PRE-FEASIBILITY PROJECT REPORT

of

Proposed Ferro Alloys & Integrated Steel Plant

of

M/s Grace Industries Limited.

to be located

at

A-24 & Other, MIDC Industrial Area, Tadali Growth Centre,
Tadali, Dist. - Chandrapur
Maharashtra.

May -2015
1. Executive Summary

The proposed Ferro Alloys & Integrated Steel Plant will be located at Plot No. A-24 & Other, MIDC Tadali, Chandrapur, Maharashtra. Total land acquired for this project by Grace Industries Ltd (GIL) is 99.33 HaR (245.44 Acres) in which MIDC has leased 76.85 HaR land for this project to Grace Industries Ltd and company has purchased private land of 22.48 HaR adjacent to MIDC land. In MIDC Tadali, only 5 major industries are existing and in it sponge iron plant of Grace Industries Ltd is also existing.

The proposed site is accessible by State Highway No. 264 at crow fly distance of 2.15 km in NE. Nearest Railway Station is Tadali about 2.9 Km in N direction and nearest Airport is Sonegaon about 121.0 Km in NNW direction from existing Site as crow flies.

Nearest City is Chandrapur located at a crow fly distance of about 11.5 km in SE direction of the existing site. Wardha River is 7.5 km away towards West direction. Proposed project cost estimated is of Rs. 1200 Crores.

The major raw material required for the proposed Ferro Alloys & Integrated Steel Plant are Iron ore, Manganese Ore, Coal, Limestone etc.

The proposed Ferro Alloys & Integrated Steel Plant will be a enlargement project just adjacent to existing sponge iron plant of Grace Industries Limited, MIDC Tadali, Chandrapur, Maharashtra. The sponge iron produced in the existing plant will be utilized in the proposed project to manufacture steel products. The existing infrastructure facilities will help in successful implementation of proposed project. The proposed project will improve the viability of the existing sponge iron plant. Similarly, the group company has secondary steel plant and consuming ferro alloys in substantial quantity purchased from the market. GIL is planning to consume ferro alloys produced in the proposed project and in group company to increase the economy of group company and to earn greater revenue by selling remaining ferro alloy.

It is proposed to provide adequate air pollution control arrangements to all possible sources of proposed project to meet stringent norms. Waste gases of sponge iron plant will be utilized for captive power generation. Blast furnace gases will be utilized in reheating furnaces. Fugitive dust will be controlled by providing pulse jet bag filters to all transfer points. Dusts collected in pulse jet bag filters will be recycled to sinter plant. Majority of the solid wastes will be utilized for sinter manufacture.

Water requirement for the project will be sourced from MIDC water supply, which is also the source of the water for existing GIL plant. Industrial effluent generation will be very less. Effluent generated will be treated and used for green belt development.
Green belt development is in progress. Suitable plant species will be planted all along the internal road, raw material storage & handling, ash/dust prone areas. It is planned to plant saplings considering the parameters as type, height, leaf area, crown area, growing nature, water requirement etc. Green belt will be progressively developed on land.

The various aspects of the Pre-Feasibility Report as per MoEF Guidelines vide O.M. J-11013/41/2006-IA.II(I) dtd. 30-12-2010 are given in the subsequent sections.

2. **Introduction of the Project/Background Information**

   **(i) Identification of Project and Project Proponent**

   M/s. Grace Industries Limited (GIL) incorporated in August 2003 has Sponge Iron Plant at Plot No. A-23, MIDC, Tadali Industrial Area, Village - Tadali, Taluka & Dist. -Chandrapur. Total land area of this plot is 12.25 Ha (30.3 Acres). At present, 4 x 100 TPD sponge iron kilns are in operation to manufacture Sponge Iron @ 1,20,000 TPA & Char as a by-product using iron ore, coal & dolomite as raw material.

   Adjacent to existing set-up, the GIL has acquired the seven plots (A-24, A-29, A-30, A-30part, A-31 and D-14 & other) totaling land area as 76.85 ha (190 Acres) in MIDC, Tadali, Industrial Area, Village - Tadali, Taluka & Dist. -Chandrapur. In addition to this land, GIL has acquired 22.48 HaR (55.54 acres) private land. Now, GIL has planned a new project at these new plots & private land as Ferro Alloys Plant, Integrated Steel Plant comprising Mini Blast Furnace, Direct Reduced Iron Plant, Beneficiation of Iron Ore and Pelletization Plant, Steel Melt Shop (IF, EAF, LRF, AOD, VOD, Continuous Caster etc.), Rolling Mill, Producer gas Plant and Captive Power Plant for utilization of waste gases.

   The project proponents are well experienced in the integrated steel manufacturing sector as they are running primary steel plant (sponge iron plant), secondary steel plant (Induction Furnaces, AOD, Producer Gas Plant, Rolling Mill etc.), several steel rolling mills. They have also installed 33 MW captive power plant. All the plants are existing in Vidarbha region of Maharashtra.

   M/s. Grace Industries Limited (GIL) has excelled in both physical and financial performances within a short span of time of their inception. The directors along with key persons of the group are confident for the successful execution and operation of proposed Ferro Alloys & Integrated Steel Plant along with environmental conservation to be located adjacent to existing GIL sponge iron plant.

   **(ii) Brief description of nature of the project**

   The proposed project will consume minerals mainly iron ore, iron ore fines & coal as raw materials and produce Sponge Iron. The waste gases and low calorific value solid wastes will be utilized for electricity generation. All other solid wastes will be suitably used for various purposes.

   As per EIA Notification 2006 the proposed Ferro Alloy and Secondary Steel Plant falls under Schedule in serial No. 3(a) - Metallurgical Industry (ferrous & non-ferrous). Based on lease
area and general conditions mentioned in the schedule of EIA Notification, the project is categorized as Category A.

(iii) Need for the project and its importance to the country and or region

Due to rapid industrial & infrastructure development there is constant increase in need of sponge iron, steel & alloys steel in the market. Steel products are used by the large section of the public such as industrial establishments, schools colleges, farmers, agriculturists, builders and general public at large.

