Forced air cooling system, a complete & turnkey solution for blast furnace runners

BACKGROUND
Customers needs

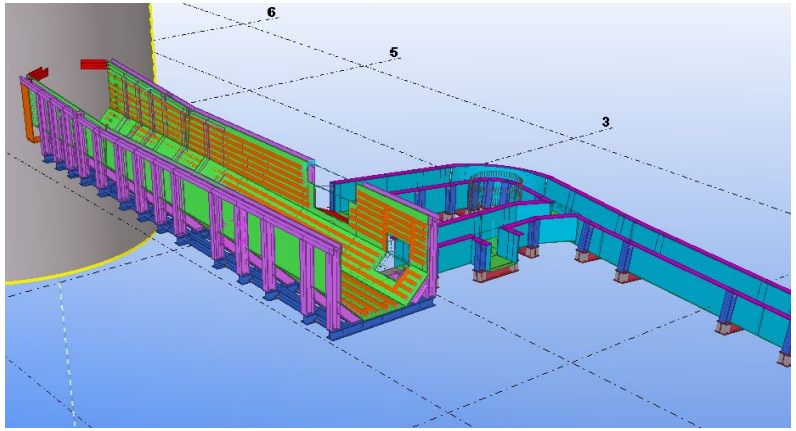
CONCEPT
Calderys solution

SUMMARY
Recap of the solution

RESULTS
Concrete benefits

The background situation

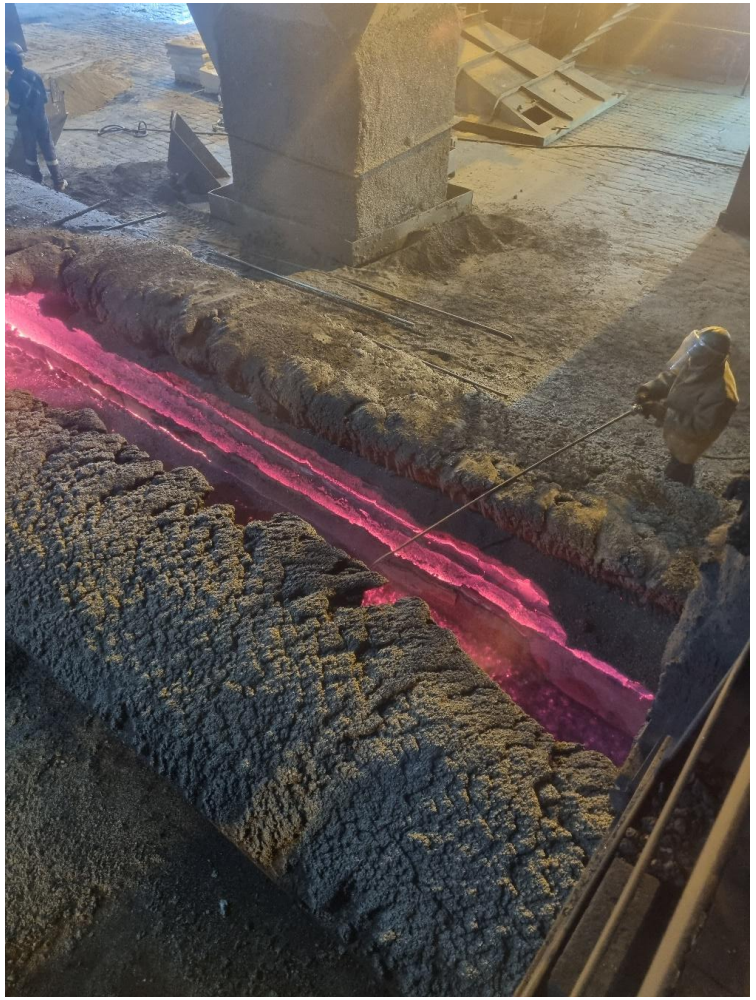
Over the last years, customer has experienced several breakthroughs and took the opportunity to redesign the casthouse from a structural point of view and from a mechanical point of view. They have consulted Calderys to solve this issue causing health and safety concerns as well as important costs.



The request from the customer

The customer, a large steel producer, has consulted Calderys to propose a new mechanical steel structure for the main runner steel casing and implement together a Force Air Cooling (FAC) system.

Calderys has worked on a new casthouse design to offer a safer environment for the workers as well as flexibility for the customer.



