

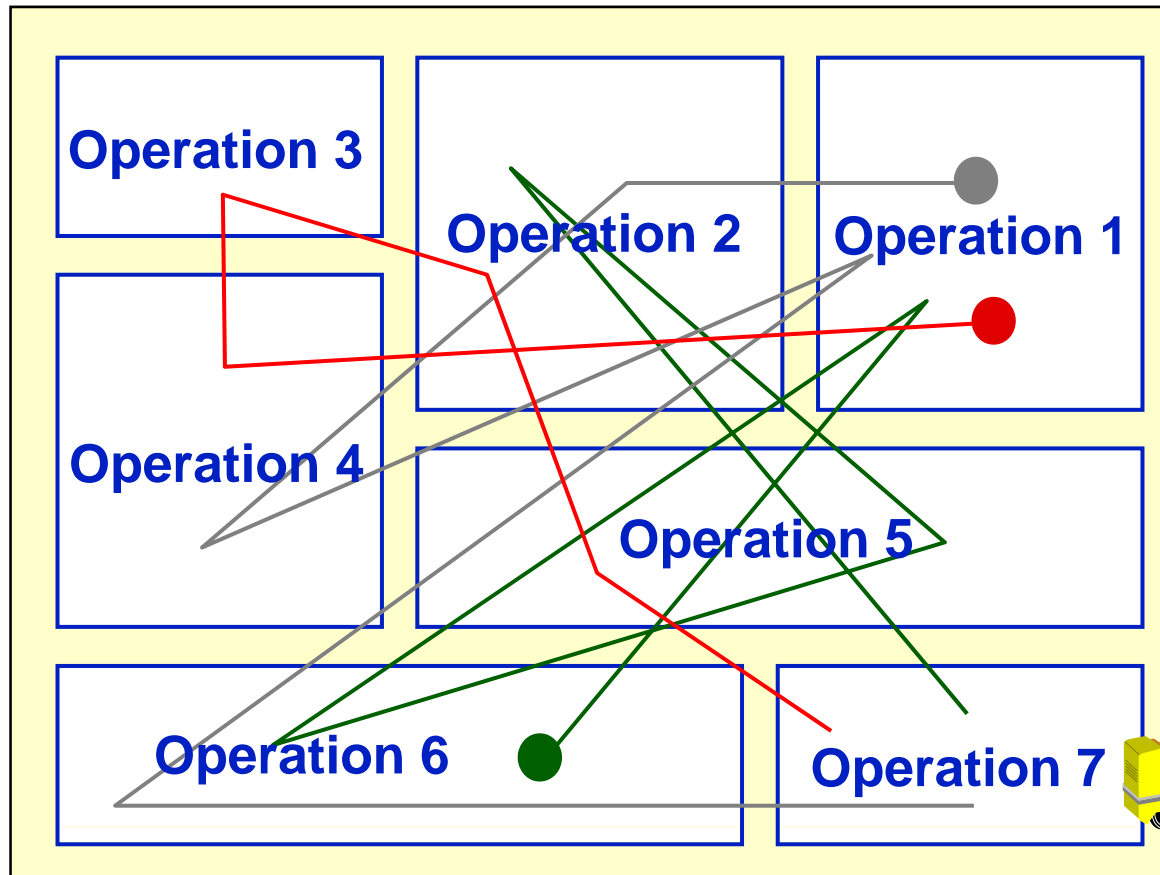
Workflow

Continuous Flow

# The Traditional Approach



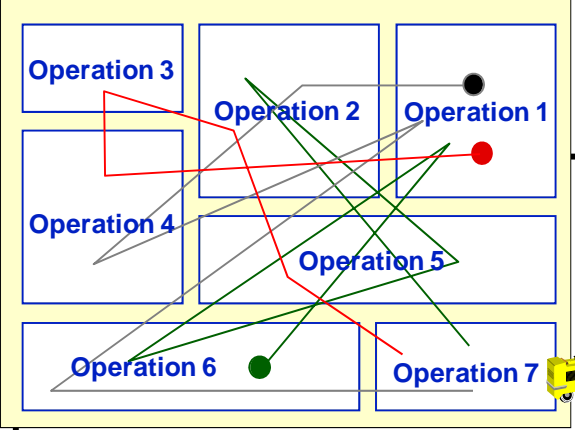
## Specialist departments



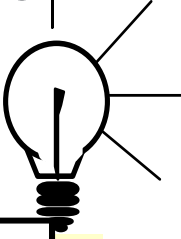
    
Delay | Transport | Storage

- Long distances
- Long lead times
- Big batches
- High WIP
- High cost
- Poor problem solving & team spirit

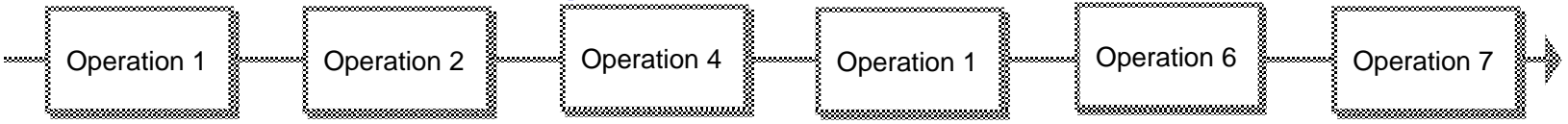
# Dedicated Line Solution



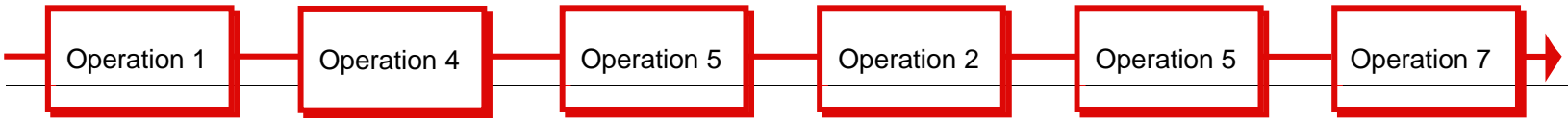
*ELIMINATE  
the delays  
the transport  
and storage times*



thanks to parts families and dedicated lines



rather than diffused lines

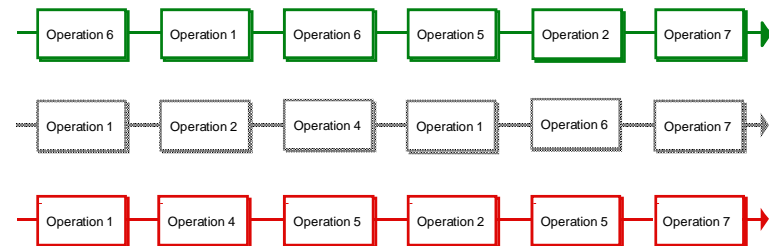


# Steps to implement dedicated lines

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- ➔ Define **PARTS FAMILIES**
- Design IDEAL DEDICATED LINES
- Find solutions to ACTUAL CONSTRAINTS
- Find solutions to ORPHAN PARTS
- Design REALISTIC DEDICATED LINES
- Find solutions to MEET THE DEMAND
- Implement dedicated lines and ONE-PIECE FLOW

