DIRECTORATE GENERAL BORDER ROADS

TECHNICAL INSTRUCTION NO 7
(REVISION – 2022)

WORK STUDY

अजय भट्ट
AJAY BHATT

सत्यमेव जयते

आज़ादी का अमृत महोत्सव

रक्षा एवं
पर्यटन राज्य मंत्री
भारत सरकार
Minister of State for
Defence and Tourism
Government of India

MESSAGE

The revised DGBR Technical Instructions are unique as they combine technical content and codes with practical advice on practice of specific subjects. These Technical Instructions have definite data/content which explicitly bring out tools, process and methodology to be followed for various road construction and infrastructure development associated activities.

The literature is a repository of technical and ground experience amassed by the BRO, working over six decades in inhospitable terrain with harsh climatic conditions as well as latest technical advancements in the field of road communication infrastructure development. I personally find these technical instructors informative, exhaustive and practical in approach. These will mitigate the need for ground executers to refer various books/codes where working on various aspects of road construction and will go a long way in assisting the coming generations of BRO executives.

Jai Hind !

Ajay Bhatt

(Ajay Bhatt)

Dated : 20 Dec, 2021
New Delhi

डा. अजय कुमार
रक्षा सचिव
Dr. Ajay Kumar
Defence Secretary

सत्यमेव जयते

आज़ादी का अमृत महोत्सव

भारत सरकार
रक्षा मंत्रालय
Government of India
Ministry of Defence

FOREWORD

1. I am pleased to note that the Border Roads Organisation (BRO) has revised its twenty seven Technical Instruction, after a gap of 10 years having updated technical content and IRC codes. These Technical Instructions will positively prove to be very useful and ready reckoner for the BRO ground executives while steering them towards the correct methodology and processes to be followed for diverse road construction and associated activities.

2. Since the past six decades, BRO has been developing road infrastructure in the remote regions of the nation. It has contributed immensely in nation building and ushered in prosperity and development in the border areas. A robust mechanism to channelize the road construction activities is an essential planning process and therefore, the revised Technical Instructions will facilitate in dissemination and application of engineering knowledge with updated codes and provisions, to enable the executives to construct roads with the latest specifications as laid down by IRC.

3. I congratulate Team BRO for their stupendous efforts put in for revision of the twenty seven Technical Instructions which will further strengthen their technical proficiency.

(Ajay Kumar)

New Delhi,

March 3, 2022.

श्रमेण सर्वम साध्यम्

ले. जनरल राजीव चौधरी, वी एस एम
महानिदेशक सीमा सड़क
एवं कर्नल कमांडेंट, सीमा सड़क संगठन

Lt Gen Rajeev Chaudhry, VSM
Director General Border Roads &
Colonel Commandant
Border Roads Organisation

FOREWORD

1. DGBR Technical Instruction Number 7 (Revision 2022) lays down guidelines on Work Study in BRO.

2. The Technical Instruction Number 7 has now been updated and revised incorporating the current standards and specifications. The specific requirement of roads under BRO, also have been kept in view while formulating the Technical Instruction.

3. Application of technique of work study to a project is of paramount importance for the most economical use of resources in performing a given task by improving conditions, methods, tools and lay out. This technique will also ensure better balance between the resources and employ them effectively.

4. This Technical Instruction will come into force with immediate effect.

Station: New Delhi

Dated: Mar 2022

(**Rajeev Chaudhry**)
Lt Gen
Director General Border Roads

INDEX

TECHNICAL INSTRUCTION NO 7

WORK STUDY

1. INTRODUCTION

1.1 Work study is the investigation, by means of a consistent system of the work done in an organization in order to attain the best utilization of resources i.e. Materials, Machines, Men and Money. All the technologies and management systems are related with productivity. Work Study is a management exercise for devising the one best way to do a job. As more sophisticated machines, tools and equipments have been designed and become available and new materials and processes developed in BRO, it has become increasingly important to apply work study techniques for the most economical use of resources in performing a given task by improving conditions, methods, tools or layout, eliminating ineffective work and movements, ensuring better balance between operators, gangs or machineries, employing better services and ensuring a steady flow of material to do a job. DBGR Technical Instruction No. 7 on Work Study has been prepared to give insight to the subject and also guidelines for conduct of work study of specific activity or problem for improved output and better performance.

1.2 Generally work study is used to describe a complete set of techniques with the help of which work can be simplified, standardized and measured. Work Study is a vast subject requiring proper understanding and correct application. In view of this, the salient features of the defining of work study techniques and methodologies have been discussed along with the operational instructions for the conduct of the same. The first part gives general concept/approach and is in no way substitute to the technical professional studies. The TI will be applied for activities relating to the BRO with reference from the authoritative publications and literature for elaboration and understanding.

1.3 DGBR TI No. 7 (2021) on Work Study supersedes the DGBR TI No. 7 (Revision 1994) on Work Study.

2. WORK STUDY AND ITS OBJECTIVES

2.1 Work study is one of the basic techniques of improving productivity. In order to resolve this aspect, work study aims:-

(a) To analyze the work in order to achieve work simplification and thereby improving productivity of the system.

