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Scrap Reduction in TMT Reinforcement Bar Production and Loss is Minimize

Manoj Majhi
Swami Vivekananda University Telinipara, Barasat-Barrackpore Rd, Bara Kanthalia, West Bengal-700121.Dept.of.Mechanical Engineering(Specialization Manufacturing Technology) April 16 2022.

Abstract: *In this study the main aims of reduced scrap value and loss is minimized which affects the cost of production along with the scrap rate. Mainly large amount of scrap are generated by four stage.(1) Use of incorrect billets size (2) Shear cut (3)Non-value added activity (4) Cobble rate(miss roll).the large amount of scrap which affects cost of production with the scrap rate In this condition the billets size changed to produce maximum and the scrap value at the mill has automatically decresed this is the only way through which production cost can be reduced.*

Key words*: Rolling, billet reduction percentage, billet size elongation in per pass, shear cut, cobble rate, mill utilization.*

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I. Introduction:

The manufacturing process where top quality raw material such as coke, iron, dolomite limestone they are pilled recovered and mixed in the right properties. In this study the aims is reducing scrap value and loss is minimized for TMT processing. In India presently scrap value or price is very high 100% old condition mild steel scrap price INR 70.00 and 100% old condition mild steel melting scrap price INR 56.00. according to Sabiya.K.M.Shilpa [1]Reducing waste maximizes the customer value which involves the learn technique with this lean technique the customer value increased there by this process is utilized by the organization with an aim to reach the zero waste process . A manufacturing process involve many operation that convert the raw material to finished goods. During this productivity may be reduced due to various types of scrap that generated.

II. Objective

1.How much billet area reduction during rolling process
2. **.**How much billet size elongated in per pass during rolling process
3.Determine the right size of billets selection to minimize the scrap value and loss is minimize.
4.Cobble rate
5.Mill utilization
6.Improved the production percentage

III. Material and Methodology :

According to IS:2830-2012 A semi – finished product obtained by forging, rolling or casting . it is not exceeding 125mm ×125mm in cross-section with round corners.

Chemical Composition as per IS:2830-2012

Si.no.	Designation	Carbon	Manganese
1	C15	0.12-0.18	0.30-0.60
2	C18	0.15-0.21	0.30-0.60
3	C20	0.17-0.23	0.30-0.60

The carbon content shall mutual agreement between the purchase and manufacture.
Carbon equivelant (CE) ladle analysis $C+Mn \div 6 + (Cr + Mo + v) \div 6 + (Ni + Cu) \div 15$
As per to IS:2830-2012 when the steel is killed by aluminum alone the total Aluminum content shall not be less then 0.02%. when steel is killed by Silicon the Silicon content not less then 0.10%. when the Silicon Aluminum killed the Silicon content not less then 0.03% and total Aluminum content not less then 0.01%.
Process: The various type of process are involve in TMT production rolling, quenching, tempering . in rolling process involve roughing, inter, finish mill operation before TMT production the billet heated in reheating furnace around 1300°C temperature. Then the hot billet goes to roughing mill by roller convey for reducing

diameter of billet by roller. In this study use of billet size 10.1× 10.1 × 150cm^3 for 0.8cm reinforcement bar and 13pass are used. Roughing has 6paa inter has 4pass and finish has 3pass
Maximum draf : 10.1-0.8/13 = 0.715 cm
Total draf = 0.715× 13 = 9.295 cm (approx 93mm

3.1 Billet Reduction During rolling process in Roughing mill

Roughingmill passes	Actual size-maximum draf	Reduction size	Total reduction
1	10.1-0.715 cm	9.385cm	
2	9.385-0.715cm	8.67cm	
3	8.67-0.715cm	7.955cm	
4	7.955-0.715cm	7.24cm	
5	7.24-0.715cm	6.525cm	
6	6.525-0.715cm	5.81cm	4.29cm

