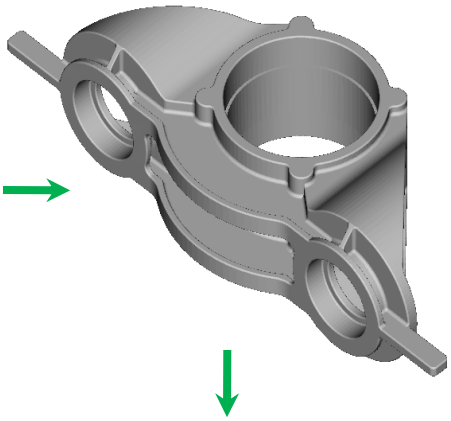
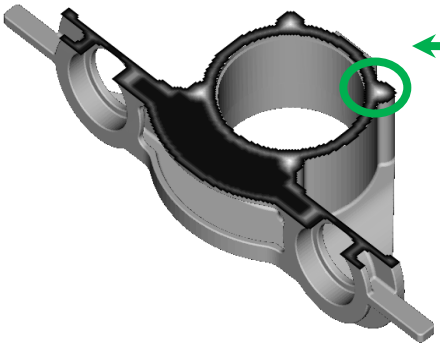
Axle Box Housing

Cast Steel, Green Sand Casting

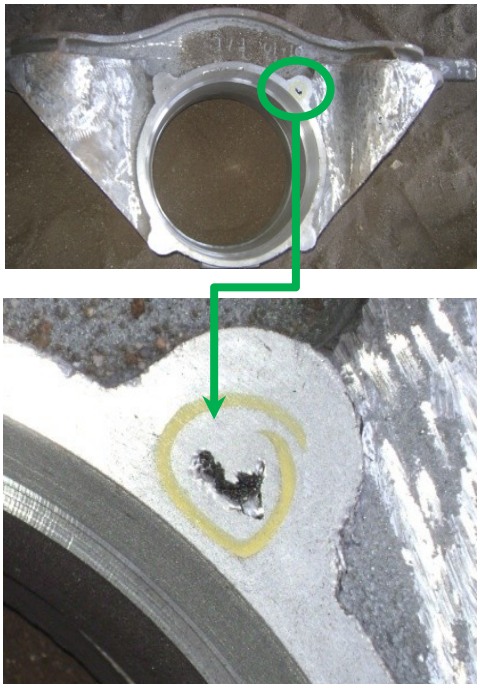
***Insight*: Under neck shrinkage porosity observed during fettling and machining stage resulting in high rejection.**



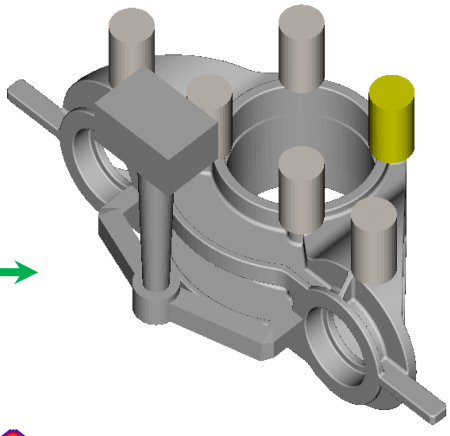
The cast steel axle box housing is used in railways. It is of overall size 1050 mm x 420 mm x 280 mm and weighs 92 kg. It is in regular production, and suffered from frequent rejections due to internal shrinkage porosity in central bore and under-neck porosity observed at machining stage.

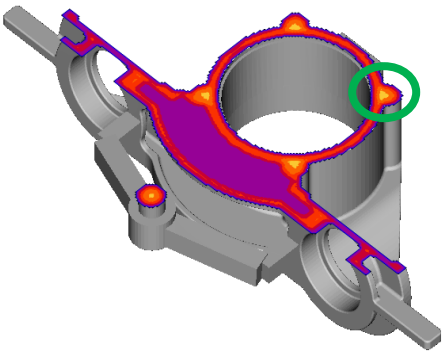


Thickness analysis of the part shows maximum wall thickness of 42 mm, connected to central bore region.



Current methoding of the casting includes eight top feeders of 80 mm diameter and height of 120 mm.