(b) To have optimum utilization of resources i.e., 4 Ms (Men, Material, Machinery and Money)

(c) To evaluate the work content through work measurement.

(d) To set time standards for various jobs.

(e) To study various processes involved in a work.

2.2 In nutshell work study is mainly concerned with the examination of human work. In fact planning is not possible unless one knows how long it will take to do a particular job. Work study is not a theoretical concept but essentially a practical one and deals with human beings who have their own attitude and style of working. So the success of work study is dependent upon the relations between the labour/employees and the management. Work study involves lot of changes in various working methods. Since the manpower in general does not like changes but prefers to continue as already doing, so there will always be a tendency to resist any modification or new method suggested by work study people (officers/ workers). If the manpower and the workers have confidence in the ability, integrity and fair-mindedness of work study man, there is a good chance that sound proposals will be accepted willingly by the manpower.

2.3 The ultimate aim of any work study is the most economical use of resources in performing a given task. It is sometimes thought that the main or only object of work study is to increase output or operator performance but this is not true. Actually output and performance can be improved by improving conditions, methods, tools or layout, eliminating ineffective work and movements; ensuring better balance between operators, gangs or machines employing better services and ensuring a steady flow of material to do a job. None of these items calls for more efforts from the operator, but they do call for more attention and efforts from management.

2.4 British Standard Institution defines work study as a generic term for those techniques particularly "Method study" and "Work Measurement" which are used in the examination of work in all its contexts and which leads systematically to the investigation of all the factors which affect the efficiency and economy of the situation being reviewed in order to incorporate improvements at various levels. Work study may be defined as "The systematic critical, objective and imaginative examination of all factors governing the operational efficiency of any specific activity in order to achieve/ effect improvement."

2.5 One phase of work study is called Method Study or Motion Study which aims at determining the best possible manufacturing procedure

which involves least time and cause minimum fatigue to workers employed for performing the work. In short, method study is concerned with determination of the best way of doing a job. Method study may be defined as the systematic investigation of the existing method of doing a job in order to develop and install an easy, quick, effective, efficient and comparatively less tiring method or procedure for doing the same job. This is generally achieved by eliminating unnecessary movements or motions involved in a certain procedure or by changing the sequence of the operation of the process itself.

2.6 The role of time study or work measurement starts with the determination of the time allowed to complete the job by the developed improved procedure for doing that job. Thus work measurement may be defined as the application of different techniques to measure and establish the time required to complete the job by a qualified worker at a defined level of performance.

3. AREAS FOR APPLICATION OF WORK STUDY

3.1 In general there are six lines of attack to raise productivity as mentioned below:-

Sr No.	Points to raise Productivity	Remarks
(a)	Improve basic processes by research and development	Long term; will require capital
(b)	Improve existing, and provide better plant, equipment and buildings	
(c)	Improve and simplify the work procedures	Short term; will require little or no capital
(d)	Improve methods of operating existing material resources	
(e)	Improve the planning of work and the use of manpower	
(f)	Improve the effectiveness of allEmployees by ensuring their better carrier progression, pay, perks and living conditions	

3.2 Cost is the usual basis for the selection of operations, sections or departments likely to benefit from method study. The following areas in an organization indicate where method study is likely to bring worthwhile savings:-

(a) Poor management of materials, labourers and machines capacity resulting in high scrap and re-processing costs.

(b) Bad layout or operation planning resulting in unnecessary movement of materials.

(c) Lengthy procedure for procurement of spare parts and goods.

(d) Inconsistencies in quality.

(e) Highly fatiguing work.

(f) Poor carrier progression of employees.

(g) Poor living accommodations at site.

3.3 Areas for Work Study in BRO including but not limiting to are as below:-

(a) Introduction of new and sophisticated vehicle/plant/equipment, fix their norms for areas of different geological and geophysical conditions of terrain.

(b) Updating norms of existing equipment.

(c) Streamlining organization and function of units to improve productivity.

(d) Study of existing/already constructed structures and devising means of improvements and use of alternative and local materials.

(e) Review of specifications.

(f) Greater automation and equipping offices with latest MIS machines (study on cybernetics).

(g) Study on ergonomically health hazard aspects.

(h) Review of existing work sanctions and laying out procedures so that barest essential structures are included in the initial estimates.

(j) Streamlining of estimate preparation with special reference to earth work and other items.

(k) Effective budgetary and financial control.

(l) Formation cutting with heavy earth moving plant separately for cutting and forming embankments.

(m) Execution of cross-drainage works including protective works required for such structures.

(n) Preparation and compaction of subgrade for road pavements.

(o) Establishment and working of field laboratories for carrying out quality control tests on road and bridge works.

(p) Review of reports and returns to cut down paper work.

(q) Any other item of major practical relevance to our department.

(r) Improvement of living standard of employees in work sites.

(s) Carrier progression of employees.

(t) Move of plant and equipment from one sector to other.

