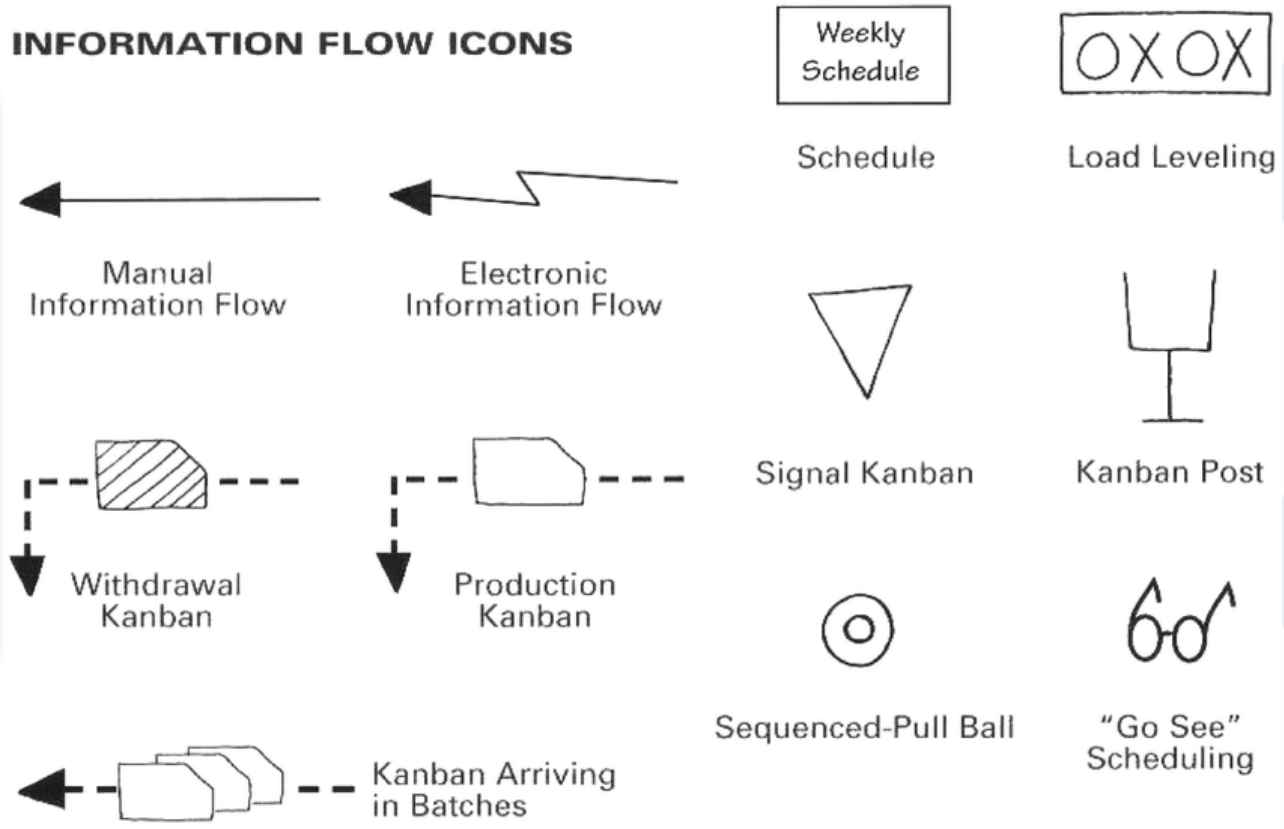
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A few Mapping tips

Content

Begin with a quick walk along the entire door-to-door value stream

Begin at the shipping end and work upstream

Bring your stopwatch and do not rely on standard times or information that you did not personally obtain

Map the whole value stream yourself
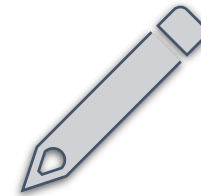
Always draw by hand in pencil
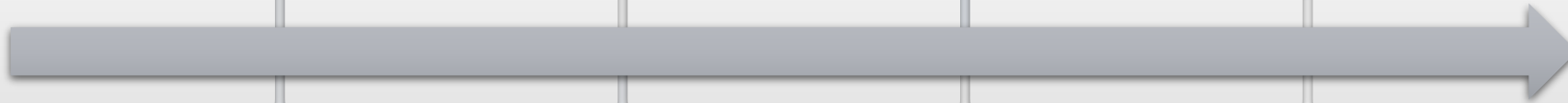
Good to Know

- Always collect current-state information while walking along the actual pathways of material and information flows yourself.

- Drawing by hand can be done without delay, while you are on the floor. As you draw you will think of further information that you need.

