



Textile Manufacturing – Six Sigma in a Woven World

Temecula Valley Section 0713

Matthew Cameron

1/21/21

January 2021 Monthly Section Meeting

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Background & Introduction

- ▶ Small Business Owner of **Lean on Sigma, LLC**, a consulting agency dedicated to providing a pathway for change within companies on any scale; leaning on the foundations of Six Sigma and Lean methodologies to inspire and create change agents.
- ▶ Proud **ASQ Sigma Black Belt & ASQ Temecula Chapter Publicity Chair Board Member**.
- ▶ Chemistry Graduate from the **University of Tennessee** 2015 (Go Vols!)
- ▶ Published Co-Author in **The Journal of Polymer Science**
- ▶ North Carolina State University **Certified Kaizen Leader**
- ▶ Certified Guaranty Company (CGC) Authorized Verifier for Quality
- ▶ Twitch Streamer & Affiliate (we are live now!)

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Leaning On Sigma

The Mission: to create and inspire change in the way we approach and think of processes, to shift and pressure company culture to grow and adapt – creating stronger teams with better communication, to drive continuous and on-going improvement.

Core Values:

- ▶ Driving Change, Efficiency & Improvement
- ▶ Building Relationships & Communication
- ▶ Growing Business Culture with Results
- ▶ Empowering Creative Problem Solving

Always be ready to learn. Bring to the table the mindset of collaboration to others by understanding together the projects and working to improve in a positive open environment. Be a leader, solve problems by being aware of your surroundings, and never give up, there will always be an answer.

Seek continuous improvement. Lean Six Sigma offers structure to as a group keep improving continually while having a guiding source that will continually point towards True North. Like a compass following the magnetic lines of the world, company values and qualities are meant to instinctively guide us to our goal. With a proven structure, we can all learn, and from the bottom to the top, we can make a difference.



Previous Work Experience

- ▶ **TVA Weekend Academy:** Tutor Leader
- ▶ **Black Carpets:** Carpet, linoleum, tile installer
- ▶ **Pizza Hut:** Shift Leader
- ▶ **Elavon:** New Merchant Software Instructor, Software Technical Support
- ▶ **Koide:** Chamfering Machine Operator - ISO9001 Certified – 96 M units /yr.
- ▶ **EdFinancial:** Debt Management Coordinator
- ▶ **CM Games:** Conversion of a Toy store into a Video Game/Card store
- ▶ **Vanderbilt Mortgage and Finance:** First Contact Account Manager
- ▶ **Cone Denim – International Textile Group, Elevate Textiles:** Lean Six Sigma Plant Facilitator, Research & Development Chemist; ISO9001 Certified; Greensboro, NC
- ▶ **Cone Denim Parras:** Finishing Department Manager, Lean Six Sigma Department Leader, Technologist, Chemist; ISO9002 Certified; Parras, MX
- ▶ **Lean on Sigma:** Training Consultant, Business Developer, Translator, Tradeshow Manager

Previous Game/Life Experience

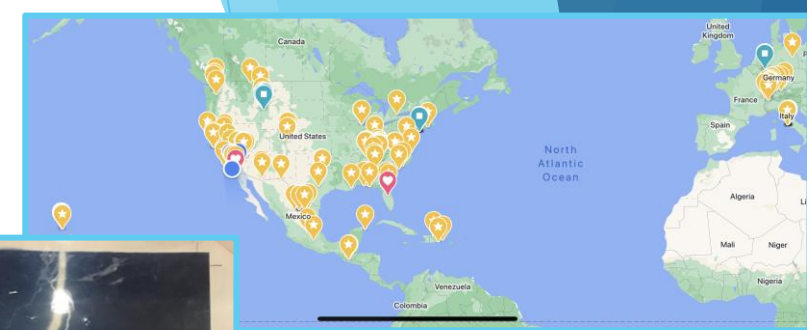
Gaming:

- ▶ **Halo 2/3:** Semi Pro; Major League Gaming (MLG)
- ▶ **Fortnite:** Epic Games Content Creator, Twitch Affiliate
- ▶ **World of Warcraft (WoW):** 2nd in the US, 9th in the world; Tank/Healer
- ▶ **Magic the Gathering:** Top 10 TN, top 250 US; 2k+ rating
- ▶ **Starcraft 2:** Masters Protoss
- ▶ **League of Legends:** Platinum S3-7, UTK 2nd Place Collegiate League
- ▶ **Counter Strike GO:** Supreme Master First Class (top 1%)

Fun Facts:

- ▶ Deftones album “Ohms” – Listed in the special thanks section
- ▶ Lived next to the 2nd oldest vineyard in the world, 1st oldest in the Americas, Casa Madero, Parras Mx.
- ▶ Talks like Mickey Mouse! (Same birthday as Walt Disney himself, 12/5)
- ▶ Walked around NYC with an over \$1 million piece of artwork – Original cover of Frank Miller’s “Batman: The Dark Knight Returns”
- ▶ Grandfather was a Korean War Veteran which installed Jupiter Missiles for the Chrysler Corp. in Italy, Turkey during the 60’s, retiring from both the Apollo Mission as an Engineering Team Leader and from the Tennessee Valley Authority (TVA).

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Let's talk Denim. (Finally)

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Cone Denim®

White Oak continuously produced denim from 1905 to 2017, demonstrating more than 112 years of denim leadership. The White Oak legacy lives on as a tribute to the talent, dedication and innovation of generations of employees, customers and denim enthusiasts that are forever a part of the brand heritage and innovative spirit that will always be the heart and soul of Cone Denim. Today Cone Denim maintains its headquarters in North Carolina with a global platform that includes denim operations in Mexico and China and a team of R&D, merchandising, product design and sales talent across the world. The Cone Denim legacy continues to inspire with a passion that brings together the best in denim art and science and an unwavering commitment to innovation, sustainability and industry expertise.