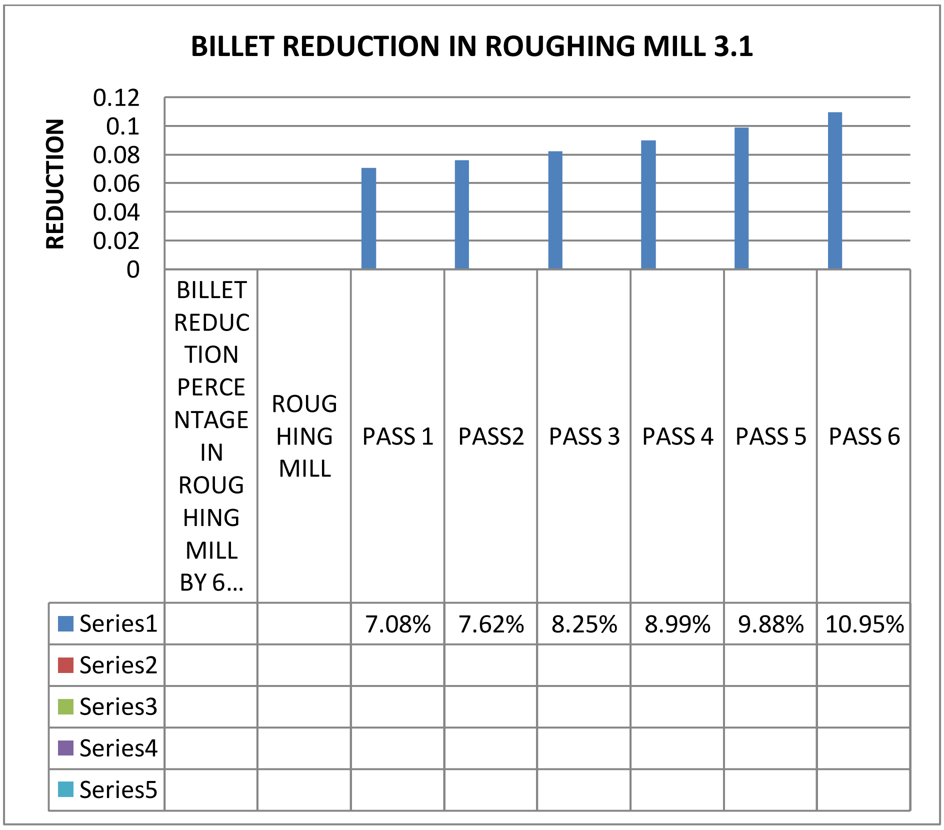
3.2Billet Reduction During rolling process in Inter mill

Inter mill passes	Actual size-maximum draf	Reduction size	Total reduction
7	5.81-0.715cm	5.095cm	
8	5.095-0.715cm	4.38	
9	4.38-0.715cm	3.665cm	
10	3.665-0.715cm	2.95cm	2.86cm

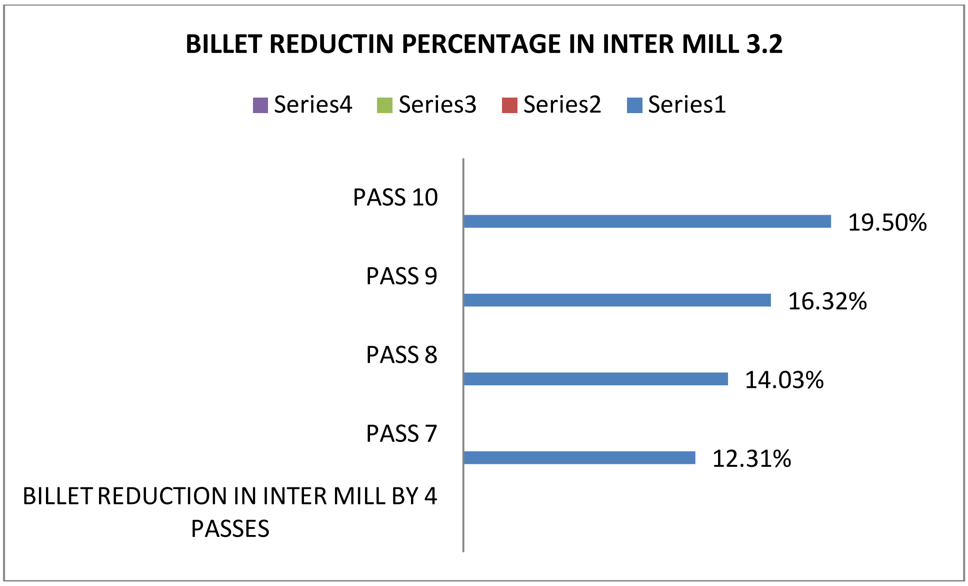
3.3Billet Reduction During rolling process in Finish mill

