Faculty of Engineering
Department of Textile Engineering

PROJECT REPORT

Study on Investigation of Fabric Wastage in Cutting Section of a Knit Garments Industry

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This report submitted in partial fulfillment of the requirements for the degree of Bachelor of Science in Textile Engineering.

Advance in Apparel Manufacturing Technology

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DECLARATION

We openly declare that,

This Industrial Attachment has been completed to proper works by us. We also declare that the information neither of this Industrial Attachment or any part of it didn't submit elsewhere for offer of any degree or diploma.

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Approval Sheet

This report entitled "**Study on Investigation of Fabric Wastage in Cutting Section of a Knit Garments Industry''** is prepared and submitted by **P.M. Touhidur Rahman (ID# 162-23-237) & B.M. Tariqul Islam (ID# 162-23-241)** in partial fulfillment of the requirement for the degree of BACHELOR OF SCIENCE IN TEXTILE ENGINEERING has been examined and hereby recommended for approval and acceptance.

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Dedication

We dedicate this project to Allah Almighty my creator, my strong pillar, my source of the greatest inspiration, knowledge and understanding. He has been the source of our strength throughout this attachment and on His wings only have we soared. We also dedicate these work to our future employee and to our dignified honorable parents, teachers & brother (Md. Masudur Rahman). Our love and respect for yours all can never be quantified. God bless us & may long live.

ABSTRACT

This report is titled **"Study on Investigation of Fabric Wastage in Cutting Section of a Knit Garments Industry''**. This project is the most important of any RMG industry. We know that the Cutting Section plays the most important role to reduce the fabric wastage %, cost and make the proper Garments. The paper is the most useful process of achieving the practical experiences. It gives sufficient practical knowledge about Relaxation of fabric, Cut order planning, Re-cutting panels, Types of wastage, Part changing, General & Combination system, Inspections, Wastage from Marker, Short Marker & Hand Scissor etc. The approach was to know and work with all the parameters of cutting section and practice with technical experts. Observed sincerely in all the equipment's, process, condition & Methods and worker efficiency in different style as if easily finding the level best of reduction the fabric wastage & increase the efficiency %. We worked in two floor (JAL & JFL) in style and system wise, one floor is General system & other is Combination system. Then compared it in mathematically & showed in Graph. In 574 kg fabrics, the general and combination system between of total wastage % 20.01 & 19.25, Marker wastage (kg) 97.34 & 97.34, Reject panel weight (kg) 11.4 & 8.74, Wastage of replacing (kg) 4.17 & 2.18, Unused fabric (kg) 1.15 & 4.52 for a style.

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CHAPTER-1

INTRODUCTION

1.1 Introduction

Bangladesh, the southern Asian incorporates a population of roughly 164.7 million people. The economy of Bangladesh is considerably keen about agriculture. However it’s an excellent news for the country that, ready made garments (RMG) sector of Bangladesh has raised because the biggest wage earner of foreign currency. This sector creates concerning 4.00 million employment opportunities and contributes considerably to the value. Ready made garments (RMG) of Bangladesh is power-driven by young, urbanizing, workers, wherever most of them are women. In the early eighties, Bangladesh entered into the clothes business. The RMG sector has intimate with an exponential growth since 1980. In year 1984-85 the amount of clothes plant were 384 with 0.12 million employees that reached at a complete variety of clothes plant 4560 with 4.00 million employees in year 2017-18.

Though, Bangladesh are manufactured many types of garments, but all of the readymade garments are classified into 2 categories, where one is woven items and another one is knitted items. Woven products includes Shirts, Pants and Trousers etc. On the other hand, knitted product includes T-Shirts, Polo Shirts, Undergarments, Socks, Stockings, Leggings, Rampers and Sweaters etc. Woven garments still tames the export incomes of the country. From BGMEA website it’s seen that, day by day knitted garments production is increasing in important rate and now about 46% export incomes has achieved from knitted products.

In the last three decades this country has overcome the challenge of producing garments though it is not a major cotton producing country. Bangladesh RMG industries have radically changed the lives of millions of Bangladeshis. The sector has employed around 4.2 million people, 85% of them are women which helps to reduce poverty from this country as 22 million people are directly or indirectly involved with this industry. It provides job facilities for Bangladeshis mainly woman from low income families.

In the financial year 2017-2018, Bangladesh has exported garments and worth around US$ 29.41 billion in 148 countries across the Globe which covers 82.71% of total export. In Bangladesh, there is 4560 garments factory whose net worth is 22 billion dollar, has achieved reputation in producing world class garment products and acquired the second position in the ranking of global RMG producing countries right after China.

Several opportunities are knocking for this industry as China has declared to withdraw their investment from garments industry in near future. To meet up the target, garment manufacturing companies need to concentrate on mass production ensuring defect free high quality products within the limited resource they have. The world economy is changing in a rapid motion. RMG sector developed very fast in Bangladesh due to two major reasons; export-quota system and cheap labor.

There haven't been major changes within the method of cutting ancient tailored clothes the 16^{th} century. The changes that have happened have been more related to the mass-customization of tailored garments. More than 126 years past, discoverer introduced the first electrical cloth-cutting machine that allowed the covering works to evolve from the manual donkeywork of cutting to a contemporary operation. In 1888, discoverer introduces 1^{st} cloth cutting machine.

The fabric is the core of apparel manufacturing. For this concern, many studies have been carried out with the target to reduce fabric wastage in the production process. Cutting floor is a place where a huge amount of fabric loss is generated. Fabric loss in cutting floor is mainly caused by 2 operations-marker making and fabric spreading. Although marker making shares a large production of material wastage, fabric loss due to spreading is of equally important for material utilization control.

1.3 Objectives:

- To find out the data and order in JAL & JFL.
- To reduce fabric wastage in the cutting room.
- To maximize the fabric utilization.
- To utilize defected cut panels as much as possible.
- To replace the panels in a systematic way.
- To Find out / Calculate proper result.

CHAPTER-2

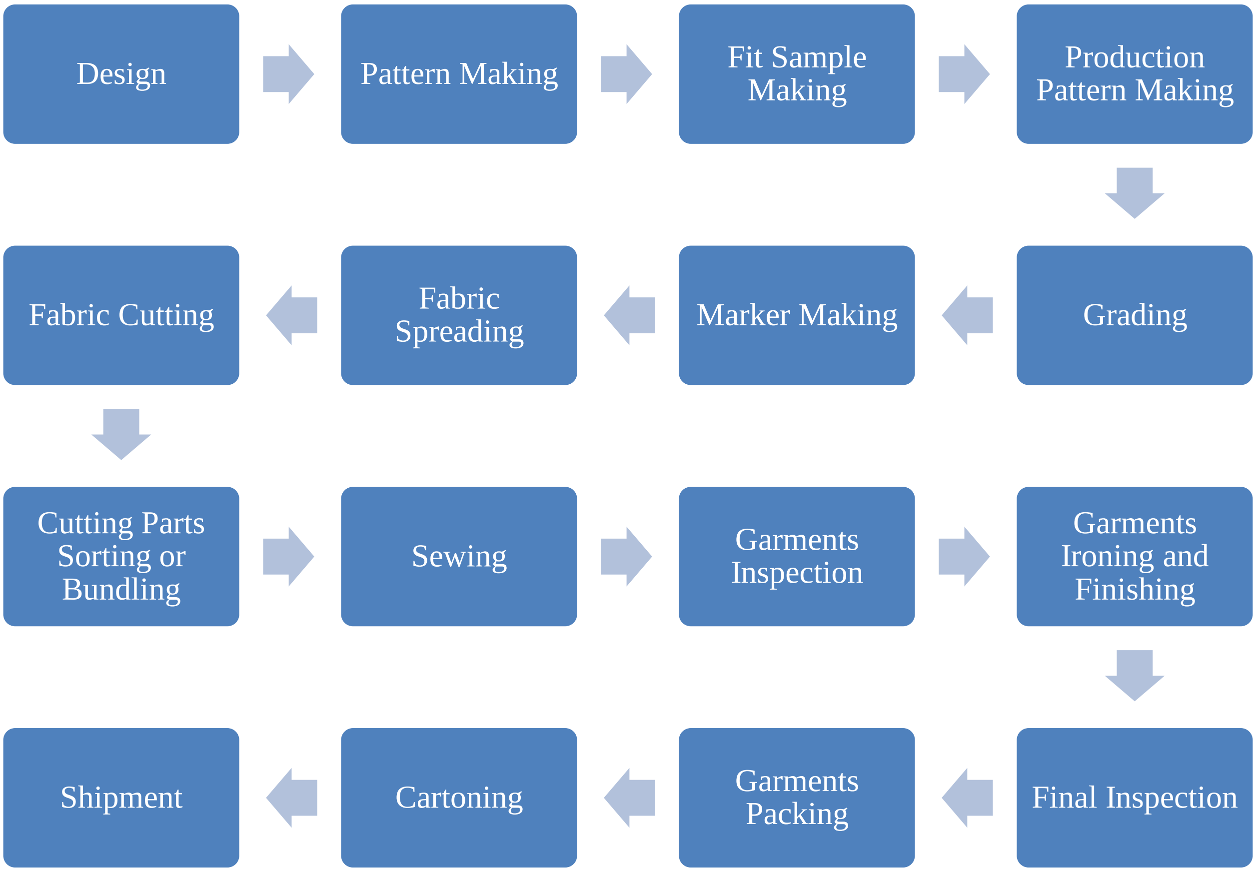
LITERATURE REVIEW

2.1 Garments Manufacturing:

A complete garments must face many process from its order receiving to cargo. Throughout clothes producing, a method flow chart should be required to finish associate in nursing order simply. Also, a method flow chart helps to know a garments producing technic that however the raw materials square measure reborn into the wearable clothes.

2.2 Flow Chart of Garments Manufacturing Process / Technology:

A basic garments producing flow chart is given within the below:



Each method of clothes producing flow chart is mentioned within the below with the details:

2.2.1 Design:

The design is provided by the client when inserting associate order emptor send the technical sheet associated art-work of an order to the Merchandiser. This method is completed by each manually or by using computer.

2.2.2 Pattern Making:

By following technical sheet and art-work, pattern of every garment vogue ought to be created. It's done by each manually and by victimization processed technique.

2.2.3 Fit Sample Making:

The main target of creating a fit sample is to follow the details information about that garments style. Once creating it's sent to the buyer to rectify. It's done by manually.

2.2.4 Production Pattern Making:

For bulk production, allowance supplementary here with internet dimension. Production Pattern creating is finished by each manually and by using computer.

2.2.5 Grading:

During associate order confirmation, the customer suggests concerning the scale quantitative relation of that order. So order ought to be stratified in line with the buyer's instruction. Grading is finished by manually or by using computer.

2.2.6. Marker Making:

Marker may be a terribly skinny paper that contains all the components of a selected garment. To form the cutting method simple, it's should be required. Marker creating method is done by each manually and by using computer.

2.2.7 Fabric Spreading:

To cut the material properly fabric is unfold in lay type cloth Spreading is completed by manually or by exploitation processed technique.

2.2.8 Fabric Cutting:

Fabrics need to cut here in step with marker of clothes. Cloth cutting method is completed by mistreatment manual technique or processed technique.

2.2.9 Cutting Parts Sorting or Bundling:

Here, cutting elements ought to delineated or build bundling to send these simply into successive method. This method is completed by manually.

2.2.10 Sewing:

All of the portion or pieces of a garment are joined here to make a complete garment. Sewing process is done by manually.

2.2.11 Garments Inspection:

After finishing stitching scrutiny ought to be done here to create fault free clothes. Clothes scrutiny is completed by victimization manual technique.

2.2.12 Garments Ironing and Finishing:

Here clothes area unit treated by steam additionally needed finishing ought to be completed here. This method is finished by exploitation manual technique.

2.2.13 Final Inspection:

Finally the entire clothes are inspected here consistent with the buyer's specification. Final scrutiny is completed by manual technique.

2.2.14 Garments Packing:

Complete clothes are packed here by mistreatment consumers schooled poly bag. Clothes packing are done by mistreatment manual methodology.

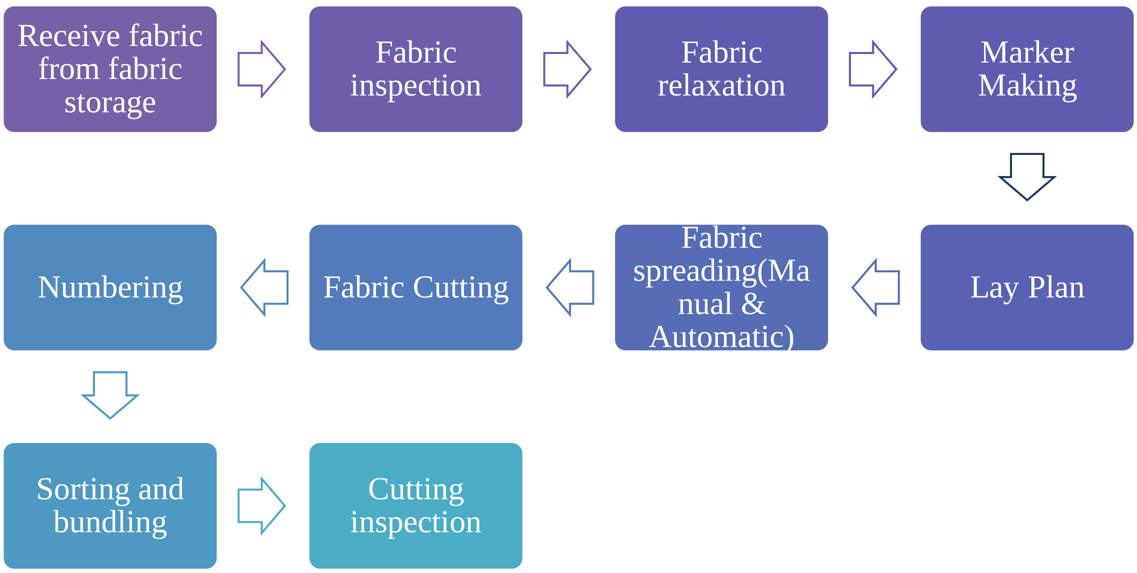
2.2.15 Cartooning:

To minimize the damages of garments, all the clothes got to cartooned by maintaining consumers instruction. This method is finished by manually.

2.2.16 Shipment:

After completing all the required processes it's finally sent to the buyer.

2.3 Process sequence of cutting section:



2.3.1 Take fabric from the fabric store:

The cutting department gets a cut order from the assembly manager. In step with the cutting set up, the cutting in-charge generates a material demand sheet or requisition slip to the material store to issue materials.

2.3.2 Fabric inspection:

Major Defects in Fabric are given below:

Color contamination: A changing of color from one fabric to another. All injury and color migration ought to be through of defective.

- **Color out:** The results of color running low in the reservoir on printing machine.
- **Crease mark:** Crease mark seem wherever creases area unit caused by material folds within the finishing method. On brushed material, final pressing might be ready to restore material or original condition. Typically discoloration may be a downside.
- **Crease streak:** Occurs in tubular knitting fabrics. Results from rumpled cloth passing through squeeze rollers within the coloring method.
- **Drop stitches:** Results from away needle or jack. Can seem as holes or missing stitches.
- **Dye streak in printing:** Result from a broken doctor blade or a blade not clean properly. Typically an extended streak till the operator notices the matter.
- **Hole:** Caused by broken needle.
    - These are the results of yarn breakage or yarn cracks.
    - During loop formation the yarn breaks in the region within the needle hook.
    - If the yarn count isn't correct in concerning structure, gauge, course and density.
    - Badly knot or splicing.
    - Yarn feeder badly set
- **Missing yarn:** Results from wrong fiber yarn (or wrong size yarn) placed on warp. Fabric could appear as thick end or different color if fibers have different affinity for dye.
- **Mottled:** Color applied unevenly throughout printing.
- **Needle line:** Caused by bent needle forming distorted stitches. Typically a vertical line.

- **Runner:** Caused by broken needle. The runner can seem as vertical line. Most machines have a stopping device to prevent the machine once a needle breaks.
- **Slub (Knit fabric):** Usually caused by a thick or heavy place in yarn, or by ling getting onto yarn feeds.
- **Snag:** A pulled thread in the fabric. All snags should be considered defective
- **Water spots:** Usually caused by wet fabric being allowed to remain too long before drying: color migrates leaving blotchy spots.
- **Pilling:** Too high mechanical stress on the surface of the fabric.
    - Excess speed during processing
    - Excess foam formation in the dye bath
- **Shade variation (Batch to batch):** Batch to batch shade variation is common in exhaust dyeing which is not completely avoidable.
- **Dye spot:** Improper mixing of dyestuff in the solution, in right amount of water, at the temperature.
- **Pin hole:** Due to break down or bend of the latch, pin hole may come in the fabric.
- **Oil line:** Due to minimization of the friction we have to use oil. Oil fall on fabrics & makes a line along the fabric length.
- **Thick & thin place:** Fault is accountable for yarn thick place. Its look is that one place of the fabric is thin and thick.
- **Shrinkage:** Shrinkage is that the method within which a cloth becomes smaller than its original size, typically through the method of laundry. Cotton cloth suffers from two main disadvantages of shrinking and creasing throughout ulterior laundry. There are two kinds of shrinkage happens throughout laundry.
    - Length wise
    - Width wise
- **Yarn contamination:**
    - If yarn contains foreign fiber then it remains in the fabric even after finishing.
    - Lot mixing and count mixing is responsible for these faults.
- **GSM variation:** The fabric will appear to have a visible variation in the density, from roll to roll or within the same roll of, the same dye lot.

- Roll to roll variation in the, process parameters, of the fabric, like; Overfeed & Width wise stretching of the dyed fabric, on the Stenter, Calender & Compactor machines.
- Roll to roll variation in the fabric stitch length.

4- Point system:

The 4-Point System, conjointly known as the American Apparel Manufacturers (AAMA) point-grading system for deciding fabric quality, is widely used by producers of apparel fabrics and is endorsed by the AAMA as well as the ASQC.

Fabric defects are assigned points based on the following:

Defect length for warp way and weft way	Points
Up to 3inch	1
Up to 3 inch over 6 inch	2
Up to 6 inch over 9 inch	3
Above 9 inch	4

Defects area for holes and openings	Points
1 inch or less than 1 inch	2
Above 1 inch	4

Total defect points per 100 sqr yds are calculated, and normally those fabric rolls containing more than 40 points / 100 sqr yds are considered rejected. However, a garment manufacturer, based on the price line & type of garments produced, may use more or less than 40 points per 100 yds sqr as acceptance criteria.

$$\text{Points/100 yds: } \frac{\text{Total point} \times 3600}{\text{Fabric length (yds)} \times \text{Actual width (inch)}}$$

2.3.3 Relaxation of fabrics:

Knitted fabrics need relaxation before cutting. Once receiving the fabric from the fabric store, the cutting department opens the fabric from the fabric roll and lays it on the table for relaxation for a few hours before cutting. Factories conjointly relax fabric within the fabric store long once gap the fabric rolls.

2.3.4 Cut order planning:

Cutting programme the quantity of markers they have to arrange, the scale combination to be every marker and therefore the variety of plies to be arranged in each marker.

2.3.5 Marker making:

Marker creating is that the method of determination the foremost economical layout of pattern items for a fixed style, fabric and distribution of sizes.

- **Manually produced markers:** May be created by transcription full size pattern items on marker paper or directly on the highest ply of cloth in an exceedingly unfold. Pattern items area unit derived employing a pencil or tailor's chalk. Manual ways of marker creating area unit long and need a good deal of area.

- **Computerized marker making:** This is additional correct and provides the best chance for pattern manipulation, marker potency, reprocess of antecedently created markers and shortest reaction time. Additionally, parameters for markers area unit entered into the PC from cutting orders. These would possible embrace style numbers, size distribution and cloth breadth. Among the assorted processes of garment production cutting is that the major space wherever cloth waste is generated. Within the room a lot of attention ought to be to cut back the fabric wastage. One of the methods to minimize the fabric wastage is to prepare the most efficient marker by the CAD system.

