Divine Steels Limited, Dar-Es-Salaam
Techno Economic Feasibility Report for
300,000 MT Steel Wire-Rod Mill

Contents

1 Introduction

1.1 Project

Divine Steels Limited is planning to set up a steel manufacturing facility in Tanzania for 300,000 tons per annum of tmt bar, Structural steels & Wire Rod. The plant will be located 75 km from capital of Tanzania Der-es-Salaam and shall be in being established at plots no. 42 & 44 block "2" located at Kikongo Mlandizi area Kibaha district council. Future plans at the site include setting up a 150,000 tpa billet production, with forward integration of rolling mill, wire rod mill, Structural steels and wire-rod mill taking the plant capacity up to 450,000 tpa.

Divine Steels Limited has recently registered its office in Dar-es-salaam, Tanzania and got a letter of approval for land allotment of around 43 acres. The objective of the project is to serve the market in Tanzania as well as adjoining countries, replacing imports. This will make Tanzanian economy robust and self-sufficient in the manufacturing industry.

There is a provision for backward integration for a DRI Plant, integrated power plant & Steel Melt shop as the company has technical expertise in the field. Also we propose to bring in state of art technology in DRI and power plant which will reduce usage of ground water and very less polluting industry.

Divine Steels Limited will invest a total of USD 37.5 million in the subsequent phases covering total proposed installation. A backward integration and expansion to 150,000 TPA along with DRI and power plant will make total investment of USD 97 million.

1.2 Promoter's Profile

Mr. Nimish Gadodia

- Mr. Nimish Gadodia comes from an outstanding lineage of home-grown Industrialists and a hugely respected business house from the state of Odisha. An MBA Graduate from the prestigious Symbiosis Institute of Business Management Pune. He has spent the formative years of his life developing deep analytical policies and frameworks which led to creating a benchmark on which the Nav Durga Group operates. Under his outstanding leadership and business acumen, Navdurga Group has grown into a strong and profitable enterprise.
- He has transformed Navdurga Group into a powerful industrial house with a dominant presence in the steel sector across 6 states in India. With units situated at Odisha, Telangana, Chhattisgarh and Karnataka to name a few. Apart from steel, Nav Durga has also forayed into the Real Estate, Resorts, Tea and Aviation business verticals where it is continuously driving innovation and growth.

Mr. Anoop Bansal

- Mr. Anoop Bansal is an Indian businessman with more than 20 years of business experience in different sectors including real-estate, steel manufacturing, etc. He has a graduate degree in Business Management.

Mr.Vivek Sharma

- Mr. Vivek Sharma is an Indian entrepreneur with 20 years of experience in the Iron & Steel Manufacturing and international trading sector, bringing planning & problem-solving abilities. Successful in overseeing all areas of daily operations and making effective policy decisions to positively impact business direction.
- He is focussed on maximizing resource utilization to support scalable operations and increase bottom line profitability
- He is organized and systematic with natural relationship-building and leadership talents.
- He has a graduate degree in Commerce.
- He is currently Managing Director of Capstone Endeavors Pvt. Ltd. Which deals in imports of components for the fast-growing EV Industry in India. It also deals in Imports & Exports of Metals & Minerals.

1.3 Project Parameters

- **Billets, Tmt bars, Structural steels & Wire Rod Mill Parameters**

Capacity	:	300,000 tpa of billet with equivalent rolled product
Raw Materials	:	30000 tons per month of Scrap and DRI
Product	:	8 to 40 mm TMT Bars in straight lengths
		5.5 to 12 mm dia Wire Rods in coils
		9 to 40 mm dia flat, square and round structure
		35*35*5 mm to 150*150*12 mm angle
		75*40 mm to 300 mm channel and joist
Steel grades	:	Construction Steels / Carbon Steels
Production Facilities	:	30 tph Reheating Furnace
		2Hi 6 stand roughing mill
		2Hi 6 stand intermediate
		2 Hi 6 Stand finishing mill
		8 stand No twist Mill
		TMT line
		Flying shear
		Rake type cooling bed
		Coil compactor
		Coil transfer car
		Cold shear

1.4 Strengths of Project

- **Meeting the domestic and EAC demand of Rebars & Wire rods.**
  - In Africa the crude steel production, since the beginning of 2000, is growing at a growth rate of 4-5 % while the demand is growing at around 10% requiring more imports.

    Tanzania is a growing market where the growth is higher than the rest of Africa and the growth of finished steel demand is expected to be around 17.5%.
  - There is a wide gap between domestic production and consumption for rebars, TMT bars, Structural steels and wire rods in Tanzania, and the project will partially meet this demand as well as cater to the demand of other African countries including EAC (comprising five countries in East Africa: Burundi, Kenya, Rwanda, Tanzania and Uganda)

- **Import substitution**
  - Presently the demand for rebars, wire rods and sections in Tanzania is largely met through imports. Setting up this project will lead to import substitution replacing foreign imports with domestic production. This import substitution will generate employment, reduce foreign exchange demand, stimulate innovation and would help lead the country towards self-reliance.

- **Advanced State of Art Wire Rod mill in the country/Region.**
  - This project will be the first State of Art automatic wire rod mill in the country/ region with over 1 ton coil to increase overall productivity of the region.

- **Industrialization.**
  - The industrial sector is a driver of economic growth. Industrial sector is important in terms of its contribution to Gross Domestic Product (GDP) and employment.

- Tanzania Government conceived the National Development Vision-2025 in 1999, under which industry was accorded the leading role in transforming the economy. In fact, the Government underlined the determination to have Tanzania become a fully-industrialized country by 2025.
- This project will assist in moving towards that goal.

Employment Generation Direct & Indirect.

- In addition to the economic opportunities offered directly by the proposed project, its activities in and around its areas of operation shall promote the economic well-being of people through indirect employment and business opportunities. To run and operate the plant direct employment is estimated as **300.**
- The project will create enormous opportunities for developing ancillary and down-stream industries close to the steel manufacturing facilities that thrive on the strength of the main industry are also a permanent source of sustainable employment. Some of the industries that are likely to come up include construction material manufacturing, supplement material providing, maintenance shops and downstream industries like steel fabrication, etc. Indirect employment opportunities will also be created for running trucks for material movement, canteens, restaurants, hotels and markets.
- There is a vast scope of indirect employment opportunity once the ancillary industries are set up in the area. It is estimated that for each **1 job created in direct employment there would be potential for creation of 7 jobs under indirect employment. Thus there is a potential of creation of 2,100 jobs under indirect employment.**
- The project will significantly contribute to the development of Tanzania's economy and society at large.

Executive Summary

2.1 Introduction

Divine Steels Limited is planning to set up a 300,000 TPA Bars & Wire Rods Mill at Kikongo, Mlandizi Area, District Kibaha, situated around 80 kilometres from Dar-es-Salaam Tanzania. The company has been allocated land of total size of 42.6 Acres by Tanzania Investment Council (TIC).

Divine Steels Limited will invest a total of USD 97 Million in the subsequent phases covering backward integration and expansion to 750,000 TPA.

2.2 Plant Parameters

15 ton induction furnace x 5 nos = 25000 ton per month billet production by utilizing 30000 ton scrap to finish steel. 2 nos. 4/7 radius continuous casting machine in Steel melting Shop to produce billets to be utilized for rolled product.

10000 tons production capacity rolling mill designed with state of art technology with automatic cooling bed utilizing billet size-110 x110 mm. This mill will be designed to manufacture Tmt sizes ranging from 8 mm to 32 mm. This mill in addition will be designed to manufacture smaller sections of Structural steels including Square bar, Round bar and flats.

5000 ton structural steel mill with production planning for heavier sections and structures like angles, channels & beam/joists utilizing billet size 160 x 160 mm. This will be state of art fully automated Structural rolling mill to produce quality structure with zero defect.

6000 ton of Patra mill with ultra innovative tube-mill for various manufacturing of various sections of pipes utilizing billet size 130 x130 mm. the tube-mill will be designed in state of art technology where in one assembly line the pipe with be sized, welded and cut to excellence.

2.3 Manpower Requirement

Executives	Managerial	Supervisor	Skilled	Unskilled	Total
5	15	20	90	170	300

2.4 Strengths of Project

- Meeting the domestic and neighboring region's (EAC) demand of Tmt bar, Structural Steels & Wire rods.
- Import substitution.
- Industrialization.
- Employment generation Direct & Indirect.

2.5 Socio-Economic Condition of Tanzania

- Tanzania is a peaceful country and politically stable

2.6 Project Implementation Schedule

The project completion schedule for the proposed plant is estimated at 12 months from the date of the order of major suppliers. It is assumed that the consultants will 3 months before the project commencement.

2.7 Backward Integration Provision

The Company has adequate land for future expansion of the plant for upstream facilities of DRI plant and Steel Melt Shop and captive power plant.

2.8 Capital Cost Estimate

The project cost estimates for 300,000 TPA billet, TMT Bar, Structural Steels & Wire Rod Mill) is given below:-

Item	Total cost Million USD
Land	1.50
Site Development	1.02
Civil & Structural Works	3.33
Plant & Equipment	26.32
Integration Facilities	1.27
Erection & Commissioning	0.98
Consultancy & Engineering	0.40
Pre-operative Expenses	0.55
Contingency	2.13
Sub Total	**37.50**

Means of Finance

		Million USD
Phase 1	33%	12.5
Phase 2	33%	12.5
Phase 3	33%	12.5

Market Scenario of Steel in Tanzania Region

3.1 Market Scenario in Africa

The crude steel production of Africa as a whole including South Africa and Egypt was estimated at about 21.10 million tons in 2021 out of which South Africa and Egypt itself accounted for 15.3 million ton. This means the rest of Africa produced only about 5.8 million ton. This is mainly in the form of ingots and billets that are converted into rebars.

It is observed that in Africa the crude steel production, has been erratic with some years of growth and some years of decrease during the period from 2008 to 2016. However, with price stability coming in the market since 2017 the continent has witnessed a sizeable growth in production. However, with demand increasing at a much higher rate than the production thereby requiring more imports.

The Africa steel market size reached a volume of approximately 39.49 Million Tons in 2023. The market is further expected to grow at a CAGR of 3.10% between 2024 and 2032, reaching a volume of 51.86 Million Tons by 2032.

