LABOUR PRODUCTIVITY ENHANCEMENT BY USING WORK STUDY METHOD IN CONSTRUCTION

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ABSTRACT

Productivity remains an intriguing subject and a dominant issue in the construction sector, promising cost savings and efficient usage of resources. Productivity is one of the most important issues in both developed and developing countries. The developed countries are aware of the importance of economic growth and social welfare. The developing countries which face unemployment problems, inflation and resource scarcity seek to utilize resources and in such a way as to achieve economic growth and improve citizens lives. The aim of this project work is to identify factors affecting labour productivity and also to study causes i.e. labour problems on site and its effects on the construction projects. Some of the important factors affecting labour productivity are; quality of site management, material shortage, timely payment of wages, labour experience, misunderstandings between labour and superintendent etc.

Here problems faced by the labour on Indian construction sites are dealt in detail. Problems like non-availability of proper accommodation, basic amenities, low wages, safety related problems, security etc., exists in almost all Indian construction sites. This work concentrates on labour productivity ratios that are reducing day by day, which in turn harms organization's profitability. In this study an attempt has been made to relate the ill effects of falling labour productivity with the productivity of other resources such as material, equipment and capital. Analysis of the data collected was done using different statistical methods. This report includes explanations on labour productivity, productivity improvement using work study, factors affecting labour productivity and the remedies for the same.

1. Introduction

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1.1 GENERAL

Modernization and industrialization have helped the construction industry to grow in leaps and bounds. Small towns and cities have become more urbanized and, the construction sector too has got a boost. Irrespective of occasional slumps in the economy or in construction works, the sector is going through a faster growth. Apart from old / traditional urban/ industrial centres, new industrial / urban centres have appeared on the map where construction works are going on. Expanding and fast growing construction sector, in general, has drawn large number of workers due to lack of greater employment

opportunity elsewhere. There are more than 20 million of construction workers in India at present. Cities, like Delhi alone have around more than 600 thousand of them. Apart from metros other cities, like Jamnagar in Gujarat, Guwahati & Shillong in the Northeast are also expanding at fast rate. Migration from different states to other states in India has now become so rampant that its impact is felt in every aspect of life. Migration becomes a way of life to many, who are unskilled and semi- skilled and find it difficult to get better jobs within their native and locality. These migrant workers are spread across the width and length of the country. Most of the construction labourers have migrated from different regions and states leaving their native villages in search of job. These people in general are nomadic in their life and usually do not return to their birthplace or natives. They travel from one area of work to other area along with their families and live in a place, which is either provided by the owner of the construction company or somewhere near by, building temporary shelters. They have maximum mobility because of the nature of their work. These labourers are engaged in huge industrial constructions, residential flat constructions, city beautification works. These construction labourers, comprising the unorganized work force remain the most exploited ones even after five decades of independence. In the recent past the trend shows that all big cities in the country have become the centres to recruit casual labourers as construction labourers to cities and urban areas. Most of the construction labourers migrate to cities and metros are from poor families and are illiterate. Their lack of education and skill make their choices very limited. When they come to big cities, they have to face a number of problems because of their inexperience and lack of skill. They become easy victims of exploitation and have to work for their day-to-day sustenance. The present work is to analyze the extent of construction labour problems that affect productivity. The construction business is booming encouraged by the employment mobility of business class

people, blue collar officers, IT employees, students etc. Since need of accommodation is essential, the construction industry is also finding their business growing to peak levels.

2. OBJECTIVES

The Objectives of this study are

1. Improvement of manufacturing processes and procedures.
2. Improvement of working conditions.
3. Improvement of plant layout and work place layout.
4. Reducing the human effort and fatigue.
5. Reducing material handling
6. Improvement of plant and equipment design.
7. Improvement in the utility of material, machines and manpower.
8. Standardisation of method.
9. Improvement in safety standard.

3.How to Optimize?

- Effective use of plant and equipment
- Effective use of human effort
- Evaluation of human work to make it more convenient

4. SCOPE OF STUDY

Previous studies were concentrated on the matters of labour, material and equipment separately. For example, one finds studies on work productivity and productivity in construction.