Analysis of the customer request

The breakthroughs were due to the steel structure and casthouse design which was causing tremendous thermomechanical stresses in the refractory lining leading to iron penetration and breakthroughs.

Technical Support team, Engineering department and local project team joined forces to develop a suitable solution and address this issue.

Calderys solution

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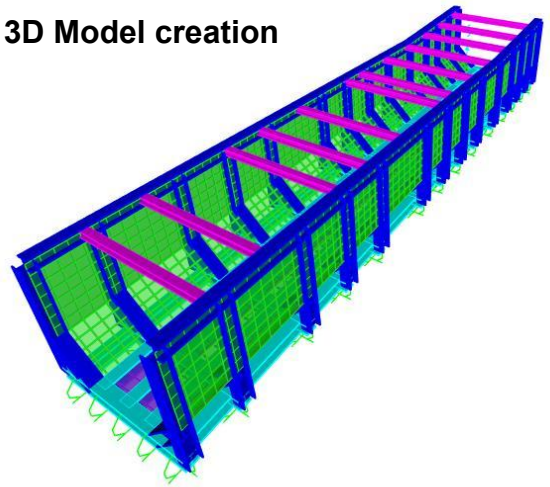
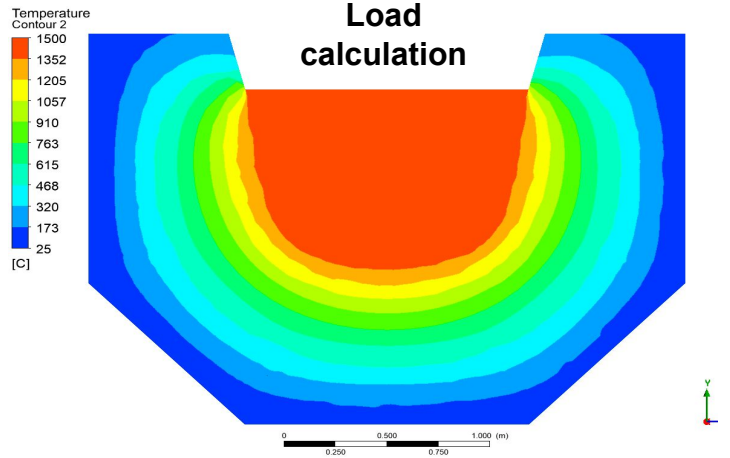
The main work was made on the design of:

- A new steel structure with load and expansional calculation for the main runner and iron runner as well as the redefinition of fixed, semi fixed and mobile point of contact
- A forced air cooling (FAC) system on the main runner (thanks to thermomechanical load calculations)
- Implementation of thermocouples to monitor the temperature lining evolution

3D Model creation



Load calculation



Benefits brought by the solution

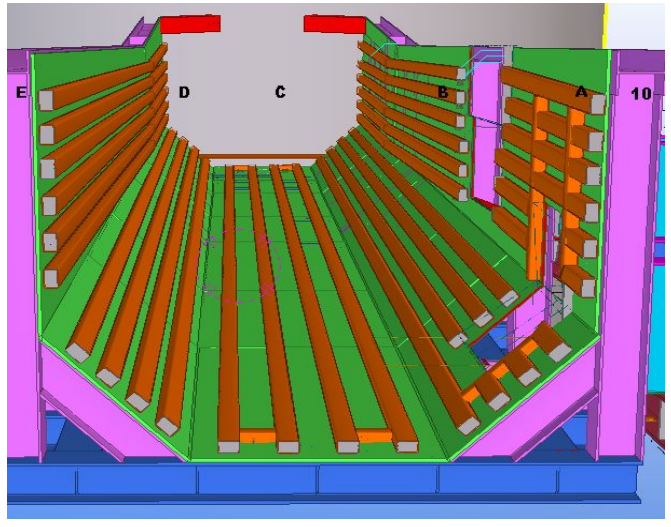
The redefinition of the design has ensured a more stable casthouse structure with a better understanding of the load.

