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Influence of ring traveller number and their appropriate selection for the different count in compact card hosiery yarn process

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Abstract: Traveller is a small portion among all the parts of ring frame machine but significant part in ring frame in a short staple spinning mill. Traveller has a great impact on yarn quality parameters specially hairiness. The traveller imparts twist to the yarn and enables winding of the yarn on the cop. Yarn quality varies due to different traveller number. Several investigations have been carried out on the influence of the ring traveller of Bracker brand. In some studies, it was observed that yarn properties(U%, CVm%, hariness%, IPI and end breakage) decreased as the weight of the traveller increased, whereas in some others it was stated that as the traveller weight is decreased as yarn properties increased. Therefore, specific number of traveller should be used for a particular count of yarn. And it is important for the technologist to understand this and act on them to optimised the yarn production and quality.

Keywords: Traveller, Uster Evenness tester 5, HVI, AFIS, compact card hosiery yarn, Yarn properties.

I. Introduction

The textile industry makes available job opportunities to millions (or even more) of people and this contributes to the manufacturing world. However, it is considered as the old style industry [1]. For apparel production, ring spinning system is well-thought-out as the leading spinning system [2]. The reasons behind the domination of ring spinning system over other spinning systems are due to the fact that it is a flexible spinning system. Additionally, it has a range of fibre types and can be spun yarn at the finer end of the usable count range. The most significant feature is seen in the structure and properties of the yarn [3]. The development of new spinning systems alternative to ring spinning system had been completed within late sixties and early seventies for the course and medium count range, high production, elimination of winding and roving, and familiarizing autoamtion [4]. Hairiness properties of ring spun yarn require a certain amount of fibres protruding from the main body [5]. One of the reasons for excessive hairiness in the yarn is as a result of an improper profile of traveller [6]. " Traveller is a wire clip (made from good tempered steel) which fits loosely on the flange and races on its circular path by the yarn pull to introduce twists in to strand of fibres emerging from the front roller nip" [7]. It is used as a guide of the yarn and was invented in the USA by Messrs [8]. The choice of the weight of the traveller is completed to control the winding tension which may make the lower ballon tension at the other side of the traveller. Ballon tension becomes less than half of the winding tension due to the yarn traveller friction. The rise of the spinning tension between the lappet and the front roller nip depends on the ballon tension [8]. It does not have its own motion, and it is dragged along behind the spindle. The difference in speed between spindle and traveller helps to wind. The reason for the formation of large contact pressure (up to 35 N/mm²) between the ring and traveller in the period of winding is a centrifugal force. Strong frictional forces are induced by this pressure which causes generation of heat.The lightweight traveller cannot dissipate the generated heat quickly. Thus, this results in the limitation of the operating speed of traveller. The following shapes are in use in the short-staple spinning mills: (1) C-traveller (2) Flat or oval traveller (3)Elliptical traveller (4) N-traveller [9]. Usually, C-traveller is used in short-staple spinning. C-traveller and Bracker brand were used in this work.

II. Materials and Method

The fiber selected for this paper was Benin for the production of yarn. Properties of fibers were tested by using the High Volume Instrument (HVI) and Advanced Fibre Information System (AFIS). HVI and AFIS machines play a vital role in quality confirmation in a spinning mill. Without these machines, full quality work of a spinning industry will be incomplete. Before testing, fibres were conditioned. This was done to test the atmospheric condition. The test results of the two machines are provided below.

