How to Establish Work Content Time

Value Chain Competitiveness (VCC)

Version: 1

December 2019

How to Establish Work Content Time

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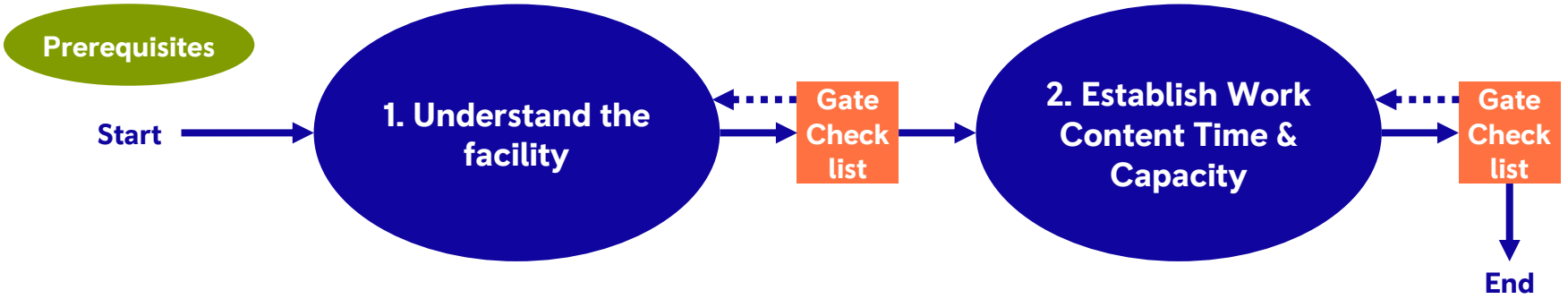
Scope

Objectives & Principles



Scope

This ‘How to’ will enable you to:

- Understand the different uses of work content time within the business
- Select the appropriate work measurement technique

Objective and Principles

- Industrial Engineering is a set of techniques used to minimise variability, inconsistencies and waste from the work place, with emphasis is on improving safety, quality and productivity

- Determining work content gives a sound basis for determining standardised working practices and ensures accurate planning, monitoring and control of capacity and costs in the business

- Establishing accurate Work Content Times allows Production Leader to make better decisions based on robust planning data.

- Work Content Time is used to:
  - Form a base to compare the efficiency of alternative methods
  - Identify ineffective time and opportunity to eliminate waste
  - Balance work between team members and facilities
  - Provide the basis for production planning and control
  - Develop measures for performance and cost control

Objective and Principles

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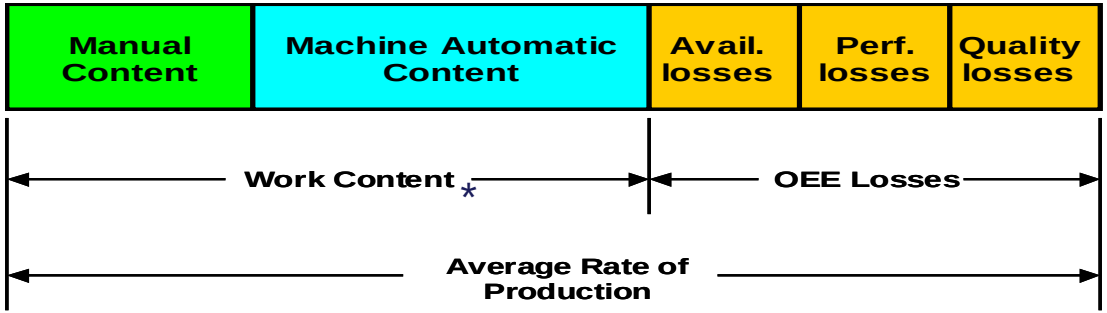
Work Content Build up and uses



