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Research Article

Optimized Process & SMV of Five Pockets Denim Trouser for Higher Productivity

Ahsan Habib* and Kamrul Hassan Bhuiyan

Lecturer, Department of Textile Engineering, Sonargaon University, Dhaka, Bangladesh

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Abstract

This study tries to measure the Standard Minute Value (SMV) of five pockets denim trouser (ladies). Traditional production system of garment manufacturing causes lower productivity, poor line balancing, longer production time, more lead-time ultimately increases the cost of Garment and profit margin becoming lower. This paper will provide an inclusive idea for making a five pockets denim trouser where a best optimization of line balancing, machine requirements, man power allocation, operational sequence of the manufacturing process as well as setting a feasible target for achieving higher efficiency. The data and information of this experiment may directly help to planning department, sewing production department as well as Industrial Engineering department in a RMG Industry for minimizing the product cost and achieving the higher profit margin.

Keywords: *SMV, Five Pockets Denim Trouser, Line Balancing, Efficiency, Operation Bulleting.*

Introduction

Trousers, slacks, or pants (North American English) are an item of clothing that might have originated in Central Asia, worn from the waist to the ankles, covering both legs separately. In most of Europe, trousers have been worn since ancient times and throughout the medieval period, becoming the most common form of lower-body clothing for adult males in the modern world. The five pockets trouser concept comes from the denim pant styling. During 1871 the first denim pant was invented and there were firstly four pockets were added, two at the front, one in the back and a miniature version in the front right pocket, designed to protect a pocket watch. A fifth pocket, on the back, was soon added. As seen the style of denim pant the designers are nowadays making the five pockets trouser. It may be both different fabrication like knitted trouser and woven trouser (denim or non-denim). In this study we have worked with five pockets denim trouser (ladies). The beauty of the denim trousers are endless options, durable, stylish, comfortable, easy to maintain, versatility etc.

Objects of the Study

The main objective of the study is to get better synchronization with man, machine, materials and methods to achieve higher efficiency with a better optimization.

It is also designed to address the following issues:

- Calculation the product SMV (summation of all individual process SMV).
- Determination of line balancing.
- Determination the optimal operational sequence of five pockets denim trouser manufacturing.
- Setting the production target.
- Calculation the efficiency and cross check with before data.
- Determination of man or machine requirements.
- Determination and allocation of man power according every process manufacturing.

Methodology

This experiment has been done based on denim item in a composite mill named Denim Asia Ltd., Bangladesh. Here we have used the Primary Data. There are many types of data like primary, secondary, tertiary etc. As we directly collected the data from main source (sewing floor) thus it is a primary data. How we have conducted the full experiment are following the below steps-

Step 01: We have first observed the regular process of the five pockets denim trouser manufacturing line, such as SMV, daily total production pieces or output, daily line target, observed throughput, individual target of operator, efficiency%, man to machine ratio.

Step 02: We recorded the regular day's data like SMV, total output, efficiency%, man to machine ratio etc before this study.

*Corresponding author Ahsan Habib (ORCID ID: 0000-0002-6053-6320) and Kamrul Hassan Bhuiyan are working as Lecturers
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Step 03: Then we have changed the regular layout and bring some change among the process layout (throughput). We have changed the following areas in the production line layout;

- Eliminated some analog machine by supplanting automatic sewing machine which can execute auto thread cutting and machine speed has more rpm than conventional sewing machine.
- Eliminated some manpower by line balancing properly.
- Divided task accurately among multitask operator and single task operator.
- Made some operator as multi-skilled operator from single machine operator.
- Correct material handling or method improvement.
- Optimum synchronization of every process to another process.
- Motivated operators.
- Maintained the correct ergonomics of operators for retaining their longer physical energy.

Step 04: Then we recorded the each data from newly set-up line after changing. What data we have recorded from the newly set-up sewing line is following items;

- Recorded each operation/ process time (by doing Time Study).
- Made new SMV.
- Bottle neck finding and solved (by using Line Balancing technique).
- Recorded hourly and full day production.
- Recorded hourly and full day efficiency.
- Recorded hourly target and achievement.
- Recorded the capacity.
- Recoded man to machine ratio.
- Recorded pitch time.
- Calculated required number of manpower (operators).

Step 05: Then we have made comparison the new generated data after newly set-up line with the old data before this study.

Step 06: We have compared the data by using table and diagram.

Step 07: Lastly we have drawn a result and conclusion of our study.