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Table 1: Fibres properties

HVI		AFIS	
Properties	Values	Properties	Values
SCI	130	Nep (Cnt/g)	232
Moisture (%)	7.5	Mean size (um)	700
Mic	4.34	SCN (Cnt/g)	24
Maturity ratio	.87	SCN (um)	1003
UHML (mm)	28.93	SFC (%)	6.5
UI (%)	82.7	UQL (W)[mm]	31
SFI (%)	9.5	L(N) [mm]	21.2
Strength (GPT)	30.2	Fineness (mtex)	145
Elongation (%)	5.3	IFC (%)	7.3

In this study 20/1 Ne, 26/1 Ne, 30/1 Ne and 36/1 Ne compact carded hosiery yarn were made from roving of hank 0.78 with six types Bracker traveller. Specific ring frame was selected and then any specific 10 spindles of that frame were selected. Moreover, all samples are produced with some parameters such as Break draft, Total draft, Spindle speed, TPI, Traveller number, etc. in four counts. Major parameters of ring frame are given in below.

Table 2: For 20/1 Ne compact yarn

Traveller no.	2	1	1/0
Break draft	1.25	1.25	1.25
Total draft	26.92	26.92	26.92
Spindle speed(rpm)	15000	15000	15000
TPI	16.16	16.16	16.16

Table 3: For 26/1 Ne compact yarn

Traveller no	2	1	1/0
Break draft	1.25	1.25	1.25
Total draft	35.0	35.0	35.0
Spindle speed(rpm)	15000	15000	15000
TPI	18.32	18.32	18.32

Table 4: For 30/1 Ne compact yarn

Traveller No	1/0	2/0	3/0
Break draft	1.25	1.25	1.25
Total draft	40.38	40.38	40.38
Spindle speed(rpm)	16000	16000	16000
TPI	19.09	19.09	19.09

Table 4: For 36/1 Ne compact yarn

Traveller no.	2/0	3/0	4/0
Break draft	1.25	1.25	1.25
Total draft	53.84	53.84	53.84
Spindle speed(rpm)	16000	16000	16000
TPI	23.68	23.68	23.68

After the collection of the sample from the ring frame, it was conditioned to test all the parameters of yarn. Unevenness percentage (U%), CVm%, hairiness (H), Standard deviation of hairiness (sh), thin (-50%)/km, thick (+50%)/km, neps (+200%)/km, were tested by Uster Tester-5. Imperfection index of yarn (IPI) was calculated and end breakage rate (EBR) per 1000 spindle-hr aslo studied in each cases. Due to both lighter and heavier traveller end breakage rate vary and quality of yarn decrease by increasing the EBR. Then the test results were analyzed for identifying suitable traveller number for above mentioned counts.

Comparative Chart of traveller weights [10]**.**

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Table: 5

	Travel. No.	R+F ISO-Nr	Bracker ISO-Nr.	Carter ISO-Nr	Kanai ISO-Nr
Lighter	**15/0**	**14**	**15**	**22.7**	**16.6**
	14/0	**15**	**16**	**24.3**	**18.3**
▲	**13/0**	**16**	**17**	**26**	**20**
	12/0	**18**	**18**	**27.5**	**21.6**
	11/0	**19**	**20**	**29**	**23.4**
	10/0	**20**	**22.4**	**31**	**25**
	9/0	**22.4**	**23.6**	**32**	**26.8**
	8/0	**23.6**	**25**	**34**	**28.5**
	7/0	**26.5**	**28**	**36**	**30.2**
	6/0	**30**	**31.5**	**39**	**32.2**
	5/0	**31.5**	**35.5**	**42**	**35.1**
	4/0	**35.5**	**40**	**45**	**38.3**
	3/0	**40**	**45**	**49**	**42.2**
	2/0	**45**	**50**	**52**	**48.3**
	1/0	**50**	**56**	**58**	**54.6**
	1	**60**	**63**	**65**	**62.2**
	2	**71**	**71**	**71**	**73.6**
	3	**80**	**80**	**78**	**81**
	4	**85**	**90**	**84**	**87.7**
	5	**95**	**95**	**91**	**95.3**
	6	**106**	**100**	**104**	**108.8**
	7	**112**	**112**	**117**	**121.8**
	8	**125**	**125**	**130**	**135.9**
	9	**140**	**140**	**149**	**154.4**
	10	**160**	**160**	**168**	**174.8**
	11	**180**	**180**	**194**	**199**
	12	**200**	**200**	**214**	**219.8**
▼	**13**	**224**	**224**	**233**	**237.8**
	14	**236**	**250**	**253**	**258.7**
Heavier					

*Weight series of the most important types (ISO No. = traveller weight in mg)

III. Result and Discussion

Count and traveller number wise Uster test report and end breakage rate per 1000 spindle-hr for 20/1 Ne compact carded hosiery yarn is given in below.

