# Rane (Madras) Limited – Brake Components Division

P4-Trichy

## CII NATIONAL AWARD FOR ENVIRONMENTAL BEST PRACTICE - 2025

## Category : Waste Management & Recycling

Sankar Prasath D

EHS & Sustainability

Harishkumar S

Manufacturing

# RML BCD Milestones towards Sustainability

**RML BCD Vision :**

To establish global presence and enhance domestic leadership by providing eco-friendly friction solutions

**1964** RBL Commenced operations – Technical collaborations with Small & Parkes - UK ;Chennai plant commenced (P1)

**1985** Collaboration with Nisshinbo(NISB), Japan

**1991** Hyderabad plant (P2) operations commenced

**1997** Puducherry Plant (P3) operations commenced

**2003** Deming Award

**2008** Trichy Plant (P4) operations commenced for Asbestos free Passenger Car Disc pad

**2011** CVL facility started for Asbestos free Brake Lining (Commercial Vehicle)

**2019** PCL facility started for Asbestos free Brake Lining & Won Excellence in Energy Efficient unit from CII


**2021** Won Silver Award For Excellence In Health, Safety, Sustainability In The ACMA

**2022** Won Gold Award For Excellence In Health, Safety, Sustainability In The ACMA

**2023** Won 2nd price for Best Environmental management form TNPCB

**2024** Won Energy Efficient Unit & Green Co Gold from CII

# RML BCD - Trichy plant profile

## RML BCD – Trichy plant

Started in **June 2008**

- Spread over an area of **81,000 Sq. meter** (20 acres) land built up area of 15,000 Sq. meter

Certified for

- **ISO 9001: 2015** (QMS)
- **IATF16949 : 2016** (QMS)
- **ISO 14001 : 2015** (EMS)
- **ISO 45001: 2018** (OHSAS)
- **ISO27001:2013** (IT)
- **CII Green co Gold** (Sustainability)

From 2008, Audited & approved by

- **Suzuki, MSIL, TATA,MG, Honda for Passenger car Disc pads**
- **TMD, Germany for Commercial Vehicle Brake Lining**
- **Suzuki, MSIL, TATA for Passenger car lining**

**Eco Friendly environment,**

- Manufacturing **asbestos free** Disc pads, HCV & PCL Brake lining
- Planted more than **700 saplings** in the Plant
- 25 % of the plant area proposed for **Green belt development**

## CREDENTIALS

*Deming Prize In 2003*

*Deming Grand Prize In 2013*


*Last 8 Years*

**Manufacturing 100% Asbestos free Disc pads & Brake Linings**

# Projects Identified to reduce waste & recycling

1

"Track to Zero"

**Minimizing Waste through Under-Layer Traceability system**

Disc Pad

2

"Precision Engineering for Sustainability"

**Innovative Reduction of Grinding Dust generation**

Disc Pad

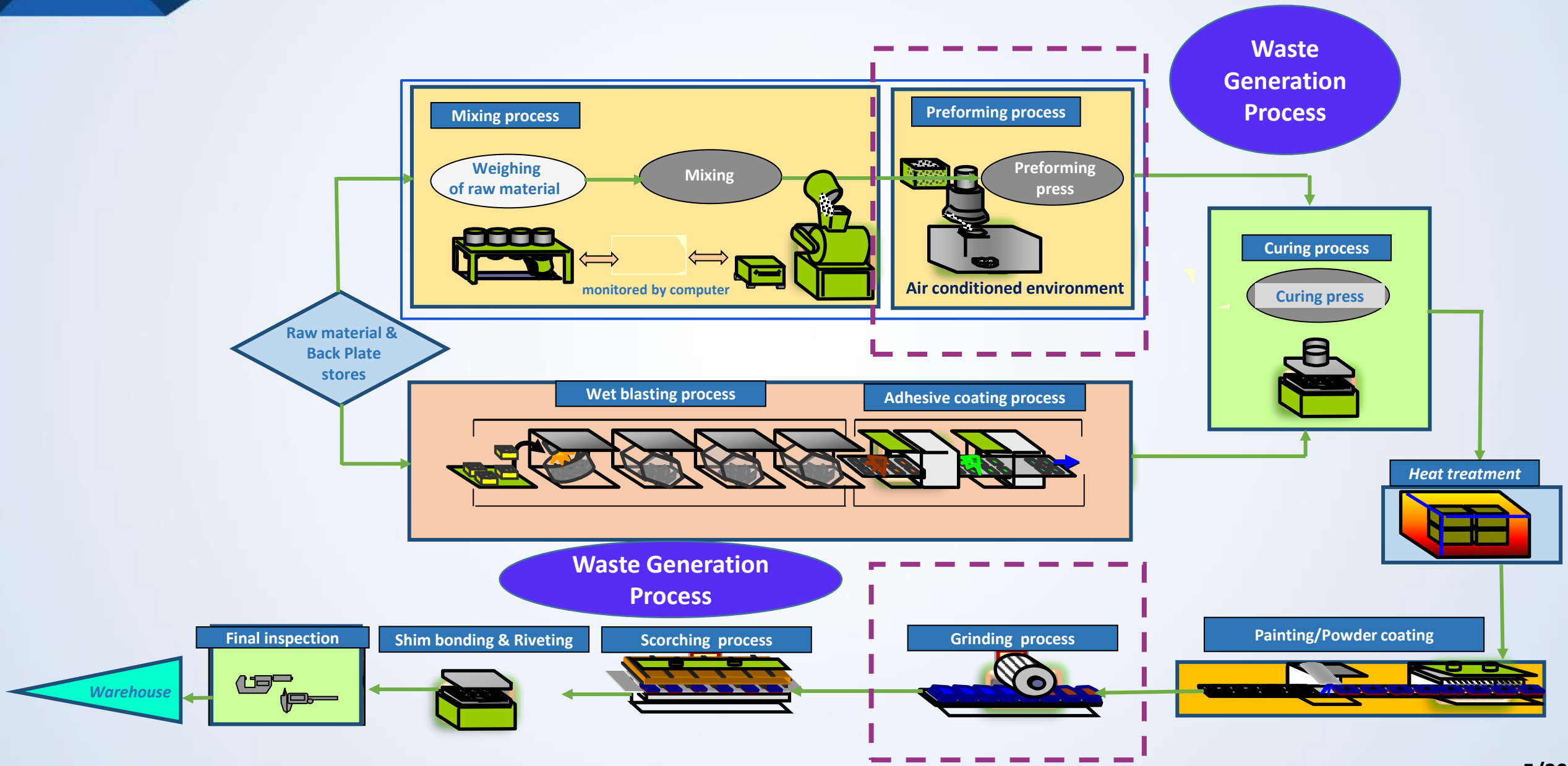
3

"Grinding Green"

**Converting Dust Waste into Performance Materials**

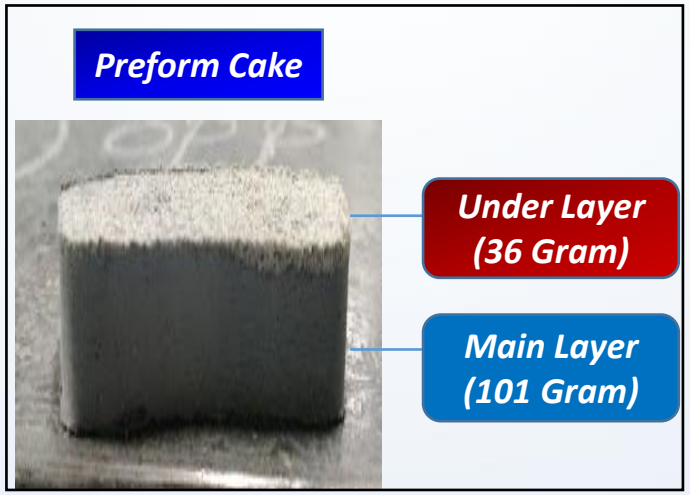
Brake Lining


# Process Flow – Disc Pad Division



# Project - 1 "Track to Zero: Minimizing Waste with Under-Layer Traceability”

- **Raw Material Preparation:** Friction raw materials are blended through a controlled mixing process to ensure uniform composition.
- **Preform Composition**: The preform mix consists of two critical elements –
  Main Mix: Functions as the friction-generating material in the disc pad.
  Under Layer Mix: Acts as a bonding layer, firmly bonding the friction material to the back plate.
- **Preform Formation:** Both main mix and under layer mix are compacted into a defined preform cake shape using a precision-controlled hydraulic press.