For avoiding any mistake we have recorded every data for 3 times. To complete this study we have used several mathematical formulas which are vastly used in sewing production department and industrial engineering department. The formulas are following;

- ✓ SMV (min) = (Basic time) + Allowance of Basic time
- ✓ Pitch Time (min) = Total SMV / Total Manpower
- ✓ Target per hour = (60×Manpower) / SMV; (If 10 hrs then multiply 10 with this formula)
- ✓ Efficiency% per hour= (Total Output×SMV×100) / (Total Manpower×60); (If 10 hrs then multiply 10 with this formula)
- ✓ Line Balancing% = (Pitch time/ Bottle neck process SMV time) × 100
- ✓ Manpower require = (Target×SMV of the required process) / 60

Anatomy of a Five Pockets Denim Trouser

Common parts of five pocket denim trousers are waist band, belt loop, button, fly piece, coin pocket, front pocket, back pocket, jeans rivets or eyelet, crotch point, back yoke, bottom hem, back rise, front rise, side seam, inseam and zipper.

Trouser is usually made of 100% cotton, woven fabric or less common cotton-polyester blended fabric & synthetic fabric.

General Process of Five Pockets Denim Trouser from Fabric Booking to Shipment

1. Preparation of the yarn booking
2. Preparation of the fabric booking
3. Prepare the accessories booking
4. Fabric relaxation
5. Quality check of the finished fabric
6. Fabric cutting
7. Quality check of the cut panel
8. Size numbering
9. Bundling size (shade wise)
10. Size Set & PP Sample
11. Sewing

12. Quality check after completed garments
13. Send to wash
14. Quality check after washed garments
15. Finishing
    a) Button attach
    b) Label attach
    c) Thread cut
    d) Bur-tuck
    e) Quality check
    f) Iron
    g) Quality check
    h) Metal pass
16. Packing
17. Final Inspection by 3rd party
18. Shipment

Operation/ Process Sequence of Five Pockets Denim Trouser Manufacturing

1. Coin pocket rolling with 1/4 top stitch m/c
2. Coin pocket join
3. Seam join with pocketing
4. Front pocket bag & seam overlock
5. Front pocket turn & 1/4 top stitch
6. Front pocket join
7. Front pocket rolling
8. Front pocket opening tack
9. Front rise & single fly attach with body
10. Single fly top stitch & zipper attach
11. Double fly join & two part closing
12. J- Stitch with 1/4 top stitch
13. Front rise closing
14. Back pocket rolling
15. Attach back pocket
16. Join back yoke
17. Join back rise
18. Wash tack & back pocket tuck
19. Join inseam
20. Side seam
21. Side seam safety stitch
22. Label join with poly
23. Side seam top stitch
24. Run stitch
25. Waist band attach with body
26. Mouth close inside
27. Mouth close top side
28. Bartack
29. Bottom hem
30. Loop make
31. Loop attach with body
32. Eyelet hole

Table 1: Operation Bulletin

S/L	Operation	Machine	SMV	100% Capacity	Actual Man Power	Pitch Time	Line Balance %
	Front Part						
1	Seam & pocket position mark and coin pocket rolling	SNCS M/C	0.4	150	1	0.4	100%
2	Coin pocket join with seam-1/4	DNLS M/C	0.43	140	1	0.4	93%
3	Seam join with front	5TOL M/C	0.4	150	1	0.4	100%
4	Front pocket mouth rolling	DNLS M/C	0.46	130	1	0.4	87%
5	Front rise overlock- Single fly and double fly overlock	4TOL M/C	0.45	133	1	0.4	89%
6	Zipper join & single fly top stitch	DNLS M/C	0.47	128	1	0.4	85%
7	J- Stitch (1/4 set)	HI-TECH	0.38	158	1	0.4	105%
8	Double fly join & two part close	SNLS M/C	0.45	133	1	0.4	89%
9	Hi close	DNLS M/C	0.4	150	1	0.4	100%
10	Label join and poly	SNLS M/C	0.4	150	1	0.4	100%
	SMV of Front Part Section		**4.24**		**10**		
	Back Part						
11	Back part mark for pleat (ticken) and back dirt make	SNLS M/C	0.45	133	1	0.4	89%
12	Back dirt top stitch	SNLS M/C	0.35	171	1	0.4	114%
13	Back pocket rolling and back yoke mark	HI-TECH	0.44	136	1	0.4	91%
14	Attach back pocket and belt mark	HI-TECH	0.42	143	1	0.4	95%
15	Attach back yoke	5TOL M/C	0.47	128	1	0.4	85%
16	Top stitch on back yoke	FOA	0.4	150	1	0.4	100%
17	Attach back rise	5TOL M/C	0.35	171	1	0.4	114%
18	Top stitch on back rise	FOA	0.35	171	1	0.4	114%
	SMV of Back Part Section		**3.23**		**8**		