Moses Cone



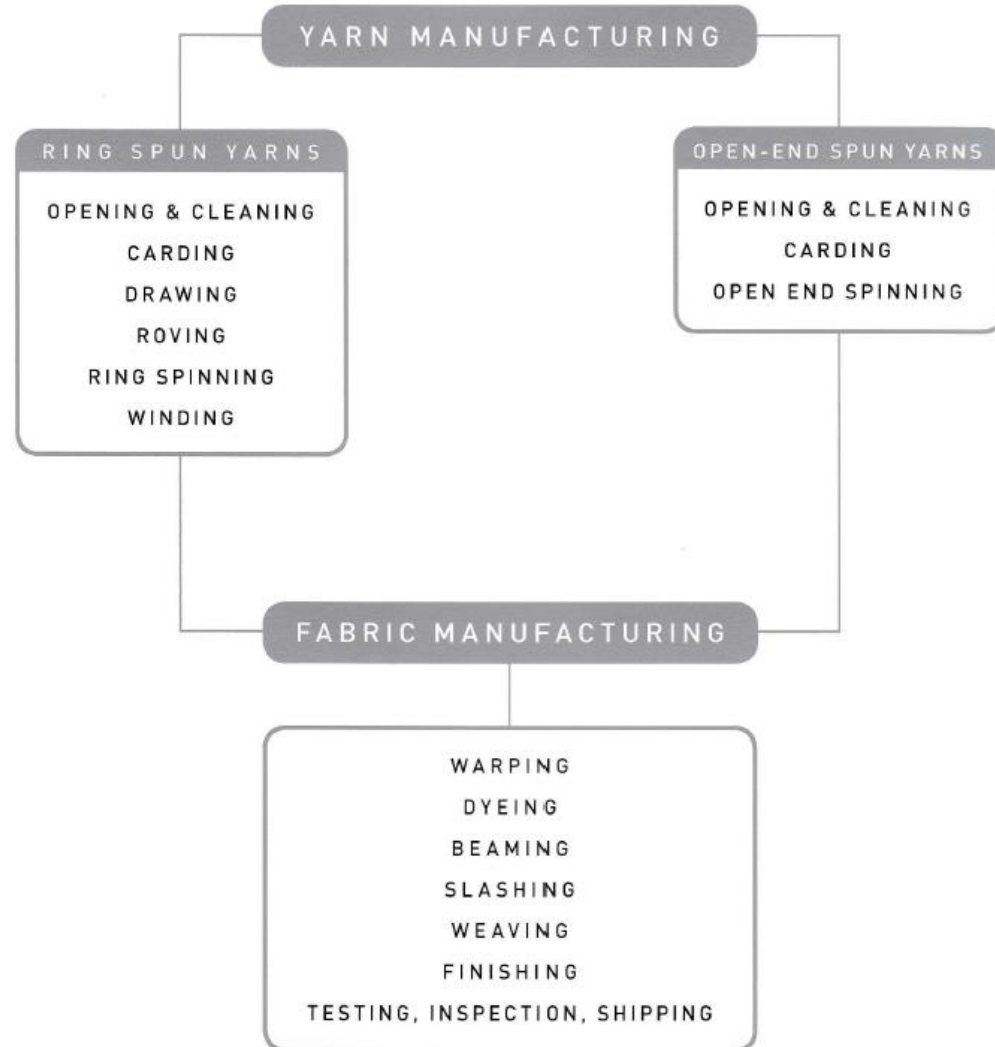
Ceasar Cone

From its beginning in 1891, Cone Denim has been a leading supplier of denim to top apparel brands. Formed out of the entrepreneurial spirit of brothers Moses and Ceasar Cone and grounded in American heritage, Cone Denim is synonymous with authenticity and innovation. The turn of the century brought a new energy and excitement to America. Denim fabrics gained popularity as a favored “workwear”, and the Cone brothers embarked on what would become an icon in the denim industry, a mill called White Oak.

WHITE OAK MILL

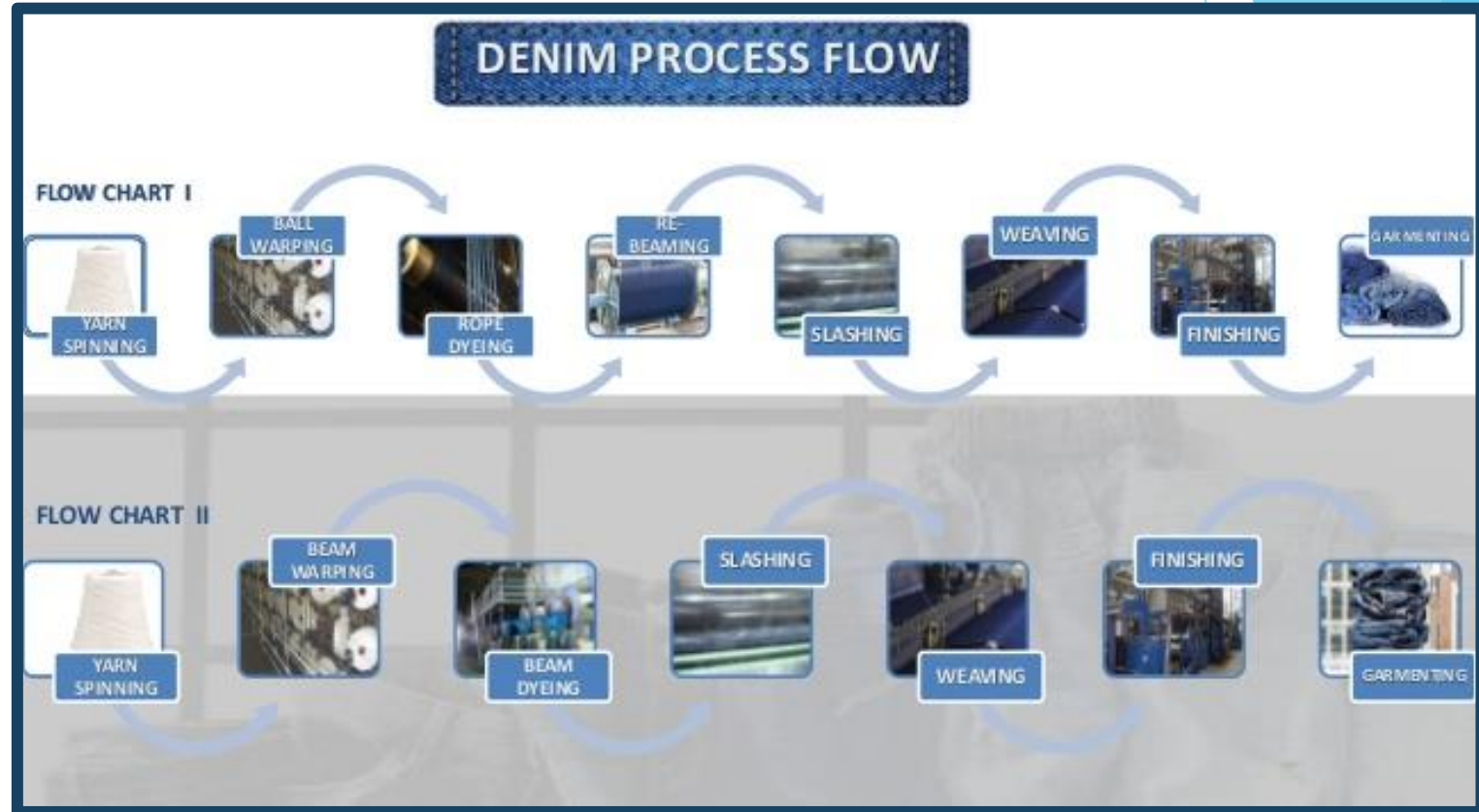
The mill was named for the 200 year old tree that stood nearby and served as a gathering place for people traveling to Greensboro from the surrounding countryside. Construction began in 1902, and the first bobbin of yarn was produced on April 20, 1905. Known from the beginning as an innovator in denim, White Oak focused exclusively on denim throughout its history. White Oak successfully combined the tradition of producing high-quality products with a heritage of cultivating strong relationships with employees, customers, suppliers, and its community.

THE DENIM MANUFACTURING PROCESS



Denim 101 & Virtual Tour!

- ▶ Yarn
- ▶ Warping
- ▶ Dyeing
- ▶ Beaming
- ▶ Slashing
- ▶ Weaving
- ▶ Finishing
- ▶ Sanforizing
- ▶ Inspection
- ▶ Quality Testing



Yarn

- ▶ Opening & Cleaning
- ▶ Carding
- ▶ Drawing
- ▶ Roving
- ▶ Link Ring Spinning
- ▶ Winding
- ▶ Open End Spinning

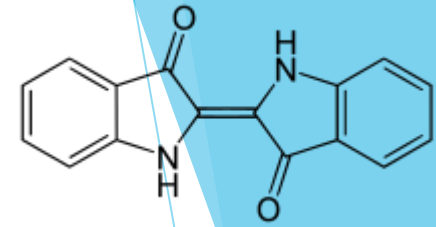
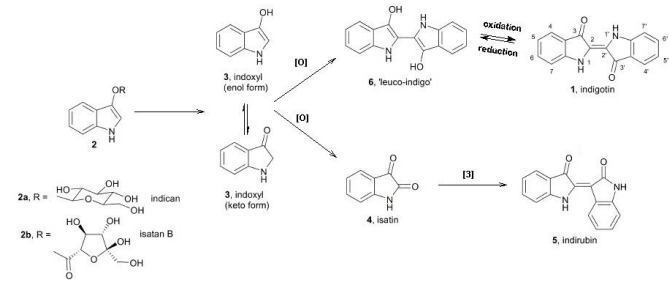


Warping

- ▶ In the warping process, 300 to 450 packages of yarn are placed on a rack called a creel.
- ▶ The yarns thread through the creel to the front of the machine where they are separated and paralleled as they pass through a comb. A lease is inserted to guarantee the paralleled yarn is in order.
- ▶ The ends are pulled simultaneously through a tension device, then condensed through a trumpet and wound onto a ball warp, which will be sent to dyeing. This process is necessary for long chain or rope dyeing and is unique to denim.



