



TATA STEEL UK HOT ROLLED PRODUCTS DEPARTMENT
ORGANISATIONAL CHANGE

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Module: Management, Innovation and Sustainability (ACMA5007)



APRIL 16, 2026

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WORD COUNT: 2750 (EXCLUDING TITLE PAGE, TABLE OF CONTENTS, TABLE OF TABLES AND FIGURES, BIBLIOGRAPHY AND APPEDICES)

Executive Summary

This report evaluates organisational change within a heavy industrial facility operated by a large global steel manufacturer in South Wales, UK. TATA Steel UK is currently undergoing a significant transitional period following major changes to its operating methods and a substantial restructuring of its manufacturing facilities at Port Talbot. While these large-scale changes were strategically planned and managed, the organisation has subsequently been required to recalibrate aspects of its structure in response to financial pressures caused by fluctuations in market demand.

The scope of this report is to examine additional unplanned yet necessary organisational changes affecting the remaining workforce structure. The evaluation applies established change management theories developed by recognised contributors in the field, specifically Lewin's Forcefield Analysis and Three-Step Model as well as Kotter's Eight-Step Model. The objective is to compare accepted theoretical approaches to planning and implementing change against the practical methods used during this restructuring, identifying both strengths and areas for improvement in both operational and people-focused outcomes.

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Introduction

Management of organisational change is a critical function within any organisation and should hold equal importance to the management of day-to-day operations (**Kotter, 1996**). Changes to operational processes are often necessary for a variety of reasons, including the need to improve efficiency, enhance effectiveness, or respond to evolving organisational priorities. Such changes may be driven by customer requirements, shifting market demands, or the need to reallocate resources to areas of greater strategic importance.

Regardless of the driving forces behind these changes, effective management of change is as important as the changes themselves. A well-structured management of change process ensures that proposed changes are necessary, carefully implemented, and capable of delivering the anticipated value to the organisation (**Hayes, 2022**).

TATA Steel UK, a division of a global steel conglomerate has a major site in Port Talbot, producing Hot Rolled Steel Coils (HRC) for global markets. The organisation has undergone significant transformation in recent years, including a major restructuring of its production methods. This transformation involves a strategic shift from producing liquid steel using traditional raw materials to manufacturing steel using domestically sourced UK scrap as the primary feedstock (**TATA Steel UK, Ltd., 2024**). This transition represents a move away from conventional blast furnace ironmaking toward Electric Arc Furnace (EAF) steel production, supporting industry efforts to reduce carbon emissions and improve sustainability (**TATA Steel UK, Ltd., 2026**). As a result of this change, many major processing facilities inside the plant have been decommissioned.

This large-scale operational change has resulted in workforce reductions of approximately 2,500 roles across the site. The organisation is currently in a **‘transitional phase’** expecting to last 5 years. Continuing production by processing imported steel slabs to maintain supply to customers, whilst at the same time, constructing one of the world’s largest Electric Arc Furnaces.

While the wider transformation has been strategically planned, additional operational changes have emerged during the transition period.

The focus of this report is centred on a further restructuring within the Hot Rolled Products (HRP) department, specifically involving the further reduction of 10 operator roles throughout HRP. As well as the reclassification of section boundaries with the redistribution of responsibilities among Section Leaders to further reduce 5 managerial positions.

The change was driven by a deviation from expected production volumes and the inability to meet annual production targets. The report evaluates how this change was implemented using Lewin's Forcefield Analysis (**Ashton, 2025**). As well as assesses its effectiveness using Lewin's Three Step Management Model (**Hussain et al., 2018**) and Kotter's Eight-Step Model of organisational change (**Kotter, 2025**).

Main Findings

Existing Organisational Structure (Prior to Change)

Hot Rolled Products (HRP) processes imported steel slab substrate into Hot Rolled Coil (HRC) for global distribution. The department has multiple operating '**sections**' (Assets) working in coordination to meet production and quality targets. See [\[Appendix 1\]](#) for a more thorough plant operation and process flow explanation.

There are two organisational structures within HRP as outlined in **Table 1**

Table 1 - Day and Shift Organisation Structure

Organisational Structure	Directives & Responsibilities	Roles
Day Organisational Structure Monday – Friday 09:00am—5:00pm	Leaders of the organisation, driving the operations to meet annual expectations of the wider business. They are Asset Owners, who plan and organise the route ahead for the upcoming year and navigate the assets, sections and facility as a whole through the goals and milestones dictated by the annual plan.	◆ Business Management ◆ Production Management ◆ Technical Management ◆ Quality Management ◆ Planning Departments ◆ Electrical Engineering Departments ◆ Mechanical Engineering Departments ◆ Instrumentation Engineering Departments ◆ System Engineering Departments
Shift Organisational Structure (Days and Nights) 24 Hrs a day, 365 Days a Year 07:00am-07:00pm (Days) 07:00pm-07:00am (Nights)	Asset Custodians all year around on operational side of things. To manage and operate the assets, sections and facility as a whole in the direction and tempo set by the day organisation structure. Operations, production quality and breakdown management all done in line with the overall directive of achieving the annual plan.	◆ Shift Managers ◆ Section Leaders ◆ Senior Quality Technologist ◆ Senior Operators ◆ Quality Technicians ◆ Operators ◆ Electrical Engineering ◆ Mechanical Engineering ◆ Instrumentation Engineer ◆ Systems Engineer

The organisational change being evaluated within this report specifically relates to the reduction of operator roles in HRP and the change of boundaries and responsibilities within the shift organisation structure only.

Each '**Section**' of HRP is led by a Section Leader, a first line manager who is responsible for the safety, operational performance, personnel management, and efficiency of assigned assets. These responsibilities are distributed across defined operational boundaries as illustrated in **Figure 1**.

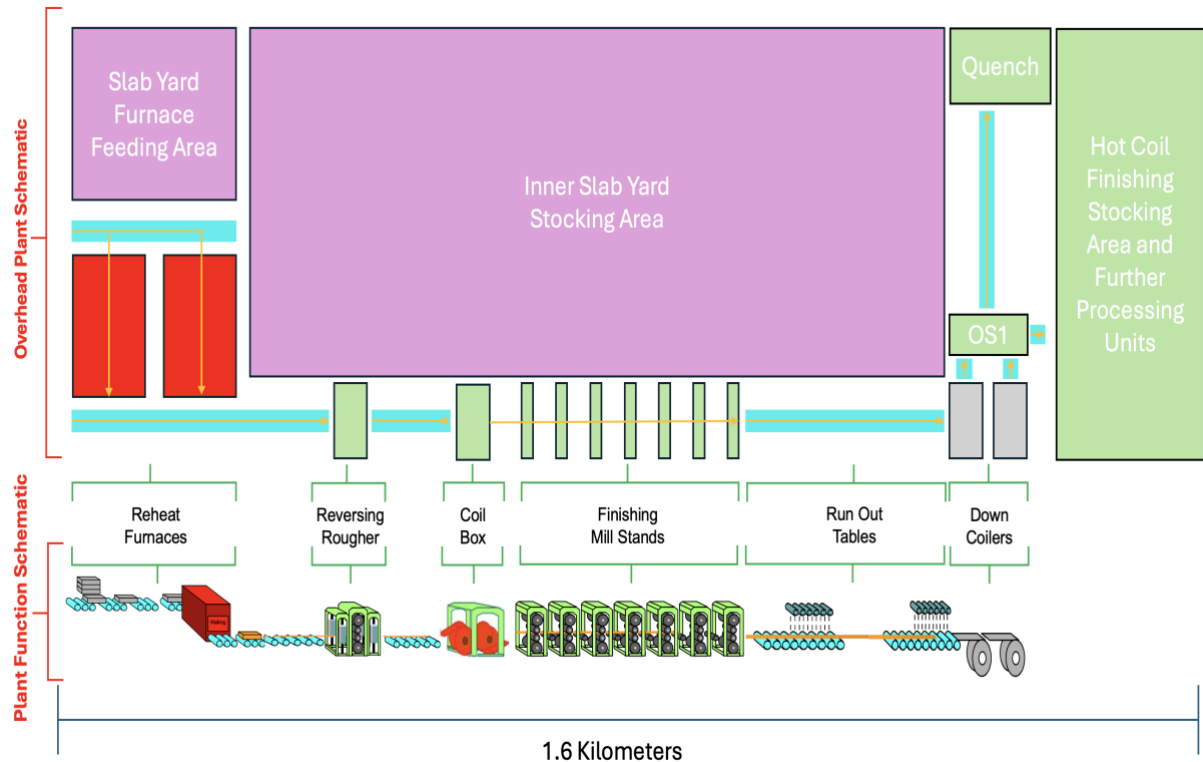


Figure 1 - HRP Plant and Process Flow Schematic/Illustrations, (Williams, L. 2026)

Additional operational areas, including the Slab Yard, Quench, and Roll Shop, are geographically separated but managed within the HRP organisational structure. These areas are illustrated in **Figure 2**, which highlights the geographical scope of responsibility associated with each section.