The Africa steel market is anticipated to grow due to increase in the number of construction projects in the African continent. A surge in investments in both public & private sectors with support from the governments in the region will likely bolster the construction sector, increasing the demand for steel.

- **Tanzania market**

Tanzania is a growing market where the growth is higher than the rest of Africa. Steel is a basic commodity required for economic growth of any country. Consumption of steel is taken to be an important indicator of economic development. Even though in 2022, per capita consumption stands at 24.5 kg it is estimated by the Bureau of Statistics of Tanzania that the growth of finished steel demand is expected to be around 17.5%.

As per the National Bureau of Tanzania the finished steel consumption in the country was 1,500,000 tons annually. The production capacity of the crude steel (ingots / billets) is estimated at about 400,000 tons per annum.

This means about 900,000 tons of steel is being imported into the country annually. Out of the total imports it is reported that about 50 % of the imports fall in the flat category. The flat imports (HR to be converted into CR and Pipes) is estimated to be about 500,000 tons, the rest being billets, rebars, wire rods and to a small extent section. The billets imported are converted into rebars in small rebar mills. The market for rebars, wire rods and sections are therefore about 400,000 tpa.

Given the wide gap between domestic production and consumption for rebars and wire rods in Tanzania, Divine Steels is planning a bar and wire rod mill for 300,000 tons capacity.

- **Regional market**

In addition, the Company will also cater to other regional African countries including EAC countries (consisting of Republics of Burundi, Kenya, Rwanda, the United Republic of Tanzania and the Republic of Uganda). As mentioned above about 18.5 million ton of long products are imported into Africa annually.

4 Site & Infrastructure

4.1 Plant Location

Divine Steels Limited is planning to set up a Bar & Wire Rod Mill of capacity 300,000 TPA in Kibaha, Tanzania. The proposed plant is going to be located in District Kibaha, Coast region, 80 km west of Dar es Salaam (commercial capital of Tanzania).

Figure 4-1: Map of Tanzania, East Africa

Figure 4-2: Map of Mlandizi Area

Salient Features of the location of the plant:

The proposed plant would be set up in the Industrial Zone of the Kikongo Area in Mlandizi, Kibaha District.

Table 4-1: Meteorological data

Elevation from Sea Level	:	180 feet (55 meters) above sea level
Latitude - Longitude	:	6° 86' S and 39° 20' E
Temperature		
Average maximum temperature	:	32°C
Average minimum temperature	:	18°C
Average humidity	:	77.9%
Annual average rainfall	:	1,100 mm (43 in)

4.2 Land Requirement

Total land to be available with Divine Steels Limited Tanzania is about 172,000 sq.mtr of which the proposed plant shall be set up on 100,000 sq.meters with balance area used for green landscaping, roads, etc.

4.3 Infrastructure Facilities

Tanzania is located in Eastern Africa and shares its boundaries with eight other countries including Kenya, Uganda, Congo, Mozambique, Zambia, Burundi, Rwanda, and Malawi.

The country has a land area of 885,000 sq km sand about 78,900 kilometers of Highways.

Tanzania with its three major ports enjoys a strategic location and access point to the land locked countries around Tanzania.The country's economy is mainly agrarian and industry is dominated by small and medium enterprises. The country is divided into 26 administrative zones.

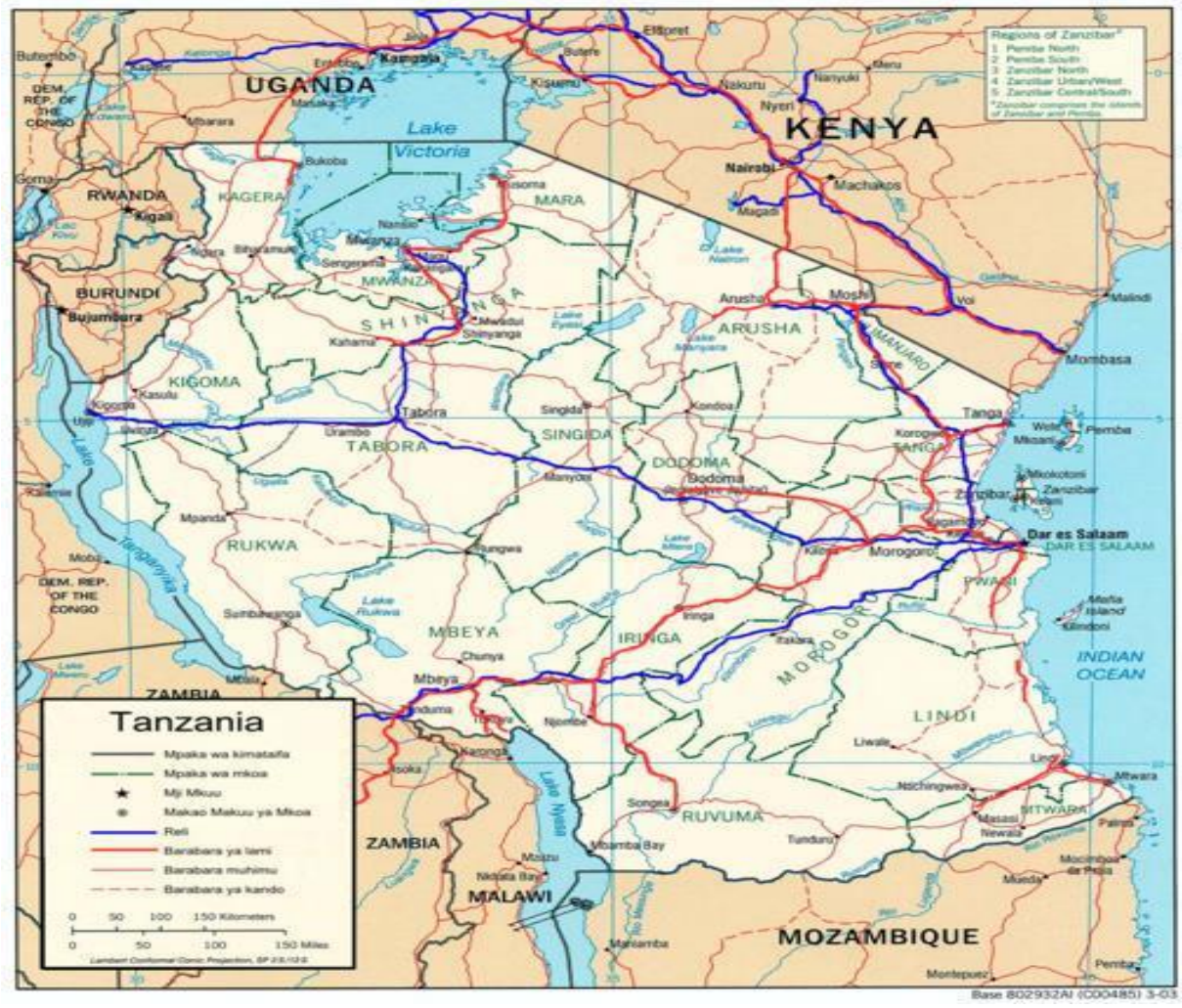
Tanzania is rich in natural resources and major resources include Iron Ore, Coal, Gold, Gemstones, and Diamonds.The three major ports of Dar es Salaam, Tanga and Matwara act as strategic hub with connectivity to all the neigh boring countries.

The country is heavily dependent on imports and foreign aids. The country has a population of 40 million with a growth rate of about 2%.Tanzania performs better than the countries in Sub Saharan Africa in business ratings.

The export and import costs are not very high in Tanzania compared to OECD region mainly because of Tanzania having a major shipping and logistic network which connects neighboring countries to Indian Ocean.

Based on independent risk assessments agency, Tanzania's business climate is relatively better than other Sub Saharan Countries.

Rail & Road Link - Figure 4-3:Rail & road map of Tanzania



Transport in Tanzania is mainly by road, supplemented by rail. However, the quality of road network is not as good as many roads are not tarmacked and thus more problematic in rainy season.

- **National highways**

Tanzania's principal paved highways are confined to the north-eastern, central-eastern, and south-western regions of the country. There are no paved links from the capital to the south-eastern, western, central and northern regions.

Most of the roads between these areas are dirt tracks, with a few improved gravel sections. Within each area there are paved roads isolated from the rest of the paved network.

- **International Highways**

The Cairo-Cape Town Highway (highway no. 4 in the Trans-African Highway network) runs through Tanzania from Namanga on the Kenyan border in the north and the Tanzanian/Mozambican border town of Tunduma in the south-west, via Arusha, Dodoma, Iringa and Mbeya, passing through.

- **Power source**

The power shall be taken from the national grid company Tanesco of Tanzania.

- **Water source**

Divine Steels Limited plans to use bore wells as the main source of water for the Plant needs. Bore well numbers, locations and depth shall be decided based on survey to be undertaken.

5 Plant Parameters and Production Capacity

5.1 Bar & Wire Rod Mill

5.1.1 Parameters

Production Capacity	:	300,000 tpa
Material Grade	:	Construction steels / Carbon steels
Billet Size	:	130 x 130 x 6/12 mtr long
Finished Product	:	Bar & Wire Rod
TMT Bars in Straight length (80%)	:	8 mm to 40 mm dia
Wire Rods in coils (20%)	:	5.5 mm to 8 mm, dia
Yield	:	95%

5.1.2 Production Capacity

The production table for the proposed mill is given in Doc No. PT 1274A as Annexure;

- Finishing speed in m/sec. for each size Bar.
- Realizable cycle time for each size Bar.
- Achievable production rate in tones per hour for each bar.
- No. of rolling hours required to achieve envisaged production.

6 Logistics

Divine Steels Limited will be located in Mlandizi Area of Kibaha, Coast Region of Der-es-Salaam,Tanzania. Transport in Tanzania is mainly by road supplemented by rail.

The site has the advantage of being located nearby the SGR Cargp station, moreover it is 1 Km away from the Kwala, Tanzania Port Authority (TPA) Dry Port and 13 km From Dar-Es-Salaam – Morogoro expressway connecting to other EAC & SADC countries.

The mode of transport for all incoming and outgoing materials of the proposed plant shall be initially through road only.

