APPLICATION OF MOTION STUDY IN GARMENTS PRODUCTION

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Textile Engineer

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of Engr. Md. Mahfuzur Rahman, Senior Lecturer, Department of Textile Engineering, Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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ABSTRACT

This project is on **"Application of motion study in Garments Production".** At present garments industry is one of the highest earning sectors of foreign currency in Bangladesh. Here the garments operators have to face various motional problems during garments processing. Basically operated garment industries are facing problems like low productivity, longer production lead time, and rejection ,poor line balancing, low flexibility of style changeover etc. so we need to develop a technique for giving better performing methods to a manufacturer because better perform methods are the key to enhancing efficiency. In this study we have mentioned a program that can evaluate an operator's movement and instantly produce a good guide that explains operator's motions. PMTS which gives a better solution in garments motion. On the other hand in this method by applying GSD that means General sewing data is a software solution that enables nontechnical staff, with little or no manufacturing expertise, to develop a "pre-cost analysis" early in the product development cycle. By applying all those procedures, we have compared the range of before production and after production. Work performance and range performance increasing after applying. Finally proposed development layout has been modeled and ensures a better performance

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CHAPTER-01

INTRODUCTION

1.0 Introduction:

Present techno economic scenario is marked by increasing competition in almost every sector of economy. The expectation of the customers are on the rise and manufacturers have to design, and produce good in as many variety as (concept of economics of scale is no more talked off) to cater to the demands of the customers. Thus there is a challenge before the industries to manufacture goods of right quality and quantity and right time at minimum cost for their survival and growth. This demands the increase in productive efficiency of the organization. Industrial engineering is going to play a pivotal role in increasing productivity. Various industrial engineering techniques are used to analyze and improve the work method, to eliminate waste and utilization of resources.

Industrial engineering is a profession in which a knowledge of mathematical and natural sciences gained by study , experience and practice is applied with judgment to develop the ways to utilize economically the materials and other natural resources and focus of nature for the benefit of mankind.

CHAPTER-02

INDUSTRIAL ENGINEERING AND ACTIVITIES

2.1 Overview:

While the term originally applied to manufacturing, the use of "industrial" in "industrial engineering" can be somewhat misleading, since it has grown to encompass any methodical or quantitative approach to optimizing how a process, system, or organization operates. Some engineering universities and educational agencies around the world have changed the term "industrial" to broader terms such as "production" or "systems", leading to the typical extensions noted above. In fact, the primary U.S. professional organization for Industrial Engineers, the Institute of Industrial Engineers (IIE) has been considering changing its name to something broader (such as the Institute of Industrial & Systems Engineers), although the latest vote among membership deemed this unnecessary for the time being.

The various topics of concern to industrial engineers include management science, financial engineering, engineering management, supply chain management, process engineering, operations research, systems engineering, ergonomics / safety engineering, cost and value engineering, quality engineering, facilities planning, and the engineering design process. Traditionally, a major aspect of industrial engineering was planning the layouts of factories and designing assembly lines and other manufacturing paradigms. And now, in so-called lean manufacturing systems, industrial engineers work to eliminate wastes of time, money, materials, energy, and other resources.

Examples of where industrial engineering might be used include designing an assembly workstation, strategizing for various operational logistics, consulting as an efficiency expert, developing a new financial algorithm or loan system for a bank, streamlining operation and emergency room location or usage in a hospital, planning complex distribution schemes for materials or products (referred to as Supply Chain Management), and shortening lines (or queues) at a bank, hospital, or a theme park.

2.2activities of Industrial Engineering:

- Selection of process and assembling methods.
- Selection and design of tools and equipment.
- Design of facilities including plant location, layout of building, machine and equipment.
- Design and improvement of planning and control system for production, inventory, quality and plant maintenance and distribution systems.
- Development of time and standards, costing and performance standards.
- Installation of wage incentive schemes.
- Design and installation of value engineering and analysis system.
- Operation research including mathematical and statistical analysis.
- Performance evolution.
- Supplier selection and evaluation.

2.3.Objectives of industrial engineering:

- To establish methods for improving the operation and controlling the production costs.

- To develop programmers for reducing for reducing costs.

2.4 Functions of an Industrial Engineer:

- Developing the simplest work methods and establishing one best way of doing the work.

- Establishing the performance standards as per the standards as per the standard method (standard method)

- To develop a sound wage and incentive schemes.

- To aiding the development and designing of a sound inventory control, determination of economic lot size and work in process for each stage of production.

- Development of cost reduction and cost control programmers and to establish standard costing system.

- Sound selection of site and developing a systematic layout for the smooth flow of work without any interruptions.

2.5 Techniques of Industrial Engineering:

- **Method study:** To establish a standard method of performing a job or an operation after through analysis of the jobs and to establish the layout of production facilities to have an uniform flow of material without back tracking.

- **Time study**: This is a technique used to establish a standard time for a job or for an operation

- **Motion economy** : This is used to analysis the motions employed by the operators do the work. The principle of motion economy and motion analysis are useful in mass production or for short cycle repetitive jobs.

- **Value analysis**: It ensure that no unnecessary costs are built into the product and it tries to provide the required functions at the minimum cost. Hence , helps to enhance the worth of the product.

- **Financial and nonfinancial Incentives**: These helps to evolve at a rational compensation for the efforts of the workers

- **Production ,planning and control**: This includes the planning for the resources (like men , machine materials) proper scheduling and controlling production activities to ensure the right quantity , quality of the product at predetermined time and pre established cost

- **Inventory control**: To find the economic lot size and the recorder levels for the items so that item should be made available to the production at the right time and quantity to avoid stock out situation and with minimum capital lock-up.

- **Job Evaluation**: this is a technique which is used to determine the relative worth of jobs of the organization to aid in matching jobs and personnel and to arrive at sound wage policy.

- **Material Handling Analysis:** To scientifically analysis the movement of materials through various departments to eliminate unnecessary movement to enhance the efficiency of material handling.

2.6 Process Flow Chart of IE:

Industrial Engineer

↓

Negotiation with Merchandiser

↓

If in-house accessories & fabric then do the preproduction meeting

↓

Planning

↓

Line balancing

↓

Go for production based on planning

↓

Production continuous meeting

↓

To achieved production as planning

↓

Production continuing (follow up)

↓

Shipment/Delivery

2.7.Activities of Executive in a factory

- Discuss with PM about absentism on line balancing.
- Co-ordinate with print/Emb
- Find out the line bottleneck & to take necessary solution.
- Hourly operator target monitoring sheet follow up.
- Make new style operation breakdown with SAM/SMV.
- Floor/line plan follow up to meet the shipment schedule.

2.8 Activities of a Senior Executive in a factory:

> Line target fix up.

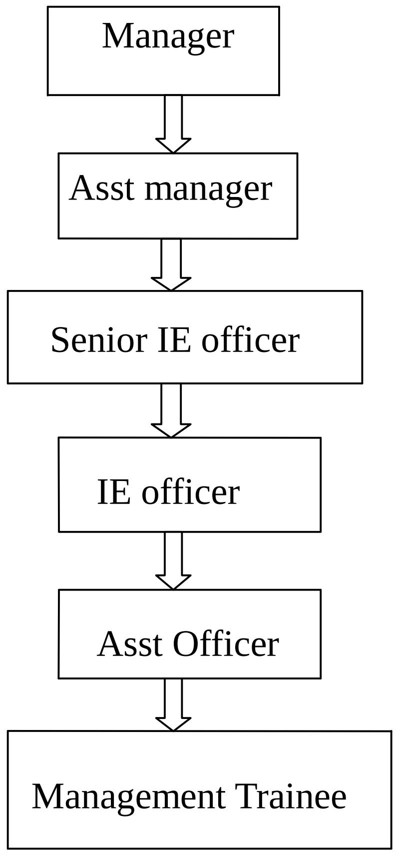
> Daily production report make & submit to concern person or Dept. head.

> Daily Quality statistical report make & submit to concern person or Dept. head.

> Monthly shipment FOB value report prepare.

> Monthly production FOB value report prepare.

2.9 organogram Of IE department In South east Textile Ltd.



CHAPTER-03

METHOD STUDY

3.1 Definition of method study:

Method study is the systematic recording and critical examination of existing and proposed ways of doing work as a means of developing and applying easier and more effective methods and reducing cost.

3.2 Objectives of Method Study:

Method study is essentially concerned with finding better ways of doing things. It adds value and increases the efficiency by eliminating unnecessary operations, avoidable delays and other forms of waste.

The improvement in efficiency is achieved through:

- Improved layout and design of workplace.
- Improved and efficiency work procedures.
- Effective utilization of men ,machine and materials.
- Improved design or specification of the final product.

The objectives of method study techniques are:

- To present and analyze true facts concerning the situation.
- To examine those facts critically.
- To develop the best answer possible under given circumstances based on critical examination of facts.

3.3 Scope of method study:

The scope of method study is not restricted to only manufacturing industries. Method study techniques can be applied effectively in service sector as well. It can be applied in offices, hospitals , banks and other service organizations.

The areas to which method study can be applied successfully in manufacturing are: ➢ To improve work methods and procedures.

- ➢ To determine the best sequence of doing work.
- ➢ To smoothen material flow with minimum of back tracking and to improve layout.
- ➢ To reduce monotony in the work.
- ➢ Elimination of waste and unproductive operations.

3.4 Steps involved in method study:

Steps in method study

SELECT : The job to be analyses

RECORD :All relevant facts about present method.

EXAMINE : The recorded facts critically.

DEVELOP : The most efficient, practical and economic method.

DEFINE : The new method.

INSTALL : The method as a standard practice.

MAINTAIN : That standard practice.

3.5 Selection of the job for Method study

Cost is the main criteria for selection of job, process, department for methods analysis. To carry out the method study, a job is selected such that the proposed method achieve one or more of the following results.

I. Improvement in quality with lesser scrap.
II. Increased production through better utilization of resources.
III. Elimination of unnecessary operations and movements.

IV. Improved layout leading to smooth flow of material and a balanced production line.

V. Improved working condition

The job should be selected for the method study based upon the following considerations:

1. Economic aspect 2.technical aspect and 3. Human aspect.

3.5.1 Economic Aspects:

The method study involves cost and time: If sufficient returns are not attained, the whole exercise will go waste. Thus the money spent should be justified by the savings from it. The following guidelines can be used for selecting a job:

I. Bottleneck operations which are holding up other production operations

II. Operations involving excessive labour.

III. Operations producing lot of scrap or defectives.

IV. Backtracking of materials and excessive movement of materials

3.5.2 Technical Aspects:

The method study man should be careful enough to select a job in which he has the technical knowledge and expertise. A person selecting a job in his area of expertise is going to do full justice.

Other factors which favor selection in technical aspect are:

I. Job having in consistent quality.

II. Operation generating lot of scraps.

III. Frequent complaints from workers regarding the job.

3.5.3 Human considerations:

Method study means a change as it is going to affect the way in which the job is done presently and is not fully accepted by workman and the union. Human consideration play a vital role in method study. These are some of the situations where human aspect should be given due importance:

I. Workers complaining about unnecessary and tiring work.
II. More frequency of accidents.
III. In consistent earnings.

3.6.Recording Techniques:

The recording techniques are designed to simplify and standardize the recording work. Graphical method of recording was originated by Gilberts. In order to make the presentation of the facts clearly. Without any ambiguity and to grasp them quickly and clearly. It is useful to use symbols instead of written description.