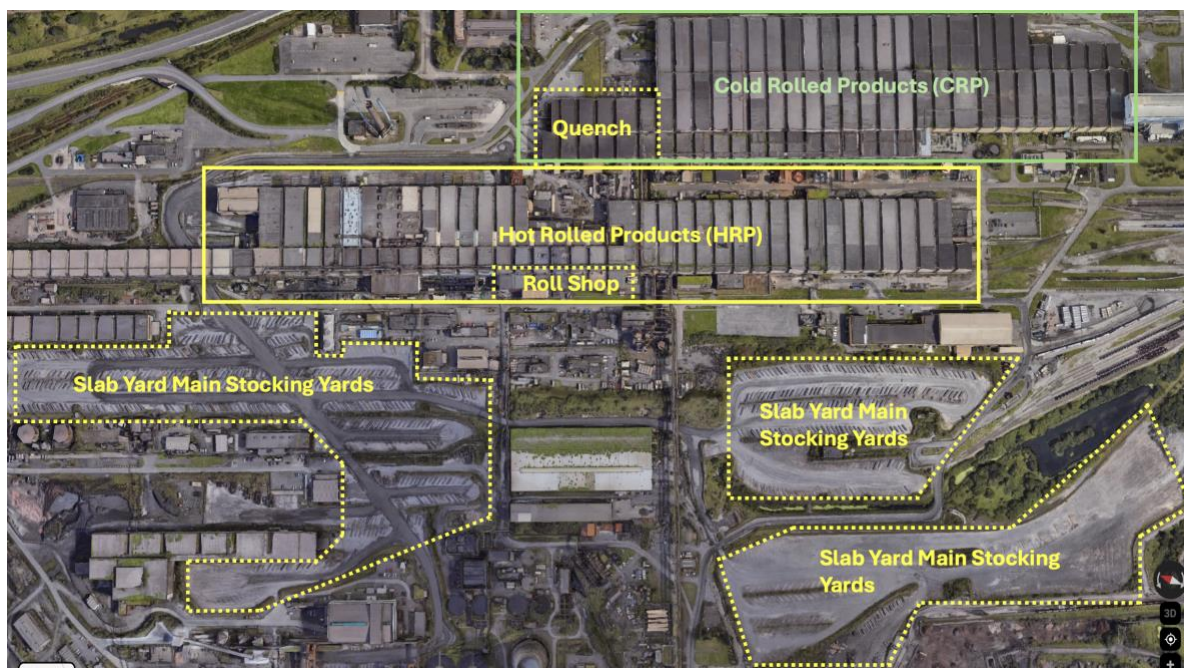


Figure 2 – Further HRP Demarcation Including Slab Yard, and Quench. (Williams, L. 2026)

Prior to the organisational change, responsibilities were distributed across five Section Leaders per shift. These responsibilities included both geographical areas and processing units, as well as direct reports as detailed in **Table 2**.

Table 2 - Section Leader Demarcation Prior to Organisational Change

Role	Demarcation Boundaries	Processes, Units and/or Functions	Number of Direct Reports
Slab Yard Section Leader	Main Stocking Yards Outer Stocking Yards Inner Stocking Yards Furnace Feed Area	• Scarfing Machine • Slab Booking • Slab Inspection • Slab Supply • 7 Over Head Cranes	9
Reheat Furnace / Reversing Rougher Section Leader	A & B Reheat Furnaces Reversing Roughing Mill	• Furnace Feed Equipment • Reheat Furnaces • Horizontal/Vertical Scale Breaker • Reversing Roughing Mill • Transfer Bar Cooling • 5 Overhead Cranes	7
Finishing Mill Section Leader	Coil Box Finishing Mills Coilers OS1 Quench	• Coil Box & Crop Shears • F5, F6, F7, F8, F9, F10, & F11 Finishing Mill Stands • C4 & C5 Down Coilers • OS1 (Coil Distribution) • Quench Tanks • 5 Overhead Cranes	10
Roll Shop Section Leader	Light Roll Shop Heavy Roll Shop	• 5 Roll Grinders • De-Chocking Area • De-Chocking Rig • Main Pumphouse • 5 Overhead Cranes	7
Hot Coil Finishing Section Leader	Hot Coil Finishing, Distribution and Further Processing	• Coil Distribution • Rail Despatch & Road Despatch • Manual & Auto Banding (Packaging) • Coil Temper Mill • Light & Heavy Gauge Sampling Units • 8 Overhead Cranes	11

Intended Organisational Change

The intended organisational change focused on the operator reduction, and redefining section boundaries with associated redistribution of responsibilities across 7 major operational areas.

- The Slab Yard (SY)
- Reheat Furnaces (RHF's)
- Reversing Roughing Mill (RR)
- Finishing Mill (FM)
- Hot Coil Finishing (HCF)
- Light Roll Shop (LRS)
- Quench (Qch)

Hot Coil Finishing, and the Light Roll Shop areas are two areas where an operator reduction took place. Both HCF and LRS lost one operator per shift, this equates to a total of 10 operator roles being made redundant. In addition to a role reduction exercise the change would also encapsulate a shift in boundary lines between the remaining five sections, and a redistribution of associated responsibilities.

A key component of the change involved transferring responsibility for the Quench unit to the Cold Rolled Products department. This removed responsibility for that asset from the Finishing Mill Section Leader. Further redistribution included:

- Moving Reheat Furnaces into the Slab Yard section
- Moving Reversing Roughing Mill into the Finishing Mill section
- Removing one Section Leader position per shift

These changes resulted in a reduction from five to four Section Leaders per shift. The before-and-after structure of responsibilities is illustrated in **Figure 3**, which demonstrates boundary reallocation across operational areas.

While the structural change appeared logical from an operational alignment perspective, the redistribution of personnel introduced increased responsibility levels for some Section Leaders.

