

## Pot Turnaround Time Reduction at Hirakud Aluminium to Enhance Productivity

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### Abstract

Hirakud Smelter a unit of Hindalco Industries Limited is a part of Aditya Birla Group. Hirakud Aluminium is an integrated aluminium smelting complex which uses GAMI technology and is one of the oldest smelters in India, established in 1959. The original potlines were converted from Søderberg to prebake pots in 2006–2009, which had inherent challenges in terms of technology and retrofitting. Subsequently, during 2012–2014, there was also a brownfield expansion of 50 kt/a with 80 235 kA side-by side GAMI pots.

Aluminium production is a continuous process and productivity depends on the number of operating pots. Hirakud Smelter maintains a pot life cycle of 6 years by relining proactively approximately 10 to 12 pots/month to prevent any sudden pot failure. To do this we had to achieve pot turnaround time (TAT) lower than 8 days. As pot replacement is carried out in-situ, many challenges are faced during the relining of cells to maintain the pot turnaround time within the target.

After lots of brainstorming sessions and analysis, various initiatives were implemented to improve day-to-day operations and maintenance. As a result, TAT decreased and production increased. When the TAT reduction project started, in the financial year (FY) 2021, TAT was 12.7 days, and it was gradually reduced to 7.5 days in FY 2025, compared to the target of 9.0 days. This is the best TAT ever achieved by Hirakud Smelter through continuous improvements in procedures and co-ordination among the teams.

**Keywords:** Pot idle time, Pot relining, Pot life, Pot changeover, Productivity.

### 1. Introduction

Aluminium smelting is an energy-intensive and continuous industrial process where maximum productivity relies on uninterrupted operation of pots. Any downtime in a pot due to failure or delay in relining has a direct and measurable impact on overall productivity, energy consumption, and financial output.

The importance of optimizing pot turnaround time (TAT) lies in minimizing unproductive periods and improving pot availability. In global aluminium industries, average benchmarking TAT ranges from 6 to 10 days depending on the smelter's automation, infrastructure age, and technology used. While newer plants using cutting-edge AP or DX+ technologies have a leaner TAT footprint, older smelters must adopt innovation and agile planning to stay competitive.

Hirakud Smelter is a unique case, a legacy unit upgraded from Søderberg to prebake pots, still reliant on traditional infrastructure. In such a context, improving operational metrics like TAT is not merely a technical challenge but a strategic priority to safeguard profitability, and future sustainability. The initiative detailed in this paper shows how cross-functional collaboration, thoughtful planning, and locally adapted innovations can yield results comparable to those from newer smelting operations.

The following sections will delve into the historical challenges faced by Hirakud, the structured methodology adopted for turnaround reduction, innovations deployed on-site, and the measurable impacts achieved in terms of productivity and safety.

## **2. Background and Historical Context**

In 2009, as part of a modernization strategy, the potlines were converted from Søderberg to prebake technology using GAMI technology from 2006-2009., marking a substantial technological and production leap by amperage increase from 55 to 85 kA [1, 2]. Subsequently, during 2012–2014, there was also a brownfield expansion of 50 kt/a with 80 side-by-side 235 kA GAMI pots in a separate potroom [1]. This upgrade improved energy efficiency and reduced environmental impacts. Unlike greenfield smelters with uniform infrastructure and automation, Hirakud operates in a retrofitted environment where physical constraints, legacy workflows, and equipment limitations affect performance metrics such as pot TAT. Historically, TAT of 12.7 days was due to in-situ relining, limited crane availability, and slow pot cooling times. These constraints prevented Hirakud smelter from following industry best practices, making Hirakud less competitive.

Benchmarking studies conducted within the Aditya Birla Group, particularly comparing Hirakud with newer plants like Aditya Smelter and Mahan Smelter, highlighted stark contrasts. While those facilities had an average TAT of 4–5 days due to modular operations and enhanced automation, Hirakud embarked on a challenge to reach similar TAT performance.

