How to Determine Optimal Manning Configuration

Value Chain Competitiveness (VCC)

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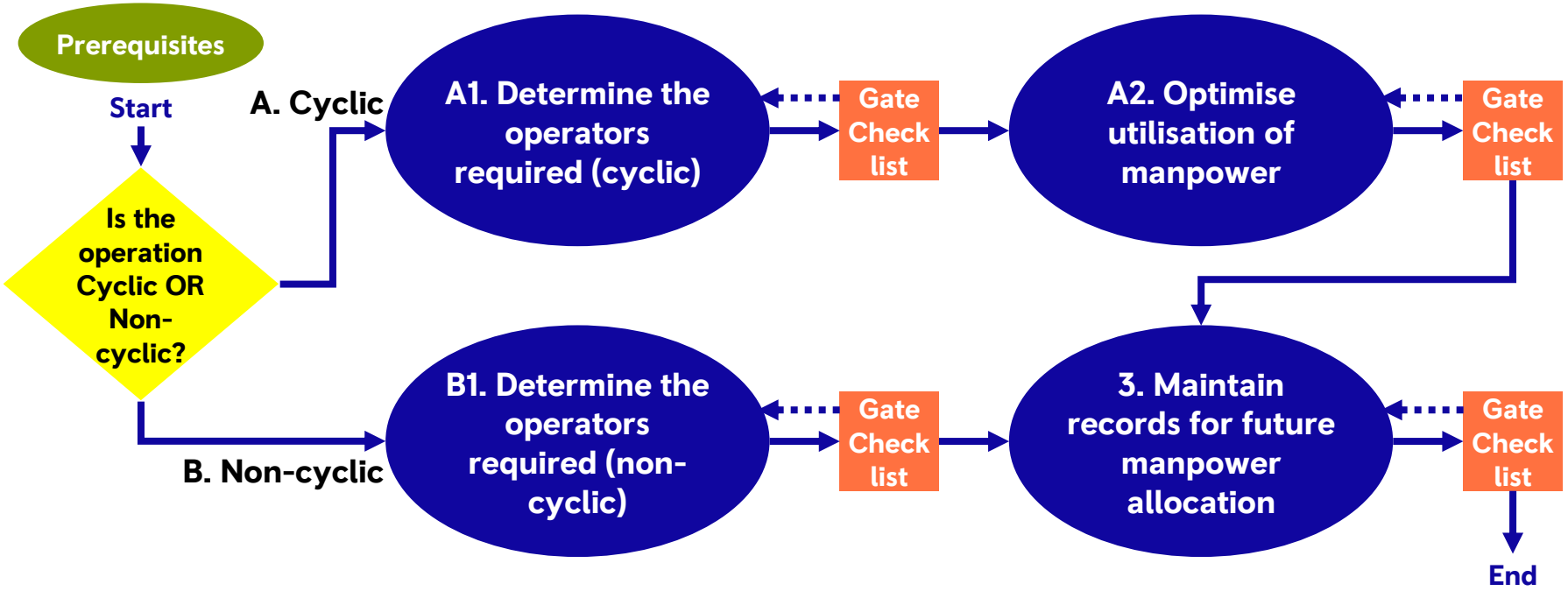
How to Determine Optimal Manning Configuration

