PRODUCTIVITY IMPROVEMENT PROGRAM
THROUGH
WORK STUDY
WORK MEASUREMENT
TIME STUDY
16ND –17TH JULY 2004
WORK STUDY

METHOD STUDY
TO SIMPLIFY THE JOB AND
DEVELOP MORE
ECONOMICAL METHODS OF
DOING IT

WORK MEASUREMENT
TO DETERMINE HOW LONG
IT SHOULD TAKE TO CARRY
OUT

HIGHER
PRODUCTIVITY

Productivity Drives National Development
DEFINITION OF WORK MEASUREMENT

WORK MEASUREMENT IS THE APPLICATION OF TECHNIQUES DESIGNED TO ESTABLISH THE TIME FOR A QUALIFIED WORKER TO CARRY OUT A SPECIFIED JOB AT A DEFINED LEVEL OF PERFORMANCE

B.S. GLOSSARY
WHY WORK MEASUREMENT

1. GIVE MANAGEMENT MEANS OF MEASURING THE TIME TAKEN IN THE PERFORMANCE OF AN OPERATION (OR SERIES OF OPERATION – REVEAL THE INEFFECTIVE TIME).

2. CAN BE USED TO SET STANDARD TIMES FOR CARRYING OUT THE WORK. ANY ACCESS TIME WILL THEN IMMEDIATELY SHOW UP AS INEFFECTIVE TIME.
USE OF WORK MEASUREMENT

• To compare the efficiency of alternative methods
• To balance the work of members of teams
• To determine the number of machines an operative can run
• To provide information for estimation of tenders, selling prices and delivery promises.
• To set standards of machine utilisation and labour performance – e.g. basis for incentive scheme
• To provide information for labour-cost control
• To provide basis for Production Planning and Control
TECHNIQUES OF WORK MEASUREMENT

• Work sampling
• Stop-watch time study
• Predetermined time standards (PTS)
• Standard data
WORK MEASUREMENT BASIC STEPS

WORK MEASUREMENT – BASIC PROCEDURE:

SELECT
RECORD
EXAMINE
MEASURE
COMPILE
DEFINE
**Work Measurement**

Select, record, examine and measure quantity of work performed using:

- work sampling
- stop-watch time study
- predetermined time standards (PTS)

with allowances to get standard time of operations

To establish standard data banks

**COMPILE**

AK/TSD/nap/MTCP - AK/PB133 - 23 Mei 2001
TIME STUDY

IS A WORK MEASUREMENT TECHNIQUE FOR RECORDING THE TIME AND RATES OF WORKING FOR THE ELEMENTS OF A SPECIFIED JOB CARRIED OUT UNDER SPECIFIC CONDITIONS AND FOR ANALYSING THE DATA SO AS TO OBTAIN THE TIME NECESSARY FOR CARRYING OUT THE JOB AT A DEFINED LEVEL OF PERFORMANCE.
Basic Equipment for Time Study

- A stop-watch
- A study board
- Time study form
- A calculator
- Measuring instrument
SELECTING THE JOB

• A new job
• A change of material or method of working
• A complaints by workers
• A bottleneck operation
• Standard time for incentive scheme
• Equipment with excessive idle time
• A preliminary to making method study or to compare proposed methods
• Job with excessive cost
TIME STUDY STEPS

1. Obtaining and recording all information about the job
2. Recording a complete description of the method – breaking down operation into element
3. Determining the sample size
4. Recording the time taken for each element
5. Assessing the effective speed of working – Rating
6. Extending the the observed times to “basic times”
7. Determining the allowances for the operation
8. Determine the “Standard Time” for the operation.
Obtaining and recording information

- Information to enable the study to be found and identified quickly when needed
- Product or part being processed
- Process, method, plant or machine
- Operative
- Duration
- Working conditions
Breaking job into element

Once the information and method of operation are OK job must be broken down into elements.

WHAT AND WHY?
DEFINITION OF AN ELEMENT

AN ELEMENT IS A DISTINCT PART OF A SPECIFIED JOB SELECTED FOR CONVENIENCE OF OBSERVATION, MEASUREMENT AND ANALYSIS.
Breaking job into elements

• To separate productive work from non productive work
• For more accurate assessing of rate of working
• To distinguish different types of elements.
• To isolate element involving high degree of fatigue for better allocation of fatigue allowances
• To facilitate checking the method – detection of insertion or omission of element
• To produce detailed work specification
• To extract frequently recurring element for compilation of standard data
Types of elements

- Repetitive
- Occasional
- Constant
- Variable
- Manual
- Machine
- Governing
- Foreign
Deciding on the elements

• Easily identifiable with definite beginnings and endings – break point
• As short as can be conveniently timed
• Choose element that represent naturally unified and recognisably distinct segments of the operation.
• Separate manual elements from machine elements
• Separate constant elements from variable elements
DEFINITION OF A WORK CYCLE