The work on labour productivity and its simultaneous effect on other resources of construction such as material, equipment, and capital are almost non-existent. This study is focused on primary data search by obtaining views from labourers as well as contractors / owners / managers.

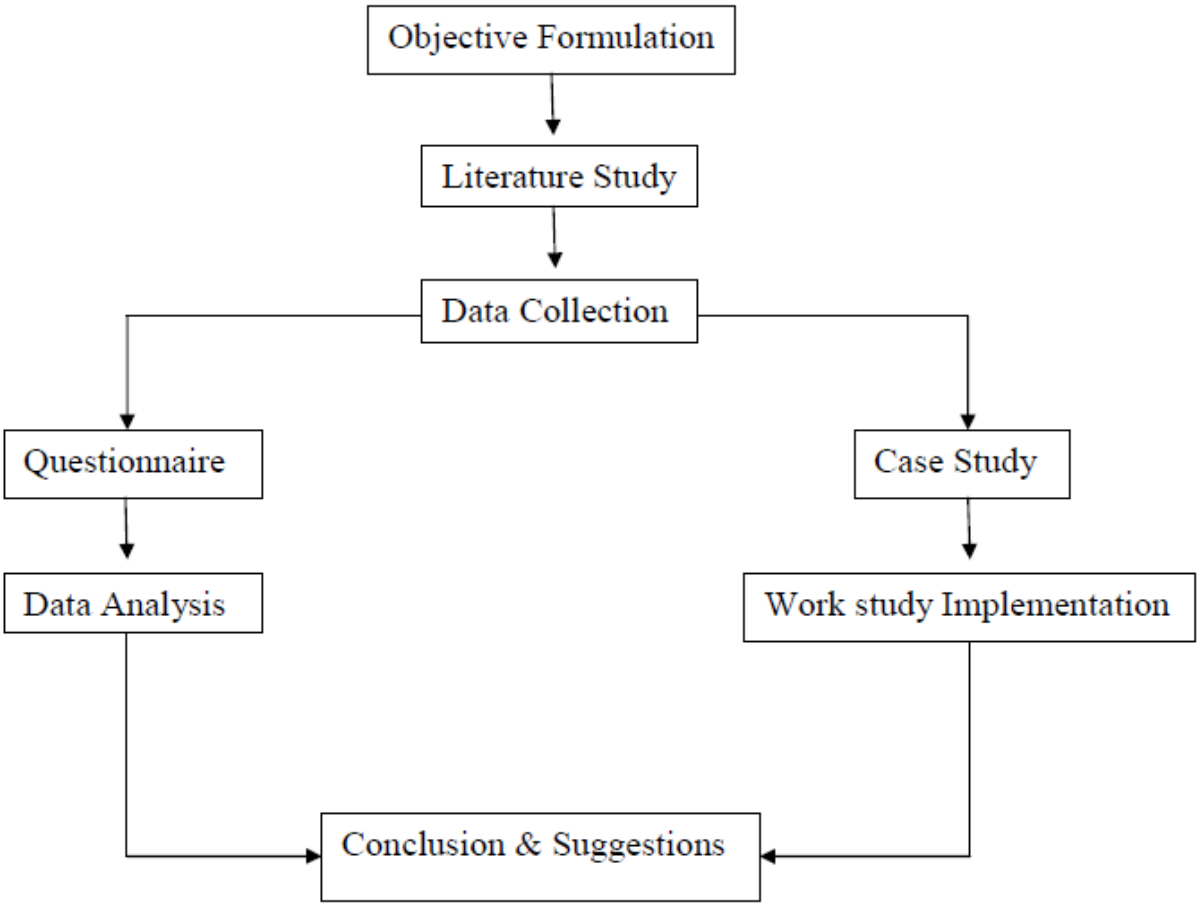
5.NEED OF THE PROJECT

- Construction Labour Motivation
- To minimize the labour burden
- To avoid cost overruns,
- To improving construction productivity
- Time saving
- Proper scheduling

6.METHODOLOGY

The preliminary insight of the subject data for this study has been collected through a literature review followed by the use of a questionnaire survey targeted at contractors, subcontractors and labors. The survey was carried out using convenient random sampling. Data were collected from medium to large size construction sites of Chennai and Mumbai. Different residential sites are visited to get variety of data.

