



BHUSHAN STEEL LIMITED
MERAMANDALI, DIST. DHENKANAL
(ODISHA)



PRE - FEASIBILITY REPORT
FOR
PROPOSED EXPANSION FROM 5.6 MTPA TO 12.8 MTPA

April, 2016

BHUSHAN STEEL LIMITED
12.8 MTPA EXPANSION PROJECT
PRE - FEASIBILITY REPORT



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Chapter - 1

Identification of the Project & Project Proponent:

India is the 3rd largest producer of crude steel globally with a total Production of around 91 MTPA (Million Tons per Annum) in the year 2015. Government is immensely encouraging and promoting the installation of steel producing units and taking steps for speedy implementation of the projects.

Bhushan Steel Limited (BSL), formerly known as Bhushan Steel & Strips Limited, was established in 1989 by Mr. B.B Singal, the Chairman of the group. The Company has three (3) manufacturing units in the state of UP (Sahibabad), Maharashtra (Khopoli) and Odisha (Meramandali) in India. Bhushan Steel Ltd is one of the prominent players in the Indian Steel industry. Backed with more than 27 years of experience, BSL is among India's largest Secondary Steel Producing Company with an existing steel production capacity of 5.6 MTPA.

BSL established 2.2 MTPA capacity Integrated Steel Plant at Meramandali, district Dhenkanal, Odisha in 2009-10. There was further expansion to 5.6 MTPA in stages and the plant operates through amalgamation of both primary and secondary steelmaking routes. As a part of business escalation and in view of growing demand for various steel products, BSL is proposing to augment their production of crude steel from 5.6 MTPA to 12.8 MTPA in their Meramandali plant, Odisha.

Brief Description of Nature of the Project:

The brief profile of the proposed steel plant located in Meramandali, Odisha is given below:

Hot Metal	..	10.7	MTPA
DRI	..	3.1	MTPA
Liquid Steel	..	13.13	MTPA
Crude Steel	..	12.8	MTPA
Saleable Products	..	12.20	MTPA

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Bar & Wire Rods	-	0.4	MTPA
Medium & Heavy Section	-	0.8	MTPA
TMT Rebars	-	1.2	MTPA
Wire Rods	-	0.6	MTPA
Plates	-	1.2	MTPA
Hot Rolled Coils	-	3.5	MTPA
Cold Rolled Products	-	4.0	MTPA
Stainless Steel Products	-	0.5	MTPA

The existing steel plant produces 5.6 MTPA crude steel and flat rolled products. BSL has now proposed to augment their existing facilities and add new installations to produce additional 7.2 MTPA crude steel in two stages.

The proposed production of liquid steel and subsequent rolling will be accomplished via Blast Furnace (BF)-DR Plant -Basic Oxygen Furnace (BOF)- Electric Arc Furnace (EAF)Induction Furnace (IF)-Caster route, followed by Hot & Cold rolling.

The project falls under category A, section 3 (a) of EIA notification September 2006 and amendment thereof vide notification no. S.O 3067 (E) dated 1st December 2009.

Need for the Project:

The Indian steel industry has entered into a new development stage from 2007-08, riding high on the resurgent economy and rising demand for steel. Rapid rise in production has resulted in India becoming the 3rd largest producer of crude steel in 2015 and the country continues to be the largest producer of sponge iron or DRI in the world.

However, India still lags behind other major steel producing countries in per capita consumption with an estimated figure of about 60 kg, against the world average of 222 kg. As per the report of the Working Group on Steel for the 12th Five Year Plan, there exist many factors which carry the potential of raising the per capita steel consumption in the country. These include among others, an estimated infrastructure investment of nearly a trillion dollars, a projected growth of manufacturing from current 8% to 11-12%, increase in

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urban population, emergence of the rural market for steel currently consuming around 10 kg per annum buoyed by projects like Bharat Nirman, Pradhan Mantri Gram Sadak Yojana, Rajiv Gandhi Awaas Yojana, proper implementation of the government's 'Make in India' coupled with aligned infrastructure development among others.

The Working Group on Steel for the 12th Five Year Plan has projected that domestic crude steel capacity in the country is likely to be 140 MT by 2016-17 and has the potential to reach 149 MT if all requirements are adequately met.

Keeping in mind of the production surge in the country and the scope for massive utilization, augmentation of the existing plant has been conceived.

Demand-Supply Gap, Imports Vs. Indigenous production, Export possibility & Domestic/Export Markets:

Presently, two sets of demand projections are available in the country – 'Ministry of Steel's (MoS) draft report on circulation' and World Steel Association's (WSA) 'India Steel Vision 2020'. The overall scenario of the forecast is presented below.

Ministry of Steel, GOI – Draft Report in Circulation (Million Tonnes)				
GDP Growth Rate	2013-14	2025-26	2032-33	
6.5%	74	176	273	
7.0%	74	186	298	
8.0%	74	208	339	
World Steel Association – India Steel Vision 2020 (Million Tonnes)				
	Scenario	Quantity		
Demand for Finished Steel	GDP 8%	155		
	GDP 7.5%	141		
	GDP 6%	128		

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Crude Steel Capacity	Realistic	202
	Optimistic	275
	Conservative	177

It may be seen from above that the forecasts made by both the agencies converge and match. The MoS's forecast of 186 million tonnes of finished steel by 2025-26 based on a GDP growth assumption of 7.0% per annum matches with the WSA's forecast of 141 million tonnes by 2020 based on a similar GDP growth assumption of 7.5% per annum. Thus the MoS's forecast is taken as the estimate of demand for this scenario analysis. Moreover, the 7.0% growth in economy is considered to be realistic and sustainable in the long run.

Steel Demand @ 7.0% GDP growth (Million Tonne)

Year	Demand	CAGR
2014-15	76.4	8.4%
2015-16	82.8	
2016-17	89.8	
2017-18	97.3	
2018-19	105.5	
2019-20	114.4	
2021-21	124.0	
2021-22	134.4	
2022-23	145.7	
2023-24	157.9	
2024-25	171.2	
2025-26	186.0	

Based on the domestic consumption level of 76.4 million tonnes in 2014-15, the projected demand is assumed to grow @ 8.4% annually which is likely to be attainable given the current thrust of the government in encouraging foreign investments in infrastructure and manufacturing sectors of the economy.

Gap Analysis:

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Keeping the above in view a comparative analysis of the likely demand, availability and gap/surplus scenarios as may be obtaining in the terminal periods of this exercise in terms of finished steel is presented in the following table.

Demand and Availability of Steel: Gap Analysis (Million Tonne):

	2015-16	2020-21	2025-26
Demand	86	126	186
Crude Steel Capacity	110	180	300
Capacity Utilization Rate	80%	80%	80%
Available Capacity	88	144	240
Yield (Crude to Finished)	90%	90%	90%
Availability of Finished Steel	79	130	216
Gap (Demand - Availability)	7	-4	30

The gap analysis shows that the projected scenario changes from one of demand efficiency or shortage scenario to a phase of supply efficiency or excess availability within a time period of 10 years by 2025-26. However, the magnitudes of the deficiencies or surpluses are indeed marginal in nature, especially in the context of the overall volume of the steel market.

What emerges out of the above analysis is the fact that the domestic steel market is expected to progress maintaining demand-supply equilibrium for the foreseeable future till 2025-26. With no independent forecast of further building-up of steel making capacity being available at present, the market is expected to enter into a phase of demand efficiency thereafter where the producers will enjoy a clear advantage over the buyers.

According to the report 'The steel Industry: Key Reforms for a Brighter Future' by the National Council of Applied Economic Research published in September 2015, developed India would require steel capacity of at least 700 million tonnes and steel consumption of at least 600 million tonnes by year 2050. NCAER study is apprehensive of India achieving the 300 million tonne capacity by 2025.

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The overall demand of steel is further split-up into two broad groups of steel products – long or shaped products comprising of Bars & Rods, Structural and Rails and flat products comprising of Plates, Coils, Sheets including Pipes & Tubes.

While splitting the overall demand of finished steel, especially over a long time horizon, allowances have been made for the expected changes in composition of the country's economy. It is well known that as constructional activities precede manufacturing operations, the share of long products dominates during the developing phase of an economy. Once developed, with gradual expansion of the manufacturing base, the share of flat products catches-up and eventually matches with that of the long or shaped products. For some highly advanced economies, the share of flat products may exceed that of long products as well.

Keeping a tab on the projected growth path of Indian economy, a set of progressively altered ratios between the consumption of long and flat products has been considered while determining the expected demand of these two groups of products for the future period.

Relative Shares of Long & Flat Products:

Periods	Long	Flat
2015-2020	56%	44%
2021-2025	54%	46%

Adopting these progressively altered shares of the long and flat products consistent with the changing character of the domestic economy, the future demand estimates of the two groups of products for the terminal years work out as under.

Demand of Long & Flat Products (Million Tonnes):

Periods	Long	Flat
2015-16	48	38
2020-21	68	58
2025-26	97	89

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Import & Export Scenario:

International trade will continue to be a natural phenomenon offering opportunities as well as inviting competition, especially in the WTO regime of the global economy. Product competitiveness in terms of price and profile is the key to survive and overcome the 'threats' from imports and add revenues through exports.

Domestic Consumption of Steel & Share of Imports (Million Tonne):

Year	Domestic Consumption	Imports		Exports	
		Quantity	%Share	Quantity	% of consumption
2009-10	59.3	7.4	12%	3.3	5%
2010-11	66.4	6.8	10%	3.5	5%
2011-12	71.0	6.9	9%	4.6	6%
2012-13	73.5	7.9	11%	5.3	7%
2013-14	74.1	5.4	7%	5.6	7%
2014-15	76.4	9.3	12%	5.5	7%

The share of imported materials has been of the order of 10-12% of the domestic consumption. The share has remained by and large steady fluctuating between a narrow band of 9-12% in the recent past. For a developing country like India, there are compulsions to allow imports, especially for those profiles and qualities currently not being produced in the country. The levels of imports should not cause any undue worry to the domestic producers as the quantum is well within the limits of normal trade practices across the world.

The recent spurt in the volume of imports, well within the normal limits though, should not be a cause of any concern. There are provisions in WTO to safeguard the interest of the domestic industry of a country against imports in violation of provisions of the WTO agreements in force.

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However, in the context of long term projections, the current market noises will not have any impact, adverse or otherwise whatsoever. The country's economy has immense potentials to grow pivoting on a rising spiral of increased availability of steel. In this context, imports will continue to play a complementary role to the domestic industry's effort to contribute and support the nation building efforts in a big way.

Nevertheless, on occasions and at certain locations, imports, in the context of today's global economy, may pose a challenge to the indigenous producers who will be obliged to maintain price parity with the landed price to remain competitive in the market.

Category-wise, flat products accounting for 80% dominate followed by long products sharing 20%. Among the flat products CR and Coated products account for 25% followed by HR products 20% and Plates 8%. Tool & Alloy steel's share is little above 25% of the total import bill.

