

# National Competition on QUICK Changeover (SMED)



**Project name : Reduction on mould change-over time in tire curing process.** 



Project Leader : P. Mugesh Kumar Team Member 1 : Velladurai Team Member 2 : Ramaka Rajesh

**PLAN** 

ACTUAL

**Project start Time** 

12.05.22

12.05.22

**Completion Time** 

01.12.22

02.11.22



Confederation of Indian industry

#### 10 April 2023



### **1952 - PRESENT : OUR TREAD MARKS**





### **OUR GLOBAL FOOTPRINT**





## Manufacturing Plant - Vizag



- Land Size Square Meter 3,92,545.
- Covered Area Square Meters 1,86,912 (Phase 1 1,16,982 & Phase 2 69,930)
- The facility produces pneumatic radial tires in Agriculture, Industrial segments and Bias tires in OTR, Forestry segments.
- The Plant is located in Denotified Area APSEZ, Atchutapuram, Visakhapatnam, Andhra Pradesh.
- Strategically located; The plant 40 Km from Gangavaram and Vizag ports and 60 km from Vizag airport.
- Current capacity: 80 Tons / Day by Jan 2023. Ramping up to 50,400 tons p.a.
- No. of Employees: 883 (Staff 175, DAT, WAT & IAT 708)





### **Overall Tire Manufacturing Process Flow**

**Tire Components Raw Materials Building, Curing & Inspection** FABRIC CORD CALENDERING 0 8 RUBBER BALES TEXTILES FABRIC **TYRE BUILDING** PLY CUTTING TYRE CURING CHEMICALS STEEL STEEL BELT CALENDERING VISUAL INSPECTION **Preparation** STEEL BELT BANBURY CUTTING X-RAY MIXER INSPECTION and BEAD ASSEMBLING BALANCE FABRIC CORD INSPECTION INNERLINER MANUFACTURE CALENDERING FORCE & MOVEMENT INSPECTION TREAD AND SIDEWALL EXTRUDING BEAD AND BELT STEEL CORD MANUFACTURE



### **Tire Curing process flow**





### **SMED/Quick Changeover - Project Details**



Prahalad Reddy- Plant Head Sponsor



B.Muthuvenkatesan Facilitator- GM- CI



P. Mugesh Kumar Leader



Velladurai Member-1



G. Raghuram Engineering Head



Ramaka Rajesh Member-2

#### **Objective:**

To reduce the mould change over time in tire curing process

#### **Background:**

Mould change over time was high , Which leads to affect the availability of curing press for production for large Off Highway Tires

#### <u>Goal / Target:</u>

Need to reduce the Changeover time 30% from current level on Nov'22





### **Process Flow of Mould Change over**

#### Last Tire Check of previous lot size Press Hand over to Engineering Team Removing Curing Mould & Bladder from Tire curing Press Curing Mould & Bladder assembly transfer from Curing area to Mould shop with help of hydra Bladder Assembling with respect Plug change with respect to planned size to planned size Bead ring change with respect to planned Bladder Inspection by Engg team size Mould correction with respect to LTC observation Sand Blasting & Vent Cleaning for Mould Mould Inspection by mould shop Team (Tech & Engg)

Curing Mould & Bladder assembly transfer from Mould shop to Curing area with help of hydra

Assembling of Curing Mould, Bladder in Tire curing Press and Press EEI Set-up

Hand over to production for Warm up & Pre-First tire check

#### **Tire Curing Press**





Parallel Activity



**Top Mould** 



Bottom Mould



### **Change Over Time Study- As is Condition**

Time Study										
			AS-IS (	Conditi	on					
	Study Date:-25.05.2022				Stu	dy Type:- M	ould Change	over		
Step No	Elemental Description	By W	/hom	ECRS-	Elimination	, Combine , Simplify	Rearrange &	Activ	Time (Min.)	
		Crew #1	Crew #2	E	С	R	S	Internal	External	
1	Removing Curing Mould & Bladder from Tire curing Press	$\checkmark$	$\checkmark$					$\checkmark$		64
2	Curing Mould & Bladder assembly transfer from Curing area to Mould shop with help of hydra	$\checkmark$				~			$\checkmark$	48
3	Plug change with respect to planned size		$\checkmark$				<ul> <li>✓</li> </ul>		$\checkmark$	142
4	Bead ring change with respect to planned size		$\checkmark$				<ul> <li></li> </ul>		$\checkmark$	62
5	Mould correction with respect to LTC observation		$\checkmark$						~	22
6	Sand Blasting & Vent Cleaning for Mould		$\checkmark$						$\checkmark$	74
7	Mould Inspection by mould shop Team (Tech & Engg)		$\checkmark$						$\checkmark$	33
8	Curing Mould & Bladder assembly transfer from Mould shop to Curing area with help of hydra	$\checkmark$				✓			$\checkmark$	47
9	Assembling of Curing Mould, Bladder in Tire curing Press and Press EEI Set-up	$\checkmark$						$\checkmark$		83
										E7E mine

