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warp knotting operation and  
improve the quality of warp  
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# **To reduce the downtime during warp knotting operation and improve the quality of warp knotting process**

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## **Abstract**

This project work mainly focuses on the reduction of down time during warp knotting process. Warp knotting is the process of tying the warp sheets at the time of beam change. The time required for warp knotting operation should not be more as it affects the efficiency of loom shed. Parameters affecting the warp knotting process and lead to increase in the down time are taken under trials. Project study is conducted in terry weaving loom shed where reduction of down time in pile warp and ground warp beam knotting operations gives significant increase in loom shed efficiency.

Trials are conducted on work practices carried out during knotting operation such as sheet cutting, clamping and dressing etc. availability of raw material i.e. warp beam, knotting instrument and man power. Trial results shows reduction of about 15 min in pile warp knotting operation and about 14 min in ground warp knotting operation. Along with it also improves the quality of warp knotting process and gives the minimum end breaks which may occurs due to crossing of ends, double end knotting, bad knotting etc.

Hence this project work helps to reduce down time of warp knotting process, to improve the quality of knotting and ultimately increases the loom shed efficiency.

## **Introduction**

This project is mainly revolves around the process of knotting in the loom shed which is primary process to run the loom satisfactorily. Better quality of knotting ensures the better performance of loom with respect to minimum end breakages which leads to cause improvement in efficiency. Warp knotting is the process of tying the warp sheets at the time of beam change. For tying of two warp sheets it takes some time and affect on loss of loom efficiency so that this time should be optimum.

The automatic knotting machines can process a wide range of yarn types and counts at highly reliable and rapid operating conditions (up to 600 knots/minute), with mechanical or electronic control on double knots and on the sequence of warp patterns in case of multi-coloured warps. The devices bearing the threads of the old warps are taken from the weaving

machine and the knotting can be started in the preparation room under better conditions, leaving the weaving machine free for rapid cleaning and maintenance operations.

### **Quality of knot:**

1. Strength of the knot should be enough sufficient that it should withstand the stresses and strain during weaving and it should not be slipped.
2. The size of the knot should be as minimum as possible since that it should pass through the heald eyes, reed dents.
3. The tail length of knot should be less about 1-2mm hence that it should not cause entanglement with another end.

By improving quality in terms of reducing cross end, double end it reduce the fault occurred due to this problems and improving the quality of warp knotting as well as warp knotting to the single end means there is no double end warp knotting and hence it reduces the time during warp knotting when this double end fault corrected.

### **Introduction to knotting:**

The ends of the old warp beam are cut and the ends of the new warp beam are tied to the corresponding ends of the old beam which is called warp knotting process. Then the warp ends are pulled through the heald eyes and reed until the knots are cleared.

There are two types of warp knotting operations.

1. Manually warp knotting
2. Automatic warp knotting

#### **1. Manually warp knotting**

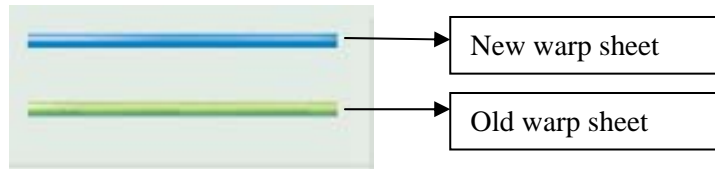
These warp knotting where used before the introduction of automatic warp knotting processes. In manual warp knotting more number of workers were required as compare to automatic. In case manual knotting the tie use made by hand, So that it contains so much time and also quality of knot varies from worker to worker in term of size of knot, length of the tail end.

#### **2. Automatically warp knotting**

Automatic warp knotting is reducing the down time in knotting operation. In this process are use automatic knotting machine, so that this process are improve the quality of knot, less worker requirement etc.

