Jaykaycem (Central) Ltd.
(Wholly Owned Subsidiary of JK Cement Ltd.)

Jaykaycem (Central) Limited

Techno Economic Feasibility Report

for

2.0 mio tpa Prayagraj Grinding Unit

(Uttar Pradesh)

December 2022
(FINAL REPORT – Version F-R0)

Holtec Consulting Private Limited

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ACKNOWLEDGEMENT

WE EXPRESS OUR SINCERE GRATITUDE TO THE OFFICIALS OF:

- **JAYKAYCEM (CENTRAL) LIMITED [JCL]**

FOR THE ASSISTANCE AND CO-OPERATION EXTENDED DURING OUR VISIT AND THROUGHOUT THE PREPARATION OF THE REPORT,

BUT FOR WHICH THIS REPORT COULD NOT HAVE BEEN SUCCESSFULLY PREPARED.

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GENERIC LIST OF ABBREVIATIONS

ABBREVIATION	DESCRIPTION
%	Percent
a	Annum
Avg.	Average
°C	Degree Centigrade
BE	Bucket Elevator
BMRP	Ball Mill Roller Press
CA	Competitive Advantage
CCBM	Closed Circuit Ball Mill
CCR	Central Control Room
CGI	Corrugated Galvanized Iron
cm	Centimeter
CMA	Cement Manufacturers Association
CPU	Central Processing Unit
DC	Direct Current
DCS	Distributed Control System
DG	Diesel Generating Set
Dia.	Diameter
Diff	Differential
dpa	Days Per Annum
DSCR	Debt Service Coverage Ratio
EDP	Electronic Data Processing
E & I	Electrical & Instrumentation

ABBREVIATION	DESCRIPTION
FY	Financial Year
GA	General Arrangement
GU	Grinding Unit
HOLTEC	**Holtec Consulting Private Limited, Gurgaon**
hpd	Hours Per Day
HT	High Tension
IRR	Internal Rate of return
JCL	**JayKayCem (Central) Limited**
kg	Kilograms
km	Kilometers
kV	Kilovolts
kVA	Kilovolt Amperes
kW	Kilowatts
kWh	Kilo Watt Hour
LMV	Light Motor Vehicle
LT	Low Tension
LV	Low Voltage
m	Meter
Max.	Maximum
MCCs	Motor Control Centres
mg	Milligrams
min	Minutes
mio	Million

ABBREVIATION	DESCRIPTION
mm	Millimeter
Min.	Minimum
MSL	Mean Sea Level
MVA	Megavolt Ampere
MW	Megawatt
NPV	Net Present Value
NSDP	Net State Domestic Production
No./ nos.	Numbers
OH	Overhead
PLC	Programmable Logic Control
p.m.	Per month
PCC	Portland Composite Cement
PPC	Portland Pozzolana Cement
PVC	Poly Vinyl Chloride
RCC	Reinforced Cement Concrete
RF	Radio Frequency
Rs.	Rupees
s	Second
SBC	Safe bearing Capacity
t	Tonnes
TEFR	Techno Economic Feasibility Report
tpa	Tonnes Per Annum
tpd	Tonnes Per Day

ABBREVIATION	DESCRIPTION
tph	Tonnes Per Hour
UPS	Uninterrupted Power Supply
V	Volt
Viz:	namely
VRM	Vertical Roller Mill
XLPE	Cross Linked Polyethylene
XRF	X-ray Fluorescence

CHAPTER 0 | PROJECT AT A GLANCE

Promoters	**Jaykaycem (Central) Limited (JCL)** is a wholly owned subsidiary of JK Cement Limited, which in turn, is the Cement vertical of the industrial conglomerate JK Organisation. **JCL**, thus, is an affiliate of the flagship JK Organisation. JK Organization has significant presence in diverse industries ranging from cement, paper, tyres, textiles, etc. It forged its presence in manufacturing of clinker and cement in year 1975 by setting up its first grey cement plant at Nimbahera in the state of Rajasthan. **JCL** have commissioned a greenfield integrated unit of 8,000 tpd clinker capacity in Panna district of Madhya Pradesh in November 2022, and is in the process of setting up a greenfield split grinding unit in Hamirpur district of Uttar Pradesh. It now envisages to setup another split clinker grinding unit near Prayagraj in the state of Uttar Pradesh to expand its footprints in the region, and service the markets of interest more efficiently

Project	**JCL** proposes to set up a 2.0 mio tpa clinker grinding unit (GU) near Prayagraj in the State of Uttar Pradesh. Clinker for the proposed GU is proposed to be sourced from their recently commissioned Panna cement plant in Madhya Pradesh.
Plant location	Village : Ledar District : Prayagraj State : Uttar Pradesh Approximate locating coordinates and altitude of the proposed site are: • Latitude : N 25° 12' 05" • Longitude : E 81° 34' 04" • Altitude : ~150m with respect to AMSL
Land	About 57 acres of land (approx. 23 hectares) is being procured for the purpose of setting up the proposed Grinding Unit. A total of about Rs.2,100 lakhs is envisioned by the company as the capital expense towards land procurement and its land-use conversion from agricultural to manufacturing purposes

Plant Capacity	Cement : 2.0 mio tpa (approx. 6,060 tpd)
Product Mix	PPC : 100%

Markets	The markets of interest for **JCL**'s proposed Prayagraj GU include East Uttar Pradesh. It is estimated that the plant should be able to achieve 100% capacity utilization by the 5th year of operation, i.e., FY29 The average net cash realization for PPC is estimated to be Rs. 4,656/ t (~ Rs. 233/ bag). Furthermore, JCL is envisaged to avail of Uttar Pradesh SGST exemption (70% of SGST for sales in Uttar Pradesh, max up to 300% of Fixed Capital Investment for 10 years) which shall help alleviate the overall net realization to Rs.5,235/ t (~ Rs. 262/ bag)

Raw material composition in the Product Mix	**Component**	**Indicative Proportions (%, by weight)**
	Clinker	63%
	Gypsum	5%
	Flyash	32%

Raw Material sources and approx. landed cost at site	**Raw material**	**Source Locality**	**Source Category**	**Approx. distance (km)**	**Approx. Landed Cost (Rs/ t)**
	Clinker	**JCL** Panna Cement Plant	Purchase	260	4,100
	Flyash	NTPC Shankargarh / Prayagraj Power Generation Company Ltd., Bara, Prayagraj	Purchase	12	550
	Gypsum	Various (Imported from Oman/Iran, and sourced through operators and importers, in pre-crushed and sized form)	Purchase	~1,250 # & 15	5,500

 # (Approx. Rail distance from seaports to nearest envisaged railway siding)

Salient parameters for technical assessment	Particular	Values considered for Report & analysis
	Plant operations (average availability)	330 dpa
	Grinding mill operation	21 hours/day
	Design/Safety factor for major sections	1.15 for grinding section & 1.25 for packing section
	Clinker to cement factor	0.63
	Estimated specific power consumption	31.5 kWh/ t PPC
	Maximum power demand	12 MW
	Water requirement	Upto 400 kl/day

Main Machinery	Item	Capacity
	Gypsum crusher (tph)	Not envisaged
	Cement grinding (tph)	1 x 330 (VRM)
	Packing (tph)	2 x 240

Main Storages	Item	Storages (t)
	Clinker storage (RCC Silo)	1 x 25,000
	Additives –Gypsum (& provision for Pond ash storage) (Linear, Covered)	1 x 3,000 + 1 x 2,500
	Flyash storage (RCC Silos)	1 x 5,000
	Cement storage (RCC Silos)	2 x 5,000

Suggested Manpower	**Phase**	**Gen. Shift**	**Other Shifts**	**Total**
	Implementation Phase	30	-	30
	Operation Phase	67	137	204

Project Implementation Period	An implementation period of **18-months** from the date of signing/ effectiveness (zero date) of the main equipment supply contract is foreseen for the project. A **6-month** period for Pre-project activities is also envisaged prior to the 'zero date' of the project implementation period.

Total Estimated Investment Cost	**Cost head**	**Estimated Capex (Rs. Lakhs)**
	Land and Site Development	4,000
	Civil Works, Buildings and Structures	11,632
	Plant and Machinery	22,061
	Expenses on technical know-how & training	450
	Miscellaneous Fixed Assets	5,125
	Pre-Operative Expenses (including Interest During Construction & Finance charges)	2,960
	Contingency (@5%)	2,229
	Margin Money for Working Capital	759
	Estimated Total Project Cost	**49,216**
	SOURCES OF FUNDS	**(Rounded-off breakup)**
	Debt	30,714
	Equity	18,502
	Total	**49,216**

Financial Indicators	Item	Value
	IRR on Total Investment	23.8%
	IRR on Equity	33.2%
	Net Present Value @ 10% (Rs. Lakhs)	63,724
	Payback Period	4 years 6 months
	Average Debt Service Coverage	2.84

Conclusion	
	The project exhibits an Internal Rate of Return (IRR) on Total Investment of **23.8%**. and Average Debt Service Coverage Ratio (DSCR) of **2.84**, having considered the SGST related incentive offered under the guidelines of U.P. State government's IIEPP 2017. Various sensitivity analyses indicate reasonable project IRR and NPV Considering the plant concept along with material and process requirements, the project is technically feasible. Subsequent to financial analyses and acceptable level of returns, the project is financially viable.

CHAPTER 1 | PREAMBLE

1.1 THE PROJECT

Jaykaycem (Central) Limited (JCL) proposes to set up a 2.0 mio tpa Greenfield Grinding Unit near Prayagraj in the State of Uttar Pradesh (U.P.) by sourcing clinker from their Panna cement plant in Madhya Pradesh.

JCL has entrusted **Holtec Consulting Private Limited, Gurgaon (HOLTEC)** to prepare the Techno Economic Feasibility Report (TEFR) for the project.

1.2 PROMOTER'S BACKGROUND

Jaykaycem (Central) Limited (JCL) is a wholly owned subsidiary of JK Cement Limited, which in turn, is the Cement vertical of the industrial conglomerate JK Organisation. **JCL**, thus, is an affiliate of the flagship JK Organisation.