Figure 6.1 outlines methodology used to carry out the study.



6.1.Methodology Flowchart

7.SELECTING

Economic considerations –

- Cost
- Worth the effort and capability of paying for itself

Focus of economic considerations –

- Whether economically sound or not?

Technical considerations –

- Availability of necessary equipment, facilities and technical knowledge for production

Focus of technical considerations –

- Production process and infrastructure

Human considerations –

- Mental and emotional reactions of men and their inherent resistance to change

Focus of human considerations –

- Worker involvement

8.PRODUCTIVITY

Productivity consciousness has acquired worldwide momentum. Higher productivity is necessary for the survival of any nation. It stands for proper utilization of available resources to achieve the best results with minimum cost. Improvement in productivity is the only answer to the problems in the industrial sphere and it is the only path to national prosperity. In India it assumes special significance owing to the resource gap. In order to overcome the hurdle of shortfall in resources, stepping up of productivity is a must.

During the last 40 years productivity measurement has emerged as a distinct and separate branch of study in management. A number of studies employing highly sophisticated mathematical and statistical techniques and tools of analysis have been conducted to measure productivity. Specialized agencies of the United Nations (UN) like the International Labour Organization (ILO), affiliated agencies of regional organization like European Association of National Productivity Centres (EANPC) of the Organization for Economic Cooperation and Development (OECD) have been published comprehensive, detailed and elaborate manuals explaining the concepts, methodologies, data requirements etc. for the measurement of plant level and overall measurement of productivity of various factors and inputs. Regional, national and local productivity organizations / associations / agencies / councils were organized and established to stimulate productivity consciousness. In India the National Productivity Council (NPC) was established in 1958. The Asian Productivity Organization (APO) with headquarters in Tokyo was established in 1961 and all countries that are members of APO established national and local productivity councils-centres / bureaus in their respective countries.

8.1.Concept of Productivity

Frederick W. Taylor in his "Task Study" said, "Human work can be made infinitely more productive not by 'working harder' but by "working smarter'.

Productivity means the economic yield from:

- Each factor of production (land, labour, capital and organization) Each input (raw materials, fuels, time and knowledge)
- An overall yield of the joint factors and resources enumerated above in combination.

Productivity denotes the efficiency with which the various inputs are converted into goods and services. Technically, it signifies the ratio between the input and output. Productivity is said to be high when more output is derived from the same input, or the same output is obtained from a less input. It is well understood as the ratio of output to input with respect to given resources. When more is produced with the same expenditure of resources it may be termed as effectiveness; when the same amount is produced at less cost it may be termed as efficiency. It should be recognized that the long-term productivity improvements can be achieved by the human factor through positive and innovative attitudes. In this sense productivity is an attitude of mind which is intolerant of waste of every kind and in any form. Productivity does not refer merely to work systems but to the development of right attitudes and a strong concern for efficiency. Efficiency, maximum output, economy, quality, elimination of waste and satisfaction of human beings through increased employment, income and better standard of living are some of the objectives of productivity movement in our country or for that purpose in any other country.

8.2.Labour Productivity

European productivity agency defines productivity as, “Productivity is a state of mind…an attitude that seeks the continuous improvement of what exists. It is a conviction that once can do better today than yesterday and that tomorrow will be better than today” In relation with output. Output measures how much we produce. Productivity

measures how much we produce per unit input. Higher productivity leads to lower costs, shorter construction programs, better value for money and a higher return on investment.

Productivity = Output / Input (Earned hours / Worked hours) To understand above formula we can take the example of an equipment operator. For instance an excavator operator operates it effectively for 5hr. 30 min. deducting lunch, tea and rest time out of total 8hr. shift. The productivity of the operator can be calculated as

5.5/8=0.687.