Warp knotting operation generally used in the following four manners

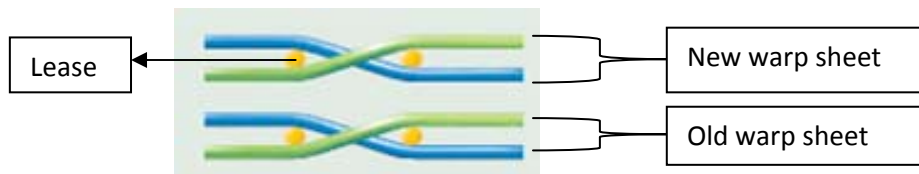
1. Sheet to sheet warp knotting operation  
Sheet to sheet warp knotting operation is same count and same qualities are running in loom are mainly use this warp knotting operation.



**Fig-1 show sheet to sheet warp knotting**

2. lease to lease warp knotting operation

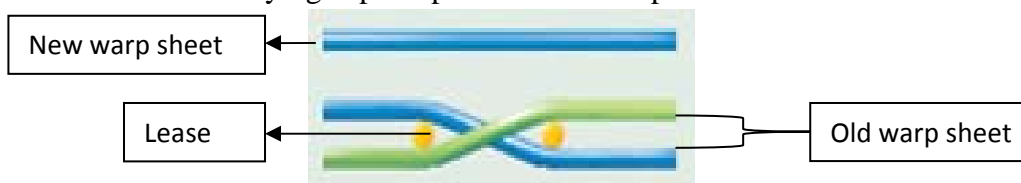
Lease to lease warp knotting operation is mainly use same colour pattern are tying operation. It avoided the cross end in colour pattern warp sheet.



**Fig-2 show lease to lease warp knotting**

3. Sheet to lease warp knotting operation

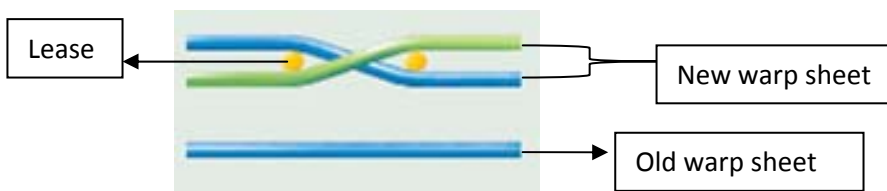
Sheet to lease warp knotting is mainly use in same number of end in two qualities. There for tying is plain pattern to colour pattern.



**Fig -3 show sheet to lease warp knotting**

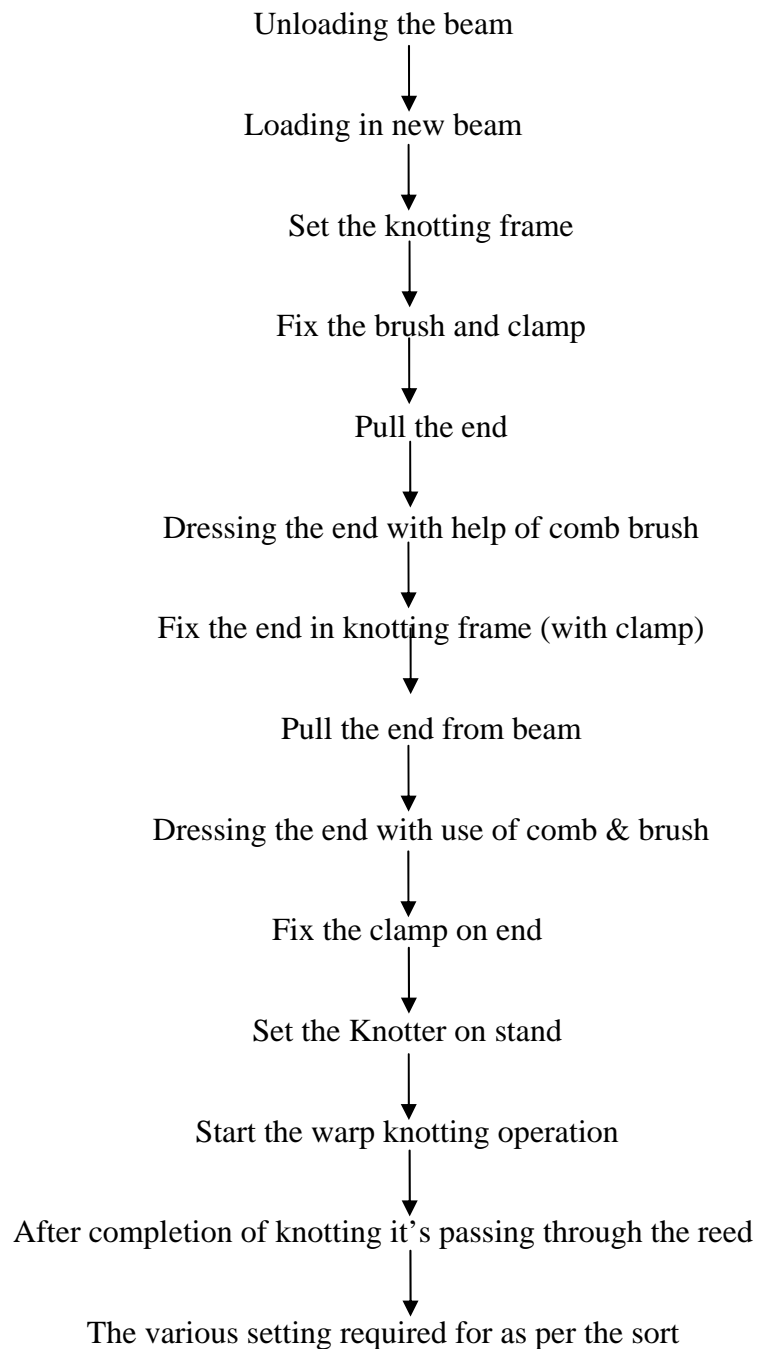
4. Lease to sheet warp knotting operation