Market Areas;

Among the many drivers of demand, the following are having maximum influence in triggering consumption of Bars & Rods, Structural and Plates:

Product/Category	Demand Drivers
Bars & Rods	Infrastructure – House Building Fasteners & Wires Bright Bars
Structural	Infrastructure – High rises Industrial Construction Heavy vehicles
Plates	Infrastructure – Bridges Railways - Wagons, Coaches, Tankers Industrial Construction

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Product/Category	Demand Drivers
	Defence Production Energy –Boilers, Pressure Vessels, Penstocks
HR Products	Tube making industry Railways - Wagon & Coach Automobiles Furniture Industrial Machinery
CR Products	White goods – Refrigerators, Air- conditioners Automobiles Silos & Containers Precision Tubes Galvanising & Coating

Employment Generation due to the Project:

The construction phase as well as in the operation phase of the expansion project would involve both direct and indirect deployment of local manpower. Additionally the expansion project entails development of ancillary industries and in turn will facilitate further indirect employment opportunities. These employment opportunities as a whole will generate income, contribute to the local economy and lead to diversification of skills.

The proposed project would generate definite scope of employment in different hierarchical position. Direct opportunities would likely to facilitate employment of about 2200 people after Stage –I, and a total of 5100 at the 12.8 MTPA crude steel production stage. The required manpower will be sourced locally as well as from across the country.

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Chapter - 2

Project description:

Type of Project Including Interlinked Project

The proposed project comprises of expansion of an existing steel plant. There are no interlinked or interdependent projects with the proposed project.

Location

BSL's existing integrated steel plant is located about 5 km from Meramandali Coast Railway). National Highway 42 runs along the northern side of plant site. The plant site is 18 km from Angul and 42 km from Dhenkanal. The nearest port is Paradeep, which is more than 215 km away. Nearest airport is at Bhubaneswar, about 130 km from Meramandali.

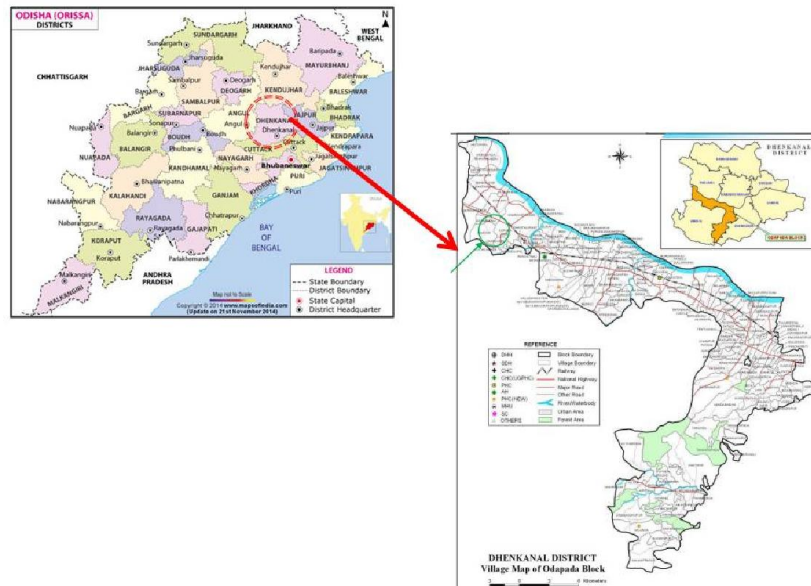


Fig. 2-1 - Site Location Map

Details of alternate sites considered and the basis of selecting the proposed site

The suitability of the site, for locating the proposed project is determined by the following major considerations.

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- Availability of adequate land for installation of production units
- Availability of adequate infrastructure
- Suitability of the land from topographical and geological considerations.
- Location away from forests, national park/sanctuaries, sea coast and ecologically sensitive elements.

The major driving force behind the selection of the proposed site is that the plant would be set up in the existing works and in the land the adjacent to existing Manufacturing units. Apart from the above factor, the site is already well-equipped with required infrastructure and other considerations such as water availability, good transportation facilities, etc which have facilitated the selection of the site.

Size or magnitude of operation:

The proposed expansion project would produce additional 7.2 MTPA crude steel, intermediate products like slabs & billets and finished rolled products including bars & rods, plates, Medium & Heavy section, hot rolled coils and cold rolled products. Hence, the total crude steel production post this expansion would be 12.8 MTPA and 12.20 MTPA of finished products.

Layout:

The plant general layout of the proposed project showing the proposed facilities is enclosed with this report. The layout is complete with the plant units, administrative buildings, water reservoir, storage area, road network and greenbelt

Project Description with Process Details:

The plant would be designed to produce 12.8 MTPA crude steel, which would be cast into both flat and long products including TMT rebars, Plates, Medium & Light sections, and Cold rolled products. The total production of 12.8 MTPA crude steel would be achieved in two stages; Stage –I (5.6 MTPA to 8.2 MTPA) and Stage-II (8.2 MTPA to 12.8 MTPA).

The proposed production of liquid steel and subsequent rolling would be accomplished via Blast Furnace (BF)-DR Plant -Basic Oxygen Furnace (BOF)- Electric Arc Furnace (EAF)Induction Furnace (IF)-Caster route, followed by Hot & Cold rolling.

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The production facilities would be adequately supported by necessary auxiliary facilities such as raw materials unloading and storage, proportioning of raw materials, electric power receiving and distribution stations, various utility facilities, water treatment and distribution system, etc.

The preliminary material flow sheet is attached with the chapter.

Coke oven and By-product Recovery Plant:

Stamp charged by-product recovery type coke oven plant has been envisaged in Coke Plant-3 along with installation of another top charged battery in Coke Plant-2 identical to the existing battery for meeting the charge coke requirement of Blast Furnaces after 12.8 MTPY crude steel expansion. Coke oven gas from the ovens would be cleaned in by-product recovery unit and would be used as a fuel in various heating applications inside the plant.

The coke requirement on dry basis for the project after 12.8 MTPY crude steel expansion stage is given in the Table below.

Hot metal production, tpy	10,700,000
Coke rate, Kg/ton of hot metal	410
Charge coke requirement, tpy	4,387,000
- Hard coke (25 to 80 mm), tpy	3,954,400
- Nut coke (10 to 25 mm), tpy	432,600

The coal requirement ⁽¹⁾ for Coke Plant-3 on dry basis based on the blend considered is shown as follows:

Gross coke production from Coke Plant-1, 2 and 3, tpy ⁽²⁾	4,999,300
Gross coke production ⁽³⁾	1,653,750
Dry blend for carbonization, tpy ⁽³⁾	2,205,000
- Imported Hard Coking Coal	441,000

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- Imported Semi Soft Coking Coal	1,653,700
- Imported Weakly Caking Coal	110,200

(1) Excluding handling loss

(1) After installation of 1 x 74 ovens, top charged coke oven battery identical to existing battery at Coke Plant-2

(2) Figures for Coke Plant 3

The production of coke and by-products from the Coke Plant-3 are tabulated below:

- Hard coke (25 to 80 mm), tpy	1,438,800
- Nut coke (10 to 25 mm), tpy	82,700
- Coke breeze (-)10 mm, tpy	124,000
- CDQ dust, tpy	8,270
Coke Oven gas generation, Gcal/yr	2,963,500
Tar, tpy	77,200
Sulphur, tpy	2,600

Two by-product recovery type stamp charged batteries having 64 ovens each has been considered for the 12.8 MTPY crude steel expansion stage. The typical basic design parameters of the coke oven battery in Coke Plant-3 are given below:

No. of battery	2
No. of ovens in each block	64
Oven useful volume, cu m	43.7
Normal carbonisation time, hrs	20
Bulk density of stamped cake, t/cu m	1 – 1.15

The coke oven plant in Coke Plant-3 would consist of following major facilities:

- Coal blending, crushing and conveying of coal to the coal towers,
- Stamp charged, recovery type coke oven batteries (2 batteries of 64 ovens each), with oven machines and auxiliaries,
- Coke dry quenching unit, with stand-by wet quenching station,

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- Land based pushing and charging emission control,
- Coke cutting and screening facilities,
- By-product recovery plant.

It is estimated that after meeting the blast furnace charge coke requirement there will be a surplus of about 90,600 tpy of BF coke.

Sinter Plant:

Sinter would constitute about 80 per cent and 85 per cent of the blast furnace burden for stage -1 and stage – 2 respectively. To achieve the above figure one 224 sqm capacity and two nos. of 480 sq m capacity sinter plant (in addition to existing three sinter machines) has been envisaged for both the stages. Two sinter machines (SP-4 and SP-5) would be installed to produce additional 6,009,100 TPY of charge sinter, which would be adequate to feed required quantity of sinter for stage - 1. Another sinter plant (SP – 6) would be installed in stage – 2 to suffice the requirement of sinter. The design basis considered for each sinter plant is as follows:

Design Basis for SP – 4:

Product sinter, tons/year	..	2,395,000
Charge sinter, tons/year	..	1,916,000
Screening at BF stock house, %	..	20
Operating days/year	..	330
Daily product sinter, tons/day	..	7,260
No. of strand	..	1
Approx. suction area, sq m	..	224
Product sinter size, mm	..	5-50
Temperature of sinter at cooler discharge, °C	..	100

Design Basis for SP – 5 /SP – 6:

Product sinter, tons/year	..	5,116,300
Charge sinter, tons/year	..	4,093,100
Screening at BF stock house, %	..	20
Operating days/year	..	330
Daily product sinter, tons/day	..	15,500
No. of strand	..	1
Approx. suction area, sq m	..	480
Product sinter size, mm	..	5-50
Temperature of sinter at cooler		

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discharge, °C .. 100

The expected chemical analysis of sinter production from sinter plant is given below:

<u>Fe</u>	<u>SiO₂</u>	<u>Al₂O₃</u>	<u>CaO</u>	<u>MgO</u>	<u>CaO/SiO₂</u>
%	%	%	%	%	ratio
56.55	4.80	3.78	8.89	1.91	1.85

Physical and metallurgical properties of sinter would be as follows:

ISO tumbler index (+6.3 mm)	..	76% (min)
Reducibility index	..	65% (min)
RDI (-3.15 mm)	..	28% (max)
Sinter size range, mm	..	5–50
Sinter mean size, mm	..	18

It is suggested that attainment of the above properties should be ensured by adopting appropriate process parameters established through necessary test work before implementation of the project.

The facilities envisaged for the sinter plant are:

- Calcined lime grinding and conveying system
- Proportioning system
- Mixing and nodulising system
- Sinter machine
- Sinter cooling system
- Sinter screening system
- Waste gas system
- Plant dedusting system
- Cranes and hoists
- Sinter storage
- Plant electrics
- Instrumentation, automation and control system
- Communication system
- Water system
- Utility system

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- Fire fighting system
- Air conditioning and ventilation system

Pellet Plant: (EC obtained):

Pellet would constitute about 15 -18 per cent and 10 - 14 per cent of the blast furnace burden for stage -1 and stage – 2 respectively. Coke oven gas-based DR plant would consume around 1.6 MTPY iron ore pellets. To meet the pellet requirement of the DR plant and BF’s it is envisaged that one pellet plant would be installed in Stage-I to produce 7 MTPA of pellets. The pellet production rate would be about 835 TPH considering 7,920 effective hours of operation per year.