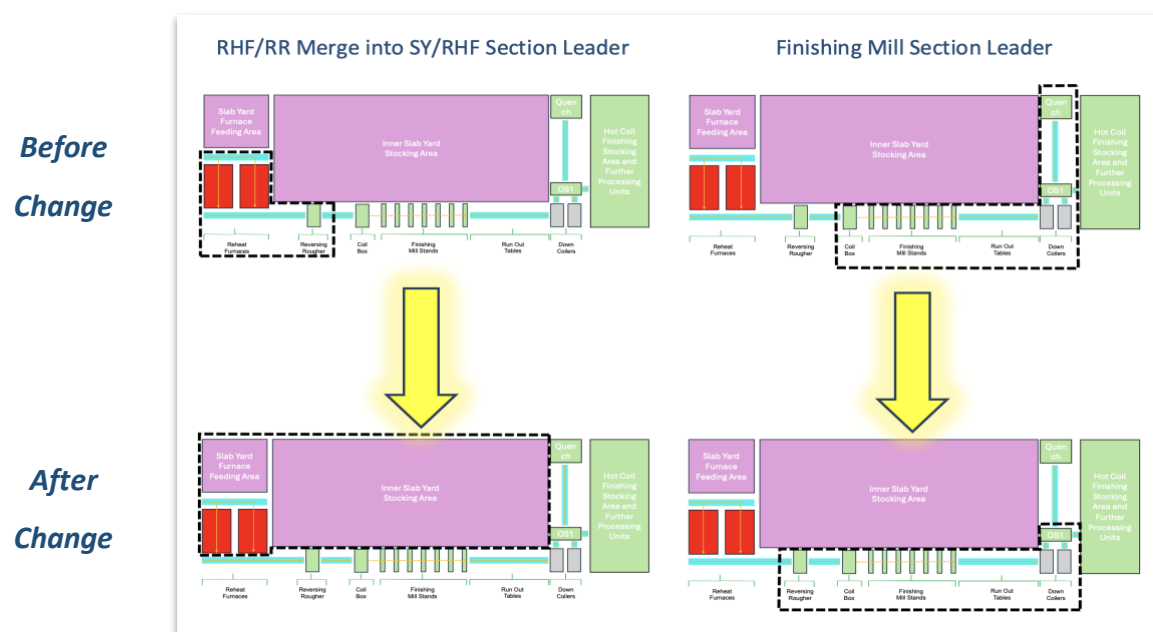


Figure 3 - The before & after demarcations of boundaries in HRP (Williams, L. 2026)

Personnel redistribution associated with this restructuring is illustrated in **Figure 4**, showing movement of operators between reporting lines.

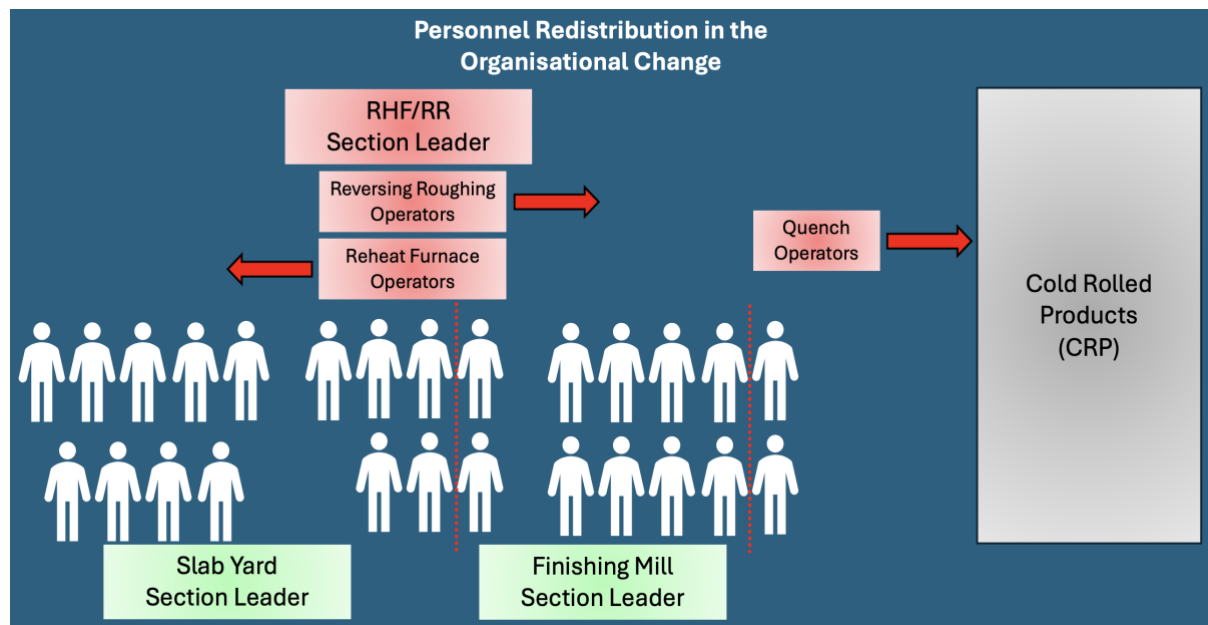


Figure 4 – Personnel Redistribution in the organisational change (Williams, L. 2026)

Drivers for Change

A prolonged reduction in production demand significantly lowered forecast output from approximately 2.1 to 1.3 million tonnes per year. Despite this decline, fixed operating costs associated with labour, services, and operational support remained largely unchanged. This created financial pressure to reduce labour expenditure and improve operational efficiency.

Workforce restructuring was therefore identified as a necessary response to maintain financial sustainability. In addition to cost reduction, the restructuring aimed to improve alignment between day-based asset ownership and shift-based operational responsibility, which had previously shown areas of misalignment.

Resistance

Resistance to change was influenced by workforce conditions following earlier large-scale restructuring across the site as outlined in the [\[Introduction Section\]](#). This period of transition reduced workforce confidence and created uncertainty regarding job security. A younger

remaining workforce demographic further limited potential voluntary redundancy uptake and increased concern regarding compulsory redundancies.

Communication & Timeline

The communication of the proposed change was delivered through a series of structured communication sessions with the general population of HRP outlining the timeline for implementation.

The Initial announcement was made to the worker population on the 29th of November 2025, with an expected implementation date of 15th of April 2026. During this time 15 personnel would leave the business under the VR scheme, or where possible redeploy to other works areas to different roles.

Managing the Transition

During the consultation period (November 2025 – April 2026) the personnel who were directly affected by this change would undergo aspirational interviews to ascertain whether they will leave the business under VR scheme or stay in the organisation in a different role. These interviews would be done with local management and HR representatives. During this period personnel looking to redeploy would undergo job specific interviews, so that the correct candidates get deployed to the correct roles.

A scoring system was to be implemented for those who were directly affected by this change, this scoring system is based on Attendance, Flexibility, Ability, Experience, amongst other factors. This scoring system was used to implement movements within the organisation should there not be enough volunteers to leave the business under the VR Scheme. There was no allocated training time, or resources given towards training personnel for role transition. Training on the new roles was done in conjunction with executing duties for the original roles.

Introducing Lewin Force Field Analysis

Lewin's force Field Analysis

Lewin's Force Field Analysis provides a structured method for identifying the factors that support or resist organisational change (*Lewin, 1951*). The model distinguishes between driving forces, which push the organisation toward change, and restraining forces, which act to resist or slow the process (*Burnes, 2004*). By identifying these competing influences, organisations can better understand the balance of forces affecting the success of change implementation (*Hayes, 2022*).

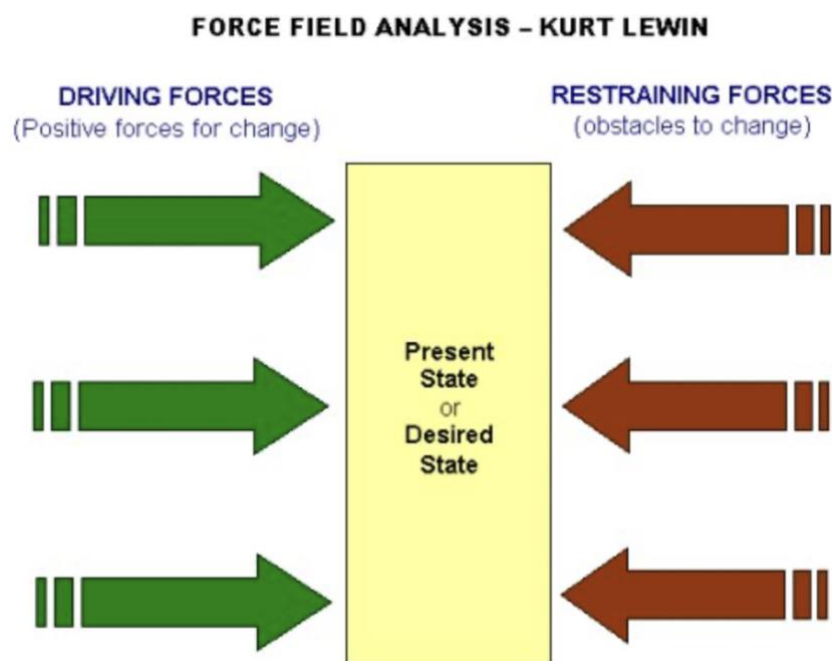


Figure 5 - Kurt Lewin Force Field Analysis Diagram (Connelly, 2023)

In the case of the HRP restructuring, several strong driving forces justified the need for change. A significant reduction in production demand created financial pressure due to the mismatch between production output and fixed operating costs. Forecast production volumes were expected to decrease substantially, requiring the organisation to reduce labour expenditure and improve operational efficiency to remain financially sustainable.