Sheet to lease warp knotting is mainly use in same number of end in tow quality. There for tying is colour pattern to plain pattern.



**Fig -4 lease to sheet warp knotting**

## Knotting process flow chart



## Knotting Activities

### 1. Beam unloading & Loading –

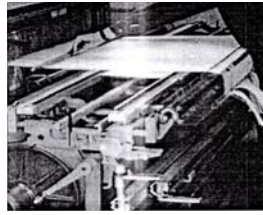
The unload exhausted warp beam in loom and cleaning, oiling of loom. There for load the new warp beam in loom.

### 2. Frame loading

After loading the new warp beam are loading the warp knotting frame in parallel to loom.

### **3. Dressing of warp sheet**

After frame loading the dressing of the beam should be done properly to avoid cross end in new & old warp sheet.



**Dressing of warp sheet**

To minimize the incidence of cross end on the beam during weaving, the end presented for drawing-in or warp tying should be made to be parallel and in their respective positions as in the beam. Proper dressing of end is, therefore of great importance. The task of dressing can be made easy and the end maintained in parallel position by pasting a gum tape across the width of weaver beam, which is about to be doffed from the size machine. The tape should be put a few inches above the line of cutting the end.

### **4. Knotting of warp sheet**

After completion of dressing of warp sheet process are tying the new warp sheet and old warp sheet. The tying of warp sheet is end to end tied. (Show fig 6)