The design basis considered for pellet plant is as follows:

Item	Value
Product pellet, tpa	7,000,000
Operating days/year	330

The indicative chemical analysis of pellet produced would be as follows:

Fe, %	..	65.59
CaO/SiO ₂ ratio	..	0.15
Al ₂ O ₃ , %	..	2.63
MgO, %	..	0.31

Some of the desired characteristics of Pellets are listed below:

<u>Property</u>	<u>Value</u>
Size range	.. 6 – 18 mm
Compressive strength	.. 250 kg/pellet
Tumbling index	
+6.3 mm	.. 92%
-500 micron	.. 6%

It is suggested that attainment of the above properties should be ensured by adopting appropriate process parameters established through necessary test work before implementation of the project.

The pellet plant would comprise following facilities:

- Storage and handling of iron ore fines,
- Storage, handling and preparation of coal, dolomite and bentonite,
- Proportioning and mixing,
- Balling, induration and cooling,
- Product screening,
- Product pellet storage,
- Auxiliary facilities like fuel storage, laboratory, etc.,
- Plant de-dusting system,
- Cranes, hoists and elevator,
- Plant electrics,
- Instrumentation and Level- 1,
- Plant communication system,
- Utility system,
- Air-conditioning and ventilation system,
- Fire fighting system.

Blast Furnace:

To cater the hot metal requirement for SMS, installation of a new blast furnace (BF-3) has been envisaged for stage – 1 and existing BF -1 and BF-2 would be augmented to higher capacity for stage - 2. Useful volume of BF-3 would be 5800 cu m and augmented capacity of BF-1 and BF -2 would be 3400 cu m and 4500 cu m respectively. The hot metal production from the proposed augmented BF – 1, BF – 2 and new BF – 3 is mentioned below:

BF – 1	.. 2,800,000 TPY,
BF – 2	.. 3,600,000 TPY.
BF – 3	.. 4,300,000 TPY.

Existing pig casting machine would be used. The design basis of all the blast furnaces is given below.

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BF -1:

Item	Quantity
Hot metal production, tpy	2,800,000
Daily production capacity, thm/day (avg.)	8,000
No. of furnaces	1
Useful volume after augmentation, cu m (approx)	3,400
Operating days	350
Productivity, t/(useful volume)/day (approx.)	2.35
Burden:	
- Sinter, %	80 - 85
- Pellet, %	15 - 20
Hot blast temperature, °C	1,150
Oxygen enrichment, %	4 to 5
Coke rate (including nut), kg/thm	422
Coal injection rate, kg/thm	150

BF - 2:

Item	Quantity
Hot metal production, tpy	3,600,000
Daily production capacity, thm/day (avg.)	10,285
No. of furnaces	1
Useful volume after augmentation, cu m (approx)	4,500
Operating days	350
Productivity, t/(useful volume)/day (approx.)	2.28
Burden:	
- Sinter, %	80 - 85
- Pellet, %	15 - 20
Hot blast temperature, °C	1,150
Oxygen enrichment, %	4 to 5
Coke rate (including nut), kg/thm	422
Coal injection rate, kg/thm	150

BF - 3:

Item	Quantity
Hot metal production, tpy	4,300,000

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Item	Quantity
Daily production capacity, thm/day (avg.)	12,285
No. of furnaces	1
Useful volume , cu m (approx)	5,800
Operating days	350
Productivity, t/(useful volume)/day (approx.)	2.12
Burden:	
- Sinter, %	80 - 85
- Pellet, %	15 - 20
Hot blast temperature, °C	1,150
Oxygen enrichment, %	4 to 5
Coke rate (including nut), kg/thm	422
Coal injection rate, kg/thm	150

The expected hot metal analysis is given below:

Si, %	..	0.4 - 0.6
S, %	..	0.045 (max)
P, %	..	0.15

The plant would comprise the following facilities:

- Blast furnace proper
- Cast house
- Slag granulation plant
- Hot blast stoves
- Gas cleaning plant
- Stock house and charging system
- Hot metal handling system
- Cranes and hoists
- Coal dust injection system
- Pig casting machine/Hot metal granulation plant
- Ladle repair shop
- Stockhouse and cast-house de-dusting system
- Air blowing system
- Top recovery turbine
- Plant electrics
- Instrumentation, automation and control system
- Communication system
- Water system
- Utility system
- Fire fighting system

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- Air conditioning and ventilation system

COG based DR Plant:

For the production of hot DRI (HDRI) as feed material for EAF, a COG based Midrex DR plant of capacity 1.6 MTPY has been envisaged for Stage-II of the expansion. Iron ore pellets produced in captive the pellet plant shall be used as feed materials. A mixture of in-plant generated coke oven gas (COG) and treated BOF gas shall be used as reducing agent. Thermal reactor system (TRS) shall be employed to convert COG into reducing gas suitable for use in DR plant. The HDRI produced shall be transported to the EAF by hot transport vessels. The design basis of the DR plant is given below:

Annual rated DRI production capacity, tpy	..	1,600,000
Hourly DRI production capacity, tons/hr	..	2,000
Annual operating time, hours	..	8,000
Feed material	..	Iron ore pellets
Reducing gas	..	Mixture of COG and BOF gas

The tentative analysis of the reducing gas to be used in the DR plant is as follows:

Parameters	Coke Oven Gas, Vol %	BOF gas, Vol %
H ₂	55-60	0
CO	5	69
CH ₄	20	0
CO ₂	5	16
N ₂	2	14.5
H ₂ O	5	0

The COG is passed through the TRS where the CH₄ is reformed to generate CO and H₂. The BOF gas is mixed with the top gas and passed through CO₂ removal system. After that the two gas streams are mixed to obtain a reducing gas with H₂/CO ration equal to or more than 9. It is then fed into the furnace.

The expected DRI analysis is given below:

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Fe (T), %	..	87-88
Degree of metallisation, %	..	92-93
C, %	..	1.3-1.8

The plant would comprise the following facilities:

- Material handling
- Midrex shaft furnace
- Hot Discharge system
- Process gas circuit
 - Top gas waste heat boiler
 - Top gas scrubber
 - Process gas compressor
 - CO2 removal system
- Reducing gas system
 - Reducing gas heater
 - Thermal reactor system
- Oxygen injection system
- Seal gas and purge gas system
- Plant water system
 - Machinery cooling water system
 - Process cooling water system
- Dust collection system

Lime Calcining Plant:

The calcining plant produces flux (calcined lime and dolomite) to be used in steelmelt shop. The net annual requirement of lime in Stage-I is 252400 tons for BOF and in Stage II is 389200 tons for both BOF and EAF. There is also a small requirement for burnt dolomite of 23300 tpa in Stage-II only. The requirement of burnt dolomite is not enough for in-plant production and hence it is proposed to outsource the same or existing production of burnt dolomite may meet the requirement.

The size of lime would be 10 to 60 mm. Calcined lime would be screened to separate out (–) 10 mm sizes before conveyed to steel melt shop. The gross annual production of lime works out to be 445360 tons and 606300 tons in Stage I and Stage II respectively.

Kiln capacity:

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It is proposed to install vertical shaft kiln of proven design to produce soft-burnt highly reactive lime. The annual net working days of calcining plant works out to be 330 days considering plant availability, repair & maintenance work and major shutdown. Based on 330 days working in a year, the daily production is estimated to be 1349 tons and 1837 tons in Stage I and Stage II respectively. However, it is proposed to keep extra kiln capacity by 10 per cent to take care of the fluctuation in the specific consumptions of lime in SMS and variation in limestone quality. On this basis, the daily requirement of lime works out to be 1483 tons and 2020 tons in Stage I and Stage II respectively. It is proposed to install three (3) nos. kiln of 600 tpd capacities in Stage I and three (3) no. additional kiln of same capacity in Stage II.

The kilns in Stage I have been over capacity considering the requirement in Stage II, since same capacity kiln design for both the Stages, offers ease of installation, operation, maintenance and less spares inventory.

Plant facilities:

The calcining plant in each Stage would comprise limestone storage and handling, kiln with waste gas system, calcined lime storage and handling facilities. The SMS grade limestone from central India is proposed to be used. For each kiln limestone would be stored in kiln feed building bunker. In order to separate out the fines generated during handling, limestone would be screened before being fed into the kiln. Calcined lime from each kiln would be conveyed by belt conveyor and stored in lime storage bunkers.

Steel Melt Shop:

Facilities and process route of steel making have been envisaged taking into consideration the ultimate plant capacity of about 12.8 MTPA of crude steel, availability of hot metal as well as hot DRI and steel grades to be produced.

Facilities envisaged under 12.8 MTPA stage are given below.

NAME OF SHOP	FACILITIES	STATUS
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SMS-1A	6 x 15 tons twin crucible induction furnace	Existing
	1 x 60 tons EAF (55 MVA)	Existing
	2 x 60 tons VD	Existing
	1 x 15 tons LF	Existing
	1 x 60 tons LF	Existing
	1 x 2-strand and 1 x 3-strand billet caster	Existing
	1 x 1-strand slab caster	Existing
SMS-1B	2 x 100 tons EAF (100 MVA)	Proposed in Stage-II
	1 x 120 tons AOD	Proposed in Stage-II
	2 x 120 tons LF	Proposed in Stage-II
	1 x 6-strand combi caster	Proposed in Stage-II

NAME OF SHOP	FACILITIES	STATUS
SMS-1C	2 x 250 tons HMDS	Proposed in Stage-II
	2 x 250 tons BOF	Proposed in Stage-II
	2 x 250 tons ARS	Proposed in Stage-II
	2 x 250 tons LRF	Proposed in Stage-II
	1 x 8-strand billet caster	Proposed in Stage-II
	1 x 1-strand slab caster	Proposed in Stage-II
SMS-2A	1 x 180 tons twin cell CONARC (145 MVA)	Existing
	1 x 180 tons LF	Existing
	3 x 1-strand slab caster	Existing
	1 x 180 tons CAS-OB, 1 x 200 tons RH-TOB	Existing
SMS-2B	4 x 200 tons HMDS	Two (2) Nos. existing and rest proposed in Stage-I
	2 x 180 tons BOF	Existing
	2 x 200 tons BOF	Proposed in Stage-I
	4 x 200 tons ARS	Two (2) Nos. existing and rest proposed in Stage-I
	2 x 200 tons twin LF	Proposed Stage-I

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	2 x 200 tons (single station LF)	2 x 200 tons (single station LF)
	2 x 1-strand (CSP flex)	- Existing
		2 x 1-strand (CSP flex) - Proposed in Stage-I

Production programme: In Stage-I, two BOFs have been envisaged for producing plain carbon steel in SMS-2B. In Stage-II expansion, about 3,000,000 tpa of additional hot metal and 1,600,000 tpa of gas based hot DRI would be used as metallic charge. In Stage-II, one EAF would be installed for producing carbon steel & alloy steels with high alloy content, along with installation of the second BOF shop. The production programme of liquid steel, semis (billets, blooms and rounds) after Stage-I and Stage-II are summarized in the table below.