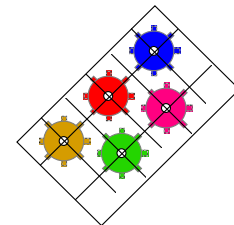


# Define parts families based on

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- High volume (80/20)
- High value (80/20)
- Similar by
  - the form
  - the material
  - the process sequence
- Runners, repeaters and strangers



# Create Process Families



Parts	Process	Op 1	Op 2	Op 3	Op 4	Op 5	Op 6	Op 7	Op 8
A			X		X		X	X	
B	X	X		X		X			
C	X	X			X	X			
D	X		X	X	X		X	X	
E	X		X	X	X		X	X	
F	X	X				X			
G				X			X	X	

**STEP 1**

*Identify the parts and their process*

# Create Process Families



Parts	Process	Op 1	Op 2	Op 3	Op 4	Op 5	Op 6	Op 7	Op 8
A			X		X		X	X	
B	X	X		X		X			
C	X	X			X	X			
D	X		X	X	X		X	X	
E	X		X	X	X		X	X	
F	X	X				X			
G				X			X	X	

**STEP 2**  
*Identify similar processes*

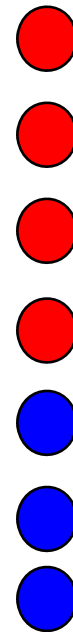
# Create Process Families



Parts	Process	Op 1	Op 2	Op 3	Op 4	Op 5	Op 6	Op 7	Op 8
A			X		X		X	X	
D	X		X	X	X		X	X	
E	X		X	X	X		X	X	
G				X			X	X	
B	X	X		X		X			
C	X	X			X	X			
F	X	X				X			

## STEP 3

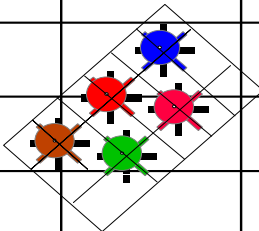
*Create parts family by processes*



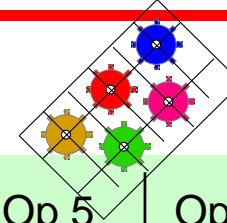
# Analyse the Processes



Plant: _____		Team: _____		<b>PARTS/PROCESS MATRIX</b>										Date: _____	
Qty	Part #	Machine No	Cutter	Auto lathe	Single purpose lathe	Multi spindle drill	Drill	Multi spindle tapping	Milling machine	Wash tank	Rolling machine		Gear hub	Milling machine	Broach lathe
		Process	Cutting	Lathe cutting	Lathe cut 2	Drilling	Chamfering	Screw cuttin	Milling	Clean- ing	Rolling	Debur- ing	Gear teeth cutting	Milling	Drilling
1	9985M26		○	○	○	○									
2	9176M25		○	○	○	○	○					○			
3	9383M42			○		○		○	○	○			○	○	○
4	9522M60			○		○	○	○	○	○			○	○	○
5	9522M58			○		○		○	○	○			○	○	○
6	9522M50			○		○		○	○	○			○	○	○
7															
8															
9															
10															