**Tying Process**

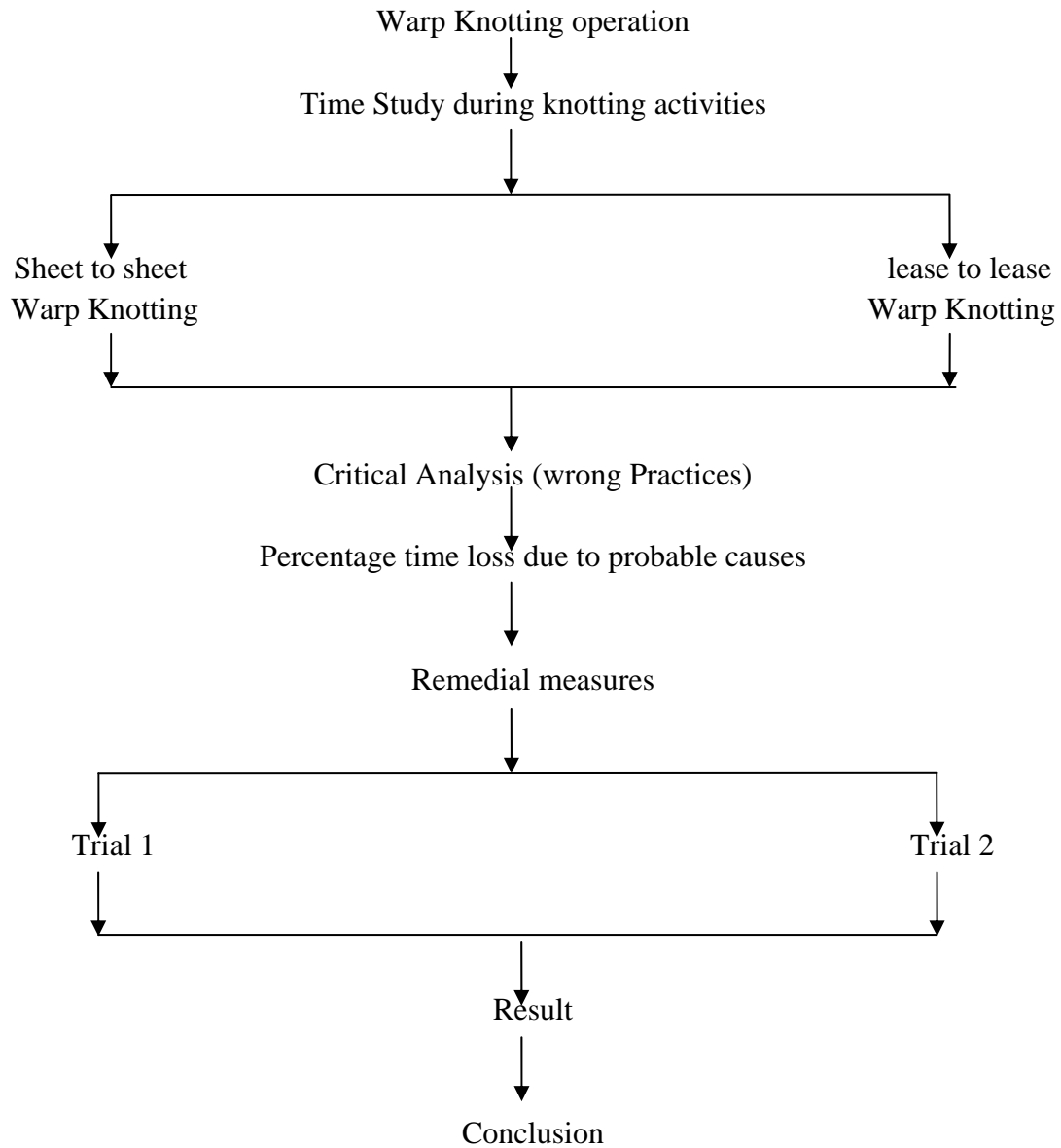
### **5. Frame unloading**

After completion of warp knotting process are removing the tension plate in warp knotting frame, knotting machine and knotting frame.

### **6. Knotting passing**

After compilation of frame unloading the next process is passing the knot in drop-pin, heald wire and reed for manually running for loom.