		Approx. Tons/Year
Stage-I:		
Liquid steel	:	8,479,600
Semis (slabs, billets)	:	8,200,000
Stage-II:		
Liquid steel	:	13,129,600
Semis (slabs, billets, blooms & rounds)	:	12,800,000

Considering the best utilization of the raw materials and to produce plain carbon steel and alloy steel including stainless steel both BOF and EAF routes are envisaged for steel making. The steel making facilities would be envisaged in two Stages as mentioned below:

- Stage-I** : 8.2 MTPA on crude steel basis
- Stage-II** : 12.8 MTPA on crude steel basis

BSL already have two steelmaking shops, i.e. SMS-IA and SMS-II. The capacity of SMS-1A is about 0.6 MTPA. The capacity of the plant after augmentation of SMS-II is 5.6 million tons per year.

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Proposed Steelmaking at 8.2 MTPA Stage

Major Plant Facilities:

Hot metal desulphurisation plant: The sulphur content in hot metal is 0.045 per cent (max). In order to meet the requirement of low sulphur content in steel, desulphurisation of hot metal has been envisaged prior to feeding into steel making furnaces. Hot metal would be desulphurised by deep injection of a combination of desulphurising reagent (calcium carbide and magnesium) in charging ladle by injection lances. Provision for mono-injection (CaC₂) and co-injection (CaC₂ + Mg) as well as deslagging would be provided.

Basic oxygen furnace: Considering relining time, mid campaign shutdowns, annual shutdown and unplanned outage, two converters of 200 ton capacities would be installed in SMS-IIB shop in addition to the existing converters. However, proper design integrities need to be checked at a later stage during conceptualization.

Total No. of converters	..	4
Total No. of heats	..	30,000
Heat size, tons	..	200
Production capability (liquid steel)	..	6
with two converters, MTPA		

Ladle furnaces: Twin LF has been proposed in upstream of thin slab casting (CSP) to maintain sequence casting. Two Nos. new 200 ton twin ladle furnaces (LF) would be installed in secondary refining aisle in addition three Nos. existing ladle furnace in secondary metallurgy bay of existing shop. The ladle furnaces would be capable of performing heating, alloy adjustment, desulphurization, inert gas stirring and carbon injection. The unit would be complete with facilities for alloy storage, batching and charging, sampling and temperature measurement. The furnace would be equipped with water cooled furnace cover or refractory cover with raising and lowering facilities. Provision for wire feeder has also been envisaged. The salient features of the ladle furnace are as follows:

Type of unit	..	Arc heating and inert gas stirring
Heat size, tons	..	200
Rate of heating, °C/min	..	Approx. 4-5

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Thin Slab Casting (CSP-Flex):

2 x 1-strand thin slab caster (CSP flex) would be installed under 3.5 MTPA name plate capacity to meet the stringent production requirement. The salient features of this machine are as follows:

Caster type	.. Vertical caster – vertical solid bending
Slab dimension	.. 55-85 mm
Width	.. 900-1560 mm
Length	.. 10-50 mm

In stage-I the metallic inputs of steel making would be mainly hot metal and coal based DRI for existing CONARC furnace and proposed BOF shop and balanced with scrap, iron ore, calcined lime and dolomite as flux. In future during Stage-II, around 387,000 tons of liquid transfer has been shown from proposed SMS-IB shop to meet the underutilization of CSP in stage-1 expansion but proper care needs to be taken during liquid transfer to SMS-IIB. Temperature drop, excess refractory consumption and above all increase in operational cost (OPEX) are envisaged. Proper logistics solution needs to be ensured during feasibility and engineering stage.

Proposed Steelmaking at 12.8 MTPA Stage:

In addition to existing SMS-1A, SMS-2A and SMS-2B shop during Stage-I expansion, two completely new shops, SMS-1B and SMS-1C would be envisaged during Stage-II for 12.8 MTPA expansion.

Major Facilities Proposed Under SMS – IB:

Electric arc Furnace (EAF): Two Nos. EAF of 100 ton capacity with transformer rating of approx. 100 MVA is proposed to be installed in Stage-II for producing carbon steel as well as alloy and stainless steels. Provision of high powered transformer and oxygen assisted melting facility would reduce the melting time considerably.

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Charge-mix: The metallic charge of the EAFs would generally comprise about 100% gas based hot DRI and plant return scrap if required and also about 10-15% ferro alloy. Ferro alloys and additives would be added to get the desired chemical composition.

The technical parameters of EAF are given as follows:

Liquid steel production (output from EAF) (tons/annum)	..	1,550,000
Transformer rating, MVA	..	100
Tap-to-tap time approx, min	..	65
Nos. of heats to be produced per day/EAF	..	22 - 23
Nos. of EAF operating days/year	..	320
No. of EAFs	..	2

Argon oxygen decarburization (AOD) converter: One 120 ton AOD converter would be installed in Stage-II for production of stainless steel. Some proportion of liquid steel of around 0.5 MTPA would go into AOD converter for stainless steel production.

The sequence of refining operation in the AOD after tapping from the EAF would be decarburization followed by reduction and desulphurization of the melt.

Ladle furnace: For the purpose of secondary metallurgy, two Nos. ladle furnaces (LFs) of 120-ton capacity with auxiliaries are envisaged for further treatment of liquid steel including homogenization of chemistry and to raise temperature from EAF before casting.

These two No. LFs would also function as a holding unit for facilitating sequence casting of heats in the caster.

Number of units	..	Two
Type of station	..	Single station type with arc heating and inert gas stirring
Heating rate	..	4-5°C/min.
Furnace cover (roof)	..	Water cooled lift and lower type

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Continuous casting machine: One No. of 6-strand combi-caster would be installed in Stage-II for casting of billet, blooms and rounds. This combi caster would be designed to cast for size ranges of 130 x 130 mm to 240 x 280 mm and blooms up to 320 x 400 mm and up to 750/800 mm dia rounds. This caster would feed material to bar mill, rod mill and medium and heavy section mill.

Billet conditioning system: Cast semis which do not require any conditioning would be directly sent to the reheating furnace of the proposed rolling mills. The semis which require conditioning would be ground by grinders and stored in the shop before being sent to the rolling mills. Three Nos. of swings and one No. auto billet grinder have been envisaged for conditioning of semis.

Major Facilities Proposed Under SMS-IC:

Hot metal desulphurization plant: The sulphur content in hot metal is 0.045 per cent (max). In order to meet the requirement of low sulphur content in steel, desulphurisation of hot metal has been envisaged prior to feeding into steel making furnaces. Hot metal would be desulphurised by deep injection of a combination of desulphurising reagent (calcium carbide and magnesium) in charging ladle by injection lances. Provision for mono-injection (CaC_2) and co-injection ($\text{CaC}_2 + \text{Mg}$) as well as deslagging would be provided.

Basic oxygen furnace: Considering relining time, mid campaign shutdowns, annual shutdown and unplanned outage, two Nos. new converters of 250T capacities would be installed in SMS-IC shop.

Total No. of converters	..	2
Total No. of heats	..	15500
Heat size, tons	..	250
Production capability (liquid steel), MTPA	..	3.1 with two converters

Ladle furnaces: Two Nos. new 250 T ladle furnaces (LF) would be installed in secondary refining aisle of SMS- IC shop. The ladle furnaces would be capable of performing heating, alloy adjustment, desulphurization, inert gas stirring and carbon injection. The units would

be complete with facilities for alloy storage, batching and charging, sampling and temperature measurement. The furnace would be equipped with water cooled furnace cover or refractory cover with raising and lowering facilities. The salient features of the ladle furnace are as follows:

Type of unit	..	Arc heating and inert gas stirring
Heat size, tons	..	200
Rate of heating, °C/min	..	Approx 4-5

Billet caster: One No. 8-stand billet caster would be considered for SMS-IC shop. Billet caster would be capable of producing billets up to 200 mm sq for the proposed rebar and wire rod mill. Necessary billet storage and handling would also be considered. Around 157,500 ton of liquid steel transfer from SMS-IB is envisaged during 12.8 MTPA stage. Proper care should be taken for liquid transfer.

Slab caster: One (1) No. single strand conventional slab casting machine with necessary auxiliaries would be installed. The slab caster would be able to cast slab width up to 4000 mm. Necessary slab storage with slow cooling facility, inspection and scarfing facility are also envisaged for the plant. The slabs would be rolled into finished products in the proposed 4-high reversing plate mill.

The other facilities proposed to be installed in the steel melt shop are as follows:

- Scrap handling facilities
- Hot metal handling facilities
- Converter auxiliaries
- BOF primary gas cleaning plant
- Secondary emission control
- Flux handling facilities
- Steel handling facilities
- Slag handling facilities etc.

Rolling Mill:

A combination of flat and long product mill is proposed for the project. In flat product segment hot rolled coils (HRC) and plates has been envisaged. HRC shall be produced through latest generation of Thin Slab Casting and Rolling (TSCR) and would be further processed in both proposed new cold rolling complex, and expansion of existing cold rolling complex. Plates would be produced in a dedicated new plate mill. In long product segment, bar, rods, wire rods, medium sections and heavy sections would be produced through new bar and rod mill, wire rod mill, re-bar mill and medium and heavy section mill.

Flat products:

Based on the product-mix and the production programme, the following mills have been considered for production of flat products:

Thin slab casting and rolling mill (TSCR): The latest generation of thin slab casting and rolling mill has been envisaged for a production of around 3.5 million tons of hot rolled coils.

Liquid steel from the steel melt shop would be used as input for the thin slab caster of TSCR. The HRC produced would have the following specification:

Width, mm	..	800-1,600
Thickness, mm	..	0.8 – 12.6
Coil weight (max), ton	..	42

Liquid steel would be transferred in ladles from steel melt shop to the TSCR, which would comprise of the following major facilities:

- a) Thin slab casters,
- b) Pendulum shears at casters exit ,
- c) Tunnel furnace,

- i) Pendulum shear at entry of mill,
- ii) De-scaling system,
- iii) Group of stands.

- iv) Run-out roller table,
- v) Laminar cooling system,
- vi) Down coilers,
- vii) Coil conveyor system (with inspection & sampling station, coil strapping, coil weighing and coil marking machine).

However, the line configuration of TSCR would be finalised after the selection of technology supplier. Apart from the above, the shop would be provided with roll shop, handling facilities, auxiliary and ancillary facilities.

Cold Rolling Mill Complex:

The process flow of the cold rolling mill complex is briefly described below:

- a) Hot rolled coils shall be de-scaled, pickled and subsequently cold rolled to the required thickness in a coupled continuous pickling and tandem cold rolling mill (PL-TCM) of 2.0 MTPA capacity.
- b) 1.2 MTPA of full hard cold rolled (FHCR) shall be used for production of continuous annealed sheet in coil form through continuous annealing line.
- c) Remaining 0.7 MTPA of FHCR coils shall be processed through continuous hot dip galvanizing lines for production of galvanized coils.
- d) Approximate 25 per cent of the annealed coil and galvanized coil shall be passed through recoiling and inspection line for further inspection and salvaging.
- e) Total product of CRM shall be properly packed and delivered to the dispatch yard through two automatic coil packaging line.
- f) For production of narrow and wide cold rolled sheet, cut-to-length line and slitting lines are proposed to be installed.