# Align the processes to optimise families



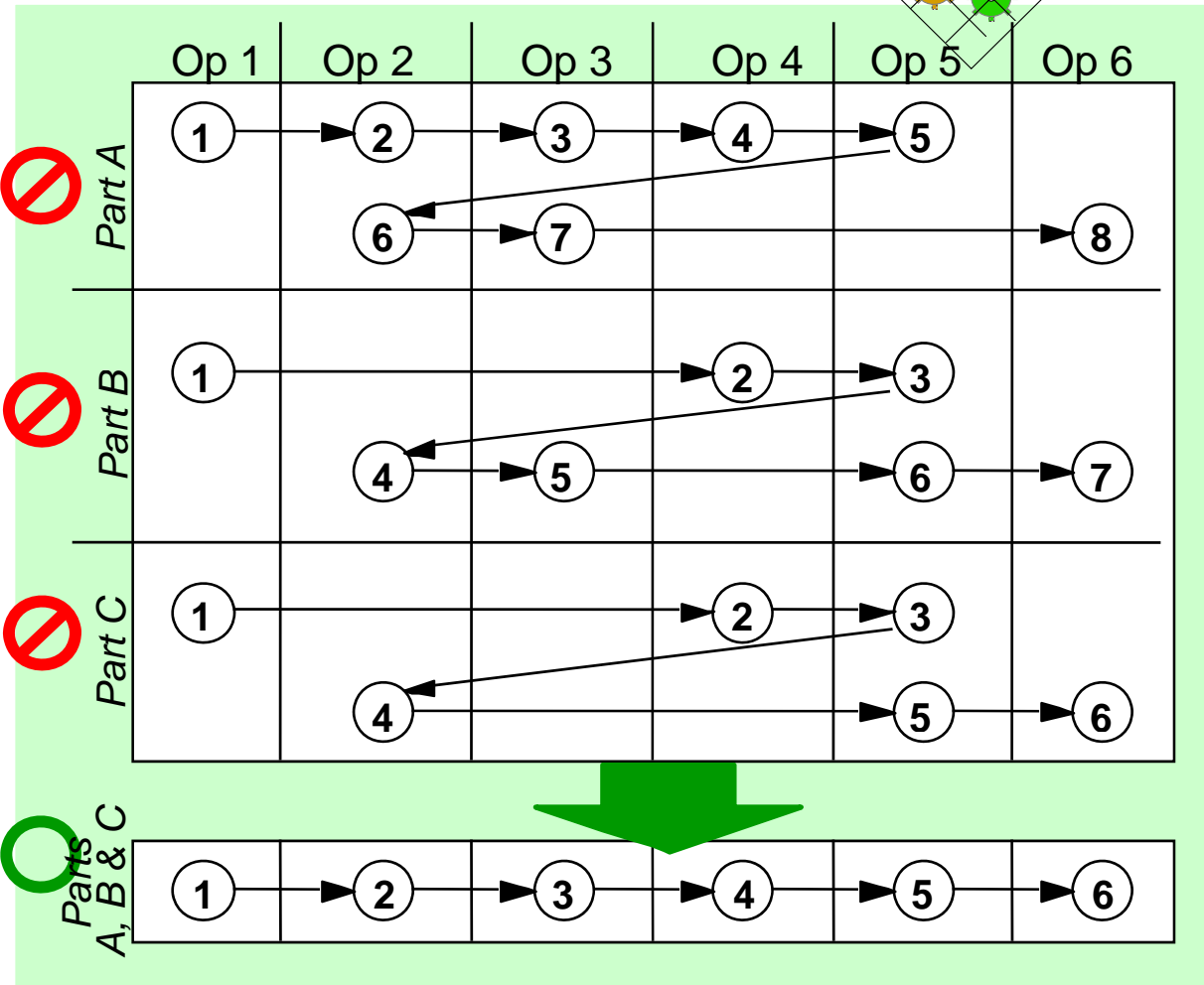
**ELIMINATE**



**COMBINE**



**SIMPLIFY**



# Steps to implement dedicated lines

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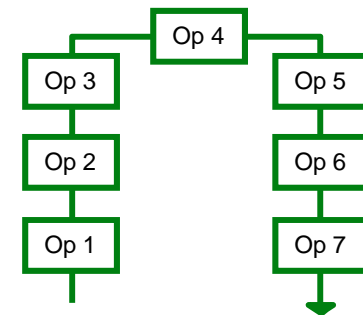


- Define PARTS FAMILIES
- ➔ • Design **IDEAL DEDICATED LINES**
- ➔ • Find solutions to **ACTUAL CONSTRAINTS**
- ➔ • Find solutions to **ORPHAN PARTS**
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- Find solutions to **MEET THE DEMAND**
- Implement dedicated lines and **ONE-PIECE FLOW**

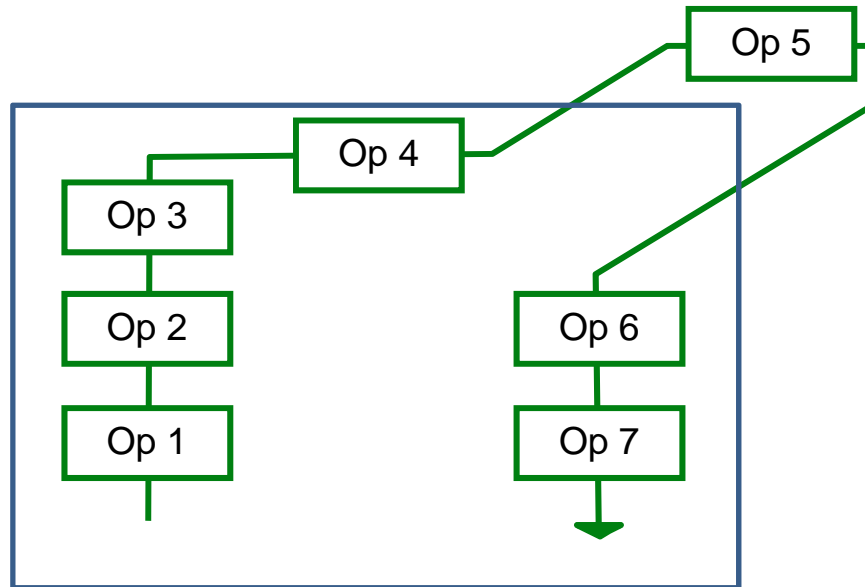
# Design ideal dedicated lines

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- One line per parts family
- The shortest path from raw materials to finished part including
  - every operation
  - every function
  - support activities
  - specialised activities
- The total linkage of all operations and functions required to make a part (everything is linked by an imaginary conveyor)
- Dedicated equipment and dedicated workers in a dedicated place
- U shaped flow line