Scope

Objectives & Principles



Scope

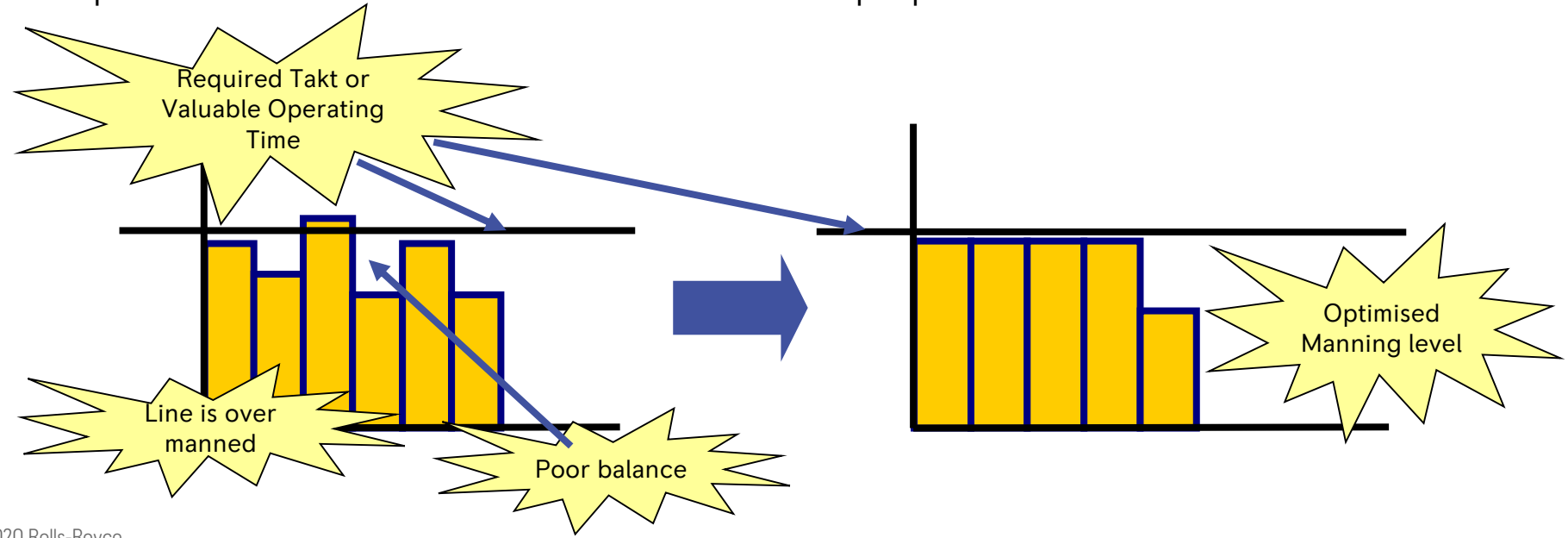
BACK Map NEXT

This ‘How To’ will enable you to:

- Interpret work element times within the ‘TAKT’ time (customer required output rate) and Target Cycle Time for **Cyclic operations**
- Based upon customer demand and manual work content, establish the required manpower for **non-cyclic operations.**
- Allocate work for optimal utilisation of operators
- Update standardised work combination documents
- Determine guideline manning levels for a range of demand profiles

Objective and Principles

- Optimise manpower utilisation and productivity levels for both cyclic and non-cyclic type operations
- Allocating work tasks to the correct number of people consistent with demand and productivity targets will ensure that only that production which is required is actually produced and that this production is carried out with the fewest number of people



Objectives

To understand the difference between Required to Operate and Required On Roll headcount

- For the examples in this how to, the manpower identified is the **Required to Operate (RTO)** headcount. That is the number of heads required for ***every hour the cell is working.***

- In order to ensure the above is available, the **Required on Roll (ROR)** headcount needs to be identified. That is how many people are required on the payroll to ensure that the RTO is always available, obviously failure to do this will put customer delivery at risk.

- To establish the ROR headcount, allowance must be made to cover reasons for non attendance; e.g. Sickness absence, floating holidays etc.

Notes

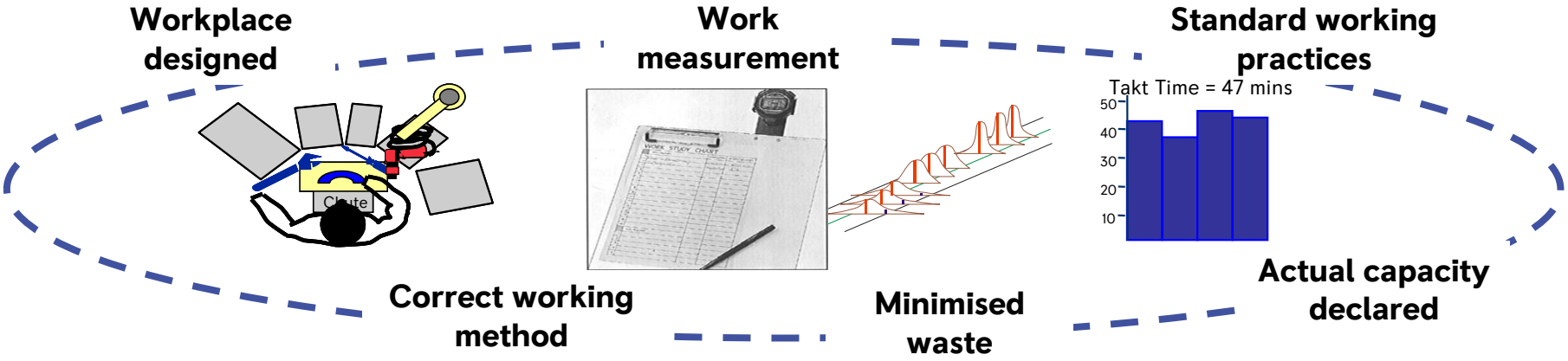
- The additional heads to cover the above levels of absences would usually be added to an area rather than an individual cell to offset the rounding up of calculated decimal heads.

- Any occasion when more than the RTO levels of headcount are present at work it is an ideal opportunity to progress continuous improvement actions.

Process Principles

1. Break work elements into small enough time buckets

2. Allocate work elements to minimise balance loss within Target Cycle Time or Valuable Operating Time



3. Ensure any partial loading falls on the last operator or stage

Prerequisites

Knowledge of:

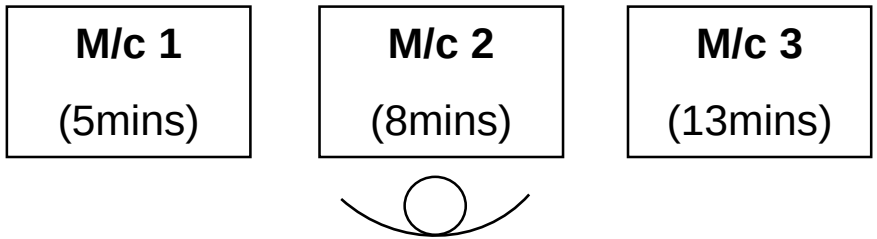
- Lean Manufacturing principles
- Customer requirements
- Product and process knowledge

Note; *Non-cyclic refers to those environments in which the manual and machine cycle times between the parts produced are variable and it is impractical to implement a repeatable standardised work cycle for the operator.*

Non-Cyclic Standardised Work

In certain environments in which the manual and machine cycle times between parts are variable, it is impractical to implement a repeatable standardised work cycle for the operator. This is normally because the required frequency of the operators visit to each machine is different.

