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Stabilization of HCR 500 Rolling from 'B','C'&'D' Strand of Wire Rod Mill, Bhilai Steel Plant – A Review of Rolling Mill

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ABSTRACT

A process control analytical review has been done with rolling strands and it is investigated on the basis of strength and elongation in output of rolling that if the banana shape receiver pipe with steeper nozzle are used in pressurized water flow zone in the rolling process for quenching, then it is possible to control the process easily and rolled product strength is increased with good elongation properties of plain roll and TMT roll with the product up to 12mm size. By this review we the points are allocated where the investigation is much required and which can be treated as the controlling parameters point for future analysis.

***Keywords*—** Hot Rolling, Tanana shaped receiver pipe, HCR, Re-Vamping, strength of TMT.

I. INTRODUCTION

a. Bhilai Steel Plant

Bhilai Steel Plant is a symbol of Indo-Soviet Technology and Economic collaboration and can be said as a leading unit of The Maharatna Company Steel Authority of India Ltd. It is the best Integrated Steel Plant as it won Prime Ministers Trophy for 10 times for it. It has great achievements in the field of Safety, Environment, Quality, Productivity, and social responsibilities.

b. Wire Rod Mill

The 4 strand 250mm continuous Wire Rod Mill, commissioned on September 1, 1967, was designed to roll 6, 7, 8, 10mm diameter wire rods from square billets of 80mm x 80mm cross section (of length 11 to 11.8 meters) with rated capacity of 4,00,000 T per annum. The billet size was further enhanced to 85 mm^2, 90 mm^2, 100 mm^2, 105 mm^2 to improve in coil weight from 540 kg (May1967) to 930 kg (Apr.2002). After the revamping of Right Side, sections 5.5 - 12 mm dia. wire rods are rolled in B, C&D strands, whereas 8mm & 10mm are rolled on left side (`A' strand).

i. Brief Description of the Mill

Inspected billets are fed on the charging grate of the furnace by magnetic finger cranes. The billets are fed one by one to the furnace, through roll table and draw-in-roller mechanism. Billets are moved into the furnace by means of pushers at the charging end. Soaked billets are ejected out by means of Ejector Ram from the discharging end.

The reheating furnace of the size 18m x 12m is having 28 burners, which includes 13 in the heating zone and 14 in the soaking zone. Mixed (Coke Oven & Blast Furnace) gas with calorific value of 1800 -2000 k Cal/m^3 is used in the furnace as fuel. Capacity of the furnace is 120T/Hr. Gas and air is preheated to 250°c and 450°c in metallic and ceramic recuperators respectively.

The roughing group consists of nine horizontal stands in which combined drive is provided for stands 2-3 and 4-5; whereas stands 1, 6, 7, 8 and 9 are individually driven. All the drives are controlled by thyristor converter. Flying Shear is provided after stand no. 9 for front-end cutting & cobble cutting.

First intermediate group has 6 horizontal stands, out of which stand No. 12 & 13 are not being used. Stand No. 10 & 11/14 & 15 are used for rolling on all the strands. After strand No. 15, the Mill is divided in four strands, old line (A) and modernized line (B, C&D).

ii. Re-Vamping of `B', `C' & `D' Strands

The rod exiting from stand no.15 is fed to stand no.16 located at a height of 5.1 meters above ground level through a series of feed guides. Before stand no 16, a Universal Shear is provided for cutting front end and cobbles in C and D strand and drum shear in B strand. Intermediate cooling line is provided after stand no. 15 to ensure that the rod temperature does not exceed 950°C.
After Universal Shear/Drum shear, one Horizontal (# 16) and one Vertical (#17) rolling ring stand are present. One Vertical Looper is present after Universal Shear and after stand no. 16. One Horizontal Looper is present after stand

no. 17 and before NT Block. One eight stand Rod Mill Block (No Twist Block) comprises stands 18-25.

The product from the rod mill block is fed to the Laying Head through the feed guide (primary cooling line). The laying temperature of the rod should not exceed 750°C. After No Twist Block series of Cooling Tubes are provided to produce TMT Coils and Two Pinch Rolls are installed before Laying Head. The rod convolutions formed by the Laying Head fall on the Loop Conveyors/ Roller conveyor that carries the overlapping rings to the reforming tub. The overlapping rings moving over the loop conveyors get cooled by air flow generated by blowers. The rings fall into the Reforming Tub which is consists of an auxiliary mandrel with two catcher arm levels.

The convolutions dropping over the mandrel get collected onto a pallet placed below the reforming tub. The loaded coil pallet then moves to the compacting and strapping installations where the coil is compacted and then strapped at four places. The pallet with the compacted coils are then unloaded at the Tilter and placed on to the Coil Collector with the help of Load Car. Coils from the coil collector are removed by cranes for storage. After stand 15 the rolling in B C and D strand is totally under level -II automation.

b. Performance Parameters

Billet dimensions	:	105× 105 × 11600mm^3
Furnace capacity	:	120T/Hr
Actual discharge capacity	:	90 - 93 T/Hr
Billet weight	:	982 Kg
Coil weight	:	940 Kg

Table 1

Product which can be rolled

Rolling Stock	Final Length	Final Speed
5.5 mm	4890	55.0
6 mm	4220	45.0
7 mm	3100	35.0
8 mm	2350	26.0
10 mm	1500	16.5
12 mm	1050	12.0

Characterization of steel rebars is as important as that of concrete for a sound RC structure of desired strength. Present paper tries to address the various aspects of characterization of reinforcement and also related issues, which are important for design. Only passive reinforcement bars falls within the scope of the paper. Clear understanding of mechanics of reinforced concrete structures helps in understanding the intricacy involved with the characterization of rebar's.