Solidification simulation reveals that the feeders are undersized, but they can not be enlarged due to the small size of the bosses on which they are placed. This results in shrinkage porosity formation which is exactly matching the defect in original casting.

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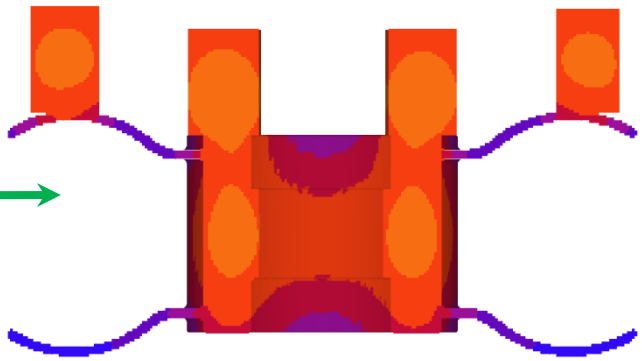
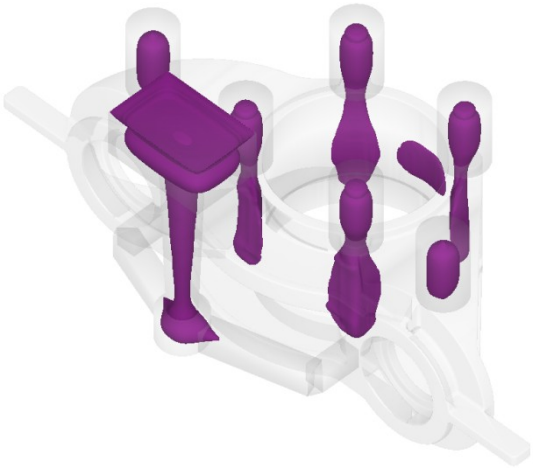
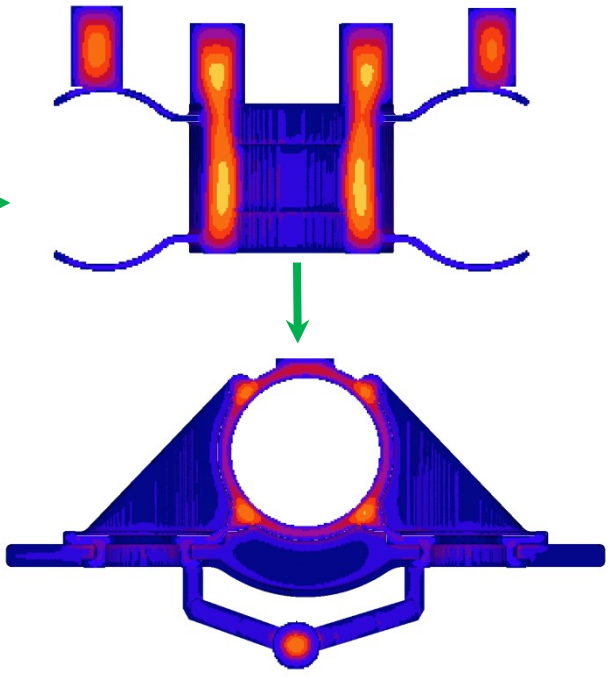
Solidification analysis shows isolated temperature regions inside the casting and at the neck of feeder which leads to shrinkage at the same location of shop floor defect.

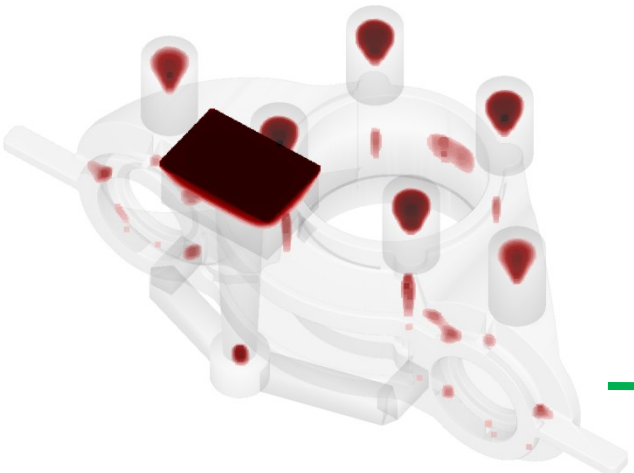




Liquid fraction shows metal solidifying last in the casting which leads to porosity, which at same circular section where defects observed in shop floor

Solidification time analysis shows last solidifying region is at neck and in circular hub section which matches with hotspot and solidification analysis along with shop floor defect.