This historical backdrop underscores why TAT improvement at Hirakud is both an operational challenge and a strategic opportunity. The shift from reactive to proactive relining planning, supported by engineering innovations and cross-functional collaboration, have been essential for the success of the project.

## **3. Problem Definition and Objectives**

### **3.1 Problem Definition**

In 2020, Hirakud Smelter faced persistent challenges with high TAT, averaging between 11–13 days. The core issues stemmed from in-situ repairs of both the pot shell and pot superstructure (PSS) while the pots were located in live operational areas. This high TAT not only affected aluminium production volume due to idle time but also led to inefficient manpower utilization and frequent scheduling conflicts with operational jobs.

The complexity was further magnified by the smelter's infrastructure. Only two overhead cranes are available in each potroom, which are already engaged with routine operations. Additional delays arose from slow pot cooling rates, extended castable curing time, and lack of pre-prepared pot shell. Collectively, these constraints placed tremendous pressure on both production planning and resource allocation.

Key bottlenecks contributing to high TAT included:

- Longer cooling time due to slower air-cooling processes.
- In-situ repairing challenges, including high magnetic fields in the potrooms that causes high spattering during welding, which leads to inferior and longer welding time.
- Sequential, non-parallel workflows, where potshell repairs, PSS repairs and pot delining/relining could not be executed simultaneously due to safety.
- High curing time of conventional castable, which delayed the further course of actions.
- Unplanned pot failures, which often led to metal spillage and cathode busbar melting, resulting in extended downtime and complicated recovery efforts.
- Unavailability of Electric Overhead Travelling (EOT) cranes, due to their engagement in regular operational activities, often delayed critical relining work and contributed significantly to increased TAT

These inefficiencies resulted in high pot idle time, reduced metal output, and increased workload pressure on lining and maintenance teams.

### 3.2 Objectives

This initiative aimed to demonstrate that, even within an ageing infrastructure, significant productivity gains can be achieved through disciplined coordination, strategic planning, and innovation. More specifically, the goals were the following:

- Reduce average TAT to lower than 9 days.
- Improve overall potline productivity.
- Eliminate in-situ repair dependencies by introducing pre repaired shell replacement.
- Enable parallel task execution through innovative planning and resource alignment.
- Develop a skilled and multi-functional team capable of executing complex lining tasks efficiently by frequent training.

### 4. Methodology

The initiative followed a structured planning approach by using continuous improvement methodology and cross-functional teams' collaboration. The planning began with detailed problem mapping and extensive brainstorming sessions involving representatives from Operations, Lining, Mechanical, Electrical, and Fume Treatment Plat (FTP) teams. More than 15 cross-functional brainstorming sessions were held over 10 weeks.

Key activities during the planning phase included:

- **Site and Equipment Studies:** To ensure a technical and feasible solution, the planning process began with an in-depth engineering study. This included the analysis of structural drawings of potroom civil structure, pot shell, and pot superstructure. Key parameters such as dimensions, load-bearing capacity, and clearances for lifted PSS/Shell over the operating pots by crane. The structural components were evaluated to assess the feasibility of lifting and shifting the potshell and pot superstructure (PSS).
- **Pot relining Gantt Chart Development:** A comprehensive Gantt chart was created to define the sequence and interdependencies of every task from pot shunting to pot startup. Each department's responsibilities were clearly defined to avoid overlaps.
- **Tool and Equipment Modification:** EOT cranes were adjusted for extended hoist height. A flatbed trailer was arranged for transporting shells between the Potroom and the shell-repair facility.
- **Material Preprocessing:** Insulating bricks/boards were pre-cut, and relining materials were relocated closer to job sites in advance to save time during execution.

- **Cooling Optimization:** A water sprinkler system was engineered and deployed to uniformly reduce pot temperature faster, enabling quicker access for lining work. Safety of this operation was considered.
- **Training and Demonstration Sessions:** Workforce members were trained on each activity phase to standardize execution and improve safety adherence.
- **Risk Assessment:** Detailed Hazard Identification and Risk Assessment (HIRA) and Standard Operating Procedure (SOP) reviews were conducted by safety officers and reviewed regularly by plant leadership, including the Unit Head and Plant Head.
- **Job Rescheduling by Operations Team:** Potroom operational activities were proactively realigned to ensure timely availability of cranes for pot lining activities and minimize idle intervals.