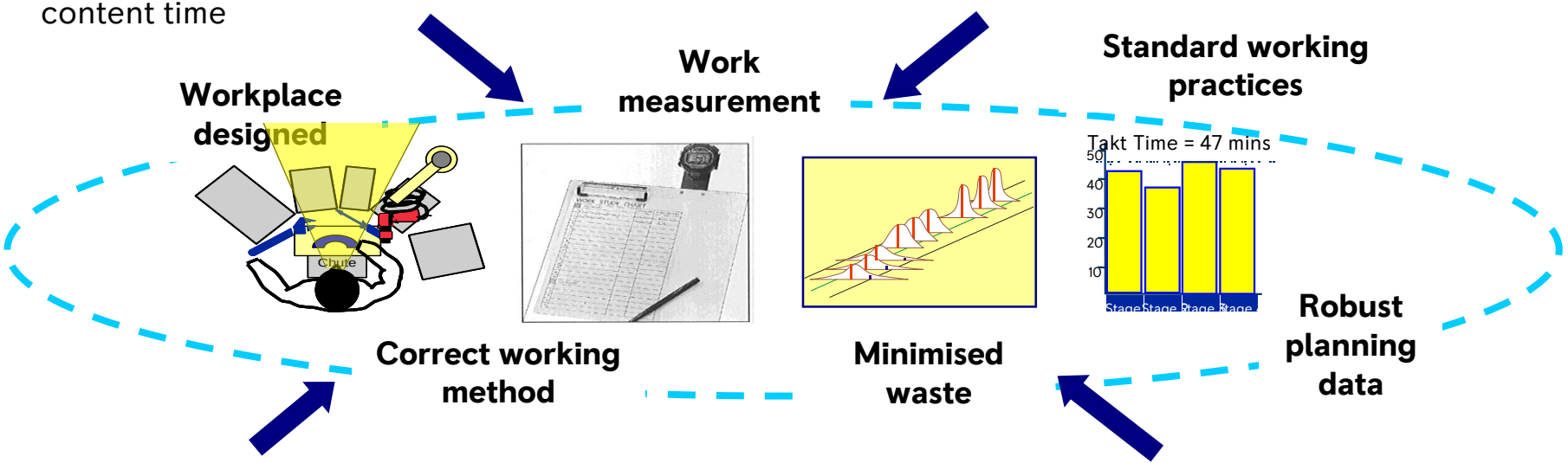
- Work Content looks at all the elements, manual and machine – identifying whether the elements are outside or inside the machine cycle.
- Analysis of Work Content and Overall Equipment Effectiveness (OEE) losses is used to focus actions on the reduction / elimination of waste.
- Work Content identifies the **Gross Capacity**
- When the OEE losses are applied to the Gross Capacity it determines the **Maximum Achievable Capacity**
- Load Planning needs to understand the total duration of the job including all the OEE loss implications to accurately forecast.
  - e.g. The average rate of production

*OEE is explained in 'How to operate equipment at required effectiveness'

Process Principles

1. Ensure consistent work measurement techniques are used to derive work content time

2. Establish the appropriate measurement technique for a particular type of operation



3. Utilise Work Content Time as the single measure for capacity planning and Standard Cost Development

4. Robust data for informed business decisions

Prerequisites

Knowledge of:

- Lean Manufacturing principles
- Process design
- Product and process knowledge
- Work measurement techniques

