FEASIBILITY REPORT

On

PROPOSED EXPANSION OF CEMENT PLANT

CLINKER

FROM 700 TPD TO 1,350 TPD

&

CEMENT

FROM 1,100 TPD TO 2,000 TPD

By

PURBANCHAL CEMENT LTD.

At

VILL: SARUTARI, P.O.: BYRNIHAT, MOUZA: SONAPUR
DIST: KAMRUP, ASSAM - 793101

-: Corporate Office:-

Megha Plaza, 2nd Floor
Basistha Chariali, Beltola, Guwahati – 781029
ASSAM

Ph. No. 0361-2305951/53/2306193

****

TABLE OF CONTENTS

CHAPTER -1: INTRODUCTION

1.1 GENERAL

The Purbanchal Cement Ltd. (PCL) has an existing 700 TPD Dry Process rotary kiln base Clinker and 1,100 TPD Cement Manufacturing Plant at Vill: Sarutari, P.O.- Byrnihat, Mouza: Sonapur, Dist: Kamrup, Assam (Pin – 793101) and having its Registered Office at Ideal Centre, 6th Floor, 9 AJC Bose Road, Kolkata - 700017 (West Bengal) and Corporate Office at Megha Plaza, 2nd Floor, Basistha Chariali, Beltola, Guwahati - 781029 (Assam). The Company was incorporated on 5th May, 2003 under the Companies Act, 1956. The plant consists of a dry process coal fired kiln with single string, 4 stage suspension preheater. The plant also has a ball mills for raw, coal and cement grinding.

Objective of Techno-Economic Feasibility Studies/Detailed Project Reports is to determine the technical feasibility and financial viability of the project assess the risks associated with the project and enumerate imminent actions that are required to be taken.

For the initial plant, main machinery was purchased from M/s. Walchandnagar Industries Ltd. Walchandnagar, Dist-Pune, Maharashtra (Pin- 413114). The plant was commissioned and commenced production from 1st April, 2008 with capacity of 400 TPD Clinker and 550 Cement. The company has taken approval for capacity enhancement of 700 TPD Clinker and 1,100 TPD Cement as per EIA Notification 2006 following EIA study and Public hearing. The Limestone for the plant is brought from Cherrapunjee/Ichamati/Lumshnong in Meghalaya and Umranshu in Assam. Coal is also sourced from Meghalaya.

PCL proposes to make expansion of Clinker Manufacturing Unit from existing 700 TPD to 1,350 TPD and Cement Grinding of OPC/PPC/PSC from 1,100 TPD to 2,000 TPD. The company had taken insights of the proposed expansion from M/s National Council for Cement and Building Materials (NCCBM)/ M/s Holtec Consulting Pvt. Ltd. and from the equipment supplier M/s FL Smidth, M/s Walchandnagar Industries for the feasibilities of the said expansion.

COMPANY PROFILE

Name	:	**PURBANCHAL CEMENT LTD.**
Registered Office	:	Ideal Centre, 6th Floor, 9 AJC Bose Road, Kolkata - 700017 (West Bengal)
Corporate Office	:	Megha Plaza, 2nd Floor, Basistha Chariali, Beltola, Guwahati - 781029 (Assam)
Works	:	Vill: Sarutari, P.O.: Byrnihat, Mouza: Sonapur, Via-14th Mile, G.S. Road (NH-40) Dist: Kamrup (Assam – 793101)
Date of Incorporation	:	20/05/2003
Existing Operation	:	Production of Cement (OPC/PPC/PSC)
Proposed Activity	:	Proposed Expansion of Cement Plant (Clinker from 700 TPD to 1,350 TPD and Cement Grinding from 1,100 TPD to 2,000 TPD)

The demand for cement in the North Eastern region has been increasing gradually. Therefore, to satisfy the present need of the North Eastern States, PCL proposes for expansion of its present production capacities with the help of most State-of-the Art Technology.

Looking into the bullish cement industry scenario and good product response from the market, PCL proposes to increase its cement manufacturing capacity as follows:

Particulars	**Present Capacity**	**Proposed Capacity**
Clinker Manufacturing	700 TPD	1,350 TPD
Cement Grinding	1,100 TPD	2,000 TPD

1.2 PROMOTERS

Purbanchal Cement Ltd. has been promoted by Mr. Sunil Kr. Agarwal, President (Commercial) and Mr. Prabir Konar, Vice – President (Works) of the Company headed by the Directors Mr. Madhur Agarwalla and Mr. Robin Gupta and backed by capable professional team of Engineers, C.A., C.S. etc. and other experienced managerial professionals. The promoters are reputed and well known industrialist having vast experience in various industries and businesses based in Eastern Region and North Eastern Region of India. Other companies promoted by them are running successfully and have created a niche for themselves in the respective industries. These companies have sound financial and excellent track records with Banks and other Financial Institutions.

1.2.0 MANAGEMENT PROFILE:

1.2.1 MR. MADHUR AGARWALLA

1.	Full Name	:	Sri Madhur Agarwalla
2.	Father's Name	:	Sri Binod Agarwalla
3.	Age	:	36 years
4.	Present Address	:	2C, Mangalam, 35, Ahiripukar Road, Dist.- Kolkata Pin-700019 (West Bengal)
5.	Education	:	B. Tech (Mech.), M.B.A.
6.	PAN No.	:	AFHPA7194R
7.	Experience	:	

Sri Madhur Agarwalla is one of the directors of PCL. He has a vast experience of over 12 years in trading and manufacturing of various fields such as Iron & Steel, Ferro Alloys, Power Plant, Cement and Refractories. He is looking after day-to-day business activity of the company. He is designated as whole time director in the company.

1.2.2 MR. ROBIN GUPTA

1.	Full Name	:	Sri Robin Gupta
2.	Father's Name	:	Late Prakash Gupta
3.	Age	:	32 years
4.	Present Address	:	P.O. Tarun Nagar, Bhangagarh, Dist. – Guwahati–781005, Assam
5.	Education	:	B.Com (Hons.)
6.	PAN No.	:	AIFPG7551B
7.	Experience	:	

He has experience more than 10 years in various fields such as Cement, Coal Mining, Construction and other Businesses. He is also involved in various other companies such as Megha Assam Coal Mines Ltd. and Macil Projects Pvt. Ltd.

1.2.4 MR. RAM KISHORE KEJRIWAL

1.	Full Name	:	Sri Ram Kishor Kejriwal
2.	Father's Name	:	Late Khushi Ram Kejriwal
3.	Age	:	70 years
4.	Present Address	:	108B, Narkeldanga Main Road, Kolkata – 700071 (West Bengal)
5.	Education	:	B.Com
6.	PAN No.	:	AESPK5886N
7.	Experience	:	

He has adequate experience over 44 years in trading and manufacturing of various fields such as Refractory and Ferro Alloys.