The methodology not only streamlined the execution process but also built organizational resilience by improving communication, ownership, and technical readiness across all departments involved.

## 5. Implementation and Execution Flow

The execution of the TAT reduction initiative was phased into sequential, interdependent stages. Each stage was designed to maximize efficiency, reduce idle time, and enable parallel tasks execution without compromising safety and quality.

### 5.1 Phase 1: Preparation and Pre-Shift Logistics

The first stage of implementation focused on ensuring the readiness of the major components, especially the pot shell. In the revised approach, spare potshells were pre-repaired in the shell repair building, located away from the high magnetic field of the potrooms. This significantly improved welding quality and safety due to the absence of electromagnetic interference, which previously led to excessive spattering and poor weld integrity.

The repaired potshell was kept ready to replace the old one immediately after de-lining, eliminating the traditional 3–4 days for in-situ repairs. With the new process, potshell replacement could be achieved in 8 hours, saving nearly 3 days in the TAT cycle.

Further improvements were made in material preparation. Calcium silicate boards for sidewall insulation, were precisely pre-cut to accommodate collector bars. This made their installation faster, saving an additional 4–6 hours per pot.

A detailed engineering and logistics study was conducted to evaluate safe and efficient potshell transportation. Given the 14.7 m length of the potshell, a flatbed trailer of 15 meters was introduced. The flatbed design ensured the potshell remained horizontal and stable during transit, unlike step-deck or double-drop trailers, which would have introduced a potentially unsafe incline due to their bed profile. Thus, the flatbed trailer provided the optimal balance between safety, manoeuvrability, and structural compatibility. For additional safety, two traffic marshals were deployed to escort the vehicle during each movement phase inside the plant.

With this preparation and pre-shift logistics, the availability of cranes was scheduled in advance for relining jobs. This addressed the usual constraint of limited crane availability due to their utilization in routine operational tasks. Additionally, the water sprinkling system and pot cooling blowers were tested and kept ready for immediate deployment. These systems were installed right after the completion of anode removal from the stopped pot, allowing faster and controlled cooling of the pot cavity prior to de-relining operations.

### 5.2 Phase 2: Scheduling and Planned Shunting of Pot

A proactive approach was adopted to cut out old and critical pots in advance to avoid sudden metal tap-out during operation. Such tap-outs often result in melting of the pot cathode busbars and spillage of molten metal into the basement area, requiring 3–4 days of unplanned downtime for cleaning and welding repairs. Based on this plan, the exact pot cutout time was fixed to align with downstream activities like de-lining, relining, potshell replacement, and equipment deployment. This alignment helped minimizing idle time and contributed to overall TAT reduction. Table 1 gives details of pot relining activities.