Shrinkage porosity analysis gives the same locations for the shrinkage in circular hub sections where defects observed in shop floor .

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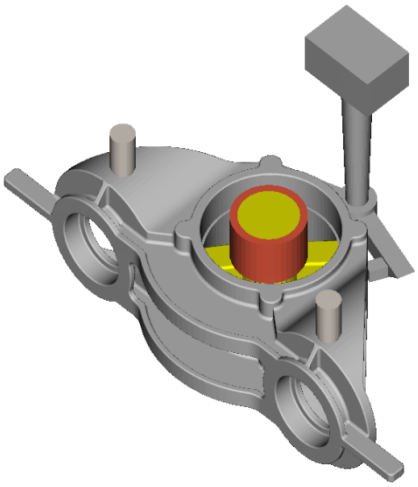
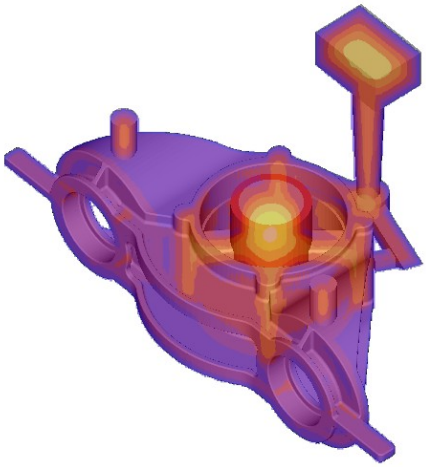
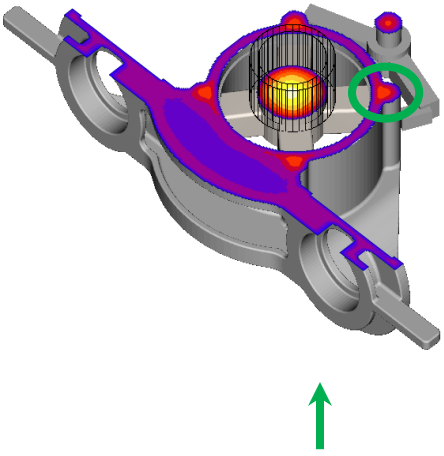
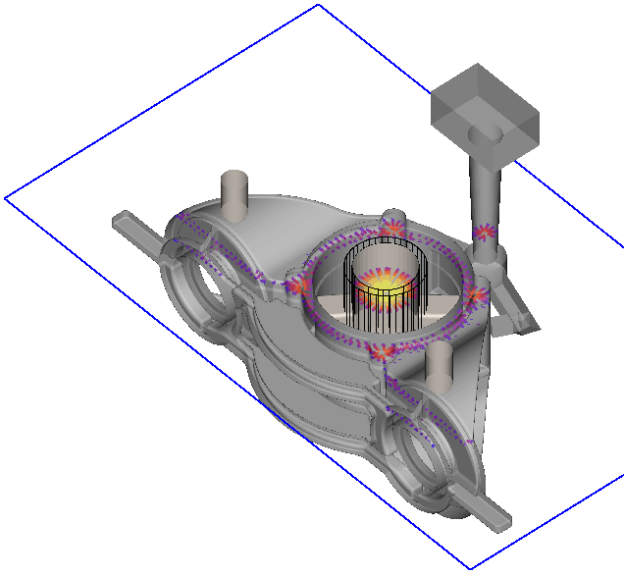


An improved methods design uses a larger feeder of 120 mm diameter and 150 mm height placed in the core. It has four necks connected close to the defect locations. An exothermic sleeve is also used.

3-dimensional solidification contour of the casting model shows improved temperature contour, with no isolated hot spot in the casting.







Solidification simulation and feed path a at the critical section reveals improved temperature contour and temperature gradient lines and thereby indicating the spots in the defect area are minimized.