Marker efficiency

The quantity of fabric usage depends upon the marker efficiency. Mathematically the marker efficiency is the percentage of the total fabrics that is actually used in garment parts, i.e.

Marker efficiency (%) = (Total area of the pattern in marker/Total area of marker) ×100%

Higher is the marker efficiency higher is the fabric usage. Expectations for marker efficiency differ from manufacturer.

2.3.6 Fabric Spreading/ layering:

Spreading is that the method of superimposing lengths of material on a spreading table, cutting table or specially designed surface in preparation for the cutting method. A spread or lay-up is that the total quantity of fabric steel oneself against one marker. A spread might contains one ply or multiple plies. The peak of a lay-up or unfold is restricted by fabric characteristics, size of the order to be cut, cutting technique and therefore the vertical capability of the spreader.

2.3.7 Cutting fabrics:

After creating the marker, garment patterns area unit cut and brought out from the layer. Numerous technologies are used for cutting fabric layers, like straight knife cutting, band knife machine cutting and a computer-controlled automatic cutting machine.

2.3.8 Sorting, bundling and numbering of garment plies (parts):

After cutting the fabric, layers are sorted size-wise and color-wise. Each ply is numbered using stickers. Bundles are kept on inventory tables, before these are sent to endure consequent method.

2.3.9 Inspecting cut components:

To maintain the cutting quality, commonplace cutting parts area unit checked randomly by quality checkers. If defective parts area unit found, they replace those defective elements.

2.3.10 Re-cutting panels:

Re-cutting is finished for garment elements that need being replaced in bundles. Re-cutting requests area unit received from the stitching department garments components. Re-cutting is additionally in serious trouble block panels cut for the printing and embroidery processes. Once receiving garment panels from the printing or embroidery, these panels area unit reshaped.

2.4 Different types of wastage in cutting section:

Fabric wastage outside the marker: The marker provides the dominant management of cloth usage minimizing the material loss. Throughout the cutting method 2 forms of cloth losses occur, specifically marking loss and spreading loss. The marking loss arises due to the gap and also the non-usable areas at places between the pattern items of a marker. Marker potency indicates the number of marking loss. Spreading loss is that the cloth loss outside the marker. The assorted cloth losses outside the marker is generally classified into totally different teams, specially ends of ply losses, ends of piece losses, edge losses, conjunction losses, remnant losses, ticket length losses, etc. that is mentioned below:

- **Ends of Ply Losses:** The flexibility, softness and extensibility fabrics beside the limitation of spreading machinery necessitate an allowance of some fabric at the top of every ply. These losses is also up to a fair of cm at every finish or 4 cm per ply. Just in case of some stable fabrics it should be less and for a few unstable fabrics it should be additional. The ends of ply loss area unit 1-2% of the full material usage.

- **Ends of Piece Losses:** During finishing these fabrics ends are sewed along for continuous operation that makes the fabric ends unsuitable to be used thanks to marks or distortion created. The foremost vital loss comes as a result of the fabric length isn't actual multiple of the marker length. The spreader should either splice within the next piece, leading to a loss of cloth from the tip of the piece to the closest splice purpose or the half ply should be arranged aside as a remnant and processed individually. The ends of piece loss varies from 0.5-1% of the entire fabric usage. This loss is reduced if the common length of the items that are purchased is multiplied.
- **Edge Losses:** In traditional apply through marker coming up with the dimension of the marker is unbroken many centimeters but the edge-to-edge dimension of the fabric. Let the fabric edge-to-edge width is a 100 cm and also the marker dimension is 3 cm less the fabric width. The edge loss is 3% dimensional. If the fabric edge-to-edge dimension is a 150 cm, the loss is a pair of. So wider dimension fabrics produce other advantages besides improved marker potency. This easy calculation reveals that the fabric loss outside the marker is incredibly sensitive to the edge waste allowances. Width variation in fabrics should be controlled aboard the edge allowances.
- **Splicing Losses:** Splicing is that the method of overlapping the cut finishes (the end of 1 length of fabric and also the starting of another) of 2 separate items of fabrics so spreading will be continuous. Conjunction is important together roll of fabric is finished and a replacement roll is taken into use. These faults are removed by cutting the lay at the fault purpose and incorporating conjunction position into marker plans. The splicing losses could vary up to five% of the full fabric usage.

2.5 Fabric wastage inside the marker:

- **Marker wastage:** Marker wastage % is the percentage of total wastage of the fabric in the marker. Marker wastage is occurred due to the various shape of the pattern and sizes of the components. When the components are arranged in marker some portion of fabrics remain unused which are termed as marker wastage. Marker wastage % varies due to marker length, marker width, styling, size ratio etc. Marker wastage is calculated by marker efficiency %.
    - **Marker efficiency:** In every marker, marker efficiency express the usage of the fabric. Such 85%efficiency means fabric used in the marker and 15% fabric waste.

- **Fabric fault/piece losses:** If any fault in the fabric present in the marker, then it cannot be used .That means the pattern will be rejected and along with this the garments also.
- **Shading**: When shading is found in the fabric, two patterns cannot be joined together for running shading .it could be very high or low depending on fabric quality .Shading is two types :
  - **Layer to layer shade variation:** The shade variation between the different layers of fabric is called layer to layer shade variation.
  - **Running shade:** The shade variation between different layers of fabric is called running shade.

2.6 Part changing:

It is not associate supposed method in garment producing however this method is there as a result of three square measure bound reasons wherever we tend to can't management the reason for material damages within the clothes fully. However, wherever attainable, we've got to reduce short cargo and improve our sales. Half dynamical is mostly wined out finishing stages. Most of the material defects that don't seem to be acceptable in clothes square measure removed throughout cutting and sewing process.

End bit usage for part changing: Before cutting, a cloth roll is opened and ordered on the cutting table. The lay length is set as marker length. The fabric at the end of each roll which can't be laid on the marker due to the short length of the fabric ply is called as end bits. It is not possible to get all rolls which length is multiple of marker length. So for the part change those end bits can be used without increasing fabric consumption. But here care should be taken about shade matching or lot matching of the fabrics with the damaged garments.

- **Fresh fabric usage for Part changing:** If end bits are not enough to replace the damaged parts from the garment, use available fresh fabric. When using fresh fabric, a problem with shade matching may occur. Only use recent cloth if there's no downside with shade matching. Except for solid colors and yarn bleached cloth, there's no issue associated with shade matching.

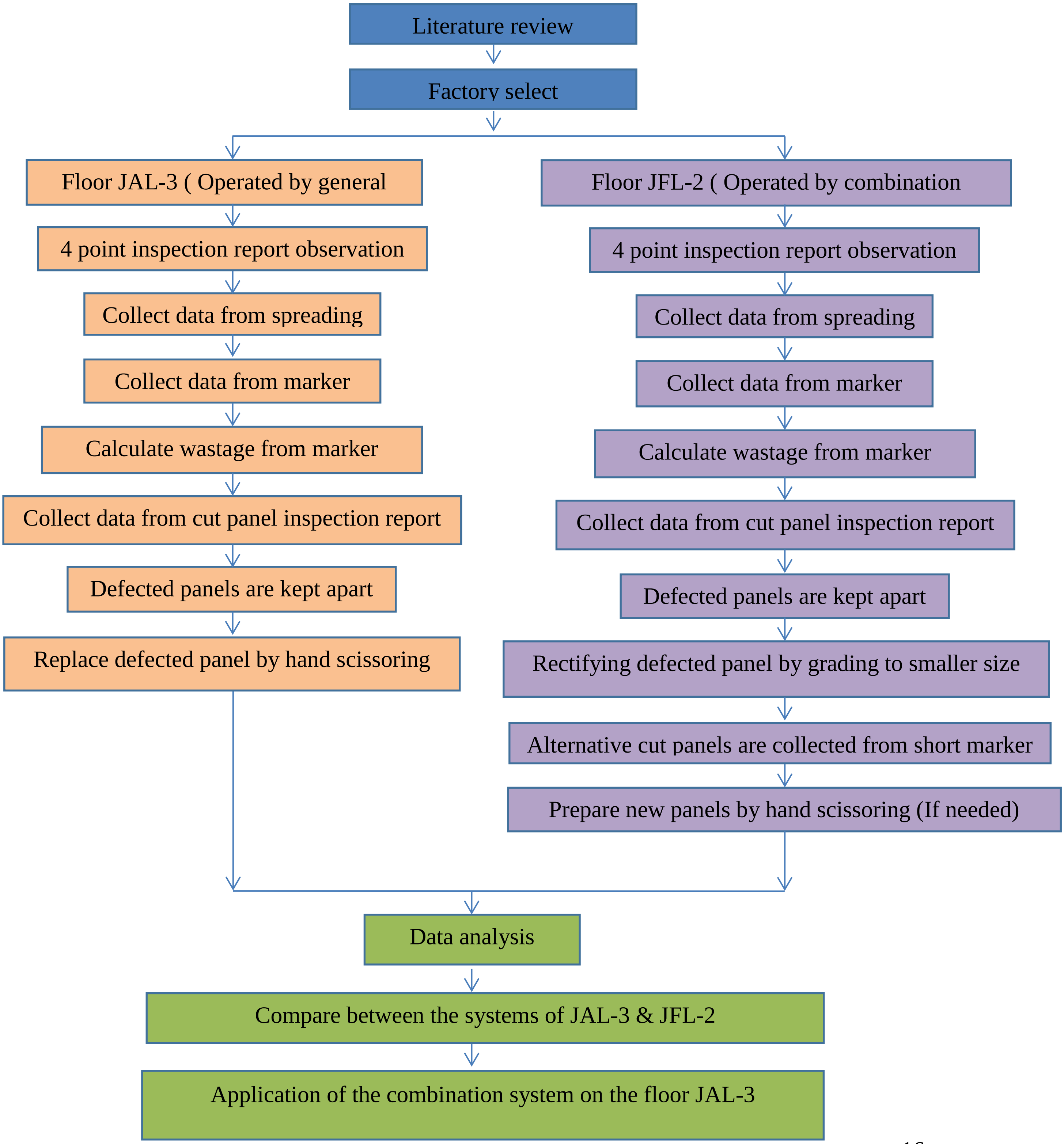
Using good components from other damaged garments: This option is chosen once clothes square measure colored and there are not any contemporary material or finish bits or contemporary material for that order. The reason, rather than rejecting all clothes. Additionally for the high worth garment with fine hand embroidery work and wherever you've got less time to finish the cargo, this selection is most popular. Like higher than choices, you've got to worry regarding the garment components shade matching.

CHAPTER-3

METHODOLOGY

3.1 Methodology

The project work was done by collecting necessary information step by step. The data were collected by monitoring and recording throughout the period of implementation for analysis purposes. The impact of cut panel (faulty) replacing system was analyzed via discussing and observation of the personnel who were directly involved in the implementation process.



3.2 Procedure:

1. A literature review has been made by studying journals, books, articles, report, blog, website, online newspaper and online magazine.
2. Then two suitable factory has been selected where in Jinnat apparels Ltd (JAL-3) cutting floor, we followed the procedure of replacing cut panel by hand scissoring and in Jinnat fashion Ltd (JFL-2) cutting floor, we followed the procedure of replacing cut panel by the combination of grading, short marker and hand scissoring. Material used in following orders are given below.

Table 3.1 First order in JAL-3

	Order No	YGIBF 1388
	Product Name	Pique Legging
	Size Range	S,M,L
	Fabric Construction	Single jersey
	Fiber Composition	96 % Cotton 4 % Elastane
	GSM	220

Table 3.2 Second order in JAl-3

	Order No	YGIBF 13865
	Product Name	Pique Legging
	Size Range	S,M,L,XL
	Fabric Construction	Single jersey
	Fiber Composition	94 % Cotton 2% Viscous 4 % Elastane
	GSM	190

Table 3.3 Third order in JAL-3

	Order No	YGIBF 1247
	Product Name	Pique Grey Marl Legging
	Size Range	S,M,L
	Fabric Construction	Single jersey
	Fiber Composition	96 % Cotton 4 % Elastane
	GSM	190

Table 3.4 Fourth order in JAL-3

	Order No	YGIBF 1248
	Product Name	Pique Legging
	Size Range	S,M,L
	Fabric Construction	Single jersey
	Fiber Composition	96 % Cotton 4 % Elastane
	GSM	190

Table 3.5 First order in JFL-2

	Order No	YJBD 1644
	Product Name	Graffiti Print Single Legging
	Size Range	S,M,L,XL
	Fabric Construction	Single jersey
	Fiber Composition	91 % Cotton 5 % viscose 4 % Elastane
	GSM	220

Table 3.6 Second order in JFL-2

Order No	YJBD 1074
Product Name	AOP Pique Legging
Size Range	S,M,L,XL
Fabric Construction	Single jersey
Fiber Composition	94 % Cotton 2 % Viscose 4 % Elastane
GSM	190

Table 3.7 Third order in JFL-2

Order No	BTGBD 1675
Product Name	Pique Legging
Size Range	S,M,L
Fabric Construction	Single jersey
Fiber Composition	96 % Cotton 4 % Elastane
GSM	190

Table 3.8 Fourth order in JFL-2

Order No	BTGBD 1676
Product Name	Pique Legging
Size Range	XS,S,M,L
Fabric Construction	Single jersey
Fiber Composition	96 % Cotton 4 % Elastane
GSM	190

3. From the 4 point inspection system we get total penalty points. After getting the points we input it on the following formula :

   The fabric is rejected if the defected point is greater than 28. Fabric getting up to 20 points is rated as 'A' grade and fabric getting from 20 to 28 points is rated as 'B' grade. Fabric getting above 28 points is rated as 'C' grade and it's considered as reject.

   10% of the total fabric lot are inspected. If the acceptable fabric is not found within that 10% fabric, then 25% fabric is inspected. Again, if it is not in acceptable range 50% fabric is inspected and for further need 100% fabric is inspected.

4. Spreading is done by automatic Spreading machine. In the time of Spreading, the fabrics are spread according to the marker length. Fabric with large hole is spread in this time without any recovery. In this time number of lay is counted.

5. Marker is prepared from the CAD room. From Marker we got the length and width of the marker. We also got the marker efficiency from CAD software. Total fabric in 1 spreading is calculated by the following formula:

6. We got the fabric wastage after cutting by following formula:

   Fabric wastage after cutting = (total fabric weight in spreading) - (total fabric weight spreading × marker efficiency)

7. From cut panel inspection report we got the number of rejected panel. Which can't be rectified by washing or spot removing. These panels are kept apart.
8. **Replacing by hand scissoring system:** In this system defected panels are replaced by only hand scissoring from the End Bits which are previously kept from each roll for this purpose. We measured the weight of fabric which is used to prepare GSM card, shade card, marking on the roll etc. We calculated the wastage percentage by following formula:

Total Wastage %

$$= \frac{\text{(Marker wastage + Rejected panel weight + Wastage by hand scissor + other wastage)}}{\text{total fabric weight}} \times 100\%$$

9. **Replacing by the combination of grading, short marker and hand scissoring system:** In this system some panels are reused by grading from larger to a smaller size. These panels are kept separated during cut panel inspection. The person who inspected the cut panels decided which panel can be reused by grading. Wastage from short marker is calculated by the marker efficiency. We calculated the wastage percentage by the following formula:

$$Total\ wastage\ \% = \frac{\text{(Marker wastage + Rejected panel weight+ Short marker wastage + Hand scissoring wastage + other Wastage)}}{\text{Total fabric weight}} \times 100\%$$

10. We applied the procedure of JFL-2 (combination system) on JAL-3 (general system). To apply this system we identified some points and took the average value percentage. The average percentage of the cut panel that can be rectified by grading, percentage of the cut panel that have to be cut by hand scissoring, average value of the wastage that included into other wastage and the average value of marker efficiency of short marker. Then these values are applied on general system according to combination system.

Chapter-4

RESULT AND DISCUSSION

4.1 General system:

4.1.1 First order

Table 4.1-Fabric inspection report

Order no.	Batch no.	Batch quantity (Piece)	Total roll no.	Average roll weight (Kg)	Points per 100 sq yds (%)	GSM
YGIBF 1388	3233	3900	25	23.84	17.07 18.15	220

Total fabric = 596 kg

End bits from roll = 19 kg

Table 4.2 -Wastage from marker

Spreading no.	Marker length (m)	Marker width (cm)	Lay no.	Marker efficiency (%)	Wastage (Kg)	Total wastage (Kg)
1	7.24	214	90	82.33	54.21	101.05
2	7.21	214	79	82.51	46.84	

Table 4.3 – Panel wastage

Defected panel no.	Rejected panel no.	Rejected panel weight (Kg)
223	All	11.73

Table 4.4 -Wastage by hand scissor

Replace panel weight by hand scissor (kg)	Wastage by hand scissor (kg)
17.74	4.20

Unused fabric = 1.26 Kg

Other wastage = 2.42 Kg

Total wastage = Wastage from marker + Panel wastage + Wastage by hand scissoring + Other wastage

= (101.05+11.73+4.20+2.42) Kg

= 119.40 Kg

Total wastage % = (119.40÷596) × 100%

= 20.03%

4.1.2 Second order

Table 4.5 -Fabric inspection report

<table>
<tr><th>Order no.</th><th>Batch no.</th><th>Batch quantity (Piece)</th><th>Total roll no.</th><th>Average roll weight (kg)</th><th>Points per 100 sq yds (%)</th><th>GSM</th></tr>
<tr><td rowspan="2">YGIBF 13865</td><td rowspan="2">626200</td><td rowspan="2">4500</td><td rowspan="2">28</td><td rowspan="2">23.03</td><td>18.07</td><td rowspan="2">190</td></tr>
<tr><td>17.15</td></tr>
</table>

Total fabric = 645 Kg

End bits from roll= 19.32 Kg

Table 4.6- Wastage from marker

<table>
<tr><th>Spreading no.</th><th>Marker length (m)</th><th>Marker width (cm)</th><th>Lay no.</th><th>Marker efficiency (%)</th><th>Wastage (Kg)</th><th>Total wastage (Kg)</th></tr>
<tr><td>1</td><td>7.41</td><td>214</td><td>100</td><td>82.35</td><td>58.50</td><td rowspan="2">108.83</td></tr>
<tr><td>2</td><td>7.33</td><td>216</td><td>91</td><td>82.75</td><td>50.33</td></tr>
</table>

Table 4.7- Panel wastage

Defected panel no.	Rejected panel no.	Rejected panel weight (Kg)
231	All	11.88

Table 4.8- Wastage by hand scissor

Fabric used to replace the panel (Kg)	Wastage by hand scissor (Kg)
17.56	4.36

Unused fabric = 1.76 Kg

Other wastage = 2.48 Kg

Total wastage = Wastage from marker + Panel wastage + Wastage by hand scissoring + Other wastage

= (108.83 + 11.88 + 4.36 + 2.48) Kg

= 127.55 Kg

Total wastage % = (127.55÷645) ×100 %

=19.78%

4.1.3 Third order

Table 4.9-Fabric inspection report

Order no.	Batch no.	Batch quantity (Piece)	Total roll no.	Average roll weight (Kg)	Points per 100 sq yds (%)	GSM
YGIBF 1247	33917	5500	36	22.76	17.07 18.15	190

Total weight= 819.51 Kg

End bits from roll= 35.12 Kg

Table 4.10-Wastage from marker

Spreading no.	Marker length (m)	Marker width (cm)	Lay no.	Marker efficiency (%)	Wastage (Kg)	Total wastage (Kg)
1	7.45	214	100	82.20	53.92	135.92
2	7.30	214	80	82.55	41.44	
3	7.40	214	80	83.15	40.56	

Table 4.11 - Panel wastage

Rejected panel no.	Rejected panel no.	Rejected panel weight (Kg)
415	All	21.24

Table 4.12- Wastage by hand scissor

Replace panel weight by hand scissor (Kg)	Wastage by hand scissor (Kg)
32.62	8.28