The proposed Ferro Alloys & Integrated Steel Plant will be a enlargement project just adjacent to existing sponge iron plant of Grace Industries Limited, MIDC Tadali, Chandrapur, Maharashtra. The sponge iron produced in the existing plant will be utilized in the proposed project to manufacture steel products. The existing infrastructure facilities will help in successful implementation of proposed project. The proposed project will improve the viability of the existing sponge iron plant. Similarly, the group company has secondary steel plant and consuming ferro alloys in substantial quantity purchased from the market. GIL is planning to consume ferro alloys produced in the proposed project and in group company to increase the economy of group company and to earn greater revenue by selling remaining ferro alloy.

The survival of the steel industries in the region is at stake due to higher raw material cost and highly competitive cost of the products. The proposed project will carry out iron ore fines beneficiation to minimize raw material cost.

(iv) Demand Supply Gap

Being a core sector, steel industry tracks the overall economic growth in the long term. Also, steel demand, being derived from other sectors like automobiles, consumer durables and infrastructure, its fortune is dependent on the growth of these user industries. The Indian steel sector enjoys advantages of domestic availability of raw materials and cheap labour. Iron ore is also available in abundant quantities. This provides major cost advantage to the domestic steel industry.

The Indian steel industry is largely iron-based through the blast furnace (BF) or the direct reduced iron (DRI) route. About 60% of the crude steel capacity is resident with integrated steel producers (ISP). But the changing ratio of hot metal to crude steel production indicates the increasing presence of secondary steel producers (non integrated steel producers) manufacturing steel through scrap route, enhancing their dependence on imported raw material.

World crude steel production was 1547 million tonnes (MT) in 2012, as per World Steel Association (WSA). China accounted for 46% of the world's total crude steel production in 2012, reaching 716.5 MT. During 2012, India maintained its ranking as the 4th largest steel producing country in the world behind China, Japan and the US with a crude steel production of 76.7 MT.

Global advisory firm Ernst & Young in its recent study said that India's steel consumption would grow by over 5% in the calendar year 2014 to 83 million tonnes compared with 79 million tonnes the country consumed in the previous calendar year.
In general there is demand of steel products in the region as well as country and its demand is increasing day by day due to developmental activities.

The supply of steel is solely depends on the steel producing industries in India. This Vidarbha region can be a significant contributor in supply of steel in India due to abundantly available resources in the region. The proposed Ferro Alloys and Integrated Steel Plant is part of it and it can be helpful in fulfilling the supply-demand gap due to rapidly increasing demand on regular basis.

(v) Imports vs. Indigenous Production

Though demand of steel and alloy steel in the market is rapidly developing but the transportation cost and distance criteria for immediate supply are the major factor.

Total steel imports by India during the last fiscal (2013-14) stood at 5.44 MT as per Joint Plant Committee (JPC), a unit of the steel ministry and it is mainly related to high quality steel.

The steel production in India would grow somewhat 3% to 84 million tonnes in the current calendar year compared with 81 million tonnes in the previous year. The availability of raw materials in the vidarbha region is suitable for indigenous production at the proposed project.

(vi) Export Possibility

Total steel exports by India during the last fiscal (2013-14) stood at 5.59 million tonnes (MT). The high quality steel products of the proposed project will reduce the imports to some extent and also there will be export possibility.

(vii) Domestic/Export Markets

The market in India for steel and alloy steel is well established and regular demand is fulfilled to the possible extent by the various steel manufacturing units in the country.

The Indian steel industry continued to showcase trends of higher consumption of finished steel and continued to be a net importer on account of increased demand for special grades of steel in the country. India's current per capita finished steel consumption at 57 kg is well below the world average of 217 kg. With rising income levels expected to make steel increasingly affordable, there is vast scope for increasing per capita consumption of steel.

India is going to turn into a net exporter of steel in FY14. A weak currency and slowing exports from China are expected to aid Indian exports. China is slated to cut steel capacity. China is estimated to have exported 52 million tonnes of steel in 2013 and this is expected to decline by 11 million tonnes by FY15 to 41 million tonnes. This would be an opportunity for Indian steel makers. With global demand for steel increasing and China cutting exports, Indian steel makers have very good chances of steel.

(viii) Employment Generation (Direct and Indirect) due to the project

For the operation of proposed project direct & indirect employment requirement on regular basis will be about 1000 persons.
3. Project Description

(i) Type of project including interlinked and interdependent project, if any

The proposed Ferro Alloys & Integrated Steel Plant will be located at adjacent plots to the existing 4 x 100 TPD Sponge Iron Plant of GIL. In the proposed project, shortfall of the sponge iron will be completed from the existing sponge iron plant of GIL. Thus, the proposed project will be interdependent project. The part of ferro alloys manufactured in the proposed project will be consumed partially and also utilized in the group company plant for the manufacture of alloy steel and the remaining will be sold in the market. Also the power generated at the proposed project CPP will be consumed for operation of the proposed plant and remaining, if any, will be sold to the power distribution companies. The finished rolled steel products will be sold in the market.

(ii) Location (map showing general location, specific location and project boundary & project site layout) with coordinates

The proposed project will be located at adjacent plots to the existing factory premises of GIL and the land is covered in Survey of India 56M-1, 56M-5, 55P-4 & 55P-8. The location maps viz. topographic location map and map with project boundary marked on it are given with Form-1.

(iii) Details of alternate sites considered and the basis of selecting the proposed site, particularly the environmental consideration gone into should be highlighted.

The proposed project will be located in adjacent plots to the existing sponge iron plant of GIL. The sponge iron from existing plant of GIL will be a major raw material to proposed project. Also erection of 33 MW CPP is in progress and additional 24 MW CPP is planned in the proposed project. The electricity needs will be fulfilled from these two CPPs. Also adequate transportation facilities are available for transportation of product to financial capital of country Mumbai and other important parts as well. By installing proposed project in adjacent plots to existing factory premises, GIL is planning to increase the economy of existing plant and to earn greater revenue by selling remaining ferro alloys and alloy steel products. Hence the proposed project will be beneficial and techno-economically feasible. Hence, no alternative site is analyzed.