Similarly five workers doing placement of concrete for an hour can place 10 m3 of concrete. The productivity of the labour can be calculated as

5/10=0.5 man-hours/m3.

i.e. each labour can place 2m3 of concrete every hour; hence the reciprocal formula for productivity can be,

Productivity = Input / Output (Man-hours per unit produced)

Above formulae says that productivity is mainly dependent on hours earned by the labour and the working hour of the labour or else it is highly dependent on how many man hours are required for producing one unit.

9.**Frederick Taylor's Scientific Method**

Taylor published the book *The Principles of Scientific Management* in which he explained his techniques that were adopted to improve the productivity of employees at Bethlehem Steel. His techniques proved to be a great success and as a result Taylor became recognized as the founder of the Work Study movement.

According to Taylor, the majority of workers put minimal effort into their work if they knew they could easily get away with it. He referred to this mode of behavior as *soldiering* and he

attributed this problem with mismanagement of the work at the lowest levels of the organization. This lack of proper organization manifested itself in a lack of productivity.

9.1.Time study

Time study is a direct and continuous observation of a task, using a timekeeping device (e.g., decimal minute stopwatch, computer-assisted electronic stopwatch, and videotape camera) to record the time taken to accomplish a task and it is often used

- there are repetitive work cycles of short to long duration,
- wide variety of dissimilar work is performed, or
- process control elements constitute a part of the cycle.

The Industrial Engineering Terminology Standard defines time study as "a work measurement technique consisting of careful time measurement of the task with a time measuring instrument, adjusted for any observed variance from normal effort or pace and to allow adequate time for such items as foreign elements, unavoidable or machine delays, rest to overcome fatigue, and personal needs.

The systems of time and motion studies are frequently assumed to be interchangeable terms, descriptive of equivalent theories. However, the underlying principles and the rationale for the establishment of each respective method are dissimilar, despite originating within the same school of thought.

The application of science to business problems, and the use of **time-study methods** in standard setting and the planning of work, was pioneered by Frederick Winslow Taylor .Taylor liaised with factory managers and from the success of these discussions wrote several papers proposing the use of wage-contingent performance standards based on scientific time study. At its most basic level time studies involved breaking down each job into component parts, timing each part and rearranging the parts into the most efficient method of working. By counting and calculating, Taylor wanted to transform management, which was essentially an oral tradition, into a set of calculated and written technique

Taylor and his colleagues placed emphasis on the content of a **fair day's work**, and sought to maximize productivity irrespective of the physiological cost to the worker. For example, Taylor thought unproductive time usage (soldiering) to be the deliberate attempt of workers to promote their best interests and to keep employers ignorant of how fast work could be carried out This

instrumental view of human behavior by Taylor prepared the path for human relations to supersede scientific management in terms of literary success and managerial application.

9.2.Motion studies

In contrast to, and motivated by, Taylor's time study methods, the Gilbreths proposed a technical language, allowing for the analysis of the labor process in a scientific context.The Gilbreths made use of scientific insights to develop a study method based upon the analysis of **work motions**, consisting in part of filming the details of a worker's activities while recording the time.The films served two main purposes. One was the visual record of how work had been done, emphasising areas for improvement. Secondly, the films also served the purpose of training workers about the best way to perform their work.This method allowed the Gilbreths to build on the best elements of these work flows and to create a standardized best practice

10.EXTERNAL FACTORS AFFECTING PRODUCTIVITY ON CONSTRUCTION SITE

10.1.Space limit

The delay is offset by increasing labour, materials and equipment. However, due to space or area limitations, it may not be feasible to permit more than a fixed number of workers onto the site at any one time. If there is a physical space constraint, the project may not
be completed on time.

10.2.Availability of resources

The five resources identified as critical for labour productivity can be scarce. It is often cost-prohibitive to obtain access to an unlimited supply of material and equipment in a short period of time. The pool of labour is often very limited, particularly when skilled labour is necessary. And there can be stiff competition amongst firms to retain good management and planning resources. If the project suffers from a schedule delay, desired human resources needed to complete a project on time may exceed management's capacity to adequately manage the labour and the project may not be able to overcome the schedule delay.