575 mins

9.58 Hrs



#### **Current Situation on Mould Change over time**





### Approach on Time Study- Flow Methodology





### Change Over Time Study- Proposed Action Plan

	Time Study																		
AS-IS Condition												Proposed Improved Method						l Improved Method	
Study Date:-25.05.2022 Study Type:- Mould Change over									Work Station:-Tire Curing & Mould Shop Studied By:-P. Mugesh Kumar					g & Moul sesh Kum	ld Shop ar		Manpower Deployed:- Crew 1- Curing Engg team 5 nos Crew 2- Mould Shop Engg & tech team 6 nos		
Step No	Elemental Description	emental Description By Whom ECRS-Elimination , By Whom Combine ,Rearrange & Activity Type Time Simplify (Min.)		Activity Flow Chart Activity Type					Activi	ty Type	Propose d Time (Min.)	Scope for Improvement							
1	Removing Curing Mould & Bladder from Tire curing Press	Crew #1	Crew #2			к	5	Internal V	External	64						Internal V	External	64	
2	Curing Mould & Bladder assembly transfer from Curing area to Mould shop with help of hydra	~				~			$\checkmark$	48							~	10	Mould shop location to be changed near to curing process for improving transportation of Mould
3	Plug change with respect to planned size		~				~		~	142							~	45	<ol> <li>Searching time for Plugs to be reduced through vertical storage system rearranging the spares in right place and retrieval at right time also increase the more space in mould shop facility.</li> <li>To be modified the work bench design (Fixture) for simplification of plug change &amp; bead ring change process</li> </ol>
4	Bead ring change with respect to planned size		~				×		~	62							~	25	Location to be identified for bead ring storage for easy retrieval.
5	Mould correction with respect to LTC observation		$\checkmark$						$\checkmark$	22							$\checkmark$	22	
6	Sand Blasting & Vent Cleaning for Mould		$\checkmark$						~	74							$\checkmark$	74	
7	Mould Inspection by mould shop Team (Tech & Engg)		~						~	33							$\checkmark$	33	
8	Curing Mould & Bladder assembly transfer from Mould shop to Curing area with help of hydra	$\checkmark$				~			$\checkmark$	47							~	10	Mould shop location to be changed near to curing process for improving transportation of Mould
9	Assembling of Curing Mould, Bladder in Tire curing Press and Press EEI Set-up	$\checkmark$						~		83						$\checkmark$		83	
575         366           9.58         6.10										10									
Leger	ds											,		1					
0	Operation U Delay U Inspection V Storage										′ St	torage	2		NALLIANLE GALAXY PRIMEX				



### Action Plan Proposed & its implementation

Action Points for Making Improvements											
S.No	Action Points	Target Date	Resp.	Completion Date							
1	Mould shop location changed from outer peripheral area to near curing process for improving transportation of Mould	July'22	Naveen- Projects	25.07.2022							
2	Searching time for Plugs to be reduced through vertical storage system rearranging the spares in right place and retrieval at right time also increase the more space in mould shop facility.	Aug'22	Velladurai- Technical	18.08.2022							
3	To be modified the work bench design (Fixture) for simplification of plug change & bead ring change process	Aug'22	Rajesh - Engineering	22.10.2022							
4	Location to be identified for bead ring storage for easy retrieval.	Aug'22	Sudhandira Selvan- Technical	27.09.2022							

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#### **Relocation of Mould shop**





Distance between Tire Curing area to Mould shop – 600 metres. Mould shop loacated at outer pheripheral Relocated the mould shop near tire curing process in manufacturing facility and reduced 550 meters



### **Action Implementation on Plug & Tools Storage**

Before



Searching time was more due to improper storage of Plugs and tools. Plugs also missing due to handling issue.



Searching time was reduced due to proper storage of Plugs and tools in Vertical storage system

Plugs are stored in vertical storage system and made easy to handle & retrieve within 5 mins with respect to size

2



#### Work Bench design modification





### **Storage of Rims in Mould shop- Before**



Rims are stored in Horizontal one another one and difficult to search and not easy to handle the rims