**Table 1. Pot relining activities.**

TAT Activity wise time break up											
Pot no- 37 (Age-1975)	ACTUAL					ACTUAL					
Activity	START DAY	From	To	END DAY	Duration (Hrs)	START DATE	From	To	END DATE	Duration (Hrs)	Remark
Cut out	Day-1	12.47AM	1.30AM	Day-1	0.78	30/Apr/25	12.47AM	1.30AM	30/Apr/25	0.71	
Metal Tapping	Day-1	1.30AM	9.30AM	Day-1	8.00	30/Apr/25	1.30AM	9.30AM	30/Apr/25	8.00	
Butt Removal	Day-1	9.30AM	11.00AM	Day-1	1.50	30/Apr/25	9.30AM	11.00AM	30/Apr/25	1.50	
Air cooling	Day-1	11.00AM	5.00 PM	Day-1	6.00	30/Apr/25	11.00AM	5.00 PM	30/Apr/25	6.00	
Water cooling	Day-1	5.00 PM	3.00AM	Day-2	10.00	30/Apr/25	5.00 PM	3.00AM	1/May/25	10.00	
Cavity cleaning (Bath & Metal removal)	Day-2	3.00AM	8.00AM	Day-2	5.00	1/May/25	3.00AM	8.00AM	1/May/25	5.00	
PSS removal	Day-2	10.00 AM	11.00 AM	Day-2		1/May/25	10.00 AM	11.00 AM	1/May/25		Parallel Job
Side digging and riser clad cutting+collector bar cutting	Day-2	8.00AM	8.00AM	Day-4	24.00	1/May/25	8.00AM	8.00AM	2/May/25	24.00	
Block removal	Day-3	8.00AM	2.00PM	Day-4	6.00	2/May/25	8.00AM	2.00PM	2/May/25	6.00	
Bottom delining	Day-3	2.00PM	6.00AM	Day-4	16.00	2/May/25	2.00PM	6.00AM	3/May/25	16.00	
Shell removal	Day-4	6.00AM	10.00AM	Day-4	4.00	3/May/25	6.00AM	10.00AM	3/May/25	4.00	
shell Placement	Day-4	10.00AM	2.00PM	Day-4	4.00	3/May/25	10.00AM	2.00PM	3/May/25	4.00	
Bottom insulation	Day-4	2.00PM	6.00PM	Day-4	4.00	3/May/25	2.00PM	6.00PM	3/May/25	4.00	
DIM filling, levelling & compaction	Day-4	6.00PM	2.00AM	Day-5	8.00	3/May/25	6.00PM	2.00AM	4/May/25	8.00	
Block placement	Day-5	2.00AM	6.00AM	Day-5	4.00	4/May/25	2.00AM	6.00AM	4/May/25	4.00	100% graphitized (COBEX-BN-XD/W)
PSS placement	Day-5	9.00AM	11.00AM	Day-5		4/May/25	9.00AM	11.00AM	4/May/25		Parallel Job
End casting and Side casting	Day-5	6.00AM	6.00AM	Day-7	24.00	4/May/25	6.00AM	6.00AM	5/May/25	24.00	
Curing, Clad & Rim plate welding	Day-6	6.00AM	6.00AM	Day-7	24.00	5/May/25	6.00AM	6.00AM	6/May/25	24.00	
Load testing	Day-6	12.00PM	2.00PM	Day-6		5/May/25	12.00PM	2.00PM	5/May/25		Parallel Job
SIC fixing	Day-6	10.00PM	6.00 AM	Day-7		5/May/25	10.00PM	6.00 AM	6/May/25		Parallel Job
Slot and Side Tamping	Day-7	6.00 AM	6.00PM	Day-7	12.00	6/May/25	6.00 AM	6.00PM	6/May/25	12.00	
Coke laying	Day-7	6.00PM	8.00PM	Day-7	2.00	6/May/25	6.00PM	8.00PM	6/May/25	2.00	
Pot Preparation	Day-7	8.00PM	10.00PM	Day-7	2.00	6/May/25	8.00PM	10.00PM	6/May/25	2.00	
Soft connection, shunt & strtpup device fixing	Day-7	10.00PM	3.00 AM	Day-8	5.00	6/May/25	10.00PM	3.33AM	7/May/25	5.55	
					170.28					170.76	
					7.10				TAT	7.12	

### 5.3 Phase 3: Air and Water Cooling

High-capacity blowers were installed for rapid cooling of the pot to below 400 °C (Figure 1). One notable innovation was the development of a water sprinkler system that delivers droplets throughout the pot cavity uniformly in a slow and controlled manner (Figure 2). This method prevents sudden explosion caused by water entrapment in residual molten metal. The controlled droplets allow safe vaporization upon contact with the hot pot surface by absorbing the latent heat of vaporization, effectively reducing the pot temperature without incident.



**Figure 1. Air cooling by high-capacity fans in 235 kA potline.**



Figure 2. Water Spraying by water sprinkling system on a 235 kA pot.