(u) Move of TF/RCC/Platoon from one sector to other within a project or to other project.

4. ISSUE PROJECT DIRECTIVE

4.1 After the selection of the problem, HQ DGBR will issue Project Directive. The Project Directive will clearly define the problem and objective of the study. The Project Directive should be exhaustive, specific and lay down the limitations and constraints. It will give the composition of the team and the responsibility for providing administrative cover to the team. A sample Project Directive is placed as Appendix 'A'. It will be ensured that the Project Directive defines the scope of the problem and decides what is involved and what is excluded. It will direct:-

(a) To obtain all facts that appear relevant by discussion, study of records, direct observation or time study.

(b) To decide which facts are important.

(c) To develop new method, procedure and drill.

(d) To implement the new method.

(e) To examine the maintenance of the new method.

(f) To finalise the new method and submit recommendations for application.

5. STUDY OF EXISTING METHOD

5.1 It is conducted in two parts:

(a) Method Study.

(b) Workshop.

5.2 **Method Study**

5.2.1 The sequential order of the correct procedure to be adopted for having effective or purpose oriented results of method study include the following:-

(a) Select the work/procedure to be analyzed.

(b) Record all the relevant information related with the existing work system with the help of various recording devices or techniques.

(c) Make critical examination of collected data/facts.

(d) Develop and improve the method which is economical and practical after giving due consideration to the alternative method possible.

(e) Install the new selected method with proper instructions.

(f) Maintain the latest standards of methods through periodic verification etc.

(g) The desire and determination to produce results.

(h) Ability to achieve results.

(j) Layout of physical facilities and work station design.

5.2.2 **Objectives of Method Study**. Some important objectives of method study are:

(a) Better design of plant equipment and buildings.

(b) Less fatigue for workers by avoiding unnecessary movements of manpower.

(c) Better working conditions and environment for workers/ employees.

(d) To have more effective utilization of materials, machines and manpower and money.

(e) Better Product quality.

(f) Efficient and fast material handling equipment.

(g) Leads to standardisation, rationalisation, simplification and specialisation.

(h) Efficient planning of the section.

(j) Streamlined working procedures.

(k) Reduction in monotony in work.

5.2.3 **General Principles**. Much of the value of method study is due to the flexibility with the techniques may be used in so many different situations. General principles are as under: -

(a) **Existing Resources**. Method study applies equally to existing and proposed work, but one of its most important rules is to improve the use of existing resources.

(b) **Un-necessary Work**. The elimination of un-necessary activities is one of the greatest potential source of savings and producing early results. This requires persistent efforts to persuade others that some work is indeed un-necessary.

(c) **Management Control**. Often decisive results cannot be achieved without the complete re-organization of managerial functions leading to better work selection, planning, control and supervision.

(d) **Human Considerations**. The revolutionary changes which are often necessary cannot succeed without good relations at work.

(e) **Continuity**. Improvement is a continuous process, each change paving the way to a still better method.

(f) **Speed**. There is right and a wrong type of short-cut but solutions should take no longer than the problem demands. Obvious solutions should be applied at once and part improvements, if practicable, should also go in and should not await the new schemes in its entirely.

5.2.4 **Techniques Used in Method Study**. In order that the activities selected for investigation are visualized in their entirety, it is essential to have some means of placing on record all the necessary facts of the existing method. The principle should be to use the simplest and most economical techniques which will serve the purpose and is capable of producing full and accurate records of procedures in the method under view. Some of the techniques used in Method study are tabulated below:-

Table 1: Techniques Used in Method Study

Technique	Purpose	Uses
Charts	Utilized for examining	
Outline process	Principal operations and inspections	(a) Obtain overall view of the process (b) Decide what further recording is required. (c) Suitable for 'design' or planning stage.

Technique	Purpose	Uses
Flow process	Activities of men material equipment	More intensive analysis of any process than possible With outline process chart.
Two handed process.	Activities of worker's two hands.	Assess relative utilization of each hand.
Multiple activity	Activities of men and material on a common time scale	Analysis of activities in relation to more than one factor leading to possible re-arrangement of the job.
Simultaneous motioncycle (Simograph)	Activities of workers hands, legs and other body movements on acommon time scale	Study the detailed motion of fingers, wrist, arm and shoulders generally justified only for repetitive jobs.
Diagrams and models		
Flow and string diagrams	Paths of movement of men and material.	Study extent of movement and desirability of re-arranging work sites.
Two and three dimensional models.	Layout of work place of men and material.	Study movement in all planesfor deciding on proper layout and placement used for investigating movements in teamwork or when one worker is working on more than one machine or process. Also for testing layouts.
Cyclographs and Chronocyclo-graph	High speed short cycle operation	For more detailed analysis of movements, Where movement cannot be visually distinguished with great accuracy. Also serves as a permanent record