Company Directors of **JCL**, as on date, are:

- Mr. Ajay Kumar Saraogi : *Managing Director*
- Mr. Madhavkrishna Singhania : *Additional Director*
- Mr. Anil Kumar Agrawal : *Director*
- Dr. Krishna Behari Agarwal : *Director*

JCL have commissioned a greenfield integrated unit of 8,000 tpd clinker capacity in Panna district of Madhya Pradesh in November 2022, and is in the process of setting up a greenfield split grinding unit in Hamirpur district of Uttar Pradesh.

It now envisages to setup another split clinker grinding unit near Prayagraj in the state of Uttar Pradesh to expand its footprints in the region, and service the markets of interest more efficiently.

1.3 CONSULTANT BACKGROUND

This study has been carried out by:

Holtec Consulting Private Limited
HOLTEC Centre,
A - Block, Sushant Lok
Gurugram – 122 001, Haryana, INDIA

Incorporated in 1967, **Holtec Consulting Private Limited** is an ISO-certified advisory, primarily positioned to service the entire gamut of consulting needs of the global cement industry. Its portfolio spans services in all disciplines of Engineering, Business Consulting, Geology & Mining, Project & Construction Management, Environment Management, Performance Enhancement, Logistics, etc.

In addition, **HOLTEC** operates and manages cement plants globally and also provides solutions encompassing the integrated delivery of services & products through its two wholly owned subsidiaries, **Holtec Global Solutions FZE** operating from Sharjah, U.A.E. and **Holtec Global Solutions Private Limited**, headquartered in India.

HOLTEC's ensemble of 900+ clients, in 90+ countries, includes cement producers, equipment & service providers, EPC & construction firms, infrastructure developers, investing & funding bodies and all other relevant stakeholders.

Since its inception, **HOLTEC** has delivered significant value to its clientele through 4,000+ consulting assignments executed by its multi-disciplinary staff with an experience inventory of over 8,500 man-years.

1.4 THIS REPORT

HOLTEC constituted a multifunctional study team for preparation of the Techno Economic Feasibility Report. A field visit was carried out during the period of 2nd to 4th October 2022 to collect enabling data from the proposed plant site.

This Report has been formulated based upon the primary and inferred input data received from **JCL**; interactive exchange of views with **JCL** representatives; broad data assessment and secondary research. This study draws extensively from **HOLTEC**'S database of plant designs & investment costs, etc.

The primary purpose of this Report is to appraise **JCL** of the broad conceptualization outlay of the proposed cement manufacturing project, which briefly covers parameters pertaining to plant's configuration, major equipment & storage sizing related details, its foreseeable markets, the input/raw material scenario, and indicative capex outlay along with a preliminary project viability scenario.

This Report also takes into account the broadly stipulated incentives for a manufacturing unit as suggested in U.P. State's Industrial Investment and Employment Promotion Policy 2017 (IIEPP-2017).

CHAPTER 2 | THE CEMENT MARKETS

2.1 INTRODUCTION

Jaykaycem (Central) Limited (JCL) proposes to set up a 2.0 mio tpa grinding unit at Prayagraj, Uttar Pradesh.

This chapter examines the estimated market position of **JCL**. The indicatively estimated sale volumes and the net sales realization that could be achieved have also been assessed.

Detailed market scenarios at the national and state level are furnished under **Annexure 2.1** and **Annexure 2.2** respectively.

2.2 MARKETS OF INTEREST

The markets of interest envisaged for the proposed Grinding Unit (GU) are the following:

Uttar Pradesh (UP)

- **South East UP**

  which includes Allahabad, Azamgarh, Jaunpur, Kaushambi, Mirzapur, Pratapgarh, Sant Ravidas Nagar, Sonbhadra, Sultanpur, Varanasi, Chandauli, Ghazipur, Mau, Ballia.

- **North East UP**

  which includes Shravasti, Ambedkar Nagar, Balrampur, Basti, Deoria, Kushinagar, Faizabad, Gonda, Gorakhpur, Maharajganj, Sant Kabir Nagar, Siddharthanagar.

The proposed plant's location and its primary regions of interest have been indicatively earmarked on part of the map, and furnished under **Chart 2.1** below:

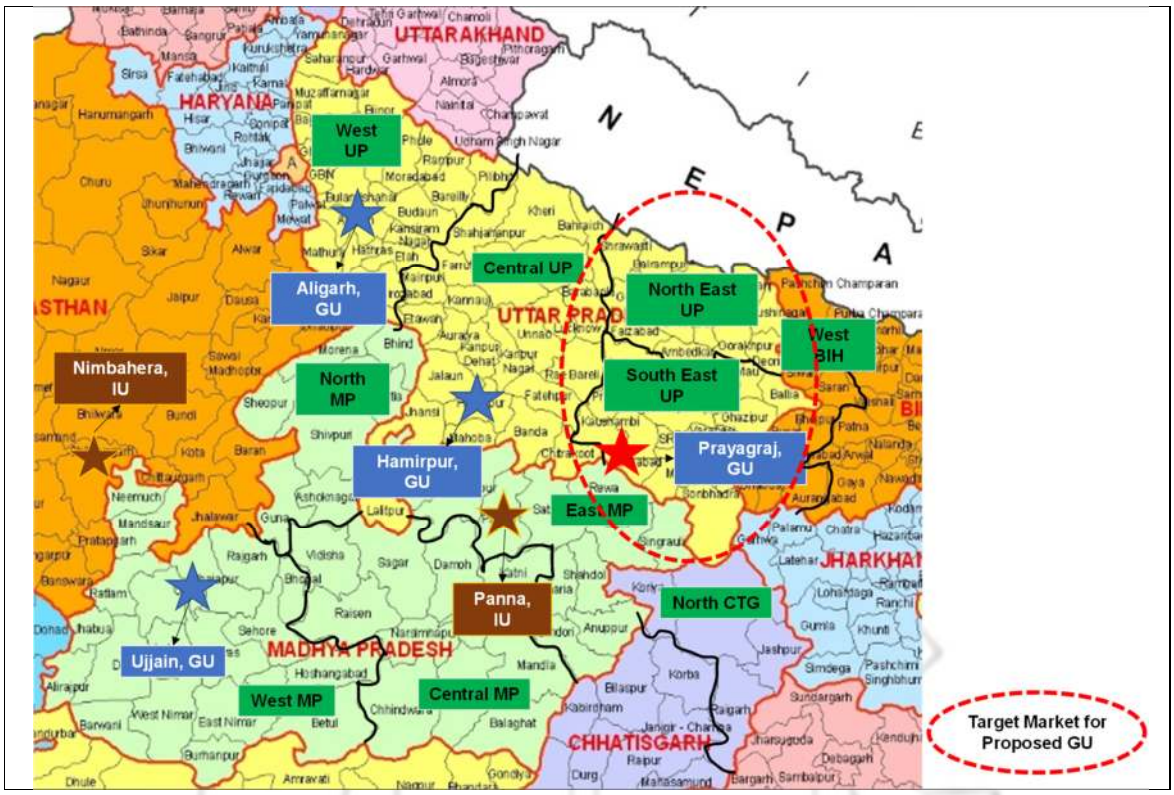


Chart 2.1 | Markets of Interest for proposed Grinding Unit

The project envisages to utilize the incentives available under Uttar Pradesh State's Industrial Investment and Employment Promotion Policy 2017 (IIEPP-2017). 70% State GST (SGST) exemption, which is permitted to go up to 300% of the proposed Fixed Capital Investment over a period of 10 years. The proposed grinding plant shall cater to the markets within Uttar Pradesh itself.

2.2.1 Current Demand

The demand for different regions of markets of interest is given in the following table:

Figures for FY 22

Market	Consumption (mio t)	Share of target market %
South East UP	6.7	58%
North East UP	4.8	42%
Total	**11.5**	**100%**

Source: Holtec Analysis

Table 2.1 | Cement consumption in various regions of market of interest

The estimated cement consumption in the markets of interest for FY22, based on market information, is around 12 mio t.

2.2.2 Market Shares

The market shares of cement players in the states of interest i.e. Uttar Pradesh, for FY 22 are as follows:

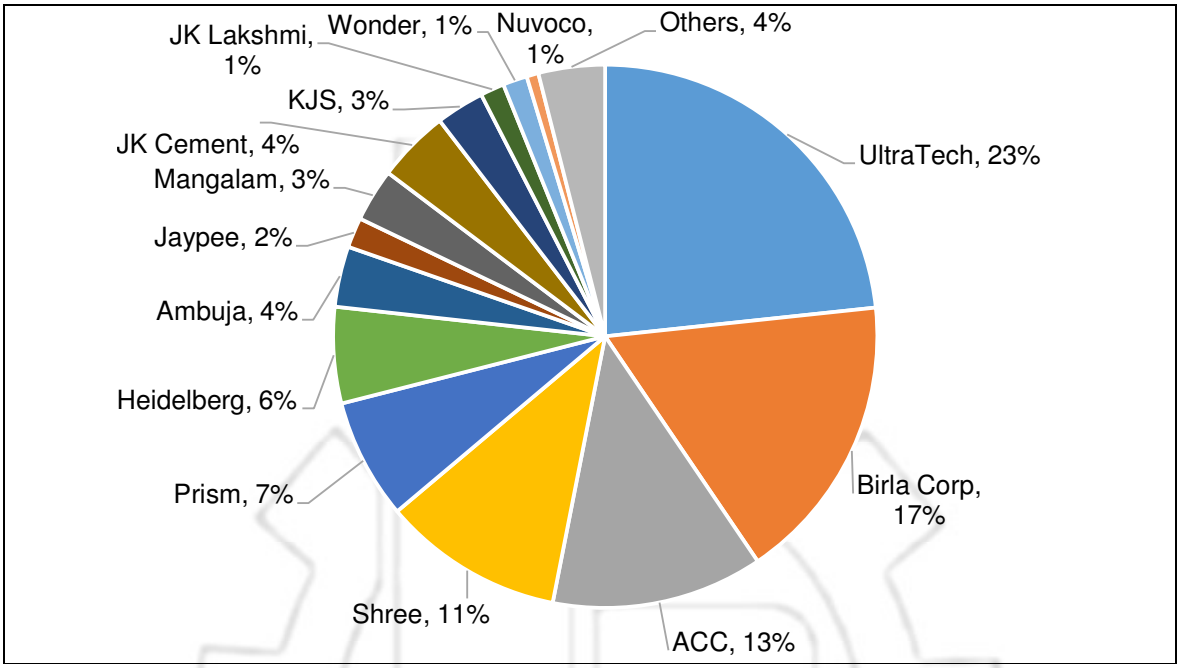


Chart 2.2 | Estimated Market Shares in Target Market

UltraTech is the market leader with a market share of around 23%, followed Birla Corp, ACC, Shree, Prism and Heidelberg. Top six players jointly hold more than 77% market share.