At the same time, several restraining forces were present within the workforce environment. Previous large-scale restructuring across the site had already created uncertainty and reduced

morale among employees. The introduction of further structural changes increased concern regarding job security and contributed to resistance to additional organisational change.

The balance between these driving and restraining forces is summarised in **Figure 6**.

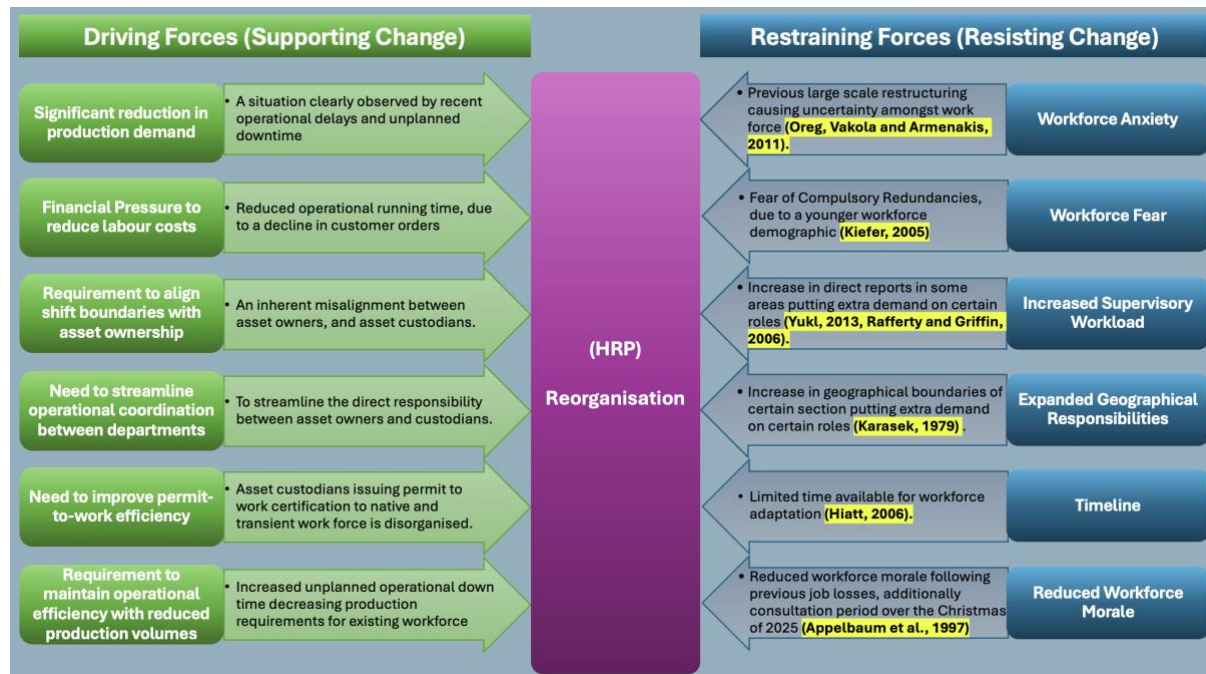


Figure 6 - Lewin's Forcefield Analysis of HRP's Reorganisation (Williams, L. 2026)

The Force Field Analysis demonstrates that while strong operational drivers justified the need for restructuring, restraining forces related to workforce confidence and workload expectations remained significant. Although the business case for change was clear, limited emphasis appears to have been placed on actively reducing resistance prior to implementation. This imbalance between operational necessity and workforce readiness likely contributed to increased anxiety among employees and reduced acceptance of the restructuring process.

Application of Lewin's Three Step Model

Lewin's Three-Step Model provides a useful framework for evaluating how an organisational change was introduced and implemented (*Lewin, 1947*).

Unfreeze Stage

The unfreeze stage involves preparing individuals to accept that change is necessary. In this case, the reduction in production demand created strong operational pressure to restructure workforce responsibilities.

The business justification for change was clear, supported by declining production volumes and increasing financial pressure. However, the workforce environment was already affected by previous restructuring, creating resistance to further change initiatives.

Although communication meetings were conducted, the psychological readiness of employees remained limited. Workforce concerns regarding redundancy and role uncertainty contributed to resistance during this stage.

Overall, the unfreeze stage was partially effective in establishing business necessity but less effective in preparing employees emotionally for change. Lewin emphasises the importance of reducing restraining forces during the unfreeze stage; however, as identified in the Force Field Analysis, workforce resistance remained significant

Change Stage

The change stage involved implementing the revised boundary structure and redistributing operational responsibilities, as well reducing the overall operator roles.

Positive outcomes were identified during this stage. The realignment of boundaries improved coordination between shift and day organisational structures. Permit-to-work processes became more streamlined due to clearer authority boundaries.

However, the redistribution of responsibilities also increased workload demands for some Section Leaders. In several cases, direct reporting responsibilities increased significantly, increasing management pressure and reducing available time for operational oversight.

Geographical responsibilities also expanded, particularly within the Slab Yard area, increasing logistical and safety management complexity.

From a people perspective, employees were required to participate in interviews and reassignment discussions, contributing to increased stress during the transition period.

Little to no time was allotted for retraining during this transition. Training was required for the redeployment and the redistribution of responsibilities, but no time or resources were given towards it.

Refreeze Stage

The refreeze stage involves embedding new working practices into daily operations to ensure long-term stability. This stage typically includes training, reinforcement of new behaviours, and ongoing evaluation of performance (*Lewin, 1951; Burnes, 2020; Hayes, 2022*).

In the HRP restructuring, very few training activities were introduced to support the transition into new roles. Employees were required to assume new responsibilities shortly after training completion, reducing the opportunity to develop confidence in new working arrangements before full operational accountability was assigned.

In addition, there was limited evidence of structured reinforcement mechanisms following implementation. Lewin emphasises that the refreeze stage is critical for ensuring long-term stability of organisational change. Without structured reinforcement activities such as performance reviews, feedback collection, and workload monitoring, there is a risk that operational pressure may destabilise the new structure.

Overall, while the structural aspects of the change were successfully implemented, the refreeze stage appears to have been less effectively supported. This may affect the long-term sustainability of the organisational restructuring (*Burnes, 2020; Kotter, 1996; Hayes, 2022*).

Evaluation Using Kotter's Eight Step Model

Kotter's Eight-Step Model provides a framework to provide insight into how effectively a change process is managed (*Kotter, 1996*).



Figure 7 - Kotter's Eight step mode, (*Kotter, 2025*)

While Lewin's Force Field Analysis focuses on identifying the forces influencing change, Kotter's Eight-Step Model provides a structured approach for managing those forces through leadership actions. In the context of the HRP restructuring, the Force Field Analysis highlights the presence of strong restraining forces, particularly workforce anxiety and uncertainty following previous restructuring.

Kotter's model suggests that such restraining forces should be addressed through actions such as building a guiding coalition, communicating a clear vision, and reinforcing early successes. The limited reduction of restraining forces observed in the HRP restructuring indicates that several stages of Kotter's model were not fully developed. As a result, although the operational drivers for change were strong, workforce acceptance remained limited, highlighting the importance of addressing human factors alongside structural requirements.

