INDUSTRIAL ENGINEERING

Lesson 5
Methods Study

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Synopsis

This chapter discusses methods study used to analyze the movement of individuals or materials, activity of human and machines, and body movement.

Expected Outcome

1. Understand the objectives of methods study.
2. Apply the concepts and tools of methods study to improve work methods.

Work Study

Methods Study

To improve methods of production

To determine the best way to complete a repetitive task

Resulting in more effective use of material, manpower, machine & equipment

Work Measurement

To assess human effectiveness

To measure how long it takes to complete a task at a normal pace.

Making possible improved planning & control, & as a basis for a sound incentive scheme

Higher Productivity

Methods Study

Also known as methods engineering.

It is a systematic examination of existing methods of work, as a means of improving the work to be more productive, effective & efficient.

It is subjecting every single element of work to eliminate all the unnecessary work element.

Methods study is used to analyze…

- Movement of individuals or materials
- Activity of human & machines
- Body movement (primarily arms & hands)

Purposes of Methods Study

- Improve processes & procedures
- Improve facility layouts
- Reduction of unnecessary fatigue
- Improve the use of resources
- To make physical working environment better

How to Analyze Current Methods?

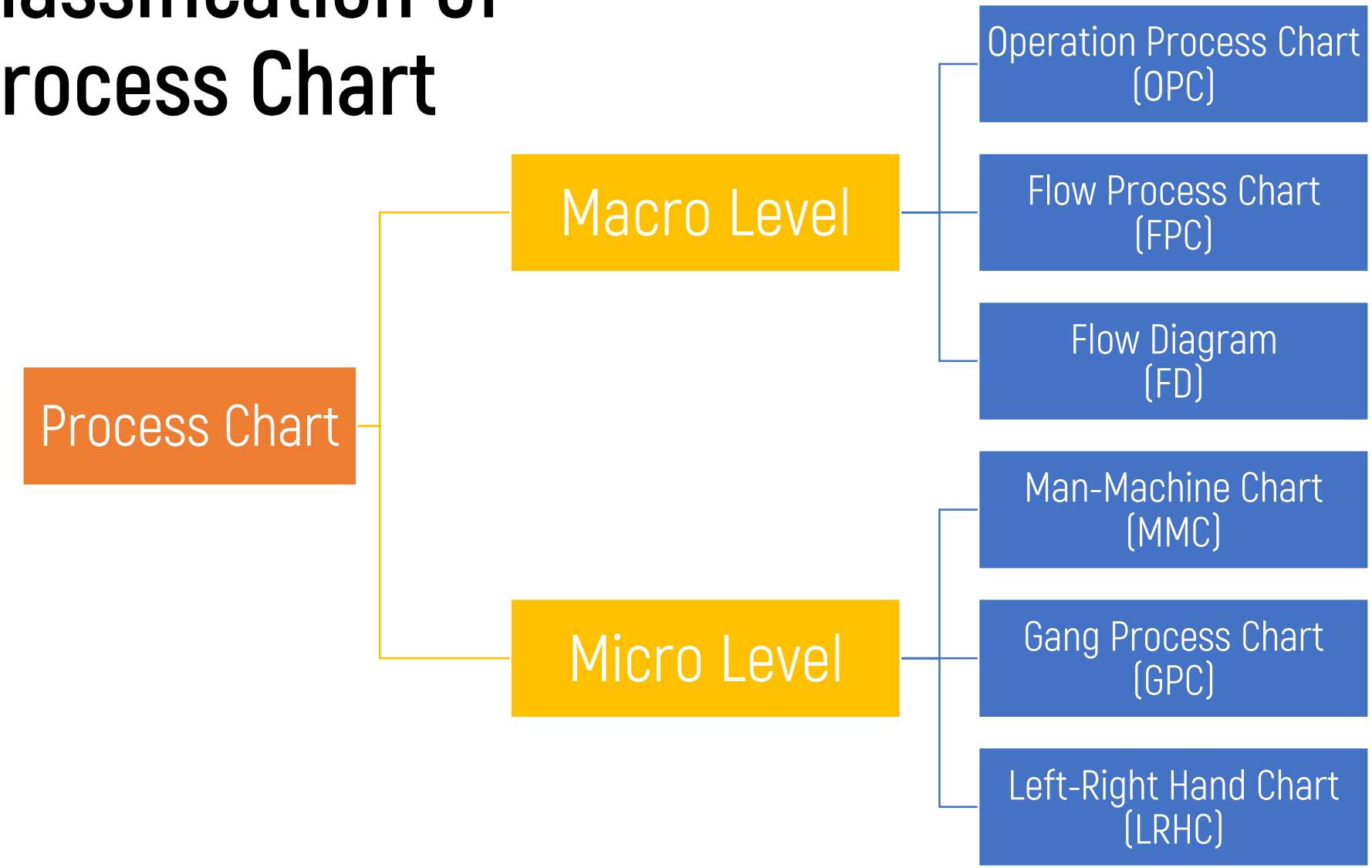
- Obtain production requirements
- Procure engineering data
- Describe & sketch workstations
- Use process chart
- Procure manufacturing & cost data