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Steps for Current State Map

Content

Understand Customer Requirements
- Demand Rate
- Raw Material Required

Draw The Basic Production Processes
- Cycle Time
- Uptime
- N Operators

Draw Inbound & Outbound Logistics
- Shipping from Supplier
- Shipping to Customer

Draw the Information Flow
- Manual Information Flow
- Electronic Information Flow
- External Information Flow
- Internal Information Flow

Draw the Timeline
- Cycle Times
- Waiting Times

Good to Know

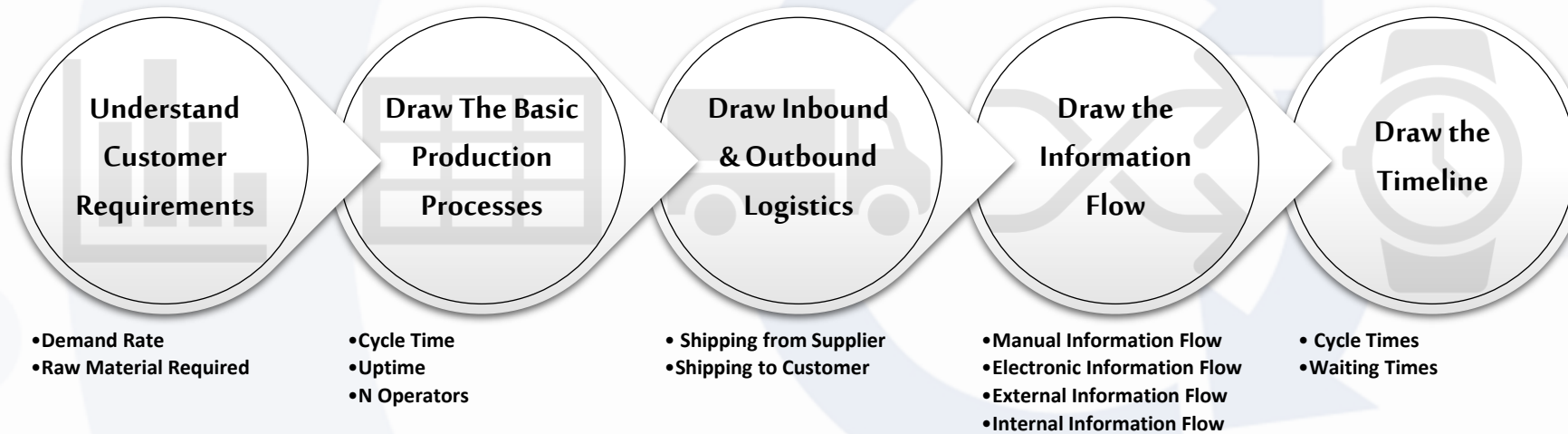- Always collect current-state information while walking along the actual pathways of material and information flows yourself.

- Drawing by hand can be done without delay, while you are on the floor. As you draw you will think of further information that you need.

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The Current State Map

Drawing Step 1 – Understand Customer Requirement

Understand Customer Requirements

Draw The Basic Production Processes

Draw Inbound & Outbound Logistics

Draw the Information Flow

Draw the Timeline

Source: Rother, M., Shook, J., & Lean Enterprise Institute. (2003). Learning to see
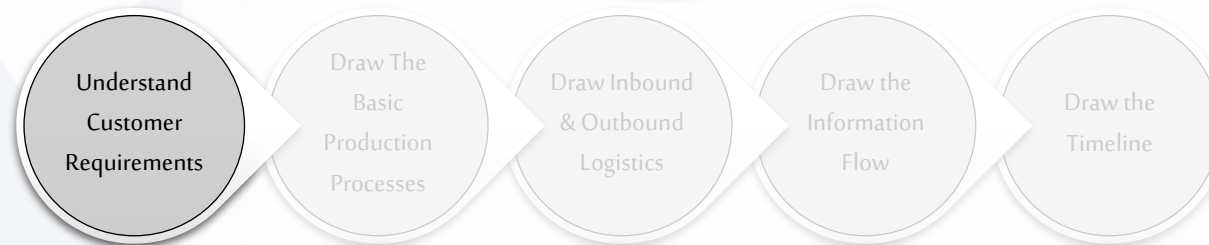
Drawing Step 1 – Understand Customer Requirement

Content

- Acme's product family to be mapped is a stamped-steel steering bracket.

- Because there is no variability in the design beyond the left-drive and right-drive versions, the **product family is very narrow** in this example.

Input	Process	Output

Acme
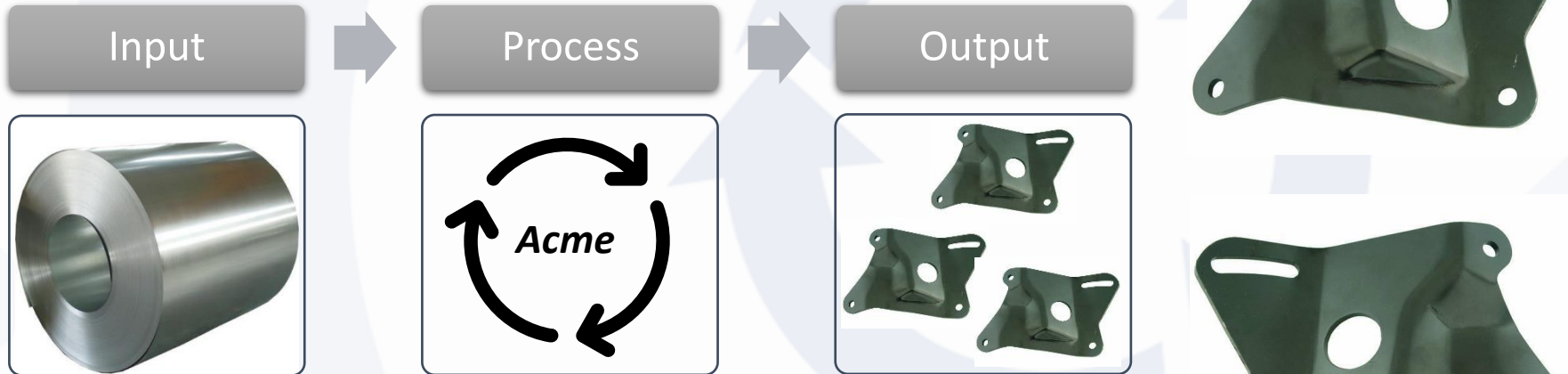
- State Street Assembly operates on **two shifts**. This customer uses **18,400 steering brackets per month** and requires daily shipments. Typically **12,000** "left-hand drive" brackets **and 6,400** "right-hand drive" are needed every month.