Financial and social benefits with special emphasis on environmental consideration and benefit to the local people will be kept as top priority for the proposed project.

(iv) Size or magnitude of operation

The proposed project is a large scale unit and Govt. of Maharashtra has given the mega status. All priority sanctions and concessions will be given by Govt of Maharashtra for implementation of this project.
(v) Project description with process details (a schematic diagram/flow chart showing the project layout, components of the project etc. should be given)

In the proposed project, ferro alloys plant & integrated steel plant with allied plants for manufacturing rolled steel products @ 1.0 million TPA will be installed. The finished products will be transported through the existing rail and road network.

Total land acquired for the proposed project is 99.33 HaR (245.44 Acres). Total water requirement for the proposed project will be about 1200 KLD. Water requirement for the project will be sourced from MIDC water supply, which is also the source of water for existing plant. Electricity requirement will be fulfilled from in-house captive power plant. The details of various units of the proposed project with production capacity are given below:-

1. Ferro Alloys Plant with capacity of 0.1 million Tons per Annum (TPA).
2. Blast Furnace of capacity 0.6 million TPA
3. Direct Reduced Iron Plant of capacity 0.36 million TPA (1200 TPD).
4. Beneficiation and Pelletization Plant for Iron Ore of capacity 0.5 Million TPA.
5. Sinter Plant of capacity 1.0 Million TPA.
6. Steel Melt Shop of capacity 1.0 Million TPA having Induction Furnace, Electric Arc Furnace, Ladle Refining Furnace, Argon Oxygen Decarburization (AOD), Vacuum Oxygen Decarburization (VOD), Continuous Caster etc.
7. Rolling Mill for Rolled Steel Products of capacity 1.0 Million TPA.
8. Producer Gas Plant (Gasifier Unit) of capacity 40000 KWH.
9. Captive Power Plant of capacity 24 MW

The manufacturing process technologies are indigenous and well established. The details are given below:

1. **Ferro Alloys Plant**:

   The submerged electric arc furnaces will be installed in the ferro alloys plant. The submerged arc process is a reduction smelting operation. The reactants consist of metallic ores (ferrous oxides, silicon oxides, manganese oxides, chrome oxides, etc.) and a carbon-source reducing agent, usually in the form of coke, low-volatility coal or wood chips. Limestone may also be added as a flux material. Raw materials are crushed, sized, and in some cases, dried, and then conveyed to a mix house for weighing and blending. Conveyors, buckets, skip hoists, or cars transport the processed material to hoppers above the furnace. The mix is then gravity-fed through a feed chute either continuously or intermittently, as needed. At high temperatures in the reaction zone, the carbon source reacts with metal oxides to form carbon monoxide and to reduce the ores to base metal.
Smelting in an electric arc furnace is accomplished by conversion of electrical energy to heat. An alternating current applied to the electrodes cause current to flow through the charge between the electrode tips. The furnace shell is water cooled to protect it from the heat of the process. A water-cooled cover and fume collection hood are mounted over the furnace shell. Normally, three carbon electrodes arranged in a triangular formation extend through the cover and into the furnace shell opening. Pre-baked or self-baking electrodes are typically used. Raw materials are sometimes charged to the furnace trough feed chutes from above the furnace.

The surface of the furnace charge containing both molten material and unconverted charge during operation is typically maintained near the top of the furnace shell. The lower ends of the electrodes are maintained at about 1 to 2 meters below the charge surface. Three-phase electric current arcs from electrode to electrode, passing through the charge material. The charge material melts and reacts to form the desired product as the electric energy is converted into heat. The carbonaceous material in the furnace charge reacts with oxygen in the metal oxides of the charge and reduces them to base metals. The reactions produce large quantities of carbon monoxide which passes upward through the furnace charge. The molten metal and slag are removed (tapped) through one or more tap holes extending through the furnace shell at the hearth level. Feed materials may be charged continuously or intermittently. Power is applied continuously. Tapping is intermittent based on production rate of the furnace.

The molten alloy and slag that accumulate on the furnace hearth are removed at one to five hour intervals through the tap hole. Tapping typically lasts 10 to 15 minutes. In some cases, tapping is done continuously. Tap holes are opened with pellet shot from a gun, by drilling or by oxygen lancing. The molten metal and slag flow from the tap hole into a carbon-lined trough, then into a carbon-lined runner which directs the metal and slag into a reaction ladle, ingot molds, or chills (chills are low, flat, iron or steel pans that provide rapid cooling of the molten metal). After tapping is completed the furnace is resealed by inserting a carbon paste plug into the tap hole.

After cooling and solidifying, the large ferro alloy castings may be broken with drop weights or hammers. The broken ferroalloy pieces are then crushed, screened (sized) and stored in bins until shipment. In some instances, the alloys are stored in lump form in inventories prior to sizing for shipping.

High Carbon Ferro Manganese is produced in three phase, in a closed top furnace of a power of 7500 kW with electrodes depth 800–1000 mm operating at a linear voltage of 164 V. The hearth and walls of the furnace are lined with carbon blocks and the upper portion of wall is lined with fire clay bricks. The charge for making High Carbon Ferro Manganese may be composed of manganese ore and coke breeze. Manufacturing of High Carbon Ferro Manganese is smelted by a continuous process with the electrodes submerged deep into the charge.

Hygroscopic moisture of the charge materials is removed in 10–15 minutes per charging, while the volatile matters are run off in the temperature range of between 200 – 1000°C. The iron contained in the manganese ore is reduced to a high extent in the process. Ferric oxides are reduced with carbon monoxide and hydrogen at low temperature. Ferrous oxides are first reduced
with carbon monoxide and hydrogen at 500-600°C temperature and after that with solid carbon in the deeper zones of the bath.