3.6.1 Method study symbols:

○ Operation

□ Inspection

⇨ Transportation

D Delay

▽

Storage

Operation :

An operation occurs when an object is intentionally changed in one or more of its characteristics. This indicates the main steps in a process, method or procedure. An operation always takes the object one stage ahead towards completion

Inspection :

An inspection occurs when an object is examined and compared with standard for quality and quantity. The inspection examples are:

- Visual observations for finish.
- Count of quantity of incoming material.
- Checking the dimensions.

Transportation:

A transport indicates the movement of workers, materials or equipment from one place to another. Example:

- Movement of materials from one work station to another.
- Workers travelling to bring tools

□ **Delay:**

A delay occurs when the immediate performance of the next planned thing does not take place. Example:

- Work waiting between consecutive operations.
- Workers waiting at tool cribs
- Operators waiting for instructions from supervisor.

▽ **Storage:**

A storage occurs when the object is kept an authorized custody and is protected against unauthorized removal . For example:

- Materials kept in stores to be distributed to various work centres.

3.7 Line Balancing:

Line balancing is associated with a product layout in which products are processed as they pass through a line of work centre. An assembly line can be considered as a

―PRODUCTION SEQUENCE‖ where parts are assembled together to form an end product. The operation are carried out at different work stations situated along a line.

3.7.1Advantage Of Line Balancing:

- ➢ Uniform rate of production.
- ➢ Less material handling.
- ➢ Less work in process.
- ➢ Easy production control.
- ➢ Effective use of facilities labour.

3.7.2 Dis-advantage of Line Balancing:

- More capital intensive.
- Low flexibility.
- Monotony of work for operators.

3.7.3 Problem of Line Balancing arises due to the following factors:

1)The finished product is the result of many sequential operations

2) There is a difference in production capacities of different machines.

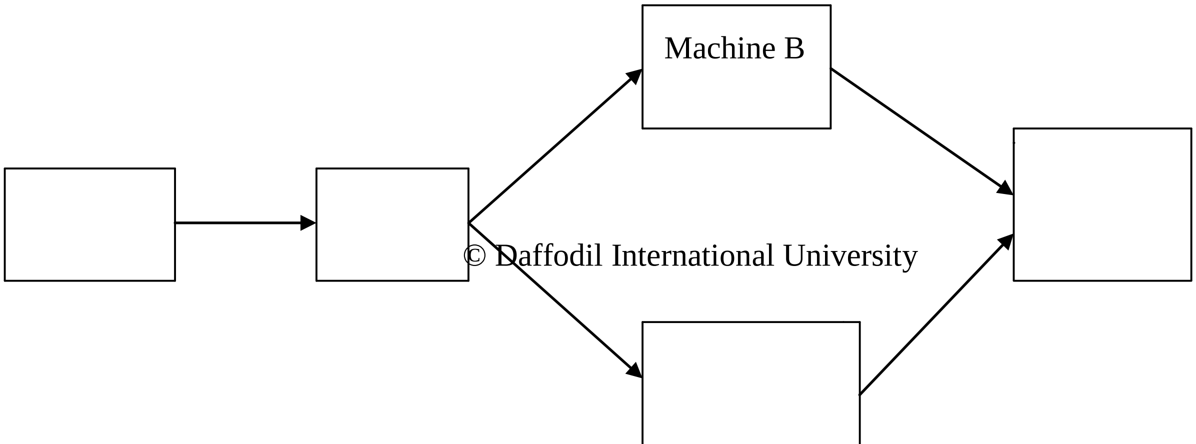
Line balancing is the apportionment of sequential work activities into workstations in order to gain a high utilization of and equipment so as to minimize the idle time.

For example, the production capacities of two machines lathe and milling is as under for a particular job.

-Lathe 50 pieces/hour

- Milling 25 pieces/hour

Now if only one machine of each is provided, then machine B will produce 25 units /hour whereas the machine A can produce 50 units. But because of the sequence only 25 units are produced per hour, i.e. machine A will work only 50 percent of its capacity and the remaining 30 minute in one hour. It is idle, this idle time can be minimized by introducing one more machine of kind B in the production line.



Receipt of M/C Output material

A

50 units/hour 50 units/hour

Machine B

25 units/hour

Fig: 01 Line balancing

Capacity Study Sheet

Buyer	Sainsbury
Style	Polo Shirt
Line #	21

SL NO	Operation	Name	ID	Cycle time 1	2	3	4	5	AVG Time	AVG Time with Allowance	SMV	TGT / Hour	Running TGT	Potential TGT
1	Hem Sleeve	Shahadat	61248	14	13	15	15	14	14	16	0.27	220	130	150
2	Placket mark & rolling	Momtaj	61199	19	18	17	20	17	18	21	0.35	172	130	150
4	Placket att. & top sth	Dulali	61153	20	19	21	20	20	20	23	0.38	157	130	150
5	Tack care label	Rozina	60354	12	13	11	12	14	12	14	0.24	252	130	150
6	Nose tack & middle cut	Asma	60300	23	22	24	23	21	23	26	0.43	139	130	150
7	Join shoulder	Parvin	60515	16	18	17	15	17	17	19	0.32	189	130	150
8	Collar mark & cut	Mehedi	60205	16	15	18	17	16	16	19	0.31	191	130	150
9	Collar tack at neck	Shopna	61433	17	15	17	16	19	17	19	0.32	186	130	150
10	Collar att	Musa	60949	20	18	19	17	19	19	21	0.36	168	130	150
11	Att. Bk tape piping	Babar ali	60280	17	18	18	19	20	18	21	0.35	170	130	150
12	Collar top sth	Jahirul	60575	17	18	18	16	17	17	20	0.33	182	130	150
13	Lower plckt 1/16 top sth	Salina	60581	17	18	15	17	16	17	19	0.32	189	130	150
14	Upper plckt 1/16 top sth	Shirin	61354	13	12	14	11	15	13	15	0.25	241	130	150
15	Make plckt box	Shila	60541	17	16	19	18	17	17	20	0.33	180	130	150
16	Att Sleeve	Basanti	61421	20	22	24	21	23	22	25	0.42	142	130	150
18	Side seam	Farzana	60363	38	35	36	35	37	36	42	0.69	86	130	150
19	Side seam	Joy	61425	40	42	39	41	41	41	47	0.78	77	130	150
20	Tack at Sleeve (5 tack)	Nurjahan	60297	18	20	19	21	18	19	22	0.37	163	130	150
21	Bottom hem	Anarul	20007	20	18	19	18	17	18	21	0.35	170	130	150
22	Tack at hem& stitcker remove	Eti	61420	24	23	24	25	21	23	27	0.45	134	130	150
23	Plckt hole & mark	Dulali	20239	17	16	15	17	18	17	19	0.32	189	130	150
24	Button att & insert	Rozina	65134	15	16	16	14	15	15	17	0.29	206	130	150

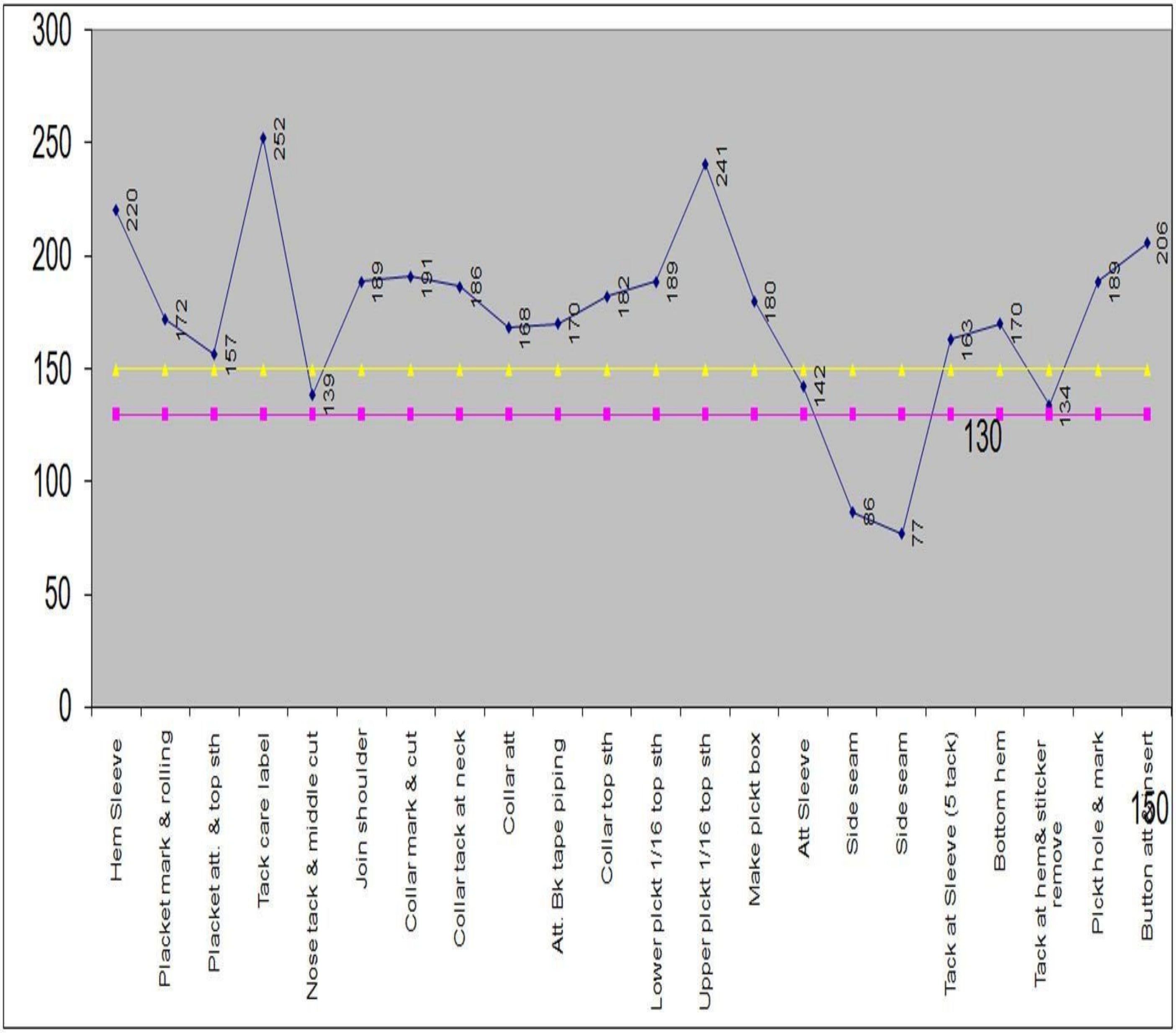


Fig: 2 line balancing graph

CHAPTER-04

MOTION STUDY

4.1 Definition of motion study:

systematic observation, analysis, and measurement of the separate steps in the performance of a specific job for the purpose of establishing a standard time for each performance, improving procedures, and increasing productivity —called *motion study.*

In contrast to, and motivated by, Taylor‘s time study methods, the Gilberts proposed a technical language, allowing for the analysis of the labor process in a scientific context. The Gilberts 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, emphasizing 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 Gilberts to build on the best elements of these work flows and to create a standardized best practice.