- State Street Assembly requests palletized returnable tray packaging with **20 brackets in a tray** and **up to 10 trays on a pallet**. The customer orders in multiples of trays, so the "pack size" is one tray of 20 parts. All of the brackets on each pallet need to be either left-drive or right-drive style

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Drawing Step 1 – Understand Customer Requirement

Content

- CUSTOMER REQUIREMENTS :
  - 18,400 pieces per month
  - 12,000 per month of Type "LH" 6,400 per month of Type "RH"
  - Customer plant operates on two shifts
  - Palletized returnable tray packaging with 20 brackets in a tray and up to 10 trays on a pallet. The customer orders in multiples of trays.
  - One daily shipment to the assembly plant by truck

- WORK TIME :
  - 20 days in a month
  - Two shift operation in all production departments
  - Eight (8) hours every shift, with overtime if necessary
  - Two 10-minute breaks during each shift Manual processes stop during breaks
  - Unpaid lunch

- ACME PRODUCTION CONTROL DEPARTMENT :
  - Receives State Street's 90/60/30-day forecasts and enters them to MRP
  - Issues Acme 6-week forecast to Michigan Steel Co. via MRP
  - Secures coil steel by weekly faxed order release to Michigan Steel Co.
  - Receives daily firm order from State Street
  - Generates MRP-based weekly departmental requirements based upon customer order, WIP inventory levels, F/G inventory levels, and anticipated scrap and downtime
  - Issues weekly build schedules to Stamping, Welding, and Assembly processes
  - Issues daily shipping schedule to Shipping Department

Good to Know

- Always collect current-state information while walking along the actual pathways of material and information flows yourself.
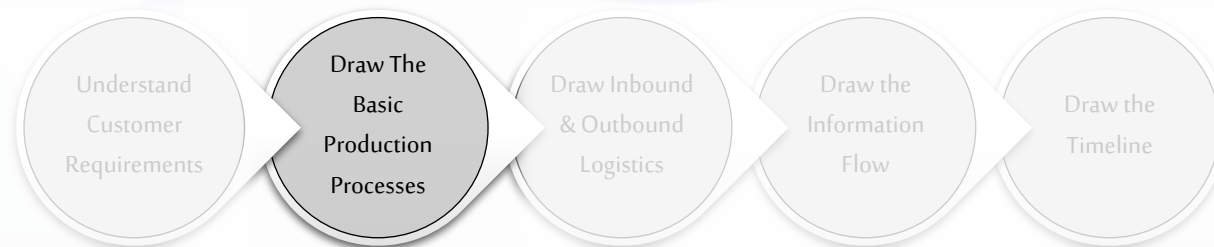
Trainer

State Street Assembly

18,400 pcs/mo
–12,000 "L"
– 6,400 "R"

Tray = 20 pieces

2 Shifts

First View of the Current-State Map Showing the Customer

Drawing Step 2 – Draw The Basic Production Processes

Content

- Since drawing one box for every single processing step would make the map unwieldy, we **use the process box to indicate one area of material flow**, ideally a continuous flow.
  - For example, an assembly process with **several connected workstations**, even if there is some WIP inventory between stations, **would be drawn as one process box**. But if one assembly process is disconnected from the next assembly process downstream, with inventory stagnating, accumulating, and being moved in batches between them, then two process boxes would be used.
  - Likewise, a **machining line of say 15 sequential machining operations, such as drilling,** tapping, etc., that are connected by a transfer line between each operation would be shown with **only one process box** on the door-to-door map, even if some inventory accumulates between machines.

- Material flow is drawn from **left to right** on the bottom half of the map in the order of processing steps; **not according to the physical layout of the plant.**

ASSEMBLY

Manufacturing Process

| C/T = 45 sec. |
| C/O = 30 min |
| 3 Shifts |
| 2% Scrap |

Data Box

△ I

300 pieces
1 Day

Inventory
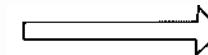
Finished Goods
to Customer

Good to Know

- The general rule of thumb for the door-to-door map is that a process box indicates a process in which the material is flowing.

Trainer

Drawing Step 2 – Draw The Basic Production Processes

Content

- As you walk this flow on the shop floor, you need to **collect data** that is **important** for deciding what the future state will be. So a **data box** is drawn under each process box.