The reduction of Mn from pyrolusite occur as: \( \text{MnO}_2 > \text{Mn}_3\text{O}_4 > \text{MnO} > \text{Mn}_3\text{C} \) with a reducing atmosphere in the furnace, the dissociation of manganese oxides can take place at low temperatures. Carbon monoxide and hydrogen can also reduce \( \text{Mn}_3\text{O} \) to \( \text{MnO} \) at low temperature. High Carbon Fe Mn can be smelted with addition of fluxes or by flux-less process. In the latter case, a valuable by-product of the process is high manganese low phosphorus slag which is used in smelting Silico Manganese and manganese metal. The reducing conditions in the furnace ensure that phosphorus be reduced almost fully. The acid slag cannot absorb phosphorus which is removed with furnace gases and 75 – 80 % passes to the alloy.

A great part of electric energy is lost in the slag which raises the temperature of the slag above that of the metal. The mass of manganese ore in the batch charge is established at 500 – 700 kg. Mixed charge is delivered to the furnace from furnace bays along four movable chutes. Three chutes serve to deliver the charge to spaces between the electrodes and the fourth, into the space between the central electrode and furnace wall.

Charging is done periodically to allow the previous charge settled at the top, to move down. With normal run of the furnace, yellow flames shoot up evenly all over the surface of the furnace top.

1. **Mini Blast Furnace**

Mini Blast Furnace is vertical shaft where the raw material mix i.e. Coke, Iron Ore and fluxes travels down the shaft while air is blown in at pressure up the shaft. The molten iron and slag by-product is drawn out from the bottom of the furnace.

The raw material, i.e. Sinter, Iron Ore, Sinter, coke, dolomite, limestone, quartzite and Manganese ore are received in the raw materials storage yard and conveyed to the stock house by ground hopper and conveyors. All the required raw materials are stored in day bins. Iron ore and coke is screened. The raw material is fed from the top by a charging conveyor through a top charging system, which also serves to distribute the charge uniformly in the furnace and also performs the task of sealing the furnace from the atmosphere.

The blast for the mini blast furnace (MBF) is generated through a system of fans connected in series in such a way that any number of fans can be operated at a time. The cold blast is preheated in hot blast stoves, which consists of continuous checkers shaped bricks, which is preheated by blast furnace gas to deliver a blast at temperature of upto 1200°C. The main blast furnace is built of structural steel plate, which is cooled by stave coolers. It is lined internally with 62% dense & 70% mullite bricks & alumina refractory bricks. The furnace stands directly on a RCC foundation. The tuyeres of the blast furnace are fed with the hot blast from the bustle through the blowpipes.

The furnace has one tap hole from where both hot metal and slag is taken out. A skimmer plate, properly located in the trough placed on the working platform, separates the slag. The hot
metal flows into a ladle, while the slag is conveyed to the slag granulation system from where the slag is removed by a front-end loader. The hot metal is taken away in the ladle and taken away to the steel melting shop.

The exhaust gases at the top of the furnace are cleaned in two stage venturi scrubber. About 50 % of the clean gas is used for firing in the burner stoves, 25 % of the clean gas is used in the MBF boiler to produce and excess 25 % cleaned gas is flared in MBF flare stack. The settled dust is separated in a thickener and after it is disposed as MBF slag.

3. Direct Reduced Iron Plant

The process involves feeding of sized iron ore (5 to 20 mm size), coal (0 to 25 mm size) and dolomite (1 to 4 mm size) at the charging end of an inclined rotary kiln. Air is supplied by kiln mounted blowers and also coal is injected from the discharge end with the help of air. The iron ore reduction starts at 900 to 1050°C. Once this temperature is attained the exothermic reactions start which maintain the kiln temperature. The initial heating of the kiln refractories upto 1050°C to 1100°C is done by oil fuel. The iron ore and coal tumbling down the kiln react in the presence of oxygen of the air and iron ore gets reduced to iron.

The reduced iron is discharged into coolers where it is cooled by spraying water and conveyed through conveyors for magnetic separation and subsequent storage/consumption.

The flue gases from the kiln containing carbon monoxide and unburnt coal fines are burnt in the Waste Heat Recovery Steam Generator (WHRS). The burnt flues gases are cooled down due to heat exchange in the WHRS. These flue gases then cleaned for removal of particles matters in the electrostatic precipitator. The settled particles on electrodes are scrapped from the electrostatic precipitators and disposed in the earmarked area using dumpers as ESP dust. The cooled and cleaned flue gases are released to atmosphere by forced draft stack.

1. Beneficiation and Pelletization Plant

The Beneficiation of the iron ore starts with screening of raw ores through a vibrating grizzley. The ores larger than 30mm in diameter is crushed by a jaw crusher. This material passes through another vibrating screen from which if the particle is 1mm less than required diameter goes to the sump and particles 1mm larger than the required diameter goes to the ball mill. The discharge if the ball mill moves to another highly specialized screen from which again the ores if smaller than the required size by 1mm moves to sump and the ores larger by 1 mm is fed back to the ball mill. The material from the sump is pumped to Hydrocyclone. Underflow of Hydrocyclone is collected in the sump and pumped to cluster of cyclone. The underflow of cluster of cyclone goes to the Primary Spiral. The concentrate of the primary spiral goes to secondary spiral and the rejects goes to the Tailing pond. Similarly, the reject of the secondary spiral also goes to the tailing pond. The concentrate of the secondary spiral is the finished.

For pelletisation, four additives used in the pelletizing blend viz., bentonite as binder, limestone and / or dolomite as flux, coal or coke as solid fuel.
Mixed material from the mixer is conveyed to surge bins in the balling section and fed by weigh-feeders to the pelletizing discs. Green pellets discharging from the discs are conveyed to a double deck roller screen ahead of indurating machine. The oversize and undersize green pellets are re-circulated and on-size green pellets fed to the straight travelling grate type indurating furnace which is fed continuously from the double deck roller screen feeder. This lays down the green balls across the full width of the machine on top of a protective hearth layer. Induration of green pellets takes place on the travelling grate, having a number of wind boxes.