4.2 Types of Motion:

- Translation: Motion along a path examples: Position,
  Velocity, Net force

- Rotational: Rigid of a body about an axis

- Rotational: Orientation of the axis, Angular position, -
  Deformation: Bending, stretching, twisting,

examples: Internal elastic forces, springs, tension and compression

4.3 Micro-Motion Study:

Micro-motion study provides a technique for recording and timing an activity. Micromotion study is a set of techniques intended to divide the human activities in a groups of movement or micro-motions and the study of such movements helps to find for an operator one best pattern of movement that consumes less time and requires less effort to accomplish the task. Therbligs were suggested by Frank B . Gilbert, the founder of motion study was originally employed for job analysis but new uses have been found for this tool.

The applications of micro-motion study include the following:

I. Is an aid in studying the activities of two or more persons on a group work
II. As an aid in studying the relationship of the activities of the operator and the machine as a means of timing operations.
III. As an aid in obtaining motion time data time standards.
IV. Acts as a permanent record of the method and time of activities of the operator and the machine.

The micro-motion group of techniques is based on the idea of dividing human activity into divisions of movements or groups of movements according to purpose for which they are made. Gilbert differentiated 17 fundamental hand or hand and eye motions to which an eighteen has subsequently been added each therblig has a specific color symbol and letter for eighteenth purposes.

Therbligs refer primarily to motions of human body at the workplace and to the mental activities associated with it. They permit a much more precise and detailed description of the work than any other recording techniques.

Micro-motion study involves the following steps:

I. Filming the operation to be studied.
II. Analysis of the data from the films.
III. Making recording of the data.

4.3.1 Filming the operation :

Micro-motion study consists of taking motion of taking motion pictures of the activity while being performed by an operator. The equipment required to make a film or video tape of the operation consists of 16 mm movie camera, 16 mm film, wink counter and other usual photographic aids.

4.3.2 Analysis of data from films:

Once the operation has been filmed and film is processed, then the film is viewed with help of projector for analysis of micro-motions.

- Film is run at normal speed so as to get familiar with the pattern of movement involved.
- A typical work cycle is selected from amongst the filmed cycles.
- Film is run at a very low speed and is usually stopped or reversed frequently to identify the motions.

4.3.3 Making Recording of the data:

Recording of data is done using SIMO chart

4.3.3.1. SIMO CHART:

Simultaneous motion cycle chart is a recording technique for micro-motion study. A Simo chart is a chart , based on the film analysis, used to record simultaneously on a common time scale the therbligs or a group of therbligs performed by different parts of the more operators.

It is the micro-motion form of the the man type flow process chart . To prepare simo chart, an elaborate procedure and use of expensive equipment are required and this study is justified when the saving resulting from study will be very high. The format for simo chart is shown in bellow fig:

SIMO CHART

Operation: …………				Film no :………..			
Part drawing no: …….				Chart no : ……… Method:			
………			Date : ………….				
Operation : …….				Charted by : ……			
Wink counter reading	Left hand description	therbligs	time	Time in200/m	time	therbligs	Right hand description

Fig-03: format for simo chart

4.4. Memo-motion study:

Before leaving the general area of micro motion study, let us touch briefly on memo motion study. Memo motion study, which was originated by M.E. Mendel, is a special form of micro motion study in which the motion pictures or videotape are taken at slow speeds. Sixty and one hundred frames per minutes are most common.

Memo motion study has been used to study the flow and handling of materials, crew activities, multiperson and machine relationships, stockroom activities, department store clerks, and a variety of other jobs. It is particularly valuable on long-cycle jobs or jobs involving many interrelationships. In addition to having all of the advantages of micro motion study, it can be used at relatively low film or tape cost (about 6% of the cost at normal camera speeds) and permits rapid visual review of long sequence of activities.

4.5. Why- Motion Economy?

- Reduce the number of motions

- Reduce the distances moved
- Reduce the precision
- Reduce eye shift
- Simplify grasps
- Toss dispose rather then place dispose
- Best use of both hands
- Encourage rhythm

4.6. Principles Of Motion Economy:

Through the pioneer work of Gilbreth, Ralph M. Barnes and other investigators, certain rules for motion economy and efficiency have been developed. Some of the more important of these principles are the following:

- The movements of the two hands should be balanced and the two hands should begin and end their motions simultaneously.

- The hands should be doing productive work and should not be idle at the same time except during rest periods.

- Motions of the hands should be made in opposite and symmetrical direction and at the same time.

- The work should be arranged to permit it to be performed with an easy and natural rhythm.

- Momentum and ballistic-type movements should be employed wherever possible in order to reduce muscular effort.

- There should be a definite location for all tools and materials, and they should be located in front of and close to the worker.

- Bins or other devices should be used to deliver the materials close to the point of use.

- The workplace should be designed to ensure adequate illumination, proper workplace height, and provision for alternate standing and sitting by the operator.

- Wherever possible, jigs, fixtures, or other mechanical devices should be used to relieve the hands of unnecessary work.

- Tools should be prepositioned wherever possible in order to facilitate grasping them.

- Object should be handled, and information recorded. Only once.

4.7. Classification of body movement:

- Knuckle -Finger
- Wrist - Hand &Finger
- Elbow - Forearm, hand &finger
- Shoulder-upper arm, fore-arm, hand &finger
- Trunk - Torso, upper arm, forearm, hand &finger.

4.8. Tools for Motion Analysis:

There are various tools &equipment in motion study which are necessary for industrial engineering.

4.8.1. Process Chart:

A flow process chart is a graphic symbolic representation of the work performed or to be performed on a product as it passes through some or all of the stages of a process. Typically, the information included in the charts is quantity, distance moved, type of work done by symbol with explanation, and equipment used. Work times may also be included:

- Right and Left – Hand Operation Chart
- Symbol Name Activities Represented
- Operation Modification of object at one workplace. Object may be changed in any of its physical or chemical characteristics, assembled Arranged for another operation, transportation ,inspection or storage.
- Transportation Change in location of object from one place to another ➢ Inspection Examination of object to check on quality or quantity characteristics.
- Delay Retention of object in a location awaiting next activity.
- Not authorization is required to perform the next activity.

4.8.2. Multiple Activity Chart:

In those operations involving the combination of a person and a machine, a person and several machines, or any combination of people and machines where delays are prevalent, the multiple activity chart provides a convenient technique for analyzing the combined activity. Very often the objectives of this type of analysis are to attain the maximum utilization of a machine, to attain the optimum person to machine relationship, or to bring about the best balance of crew activity.

For this reason, the time factor is an important consideration and necessitates the use of a graphical representation involving time.

4.8.3. Use of Videotape:

In the past, the experienced methods engineer found that one of the most important aids was the use of motion pictures. There are many situations in which it is difficult to observe all of the action taking place because of the high speed of activities or the complexity of the operation.

Having observed slow-motion motion pictures, we are familiar with the fact that one can take motion pictures at high speed and then, by projecting them at normal speed, slow the action down. By the same token, we can take the pictures at slow speed and project them at what appears to be high speed.

4.9. Job Enlargement and Enrichment:

This has led to the contention of a number of social scientists that hobs need to be enlarged or enriched. Feed rick Herzberg, one proponent of job enrichment, feels that the purpose of job enrichment should be to eliminate the undesirable characteristics of highly repetitive, specialized work by enlarging it to include:

- Greater variety of knowledge and skill
- Giving a person a complete natural unit of work (module, division, area, etc.)
- More complex utilization of the important cognitive and motor abilities possessed by the worker.
- More freedom and responsibility in the performance of the tasks at hand.

Among the principles that commonly are applied in job enrichment programs, the following are attended to by one large company.

- Ensure that there is variety in the job content.
- Include in the work situation an opportunity for the worker to grow and learn
- Provide an opportunity for each worker to have knowledge of the part that his or her job plays in the total manufacturing process required to produce the product.
- Design the work so that it has meaning to the worker and provides pride in performance to the worker.
- Ensure that the work is reasonably demanding and functionally inclusive. Provide for self-direction of the work and for the checking of quality of output.

4.10. Value Analysis:

As a part of the approach to methods improvement, the methods engineer should question the impact of the design of the parts, the materials used, and the equipment used on the productivity of operations. That is, the methods engineer should be thoroughly familiar with value analysis, an activity that is closely both to the methods improvement programs and to purchasing and that is being used extensively in industry and the government.

Value analysis is an objective study of every item of cost in every component part, subassembly, or piece of equipment. This includes a study of the design, the material, and the process in a continual search for other possible materials and new processes. Value analysis involves the evaluation of an items function and relates its effect to the end product. The purpose is to attempt to ensure that every element of cost contributes proportionately to the function of the item

4.11.StopWatch Time Study:

Why do we break down the activity to be studied into elements? (Why not measure time straightly)

4.11.1 PMTS:

PMTS also make use of previously collected data but it deals with basic human motions (or therbligs) of duration 0.1 seconds or less. Whereas in synthesis duration may be 3-4 seconds.thats are following:

- For short cycle & highly repetitive jobs
- Uses video film (micro motion study)
- More accurate than stopwatch time studies
- No rating factor required but allowances need to be added
- But can deal with only manual motions of the operation

1 TMU = 0.0006 minutes (TMU = Time Measurement Unit)

1 wink = 0.0005 minutes (used in SIMO chart/micro motion study

4.11.2. Analytical Estimating:

Analytical estimating is used when past time data is not available and estimator has to rely on his past experience

4.12. Standard time and motion analysis solution for more accurate estimate:

IEES (Industrial Engineering Execution System) helps the sewing industry and our industrial engineers set time standards and rationalize work methods to minimize our daily operating costs and maximize our productivity. We can analyze and plan every single operation in the sewing of a garment, whether its a machine or manual operation. With IEES we can cost our products, with a higher level of accuracy, before we start the production process.

IEES gives us the knowledge to take the guesswork out of the garment pre-production process.

4.13. Tracking:

- Collect and store labor standards
- Create and track detail work methods
- Create and track cost estimates
- Create and track procedures and methods

4.14. Easier time standards development

- Quick search across organizational wide IE data
- Benchmark standards based on MTM-2
- Update standards across organization

4.15. How benchmarking and standard work analysis works:

1. **Collect motion and time data** — with video camcorders, industrial engineers capture sewers time and motion measurements of operations in a style before mass production starts.