1. Understand the facility

Determine the level of process technology

Determine human versus Auto features

Manual

Dimensional check

Auto

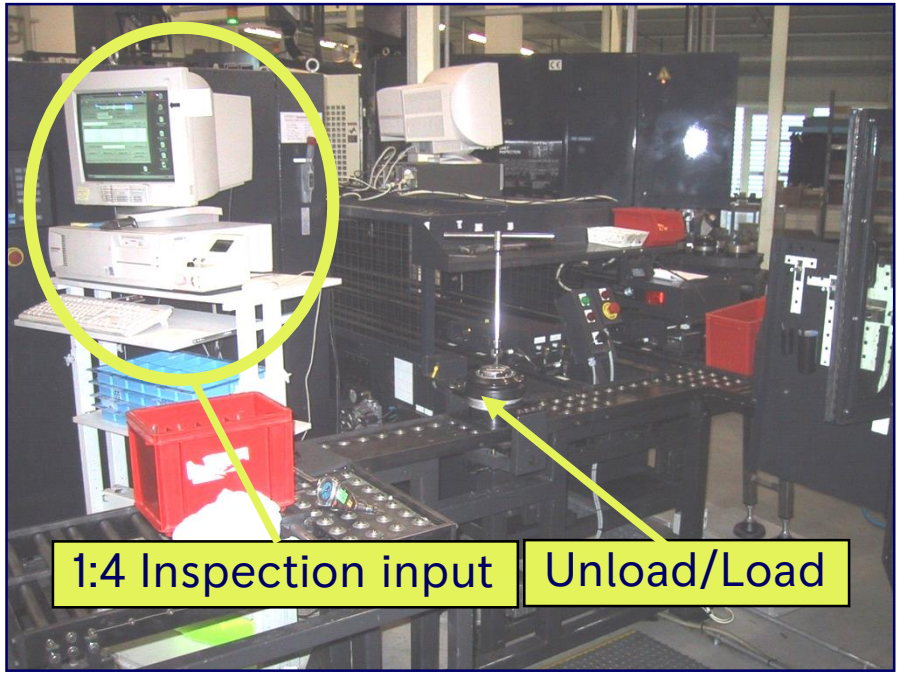
Checked via probe

- It is important to determine the level of automation within the facility as this will give a clearer understanding of
  - Areas for OEE* Losses
  - Inspection and checking times how these are carried out
- By understanding the levels of human/automatic intervention we can decide where and how to obtain time information
  - Human – Estimates, Time Study etc.
  - Auto – Process routings, Method data
- This analysis allows you to draft out the Work Content Time analysis sheet based on accurate, real life observation of the facts
  - Not what people think happens
  - Not theoretical inputs

*OEE is explained in 'How to operate equipment at required effectiveness'

1. Understand the facility

Establish any non-cyclic human interventions



- Non Cyclic elements are those elements which are carried out to a frequency within the operation and are sometimes referred to as frequential elements
  - Quality Checks
  - Changing tips, blades or wheels that are worn – but not tooling
  - Indexing tools
- These should be highlighted in the process instructions but can sometimes be presented at too high a level, expressed as an average time over the cycle
  - Speak with the operators to understand and validate this process data against what happens in real life (and how often)

1. Understand the facility

Obtain any relevant historical data or standards information

DATE: ...10/11/01. **TIME STUDY SHEET** SHEET 1 OF 1

ELEMENTS	R	EL OB BMT	R	EL OB BMT	R	EL OB BMT	R	EL OB BMT	R	EL OB BMT	AV. Mins	Fatigue Allow.	Av. Basic Mins
Attach sling & crane to comp.	100	0.40 0.40	90	0.45 0.45							0.403		0.403
B/P arrive at comp.		0.400		0.405									
Hoist comp.	100	0.30 0.70	100	0.30 0.75							0.300		0.300
B/P arrive at bench		0.300		0.300									
Clean comp.	110	1.00 1.70	100	1.05 1.80							1.075		1.075
B/P aside rag		1.100		1.050									
Check serial no.	100	0.50 2.20	90	0.55 2.35							0.498		0.498
B/P move to m/c		0.500		0.495									
Call up program	100	0.30 2.50	80	0.45 2.80							0.330		0.330
B/P program visual		0.300		0.360									
Table rotate	100	0.30 2.80	100	0.30 3.10							0.300		0.300
B/P table stopped		0.300		0.300									
Load comp. To fixture	100	0.90 3.70	90	1.00 4.10							0.900		0.900
B/P release clamp		0.900		0.900									
Aside crane	100	0.20 3.90	100	0.20 4.30							0.200		0.200
B/P back at m/c		0.200		0.200									
Table rotate & column trav.	100	0.70 4.60	100	0.70 5.00							0.700		0.700
B/P table stopped		0.700		0.700									
Probe face 'R' 3 points	100	1.10 5.70	100	1.10 6.10							1.100		1.100
B/P after 3rd point		1.100		1.100									
Probe bore 4 points	100	0.60 6.30	100	0.60 6.70							0.600		0.600
B/P end of point		0.600		0.600									
Run auto program	100	27.10 33.40	100	27.20 33.90							27.150		27.150
B/P Traverse end		27.100		27.200									
TOTALS C/FWD													