## PLAN OF WORK

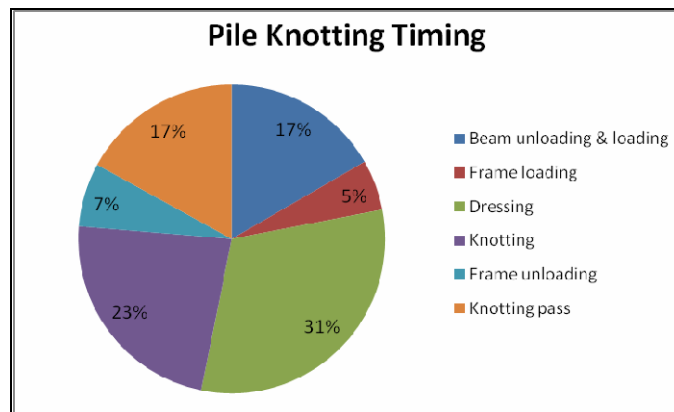


## EXPERIMENTAL WORK

Before Trial average timing in warp knotting operation

1. Pile warp knotting operation

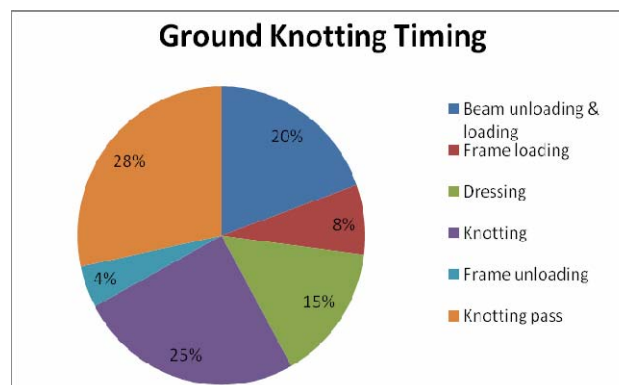
The conducted number of 8 studies in pile warps knotting operation, so that this is average timing trend in pile warp knotting activity.



N0.	Activity	Timing
1	Beam unloading & loading	10.4min
2	Frame loading	3.3min
3	Dressing	19.5min
4	Knotting	14.4min
5	Frame unloading	4.2min
6	Knotting pass	11 min
	Total	63.2min

## 2. Ground warp knotting operation

The conducted numbers of 8 studies in ground warp knotting operation, so that this is average timing trend in ground warp knotting activity.





N0.	Activity	Timing
1	Beam unloading & loading	13.3min
2	Frame loading	5.2min
3	Dressing	10.1min
4	Knotting	17.2min
5	Frame unloading	3.1min
6	Knotting pass	19.3min
	Total	68.2min

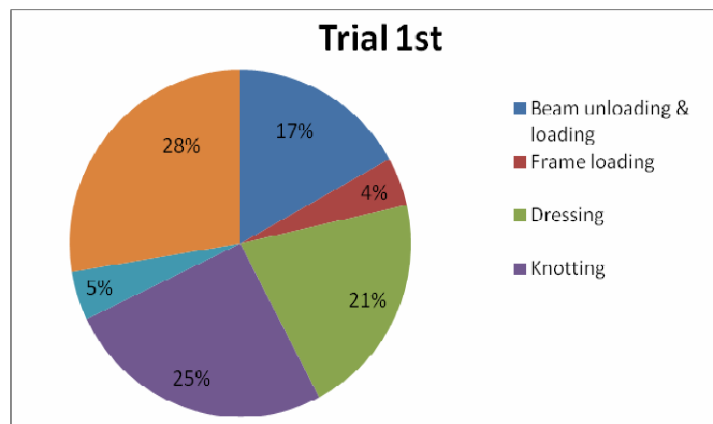
### Details of trials

#### 1. Pile knotting

##### A. Availability of instrument and raw material:-

By proper availability of knotting instrument at its required place, by this way there will be a less time consume for knotting instrument in knotting time hence there will be a reduction of knotting time.

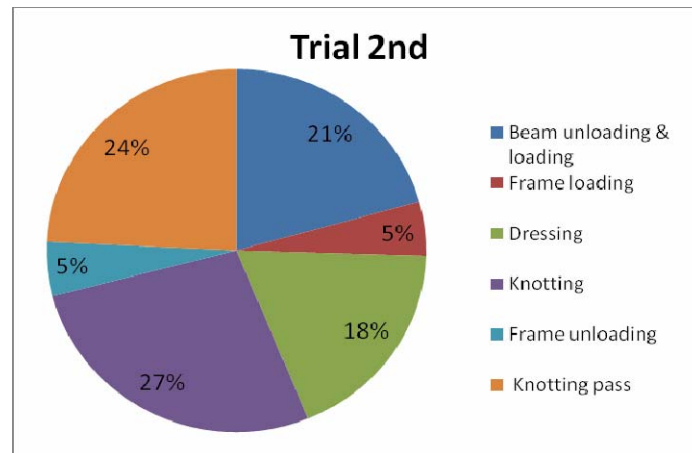
- a) Raw material
  - I. Beam – Pile
- b) Knotting instrument
  - I. Frame
  - II. Knotting machine
- c) Man utilization
  - I. Knotter
  - II. Beam loader



No.	Activity	Before Time	After Time
1	Beam unloading & loading	10.4min	8.07min
2	Frame loading	3.3min	2.17min
3	Dressing	19.5min	10.01min
4	Knotting	14.4min	12.17min
5	Frame unloading	4.2min	2.18min
6	Knotting pass	11 min	13.2min
	Total Time	63.2min	49.2min

**B. Dressing after knotting**

After completion of knotting there is combing of warp sheet for avoiding the entanglement of warp end and also avoid the slippage of knot so hence it give are less breakage during knotting passing and knotting can pass easily.