2. **Upload for analysis** — In GPRO‘s work analysis solution, digital motion videos and time data are uploaded and categorized.
3. **Define and work break down** — Video of work motions are analyzed, time and work elements broken down and defined. Standard time is derived. Additional work factors such as machine RPM, material handling time, etc are factored in.
4. **Analyze and summarize** — Compare before and after charts. Simplify. Review methods used by operators.
5. **Improve** — Identify improvement opportunities. Measure gains, check in and reuse

4.16. Work Analysis:

Remaking the same styles over and over? Got thousands of repetitive operations for hundreds of ordered styles

Break down hours of operations into their elements, and find the secret in leaner production — optimized work designed to reduce motion waste. Wastes take value out of your production chain, and adds to your cost. Take control, increase efficiency, work smarter and learn better with work analysis done right. Continuously discover new ways to sew styles better for the 21st century. By designing work better, GPRO‘s work analysis solution can help you realize savings of up to 25%.

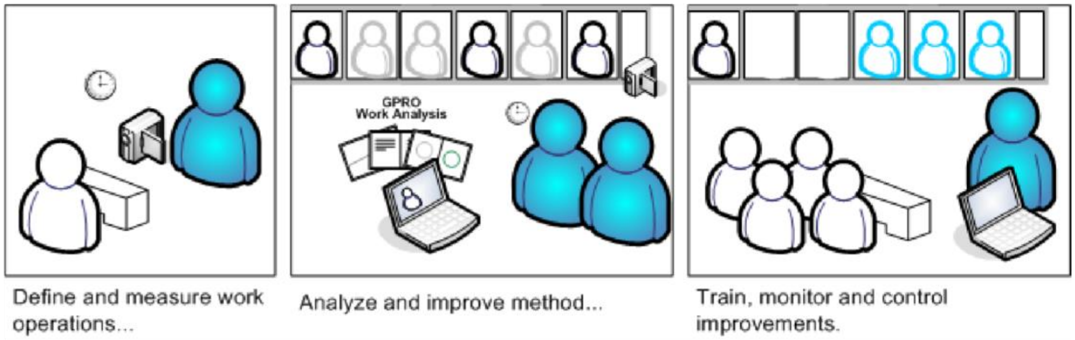


Fig:4Work analysis solution to improve sewing operations with time and motion data

4.17. Analysis of Motion:

The purpose of motion analysis is to design an improved method which eliminates unnecessary motion & employs human efforts more productively.

Steps involved in motion analysis are:

1. Select the operation to be studied
2. List & chart various motions performance the operator.
3. Identify the Productive & Idle motions
4. Eliminate the unnecessary & nonproductive motions
5. Redesign the existing operating procedure by employing minimum number of motions in the most appropriate sequence & in accordance with the principles of motion economy.

4.18. Standard Time:

Standard Time may be defined as the amount of time required to complete a unit of work under existing conditions, using the specified method & machinery, by an operator able to do the work in a proper manner and at a standard pace.

OT	PRF	PA	RPA	SA	POA
Normal Time		Allowances %			
Standard Time					

OT- Observed Time

PRF - Performance Rating Factor

PA- Process Allowances

SA - Special Allowances

POA - Policy allowances

Standard Time = (Average Observed Time X Rating %)+Allowances %

Normal Time = (Average Observed Time X Rating %)

- Standard Time = Normal Time + Allowances % => N.T + (NT X Allow % /100) Example:

Calculate the Standard time with the given information: Average Observed time = 2 min; Rating % = 50 % , Allowances = 15 %

Sol:

Std Time =Normal time + Allowance %

Normal time = Average Observed Time X Rating %

= 2 X 0.5 = 1 min

Standard time = 1 min + 15% =1+0.15 = 1.15 min

CHAPTRE-05

GSD INFORMATION

5.1GSD – General Sewing Data:

General Sewing Data (GSD) is the world leading ‗Pre-determined Time System' (PTS), consisting of a database of codes and times that enable the user to predicatively and empirically analyze working methods, building such data into commonly used design features, thereby facilitating rapid and predictive evaluation and quantification of manufacturing times and, ultimately, production costs, production planning and product delivery.

GSD provides a scientific, ethical and auditable approach to quantifying manufacturing methods, times and costs and accurately and consistently establishes International Standard Time for complete products (styles), or individual product components (features). GSD provides the ability to establish and quantify each step or operation in the manufacturing process. Using GSD businesses can:

5.2 GSD Code:

THE GSD CODES Specifically designed for the sewn products industry, the garment manufacturer, or any production facility where sewing forms part of assembly, General Sewing Data Limited continues to provide and develop a consistent, accurate, easy to understand methods analysis and time determination technique through the use of its GSD codes**.**

Using the unique information available from GSD, the operator is able to specify all types of sewing operation. GSD utilizes 39 basic codes which represent the most commonly used motion sequences encountered in the sewn products industry.

5.3 History Of GSD:

In the 1940's detailed research was undertaken on what kind of Gets and Puts are needed to complete certain tasks. Some Gets are easier than others (imagine picking up a coffee cup compared to picking up one button from a number of buttons within a box.) The same with Puts; place a coffee cup down or put the button into the jaws of a buttoning machine. Each

Get & Put was classified and recorded using old fashioned "cine film", with the cine camera running at 16 frames per second. This was repeated 1,000's of times to establish the statistical average number of frames, and therefore time, for each class of Get & Put.

The problem with these early systems was that they took a long time to build usable data, based on the difficulty & distance of each Get or Put.

In 1976 GSD investigated and focused on the "sewn products industry" (includes; shoes, apparel, luggage, furniture, bedding etc.) and we used the statistically accurate Get & Put data to compile larger data blocks that were relevant to handling fabric, so the analysis of the movements is much quicker and the chance of making the wrong choice is eliminated; making GSD fast, consistent and accurate to use.

The global average times have been established from over 70 years of research and incorporated within GSD through the use of MTM Core Data to construct higher level

GSD data blocks or ―codes‖ with associated time values. All the user then needs to do is to create GSD based data relevant to the methods they use today, depending upon your products, your machinery, your workplace layouts and the production flow system (e.g. conventional bundle or rail system?).

5.3 GSD System In 51 Countries:

Great Britain	Ireland	Germany	Austria	Switzerland
Scandinavia	Spain	Portugal	Malta	France
Israel	Jordan	Egypt	USA	Canada
Mexico	Brazil	Hong Kong	Taiwan	Japan
India	Sri Lanka	China	South Africa	Australia

Fig 5: GSD Country's

5.4 Product sectors actively using GSD include:

BABYWEAR	CORPORATEWEAR	CHILDRENSWEAR	FOOTWEAR
HOMEWEAR	KNITWEAR	LEISUREWEAR	LADIESWEAR
MOD	NIGHTWEAR	OUTERWEAR	RETAIL
SAFETYWEAR	UPHOLSTERY	WORKWEAR	AUTOMOTIVE
LINGERIE	LUGGAGE	MENSWEAR	MILLINERY

5.5 The Benefits Of GSD:

Used correctly GSD will provide a basis for Predictive Costing, and will also facilitate Method Engineering. As a by-product of these activities, the GSD system will generate

Standard Times for methods and processes, which are then used to ―drive‖ other external activities such as :

- Capacity Planning and Factory Loading
- Line Balancing
- Work Targets Ticket Printing
- Appraisal of Capital Investment
- Performance and Efficiency monitoring
- Payment Standards
- Operator Training

5.6 Plant Rely On GSD for:

- Methods engineering
- Methods improvement
- Line balancing
- Operator training
- Learning curve analysis
- Style change evaluation
- Pre-production planning
- Costing of new designs
- Management reporting information

5.7 Advantage Of Applying GSD:

The primary advantages of applying GSD are the ability to compile Predictive Costing Analyses, and the fact that GSD is a powerful and efficient Method Engineering tool that can be utilized to make significant improvements in productivity in the manufacturing environment. These two factors combined mean that an organization that commits to GSD is able to accurately measure manufacturing cost prior to entering the sales environment (thereby giving the manufacturer confidence in profit margin and lead times) and that it is also able to accurately plan production and delivery dates**.**

A further advantage is that this predictive process provides the shop floor with a comprehensive series of Standards and Targets, enabling the operators to ―work to target‖ as soon as the product enters the manufacturing process. Furthermore, this ―predictive advantage‖, frees the Industrial Engineers (or Work Study personnel) from the laborious task of checking each value, thereby allowing them the time to perform ―Method

Engineering‖, with the goals of

- improving the Standard Times which are generated at the costing stage
- shortening the manufacturing process
- Improving productivity.Increasing profitability.

5.8 Dis- Advantage of Applying GSD:

If the system is applied correctly, there should be few disadvantages other than the following:

- Cost of GSD implementation and training (which should be measured against the return on investment, discussed later)
- Additional cost, having already invested in Time Study
- Time scale to implement GSD (4 to 6 months)
- It is unlikely that the benefits of GSD will be fully realized unless payment procedures incorporate some form of ―payment by results‖ scheme i.e. piecework, or something similar (although it should be noted that the long term effects of applying such a scheme would be nothing other than beneficial).

Each of the above should be considered in conjunction with the Advantages listed earlier. There are many benefits to be enjoyed from introducing General Sewing Data, but they will only be realized through a strong commitment to the system - at all levels of the company - and by correctly positioning the system within the organization, so that it becomes the foundation on which many other activities depend

5.9 GSD and Product Lifecycle Management:

A key element of managing the product lifecycle, and the associated costs, is the ‗Bill of Labour‘ (BOL). With competition at its highest for decades, no company can afford to estimate any element of cost, including the BOL which is, all too frequently, based on historical figures

The only safe way to ensure accurate product cost evaluation, and therefore effective control over the product lifecycle, is to accurately and consistently quantify BOL and related costs. To effectively do so requires the use of a logical, scientific and predictive costing technique.

Fig6:product life cycle

5.10 Further Benefits Of GSD:

Customization – GSD is designed to "talk the language" of your production facility, regardless of size, product type or production configuration. Each GSD installation is tailored to the needs and specifications of the facility.

Flexibility - GSD was designed to accommodate the unique production requirements of each sewn product facility. Installation of the system includes free adjustment of menus, result and printout configurations. There is no limit to the number or complexity of changes.

Modem support –

GSD was one of the first companies in the industry to provide a “help desk", the modem support package, online help. These communication features permit modifications of the program, renewals and assistance by modem, internet, and telephone

Graphics, MPG and AVI compatible - GSD interfaces with AutoCAD and Auto sketch as well as with any graphic Program that can produce "Bitmap" or WMF files, in order to produce work place layouts, part enlargements, quality specifications and style profiles.

In addition, GSD can save MPG and AVI movies of operations for future reference.

Production-responsive - The Quick Response "style" environment demands that sewnproducts technology match the pace of today's frantically changing production runs. GSD allows your facility company to anticipate, test and respond to hundreds of production variations - and to pre-engineer and pre-cost each variation with unequaled accuracy.