## List of Main Mix & UL mix:

| S.No. | Main mix grade | UL mix grade |
|---|---|---|
| 1 | RD6934H2 | RB20 |
| 2 | RD6934H2 (S) | |
| 3 | RD6934H2(M) | |
| 4 | R5102L(M) | |
| 5 | SA02A | RB23 |
| 6 | SA02B | |
| 7 | RD6768H-T14 | |
| 8 | RL6755-DP23H R5102L(A) | RB23(A) |
| 9 | R5102L(A) | |
| 10 | RN609H | |
| 11 | R5102L(M2) | |
| 12 | RD6981H | RB32 |
| 13 | R5102L | |
| 14 | RD6920H2 | RB40 |
| 15 | R808T(A) - 85 / R8170 | |
| 16 | R9001 | |
| 17 | R809 | |
| 18 | R5104 | |
| 19 | R9405H | |
| 20 | RL6320A1 | RU12 |
| 21 | R812M | UL4 |
| 22 | R9303H | UL 04 - 03 |

**22 Main mix and 8 Under layer**

# Project - 1 "Track to Zero: Minimizing Waste with Under-Layer Traceability”

## Trigger :

- To ensure accuracy and traceability, the **main mix storage** bins are equipped **with RFID devices**, which are **fully synchronized with the QT (Quality Traceability) system** on the machines.
- This integration **enables real-time verification** and guides operators in **selecting the correct main mix** for the specific machine and application, thereby minimizing the risk of mix-ups.

## Uniqueness of the project :

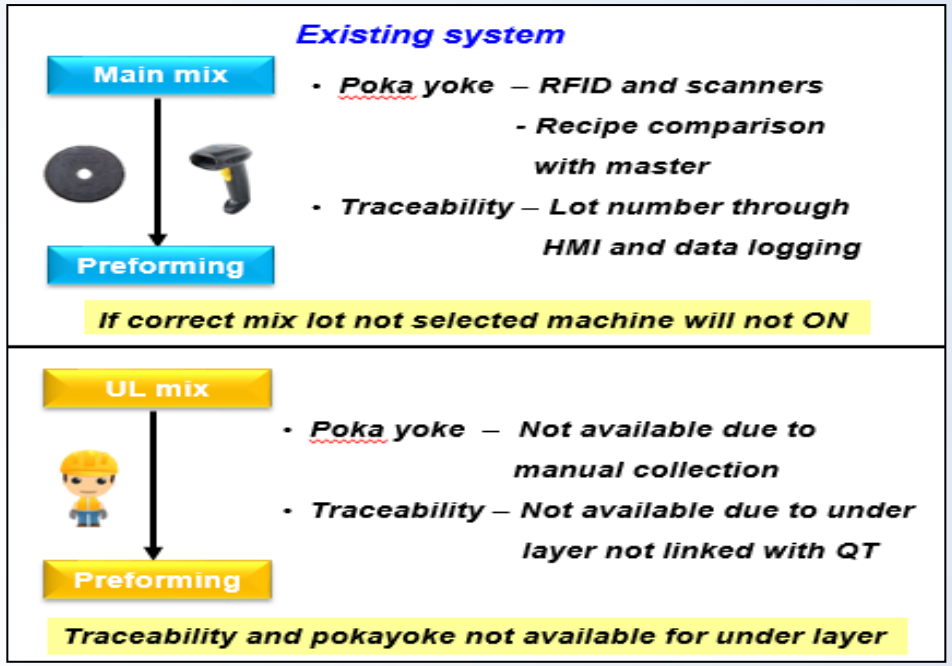
- **New application** - Quality traceability implemented for **Underlayer mix** for the first time (among 4 plants) – **In-house development**

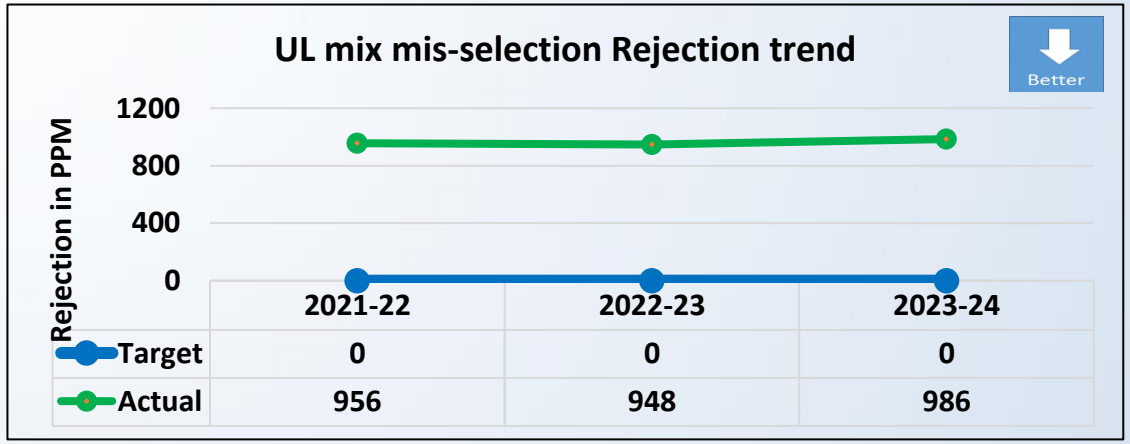
## Project period :

- **Start month :** Apr’24
- **End month :** Sep’24

## Milestone :

- **Nisshinbo, Japan** team appreciated & benchmarked in Oct’24



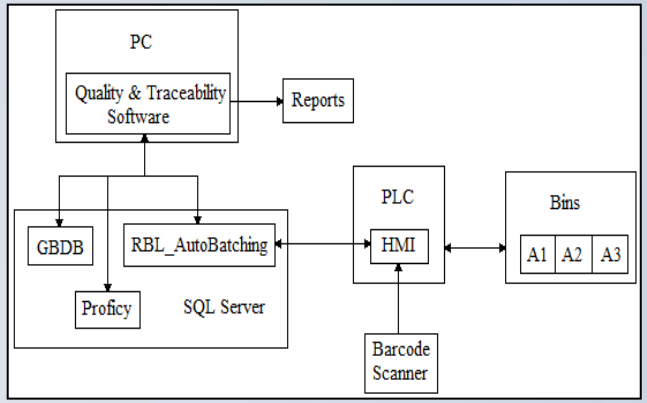




**963 PPM on average, 1.48 Mton Waste on average**

# Project - 1 "Track to Zero: Minimizing Waste with Under-Layer Traceability”

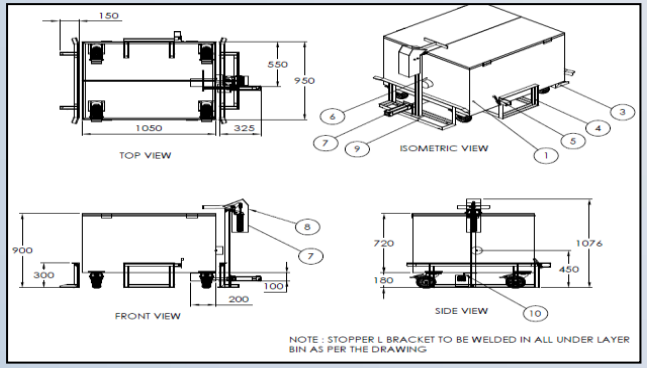
## Action :

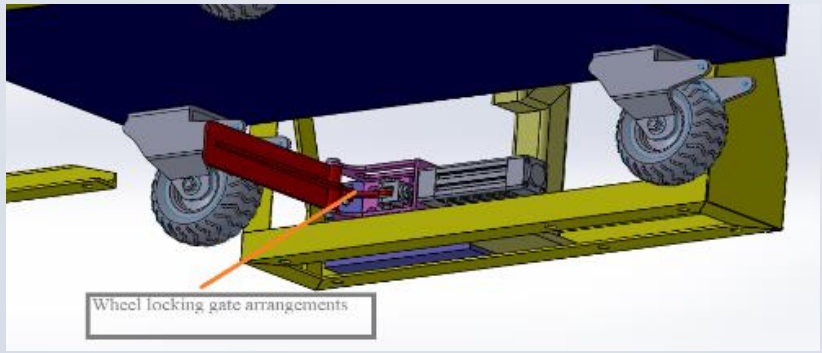
- **System & Software Development:**
  - ✓ Extended existing Poka-Yoke (error-proofing) mechanisms from main mix to under layer mix for consistent process validation.
  - ✓ Lot tracking module ensures that only the correct under layer mix, matching the batch and machine specification, is released.