No.	Activity	Before Time	After Time
1	Beam unloading & loading	10.4min	9.39min
2	Frame loading	3.3min	2.18min
3	Dressing	19.5min	8.34min
4	Knotting	14.4min	12.33min
5	Frame unloading	4.2min	2.18min
6	Knotting pass	11 min	11.01min
	Total Time	63.2min	45.43min

## 2. Ground knotting

### A. Availability of instrument and raw material

By proper availability of knotting instrument at its required place, by this way there will be a less time consume for knotting instrument in knotting time hence there will be a reduction of knotting time.

#### A. Raw material

##### I. Beam – Ground

#### B. Knotting instrument

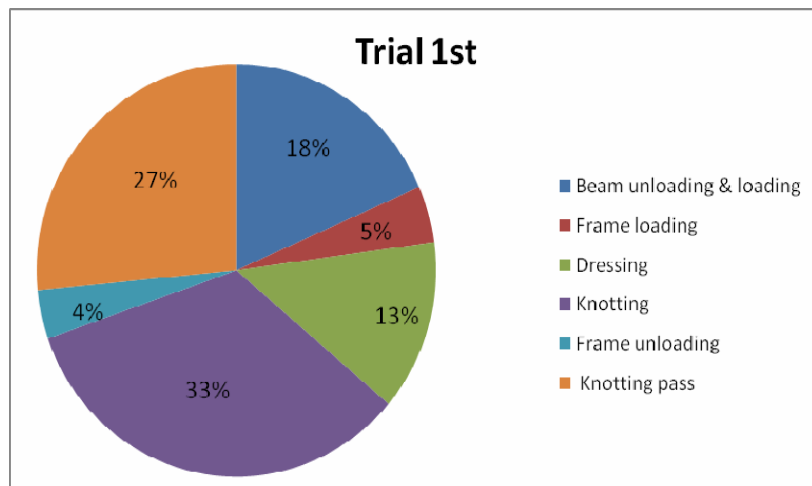
##### I. Frame

##### II. Knotting machine

#### C. Man utilization

##### I. Knotter

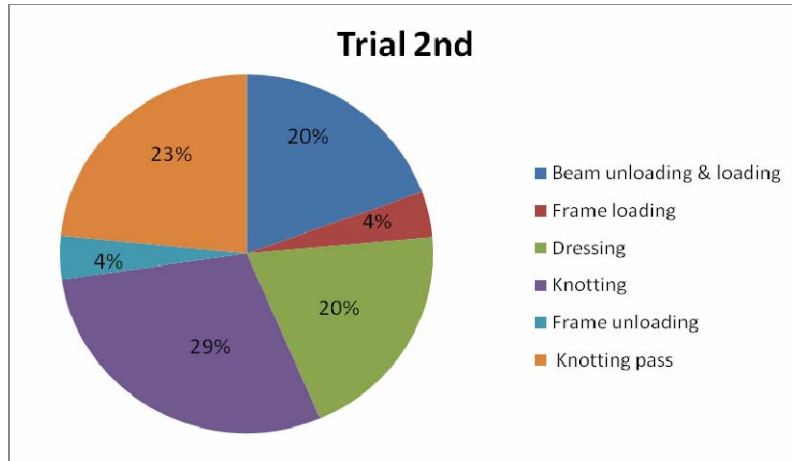
##### II. Beam loader



No.	Activity	Before Time	After Time
1	Beam unloading & loading	13.3min	10.03min
2	Frame loading	5.2min	2.42min
3	Dressing	10.1min	7.3min
4	Knotting	17.2min	18.23min
5	Frame unloading	3.1min	2.09min
6	Knotting pass	19.3min	14.47min
	Total Time	68.2min	54.54min