Unused fabric = 2.5 Kg

Other wastage = 3.31 Kg

Total wastage = Wastage from marker + Panel wastage + Wastage by hand scissoring + Other wastage

Total wastage = (135.92 + 21.24 + 8.28 + 3.31) Kg

= 168.75 Kg

Total wastage % = (168.75÷819.51) × 100 Kg

= 20.59 %

4.1.4 Fourth order

Table 4.13-Fabric inspection report

Order no.	Batch no.	Batch quantity	Total roll no.	Average roll weight (Kg)	Points per 100 sq yds (%)	GSM
YGIBF 1248	33920	3900	28	20.50	17.07 18.15	190

Total weight of fabric= 574 Kg

End bits from roll= 18 Kg

Table 4.14-Wastage from marker

Spreading no.	Marker length (m)	Marker width (cm)	Lay no.	Marker efficiency (%)	Wastage (Kg)	Total wastage (Kg)
1	7.41	214	100	82.05	54.08	97.34
2	7.33	216	84	82.88	43.26	

Table 4.15-Panel wastage

Rejected panel no.	Rejected panel no.	Rejected panel weight (kg)
214	All	11.4

Table 4.16-Wastage by hand scissor:

Replace panel weight by hand scissor (Kg)	Wastage by hand scissor (Kg)
16.85	4.17

Unused fabric = 1.15 Kg

Other wastage = 1.92 Kg

Total wastage = Wastage from marker + Panel wastage + Wastage by hand scissoring + Other wastage

Total wastage = (97.34 + 11.4 + 4.17 + 1.92) Kg

= 114.83 Kg

Total wastage % = (114.83 / 574) × 100% =20.01%

4.2 Graphical representation

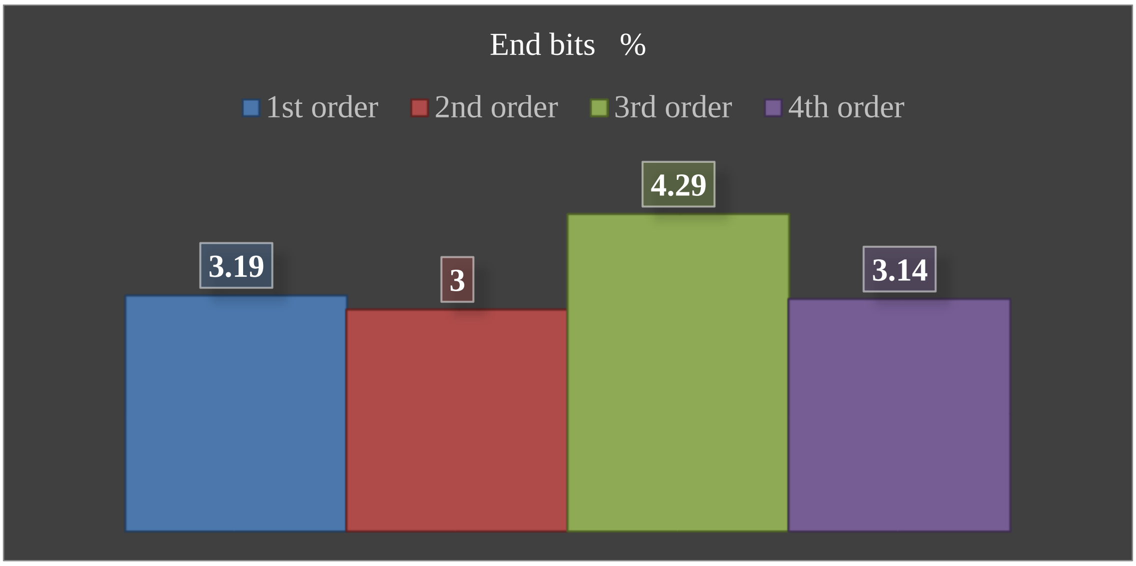


Figure 4.1 End bits %

Here in this graph, X-axis denotes different orders and Y-axis denotes end bits in the percentage of total fabric weight. We found the range of end bits is around 3.00% to 4.30 % of total fabric weight.

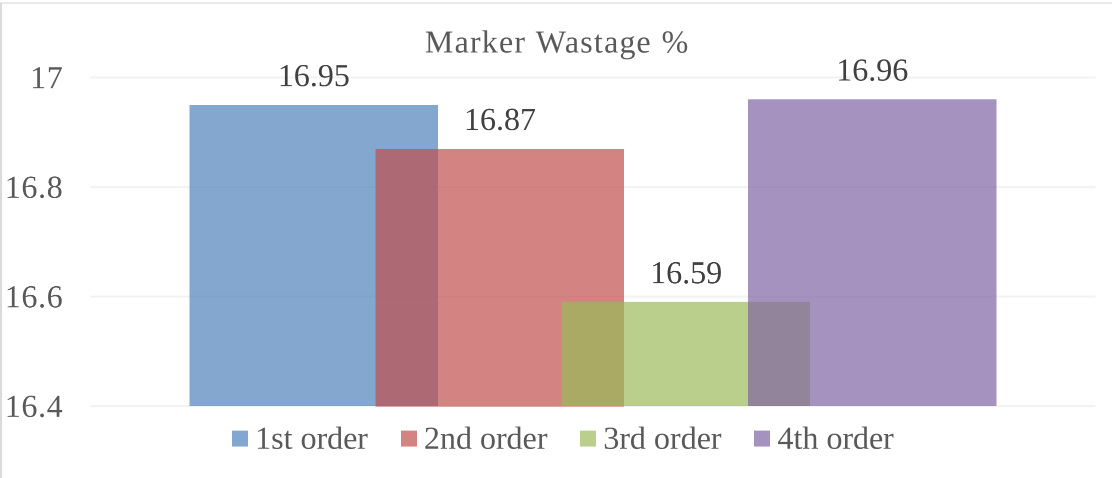


Figure 4.2 Marker wastage %

In this graph, X-axis denotes different orders and Y-axis denotes marker wastage in the percentage of total fabric weight. In our observation we found marker wastage % varies at a range from about 16.50 % to 17 % of total fabric weight.

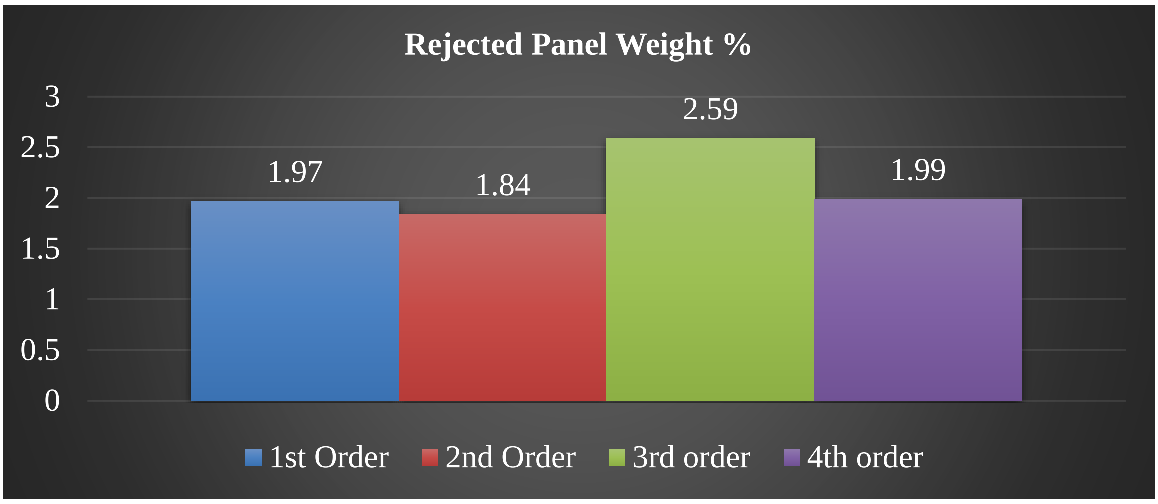


Figure 4.3 Rejected panel weight %

In this graph, X-axis express different orders and Y-axis denotes reject panel weight in the percentage of total fabric weight. Rejected panel weight % is the percentage of weight of cut panels that are rejected due to faults like Holes, Needle mark, Sinker mark, Shade variation, incorrect size etc. It can be reduced by using fabric free from faults as much as possible, cutting the panel according to the size accurately. In our observation we found rejected panel weight % varies at a range of 1.80 % to 2.60 % of total fabric weight.

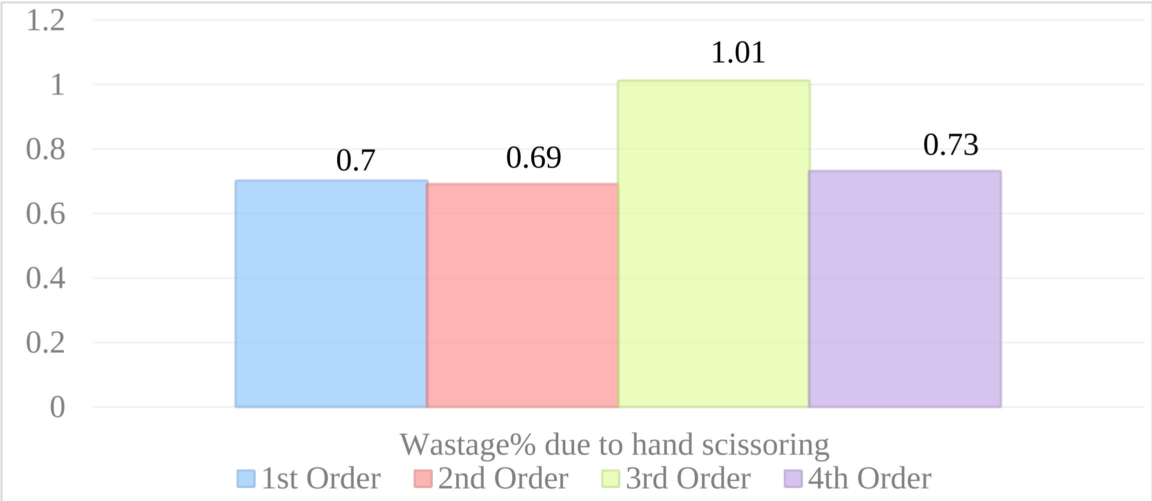


Figure 4.4 Wastage % due to hand scissoring

In this graph, x-axis denotes different orders and Y-axis denotes wastage due to hand scissoring in the percentage of total fabric weight. Wastage % due to hand scissoring occurs in the time of hand scissoring in order to replace the faulty panels. End bits are used to replace faulty cut panels by hand scissoring. In our observation we found wastage % due to hand scissoring varies at a range of 0.65 % to 1.05 % of total fabric weight.

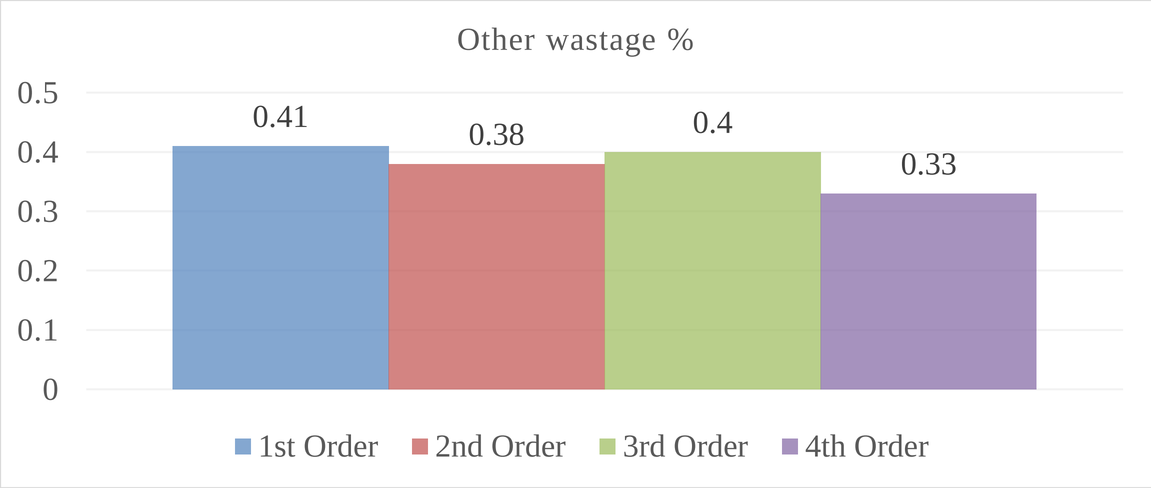


Figure 4.5 Other wastage

In this graph, X-axis express different orders and Y-axis denotes other wastage in the percentage of total fabric weight. There is some wastage like wastage for GSM card, Shade card, wastage due to adjusting the plies according to marker, cutting marking portion on the roll etc. In our observation we found other wastage % varies at a range from 0.30 % to 0.45 % of total fabric weight.

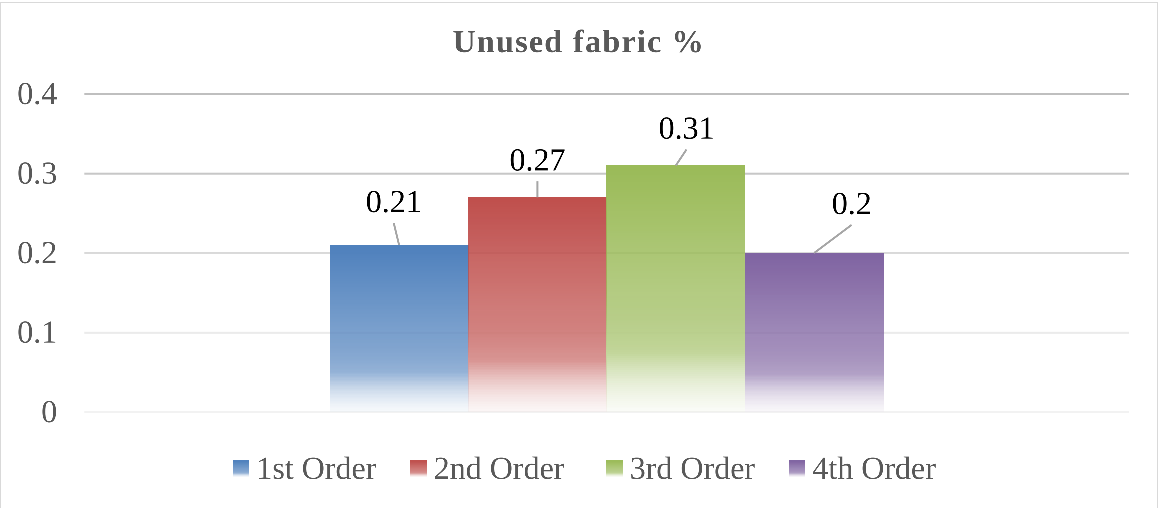


Figure 4.6 Unused fabric

In this graph, X-axis denotes different orders and Y-axis denotes unused fabric in the percentage of total fabric weight. Unused fabric % is the percentage of the total fabric that are remain unused after completion of a batch quantity. These fresh fabrics can be used after total batch quantity is fill up in order to produce extra garments or if end bits of the roll is not sufficient to replace the faulty panels to next following batches. In our observation we found unused fabric weight % varies at a range of around 0.15 % to 0.35 % of total fabric weight.

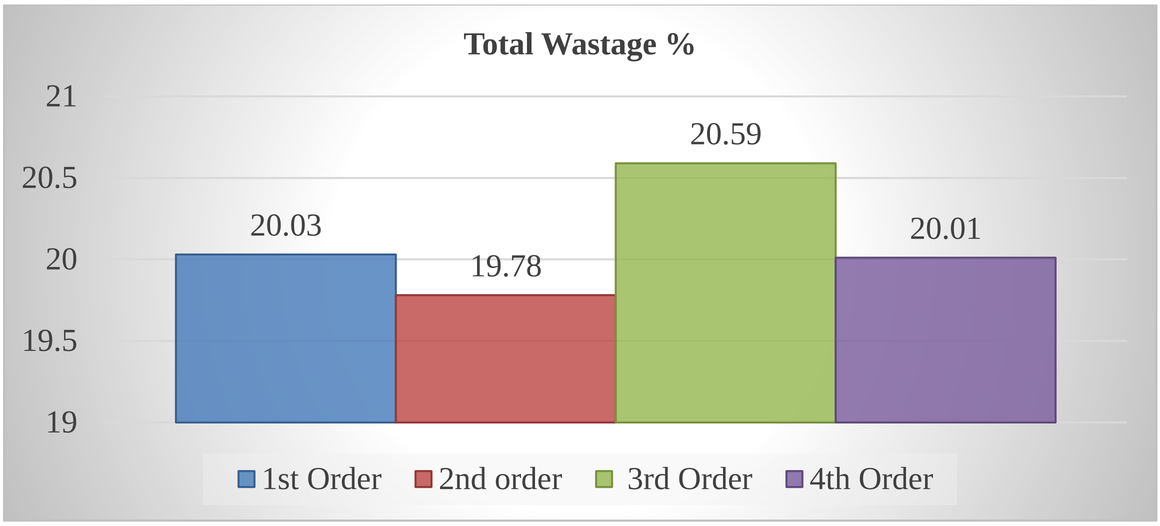


Figure 4.7 Total wastage %

In this graph, X-axis express different orders and Y-axis denotes total wastage in the percentage of total fabric weight. Total wastage % is the percentage of total wastage occurred in the cutting room to the total fabric weight. This wastage includes marker wastage, faulty cut panel weight, wastage due to hand scissoring and other wastage. In our observation we found total wastage % varies at a range of 19.75 % to 20.60 % of total fabric weight.

4.3 Combination system

4.3.1 First order

Table 4.17 Fabric inspection report.

Order no.	Batch no.	Batch quantity (Piece)	Total roll no.	Average roll weight (Kg)	Points per 100 sq yds (%)	GSM
YJBD 1644	30314	3050	15	31.03	19.31	190
					19.05	

Total weight=465.5

End bits from roll=14 Kg

Table 4.18 -Wastage from marker

Spreading no.	Marker length (m)	Marker width (cm)	Lay no.	Marker efficiency (%)	Wastage (Kg)	Total wastage (Kg)
1	5.79	179	100	82.02	41	80.56
2	5.64	179	100	82.18	39.56	

Table 4.19 - Wastage from cut panel.

Defected cut panel no.	No. of used panel by grading.	Rejected cut panel no.	Wastage from cut panel (Kg)
190	50	140	7.2

Table 4.20- Wastage from short marker.

Short marker length (m)	Short marker width (cm)	Lay no.	Short marker efficiency (%)	Wastage (Kg)
0.95	179	28	85	1.54

Table 4.21- Wastage by hand scissor.

Fabric used for cut panel (By hand scissoring) (Kg)	Wastage (By hand scissoring) (Kg)
1.5	0.35

Other wastage = 1.7 Kg

Unused fabric= 2 Kg

Total wastage = (Wastage from marker +Wastage of rejected cut panel+ Wastage of short marker+ Wastage due to hand scissoring +Other Wastage) Kg

Total wastage = (80.56+7.20+1.54+0.35+1.70) kg =91.35 Kg

Total wastage (%) = 91.35/465.50 ×100 =19.62 %

4.3.2 Second order

Table 4.22 Fabric inspection report

Order no.	Batch no.	Batch quantity (Piece)	Total roll no.	Average Roll weight (kg)	Points per 100 sq yds (%)	GSM
YJBD 1047	30336	5500	24	35.35	19.31	190
					19.31	

Total weight = 848.50 Kg

End bits from roll =28.36 Kg

Table 4.23 Wastage from marker

Spreading no.	Marker length (m)	Marker width (cm)	Lay no.	Marker Efficiency (%)	Wastage (Kg)	Total wastage (Kg)
1	7.11	218 cm	100	82.23	52.24	143.94
2	7.14	218 cm	100	82.64	51.39	
3	6.91	216cm	80	82.26%	40.31	

Table 4.24 Wastage from cut panel.