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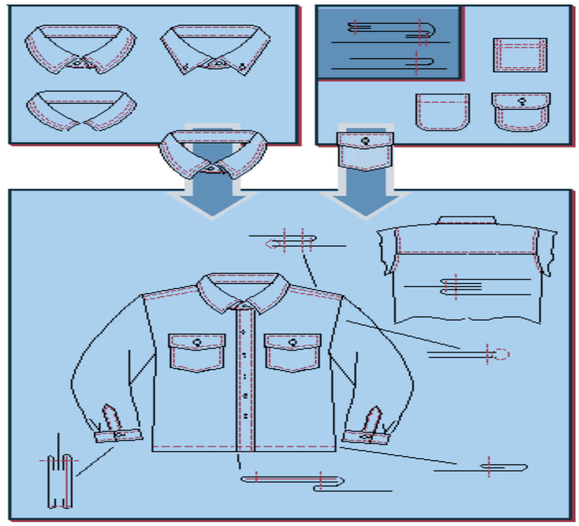
Networking - The system allows sharing of information throughout a facility: Engineers, costing, management and the productionline can access for same information at the same time



Computer-Integrated Manufacturing- - GSD interfaces with other technology, including shop floor control systems, Unit Production Systems and company mainframes, making GSD ideal for current and future CIM scenario.

Fig8: GSD graphics technology

Allows in-progress job analysis and Costing of component parts and Workplace activities.

Add-On Modules - optional modules which interact with the GSD data base address cutting and spreading activities, capacity planning and ticket printing.

Operator Training - GSD believes that the optimization of the operator is the key to superior productivity. The GSD method specification is the first means of communication. The G.O.L.D.Bar System (General Operator Learning Data) option helps improve work efficiency by projecting training time for new, transferred or retrained workers. Adaptable to client data base.

Languages - GSD is available in English, German, French, Spanish, Portuguese, Russian, Arabic and Hebrew, a feature invaluable to 807 and offshore contractors.

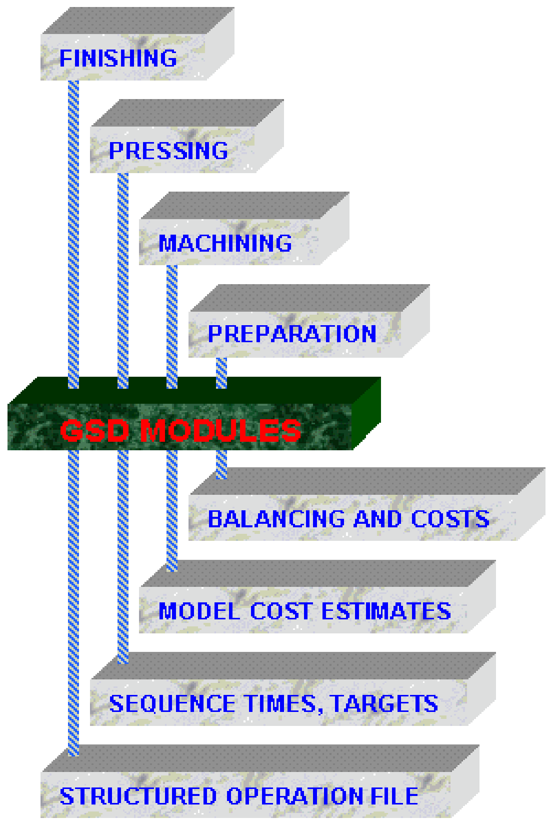


Fig9: GSD Model

CHAPTER-O6

DATA MOTION

Table 1 **: Operation for a L Sleeve T shirt with its motion**

South East Textiles (Pvt.) Ltd.										
Operation chart										
Product:	L.Slv T.Shirt	Buyer: Sainsbury			Date:	15/6/2012			Floor:	
Colour:	White,Red Stripe	Order No:		Size:					Line:	
TGT/HR :	120	TGT/8HR	960		TGT/10HR:		1200	Order Quanty:		
SL.No.	OPERATION	M/C	EST. SMV	CAPICITY	EST. TGT	PLAN TGT	REQ. MAN	ACTUAL M/C	ACTUAL HELPER	REMARKS
1	Bk & Fnt part match	Helper	0.15	400	280	120	0.43		1	
2	Care LBL join at Bk part	P.M	0.19	316	221	120	0.54	1		
3	Shoulder join At Right	O.L	0.19	316	253	120	0.48	1		
4	Plkt Liling att	Helper	0.19	312	218	120	0.55		1	
5	Plkt Rolling	O.L	0.26	230	184	120	0.65	1		
6	Sldr Psn Plkt Join	P.M	0.22	273	191	120	0.63	1		
7	Plkt T/st	P.M	0.33	183	164	120	0.73	1		
8	NK Binding	F.L	0.23	261	235	120	0.51	1		
9	Bk Tape join	F.L	0.36	165	149	120	0.81	1		
10	Tack at Bk tape End & cut	P.M	0.31	194	174	120	0.69	1		
11	Bk tape T/st	P.M	0.32	185	167	120	0.72	1		
12	Slv Sharing	P.M	0.25	240	216	120	0.56	1		
13	Make Slv Hem	F.L	0.29	204	183	120	0.65	1		
14	Slv Match	Helper	0.15	400	280	120	0.43		1	
15	Slv join	O.L	0.46	130	91	120	1.32	2		
16	Close side seam	O.L	0.62	97	97	120	1.24	2		
17	Body Hem	F.L	#REF!	#REF!	#REF!	120	#REF!	1		
18	Tack at slv end	P.M	0.35	171	171	120	0.70	1		
		TOTAL SMV	#REF!					17	3	
								TTL.M/P:	20	

Machine summery				
P/M	O/L	F/L	Others	Total
8	6	3		17

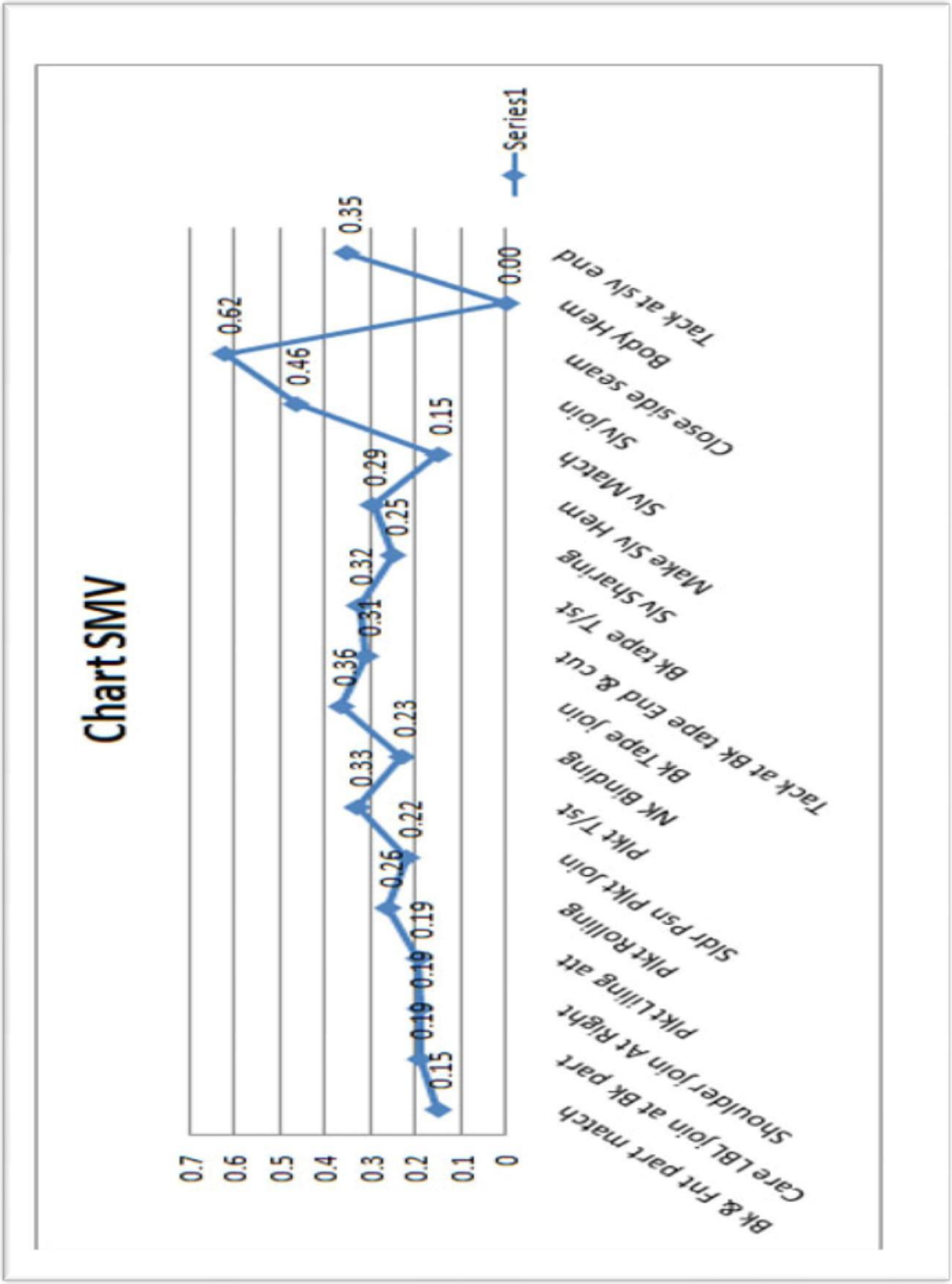


Chart SMV
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.15
0.19
0.19
0.19
0.26
0.22
0.33
0.23
0.36
0.31
0.32
0.25
0.29
0.15
0.46
0.62
0.00
0.35
Bk & Fnt part match
Care LBL Join at Bk part
Shoulder Join At Right
Plkt Liling att
Plkt Rolling
Sldr Psn Plkt Join
Plkt T/st
NK Binding
Bk Tape Join
Tack at Bk tape End & cut
Bk tape T/st
Slv Sharing
Make Slv Hem
Slv Match
Slv Join
Close side seam
Body Hem
Tack at slv end
Series1

Table2: List of GSD code with its motion and TMU value

Number	GSD code	Motion	TMU
1	B30	Pick up bundle and place in table	66
2	B13	Open bundle by relasing bow	63
3	PP2H	Pick up part with 2 hand and position under foot	76
4	PP1H	Pick up part with 1 hand and position under foot	57
5	AP2P	Align parts or adjust	56
6	SEW	1.85185 1.07013 1.1 3 7	23.5397
7	EP2H	Evacute part with 2 hands	42
8	B26	Tie bundle with bow	3.56
9	EP1H	Evacute part with 1 hand	39
10	GT1E	Get part with 1 hand	12
11	CE12	Pick up pencil and mark	56
12	GT2H	Get part with 2 hands	36
13	FSLD	Fold 1 time a part	42
14	PTAL	Put part an approximate location	66
15	APSH	Align or adjust parts by sliding	24
16	GT2H	Get loop	33
17	PP2T	Pick up 2 parts together	70
18	F.Motin	Move and position under foot pressure	33
19	AP1P	Align 1 part or adjust	60
20	TC1T	Pick up scissor and trim return	48
21	MCTB	BK tack start of seam	35
22	TCAC	Additional cut	24
23	FFLD	Form fold	43
24	B16	Lay out bundle for sewing	90
25	CE2	Get elastic and scissor	124
26	CE3	Locate corret position and cut	80
27	CE11	Get pencil	56
28	CE13	mark	56
29	B2	Reach get and carry bundle	60