B. Dressing after knotting

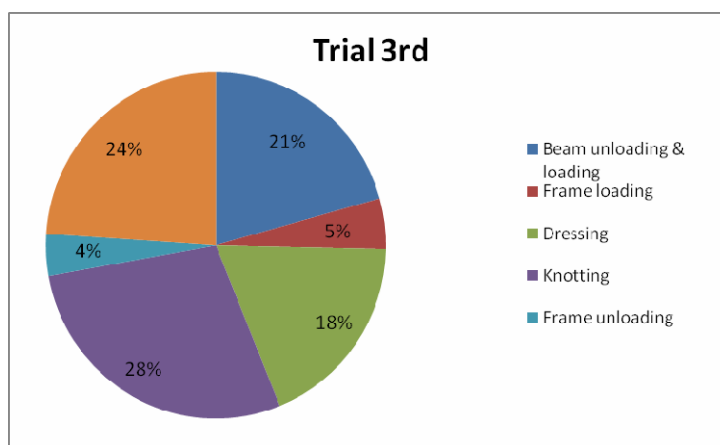
After completion of knotting there is combing of warp sheet for avoiding the entanglement of warp end and also avoid the slippage of knot so hence it give are less breakage during knotting passing and knotting can pass easily.



No.	Activity	Before Time	After Time
1	Beam unloading & loading	13.3min	10.25min
2	Frame loading	5.2min	2.15min
3	Dressing	10.1min	10.55min
4	Knotting	17.2min	15.36min
5	Frame unloading	3.1min	2.07min
6	Knotting pass	19.3min	12.33min
	Total Time	68.2min	53.11min

c. Clamping at unloading of beam

Generally knotting is camped by cutting the beam and then make the bunch of yarn sheet so there will be a crossing required more dressing consume more time so that by before cutting the beam clamping plat and then cut the beam so that there will be a yarn sheet already from so hence there is no more dressing required and also the less crossing of warp ends.



No.	Activity	Before Time	After Time
1	Beam unloading & loading	13.3min	11.35min
2	Frame loading	5.2min	2.59min
3	Dressing	10.1min	10.2min
4	Knotting	17.2min	15.55min
5	Frame unloading	3.1min	2.15min
6	Knotting pass	19.3min	13.17min
	<b>Total Time</b>	<b>68.2min</b>	<b>55.11min</b>

## Summary and Conclusion

### Project Summary

No.	Activity	Pile			Ground		
		Before	After	Time saved	Before	After	Time saved
1	Beam unloading and loading	10.4min	9.1min	1.3min	13.3min	10.54min	3.2min
2	Frame loading	3.3min	2.2min	1.1min	5.2min	2.4min	3.13min
3	Dressing	19.5min	9.2min	10.3min	10.1min	9.4min	0.7min
4	Warp knotting	14.4min	12.3min	2.1min	17.2min	16.4min	0.8 min
5	Frame unloading	4.2min	2.2min	2 min	3.1min	2.10min	1 min
6	Warp knotting Passing	11 min	12min	1.3 min	19.3min	13.2min	6.1min
	<b>Total</b>	<b>63.2min</b>	<b>47min</b>	<b>16.2min</b>	<b>68.2min</b>	<b>54.5min</b>	<b>15.3 min</b>

**Table No. 8 Summary of Project Result**

## **Conclusion**

By taking corrective action of warp knotting following is the improvement in warp knotting time.

### **1) Pile warp knotting**

1. Availability of warp knotting instrument, warp beam and man power during warp knotting shows 3.4 min reduction in down time during warp knotting operation.
2. Work Practices - dressing before knot passing will prevents the sticking and engaging of knots with each other, this work practices in reduce 1.3 min warp knotting time.

### **2) Ground warp knotting**

1. Availability of warp knotting instrument, warp beam and man power during warp knotting shows 7.2 min reduction in down time during warp knotting operation.
2. Work Practices - Dressing before knot passing will prevents the sticking and engaging of knots with each other, this work practices in reduce 6.1 min warp knotting time.
3. Work practices - Clamping the dressing plate before beam cutting. It removing the cross end and entanglement, this work practices in reduce 4.5 min warp knotting time.

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