#### 5.4 Phase 4: Pot Superstructure and Shell Shifting

Following adequate pot cooling, the pot superstructure (PSS) was carefully dismantled and shifted to a dedicated maintenance area in the potroom, away from the magnetic field to avoid spattering during welding process and ensure better working conditions. This operation required a detailed structural and dimensional feasibility study. Engineering drawings of the potroom civil structure, cranes, pot shells, and PSS assemblies were thoroughly analysed to plan the lifting and shifting process.

Given the height of the PSS, the crane hoist height was calibrated and adjusted accordingly to allow safe and unobstructed horizontal movement over the operating pots. The PSS, weighing approximately 20 tonnes, and the pot shell, weighing about 14.7 tonnes, were both subject to load calculations and balance assessments to avoid stress concentrations during lifting. A custom-designed jig was fabricated for safe hitching and shifting of the shell. This jig underwent rigorous load testing prior to deployment. SOP and HIRA documents were prepared, reviewed, and approved by higher management, including the plant and unit heads, prior to the first execution of this heavy-lifting job. This stage ensured that structural integrity, safety norms, and engineering accuracy were maintained throughout the operation. PSS removal is shown in Figure 3 and pot shell removal in Figure 4.



Figure 3. First ever PSS removal for off-site maintenance.



**Figure 4. First ever pot shell removal for off-site maintenance.**

### **5.5 Phase 5: Use of Fast Curing Castable and Utilization of Idle Time of Curing**

Previously, standard refractory castable were used for lining activities, which required a curing time of approximately 48 hours. This created a significant idle window in the pot turnaround schedule. To address this, a switch was made to a specially engineered fast-curing castable, which reduces the curing cycle to 24 hours, thereby saving a day in TAT. To utilize this curing time efficiently, the team adopted a parallel task execution strategy without affecting the castable integrity. Several interrelated engineering tasks were scheduled to occur during the curing window, such as electrical connection of anode beam motors and EPC, load testing of anode motor and jacks, and fixing of silicon carbide side blocks.

### **5.6 Phase 6: Pot Ramming**

Earlier, hot paste was used for pot ramming, which was a labour-intensive and time-consuming process. The preparation and application of hot paste involved batch-by-batch paste making and strict temperature control during ramming to ensure bonding integrity. This process extended the total lining time to nearly two days, significantly affecting TAT.

To address this, a shift was made to cold ramming paste technology, which enabled more efficient ramming operations. Cold paste, being readily available at the site, eliminated the need for on-site heating and batch-wise preparation. As a result, both slot ramming and side ramming could be completed in a single day.

### **5.7 Phase 7: Startup Preparation, Final Checks and Startup**

Pot startup was previously a labour-intensive and time-consuming, typically taking up to 24 hours. This included sequential steps such as coke bed laying, anode fixing, anode covering, flexible installation, shunt and start-stop device installation. The lack of synchronization among support teams and crane availability further contributed to long turnaround time.

With a structured approach, the startup cycle was reduced to approximately 10 hours. This was achieved by pre-scheduling crane availability, providing frequent training and hands-on guidance to the working crew, and aligning supporting tasks with the master Gantt chart. Each team was briefed on their deliverables and sequence dependencies.

Upon completion of startup preparation, a cross-functional quality check was conducted involving representatives from operation, lining, mechanical, and electrical departments. This inspection was carried out according to a standardized checklist shown in Table 2, ensuring that all systems and components met the defined readiness criteria.