Table: 4

Traveller No.	U %	CVm %	Thin (-50%)/ km	Thick (+50%)/ km	Neps (+200%)/ km	IPI	Hairiness	sh	EBR/ 1000 Spindle-hr
2	9.24	11.72	0.0	23.8	77.3	101.1	6.14	1.21	127
1	9.53	11.91	0.5	29.6	83.5	113.6	6.45	1.34	145
1/0	10.2	12.75	1.0	42.7	99.5	143.2	6.65	1.52	163

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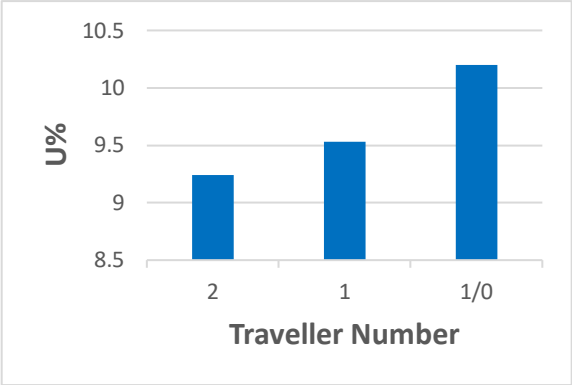

Figure 1: Traveller number Vs Unevenness %

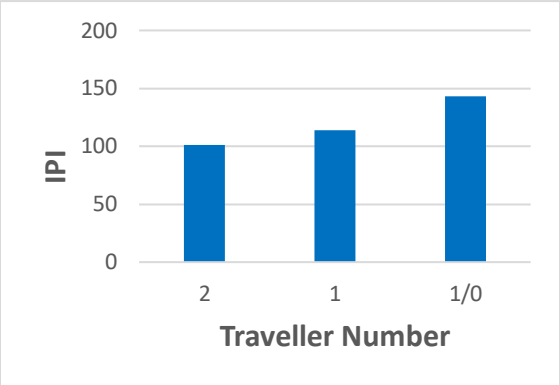

Figure 2 : Traveller number Vs IPI

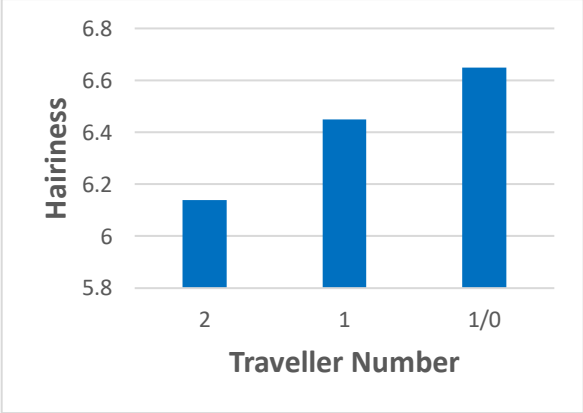

Figure 3: Traveller number Vs Hairiness

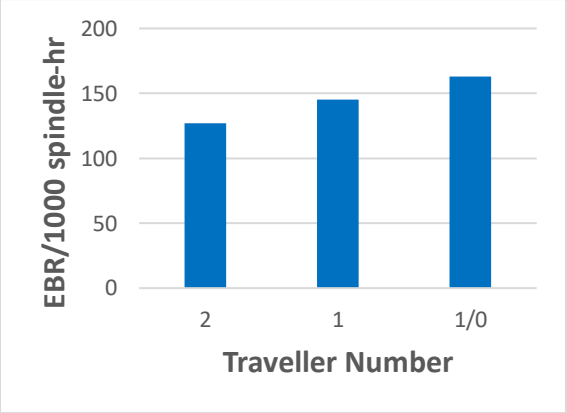

Figure 4: Traveller no. Vs EBR/1000 spindle-hr