Production facilities:

The cold rolling mill complex shall comprise the following production facilities:

- a) One continuous coupled pickling line and tandem cold rolling mill (PL-TCM) of 2.0 MTPA capacity for production of cold rolled coils with matching capacity of Acid regeneration plant.
- b) One continuous annealing line (CAL) of 1.2 MTPA capacity.
- c) Two continuous hot dip galvanizing line (CGL). One 0.4 MTPA capacity and other of 0.3 MTPA capacity.
- d) Three Recoiling and inspection line (RCL)
- e) Two fully automatic coil packaging lines (CPL). One for annealed product and other for galvanized product.
- f) Two cut-to-length line and two slitting line for production of cold rolled sheet.

A new cold rolling mill complex of 0.8 MTPA capacity is proposed. The complex comprises of following major facilities:

- i) One pickling line
- ii) One twin stand reversing cold rolling mill
- iii) One electrolytic cleaning line
- iv) Batch annealing furnaces
- v) One skin pass mill
- vi) Two continuous hot dip galvanizing line (CGL)
- vii) One cut-to-length line and slitting line each

New Stainless steel complex of 500,000 TPA capacity comprises of following facilities:

- a) One hot rolled coil slitting line

- b) One hot rolled annealing and pickling line
- c) Two 20-Hi cold rolling mills
- d) Two cold rolled annealing and pickling line
- e) One bright annealing line
- f) One strip grinding line
- g) One skin pass mill
- h) Two slitting lines and cut-to-length lines each

The input stainless steel hot rolled coil would be available from existing hot strip mill.

In addition to the new cold rolling mill complex indicated above, capacity augmentation of existing cold rolling mill complex from 0.6 MTPA to 1.2 MTPA is proposed. The product mix includes electrical steel (CRNO grade) along with normal carbon steel. The capacity augmentation includes following facilities:

- a) Pickling line
- b) Two reversing cold rolling mill (one each for normal carbon steel and electrical steel)
- c) Annealing coating line for electrical steel
- d) Two continuous hot dip galvanizing line (CGL)
- e) One colour coating line

Plate Mill:

A plate mill is proposed for production of 1.2 MTPA of plates, with following specification:

Plate thickness, mm	..	8 – 120
Width, m	..	4 (max.)
Length, m	..	5 – 12.5

The major facilities of the plate mill comprises of:

- a) Reheating furnace
- b) High pressure descaler
- c) Reversing mill stand

- d) Plate leveler
- e) Plate cooling facilities
- f) Cooling beds
- g) Finishing facilities (i.e. UST machine, side trimmer, leveler, shears, normalising furnace, marking machine etc.)

Long Products:

For production of bar, rod, rebar, medium sections and heavy sections, following mills have been considered:

- a) Bar and rod mill of 400,000 TPA capacity for production of bars and rod in the diameter range of 20 to 100 mm in straight form.
- b) Wire rod mill of 600,000 TPA capacity for production of wire rod in the diameter range of 5.5 to 20 mm in coil form.
- c) Rebar mill of 1,200,000 TPA capacity for production of rebars in the diameter range of 8 to 50 mm in straight form.
- d) Medium and heavy section mill for production of medium and heavy sections

Input material i.e. billet, bloom and beam blank would be available from steel melt shop.

Raw material handling system:

Materials would be stored in the respective storage area by stacker and travelling tripper. Storage of 30 days for each material has been considered at plant. Open storage yard has been considered for all the materials except PCI which would be kept under covered storage area.

Dispatch of raw materials to the various consuming units would be done mainly through conveyor system. The following facilities have been considered for raw material handling system:

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- PLC
- Belt weighing system
- Belt changing facility
- Maintenance facility
- Air conditioning and ventilation
- Pollution control system
- Sampling system

Coke Oven and By-Product Plant: Annual requirement of different grades of coal for coke production for the expansion are as follows:

Imported Hard Coking Coal, TPA	462,100
Imported Semi Soft Coking Coal, TPA	1,733,000
Imported Weakly Caking Coal, TPA	115,500

Sinter Plant: The annual input material consumption for SP- 4, 5 and 6 is given below.

Materials	Annual Consumption (TPY)	
	SP -4	SP -5 / SP - 6
Iron ore fines	1,693,800	3,618,300
Limestone fines	205,000	438,000
Dolomite fines	116,900	249,700
Flue dust	15,300	32,800
Mill scale	28,700	61,400
Calcined lime fines	28,700	61,400
Coke breeze	120,700	257,900

(Quantities are approximate net input for sinter plant on net and dry basis)

The typical analyses of input raw materials (dry basis) for sinter production are given below.

Raw Materials	Fe (%)	SiO ₂ (%)	Al ₂ O ₃ (%)	CaO (%)	MgO (%)	LOI
I/O fines	62.50	4.00	3.50	0.50	0.60	3.50

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Limestone		4.50	3.00	50.00	1.00	35.00
Lime		2.75	0.50	87.50	2.00	
Dolomite		4.00	0.40	24.00	18.00	

Pellet Plant: The annual consumption of input materials on dry and net basis for production of product pellet after each Stage is given in table.

Material	Quantity, tpa After Stage-I
Pellet feed concentrate (iron ore)	7,091,000
Non-coking coal	217,000
Bentonite	70,000
Dolomite	105,000

(1) Quantities are on net and dry basis.

The typical analyses of input raw materials (dry basis) for pellet production are given below.

Raw Materials	Fe (%)	SiO₂ (%)	Al₂O₃ (%)	CaO (%)	MgO (%)	LOI
I/O fines	65.10	2.50	2.00	-	-	3.50
Limestone		4.50	3.00	50.00	1.00	35.00
Bentonite	2.50	53.00	15.00	1.60	1.50	
Dolomite		4.00	0.40	24.00	18.00	

Blast Furnace: The requirement of annual input materials on dry and net basis for three blast furnace is as follows:

	Material	Annual requirement
		<i>tons/year</i>
BF1	Charge sinter	3,956,400
	Pellet	644,000
	Charge Coke	1,181,600
	PCI coal	420,000

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BF2	Charge sinter	5,086,800
	Pellet	828,000
	Charge Coke	1,519,200
	PCI coal	540,000
BF3	Charge sinter	6,075,900
	Pellet	989,000
	Charge Coke	1,814,600
	PCI coal	645,000

(Quantities are on net and dry basis)

The typical analyses of input raw materials (dry basis) for hot metal production are given below.

Raw Materials	Fe (%)	SiO ₂ (%)	Al ₂ O ₃ (%)	CaO (%)	MgO (%)	LOI
I/O fines	65.10	2.50	2.00	0.50	-	3.50
Limestone		4.50	3.00	50.00	1.00	35.00
Quartzite	0.60	93.85	1.50			
Dolomite		4.00	0.40	24.00	18.00	

COG based DR Plant: The annual requirement of input materials on dry and net basis is as follows.

Material	Annual requirement
	tons/year
Iron ore pellets	2,400,000
Lime	3,600

The tentative composition of iron ore pellets is as follows:

Fe (T), %	..	65-66
SiO ₂ +Al ₂ O ₃ , %	..	5-6
P, %	..	0.05
S, %	..	0.015

Basic Oxygen Furnace: Estimated requirement of major raw materials for BOF converters is indicated below:

Annual Quantity
(TPY)

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Hot metal (after desulphurisation)	..	6,336,000
Scrap	..	333,500
Calcined lime	..	507,400
Calcined dolomite	..	90,000
Iron ore	..	119,400

In addition, ferro manganese, ferro silicon, silicon manganese or other ferro alloys, aluminium would be used for deoxidising and alloying of steel. The steel-melt shop would also require gases like oxygen, nitrogen, argon, compressed air and steam along with water and power. The requirement of gas would be met from oxygen plant with buffer vessels and pressure reducing station. Oxygen consumption of 60 Nm³ per ton of liquid steel has been considered.

Resource Optimisation/Recycle & Reuse envisaged in the project:

One of the most important resources is energy and it is proposed to utilise the off gases from the Project to the extent feasible, for generation of power, thus optimising the utilisation of energy for the Project. In addition, adopting a compact layout for the Project would enable to optimise the utilisation of land, which is another critical resource. By utilising the fines and scrap generated during the process within the project for the production process, usage of raw materials is optimised. Water consumption would also be optimised by treatment of water to the extent possible and recycle of treated water as make-up in the network.

Availability of Water and Power:

Water: The total make-up water requirement for the proposed expansion plant shall be around 5305 cum/hr out of which 65 cum/hr shall be soft water requirement, 90 cum/hr shall be DM water requirement and 80 cum/hr shall be used for drinking and sanitation purpose. The source of water for the existing steel plant is river Brahmani from where raw water is pumped and stored in a raw water storage tank. BSL has a permission of withdrawal of 90 cusec water from River Brahmani from the concerned Authority. At present, only 45 cusec of water is withdrawn from the River. Hence, the remaining 45 cusec is available for the proposed expansion.

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Considering treatment plant losses, raw water at about 5410 cum/hr would be pumped from raw water reservoir to a new raw water treatment plant. Treated raw water at about 5305 cum/hr would be pumped to on-ground make-up water storage tank. For meeting the industrial quality make-up water requirement of the proposed expansion plant, make-up water at a rate of 5070 cum/hr would be pumped to an overhead tank from where same would be distributed to various consumers. Make-up water at a rate of 90 cum/hr shall be pumped to de-mineralised plant for production of 86 cum/hr DM make-up water. Make-up water at a rate of 65 cum/hr is also pumped to softening plant for production of soft make-up water at a rate of 63 cum/hr. Make-up water at a rate of 80 cum/hr is also sent to pressure filters and on-line chlorinators for making it suitable for drinking purpose.

Power: The overall power requirement for the plant after implementation of the proposed project is estimated to be about 1632 MW (15-min maximum demand). The annual electrical energy consumption is estimated to be about 10649 Million units.

Power required for the plant after implementation of the project is proposed to be met from the following two sources:

- i) Captive power generation units.
- ii) Grid power supply system.

It is envisaged that the off-gases from various in-plant processes would be able to generate about 638 MW net sent-out power considering their availability. Balance 994 MW power would be drawn from the grid power supply system. However, the drawal of power from grid power supply system will increase to about 1159 MW for plant operation at rated capacity in case of non-availability of the single largest power generating unit of the captive power plant.

Waste Generation and Management:

Wastewater generation & Management: With reference to the water balance diagram 11388-97A-000-WTS-0001 attached with this report, the effluents has been identified and are provided below:

Type of effluent	Estimated quantity of wastewater release, cum/hr	Treatment plan
Cooling Tower Blow down	727	Treated in Effluent treatment plant (ETP)

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		before adding to fresh up circuit
STP effluent	60	Further treated in ETP
BOD plant effluent	125	Treated in ETP
Treated effluent from CRM	96	Treated in ETP
Treated effluent from CPP	250	Treated in ETP

Cooling tower blow downs, treated effluent from BOD plant of Coke ovens, CRM would be taken to the ETP for further treatment and reuse as make-up water. The power plant effluent would be the backwash of DM water plant, which would be neutralized in the neutralization pit and the treated waste water would be further treated in ETP.