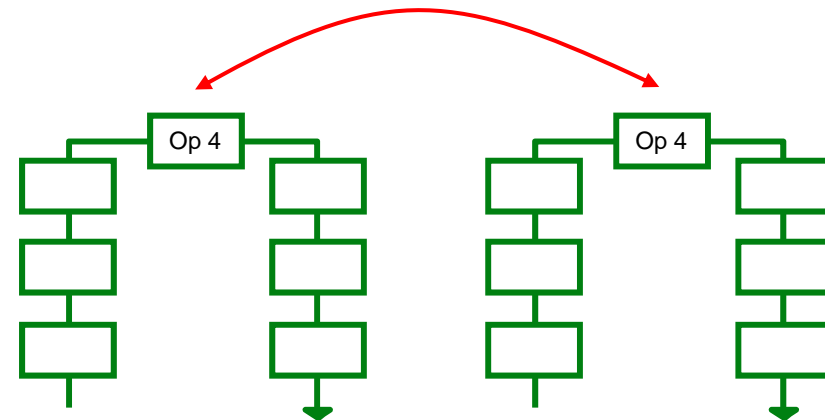


# Find actual constraints



## External operation

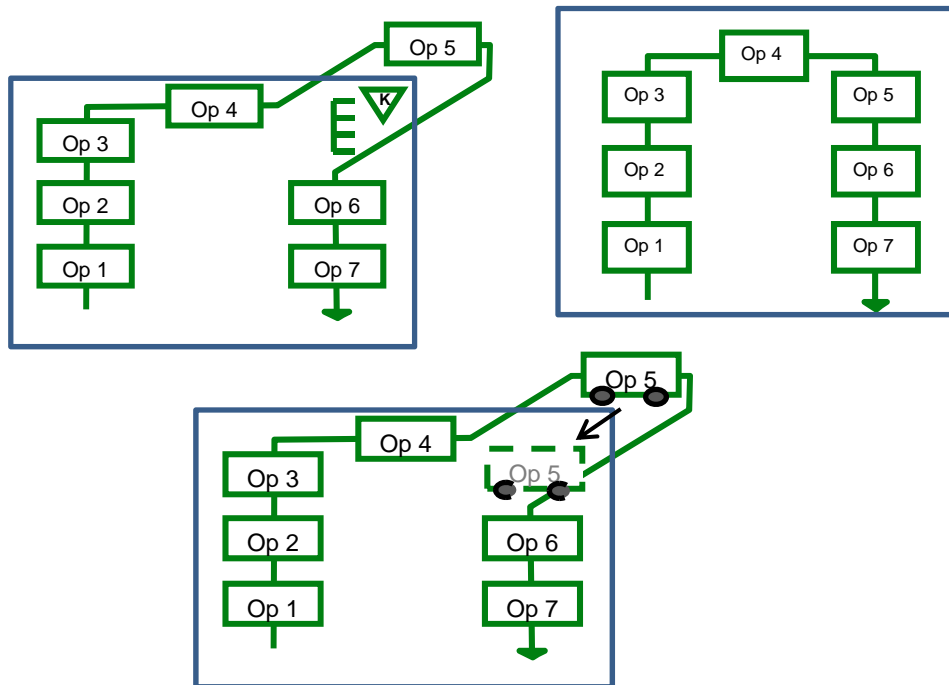
- Supplier operation
- Immoveable plant/equip
- Infrequent operation



## Shared operation

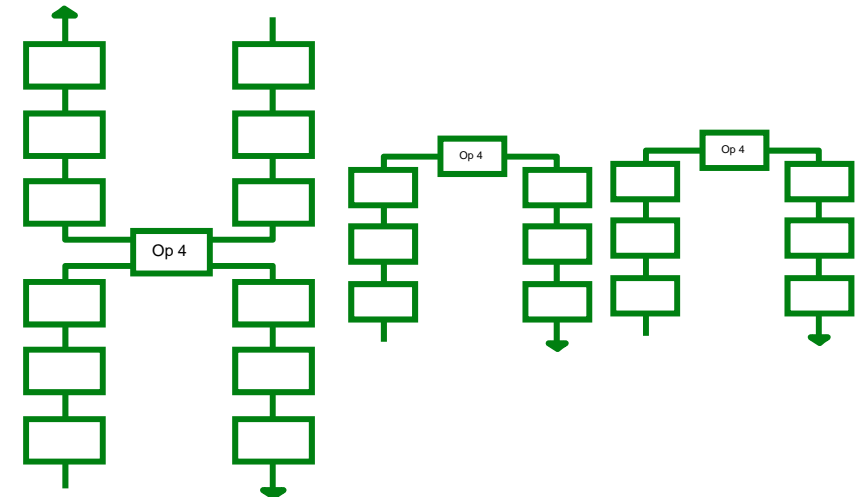
- Expensive equipment
- Limited skills
- Similar characteristics
- Close proximity

# Find solutions to actual constraints



## External operation

- JIT with supplier
- Move cell to plant/equip
- Moveable equipment



## Shared operation

- Share equipment (shifts, schedule)
- Retrain or move the skills
- Modify for both characteristics
- Move together proximity