- To help you get started here is a list of typical process data:

C/T (cycle time)	C/O (changeover time)	Uptime (on-demand machine uptime)	EPE (production batch sizes)	number of operators

number of product variations	pack size	working time (minus breaks)	scrap rate

ASSEMBLY

Manufacturing Process

| C/T = 45 sec. |
| C/O = 30 min |
| 3 Shifts |
| 2% Scrap |

Data Box

I

300 pieces
1 Day

Inventory

Finished Goods
to Customer

Good to Know

- Many value streams have multiple flows that merge. Draw such flows over one another as shown here. But don't try to draw every branch if there are too many. Choose the key components first and get the others later if you need to.
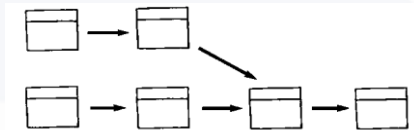
Trainer

Drawing Step 2 – Draw The Basic Production Processes

Content

- At Acme Stamping, we have the following information to record in the data box under each processing step:
  - The **cycle time** (time that elapses between one part coming off the process to the next part coming off, in seconds);
  - The **changeover time** to switch from producing one product type to another (in this case switching between left-drive and right-drive brackets);
  - The **number of people** required to operate the process;
  - The **available working time** per shift at that process (in seconds, minus break, meeting, and cleanup times); and machine **uptime** information.
  - Available work time divided by cycle time multiplied by uptime percent is a measure of **current process capacity**, if no changeovers are made.

- In the "stamping" data box we also show EPE, which stands for "every part every _____" and is a measure of production batch size in a Time Unit. For example, if you change over to produce a particular part once every three days, then the production batch size is about three days worth of parts.

- Use a "**warning triangle**" icon to capture the location and amount of inventory.
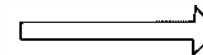
ASSEMBLY

Manufacturing Process

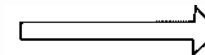| C/T = 45 sec. |
| C/O = 30 min |
| 3 Shifts |
| 2% Scrap |

Data Box

300 pieces
1 Day

Inventory

Finished Goods
to Customer

Good to Know

- Value stream mapping uses seconds as the time unit for cycle times, takt times, and available working times.

- The **cycle time** is the time between parts coming off the end of the process and not the total cycle time it takes one part to move through all process steps.

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Drawing Step 2 – Draw The Basic Production Processes

Content

1. STAMPING (The press makes parts for many Acme products)

- Automated 200 Ton press with coil (automatic material feed)
- Cycle Time: 1 second (60 pieces per minute)
- Changeover time: 1 hour (good piece to good piece)
- Machine reliability: 85%
- Observed Inventory:
  - 5 days of coils before stamping
  - 4,600 pieces of Type "LH" finished stampings 2,400 pieces of Type "RH" finished stampings

2. SPOT-WELD WORKSTATION I (dedicated to this product family)

- Manual process with one operator
- Cycle Time: 39 seconds
- Changeover time: 10 minutes (fixture change)
- Reliability: 100%
- Observed Inventory:
  - 1,100 pieces of Type "LH" 600 pieces of Type "RH"

3. SPOT-WELD WORKSTATION II (dedicated to this product family)

- Manual process with one operator
- Cycle Time: 46 seconds
- Changeover time: 10 minutes (fixture change)
- Reliability: 80%
- Observed Inventory:
  - 1,600 pieces of Type "LH"
  - 850 pieces of Type "RH"

4. ASSEMBLY WORKSTATION I (dedicated to this product family)

- Manual process with one operator
- Cycle Time: 62 seconds
- Changeover time: none
- Reliability: 100%
- Observed inventory:
  - 1,200 pieces of Type "LH" 640 pieces of Type "RH"

5. ASSEMBLY WORKSTATION II (dedicated to this product family) Manual process with one operator

- Cycle Time: 40 seconds
- Changeover time: none
- Reliability: 100%
- Observed Finished-Goods Inventory in Warehouse:
  - 2,700 pieces of Type "LH" 1,440 pieces of Type "RH"

6. SHIPPING DEPARTMENT

- Removes parts from finished goods warehouse and stages them for truck shipment to customer

Good to Know

- Always collect current-state information while walking along the actual pathways of material and information flows yourself.

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State Street Assembly

18,400 pcs/mo
–12,000 "L"
– 6,400 "R"

Tray = 20 pieces

2 Shifts

1. STAMPING (The press makes parts for many Acme products)

- Automated 200 Ton press with coil (automatic material feed)
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- Machine reliability: 85%
- Observed Inventory:
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  - 4,600 pieces of Type "LH" finished stampings 2,400 pieces of Type "RH" finished stampings

Second View of the Current-State Map with all Processes, Data Boxes, and Inventory Triangles

State Street Assembly

18,400 pcs/mo
–12,000 "L"
– 6,400 "R"
Tray = 20 pieces
2 Shifts

Coils
5 days

STAMPING

200 T

| C/T = 1 second |
| C/O = 1 hour |
| Uptime = 85% |
| 27,600 sec. avail. |
| EPE = 2 weeks |

Second View of the Current-State Map with all Processes, Data Boxes, and Inventory Triangles