For example: in a machining cell making different parts, with one operator;



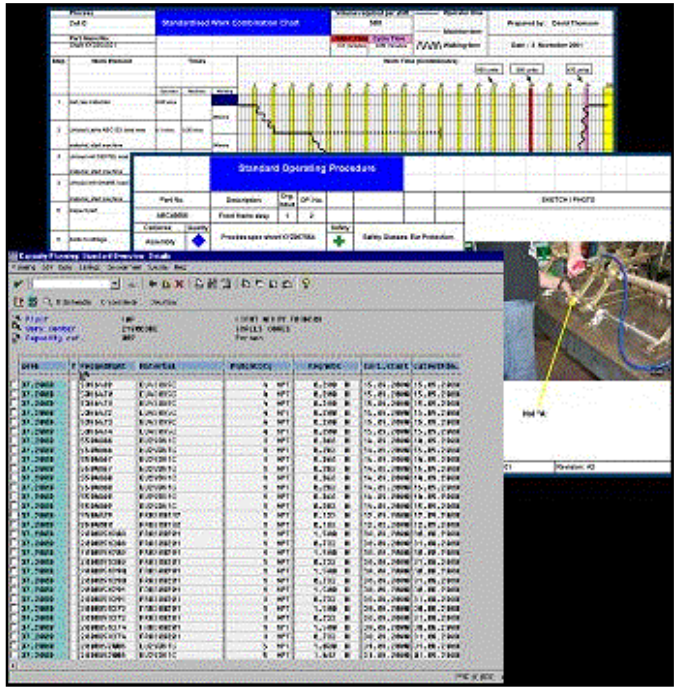
If the operator follows the same sequence each time, there will be excessive waste of waiting for both the operator and the machine. In order to maximise productivity the operator must react to each machine as it stops (in some cases more than one machine will be waiting and an appropriate prioritisation logic should be used).

In this scenario, a reference time period is created (eg. one hour, one shift, one day or one week). Based on customer demand and manual work content we can establish the required manual work content within this time period. By comparing the total manual work content with the time available we can establish the required manning.

A1. Determine the number of operators required (Cyclic work)

BACK Map NEXT

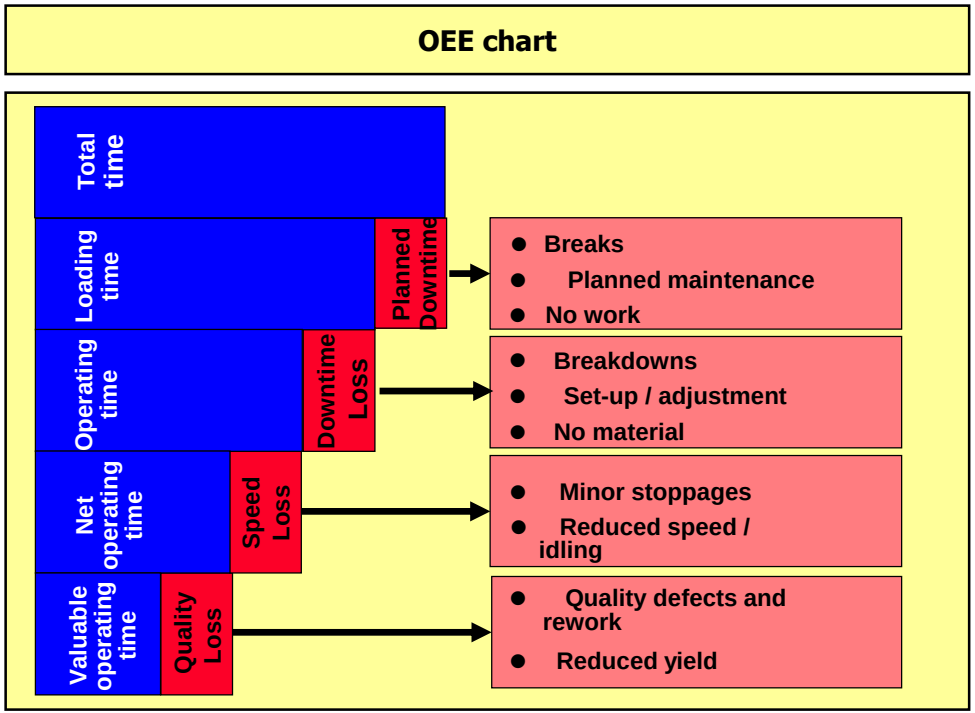
Obtain the work content times and the volume information



- Obtain Process Plan operation information
- Obtain Standardised Work information
- Obtain Work Content elemental times
- Obtain Product Volume requirements

A1. Determine the number of operators required (Cyclic work)

Calculate Target Cycle Time



Obtain or calculate Overall Equipment Effectiveness (OEE%) – see 'How-to operate equipment at required effectiveness'

TAKT = Loading Time / Customer Requirement

- Note: This is sometimes referred to as 'pure' TAKT in acceptance of the difficulty experienced in achieving this as a target time

Target Cycle Time = TAKT x OEE%

- The practical cycle time to be used for work balancing whilst the level of OEE is being improved
- Necessary to avoid setting impractical targets