	Assemble						
19	Front & back part matching and front rise position fusing	Iron Machine	0.47	128	1	0.4	85%
20	Belt tuck	SNLS M/C	0.25	240	1	0.4	160%
21	Join inseam overlock	5TOL M/C	0.4	150	1	0.4	100%
22	Top stitch on inseam	FOA	0.4	150	1	0.4	100%
23	Join side seam	5TOL M/C	0.5	120	1	0.4	80%
24	Side safety stitch and Waist band mouth cutting and open	SNLS M/C	0.35	171	1	0.4	114%
25	Waist shearing	3TOL M/C	0.33	182	1	0.4	121%
26	Attach waist band to body	KANSAI M/C	0.4	150	1	0.4	100%
27	Mouth close inside (Top position mark)	SNLS M/C	0.4	150	1	0.4	100%
28	Mouth close top side	SNLS M/C	0.38	158	1	0.4	105%
29	Bartack (8 Point)	BT M/C	0.36	167	1	0.4	111%
30	Bottom hem	SNLS M/C	0.33	182	1	0.4	121%
31	Loop make and final thread cutting	FL M/C	0.36	167	1	0.4	111%
32	Loop attach to body and Eyelet hole	HI-TECH, Eyelet	0.4	150	1	0.4	100%
	SMV of Assemble Section		**5.33**		**14**		
	Total SMV and Manpower		**12.8**		**32**		

Table 2: No. of Machine and Man

M/C Name (Short)	M/C Name (Full)	No. of M/C	No. of Manpower
SNCS	Single Needle Chain Stitch	1	1
DNLS	Double Needle Lock Stitch	4	4
5TOL	5 Thread O/L	5	5
4TOL	4 Thread O/L	1	1
3TOL	3 Thread O/L	1	1
HT	High Tech	4	3
SNLS	Single Needle Lock Stitch	9	9
FOA	Feed of the Arm	3	3
Kansai	Kansai	1	1
BT	Bartack	1	1
FL	Flatlock	1	1
Eyelet	Eyelet	1	1
Iron	Iron Machine	1	1
Total		**33**	**32**

Comparison between Newly Generated Data with Old Data

In this section it is explicitly showed the best comparison of the newly data (after changing layout) with old data (before changing layout).

Before comparing the data, first see the process where we have minimized as well as optimized by this study;

- Eliminated 2 analog machines by supplanting automatic sewing.
- Eliminated 1 operator, 6 helpers and 1 iron man by line balancing properly.
  - ✓ Eyelet hole (eliminating operator)
  - ✓ Back part mark for pleat (eliminating helper)
  - ✓ Back yoke mark (eliminating helper)
  - ✓ Belt mark (eliminating helper)
  - ✓ Match front and back part (eliminating helper)
  - ✓ Waist band mouth cutting and open (eliminating helper)
  - ✓ Front rise position fusing (eliminating iron man)

- Divided task accurately among multitask operator and single task operator.
  - ✓ Here we have given the task to the operator after proper line balancing where we have eliminated the helper and iron man.

- Made some operator as multi-skilled operator from single machine operator
  - ✓ We have made some operator as multi-skilled operator. 2 chain stitch sewing machine operator whom were trained and made for also overlock machine operator. This was done for proper line balancing.

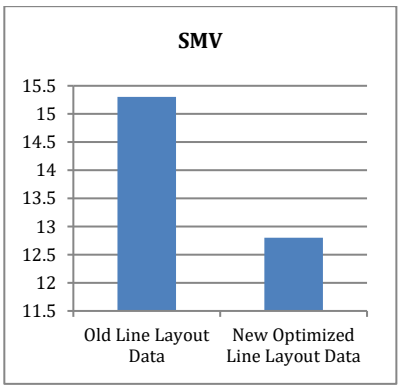
- By correct material handling or method improvement
  - ✓ Here we showed to operator the minimum material movement thus less time required for

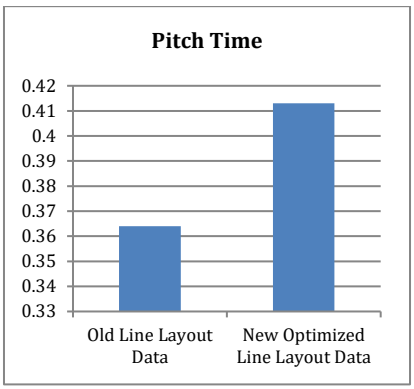
completing operation. It helps to minimize the total SMV time.

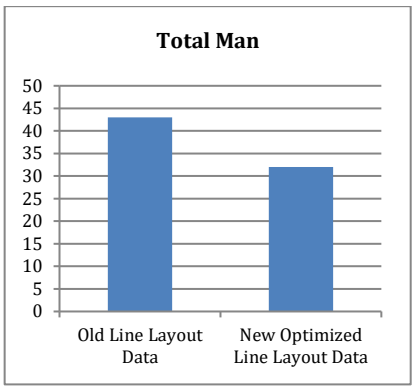
- Optimized synchronization of every process to another process
  - ✓ Changed some operational sequence which helped for better material movement and taken lesser time. Thus SMS time has been minimized.
- Line has been balanced on 80%.
- Motivated operators
  - ✓ It helped to get positive mindset from all related personnel especially operator. Ultimately productivity has improved.
- Maintained the ergonomics for operators for keeping their longer physical energy.
  - ✓ It helped to get a better long lasting productivity Thus hourly output touched higher.