Time Study Example

- Obtain any system data relating to the job
- Obtain any time standards compiled through
  - Time study and Rating
- Obtain information relating to similar operations or operation elements that can be used for comparative estimating

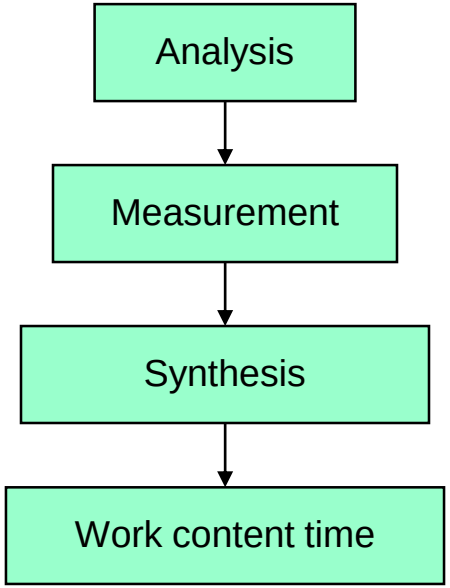
Gate checklist 1: Understand the facility

- ☑ Level of technology understood
- ☑ Non-cyclic human interventions determined
- ☑ Relevant data and standards obtained

2. Establish Work Content Time & Capacity

Understand the work measurement techniques

Work measurement is the process of establishing the time that a given task would take when performed by a qualified worker

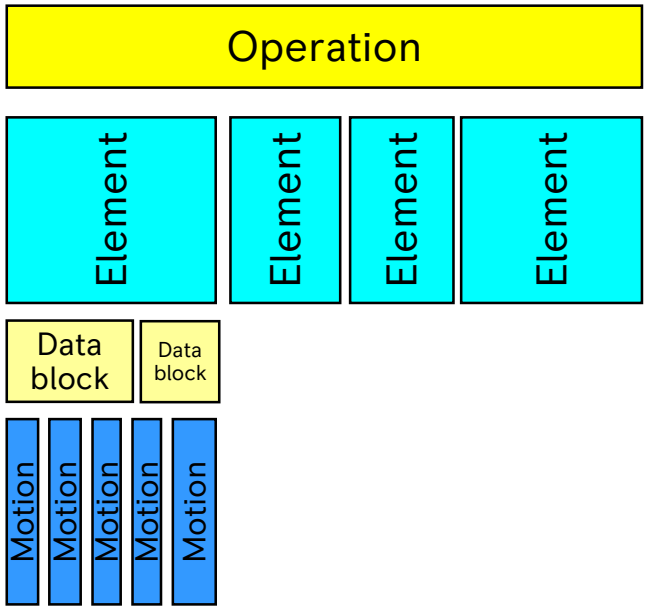


- The basic procedure, irrespective of the particular measurement technique being used, consists of 3 stages;
  - an analysis phase in which the job is divided into convenient, discrete components,
  - a measurement phase in which the specific measurement technique is used to establish the time required to complete each component;
  - a synthesis phase in which the various component times are added, together to construct the time for the complete operation

2. Establish Work Content Time & Capacity

Understand the work measurement techniques

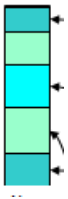
Analysis is managed by breaking down the operations in to lower level components of time



- Operations are made up of ‘elements’ e.g. ‘assemble frame installation’
- Elements are made up of ‘motions’ e.g. ‘fasten 4 screws with torque spanner’
- Datablocks (used in synthetic systems) are convenient groupings of motions that are built up to give elemental times for a number of operations
- Motions are the lowest level components of time e.g. ‘grasp’ or ‘reach’

2. Establish Work Content Time & Capacity

Understand the work measurement techniques



Estimating

OR

Data block

Use of Synthetics

OR

Use of Predetermined Motion Time System (PMTS)