## Challenges :

- **Bin locking drawing :**
  - ✓ Physical lock system installed on material bins to prevent access to incorrect mixes.
  - ✓ Locks are electronically controlled and linked with the traceability software.



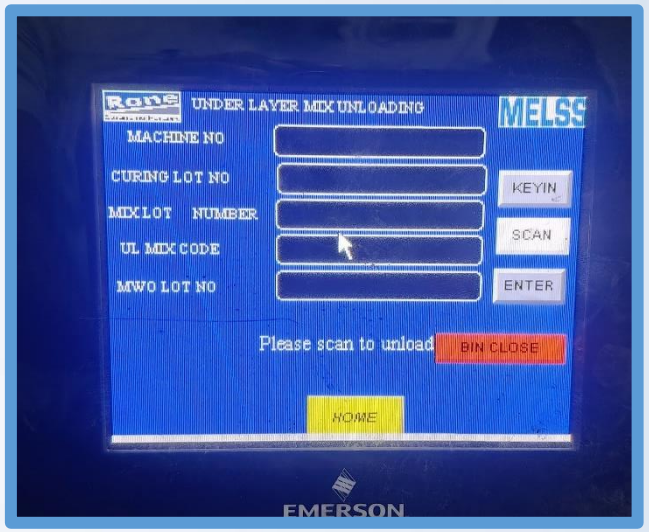




- **Double Scanning :**
  - ✓ To avoid wrong usage of UL mix trays

# Project - 1 "Track to Zero: Minimizing Waste with Under-Layer Traceability”

## Action :

- ✓ Each under layer mix bin is equipped with a physical electronic lock.
- ✓ Operator scans the designated **1D barcode** for the specific lot.
- ✓ The system cross-checks the **machine ID** with the batch details.
- ✓ Operator scans the process card containing job and part details.
- ✓ Software automatically checks if the part number matches the process and mix.
- ✓ Critical details such as **lot number, time stamp, machine no., and bin status** are logged.
- ✓ Once **all validations** are passed, the system unlocks the mix bin



# Project - 1 "Track to Zero: Minimizing Waste with Under-Layer Traceability”

## Tangible benefits :

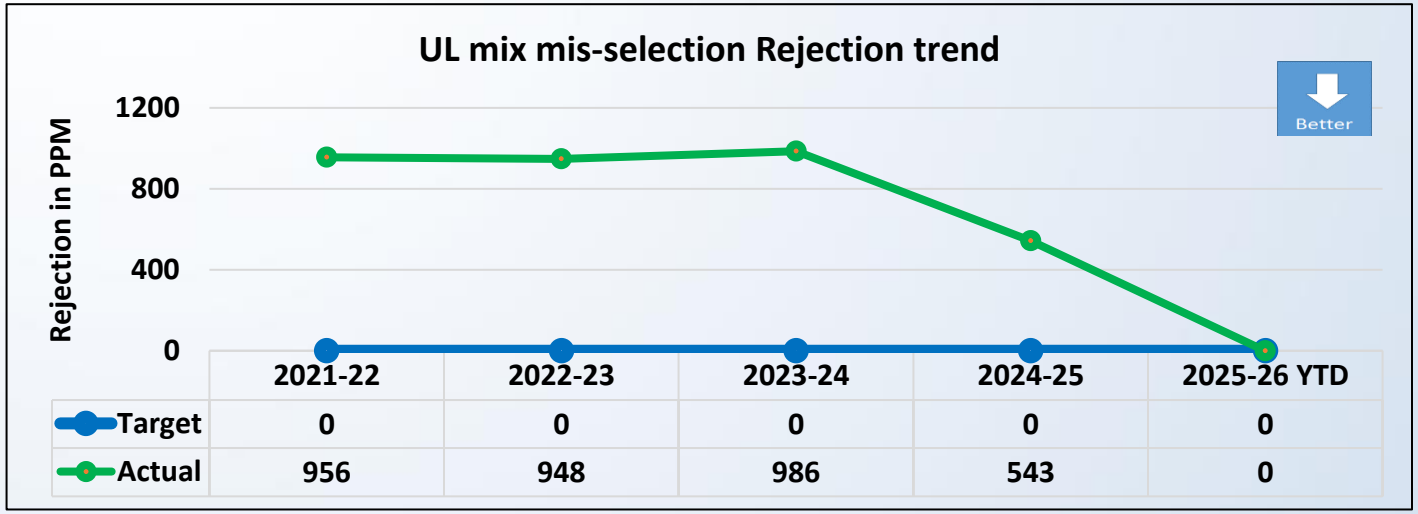
- **17.48 Mton/annum Wastage** generation eliminated
- **UL mix mis-selection** Rejection 963 PPM eliminated
- Cost Savings – INR 73.3L/annum (RM, Disposal, Operational cost)
- **OEE improved** from 78% to 81% (By improving Quality rate from 98.2% to 99.1%

## Intangible benefits :

- **Deskilled** the activity - Selection of UL mix
- **Team** got **motivated** & involved in **other phenomenon elimination activities**
- **Team morale improved**
- **Due to Material Saving, Mining process** reduced to extract RM
- **Carbon emission reduction, Energy Saving** by reducing transport & process

## Replication :

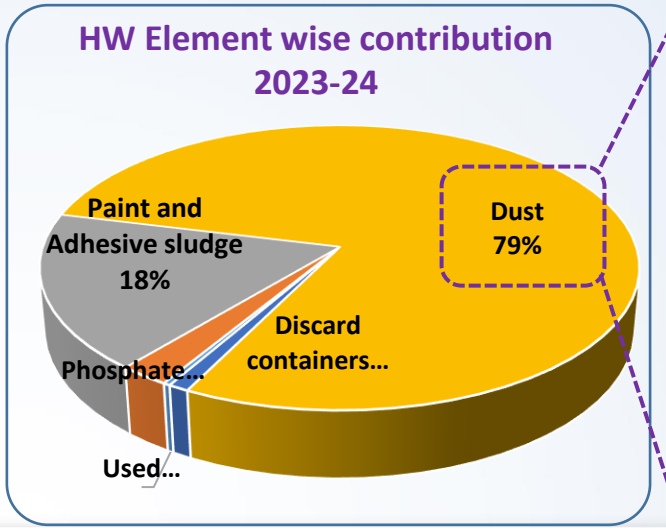
| Locations | Material Saving/annum (MT) | Cost Savings (Lakhs/annum) |
|---|---|---|
| Chennai Plant | 10.7 | 48.3 |
| Hyderabad plant | 12.6 | 52.4 |
| Puducherry plant | Implementation in progress | |

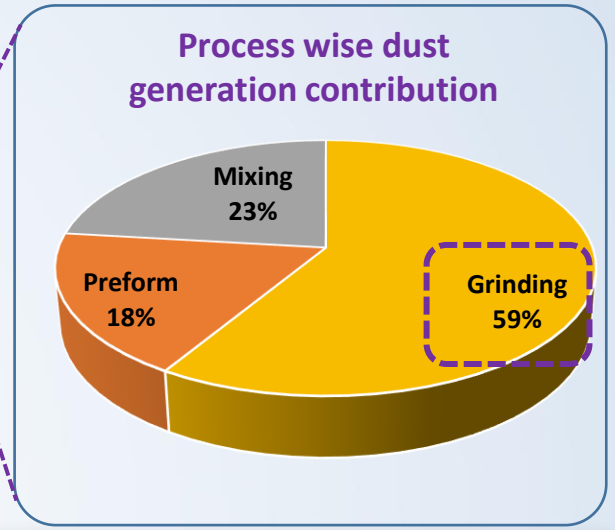


# Project - 2 "Precision Engineering for Sustainability"– Innovative Reduction of Grinding Dust

## Trigger of the Project :

- **Hazardous waste generation** is high **282 MT in 2023-24**
- **In Hazardous waste (HW)** generation elements**, Dust generation** contribution is high 222.7 MT (79%)
- So, **Management** focused on **Dust generation reduction.**




## Uniqueness of the project :

- **Raw material utilization** through **Machine / Mould parameter** optimization through **DMAIC - LSS (Define, Measure, Analyse, Improve & Control)** approach

## Project period :

- **Start month :** May'24
- **End month :** Oct'24

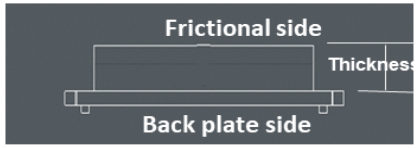
## Milestone :

- **Sustainability Integration :** Yield saving linked with reduced solid waste disposal & improved eco-compliance.
- **Unique approach designed** for yield improvement that are suitable for all product segments & followed during New product development stage

# Project - 2 "Precision Engineering for Sustainability"– Innovative Reduction of Grinding Dust

## Understanding Preform weight, Cure pad thickness & Grinding pad thickness :

### Drawing




### Preform Weight

To achieve the thickness, mix mass calculated.