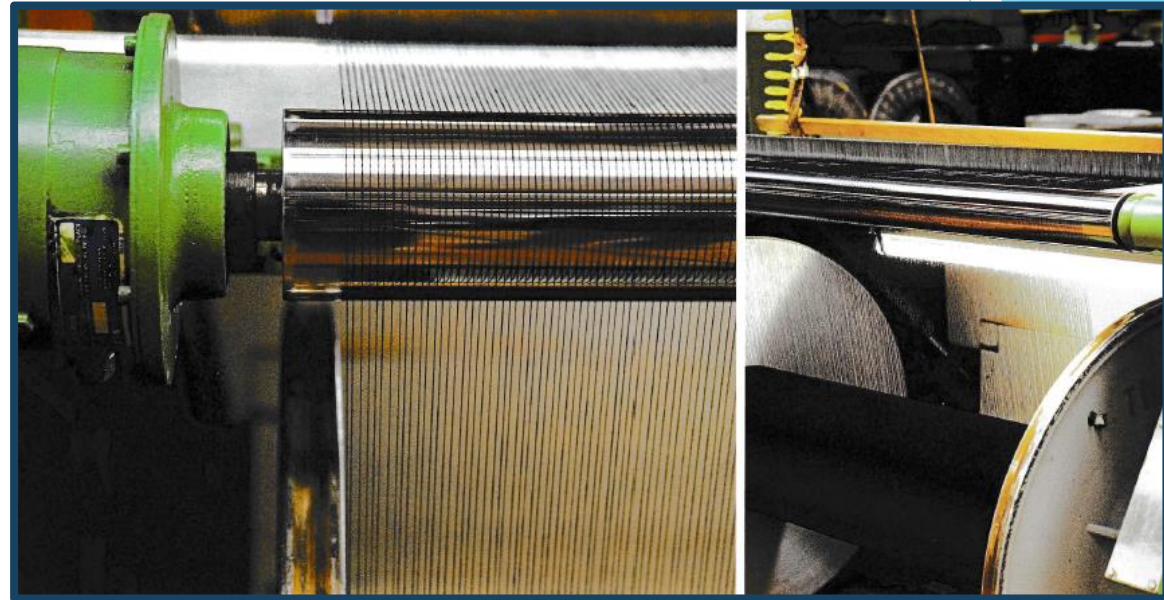
Dyeing



- ▶ The warp yarns are dyed before the fabric is woven.
- ▶ Rope dyeing, or long chain dyeing, is a process unique to the application of indigo. The ball warps are loaded at the entry end of the range and are processed through a series of boxes, which contain dye.
- ▶ After each box or dip, the ropes are exposed to air in a process known as skying, where oxidation of the dye takes place. When the ropes come out of the first dip in indigo they are bright green, but immediately begin to turn blue as oxygen returns the dye to its insoluble state. Several dips are required to build a dark shade.
- ▶ At the end of the range, the yarn is passed over steam-heated cans for drying. The ropes of yarn are then coiled into large tubs ready for the beaming process.

Beaming

- ▶ The purpose of beaming is to separate and parallel the yarns from the original rope from and wind them onto a section beam.
- ▶ Dyed Yarn, ran quickly but had to see the stops and repair by hand, due to the intense ness of the position was paid highly.
- ▶ The rope is pulled from the tub and brought forwards to a comb where the warp ends are separated and paralleled.
- ▶ The strands of yarn are straightened where tangled, tied back if broke, and wound onto what is called a section beam for the slashing process.
- ▶ Generally it takes 12 section beams to make the warp for a wide fabric.



Slashing

- ▶ In preparation for weaving, a protective coating of starch called warp size is applied to the warp yarns. This coating is applied to give the warp yarns the strength and flexibility to withstand the stress and abrasion of weaving.
- ▶ 6 - 12 beams were combined here to develop a full loom beam. Keeping individual strands in still consecutive order.
- ▶ After the yarns are dipped in sizing they pass through squeeze rolls and onto steam filled dry cans, then through a series of separator bars to break them apart, and finally wound onto a warp beam that will be used at weaving.



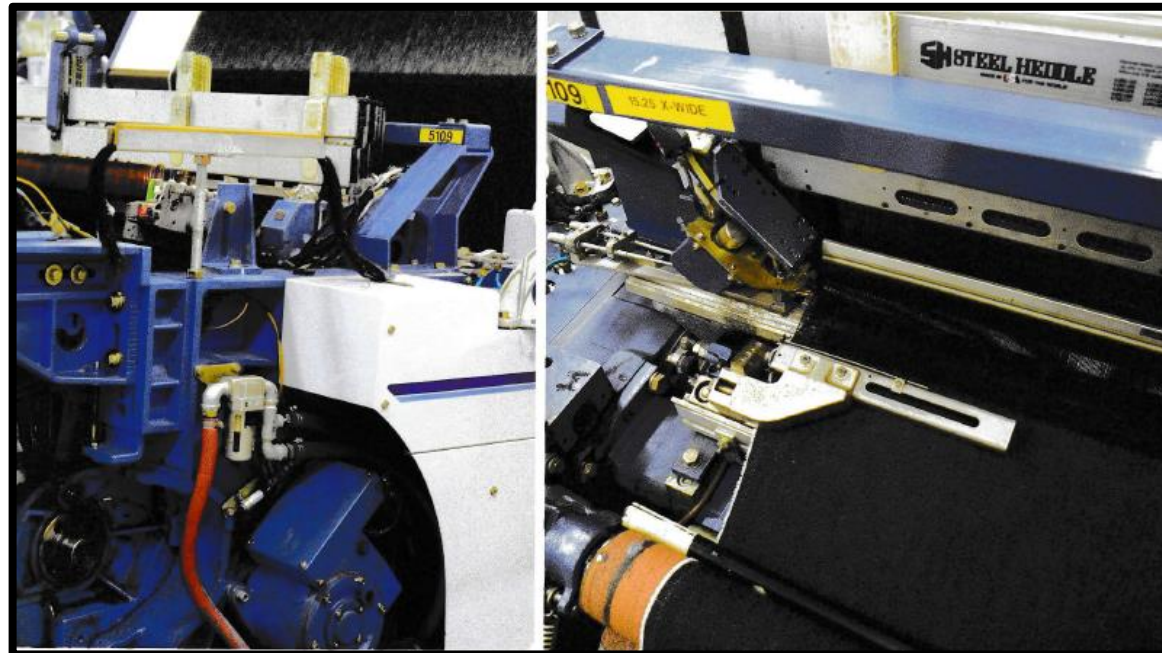
Weaving

- ▶ Weaving - Types of Looms:
Nissan (air jet) 35 ypm
Sultzer (Rapier) 28 ypm
Shuttle (X3) 12 ypm
- ▶ Weft yarns (fill) are interlaced with the warp yarns during the weaving process.
- ▶ The warp yarns are controlled individually.
- ▶ Part of the warp yarns are raised and part are lowered to form an opening called a shed. In typical denim weaves either $\frac{3}{4}$ or $\frac{2}{3}$ of the warp yarns would be raised (3/1 or 2/1, respectively).