Using this model additional insight into how effectively the change process was managed at HRP can be valuated as shown in **Table 3**.

Table 3 - Evaluation using Kotter's Eight step Model

Kotter Step	Enhanced Evaluation (Stronger Emphasis)
Create Urgency	A strong sense of urgency was evident due to declining production output and increased operational downtime. These performance issues were highly visible and measurable across the HRP workforce, creating clear operational awareness of the need for change.
Build Guiding Coalition	There was limited to no visible involvement of frontline leadership during the preparation phase of the organisational change. A lack of cohesion between Days management and Shift management further weakened leadership alignment. Additionally, the absence of reductions within the day organisational structure created perceptions of inequity, reducing workforce confidence in leadership decisions.
Create Vision	While structural objectives were clearly defined at management level, the wider organisational vision was not effectively translated to the workforce. Ongoing uncertainty surrounding redundancies and redeployment opportunities created confusion and reduced clarity regarding long-term direction.
Communicate Vision	Formal communication meetings were conducted; however, workforce uncertainty persisted. The timing of communications over the Christmas period was widely viewed as inappropriate, reducing engagement levels and limiting the workforce's ability to fully process and respond to the proposed changes.
Remove Barriers	Increased workload created significant operational barriers to successful implementation. Limited training opportunities and insufficient supporting resources restricted workforce readiness for redeployment. Areas experiencing operator reductions were not adequately restructured to accommodate redistributed workload, increasing operational strain.
Create Short-Term Wins	No clearly defined short-term success indicators were established. This was compounded by minimal training provision and a lack of structured planning for workload redistribution. As a result, opportunities to demonstrate early success and build workforce confidence were largely absent.
Sustain Acceleration	Implementation followed a structured timeline; however, limited training for redeployed personnel reduced workforce capability during transition. The execution deadline occurring immediately following the consultation period created pressure conditions, resulting in the change being adopted with negative workforce perception.
Anchor Change	Reinforcement mechanisms were limited following implementation. Insufficient training provision and inadequate planning for workload redistribution reduced the ability to stabilise new working arrangements, increasing the risk of long-term operational inefficiency and workforce dissatisfaction.

Overall, while urgency was clearly established, several later stages of the Kotter model appear underdeveloped. This contributed to negative workforce perception despite operational necessity.

Operational and People Impact

The restructuring delivered both positive and negative impacts across operational and workforce domains as can be seen in **Table 4**.

Table 4 - Impact on Operations and People

Impact Category	Positive Outcomes	Negative Outcomes
Operational	Improved alignment between shift responsibilities and asset ownership improved procedural efficiency Permit-to-work processes became more streamlined, by reducing duplication of authority responsibilities.	Increased geographical responsibility increased supervisory workload. In some cases, significant increase in direct reporting responsibilities, introducing potential risks to operational oversight and safety monitoring which created additional operational complexity. A lack of training time, and resource adding to the difficulty in adopting the change.
People	Redeployment opportunities maintained workforce continuity. Availability of Voluntary Redundancy opportunities	Workforce morale was affected by ongoing restructuring across the wider organisation. The timing of change announcements and the proximity of voluntary redundancy deadlines created additional pressure on employees. Employees were required to make career decisions within limited timeframes, increasing stress and uncertainty.

These factors contributed to reduced confidence in the change process despite recognition of its operational necessity

Conclusion

The reduction in operating roles and restructuring of section boundaries within the Hot Rolled Products department was driven by clear operational and financial pressures resulting from declining production demand. From a business perspective, the decision to reduce Section Leader positions and realign responsibilities represented a logical approach to maintaining operational efficiency under constrained production volumes. Additionally, reducing operator roles during a time of reduced operational capacity is an efficient cost reduction to offset the deviation from expected production volumes.

Application of Lewin's model demonstrates that while strong operational drivers supported the need for change, the human aspects of the unfreeze stage were less effectively managed. Workforce readiness was limited due to recent restructuring activity, increasing resistance to further organisational change.

During the implementation phase, several operational benefits were achieved, particularly in relation to improved boundary alignment and permit-to-work efficiency. However, increased workload responsibilities and expanded supervisory coverage introduced new operational risks.

Evaluation using Kotter's model further highlights weaknesses in workforce engagement and reinforcement stages. While urgency was established, the absence of structured reinforcement and early success indicators contributed to uncertainty among employees.

Overall, the change was operationally necessary but not optimally managed from a people perspective. Future organisational changes of similar scale should prioritise early workforce engagement, structured reinforcement mechanisms, and clearer communication of long-term vision to improve acceptance and long-term effectiveness.

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Appendices

Appendix 1: Port Talbot Hot Strip Mill Process Summary (Williams, L. 2025)

Hot Rolled Products (HRP) Process Overview

Hot Rolled Products (HRP) is a key part of steel production at TATA Steel UK's Port Talbot site. The department fits directly between the steel slab substrate imported and the further processing unit Cold Rolled Products (CRP), and/or the Customer.

HRP receives steel slab substrate imported from suppliers from around the world. They are typically between 10 tonnes and 30 tonnes in weight and approximately 10m x 0.30m in length and thickness. The primary function of HRP and all of its processing units is to reheat the steel slab substrate and to reduce them in thickness (Gauge) so further processing can be undertaken, either by further processing units within the business or by the end customer. The finished product from HRP is a Hot Rolled Coil of steel (HRC), the gauge and width is dependent on the customer's requirements and the end user's intended application.

The steel slab substrate imported can be made of varying chemical compositions, with differing trace elements used during the casting process. This is to ensure specific customer requirements can be met regarding the mechanical properties they require for the end use of the steel being produced. HRP plays a pivotal role in providing these specific requirements through the heating, rolling and cooling phases of its operations.

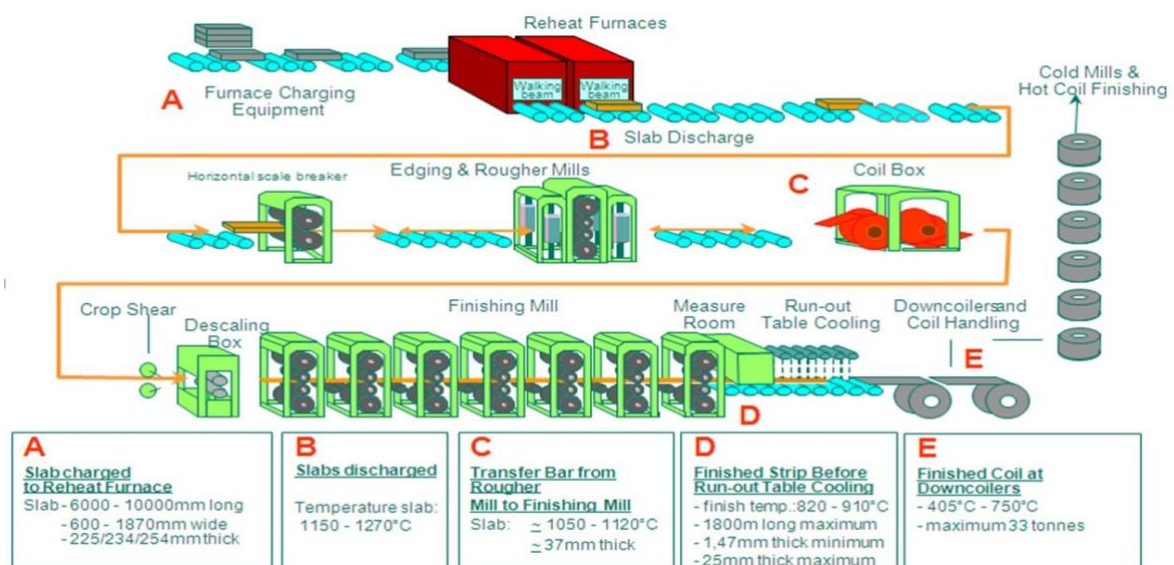


Figure 8 - Process flow of HRP

HRP is a department with many operating functions and units which are grouped into 6 specific key operational areas working together in harmony. The 6 key areas of HRP are:-

- **Slab Yard** – Stocking Yards, Slab Processing and Furnace Feed.
- **Reheat Furnace** – A and B Reheating Furnaces
- **Hot Strip Mill** – HSB, Reversing Roughing Mill, Coil Box, Finishing Mill, Run Out Tables and Down Coilers.
- **Light Roll Shop** – Finishing Mill Work Roll Maintenance Shop
- **Heavy Roll Shop** – Back Up Roll Maintenance Shop
- **Hot Coil Finishing** – HRC storage, further processing, Rail and Road Dispatch.