Heat for downdraft drying air is supplied from firing zone wind boxes. The configuration of packed spheres in the blast furnace allowing air to flow between, decreasing the resistance to the air that flows up through the layers of material during the smelting helps in the formation of iron pellets.

5. **Sinter Plant**

In order to improve the quality of agglomeration, pre-distribution and mixing process of iron-bearing material is recommended. The mixing ore is composed of hematite ore fines mainly used as a little EAF GCP dust, Mill Scale.

Dolomite (or Limestone) and quicklime are used as flux. The size of bought out limestone and dolomite shall be within 40 mm and will be broken up to 3 mm for sintering process in the plant. The bought out lime with size of within 3 mm shall be supplied to the enclosed lime bunker in order to realize environment protection purpose.

The solid fuel for sinter plant is coke breeze. The size of coke breeze shall be within 40 mm and will be broken up to 3 mm for sintering process in the plant.

The gas fuel for sinter plant is BF gas which shall be used as ignition fuel for pre-heating ignition furnace. Its heat generation value is 750 – 800 Kcal/m³ and shall be sent by pipes to the sinter plant under the pressure of 5000 Pa and dust density of less than 10 mg/m³ at connecting point.

6. **Steel Melt Shop**

The steel making process involves melting, refining of direct reduction iron, steel scrap & hot metal in electric arc furnace / induction furnace using electricity & refining of molten steel in ladle heating furnace thus achieving the desired chemistry of molten steel by addition of alloying elements and heat energy in ladle heating furnace.

6.1 **Melting in Induction Furnace**

The melting of the sponge iron, steel scrap, ferro alloys will be carried out in induction furnaces using the intense heat generated by electricity. The molten slag generated in the furnace, being lighter than steel, will be removed from the furnace. Each set of induction furnace will have two crucibles.

Liquid metal from the furnace will be poured / tapped in preheated refractory lined ladles. Preheating of empty ladles will be carried out by using furnace oil burning. The ladle filled with
molten metal will be transferred to SSM Converter / V.D. Plant for improving the quality of steel or to ladle reheating furnace for further reheating and casting.

6.2 Melting & Refining in Electric Arc Furnace

The melting of the Hot metal, direct reduced iron and steel scrap is done in electric arc furnace using the electricity due to heat generated by the arc between the three graphite electrodes. The oxides of silicon, manganese, aluminium etc. form slag. The molten slag being lighter than steel is removed from the top of the furnace.

The carbon content in the hot metal is reduced by oxygen blowing. The exhaust gases are cooled and cleaned in gas cleaning plant. Cooled and cleaned gases are released to atmosphere through 43 m height forced draft chimney. The liquid metal is poured in refractory lined ladles and transferred to ladle heating furnace for further refining.

6.3 Steel Refining in Ladle Heating Furnace

The liquid steel in the ladle is further refined and the desired chemistry of steel is obtained by adding alloying elements.

For homogenizing the liquid steel inert gas argon is purged through the liquid steel and the flue gases are removed from the top of the ladle through cooled ducting, bag filter and released to atmosphere after cooling and cleaning the gases for particulate matter through chimney.

6.4 Steel Refining in Vacuum Degassing Plant

At VD Plant, a ladle of molten steel above the melting point of the steel is placed in the vacuum chamber & connection of inert gas is made to the ladle and stirred & thereafter, the chamber is closed. Vacuum is applied to homogenize the liquid steel and expel hydrogen and nitrogen. Steel is sampled & ferroalloys are added to fine tune the composition which is called trimming addition.

The steel is now ready to be cast into billets.

6.5 Stainless Steel Refining in AOD Converter

SSR process is advantageously used for refining speciality steels & alloys and it is the most significant advance in the manufacture of these materials. In the case of electric arc furnace (EAF), five to six hour heat are required to produce final carbon content below 0.03% whereas routine production of extra low carbon (ELC) can be achieved in Stainless Steel Refining Converter in less than two hours. Similarly, even 0.001% sulphur is feasible with Stainless Steel Refining Converter.

Stainless Steel Refining Converter accepts molten metal transfer not only from EAF but also from Induction Furnaces, LD or BOP converters and Submerged Arc Smelting Furnaces. On an intermittent basis, metal from hot metal sources including Blast Furnaces (BF) and Cupolas can be refined in Stainless Steel Refining Converter.
Stainless steel production from stainless steel refining process comprises of three phases which are indicated below together with key parameters of each phase:

**6.5.1. Decarburisation**

Once the heat has been transferred to the SSR vessel, bath temperature is observed. Based on the starting temperature, chemistry and weight, a series of calculations to guide the process is made.

At some point prior to the end of the decarburisation period, a sample is subjected to carbon analysis. This is used to verify and fine-tune the original end point calculations. Based on this updated oxygen requirement, a precise determination of reduction additions and fluxes is made.

**6.5.2. Reduction / Desulfurisation**

After attaining the aimed carbon level, alloys and fluxes which promote recovery of any oxidised metallics are added (in batch) to the Stainless Steel Refining Converter. Since the amount of oxygen consumed by metallic oxidation is determined precisely, the amount of reduction material (usually silicon ferro alloys or aluminium) is determined accurately. The reduction mix is stirred with inert gas for a period sufficient to allow completion of oxidation/reduction reactions and slag formation.

If the initial sulphur content is high, desulfurisation slag (CaO/SiO₂ >2) is added after the original reduction slag is decanted. Stirring is provided for promoting slag formation.

**6.5.3. Trim**

Small adjustments in composition are made based on the after reduction chemistry. Temperature adjustments are also possible within 5°C in view of predictability of the process.

Modern SSR practice is characterised by rapid heat times, achieved through the use of a top lance and occasionally a sublance for sampling and long refractory campaigns resulting in high productivity and low refining costs.

**6.6. Continuous Caster**

The continuous caster is a machine that converts liquid steel to solidified billets of size and shape suitable for a rolling mill. The liquid steel is brought to the caster in a refractory lined vessel called a ladle. The machine receives the ladle by two steel arms, called a turret, which can revolve and swing the ladle to the casting position. The turret can carry two ladles at one time and thus facilitate a complete sequence of ladles that permits continuous casting as long as the ladles can be exchanged in time.