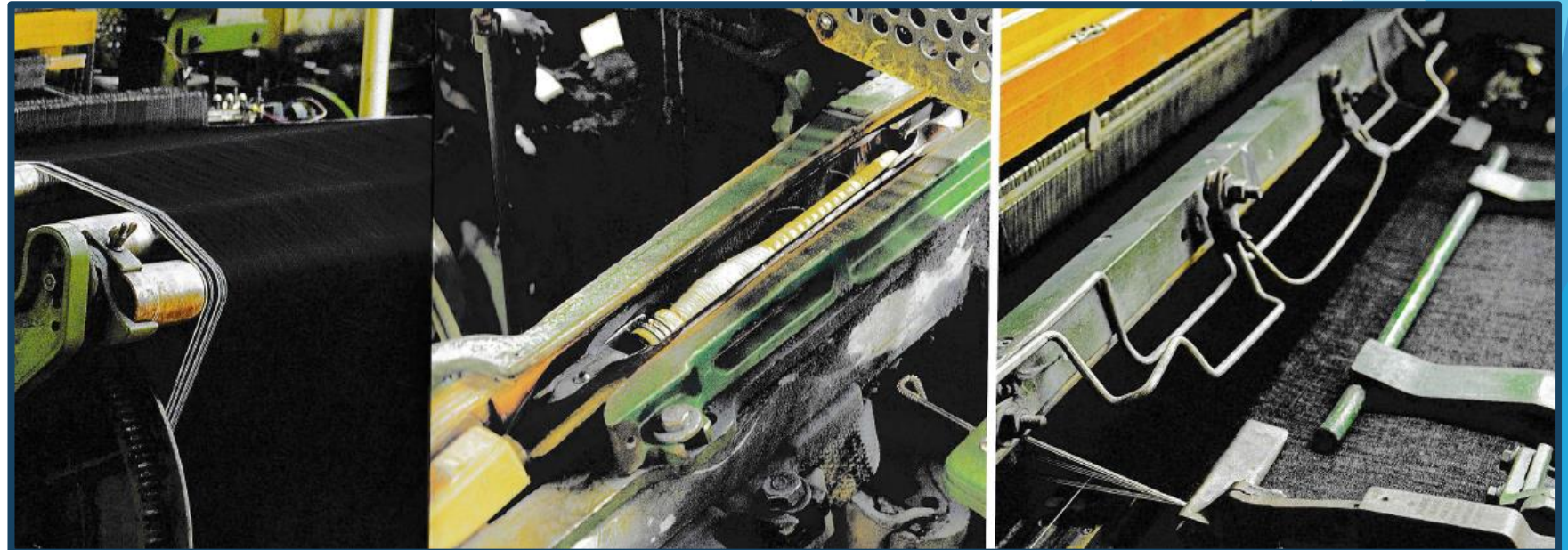
Weaving (cont.)

- ▶ To form the interlacing the weft yarn is inserted into the shed. High-speed looms propel the weft yarns through the shed in different ways depending upon the machine type.
- ▶ Some weaving machines use small projectiles to pull the weft yarn across; other looms use a jet of air to propel the weft; still others pull the weft by means of a rapier.
- ▶ The yarn is cut after each pick, or weft insertion, to produce a fringe at the edge of the fabric. A warp of more than 2,000 yards is woven into one continuous roll of fabric ready for finishing.



Vintage Shuttle Weaving

- ▶ In shuttle weaving the shed opening of the warp is created in the same way as on the new looms; however, the weft insertion method is different.
- ▶ As the name applies, a shuttle carries the weft yarn back and forth to form the weave. The selvage formed in this process is called a "fast selvage" because the weft yarn is not cut after each pick.
- ▶ The fabric produced from these looms is referred to as "selvage denim" and is typically sold at 28" to 31" in width.
- ▶ Slowest, but highest price per yard. ~\$7.00



Finishing

- ▶ Finishing involves processing the fabric through a continuous range where desired shrinkage and stiffness levels are achieved.
- ▶ Finishing also gives the fabric a desired surface effect and sets the desired width.
- ▶ Conventional Dye House - Multiple different machines. Guaranteed to be processed.
- ▶ Includes: Mercerizer (Caustic treatment for luster, strength, and receptiveness to dyes), Tenter Frame (application of chemical finishes including anti-microbial & overdyed pulled to width), and Cans (for x3 fabric).
- ▶ Process possibilities:
 - ▶ Singeing
 - ▶ Desizing
 - ▶ Scouring
 - ▶ Bleaching
 - ▶ Mercerising
 - ▶ Dyeing
 - ▶ Width Control



Sanforizing

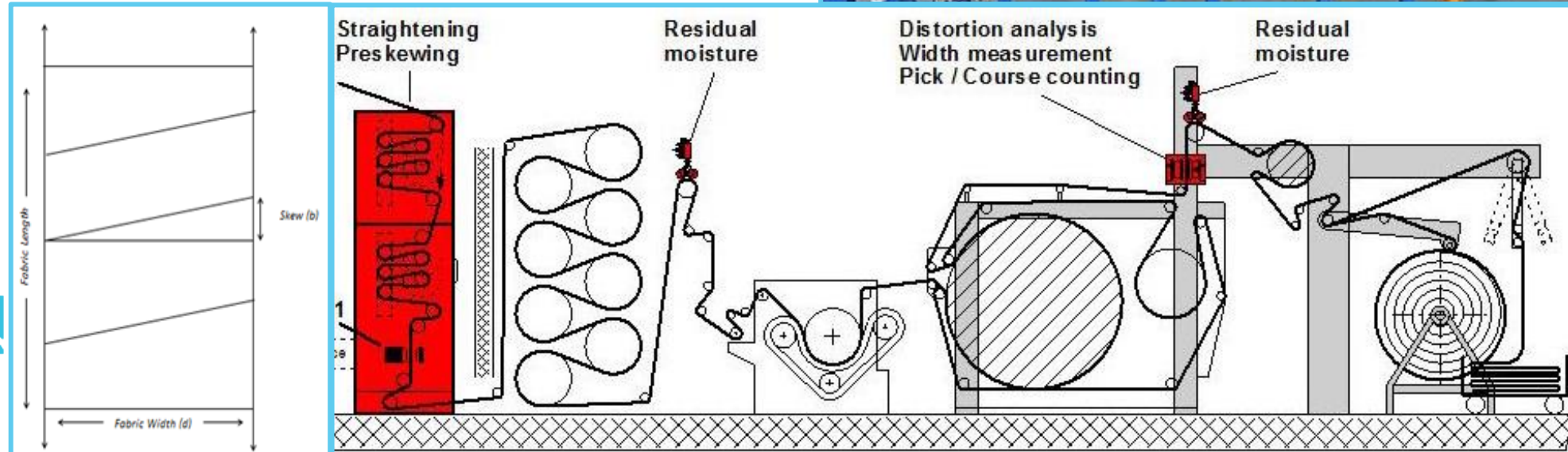
- ▶ The warp shrinkage of the fabric is established at the Sanforizer. This is accomplished by a rubber belt section that is compressed while the fabric passes over it, bringing the fabric to its desired dimensions.
- ▶ Denim has a stronger skew curve due to the 3/1 weaving process, a typical weave pattern would require less skew.
- ▶ It is during the finishing process where skew is added to the fabric to prevent leg twisting in garments.
- ▶ Cone Denim was the first manufacturer to apply skew to fabrics.
- ▶ Skew is shown as:

$$= \frac{b}{d} \times 100$$

*b = skew

*d = width

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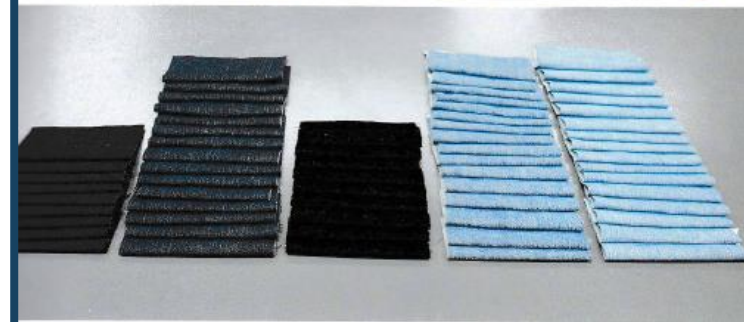
Inspection & 3n1

- ▶ In addition to the quality testing and inspections conducted throughout the entire manufacturing process, 100% of the fabric is inspected at tables after the finishing process.
- ▶ Inspectors enter errors into a computer which analyzes the defects and is able to print out an optimized map of all problem areas with instructions on where to cut out pieces of damaged fabric.
- ▶ The final step before storage/shipping is the “3n1” roll up system which includes removal of defects, seams for recombining cut pieces, and a final inspection of the fabric.