A1. Determine the number of operators required (Cyclic work)

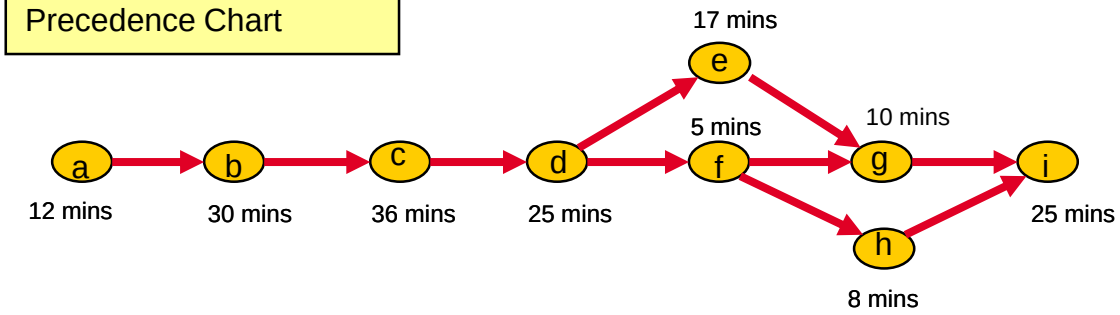
Determine optimum operating sequence

Operation	Basic times
a	12 mins
b	30 mins
c	36 mins
d	25 mins
e	17 mins
f	5 mins
g	10 mins
h	8 mins
i	25 mins

Total Basic Time = 168 mins

- Use a Precedence chart to structure the raw data from the routings or Standardised Work Procedures
- Work backwards from the final operation to establish what needs to be done and in which order
- Transfer this data to the chart – two key rules:
- The circles which represent work elements are drawn as far to the left as possible
- Arrows are never vertical

Precedence Chart



A1. Determine the number of operators required (Cyclic work)

Determine the manning levels to support target cycle time

Operation Basic times	
a	12 mins
b	30 mins
c	36 mins
d	25 mins
e	17 mins
f	5 mins
g	10 mins
h	8 mins
i	25 mins

Total Basic Time = 168 mins

- Use Required Manning Calculation to determine number of operators required
- Divide Total Basic time for the operation by the Target Cycle Time

Target Cycle Time **= TAKT x OEE**
= 82.65 x 57.5%
= 47.52 Minutes

Required Manning Calculation

$$\frac{\text{Total Basic Time}}{\text{Target Cycle Time}}$$

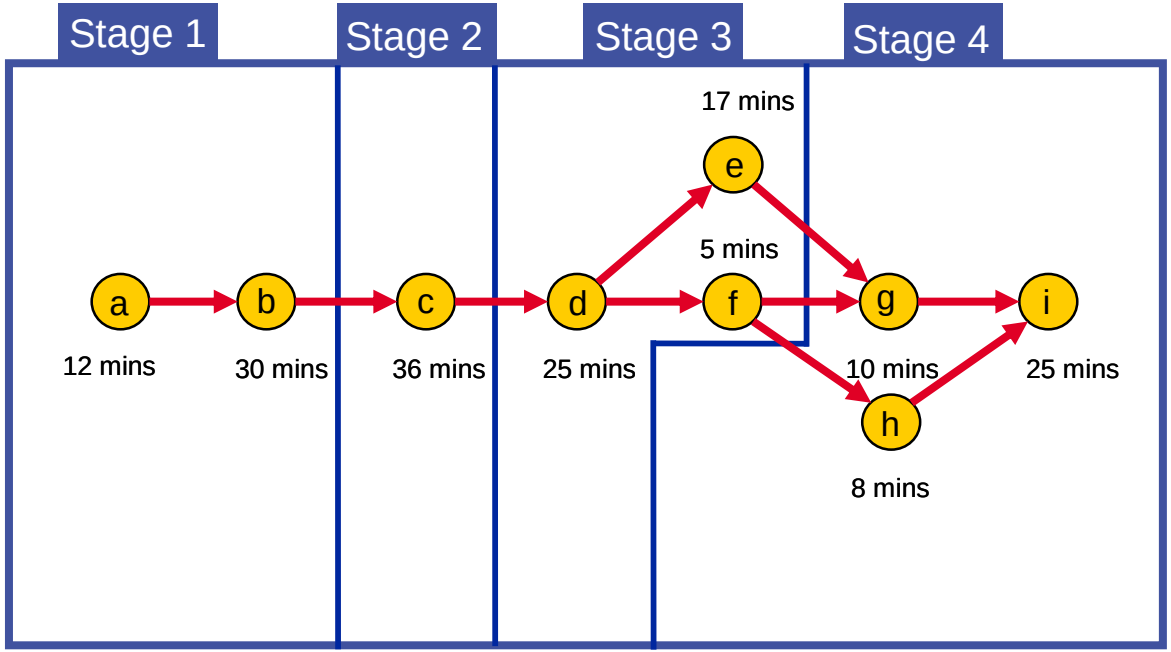
$$\frac{168 \text{ minutes}}{47.52 \text{ minutes}}$$