5.2.5 **Examination**. The critical examination of the problem is the crux of the basic procedure. The whole examination procedure will require exhaustive collaboration with everyone in a position to offer information which may prove useful and also full use of all available sources of technical information. Although transport and delays may superficially appear to give the greatest scope for improvement, it may be possible to reduce work by eliminating certain operations, or by changing their sequence, and this will automatically effect transports and delays. An examination of the operations in a process will, therefore, be first made in order of their importance to the over-all process. The information collected will be tabulated in the flow charts by application of the techniques used in Method Study as described in Para 5.2.4. These ample charts are placed at Appendices B, C, D and E as below: -

Technique	**Utilized for Examination**	**Appendix**
Outline process	Principal operations and Inspections.	'B'
Flow process	Activities of men, material or equipment	'C'
Two handed process	Activities of worker's two hands	'D'
Multiple activity	Activities of men and material on acommon time scale	'E'

5.2.6 **Analysis.** Critical examination will be made of the followings:-

(a) **Purpose.** The questions "What is achieved" ? and "Why"? challenge the existence of the activity. The answers to these questions determine whether the particular activity will be included in the new method.

(b) **Means**. Means of carrying out the activity are challenged by asking "How is it achieved"? and *Why that way"?

(c) **Sequence**. The sequence of the activity in relation of other activities is challenged by asking "When is it achieved"?andWhy then"?

(d) **Place**. The questions asked under this heading are "Where is it achieved"? and "Why there"?

(e) **Person**. Finally, questions refer to the person performing the activity. They are *Who achieves it" ? and * Why that person"?

5.3 **Work Measurement**

5.3.1 Similarly, the logical order of correct procedure to be adopted for having effective results of work measurement includes the followings:-

(a) Divide the selected procedure into small work elements.

(b) By direct observations record the relevant information regarding the various work elements.

(c) In the light of relevant information examine the work critically.

(d) Measure the work content in the terms of time of the work elements involved in method being adopted.

(e) Define and design the new selected method.

(f) Finally convert the work content time in standard time.

5.3.2 **Objectives of Work Measurement**. Effective planning and control of production, distribution and administration cannot be achieved unless these are based on facts. One of the most important of these facts is the time required for job completion which can be obtained by motion study or work measurement.

5.3.3 Other objectives of work measurement are as follows:

(a) When two alternative methods which seem equally advantageous, one which requires less time for completion of the job (i.e. faster) can be established.

(b) The man power required for a job or new plant can be determined on the basis of accurate knowledge of the amount of work that has to be done so it helps in manpower economy.

(c) Work measurement data provides reliable basis to decide equipment.

(d) Provides requisite information for effective production planning and improving efficiency of the system.

(e) Provides basis for fair and reliable incentive schemes.

(f) Decides realistic labour budgeting and provides a basis for standard costing system.

5.3.4 **Techniques**. The problem will be subject to Work Measurement to establish the work content of the specified task by determining the time required for carrying it out.

5.3.5 Followings are the principal techniques by which Work Measurement is carried out:-

Technique	**Application to**
(a) Time Study (including production study)	Repetitive work
(b) Ratio-delay study operations	Heterogeneous
(c) Synthesis from elemental data	Non-repetitive work
(d) Pre-determined motion time standards	Repetitive work
(e) Analytical estimating	Non-repetitive work
(f) Historical data method	Past performance data to set performance standards.

5.3.6 It will be measured and computed in the Format of time Study given at Appendix 'F'.

5.3.7 In measuring work in terms of time, there are three ways in which time may be spent when doing a job or work:-

(a) **Effective**. Time spent effectively in doing the required job.

(b) **Ineffective**. Time spent in doing things not essential to the task.

(c) **Relaxation**. Time spent in resting and other forms of relaxation in order to be able to maintain a steady rate of effective work.

Any unit of work must include item (a) and (c) but not item (b). The unit used is defined as the amount of work performed in one minute at a standard rate of working, including time for relaxation. This unit involves a definition of a standard rate of working. A standard rate of working is taken to mean the normal or moderate rate which can be kept up without undue fatigue by an average qualified worker at a normal performance.

5.3.8 Tools required for making a Time Study are:-

(a) Pencil and paper.

(b) Stop watches.

(c) Study Board.

(d) Cine Camera or similar special equipment for micro-motion study work.

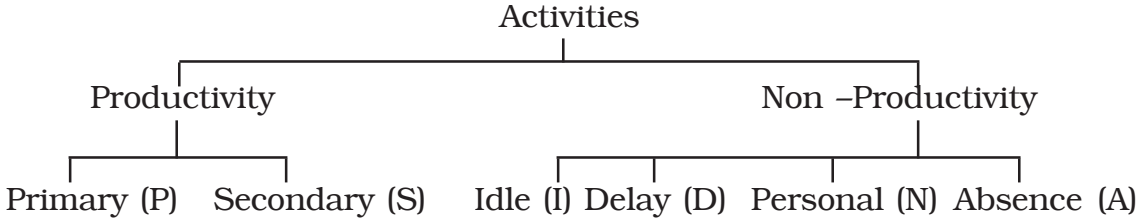
5.3.9 A specially printed form will be used for Time Study as per Appendix 'F' or modified to suit the problem. On the reverse of the sheet an adequate description and details of the operation notes will be recorded. Each recorded time will be converted into a standard time by applying the following formula:-

$$\text{Standard time} = \frac{\text{Observed time x Observed rating}}{\text{Normal rating}}$$

5.3.10 **Ratio-Delay Study**

5.3.10.1 Ratio delay is the name of the sampling method used to determine the part of the working day during which the operator is working productively and the part of the day during which he is not working. The particular technique most often used in this type of study is known as Activity Sampling.