The plant sanitary waste water including canteen effluent would be treated in a Sewage Treatment Plant (STP) for separation of floating oil and reduction of BOD level and the treated effluent would be sent to ETP for further treatment and use.

Solid Waste Management: The estimated generation of the solid wastes for the proposed augmentation is tabulated below:

Solid wastes	Expected generation (tpa)	Management Scheme
BF Slag	4,173,,000	The slag is granulated in Slag granulation plant and sold off to potential buyers for manufacture of cement in Cement plant.
BOF Slag	1,265,000	Around 35% metallic recovery and 15% recovery of non-metallics, used in Sinter and BOF. Balance would be utilized as railway ballast, in construction aggregate, after weathering
EAF Slag	718,480	EAF Slag would be used for construction purposes and road making.
LF Slag	115,344	LF Slag would be used for construction purposes.
Flue Dusts	121,000	100% reuse in Sinter Plant
Mill Scales/ Sludge	226,600	100% reuse in Sinter Plant after de-oiling

There would be a number of solid by-products like BF, BOF, EAF and LF slags, mill scales, mill sludge, caster and mill scrap, refractory debris, flue dusts etc. generated from the proposed steel plant. BF slag would be granulated for utilization in the cement

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manufacture. The iron scrap generated from the caster lines would be recycled to BOF. Mill scales, flue dusts and part of the BOF slag would be utilized in sinter plant after recovery of the metallic portion in slag. The balance BOF slag would require weathering, after which it would be used for applications such as railway ballast, construction aggregate, etc. Mill scales and mill sludge would undergo de-oiling before reuse in sinter plant to prevent any damage to the ESPs and reduce dioxin and furan emissions. Other solid wastes would be stored temporarily in the earmarked storage area within the plant boundary till new users are found out for the same.

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Chapter - 3

Site analysis:

The existing integrated steel plant is located in Narendrapur, Meramandali, district Dhenkanal, Odisha.

Connectivity:

Road Connectivity: National Highway (NH) 42 passes from the northern side of the plant site.

Rail Linkage: The existing steel plant is located about 5 km from Meramandali Railway Stations (on Angul - Cuttack broad gauge main railway line of East Coast Railway)

Airport:

Nearest airport is at Bhubaneswar, about 130 km from Meramandali.

Sea Port:

The nearest port is Paradeep, which is more than 215 km away.

Land Form, Land Use And Land Ownership:

BSL's existing steel plant is located within their acquired area of 1600 acres. The expansion would require around 1632 acres of additional land which is adjacent to the existing plant and is located in its south. The required land has been identified by BSL. It comprises both of Government and Private land. Out of the requirement of 1632 acres, final application to IDCO against 500 acres is under process. Planning of acquisition of the remaining area is under process.

The present land use is basically built-up area for industrial purpose with greenbelt, water reservoir and solid waste processing & storage area.

Topography:

The district can be broadly divided into four natural physiographic units. These are (i) Southern Mountainous Region, (ii) Eastern Valley and Plain, (iii) Central Undulating Plain and (iv) Northern Mountainous Region.

The study area is majorly a plain area falling in the Central Undulating Plain which is characterized by undulating to broad flat topography with low-lying hills having flat top. Part of the study area in the south and south-east lies in the Southern Mountainous Region which comprises of hill ranges trending NNW-ESE. The hill slopes are covered with moderate to dense forest. The study area has an elevation varying from 45 m to 280 m above mean sea level.

In the study area drainage is controlled by Brahmani river as it passes through north eastern part of the area within 10 km radius area of the project. Many other small and big nalas from west and south direction join Brahmani River and form the catchment of the river basin.

The topographic map of the region can be seen from Fig 3-1. (The blue circle indicates the plant location)

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Fig. 0-1 - Topography of the study area

Existing Land Use:

The reconnaissance revealed that the land around the proposed site (buffer zone) is dominated by Agricultural Land, Industrial Area and water bodies.

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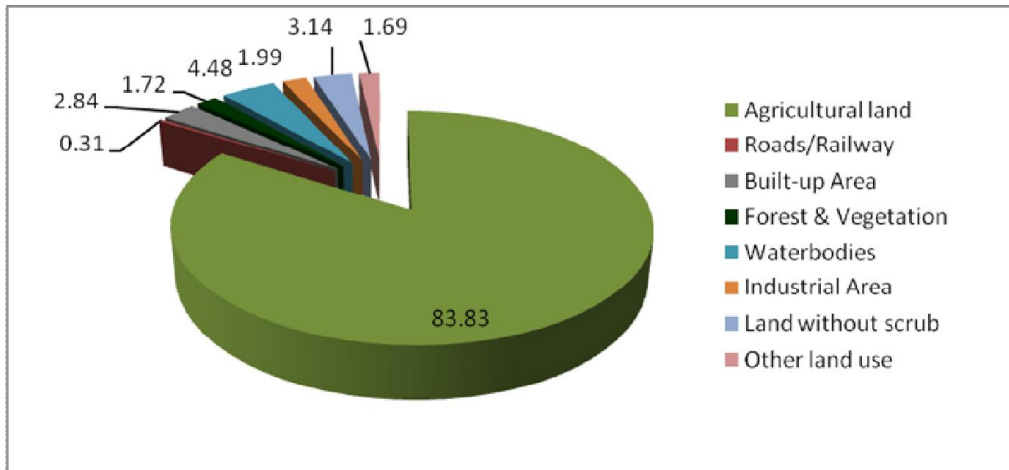


Fig. 0-2 - Existing land use of study area

The area around the project site is mainly dominated by agricultural land (~83.83%). Other key components of land use are water bodies, Industrial area, built-up area, etc.

Soil:

The major part of the district is covered by red sandy soil, red loamy soil, red gravelly and old alluvial soils. In the study area the soil pH is reported to be majorly acidic to neutral. As per available report of earlier studies, the tested soil samples collected from different location pertaining to the study area have nutrients ranging from low to high concentration. Organic carbon has been reported to be of medium to high concentration. Available Phosphorus and Nitrogen are reported to be in low to medium concentration, whereas availability of Potassium varies from medium to high.

Climatic Conditions:

The Climate of the region is hot and dry sub humid type with an average annual rainfall of 1287 mm. The average annual dry-bulb temperature is in the tune of about 27° C. The average maximum and minimum relative humidity is about 74% & 54% respectively. The average wind speed is about 6.7 kmph.

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Social Infrastructure Available:

- Meramandali is situated on the Cuttack-Sambalpur road (NH 42) and on Angul – Cuttack broad gauge main railway line of East Coast Railway , thereby facilitating connection with economic centres and remote villages
- Meramandali is situated in the Dhenkanal district, which has its administrative headquarters in the Dhenkanal town. This district is characterized by 4 urban bodies, 8 tehsils, 198 gram panchayats and 15 police stations
- Bhushan Steel Limited (BSL) has set up an super specialty hospital in the Integrated Township of Meramundali, Dhenkanal. The Govt. Hospital and Private Hospitals are located in Angul, 19 Km. from Bhushan Residential Township.
- With regard to education, several renowned professional institutions such as Indian Institutes of Mass Communication (IIMC), Dhenkanal College and Dhenkanal Law College are present in the district. There are several middle level educational institutions such as Brajanath Badajena High School, Sarangadhar High School, Kamakhyanager and Jawahar Navodaya Vidyalaya. A Nursery school managed by Company is located within the Residential Township. There are four no. of schools located in Angul. Other major technical institutes are Indira Gandhi Institute of technology, Govt. Polytechnic, Dhenkanal, Govt. ITI, Synergy Institute of Engineering and Technology, Odisha Institute of Engineering and Technology and Pathani Samanta Institute of Engineering and Technology.
- There is a Branch of State Bank of India is located within premises of Bhushan Steel. There are two (2) nos. of ATM's located inside the Residential Township. There is an air conditioned shopping mall inside the Township to cater the daily needs of people residing inside the Residential Township.

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Chapter - 4

Planning Concept:

The plant site is located 18 km from Angul and 42 km from Dhenkanal. The existing plant has a township in congruence. The total project area for the expansion would be around 1632 acre, where plant units would be installed along with other auxiliary and ancillary units.

The major industries in the study area are Navbharat Ferro Alloys, Rungta Ferro Alloys, Hind Metals, BRG Steel, etc.

Population Projection:

Meramandali village is located in Motunga area of Dhenkanal district, Orissa. As per Population Census of 2011, the village has population of 1377 and comprises of 351 households. Out of the total population, 701 are males while 676 are females. The average Sex Ratio of the village is 964. This ratio is lower than that of Orissa state average of 979. The population of children with age 0-6 is 136 representing 9.88 % of total population of village.

Meramandali village has higher literacy rate compared to Orissa. In 2011, literacy rate of Meramandali village was 76.95 % (male literacy stands at 87.78 % while female literacy rate was 65.79 %) compared to 72.87 % of Orissa.

The population of Meramandali village in the years 2001 and 2011 are 1223 & 1377 respectively. The decadal growth is of 12.59 %. Thus the projected population of Meramandali village for the year 2016 is around 1457.

Land use planning:

The total area of plant site for the proposed expansion is around 1632 acres. The following units will be located inside the plant boundary:

- Raw material yard
- Coke Oven

- Sinter plant
- Blast Furnace
- SMS (Steel Melt Shop) with Casters
- Oxygen Plant
- Water Facilities
- Water reservoir
- Power Plant

The total greenbelt would be about 539 acres. The total area would also include space for transportation, railway tracks, stores, canteen, administrative buildings, workshop etc.

Assessment of Infrastructure Demand:
(Physical and Social)

- Vocational and Industrial Training to youth and labourers for enhancing skills in order to qualify for better employment opportunities
- Provision for strong environmental safeguard measures especially with regard to air and water quality
- Augmentation of medical facilities in the Project Influence Area
- Provision of sanitation and drinking water facilities in surrounding villages
- Demand for regular supply of electricity in the households of the surrounding villages
- Support towards developing social housing schemes for rural poor

Chapter - 5

Proposed infrastructure:

Industrial Area:

The total area plant area for the proposed project is about 1632 acre, within the boundary of which the expansion would take place. The process units, water reservoir, solid waste processing & storage area for the existing facilities as well as the proposed would be housed within this area of 1632 acre.

Residential Area:

BSL already has an existing township for workers and other staffs of the steel plant, which has 1442 dwelling units in a total area of about 50 acre of township. The township is well endowed with basic infrastructural facilities. A small hospital run by the company is located within the township. There is a 24 * 7 medicine shop managed by Apollo Pharmaceutical located inside the Residential Township. A Nursery school managed by Company is located within the Residential Township. There are four no. of schools located in Angul. There are Fresh Water Treatment Plant, Sewage Treatment Plant with Sewage Line, Incinerator with Chimney and Strom water Drainage System, exclusively for the Residential Township to take proper care of health & hygiene of the residents living inside the Township. There is centralized air conditioned system with extended network for all the buildings inside the Residential Township. There are RCC roads inside the Township.