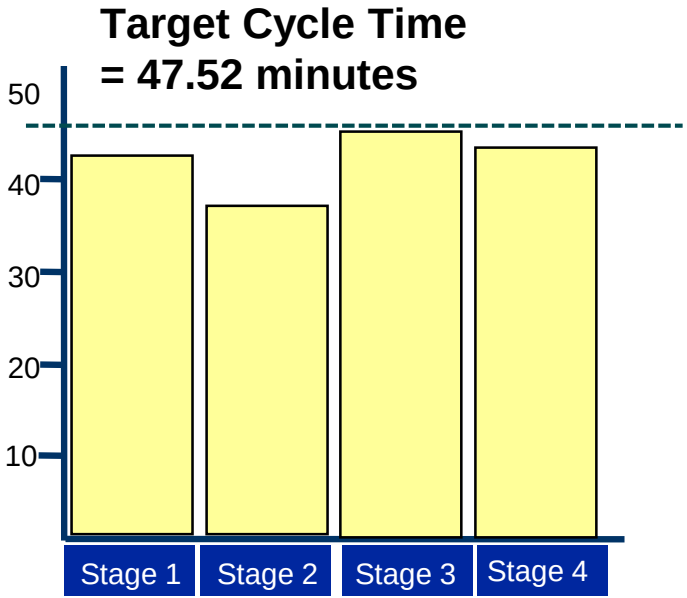
Required Manning:
3.54 or 4 people

A1. Determine the number of operators required (Cyclic work)

Identify combinations of stages that be completed within the Target Cycle Time

Example





- Use the Precedence chart to bundle work in line with the required Target Cycle Time

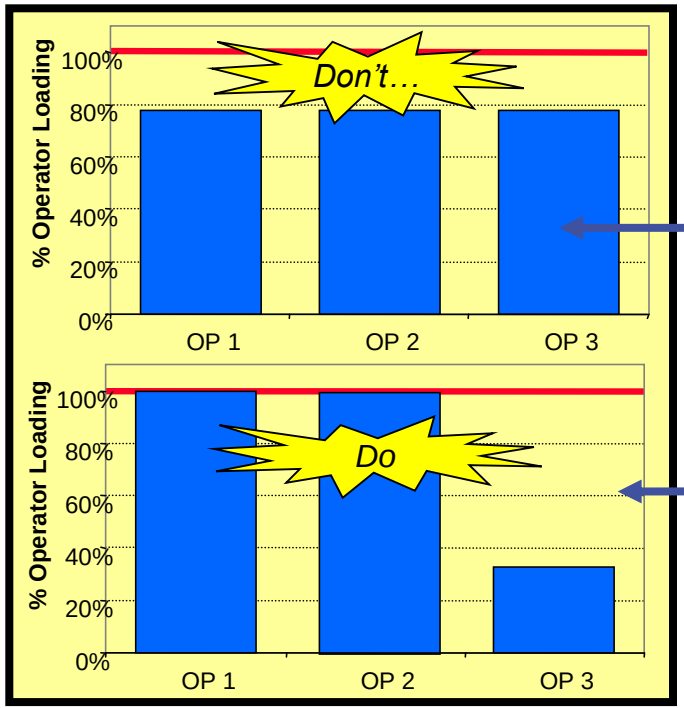
Gate checklist A1: Determine the number of operators required (Cyclic work)

BACK Map NEXT

- ☑ Basic times established and customer volumes obtained
- ☑ Required TAKT and Target Cycle Times and OEE calculated, and Optimum sequence of operations established
- ☑ Manning levels and production stages established

A2. Optimise utilisation of labour within the cell (Cyclic work)

Work Balance Table



Allocate work assignments

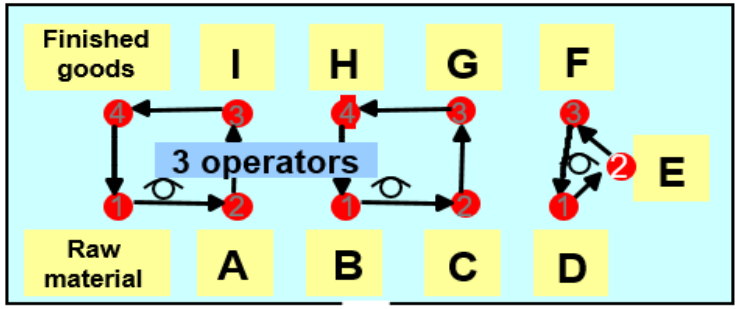
- Load work to fill operators time, rather than spread waste between operators (100% occupation)
- Issue relevant procedures appropriate to the required production stages
- Allocate Worker Assignments to required skill level

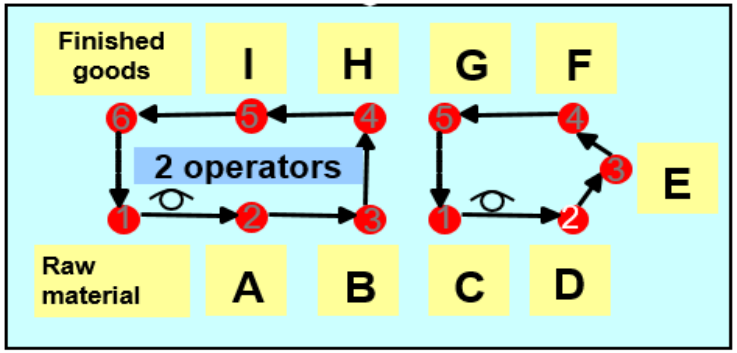
Traditional line balancing spreads the workload and waste of waiting time between all three Operators
- Difficult to eliminate waste
- Leads to Operators working in isolation and risk of over-production