1.2.6 Key Executives, CA, CS and Engineers:

Sl. No.	Name	Qualification	Designation	Experience
1.	Mr. Sunil Kr. Agarwal	CA, CS,	President (Commercial)	Having more than 20 years of experiences in Financial and Commercial Lines.
2.	Mr. Prabir Konar	Dip. in Mechanical Er.	V.P. (Works)	Having 30 years of experience in Cement Industry viz.- L&T and Ultra Tech Cement Ltd.
3.	Mr. Goutam Bhattacharya	MBA Marketing	GM (Sales & Mkt.)	More than 30 years of experience in the field of marketing of FMCG and Building Materials in the various parts of the Country.
4.	Mr. Rajnish Pandey	B.Sc.	Sr. Manager (Operation & QC)	15 years of experience in cement and other Industries in various parts of the Country.
5.	Mr. Sarat Hazarika	Dip. (Mech. Er.)	Manager (Mechanical)	He has 15 years of experience in cement Industries and others.
6.	Mr. Debasish Paul	B.E. (Mechanical)	Manager (Mechanical)	He has 12 years of experiences in various cement Industries etc.
7.	Mr. Umesh Panda	Dip. in Elect. Engineering	Manager (Elect.&I)	He has worked for 15 years in electrical departments of various cement and other companies.
8.	Mr. Barun Modi	CA	AGM (F&A)	More than 12 Years of Experience in Accounts and Finance in various reputed organization.
9.	Mr. Samir Kumar	B.E.	Sr. Manager (Technical)	Having 15 years of experience has worked with various reputed organization like ACC Cement Ltd, Star Cement, MCC etc.
10.	Mr. Joy Ghose	PGDBM	Sr. Manager Sales & Mkt.	He has more than 17 years of experience and has worked with various reputed organization like Oxford University Press, TATA Mcgraw Hills, Star Cement, etc.
11.	Mr. Dipen Sharma	Dip. in Labour Laws	Manager (Personnel)	Having more than 25 years experience in the field of HR in various parts of the Eastern & North East.

1.3 BANKING ARRANGEMENTS

The present bankers of the company are the State Bank of India and the UCO Bank. The expansion project will involve capital outlay of 126.18 Cr . The debt equity will be 60:40 ratio.

1.4 Production of the existing Unit

PCL has started its operation of cement production from April 2008. The Initial cement grinding was started by procuring Clinker from the nearby plants. Clinker production was started w.e.f. August 2008. The production quantity during the various financial year are as under:

Sl.	Financial Year	Cement Production	Clinker Production
1.	2008-09	1,16,485	71,516
2.	2009-10	1,61,883	1,26,837
3.	2010-11	1,97,070	1,32,794
4.	2011-12	2,36,460	1,35,007
5.	2012-13	2,83,672	1,32,055
6.	2013-14	2,76,750	1,01,015
7.	2014-15	2,95,394	1,23,889
8.	2015-16	3,03,850	1,19,454
9.	2016-17	3,15,222	1,27,631

PCL, since its inception, has been doing fairly well and maintains a good brand image in its target market. It also has a sound financial track record.

1.5 CONSULTANT

The Proposed Expansion Project of PCL is taken under the guidance of various renowned consultants of the country and overseas. Some of them are NCCBM, WIL, FLSmidth and Holtec Consulting Pvt. Ltd. as the Consultants.

1.5.1 M/S. NATIONAL COUNCIL FOR CEMENT AND BUILDING MATERIALS:

National Council for Cement and Building Materials (NCCBM), then Cement Research Institute of India (CRI) was founded on 24th December 1962 with the objective to promote research and scientific work connected with cement and building materials trade and industry.

NCB is the premier body under the administrative control of Ministry of Commerce and Industry, Govt. of India, for technology development, transfer, continuing education and industrial services for cement and construction industries.

NCB serves as the nodal agency for providing the Government the necessary support for formulation of its policy and planning activities related to growth and development of cement industry. It is devoted to protect the interests of consumers of cement and concrete in the country.

1.5.2 M/S. WALCHANDNAGAR INDUSTRIES LIMITED:

Walchandnagar Industries Limited (WIL) is an ISO 9001:2008 certified Heavy Engineering and Project execution company. WIL has diversified business offerings across core sectors of Indian company with global presence and diversified business portfolio in Projects, Products and High-tech Manufacturing. Carrying more than 100 years of Engineering Excellence legacy, WIL has established its name as one of the best in its operational areas. WIL is known for pioneering achievements in Indian engineering industry and for its contribution to nation building activities. WIL is a listed company on the BSE and NSE stock exchanges in India.

WIL has a strong engineering, project management and manufacturing infrastructure to undertake projects and supply of machinery and equipments, in the fields of Nuclear Power, Aerospace, Missile, Defence, Oil & Gas, Steam generation plants, Independent power projects, Turnkey Cement plants, Mineral Processing, Bulk Material handling and Turnkey Sugar plants. WIL has a large proven reference list of satisfied customers across the world.

1.5.3 M/S. FL Smidth:

FLSmidth is a leading supplier of equipment and services to the global cement and minerals industries. FLSmidth supplies everything from single machinery to complete cement plants and minerals processing facilities including services before, during and after the construction. FLSmidth specializes in world-class products, facilities and systems, backed by tailored consultancy and support services. Our wealth of knowledge and resources means that we are able to provide one source solutions for even the most challenging requirements, worldwide. FLSmidth supplies the minerals and cement industries globally with everything from engineering, single machines and complete processing plants to maintenance, support services and operation of processing facilities.

1.5.4 M/S. HOLTEC CONSULTING PVT. LTD.:

Holtec is an ISO-certified consulting company, primarily positioned to service the entire gamut of needs of the global cement industry. It also offers comprehensive services in the areas of Power, Highways & Bridges and Engineering Support Services for Bulk Material Handling & Structural Steel Detailing. Its portfolio of services spans all disciplines of Engineering, Business Consulting, Geology & Mining, Project & Construction Management, Environment Management, Performance Enhancement, Logistics, etc. In addition, Holtec operates and maintains cement plants globally for its clients and also provides solutions encompassing the integrated delivery of services & products through its domestic & international group entities.

CHAPTER-2: PROJECT DESCRIPTION

2.1 INTRODUCTION

This chapter covers plant location, infrastructure details and the description of plant & machinery.

2.2 LOCATION

PCL is located at Vill: Sarutari, P.O.- Byrnihat, Mouza: Sonapur, Dist: Kamrup, Assam (Pin- 793101), which is situated in the middle part of the State.

2.3 INFRASTRUCTURE

2.4 RAW MATERIALS

The Raw Materials for cement manufacturing viz. Lime Stone, Clay/Shale, Iron Dust, Fly Ash, Clinker, Gypsum, Slag, Coal etc. is available in plenty in the State of Meghalaya, Assam, West Bengal and Bhutan.

DETAILS OF EXISTING AND PROPOSED RAW MATERIALS REQUIREMENT

Sl. No.	NAME OF THE RAW MATERIAL	RW MATERIAL REQUIREMENT MT Per Day			SOURCE OF THE RAW MATERIAL	MODE OF TRANSPORTATION
		EXISTING	ADDITIONAL	TOTAL		
1	Lime Stone	910	750	1660	Cherrapunjee /Ichamati – 150 /165km, Meghalaya	By Road
2	Additives	130	50	180	Nearby area, Assam	By Road
3	Fly Ash	277	268	545	Farraka/ Kahalgaon, West Bengal	By Rail / Road (30 KM from Digaru
4	Clinker	100	50	150	Meghalaya / Assam	By Road
5	Gypsum	11	10	21	Samdrup – 200 km, Jongkhar Bhutan	By Road
6	Slag	0	200	200	Durgapur, West Bengal	By Road
7	Coal	105	95	200	Meghalaya	By Road/Rail
8	Sludge	0	175	175	Various parts of Assam	By Road

Apart from these above existing raw materials PCL will use paper mill sludge and Dry Fly Ash for its cement manufacturing after the proposed expansion.

2.5 PLANT LAND AND ITS APPROACH

The plant is located about 1.5 km off the highway joining Guwahati-Shillong Road (NH-40). This 1.5 km stretch is under the hold of the State Government and is properly maintained.

Though the plant is situated on a stretch of land which is heavily undulated and cornered by hillocks, for all the incoming and outgoing traffic and entrance for material handling is not a constraint.

Even the limestone, brought from the mines enters from the main entrance and travels uphill to the farthest corner of the plant.

2.6. COMMUNICATION

The plant has access to a fairly good communication system and there is no constraint on this aspect.

2.7 MANPOWER

Skilled and semi-skilled manpower are locally available. Especially technical personnel have to be imported from other states.