A WORK CYCLE IS THE SEQUENCE OF ELEMENTS, WHICH ARE REQUIRED TO PERFORM A JOB OR YIELD A UNIT OF PRODUCTION. THE SEQUENCE MAY SOMETIMES INCLUDE OCCASIONAL ELEMENTS.
WORK CYCLE

A work cycle starts at the beginning of the first element of the operation or activity and continues to the same point in a repetition of the operation. That is the start of the second cycle.
SAMPLE SIZE

To determine the sample size or the number of readings that must be made for each element, given a predetermined confidence level and accuracy margin

Use Statistical Method
SAMPLE SIZE

Use Statistical Method

\[ n = \left( \frac{40 \cdot n' \cdot x^2 - (x)^2}{x} \right)^2 \]

- \( n \) = sample size we wish to determine
- \( n' \) = number of reading taken in the preliminary studies
- \( x \) = value of readings
## SAMPLE SIZE

**Conventional guide**

A number of cycles to be timed based on the total number of minutes per cycle

<table>
<thead>
<tr>
<th>Min/cycle</th>
<th>To 0.10</th>
<th>To 0.25</th>
<th>To 0.50</th>
<th>To 0.75</th>
<th>To 1.0</th>
<th>To 2.0</th>
<th>To 5.0</th>
<th>To 10.0</th>
<th>To 20.0</th>
<th>To 40.0</th>
<th>Over 40.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of cycles recommended</td>
<td>200</td>
<td>100</td>
<td>60</td>
<td>40</td>
<td>30</td>
<td>20</td>
<td>15</td>
<td>10</td>
<td>8</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>
Timing each element

- Cumulative timing
- Flyback timing
DEFINITION OF A RATING

RATING IS THE ASSESSMENT OF THE WORKER’S RATE OF WORKING RELATIVE TO THE OBSERVER ‘S CONCEPT OF THE RATE CORRESPONDING TO STANDARD PACE
STANDARD RATING

THE AVERAGE RATE AT WHICH QUALIFIED WORKERS WILL NATURALLY WORK AT A JOB, WHEN USING THE CORRECT METHOD AND WHEN MOTIVATED TO APPLY THEMSELVES TO THEIR WORK.
STANDARD RATING - CONTINUE

EQUIVALENT TO THE SPEED OF MOTION OF LIMBS OF A MAN OF AVERAGE PHYSIQUE WALKING WITHOUT A LOAD IN A STRAIGHT LINE ON LEVEL GROUND AT A SPEED OF 4 MILES AN HOUR (6.4 KM PER HOUR)
FACTORS AFFECTING RATE OF WORKING

1. Variation in quality of material
2. Changes in operating efficiency of tools and equipment
3. Changes in methods or conditions of operation
4. Variation in mental attention for the performance of work
5. Changes in surrounding conditions – light, climate, temperature etc.
SCALE OF RATING

IN ORDER THAT A COMPARISON BETWEEN THE OBSERVED RATE OF WORKING AND THE STANDARD RATE MAY BE MADE EFFECTIVELY, IT IS NECESSARY TO HAVE A NUMERICAL SCALE AGAINST WHICH TO MAKE THE ASSESSMENT

60 – 80 SCALE (CHARLES E BEDAUX)

75 – 100 SCALE

100 – 133 SCALE

75 – 100 SCALE (BRITISH STANDARD SCALE)
PERFORMANCE RATING

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FREQUENCY

High rating
Normal rating
Low rating

Time

Fast workers
Standard workers
Slow workers

PERFORMANCERATING
<table>
<thead>
<tr>
<th>Scales</th>
<th>Description</th>
<th>Comparable Walking Speed*</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 – 80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75 – 100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>133</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 – 100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 – 100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(standard)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td><strong>No activity</strong></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td><strong>Very slow; clumsy, fumbling movement; operator appears half asleep; with no interest in the job.</strong></td>
<td>2</td>
</tr>
<tr>
<td>50</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td><strong>Steady, deliberate unhurried performance, as for a worker not on piecework but under proper supervision; looks slow, but time is not being intentionally wasted while under observation.</strong></td>
<td>3</td>
</tr>
<tr>
<td>75</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>133</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 (standard rating)</td>
<td><strong>Brisk, businesslike performance, as of an average qualified worker on piecework; necessary standard of quality and accuracy achieved with confidence.</strong></td>
<td>4</td>
</tr>
<tr>
<td>80</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>133</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 (standard rating)</td>
<td><strong>Very fast; operator exhibits a high degree of assurance, dexterity and co-ordination of movement, well above that of an average trained worker.</strong></td>
<td>5</td>
</tr>
<tr>
<td>125</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>167</td>
<td></td>
<td></td>
</tr>
<tr>
<td>125</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150</td>
<td><strong>Exceptionally fast; requires intense effort and concentration, and is unlikely to be kept up for long periods; a “virtuoso” performance only achieved by a few outstanding workers.</strong></td>
<td>6</td>
</tr>
<tr>
<td>150</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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ATTRIBUTE OF AN EXPERIENCE WORKER

- achieves smooth and consistent movements
- acquires rhythm
- responds more rapidly to signals
- anticipates the difficulties and is more ready to overcome them.
- Carries out the task without the appearance of conscious attention and is there more relaxed.
RECORDING THE RATING

IN GENERAL, EACH ELEMENT OF ACTIVITY MUST BE RATED DURING ITS PERFORMANCE BEFORE THE TIME IS RECORDED, WITHOUT REGARD TO PREVIOUS OR SUCCEEDING ELEMENTS.