OR

Use of Time Study

Estimating used for product introduction

- To prepare a bid (product introduction)
- To support outsourcing / in sourcing decisions
- To establish times for low volume, infrequently performed work

Measured times (synthetics, PMTS or time study)

- To make estimated time an actual time
- To update time after a change
- To analyse components of time in case of underperformance, for example capacity bottleneck or variability in productivity

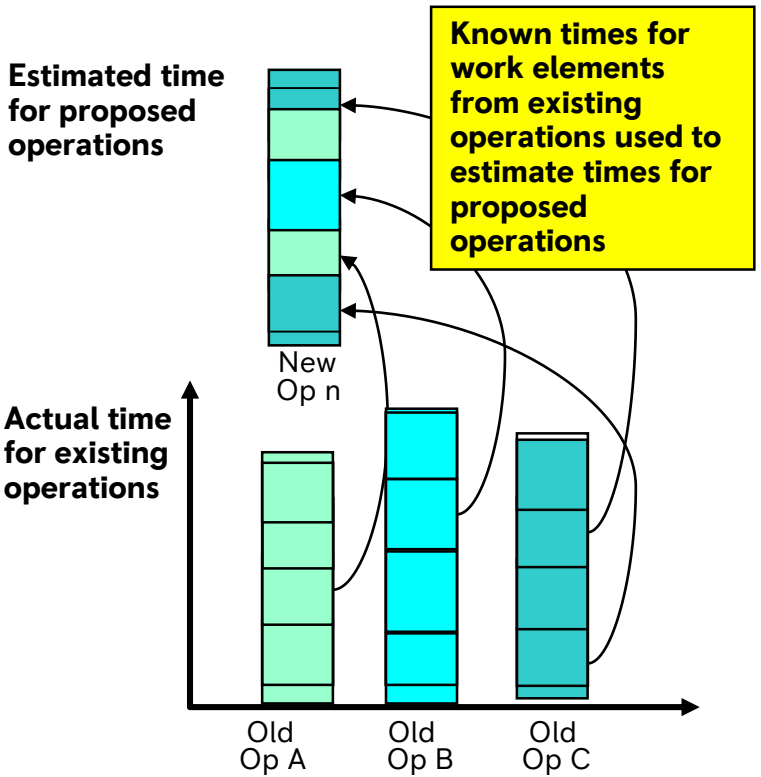
Synthetic uses common datablocks to build up the work content of new work

PMTS requires qualified practitioners and is restricted to work which is repeated many times

Time study is direct observation of work. Training is required in rating work.

2. Establish Work Content Time & Capacity

Use of Estimating

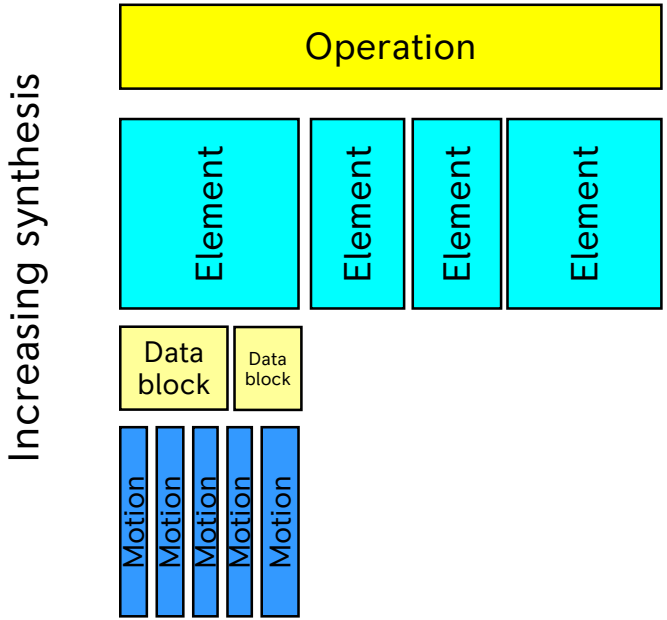


Estimating is a means for assessing the time required to carry out work, based on knowledge of similar types of work