State Street Assembly

18,400 pcs/mo
~12,000 "L"
~ 6,400 "R"
Tray = 20 pieces
2 Shifts

Coils 5 days	STAMPING 200 T	4600 L 2400 R	S. WELD #1 ⊙1	1100 L 600 R	S. WELD #2 ⊙1	1600 L 850 R	ASSEMBLY #1 ⊙1	1200 L 640 R	ASSEMBLY #2 ⊙1	2700 L 1440 R	SHIPPING Staging

STAMPING	S. WELD #1	S. WELD #2	ASSEMBLY #1	ASSEMBLY #2
C/T = 1 second	C/T = 39 seconds	C/T = 46 seconds	C/T = 62 seconds	C/T = 40 seconds
C/O = 1 hour	C/O = 10 minutes	C/O = 10 minutes	C/O = Ø	C/O = Ø
Uptime = 85%	Uptime = 100%	Uptime = 80%	Uptime = 100%	Uptime = 100%
27,600 sec. avail.	2 Shifts	2 Shifts	2 Shifts	2 Shifts
EPE = 2 weeks	27,600 sec. avail.	27,600 sec. avail.	27,600 sec. avail.	27,600 sec. avail.

Second View of the Current-State Map with all Processes, Data Boxes, and Inventory Triangles

State Street Assembly

18,400 pcs/mo
–12,000 "L"
– 6,400 "R"
Tray = 20 pieces
2 Shifts

	STAMPING		S. WELD #1		S. WELD #2		ASSEMBLY #1		ASSEMBLY #2		SHIPPING
Coils 5 days	200 T	4600 L 2400 R	☺1	1100 L 600 R	☺1	1600 L 850 R	☺1	1200 L 640 R	☺1	2700 L 1440 R	Staging

STAMPING	S. WELD #1	S. WELD #2	ASSEMBLY #1	ASSEMBLY #2
C/T = 1 second	C/T = 39 seconds	C/T = 46 seconds	C/T = 62 seconds	C/T = 40 seconds
C/O = 1 hour	C/O = 10 minutes	C/O = 10 minutes	C/O = Ø	C/O = Ø
Uptime = 85%	Uptime = 100%	Uptime = 80%	Uptime = 100%	Uptime = 100%
27,600 sec. avail.	2 Shifts	2 Shifts	2 Shifts	2 Shifts
EPE = 2 weeks	27,600 sec. avail.	27,600 sec. avail.	27,600 sec. avail.	27,600 sec. avail.

Second View of the Current-State Map with all Processes, Data Boxes, and Inventory Triangles

Drawing Step 3 – Draw Inbound & Outbound Logistics

Content

Outbound Logistics (Right Side)

- After Acme's last assembly workstation, steering brackets in trays are taken to a storage area (triangle icon). They are then staged in the shipping area according to the daily shipping schedule and **delivered daily** by truck to the customer's assembly plant.

- A **truck** icon and a **broad arrow** indicate movement of finished goods to the customer. (Create rail or air freight icons if you need them.)
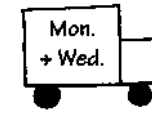
Inbound Logistics (Left Side)

- We'll represent the steel supplier with another factory icon.

- We use the same truck icon and broad arrow to show movement of material from the supplier to Acme.

- The steel supplier receives a weekly order from Acme and ships twice a week.

- We record in a **data box** that the supplier's pack size is a 500 foot roll of coiled steel. (In other words, the supplier cannot deliver less than a full coil but can deliver any number of full coils, as requested.)

- Do not map every purchased part in your product family. Just draw the flow for one or two main raw materials.
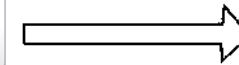
Mon.
+ Wed.

Truck
Shipment

Finished Goods
to Customer

Good to Know

- Value stream mapping uses seconds as the time unit for cycle times, takt times, and available working times.

Trainer

State Street Assembly

18,400 pcs/mo
–12,000 "L"
– 6,400 "R"

Tray = 20 pieces

2 Shifts

	STAMPING			S. WELD #1			S. WELD #2			ASSEMBLY #1			ASSEMBLY #2			SHIPPING
Coils 5 days	200 T	4600 L 2400 R		1	1100 L 600 R		1	1600 L 850 R		1	1200 L 640 R		1	2700 L 1440 R		Staging

STAMPING	S. WELD #1	S. WELD #2	ASSEMBLY #1	ASSEMBLY #2
C/T = 1 second	C/T = 39 seconds	C/T = 46 seconds	C/T = 62 seconds	C/T = 40 seconds
C/O = 1 hour	C/O = 10 minutes	C/O = 10 minutes	C/O = Ø	C/O = Ø
Uptime = 85%	Uptime = 100%	Uptime = 80%	Uptime = 100%	Uptime = 100%
27,600 sec. avail.	2 Shifts	2 Shifts	2 Shifts	2 Shifts
EPE = 2 weeks	27,600 sec. avail.	27,600 sec. avail.	27,600 sec. avail.	27,600 sec. avail.