10.3.Overtime

Allowing the use of overtime can increase the Completion Rate without hiring additional labour. The use of overtime (expending more than eight hours in a workday and/or working on weekends) is a management decision. Naturally, there is a limit to overtime - no one is able to work more than twenty-four hours in a single day. The extended use of overtime may have an adverse impact on productivity.

10.4.Learning Curve

As new employees gain experience, their productivity increases which, in turn, raises the Completion Rate. The less time New Employees need to gain experience, the less need to hire additional people to complete the project on time. An increase in the Time to Gain experience leads to a lower rate of flow from New Employees to Experienced Employees.

10.5.Willingness to hire

Project managers may not be willing to hire additional labour at the end of a project. Therefore, they have to rely on overtime at some point rather than going through the process of hiring and training new people for a short period of time. It also captures the idea that labour may be unwilling to commit to working on a project if for only a short

time. In the construction project management, management's willingness to increase labour declines towards the end of the project. One of the attributes of the construction worker is the ability to perform the duties of this trade in a variety of environments. How long will it take the worker to adjust to a new task and environment depends on how closely related the task is to his experience or how typical it is to the work usually performed by his craft. The time required for a worker (or crew) to reach full productivity in a new assignment is not constant. It will vary with skill, experience, and the difference between the old and new task. For example, an ironworker is moved from placing reinforcing bars to the structural steel erection crew. He is qualified by past training

to work on structural steel, but the vast majority of his experience has been with rebars, and the two tasks are significantly different. If the same ironworker is moved from placing reinforcing bars for Building Ato the same work in Building B, which is similar but not identical to Building A, the loss of productivity would be significantly less.

11.PRODUCTIVITY IMPROVEMENT USING WORKSTUDY

Productivity can be improved by using two techniques namely, employee-based and task-based techniques. From the beginning, there has been a need to recognize that people are a very important part of the work system. Productivity improvement does not just happen by accident. It requires on-going commitment from both management and employees to do the job right the first time, at the source, through the application of basic skills, tools and techniques.

11.1.Field Observation

A project is identified and field work is done for about two months. The work done and the labour category are observed in the site and using that the productivity rate is calculated for every day. At the period of first month, the progress and the outcome of the project relating to the productivity is observed. And in later month, the work studies are implemented to improve productivity in the site. Meanwhile the process and outcome of activities for the second month is also observed. Thus the differences in the work efficiency and productivity rate between two months clearly show the improvement of productivity in project.

The productivity rate is calculated using the data that was acquired from direct site observation. Labour plays a major role in construction productivity. Thus labour productivity can be measured from the formula