From figure 1 to 4 show that U%, IPI, hairiness and end breakage are the lowest for traveller number 2. In this traveller number, the above four quality parameters result is the best. So it can be concluded that in case of 20/1 Ne compact carded hosiery yarn, traveller number 2 is suitable.

Count and traveller number wise Uster test report and end breakage rate per 1000 spindle-hr for 26/1 Ne compact carded hosiery yarn is given in below:

Table: 5

Traveller No.	U %	CVm %	Thin (-50%)/ km	Thick (+50%)/ km	Neps (+200%)/ km	IPI	Hairiness	sh	EBR/ 1000 Spindle-hr
2	10.57	13.21	1.5	78.7	155.3	235.5	5.65	1.43	114.6
1	10.26	12.82	0.8	65.2	117.6	183.6	5.43	1.25	99.72
1/0	10.11	12.88	0.3	51.7	102.3	154.3	5.28	1.13	86.48

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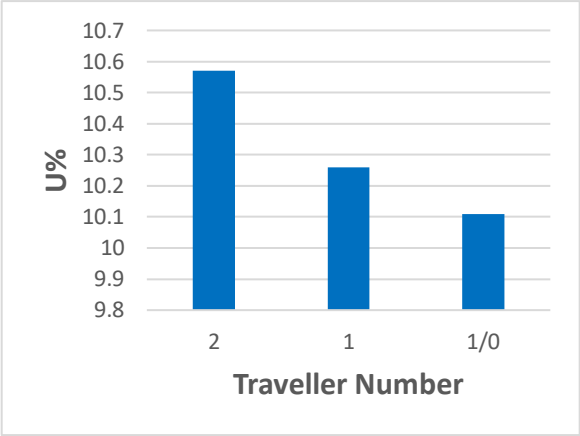