At the casting position a preheated intermediate vessel called a turndish is brought under the ladle. The function of the turndish is to hold a reservoir of metal for casting and permit exchange of ladles without interrupting casting. The turndish also serves to remove inclusions and is also therefore a necessary metallurgical tool. The turndish has a stopper rod, which sits on the
nozzle. The stopper rod lifting controls the steel flow through the nozzle and is in turn controlled by measuring the level of steel in the mould.

The liquid steel is let into a water-cooled vertical curved mould and starts solidifying inside the mould. The solidifying bar of steel is pulled out by a dummy bar to start the process and after wards by the solid bar itself. The extraction is accomplished by a set of rolls, which are driven by a variable speed drive. During extraction of the steel bar, the solidifying bar is sprayed by a set of nozzles, which deliver water at a controlled rate.

The bar takes distance to solidify and a time depending on the size of the billet (the solid is called a billet or bloom depending on the actual size,). The billet is cut to the desired length after complete solidification and then lifted from the roller table to a turnover cooling bed or pusher cooling bed. (If slow cooling is desired)

The billets are now marked inspected and made ready for rolling.

7. Rolling Mill.

The rolling mill process consists of reheating of the cooled / semi hot billets produced in continuous casting machine to the hot rolling temperature of 1100 to 1200°C in the blast furnace gas / producer gas fired walking hearth furnace. The heated and soaked billets are discharged from the furnace and are rolled into different sizes in a continuous rolling mill. The heated billet material enter the gap between the rotating rolls and gets the shape and size of the opening made by the grooves cut in the pair of rolls. Depending upon the size and shape of the finished product the grooves in the pad of rolls and the number of roll pairs are selected. The shape of the groove in the rolls decides the shape and size of the rolled piece coming out of the rolls. The cross section of the work piece is reduced successively in each pair of rolls and the speed of the succeeding rolls is increased to match the speed of the rolled pieces.

The process is purely a mechanical reduction and water is used for cooling the rolls as well as the work pieces. The rolled pieces are cut into required sizes and stacked in the storage area by means of overhead cranes.

8. Producer Gas Plant

The coal received at unit is initially screened manually. Coarse coal is fed into feeder bunker through which it is entered into gasifier. Fine coal dust separated at screen is collected in a bag and it is disposed by sale to convert in to coal briquettes.

Gasifier unit has closed chamber in which in the absence of air, coal is burnt on bed. Water is sprinkled over the bed of burning coal thereby eliminating the generation of CO₂. The reaction of gas with water creates hydrogen and carbon inter-phase and it generates Producer Gas a mixture of CO & H₂O. Through Gasifier Unit, no emissions are allowed to discharge in to atmosphere as it is basically fuel producer gas.
9. Captive Power Plant

The CPP comprises of WHR Boiler, TG Sets and other power plant related auxiliaries such as cooling tower and boiler feed pumps. In the existing set-up of CPP, Turbine Generator (TG) Set is under operation. Steam requirement of the CPP are fulfilled from one WHR Boiler and one FBC boiler. The waste gases from the DR plant, kiln exhaust are passed through WHR Boiler that is top supported and is a three pass natural circulation boiler. WHR Boiler utilizes heat for generating steam. FBC boiler consumes as fuel the by-products of DR Plant such as DRI ash, ESP dust, coal fines coal etc. The steam exhausted from the turbines is condensed in a surface steam condenser and thereafter taken through ejectors, vent steam and gland steam condensers for de-aeration and feed storage with the help of condensation extraction pumps. A cooling tower is provided for exhausting the heat generated during the process of condensation.

The schematic flow diagrams and plant layout are enclosed herewith as Enclosure-1.

(vi) Raw material along with estimated quantity, likely source marketing area of final products, mode of transport of raw material and finished product.

Major raw materials required will be iron ore, manganese ore, coal, coke, limestone etc. Raw material required will be received by railway and road. Major quantity of raw materials will be procured from rail link existing adjacent to plots. The major raw material requirement for various plants is given below:

1. **Ferro Alloy Plant** @ 0.1 Million TPA requires Manganese Ores @ 1, 88,100 TPA for Silico Manganese & @ 2, 47,500 TPA for Ferro Manganese production, Dolomite & Quartzite @ 17,820 TPA & 7320 TPA respectively for Silico manganese production & Coke Breeze @ 62,865 TPA for both Silico Manganese & Ferro Manganese production etc.

2. **Blast Furnace** @ 0.6 Million TPA requires Iron Ore & Sinter (In-house) @ 10, 32,000 TPA, Coke @ 36,000 TPA, Limestone @ 60,000 TPA etc.

3. **Direct Reduced Iron Plant** @ 0.36 Million TPA requires Iron ore/ Iron ore Pellets @ 5,76,000 TPA, Coal @ 4,32,000 TPA etc.

4. **Beneficiation Plant** @ 0.5 Million TPA requires 6,66,666 TPA of Iron Ores Fines, **Pelletisation Plant** @ 0.5 million TPA requires 5, 16,666 TPA of Beneficiated Iron Ore, Bentonite @ 5000 TPA, Limestone/Dolomite @ 10,000 TPA & Coke @ 7500 TPA.

5. **Sinter Plant** @ 1 Million TPA requires Hematite Iron Ore @ 7, 10,000 TPA, Sinter Fines @ 2, 60,000 TPA, Dolomite @ 1, 10,000 TPA etc.

6. **Steel Melt Shop** @ 1 Million TPA requires DRI & Pig Iron @ 8, 68,000 TPA, Steel Scrap @ 1, 88,800 TPA etc.
7. **Roll Mill** @ 1 million TPA requires Billets @1, 25,000 TPA & Producer Gas @ 40,000KWH.

8. **Producer Gas Plant** (40000 KWH) requires Coal @ 45000 TPA

9. **Captive Power Plant** of 24 MW requires Waste Heat Flue Gases of DRP @ 3, 00,000 Nm³/Hr

   (vii) Resource optimization/recycling and reuse envisaged in the project, if any, should be briefly outlined.