2.8 DESCRIPTION OF PLANT & MACHINERY

M/s Purbanchal Cement Limited is located at village – Sarutari, Mouza – Sonapur, District – Kamrup, Assam. The Plant is based on Rotary Kiln Technology. The Plant was started its Cement production on April'2008 and Clinker production on August'2008. At present company is producing PPC & OPC and markets its products in the name of "Surya Gold" & "Surya Concrete". The brand is already established in the market and sells at par with national brands present in the region. As the Cement demand is growing in the region the company planning to expand production capacity of Clinker from existing production level to 1,350 TPD and Cement from 1,100 TPD to 2,000 TPD at the same location. The capacity enhancement shall be done by installing additional Crusher, Raw Material Grinding system, Additional 4-stage pre-heater string and Cement Grinding system in the existing premises.

The total estimated project cost will be around 126.18 crores. To assess the impacts arising out of the proposed expansion and to prepare a detailed environmental management plan (EMP) to minimize/eliminate those adverse impacts.

Highlights of the Expansion Project:

Company has reviewed the total existing equipment capacities and worked out to increase the capacity of Clinkerization and cement grinding.

1. Company has reviewed the total existing equipment capacities and worked out to increase the capacity of Clinkerization and cement grinding. The following sections are to be modified/ added.
2. The object of power saving and coal energy saving has been taken at high priority with consistent production of 1,350 TPD clinker with specific fuel consumption 790 – 820 kcal/kg of clinker and cement production up to 2,000 TPD.

The following sections are to be modified/ added:

2.8.1 ***Up to Clinkerization:***

A. <u>Crushing Section:</u>

- *<u>Existing set up:</u>* - The main raw material used for Clinker is Limestone. Limestone obtained by mining is generally in the form of large lumps which must be crushed. Large lumps of Limestone fed into 110 ton capacity Primary Jaw Crusher through Truck tippler to reduce sizes from 600-700 mm to 200-100 mm. These crushed material carried through belt conveyor to Secondary Impact crusher. In secondary crusher size reduced from 200-100 mm to 40-50 mm. Again these materials fed to tertiary hammer crusher through set of belt conveyors and Sizer for final required size. This final product stored into 3,000 MT capacity stock pile.

- *<u>Proposed Set up:</u>* – A new Impact Blow Bar crusher of 200 TPH with Apron Feeder and all necessary conveying system to be installed considering 12 hours of operation for daily requirement of 1,800 MT and minimum 3-days stock of limestone for 1,350 MT clinker production. Existing stock pile to be modified/extension to 6,000 MT capacity with modification/extension of shuttle conveyor.

    - Technical scope of work of major items includes the following but not limited to it.
        - Impact Blow bar Crusher
        - Apron Feeder
        - Belt Conveyors
        - Re-location of existing Truck Tippler
        - Shuttle conveyor
        - Vibrating Feeders
        - Slide & Pin gates
        - Gear Boxes & Motors

B. <u>Raw Grinding Section:</u>

- *<u>Existing Set up:</u>* – The present capacity of Raw Material Grinding section capacity is 49 TPH. If the clinker production is to be increased to 1,350 TPD then the raw grinding system should be above 110 TPH.

- *<u>Proposed Set up</u>*: – A new raw material grinding system of 110 TPH to be installed with all auxiliaries system.

    - Technical scope of work shall include but not limited to the following:
        - New Grinding system of 110 TPH with lubrication system, Main Gear Box, auxiliary gear box, Motor etc.
        - Weigh Feeders
        - High efficiency Dynamic Separator
        - New ID Fan with VFD system
        - Set of Belt conveyors

- Set of Pneumatic Gravity Conveyors
- Insulation, Ducting
- Feed Bucket Elevator
- Set of De-dusting Bag Filters & Fans
- Motorized Double Flap valve
- Motorized Damper
- Hydraulic power pack

C. <u>Kiln Feed & RABH section:</u>

- *<u>Existing Set up</u>* – The present 4-stage suspension pre heater with RABH of 1,50,000 M^3/hour including transport system is suitable for 700 TPD Kiln. Existing Blending Silo capacity is only 2,500 MT.
- *<u>Proposed Set up</u>* – A new pre heater string to be installed parallel to existing one with additional RABH and its conveying system suitable for 1,350 TPD clinker

  - Technical scope of work shall include but not limited to the following:
    - A new 4-stage pre-heater string to be installed parallel to existing one
    - All stages cyclone with Riser Duct, Down Comer Duct etc
    - Modification of existing Calciner to common calciner for both existing and proposed pre-heater string.
    - Set of Flapper valves
    - Set of Feed chutes
    - Immersion Tube as per requirement
    - Insulation, Ducting
    - Set of Air Slides with Fan
    - Bucket Elevator for Blending Silo Feed
    - Bucket Elevators for pre heater & Kiln feeding
    - Controlled Flow storage silo with accessories
    - Silo aeration system with all accessories
    - Roots Blower for Silo aeration
    - Pneumatic cut off gates
    - Motorized Flow control gates
    - Dust Collectors for Silo and transport equipment
    - Solid Flow Meters
    - Dust Collector for Bin
    - Set of Damper & Expansion joints
    - Pre heater fan with VFD system Motor
    - Set of Shock Blasters
    - Meal Pipe & Feed Boxes
    - Refractory for new pre-heater string and new cyclones & duct
    - Additional Blending Silo of 2500 MT capacity.

D. <u>Rotary Kiln, Cooler & Coal Mill Section:</u>

- *<u>Existing Set up</u>* – The present Rotary Kiln is Ø3m*45m in length with operating speed 2.5 RPM which is suitable to achieve 700 TPD clinkers. Grate cooler capacity is 16.5 m^2 and

the specific cooler loading works out as 42.4 TPD/m² which is within the acceptable norms for 700 TPD (<45 TPD/m²). Present pre-heater fan capacity is 1,04,000 m³/hr which is suitable for present production level. Existing Cooler ESP capacity is 76,000 m³/hr which is sufficient for handling present gas volume. Existing Coal Mill capacity is 5-6 TPH.

- *Proposed Set up* – Kiln RPM to be increased to 4 – 4.5 to accommodate required kiln feed for 1,350 TPD clinker production. Therefore, Existing Kiln Drive arrangement with Motor & Gear Box to be replaced. Due to increase in RPM, Girth Gear & Pinion to be replaced. The specific cooler loading works out as 85 TPD/m² for 1,350 TPD. Therefore, existing grate Cooler to be modified/replaced to get 43.3 m² from 16.5 m² with new Drive system. Additional 12 TPH Coal grinding system to be installed with all axillaries system. A similar capacity ESP to be installed parallel to the existing

  - Technical scope of work shall include but not limited to the following:
    - Main Gear Box with 150 KW, 1,000 RPM AC variable speed drive, Auxiliary Gear Box with Motor.
    - 06 Nos Roller assemblies with Ø300 mm including Bearings and its Housing.
    - Girth Gear & Pinion
    - Modification of Kiln Hood
    - Set of Grate Cooler SS310 Plates
    - Drive Gear Box with variable speed drive or Hydraulic drive unit to be installed
    - Set of cooler ID Fans with VVFD.
    - Water Spray arrangement at Cooler
    - Additional ESP of 76,000 m³ /hr at 250° C
    - New ID Fan for ESP
    - New Coal Grinding system – 12 TPH
    - Dust Collector for Coal Grinding system with ID fan & motor
    - Coal Grinding Lubrication system
    - Set of Pneumatic Gravity Conveyor with Blower
    - Explosion relief valve
    - FK Pump for coal firing
    - Booster Fan with Motor
    - Damper and Expansion joint
    - Interconnection Ducts & Chutes
    - Screw Sampler
    - Course return Screw Conveyor
    - High efficiency dynamic separator
    - Double Flap Valve
    - Screw Conveyor for Fines
    - Dust Collector for Bin including Fan
    - Twin Screw conveyor with Agitator for hopper
    - Rotary Air Lock
    - Motorized Diverting Gate
    - Root Blower for FK Pump

- Loss & Weight system for coal firing
- Pneumatic Butterfly Valves

2.8.2 ***Post Clinkerization:***

Clinker Storage, Transport and Extraction system:

- *Existing Set up* – Existing Deep Bucket Conveyor capacity is 45 TPH which is suitable for present production level. Clinker storage capacity is only 5,000 MT. Extraction system from covered clinker yard through Pin gate & HR grade Belt conveyor feeding Chain type Bucket Elevator and RBC to Cement Mill Hopper section.