Process Chart

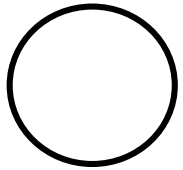
Chart of workflow, working process, systems, or procedures to record the essential features of a work situation for subsequent analysis.

Graphical representation of the sequence of steps or tasks (workflow) constituting a process, from raw materials to finished product.

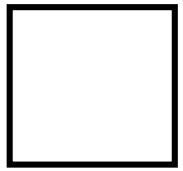
Classification of Process Chart



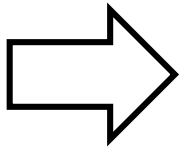
Symbols Used in Process Chart



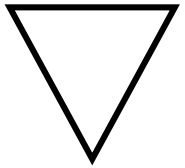
Operation: A main process (i.e., modification of product.



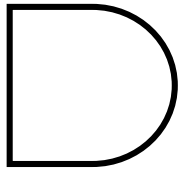
Inspection: Quality or quantity checking.



Transport: The movement of workers, material, machine or equipment.



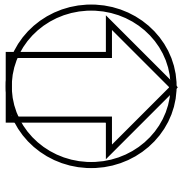
Storage: Controlled storage. Receiving into & issue materials from a store



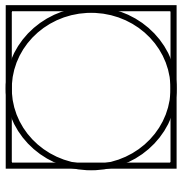
Delay or Temporary Storage: A delay in the process.

Symbols Used in Process Chart

Non-standard process chart symbols

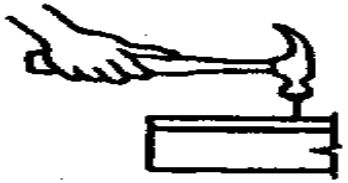
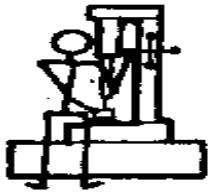
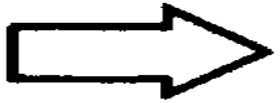
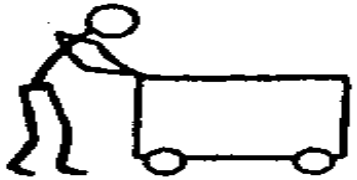
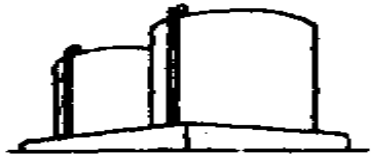
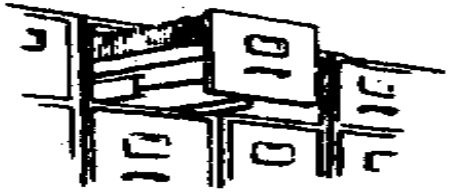


Operations and transportation take place simultaneously



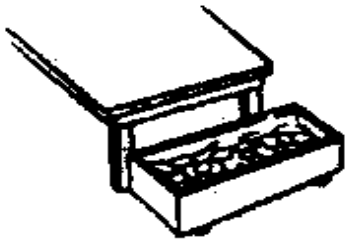
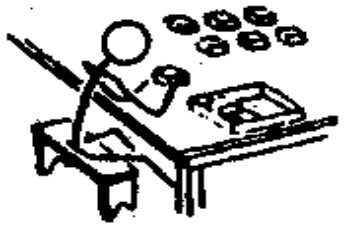
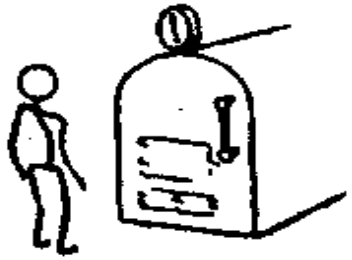
An inspection was performed in conjunction with operations

Example of Process

Operation  A large circle indicates an operation such as	 Drive nail	 Mix	 Drill hole
Transportation  An arrow indicates a transportation, such as	 Move material by truck	 Move material by conveyor	 Move material by carrying (messenger)
Storage  A triangle indicates a storage, such as	 Raw material in bulk storage	 Finished stock stacked on pallets	 Protective filing of documents