Table 3: motion chart :

Operatio	Att.Loop	Style #		5323
		Target/Hr	100%	312
Machine		Target/Day	100%	2493
		Target/Hr	80%	249
SMV	0.19	Target/Day	80%	1994

Complete Method-Att. loop

		MST- Minimum sweing time	HSF- High spee factor	CG	CM- Centimeter	FT- Feed tensioning	ESA- Estimate stopping accuracy	SPI-Stitch per inch	RPM- Rotation per minute	Time Value	
Element Number	Code	Element Description						Distance in CM	Frequency	TMU	SMV
1	B30	Pick up bundle & place in table								66	0.0040
2	B13	e								63	0.0038
3	PP2H	Pick up part with 2 hands & position under foot						30		76	0.0456
4	GT2H	Get loop						15		33	0.02
5	FSLD							5		38	0.02
6	AP2P	Align 2 parts or Adjust						5		56	0.0336
7	SEW	1.851851852	1.070126886	1.1	3	17		5	4500	23.5397	0.0141
8	EP2H	Evacute part with 2 hands						30		42	0.0252
9	B26	Tie bundle with bow								356	0.0214
10	EP1H	Evacute part with 1 hand						80		39	0.0023
											0.00
											0.00
Total Allowed Time in TMU and Minute										792.54	0.19

Operatio	Care Lbl join	Style #		5323
		Target/Hr	100%	326
Machine	P/M	Target/Day	100%	2606
		Target/Hr	80%	261
SMV	0.18	Target/Day	80%	2085

Complete Method- Care label join

		MST	HSF	CG	CM	FT	ESA	SPI	RPM	Time Value	
Element Number	Code	Element Description						Distance in CM	Frequency	TMU	SMV
1	B30	Pick up bundle & place in table								66	0.0040
2	B13	Open bundle by releasing bow								63	0.0038
3	PP2H	Pick up part with 2 hands & position under foot						30		76	0.0456
4	PP1H	Pick up part with 1 hand & position under foot						15		57	0.0342
5	AP2P	Align 2 parts or Adjust						5		56	0.0336
6	SEW	1.85185	1.07013	1.1	3	17		5	4500	23.5397	0.0141
7	EP2H	Evacute part with 2 hands						30		42	0.0252
8	B26	Tie bundle with bow								356	0.0214
9	EP1H	Evacute part with 1 hand						80		39	0.0023
											0.00
											0.00
Total Allowed Time in TMU and Minute										778.54	0.18

Operation	Mobion tape	Style #		5323
Machine	P/M	Target/Hr	100%	148
SMV	0.40	Target/Day	100%	1187
		Target/Hr	80%	119
		Target/Day	80%	949

Complete Method-Mobilon Tap

		MST	HSF	CG	CM	FT	ESA	SPI	RPM	Time Value	
Element Number	Code	Element Description						Distance in CM	Frequency	TMU	SMV
1	B30	Pick up bundle & place in table								66	0.0040
2	B13	Open bundle by releasing bow								63	0.0038
3	PP2H	Pick up part with 2 hands & position under foot						30		76	0.0456
4	GT2H	Get Part with 2 hands						30		36	0.0216
5	FSLD	Fold 1 Time a part						15		42	0.0504
6	CE12									56	0.0672
7	PP1H	Pick up part with 1 hand & position under foot						15		57	0.0342
8	AP2P	Align 2 parts or Adjust						15		60	0.0360
9	SEW	1.85185	1.07013	1.1	1	17		5	4500	19.1799	0.0115
10	PP1H	Pick up part with 1 hand & position under foot						15		57	0.0342
11	AP2P	Align 2 parts or Adjust						15		60	0.0360
12	SEW	1.85185	1.07013	1.1	1	17		5	4500	19.1799	0.0115
13	EP2H	Evacute part with 2 hands						30		42	0.0252
14	B26	Tie bundle with bow								356	0.0214
15	EP1H	Evacute part with 1 hand						45		33	0.0020
											0.00
											0.00
Total Allowed Time in TMU and Minute										1042.36	0.40

Operation-Sateen tape join
M/C-P/M

SMV-0.18

Complete Method-Sateen tape join

		MST	HSF	CG	CM	FT	ESA	SPI	RPM	Time value	
Element number	code	Element description						Distance in cm	Frequency	TMU	SMV
1	B30	Pick up bundle& place in table								66	0.0040
2	B13	Open bundle by releasing bow								63	0.0038
3	PP2H	Pick up part with 2 hands &position under foot						30		76	0.0456
4	PP1H	Pick up part with 1hands &position under foot						15		57	0.0342
5	AP2H	Align 2 parts or Adjust						5		56	0.0336
6	SEW	1.85185	1.07013	1.1	1	17		5	4500	19.1799	0.0115
7	EP2H	Evacute part with 2 hands						30		42	0.0252
8	B26	Tie bundle with bow								356	0.0214
Total Allowed Time in TMU and Minute										768.18	0.18

Operation	Match & Shoulder join
Machine	O/L
SMV	0.26

Style #		5323
Target/Hr	100%	230
Target/Day	100%	1839
Target/Hr	80%	184
Target/Day	80%	1471

Complete Method-Match & Shoulder join

		MST	HSF	CG	CM	FT	ESA	SPI	RPM		
Element Number	Code	Element Description						Distance in CM	Frequency	Time Value TMU	SMV
1	B30	Pick up bundle & place in table								66	0.00396
2	B13	Open bundle by releasing bow								63	0.00378
3	PP2T	Pick up 2 parts together						30		70	0.042
4	F.Motion	Move & Position under foot presure						5		33	0.0198
5	AP2P	Align 2 parts or adjust						15		60	0.036
6	SEW	1.2121212	1.1081015	1.1	6	17		4	5500	25.864812	0.016
7	PP2H	Pick 1 part with 2 hands & position under foot						15		66	0.0396
8	AP2P	Align 2 parts or adjust						15		60	0.036
9	SEW	1.2121212	1.1081015	1.1	6	17		4	5500	25.864812	0.016
10	EP2H	Evacute part with 2 hands						30		42	0.03
11	B26	Tie bundle with bow								356	0.02136
12	EP1H	Evacute part with 1 hand						80		39	0.00234
Total Allowed Time in TMU and Minute										906.73	0.26

Operation	Rib Tack & Make fold
Machine	P/M
SMV	0.22

Style #		5311
Target/Hr	100%	273
Target/Day	100%	2188
Target/Hr	80%	219
Target/Day	80%	1750

Complete Method-Rib Tack & Make fold

		MST	HSF	CG	CM	FT	ESA	SPI	RPM		
Element Number	Code	Element Description						Distance in CM	Frequency	Time Value TMU	SMV
1	B30	Pick up bundle & place in table								66	0.0008
2	B13	Open bundle by releasing bow								63	0.0008
3	PP2H	Pick up 1part with 2 hand & posion under food						30		76	0.0456
4	AP2P	Align 2 parts or adjust						15		60	0.0360
5	SEW	1.8518519	1.0701269	1.1	6	17	0	5	4500	30.079	0.0180
6	PP2H	Pick up 1part with 2 hand & posion under food						15		66	0.0396
7	AP1P	Align 1part or adjust						15		60	0.0360
8	FSLD	Fold one time a part						5		38	0.0228
9	EP1H	Evacute part with 2 hands						45		33	0.0198
											0.00
											0.00
Total Allowed Time in TMU and Minute										492.079	0.22

Operation	Nk join	Style #		5311
		Target/Hr	100%	183
Machine	O/L	Target/Day	100%	1461
		Target/Hr	80%	146
SMV	0.33	Target/Day	80%	1168

Complete Method

		MST	HSF	CG	CM	FT	ESA	SPI	RPM		
Element Number	Code	Element Description						Distance in CM	Frequency	Time Value TMU	SMV
1	B30	Pick up bundle & place in table								66	0.00396
2	B13	Open bundle by releasing bow								63	0.00378
3	PP2T	Pick up 2 parts together						30		70	0.042
4	Foot	Move & Position under foot presure						5		33	0.0198
5	AP2P	Align 2 parts or adjust						15		60	0.036
6	SEW	1.5151515	1.0890932	1.1	5	17	0	5	5500	26	0.02
7	AP2P	Align 2 parts or adjust						15		60	0.036
8	SEW	1.5151515	1.0890932	1.1	21	17	0	5	5500	55	0.03
9	AP2P	Align 2 parts or adjust						15		60	0.036
10	SEW	1.5151515	1.0890932	1.1	21	17	0	5	5500	55	0.03
11	TC1T	Pick up scissor & Trim return scissor						15		48	0.0288
12	EP1H	Evacute part with 1 hand						30		28	0.017
13	B26	Tie bundle with bow								356	0.02136
14	EP1H	Evacute part with 1 hand						80		39	0.00234
Total Allowed Time in TMU and Minute										1019	0.33

Operation	Bk Tape join(S-S)	Style #		
		Target/Hr	100%	165
Machine	FL	Target/Day	100%	1320
		Target/Hr	80%	132
SMV	0.36	Target/Day	80%	1056

Complete Method

		MST	HSF	CG	CM	FT	ESA	SPI	RPM		
Element Number	Code	Element Description						Distance in CM	Frequency	Time Value TMU	SMV
1	B30	Pick up bundle & place in table								66	0.0040
2	B13	Open bundle by releasing bow								63	0.0038
3	PP2H	Pick up 1 part with two hands & position under foot						30		76	0.0456
4	PP2H	Pick up 1 part with two hands & position under foot						15		66	0.0396
5	AP2P	Align 2 part or adjust						5		56	0.0336
6	SEW	1.8518519	1.0701269	1.1	5	17		5	4500	27.899441	0.0167
7	AP2P	Align 2 part or adjust						5		56	0.0336
8	SEW	1.8518519	1.0701269	1.1	5	17		5	4500	27.899441	0.0167
9	AP2P	Align 2 part or adjust						5		56	0.0336
10	SEW	1.8518519	1.0701269	1.1	5	17		5	4500	27.899441	0.0167
11	TC1T	Pick up scissor & Trim return scissor						15		48	0.0288
12	AP2P	Align 2 part or adjust						5		56	0.0336
13	SEW	1.8518519	1.0701269	1.1	5	17		5	4500	27.899441	0.0167
14	EP1H	Evacute with 1 hand						30		28	0.0168
15	B26	Tie bundle with bow								356	0.0214
16	EP1H	Evacute with 1 hand						80		39	0.0023
											0.00
Total Allowed Time in TMU and Minute										1077.6	0.36

Operation	T/st at Fnt Nk	Style #		430
Machine	F/L	Target/Hr	100%	320
SMV	0.19	Target/Day	100%	2556
		Target/Hr	80%	256
		Target/Day	80%	2045