- *Proposed Set up* – 85 TPH capacities Deep Pan Conveyor to be installed to carry clinker. Additional Clinker Silo of 10,000 MT is proposed.

  - Technical scope of work shall include but not limited to the following:
    - Deep Pan Conveyor with new Gear Box & Motor
    - 3-way motorized diverting gate
    - Motorized Sector Gates below Clinker Silo
    - Pin Gates above Sector gate
    - Belt Conveyor system below Sector Gate
    - Insertable Bag Filter for Clinker extraction
    - Horizontal Gravity Take – up arrangement for Belt Conveyor
    - Dust Collector for Clinker Silo top
    - RCC close stock pile/Silo of clinker – Capacity 10,000 MT

A. Cement Grinding Section:

- *Existing Set up* – 2 Cement Grinding Ball Mill each 25 TPH OPC with Hopper building.

- *Proposed Set up* – It has proposed to install Cement Grinding System/ Pre Grinding System to increase capacity from 1,100 TPD to 2,000 TPD.

  - Technical scope of work shall include but not limited to the following:
    - Hopper for Clinker, Gypsum & Fly Ash
    - Pin Gate below clinker & Gypsum hopper
    - Slide gate below Fly Ash hopper
    - Weigh Feeder for Clinker, Gypsum & Flay Ash – All variable speed motor with reduction Gear Box
    - Dust Collector for Weigh Feeder Venting with complete standard accessories
    - Fan for Dust Collector with Motor
    - Belt Conveyor feeding Mill Inlet
    - Grinding system with full accessories.

2.8.3 Electrical & Instrumentation System:

- Electrical & Instrumentation scope of work shall include but not limited to the following
  - 33KV Vacuum Circuit Breaker
  - 33/6.6KV Power Transformer
  - On load Tap Charger
  - 6.6KV/415V distribution transformer with off load tap changer
  - Liquid Rotor Starter, Motorized
  - HT Capacitor Bank
  - Battery and Battery Charger System
  - 415 LT Panels
  - APFC Panel
  - LT Capacitor
  - Power, Control & Instrumentation cables
  - Instrumentation Items
  - AC Variable Frequency Drive
  - Up gradation of existing PLC system
  - HT & LT Motors
  - Cable Trays
  - Cable Gland & Lugs
  - PLC Hardware
  - Operating Station with Server – 250 display
  - Any other items required for completion of E & I work
  - Installation and commissioning of all Electrical & Instrumentation items.

2.8.4 Paper Sludge Drying System:

This is describes the potential use of paper mill sludge as one of the ingredients in Portland cement manufacturing.

Paper mill sludge is a major economic and environmental problem for the paper and board industry. The material is a by-product of the re-pulping of paper. The main recycling and disposal routes for paper sludge are land-spreading.

Paper sludge consists of cellulose fibers, fillers such as calcium carbonate and china clay and residual chemicals bound up with water. The moisture content is typically up to 40 – 45%. The material is viscous, sticky and hard to dry. For usage of paper reject lime sludge which is rich in lime content to the extent of 45 to 53% Cao. Use of slug mainly require the drying system, feeding systems.

Project Description:

A new Rapid Dryer of suitable capacity to be installed with all auxiliaries system.

- Technical scope of work shall include but not limited to the following:

  - Rapid Dryer, Model: AS 508
  - Counter Weight type double flap valve

- Twin Cyclone
- Rotary Vane Feeder
- Set of Bag Filters with its Fan and rotary air lock
- Dry Sludge Silo
- Bucket Elevator feeding to silo
- Set of Air Slides
- Aeration system for Sludge
- Blower for aeration system
- Solid Flow Meter (SFM)
- Compressors for Bag Filter
- Electrical Motors, Cables & Instrumentation items

➢ Civil scope of work shall include but not limited to the following

- Piling work wherever required
- Equipment Foundation as per Civil drawing
- Construction of RCC building for Rapid Dryer equipments
- Construction of new silo for Dry Sludge

2.8.5 <u>Dry Fly Ash Handling System:</u>

- *<u>Existing set up:</u>* Fly Ash received from various sources through Rail & Road transport in bag packing. The present the moisture content is in average range of 4 – 6%. After cutting the bags, loose Fly Ash is feed into ground dump hopper and conveying through Belt Conveyor to Cement Mill Hopper and extraction the same from the hopper bottom and further conveying through Weigh Feeder & Belt Conveyor into Cement Mill for grinding with Clinker for producing PPC.

- *<u>Proposed Set up:</u>* A new Dry Fly Ash unloading system to be installed. Dry Fly Ash will be brought from nearby power plant through Bulker / Closed Trucks (close Containers) as its moisture content available in the range of 0.5% to 1.00%. From Bulker, material will be unloading by compressed air and stored into steel silo. This will extracted from bottom of steel silo with the help of bottom aeration system and transport the material through set of Air Slide & Bucket Elevator to Cement Mill Inlet or directly to Mill Separator depending upon fineness of raw fly ash.

  ➢ Technical scope of work shall include but not limited to the following:
  - Fly Ash pneumatic conveying system
  - Compressor with Air Dryer and Receiver
  - Fly Ash storage Silo – Steel Construction with complete Insulation
  - Insertable Bag Filter on Steel Silo for venting during unloading
  - Fan for Bag Filter
  - Set of Aeration system for steel silo
  - Shut off gate Manual
  - Shut off gate Pneumatic
  - Dosing Valve

- Intermediate Bin wit Load Cell
- Root Blower for silo aeration – 2 Nos. (One for operation & One for standby)
- Motorized Flow control gate
- Set of Pneumatic Gravity Conveyor
- Bucket Elevator
- Fan for pneumatic conveyor
- Suction Bag Filter with Fan
- Electrical & Instrumentation items including Cables, Cable Tray, Motors etc

➢ Civil scope of work shall include but not limited to the following

- Piling work wherever required
- Equipment Foundation as per Civil drawing

Civil:

➢ Civil scope of work shall include but not limited to the following

- Liner extension of Limestone stock pile
- New transfer house for crusher section
- Construction of new RCC Hopper & Mill building for Raw Material Grinding section
- Construction of new RCC Blending Silo
- Construction of new RCC pre – heater building parallel to existing building
- Construction of new Clinker stock pile
- Construction of new RCC Cement Silo
- RCC building for Motor Control Centre
- Pile foundation wherever required
- New machines foundation as per drawing

Pollution Control Equipment:

➢ An effective air pollution control system is essential and Pollution control system for Rotary Kiln and other grinding section are designed with separate de-dusting systems comprising with Jet Pulse Filter, extraction Duct, Combustion chamber cum spark arrestor, Heat Exchanger, ESP and centrifugal ID Fan with multi vane inlet damper actuated by pneumatic cylinder & motorized system and Stack. SPM level of emissive gas from stack measured by Pollution Control Board is always within 30 mg/NM^3. We have already installed On Line monitoring system (Opacity Meter) at Reverse Air Bag House stack for Raw Mill & Kiln and ESP for cooler gas which is connected to CPCB main server for continuous monitoring. Necessary clearance like NOC for consent to establish has been obtained from State Pollution Control Board (PCB)