Source: http://www.transtutors.com

Example of Process

Delay  A large capital D indicates a delay, such as	 Wait for elevator	 Material in truck or on floor at bench waiting to be processed	 Papers waiting to be filed
Inspection  A square indicates an inspection such as	 Examine material for quality or quantity	 Read steam gauge on boiler	 Examine printed form for information

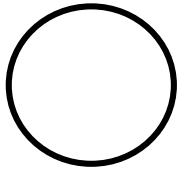
Source: http://www.transtutors.com

OPC shows…

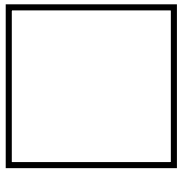
- All productive operations & inspections
- Time of the processes
- Materials used

OPC

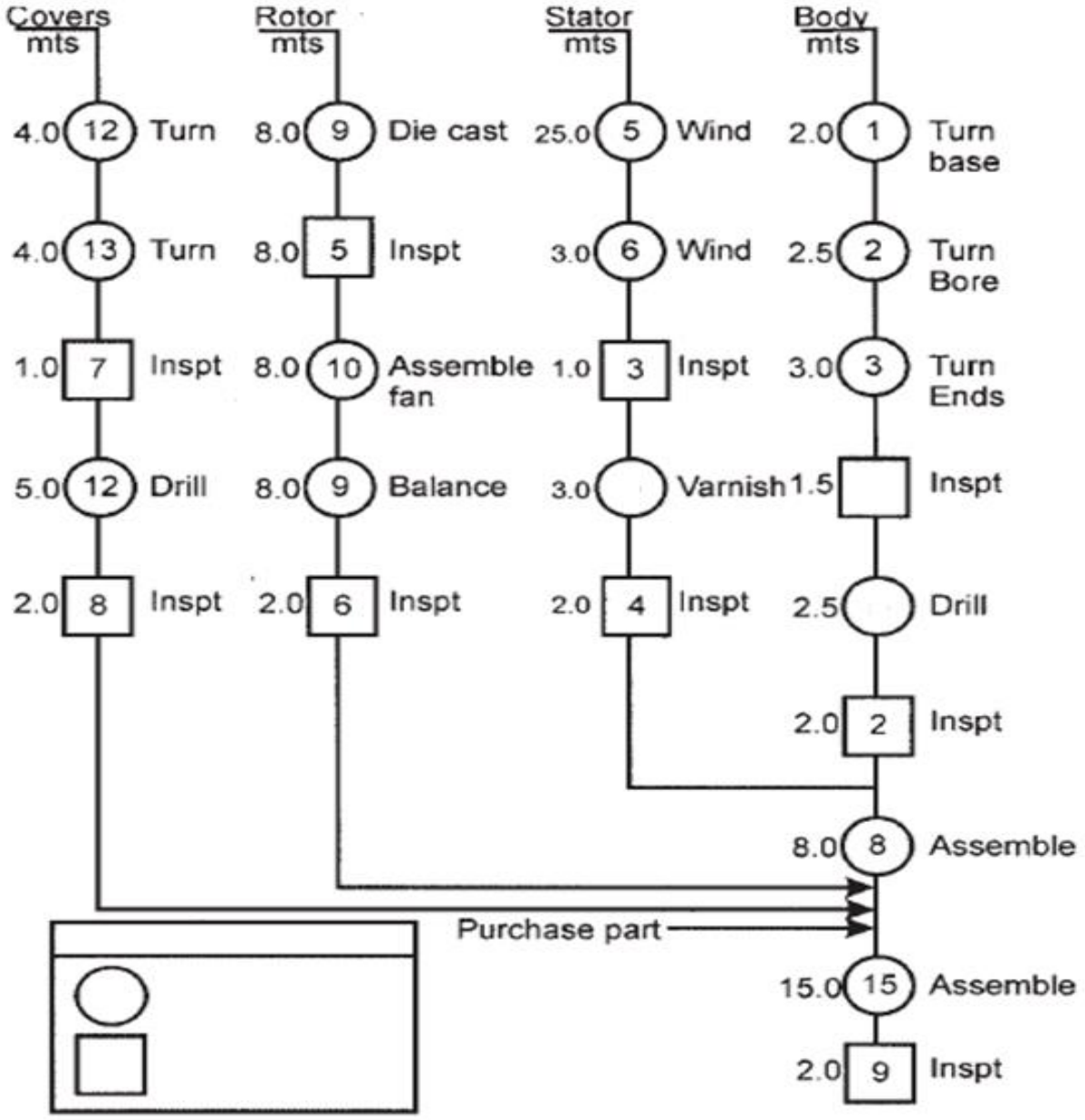
Only 2 symbols are used in OPC:



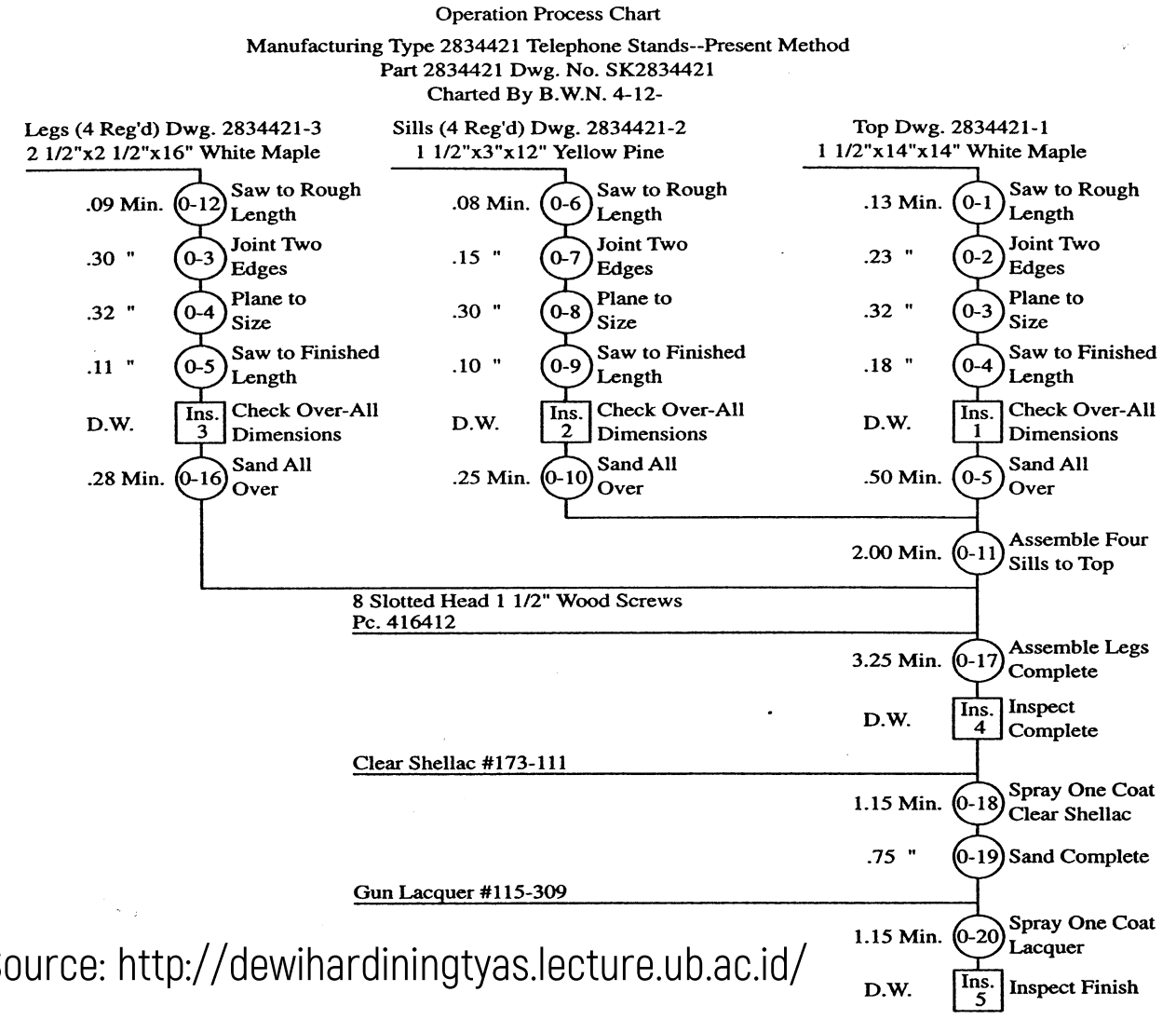
Operation: A main step where the part, material or product is usually modified or changed.



Inspection: Indicates a check for quality or quantity.