Defect cut panel no.	No. of used panel by grading.	Reject cut panel no.	Wastage from cut panel (Kg)
412	106	306	15.42

Table 4.25 Wastage from short marker.

Short marker length (m)	Short marker width (cm)	Lay no.	Short marker efficiency (%)	Wastage (Kg)
1.03	216	54	84.4	3.55

Table 4.26- Wastage by hand scissor.

Fabric used for cut panel (By hand scissoring) (Kg)	Wastage (By hand scissoring) (Kg)
2.93	0.73

Other wastage = 3.40 Kg
Unused fabric = 2.24 Kg
Total wastage = (Wastage from marker +Wastage of rejected cut panel+ Wastage of short marker+ Wastage due to hand scissoring +Other Wastage) Kg

Total wastage = (143.94+15.42+3.55+0.73+3.40) kg =167.04 Kg

Total wastage % = (167.04/848.50)×100 =19.69 %

4.3.3Third order:

Table 4.27-Fabric inspection report

Order no.	Batch no.	Batch quantity (Piece)	Total roll no.	Average roll weight (Kg)	Points per 100 sq yds (%)	GSM
BTGBD 1675	30246	4700	25	26.87	19.31	190
					19.31	

Total fabric weight = 671.85kg

End Bits from roll =16.74kg

Table 4.28- Wastage from marker

Spreading no	Marker length (m)	Marker width (cm)	Lay no.	Marker efficiency (%)	Wastage (Kg)	Total wastage (Kg)
1	5.31	197 cm	120	82.30	42.53	114.67
2	5.37	197 cm	120	82.56	42.07	
3	5.37	197cm	85	82.40	30.07	

Table 4.29 Wastage from cut panel

Defect cut panel no.	No of used panel by grading	Reject cut panel no.	Wastage from cut panel (Kg)
227	53	174	8.45

Table 4.30 Wastage from short marker

Short marker length (m)	Short marker width (cm)	Lay no.	Short marker efficiency (%)	Wastage (Kg)
1.04	197	31	84.02	1.93

Table 4.31 Wastage by hand scissor

Fabric used for Cut panel (By hand scissoring) (Kg)	Wastage (By hand scissoring) (Kg)
1.47	0.38

Other wastage = 3.02 Kg

Unused fabric=2 .94 Kg

Total wastage = (Wastage from marker +Wastage of rejected cut panel+ Wastage of short marker+ Wastage due to hand scissoring +Other Wastage) Kg

Total wastage = (114.67+8.45+1.93+.38+3.02) =128.45 Kg

Total wastage % = 128.45/ 671.85×100 =19.12%

4.3.4 Fourth Order

Table 4.32 Fabric inspection report

Order no.	Batch no.	Batch quantity (Piece)	Total roll no.	Average roll weight (Kg)	Points per 100 sq yds (%)	GSM
BTGBD 1676	30314	5000	30	23.95	19.31	190
					19.31	

Total weight= 718.55 Kg

End bits from roll=19.28 Kg

Table 4.33 Wastage from marker

Spreading no.	Marker length (m)	Marker Width (cm)	Lay no.	Marker efficiency (%)	Wastage (Kg)	Total wastage (Kg)
1	5.44	197	120	82.40	43	120.4
2	5.34	197	120	83.05	40.68	
3	5.4	197	105	82.7	36.72	

Table 4.34 wastage from cut panel

Defect cut panel no.	No of used panel by grading	Reject cut panel no.	Wastage from cut panel (Kg)
270	47	223	11.15

Table4.35 Wastage from short marker.

Short marker length (m)	Short marker width (cm)	Lay no.	Short marker efficiency (%)	Wastage (Kg)
1.02	197	39	84.5	2.3

Table 4.36 Wastage by hand scissor

Fabric used for Cut panel (By hand scissoring) (Kg)	Wastage (By hand scissoring) (Kg)
1.74	0.41

Other wastage = 3.1 Kg

Unused fabric=2.7 kg

Total wastage = (Wastage from marker +Wastage of rejected cut panel+ Wastage of short marker+ Wastage due to hand scissoring +Other Wastage) Kg

Total Wastage = (120.4+11.15+2.30+0.41+3.10) Kg=137.36 Kg
Total wastage (%) = (137.36/718.55)×100=19.12%

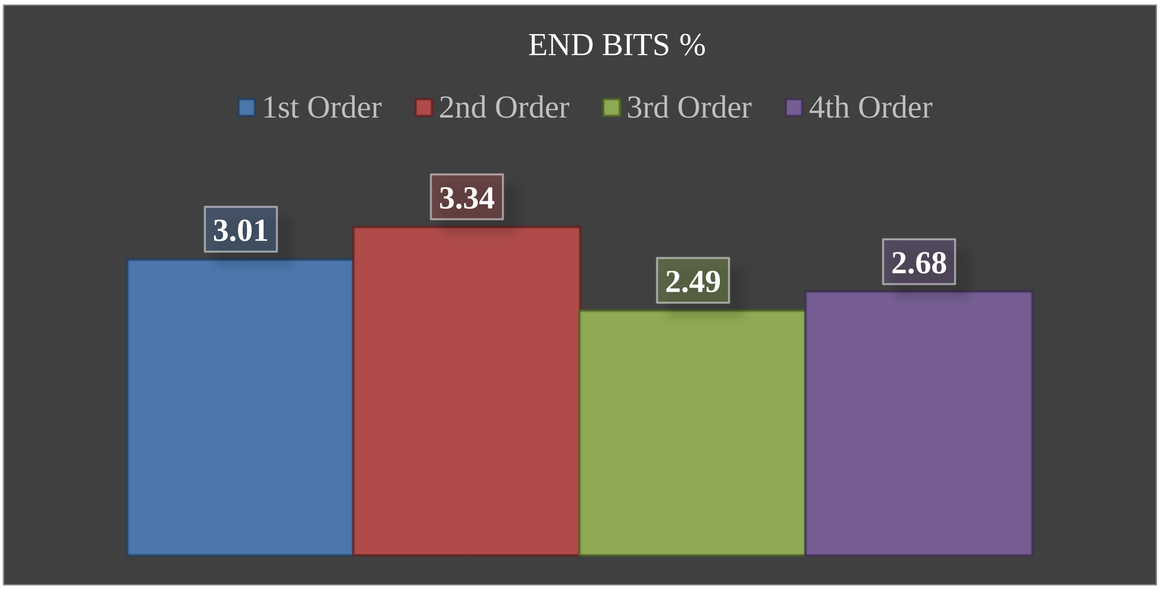


Figure 4.8 End bits %

Here in this graph, X-axis denotes different orders and Y-axis denotes end bits in the percentage of total fabric weight. We found the range of end bits is around 2.45% to 3.35 % of total fabric weight.

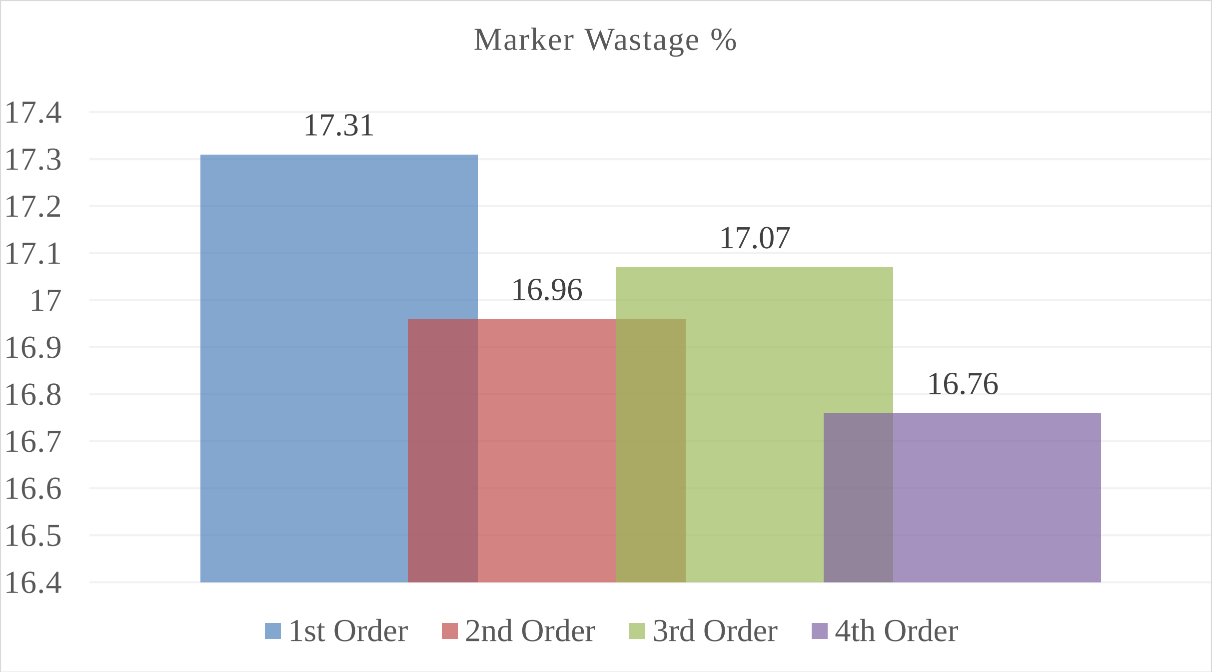


Figure 4.9 Marker wastage %

In this graph, X-axis denotes different orders and Y-axis denotes marker wastage in the percentage of total fabric weight. In our observation we found marker wastage % varies at a range from about 16.75 % to 17.35 % of total fabric weight.

In this graph, X-axis denotes different orders and Y-axis denotes pane

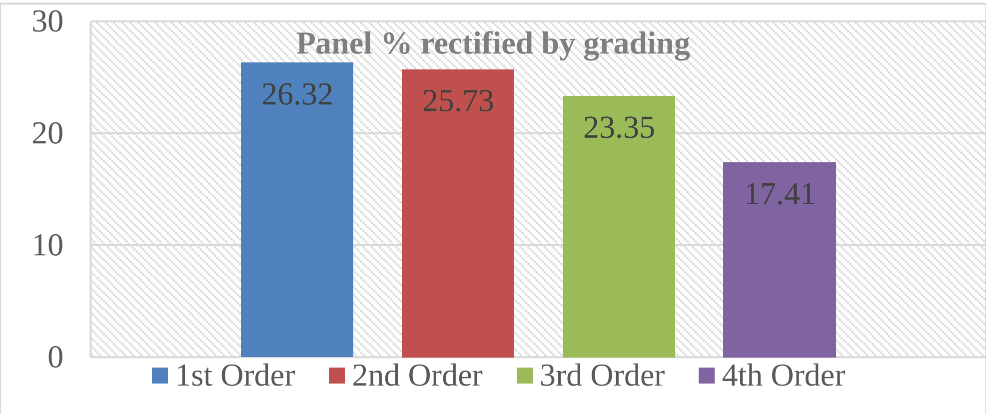


Figure 4.10 Panel % rectified by grading

Is rectified by grading in the percentage of total defected panel number. Some panels are rectified by grading from larger to a smaller size. This is done by placing smaller size pattern on the larger size faulty panel and cut by hand scissoring according to pattern shape. In our observation we found panel % rectified by grading varies at a range of 17.40 % to 26.35 % of total defected panel.

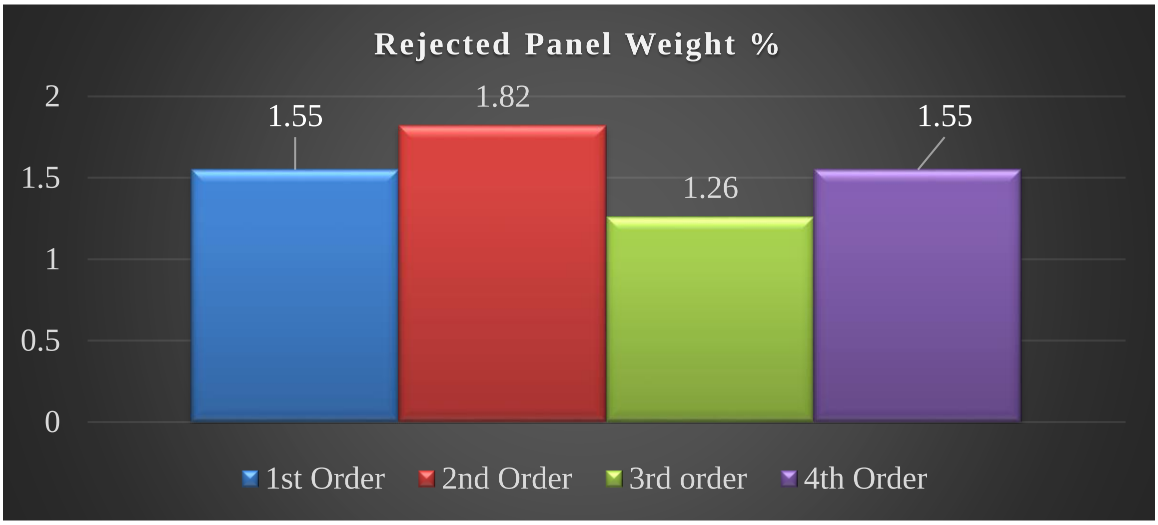


Figure 4.11 Rejected Panel Weight %

In this graph, X-axis express different orders and Y-axis denotes reject panel weight in the percentage of total fabric weight. Rejected panel weight % is the percentage of weight of cut panels that are rejected due to faults like Holes, Needle mark, Sinker mark, Shade variation, incorrect size etc. It can be reduced by using fabric free from faults as much as possible, cutting the panel according to the size accurately. In our observation we found rejected panel weight % varies at a range of 1.25 % to 1.85 % of total fabric weight.

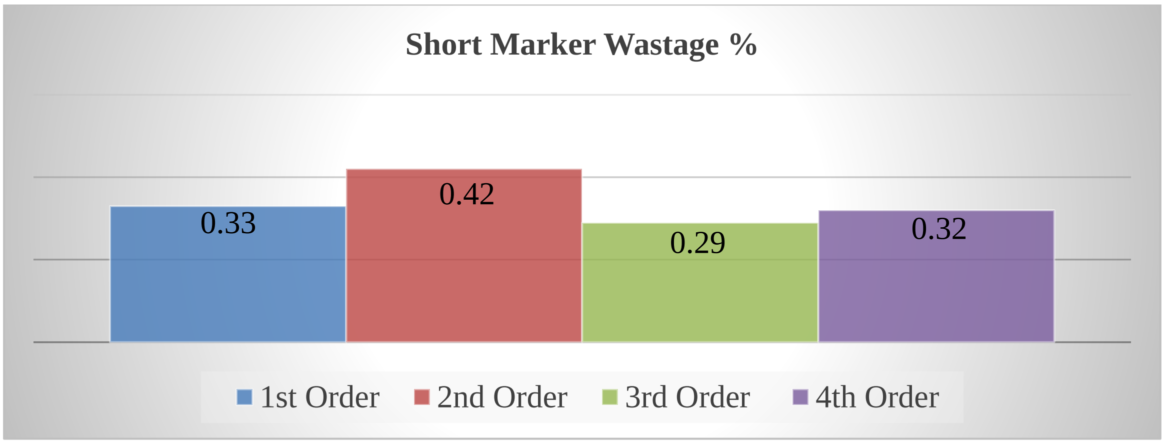


Figure 4.12 Short Marker Wastage %

In this graph X-axis denotes different orders and Y-axis denotes short marker wastage in the percentage of total fabric weight. The short marker is designed according to the ratio of faulty panels. End bits are used to make a short marker. Short marker wastages are happened due to the same reasons for what marker wastages happen. In our observation we found short marker wastage % varies at a range of 0.25 % to 0.45 % of total fabric weight.

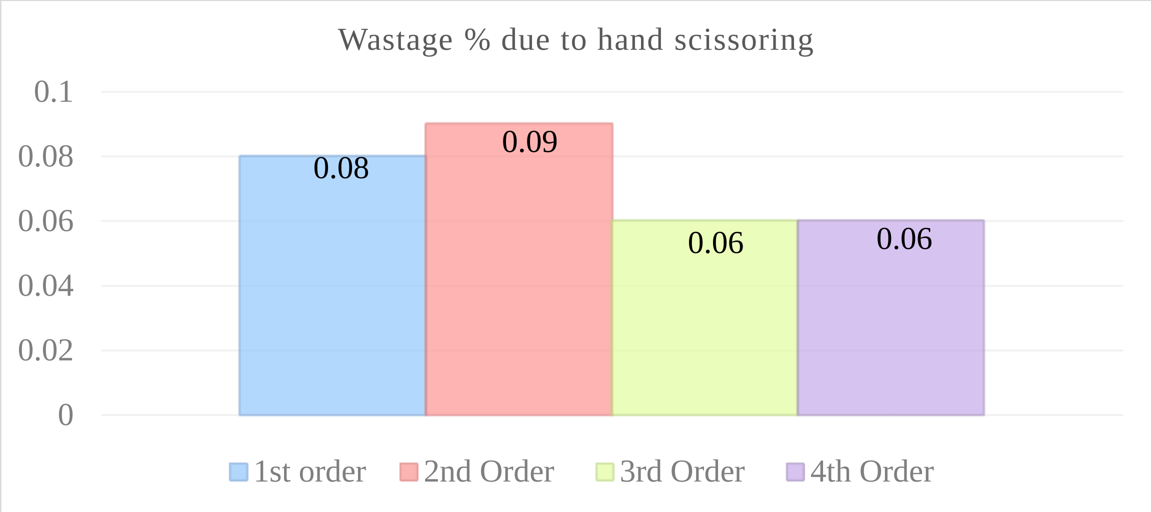


Figure 4.13 Wastage % due to hand scissoring

In this graph, X-axis express different orders and Y-axis denotes wastage due to hand scissoring in the percentage of total fabric weight. Rejected panels are replaced by new panels from the short marker. Here some panels found faulty again which are replaced by hand scissoring. In order to replace the faulty panels the patterns were kept on the end bits and cut according to the pattern. In our observation we found wastage % due to hand scissoring varies at a range of 0.06 % to 0.09 % of total fabric weight.

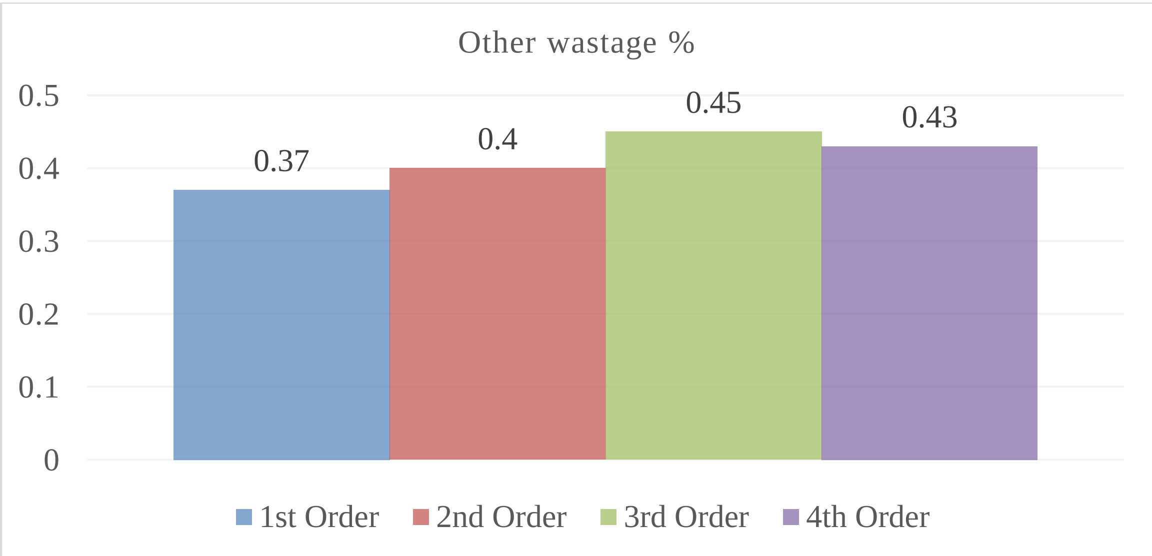


Figure 4.14 Other wastage %

In this graph, X-axis denotes different orders and Y-axis denotes other wastage in the percentage of total fabric weight. There are some wastages like wastage for GSM card, shade card, wastage due to adjusting the plies according to marker & short marker, wastage due to grading, cutting marking portion on the roll etc. In our observation we found other wastage % varies at a range of 0.37 % to 0.45 % of total fabric weight.