The outlet emission figure will be as below as per designed of pollution equipment:

- Dust content in the outlet gas of Reverse Air Bag House while operation of Raw Mill & Kiln are: 30 mg/NM^3
- Dust content in the outlet gas of the Coal Mill Jet Pulse Filter is: 30 mg/NM^3
- Dust content in the outlet gas of the Cooler ESP is: 30 mg/NM^3

- Dust content in the outlet of other Bag Filters are : 30mg/NM^3

Scope of Environmental Impact Assessment (EIA)

- Project Description:
  - Detailed description of the Project
  - Raw material requirement and manufacturing process details
  - Land use for the expansion project
- Environment pollution and control measure:
  - Sources of fugitive dust emission and control measures
  - Point sources of Air pollutants and control measures
- Water and Wastewater:
  - Water requirement and sources of water supply
  - Domestic effluent generation and disposal
- Hazardous Waste Management:
  - Sources and quantities of hazardous waste
  - Handling, storage and disposal of hazardous waste
- Environment Impact Assessment
  - Ambient Air quality monitoring

Scope of Environmental Management Plan (EMP)

- Air Pollution Control measures
- Rain water and other natural sources of Water Harvesting systems
- Risk assessment and detailed safety control measures to mitigate the risk and hazards
- Occupational health and safety measures
- Socio economic development activities
- Green belt development plan
- Control measures for noise pollution

2.10 Water requirements:

WATER:

There is sufficient arrangement of water for the existing unit's Cooling Tower for cooling of hot water, which comes from kiln outlet and for cooling the various rotating components of kiln and also for drinking and general purposes. Water is sourcing from the Roof-Top Rainwater harvesting system located within premises and from the nearby Digaru River. So water is not a problem at the Plant.

For the proposed expansion project there is very less requirement additional water and it will be sourced from the existing sources.

Water requirement will be mainly for domestic use, for gardening and dust suppression. Details of water requirement and waste water generation are given in the following table.

WATER CONSUMPTION:

SR. NO.	PARTICULAR	EXISTING	ADDITIONAL	TOTAL
		KL/Day		
1.	Industrial Purpose (Cooling & Dust suppression)	15	1	16
2.	Domestic Purpose	5	2	7
3.	Gardening & Other	20	1	21
	TOTAL	40	4	44

WASTE WATER GENERATION:

SR. NO.	PARTICULARS	EXISTING	ADDITIONAL	TOTAL
		KL/Day		
1.	Industrial Purpose	0	0	0
2.	Domestic Purpose	3	0.8	3.8
3.	Gardening & Other	0	0	0
	TOTAL	3	0.8	3.8

Note: No industrial waste water will be generated from the proposed project.

CHAPTER 3: SITE ANALYSIS

3.1 Connectivity

PCL is located at Vill: Sarutari, P.O. - Byrnihat, Mouza: Sonapur, Dist: Kamrup, Assam - 793101, which is situated in the middle part of the State of Assam. The nearest airport is Lokpriya Gopinath Bordoloi International Airport, Borjhar, Guwahati, Assam-781015 also known as Guwahati International Airport and formerly as Borjhar Airport is the primary international airport of the North-Eastern States of India located at about 30 km from the plant site.

The nearest Railway Station is the Digaru Railway Station at a distance about 13 km from the plant site.

Moreover, the NF Railway is in progress of constructing a New BG Railway Line from Tetalia Station to Byrnihat via Kamalajhari on the Guwahati - Lumding Division main line. As the New Railway Station at Byrnihat is going to open nearby our factory site, this will be an added advantage for the inbound and outbound movement of our materials.

Transportation facilities to access various markets are readily available. The choice of the site is appropriate from the point of view of raw materials availability and market access.

3.1.1 Road Connectivity

The plant location is about 1.5 Km from the National Highway NH-40 (i.e. Guwahati-Shillong Road).

3.1.2 Rail

The Area is well connected by Railway. The Digaru Railway Station is about 13 Km from the project site.

3.1.3 Communication

The site has access of telephone and mobile connectivity.

3.2 LAND FORM, LAND USE AND LAND OWNERSHIP

Land area covered by existing plant is 23.976 Acres. For the proposed project existing land available with proponent will be utilized which is around 11.474 Acres. After proposed expansion total area covered by unit will be 35.45 Acres (107 Bigha).

3.3 TOPOGRAPHY

Topography of the area is hilly.

3.4 EXISTING LAND USE PATTERN

The Existing Land is a free hold land. The Proposed Expansion project will be carried on the existing land available with proponent. There are Reserve Forests and Wild life sanctuary present within 15 km radius of the project site. The ESZ of Amchung Wild Life Sanctuary is around 4.5 Km distance approximately form the project area.

CHAPTER-4: RATIONALE FOR EXPANSION OF THE EXISTING UNIT

4.1 Location Advantages

The location of the Project at Vill: Sarutari, P.O.- Byrnihat, Mouza: Sonapur, Dist: Kamrup (Assam - 793101) has the following advantages:

(a) Proximity to market i.e. Guwahati and other parts of North East.

(b) Proximity to Meghalaya State for easy procurement of raw material such as Lime Stone & Coal etc.

(c) Proximity to High Tension Power Line (33 KVA).

(d) Proximity to State Highway gives easy access and convenience for transportation.

(e) Proximity to Nearby Railway Siding.

4.2 Marketing & Selling Arrangements

We have launched our products in April, 2008 and within a short span our Brand Name "Surya Gold Cement" is familiar in the market and we have established our name as one of the leading and quality cement manufacturer in N.E. Region. At present our production is maximum 1,100 MT per day and we are selling these materials in Assam with an at par prices with other leading Cement Brands in the market etc.

Presently, the N.E. Region represents a very high growth cement market and also substantially increasing infrastructure with various Hydel Projects (NHPC, NEEPCO), Irrigation, Railways, Housing and Road Projects (NHAI). Moreover, the region is likely to witness industrial activity on account of the fiscal incentives provided by the Government.

At present the demand of Cement in NE States is about 7.5 million tonnes and out of which 65% of the same is consumed in Assam itself and 8% in Meghalaya and balance 27% in other States of N.E. Region. Since, our factory is also situated in Kamrup District of Assam, we can easily capture and sell our factory fresh cement in Assam and neighboring States. Presently, 80% of market share is catered by local major brands like Surya Gold, Dalmia, Star, Topcem etc. and rest 20% is coming from main line (national cement brands like Century, Ultratech, Ambuja, Lafarge, Birla etc.)

In our present network, we are having 25 Sales Promoters and about 340 of Dealers and selling about 31000 MT of cements per month. This is just 4.0 % of the total market potential of N.E. Region and 6.5 % of the demand of Assam. Since, our factory is situated

in Assam, we can capture Assam based market and can sale 50,000 MT of cement per month within Assam and neighboring States. The demand for cement is likely to grow at 7-8% in coming years and we are also expecting a market share of our sales about 8-9%.

Our products are already approved with BIS, PWD, BCPL, N.F. Railway and other approvals are on final stage with CPWD, MES and other upcoming projects of State & Central Governments and Builders of N.E. Region. Our Company is also an ISO 9001:2015 and 14001:2015 Certified Company produces comprehensive range of cements as per the latest BIS Standards. The plant also produces high quality Clinker, a major raw materials used in cement manufacturing.

CHAPTER- 5: IMPLEMENTATION SCHEDULE

5.1 INTRODUCTION

This chapter covers the time estimates for plant expansion project taking into consideration various relevant factors which contribute to the successful completion of the project.

The considerations and actions required to be taken at different stages of project implementation are also outlined.