5.3.10.2 The technique will require spot observations by visiting the individuals in sequence, recording in each case what activity or delay is occurring at the instant of observation. This fact finding technique will be used to determine the proportions of time devoted to different activities and delays by groups of either men, machines of pieces of equipment. The activities are classified as under:-



5.3.10.3 Number of random observations to be made depends on the degree of accuracy required. Number of observations required is obtained from the following formula:-

$$L = 2 \frac{P(1-P)}{N}^{1/2}$$

Where,

L = Limit of permitted variation,

P = Precision level or non-working time

$$= \frac{\text{Non-productive observations}}{\text{Total random observations}}$$

N = Total random observations.

5.3.10.4 The information will be collected and tabulated in the proforma for Activity Sampling given at Appendix 'G'.

5.3.10.5 Analysis of the data will be carried out as in the second Proforma-Total Productive and Non-Productive given at Appendix 'G'.

5.3.10.6 The working of each machine is prepared in the form of Histogram for each machine as given in the third formal, Histogram as per the present working for Machine No. (Appendix 'G').

5.3.10.7 This will give a clear picture of the productive and non-productive time element and the weak areas requiring improvement.

5.3.11 The above technique with modification will be used to determine the Work content and standard times for jobs. After recording the appropriate activities, observers will make rating assessments by watching workers for short periods of time (say10-12 seconds). Activity Sampling records will be in general terms only what actually happens, even if workers are rated in the broad context.

5.4 **Synthesis from Elemental Data**

5.4.1 Synthesis will be applied only to operations made up of elements coming within the range of studies (by dimension, shape, weight, etc.) to which the data is applicable.

5.4.2 Most of the data required will be derived from time studies carried out along the general lines. Since the rate of accumulation of data is slow, it is usual for a series of special studies to be made. Where, however, frequent repetition of very short elements is involved, the data should be expressed in terms of pre-determined motion times. The simplicity with which synthetic data can be applied will depend very largely on the suitability of the clarification system adopted. The manner in which synthetic data are classified depends mainly upon the circumstances under which they will be used. For operations likely to be of a highly repetitive nature, careful element-by-element synthesis will be necessary. In selecting the actual

elements listed, account will be taken of the method, location and worker as well as materials and equipment concerned. Full details of these would accompany the work content issued. In the case of less repetitive work, where the same degree of detail is not necessary, it may be sufficient to use data represented in the form of a curve or even a family of curves. Again, however, full information should be given respecting the conditions under which a curve is applicable. A curve would be accompanied by a specification of type, surface characteristics and the minimum area for which the data are valid. This system has the advantage that it enables intermediate readings, which may not be on any of the curves to be estimated reasonably accurately. The number of variables which can be accommodated is however, limited. In special circumstances synthetic data may be used as the basis of formulae or for the preparation of Nomography to enable element on operation times to be obtained by calculation.

5.4.3 The first stage of application is then to decide which elements are constant and are not influenced by changes in the physical characteristics of the object on which the operation is performed and which elements are available. For constant elements, basic times should be available in the tables to be assigned without further consideration. For these elements which are subject to variation in the work involved because of differences in the physical characteristics of different objects worked on (as for example in the case of painting different surfaces or using different kinds of paint) the basic times must be obtained from the available data by inspection. This requires a proper appreciation of the controlling factors before suitable times can be selected. Special cases may be found where a number of factors operate so that their combined effect is the significant variable. Such cases call for more detailed investigations involving the aid of statistical treatment.

5.4.4 When a basic time for each element of the operation has been obtained, the sequence of elements will again be checked to ensure that it conforms to the prescribed method of working and fulfills the operation specifications.

5.4.5 Some important questions are given in Para 5.2.6.

5.4.6 The Histogram of each machine will be corrected to the proposed time element.

5.4.7 By synthesizing the data, a new method will be proposed.

6. DEVELOPMENT OF NEW METHOD/PROCEDURE

6.1 The most practical, economical and effective method will be outlined having regard to the type of solution required: -

(a) Short term for partial improvement.

(b) Long term entailing capital investment.

(c) Phased improvements.

(d) Trial basis.

(e) Further discussion to reflect all new points and reach agreed solution.

6.2 The frame work of the proposed method will specify the construction of samples, models, prototypes, etc. and also if it is proposed as full-scale trial. The organization of experiments will be clearly defined.

7. ISSUE

7.1 Clear description of the method approved by HQ DGBR in the form of Implementation Directive for installation of the system under the category earmarked in Para 6.1 above will be issued by HQ DGBR.