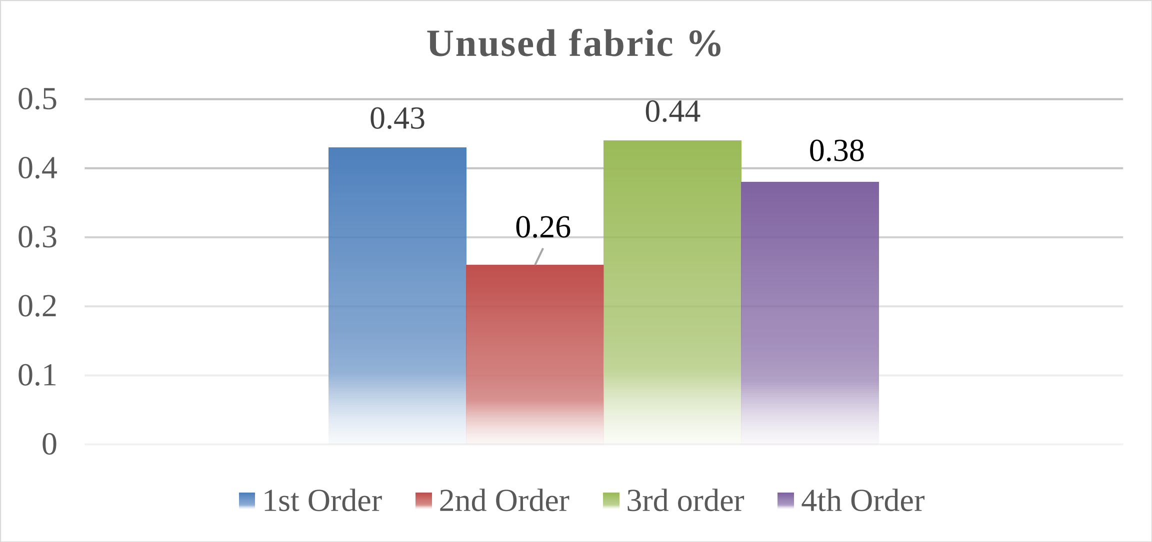


Figure 4.15 Unused fabric %

In this graph, X-axis denotes different orders and Y-axis denotes unused fabric in the percentage of total fabric weight. Unused fabric % is the percentage of the total fabric that are remain unused after completion of a batch quantity. These fresh fabrics can be used after total batch quantity is fill up in order to produce extra garments or if end bits of the roll is not sufficient to replace the faulty panels to next following batches. In our observation we found unused fabric weight % varies at a range of around 0.15 % to 0.35 % of total fabric weight.

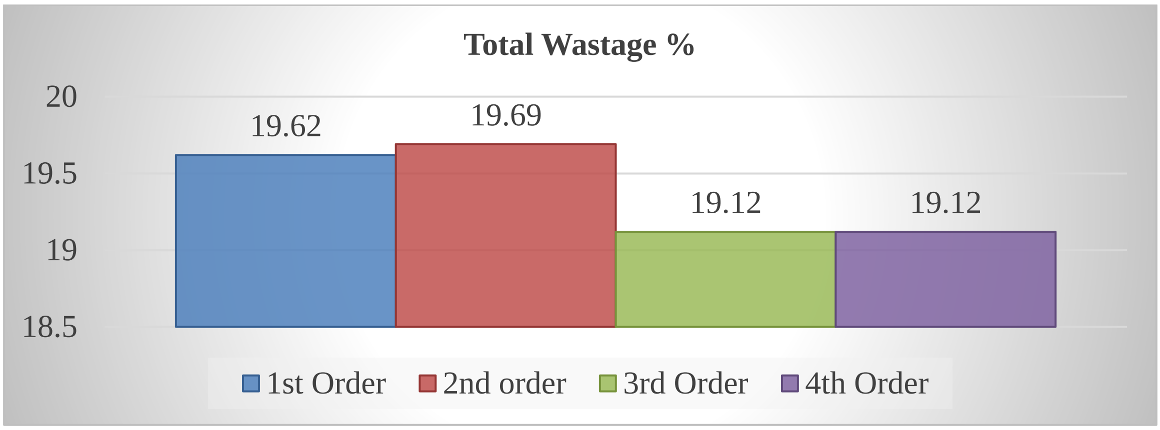


Figure 4.16 Total wastage %

In this graph, X-axis express different orders and Y-axis denotes total wastage in the percentage of total fabric weight. Total wastage % is the percentage of total wastage occurred in the cutting room to the total fabric weight. This wastage includes Marker wastage, Faulty cut panel weight, Short Marker wastage, Wastage due to hand scissoring and other wastage. In our observation we found total wastage % varies at a range of 19.10 % to 19.70 % of total fabric weight.

4.4 Application of the system of floor JFL-2 (Combination system) on the floor JAL-3 (General system): After analyzing the data of combination system we can get some results such as-

Table 4.37 Panel % rectified by grading

Order No	Number of defected panels	Number of panels rectified by grading	Percentage
1	190	50	26.32
2	270	47	17.41
3	227	53	23.35
4	412	106	25.73
Average % = 23.20			

From this table we can see the number of defected panels, number of panels can be rectified by grading and its percentage. From the above data we can see that about 23.20 % (Average) of defected panels can be rectified.

Table 4.38 Panel % recut by hand scissoring

Order No.	Number of panels cut from short marker	Number of defected Panels	Percentage
1	140	19	13.57
2	223	23	10.31
3	174	19	10.92
4	303	36	11.88
Average % = 11.67			

From this table, we can see the number of panels cut from the short marker and the number of defected panels. These panels are replaced by hand scissoring.so we can see that about 11.67 % (Average) panels have to recut by hand scissoring.

There is no specific quantity of other wastage in any specific stage. In our observation and taking the opinion of the experience people in cutting section we came to know other wastage in combination system is slightly higher than general system & we added 0.33 kg other wastage with the other wastage of general system.

4.4.1 First order

Table 4.39 Fabric inspection report

Order no.	Batch no.	Batch quantity (piece)	Total roll no.	Average roll weight (Kg)	Points per 100 sq yds (%)	GSM
YGIBF 1388	3233	3900	25	23.84	17.07%	220
					18.15%	

Total weight of fabric= 596

End Bits from roll= 19

Table 4.40 Wastage from marker

Spreading no.	Marker length (m)	Marker width (cm)	Lay no.	Marker efficiency (%)	Wastage (Kg)	Total wastage (Kg)
1	7.24	214	90	82.33%	54.21	101.05
2	7.21	214	79	82.51%	46.84	

Table 4.41 Wastage from cut panel

Defect cut panel no	No of used panel by grading.	Reject cut panel no	Wastage from cut panel (Kg)
223	52	171	8.99

Table 4.42 Wastage from short marker.

Short marker length (m)	Short marker width (cm)	Lay no.	Fabric need for short marker (Kg)	Short marker efficiency (%)	Wastage (Kg)
1.03	214	26	12.59	84.5	1.95

Table 4.43 Wastage by hand scissor.

Fabric used for cut panel (By hand scissoring) (Kg)	Wastage (By hand scissoring) (Kg)
1.6	0.38

Other wastage = (2.42+0.33) kg = 2.75 Kg

Unused fabric = 4.48

Total wastage = (Wastage from marker + Wastage of rejected cut panel + Wastage of short marker + Wastage due to hand scissoring + Other wastage) Kg

= (101.05+8.99+1.95+0.38+2.75) Kg

= 115.12 Kg

Total wastage (%) = 19.31%

Difference = (20.03-19.31) %

=0.72%

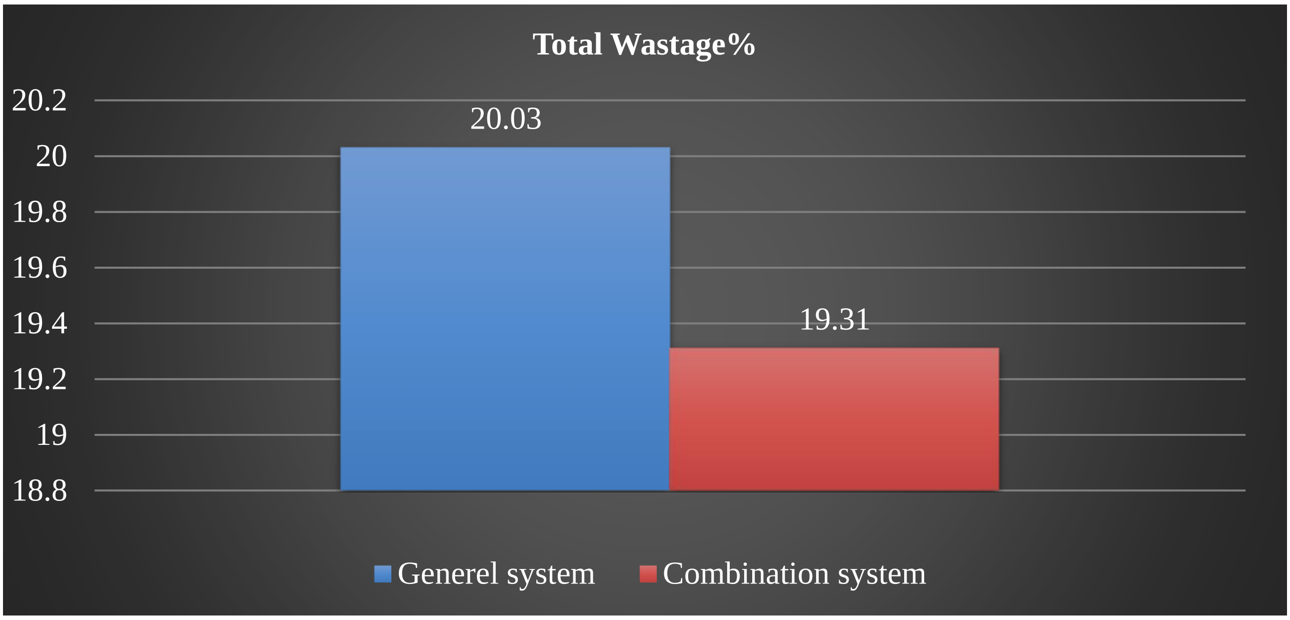
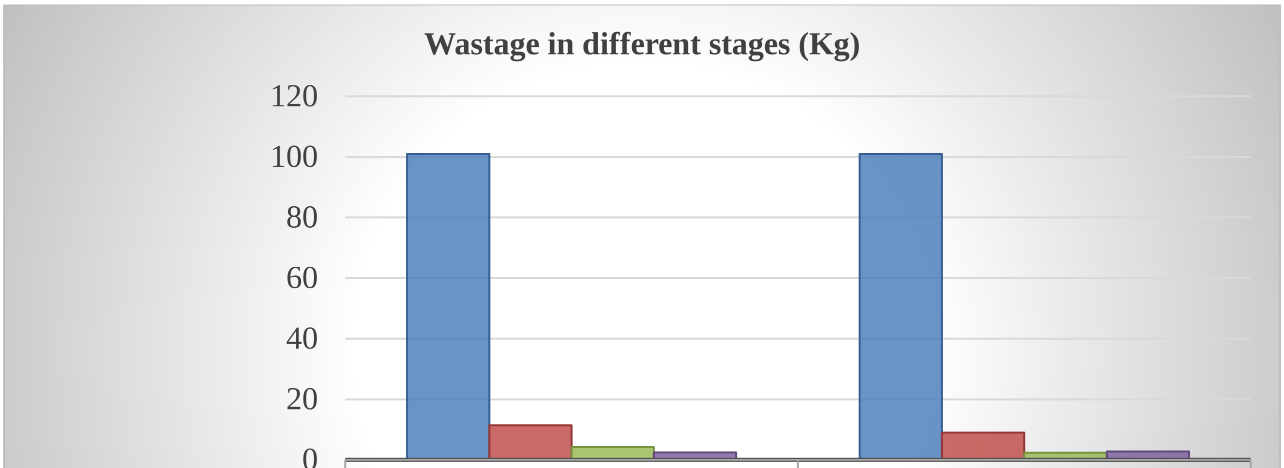


Figure 4.17 Total wastage %

In this graph, X-axis express the same order in general system & in combination system and Y-axis denotes total wastage in the percentage of total fabric weight. Here in the chart we can see that total wastage % of the fabric is higher in the general system than combination system. As in general system faulty cut panels are only replaced by hand scissoring which causes more fabric wastage than combination system. As combination system includes Grading, Short marker, Hand scissoring. We can see that if we apply combination system instead of general system the total wastage % can be reduced about 0.72 %.



	Generel system	Combination system
Marker wastage	101.05	101.05
Reject panel weight	11.43	8.99
Wastage for replace	4.2	2.33
Other wastage	2.42	2.75

Figure 4.18 Wastage in different stages

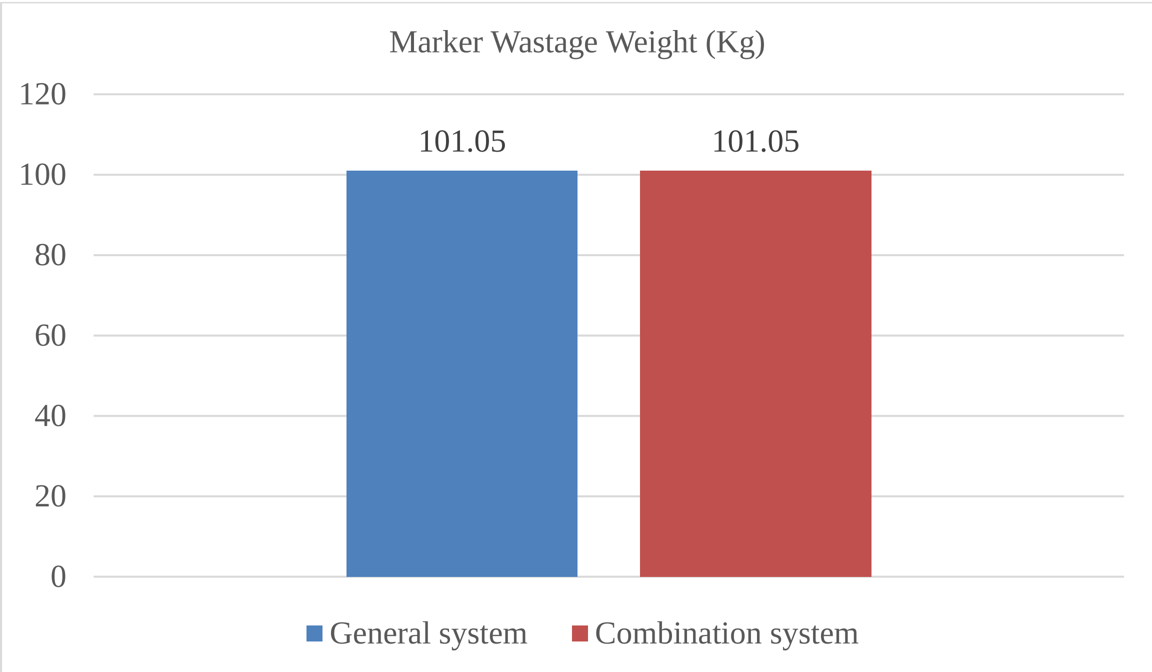


Figure 4.19 Marker wastage weight

Here in this graph, X-axis denotes the same order in general system & in combination system Y-axis denotes weight in Kg. We applied the system of floor JFL-2 (Combination system) on the floor JAL-3 (General system) where we keep some parameters constant like total fabric weight, batch quantity, marker length, marker width, marker efficiency, number of ply, number of spreading and defected cut panel number. For this reason we keep marker wastage same for both systems.

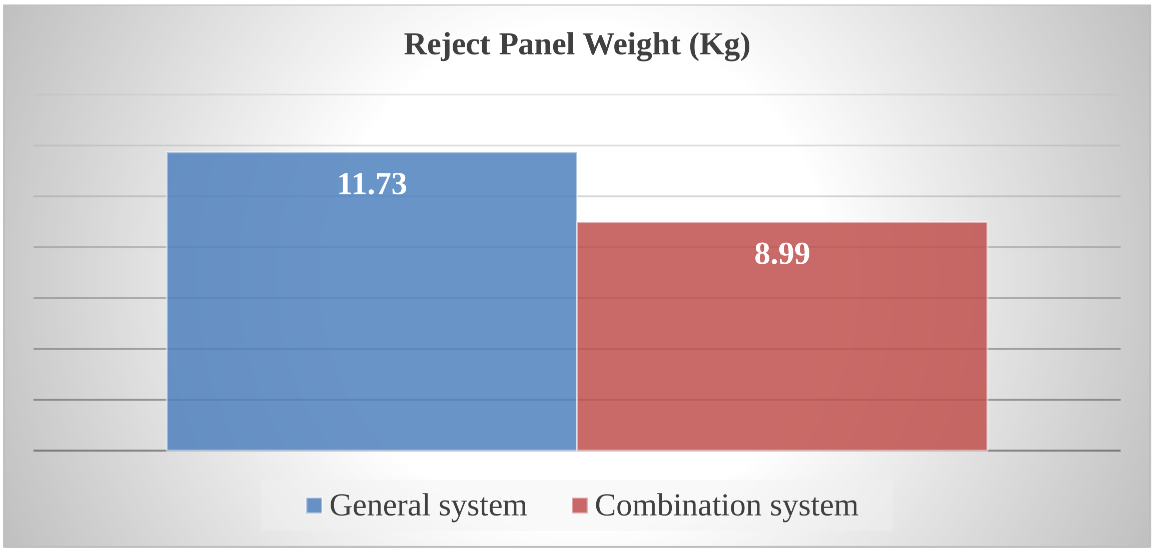


Figure 4.20 Reject panel weight (Kg)

In this graph, X-axis express the same order in general system & in combination system and Y-axis denotes weight in Kg. If we apply the system of floor JFL-2 (Combination system) on the floor JAL-3 (General system) we can see that reject panel weight can be reduced as in combination system some faulty panels can be rectified by grading.

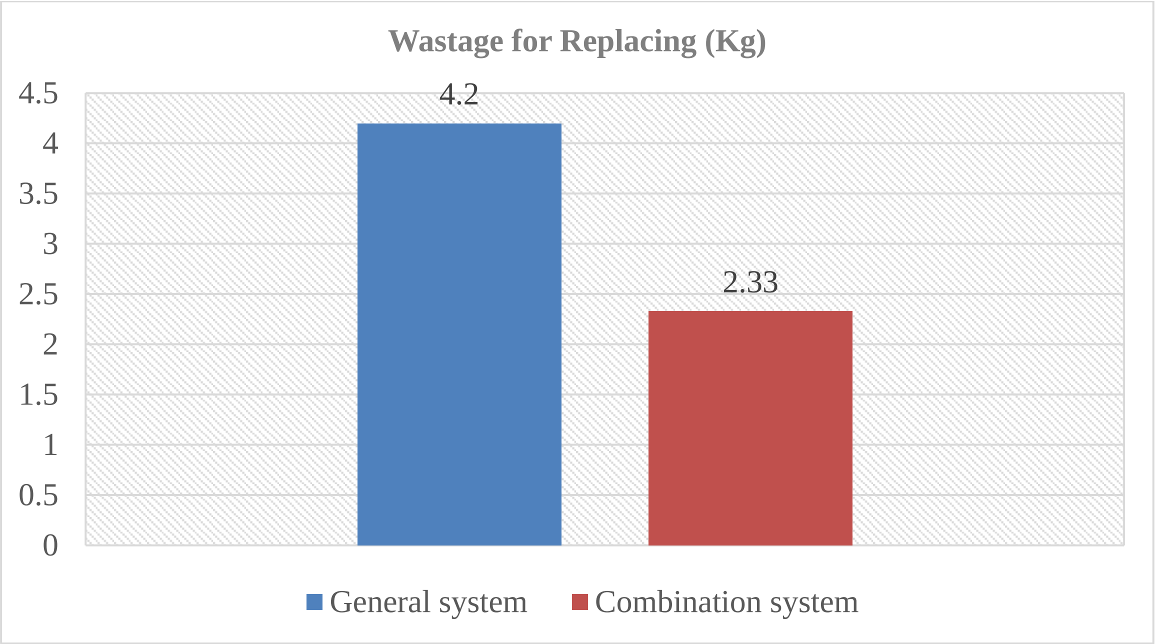


Figure 4.21 Wastage for replacing (Kg)

In this graph, X-axis express the same order in general system & in combination system and Y-axis denotes weight in Kg. After application of the system of floor JFL-2 (Combination system) on the floor JAL-3 (General system) we can see that wastage % for replacing is higher in general system as in combination system faulty panel replacement includes grading, short marker, and hand scissoring where general system only includes hand scissoring.