2.2.3 Prices

Region wise retail price range for PPC (September 2022) are given in the **Table 2.2**:

Market	Price Range for PPC (Rs per bag)
South East UP	325-405
North East UP	345-405

Table 2.2 | Region wise Price Range (PPC)

Price of OPC is higher by Rs 20 – 30 per bag.

2.2.4 Packaging

The cement supply in the markets of interest is primarily in 50 kg HDPE bags, however, some players also supply cement in paper bags in order to create product differentiation. The players like UltraTech, Ambuja, ACC, Birla Corp sometimes use these bags and charge premium on their product.

2.2.5 Logistics

Freight is the key component in cement distribution and pricing. Primary freight (freight from cement plant to cement depot/ warehouse in the desired market) for players has been worked out based on rail/road distances from each cement plant to each district in the target region. Cement's outward logistic for the proposed plant is considered by road.

2.2.6 Advertising & Promotion (A&P)

The most commonly used modes of advertising in the target region are wall paintings, hoardings and dealers' boards. Cement companies generally highlight their product and message using these media. Some of the cement companies also advertise in electronic and print media viz., television, newspapers, magazines, etc. Local companies also advertise their products in local construction directories.

Promotional tools like gifts, calendars, diaries, key chains, etc. are distributed among the channel members.

2.3 FUTURE OUTLOOK

2.3.1 Cement Demand

The estimated future growth rates for different markets in the target region are tabulated below. The details of this visibility are furnished under **Annexure 2.2** of this Report.

Market	Future CAGR*
South East UP	7.2%
North East UP	7.2%

**CAGR: Compound Annual Growth Rate*

Table 2.3 | Future growth rates of different markets (FY 20 - FY 27)

Based on the above given region wise future CAGR, **Table 2.4** shows the trend of future cement demand in different markets of the target region.

Figures in mio t

Markets	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27
South East UP	6.7	7.2	7.7	8.2	8.8	9.5
North East UP	4.8	5.1	5.5	5.9	6.3	6.8
Total	**11.5**	**12.3**	**13.1**	**14.1**	**15.1**	**16.2**

Table 2.4 | Cement Demand Forecast

From a level of around 12 mio t in FY 22, cement demand in the target region is likely to reach around 16 mio t in FY 27 growing at a CAGR of around 7%.

2.4 PROJECTED SALES VOLUMES AND NET CASH REALIZATION

2.4.1 Market Selection

JCL already has presence in the Uttar Pradesh market through its proposed plant in Hamirpur and through its Parent company JKCL (JK Cement Ltd.) by way of an existing grinding unit at Aligarh in West Uttar Pradesh. Apart from this, **JCL** also has an integrated cement plant at Panna, Madhya Pradesh. Taking this aspect into cognizance, the market analysis takes into account future supply from the existing and future cement plants while estimating the sales volumes from **JCL**'s proposed cement grinding at Prayagraj, Uttar Pradesh.

Market selection is done based on the competitiveness of the plants to service a market.

2.4.2 Volumes for JCL

We believe that a company's strength in a market, as denoted by its market share, depends primarily on its **Competitive Advantage**.

Competitive Advantage (CA): CA for a player can be measured by comparing its "Net Cash Realization" in a market center with that of the other players. CA indicates how well a player is positioned with respect to its competitors, to sell in a given market.

Steps followed in CA Analysis:

- The potential competitors of **JCL** in various markets were first identified.
- For each of these players, the components of its "**Net Cash Realization**" were estimated, where

  NCR = Retail Price – GST – Channel Margin – Primary & Secondary Freight
  (GST Rate considered at 28%)

- Using this information, **NCR** was then computed for each of the players in the markets of interest to **JCL.**
- Competitive Advantage Index (CA Index) for **JCL** and all its probable competitors was computed where,
- **CA Index =** $\dfrac{\text{Net Cash Realization for a player in a market}}{\text{Average Net Cash Realization for all players in a market}}$

  A competitiveness Index = 1 means that the player has average competitiveness in the market. CI > 1 implies good competitiveness.

- Achievable market shares for **JCL** in the target market was estimated based on:
  - Competitive advantage
  - Present market shares of **JCL**
  - Future Capacity additions
  - Estimated future demand

2.4.3 Achievable Volumes and Market Shares

Based on the **CA** analysis, **Prayagraj GU** is estimated to sell its entire cement volumes in its 5th Year of operation i.e., FY 29. The plant shall operate for only 8 months in its first year of operation as the commissioning date for the unit is envisaged as 1st August 2024.

The following table gives the market wise achievable sales volume and market shares for **JCL**'s plant in Year 1 (i.e., FY25).

Figures in mio t

Market	Market Size (FY 25)	Achievable Sales Volumes (FY 25)	Market Share	Sales Dispersion
South East UP	8.2	0.90	11%	59%
North East UP	5.9	0.64	11%	41%
Total	**14.1**	**1.54**	**11%**	**100%**

Source: Holtec Analysis

Table 2.5 | Achievable Volumes for JCL – Year 1

As the market grows the achievable sales volumes are also envisaged to grow. Year wise achievable cement volumes and capacity utilization for **JCL** are given as follows:

Year	Achievable Sales Volumes (mio t)	Achievable Capacity Utilization
Year 1 (FY 25)	1.54	77%
Year 2 (FY 26)	1.65	82%
Year 3 (FY 27)	1.77	88%
Year 4 (FY 28)	1.88	94%
Year 5 (FY 29)	2.00	100%

Source: Holtec Analysis

Table 2.6 | Year wise achievable volume and capacity utilization

Based on the markets-based achievable sales volume estimates, **JCL**'s Prayagraj GU can achieve 100% utilization in its 5th years of operation, i.e., FY 29.

2.4.4 Net Cash Realization

The realization estimated for cement (PPC) is as follows:

Figures in Rs./ t of PPC

Particulars	Amount
Retail Price	7,560
GST	1,654
Margins	500
Freight	750
Realisation, Rs./ tonne	**4,656**
Realisation, Rs./ Bag	**233**

Source: Holtec Analysis

Table 2.7 | Estimated Realization of JCL

After considering expected SGST exemption (70%) for sales in Uttar Pradesh, which is permitted to go up to 300% of the proposed Fixed Capital Investment over a period of 10 years), the realization calculated for cement is as follows:

Figures in Rs./ t of PPC

Particulars	Amount
Retail Price	7,560
GST	1,075
Margins	500
Freight	750
Realisation, Rs./ tonne	**5,235**
Realisation, Rs./ Bag	**262**

Source: Holtec Analysis

Table 2.8 | Realization of JCL – Initial Years (Higher due to SGST exemption in Uttar Pradesh)

2.4.5 Product Mix

JCL proposes to produce 100% PPC from its **Prayagraj GU**.

2.5 OVERALL CONCLUSION

The markets of interest for **JCL's** proposed **Prayagraj GU** include East Uttar Pradesh. It is estimated that **JCL** should be able to achieve 100% capacity utilization by the 5th year of operation, i.e., FY29.

The average net cash realization for PPC is estimated to be **Rs. 4,656/ t (~ Rs. 233/ bag)**. Furthermore, **JCL** is envisaged to avail of Uttar Pradesh SGST exemption (70% of SGST for sales in Uttar Pradesh, max up to 300% of Fixed Capital Investment for 10 years) which shall help alleviate the overall net realization to Rs.5,235/ t (~ Rs. 262/ bag).

Annexure 2.1

NATIONAL SCENARIO

2.1.1 INTRODUCTION

This section covers the past and future trends of Indian Cement Industry.

2.1.2 DEMAND

The cement consumption of India based on the market information and **HOLTEC** estimates, for FY 22 is estimated to be 340 mio t. Its progression over the past is given in the table that follows. The compound annual growth rate (CAGR) during the last 10 years has been 3.5% pa. The consumption given in the following table is inclusive of the consumption of cement produced by mini cement plants.