Table 6-1: Incoming Raw Materials

Production units	Estimated requirement (net and dry) TPA
Billets	315,800

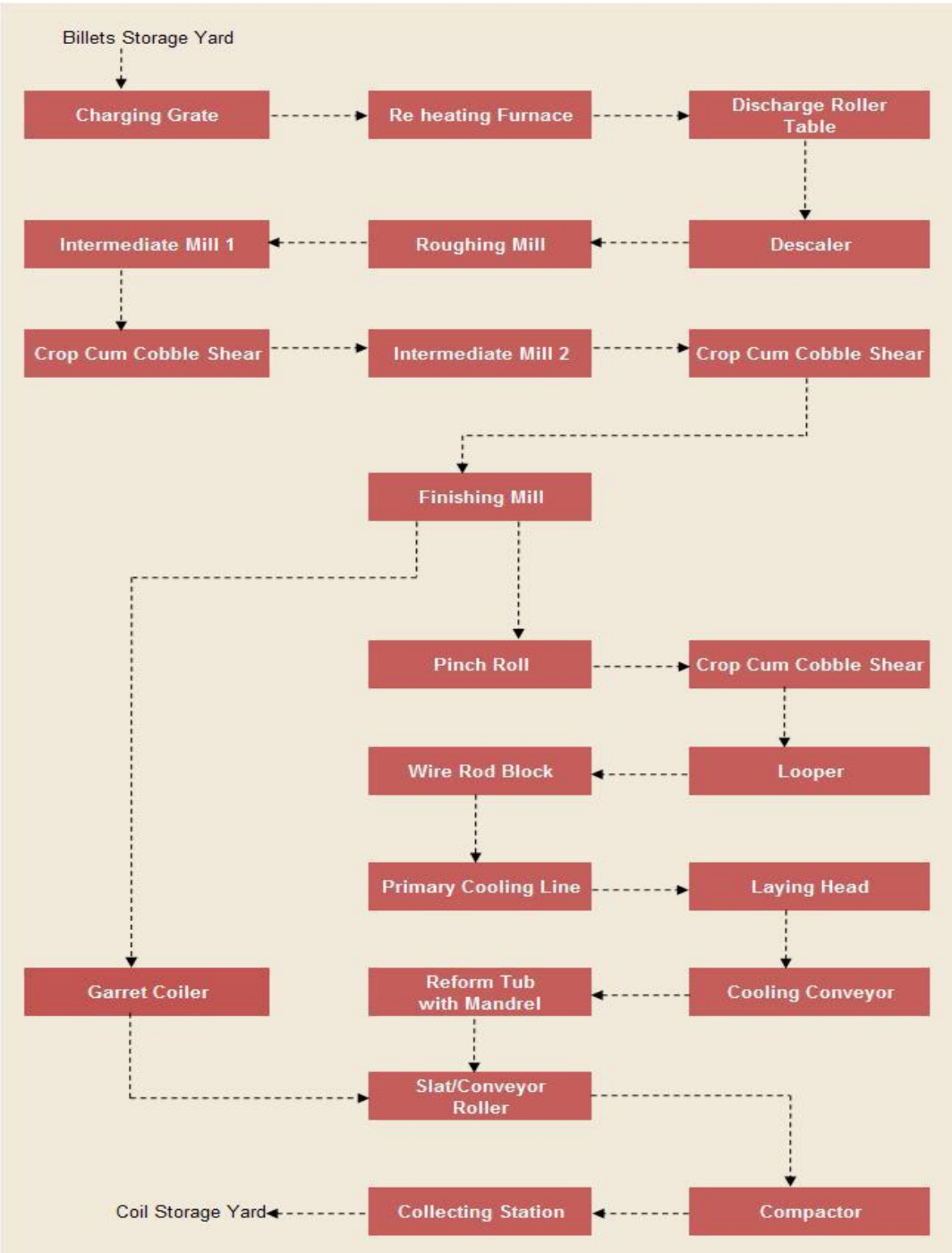
Table 6-2: Outgoing Materials

Finished Product	Annual Production in TPA
Deformed Bars	150,000
Wire Rod	150,000
Total	**300,000**
Other Products	
Mill scale	6,300
Refractories	4,200

7 Process Flow Sheet, Manufacturing Process

7.1 Process Flow Sheet

The process flow sheet for the proposed Bar & Wire rod mill is shown below.



7.1.1 Rolling Process

In the proposed rolling practice, billets are charged in single row in 60 tph pusher type walking beam reheating furnace. The soaked billet from furnace is then discharged on to the mill approach roller table through ejector & side discharged roller table. Hot billet then moved to roughing mill comprising of six stands arranged in cross country configuration with alternate Horizontal and vertical stand, here hot billet get rolled in multiple passes through escapement repeaters installed in between stands. After passing roughing mill stands, front and tail end of bars which usually gets cold split shall be cut by crop cum cobble shear installed before intermediate mill. Intermediate mill (I.M.) shall consist of six stands arranged in cross country configuration. One escapement / fixed type repeaters shall also be installed in this mill.

After I.M., Finishing Mill comprising of 6 stands shall be arranged in continuous mode to roll sizes 8.0 to 40 mm dia round. 8, 10 & 12 mm dia round shall be rolled through sliting process in last four strands. All stands are driven individually by DC motors. In between I Mill and Finishing Mill, a flying shear shall be installed, which is used to cut front & tail ends of the split bar as well as chopping the bar into small pieces during the event of cobbling in the successive stands. In finishing mill, vertical loppers shall be installed to ensure tension free rolling in the mill to get better surface quality & grade of finished product.

Finished bar from continuous mill shall be fed to the quenching line to produce quenched grades of rebar. During rolling of plain round bars quenching line shall be by passed. Quenched bars / plain round finished bar then moved to the high speed dividing shear installed before the I cooling bed to cut the long finished bar as per the cooling bed length. Cooled bars (temp. 100 °C) on to the cooling bed shall be shifted to the exit side roller table. These cooled bars on to the exit roller table moved towards cold shear installed to cut the layer of bars as per saleable length of 12 m long. After cold shear these bars collected in the cradle to form bundle of bars tied manually by labors, thus ready for dispatch to storage yard.

Quenched Bar

The bar external surface changed to martensitic structure due to sudden quenching whereas the inner core is still austenitic structure (soft). Then the intense heat of inner core tempers the martensitic hard surface to tempered martensitic, Bainite and pearlite structure also known as ferrite pearlite structure.

The desired chemistry of steel for billet / ingot is as given below for 450/500N/mm^2.

Grade of quenched reinforcement bar:

Item	Range	Average
Carbon	0.20-0.24	0.22
Manganese	0.70-0.90	0.80
Silicon	0.16-0.28	0.22
Phosphorus	0.03-0.05	0.04
Sulfur	0.03-0.05	0.04
Carbon equivalent	0.31-0.39	0.35

The carbon equivalent is very important as this controls weld ability. The recommended carbon equivalent value for 400 / 500 N / mm2 is between (0.33 to – 0.36.)

Carbon range tolerance is C ± 0.03 max.

With good controlled quenching process bar quality could be produced within a tolerance of ± 20 Mpa for the billets / ingots of the same heat. The elongation is approx. 18%.

Wire Rod Block.

The Wire Rod line takes off from rolling line by bar divertor, side looper & cobble shear in parallel and constitutes a set of eight cantilever stands nos 19 to 26 as no Twist Block unit. Each is a single stand. Rolling speeds for these lines are comparatively higher. The rolled hot material passes through water cooling line, Rod laying head coil collecting chamber & conveyed further. The production volumes and rolling speed details are given in the below mentioned Production table.

8 Specification of Production Equipment

8.1 Bar & Wire Rod Mill

8.1.1 Production Requirement

Products	**:**	**Thermo-Mechanically Treated (TMT) Bar & Wire Rod**
Size Range	:	TMT Bars-8 to 40 mm dia, in straight lengths Wire Rods- 5.5 to 8 mm dia in coils
Capacity	:	300,000 tpa
		As per the details given in attachment no PT 1274A-004
Available Hours	:	6,900
Yield	:	95%

8.1.2 Billets to be rolled

Billets to be rolled with full production capacity of Mill are indicated in Production Table Doc No PT-1274A has been attached at the end of this report.

For Production	:	300,000 tpa
Billets to be rolled	:	315,800 tpa

8.1.3 Billet Rolling Rate

For rolling billets weighing	:	315,800 tpa
Net Rolling Hours	:	5,620 hours
Average Billet Rolling Rate	:	55-65 tph (60 tph approx.)

8.2 Equipment

8.2.1 Billet Charging Grate

Nos.	**:**	**One (1)**
Type	:	Crank Driven, Shuffle Bar
Drive	:	Electric Motor through Reduction Gear Box
Billet Holding Capacity	:	60 tons normal, 100 tons maximum

Working	:	The charging grate receives the bundle of cold billets by EOT Crane, separates them and delivers them one at a time to the charging roller table

8.2.2 Charging Roller Table

Length	:	27600 mm
Roller speed	:	0.5 m / s
Roller Drive	:	Group drive through Chains ;
Motor	:	10 Kw, 750 rpm AC

8.2.3 Discharge Roller Table

Length	:	13650 mm
Roller speed	:	0.5 m / sec
Roller Drive	:	Individual AC geared motors 2.2 KW, 39.1 rpm

8.2.4 Reheating Furnace – Walking Hearth Type

i)	Furnace capacity	:	60 t / hr
ii)	Charge Details	:	Billets of size 130 x 130 x 6000/12000 mm long in two row
iii)	Charge material	:	Med. Carbon steels & low alloy steels
iv)	Charging temperature	:	Ambient
v)	Method of charging	:	Side charging through charging roller table onto water cooled roller table inside the furnace
vi)	Method of discharging	:	Side discharging from water cooled roller in the furnace on to discharging table.
vii)	Billet surface temp. at Discharge	:	$1200^{o}C$
viii)	Temp. differential across billet cross section	:	$20^{o}C$
ix)	Specific fuel consumption (Natural Gas)	:	37 Nm^3 / ton
x)	Scale Loss	:	2%
xi)	Type of Chimney	:	Natural draft
xii)	Height of chimney	:	30 m