Figure 5: Traveller number Vs Unevenness %

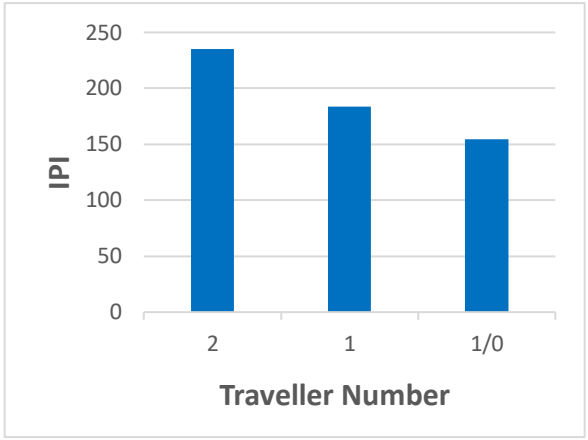

Figure 6: Traveller number Vs IPI

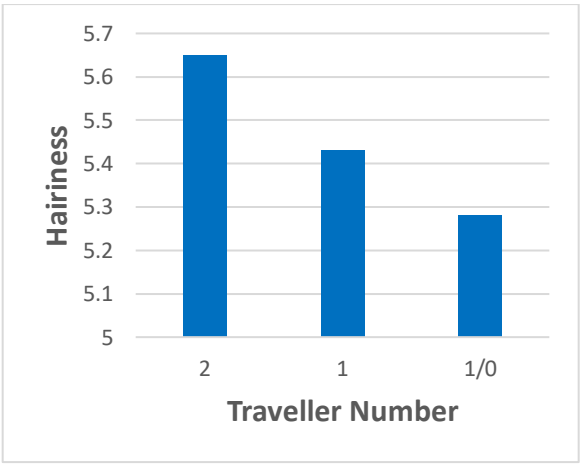

Figure 7: Traveller number Vs Hairiness

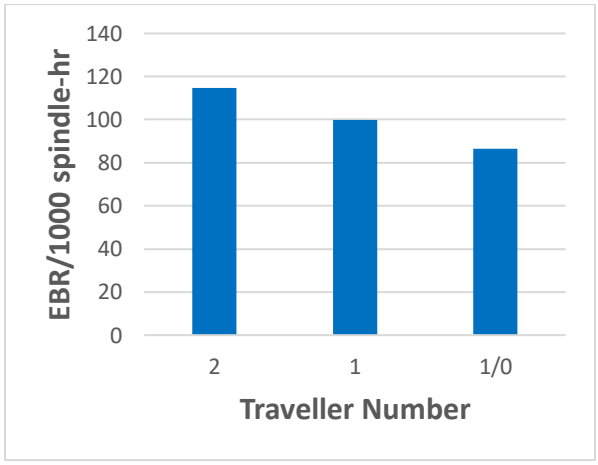

Figure 8: Traveller no. Vs EBR/1000 spindle-hr

The figure 5 to 8 demonstrate that U%, IPI, hairiness and end breakage rate are the lowest for traveller number 1/0. With respect to above four quality parameters the best result is in this traveller number. So it can be concluded that in case of 26/1 Ne compact card hosiery yarn, traveller number 1/0 is appropriate.

Count and traveller number wise Uster test report and end breakage rate per 1000 spindle-hr for 30/1 Ne compact hosiery yarn is given below:

Traveller No.	U %	CVm %	Thin (-50%)/ km	Thick (+50%)/ km	Neps (+200%)/ km	IPI	Hairiness	sh	EBR/ 1000 Spindle-hr
1/0	10.84	13.55	1.5	123.1	197.6	322.2	5.61	1.58	87.31
2/0	10.69	13.36	1.0	108.6	177.2	286.8	5.48	1.39	73.25
3/0	10.49	13.38	0.0	91.8	168.5	260.3	5.39	1.20	62.54

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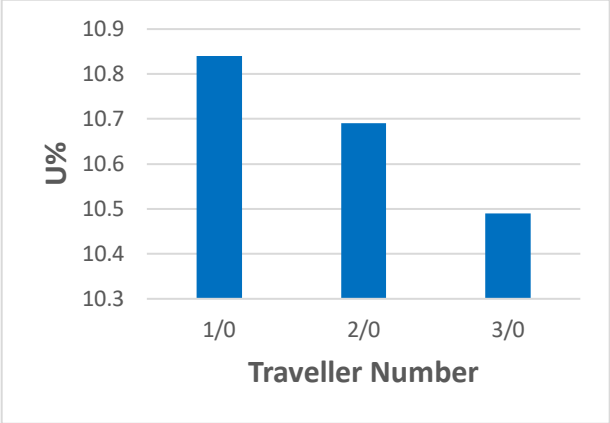