The implementation of a cooling system bring the following benefits:

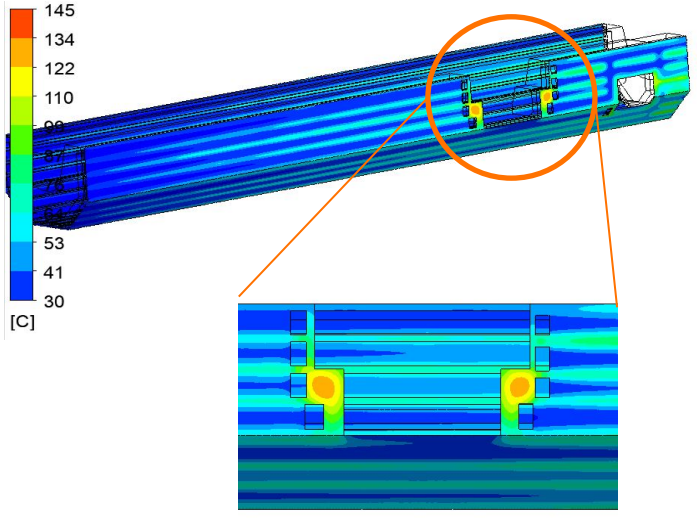
- Push the iron freezing isotherm inside the lining which has a direct effect on the operational safety and act on the heat gradient in the working lining leading to lower refractory consumption
- Reduce the heat load on shell which has an impact on the shell expansional behavior and therefore on the thermomechanical stresses of the full assembly

The implementation of the thermocouple will provide operational safety to the customer due to a continuous temperature record at the safety lining level.

Customer has also the benefit to work with a single interlocutor both the engineering until the commissioning. The installation and the supply of the goods were exclusively from local market and Calderys plant.

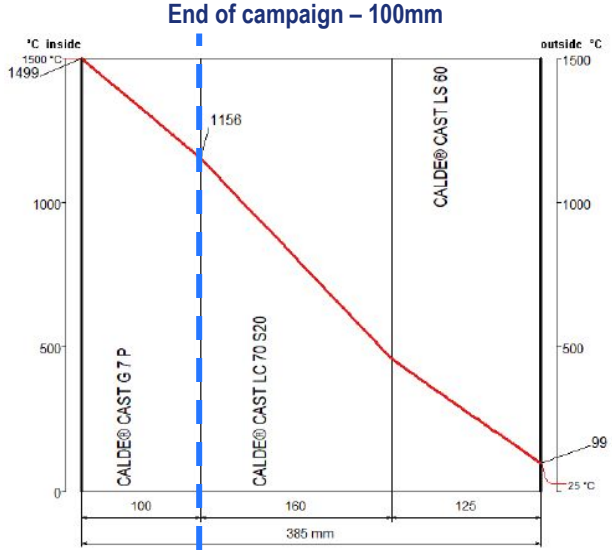


Piping arrangement



Heat load evaluation on cooling pipes

The freezing isotherm of the iron (1,150°C) is always located in the working lining or at the interface between working lining and safety lining



FORCED AIR COOLING SYSTEM, A COMPLETE & TURNKEY SOLUTION FOR BLAST FURNACE RUNNERS

Concept presentation

The FAC system was designed based on FEM calculations to ensure a steel shell structure below 100°C and a freezing isotherm located in the safety lining.

Our product selection was made to ensure a steep gradient in the refractory lining thanks to a highly conductive back layer to take benefits of the cooling system.

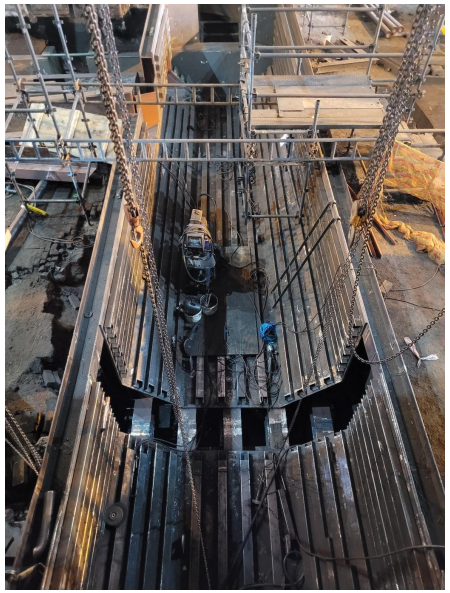
The safety lining was precast to ensure maximum reliability in use and the working lining was selected based on slag and iron chemistry.

Services - Expertise

Calderys accompanies its customers in the steelmaking practices of tomorrow, especially with full turnkey project solution.
Our global project approach is centered around EHS and a sound techno economical consideration to offer the best return on investment to our customers.

We have been able to deliver an improved industrial solution to our customer allowing not only a safer environment but also a complete solution improving the their performance with a reduction of the refractory consumption of 30%.

Strong of this success, we are working to implement the same solution on the other runner of the blast furnace.



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