5.2 PLANNING FOR PROJECT REALISATION

The main critical activities which play a crucial role in project realization are:

- **Pre-Project Activities (till conclusion of contracts for main machinery)**
  - Receipt of requisite clearances from competent Authorities in respect of :
    - State Pollution Control Board clearance (if required)
    - Sanction and supply of additional power from State Government.
  - Basic engineering including preparation of main machinery tender specifications.
  - Floating Tender Inquiries, evaluation and placement of order of main machinery.

- **Project Activities (After Conclusion of Contracts for Main Machinery)**
  - Detailed engineering of the project
  - Procurement of auxiliary equipment and systems
  - Erection of machinery including installation of electrical equipment and instrumentation
  - Civil & Structural Activities
  - Trial runs and Commissioning of the plant

5.3 KEY FACTORS STRATEGIES

The key factors strategy which would help in successful and timely project implementation are:

- Timely and proper choice of external agencies.
- Machinery suppliers
- Contractors for civil construction and erection of equipment
- Adequate attention at the time of formulating technical concept and system design selection for the plant
- Formulation of an effective project team led by an experienced project manager
- Establishment of an efficient system of project planning and monitoring including reporting procedures for progress review and co-ordination

5.4 IMPLEMENTATION SCHEDULE

Implementation of Project within a pre-determined time frame is an important factor for the success of a project. Timely implementation saves on various costs like interest, administrative overheads and helps to realize the goals as per pre-determined objectives.
Implementation of Project involves co-ordination of different activities at various levels of the firm and amongst different outside agencies. We are giving here under the details of the Project Implementation:

From the date of start, the implementation schedule envisages completion of project in 18 months. It is considered that preliminary activities such as obtaining necessary statutory clearance for installation of the cement (grinding unit) making plant complex and financial arrangements for the implementation of the project will be made at proper dates.

The Schedule of implementing the proposed expansion project is as under:

Activity	***Scheduled date of completion***	
	Start Date	**End Date**
Detailed Engineering		
Civil Works	1 Months	14 Months
Structural Work	3 Months	14 Months
Major Equipment Ordering	1 Months	6 Months
Erection of Equipment	12 Months	17 Months
Commissioning	17 Month	18 Months

CHAPTER- 6: ESTIMATE OF CAPITAL COSTS

6.1 Introduction

This chapter covers the estimates for capital costs.

6.2 Investment

Based on the infrastructural aspects and technical concepts the total capital cost on the project is 126.18 Crores.

6.2.1 Land and Site Development

Towards site development, a nominal amount has been considered since the plant is already in existing.

6.2.2 Buildings

The cost of various plant structures has been estimated based on the technical concept. The cost estimates are generally based on similar projects carried out by consultant after suitable modifications due to change in concept. For various item rates, costs prevailing in the area have been considered.

6.2.3 Plant and Machinery

The cost estimates for plant and machinery have been worked out in line with the requirements of the technical concept and based on the cost figures available from orders placed for similar items in the recent past, duly updated to cover price escalations in the intervening period.

Cost of plant and machinery including impacts of taxes and duties, transportation, erection etc. The cost estimates also include costs of mechanical, electrical and instrumentation items, as also miscellaneous items like ducts, chutes and auxiliary equipment.

6.2.4 Technical and Engineering Fees

The technical and engineering fee has been considered keeping in view the involvement of Indian Consultants, for requisite services.

6.2.5 Miscellaneous Fixed Assets

Details of electrical installation for power distribution have been considered commensurate with plant process systems. The details of elements of cost have been worked out.

Other miscellaneous fixed assets have been provided on block basis as per information available with consultants for similar projects.

6.2.6 Pre-Operative Expenses

Pre-operative expenses would include Project follow up/ expediting expenses, traveling expenses, post/internet/legal expenses, startup expenses, interest during construction, insurance during construction etc.

Other expenses have also been suitably considered based on available information.

6.2.7 Contingency

Contingency@ 3% has been considered for proposed project cost.

6.2.8 Interest during Construction Period

Interest on the funds borrowed from FI's/ Commercial Banks during the construction period has been calculated.

6.3 CAPITAL COST

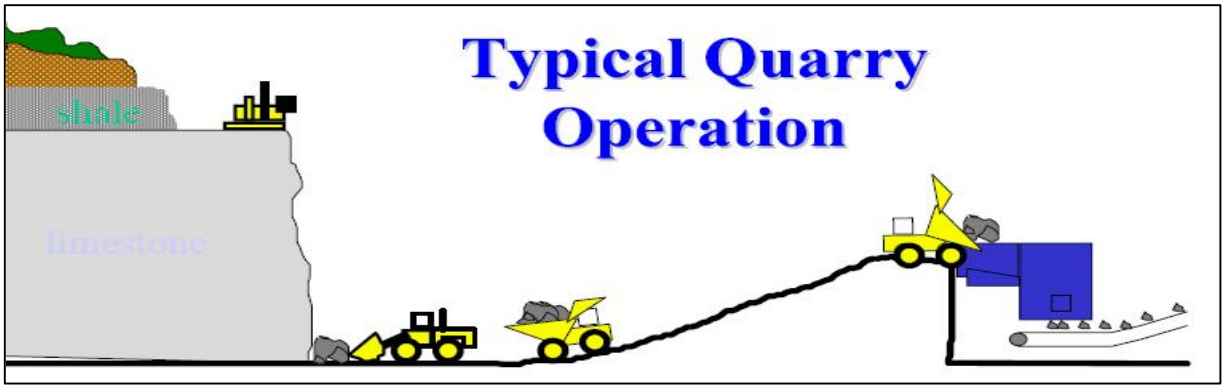
Based on the above, as also the margin money computations, the total project cost works out to Rs. 126.18 Crores.

CHAPTER-7: TECHNICAL OVERVIEW OF MANUFACTURING

7.1.0 CEMENT MANUFACTURING PROCESS

Purbanchal Cement Ltd. (PCL) is engaged in production of Cement 1,100 TPD and Clinker 700 TPD at Vill: Sarutari, P.O.: Byrnihat, Mouza: Sonapur, Dist: Kamrup (Assam - 793101). The primary raw material lime stone is crushed in primary and secondary crusher and conveyed to the storage hopper. Each raw material/consumables such as crushed lime stone, shell/clay and iron dust are weighed as per designed quantity and feed to raw mill for grinding. The grinded raw mix through the pre heating system feed to the Kiln. All the process parameters are being controlled through PLC system and closely monitored by the senior Process Engineer in all 3 shifts/Round the Clock. The detailed manufacturing process is as under: -

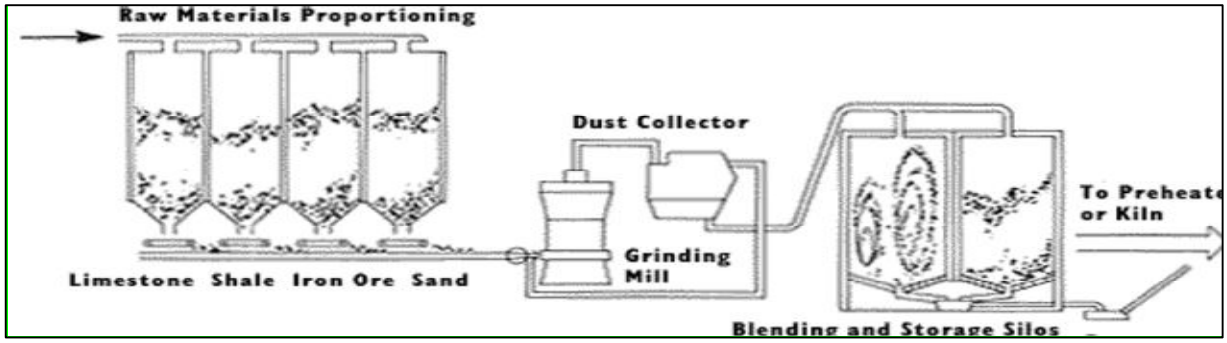
7.1.1 The cement manufacturing process begins when limestone, the basic raw material used to make cement.