Finisg mill passes	Actual size-maximum draf	Reduction size	Total reduction
11	2.95-0.715cm	2.235	
12	2.235-.0715cm	1.52	
13	1.52-0.715cm	0.805cm	2.145cm
			Total reduction of billet roughing to finish mill 9.295cm

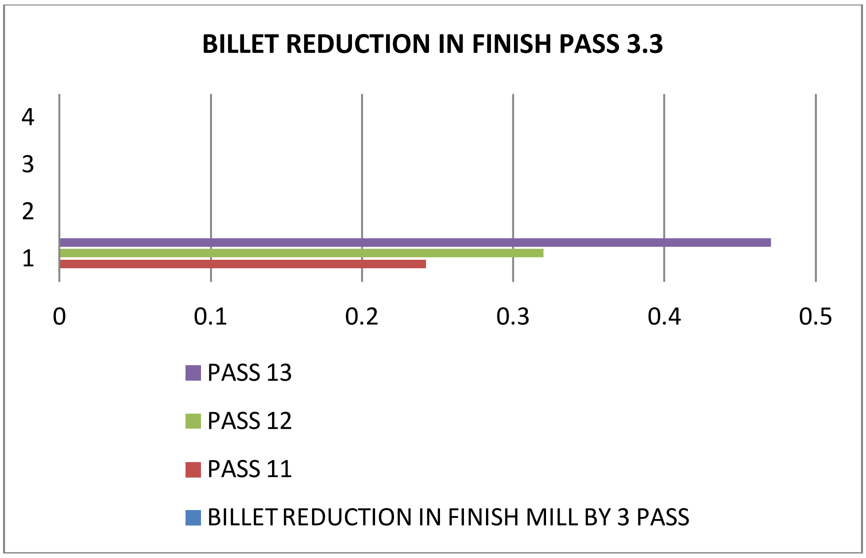
It is show through the graph that how much billet reduction during rolling process by using 13 pass. Roughing has 6pass inter has 4 pass and finish has 3 pass.



IN ROUGHING MILL BILLET REDUCTION 4.29 CM



IN INTER MILL BILLET REDUCTION 2.86 CM



IN FINISH MILL BILLET REDUCTION 2.11CM

Use of billet size 10.1× 10.1 × 150 cm^3
Total reduction of billet size 92.95mm its main 9.295cm
Billet size 10.1-9.295=0.805cm its mean 8.05mm (finish product TMT bar actual size 8mm)after rolling process using by 13 pass Roughing has 6pass inter has 4pass finish has 3 pass

IV. Area of pass for reducing dia

Using billet size volume =10.1× 10.1 × 150=15301.5cm^3

Pass design		Area of passes cm^2
1 square	9.385× 9.385	88.078 cm^2
2 oval	4.335× 2.1675	29.5037 cm^2
3 round	$0.785(7.955)^2$	49.676 cm^2
4 oval	3.62× 1.81 × 3.14	20.573 cm^2
5 round	$0.785(6.525)^2$	33.421 cm^2
6 oval	2.905× 1.4525 × 3.14	13.249 cm^2
7 round	$0.785(5.095)^2$	20.377 cm^2
8 oval	2.19× 1.095 × 3.14	7.529 cm^2
9 round	$0.785(3.665)^2$	10.544 cm^2

10 oval	1.475× 0.737 × 3.14	3.415 cm^2
11 round	$0.785(2.235)^2$	3.921 cm^2
12 oval	0.76× 0.38 × 3.14	0.906 cm^2
13 round	$0.785(0.805)^2$	0.5086 cm^2