HRP Working Areas Overview

Slab Yard

The **slab yard** is a slab stocking and handling area for steel slab substrate; it is the largest department by area in the whole of the Port Talbot site. The slabs are imported from a global supply chain across the world oceans. They are received by the slab yard via the UK rail network and unloaded for inspection and itemisation as can be seen in [Figure 6](#) before they are scheduled to be processed through HRP.

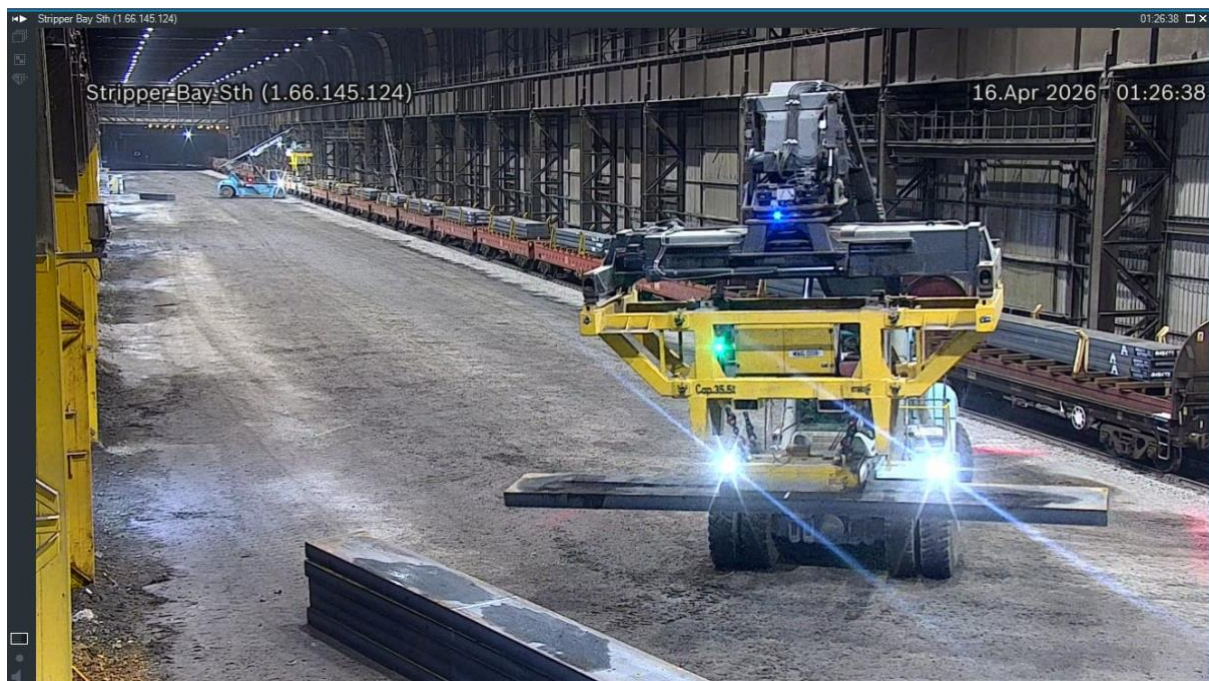


Figure 9 - Imported Steel Slab Substrate being unloaded.

The main role of the slab yard is to receive, correctly identify, inspect, itemise, and schedule each slab that is to be processed through HRP. They work closely with the procurement and scheduling departments to provide the slabs ready for processing in the correct order for the customer. After being unloaded and received by the slab yard the slabs are either scheduled for processing through HRP immediately or are stocked in one of many of the stocking yards around the Port Talbot Site ready for scheduling later. They are transported and handled using bespoke heavy plant called Kress Carriers and Over Head Cranes as seen in **Figure 10** and **Figure 11**.



Figure 10 - Kress Carrier transporting slabs in the slab yard

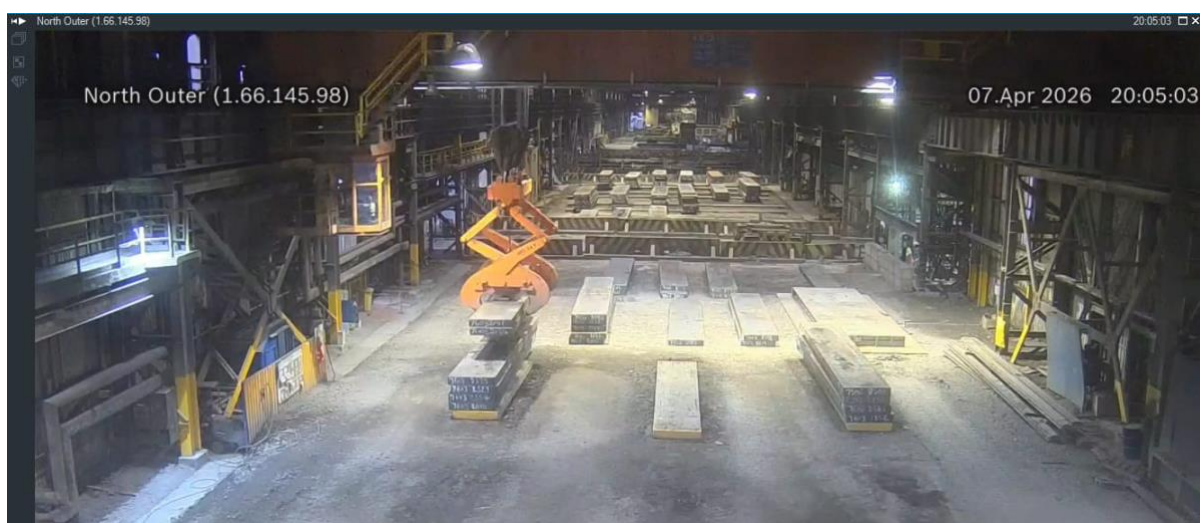


Figure 11 - Overhead crane stacking steel slabs ready for processing in HRP.

Reheat Furnaces

The **Reheat Furnaces** (RHF's) reheat the slab substrate for further processing in the HRP. The two furnaces are natural gas heated, refractory lined walking beam furnaces. The internal dimensions are 60 meters long, by 11 meters wide and 6 meters high. These internal dimensions enable Tata Steel UK to process slabs in the region of 7 to 10 meters long by 0.6 to 1.9 meters wide which equates to weights in the range of 10-36 tonnes. This allows the business to cater for a large customer base with varying specifications for the end use of the product. The Reheat furnaces configuration including the hydraulic, gas and water systems are larger, and give the area a larger footprint the size of several 5 storey houses joined together. Each furnace is heated by computer-controlled pulse firing burners using Natural Gas as the fuel. Typical Temperature of the Furnaces is 1100-1350°C.