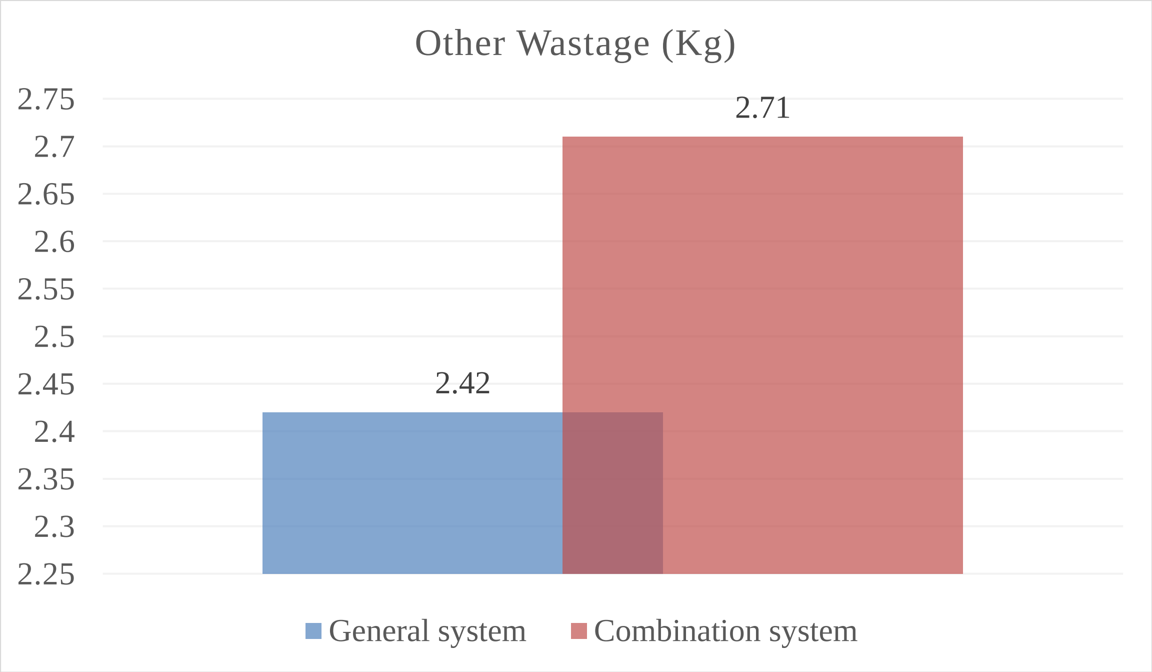


Figure 4.22 Other wastage (Kg)

In this graph, X-axis express the same order in general system & in combination system and Y-axis denotes weight in Kg. Here in combination system, other wastage is higher than general system because here another short marker is used & again grading is done to get required panels in desired size ratio.

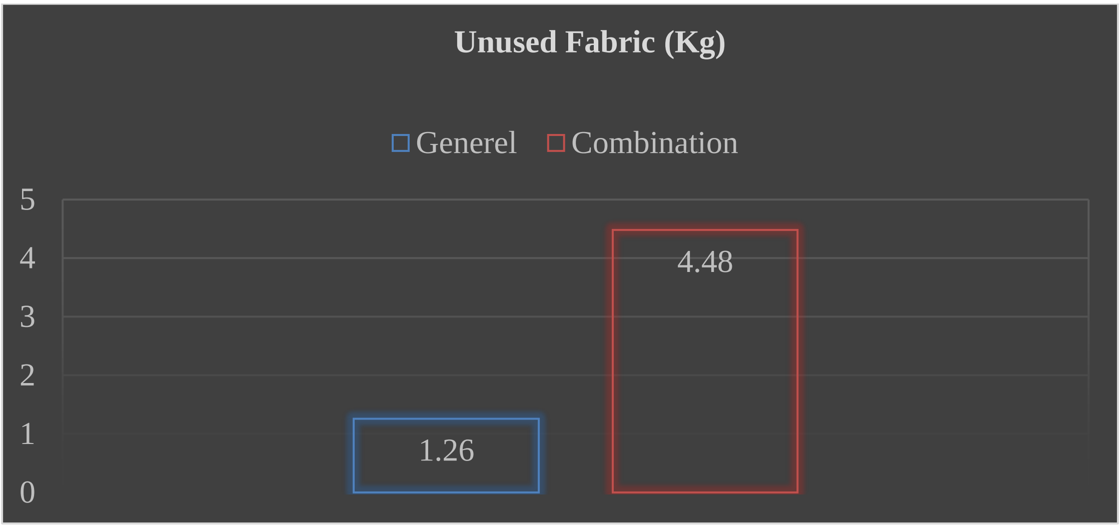


Figure 4.23 Unused fabric (Kg)

In this graph X-axis express the same order in general system & in combination system and Y-axis denotes weight in Kg. Here in Combination system, unused fabric % is higher than general system. In combination system less fabric is required to replace the faulty cut panel because the number of the panel is reduced by grading, short marker is used and hand scissoring is done for very small quantity of panels in a systematic way.

4.4.2 Second order

Table 4.44 Fabric inspection report

Order no.	Batch no.	Batch quantity (Piece)	Total roll no.	Average roll weight (Kg)	Points per 100 sq yds (%)	GSM
YGIBF 13865	626200	4500	28	23.03	18.07 17.15	190

Total weight of fabric= 645 Kg
End bits from roll= 19.32 Kg

Table 4.45 Wastage from marker

Spreading no.	Marker length (m)	Marker width (cm)	Lay no.	Marker efficiency (%)	Wastage (Kg)	Total wastage (Kg)
1	7.41	214	100	82.35	58.50	108.83
2	7.33	216	91	82.75	50.33	

Table 4.46 Wastage from cut panel.

Defect cut panel no.	No. of used panel by grading	Reject cut panel no.	Wastage from cut panel (Kg)
231	54	177	9.1

Table 4.47 Wastage from short marker

Short marker length (m)	Short marker width (cm)	Lay no.	Fabric need for short marker (Kg)	Short marker efficiency (%)	Wastage (Kg)
1.07	216	28	12.26	84.5	1.90

Table 4.48 Wastage by hand scissor.

Fabric used for cut panel (By hand scissoring) (Kg)	Wastage (By hand scissoring) (Kg)
1.60	0.40

Other wastage = (2.48+0.33) kg = 2.81 Kg

Unused fabric= 5.13 Kg

Total wastage = (Wastage from marker +Wastage of rejected cut panel+ Wastage of short marker+ Wastage due to hand scissoring +Other Wastage) Kg

Total wastage = (108.83+9.10+1.90+0.40+2.81) Kg

=123.04 Kg

Total wastage (%) = (123.04/645) ×100%

= 19.08%

Difference = (19.78-19.08) %

= 0.70%

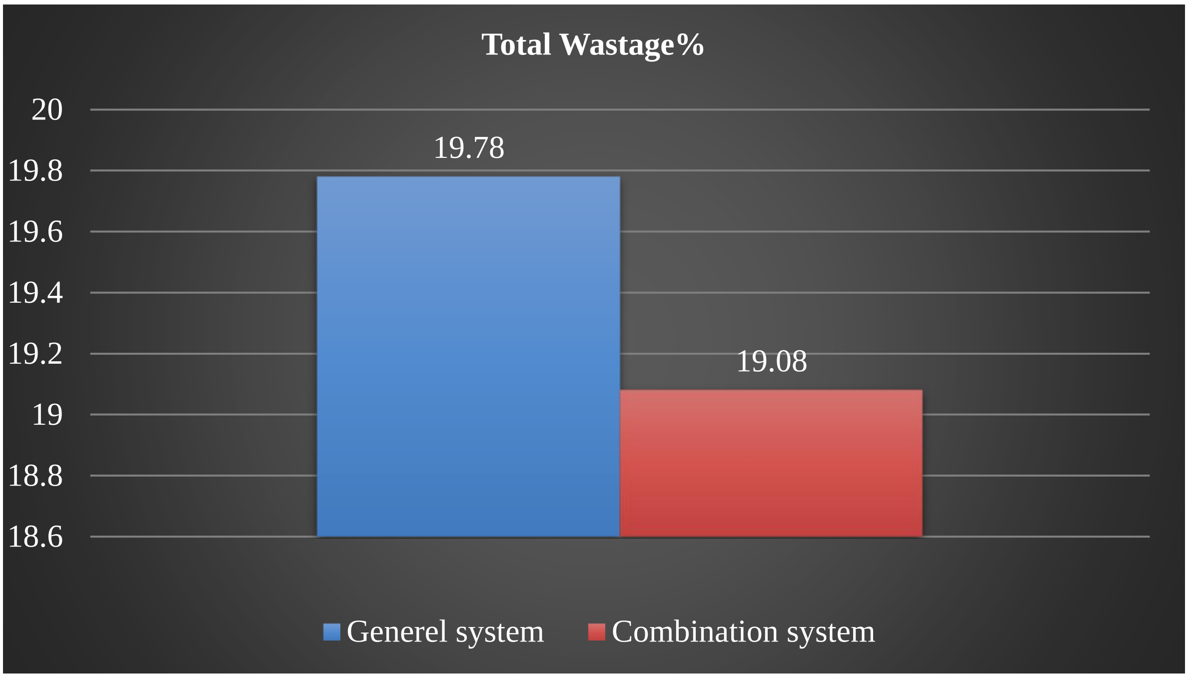


Figure 4.24 Total wastage %

In this graph, X-axis express the same order in general system & in combination system and Y-axis denotes total wastage in the percentage of total fabric weight. Here in the chart we can see that total wastage % of the fabric is higher in the general system than combination system. As in general system faulty cut panels are only replaced by hand scissoring which causes more fabric wastage than combination system. As combination system includes Grading, Short marker, Hand scissoring. We can see that if we apply combination system instead of general system the total wastage % can be reduced about 0.70 %.

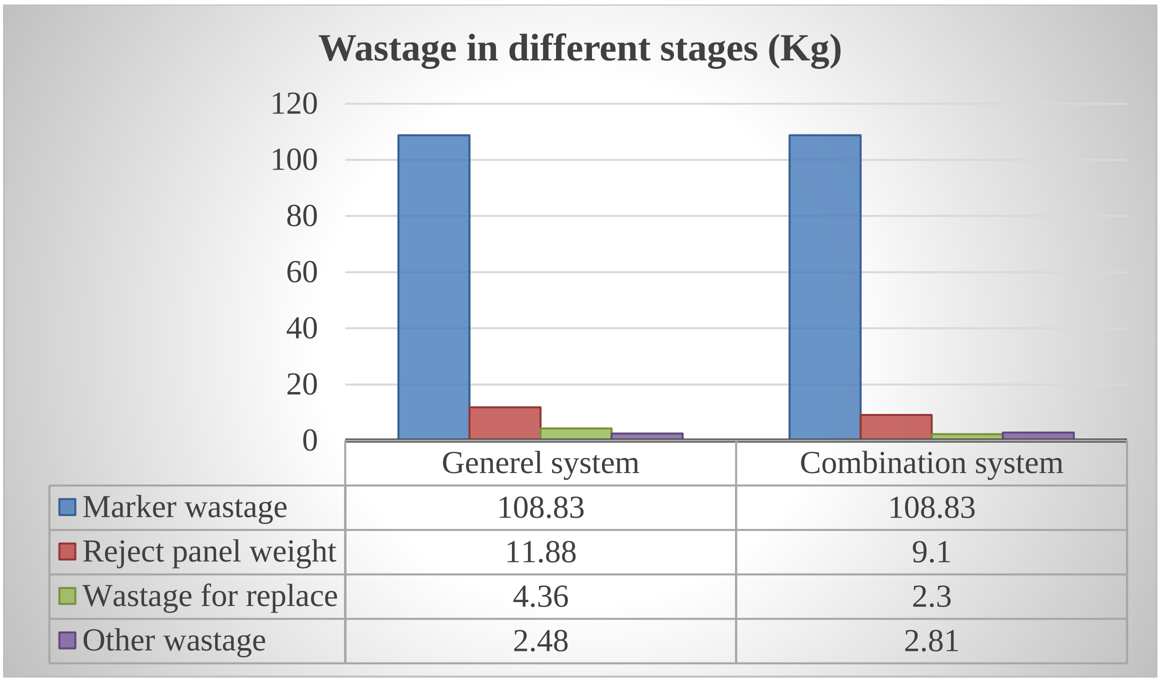


Figure 4.25 Wastage of different stages

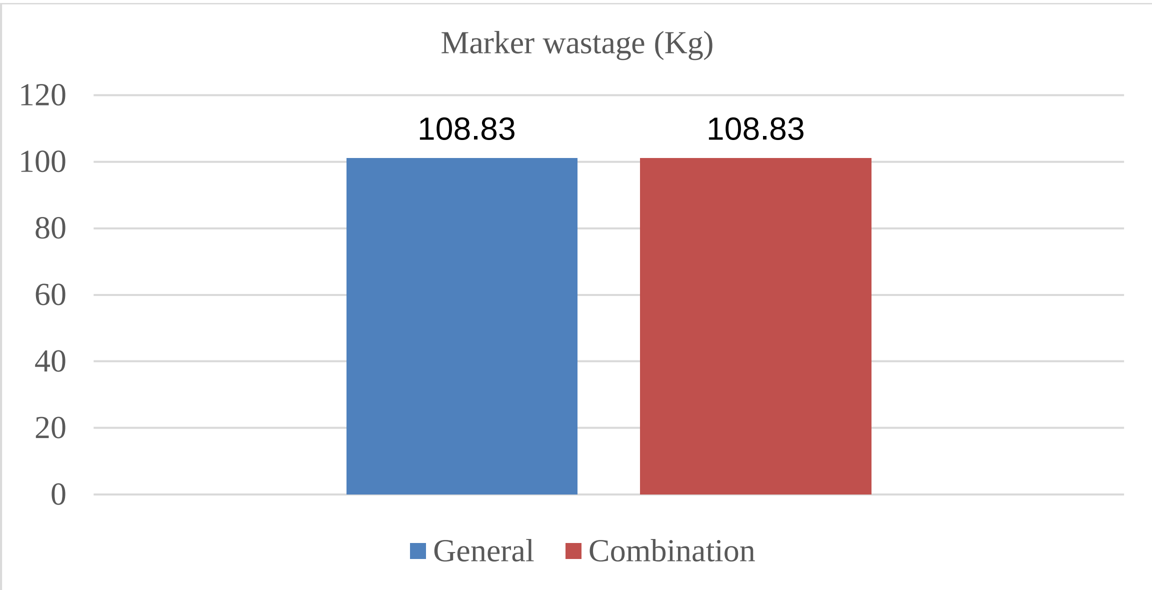


Figure 4.26 Marker wastage (Kg)

Here in this graph, X-axis denotes the same order in general system & in combination system Y-axis denotes weight in Kg. We applied the system of floor JFL-2 (Combination system) on the floor JAL-3 (General system) where we keep some parameters constant like total fabric weight, batch quantity, marker length, marker width, marker efficiency, number of ply, number of spreading and defected cut panel number. For this reason we keep marker wastage same for both systems.

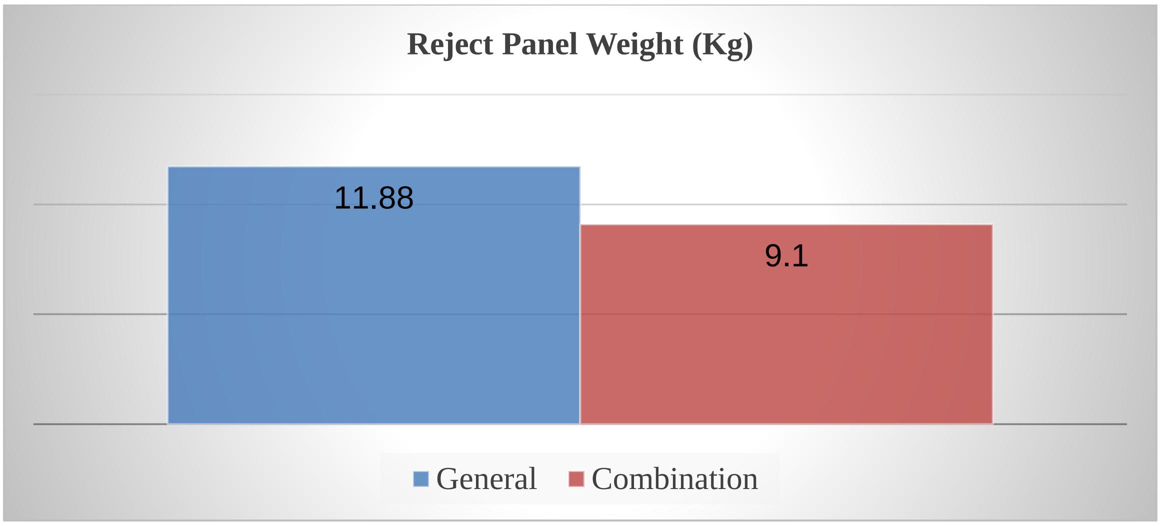


Figure 4.27 Reject panel weight (Kg)

In this graph, X-axis express the same order in general system & in combination system and Y-axis denotes weight in Kg. If we apply the system of floor JFL-2 (Combination system) on the floor JAL-3 (General system) we can see that reject panel weight can be reduced as in combination system some faulty panels can be rectified by grading.

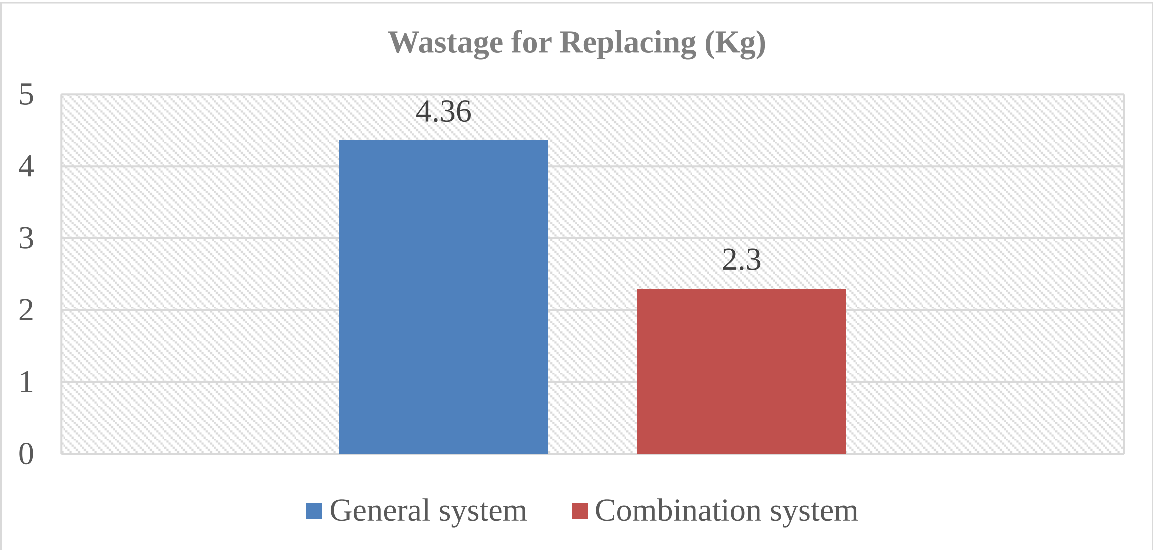


Figure 4.28 Wastage for Replacing (Kg)

In this graph, X-axis express the same order in general system & in combination system and Y-axis denotes weight in Kg. After application of the system of floor JFL-2 (Combination system) on the floor JAL-3 (General system) we can see that wastage % for replacing is higher in general system as in combination system faulty panel replacement includes grading, short marker, and hand scissoring where general system only includes hand scissoring.