Figures in mio t

Year	Domestic Dispatches by large plants	Dispatches by mini cement plants	Total Domestic Cement Consumption	Growth year on year
FY 12	235	6	241	9%
FY 13	248	6	254	5%
FY 14	256	6	262	3%
FY 15	270	6	276	5%
FY 16	283	6	289	5%
FY 17	290	6	296	3%
FY 18	308	6	314	6%
FY 19	347	6	353	12%
FY 20	343	6	349	-1%
FY 21	308	6	314	-10%
FY 22	334	6	340	8%

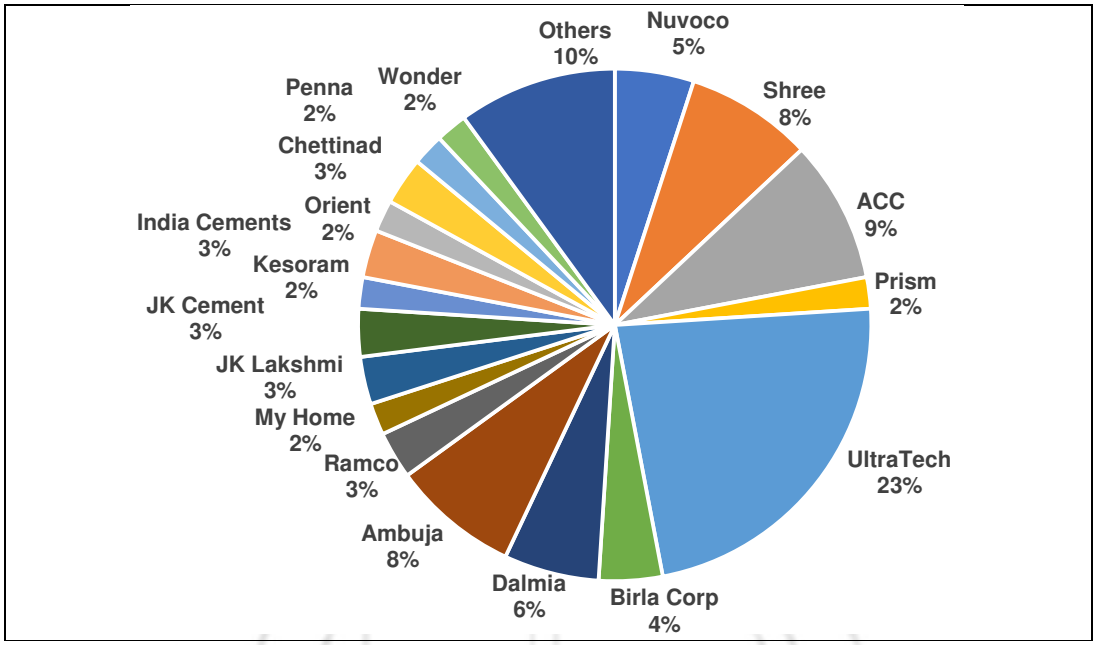
*Source: **HOLTEC** Analysis*
FY=Financial Year
Table 2.1.1: Past National Cement Consumption

2.1.3 PRESENT CAPACITIES

The total rated capacity as per the **HOLTEC**'s estimates is 559 mio tpa for FY22. However, the effective capacity as per **HOLTEC**'s estimates is 489 mio tpa.

2.1.4 MAJOR PLAYERS AND THEIR MARKET SHARES

Market shares of major players at India level are given in the following chart:



*Source: Market Information and **HOLTEC** Analysis*
Chart 2.1.1: Market Shares in India – FY 22

At all India level, there are two major players viz., UltraTech and LafargeHolcim (includes Ambuja and ACC plants) which command a market share of around 40%.

In the next level, there are 16 players which have a combined market share of 50% and their individual market shares range between 2 - 8% each.

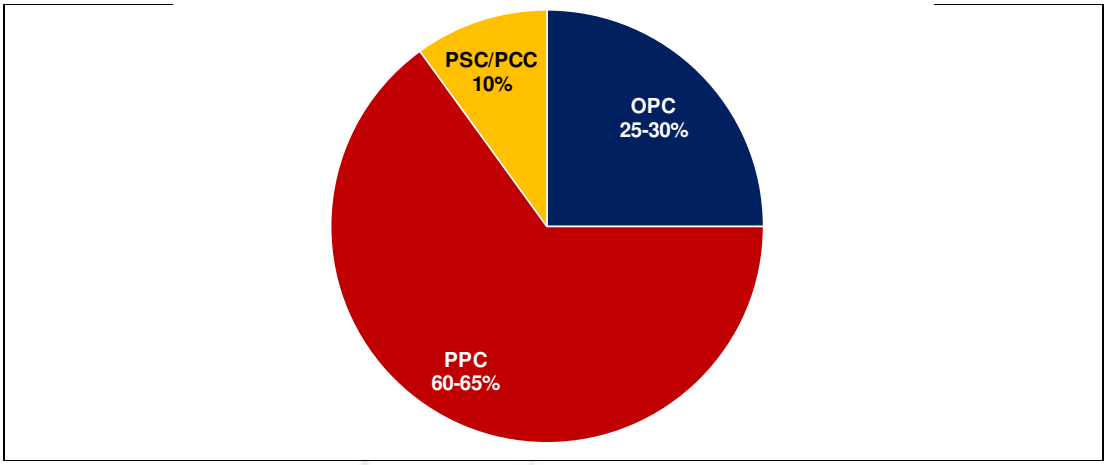
The balance 10% market share is held by over 50-60 players.

2.1.5 PRODUCT MIX

Portland Pozzolana Cement (PPC) is the most prevalent cement type consumed in India.

PPC consumption is in the range of 60% to 65% of the total cement consumption followed by OPC which is in the range of 25% to 30% of the total cement consumption.

The current product mix is shown in the following chart:



*Source: Market Information and **HOLTEC** Analysis*
Chart 2.1.2: Product Mix in India – FY 22

2.1.6 FUTURE CONSUMPTION

The future cement demand was estimated by alternate methods and these methods were given suitable weightages to arrive at the final demand forecast. The following alternate methods were used for demand forecasting:

- **Correlations of Cement Demand versus Independent Variables**: Independent variables considered are as under:
  - Gross Domestic Product (GDP)
  - Population
  - Time

- **End-use based Method**: Based cement used by different End Use segments. These segments are classified under following heads
  - Housing
  - Infrastructure and
  - Commercial & Industrial segments

2.1.6.1 Correlations of Cement Demand versus Independent Variables

- **Correlation with GDP:** Growth in cement consumption, in most countries, shows a strong correlation with GDP growth and is traditionally used for forecasting cement demand. GDP has a direct impact on cement demand, since an increase in country's income leads to higher investment in both housing and infrastructure, which consume cement.

  The growth in real GDP, based on multiple agencies, is expected to be about 8-9% for FY 22. Thereafter, based on projections by World Economic Outlook and World Bank Report, real GDP is estimated to grow by around 7% pa.

  In order to estimate the future cement demand based on GDP, a causal relationship in the form of a mathematical equation is established between GDP and cement demand.

Future cement demand growth rate based on this method is estimated at 6.3% - 9.0% p.a.

- **Correlation with Population:** Future cement demand growth rate based on Population is estimated at 1.2% - 3.8% p.a.

- **Correlation with Time:** Future cement demand growth rate based on Population is estimated at 1.7% - 3.9% p.a.

2.1.6.2 End Use Based Method

End Use Method is based on the premise that the growth in cement demand depends upon the growth in End Use segment. The relative cement consumption by different end user segments is given in below:

- Housing (60-65%)
- Infrastructure (15-20%)
- Commercial & Industrial segments (15-20%)

Housing

According to the Economic Times Housing Finance Summit, about 3 houses are built per 1,000 people per year compared with the required construction rate of five houses per 1,000 population. The current shortage of housing in urban areas is estimated to be ~10 million units. An additional 25 million units of affordable housing are required by 2030 to meet the growth in the country's urban population. Government of India's Housing for All initiative is expected to bring US$ 1.3 trillion investments in the housing sector by 2025.

In India, the real estate sector is the second-highest employment generator, after the agriculture sector. Real estate sector in India is expected to reach US$ 1 trillion in market size by 2030, up from US$ 200 billion in 2021. *Source: Ministry of External Affairs (Investment and Technology Promotion Division*).

The industry experts are looking towards a growth rate of + **6%** per annum from the housing sector's demand for cement. *Source: businesstoday.in & World Cement*

Infrastructure

India has a lot of potential for development in the infrastructure and construction sector and the cement sector is expected to largely benefit from it. Strong focus of Government of India on infrastructure basically concepts like Dedicated Freight Corridors and many ports are under development.

Metro rail projects in most major cities, airports, motorways, irrigation canal, construction of smart cities (Smart cities mission) and project AMRUT (Atal Mission for Rejuvenation and Urban Transformation) are already underway.

In Union Budget 2022-23 focus was on the PM GatiShakti - National Master Plan for multimodal connectivity to economic zones. Everything, from roads to trains, from aviation to agriculture, as well as many ministries and departments, will be integrated under the PM

GatiShakti National Master Plan. The government is planning to launch geospatial digital platform to facilitate planning and monitoring of projects ranging from telecom networks, gas pipelines to road and railways. In Union Budget 2022-23, the government has given a massive push to the infrastructure sector by allocating Rs. 10 lakh crore to enhance the infrastructure sector.

On this mega infrastructure push by the Govt. of India, the growth rate of + **7%** per annum is expected from the infrastructure sector's demand for cement. *Source: economictimes.com, Mordor Intelligence.*

Commercial & Industrial segments sector

Mega infrastructure push and a strong economic growth are expected to lead to growth of the industrial sector. This industrial development would in turn increase cement demand in the long run.

The future growth rate is expected to be + **11%** per annum from Industrial Development i.e. Commercial and Institutional sector. *Source: Mordor Intelligence*

Growth rate considered

Parameter	Housing sector	Infrastructure sector	Industrial sector	End Use based method
Weightage	*65%*	*20%*	*15%*	***100%***
Expected future growth rate - FY 22 to FY 28	6-7%	7-8%	11-12%	**7% - 8%**

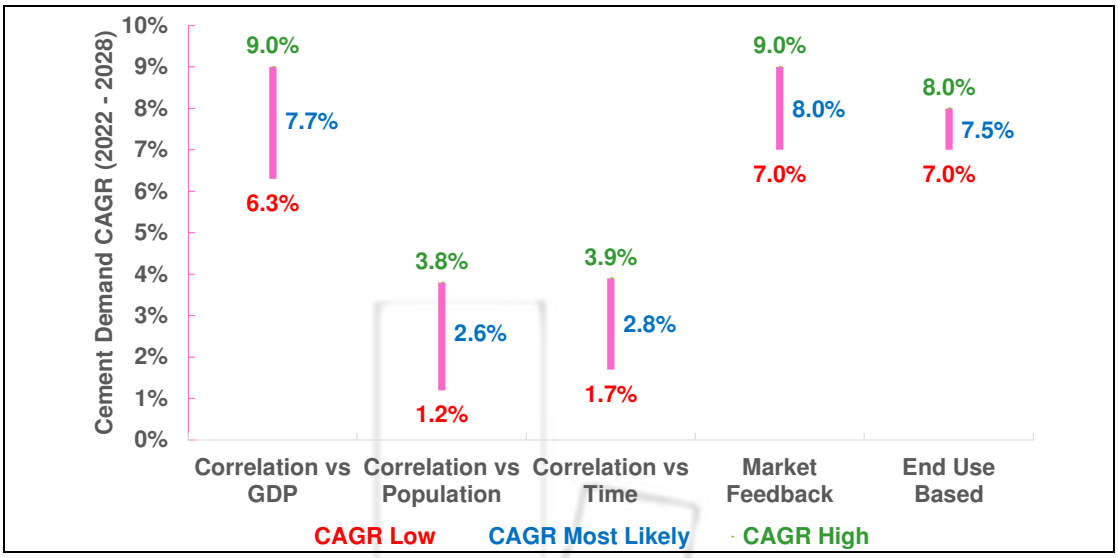
Source: ***HOLTEC*** *Analysis*

Table 2.1.2: Range of future growth rate for End Use based method

Future cement demand growth rate based on End-use method is in the range of **7% - 8%** per annum.