OPC of electric motor manufacturing



Source: http://dewihardiningtyas.lecture.ub.ac.id/

Summary:

Event	Number	Time
Operations	20	17.58 minutes
Inspections	5	Day work

OPC of telephone stand manufacturing

Flow Process Chart (FPC)

Represents all the processes (productive & non-productive), to understand & improve them.

FPC represents graphically the sequence of steps of the process from the 1st process to the end.

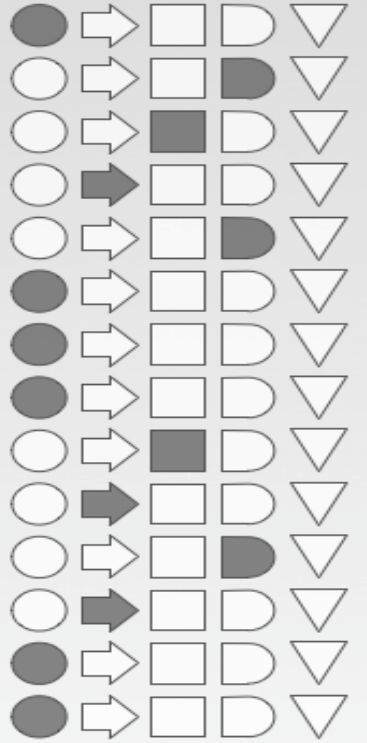
Objective of Using FPC

- ✓ To identify all the events involved in a process.
- ✓ To show the relationship among the parts & fabrication complexity.
- ✓ To differentiate between produced & purchased parts.
- ✓ To give information on the requirement of workers.
- ✓ To provide information on the time required to perform each process.
- ✓ To identify nonproduction hidden costs.

ELEMENT DESCRIPTION	SYMBOL	DISTANCE (m)	TIME
50 mmΦ c 1004 bar from stores			
Sent to Cutting Machine		15	
Cut to Size			2.5
Sent to Lathe		35	
Delay or wait			1.8
Facing Drilling and Reaming			
To Lathe		5	
Facing of other side, turn to size			1.8
To gear hobbing machine		4	
Wait			
Machine the Gear			4.5
To inspection		10	
Wait			
Inspection for size			
To heat treatment deptt.		12	0.5
Wait			
Hardening			
To inspection		15	
Wait			
Inspection for hardness			
To spare part stores		2	
Storage for reissue			

Source: http://www.yourarticlelibrary.com

Process of Making Copies at Photocopy Shop	
1	Desk Operator Fills out Work Order
2	Work Order Placed in "Waiting Job" Box
3	Job Picked up by Operator and Read
4	Job Carried to Appropriate Copy Machine
5	Operator Waits for Machine to Vacate
6	Operator Loads Paper
7	Operator Sets Machine
8	Operator Performs and Completes Job
9	Operator Examines Job for Irregularities
10	Job Filed Alphabetically in Completed Work Shelves
11	Job Waits for Take away
12	Job Carried for Take away by Cashier
13	Cashier Completes Operation
14	Cashier Pack Up Job