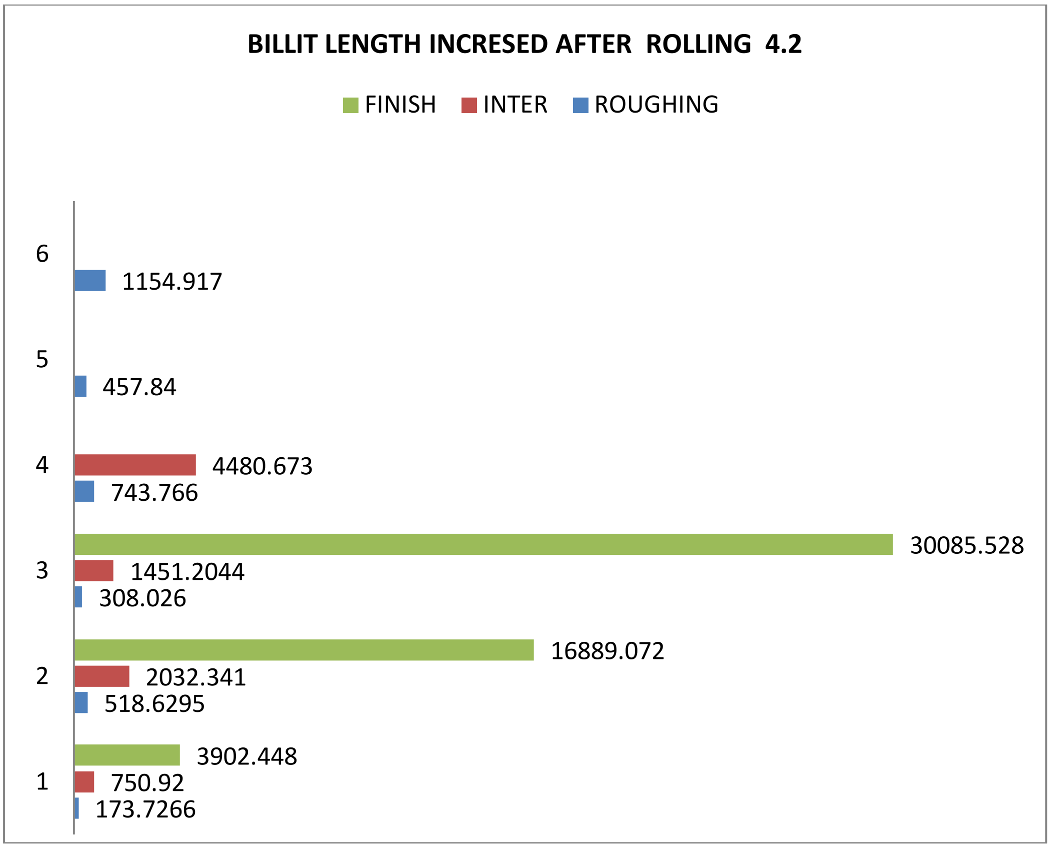
4.1.Billet size elongated in per pass during rolling process

Billet elongation in roughing mill (volume of billet 15301.5cm^2)
Pass 1.Volume of billet /area of reduction size =(15301.5/88.078)= 173.726 cm
Area ×length =88.078×173.726 = 15301.5 cm^3
Pass 2. .Volume of billet /area of reduction size =(15301.5/29.5037)= 518.6257 cm
Area ×length=29.5037×518.6257 = 15301.5cm^3
Pass 3. .Volume of billet /area of reduction size =(15301.5/49.676)= 308.026 cm
Area ×length=49.676×308.026= 15301.5cm^3
Pass 4. .Volume of billet /area of reduction size=(15301.5/20.573)=743.766 cm
Area ×length=20.573×743.766=15301.5cm^3
Pass 5. .Volume of billet /area of reduction size=(15301.5/33.421)=457.840 cm
Area ×length=33.421×457.840=15301.5cm^3
Pass 6. .Volume of billet /area of reduction size=(15301.5/13.249)=1154.917 cm
Area ×length=13.249×1154.917=15301.5cm^3
Pass 7 .Volume of billet /area of reduction size=(15301.5/20.377)=750.920 cm
Area ×length=20.377×750.920=15301.5cm^3
Pass 8 .Volume of billet /area of reduction size=(15301.5/7.529)=2032.341 cm
Area ×length=7.529×2032.341=15301.5cm^3
Pass 9. .Volume of billet /area of reduction size=(15301.5/10.544)=1451.2044 cm
Area ×length=10.544×1451.2044=15301.5cm^3
Pass 10..Volume of billet /area of reduction size=(15301.5/3.415)=4480.673 cm
Area ×length=3.415×4480.673=15301.5cm^3
Pass 11. ..Volume of billet /area of reduction size=(15301.5/3.921)=3902.448 cm
Area ×length=3.921×3902.448=15301.5cm^3
Pass 12. Volume of billet /area of reduction size=(15301.5/0.906)=16889.072 cm
Area ×length=0.906×16889.072=15301.5cm^3
Pass 13. Volume of billet /area of reduction size=(15301.5/0.5086)=30085.528 cm
After leaving the last stand of mill billet length are increase total length of billet is 30085.528cm.
Before rolling billet volume is 10.1 × 10.1 × 150=15301.5cm^3
Total weight of billet (volume×density) 15301.5× 7.85= 120.116kg
After rolling billet weight is (length×area×density) 30085.528×0.5086×7.85=120.116kg
In this condition the billet density and volume are same only change in size and shap