8. NEW METHOD

8.1 A general programme for the installation should be drawn up as under: -

(a) One person only should have responsibility during installation of the method. He may need to delegate his authority but everyone should know in whom final responsibility and authority rests.

(b) If the installation is to take place in stages and they have not already been announced before the preparation of the report, actual dates should be fixed for each stage.

(c) Copies of any time-table drawn up to cover the installation should be brought into line with the dates selected for each stage.

8.2 Installation of new method will require the active support of an opportune moment which be chosen for installing the method and no attempt should be made to introduce the changes until the adequate preparation has been made.

9. MAINTENANCE

9.1 The new method will be subjected, activity by activity, to the same analysis as that applied to the existing method.

9.2 The new method will be improved on the basis of the above analysis and synthesis. Thus it will reach the stage of Improved Method.

9.3 After an improved method has been installed and is operating satisfactorily, it does not necessarily follow that its benefits can be maintained without further effort. The conditions are liable to change from time to time, and this may mean that some of the assumptions, upon which the improved method was built up, are no longer valid. The labour for manning the improved method has been allotted on the basis of work content of the method as set out in the implementing instructions. Consequently any change may after the balance between the work content and the labour allotted for carrying out the method. The method will be reviewed at intervals to make allowances for any changes. The frequency with which a method should be reviewed will depend on the nature of the work. The main purpose of the review is to discover whether there are any discrepancies between the authorized procedure as defined in the operating instructions and current practice at the time of review. Reasons for any variation in the method will be investigated. Changes that have occurred due to valid reasons be accepted and the operating instructions amended accordingly.

10. GENERAL DATA COLLECTION

10.1 At times there is requirement to carry out Work Study of the overall performance by quantitative and financial assessment of work done. Data bank will be maintained at HQ DGBR (PP Dte) for the followings

(a)	Financial Position Return	-	Appendix 'H',
(b)	Plant Output Return	-	Appendix 'J',
(c)	Personnel Employment Return	-	Appendix 'K'.

10.2 The above returns duly signed by the Chief Engineer will be submitted by the Projects yearly so as to reach HQ DGBR (PP Dte) by 20 April of every year. PP Dte will compile and maintain these records.

11. CONCLUSION

There is a requirement for general consciousness of the necessity and importance of Work Study. The Work Study will be conducted with due care and attention for improvement in our methods and performance.

Appendix A'
(Refer Para 4.1)

WORK STUDY FOR PROCESSING LAND ACQUISITION CASES BY PROJECTS

General

1. Land Acquisition (LA) is a tedious process. Project officials detailed to deal with processing of land acquisition needs to understand land acquisition process and applicable laws and available tools so that while interacting with revenue officials, they can easily communicate and get LA case processed as per applicable law.

2. The study will work out the reasons for time delay in LA process and suggest remedial measures to streamline the method followed for LA process and follow up with revenue authority by the projects.

Reports

3. The work study team will study and give report on the following: -

(a) Present establishment and Organisation of section dealing with LA cases in HQ CE Project.

(b) The staff efforts required in processing LA cases.

(c) Analyse and logically group the functions at various levels based on their relationship of functions, inter-alias considering the following aspects: -

(i) The Role and duties, span of control, etc, of DIR (Estg and Plg) posted in the Project HQ.

(ii) The role of Platoon Cdr, OC RCC and Cdr TF for expediting LA cases.

(iii) The appointment of nodal officer by the Project.

(d) Recommendations to the proposed structure for dealing LA cases.

(e) Suggest type of training and courses required for the dealing officers and staff with LA cases to getting themselves oriented/

acquainted with the latest rules and procedures on the subject.

(f) The work study will also work out the requirement of Officers/ JCOs/Supvrs/Ors required at each level.

Composition of the Team

4. **The team will consist of:**

(a)	Leader		-
(b)	Members	1	-
		2	-
		3	-

Liaison/Administration

5. All sections of HQ DGBR will extend required assistance to the work study team during the study. The team will have access to required documents in pursuance of the Project.

If required, the team can visit HQ Chief Engineer Project or HQ TF. The move sanction will be issued by DDG (Pers). All Projects will furnish the requisite information on Priority basis, if any, asked by the team in pursuance of the work study.

Transport

6. Director (Organisation) will arrange transport as and when required.

Reporting

7. The report will be submitted by the team to DDG (TP).
Dte General Border Roads,
Seema Sadak Bhawan,
Ring Road, Delhi Cantt., New Delhi-110010

Distribution

Distribution should be given as under :-
All Chief Engineers (Project) with 2 copies.
DDG (TP)
All members of the Team
All sections of HQ DGBR.