Testing

- ▶ **Chemical testing lab** - Process controls are in place on every major facet of wet processing from dyeing through finishing.
- ▶ In the **physical testing lab**, sophisticated equipment and skilled lab technicians ensure established quality standards are met.
- ▶ The **physical testing lab** monitors shrinkage, weight, strength, and other physical properties.
- ▶ The **shade room** monitors color while the dye lab monitors all dyes and chemicals to verify they meet established guidelines and standards.
 - ▶ Samples from each roll are washed according to customer wash targets.
 - ▶ A color measurement instrument reads the samples and prepares a sequence for shipping by shade.



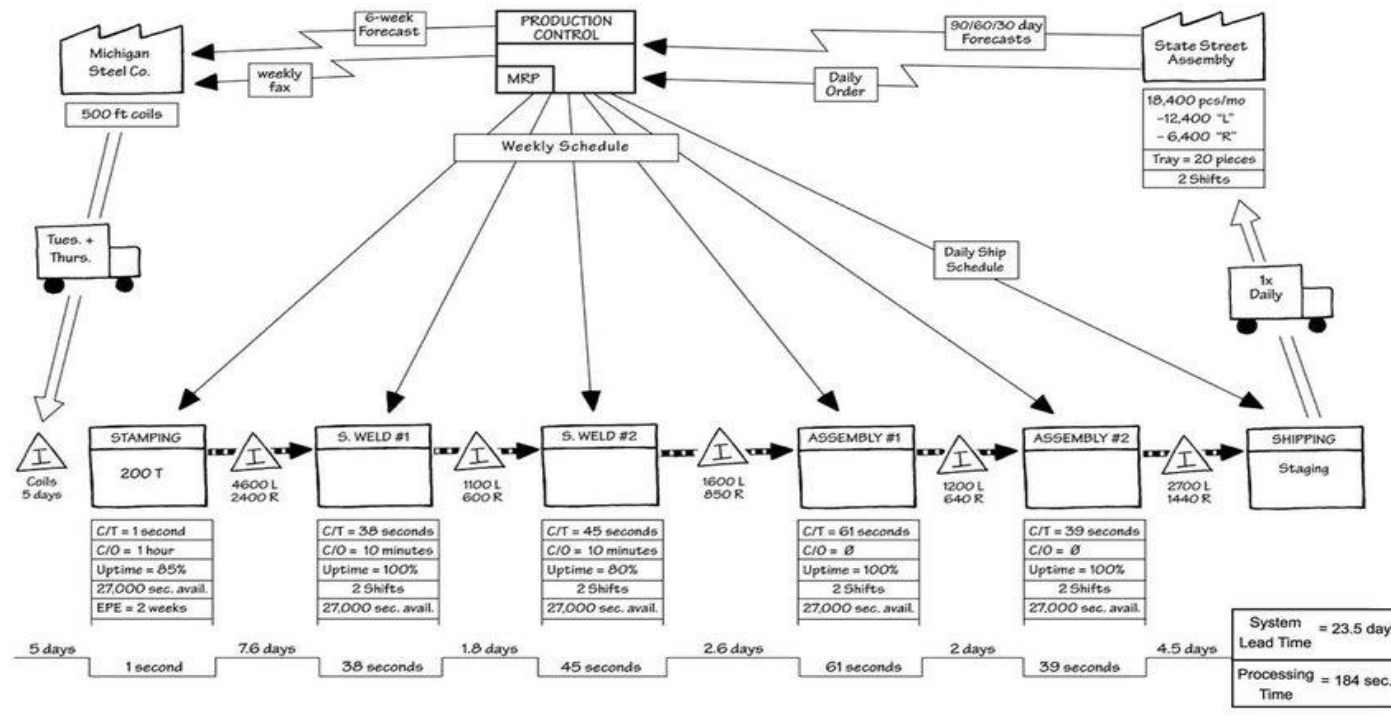
Questions on the tour?

- ▶ The manufacturing process is complete! Now onto projects and development of Six Sigma inside of the facility!
- ▶ Next we'll cover:
 - ▶ VSM
 - ▶ Kaizen
 - ▶ Tough Projects
 - ▶ Daily Management



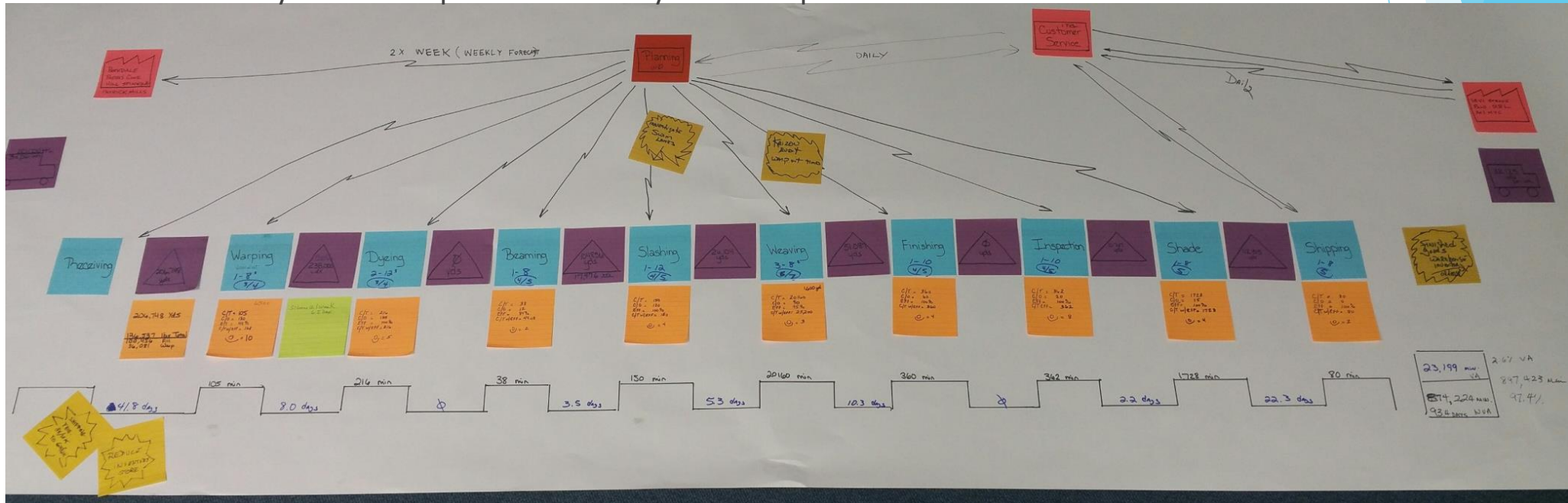
VSM – Value Stream Mapping

- ▶ VSM - Measuring the metrics of each department following different processes to determine a current state. These metrics are then used to develop a future and ideal state while also identifying possible “bottlenecks” in the production of any product, both manufacturing and inner office. The included examples were done from producing one roll of 2000 yards of denim. Time is in minutes.
- ▶ Can be taken from full facility to individual processes and vice versa.
- ▶ Overproduction vs. Waste considering system efficiency.



VSM – Value Stream Mapping

- ▶ Let's talk about the important parts:
 - ▶ C/T – Cycle Time: How often a product is completed
 - ▶ C/O – Changeover: Process of switching from production of one to another.
 - ▶ People – Number of people required to produce the product
 - ▶ C/T w/Eff – Efficiency: Amount of cycle time considering the efficiencies of stops/other issues.
 - ▶ TT - Takt Time – Synchronizes pace of assembly to match pace of sales.