Complete Method-T/st at Fnt Nk

		MST	HSF	CG	CM	FT	ESA	SPI	RPM		
Element Number	Code	Element Description						Distance in CM	Frequency	Time Value TMU	SMV
1	B30	Pick up bundle & place in table								66	0.0040
2	B13	Open bundle by releasing bow								63	0.0038
3	PP2H	Pick up 1 part with two hands & position under foot						30		76	0.0456
4	AP1P	Align 1 part or adjust						15		42	0.0252
5	SEW	1.2820513	1.1035519	1.1	40	17		5	6500	79.251648	0.0476
6	TC1T	Pick up scissor & trim return scissor						15		48	0.0240
7	EP1H	Evacute part with 1 hand						30		28	0.0140
8	B26	Tie bundle with bow								356	0.0214
9	EP1H	Evacute part with 1 hand						80		39	0.0023
											0.00
											0.00
											0.00
Total Allowed Time in TMU and Minute										797.252	0.19

Complete Method-Make slv hem

		MST	HSF	CG	CM	FT	ESA	SPI	RPM		
Element Number	Code	Element Description						Distance in CM	Frequency	Time Value TMU	SMV
1	B30	Pick up bundle & place in table								66	0.0040
2	B13	Open bundle by releasing bow								63	0.0038
3	PP2H	Pick up 1 part with 2 hand & position under foot						30		76	0.0456
4	AP2P	Align 2part or adjust						15		60	0.0360
5	SEW	1.2820513	1.1035519	1.1	18	17		5	6500	45.013242	0.0270
6	PP2H	Pick up 1 part with 2 hand & position under foot						30		76	0.0456
7	AP2P	Align 2part or adjust						15		60	0.0360
8	SEW	1.2820513	1.1035519	1.1	18	17		5	6500	45.013242	0.0270
9	TCIT	pick up scissor & trim returt scissor						15		48	0.0288
10	TCAC	Additional Cut						15		24	0.0144
11	EP2H	Evacute part with 2 hand						30		42	0.0025
12	B26	Tie bundle with bow								356	0.0214
13	EP1H	Evacute part with 1 hand						80		39	0.0023
										1000.0265	0.29

M/C-FL

SMV-0.32

Target/day100%-1481

Target/Hr 80%-148

Target/day80%-1185

Complete method- back tape top stich

		MST	HSF	CG	CM	FT	ES A	SPI	RPM	Time value	
Element number	code	Element des cription						Distance in cm	frequency	TMU	SMV
1	B30	Pick up bun dle and place in table								66	0.0040
2	B13	Open bundle by releasing bow						30		63	0.0038
3	Pp2h	Pick up 1 pa rt with 2 hands & Position und er foot						5		-6	0.0456
4	Ap2h	Align 2 part or adjust						5	4500	56	0.0336
5	sew	1.8518519	1.0701269	1.1	5	17		5		27.899 441	0.0167
6	Ap2h	Align 2 part or adjust						5	4500	56	0.0336
7	sew	1.8518519	1.0701269	1.1	5	17		5		27.899 441	0.0167
8	Ap2h	Align 2 part or adjust						5	4500	56	0.0336
9	Sew	1.8518519	1.0701269	1.1	5	17		5			0.167
10	Ap2h	Align 2 part or adjust						5			0.0336

11	sew	1.8518519	1.0701269	1.1	5	17		5	4500	27.899441	0.0167
12	Tc1T	Pick up scissor &trim return scissor						15		48	0.0288
13	Ep1h	Evacute with 1 hand						30		28	0.0168
14	B26	Tie bundle with bow								356	0.0214
15	Ep1h	Evacute with 1 hand						80		39	0.0023
Total allowed time in TMU & minute										1011.6	0.32

operation	Tack at back tape end
Machine	FL
SMV	0.30

Target/Hr 100%-203

Target/Day 100%-1623

Target/Hr 80%-162

Target/Day 80%-1299

Complete method-Tack at back tape end

		MST	HSF	CG	CM	FT	ESA	SPI	RPM	Time value	
Element number	code	Element description						Distance In CM	frequence	TMU	SMV
1	B30	Pick up bundle &place in table								66	0.0040
2	B13	Open bundle by releasing bow								63	0.0038
3	PP2H	Pick up 1 part with 2 hand &position Under foot						30		76	0.0456
4	AP1P	Align 1 part or adjust						5		39	0.0234
5	MCTB	Bk tack start of seam								35	0.0210

6	PP2H	Pick up 1 part with 2 hand&and position under foot	15		66	0.0396
7	AP1P	Align 1 part or adjust	5		39	0.0468
8	MCT E	Bk tack end of seam			38	0.0456
9	TC1T	Pick up scissor and trim return scissor	15		48	0.0288
10	EP1H	Evacute part with 1 hand	15		23	0.0138
11	B26	Tie bundle with bow			356	0.0214
12	EP1H	Evacute part with 1 hand	45		33	0.0020
		Total allowed time in TMU&Min		882		0.30

Complete Method-Make slv hem

		MST	HSF	CG	CM	FT	ESA	SPI	RPM		
Element Number	Code	Element Description						Distance in CM	Frequency	Time Value	
										TMU	SMV
1	B30	Pick up bundle & place in table								66	0.0040
2	B13	Open bundle by releasing bow								63	0.0038
3	PP2H	Pick up 1 part with 2 hand & position under foot						30		76	0.0456
4	AP2P	Align 2part or adjust						15		60	0.0360
5	SEW	1.2820513	1.1035519	1.1	18	17		5	6500	45.013242	0.0270
6	PP2H	Pick up 1 part with 2 hand & position under foot						30		76	0.0456
7	AP2P	Align 2part or adjust						15		60	0.0360
8	SEW	1.2820513	1.1035519	1.1	18	17		5	6500	45.013242	0.0270
9	TCIT	pick up scissor & trim returt scissor						15		48	0.0288
10	TCAC	Additional Cut						15		24	0.0144
11	EP2H	Evacute part with 2 hand						30		42	0.0025
12	B26	Tie bundle with bow								356	0.0214
13	EP1H	Evacute part with 1 hand						80		39	0.0023
										1000.0265	0.29

Total allowed time in TMU &Min

Complete Method-False join at slv

		MST	HSF	CG	CM	FT	ESA	SPI	RPM		
Element Number	Code	Element Description						Distance in CM	Frequency	Time Value	
										TMU	SMV
1	B30	Pick up bundle & place in table								66	0.00396
2	B13	Open bundle by releasing bow								63	0.00378
3	PP2H	Pick up 1 part with 2 hand & position under foot						15		66	0.0396
4	AP2P	Align 2parts or adjust						5		56	0.03
5	SEW	1.2121212	1.1081015	1.1	28	17	0	4	5500	58.369122	0.04
6	PP2H	Pick up 1 part with 2 hand & position under foot						15		66	0.0396
7	AP2P	Align 2parts or adjust						5		56	0.03
8	SEW	1.2121212	1.1081015	1.1	28	17	0	4	5500	58.369122	0.04
9	TC1T	Pick up scissor & trim return scissor						15		48	0.03
10	TCAC	Additional Cut						30		2.9	0.00174
11	EP2H	Evacute part with 2 hand						30		42	0.03
12	B26	Tie bundle with bow								356	0.02136
13	EP1H	Evacute part with 1 hand						80		39	0.00234
										977.63824	0.30

Total allowed time in TMU &Min

operation	False sleeve hem
machine	F/L
SMV	0.31

Target/Hr 100%-192

Target/Day 100%-1533

Target/Hr 80%-153

Target/Day 80%-1227

Complete method-False sleeve hem

		MST	HSF	CG	CM	FT	ESA	SPI	RPM	Time value	
Element number	code	Element description						Distance-cm	frequency	TMU	SMV
1	B30	Pick up bundle &place in table								66	0.0040
2	B13	Open bundle by releasing bow								63	0.0038
3	PP2H	Pick up 1 part with 2 hand &position Under foot						30		76	0.0456
4	AP2P	Align 2 part or adjust						15		60	0.0360
5	SEW	1.2820513	1.1035519	1. 1	28	17		5	6500	60.576154	0.063
6	PP2H	Pick up 1 part with 2 hand &position Under foot						30		76	0.0456
7	AP2P	Align 2 part or adjust						15		60	0.0360
8	SEW	1.2820513	1.1035519	1.1	28	17		5	6500	60.576154	0.0363
9	TC1T	Pick up scissor &trim return scissor						15		48	0.0288
10	TCAC	Additional cut						15		24	0.0144
11	EP2H	Evacute part with 2 hand						30		42	0.0025
12	B26	Tie bundle with bow								356	0.0214
13	EP1H	Evacute part with 1 hand						80		39	0.0023

		Total allowed time in TMU &Min			1031.152 3	0.31

0peration	Sleeve join
Machine	OL
SMV	0.46

Target/Hr 100%-130

Target/Day100%-1036

Target/Hr 80%-104

Target/Day 80%-829

Element Number	Code	Element Description	Distance in CM	Frequency	Time Value	
					TMU	SMV
1	B30	Pick up bundle & place in table			66	0.0040
2	B16	Lay out bundle for sewing			90	0.0054
3	B13	Open bundle by releasing bow			63	0.0076
4	PP2T	Pk up 2 parts togethe	30		70	0.0420
5	F.Motion	Move & position under foot presure	5		33	0.0198
6	AP2P	Align 2 parts or adjust	15		60	0.0360
7	SEW	1.2121212 1.1081015 1.1 18 17 0	4	5500	43.594435	0.0262
8	AP2P	Align 2 parts or adjust	15		60	0.0360
9	SEW	1.2121212 1.1081015 1.1 18 17 0	4	5500	43.594435	0.0262
10	FSLD	Fold 1 time a part	15		42	0.0252
11	PP2T	Pk up 2 parts togethe	30		70	0.0420
12	F.Motion	Move & position under foot presure	5		33	0.0198
13	AP2P	Align 2 parts or adjust	15		60	0.0360
14	SEW	1.2121212 1.1081015 1.1 18 17 0	4	5500	43.594435	0.0262
15	AP2P	Align 2 parts or adjust	15		60	0.0360
16	SEW	1.2121212 1.1081015 1.1 18 17 0	4	5500	43.594435	0.0262
17	EP2H	Evacute part with 2 hand	30		42	0.0252
18	B26	Tie bundle with bow			356	0.0214
19	EP1H	Evacute part with 1 hand	80		39	0.0023
					1318.3777	0.46

Total allowed time in TMU &Min

Complete Method-Armole top stitch

		MST	HSF	CG	CM	FT	ESA	SPI	RPM		
Element Number	Code	Element Description						Distance in CM	Frequency	Time Value TMU	SMV
1	B30	Pick up bundle & place in table								66	0.0040
2	B13	Open bundle by releasing bow								63	0.0076
3	PP2H	Pick up 1 part with 2 hand & position under foot						15	1	66	0.0396
4	AP2P	Align 2 parts or adjust						5		44	0.0264
5	SEW	1.2820513	1.1035519	1.1	36	17	0	5	6500	73.026483	0.0438
6	PP2H	Pick up 1 part with 2 hand & position under foot						15	1	66	0.0396
7	AP2P	Align 2 parts or adjust						5		44	0.0264
8	SEW	1.2820513	1.1035519	1.1	36	17	0	5	6500	73.026483	0.0438
9	TC1T							15		48	0.0288
10	EP2H	Evacute part with 2 hand						30		42	0.0252
11	B26	Tie bundle with bow								356	0.0214
12	EP1H	Evacute part with 1 hand						80		39	0.0023
										980.05297	**0.31**