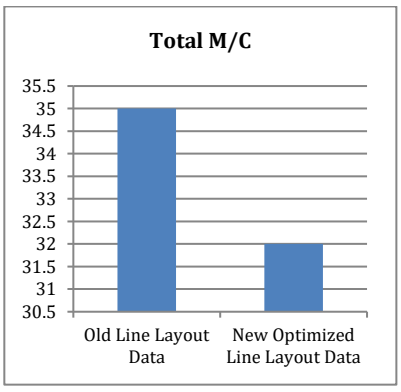
Table 3: Comparison Data Table

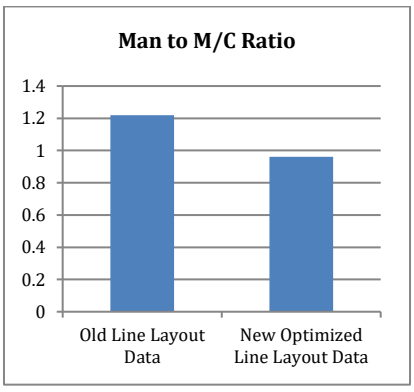
	1	2	3	4	5	6	7	8	9	10
	SMV (min)	Pitch Time (min)	Total Man	Total M/C	Man to M/C Ratio	Target (75%) per hr	Target (75%) for daily (10 hrs)	Hourly output (Avg of 10 hrs daily)	Daily total output (Total 10 hrs)	Eff% (10 hrs daily
Old Line Layout Data	15.3	0.364	43	35	1.22	103 Pcs	1029 Pcs	95 Pcs	950 Pcs	56.34%
New Optimized Line Layout Data	12.8	0.413	32	32	0.96	113 Pcs	1125 Pcs	102 Pcs	1020 Pcs	68.00%

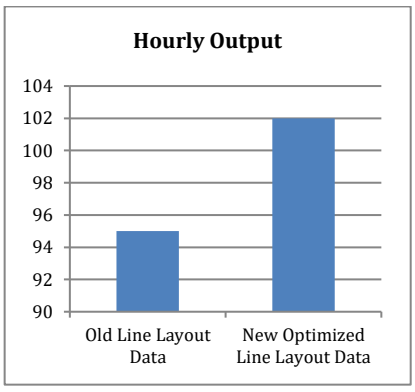


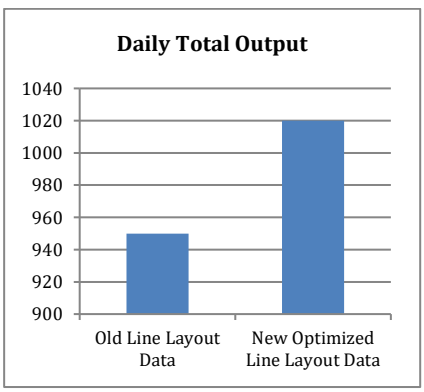


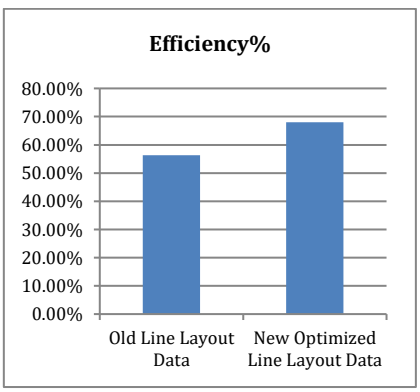












Result and Discussion

From the above SMV table, comparison table and visual column chart we can see the optimized SMV which can be a standard for manufacturing five pockets denim trouser. Regular or conventional line layout may be the defiant of higher productivity which we showed in the comparison table. Conventional line was giving 950 Pcs output where a newly optimized line providing 1020 Pcs output daily. The most important factor is efficiency also. We found that here the bigger difference where conventional line efficiency was 56.34% and newly optimized line carrying a 68% efficiency%. The more efficiency means the utilizing the less 3M (man, machine, material) but getting the more output means the minimization of cost. We can see that using minimum (lower) manpower in the optimized layout than regular line layout, there are less SMV time, more balanced line, more output and more efficiency. Ultimately it brings a larger profit margin in the company.

Conclusion

An optimized SMV and process is a positive driven for maximum output of any product. RMG sector in Bangladesh is nowadays passing very competitive eon. Many industries are now following cutting edge technology for minimizing cost and maximizing profit. Though we have tried our best exertion for the optimization of five pockets denim trouser, the above data and information obviously lead a cutting edge production and help to achieve customer satisfaction as well as the organizational goal.

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