Process (Min)	Warping	Dyeing	Beaming	Slashing	Weaving	Finishing	Inspection	Shade	Shipping	Total
C/T	105	216	38	150	20160	360	362	1728	80	23199
C/O	180	135	12	120	90	60	20	15	0	632
People	10	5	2	4	3	4	8	4	2	42
Eff	40%	100%	84%	100%	75%	100%	100%	100%	100%	
C/T w/Eff	168	216	44.08	150	25200	360	362	1728	80	28308.08

What is a Kaizen Event?

Kaizen is a Japanese term meaning "change for the better" or "continuous improvement."

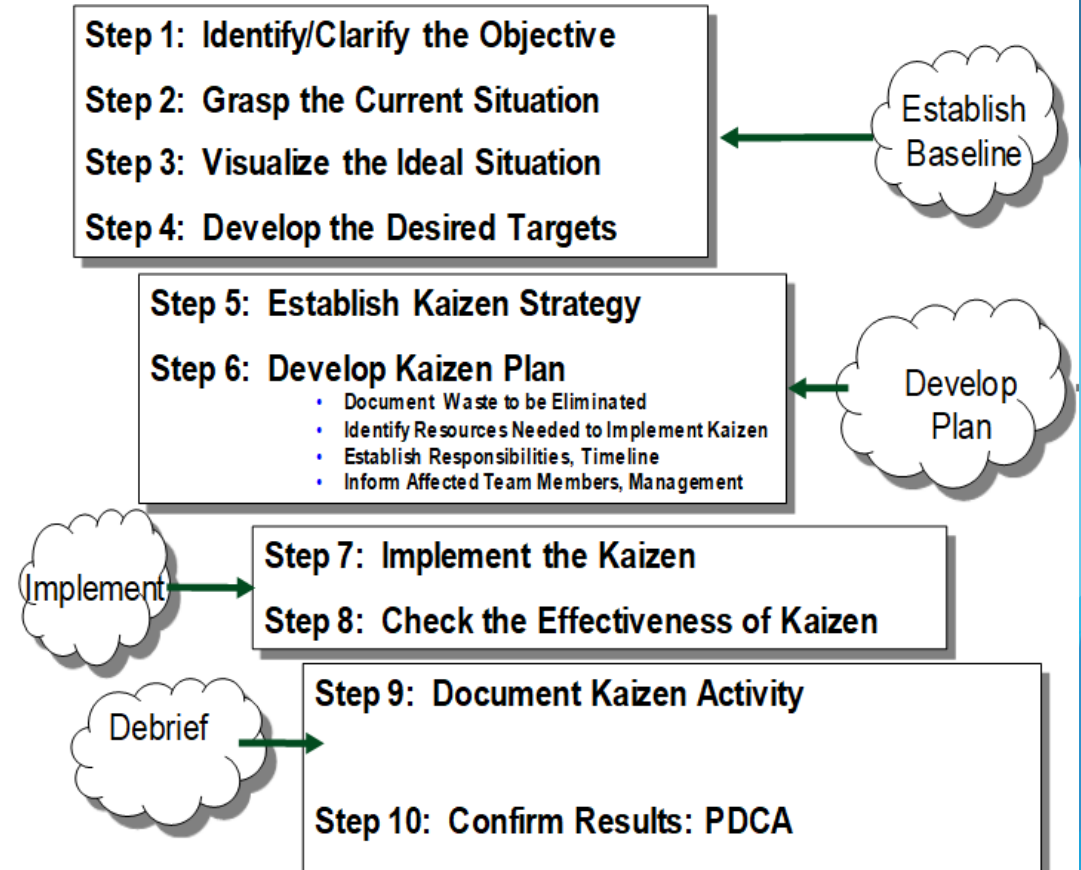
Kaizen events are short duration improvement projects with a specific aim for improvement; typically they range from a few days to even week long **events** led by a facilitator with the implementation team being predominantly members of the area in which the **kaizen event** is being conducted plus a few additional people from either side of the process and management.



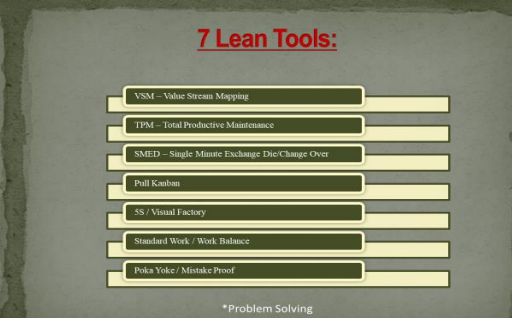
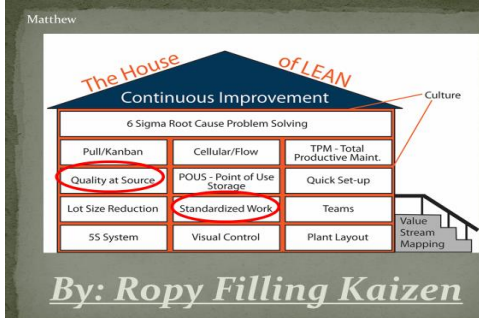
Kaizen Facilitation

- ▶ Taking both sides of the process. Go and See. Let people know after! Make sure there is a schedule, and people from before and after the process are present. Get hands on with ideas.
- ▶ Tool Box for creativity - But how do I keep the conversation going? What if we start to circle? (Make a note that it can be addressed later!)
- ▶ As a Kaizen Leader - prepare beforehand!
- ▶ DMAIC - Collect info about your projects. Analyze step is the Kaizen but the host collects the data before hand and has ideas prepared with tools to keep the group going, but can understand the flexibility needed based on the value of time to the topic.
- ▶ Follow up meeting! Control - make sure you hear reviews of the process and agree that the project can be placed on interval review to come back with the option to implement quality checks at intervals.

The Ten Step Kaizen/VSM Process



Kaizen & Tough Projects!



Jim

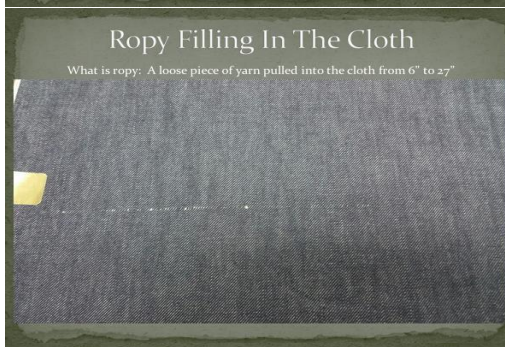
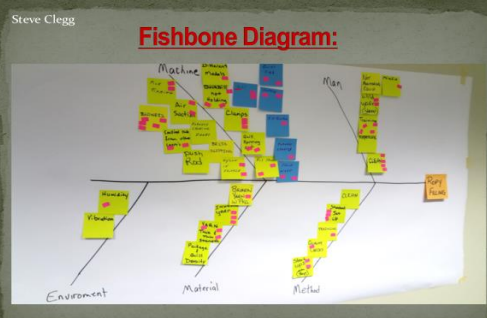
KAIZEN EVENT PLANNER

EVENT NUMBER	NAME	DEPARTMENT	PLANT	START DATE	POKE	END DATE	STATUS
11	Matthew Clegg	Plant Leader	WOC				
12	John Duggan		WOC				
13	John Duggan		WOC				
14	John Duggan		WOC				
15	John Duggan		WOC				
16	John Duggan		WOC				
17	John Duggan		WOC				
18	John Duggan		WOC				
19	John Duggan		WOC				
20	John Duggan		WOC				
21	John Duggan		WOC				
22	John Duggan		WOC				
23	John Duggan		WOC				
24	John Duggan		WOC				
25	John Duggan		WOC				

ESTIMATED EVENT COSTS

ESTIMATED EVENT COSTS

ESTIMATED EVENT COSTS



- Matthew Potential Savings Defined By Ropy Kaizen Event
- The average Sales per yard of an X-3 first = \$7.00
 - Irregulars are sold at \$1.40/yd
 - The \$5.60/yd differential times the YTD irregulars of 42,294 yds equates to \$236,846.
 - Annualized estimates show a projected dollar amount equal to \$406,022.
 - The White Oak team projects cutting irregulars on ropy filling by 50% or \$203,011 on an annualized basis through this Kaizen event and the ones to follow.