4.2 Billet size elongation in per pass

Roughing pass	Inter pass	Finish pass
173.7266 cm	750.920cm	3902.448cm
518.6295cm	2032.341cm	16889.072cm
308.026cm	1451.2044cm	30085.528cm
743.766cm	4480.673cm	
457.840cm		
1154.917cm		

It is show through the graph that how much billet length increased during rolling process.



Before rolling the billet size was 10.1×10.1×150 cm^3 and when it is passing through roughing inter or finish mill the billet length will increase and the value get on this graph. The actual length is 30085.528cm. before rolling billet weight was 120.116kg and after rolling billet weight 0.586×30085.528×7.85=120.116kg. in this condition the billet volume or density has constant.

V. Determine the right size of billets selection to minimize the scrap value and loss is minimize

In this study the billet size and weight is 10.1 × 10.1 × 150 × 120.116kg
finishing product 8mm reinforcement bar stander weight dia×dia/162× 12 = $4.740kg$
8mm reinforcement bar weight tolerance is as per IS:1786 8mm to 10mm bar ±7% minimum wt.0.367 maximum wt. 0.423 and stander length is 12mtr so the number of rod in 1 billet is 120/4.740=25.31
25pices rod in 1 billet and the 25pices rod weight is 4.740×25=118.5kg so the loss of material in 1 billet for end cut by shear cut is 120/118.5=1.012kg loss of material where 0.31% random rod generated in 1 billet for 8mm rebar production. During hear cut operation the rod is cut at its head and tail end for this a length of 4inche to be cut at both the end of the rod and the 10pices in 1 bandle. For 8mm rebar.

5.1.Cobble rate: Cobble rate is the measure of the percentage of changed billet loss to cobbles. A cobble will occure when there is a roller malfunction the line of steel deviates from the roller path or as mentioned above the end of the steel splits. If the cobble rate is 0.75% then 0.75% of all billets charged are lost to cobbles .if the mill rolls 55555427.25billets per year then it means that 41666570.44 billets are lost. At 0.12 ton (120kg)/ billets the loss in ton is 4999988.45ton. if necessary that all attempts are to be made in the mill to reduce the cobble rate(miss roll).

5.2. Mill utilization: Mill utilization is a measure of the percentages of time that the mill is rolling steel .the trust measure of percentages is as a percentage of calendar time . Factors that in fhuence utilization are maintence outages scheduled and unscheduled holiday outage downtime for cobble clearing, roll and pass changes , excess billets gap, and other factor that creat time when a billet is not in the mill.good figures for rod mill utilization figure are 90% to 93% for structure mills.

If the rolls 66666652ton/year billet weight = 0.12ton
Billet roll per day=66666652/365=18264.8tons
Billet roll per hour=18264.8/24=761.033ton
No of billet using in hour=761.033/0.12ton=6341.944pices/hr.
No of billet using per day =6341.944×24=152206.65pices
Total using billet in year=152206.65×365=55555427.25