Actions	Summary
Operations	6
Transportations	3
Inspections	2
Delays	3
Storages	

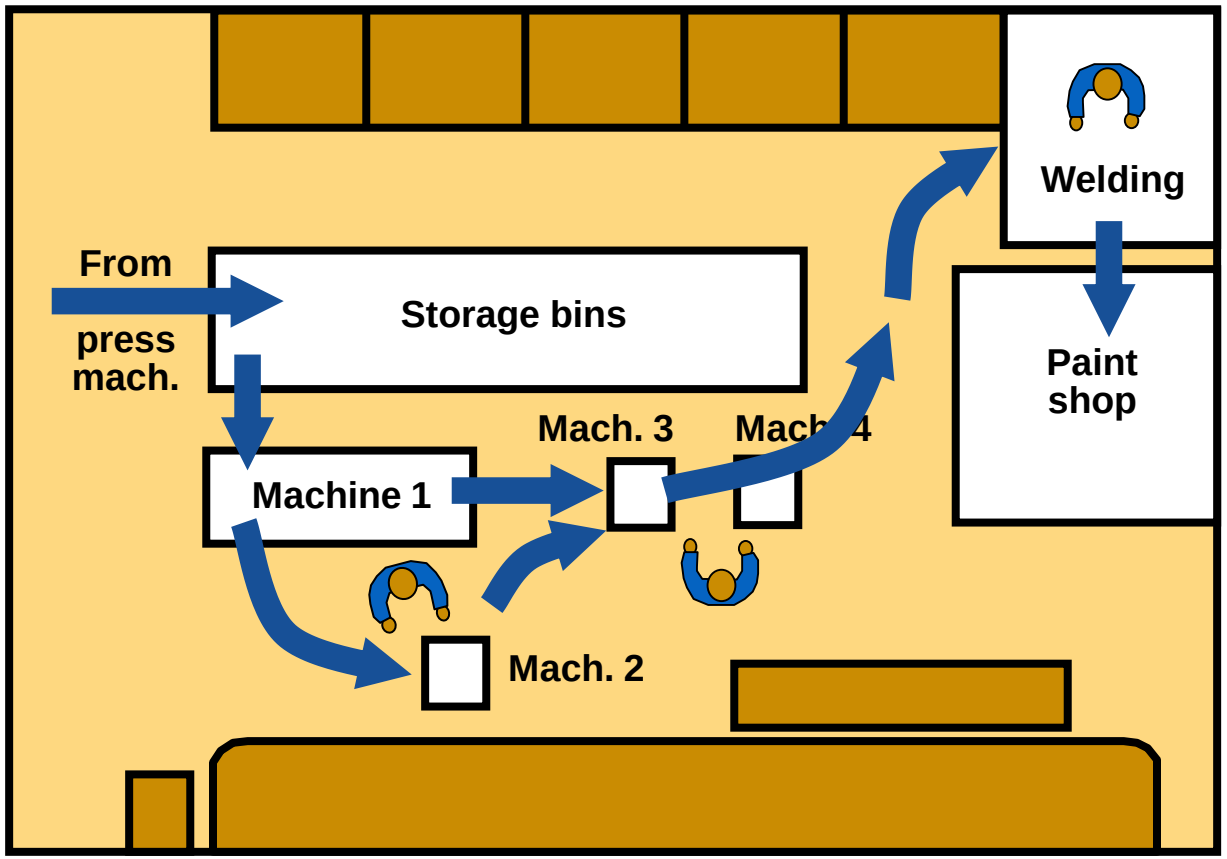
Source: http://www.conceptdraw.com

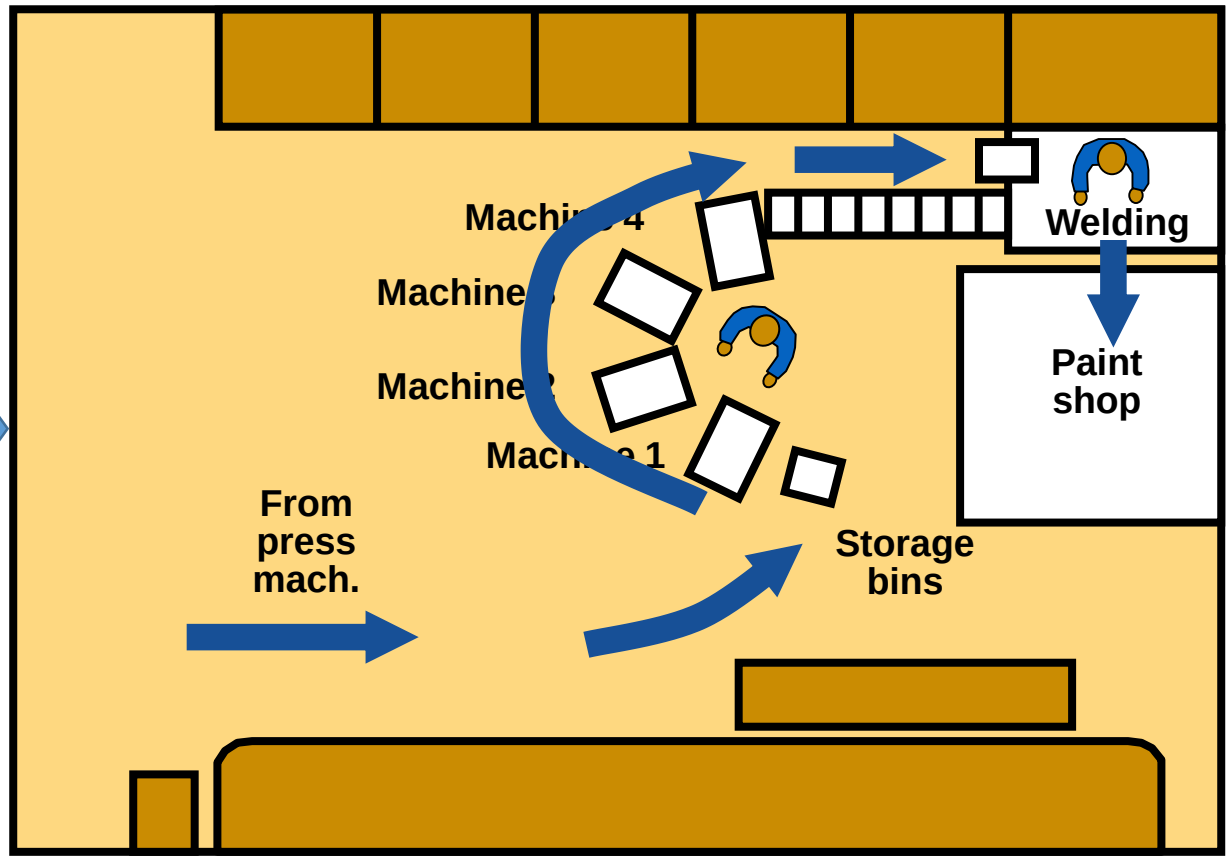
Flow Diagram (FD)