Labour Productivity = Work done/No of labourers

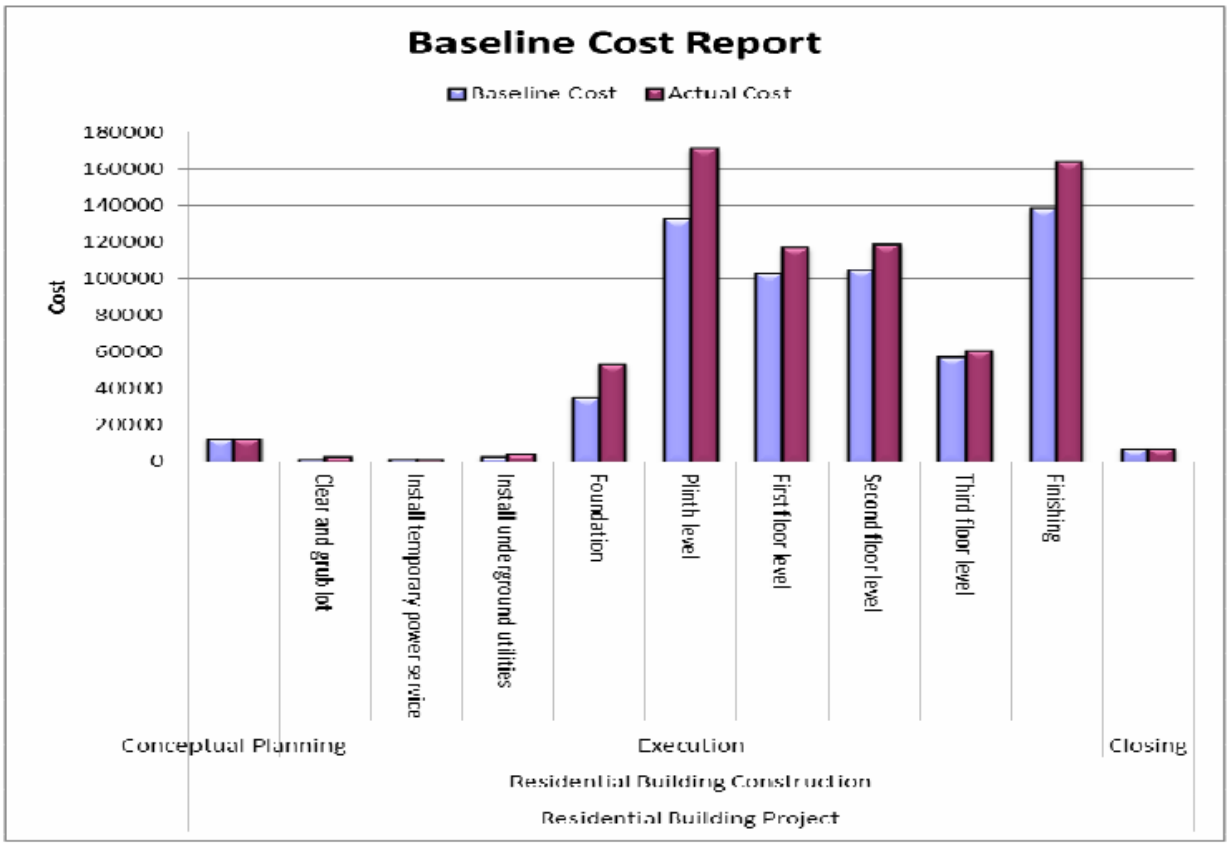
Thus the productivity is calculated for each sort of activities separately for carpentry, bar bending and concreting or masonry. The rate is found out for each and every day of the month of march.

11.2. Implementation Of Workstudy

In the next month of april, the work study was implemented in the site. A review of the previous month's productivity was conducted so that for future, work study can be discussed and implemented at site. Based on the past review, the following work study is implemented in the site.

- Provided training on work to be done.
- Planning for following days work. i.e. earlier arrangement for each and every activity.
- Using skilled supervisors and labors for appropriate type of activities.
- Reduction of distance between material storage place and work place.
- Adopting lean construction principles such as reduction of wastage.
- Usage of machines for cutting and bending the reinforcement.