Typically shale provides the argillaceous components:

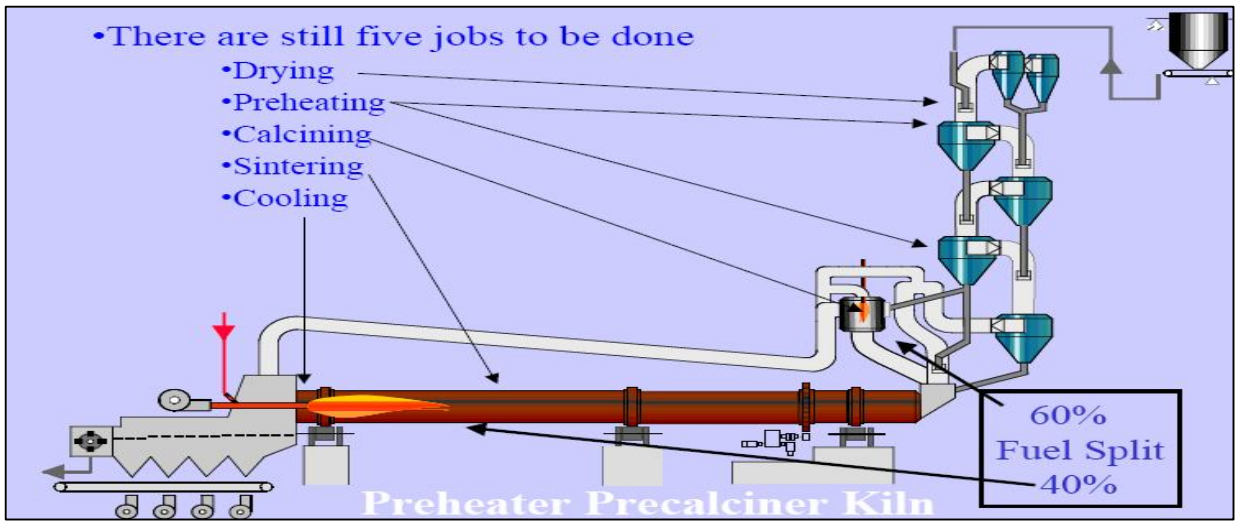
- Silica (SiO2, Aluminum (Al2O3) & Iron (Fe2O3)
- Limestone provides the calcareous component:
- Calcium Carbonate (CaCO3)
- Raw materials may vary in both composition and morphology.

7.1.2 The limestone is combined with clay, iron ore and sand. It is then ground in a crusher and

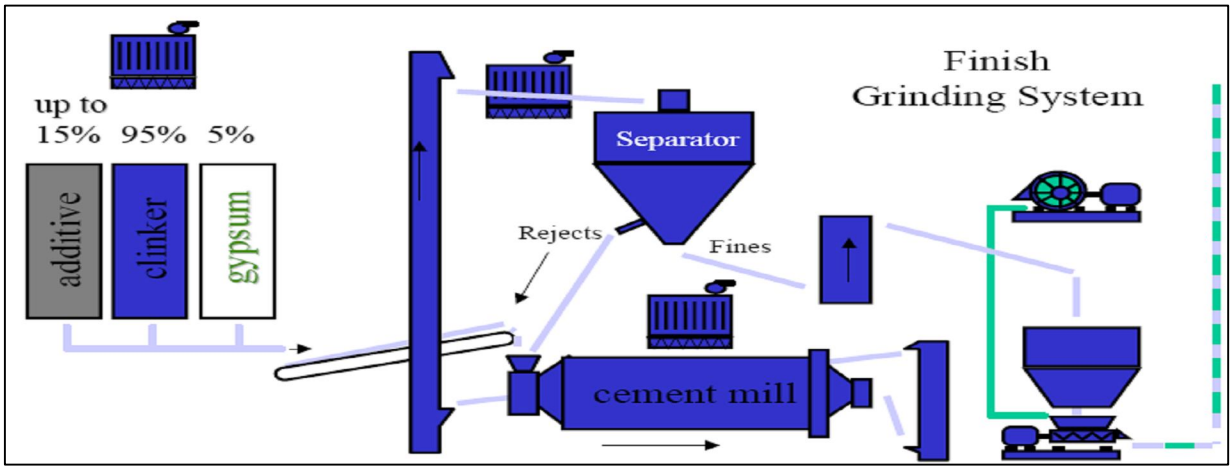


fed into.

7.1.3 Next, the fine powder is heated as it passes through the Pre-Heater Tower into a large kiln. In the kiln, the powder is heated to 1500^{o}C. This creates a new product, called clinker, which resembles pellets about the size of marbles.



7.1.4 The clinker is combined with small amounts of gypsum and limestone and finely ground in a finishing mill. The mill is a large revolving cylinder containing steel balls that is driven by a motor. The finished cement is ground so fine that it can pass through a sieve that will hold water.



Mechanism of Rotary Kiln:

A cement kiln is an inclined rotating furnace. As the raw materials of limestone, clay and shale tumble toward the 3400°F flame, a chemical reaction transforms them into clinker, which is ground together with gypsum to form Portland cement.

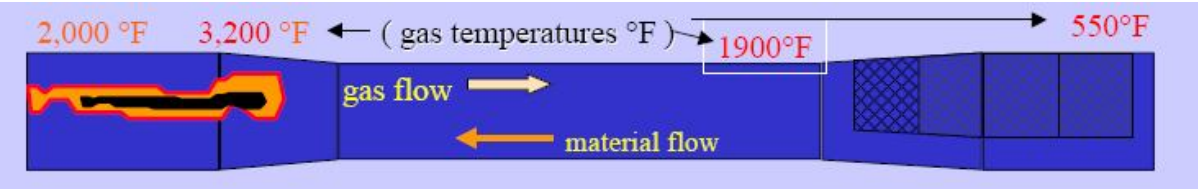
The kiln is a continuous stream process vessel in which feed and fuel are held in dynamic balance. There are 5 (five) distinct process functions are performed in the kiln:

- Dry
- Preheat
- Calcine
- Sinter
- Cool

The following chemical reaction normally takes place in rotary kiln.

$$CaCO_3 + Fe_2O_3 + SiO_2 \xrightarrow[\text{Heat}]{1800^0C} \text{3CaO.SiO2 (50-70\%), 2CaO.SiO2 (15-30\%), 3CaO.Al2O3(5-10\%), 4CaO.Al2O3.Fe2O3(5-15\%)}$$

A schematic view of Rotary Kiln is shown in the following figure.



7.2 RAW MATERIALS

Major raw materials used for manufacturing clinker are limestone, clay/shale, iron ore/mill scale and sand. Clinker is mixed with 5% gypsum ($CaSO_4, H_2O$) to produce Ordinary Portland Cement (OPC) while clinker is mixed with 5% gypsum and 35% ash to produce Portland Pozzolana Cement (PPC).