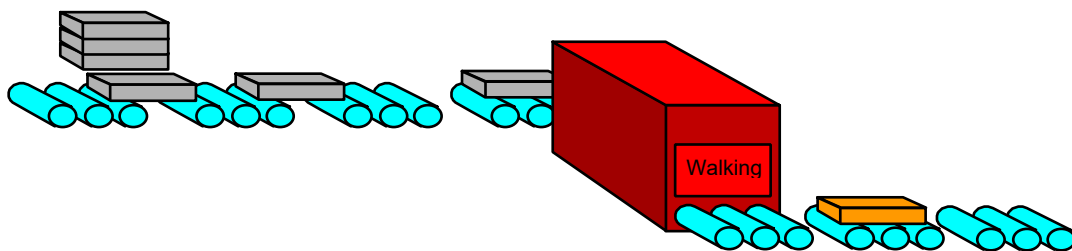


Figure 12 - RHF Process Flow Schematic

The RHF's are fed steel substrate through a magazine and roller table operation where steel slabs are provided and charged into the furnace for heating in a largely automated process, overseen by specialist operators, as seen in Figure 13 and Figure 14



Figure 13 - Magazine used for furnace charging



Figure 14 - Steel Slabs being 'charged' into RHF.

The steel slab substrate is heated above recrystallisation temperature to enable the molecular grains of the iron and additives to form in such a way that when processed and cooled the steel will have specific mechanical properties to meet the customer's specific requirements.



Figure 15 - Heated Steel Slab being Discharge from Reheat Furnace A

Vertical and Horizontal Scale Breakers (VSB & HSB)

After the slab is discharged from the RHF's and deposited onto the roller tables at a temperature of around 1150-1240°C. The slab would have built up a layer of iron oxide (FeO_2) on all surfaces. This is an expected reaction when the oxygen in the atmosphere reacts with the iron in the steel at temperatures exceeding 1000°C. However, this needs to be removed before any bulk deformation of the slab can be done. This is achieved when the slab enters the first stands called the **vertical and horizontal scale breakers (VSB & HSB)** where a single pass is made by the slab through the mill as seen in **Figure 16**. High-pressure jets of water are used to blast the scale off the slab as it makes its way through. This is a critical process, scale that is not removed can end up being rolled into the finished coil, which is an unwanted defect.



Figure 16 - Steel Slab being 'Descaled' Through the HSB/VSB

Reversing Roughing Mill

From the VSB & HSB the slab is transported to the next unit, the **Reversing Roughing Mill**. This is a four high reduction mill that will reduce the slab thickness from 250-300mm to 38-42mm, an overall reduction in thickness of circa 85%. The slab will pass back and forth through the mill several times to achieve the desired reduction prior to moving to the next

part of the process. The width of the product is achieved here in the roughing mill and is done by the edger rolls on that control product spread and squeeze on entry and exit of every pass through the mill as seen in **Figure 17**.

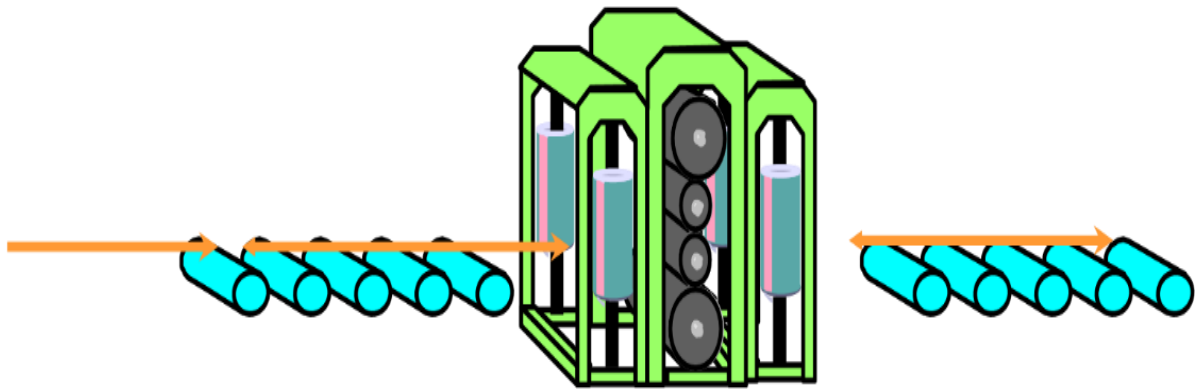


Figure 17 - Reversing Roughing Mill Schematic

Whilst producing the shape and profile (dimensions) of the steel, the reversing roughing mill also controls the scale build up by ‘descaling’ the slab with high pressure water jets during each pass through the mill. This ensures the steel slab is to the highest attainable quality standards for the customer. The use of descaling water also impacts the processing temperature of the steel slab, and this a carefully calculated and choreographed relationship between processing speed, water use and slab temperature to provide a slab to the next process at the correct temperature for further reduction in the finishing mill stands.



Figure 18 - Reversing Roughing Mill at HRP

Coil Box

From the Reversing rougher the product is no longer a 'slab' it is now known as a transfer bar, or a plate (having been reduced in thickness considerably to around 40 mm) as seen in **Figure 19**.



Figure 19 - Steel slab exiting the Reversing Rougher

This enters the **Coil Box** and is coiled into a coil as seen in **Figure 20**.



Figure 20 - Coil Box Process Flow Schematic

The **coil box** is an engineering advancement on previous configurations of Hot Rolled Products at Port Talbot. As the plant innovated over time and progressed to processing longer slabs, the area between the roughing mill and finishing mill is too short to process this longer material. The physical gap between the roughing mill stands and finishing mill stands is not large enough for the product to exit the roughing mill before processing in the finishing mills.

The coil box can coil a long transfer bar so that can be fed into and processed by the finishing mill stands. The main advantage of the coil box is its ability to retain heat in the product and reduce heat waste while being fed into the finishing mill stands for the final reduction in thickness.



Figure 21 - Coil Box feeding a transfer bar into the finishing mill stands

Finishing Mill

The **Finishing Mill** comprises of 7, four-high tandem rolling mills as seen in **Figure 22**. The Finishing Mill progressively reduces the gauge of the strip in a single pass through each mill. The rate of cooling and speed of work is governed by the required properties for the end user. Upon exiting the final finishing stand the product will be at the required gauge the customer requires.

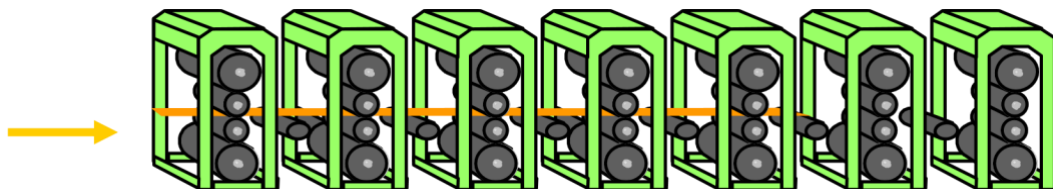


Figure 22 - Finishing Mill Process Flow Schematic

As the strip passes through each finishing mill stand and progressively reduces in thickness the length of the strip increases and so does the speed of work.

The strip enters the final finishing stand at a significantly higher speed than it enters the first stand. There is another intricate balance being struck with the speed of work, temperature retention and water use for descaling as the strip is processed.



Figure 23 - Finishing Mill Stands, also showing new work rolls on the mill floor

Run Out Tables

After exiting the finishing mill stands the product is now a 'strip' and is on width, and gauge for the end user's application requirements. The rate at which the product cools will determine the mechanical properties for the customer. Having originally been reheated and then reduced this is the last opportunity to ensure the mechanical properties are locked into the product.

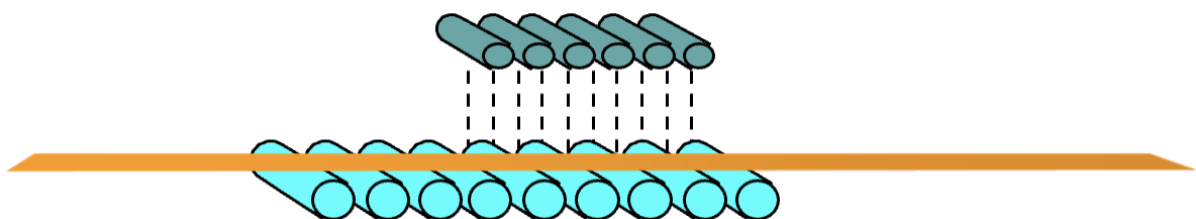


Figure 24 - Run-Out Tables Process Flow Schematic

The **run out tables** are a series of roller tables that transport the strip to the downcoilers where it will be coiled ready for stocking, dispatch or further processing in Cold Rolled Products (CRP). The run out tables have a series of cooling water banks that cool the strip as it passes underneath to control the rate of cooling of the product to ensure the phase change of the molecular grains meet the carefully considered coiling temperature to provide the customer with a product in specified parameters. As can be seen in **Figure 25**.