Greenbelt:

It is obligatory to develop dense greenbelt area in proposed project plant as per the Regulations. Green belt is proposed to develop in approx 33% of the total area. This would not only prevent the fugitive dust emissions but also improve the peripheral appearance of the plant from aesthetics point of view. Unpaved areas, if any, within the plant boundary would be provided with grass cover.

Following are the proposed species of trees which may be planned to be planted as greenbelt:

- Neem

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- Kendu
- Babul
- Siris
- Banyan
- Aam

Proposed Social Infrastructure:

The expansion project entails provision of the following in the Project Influence Area:

- Organization of a community programme to ensure effective power distribution in each household in the surrounding villages
- Development of roads and extension of the existing networks to aid connection to remote areas & economic centers of state and to further facilitate mobility of the rural population
- Initiation of social housing schemes in the surrounding village to meet the needs of the local poor
- Provision of drinking water facilities in surrounding villages through construction of hand pumps, ponds and over head tanks in surrounding villages
- Provision of sanitation facilities amongst the surrounding communities
- Increase of greenery development in and around the Project Influence Area (PIA)
- Launch of a local community-based Rainwater Harvesting Programme to capture at least an additional 1% of local rain resources every year
- Construction of Bus Stops/rest shelters for villagers
- Organization of Annual Eye camps and provision of Ambulance services and allied medical facilities for peripheral villagers
- Building of a high school and a community centre for the local population. Additionally extending support to upgrade aganwadis in the surrounding villages and awarding scholarships to local meritorious students
- Extend support to technical training institutes such as ITI in collaboration with state authority

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- Develop vocational training of local women to ensure their economic upliftment
- Extend technical aid to farmers and livelihood schemes for the local employable population
- All new units under expansion would be environmentally audited to meet the pollution control standards. Additionally occupational health set up including regular medical monitoring of employees would be undertaken

Connectivity:

The proposed project site has good connectivity in terms of both road and railway transport. National Highway (NH) 42 passes from the northern side of the plant site. The existing steel plant is located about 5 km from Meramandali Railway Stations (on Angul – Cuttack broad gauge main railway line of East Coast Railway). Nearest airport is at Bhubaneswar, about 130 km from Meramandali. The nearest port is Paradeep, which is more than 215 km away.

Drinking Water Management & Sewage System:

The requirement of drinking water for the proposed expansion would be 80 cum/hr. The source of water is River Brahmani. BSL has the permission from the Authority to withdraw 90 cusec water; though at present only 45 cusec is withdrawn. The drinking water system would cater to the water requirements of (i) plant personnel for drinking and sanitary purposes, (ii) central and area laboratories, (iii) canteen and (iv) other miscellaneous users in the plant. Necessary treatment facility shall be considered to generate potable grade water from make-up water. A 80 cum overhead tank is envisaged to meet the drinking water requirements of the plant.

The faecal sewerage network of the plant would receive effluent from the administrative building complex, canteens, and toilets of various shops, office buildings, laboratories, etc. located in different areas of the plant. The sewage water received from the above areas would be fed to a Sewage Treatment Plant (STP) for treatment.

Solid Waste Management:

There would be a number of solid by-products like BF, BOF, EAF and LF slags, mill scales, mill sludge, caster and mill scrap, refractory debris, flue dusts etc. generated from the proposed steel plant. BF slag would be granulated for use in cement making. The iron scrap generated from the caster lines would be recycled to BOF. Mill scales, flue dusts and part of the BOF slag would be utilized in sinter plant after recovery of the metallic portion in slag. The balance BOF slag would require weathering, after which it would be used for applications such as railway ballast, construction aggregate, soil conditioner etc. EAF slag would be used for construction purposes. Mill scales and mill sludge would undergo de-oiling before reuse in sinter plant to prevent any damage to the ESPs and reduce dioxin and furan emissions. Other solid wastes would be dumped temporarily in the earmarked dump area within the plant boundary till new users are found out for the same.

Organic wastes would be produced from the proposed project in tune of about 6.5 ton/day and would be handled separately by the entrusted agency.

Power Requirement & Supply/Source:

Power required for the plant after implementation of the project is proposed to be met from the following two sources:

- i) Captive power generation units.
- ii) Grid power supply system.

The overall power requirement for the plant after implementation of the proposed project is estimated to be about 1632 MW (15-min maximum demand). The annual electrical energy consumption is estimated to be about 10649 Million units. It is envisaged that the off-gases from various in-plant processes would be able to generate about 638 MW net sent-out power considering their availability. Balance 994 MW power would be drawn from the grid power supply system. However, the drawal of power from grid power supply system will increase to about 1159 MW for plant operation at rated capacity in case of non-availability of the single largest power generating unit of the captive power plant.

Chapter - 6

Rehabilitation & Resettlement:

The expansion project has a land requirement of 1,632 acres. The said land has been identified by BSL. It comprises both of Government and Private land. Out of the requirement of 1,632 acres, final application to IDCO against 500 acres is under process. Planning of acquisition of the remaining area is also under process. The current plan of acquisition of 1,632 acres does not entail displacement of any human settlement. Hence at this stage there are no identifiable issues relating to Rehabilitation and Resettlement (R&R).

Chapter - 7

Implementation Schedule:

It is envisaged that the project for Stage-I will be completed within a period of 44 months from “Go-Ahead date” and Stage-II will be completed within a period of 84 months from “Go-Ahead date” considering that construction work at site for various plant facilities of Stage-II will start after commissioning of plant facilities of Stage-I.

The schedule has been developed based on the estimated capacity of various plant facilities and shortest time required to complete project activities of various plant facilities of Stage #I and Stage #II.

The preliminary overall implementation schedule for Stage #1 and Stage #II commissioning of various plant facilities of the project is shown in the form of a bar chart which is enclosed with the Report.

Completion time of major plant facilities as shown in the schedules are indicated below:-

Stage-1:

Area	Commissioning Period from LOI/PO
Coke Oven	39 months
Sinter Plant	41 months
Pellet Plant	41 months
Blast Furnace	42 months
Steel Melt Shop	42.5 months
Power Plant	43 months
Cold Rolling Mill	44 months

Stage-2:

Area	Commissioning Period from LOI/PO
Coke Oven	74 months
Sinter Plant	76 months
Blast Furnace-1	71 months
Blast Furnace-2	80 months
Steel Melt Shop (SMS-1B (BOF-1,2))	71.5-80.5 months

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Mill (Plate Mill)	81 months
COG Based MIDREX Plant	78 months
Steel Melt Shop (SMS-1C)	79 months
Mill (Medium, Heavy Section, TMT, Wire Rod)	80-84 months
Bar and Rod Mill	82 months
Stainless Steel Complex	77 months

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Chapter - 8

Analysis of Proposal:

Financial Benefits of the Project:

The financial benefits accrued from the project would not only profit the owners but also strengthen the economy of the state due to earning from taxes and duties from the Plant.

Social Benefits:

BSL aims at continued social commitment towards the local community. The organization carries out their social benefit plan for:

- Promotion of Education and up gradation of local aganwadis
- Increase of Employment opportunities by promoting schemes on Livelihood & Income Generation
- Promotion of Health and Sanitation facilities
- Protection of Environment, Water & Energy resources & Sustainability
- Building Community Infrastructure
- Providing Relief Measures for redressal of Calamities, disasters
- Enhancing Vocational Skills

The proposed expansion project with increased investment would augment the above mentioned activities and would promote:

- Improvement in the socio-economic status of the region by generation of direct and indirect employment opportunities
- Development of ancillary small and medium industries, trade & commercial establishments and local entrepreneurship

Executive Summary

This Summary presents a brief outline of the Pre-feasibility report for the proposed plan for expansion of their existing integrated iron and steel making facilities by Bhushan Steel limited (BSL) at Meramandali, Odisha.

1. The existing facilities of BSL at Meramandali, Odisha already produces 5.6 MTPA crude steel. As a part of business escalation and in view of growing demand for various steel products, BSL is proposing to augment their production of crude steel from 5.6 MTPA to 12.8 MTPA crude steel.

2. The production plan of the proposed expansion, that would take place in two stages is as follows:

Hot Metal	..	10.7	MTPA
DRI	..	3.1	MTPA
Liquid Steel	..	13.13	MTPA
Crude Steel	..	12.8	MTPA
Saleable Products	..	12.20	MTPA
Bar & Wire Rods	-	0.4	MTPA
Medium & Heavy Section	-	0.8	MTPA
TMT Rebars	-	1.2	MTPA
Wire Rods	-	0.6	MTPA
Plates	-	1.2	MTPA
Hot Rolled Coils	-	3.5	MTPA
Cold Rolled Products	-	4.0	MTPA
Stainless Steel Products	-	0.5	MTPA

3. The existing integrated steel plant is located in Narendrapur, Meramandali, district Dhenkanal, Odisha, adjacent to which the expansion would be taking place. The plant site is 18 km from Angul and 42 km from Dhenkanal. National Highway 42 runs along the northern side of plant site.

4. The proposed production of liquid steel and subsequent rolling would be accomplished via Blast Furnace (BF)-DR Plant -Basic Oxygen Furnace (BOF)-Electric Arc Furnace (EAF)Induction Furnace (IF)-Caster route, followed by Hot & Cold rolling. The production facilities would be adequately supported by necessary auxiliary facilities such as raw materials unloading and storage, proportioning of raw

