

Management services —

Part 3: Guide to work measurement

UDC [65.015 + 06.049]:65.015.14

Confirmed November 2008

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

BSI
Documents

AVA

Document Sharing Hub

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Quality, Management and Statistics Standards Policy Committee (QMS/-) to Technical Committee QMS/31, upon which the following bodies were represented:

- British Gas plc
- Civil Service College
- Ergonomics Society
- GAMBICA (BEAMA Ltd.)
- HM Treasury
- Institute of Administrative Management
- Institute of Management Services
- Institute of Quality Assurance
- Loughborough University of Technology
- Methods — Time Measurement Association Ltd.
- Ministry of Defence
- Trades Union Congress

This British Standard, having been prepared under the direction of the Quality, Management and Statistics Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 15 December 1993

© BSI 03-1999

First published December 1985
Second edition December 1993

The following BSI references relate to the work on this standard:
Committee reference QMS/31
Draft for comment 93/408036 DC

ISBN 0 580 22270 1

Amendments issued since publication

Amd. No.	Date	Comments

Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
0 Introduction	1
1 Scope	2
2 References	2
3 Definitions	2
4 Uses of work measurement	2
5 Techniques and procedures	4
6 Choice of techniques	7
7 Development of time standards	8
8 Maintenance of time standards	16
9 Training	16
Figure 1 — Examples illustrating the construction of standard time	12
Table 1 — Choice of technique based on time frequency combinations	8
Table 2 — Advantages and disadvantages of techniques	9
List of references	Inside back cover

Foreword

This Part of BS 3375 has been prepared under the direction of the Quality, Management and Statistics Standards Policy Committee. It is a revision of BS 3375-3:1985 which is withdrawn.

BS 3375 comprises a series of standards published in response to a demand for information and guidance on how the various terms contained in BS 3138:1992 *Glossary of terms used in management services* interrelate. This revision of BS 3375 results from the publication of the fourth edition of BS 3138 in 1992.

In recent years there has been considerable development of the techniques and broadening of the areas of application of work study and organization and methods. The revision of this standard reflects the fact that these methodologies are now used across the entire spectrum of commercial and non-commercial activity and are applied to all types of work and work situation. This sphere of activity and practice of techniques has become known as “management services” and consequently it has also been decided to retitle BS 3375 as *Management services*.

This series of standards comprises the following Parts:

- *Part 1: Guide to organization study;*
- *Part 2: Guide to method study;*
- *Part 3: Guide to work measurement;*
- *Part 4: Guide to work performance control.*

When using this Part of BS 3375, it is important to refer also to the terms listed in BS 3138:1992.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 18, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

0 Introduction

0.1 Purpose of the guide

The objective of this standard is to give guidance on the uses of work measurement in organizing, controlling and monitoring work; also to demonstrate the contribution of work measurement to the whole field of operations management. This standard should be used in conjunction with BS 3138:1992.

Recognizing that the balance of terms in the work measurement section is weighted heavily towards time study, some more recent developments in other techniques are noted and explained and guidance is given in broad terms on the factors affecting choice of techniques. It was thought helpful also to expand on the information given in BS 3138 about development of time standards and to offer guidance on the maintenance of standards and on the work measurement aspects of management services training.

The increasing use of work measurement in service and administrative areas has resulted in a number of the traditional descriptions taking on broader and at times slightly different meanings. Consequently a single standard with examples for all areas of application might confuse or mislead. Given that the purpose and principles of work measurement remain the same wherever it is used, the traditional terminology has been retained.

0.2 Objectives of work measurement

In order to survive, all commercial, industrial and public service organizations need to exercise vigilance in controlling their costs and in ensuring that they get the best return from their expenditure. Profit is one measure of organizational efficiency but it can be an unreliable yardstick in conditions of imperfect competition. Competition provides a spur to economic vigilance and continued improvement but cannot, by itself, provide an absolute criterion against which to judge effectiveness. Even techniques such as budgetary control can only work effectively on the basis of sound predetermined targets for achievement.

Work measurement aims to provide this reliable and consistent basis for comparing what has been achieved against what should have been achieved from a given expenditure of resources. It seeks to determine the resources needed, at all levels of activity, to achieve defined objectives. Starting from the basis of the time required to carry out a task, the physical requirements of manpower, plant and equipment can be calculated. Those requirements should determine also the space required and, from the running times of the plant and equipment, the manpower requirements and the shift patterns, the energy needs can be assessed.

0.3 Dependence on method and design

It is clear from the definition of work measurement that it is the measurement of a task in terms of time. The definition of a task implies that both the design of the product or service and the method used to carry it out are specified. So work measurement is strictly the measurement of a given working method for a specific design in terms of the time needed for a qualified worker to carry it out at a defined rate of working. This clarification is important because it emphasizes that the objective time required for a task depends upon the method and the design that are followed. Therefore the concept of work measurement is meaningless in isolation. Method study should always be carried out before attempts are made to determine time standards and there is often a need for work measurement to be conducted on existing methods as part of data collection and for comparisons when developing improvements.