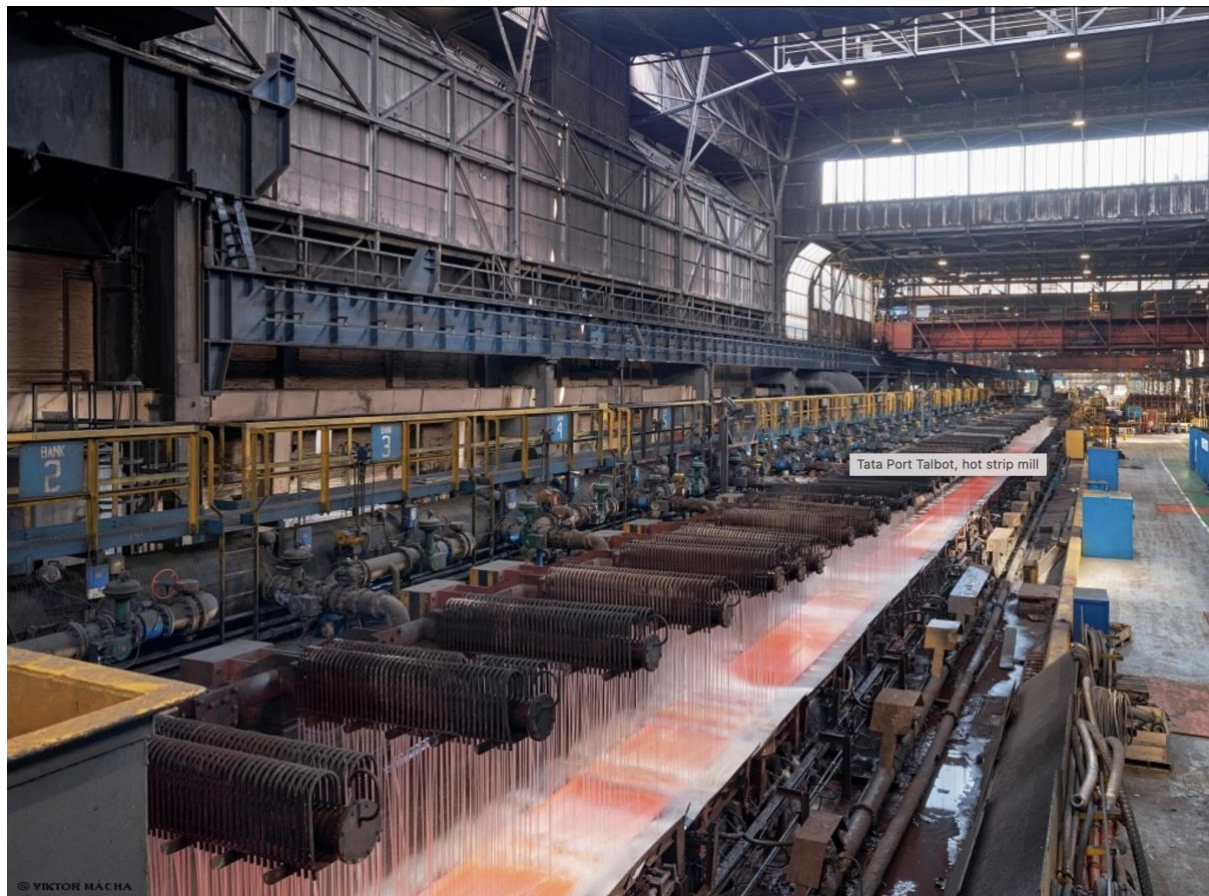


Figure 25 - Run out tables, cooling steel strip prior to coiling

Down Coilers

The **Down Coilers** will receive the strip after it exits the finishing mill stands and travels over the run-out tables. They coil it in the downward direction to form a Hot Rolled Coil (HRC), this is the end product at HRP as can be seen in **Figure 26**. The equipment will catch the steel strip between a mandrel and three wrapper rolls; the mandrel will spin fast enough to match the speeding strip as it travels into the coilers from the runout tables. The strip is pressed against the spinning mandrel with the three wrapper rolls and wind the product into a coil. There are two coilers in HRP, and they alternate between them when operating at full capacity. The

coils will be taken from the coiler mandrel by series of hydraulically operating coil cars and get a metal band placed around them to stop them from uncoiling during transport and further processing as can be seen in **Figure 27**. They will either got to Hot Coil Finishing for storage, reworking, extra packaging and dispatch. Or they can be transported directly to CRP for further processing in the Cold Reduction Process.

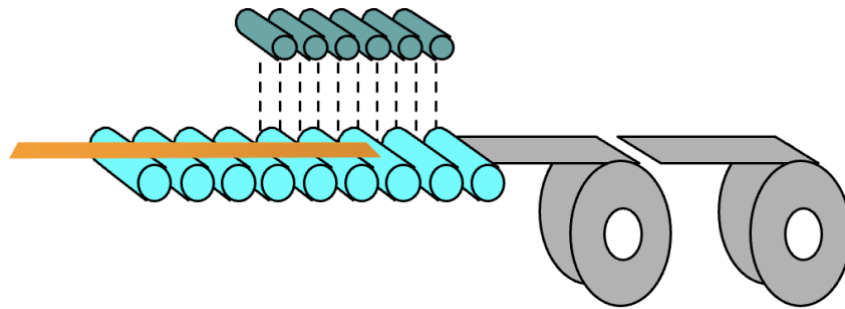


Figure 26 – Down Coiler Process Flow Schematic



Figure 27 - Hot Rolled Coil (HRC) exiting the down coilers

Hot Coil Finishing (HCF)

Hot Coil Finishing (HCF) is a storage area for the finished hot rolled coils. The coils here are stocked and dispatched via rail or road to varying distribution centres around the world or directly to our customers. There are a few processing units in HCF that can rework and further process the coils depending on the customers' requirements. Coils can be sampled, further packaged, or re-wound on a rewind line prior to finally being dispatched to customers via either the road or UK rail network.



Figure 28 - One of Hot Coil Finishing Storage Areas

Light Roll Shop (LRS)

The finishing mills in HRP all operate in an approximation of the same way, the product is passed through a series of mills to reduce the thickness with each pass until the product requirements are achieved. The contact patch with the product takes its toll on each set of the mills 'working rolls'. These work rolls have a life expectancy and need to be ground periodically in order to remain consistently the correct standard for the product requirements to be achieved. The process of working the material through these work rolls is quite impactful on the work rolls and with each product processed small amounts of damage are incurred to the work rolls. These are periodically removed from the finishing mill stands and transported to the LRS where they are ground on a cylindrical grinder to the correct

specification to be re-inserted into the finishing stands and used again. As can be seen in Figure



Figure 29 - Work Roll being ground before being reused in the Finishing Stands

Heavy Roll Shop (HRS)

Each of the mills in HRP are four high mills. The basic summary of this is the work rolls make contact with the product and work the product into the required width and gauge, but the forces to do so are immense and very damaging to the rolls and equipment if these were the only rolls in the mill stands. A Four high mill have two much large diameter non driven rolls that are the to ensure the work rolls do not bend or flex during the rolling process. This ensures the finished product is to the correct gauge uniformly. If the work rolls were left to freely bend and defect then the product produced would vary in thickness. The HRS role in the business is much the same as the LRS. They re-work the 'Heavy' back up rolls for re-use in the roughing and finishing mills.



Figure 30 - Back up roll being ground before reinsertion in the roughing mill