. Time in TMU and Minute

Method Improvement Sheet

Operation	Close side seam
Machine	O.L.
SMV	**0.36**

Style #	5323	
Target/Hr	100%	**166**
Target/Day	100%	1327
Target/Hr	80%	133
Target/Day	80%	1062

Complete Method-Close side seam

		MST	HSF	CG	CM	FT	ESA	SPI	RPM		
Element Number	Code	Element Description						Distance in CM	Frequency	Time Value TMU	SMV
1	B30	Pick up bundle & place in table								66	0.0040
2	B13	Open bundle by releasing bow								63	0.0038
3	PP2H	Pick up 1 part with 2 hand & position under foot						30	1	76	0.0456
4	AP2P	Align 2 parts or adjust						5	1	56	0.0336
5	SEW	1.2121212	1.1081015	1.1	20	17	0	4	5500	46.549373	0.0279
6	AP2P	Align 2 parts or adjust						5	1	56	0.0336
7	SEW	1.2121212	1.1081015	1.1	6	17	0	4	5500	25.864812	0.0155
8	AP2P	Align 2 parts or adjust						5	1	56	0.0336
9	SEW	1.2121212	1.1081015	1.1	5	17	0	4	5500	24.387343	0.0146
10	AP2P	Align 2 parts or adjust						5	1	56	0.0336
11	SEW	1.2121212	1.1081015	1.1	19	17	0	4	5500	45.071904	0.0270

Target/Hr 100%-216

Target/Day 100%-1725

Target/Hr 80%-173

Target/Day 80%-1380

operation	False join at Btm
Machine	O.L
SMV	0.28

Complete method- False join at Btm

		MST	HSF	CG	CM	FT	ESA	SPI	RPM	Time value	
Element number	code	Element description						Distance in cm	frquency	TMU	SMV
1	B30	Pick up bundle &place in table								66	0.00396
2	B13	Open bundle by releasing bow								63	0.00378
3	PP2H	Pick up 1 part with 2 hand &position Under foot						15		66	0.0396
4	AP2P	Align 2 parts or adjust						5		56	0.03
5	SEW	1.2121212	1.1081015	1.1	36	17	0	4	5500	70.188871	0.04
6	AP2P	Align 2 parts or adjust						5		56	0.03
7	SEW	1.2121212	1.10811015	1.1	36	17	0	4	5500	70.188871	0.04
8	TC1T	Pick up scissor &trim return scissor						15		48	0.03
9	TCAC	Additional cut						30		2.9	0.00174
10	EP2H	Evacuation part with 2 hand						30		42	0.03
11	B26	Tie bundle with bow								356	0.02136
12	EP1H	Evacute part with 1 hand						80		39	0.00238
		Total allowed time in TMU &Min								935.27774	0.28

Method Improvement Sheet

peration	Body Hem
lachine	O.L
SMV	0.38

Style #		829
Target/Hr	100%	157
Target/Day	100%	1257
Target/Hr	80%	126
Target/Day	80%	1006

Complete Method-Body Hem

		MST	HSF	CG	CM	FT	ESA	SPI	RPM		
lement lumber	Code	Element Description						Distance in CM	Frequency	Time Value TMU	SAM
1	B30	pick up bundle & place in a bin								66	0.0040
2	B13	Open Bundle by releasing bow								63	0.0038
3	PP2H	Pick up 1 part with 2 hand & position under foot						30		76	0.0456
4	AP2P							15		60	0.0360
5	SEW	1.2820513	1.1035519	1.1	20	17	0	5	6500	48.125824	0.0289
6	AP2P							15		60	0.0360
7	SEW	1.2820513	1.1035519	1.1	20	17	0	5	6500	48.125824	0.0289
8	AP2P							15		60	0.0360
9	SEW	1.2820513	1.1035519	1.1	20	17	0	5	6500	48.125824	0.0289
10	AP2P							15		60	0.0360
11	SEW	1.2820513	1.1035519	1.1	20	17	0	5	6500	48.125824	0.0289
12	TC1T							15		48	0.0288
13	EP1H	Evacut part with 1 hand						30		28	0.0168
14	B26	Tie bundle cord & toss aside								356	0.0214
15	EP2H	Evacute part with 2 hand						45		33	0.0020
Total Allowed Time in TMU and Minute										973.5033	0.38

Operatio	Patch join at Btm Hem Psn
Machine	P/M
SMV	0.34

Style #		
Target/Hr	100%	178
Target/Day	100%	1426
Target/Hr	80%	143
Target/Day	80%	1141

Complete Method-Patch join at Btm Hem Psn

		MST	HSF	CG	CM	FT	ESA	SPI	RPM		
Element Number	Code	Element Description						Distance in CM	Frequency	Time Value TMU	SMV
1	B30	Pick up bundle & place in table								66	0.0040
2	B13	Open bundle by releasing bow								63	0.0038
3	PP2H	Pick up part with 2 hands & position under foot						30		76	0.0456
4	PP1H	Pick up part with 1 hand & position under foot						15		57	0.0342
5	AP2P	Align 2 parts or Adjust						15		60	0.0360
6	SEW	1.85185	1.07013	1.1	4	17		5	4500	25.7196	0.0154
7	AP2P	Align 2 parts or Adjust						15		60	0.0360
8	SEW	1.85185	1.07013	1.1	2	17		5	4500	21.3598	0.0128
9	AP2P	Align 2 parts or Adjust						15		60	0.0360
10	SEW	1.85185	1.07013	1.1	4	17		5	4500	25.7196	0.0154
11	AP2P	Align 2 parts or Adjust						15		60	0.0360
12	SEW	1.85185	1.07013	1.1	2	17		5	4500	21.3598	0.0128
13	EP2H	Evacute part with 2 hands						30		42	0.0252
14	B26	Tie bundle with bow								356	0.0214
15	EP1H	Evacute part with 1 hand						45		33	0.0020
											0.00
											0.00
Total Allowed Time in TMU and Minute										1027.16	0.34

operation	Close side seam 2
M/c	OL
SMV	0.30

Target/Hr 100%-166

Target/Day100%-1327

Target/Hr 80%-133

Target/Day80%-1062

Complete method-close side side seam 2

		MST	HSF	CG	CM	FT	ESA	SPI	RPM	Time value	
Element number	code	Element description						Distance in cm	Frequency	**TMU**	**SMV**
1	B30	Pick up bundle &place in table								66	0.0040
2	B13	Open bundle by releasing bow								63	0.0038
3	PP2H	Pick up 1 part with 2 hand &position under foot						30		76	0.00456
4	AP1P	Align 1 part or adjust						5		39	0.0234
5	MCTB	BK tack start of seam								35	0.0210
6	PP2H	Pick up 1 part with 2 hand & position under foot						15		66	0.0396
7	AP1P	Align 1 part or adjust						5		39	0.0468
8	MCTE	BK tack end of seam								38	0.0456
9	TC1T	Pick up scissor &trim return scissor						15		48	0.0288
10	EP1H	Evacute part with 1 hand						15		23	0.0138
11	B26	Tie bundle with bow								356	0.0214
12	EP1H	Evacute part with 1 hand						45		33	0.0020
		Total allowed time in TMU and Min								**882**	**0.30**

Method Improvement Sheet

Operation	Tack at slv end & Btm
Machine	S/N
SMV	0.35

Style #		5311
Target/Hr	100%	171
Target/Day	100%	1364
Target/Hr	80%	136
Target/Day	80%	1091

Complete Method- Tack at slv end & Btm

		MST	HSF	CG	CM	FT	ESA	SPI	RPM		
Element Number	Code	Element Description						Distance in CM	Frequency	Time Value	
										TMU	SMV
1	B30	Pick up bundle & place in table								66	0.0040
2	B13	Open bundle by releasing bow								63	0.0038
3	PP2H	Pick up 1 part with 2 hand & position under foot						30		76	0.0456
4	AP1P	Align 1part or adjust						15		44	0.0264
5	MCTB	Bk Tack start of seam								35	0.0210
6	AP1P	Align 1part or adjust						15		44	0.0264
7	MCTB	Bk Tack start of seam								35	0.0210
8	PP2H	Pick up 1 part with 2 hand & position under foot						15		66	0.0396
9	AP1P	Align 1part or adjust						15		44	0.0264
10	MCTB	Bk Tack start of seam								35	0.0210
11	AP1P	Align 1part or adjust						15		44	0.0264
12	MCTB	Bk Tack start of seam								35	0.0210
13	TC1T	pick up scissor & trim returt scissor						15		48	0.0288
14	EP1H	Evacute part with 1 hand						30		28	0.0168
15	B26	Tie bundle with bow								356	0.0214
16	EP1H	Evacute part with 1 hand						80		39	0.0023
										1058	0.35

Method Improvement Sheet

Operation	Tack at slv end & Btm
Machine	S/N
SMV	0.22

Style #		5311
Target/Hr	100%	276
Target/Day	100%	2208
Target/Hr	80%	221
Target/Day	80%	1766

Complete Method -Tack at slv end & Btm

		MST	HSF	CG	CM	FT	ESA	SPI	RPM		
Element Number	Code	Element Description						Distance in CM	Frequency	Time Value	
										TMU	SMV
1	B30	Pick up bundle & place in table								66	0.0040
2	B13	Open bundle by releasing bow								63	0.0038
3	PP2H	Pick up 1 part with 2 hand & position under foot						30		76	0.0456
4	AP1P	Align 1part or adjust						15		44	0.0264
5	MCTB	Bk Tack start of seam								35	0.0210
6	AP1P	Align 1part or adjust						15		44	0.0264
7	MCTB	Bk Tack start of seam								35	0.0210
8	TC1T	pick up scissor & trim returt scissor						15		48	0.0288
9	EP1H	Evacute part with 1 hand						30		28	0.0168
10	B26	Tie bundle with bow								356	0.0214
11	EP1H	Evacute part with 1 hand						80		39	0.0023
										834	0.22

TMU FORMULA:

TMU=(MST x HSF x GT x CM)+17+P

Where ,

$$MST(\text{minimum sewing time}) = \frac{ST/CM}{(RPM \times 0.0006)}$$

$$HSF(\text{high speed factor}) = \frac{(4.5 - MST)^2 + 1}{100}$$

ST/CM=stitch per centimeter

RPM=Maximum revolution (stitch per minute that can be produced by the m/c)

0.0006= Factor to convert minute to TMU‘s

GT= Guiding and Tensioning

1 sec=27.8 TMU

1 minute=1667 TMU

1 hour= 100000 TMU

CHAPTER-07

CONCLUSION & REFERENCE

Conclusion

Industrial engineering is an important and essential part of any apparel industry. We learn all the implementations of the processes which we have studied theoretically. It gives us an opportunity to compare the theoretical knowledge with practical facts and thus develop our knowledge and skills. This project also gives us an opportunity to enlarge our knowledge of textile administration, production planning , procurement system , production process and machineries and teach us to adjust with the industrial life.

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