   Waste generation in the proposed Ferro Alloys and Secondary Steel Products is in the form of ferro manganese slag and mill scale will be recycled in the production of ferro alloys and alloy steel making process etc. Hence, there will be resource optimization in the proposed project.

   (viii) Availability of water its source, energy/power requirement and source should be given.

   The Fresh water requirement of the proposed project will be 1200 m³/day. Source of water will be MIDC Water Supply System. Coal required for the operation of the project will be obtained from the mines through coal linkage. Electric power requirement will be fulfilled by Captive Power Plant.

   (ix) Quantity of waste to be generated (liquid and solid) and scheme for their management/disposal.

   Industrial effluent generation from proposed expansion project will be low. Sewage treatment plant will be provided for the proposed domestic effluent. Treated domestic effluent will be utilized for gardening & green belt development. Industrial effluent generated will be treated and used for green belt development.

   Dusts collected in pulse jet bag filters will be reused in sinter manufacture. Majority of solid wastes will be utilized for sinter manufacture. Slag generated will be utilized for the construction of the roads and balance quantity will be disposed off by landfill. Used/waste oil generation will be very less and it will be disposed off by sale to authorized recycling vendors.

   (x) Schematic representation of the feasibility drawing which give information of EIA purpose.

   The schematic representation of the feasibility drawing giving complete information of the complete EIA process is enclosed as Enclosure - 2.

4. **Site Analysis**

   (i) Connectivity

   The proposed site is accessible by State Highway No. 264 at crow fly distance of 2.15 km in NE. Nearest Railway Station is Tadali about 2.9 Km in N direction and nearest Airport is Sonegaon about 121.0 Km in NNW direction from existing Site as crow flies.
Nearest City is Chandrapur located at a crow fly distance of about 11.5 km in SE direction of the existing site. Wardha River is 7.5 km away towards West direction.

(ii) Land Form, Land use and Land ownership

The proposed project will be located within the MIDC Tadali, Chandrapur. The land is notified for industrial use and land ownership is with MIDC. Land is leased to Grace Industries Ltd.

(iii) Topography (along with map)

The topography of the area is plain and the proposed plant of GIL is located at an altitude of 209 m from mean sea level.

(iv) Existing land use pattern (agriculture, non-agriculture, forest, water bodies (including area under CRZ), shortest distances from the periphery of the project to periphery of the forest, national park, wildlife sanctuary, eco sensitive areas, water bodies (distance from the HFL of the river), CRZ. In case of notified industrial area, a copy of the Gazette notification should be given.

The proposed land of the GIL is located in the MIDC area, which is barren, non-agricultural, non-forest land. The land is notified for industrial use. In the 10 km radius area notified forests, national parks, wildlife sanctuary and eco sensitive areas do not exist. Wardha River is 7.5 km away towards West direction.

(v) Existing Infrastructure

The MIDC has developed good infrastructure in the Tadali Industrial area and it is adequate for proposed project.

(vi) Soil classification

The majority of soil of study area is medium & shallow black soils. The numerous varieties of soil are known by many local names, yet they are grouped as Kali, Kanhar, Morand, Khardi, Wardi etc.

(vii) Climatic data from secondary sources

The climate of the district can be classified as tropical hot climate with high range of temperature throughout the year. Primarily there are two prominent seasons in the district, the very hot summer and moderate winter. The summer months are very hot and prolonged while winter is short and mild. The monsoon season starts immediately after summer till late September. The southwest monsoon brings lot of rainfall during rainy season.

(viii) Social Infrastructure available

In 2011, Chandrapur District had a population of 22,04,307 of which male and female were 1,123,834 and 22,68,595 respectively. Chandrapur District population constituted 1.96 percent of total Maharashtra population.
The initial provisional data released by census India 2011, shows that density of Chandrapur district for 2011 is 193 people per sq. km. With regards to Sex Ratio in Chandrapur District, it stood at 961 per 1000 male.

Due to Chandrapur City at 11.5 km from proposed site, adequate social infrastructure is available. The social infrastructure comprising hospitals, schools, colleges, community halls, places of worship, cemetery, crematory etc already exists and within an hour these facilities can be availed.

5. Planning Brief

(i) Planning concept (type of industries, facilities, transportation, etc.) Town and country planning/development authority classification

The proposed project will be located in (Plot No 24 & other) Tadali Growth Center, MIDC, Taluka & District- Chandrapur. In this MIDC Industrial Area, two sponge iron plants, two integrated steel plants and one thermal power plant are existing. The proposed project is integrated steel plant and similar industries are already in operation in this industrial area. The project proponent has one sponge iron plant in the industrial area and has advantage of putting integrated steel plant adjacent to existing sponge iron plant. Main raw material coal is locally available. Iron ore deposits are available at about 100 km distance which may be regular source in future. Infrastructure facilities in this MIDC area are well developed and has well connectivity by road and rail. The nearest town Chandrapur is 11.5 km away and easily accessible by road where all facilities such as schools, collages, hospitals and markets are available.

(ii) Population Projection

In the area, trained manpower is already available and in the proposed project local workers will be given priorities for employment. There will not be significant increase in population due to proposed project. The additional people influx due to the proposed project can be easily accommodated in the Chandrapur city and nearby villages. The development of new residential facility is not anticipated.

(iii) Land use planning (breakup along with green belt etc.)

The proposed project will be located in Plot No 24 (& other) at MIDC Industrial area and land use is already notified as Industrial purpose. At present, land is barren and not in any use. The proposed project will be constructed with well developed green belt all around the boundary of the plots as well as all around the various units.