The Duckbill Boxers -Boxing the Front/ Introducing a Poke Yoke

- Stable Vincent
- Victor Gattis
- Steve Clegg
- Matthew Cameron
- Steve Hoffman
- Horace Tarpley
- Beverly Richmond
- Fred Ireland - Team Lead

Example of Work Instruction For Correctly Setting Clearer Assembly

- Bring the lay forward to front center
- Check hand wheel to make sure it hasn't rolled back

Boxing the Front of the Loom Standard Operating Procedure:

- Continuing with the Right Side: Check the tension on both the inner and outer leather straps for a slight amount of tension on the shuttle. There should be enough tension to create a drag on the shuttle upon movement. Make adjustments by loosening the Inner Strap lock on Outer Strap bolt (Figure 6b) and shifting the belt. Then retighten the inner Outer Strap bolt. (Using 3/4 wrench)
- Pull the Picker Stick and Shuttle together. Check to see if the loom marker lines up correctly with the top of the bolthole. If the Picker Stick is not aligned correctly, then adjust the Picker Stick strap by loosening the Outer Strap Bolt (Figure 4c) and adjusting the strap to where the Picker Stick is pressed against the end of the shuttle. The shuttle should be in alignment with the Loom Filling Marker (Figure 5a). Then tighten back the Outer Strap bolt. (Using 3/6 wrench)



Daily Management

- ▶ Daily management is the system that provides the ability to manage departments, functions, and processes, wherein processes are defined, standardized, controlled, and improved by the process owners.
- ▶ The daily management journey at White Oak started with the desire to have a real time tracking method for the X3 fabric.
- ▶ Old Practice: Greige roll doffed, finished, inspected, and a report was sent to weaving regarding quality of the roll. (1 week for info)
- ▶ New Practice: Greige woven fabric is inspected in real time every 1-2 hours. (Instant info)

X3 Loom Efficiency Scoreboard

Handwritten: TARGET 90%

First Shift				Second Shift				Third Shift			
Date	Time	%	Initials	Date	Time	%	Initials	Date	Time	%	Initials
1-27	7:27	70	JBA	1-27	3:26	88	JBA	1-27	11:00	86	LC
1-27	8:37	78	JBA	1-27	4:40	74	JBA	1-27	1:00	78	LC
1-27	9:45	84	JBA	1-27	5:35	68	JBA	1-27	3:00	76	LC
1-27	10:16	78	JBA	1-27	6:23	80	JBA	1-27	4:00	76	LC
1-27	11:13	76	JBA	1-27	7:00	68	LC	1-27	5:00	72	LC
1-27	11:50	82	JBA	1-27	9:00	74	LC	1-27	6:15	80	ES
1-27	1:55	89	JBA	1-28	3:10	90	JBA	1-28	11:00	74	PLW
1-27	2:20	86	JBA	1-28	4:17	86	JBA	1-28	12:00	90	PLW
1-28	7:44	72	JBA	1-28	5:17	80	JBA	1-28	1:00	86	PLW
1-28	8:36	92	JBA	1-28	7:00	70	LC	1-28	2:00	82	PLW
1-28	9:37	82	JBA	1-28	8:00	60	LC	1-28	4:00	82	PLW
1-28	10:05	84	JBA	1-28	9:45	72	JBA	1-28	5:00	82	PLW
1-28	10:45	84	JBA	1-28	10:20	80	JBA				
1-28	1:30	86	JBA								
1-28	2:13	84	JBA								
1-28	7:20	72	JBA								
1-28	8:30	70	JBA								
1-28	9:15	90	JBA								
1-28	10:31	88	JBA								

BAD START UP TRACKING

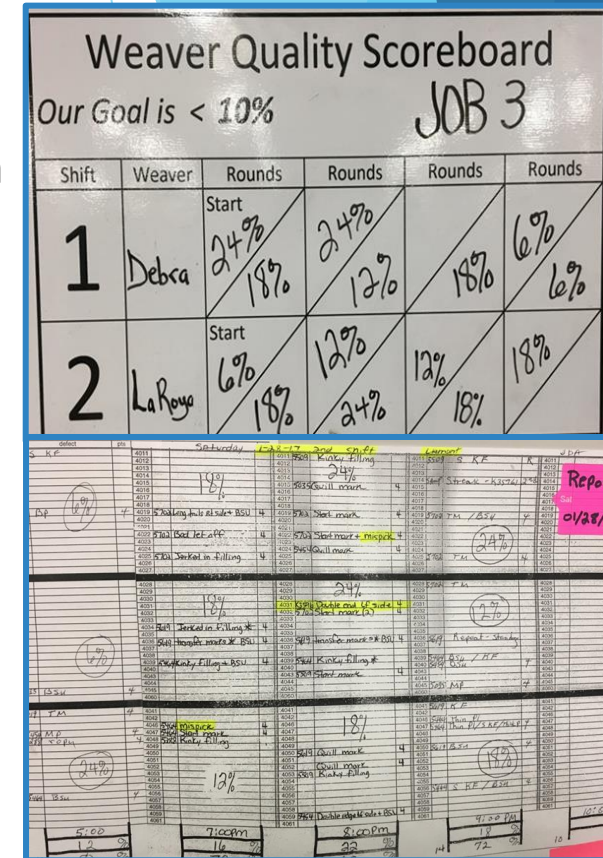
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4011	11:50	12:00	JBA	OK	
4012	11:50	12:00	JBA	OK	
4013	11:50	12:00	JBA	OK	
4014	11:50	12:00	JBA	OK	
4015	11:50	12:00	JBA	OK	
4016	11:50	12:00	JBA	OK	
4017	11:50	12:00	JBA	OK	
4018	11:50	12:00	JBA	OK	
4019	11:50	12:00	JBA	OK	
4020	11:50	12:00	JBA	OK	
4021	11:50	12:00	JBA	OK	
4022	11:50	12:00	JBA	OK	
4023	11:50	12:00	JBA	OK	
4024	11:50	12:00	JBA	OK	
4025	11:50	12:00	JBA	OK	
4026	11:50	12:00	JBA	OK	
4027	11:50	12:00	JBA	OK	
4028	11:50	12:00	JBA	OK	
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4048	11:50	12:00	JBA	OK	
4049	11:50	12:00	JBA	OK	
4050	11:50	12:00	JBA	OK	
4051	11:50	12:00	JBA	OK	
4052	11:50	12:00	JBA	OK	

Ropy Filling Tracking

Machine ID	Date	Time	Operator	Status	Notes
4011	1-27	11:50	JBA	OK	
4012	1-27	11:50	JBA	OK	
4013	1-27	11:50	JBA	OK	
4014	1-27	11:50	JBA	OK	
4015	1-27	11:50	JBA	OK	
4016	1-27	11:50	JBA	OK	
4017	1-27	11:50	JBA	OK	
4018	1-27	11:50	JBA	OK	
4019	1-27	11:50	JBA	OK	
4020	1-27	11:50	JBA	OK	
4021	1-27	11:50	JBA	OK	
4022	1-27	11:50	JBA	OK	
4023	1-27	11:50	JBA	OK	
4024	1-27	11:50	JBA	OK	
4025	1-27	11:50	JBA	OK	
4026	1-27	11:50	JBA	OK	
4027	1-27	11:50	JBA	OK	
4028	1-27	11:50	JBA	OK	
4029	1-27	11:50	JBA	OK	
4030	1-27	11:50	JBA	OK	
4031	1-27	11:50	JBA	OK	
4032	1-27	11:50	JBA	OK	
4033	1-27	11:50	JBA	OK	
4034	1-27	11:50	JBA	OK	
4035	1-27	11:50	JBA	OK	
4036	1-27	11:50	JBA	OK	
4037	1-27	11:50	JBA	OK	
4038	1-27	11:50	JBA	OK	
4039	1-27	11:50	JBA	OK	
4040	1-27	11:50	JBA	OK	
4041	1-27	11:50	JBA	OK	
4042	1-27	11:50	JBA	OK	
4043	1-27	11:50	JBA	OK	
4044	1-27	11:50	JBA	OK	
4045	1-27	11:50	JBA	OK	
4046	1-27	11:50	JBA	OK	
4047	1-27	11:50	JBA	OK	
4048	1-27	11:50	JBA	OK	
4049	1-27	11:50	JBA	OK	
4050	1-27	11:50	JBA	OK	
4051	1-27	11:50	JBA	OK	
4052	1-27	11:50	JBA	OK	