8.2.5 Mill Approach Table

Length	:	14400
Roller speed	:	(0.2 -0.5)m/s

Roller Drive	:Individual AC geared motor thru'WVF drive, 2.2 KW

8.2.6 Descaling System

No. of descaling stations	:	1
Descaling medium	:	High pressure water
Descaling pressure	:	150 kg / cm^2
Header and nozzles	:	All around the billet
Descaling Pump required	:	2 working + 1 standby
Descaling Valve	:	Descaling-cum-unloading valve

8.2.7 Mill Design Data

The mill design data has been shown in the table below:

Table 8-1: Mill Design Data – Bar & Wire Rod Mill

MILL DESIGN DATA

S.No.	Std. No.	Pinion Center (mm)	Stand Type	Roll Detail			Mill Roll Bearing Detail		Motor Power (kW)	Motor RPM		Remark
				Max. Dia.(mm)	Min. Dia.(mm)	Barrel Length (mm)	Type	Bore Dia (mm)		Base	Max	
1	C1H	560	Housing less (Horizontal)	620	530	700	Multi Row Cylindrical Roller Brg. With Thrust Brg.	260	200	400	800	
2	C2V	560	Housing less (Vertical)	620	530	700		260	200	400	800	
3	C3H	560	Housing less (Horizontal)	620	530	700		260	200	400	800	
4	C4V	560	Housing less (Vertical)	620	530	700		260	200	400	800	
5	C5H	560	Housing less (Horizontal)	570	490	700		260	350	500	1000	
6	C6V	560	Housing less (Vertical)	570	490	700		260	350	500	1000	
7	C7H	400	Housing less (Horizontal)	450	385	600		230	350	500	1000	
8	C8V	400	Housing less (Vertical)	450	385	600		230	350	500	1000	
9	C9H	400	Housing less (Horizontal)	450	385	600		230	350	500	1000	
10	C10V	400	Housing less (Vertical)	450	385	600		230	350	500	1000	
11	C11H	400	Housing less (Horizontal)	450	385	600		230	350	500	1000	
12	C12C	400	Housing less (Convertible)	450	385	600		230	350	500	1000	
13	C13H	300	Housing less (Horizontal)	360	320	600		200	500	750	1500	
14	C14C	300	Housing less (Convertible)	360	320	600		200	500	750	1500	
15	C15H	300	Housing less (Horizontal)	360	320	600		200	500	750	1500	
16	C16C	300	Housing less (Convertible)	360	320	600		200	500	750	1500	
17	C17H	300	Housing less (Horizontal)	360	320	600		200	500	750	1500	
18	C18H	300	Housing less (Horizontal)	360	320	600		200	500	750	1500	
19	B1	210	No Twist Block	215	195	-		-	1500 x 3 = 4500	1000	2000	
20	B2	210		215	195							
21	B3	210		215	195							
22	B4	210		215	195							
23	B5	170		175	155							
24	B6	170		175	155							
25	B7	170		175	155							
26	B8	170		175	155							

Note : Selection of Motor Powers are Preliminary & shall be finalized during detailed engineering.

8.2.8 Main Drive Gear Boxes and Pinion Stands

Gearbox-cum-Pinion Stands shall be required for Stand Nos. 1 to 18.The Gear Boxes will be either of Helical or of Bevel Helical type, case hardened & ground with 2-High Pinion stands.

Duty	:	24 hours continuous
Service factor	:	2.5 (minimum)
Bearings	:	Anti-friction SKF / FAG / Timken Make
Input coupling	:	Geared coupling (supplied shop mounted)

Lubrication piping	:	Suitable for connecting to centralized oil lubrication system

8.2.9 Crop-cum-Cobble Shear after Roughing Mill

Function	:	to crop front and tail end of bar and to cut cobbles into pieces.
Location	:	After stand no. 6
Type	:	4 Crank, Clutch Brake Type
Cutting Capacity	:	75 mm sq. at 900^{o}C
Crop Chute & Crop Deviator	:	to be provided
Crop buckets	:	2 Nos. (1 in line + 1 waiting)

8.2.10 Crop-cum-Cobble Shear after Intermediate Mill

Function	:	to crop front and tail end of bar and to cut cobbles into pieces.
Location	:	after stand 12 V
Type	:	4 Crank, Start Stop Type
Cutting Capacity	:	42 mm Sq. at 850^{o}C for 700 N / mm^{2} cold ultimate tensile strength of steel
Crop Chute & Crop Deviator	:	to be provided
Crop buckets	:	2 Nos. (1 in line + 1 waiting)

8.2.11 Vertical Looper

Qty.	:	Six (6)
Location	:	as per lay out
Looper actuation	:	Pneumatic Cylinder

8.2.12 TMT Line

8.2.12.1 Cooling Line

Type	:	Shift able, complete with nozzle, piping and valves.
No. of shift able trolleys	:	four (4)
Bar Sizes & Speeds		Refer Production Table Doc. No. PT 1274A
Temperature of Cooling Water at inlet	:	35^{o}C
Supply pressure of compressed air for water stripping	:	4 to 6 kg / cm2

Booster Pump Station		
No. of pumps	:3 working + 1 stand by	
Location	:	near TMT Line
Instrumentation & Controls		
Quantity	:	1 lot
It shall comprise radiation pyrometers for feedback of bar temperature before and after cooling line, pressure transmitter and gage etc.		

8.2.13 Dividing Shear with Pinch Roll and Chopping Shear

Function	:	To divide finished bars into cooling bed lengths
Qty.	:	One (1) No.
Location	:	Before cooling bed
Type	:	Flying Shear
Bars to be cut	:	TMT bars in single, double, triple strands
Bar temperature	:	600ºC

8.2.14 Cooling Bed

Type	:	Rake Type
Length	:	78 m
Width	:10 m C/C Run-in & Run-out Table	
Maximum bar speed	:	12 m/s
Rolling rate	:	60 t / h

The cooling bed shall consist of;

- Run-in Roller Table with Diverter and bar Braking arrangement
- Fixed & moving rake arrangement
- Bar aligning roller table
- Transfer device for transfer from rakes to run-out table
- Run-out roller table

8.2.15 Cold Shear with Gauge

a) Cold Shear		
Quantity	:	One (1) No.

	Type	:	Down-up cut, through clutch brake arrangement
	Cutting capacity	:	400 t
	Blade length	:	1200 mm
	Crop pusher	:	Pneumatic
	Crop collection	:	Crop chute, diverter and buckets
b)	Gauge		
	Quantity	:	One (1) No.
	Type	:	Overhead mounted travelling gauge
	Travel arrangement	:	Electro-mechanical VVVF drive
	Setting length	:	(4 – 13) m
	Disappearing Stopper	:	Pneumatically operated
	Car Locking with Beam	:	Pneumatic cylinder operated
c)	Cold Shear Run-Out Table		

8.2.16 Bar Handling System

Design Parameters**;**

TMT Bar length	:	6 / 12 m
Bundle weight	:	3 t for 6 m long bars 6 t for 12 m long bars
Production	:	60 t / h
No. of bundle bindings	:	3 bindings for 6 m long bars
		5 bindings for 12 m long bars

The equipment shall comprise:

- Chain Conveyor # 1.
- Chain Conveyor # 2.
- Bar collecting equipment with chain conveyor # 3, separating arms, collecting arms, bundle lowering arms, roller table with vertical & horizontal rolls.
- Bar counter.
- Binding table.
- Bundle former.
- Wire binding machines, wire magazines etc.

- Run out roller table.
- Bundle unloading chain conveyor.
- Electric weighing equipment with strip printer.
- Bundle storming conveyor.
- Hydraulic unit.
- Drive motors.
- Electrical equipment including PLC with software, MCC and pulpit.
- Tag embossing machine to emboss galvanized steel sheet tags with heat no. steel grade, bar size & bundle weight fed by computer.

8.3 Wire Rod Finishing Line

Bar Diverter

1 no. installed from rolling group exit #18

Side Looper

Ahead of wire rod block for tension free rolling between stand #19 and the wire rod block

Crop cum Cobble shear

In front of the block .A rotary shear for cropping of front and tail end and dividing of hot rolling stock.

Finishing Block

One finishing block, type 210/160 for production of Wire rods.

No. of stands	:	8
Rolling axis	:	fixed
Stands type	:	cantilever
Drive	:	AC Synchronous

Water cooling line

One Water cooling line to control the cooling of the hot material located downstream the wire rod block. It consists of two water boxes and two equalizing lines. It is located 30m from the center of the last stand of wire rod block approximately

Pinch roll unit

Pinch roll unit with overhung arranged pinch rolls. Both pinch rolls are driven. Central adjustment of top and bottom roll operated via pneumatic cylinder. Pinch roll assy. Fixed by one hydraulic unit.

Rod Laying Head

One Rod Laying Head for laying rod convolutions onto the Loop Control Conveyor located in front of the LCC.

Convolution Dia	:	1080 mm (approx.)
Sense of rotation	:	Anti-clockwise
Laying cone inclination	:	100

Coil Conveyors and Fans

Roller conveyor for normal, fast or retarded cooling of the rod loops. Air is fed through the openings from the fans underneath the conveyor. These radial fans are provided under the conveyor for controlled air cooling of the hot rod convolutions.

Coil forming Chamber

One Coil forming chamber for the collecting of loops fanned out into a coil, located underneath the roller deck, at the end of the LCC conveyor.

Chamber dia.	:	1250 mm
Dia. of Mandrel	:	850 mm

Coil Lowering Device

Coil lowering device, complete with Devices supporting frame Lower able and side open able arms for the support of coils in formation phase hydraulically driven movements.

External dia.	:	1200/1250 mm. approx
Internal dia.	:	800/850 mm. approx

Hook Conveyor

For transporting coils to compacting station

Pressing / tying group

A vertical pressing/ tying group for compacting the coil and tie them on four sides.

Coil weighing system

Coil weighing system installed between pressing/tying machine and coil unloading station.

8.4 Auxiliary Facilities

Required auxiliary facilities such as oil lubrication systems, grease lubrication systems hydraulic systems etc have also been envisaged.

8.5 Roll and Repair Shop

A roll and repair shop have been envisaged where grooving of new rolls as well as dressing of used rolls, dismantling, assembly of bearings, preparation of template, grinding of tools etc as well as minor repair jobs will be carried out.