Mass =
Cure Pad thickness x Grade Density x Area

(Grinding stock considered= 0.9mm to 1.2mm in thickness)

### Curing

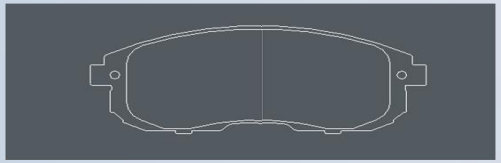
Curing thickness = Final thickness + Grinding stock


### Grinding


$$\text{Yield} = \frac{\text{Output (Final pad main mix weight)}}{\text{Input weight (Input raw material weight)}}$$

### Model L Disc pad - CAD image


Frictional side



Backplate side


**Cured pad :**

**Final pad :**

**Theoretical calculation :**

| Metric | mm | Density (gm/cc) | Area ($cm^2$) | Weight (g) |
|---|---|---|---|---|
| Curing Thickness | 17.2 | | | |
| BP Thickness | 6 | | | |
| UL Thickness | 1.7 | 2.2 | 47 | 17.58 |
| ML Thickness | 9.5 | 2.4 | 47 | 107.2 |

Main layer weighs 107 grams for thickness 17.2 mm in Cured pad

| Metric | mm | Density (gm/cc) | Area ($cm^2$) | Weight (g) |
|---|---|---|---|---|
| Final pad Thickness | 16.0 | | | |
| BP Thickness | 6 | | | |
| UL Thickness | 1.7 | 2.2 | 47 | 17.58 |
| ML Thickness | 8.3 | 2.4 | 47 | 93.6 |

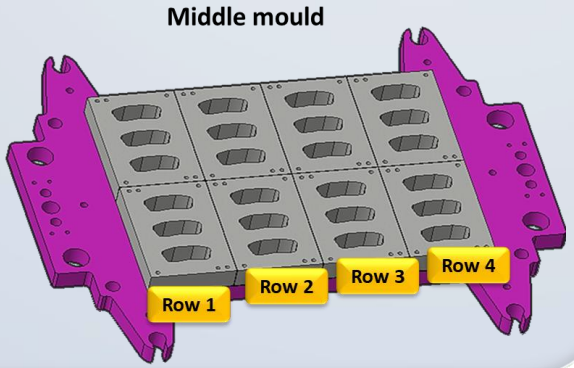
After grinding Main layer weight will be 93.6g
13.6grams scrapped as dust

$$\text{Yield} = \frac{\text{Output (Final pad main mix weight)} - 93.6}{\text{Input weight (Input raw material weight)} - 107.2} = 87\%$$

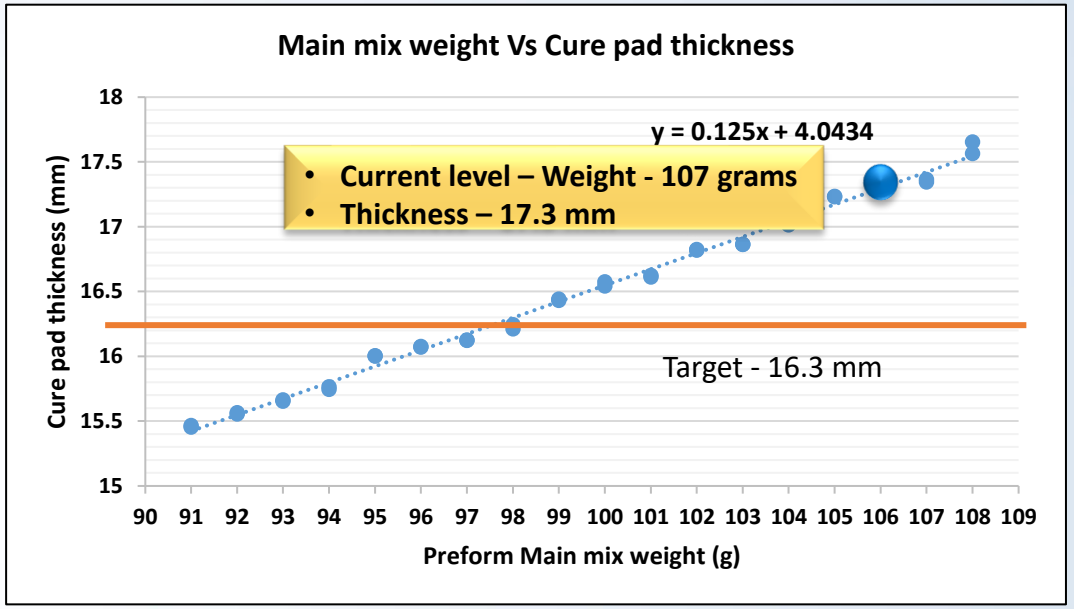
# Project - 2 "Precision Engineering for Sustainability"– Innovative Reduction of Grinding Dust

## Approach followed :

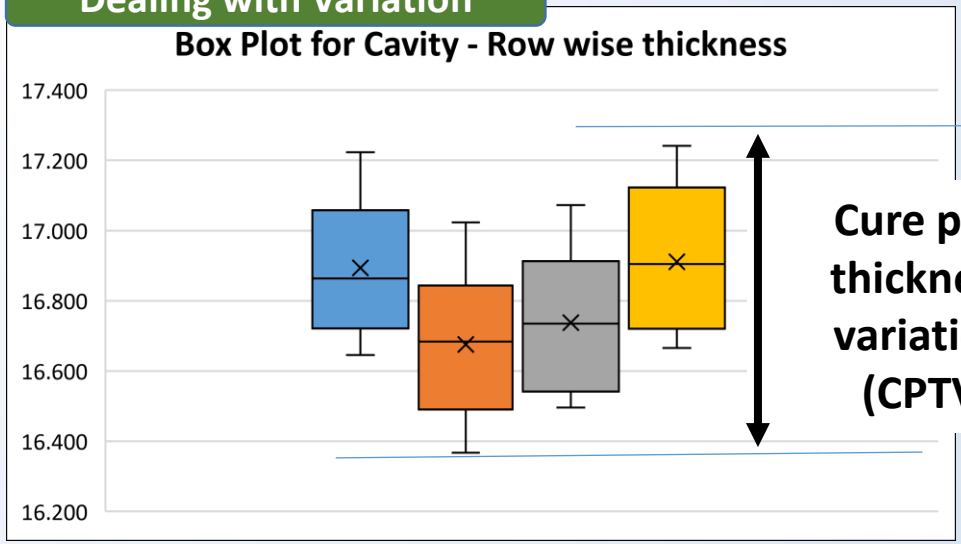
- Current scenario study using simple linear regression
- Observe variation contributors (Stratification)
- Brainstorm & apply FMEA to identify probable causes in Fishbone
- Screening test to identify top significant factors
- Consider Responses based on factors
- Level selection based on manufacturing feasibility
- Conduct experiments
- Analyse Response Vs Factors
- Response optimiser
- Shift average after variation reduction