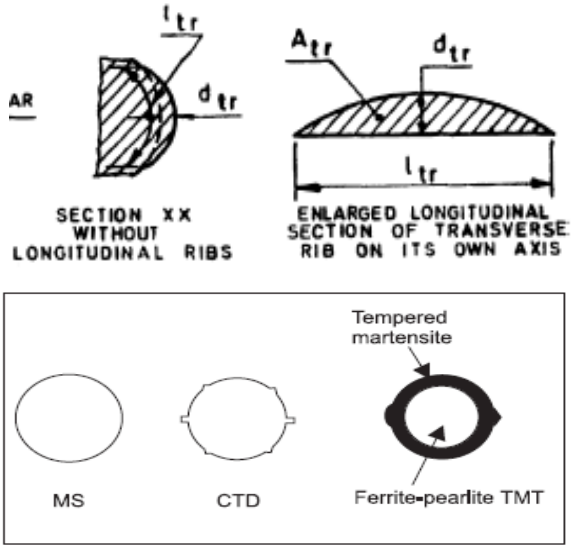

Figure: 1 Typical cross-sectional parameters of MS, CTD and TMT [3].

Moreover, basic knowledge on manufacturing process of steel helps in appreciating various facets of the characterization. These two aspects are also discussed briefly in the paper along with issues related to characteristics of rebars vis-a-vis performance of RC structure. A comparative study of the national standards of a few countries is presented followed by concluding remarks.

II. AFFECTIVE PARAMETERS

a. Effect of temperature and other parameters in material properties

Material properties which are varies with the temperature and other parameters are shown in graph form below, these material properties can varies with the parameters according to different parameters which forms the properties of a steel product when steel is passes through the rolling process with heat condition[4].

i. Chemistry of HCR

C	-	0.16 – 25 %
Mn	-	0.80 – 1.15 %
Cu	-	0.35 % min

ii. Heat Treatment

Quenching & Tempering (Q &T) or Quenching & Self Tempering (QST) THERM(AL) EX(CHANGE) TEMPCORE.

Corrosion in material with HCR [4] is **1 mA cm^{-2} = 11.6 mm y^{-1} = 456 mpy = 249 g m^{-2} day^{-1}.**

III. METHODOLOGY

a. Physical arrangement present in mill

To provide the sufficient flow of water with enough pressure the banana type shaped nozzle is connected at the end of water supply that results the supply of water to the rolling bars with enough required pressure of water flow with required amount of discharge from the nozzle outlet. The banana tube is shown in figure this is the experiment to continuity of flow of water at required manner and the amount of water discharge, the amount of discharge of water is decided according to the requirement which is varies by the temperature of the billet rolling in the strands. The four parameters which decide the next controlling for taking action are temperature of the billet at furnace outlet (first strand) temperature, temperature after roughing strand, water pressure at cooling strand and amount of water flow at cooling strand. The action will be taken by the operator or this can be requires a design of decision making device that is able to take correct decision at the right instant by observing the parameters that help to take decisions for next instant. This is only possible when the all affective parameters will be analyses by any one analyzing technique. This methodology can be taken for every strand among "A", "B" and "C" and because of the design of the mill every one strand can roll the different diameters of product or may be at a time three different products also. This is the big advantage of the mill. For analysis of the process one technique is to be among present techniques so for selection of technique the best suitability is tested by facilities and possibilities in technique. For selection optimization is a good possible so the selection for analysis is studied.

IV. CONCLUSION

Increase in mill capacity by 20 -25%. Rolling of wider range of steel grades: Mild Steel, Rimming Steel, Low Carbon, High Carbon, TMT Bars, Tyre Bead & Cold Heating Quality, etc. Rolling of wider range of profiles: 5.5, 6, 7, 8, 10 & 12mm & 8, 10, 12 TMT Bars in the rolling mill is now possible. It was not possible to roll perfectly 12mm TMT Bars before this arrangement without difficulty.

Final Improved dimensional tolerances are now better than before. The property of the HCR shows that Reduction in secondary scale formation can be achieved if rolled without any difficulty because of output strength and Better surface finish obtained. Improved draw ability of rolled product can be achieved so better shape and packaging of coils are achieved with this properties in rolled products Rimming steel, SAE 1008, TMT BARS, IS 2062 "A", SA 12, Cold Headed Steel etc. and IS 2879, IS 7887 Grade III, IV, IS 1786, SAE 1015, SEA 1008, SEA 1010. These are specified in the standards for the properties in the Mill.

The rolling analysis can be done in future, since the review is showing that there fluctuation in process so for better control the future work is possible.

Figure:2 Banana Receiver Pipe for cooling arrangement.

Figure:3 Steeper Nozzles at water flow arrangement for cooling.

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