9 Performance Guarantee Parameters

9.1 Performance Guarantee Parameters

	Bar & Wire Rod Mill	
1.	Mill Productivity	
	➢ Mill capacity	300,000 tpa.
	➢ RHF capacity	60 tph
	➢ Material loss	2%
	➢ Max. achievable rolling speed	13 m / sec.
2.	Yield overall	95% in multi strand configuration 95% in single strand configuration
3.	Material temp. at stand no. 1 entry side	1050^0 C
4.	Consumption per ton of finished product	
	➢ Power	(100-110) kWh / t
	➢ Rolls	0.3 kg / t
	➢ Natural gas	37 Nm^3/t
5.	Mill Productivity	
	Size	Mill Productivity (tph)
	Φ 8	50
	Φ 10	67.1
	Φ 12	67.1
	Φ 16	65.5
	Φ 20	67.1
	Φ 25	67.0
	Φ 32	67.1
	Φ 40	88.2

Above guarantee parameters are considered in line with industry norms.

10 Pollution Control Measures

10.1 General

The plant (plant-2) is designed for 300,000 TPA of Bar & Wire Rod products through Bar & Wire Rod Mill.

The selected process of manufacturing the finished rolled sections, by virtue of its very nature, causes minimum pollution to the environment as compared to the Primary Steel making route through coke-oven (using coal), Blast Furnace (using coke and iron ore), LD Converters (using oxygen) and even compared to EAF route.

The Pollutants are addressed in this chapter for Bar & Wire Rod Mill

10.2 Rolling Mills

10.2.1 Air Pollutants

Air Pollutants may be classified broadly in:

Particulate Matter

This comprises Dust, Ash etc.

Gases

Sulfur-dioxide, Carbon Monoxide, acidic fumes are Gaseous type of Pollutants.

Billet Reheating Furnace is the main equipment, contributing to air pollution. Burning of Natural gas in the furnace results in emission of SO_2 gas along with other products of combustion, i.e. CO and CO_2 gases.

Following calculation; determine the quantity of Sulfur, SO_2, CO and CO_2 emitted from the Billet Reheating Furnace.

Reheat Furnace capacity is 60 t/hr and it uses the Natural Gas

The consumption of Natural Gas to heat 1 t Steel Billet to Rolling Temperature	=	37 Nm^3. (max.)
Hence when BRHF is working at maximum rated capacity i.e. 60 t/hr. Natural Gas Consumption	=	60x37=2,220 Nm^3./ hr
Natural Gas Consumption in Nm^3/hr.		=2,220 x 0.95 = 2,109 Nm^3/hr.
Sulphur Content estimated in Natural Gas (Ref .to data of Union Gas)		=5.5 mg /cum by weight.
Hence amount of Sulfur burnt/hr.	=	(2,109 x 5.5)= 0.0116 Kg/hr.

Weight of SO_2 generated per hour	=	0.0116 x 2 = 0.0232 Kg /hr.

The SO_2 is to be emitted into the atmosphere through Chimney along with other products of consumption i.e. CO and CO_2, the combined volume of which is estimated at 1.1 times of the combustion air quantity

As per the guidelines for determining chimney height, the minimum height is evaluated as '

Chimney Height (H)	=	14 x $Q^{0.3}$ where Q = SO_2 emission in Kg/ hr.

As the sulfur content in Natural Gas is limited to around 5.5mg /cu m including addition of odorants (Ref data from Union Gas), the chimney height requirement based on Sulfur Di Oxide,

emissions is very limited. The chimney height therefore shall be based on other criterion of discharging emitted gases well above the tallest building in the area.

The Chimney height is decided to be 30 meters.

The other pollutant in the flue gases is the Suspended Particulate Matter (SPM) which is carried by the flue gases from the particles of the scale formed on the Steel Billets during the process of heating and the dust particles of refractory materials.

10.2.2 Liquid Pollutants

The Liquid Pollutants generated in the Bar & Wire Rod Mill are:

a) Process Waste Water Generation

- Oil and grease from the oil skimmer in the Scale Pit for Mill Stands and the Scale Pit for TMT process line.
- Blow down water.

b) Sanitary Waste Water Generation

Waste water from Toilets.

Process Waste Water Generation

The oil and grease collected by the oil skimmers from the Scale Pits is collected in used oil barrels and is disposed off to companies engaged in oil reclamation business. The annual estimated quantity is about 25 kl.

Depending upon the pH value the water is neutralized by mixing with some quantity of Blow down water.

The blow down water is partly reused as make-up water and remaining quantity is used for horticulture purposes as the same is only marginally polluted and is within the norms.

Sanitary Water

The Sanitary Water used for Toilets in the Plant (estimated at12 m^3/day) goes to septic tank of each individual Toilet Blocks followed by Soak Pits. Natural treatment through bacterial action takes place. Overflow from the soak pits is discharged to the drains.

10.2.3 Solid Wastes

The solid wastes comprise:

i) Scale from heating billets in the Reheating Furnace.

ii) Scale from rolling process and in the TMT Line.

iii) Broken Refractories of the Billet Reheating Furnace.

The generation of scale from both the above cases is 2% of the weight of Billets used which at 100% rated capacity amounts to 0.02 x 315,800 =6,300 tpa.

The flue gases are expected to carry only a negligible quantity. The bulk quantity is to be taken out of furnace / scale pit manually.

The broken Refractories at 100% capacity utilization are estimated 4,200 tpa (1.4% of production)

Solid Wastes Quantities and their Nature

Sl. No.	Solid Waste	Estimated Qty. TPA	Average Bulk t/cum	Qty. in cum Year	Composition	Nature
1.	Mill Scale from Reheating Furnace + Rolling Process in Rolling Mill and TMT Line	6,300	1.9	3315	Iron Oxide	Non-hazardous Solid Waste
2.	Dust released from fumes extracted from Billet Reheating Furnace.	83	2	42	Mainly metals oxides dust	-do-
3.	Broken Refractories from & Billet Reheating Furnace	4,200	2.8	1500		-do-
	TOTAL	**10,583**		**4,857**		

As all the solid wastes arising from the operation of Rolling Mill is non-hazardous and non-pollutant, these are taken out of the Plant through Lorries, the contents being covered with Tarpaulin to prevent their escape during transportation for dumping in Low Areas designated for such purposes.

10.2.4 Noise Pollution

The Occupational Safety and Health Administration of U.S.A. (OSHA) have prescribed norms of Noise Level as given below:

Table 10-1: Permissible exposure time for Occupational noise level

Maximum duration per day Norms (hours)	Sound Level dBA
8	90
6	92
4	95
2	100
1	105
½	110
¼	115

The proposed Bar & Wire Rod Mill shall generally produce less noise level than the hot rolling mills Moreover, when the mill is running; most of the operating people shall normally be working in Pulpits rooms and offices where noise levels shall get considerably reduced. Measure like use of ear protecting plugs shall be taken for people who have to work occasionally very near the mill for checking / inspection during running of the mill.

10.3 Ventilation and Air Conditioning System

10.3.1 General

Ventilation and air conditioning system are proposed to provide proper working conditions necessary for maintaining environment compatible with human hygienic requirements and to maintain conditions necessary for proper storage of materials and working of plant and equipment.

Ventilation and air-conditioning system will be designed considering the climatic conditions prevailing in the region and the systems will generally be installed in separate plant rooms independent of the served premises. The plant rooms will be provided integral with and adjacent to the served premises at proper locations on considerations of convenience of routing of ducts / pipes, availability of fresh uncontaminated air and creating least disturbance to the adjacent premises in terms of vibration and noise.

Ventilation and Air Conditioning System will be provided with adequate measure for safety and firefighting hazardous area and will be of flame proof / explosion proof construction.

Buildings and shops will generally be provided by natural ventilation. Mechanical Ventilation will be provided for the premises where adequate ventilation cannot be provided by natural means alone.

Depending upon the specific requirement, the shops / buildings will be provided with exhaust ventilation or pressurized ventilation. The system design will take into account the requirements of air charge as well as excess heat removal. Filters will be provided with pressurized systems. By

pressurized ventilation, the served premises will be pressurized to 2-3 mm WC to avoid ingress of dusty air.

Descriptions for ventilation systems are given in below.

Table 10-2: Descriptions for Ventilation Systems

S. No.	Locations	Facilities
1.	MCC cum Switchgear Room and Cable Gallery, ECR etc.	Pressurized Ventilation by evaporative cooling system
2.	HT / LT Hydraulic Room etc.	Pressurized Ventilation (Tube Axial Fan)
3.	Pump Houses, Toilets, T/F Rooms etc.	Exhaust Ventilation (Propeller Fan)

10.3.2 Air Conditioning System

Premises required stringent environmental, conditions of temperature and humidity will be air conditioned. Selection of account depends upon the specific requirement of the application in terms of cooling capacity, temperature humidity and freedom from dust. The instrument Control Room will generally be maintained at $23^{O}C \pm 2^{O}C$ and relative humidity 55 $\pm$ 5%. Office room will be provided with A/c for personnel comfort.

Descriptions for air conditioning systems are given below.

Table 10-3: Descriptions for Air Conditioning Systems

S. No.	Locations	Facilities
1.	Control pulpits in Mills	Package type Air Conditioning System
2.	Laboratories.	Split type Air Conditioning System

10.4 Landscaping

Green belts and green pockets with trees will be provided to minimize the effect air pollution and also to serve as aesthetic objects and provide a pleasant environment.

11 Plant Layout

The proposed General Plant & Shop Layouts for Bar & Wire Rod Mill are discussed in this chapter.

11.1 Plant Site

Divine Steels Limited has been offered by TIC land area 42.60 acres (172,000 sq. meters) of land at Kikongo, Mlandizi Area, Kibaha District situated at 75 kilometers from Dar-es Salaam, in Tanzania. The site is ideally located in terms of;

a) Nearness to the new proposed dry port

b) Investor incentives due to project location within SEZ

The major equipment's to be installed are:

i. One Bar & wire rod mill of 300,000 TPA capacity.