**Table 2. Pot handover checklist for pot startup.**

No.	Activity	Parameters checked	Responsibility	Status	Remarks
1	Duct and air hose fixing	1. Some/modified duct fitted 2. New or old hose used	Mechanical		
2	Crust breaker condition (Length of hammer unit $\geq 300$ mm)	1. New breaker changed / old breaker used 2. Length of hammer unit measured	Mechanical		
3	Point feeder condition	1. Both feeders feeding properly or not 2. Any changes made in the feeder	Mechanical		
4	Dump weight of the feeders (approx. 1.8 kg)	1. Wt. in 1 <sup>st</sup> feeder 2. Wt. in 2 <sup>nd</sup> feeder	Mechanical		
5	Dump weight of the feeders (approx. 1.8 kg)	1. Wt. in 3 <sup>rd</sup> feeder 2. Wt. in 4 <sup>th</sup> feeder	Mechanical		
	Dump weight of the AlF <sub>3</sub> feeder (approx. 1.2 kg)	Wt. in AlF <sub>3</sub> feeder	Mechanical		
	Anode change J-hook condition	1. New/old clamp used 2. Working properly / not	Mechanical		
6	Checking of pot jack screw. Foundation bolt and clevis condition	1. All jack lengths to be measured 2. Tightness of foundation bolt 3. Straightness of clevis	Mechanical		
7	Gearbox foundation bolt condition	1. Gear box working properly / not 2. Tightness of foundation bolts	Mechanical		
8	Greasing of all the jack and gear boxes	1. Greasing done for all jacks 2. Greasing done in gear boxes	Mechanical		
9	Sall shaft & coupling condition	1. Straightness of all shafts 2. Rotation direction of both shafts	Mechanical		
10	Anode beam alignment	1. Both beam level with the base plate 2. Breams pitted area rectified / not	Mechanical		
11	Load testing of pot jack alignment	1. Half-load test (with 16 anodes) 2. Full-load test (with 32 anodes)	Mechanical		
12	Air slide fitting	1. Any changes made in air slide 2. Air slide fitted properly / not	FTP		
13	EPC connections	1. EPC working properly / not 2. Any new changes made in the panel	Electrical		

14	Anode setting	1. All anodes corner broken from fillet side 2. All 32 anodes are on the same plane or not	Lining		
15	Anode effect lamp	1. Properly fitted / not 2. Properly working / not	Electrical		
16	Coke bedding	1. Height of coke bedding 2. Uniform mixing of coke and graphite	Lining		
17	Soft connection fitting	All 32 of soft connections tightened	Lining		
18	Type 1 shunt fitting	All 4 shunts tightened properly	Lining		
19	Type 2 shunt fitting	All 4 shunts tightened properly	Lining		
20	Type 3 shunt fitting	All 64 shunts welded properly	Lining		
Signature Name (Lining)			Signature Name (Control)		
Signature Name (Electrical)			Signature Name (Mechanical)		
Signature Name (Operation)					

## 5.8 Review Mechanism

- Daily Gantt chart reviews were conducted during joint morning meetings.
- Progress was tracked against planned milestones, with root cause analysis of any deviations.
- Feedback loops allowed real-time decision-making, rescheduling, and manpower reallocation.

The structured implementation reduced average TAT to 7.3 days and improved both responsiveness and reliability. It also boosted cross-functional coordination and workforce confidence, setting the foundation for further productivity improvements.

## 6. Results and Impact

The implementation of this initiative led to measurable outcomes across multiple domains, operational efficiency, safety, productivity, and team competence. Below are the key results observed after the implementation:

### 6.1 TAT Reduction Achieved

- The average Pot Turnaround Time reduced from 12.7 days in financial year (FY) 2021 to 7.3 days in FY 2025 (Figure 5).
- This surpasses the target of 9.0 days, placing HiraKud in the competitive range of modern smelters.

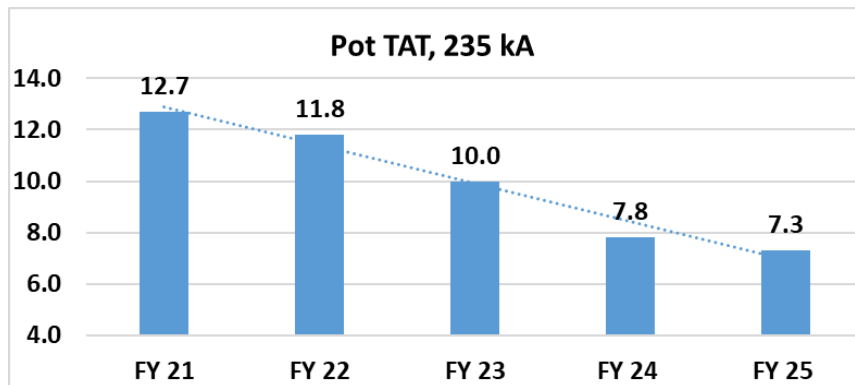


Figure 5. TAT reduction (vertical axis is TAT in days).