## Dealing with Average



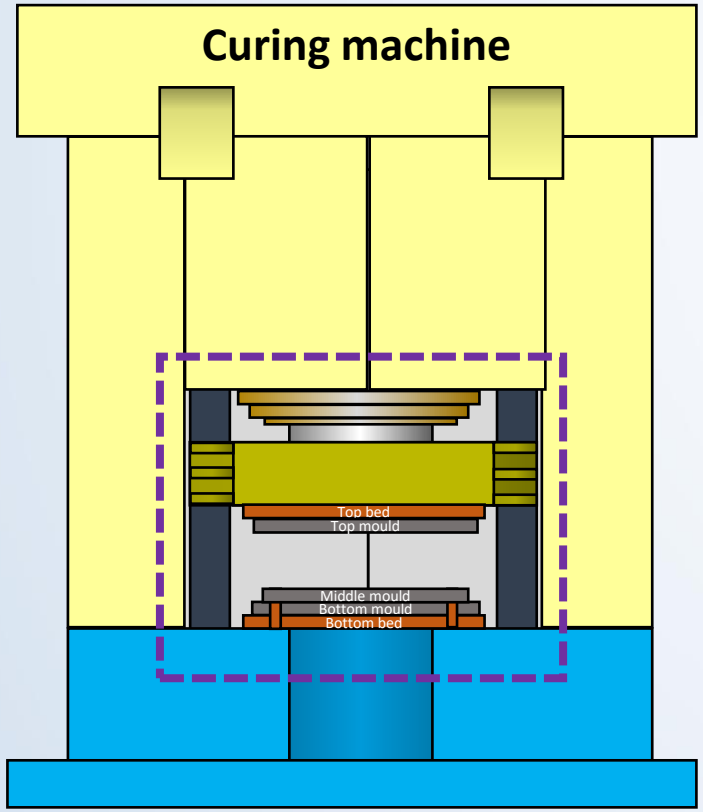

## Dealing with Variation



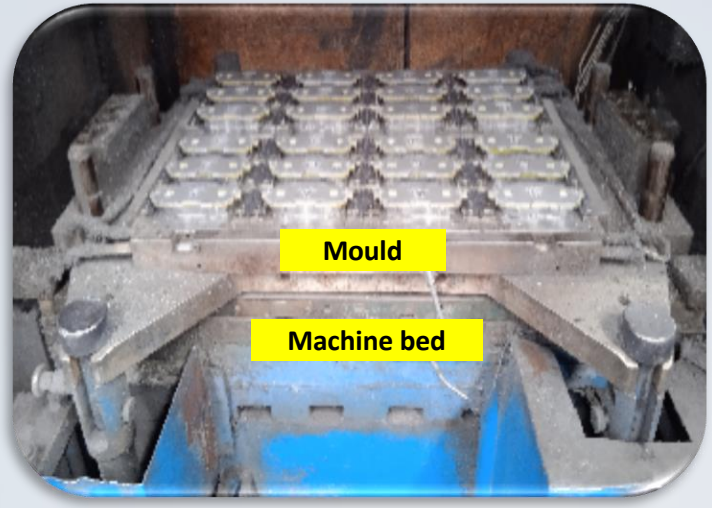
# Project - 2 "Precision Engineering for Sustainability"– Innovative Reduction of Grinding Dust

## Significant factors :

- Bed parallelism
- Middle mould flatness
- Punch height variation



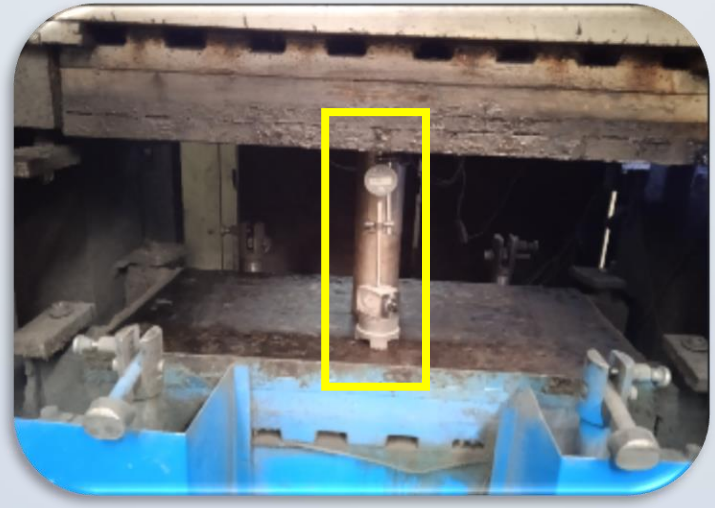

### Machine & Mould setup




### 2) Middle mould flatness

Spec : 0.3 mm max

### 1) Bed parallelism



Spec : 0.3 mm max

### 3) Punch height variation

Spec : 0.2 mm max

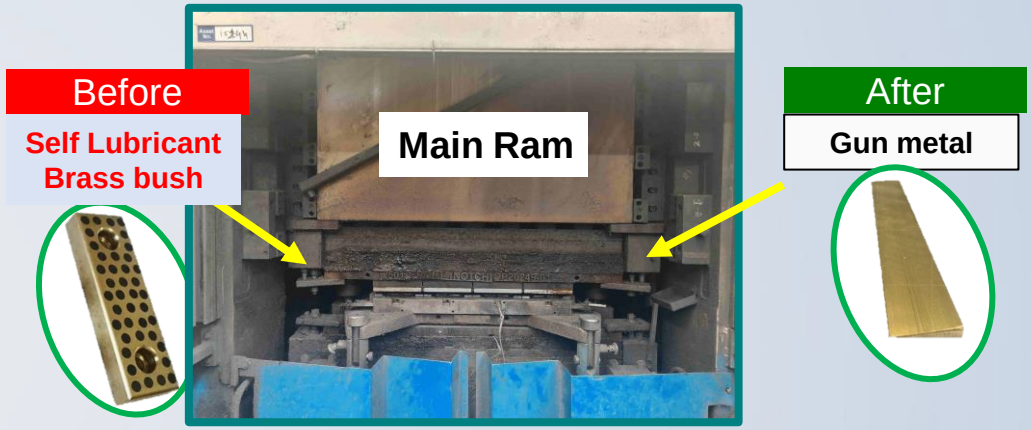
# Project - 2 "Precision Engineering for Sustainability"– Innovative Reduction of Grinding Dust

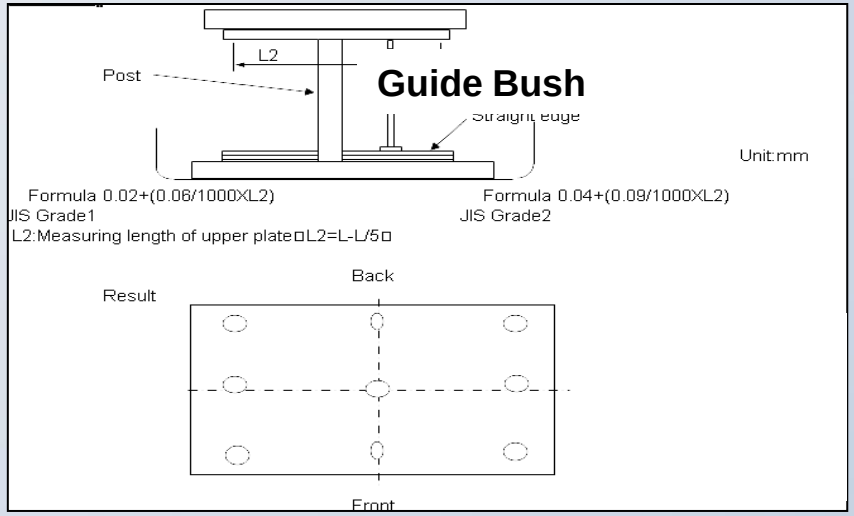
## Results after Experiments & Response optimizer :

| Sl. No | What | | | How |
|---|---|---|---|---|
| | Parameter | From | To | |
| 1 | Bed parallelism | 0.20 mm | 0.10 mm | 1. Pillar bush material changed to Gun metal (from self lubricant brass). |
| 2 | Mould middle plate flatness | 0.30 mm | 0.10 mm | 1. Mould middle plate flatness corrected by regrinding. |
| | | | | 2. Plate arm length and width increased by 52% to avoid bend |
| | | | | 3. Machine ejection system modified (connecting rod to rack & pinion) |
| 3 | Punch height variation (assembled condition) | 0.15mm | 0.08mm | 1. Bottom mould & wear plate regrinding |
| | | | | 2. Interlock made for number of cycle for periodic regrinding (50000 cycles – Once in six months) |

## Challenges (For Sustaining) :

***Machine bed parallelism action***



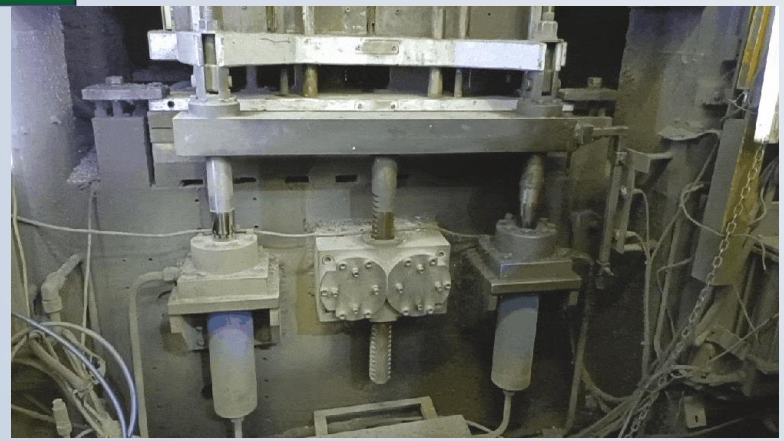
# Project - 2 "Precision Engineering for Sustainability"– Innovative Reduction of Grinding Dust