Appendix 'B'

(Refer Para 5.2)

OUTLINE PROCESS CHART

Chart begins	:		Materials at site
Chart ends	:	▽	Premix Carpet laid (one cycle).
Time		(1)	Take manpower to site.
		[1]	Inspect materials.
		(2)	Start heating bitumen
		(3)	Put chips in HMP and heating.
		[2]	Inspect temperature of bitumen and chips.
		(4)	Mix hot bitumen and chips.
		[3]	Inspect final temperature.
		(5)	Unload the mix in tipper.
		(6)	Unload into the Paver
		(7)	Start spread of mix to specified thickness.
		[4]	Crossfall/super elevation.
		[5]	Inspect temperature of laid mix.
		(8)	Commence rolling when temperature reaches 93°C to specified rolls.
		(9)	Take core sample.
		(6)	Inspect sample in laboratory.

 - Operation

 - Inspection

 - Transportation/Move

 - Delay

 - Storage

Summary

Operation 45 minutes

Inspection 15 minutes

Total cycle time 60 Hrs.

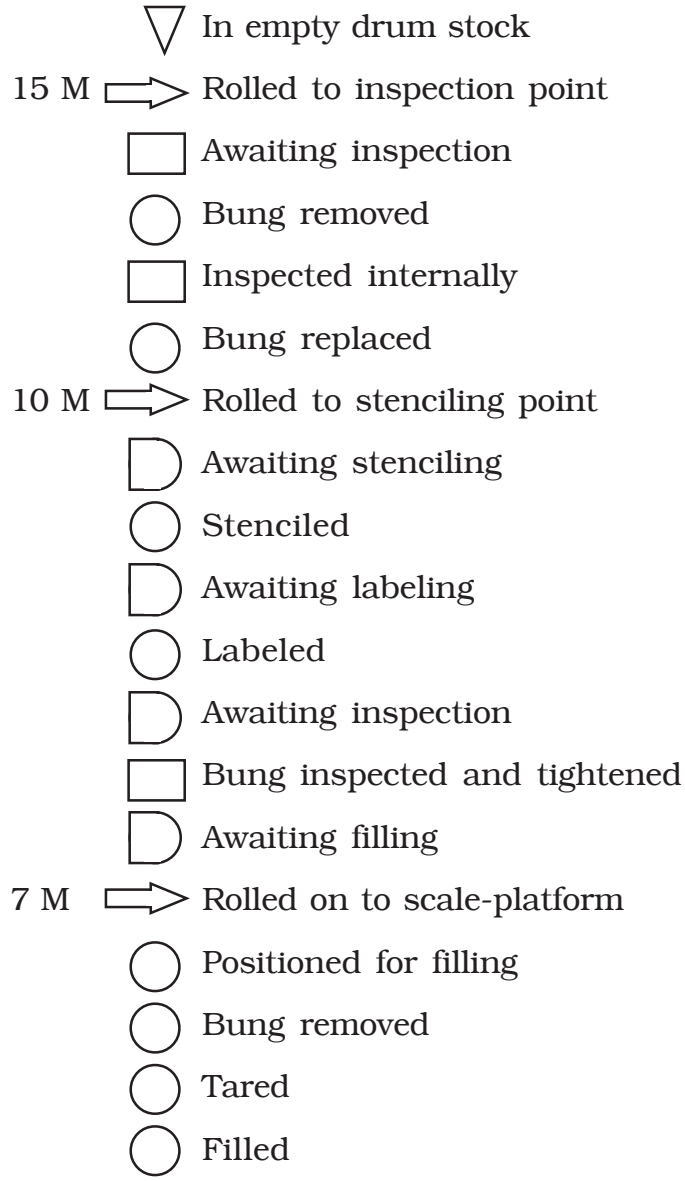
Appendix 'C'
(Refer Para 5.2)

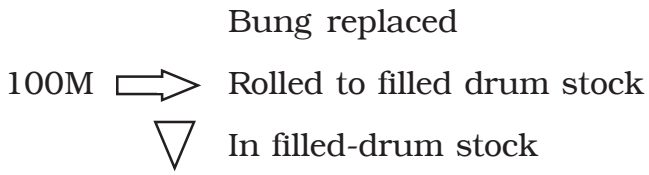
FLOW CHART

Example : Filling 20 litres drum

Chart beings : Empty 20 litres drum in stock

Chart ends : Filled 20 litres drum in stock.





Summary

Operations	-	51
Inspection	-	26
Transport	-	10
Storage	-	
Delay	-	14

Appendix 'D'
(Refer Para 5.2)

TWO HAND PROCESS

Job : Assemble two washers and nut to bolt.