- Required when there is no physical operation from which to establish the actual time
- Uses knowledge of the time taken to complete similar types of work and practical experience to 'estimate' the time for an operation
- Mainly used for new product introduction where the results may be a guide to, labour costs, capacity requirements and manning implications

2. Establish Work Content Time & Capacity

Use of Synthetics



Synthetic Data Systems use common 'datablocks' to establish accurate element times

- The 'datablocks' are derived from Predetermined Motion Time System (PMTS) tables or time study, and once established can be applied to any circumstance
- Synthetic Data Systems establish accurate elemental times

Data block system (Area description)

Operation No:

Operation Description | Obs. Code | Date: | Engineer: | Page

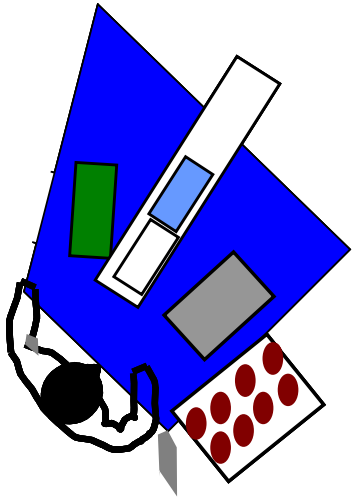
El.no	ELEMENT DESCRIPTION	D/B Code	TMU each	FREQ.	TMU'S	FATIGUE	BM's
1	Fasten 4 screws with	F1	110	1	110	5%	0.058
	torque spanner	F2	70	3	210	5%	0.110
2	Detach 2 plastic covers	D1	40	2	80	5%	0.042
3	Detach 3rd plastic cover	S1	30	3	90	5%	0.047
4	Get 10 fans	G2	100	0.1	10	5%	0.005
		S1	30	0.1	3	5%	0.002
5	Remove 2 screws from	F2	70	2	140	5%	0.074
	fan cover						
6	Aside screws	P1	20	2	40	5%	0.021
7	Assemble spacer bar	P2	40	1	40	5%	0.021
8	Assemble washer	P2	40	4	160	5%	0.084
9	Assemble fan	P4	110	1	110	5%	0.058
10	Assemble screw	P3	60	4	240	5%	0.126
11	Move to machine	P1	20	1	20	5%	0.011
12	Re-set machine	C1	30	1	30	5%	0.016
13	Fasten 4 screws for fan	F2	70	4	280	5%	0.147
14	Move to machine	P1	20	1	20	5%	0.011
15	Re-set machine	C1	30	1	30	5%	0.016
16	Fasten 4 screws with	F2	70	4	280	5%	0.147
	torque spanner						

Signatures: | Total BMV 0.994 | Relaxation Allowance 5%

Team Leader - | Operator - | TOTAL WORK CONTENT 1.044

2. Establish Work Content Time & Capacity

Use of Predetermined Motion Time Systems (PMTS)



Analysis can be made for reach, grasp, position & manipulate

PMTS uses times established for basic human motions to build up the time for an operation

- Assumption that all manual tasks can be analysed into basic motions of the body or body members
- Motions are classified according to the nature of the motion and the conditions under which it is made
- The time corresponding to each of the minutely analysed motions is then read from tables and the operation time is obtained by adding all the individual times
- Tabulated values are universal in character and most physical activities in any factory can be built up from basic times

El.no	ELEMENT DESCRIPTION	No.	SEQUENCE MODEL	FREQ.	TMU'S	FATIGUE	BM's
1	Fasten 4 screws with	2	A1 B0 G3 A0 B0 P0 A0	2	80	5%	0.042
	torque spanner	3	**A3 B0 G3 A3 B0 P1 A0**		**100**	**5%**	**0.053**
2	Detach 2 plastic covers	4	A3 B3 G3 A3 B0 P3 A0	1/10	15	5%	0.008
3	**Detach 3rd plastic cover**	6	A0 B0 G0 A0 B0 P1 A0	2	20	5%	0.011

2. Establish Work Content Time & Capacity

Use of Time Study

Time study is a very flexible technique, suitable for a wide range of work performed under a wide range of conditions

- Time study is a structured process of directly observing and measuring human work in order to establish the time required for completion of the work by a qualified worker when working at a defined level of performance
- The observer first undertakes preliminary observation of the work (a pilot study) to identify suitable elements which can be clearly recognised on subsequent occasions and are convenient, in terms of their length, for measurement
- Multiple observations of each element provides information on rating of work.