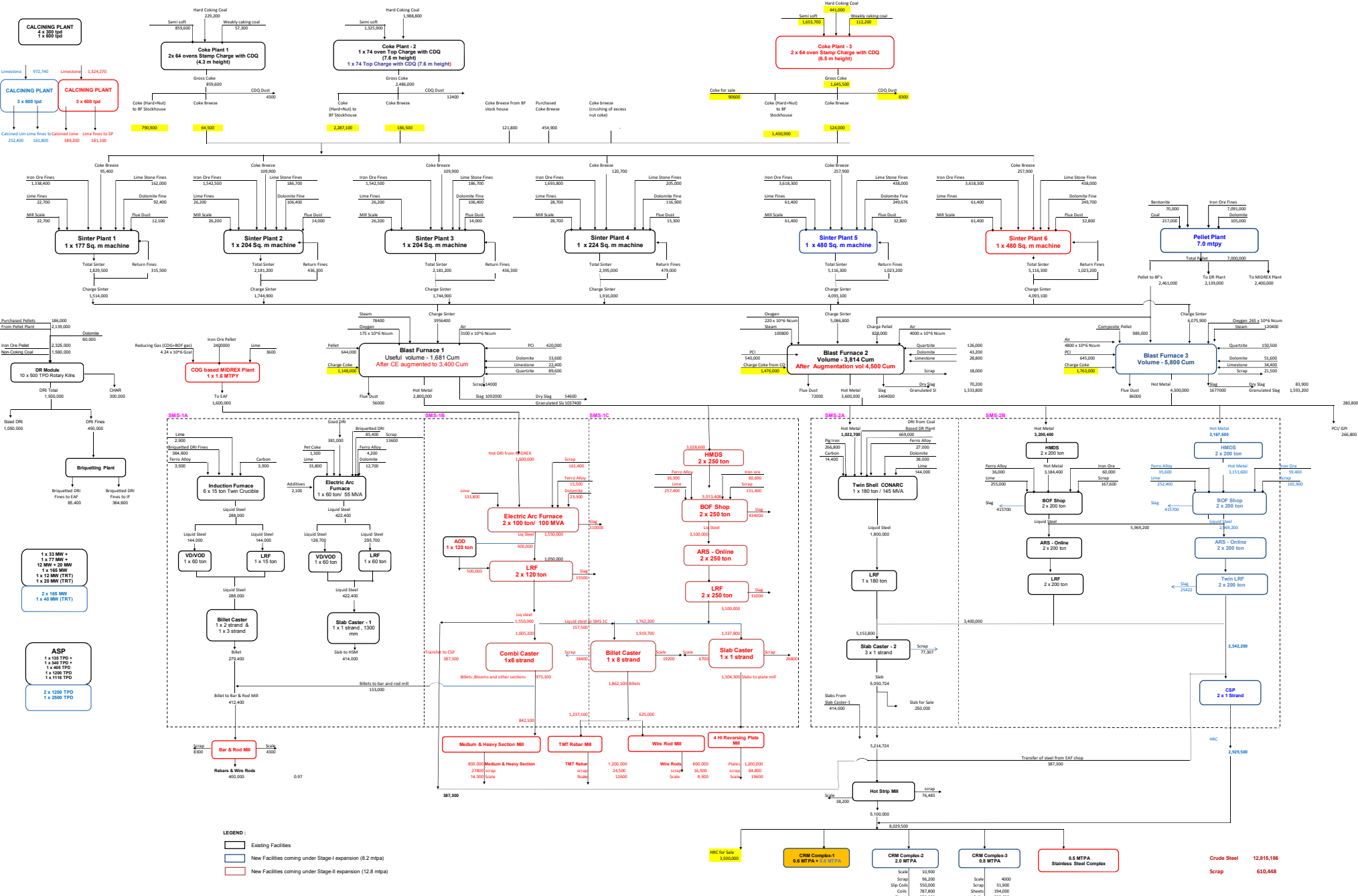
materials, electric power receiving and distribution stations, various utility facilities, water treatment and distribution system, etc.

5. The total make-up water requirement for the proposed expansion plant shall be around 5305 cum/hr. BSL has a permission of withdrawal of 90 cusec water from River Brahmani from the concerned Authority. At present, only 45 cusec of water is withdrawn from the River. Hence, the remaining 45 cusec is available for the proposed expansion.
6. The overall power requirement for the plant after implementation of the proposed project is estimated to be about 1632 MW, which would be sourced from captive generation and Grid Power supply system.
7. BSL's existing steel plant is located within their acquired area of 1600 acres. The expansion would require around 1632 acres of additional land which is adjacent to the existing plant and is located in its south. This land area will not only accommodate the facilities, but efforts would be made to develop 33% greenbelt as per regulatory requirements.
8. The proposed production facilities would generate various pollutants in form of air emission, wastewater discharge, solid waste, etc, which would be managed by adopting state-of-art technologies, installation of control devices and treatment plants and by maximum recycling/reuse of the wastes, wherever applicable.
9. BSL has been proactive in their approach towards peripheral social development since inception. They have not only developed schools and training centres, but also provided medical help and have greatly supported in overall development of the local people. It is expected that they would continue to contribute towards the social development.
10. It is envisaged that the project for Stage-I will be completed within a period of 44 months from "Go-Ahead date" and Stage-II will be completed within a period of 84 months from "Go-Ahead date".

11. It is also expected that the proposed expansion project would augment the existing social developmental activities and further promote - i) Improvement in the socio-economic status of the region by generation of direct and indirect employment opportunities, ii) Development of ancillary small and medium industries, trade & commercial establishments and local entrepreneurship, iii) Promotion of Health & sanitation facilities, iv) development of community infrastructure.

Project Cost:

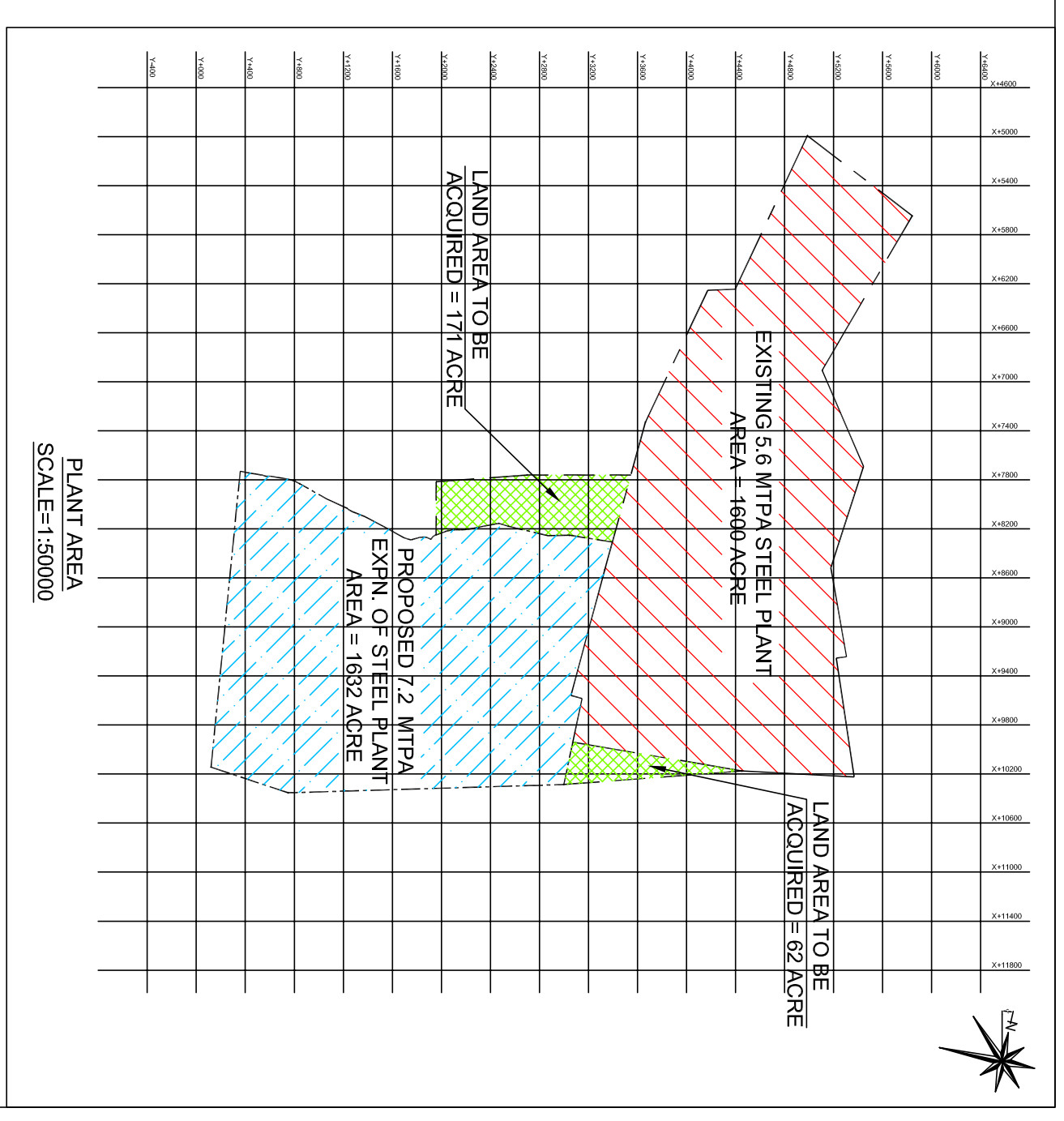
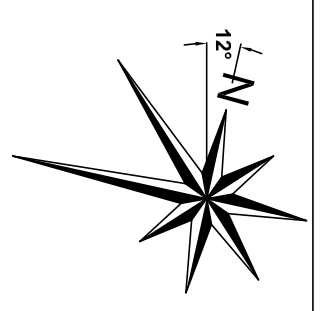
The infrastructural facilities built in 5.6 mtpa stage are available for proposed expansion of Steel Plant in Angul. The some of future plant facilities in proposed expansion envisaged on BOO (Build, Own & Operate) basis. The estimated capital cost for proposed Brownfield Expansion Project currently worked out to be around **INR 19,860 crores** in today's market situation. However, the overall project cost will be reviewed during implementation stage. The estimated cost includes the cost of Plant and Machinery (as erected) including civil and structural work, Land and enabling work, additional infrastructure facilities, Design, engineering and administration during construction and contingency costs.



LEGEND:
 Existing Facilities
 New Facilities coming under Stage I expansion (8.2 mtpa)
 New Facilities coming under Stage II expansion (12.8 mtpa)

Crude Steel 12,815,186
Scrap 610,448

HRc for Sale 3,900,000
CRM Complex-1 0.6 MTPA + 2.7 MTPA
CRM Complex-2 2.0 MTPA
CRM Complex-3 0.8 MTPA
S.M.T.P.A. Stainless Steel Complex

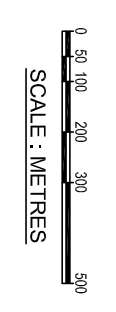


- LEGEND :-**
- 1. PROPOSED PLANT BOUNDARY SHOWN THUS.....
 - 2. PROPOSED UNIT SHOWN THUS.....
 - 3. PROPOSED ROAD SHOWN THUS.....
 - 4. PROPOSED RAILWAY TRACK SHOWN THUS.....
 - 5. PROPOSED GREEN BELT SHOWN THUS.....
 - 6. EXISTING PLANT BOUNDARY SHOWN THUS.....
 - 7. EXISTING UNIT SHOWN THUS.....
 - 8. EXISTING ROAD SHOWN THUS.....
 - 9. EXISTING RAILWAY TRACK SHOWN THUS.....
 - 10. PLANT BOUNDARY FOR PROPOSED LAND TO BE ACQUIRED SHOWN THUS.....

Y+6400 X+4600
 X+5000
 X+5400
 X+5800
 X+6200
 X+6600
 X+7000
 X+7400
 X+7800
 X+8200
 X+8600
 X+9000
 X+9400
 X+9800
 X+10200
 X+10600
 X+11000
 X+11400
 X+11800

Y+4000
 Y+4400
 Y+4800
 Y+5200
 Y+5600
 Y+6000
 Y+6400

NOTES :-
 ADDITIONAL LAND TO BE ACQUIRED FOR GREEN BELT.



DASTUR
 M. N. DASTUR & COMPANY (P) LTD.
 CONSULTING ENGINEERS, KOLKATA

FOR : **BHUSHAN STEEL LIMITED**
 MERAMANDALI

ENVIRONMENTAL IMPACT ASSESSMENT FOR
 EXPANSION OF STEEL PLANT FROM 5.6 TO 12.8 MTPA
 CRUDE STEEL AT DHERANKAL, ODISHA
 PLANT GENERAL LAYOUT
 (ALTERNATIVE-3)

DRAWN ANBC 22.02.2016
 APPROVED SCE 22.02.2016

11388-97A-000-1TL-0003

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