## Challenges (For Sustaining) :

Before

Individual cylinder middle mould ejection

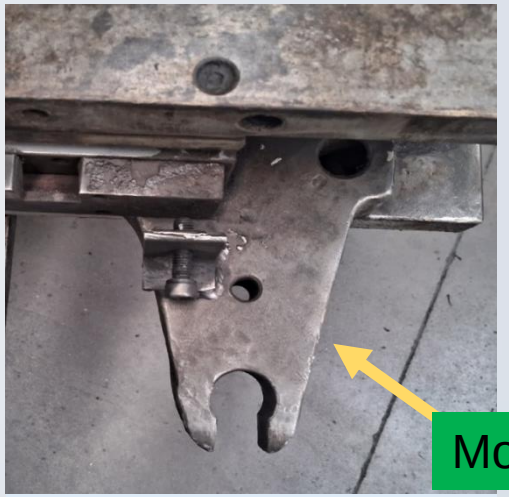
After



Rack and pinion for common ejection

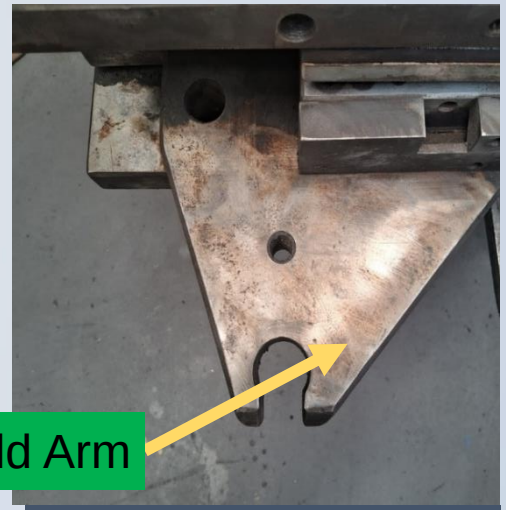
***Middle mould arm width & length increased***

Before



Area – Length - 160 mm &
Width – 130 mm

After

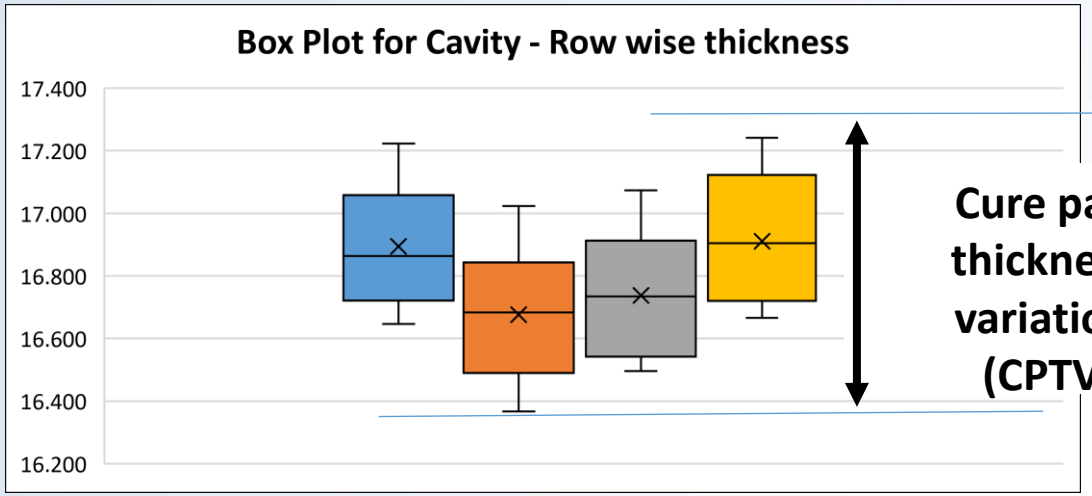


Area – Length - 250 mm
& Width – 160 mm

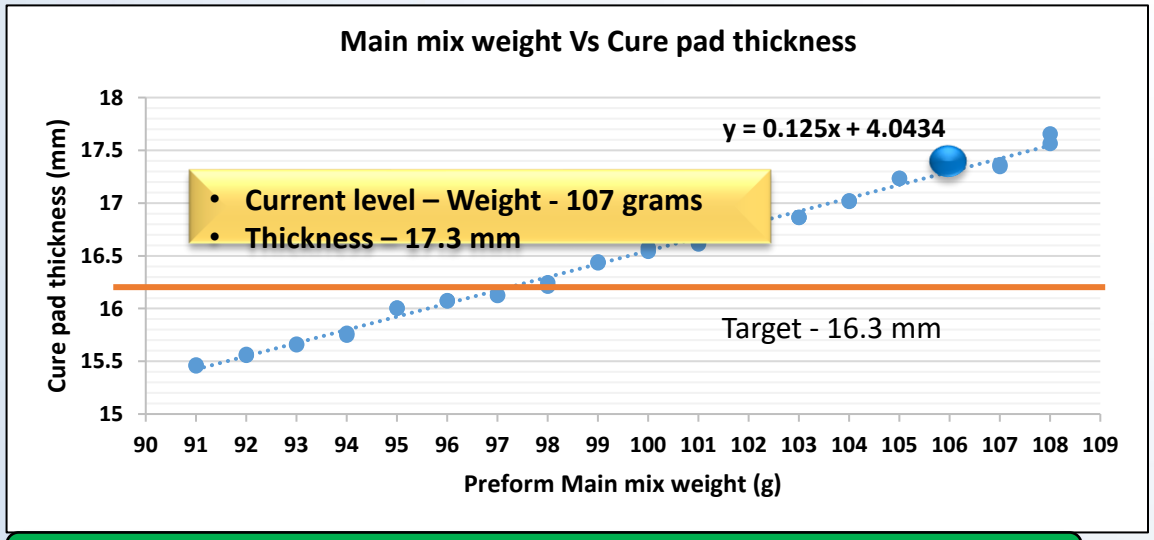
Mould Arm

52% area increased from older design arm

# Project - 2 "Precision Engineering for Sustainability"– Innovative Reduction of Grinding Dust




**Variation reduced from 0.673mm to 0.293mm**




**Weight reduced from 107 grams to 98 grams**

## Replications within PCDP module :

| S.No | Model | Before weight (Grams) | Current weight (Grams) | RM saving (Grams) | Grade |
|---|---|---|---|---|---|
| 1 | Model L | 107 | 98 | 9 | RD6934H2 |
| 2 | Model L OES | 107 | 98 | 9 | RD6934H2 |
| 3 | YNC Pin | 76 | 73 | 3 | SA02B |
| 4 | YNC plain | 76 | 73 | 3 | SA02B |
| 5 | YJC Pin | 78 | 75 | 3 | RD6768H |
| 6 | YJC plain | 78 | 75 | 3 | RD6768H |
| 7 | Z101 rear Inboard | 90 | 84 | 6 | R8070i |
| 8 | Z101 rear Outbord | 90 | 84 | 6 | R8070i |
| 9 | Aria 3 Pin | 176 | 169 | 7 | R808T |
| 10 | Aria 2 Pin | 176 | 169 | 7 | R808T |
| 11 | X2 front 3 Pin | 176 | 169 | 7 | R808T |
| 12 | X2 front 3 Pin | 176 | 169 | 7 | R808T |
| 13 | Xenon Inboard | 176 | 169 | 7 | R808T |
| 14 | Xenon Outboard | 176 | 169 | 7 | R808T |
| 15 | YCA inboard | 76 | 73 | 3 | RD6768H |
| 16 | YCA outboard | 76 | 73 | 3 | RD6768H |
| 17 | P602 Inboard | 84 | 78 | 6 | R809 |
| 18 | P602 Outboard | 84 | 78 | 6 | R809 |
| 19 | Y9T HITACHI | 72 | 71 | 1 | RD6768H |
| 20 | ALDOST | 105 | 103 | 2 | R808T |