Figure 9: Traveller number Vs Unevenness %

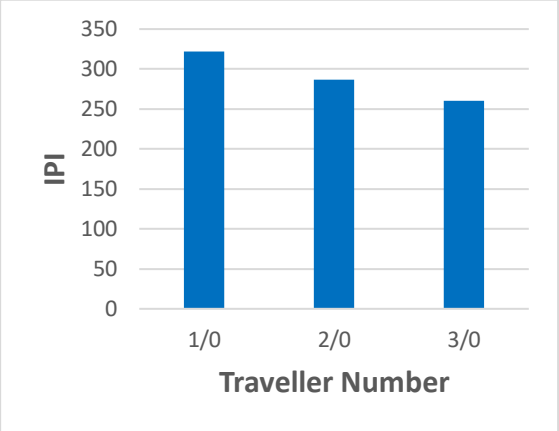

Figure 10: Traveller number Vs IPI

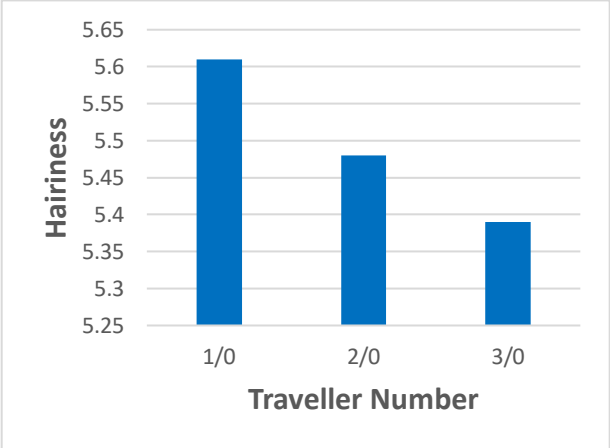

Figure 11: Traveller number Vs Hairiness

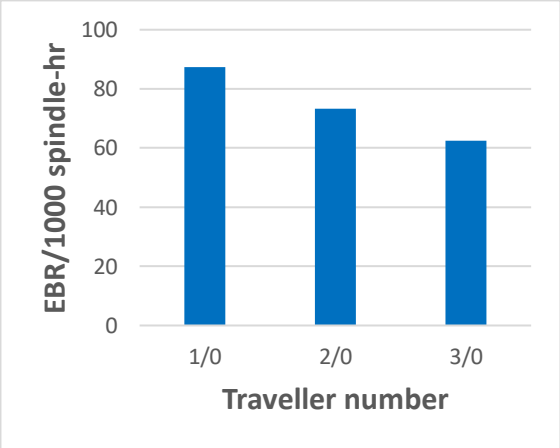

Figure 12: Traveller no. Vs EBR/1000 spindle-hr

Figure 9 to 12 show that U%, IPI, hairiness and end breakage rate are the smallest for traveller number 3/0. According to above four quality parameters the best result is in this traveller number. So it can be said that in case of 30/1 Ne compact card hosiery yarn, traveller number 3/0 is suitable.

Count and traveller number wise Uster test report and end breakage rate per 1000 spindle-hr for 36/1 Ne compact card hosiery yarn is given below:

Traveller No.	U %	CVm %	Thin (-50%)/ km	Thick (+50%)/ km	Neps (+200%)/ km	IPI	Hairiness	sh	EBR/ 1000 Spindle-hr
2/0	11.74	14.68	2.5	241.1	677.6	921.2	5.31	1.47	86.5
3/0	11.45	14.31	1.5	224.0	645.5	871.0	5.10	1.26	71.4
4/0	11.33	14.16	1.0	201.8	626.3	829.1	4.95	1.15	53.4

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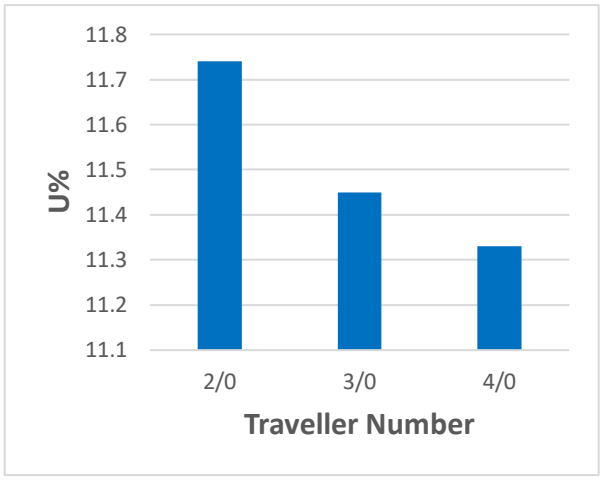