Rims are stored in vertical and made easy to handle & retrieve within 5 mins

4



### Validation of Change Over Time - After Action Implementation

	Time Study											
After action Implementation												
	Study Date:-18.11.2022 Study Type:- Mould Change over											
Step	Elemental Description	By W	hom	E	CRS-Elimiı Rearrar,	nation , Con nge & Simp	mbine lify	Activi	ty Type	Before Time (min.)	Proposed time (Min.)	Actual Time (Min.)
No		Crew #1	Crew #2	E	С	R	S	Internal	External			
1	Removing Curing Mould & Bladder from Tire curing Press	$\checkmark$	$\checkmark$					~		64	64	64
2	Curing Mould & Bladder assembly transfer from Curing area to Mould shop with help of hydra	~				~			$\checkmark$	48	10	13
3	Plug change with respect to planned size		$\checkmark$				✓		$\checkmark$	142	45	52
4	Bead ring change with respect to planned size		$\checkmark$				✓		$\checkmark$	62	25	32
5	Mould correction with respect to LTC observation		$\checkmark$						$\checkmark$	22	22	22
6	Sand Blasting & Vent Cleaning for Mould		$\checkmark$						$\checkmark$	74	74	74
7	Mould Inspection by mould shop Team (Tech & Engg)		$\checkmark$						$\checkmark$	33	33	33
8	Curing Mould & Bladder assembly transfer from Mould shop to Curing area with help of hydra	~				~			$\checkmark$	47	10	15
9	Assembling of Curing Mould, Bladder in Tire curing Press and Press EEI Set-up	$\checkmark$						$\checkmark$		83	83	83
										575 Min	366 MIn	388 Mn

9.58 Hrs 6.10 Hrs 6.47 Hrs 💓



#### **Results After Action Implementation**



**Inference:** 32% reduction on mould change over time



#### **Effect of Action Implementation**

Last Tire Check of previous lot size Press Hand over to Engineering Team **Removing Curing Mould & Bladder from Tire curing Press** 60 mins Curing Mould & Bladder assembly transfer from Curing area to Mould shop with 45 mins help of hydra Bladder Assembling with respect ivity 140 mins Plug change with respect to planned size 60 mins 187 mins Time to planned size Bead ring change with respect to planned **Reduced from** arallel A size Bladder Inspection by Engg team 15 mins 60 mins 575 mins. Series Activity Mould correction with respect to LTC 30 mins After observation Sand Blasting & Vent Cleaning for Mould Implementation 80 mins - 388 mins Mould Inspection by mould shop Team (Tech 40 mins & Engg) Curing Mould & Bladder assembly transfer from Mould shop to Curing area with help 45 mins of hydra Assembling of Curing Mould, Bladder in Tire curing Press and Press EEI Set-up 75 mins 20

Hand over to production for Warm up & Pre-First tire check



#### **Tangible Benefits:**

Availability time for curing press increased from 51% to 63 % by made available of Curing press before 187 mins for tire production.

#### **In- Tangible Benefits:**

Safety improved on the plug change with help of work bench modification and reduce the fatigue.
Eliminated the scrap due to wrong plug.
Improved the aesthetic value of tire by eliminating flash.
Eliminated the new ordering of missing plug and tools & spares by implementing the vertical storage system
Manpower utilization in mould shop for on-time delivery of curing mould
Morale improved by implementing the 2S in the workplace



### **Standardization of Implemented Action Plan**

	Action Points for Making Improvements											
S.No	Action Points	Completed Date	Resp.	Standardization	Shop floor training							
1	Mould shop location changed from outer peripheral area to curing process for improving transportation of Mould	25.07.2022	Naveen- Projects	Plant layout Revised	Operator training given for transfer the mould							
2	Searching time for Plugs to be reduced through vertical storage system rearranging the spares in right place and retrieval at right time also increase the more space in mould shop facility.	18.08.2022	Velladurai- Technical	<ol> <li>Work instruction for plug change &amp; 2S standard updated</li> <li>Video SOP created for mould change</li> </ol>	Operator training given to all mould shop technicians for retrieval & store the plugs in Vertical System							
3	To be modified the work bench design (Fixture) for simplification of plug change & bead ring change process	22.10.2022	Rajesh - Engineering	<ol> <li>Work instruction for plug change &amp; ring change, Engineering Drawing updated</li> <li>Video SOP created for mould change</li> </ol>	Operator training given for work bench usage							
4	Location to be identified for bead ring storage for easy retrieval.	27.09.2022	Sudhandira Selvan- Technical	<ol> <li>Work instruction for Ring change &amp; 2S standard updated</li> <li>Video SOP created for mould change</li> </ol>	Operator training given to all mould shop technicians for retrieval & store the rings in storage System 22							



#### **Horizontal Deployment**

- 1. All the actions are deployed for all SKU's in Curing process.
- 2. Vertical Storage system implemented in Tire Building drums & spacers.

#### Key learnings

- 1. Layout change and its impact on Change over time.
- 2. Knowledge on SMED concept & Problem Solving Methodology
- 3. How to engage and use effectively the workforce in process & Team Building

#### Way forward

SMED is a never ending journey, it's a continuous process..

Our Next Focus on Internal activity for further reduction of mould changeover time.....



# Thank You!