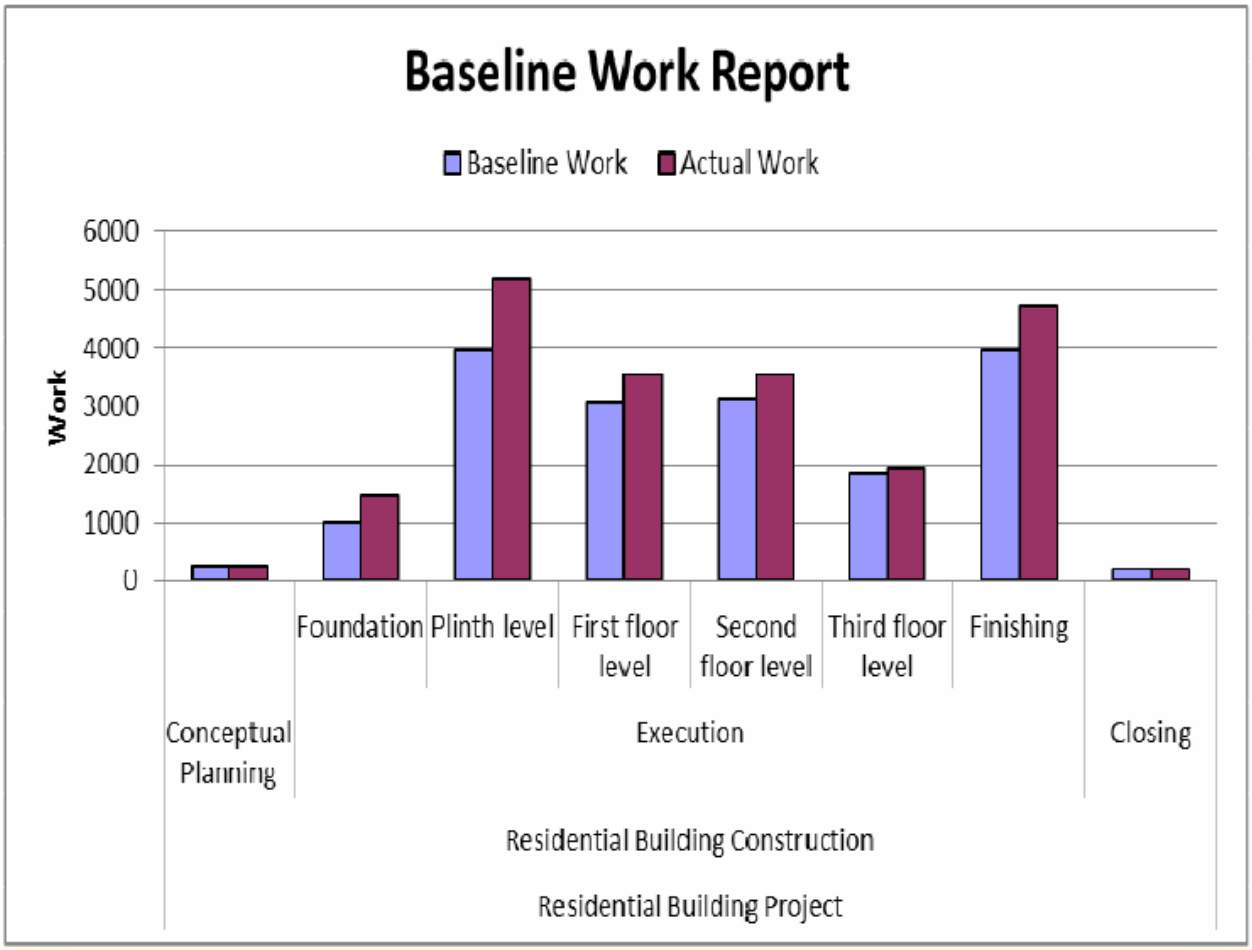
12.Baseline Cost Report



The report shows the difference between planned cost indicated as baseline cost and the actual cost incurred on each level of construction mainly divided into three stages namely: Conceptual planning, execution, and closing.

13.Baseline Work Report

this report shows the difference between planned work hours indicated as baseline work and the actual work incurred on each level of construction. This is in context with low productivity resulting in increased work hours



14.EXAMINING

What is done?

Critical examination of existing method / proposed method is done.

Purpose?

- If unnecessary, eliminate the activity altogether
- Combine activities, if feasible

- Change sequence of activities so that work or delay is reduced
- Simplify the activity to reduce the work content or the time consumed

Principles

- Examine facts without any bias
- Avoid hasty judgments / conclusions
- Do not consider new method until all undesirable features of existing method have been exposed by examination

How to be done?

- Questions
  - **?** Primary (What is to be done?)
  - **?** Secondary (What else can be done?)
  - **?** Alternatives (What should be done?)
- Critical examination sheet

15.Recommendation

A clear focus on labour productivity enhancement using work study method used to embrace the techniques of method study and work measurement, which are employed to ensure the best possible use of human and material resources in carrying out a specified activity and identify major factors affecting productivity & show effect of labour productivity on other resources and determine the problems faced by labour and suggest measures to reduce the problems and to improve productivity

These techniques are used in the examination of human work in all its contexts. They lead systematically to the investigation of all the factors which affect the efficiency and economy at the work place in order to affect improvement.

According to the British Standards Institute, *work study* is a generic term for those techniques, particularly *method study* and *work measurement*, which are used in examination of human work in all its contexts and which lead systematically to the investigation of all factors which affect the efficiency and economy of the situation being renewed, in order to effect improvement.

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