Chart beings : Hands empty: Material in boxes

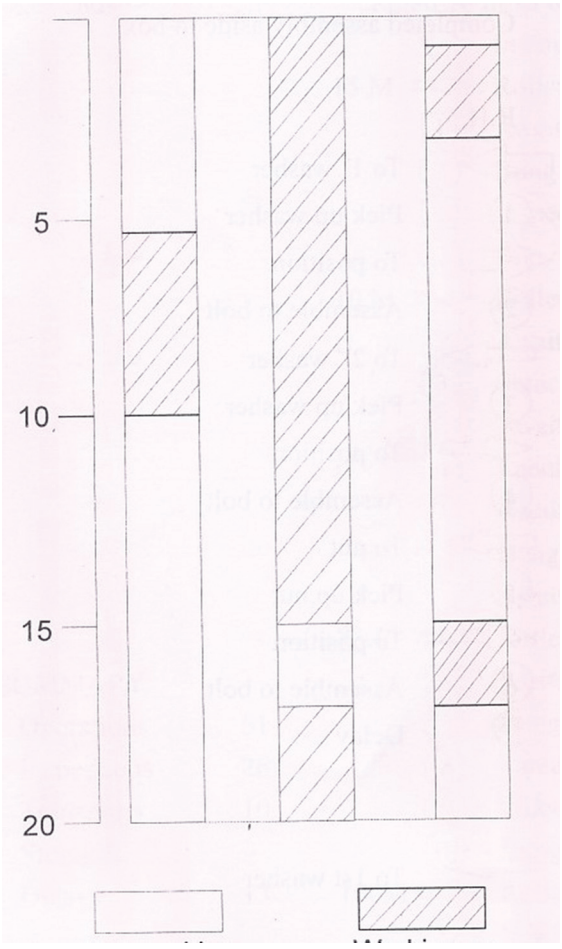
Chartends : Completed assembly aside to box

L.H.	R.H.
To bolt	To 1" washer
Pick up bolt (1)	(1) Pick up washer
To position	To position
Hold	(2) Assemble to bolt
	To 2nd washer
	(3) Pick up washer
	To position
	(4) Assemble to bolt
	To nut
	(5) Pick up nut
	To position
	(6) Assemble to bolt
	Delay
To box	
Aside to box (2)	
To bolt	To 1st washer

Appendix 'E'
(Refer Para 5.2)

MULTIPLE ACTIVITY CHART

Short Typewriter | Hand Typist Author



Typist to Author's Officer

Letter Dictated
Typist to own Officer

Prepare and Insert
Typing set
Type Letter and Copy

Remove Typing set
Separate
Copies, Check, Place in
Book to Author's

Check and Sign
Typist to own Officer

Type Envelope, Insert
Letter and Aside

Not working On Letters

Working on Letters

Appendix 'F'
(Refer Para 5.3)

TIME STUDY

SNo.	Activity	Commencing Time	Completion Time	Activity elapsed Time (te)

Appendix 'G'
(Refer Para 5.3)

ACTIVITY SAMPLING METHOD

(1) Proforma for Activity sampling

Sr. No	Random Time	Machine No.1	Optr No.1	Machine No.2	Optr No.2	Worker No.1	Worker No.2	Worker No.3
1	0730	S	S	P	P	P	N	D
2	0750	P	P	P	P	I	P	P
3	0825	P	P	P	P	I	P	D
(2) Analysis	Total Productive and Non-productivity							
Man/Machines	P	S	P+S	1	D	N	A	1+D+N+A
Machine No. 1								
Optr No. 1								
Machine No. 2								
Optr No. 2								
Worker No.1								
Worker No.2								
Worker No.3								

P + S = Productive, I + D + N + A = Non-Productive

(3) Histogram as Per Present working For Machine No 1

P	S	I	D	N	A

(4) Histogram as per Proposed Method

P	S	I	D	N

Appendix 'H'
(Refer Para 10.1)

FINANCIAL POSITION OF PROJECT

Project .....Expenditure of financial year .....

Item No	Date	Particulars of Work	Amount of Adm. Approval	Total expenditure	Outstanding Liabilities	Total Expenditure + Liabilities.
1	2	3	4	5	6	7

Appendix 'J'
(Refer Para 10.1)

PLANT EMPLOYMENT RETURN

Project .....

Job No. and Date..... Job Description.....

S. No.	Plant type and make	Total No.	Consumption of POL	Hrs Run	Quantity	Remarks

Plant and Equipment's

1. Dozer size II
2. Dozer size I
3. Hydraulic Excavator
4. Pay Loader
5. Motor Grader
6. Air Compressor
   (a) Heavy
   (b) Medium
7. Vibratory R/Roller
8. Static R/Roller

9. Pneumatic R/Roller

10. Hot Mix Plant

11. Concrete Mix Plant

Vehicles **Output in Kms**

12. Water Truck

13. Dump Truck

14. Tipper

Appendix 'K'
(Refer Para 10.1)

PERSONNEL EMPLOYMENT RETURN
PART II

Project .....

Job No. and Date ..... For the financial year .....

RANK		EMPLOYED ON																		
	Supervision of work	Unit adm	Recce/ Alignment		Jungle Clearance		Trace Cutting		Earth Work		Rock		Drainage Blasting		Culverts		Bridges		Retalring wall/ Breast Wall
			No of man days	Out put	No of man days	Out put	No of man days	Out put	No of man days	Out put	No of man days	Out put	No of man days	Out put	No of man days	Out put	No of man days	Out put	

1. Officer
2. J.C.Os

   And

   Supervisory

   Staff
3. Others
   (Including Casual Personnel)