**67 MT of Raw material saved**

# Project - 2 "Precision Engineering for Sustainability"– Innovative Reduction of Grinding Dust

## Tangible benefits :

- **67 MT/annum Wastage** generation eliminated
- **Cost Savings – INR 78 Lakhs/annum** (RM, Disposal, Operational cost)

## Intangible benefits :

- **Team** got **motivated** & involved in **other module (CVBL & PCBL) parts**
- **Material Saving, Mining process** reduced to extract RM
- **Carbon emission reduction, Energy Saving** by reducing transport & process

## Replication :

| Locations | Material Saving/annum (MT) | Cost Savings (Lakhs/annum) |
|---|---|---|
| Chennai Plant | 56 | 64 |
| Hyderabad plant | 44 | 52 |
| Puducherry plant | 48 | 16 |

# Projects Identified to reduce waste & recycling

1

"Track to Zero"

**Minimizing Waste through Under-Layer Traceability system**

Disc Pad

2

"Precision Engineering for Sustainability"

**Innovative Reduction of Grinding Dust generation**

Disc Pad

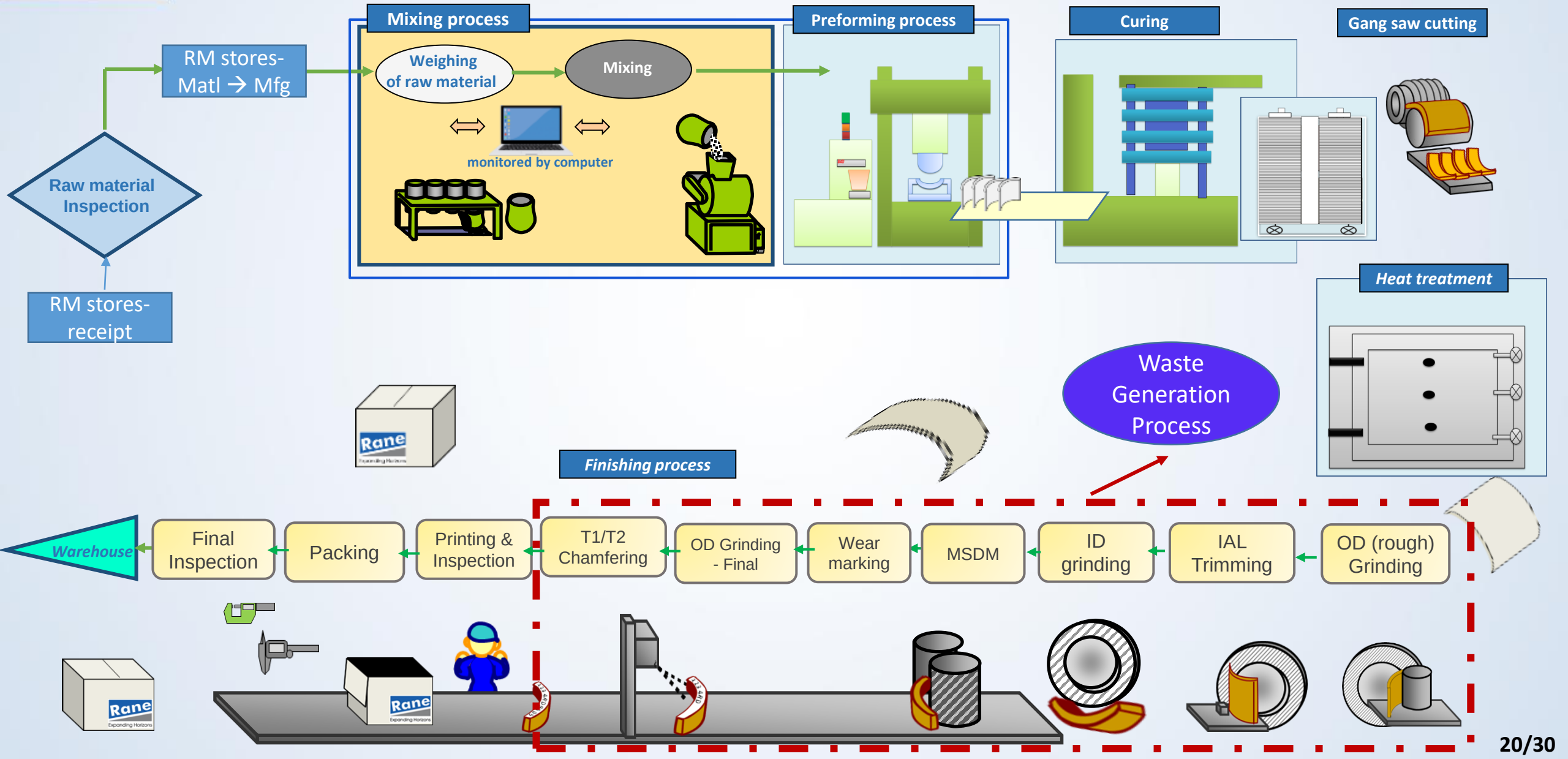
3

"Grinding Green"

**Converting Dust Waste into Performance Materials**

Brake Lining


# Process Flow Diagram – CV Brake Lining



# Project 3. "Grinding Green": Converting Dust Waste into Performance Materials

## Trigger :

- **Increase in Dust with Production Growth**
  As production volume ramps up, the amount of friction dust generated also increases. This creates additional challenges in managing and disposing of the waste.
- **Strict Regulations on Disposal**
  Government and environmental agencies have strict rules for handling and disposing of solid waste like friction dust. Non-compliance can lead to penalties or legal issues.
- **High Disposal Costs**
  Disposing of friction dust in a safe and compliant way is very costly.

## Uniqueness of the project :

- **Re-use of ground dust in formulation :**First-of-its-kind approach to convert grinding dust waste into performance-grade friction material without compromising regulatory standards.

## Project period :

- **Start month :** Sep'23
- **End month :** Aug'24

## Milestone :

- **Sustainable Manufacturing :** Achieved validated brake performance with dust-based formulation, ensuring cost saving, waste reduction, and eco-compliance.
- **RAF 7** grade approved in US market.

# Project 3. "Grinding Green": Converting Dust Waste into Performance Materials

## Analysis :

### Brake Lining Manufacturing Process :

- Our brake lining products are manufactured using **8 raw materials** in specific proportions:
  - RB 412 – 9%, RB 152 – 23%, RB 123 – 16%, RB 132 K – 12%, RB 116 – 29%, RB 04 – 3%, SP-619 – 4%, RB 140 – 4%
- These raw materials are **mixed together to form a preform mix**.
- The preform mix is then **converted into preforms and cured**.
- After curing, the brake linings go through a **grinding process** to achieve precise specifications.
- During grinding, **a large amount of dust waste is generated**, which is usually collected and disposed of through **co-processing**.

*RM collection & Mixing*


*Preform Mix*

*Preform*

*Cured Lining*

*Before finishing*

*After finishing*

# Project 3. "Grinding Green": Converting Dust Waste into Performance Materials

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# Project 3. "Grinding Green": Converting Dust Waste into Performance Materials

## Innovation – Cost Effective Formulation

**Formulation Development**

- **3R concept (Reduce/Re-cycle/Re-use)** adopted innovatively to develop cost effective formulation.
- Re-use of ground dust in formulation maximized to achieve desired cost benefit.

**Ground Dust**

### ***Advantages***


- Rich source of raw material having friction characteristics
- Considered as 'Functional Filler'
- Eliminate waste disposal → Reducing Air / Water / Land pollution
- Conserves Raw materials → Saving money

### ***Challenges***

- Formulation to be designed with very high dosage of ground dust
- Inconsistency due to multiple grade's dust & very high dosage effect
- Handling issue – Fly loss & poor compactness in Preforming
- Variation in Performance – Poor braking efficiency, low life

### ***Innovation***

- To reduce variability, Ground dust from single grade evaluated & best option used in the formulation
- Exclusive facility established to collect & store dust from single grade in bulk quantity
- New raw material code created for single grade dust and material spec standardized
- Special process was developed to avoid handling issue