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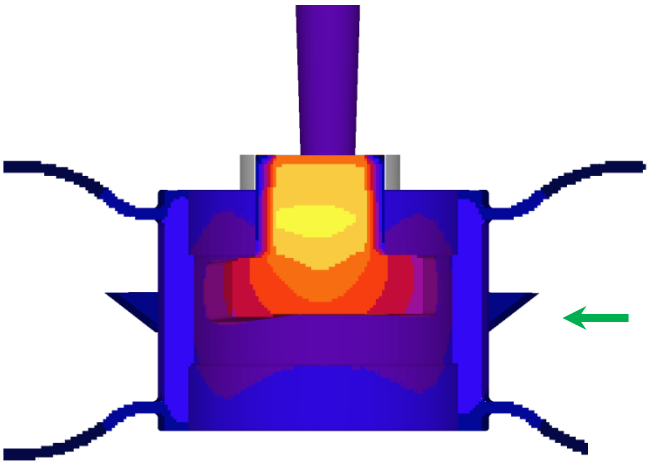
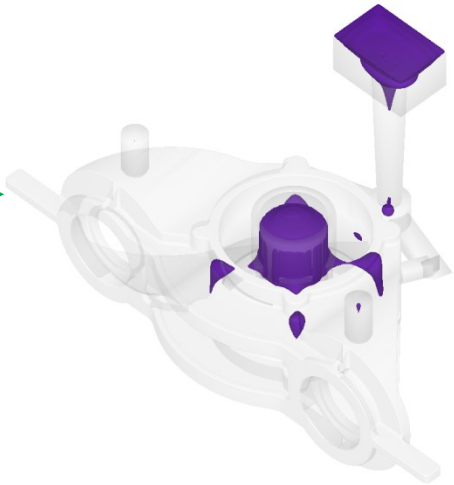
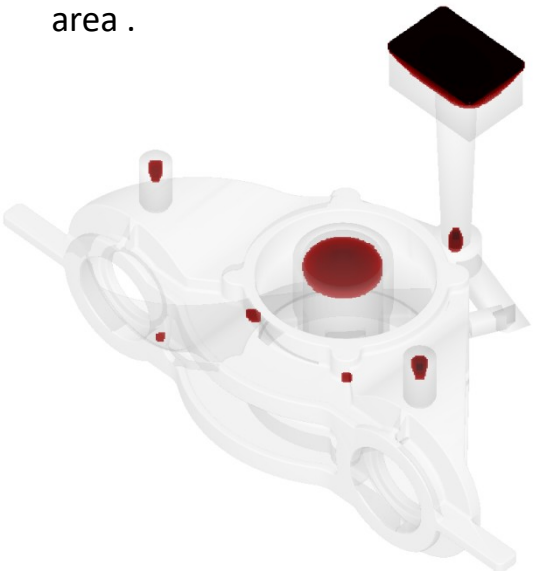


Solidification analysis shows – the hot metal is inside the feeder and circular ring is at low temperature which will solidify earlier than feeder .

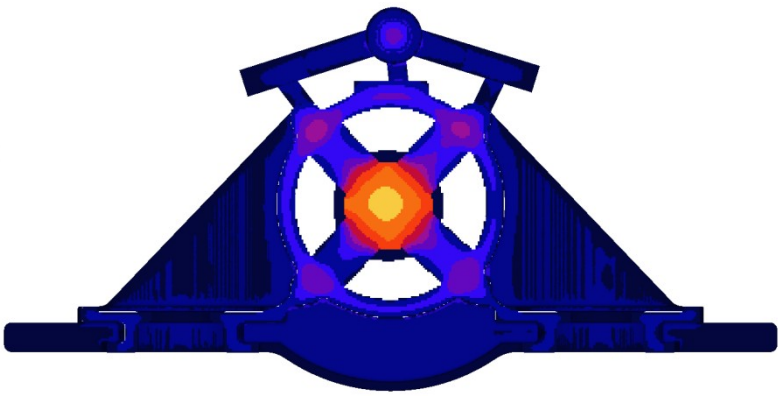
Liquid fraction shows liquid region which solidifies last. Figure shows improved results of Liquid fraction and defects are present in small area .





Shrinkage porosity results shows low probability region while defects from earlier location is get removed.

Solidification time shows improved results where feeder is solidifying last compared to circular ring section.



Summary: **An increased feeder dimension with four necks connecting each thicker section with resulted in improving the quality of the casting.**