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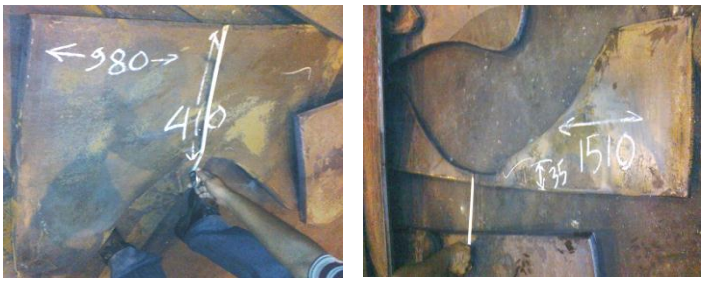
STRIP SPEED MEASUREMENT AT HSM

Presently, 0.625 % (average of Q1 FY-13) of HSM production is being scrapped due to the transfer bar head/tail end cut. It has been observed that the loss of steel due to essential chopping of transfer bar is significantly high in absence of a reliable strip speed feedback to the crop shear controller. As of now, speed of the strip at HSM is measured using the signals from two hot metal detectors, placed at a fixed distance from each other, along the direction of the strip movement. This mechanism is not very reliable due to deposition of moist iron dust and scales on the fiber optic probe head of HMD.

After receiving the speed and the position of the transfer bar by the HMD system and cut reference from the OptiCROP system, crop shear PLC controls the rotation of the blade to perform optimum cuts. Erroneous speed calculation may either result in a larger cut (yield loss) or a miss cut. Therefore, accurate speed feedback is critical for controlling the yield loss thus produced.



Before **After**

Fig 3: Typical Cuts of Transfer bar before and after system was installed.

To improve the yield of HSM by reducing the loss, Automation Division has successfully developed and implemented a machine vision system for determining accurate speed of the strip after the de-coiler. The system has been implemented on 7th Nov '2012 and since then cuts are being made based on the reference provided by this system.

The target production of HSM in FY13 is 3979000t. With a current yield loss of 0.625% the estimated production loss is around 24869t. Targeting 15% reduction of crop loss (=0.53%) reduces the HR production loss by 3780t, which would result in the increase in the bottom-line to the tune of INR 750 Lacs. Performance of the system and the yield improvement data is shown in the figure below:-

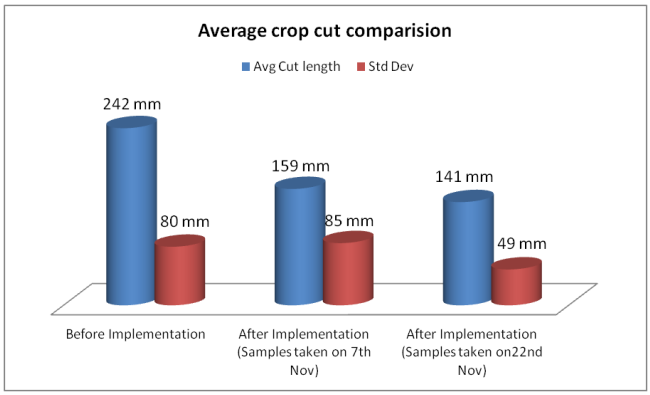


Figure-1: Manual measurement of all the pieces from scrap bucket

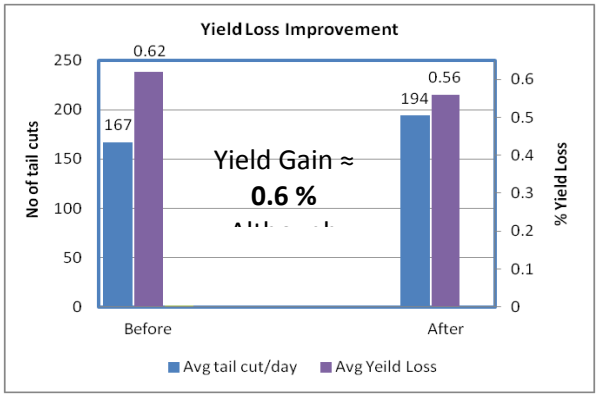


Figure-2: Yield improvement as observed between 7th-23rd Nov '2012

OASIS - ONLINE AUTOMATED SLAB INSPECTION SYSTEM AT LD#2

Cameras are installed near both upper and lower surfaces of the fully solidified strand at the end of the secondary cooling stage of continuous casting, as illustrated in fig. 1. Images picked by cameras are sent to a server at high refresh rates, from where these are displayed on screens placed in operator control room, on the one hand and image-processed in real time to identify defects on the other. The strand is red hot at this stage and its internal glow tends to exacerbate scales and damp defects, hence intense external light has to be directed at

an angle to slab surface to neutralize these intrinsic angularities. Due to these difficulties, nowhere on the globe such installations have been successfully made for automatic surface defect identification using image processing techniques. Fig. 2 provides a high-level architectural view of the system.