2. Establish Work Content Time & Capacity

Record the work Content Time and set the standard

Input the derived manual and machine times into work content time sheet

Complete WCT sheet to derive the total time

Manual Time	Machine Time
8	
4.00	
1.00	
0.00	7.3
0.75	
2.00	
0.00	26.5
2.25	
2.00	
	76.1

Rolls-Royce — Work Content Time Analysis

Part Number: NB13427 | Op Number: 30 | Programme Number: HX128415

Stage	Time / occasion	No. of occasions	Manual Time	Machine Time	Adjustments	Nett Time	Stage Time
Load Part	8.00	1	8				8.00
Clocking Job	4.00	1	4.00				4.00
MDI	1.00	1	1.00				1.00
Machine Time - Stage A			0.00	7.3	1.0	7.3	7.30
Index tip	0.75	1	0.75				0.75
ATSU	2.00	1	2.00				2.00
Machine Time - Stage B			0.00	26.5	1.0	26.5	26.50
Index tip	0.75	3	2.25				2.25
ATSU	2.00	1	2.00				2.00
Machine Time - Stage C			0.00	76.1	1.0	76.1	76.10
Index Tip	0.75	5	3.75				3.75
Clocking Job	4.00	1	4.00				4.00
ATSU	2.00	1	2.00				2.00
Machine Time - Stage D			0.00	6.8	1.0	6.8	6.80
Index Tip	0.75	1	0.75				0.75
ATSU	2.00	1	2.00				2.00
Load Steady	5.00	1	5.00				5.00
Machine Time - Stage E			0.00	5.3	1.0	5.3	5.30
Index Tip	0.75	1	0.75				0.75
ATSU	2.00	1	2.00				2.00
Machine Time - Stage F			0.00	28.6	1.0	28.6	28.60
Index Tip	0.75	1	0.75				0.75
ATSU	2.00	1	2.00				2.00
Machine Time - Stage G			0.00	33.2	1.0	33.2	33.20
Index Tip	0.75	2	1.50				1.50
ATSU	2.00	2	4.00				4.00
MDI	1.00	1	1.00				1.00
Inspection	2.00	2	4.00				4.00
Machine Time - Stage H			0.00	3.4	1.0	3.4	3.40
Index Tip	0.75	1	0.75				0.75
ATSU	2.00	1	2.00				2.00
Unload Steadies	3.00	1	3.00				3.00
Unload Part	8.00	1	8.00				8.00
Work Content (Floor to Floor)			67.25	187.2		187.2	254.45
Adjustments (Speed Loss)					0		
Work Content (hours)							4.24

2. Establish Work Content Time & Capacity

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Determine if Fatigue Allowances apply - Relaxation definitions and guidelines.

Definitions (BS 3138 : 1992)

Relaxation Factor	A factor, normally expresses as a percentage, which depends on the nature of the work done during the basic (*work content*) time and which is applied to the basic time in order to derive the relaxation time for that activity
Relaxation Time	An addition to the basic (*work content*) time: a) to afford relief to a qualified worker from the physical and mental efforts of carrying out specified work under specified conditions at standard performance; and b) to allow attention to personal needs. The additional time will depend upon the nature of the work and may be spent away from the workplace under management direction.
Note	**Relief from fatigue can also take place during unoccupied time or recovery period.**
Recovery Period	Withdrawal period to relieve stress caused by the work environment where adequate protection is impracticable. It should start when established threshold exposure limits for the work are reached and should be spent away from the workplace. Recovery periods can be concurrent with relaxation time and with unoccupied time, and other tasks can be undertaken during the withdrawal periods.