Evolution of Daily Management

- ▶ Initially the displays were intended to track a month's worth of information.
- ▶ Quickly we realized waiting a full month was too long to identify potential problems in the weave room. We needed to be more proactive.
- ▶ This brought the idea of separating the chart into different quadrants which went from every month, to two weeks, to every week, to daily, and finally to every 1-2 hours.
- ▶ Even when we reached hourly quality checks, we were still having issues making the quality checks relevant to the weavers. A collection of information can be pointless unless it is being utilized correctly. The next iteration of daily management was to separate the hourly overall quality into a per weaver overall quality.
- ▶ The quality rounds were presented in large charts that were viewable by everyone in the weave room. The weavers could not believe the off quality that was being produced, and began asking to be shown the defects. What a dream!



War Room

- ▶ Determining your KPIs that determine and directly correlate to problems down the line that can be address sooner rather than later.
- ▶ Since the facility was so large, the room was used as daily meeting point for all process managers which included visuals for metrics.
 - ▶ Lagging to leading indicators
 - ▶ True North
- ▶ The room also served as the training room and Kaizen room for meetings. Six Sigma projects and updates were posted in this room and in the process areas.

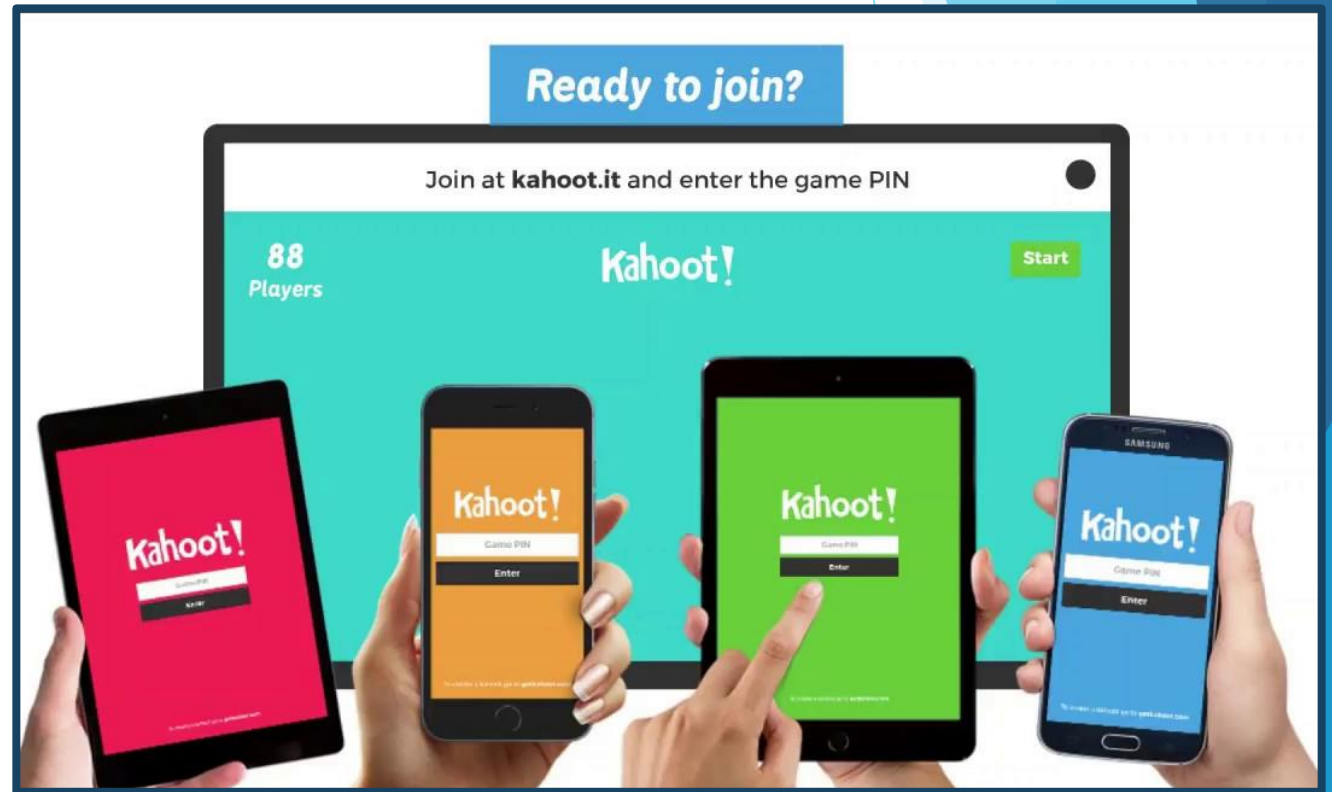
SUMMARY OF KAIZAN EVENTS								
		Date of		First Time		Action Item	Follow UP	Follow UP
	Name of Event	Event	Attending	W/O Attendees	Goal	% Complete	First	Second
1	Finishing Can CO	2/11/2016	4	4	Reduce C/O Time	100%	2/18/2016	
2	Weaving Swatch Reduction	4/28/2016	4	2	Reduce Rag Waste	100%	5/19/2016	7/6/2016
3	Beaming Coiler Room	5/25/2016	7	4	Reduce Soft Waste	100%	6/8/2016	10/5/2016
4	Training Session 8 Wastes	6/10/2016	11	6	Training	100%	Training	
5	Weaving Ropy 1st	7/27/2016	14	3	Reduce Ropy 5%	100%	8/4/2016	
6	Slashing Marker CO	8/4/2016	9	7	Reduce Soft Waste	100%	8/10/2016	
7	Weaving Ropy 2nd	9/8/2016	8	4	Reduce Ropy 15%	100%	9/22/2016	
8	Finishing Holes/Bruised/Contam	9/13/2016	10	5	Reduce Holes 50%	80%	9/22/2016	
9	Weaving Abrasion	10/4/2016	16	1	Reduce Abbr. Irr 50%	80%	10/13/2016	10/26/2016
10	Finishing Skew Line Waste	10/25/2016	20	2	\$25000 Rags Waste	70%	11/17/2016	
11	Training Session 8 Wastes	10/25/2016	7	6	Training	100%	Training	
12	Weaving Thin Places/Quill Marks	10/28/2016	10	3	Reduce TP/QM 50%	81%	11/9/2016	
13	Finishing Warp Shrinkage	12/8/2016	12	4	Reduce WS 25%	20%		
14	Training Session 8 Wastes	12/21/2016	14	11	Training	100%	Training	
15	Training Session 8 Wastes	12/22/2016	11	9	Training	100%	Training	
Total			157	71				



Trivia Quiz!

Let's see what you know about denim!

1. Grab your phone!
2. Go to Chrome or Safari and join to play by going to:
kahoot.it
3. Enter the game pin we are about to share on the screen!
4. Type in your nickname!



A stack of approximately ten fabric swatches in various shades of blue and white, arranged horizontally. The swatches show different textures and patterns, including solid colors, stripes, and woven designs. The background is a solid blue color with a white geometric shape on the right side.

Thank you! Any Questions?

LEAN ON
SIGMA