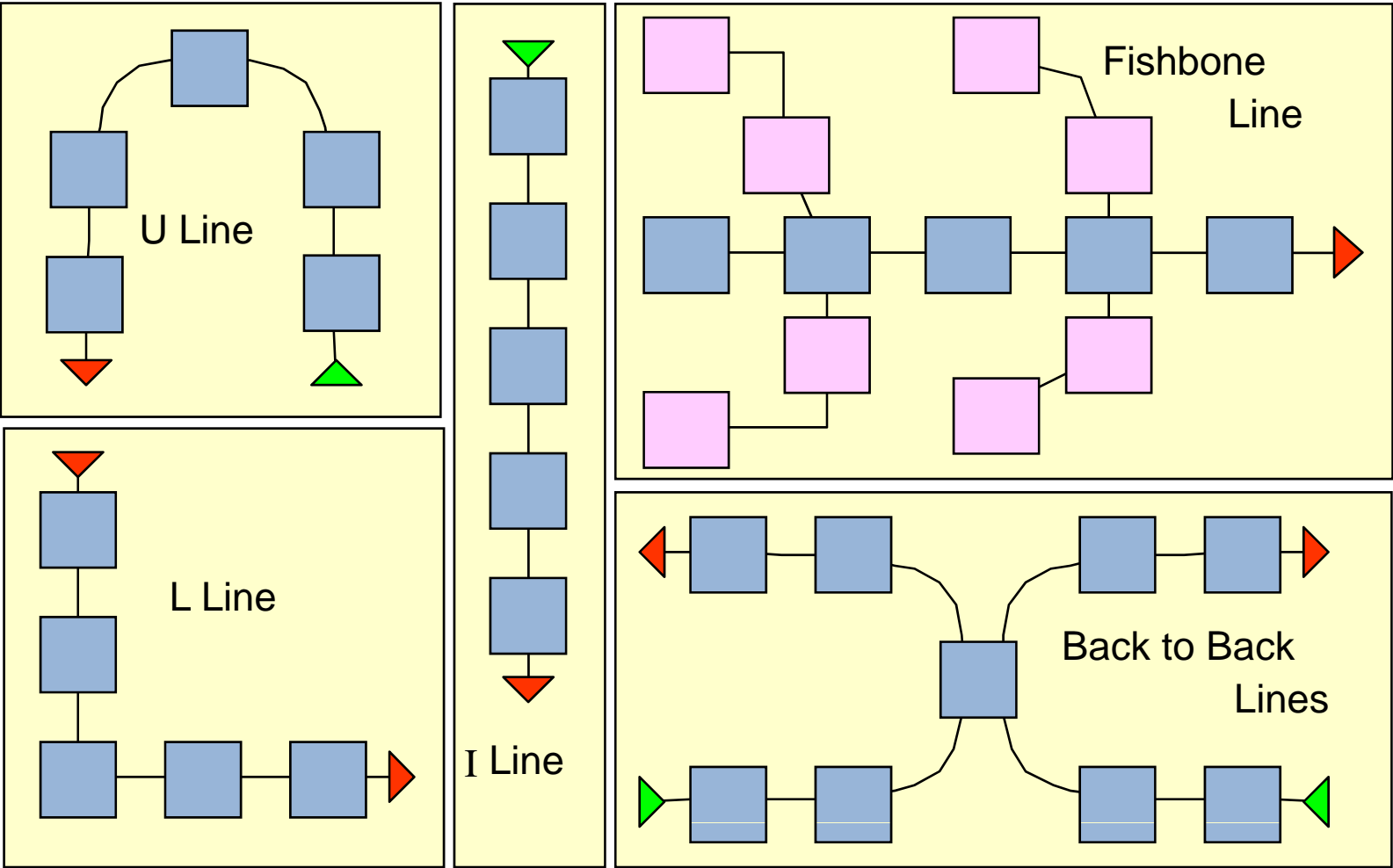
# Find solutions to orphan parts

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- Can a dedicated line adopt them ?
- Should a job shop line be created ?
- Can we use moveable equipment and flexible lines ?
- Should they be outsourced ?
- Etc.



# Design realistic dedicated lines



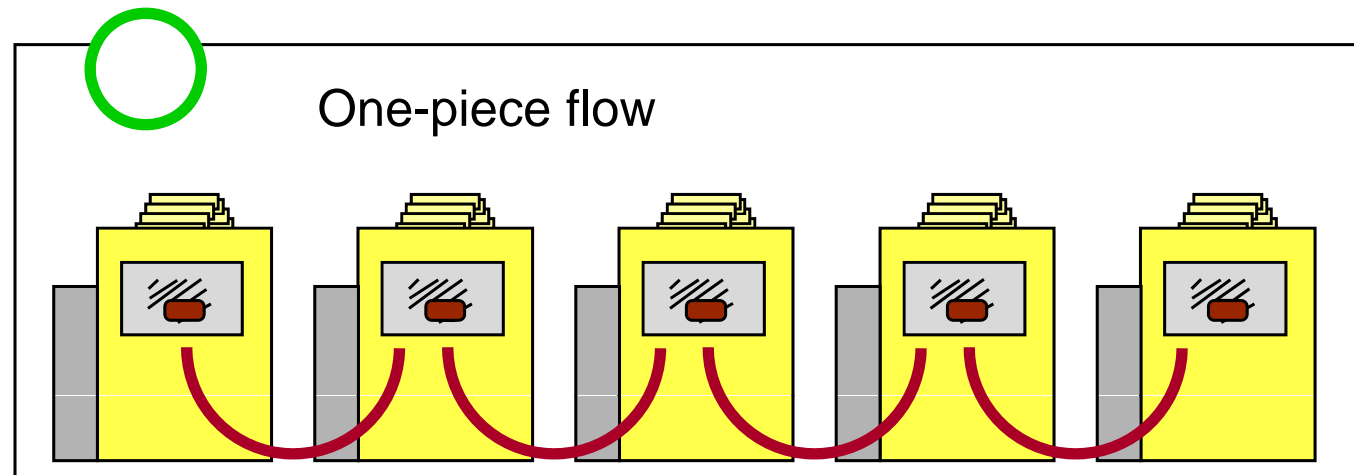
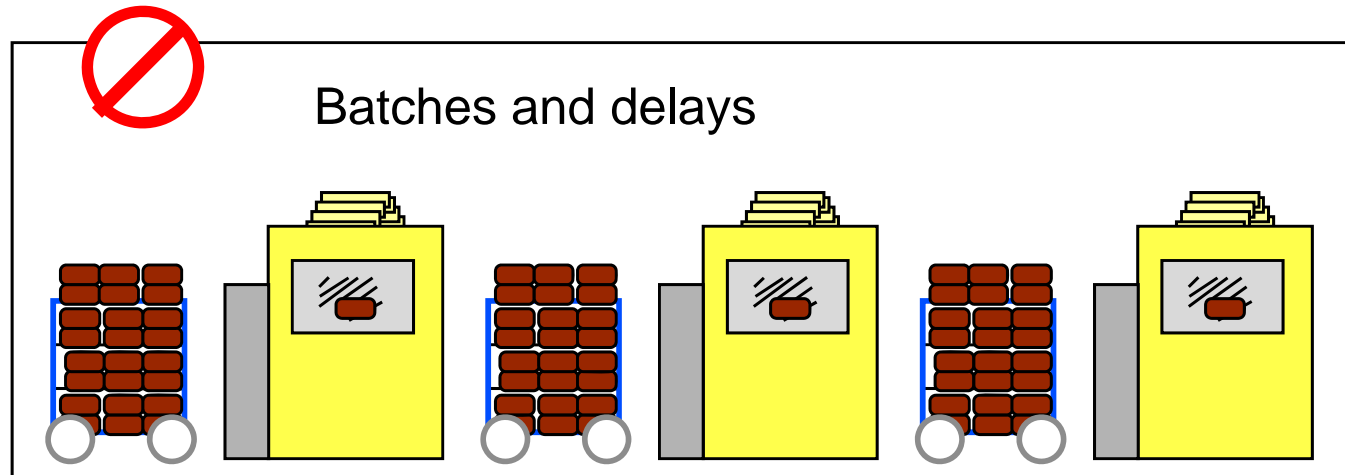
# Steps to implement dedicated lines