Land at the site is plain. Roads, boundary fencing and site construction facilities is to be developed. As the site is in Special Economic Zone, the basic facilities like power, water and approach road shall be readily available. Water will be available from external source/Bore well, as the site is adjacent to river. Power supply & transmission shall be brought to site. There is a metal road passing by the east side of the area. Taking into account the various criteria for site selection, it is an excellent site for a Steel Plant.

11.2 Proposed Plant Layout

Proposed Plant Layout is shown in Drawing No. 1274 A-001 enclosed. A perusal of the drawing shows the following.

- The available land area has been utilized to the maximum possible benefit. Manufacturing shops are located, utilizing the maximum length available. Adequate area has been provided for Raw material receipt and storage as well as storage of finished products.
- Proposed layout is designed for
  a) Rolling Mills
- Rolling Mill area consists of;
  a) Billet reheating ;
  b) Rolling of heated billets; and
  c) Storage and dispatch of rolled products.
- Scrap and Pig/Cast Iron scarp storage for future is proposed in a lean-to-bay parallel to the melting and casting bay.

- In line with the contour of the land, the Rolling Mill Bays are located in-line to the future Steel Melt Shop Bays.
- Provision of future DRI plant & Steel Melt Shop has been kept for plant expansion.
- Utilities& Services are located in open space available.

Summing up, salient features of the Master Plant Layout are as below.

a) Uni-Directional Flow of Material Scrap and other raw materials enter the shops from one end and the finished goods are dispatched from the other end. At no stage goods in process are required to move backwards or retrace their paths.

b) Attempts have been made to locate Utilities & Services in such a way so that they give rise to the minimum lengths of pipes and cables but at the same time maintain flexibility and ease of maintenance within the available space.

c) Material handling is fully mechanized through use of cranes. All the working areas are approachable by the EOT cranes.

d) Covered space is put to the optimum use by locating the concrete buildings outside the sheds as far as possible.

e) Pollution control and safety at the work place have been kept in mind while preparing the general plant layout.

f) Provision for expansion has been kept in SMS and Rolling Mill layout. Space has been earmarked for DRI plant in the layout.

12 Fluid Systems

12.1 Water

Water is required for cooling of the equipment in Bars & Wire Rods mill. Steel production involves heat intensives processes wherein a considerable quantity of cooling water is required for control of metallurgical process as well as for dissipation of unutilized heat. Water is also needed for cooling and lubrication system. In order to conserve fresh water, economy of water usage should be an underlying criterion for selection of plant and equipment. It is also proposed to adopt re-circulating system; fresh raw water will be required only as make-up to replenish the losses. Water supply system should be as near to the production equipment as possible.

12.1.1 Water System

The overall water system of Bar & Wire Rod Mill Shop includes make-up water systems, re-circulating water system, drinking, sanitary water system and firefighting water system.

12.1.2 Make-Up Water

The makeup water requirement for different units of the proposed steel plant is given below:-

Make up water requirement for Bar & Wire Rod Mill;

S.No.	Item	Make up Water (cum/hr)
1.	Bar & Wire Rod Mill	35.00
2.	Plant Drinking Water, Sanitation, Horticulture	1.33
3.	Fire fighting & Potable Water	5.00
4.	Misc.	2.07
	Total	**43.40 m^3 / hr**

The total requirement of fresh water to meet process make up and drinking needs for Bar & Wire Rod Mill shall be 43 m^3 / hr.

Requirement of Water Quality

12.1.3 Drinking and Sanitary Water System:

The drinking and sanitary water system will be tapped to meet the water requirement of the plant. Drinking quality water also will be required at the quality control laboratory. It is proposed that drinking water tank be constructed below the industrial Emergency overhead water tank in what is popularly called ‘Double Peg’ overhead tank design. Piping shall be laid from the storage tank to the consuming points in the Plant.

12.1.4 Water source, storage and supply

The average daily consumption of water is 1,040 m^3 for Bar & Wire Rod mill.

A separate raw water reservoir for storage of about 15 days requirement for the Bar& Wire Rod Mill of 15,600 cum capacity is envisaged. A pump house for Bar & Wire Rod Mill water complex along with a storage sump shall be provided all re circulating process pumps shall be housed in the pump house. Make up water shall be added to the Water complex of Bar & Wire rod Mill from reservoir after due treatment.

The location of the Water complex is shown in the lay out drawing and is near the Rolling Mill area.

12.2 Compressed Air

12.2.1 Requirement

Compressed air is mainly required for cleaning of bag filter in fume / dust extraction system and for operation of the pneumatic cylinders, pneumatic tools and general cleaning purposes.

The compressed air is required for

Rolling Mill	:	250 Nm^3 / hr
Miscellaneous	:	50 Nm^3 / hr
Total air required	:	300 Nm^3/hr

12.2.2 Distribution System

Two (2) Nos. compressors are provided. A ring main shall be provided to make the compressed air available at all points in Bars& Wire Rods Mill at the same pressure & flow. Suitable arrangement shall be made for condensation of water. Air requirement for instrumentation shall be passed through an air drier before use. Compressors are installed in a compressor room, located nearby Bar& Wire Rod Mill.

12.2.3 Specifications

Quantity	:	2 Nos. (1 working + 1 standby)
Type	:	Horizontal, reciprocating type, non-lubricated
Flow rate	:	600 Nm^3 / hr
Pressure	:	7 kg / cm^2 (max)
Working pressure	:	6 kg / cm^2 (min)
Loading / Unloading	:	Automatic
Type of cooling	:	Water

The installation shall be complete with inter coolers, after cooler and air reservoir of 2cu.m capacity.

12.3 Fuel System

Reheating Furnace needs fuel for reheating of billets to rolling temperatures of around 1100 - 1150 degree C before start of rolling.

12.3.1 Fuel System

Natural Gas

In Bar& wire rod mill natural gas will be used for heating of billet in reheating furnace.

Natural Gas shall be tapped from the gas grid. Provisions shall be made for metering of the drawn gas from the grid.

A gas control station shall be installed at appropriate location where uprating and metering facilities shall be engineered for Natural Gas.

Natural Gas consumption in proposed 60 tph Reheating Furnace for billets shall be1550 Nm^3/hr average for heating of billets up to approx. 1150 to 1200 degree C

Natural Gas calorific value has been taken as (37.5 to 43) million joule / cum.

The total consumption of natural gas for Bar & Wire Rod Mill is 1665 Nm^3/hr

Peak hourly consumption of natural gas may be about 2000 Nm^3/ hr for Reheating Furnace for billets.

13 Electric Power Supply and Distribution System

13.1 Source of Power

The electric power supply requirement for 0.3 m tpa Bar and Wire Rod Mill shall be made available at 33 kV from nearest Grid sub-station 33 kV will be brought to plant premises through underground cables/overhead power transmission line and metering kiosk shall be made. From there Medium Voltage XLPE shall be laid and cables shall be terminated in eight (08) indoor panel boards for further distribution of power to different load centers. From indoor type load centers located in plant power shall be further stepped down to 0.6 /0.7 kV for bar & wire rod mill as well 0.4 kV for all utilities & auxiliaries of mill.

13.1.1 Power Requirement

Based on the experience with similar type of Bar &Wire Rod Mills, the consultants have estimated annual power consumption as given below:

Annual production of Bar and Wire Rod	:	300,000 tpa
Estimated average consumption per ton of producing Bar and Wire rod from Mill.	:	110 kWh/ton
Maximum demand	:	6.6 MW
Annual power consumption for producing 0.3 m tpa of Bars & Wire rods product.	:	33.4×10^6 kWh

13.1.2 Power Distribution System (Ref. SLD Drg. No. 1274A-003, Sh. 1, R0)

In the design and layout of plants power distribution system, following aspects shall be given emphasis:-

a) Simplicity of main power distribution system, consistent with safety of operations, equipment and personnel.

b) Possibility of future expansions without the necessity of introducing major changes in the initial layout.

c) Maximum stability of operations under normal conditions as well as under system disturbance conditions.

d) Standardization of equipment rating as far as possible, so that the maintenance spares are reduced to minimum, thus achieving effective inventory control.

13.1.3 Design Considerations

The power distribution network shall be proposed as a radial system, with two alternative supply feeders to each load center.

The design of power distribution system and selection of equipment shall be proposed based on the considerations of safety, reliability, ease of operation & maintenance as well as convenience of future expansion.

The equipment shall conform to relevant IEC specifications and code of practice to meet the operational requirements and to ensure reliable and trouble free service in the plant.

Power Supply Conditions:

MV AC	: 33 kV
Permissible voltage variations with rated performance, rated current and control effectiveness maintained	: ±As per Tanzanian statutory requirement
Permissible Frequency variations	: ±As per Tanzanian statutory requirement
Low Voltage AC, 4 wire, solidly earthed	: 400V, 50 Hz, 3Phase

13.2 Major Facilities

13.2.1 HT Switchboards

The 33 kV switchgear shall be indoor type- sheet metal clad, draw out type comprising of VCB circuit breakers and shall be provided with necessary protection, control gear, metering and audio-visual alarm annunciation system. The circuit breaker mechanism shall be mechanically and electrically trip free. The circuit breakers shall be electrically operated, stored energy type suitable for operation on 110/220 V DC control power supply.

13.2.2 400 V Switchgear

The 400 V switch board shall comprise of air circuit breakers, in draw out design and multi-tier formation. The switchboard shall have two bus sections and a bus coupler breaker with provision for auto changeover in the event of loss of power on any one bus section.

The circuit breakers shall be electrically operated and equipped with microprocessor / static type direct acting releases for over load and short circuit as well as earth fault protection.

All motor control centers (MCCs), large drives (above 110 kW) and power distribution boards (PDBs) shall be supplied power from the 400 V switchboards. The 400 V switch gear shall confirm to relevant IEC specifications.

13.3 Electrical & Automation System

13.3.1 General

Adequately rated, quick acting circuit breakers aided by reliable and selective relaying are proposed for all parts of the power system for quick isolation of faults and to protect the equipment.

All high voltage feeders will be provided with well-engineered protection system. Transformers with higher ratings will be provided with high speed differential protection with harmonic restraint features as well as restricted earth fault protection. Protection against transformer internal faults will also be provided.

The low voltage feeders with circuit breakers will be provided with direct acting over current and short circuit releases.

Relays for other specific applications will be proposed as required for a comprehensive and well-coordinated protection scheme.