Total using billet weight in year=5555527.25×0.12=66666651.27ton
If mill roll 80% of the year =365×24×0.80=7008hour
If mill roll improve 1% of the year its means 81% of the year =365×24×0.81=7095.6hour
∴ According to 81%=7095.6 hour and 80%=7008.0 hour(7095.6-7008.0)=87.6%hours.
If the rolls 66666652ton/year using billets at 0.12ton.
If the total using billets in year =55555427.25picess that is billet gap.
If the average gap is 5 second that is (5×55555427.25)/3600=77160.31hour of billets gap
If the average gap billet reduce by 0.5second its mean 4.5 second (4.5×55555427.25)/3600=69444.28
Creating addition(7716.31-69444.28)=7716.03 hour of extra rolling.
If no of billets using per day of weight =761.033ton that is addition 761.033×7716.03=5872153.459ton of rolled steel.
Extra no of billets =5872153.459/0.12=48934612.16no of billets extra rolled.
If the average value runs production rate(66666652×7716.03)=5.14×10^{11}ton rolled.

Before Mill Utilization= No of billets use in hour 6.41.944 pices
Loss of material in one billet for 8mm rebar production 1.013kg (1kg=0.001 Tonnes)
So in a hour loss of material 1.013kg×6341.944=6424.38kg (0.001×6424.38=6.42438 ton
In a day loss of material =6.42438×24=154.18512 ton
In a year loss of material=154.18512×365=56277.5688ton
If the (66666652 ton-56277.5688) loss of material in year=66610374.43 rolled ton in a year.
After improved 1% production rate
Extra no of billets= 48934612.16pices weight 587215.3459 ton
Loss of material =1.013kg per billet =48934612 pices billet loss of material =49570.76 ton
Before mill utilization loss of material =56277.5688
After mill utilization loss of material =49570.762
Total loss in year after 1% improve mill utilization 105848.3308 ton
Total production before mill utilization =66666652.00 ton
After mill utilization 1% improve production =587215.349 ton
Total production before mill+ utilization and after improve 1% mill utilization = 67253867.35ton in a year
Total loss in a year scab value is =**105848.3308 ton**
Total production in year finishing product weight is **67148019.02 ton**
Total use of billets after mill utilization
In a day =67148019.02/365= 184257.1708 ton
In a hour=184257.1708/24= 7677.382117 ton
In a day no of billets used after mill utilization=1535476.423
In a hour no of billets used after mill utilization=63978.1833 pices

VI. Result

1. In rolling process the maxcimum draft is 0.715cm and total draf 0.715×13= 9.295cm
2. After rolling the billets elongation by using 13 passes the total length is 30085.58cm=300.85528Mtr and initial billets length was 150cm =1.5Mtr.
3. The billets reduction in Roughing mill 4.29cm, Inter mill 2.86cm and finish mill 2.145cm when it is passing through by 13 passed.
4. In this study the loss is minimized by right set PLC perfect calculation of billets size before rolling total scrap generate in 1 billets of 1.012kg after rolling for end cut by cc shearing machine.
5. If the mill rolled 55555427.25 billets per year then it means that 41666570.44 billets are loss at 0.12ton/ billets. The loss in tons is 4999988.45 tons. If the cobble rate is 0.75% then 0.75%of all billets charged are los to cobbles.
6. In a year total billets use after improving 1% of mill utilization is 67253867.355 ton, In a day 184257.1708ton, In a hour 7677.382117tons
7. In a day after mill utilization 1% improved the no of billets use is 1535476.423 and In a hour 63978.1833 pices.
8. The average gap billets reduction 0.5 second its means 4.5 second the creating addition 77160.31-69444.28=7715.49 hours of extra rolling.
9. Total production in year after 1% improved 67253867.35tons.
10. Total improved production 587215.35tons after mill utilization.
11. Before mill utilization total loss of billets 587215.35tons.
12. Before mill utilization total loss of material 56277.5688(loss of material) ton for 66666652ton production.
13. Total scrap value is 105848.3308 ton in a year after 1% mill utilization improve.

14. In a year total production after mill utilization 67148019.02ton (finishing product)

VII. Conclusion

In a TMT production plant the different types of scrap produced. The scrap value lead to increase in cost of production of TMT. Any industry overall scrap value was 6% which is more then any industry .basic of the concept of overall scrap production was reduced to 4.75% . it is important for any leading company in the steel sector.

It is clear that the rate of scrap reduced by the right set PLC setting on cobble ,shearing machine and to avoid the miscalculation of billet size for production of reinforcement bar

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