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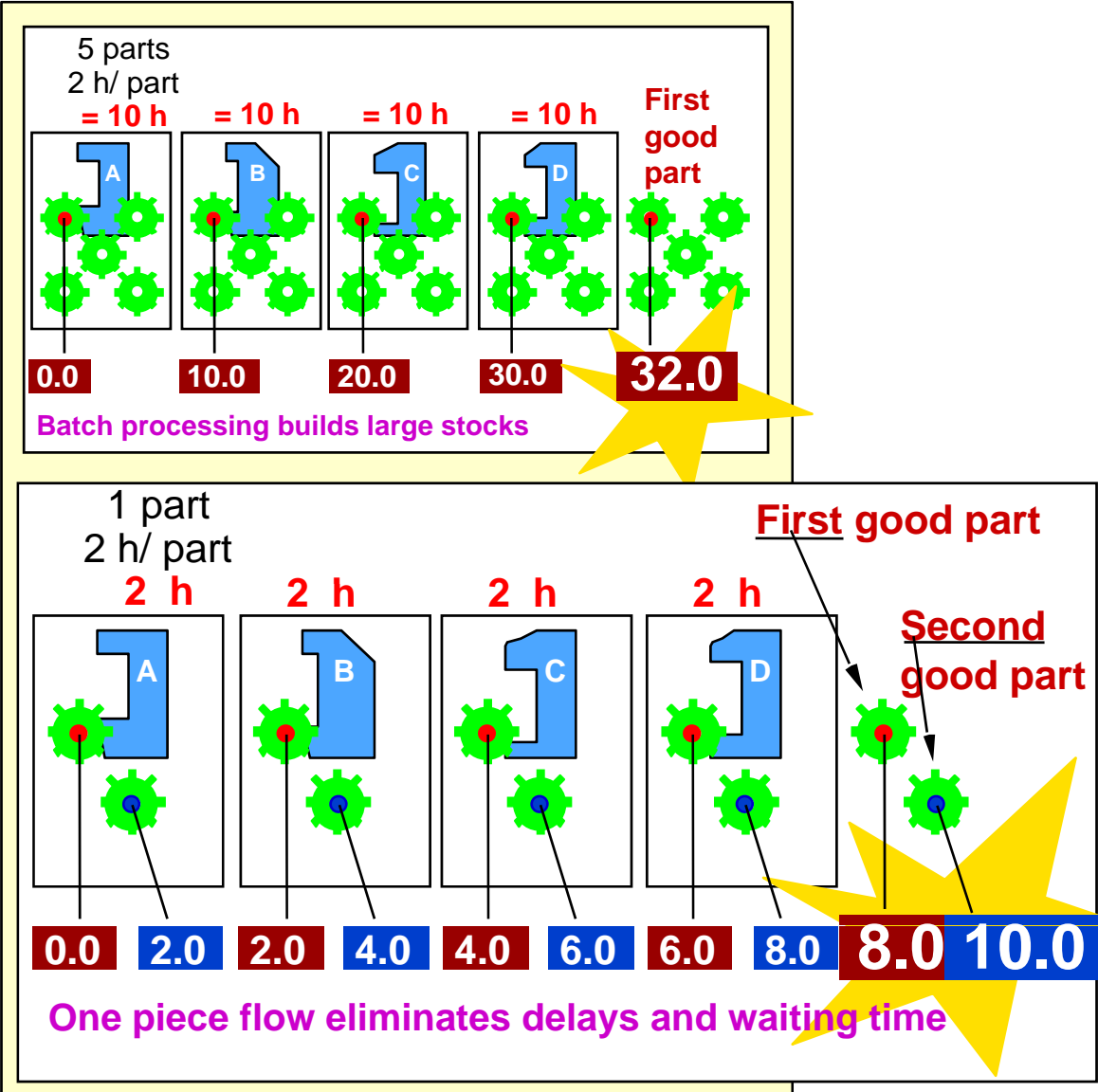


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- ➔ • Implement dedicated lines and **ONE-PIECE FLOW**

# Batch vs 1 Piece Flow



# Batch vs Flow – (Push vs Pull)



How to eliminate

storage, transport and **delay** wastes ?

One Piece Flow

# The Customer Heartbeat – Takt Time

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$$\frac{\text{Time per day}}{\text{Parts per day}}$$

Data      420 production minutes per day  
(8 hours = 480 min - 60 Minute Break)

6 parts per day  
(120 parts per month - 20 Production Days)

Solution

$$\text{TAKT} = \frac{420 \text{ mins /day}}{6 \text{ parts /day}} = 70 \text{ min/part}$$

# Example Production Line

Required quantity =

6 per day (420 min/day)