2.1.6.3 Cement Demand forecast using Different Methods

The different methods described above were weighted appropriately to arrive at the final demand forecast for the country. The results for National Demand Forecast are given in the following table:



*Source: **HOLTEC** Analysis*

Chart 2.1.3: Cement Demand Growth by Alternate Methods for India

Parameter	Correlations			Market Feedback	End use based	Total
	GDP	Population	Time			
Weightages assigned	*25%*	*10%*	*10%*	*30%*	*25%*	*100%*
Most Likely Cement Demand in FY 28, Mio t	530	395	401	539	524	505
Uncertainty (plus / minus, Mio t)	40	30	25	30	15	28
CAGR, Low	6%	1%	2%	7%	7%	6%
CAGR, Most Likely	**8%**	**3%**	**3%**	**8%**	**8%**	**6.8%**
CAGR, High	9%	4%	4%	9%	8%	8%

*Source: **HOLTEC** Analysis*

Table 2.1.3: Amalgamation of Future Cement Demand in India

The future CAGR for cement demand is taken as 7% and the cement demand forecast under most likely scenario is tabulated as follows:

Year	Demand in mio t
FY 22	340
FY 23	363
FY 24	389
FY 25	416
FY 26	445
FY 27	476
FY 28	510

*Source: **HOLTEC** Analysis*

Table 2.1.4: Estimated Future Cement Demand in India

2.1.7 FUTURE CEMENT CAPACITY

Future capacity is estimated by adding planned capacity additions to the existing cement capacity. The estimation of future capacity additions has been made based on **HOLTEC**'s awareness of developments in the Cement Industry. This includes direct contact with cement companies, constant interaction with equipment suppliers, feasibility studies being done by **HOLTEC**, press reports/ published information, etc.

Figures in mio tpa

Year	Capacity Additions	Capacity at the end of year
FY 22	31.9	559
FY 23	22.0	581
FY 24	55.6	636
FY 25	27.8	664
FY 26	17.5	682
FY 27	-	682
FY 28	-	682

*Source: Market Information and **HOLTEC** Analysis*

Table 2.1.5: Estimated Future Capacities at National Level

Expected future capacity additions have been estimated considering capacity additions through green-field, brownfield and up-gradation/ de-bottlenecking projects.

Apart from the above, more expansions/ new capacities are being planned and some may come up beyond FY 26. But since these projects are still in the planning stages and the probability of them concretizing is uncertain, they are not being considered as part of the future capacity additions.

2.1.8 DEMAND SUPPLY GAP

Effective capacity is estimated after making the following adjustments:

- Plants are estimated to work at average capacity utilization 90%. This is based on the past performance of plants
- It is assumed that in the year of commissioning, a plant is capable of supplying only 50% of its installed capacity and it starts supplying 100% from next year onward.

Estimated future capacities are given in the following table:

Year	Effective Capacity in mio tpa
FY 22	489
FY 23	514
FY 24	549
FY 25	586
FY 26	606
FY 27	614
FY 28	614

*Source: **HOLTEC** Analysis*
Table 2.1.6: Estimated Future Effective Capacity at National Level

Based on projected demand and supply figures worked out in previous sections, the demand supply gap is shown in the following table:

Figures in mio t

Year / Item	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28
Total Effective Capacity	489	514	549	586	606	614	614
Less Est. Exports (Cement Equivalent)	6	6	6	6	6	6	6
Domestic Supply	483	508	543	580	600	608	608
Domestic Demand	340	363	389	416	445	476	510
Surplus/ (Deficit)	**144**	**144**	**154**	**164**	**155**	**132**	**99**

*Source: **HOLTEC** Analysis*
Table 2.1.7: Future Demand Supply Gap

A cement surplus situation is envisaged to continue in the short-medium term, and this is likely to result in some plants working at lower capacity utilization depending upon their market strength/ competitiveness.

Annexure 2.2

STATES OF INTEREST

Primary state of interest for **Jaykaycem (Central) Limited (JCL)'s** Cement Plant located at Prayagraj (Uttar Pradesh) is:

- Uttar Pradesh

2.2.1 UTTAR PRADESH

2.2.1.1 Past and Present Scenario

Past consumption

Cement consumption for the past 10 years is given in the following table:

Year	Consumption (in mio t)	Cement Growth
FY 13	27.3	6%
FY 14	28.9	6%
FY 15	30.6	6%
FY 16	33.1	8%
FY 17	31.4	-5%
FY 18	31.1	-1%
FY 19	33.7	8%
FY 20	34.3	2%
FY 21	32.3	-6%
FY 22	34.4	6%

*Source: **HOLTEC** database & Market information*

Table 2.2.1 | Past Cement Consumption in Uttar Pradesh

Cement consumption in Uttar Pradesh grew at a CAGR (Cumulative Annual Growth Rate) of 3% and 2% in the last 10 and 5 years, respectively.

Present Capacities

Current combined capacity of cement plants in Uttar Pradesh is around 32 mio tpa. The list of current cement plants and their capacities is given in the table that follows:

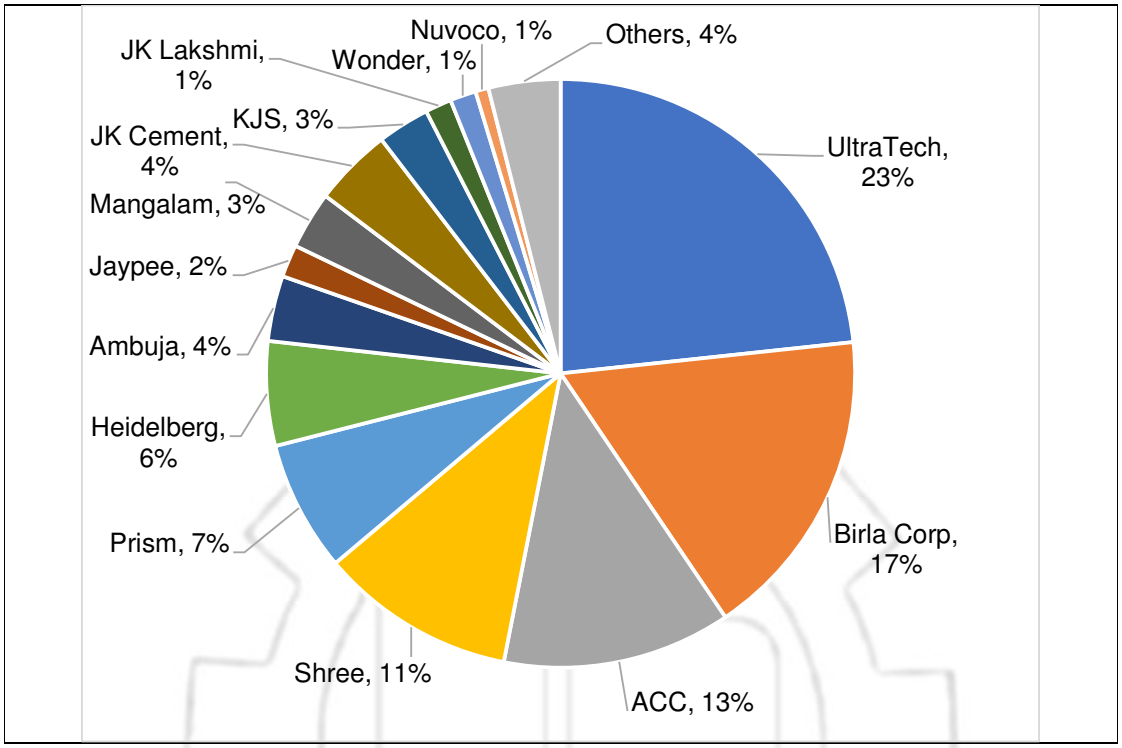
Plant	IU/ GU/ BU	Cement Capacity (in mio tpa)
ACC, Tikaria	GU	2.90
Ambuja, Dadri	GU	1.50
Birla Corp, (Reliance), Kundangunj	GU	2.20
Birla Corp, Raebareli	BU	0.50
Birla Corp, Raebareli	GU	0.80
Heidelberg, Jhansi	GU	3.25
Jaypee, Sadvakhurd	BU	0.60
Jaypee, Chunar	GU	2.50
Jaypee, Churk	GU	1.00
JK Cement, Aligarh	GU	1.50
JK Lakshmi (Kannodia Infratech), Amethi	GU	1.50
Kanodia Infratech, Sikandrabad	GU	1.60
Mangalam Cement, Aligarh	GU	0.75
Shree Cement, Bulandshahr	GU	2.40
UltraTech, Aligarh	GU	1.30
UltraTech, Dadri	GU	1.30
UltraTech (Jaypee), Ayodhya	GU	1.00
UltraTech (Jaypee), Bara	GU	4.00
UltraTech (Jaypee), Secunderabad	GU	1.00
UltraTech, Dalla	IU	0.50
Total		**32.10**

*Source: Holtec Database | * IU: Integrated Unit, GU: Grinding Unit*

Table 2.2.2 | Current Capacity in Uttar Pradesh

Market Share

The market shares of different players in Uttar Pradesh of FY 22 are given in the following chart:



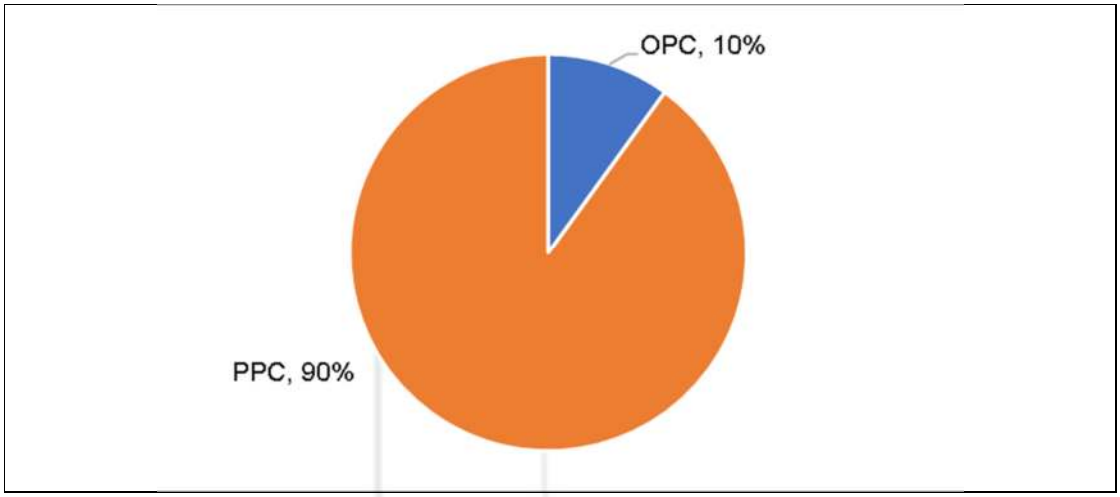
Source: Market information

Chart 2.2.1 | Market share in Uttar Pradesh – FY 22

UltraTech is the market leader with a market share of around 23%, followed Birla Corp, ACC, Shree, Prism and Heidelberg. Top six players jointly hold more than 77% market share.

Product Mix

The consumption product mix in Uttar Pradesh is given in the following chart:



*Source: **HOLTEC** database, Market information*

Chart 2.2.2 | Product Mix in Uttar Pradesh – FY22

2.2.1.2 Future Scenario

Demand

Demand forecasting has been done based on quantitative analysis substantiated by the market information. In quantitative forecasting of cement demand, a causal relationship in the form of a mathematical equation is established between a selected independent variable and cement demand. For this purpose, past data of the independent variable and cement demand is used and an attempt is made to fit various types of equations to this data.

The results are analyzed and the best fitting curves are selected. Future estimates of the independent variables are then used in the best-fit equations to forecast future values of cement consumption and CAGR's are worked out accordingly.

The following statistical tools have been used to assess the future growth rate of cement demand.

- **Regression with Net State Domestic Product (NSDP)**
- **Regression with Time**
- **Regression with Population**

Based on this analysis the future demand growth rate is seen to be around 8% for next 5 years.

Future demand forecast at region level is based on the market information about expected development like future construction and infrastructure projects in each region. Uttar Pradesh can be divided into four regions as shown in the chart that follows:

Chart 2.2.3 | Regions in Uttar Pradesh

Estimated current and future demand of Uttar Pradesh region-wise for next 5 years is given in the following table:

Figures in mio t

Year	West UP	Central UP	South-East UP	North-East UP	Uttar Pradesh
FY 22	12.0	10.9	6.7	4.8	34.3
FY 23	12.8	11.6	7.2	5.1	36.7
FY 24	14.0	12.6	7.7	5.5	39.8
FY 25	15.3	13.7	8.2	5.9	43.1
FY 26	16.6	14.9	8.8	6.3	46.6
FY 27	18.1	16.1	9.5	6.8	50.5
CAGR (FY22- FY27)	**8.6%**	**8.1%**	**7.2%**	**7.2%**	**8.0%**

*Source: **HOLTEC** analysis*

Table 2.2.3 | Future Cement Demand and CAGR in Uttar Pradesh

The cement demand forecasted to reach around 51 mio tpa in FY 27 from around 34 mio tpa in FY 22.

Capacity Addition

The cement capacity addition is given in the table that follows:

Figures in mio tpa

Company	Expected Capacity	Year of Addition
ACC Sonbhadra (GU)	2.2	FY 23
ACC Tikaria (GU)	1.6	FY 23
J K Cement, Hamirpur (GU)	2.0	FY 23
KJS Cement, Allahabad (GU)	1.0	FY 24
Penna Cement, Aligarh (GU)	1.5	FY 24
UltraTech, UP Cement, Dalla (IU)	1.3	FY 24
Wonder Cement, Aligarh (GU)	2.0	FY 24
Total	**12.6**	

*Source: **HOLTEC** Database and Market information*
Note: Capacities which are announced/ planned but the probability of them concretizing is uncertain, have not being considered as part of the Future Capacity Addition list

Table 2.2.4 | Estimated Future Cement Capacity in Uttar Pradesh

Demand Supply Gap

The likely demand supply gap has been calculated based on the estimated future demand as well as the expected growth of cement capacity in the state. The demand supply gap is given in the table that follows:

Figures in mio tpa

Year	Demand	Supply	Surplus/ (Deficit)
FY 22	34.3	32.1	(2.2)
FY 23	36.7	35.0	(1.7)
FY 24	39.8	40.8	1.0
FY 25	43.1	43.7	0.6
FY 26	46.6	44.2	(2.4)
FY 27	50.5	44.7	(5.8)

Note: Future supply has been estimated based on the assumption that in the year of commissioning a plant is capable of supplying only 50% of its installed capacity and it starts supplying 100% from the next year onwards.
*Source: **HOLTEC** analysis*

Table 2.2.5 | Demand-Supply Gap in Uttar Pradesh

Uttar Pradesh is currently a cement deficit state and likely to remain same in future as well.

CHAPTER 3 | LOCATION & INFRASTRUCTURE

3.1 INTRODUCTION

This chapter covers aspects of plant location, requirements/ availability of infrastructure facilities such as land, power, water, transport, communication, socio-economic environment, and site conditions for the proposed Clinker Grinding Unit (GU). It further covers input raw materials required in the cement manufacturing process, possible sources, transportation modes and expected average landed cost at the proposed GU.

3.2 PLANT LOCATION

3.2.1 Criteria for Selection of Plant Location

Following are the salient criteria, considered as near-ideal conditions, for locating a clinker grinding unit of the desired capacity:

- The site should have sufficient flat and/or slightly undulating land for accommodating the Plant; its ancillaries & amenities; development of greenbelt; besides keeping in view the future expansion prospects for the project.
- Availability of adequate ground and/or perennial source of water in a reasonable vicinity of the plant site.
- Availability of reliable power supply, ideally from a grid substation located at a reasonable distance.
- Proximity or proper connectivity of the unit with the transport network connecting the markets of interest.
- Plant land's sub-strata should ideally have reasonably good load bearing capacity, which results in having optimized sub-structure construction cost.
- The available land should be as far as possible, free from encumbrances such as:
  - Farming land – (being sensitive)
  - Forest land – (being sensitive)
  - Away from habitation – to avoid inadvertent disturbances during operations
- The available/envisaged plant land should as far as possible ideally be:
  - At least 10 km away from the Eco-Sensitive Zones, National Parks, Reserve forests, and similar sensitive zones.
  - Approximately 100 m away from any National Highway and major Rail lines.
  - Approximately 50 to 100 m away from high tension electricity lines.
- Proximity to an established township, which would offer reasonable amenities to the plant employees

The choice of location largely depends on that place, which could help in delivering the manufactured cement at the most economical rate, commensurate with the capital investment of the entire project.

3.2.2 Location of Cement Grinding Unit

The proposed Grinding Unit is envisaged to be located in Bara tehsil of Prayagraj district of Uttar Pradesh State.

The envisaged plant site is envisaged to be set up in relative proximity to the Prayagraj Thermal Power Station, which is located near Shivrajpur, Bara tehsil, Prayagraj.

Approximate locating geographical coordinates of the proposed GU plant site are:

- Latitude : N 25° 12' 05"
- Longitude : E 81° 34' 04"
- Altitude : Average 150 m with respect to average mean sea level (AMSL)

The choice of the site is appropriate from the point of view of the broad plant siting criteria, infrastructural accessibility, and convenient access to the markets of interest.

The proposed location provides the following distinct advantages to the envisaged GU:

- Provides efficient infrastructural accessibility to inbound as well as outbound logistics.
- Proximity to source of additive (flyash).
- The proposed location is close to the cities of Prayagraj & Varanasi which are the main target consumption centres of the region.

3.2.3 Approach and Accessibility

The proposed site shall be accessed via NH-35, connecting Kabrai and Varanasi, passing through all the major hubs in and around Prayagraj.

The choice of the site is appropriate from the point of view of market access and available infrastructure as indicated in the respective chapters.

However, **HOLTEC** recommends that all relevant statutory approvals/ clearance should be obtained before making any capital investment.

3.3 INFRASTRUCTURE

3.3.1 Land

The earmarked land for the proposed Grinding Unit is largely flatter, but marked with minor undulations and sporadic rocky outcrops. Cost provisioning towards site leveling, grading and development has been considered in the investment cost estimates on lumpsum basis.

Total land area of the proposed site under consideration totals to nearly 23 hectares (approx. 57 acres), the procurement and allied miscellaneous costs of which has been reported by **JCL** to be about Rs.2,100 lakhs. The same has been considered in the project's capex estimates.

3.3.2 Utilities

Power

The maximum power demand for the proposed Grinding Unit has been estimated as about 12 MW based on specific power consumption of 31.5 kWh/ t of PPC including power requirement for material handling, clinker grinding, packing, lighting & utilities.

Power is envisaged to be sourced from the 132/33 kV grid substation of U.P. Power Transmission Corporation Limited, located near Shankargarh spanning a distance of about 5 km from the proposed plant site. For receiving power, transmission line, switchyard and main receiving substation shall be constructed and the same has been considered in the capex estimates.

The grid tariff has been estimated as about Rs 7.70 per kWh.

To meet the emergency power requirement, a DG set of about 1 MW capacity has been envisaged in the investment cost estimate.