## 6.2 Productivity Gains

- With reduced idle pot time, the initiative directly contributed to increased aluminium output.
- An estimated additional 200 tonnes of metal was produced annually due to faster pot recommissioning.

## 6.3 Enhanced Team Capability and Morale

Multi-skill training, tool familiarization, and performance-based recognition developed a more agile and confident workforce. The teams demonstrated increased ownership, problem-solving capability, and adaptability during high-pressure schedules.

## 6.4 Safety and Quality Improvements

- Zero Lost Time Injury (LTI) cases were reported during the entire implementation period.
- Adherence to SOPs improved significantly, and critical risk mitigation measures (like PSS and potshell transport and water cooling) were closely monitored.

## 6.5 Process Innovation Outcomes

The following innovations were made:

- The use of in house developed water sprinklers for faster pot cooling, in-house development of shell lifting jig, and use of fast-curing castable for reduced curing time.
- Pre-repaired shells and PSS shifting created a breakthrough method compared to traditional in-situ practices still used in comparable smelters.

## 6.6 Strategic Alignment and Long-Term Impact

The initiative aligns with Aditya Birla Group's core values of Safety First, Speed, Teamwork, and Sustainable Productivity. The successful outcome has encouraged replication planning in other operational areas, with documentation and knowledge-sharing initiatives underway.

## 7. Lessons Learned and Recommendations

The TAT reduction initiative at Hirakud provided several critical learnings that can serve as guiding principles for similar projects in legacy industrial setups. These insights are applicable not only within aluminium smelting but also to broader engineering and production environments.

## 7.1 Lessons Learned

- **Cross-functional Ownership is Essential:** Early involvement and ownership by all stakeholders, operations, lining, maintenance, and safety, ensured seamless coordination and minimized resistance during execution.
- **Planning is a Continuous Process:** The use of detailed Gantt charts, coupled with daily reviews, created a dynamic planning culture where adjustments were made in real time based on ground-level feedback.
- **Innovation Does not Always Require High Investment:** Modifications such as adjustable EOT crane hoists, water sprinklers, and pre-repair logistics were low-cost innovations that delivered high impact.
- **Manpower Development Multiplies Results:** Investing in crew training and skill enhancement-built execution resilience and boosted morale under pressure.
- **Data-Driven Monitoring Strengthens Accountability:** Progress dashboards, Gantt chart tracking and structured feedback collection created a performance-focused ecosystem.

## 7.2 Recommendations for Replication

- **Standardize and Document the Workflow:** Create process manuals for lifting, shell shifting, and fast-track relining to ensure repeatability in other pot rooms or units.
- **Create a Modular Execution Team:** Form a core group of skilled individuals who can act as a rapid response relining unit across the plant.
- **Encourage a Recognition Culture:** Recognize high-performing teams and individuals to build a culture of excellence.

In conclusion, the TAT reduction initiative shows how legacy facilities can achieve world-class performance through structured thinking, inclusive planning, and consistent execution.

## 8. Conclusions and Future Outlook

The TAT reduction project at Hiralud Aluminium is a case study on how legacy industrial operations can achieve step-change improvements in productivity, safety, and workforce capability. By strategically replacing time-intensive in-situ repairs with modular relining techniques, and supporting this with innovative planning and tool development, the smelter has effectively transformed a chronic bottleneck into a model of operational excellence.

Looking ahead, Hiralud aims to further reduce TAT below 6.5 days by refining cooling processes, using of machine in de-lining and ramming operation and replacement of partially lined potshells. Plans are also underway to roll out the lessons from this initiative across other maintenance-intensive functions and sister units within the Hindalco and Aditya Birla network.

## 9. References

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