For the measurement of various electrical parameters at different points of the power system, indicating and integrating type instruments are proposed to be adopted.

13.3.2 Power Factor Compensation

To maintain power factor of the system > 0.95 suitable rating capacitor bank will be proposed, to minimize the effect of harmonics due to D C convertor and VVVF inverter load on the bus adequate rating harmonics filters will be proposed. The overall power factor for loads is expected to remain > 0.95, however, to maintain overall Power Factor of the system capacitor bank at MV and LV shall be proposed.

13.3.3 Converter Transformer

The Converter Transformer shall be of suitable robust design to withstand the dynamic loads of main drive motors for rolling mills. All windings and connection shall be braced to withstand shocks due to Rough handling and vibration due to short circuit or other transient conditions. The transformer cores shall be made up from high quality sheet steel.

The transformers shall be provided with all accessories & fittings as per IEC -72 standards.

13.3.4 Variable Frequency Drives (VFD) for Auxiliary Motors

The VFDs envisaged for other speed controlled drives shall be IGBT based with sine coded PWM control with vector control (with / without PG as per requirement). In case of the drive having sensor less vector control technology proper IR compensation shall be provided for the voltage or current feedback. VFD shall be of Industrial and continuous duty.

The drives shall be of single quadrant or 4 quadrant operation as per operational requirement.

The drive shall have MCCB/ ACB (as per rating), line choke / isolation transformer, input contactor, filter in the incoming side.

VFD shall communicate with basic automation system on system communication bus.

13.3.5 Visualization System (HMI)

Provision of the visualization of the system shall be through PC based HMI terminals, for the control and operation of the Plant. It shall be possible to display dynamic graphic of different sections of the plant onscreen. Graphic displays shall be field configurable only through engineering key-board with standard / user defined graphic symbols.

Graphic display shall be interactive type through which it shall be possible to control the process.

The Graphic interface to the operator shall have the required features with user friendly navigation keys.

In addition, Process diagnostic system to provide status & fault signals of the process along with process error displays shall be provided on the HMIs.

13.3.6 Communication and Connectivity

High speed communication and data exchange shall be possible between and amongst groups of equipment comprising various levels.

The Field Bus like Profibus / Modbus I Control net shall take care of the communication needs of the PLCs with Main Drives, VFDs, Soft starters, RIOs, weigh panels etc.

Different PLCs, PCS, FIMIs, etc. shall be interconnected through a high speed Ethernet Bus on the popular TCPIP protocol platform.

The system shall also be capable of communicating to other standalone plant controllers.

Multi-vendor connectivity with requisite hardware, communication interfaces & required software for exchange of signals with other PLCs has been foreseen.

All field sensors like HMDs, photocells, proximity switches, torque switches etc. shall be directly hardwired to the RIOs located in the field and in turn the RIOs shall be connected to the respective PLC through communication bus.

13.3.7 Programmable Logic Controller

Programmable logic controllers shall be used for sequencing & interlocking functions in the level-1 control system. The Programmable Controller shall specifically perform the following functions.

- Sequencing
- Interlocking
- Interfacing with Control Console and Drives
- Generation of Fault Annunciation

13.3.8 Motor Control Centers

Requisite numbers of Motor Control Centers have been proposed for control of the fixed speed auxiliary motors of the plant. The MCCs shall be free standing, Single front and compartmentalized design and shall also cater to the various power supply feeder requirements.

Motor Control Centers for Air conditioning & Ventilation system, water supply system, Compressed air system, fuel handling system etc also form part of this report.

13.3.9 Control Desk/Control Pulpits

Based on the technological and operational requirements adequate no of control pulpits have been proposed. The control pulpits shall house required nos. of control Desks and HMI terminals.

The control pulpit shall be aesthetically designed with false ceiling, false floors, decorating lighting with toughened glass front and shall be air-conditioned for proper operation of equipment and human comfort.

HMI PCs shall be provided on the Desks with operating controls and the HMI PCs shall have different screens loading/unloading of various parameters as per requirement of operation.

13.3.10 Electrical Premises

A number of electrical premises for housing Electrical and Automation equipment have been proposed. These premises include HT/LT substations, Switchgear rooms, Motor House, Electrical Control Rooms housing the Drives, PLCs, MCCs, PCS Servers, Computers, Electronic weighing panels, telephone exchange equipment, cable basement / cellars etc.

13.4 Shop Electrics & Illumination System

The following shop electrics facilities have been considered for the plant.

13.4.1 LT Distribution Boards

LT Distribution Boards have been foreseen for local power distribution to various smaller loads of the plant.

13.4.2 Earthing System

Earthing system has been considered for the safety of electrical equipment and personnel. Each mill bay / building shall have its own earthing ring. Earthing ring of each bay / building shall be interconnected through GI strips, to form an earthing network to achieve better earth resistance.

Parts of all electrical equipment and machinery not intended to be alive shall have two separate and distinct earth connections each to conform to the stipulation of the Indian Electricity Rules. Apparatus rated 240V and below may have single earth connections.

The process control equipment e.g. PLC, HMI, Engineering Stations, Drives, UPS, Instrument panels, Weigh panels etc. shall be connected to a separate Electronic Earthing System

13.4.3 Fire Detection and Alarm system

A comprehensive Automatic Fire Detection and Alarm system for ECRs, oil cellars & transformer rooms have been proposed.

The main control panel shall be microprocessor based intelligent, addressable type with required numbers of loops and located in main electrical control room.

13.4.4 Lightning Protection System

Lightning Protection System for each building has been considered against lightning, for the safety of new building, equipment and personnel.

13.4.5 Closed Circuit Television System

The Closed Circuit Television (CCTV) systems shall be proposed for control and supervision of technological processes, which are difficult to be observed directly or which require monitoring from a remote centre by the shop manager.

The System is intended for comprehensive round the clock surveillance of the operation in the shop floors.

TV cameras with all accessories shall be installed at strategic locations of the processing line shop floor to view the critical processes.

- **Energy balance sheet**

S. No.	Facilities	Capacity	Unit	Energy Consumption	Unit	Annual Energy Consumption (Million kWh)	Operating days/ year	Operating hours/ year	Average power drawn in MW	Load Factor	30 Minutes Max. Demand MW
1	Bar Mill	0.240	MTPA	100	kWh / t	24.0	234	5,620	4.3	75%	5.7
2	Wire Rod Mill	0.060	MTPA	125	kWh / t	7.5	234	5,620	1.3	75%	1.8
1	**Net power requirement**					**31.5**			**5.6**		**7.5**
2	HVAC & Lighting @ 2% of net power requirement					0.6			0.1		0.1
3	Losses @ 4% of net power requirement					1.3			0.2		0.3
4	**Total Power Consumption**					**3.4**			**5.9**		**7.9**
5	Overall power consumption (annual operation)	Diversity factor		1.20		33.4	365	8,760	3.8	%	586.6

14 Auxiliary Facilities

14.1 EOT Crane & Goliath Crane

- **Bar & Wire Rod Mill**

Sl.No.	Location of EOT Crane	Qty. In nos.	Capacity in tons	Span In mtr.
1.	Rolling Mill over cooling bed	1	10	24
2.	Rolling Mill Assembly Work	1	20 / 5	32
3.	Roll Shop		20 / 5	24
4.	Bar Bundling	1	10	32
5	Coil Handling	1	10	32
6	Scale Pit for scale removal	1	5	8

- **Scrap Yard**

Sl.No.	Location of Goliath Crane	Qty. In nos.	Capacity in tons	Span In mtr.
1.	Scrap Storage Bay	2	10 / 5	32
2	Open Scrap Yard	2	16	30

14.2 Workshop Facilities

Workshop shall be able to carry the repairs of those parts which require ordinary non-scheduled repairs in case of accidental failures.

The workshop facilities for maintenance will include

14.2.1 Mechanical workshop

The workshop will have the following equipment:-

- Roll Turning Lathe Model Cu 1000 with distance between centers 3 meter
- Precision Lathe - 6 ft. all geared
- Bearing Assembly Benches
- Indexing head for Rib Patterns

- Radial Drilling Machine - 50 mm
- Pillar Drilling Machine - 25 mm
- General Purpose Lathe - 12 ft.
- Shaping Machine - 600 mm Power Hacksaw.
- Double ended Pedestal Grinder
- Surface Table 1200x1800 mm
- Tool & Cutter Grinder
- Power & Backsaw - 200 mm
- Electric Arc Welding

  Sets: ○ 200 Amps

  ○ 300 Amps

  ○ 600 Amps

  ○ DC Welding Machine - 400 Amps
- Oxygen Acetylene Gas Cutting Sets
- Tools & Tackles comprising: ○

  Templates for Roll Turning

  ○ Spanners & Torque Wrenches

  ○ Plumber / Piping Work Tools ○

  Engineers Files

  ○ -Scrapers / Screw Drivers

  ○ Pliers

  ○ Power Tools

  ○ Crow bars / Chisels / Hammer

  ○ Measuring Instruments & Test Kits

  ○ Electrical Tools, Tackles, meters / testers such as Meggers, Multimeters, Tong Testers, Tachometers.

The general mechanical workshop is designed to under dismantling, repair and assembling work, with the limited weight of sub-assemblies.

14.2.2 Electrical Workshop

The Electrical workshop will be suitable for carrying out testing, repairing, preventive maintenance and breakdown maintenance for the electrical equipment of the plant.

The workshop will have facilities for dismantling, cleaning, winding, testing, welding and painting the various electrical equipment.

14.2.3 Electronic Workshop

The electronic maintenance workshop has been designed for testing, breakdown and preventive maintenance for the various electronics equipment in the plant.

It is also for testing and control pneumatic and hydraulic valves and measuring and recording equipment.

14.2.4 Vehicle Workshop

In this workshop all the necessary repair and maintenance operations to the vehicles use in the Integrated Steel Plant.

The checking and maintenance of engine, tyres, batteries, radiators and mechanical components will be carried out in vehicle workshop.

14.3 Laboratory

One of the major aims of sophistication in the industry today is the improvement of the quality of products. The important role in the salability of a particular product shift competition in the market. Therefore, laboratory facilities have been provided to monitor and control the entire process at all stages of manufacture.