**TAKT time =**

**70 minutes**

Cycle time operation 1 =

70 minutes

Cycle time operation 2 =

40 minutes

Cycle time operation 3 =

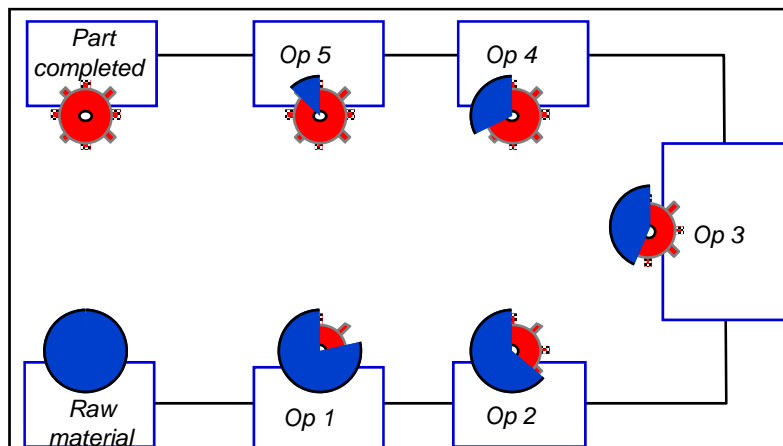
50 minutes

Cycle time operation 4 =

90 minutes

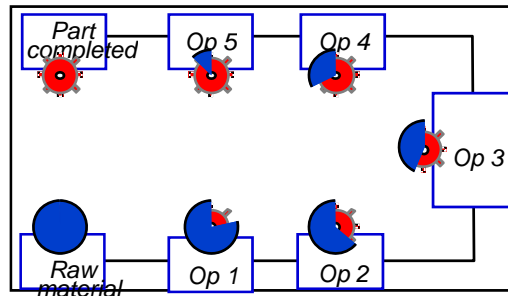
Cycle time operation 5 =

80 minutes



■ Customer Takt time  
■ Process time of each operation

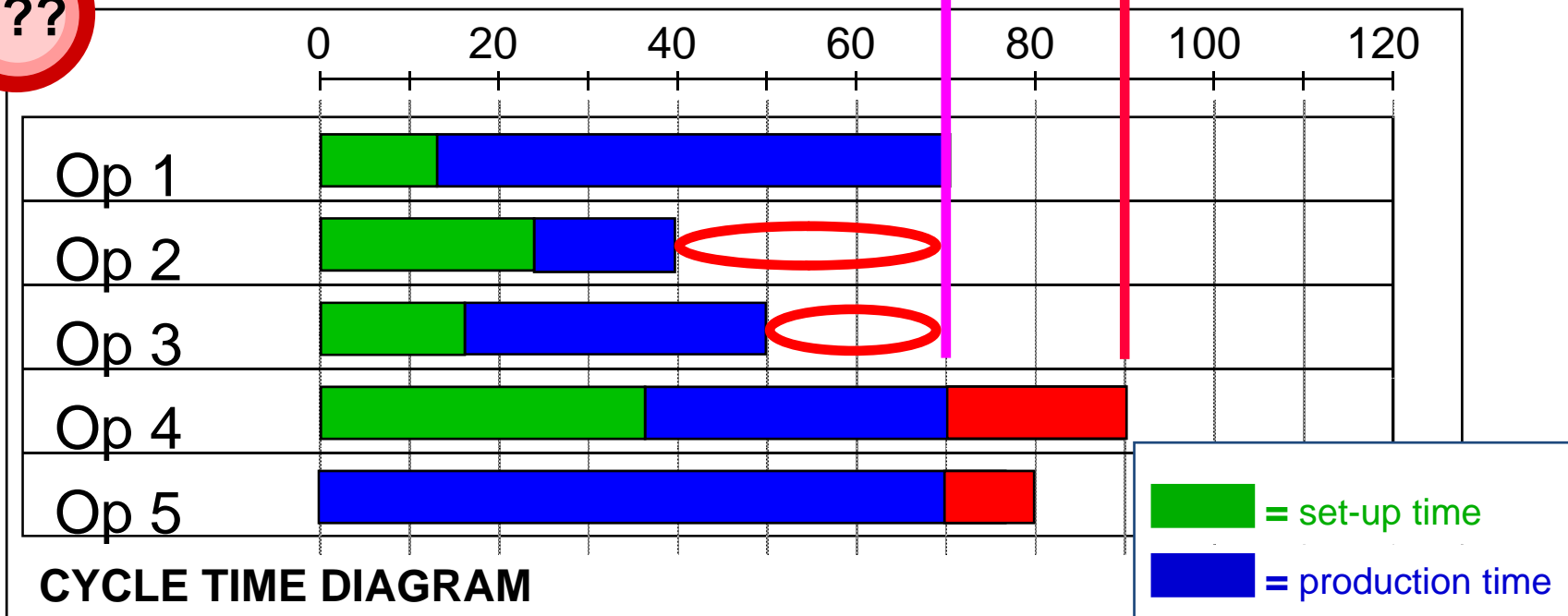
# Line Balancing



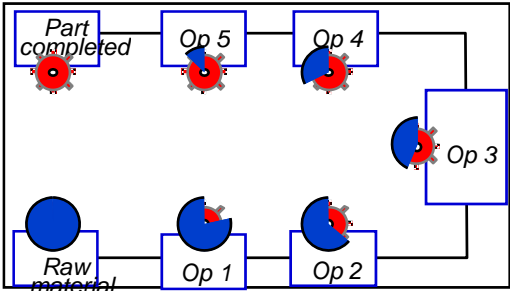
**TAKT: 70 MINUTES**  
 = 1 part every 70 minutes

Process capacity of the line  
 = 1 part every 90 minutes

???