Total land of the proposed project is 76.85 ha and about 26 ha land will be converted to Green Belt. It is proposed to plant 5000 saplings every year. Suitable plant species will be planted all along the internal road, raw material storage & handling, ash/dust prone areas. It is planned to plant saplings considering the parameters as type, height, leaf area, crown area, growing nature, water requirement etc. Green belt will be progressively developed on land earmarked for the purpose.
Assessment of Infrastructure Demand (physical & social)

The road and rail infrastructure is already well developed in the area which requires for the transport of the raw material and finished goods to the various part of the country. The manpower is local and their social infrastructure is also developed. The inflow of money in terms of taxes to grampanchayat and salaries to the manpower will further improve the physical and social infrastructure.

Amenities/Facilities

In the proposed project, additional amenities and facilities for drinking water, medical dispensary first aid box, communication facilities, emergency vehicle for shifting the workers during accident etc are available.

6. Proposed Infrastructure

(i) Industrial Area (processing area)

The infrastructural facilities are already developed in the premises of the unit as per the requirement and additional facilities for the expansion purpose will be provided as per the requirement.

(ii) Residential Area (non processing area)

The local peoples will be employed for the proposed project. The development of residential area is not needed.

(iii) Green belt

Green belt development work will be undertaken on area of 32.8 HaR.

(iv) Social Infrastructure

The social infrastructure in the region is well developed due to presence of MIDC area.

(v) Connectivity (Traffic and Transportation Road/Rail/Metro/Water ways etc.)

The connectivity in terms of traffic, transportation road is already developed and good. There are well connected roads in the area. The nearest railway station is existing at Tadali.

(vi) Drinking Water Management (Source & Supply of Water)

The MIDC water will be used for drinking purposes.

(vii) Sewerage System

Sewage treatment plant will be provided for the treatment of domestic effluent and treated effluent will be utilized for green belt development.

(viii) Industrial Waste Management

Industrial effluent generation from proposed project will be low and it will be treated in ETP. The treated effluent will be utilized for Green Belt development.
(ix) Solid Waste Management

Dusts collected in pulse jet bag filters will be reused in sinter manufacture. Majority of solid wastes will be utilized for sinter manufacture. Slag generated will be utilized for the construction of the roads and balance quantity will be disposed off by landfill.

(x) Power Requirement & Supply/Source

The power requirement will be fulfilled from proposed Captive Power Plant to maximum extent and as required power will be purchased from MSEDCL.

7. Rehabilitation and Resettlement (R & R) Plan

(i) Policy to be adopted (central/state) in respect of the project affected person including home oustees, land oustees and landless laborers (a brief outline to be given)

The rehabilitation and resettlement (R&R) is not required for the proposed project as it will be constructed in the MIDC area.

8. Project Schedule & Cost Estimates

(i) Likely date of start of construction and likely date of completion (Time schedule for the project to be given)

The board of directors have vast experience in steel manufacturing business. All necessary statutory permissions will be obtained. The construction will be started after getting Environment Clearance. It is expected that the construction will started from December 2015 & operation of the project will be started by March 2017.

(ii) Estimated project cost along with analysis in terms of economic viability of the project

The estimated gross capital investment of the proposed project is about Rs. 1200 Crores. The economic viability is still good due to availability of raw materials, market and infrastructural facilities.

9. Analysis of Proposal Final Recommendations

(i) Financial and social benefits with special emphasis on the benefit to the local people including tribal population, if any, in the area.

The proposed project will have good financial and social benefits to the local people.
Process Flow Diagrams

1.0 Ferro Alloy Plant
2.0 Blast Furnace

- Iron
- Coke
- Flux

Charging

Day bins

BF Gas

Flare

G.C.P

Clean gas main

Intermediate Bins

Granulation Plant

Hot metal

Transfer to SMS

3.0 Direct Reduced Iron Plant

- Coal
- Iron Ore
- Dolomite

Ground Hoppers

Crushing & Screening

Stock House

Rotary Kiln

Coolers

Magnetic Separation

Product Screening

Intermediate Bins

Reduced Iron
4.0 Beneficiation & Pelletisation Plant

Iron Ore

Iron Ore Screening

Crusher

Ball Mill

Screening

Sump

Hydrocyclone

Cluster of Cyclone

Primary Spiral

Secondary Spiral

Mixer

Indurating Furnace

Iron Pellets

Oversized Ore

Additives e.g. Bentonite

Tailing Pond

Enclosure-1 Contd…
5.0 Sinter Plant

Iron ore, Limestone, Coke Breeze, EAF/GCP Dust, Mill Scale, Scale, Sinter Fines etc

- Mixing & Rolling Drum
- Sintering Machine
  - B F Gases & Coke Breeze
- Cooler
- Screen
  - Sinter Fines
- Sinter
6.0 Steel Melt Shop

Sponge Iron, Pig Iron, Steel scrap, Ferro Alloys, Additives etc.

Melting & Refining in IF/ EAF/LHF/AOD/VOD

Continuous Caster

Billets
7.0 Rolling Mill

Billets

Heating at 1200°C in furnace

Producer Gas

Continuous Rolling mill

Water for cooling (recycle)

Shearing, Cutting

Rolled Steel Products

8.0 Producer Gas Plant

Coal

Screening

Feed Bunker

Water

Centrifugal Blower

Updraft Gasifier

Water Seal Tank

Venturi

Producer Gas
9.0 Captive Power Plant

Waste Heat Recovery Boilers

Emission

ESP

Chimney

Flue Gas to Atmosphere

SIP Kilns

Waste Gases

Turbine Alternator cum condenser

Electric power
The schematic representation of the feasibility drawing giving complete information of the complete EIA process

1. Application in Form-1
   Pre-feasibility Report and TOR

2. Category ‘A’
   EAC, MOEF, New Delhi

3. EAC to determine
   TOR for EIA Preparation

4. Intimation of TOR to
   project proponent and
   display in Website

5. Presentation for TOR in front of EAC

   - Acceptance
     - Yes: Issue of TOR
       - Preparation of Draft EIA
         - Public Consultation if prescribed in TOR
           - Preparation of Final EIA after incorporation
             - Public Consultation Compliance
               - Submission of Final EIA to EAC
                 - Appraisal by EAC during Scheduled Presentation
                   - Acceptance
                     - No
                       - Yes: Grant of EC

   - No