A well designed laboratory has been provided for carrying out chemical, metallurgical and mechanical testing at melting, refining, casting and rolling stage of the manufacturing process. Laboratory is located by the side of the melting shop because maximum load for testing is in this area. It shall be a double-story building with heavy mechanical testing machinery at the ground level and metallurgical testing facilities at the first floor level; which shall be at the same height as the working platform for induction furnaces, ladle furnace and billet casting machine. Thus interconnection between melting & casting operators and quality control experts will be much easier. Samples from Bar mill shall however, have to be carried to and from laboratory.

14.4 Laboratory Facilities

- **Chemical Laboratory**
  - Direct print out reading vacuum emission spectrometer analyzer with 5 programmers, 35 measuring channels for 20 elements for analyzing steel, slag and Ferro alloys.
  - Sample cutting machine ○

  Sample polishing machine
  - Carbon, Sulfur determinator
  - Calorimeter
  - Hot plate
  - Single pan digital / chemical balance
  - Muffle furnaces
  - Drying oven
  - PH meter
  - Distilled water still
  - Dimmer stats
  - Miscellaneous items such as gas burners, thermometers, glass and porcelain wares like beakers, conical flasks, flat bottomed and round bottomed flasks, burettes, pipettes, filtering flasks, thistle funnels, measuring cylinders, crucibles etc. of various sizes.
- **Physical Laboratory**
  - Universal testing machine - 20 t
  - Impact testing machine – 100 Joules
  - Brinnel, Vickers, Rockwell and shore hardness testing
  - Microscope

14.5 Fire Fighting

Steel melting, casting are heat intensive processes. All the times combustion is taking place at one place or the other. Inflammable materials are handled in the shops which give to raise fire hazards.

Adequate fire detecting and fighting equipment is envisaged. The control rooms shall be fitted with automatic sprinkler system with smoke detection equipment. A water ring main shall run throughout the plant which would be connected to the overhead tank.

Following measures are proposed.

i. Smoke Detector

Following control rooms are proposed to be fitted with smoke detector & alarm system.

- **Bar & Wire Rod Mill**

S.No.	Control Room Designation
i)	Reheating furnace
ii)	Roughing & intermediate mill

ii. Yard Water Hydrant System

Yard hydrant system is proposed for steel melt shop and Bar& Wire rod mill shed. 100 NB hydrant main shall be buried as per the standard specifications and hydrant risers shall be provided at a spacing of 36 m each. Total no. of hydrants is twenty (20). Water for the hydrant system shall be supplied from the plant clear water header which runs alongside the columns and is always under pressure of (4-5) kg/cm^2.

The Fire Water pump house shall have apart from two electrically driven pumps, an additional diesel engine driven water pump to meet any firefighting needs in case of power failures and is mandatory by statute. The pump house for firefighting needs shall be exclusive.

iii. Portable / Manual Fire Fighting Equipment

9 kg CO_2 fire extinguishers	:	4 nos.
9 liters Soda ash type fire extinguishers	:	20 nos.
45 liters wheel trolley foam type extinguishers	:	8 nos.

Firefighting equipment shall be located at critical places throughout the plant.

15 Project Implementation Schedule

15.1 Preamble

The Bar & Wire Rod Mill Project shall need meticulous planning, continuous monitoring & follow-up and co-ordination of various activities for timely implementation of the project. The project schedule is 21 months. All pre-project activities shall be completed before the start of the project. The zero date shall be counted from the date of placement of order on technological equipment supplier. Consultant shall meet to be appointed three months prior to the order on main supplier.

15.2 Pre-Project Activities

The following is the list of pre-project activities that need to be completed before commencement of site activities and release of orders on various suppliers. Divine Steels has already initiated the process of completing these activities:

- Preparation of bankable TEFR
- Finalizing of modus-operandi for the project
- Land availability
- Site survey and soil investigation.
- Site leveling work
- Appointment of reputed consultants
- Evaluation of offers of main suppliers and advance discussions with them.
- Selection of a reputed supplier for the main equipment with a track record of supplying state of the art yet proven technology and delivering equipment in the stipulated time
- Clearance from statutory authorities.
- Short listing of contractors for civil & structural work and obtaining units rates.
- LOI of the main supplier
- Financial tie-ups.
- Enabling work like construction of water lines, power line and sewerages, communication facilities, etc. for construction activities.
- Building an experienced project team for the successful and timely execution of the project.
- Identification of competent and experienced civil & structural contractors and erection & commissioning contractors.

- Identification of the reputed supplier for integration facilities like power distribution, water system, EOT cranes, roll shop facilities etc.
- Implementing the project as per schedule by planning properly all activities, ensuring that implementation is well coordinated and moves in a streamlined fashion. The constraints and problems shall be foreseen and resolved in time. The project shall be monitored on a weekly and monthly basis.
- The planning and the schedule of site work will be such that the buildings complete with lighting and overhead cranes for erection and the foundations are ready when the major equipment arrives at site so that it can sit on the anchor bolts directly.

15.3 Project Time Schedule

- A project time schedule (bar chart enclosed) has been drawn for a period of 21 months. The schedule assumes there shall be no delays on account of finances and management decisions on critical matters.
- Timely completion of work as per schedule would require excellent coordination between the consultants, the supplier and the construction agencies and strict compliance with the schedule by mobilizing adequate & timely resources.
- Suppliers shall ensure timely supply of basic data & basic engineering to enable the consultant to proceed with engineering work & preparation of construction drawings for structure and civil drawings for equipment foundations & necessary drawings for integration facilities

16 Manpower Requirements

16.1 Manpower Requirement

16.1.1 Direct employment

For efficient operation & maintenance of the plant, it is necessary to have a dynamic and economic manpower plan. The plan is to take care of the manpower needs at various stages before & after commissioning of the plant. A skeleton staff consisting of senior and junior technical and commercial personnel shall be employed to form the project implementation team within the first 2 months which will take care of coordination between suppliers, consultants and contractors as well as oversee and implement site activities. A core group of qualified & experienced maintenance and operational personnel shall be employed just before equipment erection work. The rest shall be recruited later but sufficiently in advance of commissioning to get familiarized with the plant and its operations and to undergo suitable training as required. To run and operate the plant direct employment is estimated as300.

16.1.2 Indirect employment opportunities

The proposed project's activities in and around its areas of operation shall promote the economic well-being of people through indirect employment and business opportunities. The project will create enormous opportunities for developing ancillary and down-stream industries close to the steel manufacturing facilities, e.g. construction material manufacturing, supplement material providing, maintenance shops and downstream industries like steel fabrication, etc. Indirect employment opportunities will also be created for running trucks for material movement, canteens, restaurants, hotels and markets. These are a permanent source of sustainable employment. It is estimated that for each 1 job created in direct employment there would be potential for creation of 7 jobs under indirect employment. Thus, there is a potential of creation of 2,100 jobs under indirect employment

16.1.3 Project Management Teams Functions

The Project Management Team shall have following functions to perform:

- Selection and Appointment of Contractors for executing:

  - Civil & Structural Works

  - Equipment Erection & Commissioning Work

- Calling Bids for purchasing equipment against Consultants Specifications and placement of purchase orders.

- Administration of contracts with Project Design & Engineering Consultants, various Contractors, Equipment Suppliers etc.

- Arrangement and Management of Finances.
- Procurement of Construction Materials.
- Liaison with Governmental Authorities for obtaining statutory approvals etc.
- Recruitment of plant operational and maintenance personnel.
- Supervision and co-ordination of the activities of various agencies employed / connected with Project Implementation.

16.1.4 Project Manpower Requirement

The category wise man power requirement is given in the table below

Table 16-1 Category wise man power summary

Summary of Manpower requirement		
Executive	:	5
Managerial	:	15
Supervisor	:	20
Skilled	:	90
Un skilled	:	170
Total	**:**	**300**

17 Project Cost Estimates

17.1 Project Cost and Means of Finance

The project cost is estimated at 37.50 million USD. The project cost estimates for 300,000 TPA Bar & Wire Rod Mill is given below:-

Table 17-1: Project cost estimates

Item	Total cost in Million USD
Land	1.50
Site Development	1.02
Civil & Structural Works	3.33
Plant & Equipment	26.32
Integration Facilities	1.27
Erection & Commissioning	0.98
Consultancy & Engineering	0.40
Pre-operative Expenses	0.55
Contingency	2.13
Total	**37.50**

- **Means of Finance**

The funds requirement will be met as per the following financing pattern.

		Million USD
Equity	30%	11.25
Debt – Shareholder's	70%	26.25

17.2 Basis of Pricing and Estimates

- **Land & site development**

The proposed facilities are coming up at Kibaha district, coast region near Dar-es-Salaam, Tanzania. Total land available is about 42.60 acre (172,000 m^2) which is adequate for further expansion to integrated steel plant. The cost of site development includes excavation, filling, site leveling and compaction, internal roads, landscaping, horticulture etc.

- **Buildings**

The estimated cost of civil & structural works has been worked out on the basis of proposed layout for Bar & Wire Rod Mill and rates for civil & structural works have been taken from consultant's data bank. The items included in the estimates are civil & structural works for main plant and equipment and auxiliary services.

- **Main plant and equipment**

The cost estimates for the major plant and equipment have been based on equipment from reputed European & Chinese suppliers and worked out based on the plant layout and also the inputs available with the consultant for similar projects.

- **Integration facilities (Utilities & Auxiliaries)**

Consultants have estimated prices for utility and auxiliary facilities based on their experience with similar projects where such facilities have not been offered by the main package supplier.

- **Erection& Commissioning**

Equipment erection & commissioning cost has been considered along with the main plant and equipment.

- **Consultancy and Project engineering.**

The consultancy and engineering services charges are considered approx. @ 1.5% of the project cost excluding IDC and Margin Money. It is assumed that the project management will be carried out by the Client.

- **Pre-operative expenses**

Pre-operative expenses include expenses incurred on personnel during the course of the project implementation and prior to commissioning, living expenses of suppliers and consultants personnel for site supervision, insurance during construction taken at international norms, expenses on office facilities and transportation, deposit to be paid to Electrical Authority for power connections, etc.

- **Contingency**

This has been taken at 7.5 % of the project cost excluding Margin Money to take care of any variation of the cost estimated.