Third View of the Current-State Map Showing Supplier and the Inbound & Outbound Logistics

The Current State Map

Drawing Step 4 – Draw the Information Flow

Understand Customer Requirements

Draw The Basic Production Processes

Draw Inbound & Outbound Logistics

Draw the Information Flow
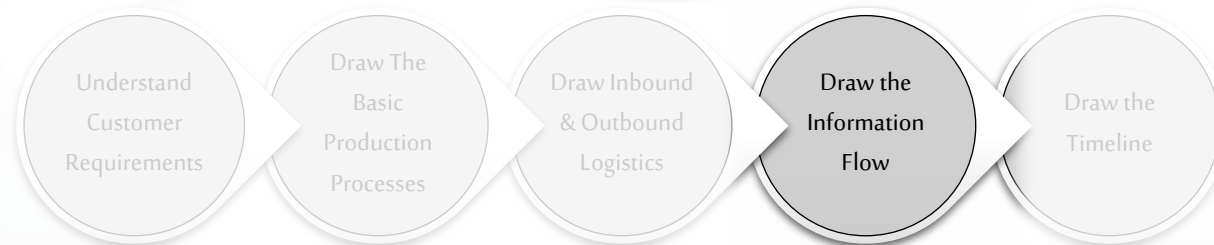
Draw the Timeline

Drawing Step 4 – Draw the Information Flow

- The Acme production control department is drawn with a process box, including the note that Acme uses a computerized Materials Requirements Planning system (MRP) to schedule the shop floor.

- Acme production control **collects information** from **customers** and the **shop floor**, consolidates and processes it, and sends specific **instructions** to each **manufacturing process** about what it should produce and when.

- Production control also sends a **daily shipping schedule** to the shipping department.

Manual
Information Flow

Electronic
Information Flow

Weekly
Schedule
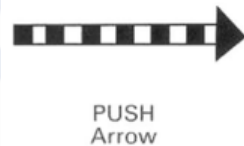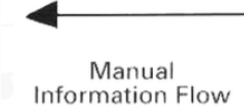
Schedule

PUSH
Arrow

- When scheduling is based on actual observation and adjustment, We call this "go see" scheduling and show it with an eyeglass icon.

"go see"
scheduling

Drawing Step 4 – Draw the Information Flow

- Information flow is drawn from **right to left** in the top half of the map space.

- In our Acme Stamping example, we draw the flow of information back from the State Street Assembly Plant to Acme's Production Control department and from there to Acme's steel-coil supplier.

- Notice there are separate line for the forecasts and daily orders, as these are different information flows.

Manual Information Flow

Electronic Information Flow

Weekly Schedule

Schedule

PUSH Arrow

ACME PRODUCTION CONTROL DEPARTMENT

- Receives State Street's 90/60/30-day forecasts and enters them to MRP
- Issues Acme 6-week forecast to Michigan Steel Co. via MRP
- Secures coil steel by weekly faxed order release to Michigan Steel Co.
- Receives daily firm order from State Street
- Generates MRP-based weekly departmental requirements based upon customer order, WIP inventory levels, F/G inventory levels, and anticipated scrap and downtime
- Issues weekly build schedules to Stamping, Welding, and Assembly processes
- Issues daily shipping schedule to Shipping Department
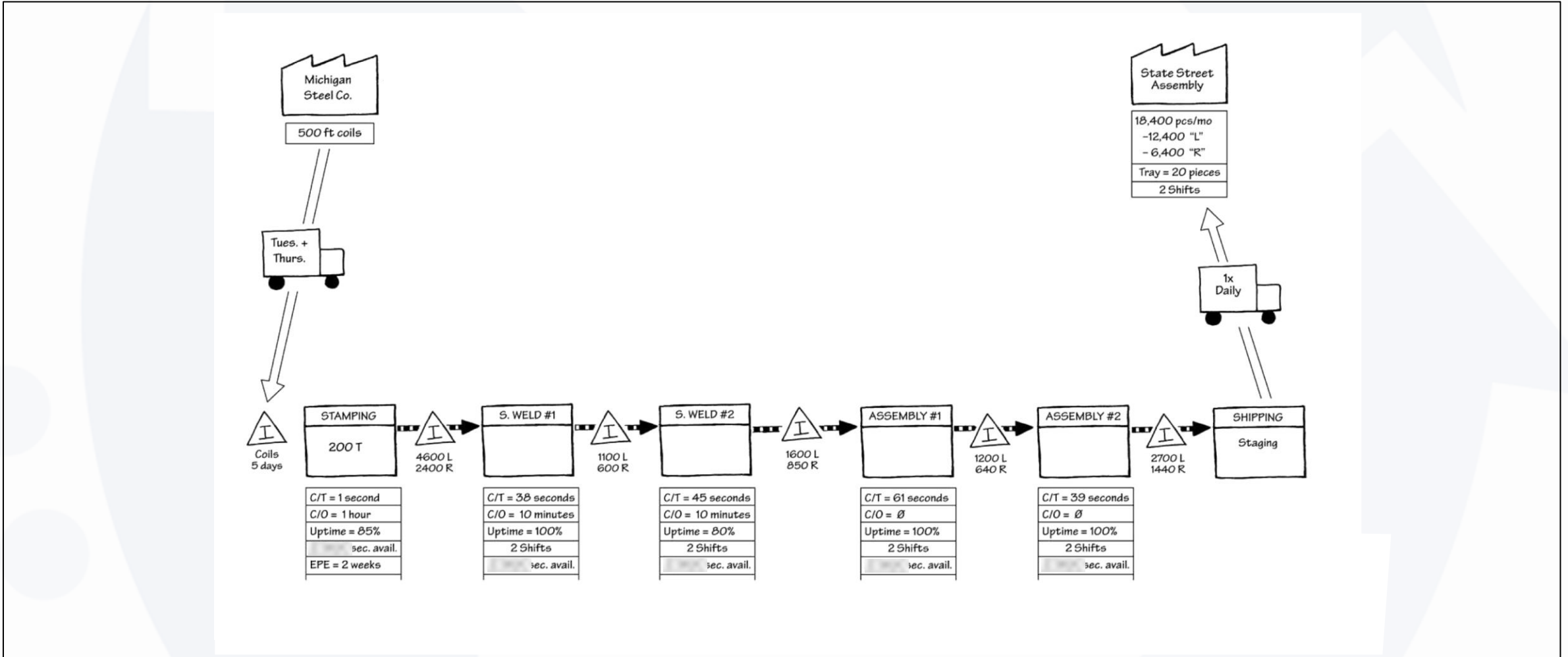
- When scheduling is based on actual observation and adjustment, We call this "go see" scheduling and show it with an eyeglass icon.