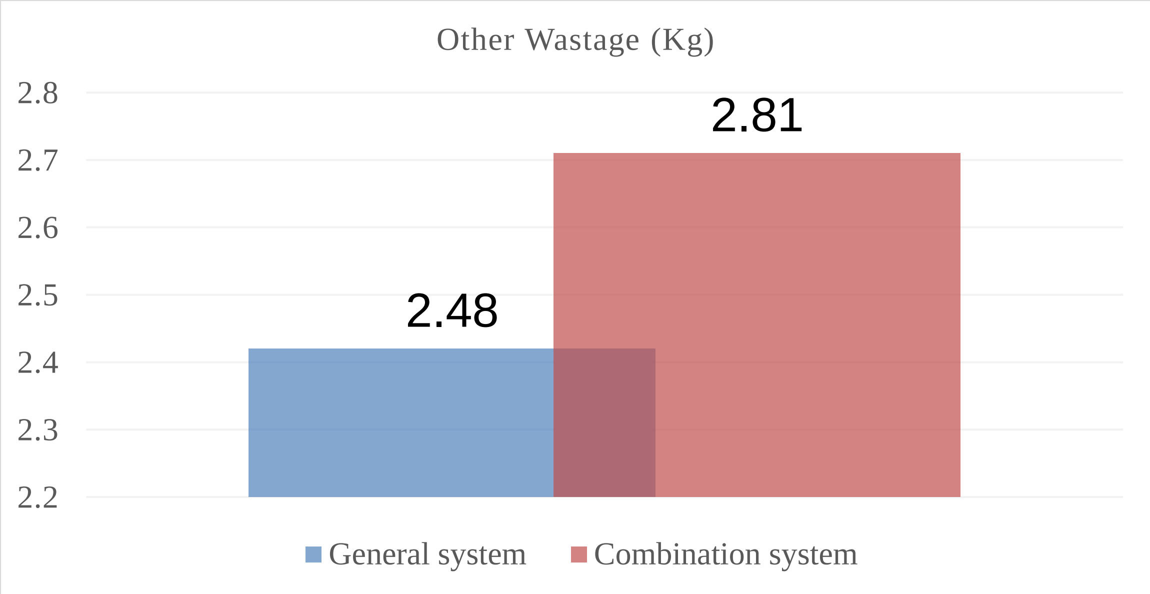


Figure 4.29 Other Wastage (Kg)

In this graph, X-axis express the same order in general system & in combination system and Y-axis denotes weight in Kg. Here in Combination system, other wastage is higher than general system because here another short marker is used & again grading is done to get required panels in desired size ratio.

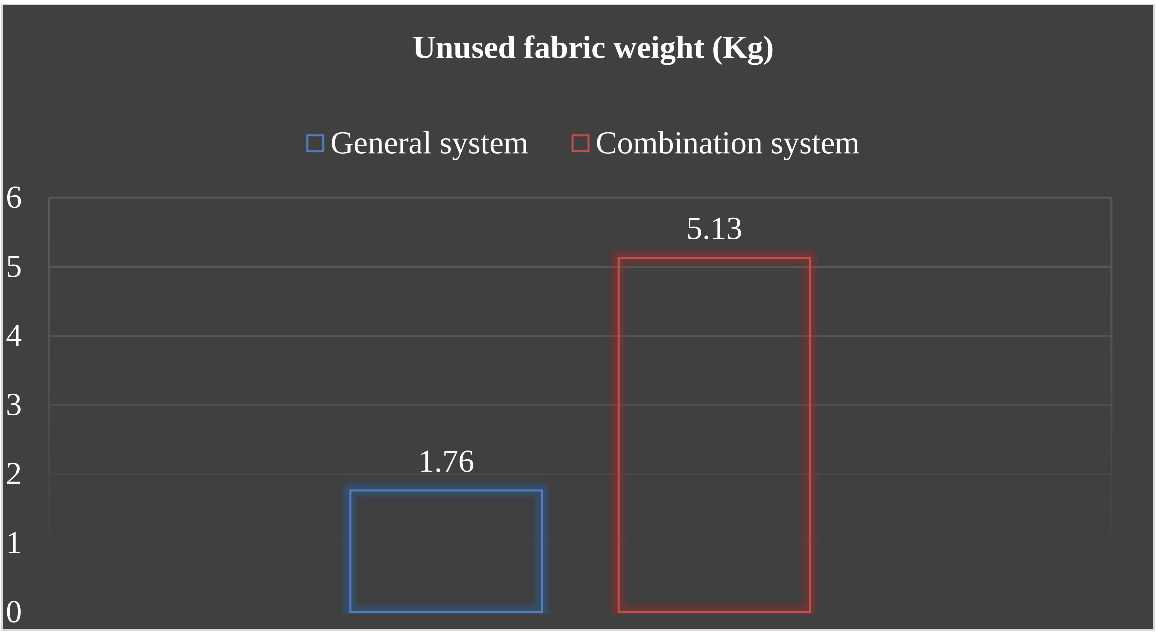


Figure 4.30 Unused fabric weight (Kg)

In this graph, X-axis express the same order in general system & in combination system and Y-axis denotes weight in Kg. Here in Combination system, unused fabric % is higher than general system. In combination system less fabric is required to replace the faulty cut panel because the number of panel is reduced by grading, short marker is used and hand scissoring is done for very small quantity of panels in a systematic way.

4.4.3 Third order

Table 4.49 Fabric inspection report

Order no.	Batch no.	Batch quantity (Piece)	Total roll no.	Average roll weight (Kg)	Points per 100 sq yds (%)	GSM
YGIBF 1247	33917	5500	36	22.76	17.07	190
					18.15	

Total weight of fabric= 819.51 Kg
End bits from roll= 35.12 Kg

Table 4.50 Wastage from marker

Spreading no.	Marker length (m)	Marker width (cm)	Lay no.	Marker efficiency (%)	Wastage (Kg)	Total wastage (Kg)
1	7.45	214	100	82.20	53.92	135.92
2	7.30	214	80	82.55	41.44	
3	7.40	214	80	82.15	40.56	

Table 4.51 Wastage from cut panel

Defect cut panel no.	No. of used panel by grading	Reject cut panel no.	Wastage from cut panel (Kg)
415	96	319	16.33

Table 4.52 Wastage from short marker

Short marker length (m)	Short marker width (cm)	Lay No	Fabric need for short marker (Kg)	Short marker Efficiency %	Wastage (Kg)
1.07	214	52	22.65	84.5	3.51

Table 4.53 Wastage by hand scissor

Fabric used for cut panel. (by hand scissoring) (Kg)	Wastage (By hand scissoring) (Kg)
2.91	0.74

Other wastage = (3.31+.33) Kg

= 3.64 Kg

Unused fabric= 9.23 Kg

Total wastage = (Wastage from marker +Wastage of rejected cut panel+ Wastage of short marker+ Wastage due to hand scissoring +Other Wastage) Kg

Total wastage = 135.92+16.33+3.51+0.74+3.64

= 160.14 kg

Total wastage (%) = (160.14/819.51)×100%

= 19.54%

Difference = (20.59-19.54) % = 1.05%

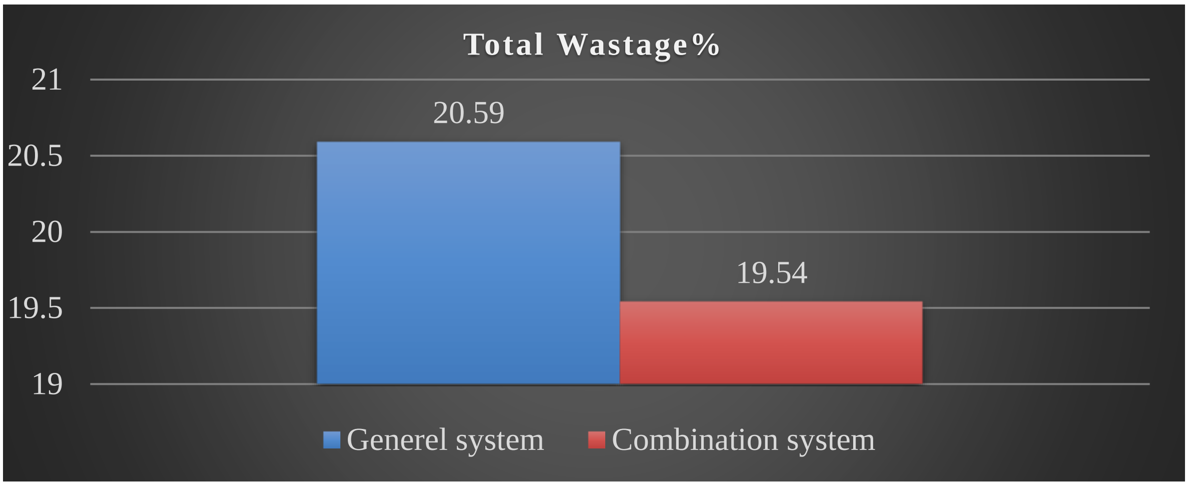


Figure 4.31 Total wastage %

In this graph, X-axis express the same order in general system & in combination system and Y-axis denotes total wastage in the percentage of total fabric weight. Here in the chart we can see that total wastage % of the fabric is higher in general system than combination system. As in general system faulty cut panels are only replaced by hand scissoring which causes more fabric wastage than combination system. As combination system includes Grading, Short marker, Hand scissoring. We can see that if we apply combination system instead of general system the total wastage % can be reduced about 1.05 %.

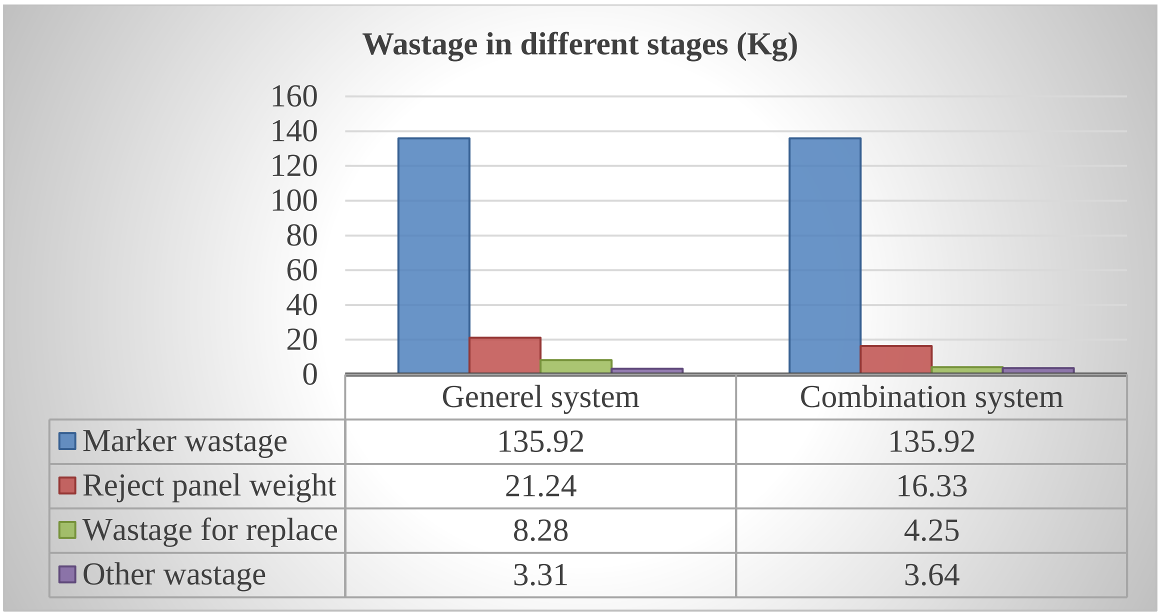


Figure 4.32 Wastage in different stages (Kg)

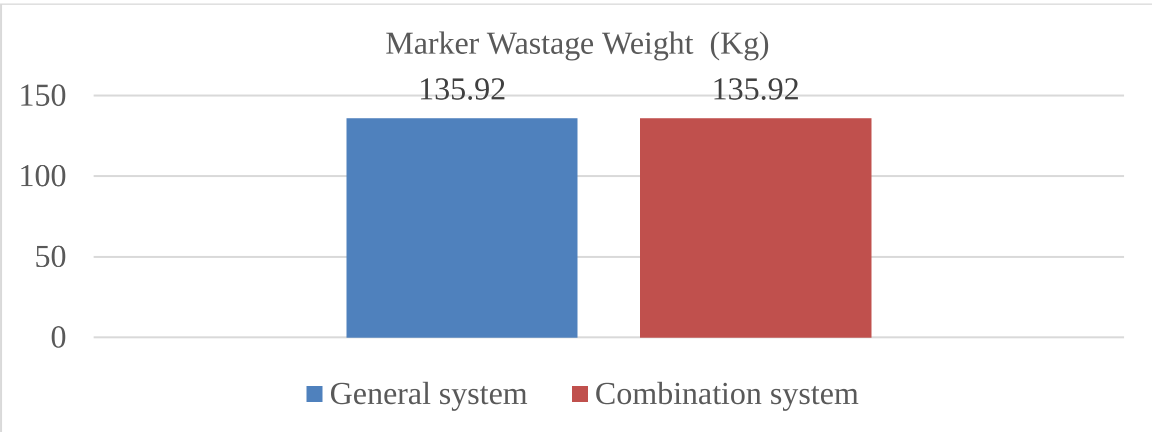


Figure 4.33 Marker wastage weight (Kg)

Here in this graph, X-axis denotes the same order in general system & in combination system Y-axis denotes weight in Kg. We applied the system of floor JFL-2 (Combination system) on the floor JAL-3 (General system)where we keep some parameters constant like total fabric weight, batch quantity, marker length, marker width, marker efficiency, number of ply, number of spreading and defected cut panel number. For this reason, we keep marker wastage same for both systems.

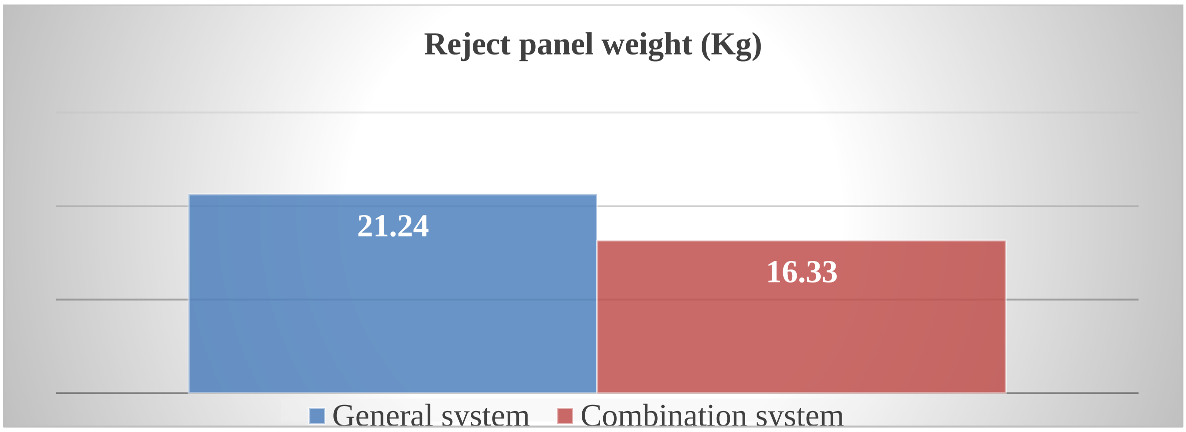


Figure 4.34 Reject panel weight (Kg)

In this graph, X-axis express the same order in general system & in combination system and Y-axis denotes weight in Kg. If we apply the system of floor JFL-2 (Combination system) on the floor JAL-3 (General system) we can see that reject panel weight can be reduced as in combination system some faulty panels can be rectified by grading.

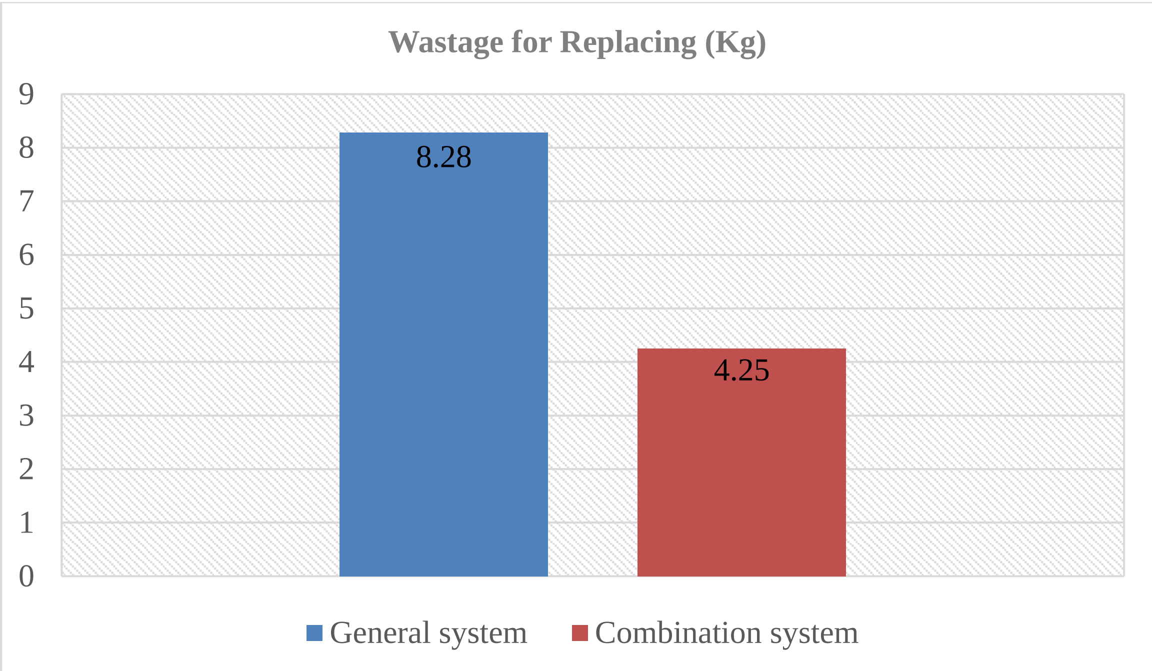


Figure 4.35 Wastage for replacing (Kg)

In this graph, X-axis express the same order in general system & in combination system and Y-axis denotes weight in Kg. After application of the system of floor JFL-2 (Combination system) on the floor JAL-3 (General system), we can see that wastage % for replace is higher in general system as in combination system faulty panel replacement includes grading, short marker, and hand scissoring where general system only includes hand scissoring.