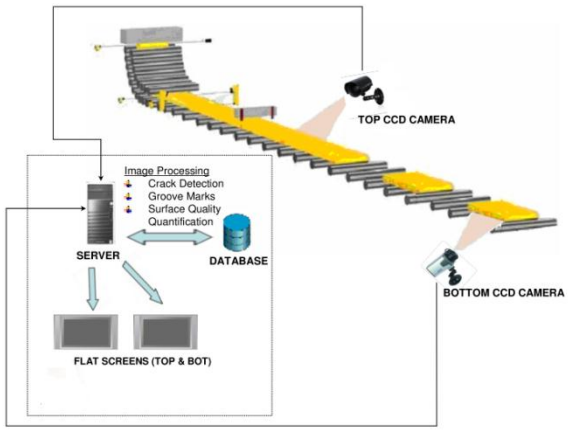


Fig 1: Schematic of the System.

The technology underlying OASIS has been patented and published. One may note the engineering issues in implementation – cooling of the cameras, preventing slime ingress in the lower camera enclosure using pressurized air out-blow through a pinhole, lighting arrangements, concurrent control-room display, parallel processing and synchronization of software modules on all cores of a server to satisfy the real-time requirements of defect identification and slab direction control.

In OASIS, specific algorithms to detect sharp gradients in brightness levels within an image are used. Then, a combination of algorithms is used to identify presence of near-straight/serpentine lines among these edges. Further, a first level of crack/groove-mark identification is done. Next, algorithms used in medical imaging are used (Relative Fuzzy Connectedness) to identify the intensity of these cracks. Thus the computer knows not only if and where a defect exists, but can tell its intensity as well as a human inspector can.

The benefits are fourfold:

- The apportioning of generated slabs to either charging- or inspection- directions is based purely on grade. As a consequence many defective slabs are directly charged into pre-rolling furnaces with attendant downstream quality problems. This will be avoided.

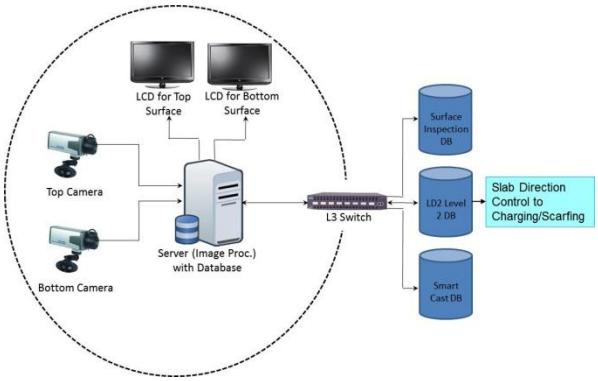


Fig 2: System Architecture

- Also, that large number of defect-free slabs are taken off-route for inspection which is wasteful, hence this will improve process efficiency
- Online defect evaluations are immediately fed-back through automation systems to the caster operators who can take corrective actions on the fly to mitigate causes of these defects
- Other Automation systems will learn the cause-effect relations between antecedent process parameters and their consequent quality effects as captured reliably by OASIS – engendering automated learning by these intelligent systems which may, subsequently, enable elimination of finely-engineered sensor-based systems like OASIS altogether.

AUTOMATION DIVISION, TATA STEEL WINS THE FIRST PRIZE AT INTERNATIONAL CONFERENCE

An International Conference on "Rolling & Finishing Technology of Steel" was organized by R&D Centre of Iron & Steel, Steel Authority of India Limited in association with Centre for Engineering & Technology, Steel Authority of India Limited & MECON Limited under the aegis of Indian Institute of Metals. The theme of the conference was "Challenges & Opportunities in Rolling Mills". The conference was organized at Ispat Bhawan, SAIL, Ranchi during 4^{th}-6^{th} October, 2012.

Automation Division of Tata Steel Limited had made a presentation on the Surface Quality Inspection System which is the first such system developed in India for online inspection of flat rolling mills.

The Automation team was awarded the first prize in the poster session of the conference.

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