Fill every Operator but one with workload consuming most of the Target Cycle Time
Exposes waste and makes it easier to improve

A2. Optimise utilisation of labour within the cell (Cyclic work)

Distribute workload - Splitting the work means that each operator is given one portion of the total work content





- Each Operator is allocated a portion of the total work content
- The sequence of work performed by the Operator may be different from the processing sequence
- 'Across-the-cell' work combinations are especially useful if work elements stack up to takt time
- Allocate first and last operations to the same Operator to create an automatic pacing effect on the whole cell
- Rotate Operators in the different work sequences to ensure skills are current and maintain interest
- Easy method for reallocating work if demand increases

Gate checklist A2: Optimise utilisation of labour within the cell (Cyclic work)

BACK Map NEXT

☑ Work distributed to correct level of manning with optimised work routes established

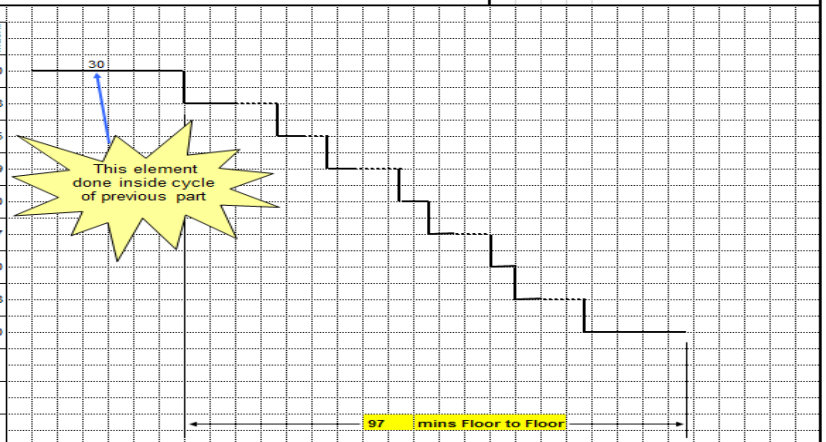
B1. Determine the number of operators required (Non-cyclic work)

Obtain manual work content times and volume information

WORK CONTENT ESTIMATE SHEET

Component	EG COMPONENT	Part No.	FW12345
Operation(s)	Turn location	Op No(s)	20
Machine Group	Vertical Borer	Date	16th Sept 20XX

Step	Work Element	Operat	Machin
1	Load pallet & part	0	0
2	Change tool, check fixture height, run prog	10	8
3	Index tip, ATSU, run prog	5	5
4	Measure dia, run prog	5	9
5	Measure dia	5	0
6	Index tip, ATSU, run prog	5	7
7	Turn part over	5	0
8	Index tip, ATSU, run prog	5	8
9	Unload part & paperwork	20	0
10			
11			
12			
13			
	Totals	60	37
	Floor to Floor	97	



Operation No		20	20 Inspect	20 Tooling					
Total Base	No/cycle	1	1	1					
Minutes	Each	62	10	25					
Operation Time		62	10	25					
Compiled by		J.Bloggs			Total Op Time		97.00	Pcs/Hr	0.62

Confirm which parts are manufactured in the cell and the volume requirements for each part.

For each part;

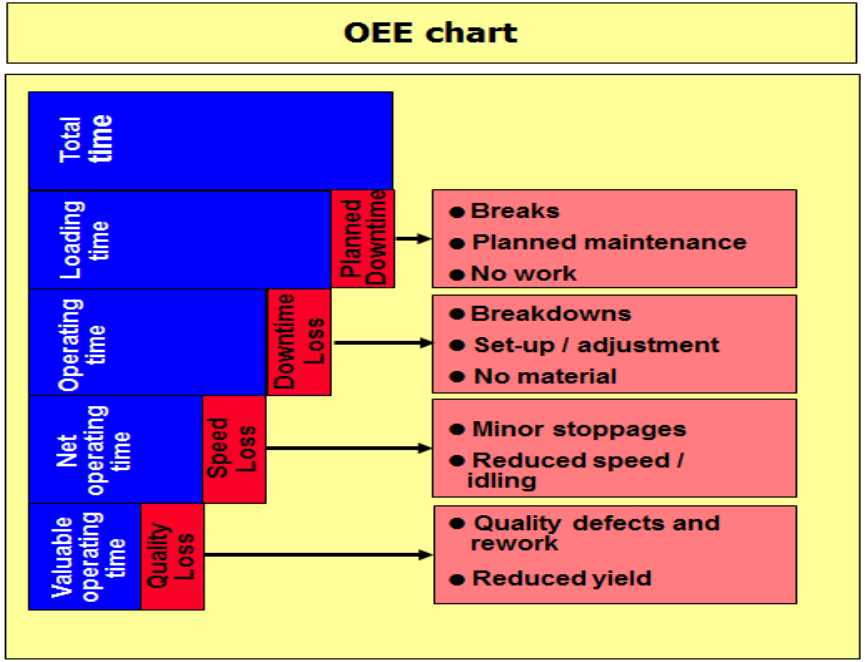
- Confirm each manual activity which needs to happen to complete the part
- Establish the work content time for each activity (for operations which involve machines we need to understand the actual **manual work** involved to complete one part)