FD is a pictorial representation of the layout, showing the locations of all processes on the FPC.

FD is a helpful supplement to the FPC showing backtracking & possible traffic congestion areas.

Flow Diagram (FD)





Source: Heizer & Render (2011)

Man-Machine Chart (MMC)

MMC is used to study 1 workstation at a time only.

MMC shows the exact time of the relationship between working cycle of worker & operating cycle of equipment/machine at a single workstation.

	PERSON				MACHINE	
	Customer	Time in sec.	Clerk	Time in sec.	Coffee Grinder	Time in sec.
0	1. Ask grocer for 1 pound of coffee (brand and grind)	5	Listen to order	5	Idle	5
10	2. Wait	15	Get coffee and put in machine, set grind, and start grinder	15	Idle	15
20	3. Wait	21	Idle while machine grinds	21	Grind coffee	21
40	4. Wait	12	Stop grinder, place coffee in package, and close it	12	Idle	12
50	5. Receive coffee from grocer, pay grocer, and receive change	17	Give coffee to customer, wait for customer to pay for coffee, receive money, and make change	17	Idle	17
70						

Source: http://dewihardiningtyas.lecture.ub.ac.id/

MMC for Coffee Store

	Customer	Clerk	Coffee grinder
Idle time	48 sec.	21 sec.	49 sec.
Working time	22	49	21
Total cycle time	70	70	70
Utilization in percent	Customer utilization = $\frac{22}{70} \approx 31\%$	Clerk utilization = $\frac{49}{70} = 70\%$	Machine utilization = $\frac{21}{70} = 30\%$

- ✓ Dark line (or solid line) represents productive time.
- ✓ Light line (or dotted line) represents non-productive time.

Gang Process Chart (GPC)

GPC is MMC showing the activities of many workers.

GPC shows the exact relationship between idle & operating cycle of machine and operator.

GANG PROCESS CHART—PROPOSED METHOD

Hydraulic Extrusion Press Dept. II Bellefonte, Pa. Plant

Charted by B.W.N. 4-15 Chart G-85

MACHINE OPERATION	TIME	PRESS OPERATOR OPERATION	TIME	ASSISTANT PRESS OPERATOR OPERATION	TIME	DUMMY KNOCKER OPERATION	TIME	PULL-OUT MAN OPERATION	TIME
Elevate Billet	.07	Elevate Billet	.07	Grease Die & Position Back in Die Head	.12	Position Shell on Small Press	.10	Pull Rod toward Cooling Rack	.20
Position Billet	.08	Position Billet	.08	Walk to Furnace	.05	Press Dummy Out of Shell	.12	Walk Back toward Press	.15
Position Dummy	.04	Position Dummy	.04						
Build Pressure	.05	Build Pressure	.05	Rearrange Billets in Furnace	.20	Dispose of Shell	.18		
Extrude	.45	Extrude	.45	Return to Press	.05	Dispose of Dummy and Lay Aside Tongs	.12	Grab Rod with Tongs and Pull Out	.45
				Idle Time	.09				
				Open Furnace Door & Remove Billet	.19	Idle Time	.23		
				Ram Billet from Furnace & Close Furnace Door	.10				
Unlock Die	.06	Unlock Die	.06			Grab Tongs & Move to Position	.05		
Loosen & Push Out Shell	.10	Loosen & Push Out Shell	.10	Run Head & Shell	.11	Guide Shell from Shear to Small Press	.20		.11
Withdraw Ram & Lock Die in Head	.15	Withdraw Ram & Lock Die in Head	.15	Shear Rod from Shell	.04				
				Pull Die Off End of Rod	.05				.09
Working Time	1.00 Min.		1.00 Min.		.91 Min.		.77 Min.		1.00 Min.
Idle Time	0		0		.09 Min.		.23 Min.		0