Figure 13: Traveller number Vs Unevenness%

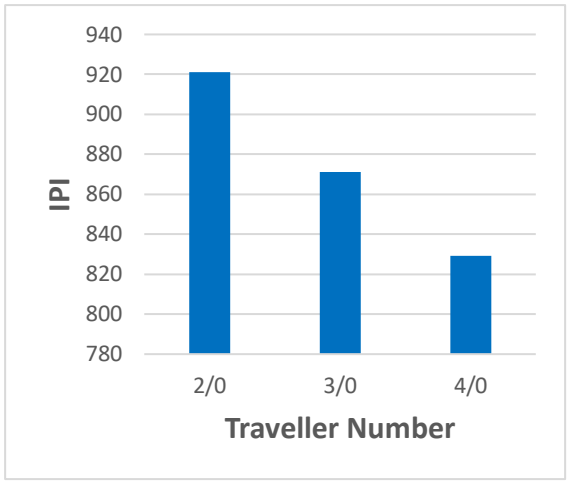

Figure 14: Traveller number Vs IPI

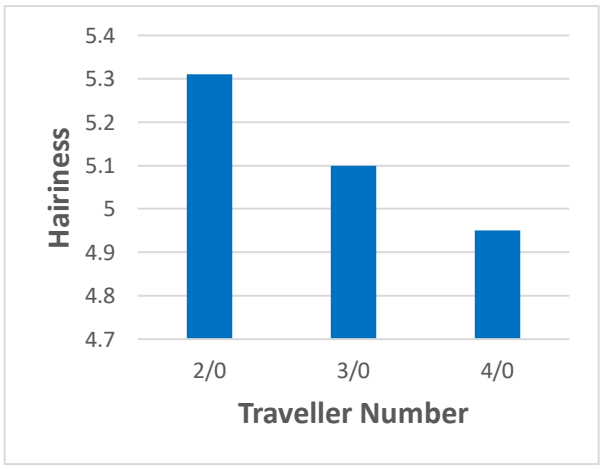

Figure 15: Traveller number Vs Hairiness

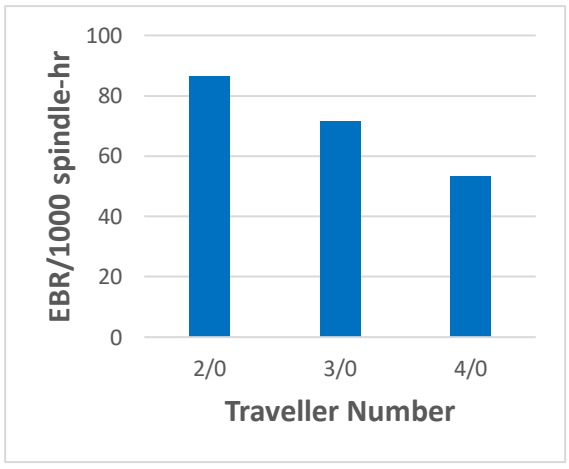

Figure 16: Traveller no. Vs EBR/1000 spindle-hr

Figure 13 to 16 exhibits that U%, IPI, hairiness and end breakage rate are the lowest for traveller number 4/0. Regarding to above four quality parameters the best result is in this traveller number. So it can be concluded that in case of 36/1 Ne compact card hosiery yarn, traveller number 4/0 is appropriate.

IV. Conclusion

From this study, it is shown that the traveller number 2 is suitable for 20/1 Ne, traveller number 1/0 is suitable for 26/1 Ne, traveller number 3/0 is suitable for 30/1 Ne and traveller number 4/0 is suitable for 36/1 Ne compact card hosiery yarn. Because of the result of unevenness percentage, imperfection index, hairiness and end breakage rate per 1000 spindle-hr, it is clearly seen that above number of travellers suitable for specific four different counts of yarn. A spinning mill that is using the traveller of Bracker brand and looking for good quality yarn should try to use above traveller number for above mentioned count of yarn. Moreover, it is also shown that traveller weight is vice versa of number of count. That means for high number of yarn count light traveller should use and for low number of yarn heavy traveller should use.

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