"go see" scheduling

Michigan Steel Co.

500 ft coils

Tues. + Thurs.

State Street Assembly

18,400 pcs/mo
– 12,400 "L"
– 6,400 "R"
Tray = 20 pieces
2 Shifts

1x Daily

Coils
5 days

STAMPING		S. WELD #1		S. WELD #2		ASSEMBLY #1		ASSEMBLY #2		SHIPPING
200 T										Staging

4600 L
2400 R

1100 L
600 R

1600 L
850 R

1200 L
640 R

2700 L
1440 R

STAMPING	S. WELD #1	S. WELD #2	ASSEMBLY #1	ASSEMBLY #2
C/T = 1 second	C/T = 38 seconds	C/T = 45 seconds	C/T = 61 seconds	C/T = 39 seconds
C/O = 1 hour	C/O = 10 minutes	C/O = 10 minutes	C/O = Ø	C/O = Ø
Uptime = 85%	Uptime = 100%	Uptime = 80%	Uptime = 100%	Uptime = 100%
sec. avail.	2 Shifts	2 Shifts	2 Shifts	2 Shifts
EPE = 2 weeks	sec. avail.	sec. avail.	sec. avail.	sec. avail.

**Fourth View of the Current-State Map with Information Flows & Push Arrows**

Drawing Step 5 – Draw the Timeline

- With the data from observation of current operations drawn or recorded on the map, we can summarize the current condition of this value stream.

- Draw a timeline under the **process boxes** and inventory triangles to compile the **production lead time**, which is the time it takes one part to make its way through the shop floor, beginning with arrival as raw material through to shipment to the customer.

- **Lead times (in days)** = $\dfrac{\text{inventory quantity}}{\text{daily customer requirement}}$.

- Add only the value-adding times or the processing times, for each process in the value stream.