Guidelines

Relaxation time	Where an agreed recognised paid break is taken within the normal shift duration. This is where the production process is stopped for a period of time for the workers to attend to their personal needs. This is a planned loss to the production output and is therefore reflected in the reduction of Loading Time for capacity calculation purposes.
Unoccupied time	Where an operator incurs waiting time, after finishing a task, for the end of the process time of a machine or process or for the end of a planned task executed by another worker in the cell. This time, whilst available for other work to be assigned, is used for recovery from fatigue and for personal needs. Therefore no loss will be incurred for capacity calculation purposes

2. Establish Work Content Time & Capacity

Apply allowances to specific Work Elements

- Every attempt should be made to improve the environment and working conditions in order to eliminate or reduce the need to apply allowances
- See “How to improve workstation and process design to minimise waste”
- Only after every attempt to eliminate a condition has been exercised, is an allowance to be considered
- Conditions affecting work elemental time can include:
  - Temperature
  - Air condition
  - Humidity
  - Noise
  - Light
  - Posture
  - Physical Weight

Note Relief from fatigue can also take place during unoccupied time within the Work Content Time or recovery period.

2. Establish Work Content Time & Capacity

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Determine Capacity

For a given work-centre use work content time (WCT) together with available time, OEE, and volume information to understand capacity and utilisation

Enter Loading time (total attendance time - planned stops)

Enter parts and work content times

Gross capacity (individual part production in the full available time)

Max achieve capacity (individual part production in reduced available time (using OEE))

Facility Utilisation Analysis

		Cost Centre	**0445 - Widget Cell**
Operating Pattern	(7) Day Working	Machine	**MC 3**
Loading Time (mins per week)	9120.00	Progamme Ref.	xyz / Weeks remaining: 38.7

Op No & Part Number	WCT (mins)	Gross Capacity per week (#pts)	OEE (% as decimal)	Max Achieve Capacity per week (#pts)	Volume Required (#pts)	Weekly Volume (#pts)	Weekly hrs required (incl. OEE loss time)
FW10600 - OP1	758.18	12.03	0.60	7.22	84	2.17	45.71
FW12559 - OP1	812.73	11.22	0.60	6.73		0.00	0.00
FW26569 - OP1	697.64	13.07	0.60	7.84	87	2.25	43.56
UL24103 - OP1	245.45	37.16	0.60	22.29	37	0.96	6.52
UL37571 - OP1	482.18	18.91	0.60	11.35	24	0.62	8.31
		0.00	0.60	0.00		0.00	0.00
		0.00	0.60	0.00		0.00	0.00
		0.00	0.60	0.00		0.00	0.00
		0.00	0.60	0.00		0.00	0.00
		0.00	0.60	0.00		0.00	0.00
		0.00	0.60	0.00		0.00	0.00
		0.00	0.60	0.00		0.00	0.00
		0.00	0.60	0.00		0.00	0.00
		0.00	0.60	0.00		0.00	0.00
		0.00	0.60	0.00		0.00	0.00
		0.00	0.60	0.00		0.00	0.00
		0.00	0.60	0.00		0.00	0.00
		0.00	0.60	0.00		0.00	0.00
		0.00	0.60	0.00		0.00	0.00
		0.00	0.60	0.00		0.00	0.00
						5.99	104.10

No. of Machines	1	Total Available Time (Hours)	152.00	Utilisation Factor	0.68
Compiled by		Date		Tel. No.	

Total available time (Loading time x no. of machines)

Enter time period in 'weeks remaining'

Enter latest OEE data

Enter volume required in time period

Weekly volume (volume required / weeks remaining)

Weekly hours required (weekly volume x WCT hrs / OEE)

Utilisation factor (Weekly hrs required / total available time)

<=1 OK

>1 Insufficient capacity

Gate checklist 2: Establish Work Content Time & Capacity

BACK Map

- ☑ Manual times have been documented and input to WCT analysis
- ☑ Machine times have been documented and input to WCT analysis
- ☑ Non-cyclic or Frequential elements have been input to WCT analysis
- ☑ WCT has been calculated and set as a Standard