Water

The water requirement for the proposed Grinding Unit has been estimated as 400 m^3/ day including about 300 m^3/ day for plant process, 25 m^3/ day for office & canteen and 50 m^3/ day for landscaping. Additionally, provision of 500 m^3 water storage has been kept for firefighting purpose.

Water requirement is envisaged to be met from underground sources by means of borewells. Appropriate statutory clearances for the same shall be obtained from regulatory authorities for utilizing ground water for industrial purposes.

For plant equipment, water shall be re-circulated after cooling to avoid any wastage and only losses shall be made up from fresh water.

3.3.3 Infrastructural Network

Road

The proposed plant site is well connected with major cities and town in the region of interest via National Highway NH-35, which is located right next to the proposed plant site.

The approximate road distances of the proposed site from the major towns/ cities are as following:

Shankargarh	:	10 km	Varanasi	:	175 km
Prayagraj	:	50 km	Azamgarh	:	220 km
Jaunpur	:	150 km	Gorakhpur	:	290 km

Air

Prayagraj is the nearest airport located at a distance of about 65 km from the proposed Grinding Unit.

Rail

Bevra Railway Station (Near Prayagraj Power Generation Thermal Power Plant) located at about 12 km from the proposed plant site; and Lohgara Railway Station located at about 15 km from the proposed plant site; are the nearest railway stations.

Prayagraj Railway station is the nearest major junction, located at a distance of about 57 km from the plant site.

Sea

The nearest major seaport is Paradeep Port, located at a distance of about 975 km from the proposed clinker grinding unit.

3.3.4 Communication

All the Communication facilities such as telephone, telefax and Internet are available in the vicinity and the same shall be extended to the proposed site of the cement grinding unit.

3.4 RAW MATERIAL

Clinker for the proposed GU is envisaged to be sourced from **JCL**'s recently commissioned cement plant located in Panna, Madhya Pradesh. The average road distance from the clinker source plant to the proposed GU site shall be around 260 km.

The estimated landed cost of clinker is given in **Table 3.1** below.

	Unit	Landed Cost (by road)
Ex-Factory Price	**Rs/ t**	3,300
Road Freight	Rs/ t	900
Landed Cost	**Rs/ t**	**4,100**

Table 3.1 | Landed cost of Indigenous Clinker from JCL's Panna Cement Plant

The average landed cost of clinker is estimated to be about **Rs. 4,100/t**
The same has been considered to carry out the financial analysis for this project.

Gypsum for the proposed GU shall be sourced through traders who import gypsum from Oman via Dahej and/or Visakhapatnam port. From Dahej and/or Visakhapatnam (or other nearby) port it shall be transported through rail until nearby Shankargarh/ Bevra/ Lohgara railway siding facility, whereafter it shall be transported by road to the proposed GU.

Flyash for the proposed GU is envisaged to be sourced from nearby Prayagraj Power Generation thermal power plant and/or Shankargarh Thermal Power Plant, located at about 12 km from the proposed plant site.

The details of input materials required, their possible sources, transportation mode and expected average landed cost at the proposed cement grinding unit are given in the following **Table 3.2**

Material	Source	Transportation mode	Approx. Distance (km)	Expected Landed Cost (Rs per t)
Gypsum	Various (Imported from Oman/Iran, and sourced through operators and importers, in pre-crushed and sized form) (Purchase)	Rail & Road	~1,250 & 15	5,500
Flyash	NTPC Shankargarh / Prayagraj Power Generation Company Ltd., Bara, Prayagraj (Purchase)	Road	12	550

Table 3.2 | Raw materials

3.5 LOGISTICS

3.5.1 Inbound

This section provides an insight into logistics of raw material to the proposed plant site. In addition to Limestone, following key raw materials are required for production of cement:

1. Clinker
2. Gypsum
3. Flyash

The estimated quantity of raw material required per day and number of trucks loads per day, based on carrying load of trucks is mentioned in **Table 3.3.**

Raw Material	Approx. per day requirement (t)	Truck capacity considered (t)	Approx. nos. of Trucks per day
Clinker	3,820	35	110
Gypsum	305	35	10
Flyash	1,950	20	100

Table 3.3 | Requirement of Trucks for Inbound Material

3.5.2 Outbound

The only outbound material is cement. The estimated quantity of cement dispatched per day and number of truckloads per day, based on carrying load of trucks is estimated as:

Product	Approx. per day dispatch at full Cap Util (t)	Truck capacity considered (t)	Approx. nos. of Trucks per day
Cement (by road)	6,060	35	175

Table 3.4 | Requirement of Trucks for Outbound Material

3.6 SOCIO ECONOMIC ENVIRONMENT

3.6.1 Habitation

Shivrajpur is the nearest populated town at about 3 km from considered plant site. All basic amenities such as school, hospital, market, etc. are available here.

Prayagraj is the nearest major city for providing all the required major amenities.

3.6.2 Social Amenities

A dedicated colony is not envisaged to be constructed for this project. It is envisaged that the plant employees shall utilize the nearby town and city dwellings for lodging purposes.

3.7 SITE CONDITIONS

3.7.1 Topography

The land for the proposed grinding unit is largely flat but with general mild gradient and minor undulations at certain localized patches in the earmarked land parcel.

As the elevation difference is not significant, cutting - filling using external earth material is not envisaged in the project. Indicatively estimated lump sum amount has been considered towards land and site grading, leveling and overall development in the investment cost estimate.

3.7.2 Temperature

The area has typical semi-arid type climate with distinct wet and dry seasons. Temperature varies from about 9^0 C in winter to about 40^0 C in summers.

3.7.3 Rainfall

The average annual rainfall of the area is about 915 mm

3.7.4 Seismology

The proposed plant site area falls in Seismic Zone III, which is considered to be moderate seismic activity zone.

Annexure 3.1

PHOTO GALLERY

Proposed plant site is largely flatter, marked with minor undulations and few rocky outcrops

Satellite imageries of the area showing the proposed Prayagraj Grinding Unit site

(Source: Google Earth)

Seasonal water pool in excavated crevices; Dense to rocky substrata is envisaged at the plant site

Boundary wall construction work in progress during the time of site visit

Access to plant site is directly from NH-35 (Varanasi – Kabrai highway)

UP Power Transmission Ltd's 132/33 kV Shankargarh substation envisaged to be the source of power

CHAPTER 4 | PLANT TECHNICAL CONCEPT

4.1 PLANT CAPACITY

Jaykaycem (Central) Limited (JCL) is proposing to set up a cement grinding unit (GU) of 2.0 mio tpa capacity in Bara tehsil of Prayagraj district of Uttar Pradesh State.

The required Clinker for the proposed GU is envisaged to be sourced from JCL's recently commissioned integrated unit (IU) near Panna (Madhya Pradesh)

JCL proposes to produce 100% PPC at its proposed GU as per relevant BIS standards: IS:1489-2015.

Product type	Proportion	Approx. Cement Volumes at full	Relevant BIS Standard
PPC	100 %	6,060 tpd	IS 1489-2015

Table 4.1 | PPC Indicative proportion and Volume

The details of the proposed product mix are as given below:

Component	Proportion, % by weight
	PPC
Clinker	63
Gypsum	5*
Fly ash	32**

Table 4.2 | Proposed Product Mix

** % Addition of gypsum shall depend upon the quality of clinker and purity of gypsum. For sizing of equipment & storages, 5% gypsum addition has been considered in this Report.*

*** Fly ash can be added in the cement manufacturing process upto 35% depending upon quality of clinker and fly ash procured. Fly ash addition in PPC has been considered as 32% for the purpose of formulation of this Report.*

Accordingly, a cement grinding and packing line comprising of suitable clinker unloading, cement grinding mill, packing and loading system along with allied auxiliary equipment have been considered to meet the desired cement production, packing and loading requirement.

Based on the above concept, it is proposed to install a GU with state-of-the-art production systems and plant design with following operating parameters:

- ✓ Cement capacity : 2.0 mio tpa (equivalent to 6,060 tpd)
- ✓ Product Mix : 100 % PPC
- ✓ Workings days considered : 330 days per annum
- ✓ Applicable Cement Standard : As per IS: 1489-2015
- ✓ State-of-the-art production systems and plant design

✓ Workings days considered as 330 days per annum

The sizing of main machinery and equipment, in this report, has been done considering the above values.

4.2 SELECTION OF MAIN MACHINERY

Criteria used in selecting the technical concept include:

- ✓ Optimum investment
- ✓ Simple operation with minimum (essential) automation
- ✓ Ease of operation and maintenance
- ✓ High operational safety and reliability and thus high availability of plant and machinery even under adverse conditions
- ✓ Ease of logistics of supplies (inflow) and dispatches (cement)
- ✓ Environmental safeguards

4.3 SIZING FOR MAIN MACHINERY AND STORAGE

The main machinery and storages have been sized in accordance with operating norms, local conditions for operation of plant coupled with **HOLTEC**'s experience for similar capacity plants. These are summarized in **Tables 4.3** and **4.4**.

Department	Operating hours considered per day	Design/ Safety Margin considered
Cement grinding	21	1.15
Packing & dispatch	15	1.25

Table 4.3 | Operating Hours and Safety Factors for Plant & Machinery

The provision of storages varies from plant to plant, depending upon the following:

- Lead distance of source from cement grinding unit
- Ownership of source i.e., self or "bought out"
- Transportation route
- Cost of resource
- Operators' comfort
- Inventory carrying cost
- Seasonality

Storage days for input materials, additives, blending material and final product considering the above are given in **Table 4.4**.

Sn	Description	Storage, days
1	Clinker	7
2	Cement	2 #
3	Gypsum	8
4	Fly Ash	2.5
5	Pond Ash (future provision)	6

 # 2 days storage considered inside plant silos, and 1 day storage in packed form warehouses

Table 4.4 | Storage Days

Envisaged Specific Electrical Energy Consumption

Total Plant ~ 31.5 kWh/ t PPC @ about 3,800 Blaine

4.4 AVAILABILITY OF MATERIALS

For the proposed cement grinding unit, the availability of input materials shall be as follows:

Clinker

Clinker for the proposed GU is envisaged to be sourced from **JCL**'s recently commissioned cement plant located in Panna, Madhya Pradesh. It is envisaged that clinker shall be transported by Road to the GU. The average road distance from the clinker source plant to the proposed GU site shall be around 260 km.