**Cost effective new grade developed innovatively by formulation design with high dosage of ground dust**

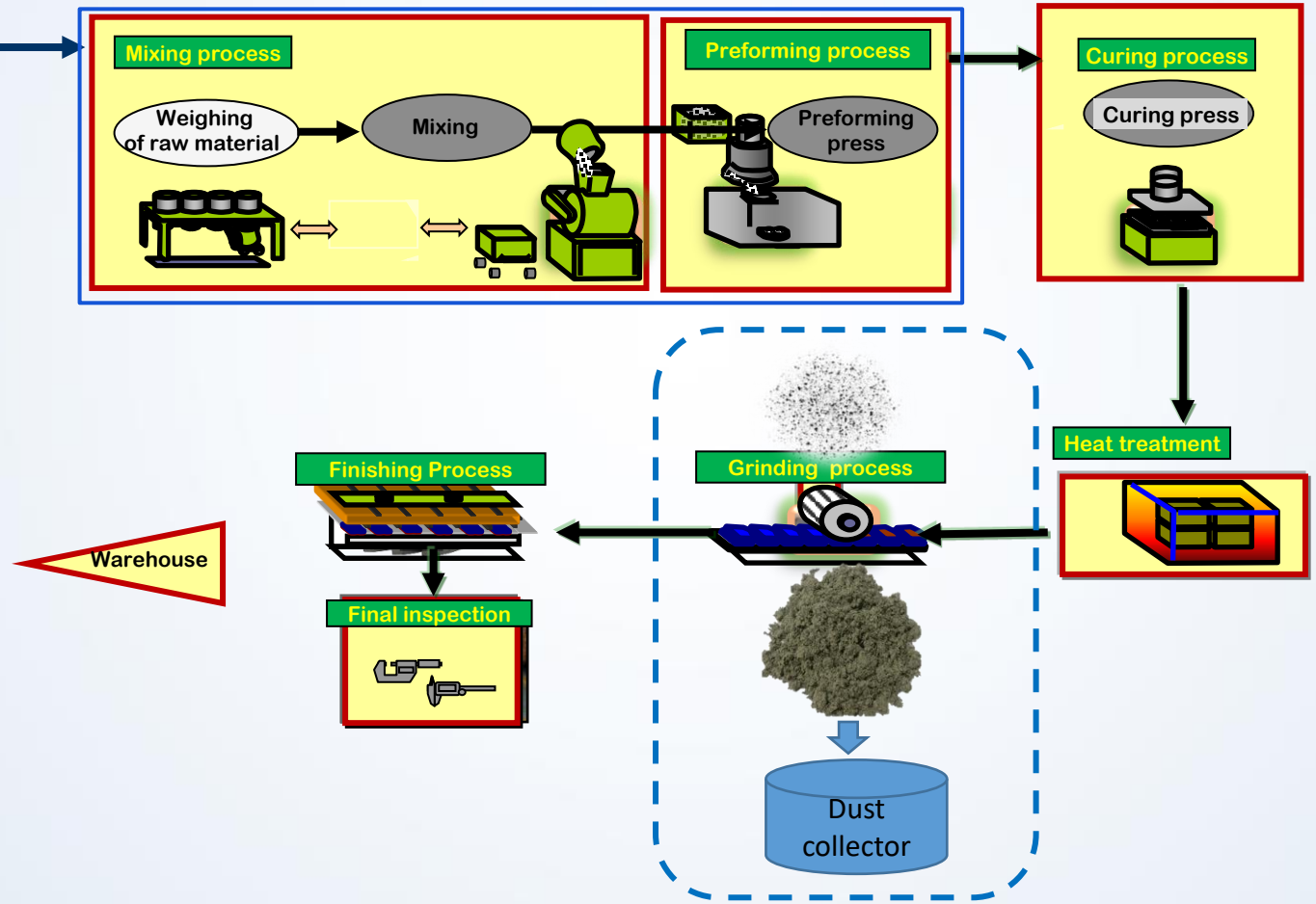
# Project 3. "Grinding Green": Converting Dust Waste into Performance Materials

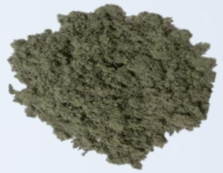
## Environment Friendly

**Formulation Development**

**Friction raw material**

- **Organics**
  Resins, friction dust.
  Binder, strength
- **Fibres**
  Organic, inorganic, metallic.
  Reinforcement
- **Abrasives**
  Alumina, Zircosil
  Friction enhancement
- **Lubes**
  Carbon, Sulphides etc.,
  Friction & wear modifier
- **Fillers**
  Multiple types
  Thermal, wear resistance



- Ground dust (GD) are fine particles of friction materials - it has all functional materials like abrasive, lube etc., which are used in the formulation.
- Current GD levels being re-used to a very limited extent in formulation
- Remaining dust are treated and disposed off in approved land-

**Adopting 3R strategy, we successfully developed a new cost effective formulation meeting US requirements**

# Project 3. "Grinding Green": Converting Dust Waste into Performance Materials

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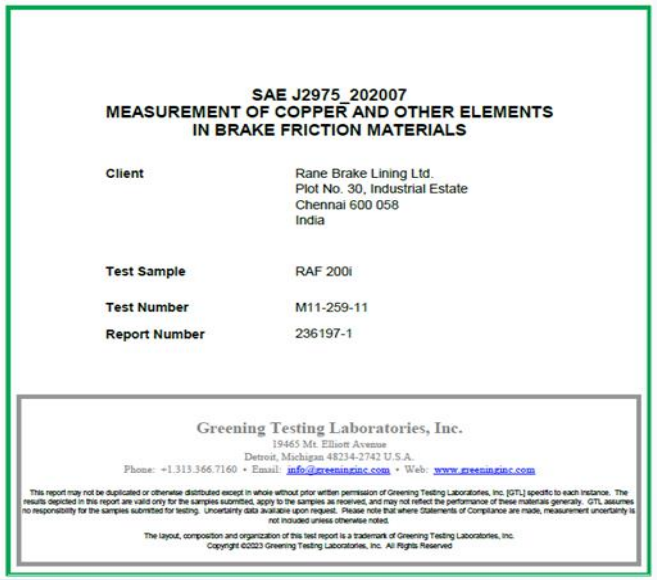
## Certification (External USA)

Testing & Compliance



SAE J2975_202007
MEASUREMENT OF COPPER AND OTHER ELEMENTS
IN BRAKE FRICTION MATERIALS

| | |
|---|---|
| Client | Rane Brake Lining Ltd.<br>Plot No. 30, Industrial Estate<br>Chennai 600 058<br>India |
| Test Sample | RAF 200i |
| Test Number | M11-259-11 |
| Report Number | 236197-1 |

Greening Testing Laboratories, Inc.
19465 Mt. Elliott Avenue
Detroit, Michigan 48234-2742 U.S.A.
Phone: +1.313.366.7160 • Email: info@greeninginc.com • Web: www.greeninginc.com



AUTOMOTIVE MANUFACTURERS EQUIPMENT COMPLIANCE AGENCY, INC.

AMECA

AMECA NOTICE OF EQUIPMENT COMPLIANCE™

This notice verifies that the item described below has been tested by an accredited laboratory and has been found to be in compliance with the jurisdictional standard(s) listed below where applicable. The issuance of this AMECA Notice of Equipment Compliance™ does not denote or imply any endorsement or recommendation of the item described below. AMECA does not warranty or guarantee parts. Parts warranties/guarantees are between the buyer and seller and can vary by state and jurisdictions involved.

Notification Number: 230227 Expiration Date: July 1, 2026

Applicant: Rane Brake Lining Ltd.
Plot No. 30, Industrial Estate
Chennai 600 058
India

AMECA Edge Code™ Marking: "RAF 200i GG" – Brake Friction Material

Use: On Motor Vehicles

## SAE J2975 – Copper Content & NSF Registration

### The Public Health and Safety Organization, USA OFFICIAL LISTING

**OFFICIAL LISTING**

NSF International has registered the products appearing on this Listing and the product manufacturers have self-certified that these products conform to the requirements of SAE J2975.

| Manufacturer Name | Manufacturer ID | Unique Identification Code | Compliance Level | OESC Exemption | Vehicle Make | Model | Model Years | Expiration Date | Self-Certification |
|---|---|---|---|---|---|---|---|---|---|
| Rane Brake Lining Limited | 181 | RAF 200i GG | N | - | - | - | - | 02/13/2026 | C0604403-00001 |

# Project 3. "Grinding Green": Converting Dust Waste into Performance Materials

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# Project 3. "Grinding Green": Converting Dust Waste into Performance Materials

## Tangible benefits :

- **Waste-to-Value Conversion**: 35 Lakhs / annum
- **Reduced Waste Disposal Cost**: 8 Lakhs/Annum

## Intangible benefits :

- **Regulatory Compliance**: Meets stricter environmental norms on dust and waste management.
- Green supply chain : Strengthens trust among OEMs looking for green supply chains.
- Developed circular economy practices in friction materials.


THANK YOU!