- The total processing time involved in making **one piece is only 184** seconds, whereas that piece takes **23.6 days to make its way through the plant**.
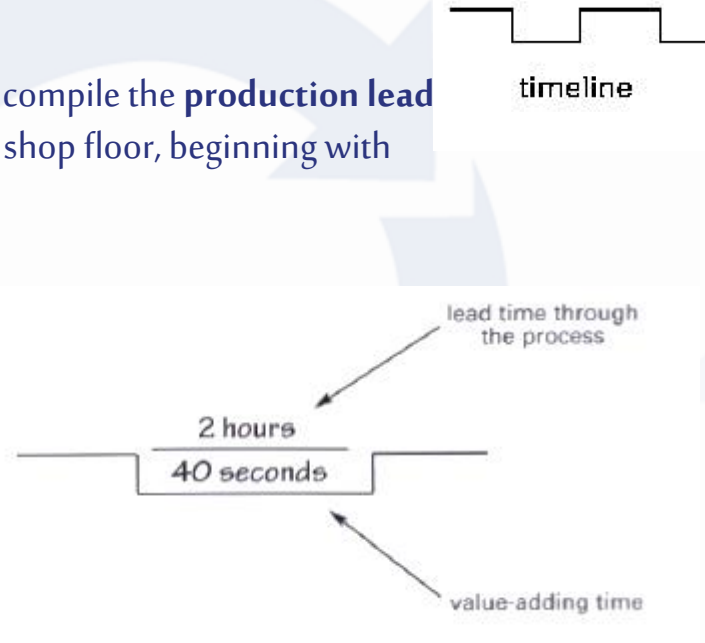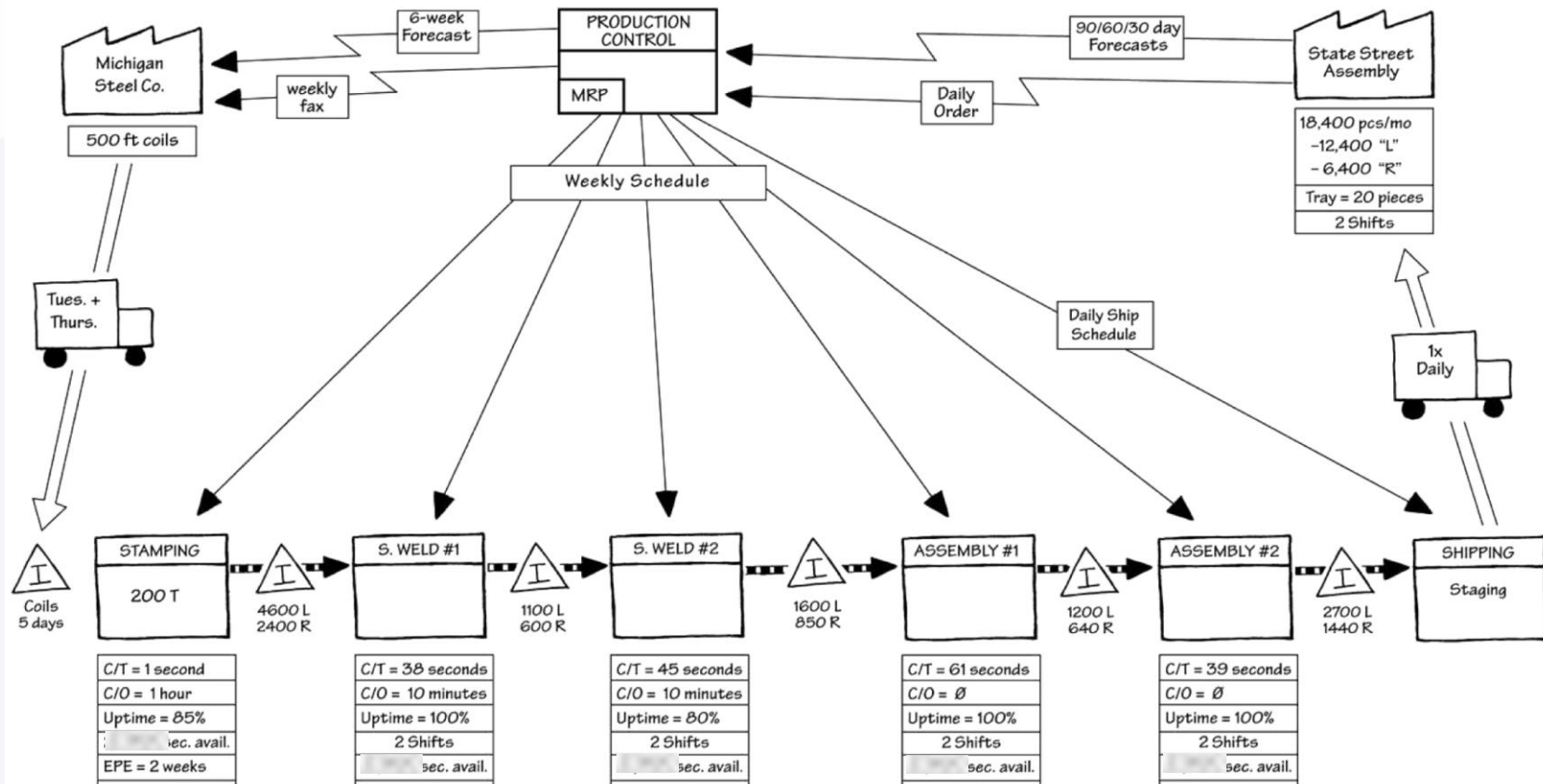
- The shorter your production lead time, the shorter the time between paying for raw material and getting paid for product made from those materials.

- For maps with multiple upstream flows, use the longest time path to compute total lead time

Fifth View of the Current-State Map with Timeline

The diagram contains the following labeled elements:

Michigan Steel Co. — 500 ft coils

PRODUCTION CONTROL — MRP
- 6-week Forecast
- weekly fax
- 90/60/30 day Forecasts
- Daily Order

State Street Assembly
- 18,400 pcs/mo
- –12,400 "L"
- – 6,400 "R"
- Tray = 20 pieces
- 2 Shifts

Tues. + Thurs. / 1x Daily

Weekly Schedule / Daily Ship Schedule

Coils 5 days

STAMPING	S. WELD #1	S. WELD #2	ASSEMBLY #1	ASSEMBLY #2	SHIPPING
200 T					Staging
4600 L / 2400 R	1100 L / 600 R	1600 L / 850 R	1200 L / 640 R	2700 L / 1440 R	

STAMPING	S. WELD #1	S. WELD #2	ASSEMBLY #1	ASSEMBLY #2
C/T = 1 second	C/T = 38 seconds	C/T = 45 seconds	C/T = 61 seconds	C/T = 39 seconds
C/O = 1 hour	C/O = 10 minutes	C/O = 10 minutes	C/O = Ø	C/O = Ø
Uptime = 85%	Uptime = 100%	Uptime = 80%	Uptime = 100%	Uptime = 100%
...ec. avail.	2 Shifts	2 Shifts	2 Shifts	2 Shifts
EPE = 2 weeks	...sec. avail.	...sec. avail.	...sec. avail.	...sec. avail.