Gang Process Chart (GPC)

Source: https://www.slideshare.net/TamerKhalaf/3-work-chartingmethods-44736448

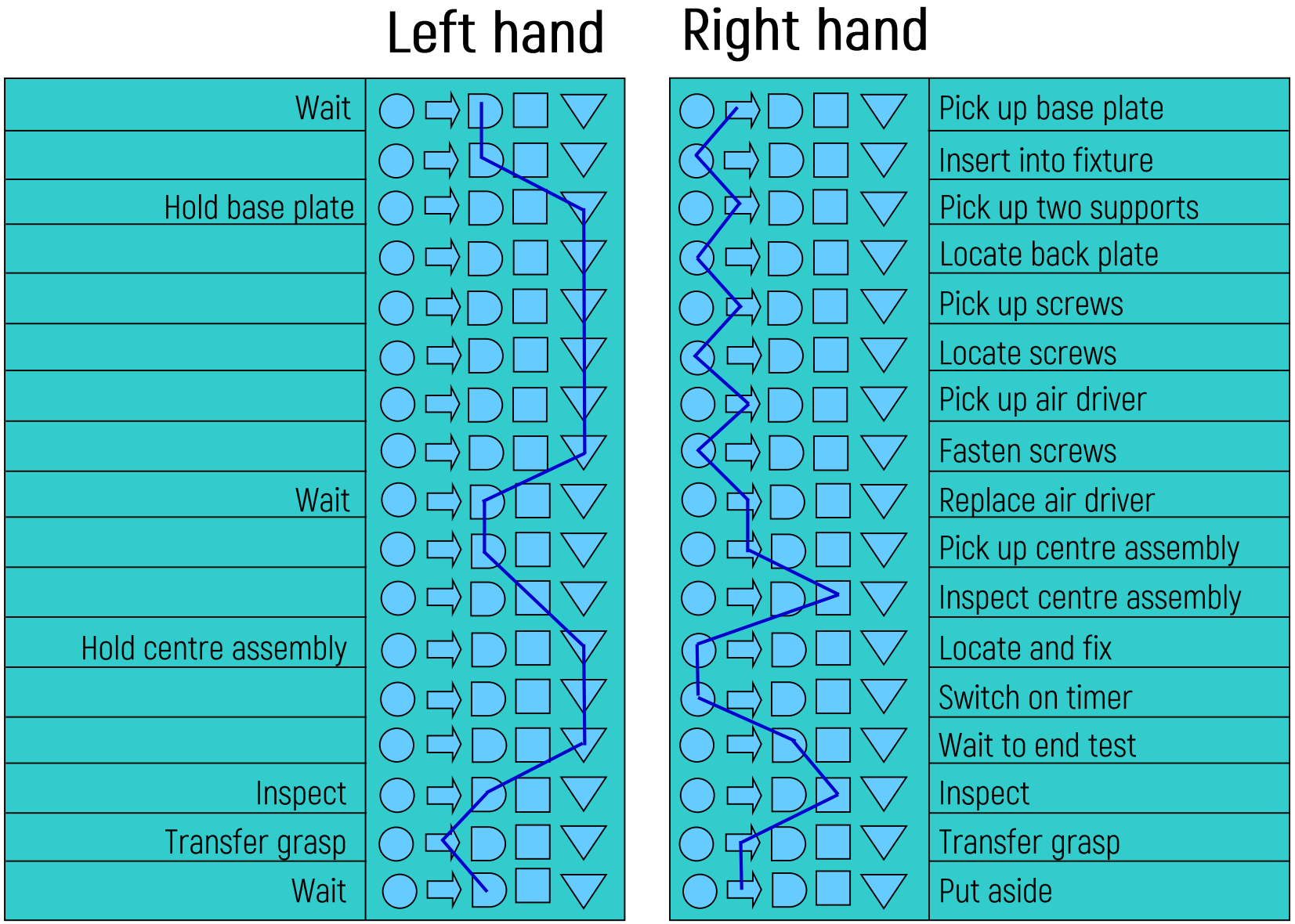
Left-Right Hand Chart (LRHC)

Also known as two-handed process chart

LRHC is used to show the activities/motions of operator's hand during work (e.g., repetitive assembly).

The purpose is to eliminate unnecessary motion, known as motion economy.

Left-Right Hand Chart (LRHC)



Source: https://www.slideshare.net/guru_fake/2-processdesign

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Thank You