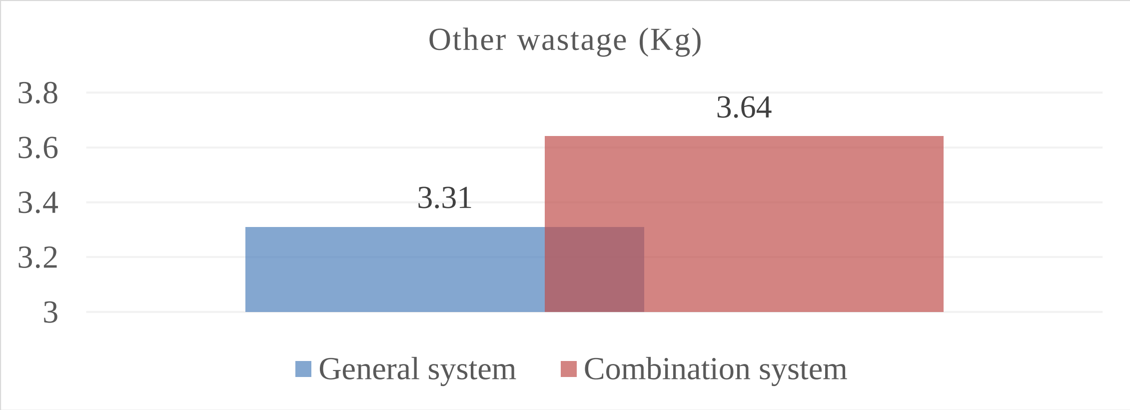


Figure 4.36 Other wastage (Kg)

In this graph, X-axis express the same order in general system & in combination system and Y-axis denotes weight in Kg. Here in Combination system, other wastage is higher than general system because here another short marker is used & again grading is done to get required panels in desired size ratio.

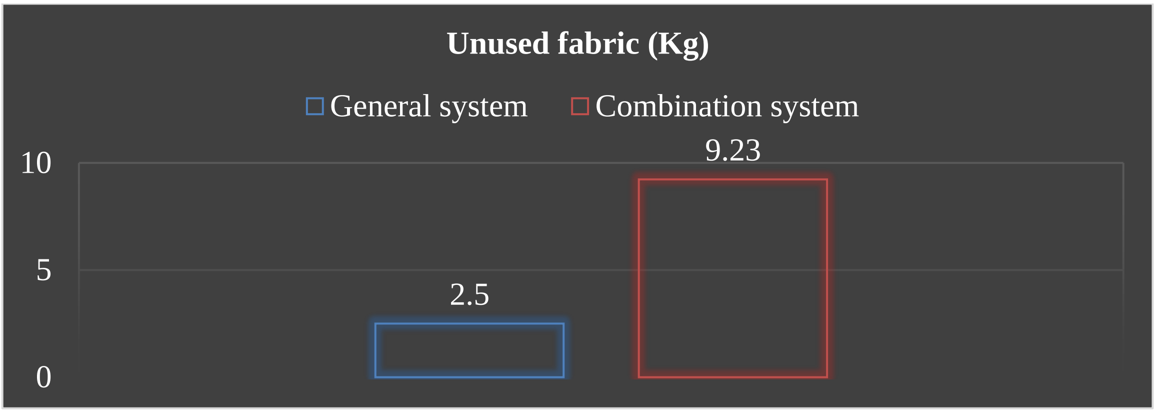


Figure 4.37 Unused fabric (Kg)

In this graph, X-axis express the same order in general system & in combination system and Y-axis denotes weight in Kg. Here in combination system, unused fabric % is higher than general system. In combination system, less fabric is required to replace the faulty cut panel because the number of the panel is reduced by grading, the short marker is used and hand scissoring is done for very small quantity of panels in a systematic way.

4.4.4 Fourth order

Table 4.54 Fabric inspection report

Order no.	Batch no.	Batch quantity (Piece)	Total roll no.	Average roll weight (Kg)	Points per 100 sq yds (%)	GSM
YGIBF 1248	33920	3900	28	20.50	17.07 18.15	190

Total weight of fabric= 574 Kg

End Bits from roll= 18 Kg

Table 4.55 Wastage from marker

Spreading no.	Marker length (m)	Marker width (cm)	Lay no.	Marker efficiency (%)	Wastage (Kg)	Total wastage (Kg)
1	7.41	214	100	82.05	54.08	97.34
2	7.33	216	84	82.88	43.26	

Table 4.56 Wastage from cut panel.

Defect cut panel no	No of used panel by grading	Reject cut panel no.	Wastage from cut panel (Kg)
214	50	164	8.74

Table 4.57 Wastage from short marker

Short marker length (m)	Short marker width (cm)	Lay no.	Fabric need for short marker (Kg)	Short marker efficiency %	Wastage (Kg)
1.02	214	28	11.65	84.5	1.81

Table 4.58 Wastage by hand scissor

Fabric used for cut panel (By hand scissoring) (kg)	Wastage (By hand scissoring) (Kg)
1.50	0.37

Other wastage = (1.92+.33) kg = 2.25 Kg

Unused fabric= 4.52 Kg

Total wastage = (Wastage from marker +Wastage of rejected cut panel+ Wastage of short marker+ Wastage due to hand scissoring +Other Wastage) Kg

Total wastage = (97.34+8.74+1.81+0.37+2.25) Kg

= 110.51 Kg

Total wastage (%) = (110.51/574) ×100%

= 19.25 %

Difference = (20.01-19.25) % = 0.76%

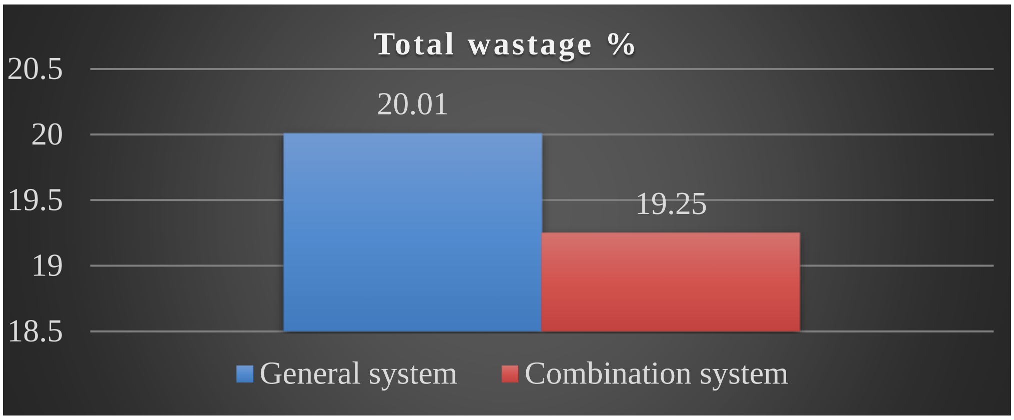
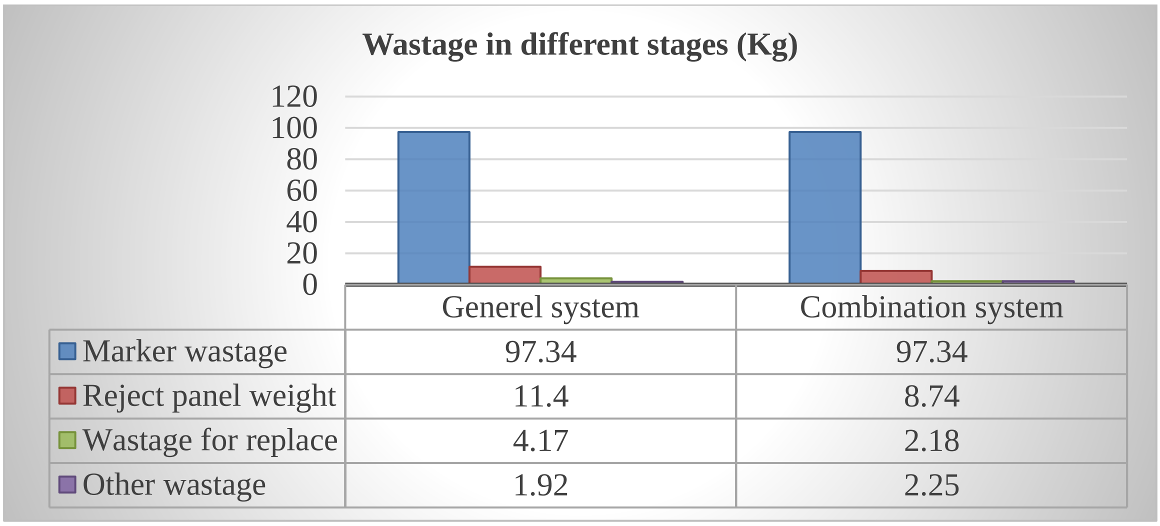


Figure 4.38 Total wastage (%)

In this graph, X-axis express the same order in general system & in combination system and Y-axis denotes total wastage in the percentage of total fabric weight. Here in the chart we can see that total wastage % of the fabric is higher in general system than combination system. As in general system, faulty cut panels are only replaced by hand scissoring which causes more fabric wastage than combination system. As combination system includes Grading, Short marker, Hand scissoring. We can see that if we apply combination system instead of general system the total wastage % can be reduced about 0.76 %.



	Generel system	Combination system
Marker wastage	97.34	97.34
Reject panel weight	11.4	8.74
Wastage for replace	4.17	2.18
Other wastage	1.92	2.25

Figure 4.39 Wastage in different stages (Kg)

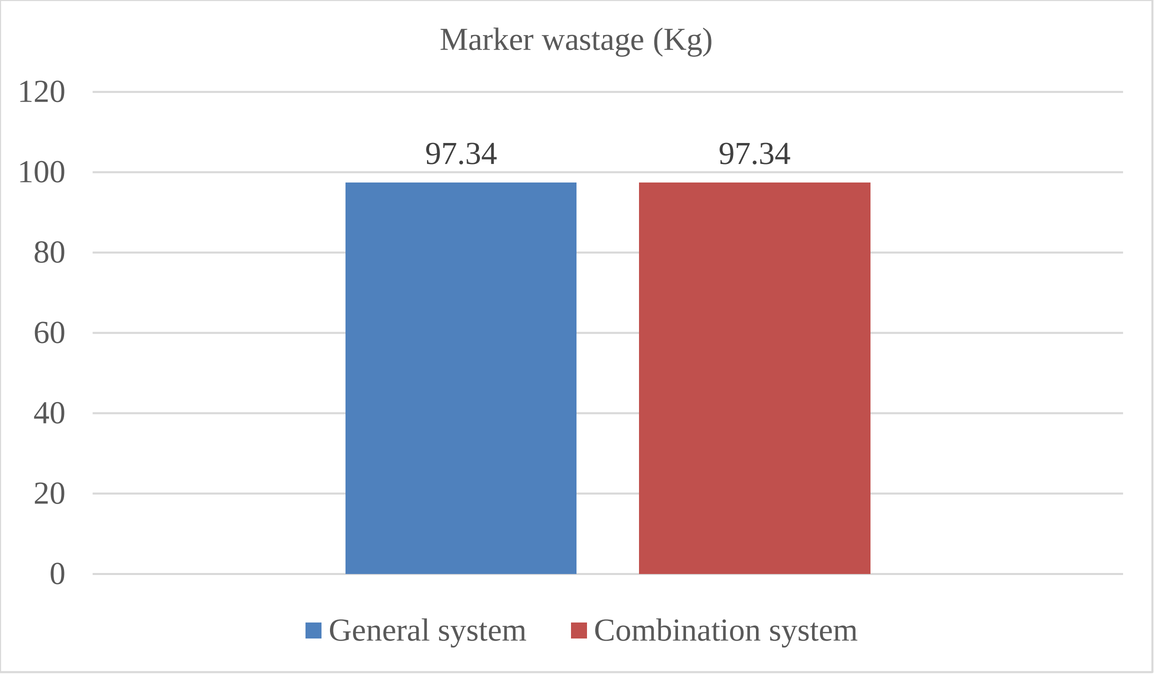


Figure 4.40 Marker wastage (Kg)

Here in this graph, X-axis denotes the same order in general system & in combination system Y-axis denotes weight in Kg. We applied the system of floor JFL-2 (Combination system) on the floor JAL-3 (General system) where we keep some parameters constant like total fabric weight, batch quantity, marker length, marker width, marker efficiency, the number of plies, number of spreading and defected cut panel number. For this reason we keep marker wastage same for both system.

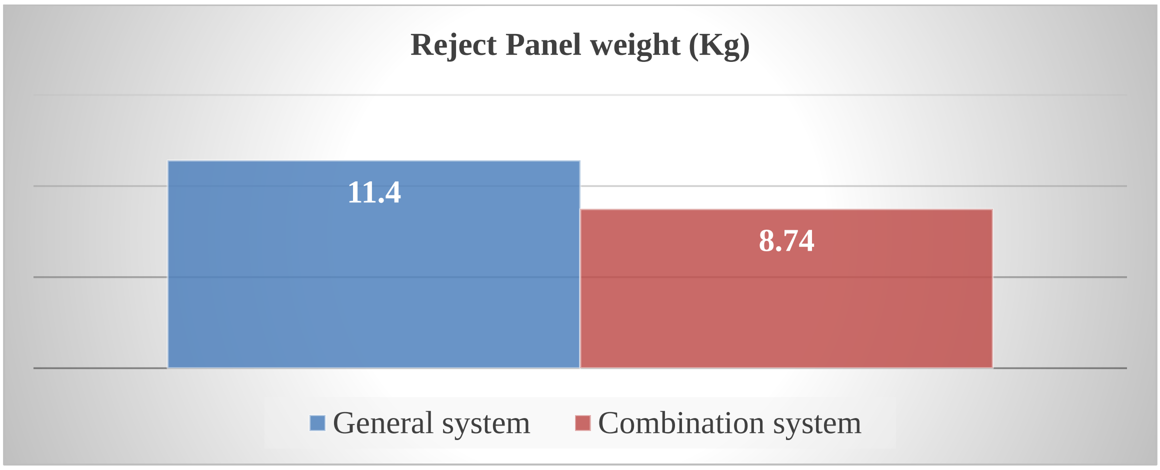


Figure 4.41 Reject panel weight (Kg)

In this graph, X-axis express the same order in general system & in combination system and Y-axis denotes weight in Kg. If we apply the system of floor JFL-2 (Combination system) on the floor JAL-3 (General system) we can see that reject panel weight can be reduced as in combination system some faulty panels can be rectified by grading.

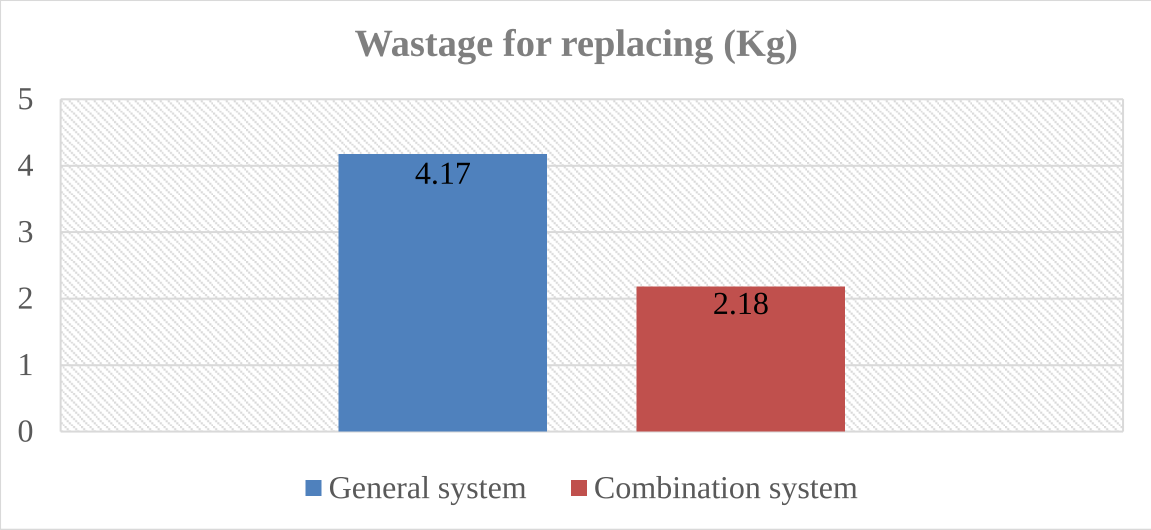


Figure 4.42 Wastage for replacing (Kg)

In this graph X-axis express the same order in general system & in combination system and Y-axis denotes weight in Kg. After application of combination system we can see that wastage % for replacing is higher in General system as in combination system faulty panel replacement includes grading, short marker, and hand scissoring where general system only include hand scissoring.

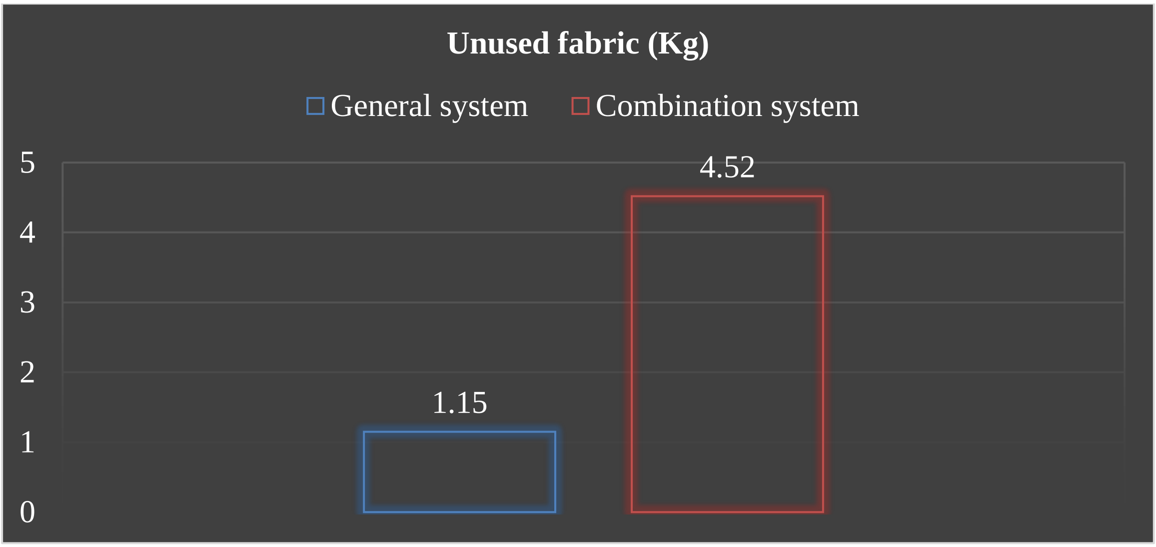


Figure 4.43 Unused fabric (Kg)

In this graph, X-axis express the same order in general system & in combination system and Y-axis denotes weight in Kg. Here in combination system, unused fabric % is higher than general system. In combination system less fabric is required to replace the faulty cut panel because the number of panel is reduced by grading, short marker is used and hand scissoring is done for very small quantity of panels in a systematic way.

Chapter-5

CONCLUSION

5.1 Limitation:

- This project work was carried out in two factories. If the study took place for the same batch, same quantity then the result and findings may not be similar to these findings.
- As the Combination system comprise of more steps, workers need to be trained and efficient.
- Due to the busy schedule of the responsible persons, some necessary data and information could not be obtained.
- This study cannot be applied for more orders due to time constraint and lack of managerial permission and support.

5.2 Conclusion:

The importance of material utilization has long been recognized by the apparel manufacturers. The material usually shares the largest portion of a garments cost. A considerable value of increased profit can be brought by reducing fabric wastage in cutting room. Among different processes in garment manufacturing, losses due to cutting dominate the largest sum of material wastage, as a result, rigorous material control over cutting is substantial and necessary.

5.3 Future Scopes:

This methodology is very effective for minimization of fabric wastage. We conducted this study only for two component garment and for single jersey fabric. If this study carried out for different types of fabric and for three or more component garments, the result and findings will be more precise.

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[1] Mohammad Zillane Patwary(2014) textilestudycenter: Knitting area.23,26-101

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[3] De silva & roger, T.(2018) Knitting fault:a global industry:5th ,ed)New York,432,433.

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