B1. Determine the number of operators required (Non-cyclic work)

Define the reference time period for work balance

The reference time period should be as short a time as possible which meets the following criteria;

- all (or the majority) of the different part numbers are manufactured
- a repeatable time such as one week, one day, one shift, one hour



Obtain or calculate Overall Equipment Effectiveness (OEE%) – see 'How-to operate equipment at required effectiveness'

Establish the Valuable Operating Time

Valuable operating time =

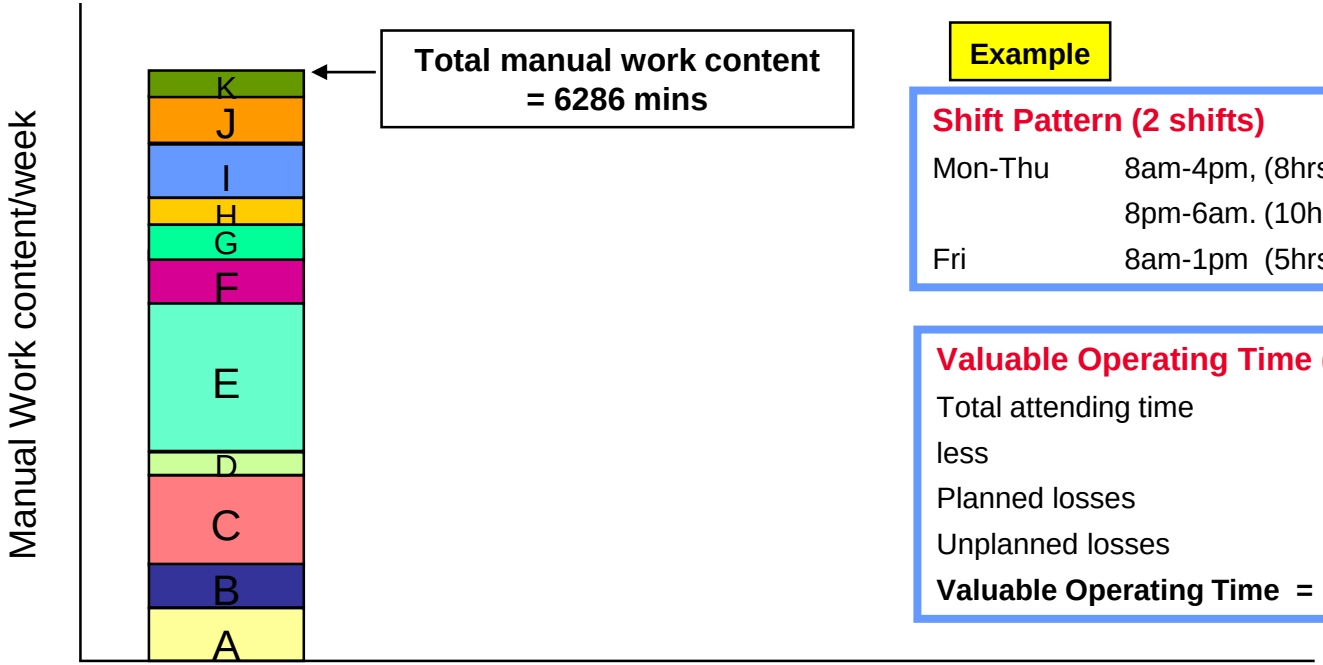
Loading time x OEE%

- The practical time to be used for work balancing whilst the level of OEE is being improved
- Necessary to avoid setting impractical targets

B1. Determine the number of operators required (Non-cyclic work)

Determine total manual work content in time period

Based on the volume requirement for each part in the time period, calculate the manual work content for each operation Stack the work to determine the total manual work content requirement.



Example

Shift Pattern (2 shifts)

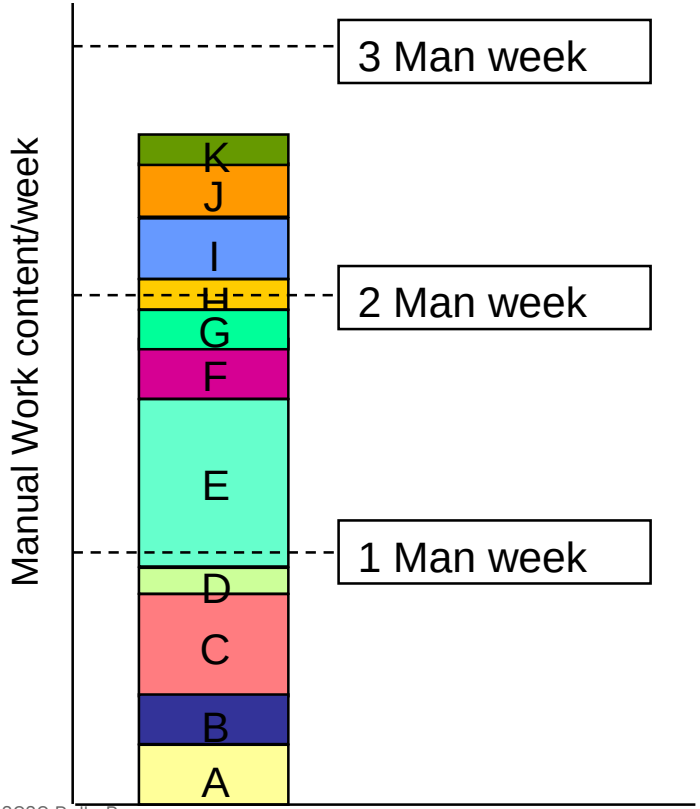
Mon-Thu	8am-4pm, (8hrs x 4 days
	8pm-6am. (10hrs x 4 days)
Fri	8am-1pm (5hrs x 1 day)