• Typical Raw Materials:

– Limestone (CaCO3)

– Sand (SiO2)

– Shale, Clay (SiO2, Al2O3, Fe2O3)

– Iron Ore/Mill Scale (Fe2O3)

Raw materials Consumption:

Sl. No.	NAME OF THE RAW MATERIAL	RW MATERIAL REQUIREMENT MT Per Day			SOURCE OF THE RAW MATERIAL	MODE OF TRANSPORTATION
		EXISTING	ADDITIONAL	TOTAL		
1	Lime Stone	910	750	1660	Cherrapunjee /Ichamati – 150 /165km, Meghalaya	By Road
2	Additives	130	50	180	Nearby area, Assam	By Road
3	Fly Ash	277	268	545	Farraka/ Kahalgaon, West Bengal	By Rail / Road (30 KM from Digaru
4	Clinker	100	50	150	Meghalaya / Assam	By Road
5	Gypsum	11	10	21	Samdrup – 200 km, Jongkhar Bhutan	By Road
6	Slag	0	200	200	Durgapur, West Bengal	By Road
7	Coal	105	95	200	Meghalaya	By Road/Rail
8	Sludge	0	175	175	Various parts of Assam	By Road

Different size of limestone and clay

Lime Stone Pile

Calcareous Component	Argillaceous Component:
(providing Lime – CaO) – limestone – marly limestone – chalk – coral limestone – marble – lime-sand – shell deposits – lime sludge	(SiO2, Al2O3, and Fe2O3) – clay – shale – calcareous marl – marl – marly clay – tuff, ash – phyllite, slate – glass

7.2.1 Limestone

Limestone ore usually contain calcium oxide, aluminum oxide, silica and iron oxide. A typical analysis of limestone is as under.

SL. NO.	CONSTITUENT		% WEIGHT OF DRIED MATERIAL
1	Silica	SiO2	0.3-1.0
2	Aluminium oxide	Al2O3	0.1-1.0
3	Iron oxide	Fe2O3	0.05--0.11
4	Calcium oxide	CaO	50.0-54.0
5	Magnesium oxide	MgO	1.0-4.0
6	Sodium oxide	Na2O	0.01-0.05
7	Potassium oxide	K2O	0.02-0.04
8	Sulphate	SO3	0.03-0.07

9	Chloride	Cl	0.01-0.02
10	Loss on ignition @900°C		42.0-44.0
11	Calcium carbonate	CaCO3	91.0-97.0
12	Magnesium carbonate	MgCO3	2.0-6.0

7.2.2 Steam Coal:

Steam coal refers to coal used by electric power plants and industrial steam boilers to generate steam to produce electricity.

Coal dust is used as reductant in kiln @ 0.15 MT/MT Clinker to be available from coal mines at Meghalaya. Other usage of coal in this manufacturing process is as solid fuel.

Specification of Steam Coal is as under:

1) Type 1

MOISTURE : 12.00 %

ASH CONTENT : 11.00 %

VOLATILE MATTER : 37.20 %

FIXED CARBON : 39.80 %

CALORIFIC VALUE : 6000 apx. K CAL/KG

To check SIZE TEST:

> 50 MM = 2.76%

> 2.38 MM = 23.97%

> 0.32 MM = 96.17%

ASH FUSHION TEMPERATURE (REDUCING):

INITIAL DEFORMATION : > 1,150 ºC

SEHERICAL : > 1,200 ºC

FLUID : > 1,250 ºC

7.3.0 Product Profile

7.3.1 CEMENT:

Cement is made by finely pulverizing the clinker produced by calcining to incipient fusion a mixture of argillaceous and calcareous materials. Portland cement is the fine gray powder

that is the active ingredient in concrete. Cement is key ingredient of concrete but makes up just 11% of the mix.

- For the production of OPC , Clinker production will be ground with 3% Gypsum to produce OPC .
- For the production of PPC, Clinker produced will be mixed with 28% Fly Ash and 2% Gypsum to produce PPC.

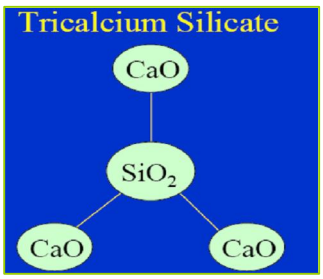
• Basic Chemical Components of Portland Cement:

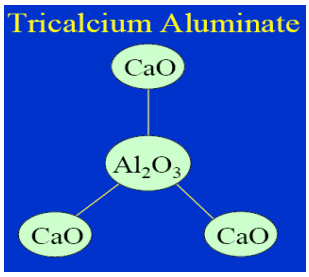
– Calcium (Ca)

– Silicon (Si)

– Aluminum (Al)

– Iron (Fe)





PRODUCT SPECEFICATION

Cement, a binder, a substance which sets and hardens independently, and can bind other materials together. In ancient times, volcanic ash and pulverized brick additives were added to the burnt lime to obtain a hydraulic binder which were later referred to as cementum, cimentum, cäment and cement. Cements used in construction are characterized as hydraulic or non-hydraulic.

Portland cement is a basic ingredient of concrete, mortar and most non-speciality grout. The most common use for Portland cement is in the production of concrete. Concrete is a composite material consisting of aggregate (gravel and sand), cement and water. As a construction material, concrete can be cast in almost any shape desired and can become a structural (load bearing) element. Portland cement may be gray or white.

Product Specification

PARTICULARS	UNIT	REQUIREMENT OF
		IS 12269 : 1987
A. CHEMICAL REQUIREMENTS:		
1. Lime Saturation Factor		0.80 - 1.02
2. Ratio of Percentage of Alumina to that of Iron Oxide	%	0.66 Min
3. Insoluble Residue (percent by mass)	%	3.00 Max
4. Magnesia (percent by mass)	%	6.00 Max
5. Sulphuric Anhydride (SO3) (Percent by mass)	%	3.00 Max
6. Loss on Ignition	%	4.00 Max
7. Chloride (Percent by mass)	%	0.10 Max
B. PHYSICAL REQUIREMENTS:		
1. Fineness (Blaine)	M2 / Kg	225 Min
2. Soundness		
a. Le. Chatelier Expansion	mm	10.00 Max
b. Autoclave Expansion	%	00.8 Max
3. Setting Time		
a. Initial	Minutes	30 Min
b. Final	Minutes	600 Max
4. Compressive Strength		
a. 72+ 1 hours (3 days)	Mpa	27 Min
b. 168 + 1 Hours (7 days)	Mpa	37 Min
c. 672 + 4 hours (28 days)	Mpa	53 Min

In Ordinary Portland Cement (OPC), 3% gypsum blended with clinker.

In Portland Pozzolana Cement (PPC), 2% gypsum and 28% ash blended with clinker.

7.3.2 CLINKER:

PRODUCT SPECEFICATION

Example of a typical clinker analysis (oxide weight%)										
SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	K_2O	Na_2O	SO_3	LOI	IR	Total
21.5	5.2	2.8	66.6	1.0	0.6	0.2	1.0	1.5	0.5	98.9
Free lime = 1.0% CaO Balance is due to small amounts of oxides of titanium, manganese, phosphorus and chromium.										

Other Parameters

Free Lime	2.00 % Max.
LSF	94 – 96 %
C3S	63 – 65 % ← Important
C2S	10 – 18 %
C3A	6 – 8 %
Bulk Density	1.30 – 1.45 (Gm. /Ltr)
Moisture	0.5 % Max.
Size	+ 3 mm – Min. 70 % – 3 mm – Min. 30 %

FORMULAE:

1. $LSF = \dfrac{CaO}{2.8\,SiO_2 + 1.2\,Al_2O_3 + 0.65\,Fe_2O_3}$

2. $C3S = 4.07\,CaO - (7.6\,SiO_2 + 6.72\,Al_2O_3 + 1.43\,Fe_2O_3)$

3. $C2S = 2.87\,SiO_2 - 0.754\,C3S$

4. $C3A = 2.65\,Al_2O_3$

CHAPTER- 8: REHABILITATION AND RESETTLEMENT (R & R) PLAN

8.1 REHABILITATION AND RESETTLEMENT

Proposed expansion project is located within its owned premises, which is already acquired and there is no habitat. So proposed project proposal does not involve any Rehabilitation & Resettlement.

CHAPTER- 9: CONCLUSION & RECOMMENDATIONS

9.1 CONCLUSION & RECOMMENDATIONS

Based on the performance indicators, it is concluded that the project is technically feasible and financially very attractive. Expeditious implementation of the project is therefore recommended.