NO CONSIDERATION SHOULD BE GIVEN TO THE ASPECT OF FATIGUE, SINCE THE ALLOWANCE FOR RECOVERY FROM FATIGUE WILL BE ASSESSED SEPARATELY.
DEFINITION OF A QUALIFIED WORKER

A QUALIFIED WORKER IS ONE WHO IS ACCEPTED AS HAVING THE NECESSARY PHYSICAL ATTRIBUTES, WHO POSSESSES THE REQUIRED INTELLIGENCE AND EDUCATION, AND WHO HAS ACQUIRED THE NECESSARY SKILL AND KNOWLEDGE TO CARRY OUT THE WORK IN HAND TO SATISFACTORY STANDARD OF SAFETY, QUANTITY AND QUALITY.
A REPRESENTATIVE WORKER

As one whose skill and performance is the average of a group under consideration and who is not necessarily a qualified worker.
DEFINITION OF STANDARD PERFORMANCE

STANDARD PERFORMANCE IS THE RATE OF OUTPUT WHICH QUALIFIED WORKERS WILL NATURALLY ACHIEVE WITHOUT OVER-EXERTION AS AN AVERAGE OVER THE WORKING DAY OR SHIFT, PROVIDED THAT THEY KNOW AND ADHERE TO THE SPECIFIED METHOD AND PROVIDED THAT THEY ARE MOTIVATED TO APPLY THEMSELVES TO THEIR WORK.

THIS PERFORMANCE IS DENOTED AS 100 ON THE STANDARD RATING AND PERFORMANCE SCALES.
Using Rating Factor

Observed time $\times$ rating = a constant
Extending the observed time to basic time
DEFINITION OF BASIC TIME

BASIC TIME IS THE TIME FOR CARRYING OUT AN ELEMENT OF WORK AT STANDARD RATING, I.E.

\[
\frac{\text{OBSERVED TIME} \times \text{OBSERVED RATING}}{\text{STANDARD RATING}}
\]
Effect of extension on the time of an element

(a) Performance above standard

(b) Performance below standard

Observed Time

Basic Time

OT X (R-100)
DEFINITION WORK CONTENT

THE WORK CONTENT OF A JOB OR OPERATION IS DEFINED AS: BASIC TIME + RELAXATION ALLOWANCE + ANY ALLOWANCE FOR ADDITIONAL WORK – e.g.

THAT PART OF CONTINGENCY ALLOWANCE WHICH REPRESENTS WORK
DEFINITION OF CONTINGENCY ALLOWANCE

A CONTINGENCY ALLOWANCE IS A SMALL ALLOWANCE OF TIME WHICH MAY BE INCLUDED IN A STANDARD TIME TO MEET LEGITIMATE AND EXPECTED ITEMS OF WORK OR DELAYS, THE PRECISE MEASUREMENT OF WHICH IS UNECONOMICAL BECAUSE OF THEIR INFREQUENT OR IRREGULAR OCCURRENCE.
DEFINITION OF RELAXATION ALLOWANCE

RELAXATION ALLOWANCE IS AN ADDITION TO THE BASIC TIME INTENDED TO PROVIDE THE WORKER WITH THE OPPORTUNITY TO RECOVER FROM THE PHYSIOLOGICAL AND PSYCHOLOGICAL EFFECTS OF CARRYING OUT SPECIFIED WORK UNDER SPECIFIED CONDITIONS AND TO ALLOW ATTENTION TO PERSONAL NEEDS. THE AMOUNT OF ALLOWANCE WILL DEPEND ON THE NATURE OF THE JOB.
Standard time is the total time in which a job should be completed at standard performance.

How the standard time for a simple manual job is made up:

- **Observed time**
- **Rating factor**
- **Relaxation allowance**
- **Cont. all delays**
- **Unavoidable delays**
- **Basic time**
- **Work content**

*(If performed at a pace greater than standard pace)*

**STANDARD TIME**
Allowances

- Personal needs
- Basic fatigue
- Stress and strain
- Environmental

- Fixed allowances
- Relaxation allowances
- Contingency allowances
- Policy allowances
- Special allowances

Total allowances

Where applicable

Basic time

Work content

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THANK YOU