Valuable Operating Time (2 shifts)

Total attending time	= 4620 mins
less	
Planned losses	- 570 mins
Unplanned losses	- 1722 mins
Valuable Operating Time =	**2328 mins**

B1. Determine the number of operators required (Non-cyclic work)

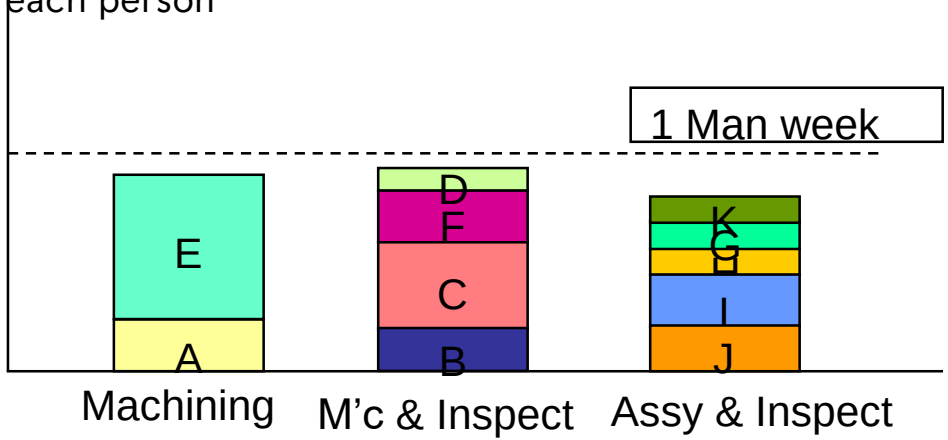
Determine the required manning distribute the manual work



Divide the total work content by the valuable operating time to establish the required manning

It may be necessary to categorise work into machine or area groupings in order to consider the most practical way to distribute the work

Combine the work to optimise the manual work content for each person

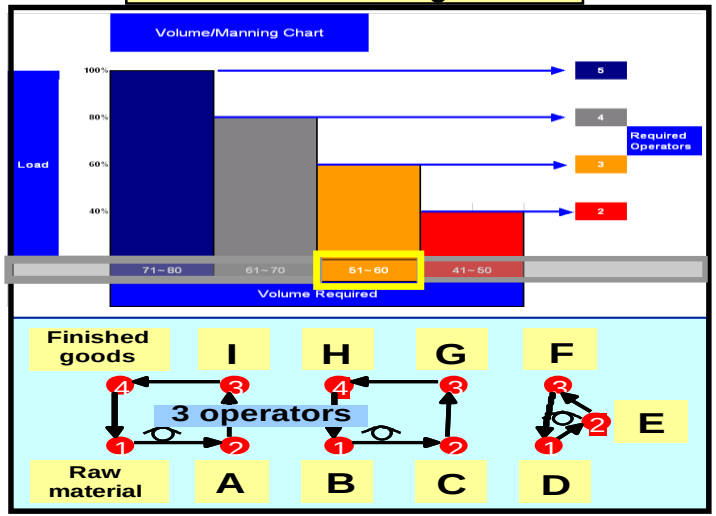


Gate checklist B1: Determine the number of operators required (Non-cyclic work)

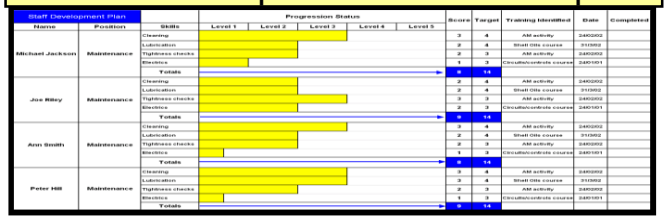
- ☑ Manual work content for all operations and customer volume information obtained
- ☑ Reference time period established (shift, day, week, month etc.)
- ☑ Total manual work content calculated for each operation to achieve customer volumes
- ☑ Optimum manning levels established by balancing the total manual work content within the reference time period

3. Maintain records for future manpower allocation

Volume/ Manning Chart



Skills Development Plan - Example



- Use the Volume-Manning Chart to act as a quick visual control of a cell or area
- It serves as an indicator of the required manning in an area, as determined by volume
- Describe various volume related scenarios and calculate the manning requirements for each
- Adjust the chart to reflect changes in
  - Nett Operating time
  - Volume required
  - Work content time
- Update the chart to show new manning level and worker assignment/routing
- Develop skills development plans for operator flexibility

Gate checklist 3: Maintain records for future manpower allocation

BACK Map

- ☑ Controls established for the areas to provide correct coverage for each operation
- ☑ Visual display of Volume and Manning created and displayed
- ☑ Skills development plans in place to ensure flexibility