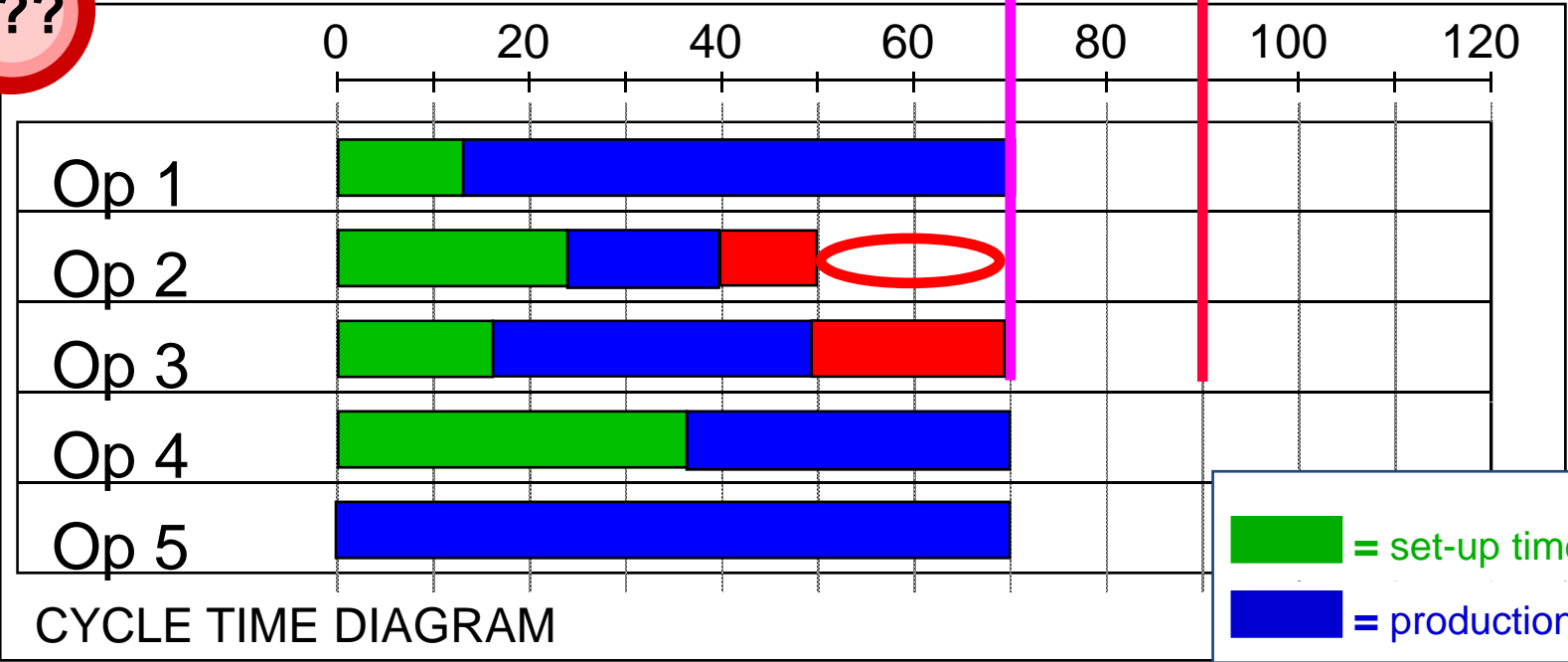


# Line Balancing

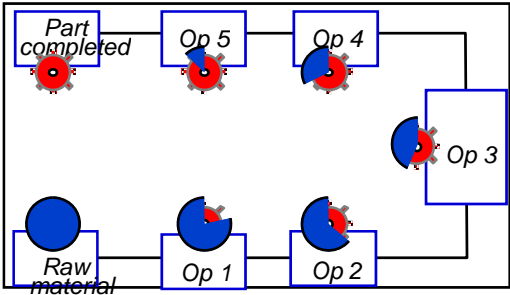


TAKT: 70 MINUTES  
= 1 part every 70 minutes

Process capacity of the line  
= 1 part every 90 minutes

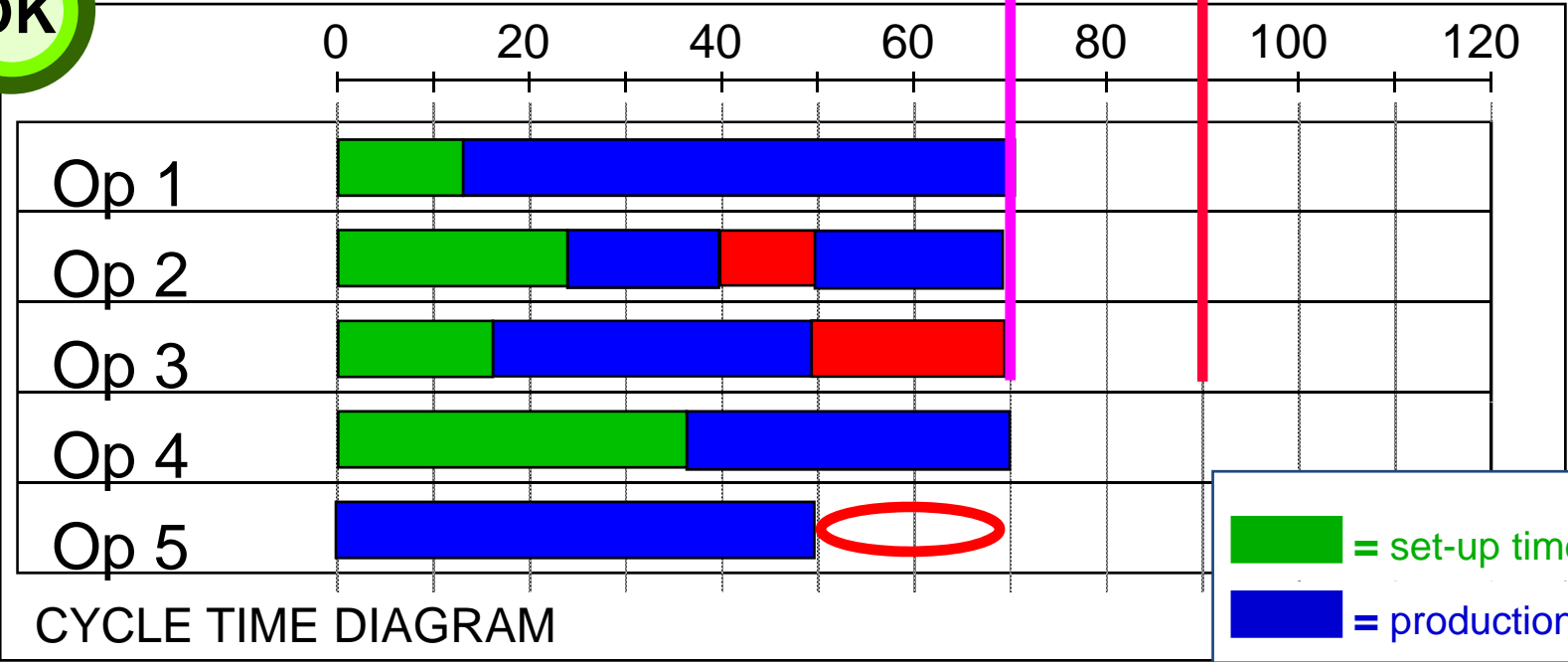


# Line Balancing

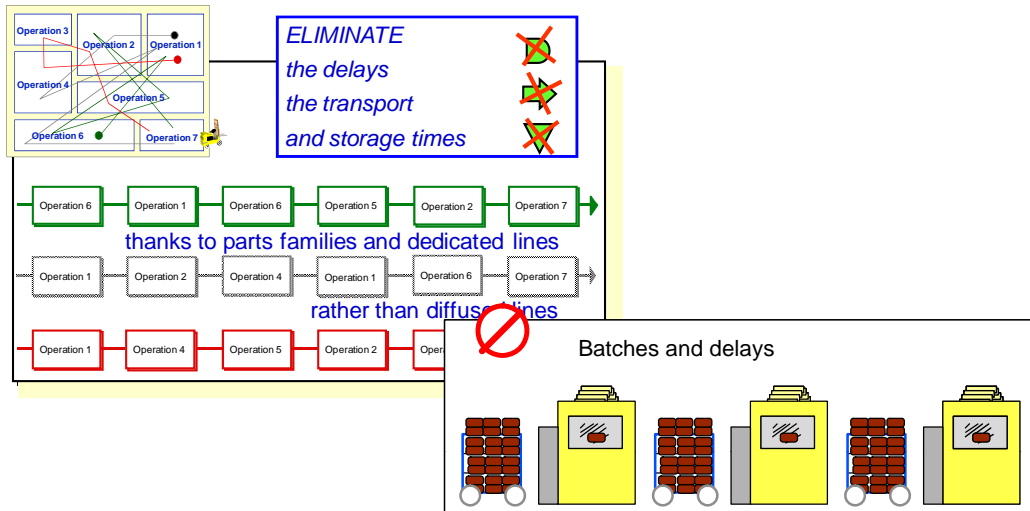


**TAKT: 70 MINUTES**  
 = 1 part every 70 minutes

Process capacity of the line  
 = 1 part every 90 minutes



# Summary



1. Set-up dedicated lines
2. Implement 1 piece flow
3. Balance the line to the Takt time