0.4 Basis for output and productivity

Increasingly, work measurement is being seen also as a basis for monitoring the productivity of an undertaking at different levels of activity, the comparison at each level being between the output and the resources expended. The productivity measure is the index of output/input where output is the number of work units (standard hours) produced and input is the expenditure of the man hours involved.

0.5 The nature of work measurement

Changes in work organization and employment patterns since the 1979 edition of BS 3138 have brought acceptance that, for valid planning, all work should be measured in some way. This has led to changes both in the frequency of use and methods of application of the established work measurement techniques and the range of some of them has been widened. With the increased numbers employed in administrative and service functions there have been some changes of emphasis in the way measurement is applied and a greater dependence on synthetic data in conjunction with statistical methods of data processing and various forms of activity sampling. The use of predetermined motion time systems (PMTS) for measuring short-run and non-repetitive work has been aided by personal computer systems and the development of recording devices that have simplified direct observation studies. It is important to recognize that although the manpower element of all work is measurable by an appropriate technique, this can be done only on the basis of an average whose limits of accuracy can be determined statistically, as in category estimating (see 5.4.6 and 5.6). Even time study, the earliest formal technique, uses what is essentially a sampling procedure in that the use of rating makes possible a smaller sample. Detailed PMTS were derived from statistically validated samples and the higher order of most PMTS were developed by statistical analysis of motion frequencies.

1 Scope

This Part of BS 3375 gives guidance on the objectives and outlines the benefits that can be gained by the use of work measurement procedures in the field of operations management. The degree of difficulty and the advantages and disadvantages of applying the various techniques are set out in tabular form for ease of comparison by senior managers, management services practitioners and specialists in other related disciplines.

2 References

2.1 Normative references

This Part of BS 3375 incorporates, by reference, provisions from specific editions of other publications. These normative references are cited at the appropriate points in the text and the publications are listed on the inside back cover. Subsequent amendments to, or revisions of, any of these publications apply to this British Standard only when incorporated in it by updating or revision.

2.2 Informative references

This Part of BS 3375 refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

3 Definitions

For the purposes of this Part of BS 3375, the definitions given in BS 3138:1992 apply.

4 Uses of work measurement

4.1 General

The primary purpose of work measurement as traditionally established is to derive times for human work. Work measurement should give a basis for determining manning levels for a given level of output and help to determine shift patterns, plant requirements and the energy demands of the work programme. In this guide a general view is taken that relates to the overall needs of an organization rather than just the traditional view of work measurement as the measurement of a task, or a group of tasks, in terms of time.

4.2 Resource organization and utilization

4.2.1 Product design

A product may be a mechanical, electronic, or structural artefact or it may be a service or an administrative control system. In each case the design aims may, for example, be as follows:

- a) ease of manufacture (e.g. material and design);
- b) ease of use (e.g. comprehensibility of a claim form to an applicant and subsequent ease of checking to an assessor); or
- c) ease of maintenance (e.g. accessibility of mechanisms or of basic data in a control system).

There is often a need to decide between competing demands, for example between the relative importance to be ascribed to ease of use, manufacture or maintenance. Work measurement can aid these decisions by providing comparative time implications for the alternatives and thus for finding the most economic compromise (see also term 21090 of BS 3138:1992).

4.2.2 Workplace layout

Ergonomics and the characteristics of easy movement are the techniques and principles that govern workplace design. Work measurement is necessary as an aid to analysis and in deciding upon the best of the alternatives presented. The detailed motion analyses offered by PMTS are particularly appropriate when designing assembly facilities for repetitive work.

4.2.3 Method

The characteristics of easy movement are relevant to the development of easier and more effective working methods. For example, other factors that have a bearing on this, in assembly work, are the presentation of components or documents to the worker, use of chutes and conveyors for passing completed work to the following stage and the development of holding devices so that both hands are free for assembly or other work. In each case work measurement can guide development of the most appropriate alternative.

4.2.4 Design and method improvement

Work measurement data should be used to work out preferred changes in product or system design, workplace layout and working methods.

4.2.5 Work balancing

In team working, particularly in short cycle work, close work balancing between individual groups and departments is essential if high utilization needs to be achieved. The output of the whole team working at standard performance can be no greater than the output of the operation with the highest task time, e.g. in a team of six the labour utilization would be only 86 % if one station had a six-second cycle and each of the other five had a five-second cycle. Work balancing under those conditions usually entails very close attention to motion patterns and handling arrangements in order that the work may be distributed equally as far as is possible between the work stations, so very detailed measurement of element times for operators and plant is necessary. There is a need also to select and train operators to maintain standard performance. Work balancing also has a significant role as between individual departments and processes in a total production system, where the final output is governed by the person with the smallest capacity.

4.2.6 Scheduling

Production schedules, delivery times and dates and other information for production or work control (see BS 5191) should be developed by relating task times to capacity.

4.2.7 Work sequencing

Where work necessarily follows a given route through several processes, the most advantageous economic order in which each task should be loaded to each process can be determined by minimizing work in progress and delays and by maximizing resource utilization within the programmed time scale. Owing to the great number of variables involved, optimization of sequencing is complicated and is most easily done by electronic data processing (EDP), although rule of thumb manual methods have been developed for the purpose. It is important to note that however the calculation is made, the operating, setting and maintenance times for each item at each stage are critical: work measurement provides this information.

4.3 Productivity and performance

4.3.1 Productivity

Manpower productivity is the relation between input and output where the output is the manpower content (standard hours) of the resultant products and the input is the attendance hours of the workers concerned. Work measurement is needed to quantify the manpower content of the products, whether those be an artefact, a service, or an administrative system.

4.3.2 Performance

Labour performance index is the relation between the hours allowed (i.e. by measurement plus any estimated work) for the work done and the number of hours (attendance hours) spent on it. (See 4.4 and 4.5 of BS 3375-4:1993). The basic distinction between productivity and performance is that performance relates to the work that is actually carried out, whether or not it is part of the standard method and operator performance excludes the time during which the operator is unoccupied.

4.4 Financial calculations

4.4.1 Costing

For accurate manpower costing it is necessary to know the direct labour costs for all the tasks that comprise a product. Standard times need to be the basis of these calculations and of any ratios, variances and budgets used in cost accounting.

4.4.2 Financial incentives

Time standards can be used in financial incentive schemes that are based upon measured achievement within a defined period. (See 6.4 of BS 3375-4:1993).

5 Techniques and procedures

5.1 Introduction

When BS 3138 was first prepared, the main work measurement technique was time study, and the main areas of application were the man/machine tasks in manufacturing industry.

Technological development and economic pressures since the 1979 revision of BS 3138 have brought changes in work organization, employee attitudes and the pattern of employment generally. These have affected both the frequency of use and the methods of application of the established techniques.

For example, the growth in the proportion of workers employed in the administrative and service functions has led to greater emphasis on techniques such as synthesis that are more suitable for measuring those functions. The definitions in Section 4 of BS 3138:1979 are still valid in their proper context, but because of this changing emphasis many of them are less relevant for practitioners working predominantly with other techniques in other areas.

There has been, therefore, a widening of the range of techniques that trained practitioners regard as necessary for complete coverage of the work that they need to measure, so, as well as amplification of many of the previous definitions, some new terms have been introduced in 5.2 to 5.6. The techniques and procedures have been classified under five headings in order to compare and contrast them more clearly.

5.2 Direct observation

5.2.1 General

Most of the techniques in this group were designed to produce a standard time for a specified task, though they may also be used to record the basic times for defined elements, for future use in synthesis or in design and methods improvement (see 4.2.4). They differ primarily in the ways of recording observed times, methods, workplace layout and working conditions.

5.2.2 Rating

Those techniques involving observation need adjustment of observed times so that they represent the rate of output expected from an average qualified worker. This can be achieved through the use of a standard rating scale where the observer makes a judgment on actual performance against the scale. Through the process of extension the observed time should be converted to basic time.

5.2.3 Time study

Time study normally involves manual recordings of the elements as they are performed and the use of a timing device to measure their actual duration. Rating needs to be applied to convert observed times to basic times and relaxation allowances should then be added to produce a standard time for the task studied. This method is most conveniently used to cover predictable work cycles of short to medium duration, involving a mixture of manual and process times for which synthetic data are not readily available. The concept of selected basic time is relevant where each element needs to be timed and rated on several occasions during a study, as in time study (see 7.2.1).

5.2.4 Activity sampling

Activity sampling measures the proportions of time spent on different activities, or states of inactivity, by an individual or group of persons and/or machines. Rating can be applied to the manual work observed; the results may then be related to the volume of work produced during the study to derive standard times for the tasks or operations studied.

5.2.5 Production studies

Production studies cover a relatively long duration; their purpose is defined in BS 3138:1992. A subcategory, known as frequency studies, should be undertaken when element times for a task or range of tasks are already available (from PMTS or other data), but where frequencies cannot readily be deduced by visualization or analysis of available records.

5.2.6 Film, video and audio recording

5.2.6.1 Film analysis

Film analysis is a method by which times for individual motions or complete elements are derived from a cine film, by counting the number of frames occupied by that motion or element. Time-lapse or normal photography may be used, but the film speed needs to be controlled accurately. Rating may be applied and observed times adjusted accordingly.

5.2.6.2 Video recording

Video recording is a method of obtaining a visual record of people at work, that can be displayed for subsequent analysis. Both film and video tapes have the advantage of providing a complete, permanent and repeatable record of the observed methods.