Fly ash & Gypsum

- Flyash for the proposed GU is envisaged to be sourced from nearby Prayagraj Power Generation thermal power plant and/or Shankargarh Thermal Power Plant, located at about 12 km from the proposed plant site. It shall be transported to the plant by bulkers. **JCL** shall enter into long term agreement with the suppliers to ensure uninterrupted supply of fly ash.

- Gypsum for the proposed GU shall be sourced through traders who import gypsum from Oman via Dahej and/or Visakhapatnam port. From Dahej and/or Visakhapatnam (or other nearby) port it shall be transported through rail until nearby Shankargarh/ Bevra/ Lohgara railway siding facility, whereafter it shall be transported by road to the proposed GU.

4.5 PLANT DESIGN

In determining equipment capacities, the moisture contents considered in the input materials are shown in **Table 4.5**.

Department	Moisture content, %
Gypsum (Mineral; imported)	12
Fly ash	<1
Clinker	<1

Table 4.5 | Average Moisture Content considered in Raw Materials

4.6 PLANT SYSTEMS

4.6.1 Clinker Transport & Storage

For unloading of material into the dump hopper, Truck Tippler & Box Feeder arrangement has been envisaged.

Clinker shall be stored in a clinker silo of capacity 30,000 t made of RCC, sufficient for about 7 days of grinding requirement of the proposed cement grinding unit.

Clinker from the silo shall be extracted and transported to the Clinker hopper of the cement mill section through set of belt conveyors and bucket elevator. Clinker shall be fed into the mill by weigh feeder provided beneath the clinker hopper.

4.6.2 Gypsum Crushing, Storage and Transport

It is envisaged that Mineral Gypsum shall be used as an additive, which shall be received in crushed form. Crushing of gypsum has therefore not been considered at the plant.

The storage capacity for gypsum considering 8 days storage requirement at 12% moisture with 2% handling losses works out as:

$$= \frac{2{,}000{,}000 \text{ X } 0.05 \text{ X } 8 \text{ X } 0.99}{(330 \text{ X } 0.88 \text{ X } 0.98)} = 2{,}783 \text{ t, } \textbf{say 3,000 t}$$

Covered yard of about 3,000 t capacity is envisaged for Gypsum storage.

Self-tipping trucks shall be unloaded directly in the covered storage yard.

The material shall be reclaimed through pay loader and shall be loaded into a ground hopper for transport to Feed Mill hopper through a set of belt conveyors.

A common conveyor shall be used to transport clinker, gypsum and additives from silo and storage yard respectively, to Mill Feed hoppers in order to save space.

Environmental control measures include installation of bag filters at BRU's and all transfer points.

4.6.3 Fly Ash Storage

Fly ash shall be brought to the proposed cement grinding unit through road bulk carriers. It shall be unloaded and transported to an RCC silo pneumatically. From the silo, fly ash shall be transported to the cement mill by a series of air slides.

Considering the proximity of the envisaged source of fly ash from the proposed plant site, a Fly Ash silo of **5,000 t** is envisaged, which shall be enough to meet plant's requirement for about 2.5 days. Additionally, provision is kept for about 2,500 t of Pond Ash adjacent to the Gypsum storage in the same covered yard, for any possible future utilization.

The quality requirements of fly ash required for production of PPC, as per IS 3812 (Part 1): 2003, are as given below in **Table 4.6**:

Characteristic	Unit	Value, as per IS 3812 (Part 1): 2003, second revision
Chemical Requirement		
LOI	%	5.0, max
SiO_2	%	35, min
Reactive silica, optional test	%	20, min
$SiO_2+Fe_2O_3+Al_2O_3$	%	70, min
MgO	%	5.0, max
SO_3	%	3.0, max
Available alkalies as Na_2O	%	1.5, max
Cl	%	0.05, max
Physical Requirement		
Moisture	%	5
Fineness, sieve residue		
+ 45 micron	%	34.0, max (Wet sieving)
Fineness, Blaine	M^2/ kg	320, min
Lime reactivity	MPa	4.5, min
Compressive strength at 28 days	N/ mm^2	Not less than 80% of the strength of corresponding plain cement mortar cubes
Autoclave expansion, max.	%	0.8, max

Note: Fly ash fineness 250 m^2/ kg (Min) is also permitted to be used in the manufacture of Portland pozzolana cement by integrating it with Portland clinker if the fly ash when ground to fineness of 320 m^2/ kg or to the fineness of the resultant Portland pozzolana cement whichever is lower, meets all the requirements specified in the above Table

Table 4.6| Quality of Fly Ash

4.6.4 Cement Grinding System

The capacity of the grinding system for the proposed product mix has been calculated considering plant operation @ 330 dpa and mill running hours as 21 hpd and 15% margin. The mill capacity without safety margin works out to:

$$= \frac{2{,}000{,}000 \times 1.15}{330 \times 21} = 331 \text{ tph}$$

say **330 tph** for manufacturing PPC @ 3,800 Blaine

For cement grinding, the following 3 main alternatives are usually available:

- Closed Circuit Ball Mill (CCBM)
- Ball Mill With Roller Press (BMRP)
- Vertical Roller Mill (VRM)

Closed circuit ball mill (CCBM)

Clinker and Gypsum shall be ground in a ball mill, where steel balls are used as grinding media. The discharge from mill shall be lifted by a bucket elevator and fed to a high efficiency separator. Fines from the separator shall be collected in the cyclones and further transported to the cement silo.

The coarse material from the separator shall be fed along with fresh feed to the mill inlet for further grinding. The fly ash may be fed directly to the separator. Partial quantity of separator circulating air is vented in a bag filter. For mill venting a bag filter or an ESP may be installed. Fines collected in bag filter/ ESP shall be transported to cement storage silo by a system of air slides and bucket elevator.

Roller Press and Ball Mill (RPBM) combination

In this system, a closed-circuit RP is installed as a pregrinder in semi finished mode before the ball mill, which shall be used for finish grinding. Fresh feed along with the RP output shall be fed to a high efficiency, static separator installed above the RP. Coarse material from this separator is taken as feed to the RP. Fines from this separator are either taken to the mill inlet or fed directly to a high efficiency dynamic separator (mill separator).

The product from ball mill shall be fed through a bucket elevator to the mill separator. Coarse material from mill separator returns to the mill inlet, while fines shall be transported to the cement silo. For mill venting a bag filter or an ESP may be installed. Fines collected in bag filter/ ESP shall be transported to cement storage silo by a system of air slides and bucket elevator.

Vertical roller mill (VRM)

VRM has an inbuilt high efficiency separator for material grinding. The mix of clinker, gypsum and fly ash is fed to the grinding table fitted with hydraulically operated rollers, which apply pressure on the material bed for grinding purpose. The ground material is air swept to the high efficiency separator, where coarse material falls back on grinding table for further grinding. Fines from separator shall be collected in a bag filter. Fines collected in bag filter shall be transported to cement storage silo by a system of air slides and bucket elevator. Depending on the suppliers' recommendation, grinding aid may be used.

In order to maintain the required gas flow through mill nozzle ring, hot gas may be required during mill startup after long shutdown. Hence, a suitably sized hot air generator (HAG) may be required.

Technically, all these cement grinding options, viz., CCBM, RPBM and VRM, are acceptable in the cement industry. However, final selection of one of the available options, or their variants thereof, depend upon various factors like Customer's experience, consultant's recommendations, initial as well as operating cost parameters, etc. to name a few.

Based on parameters like power consumption, investment cost, proven performance, and customer preference, it is envisaged to install one VRM (Vertical Roller Mill) of capacity 250 tph PPC @ 3,800 Blaine.

The brief technical details of the cement drying & grinding system are as follows:

Cement Mill Bin(s)	:	A set of 4 nos. Steel bins for the mill system , viz., 450 t capacity for Clinker, 100 t capacity for Gypsum and two steel bins of 100 t capacity for future additive(s).
Cement Mill Feeding	:	Weigh-feeders have been considered for extraction of Clinker & Gypsum in required proportion under the cement mill hoppers. Weigh feeders shall feed the material on a set of belt conveyors and bucket elevator, which shall feed the material to mill. Controlled/ measured quantities of fly ash shall be drawn from fly ash silo through dozing valves and shall be fed to the dedicated mill feed control bin through set of airslides and bucket elevator. Load cells shall be provided for online check weighing and/or calibration of control bin.
Mill System	:	The proposed VRM shall be designed with high grinding efficiency. VRM shall be equipped with the new generation high efficiency separator. A bucket elevator for external material circulation shall be provided. The external circulation system shall be equipped with bin for reject tramp metal and shall also be used for calibration of weigh feeders. The reject bin shall have controlled material extraction. The VRM shall be designed for low-pressure drop of the mill and low power consumption. The mill shall

		be equipped with planetary gearbox. Mill exhaust gas shall be dedusted in multiple cyclone battery. Exit gas from cyclones shall be transported by mill induced draft fan to Baghouse type filter. Cleaned gas from Baghouse filter shall be transported by Baghouse filter fan to the stack.
Product Collection	:	Material (product) collected at the bottom of bag filter along with dynamic separator fines collected in cyclones shall be transported to the cement storage silo with the help of bucket elevator and air slides.
Mill De dusting	:	The solution envisaged for dedusting of VRM circuit gases is with a Bag filter. Bag filter shall be designed to meet the requirements of prevalent environmental norms.

4.6.5 Cement Storage

Cement from the cement grinding section shall be transported to the storage silo by a system of air slides and bucket elevator.

JCL proposes to have about 2 days of active storage of finished product within the plant premises, while another 1 day equivalent of finished product shall be in bagged form.

Cement storage capacity based on 2 mill days requirement = 2 x 2,000,000/ (330) t = 12,121 t

JCL plans to construct **2 nos. RCC silos of capacity 5,000 t each** as active storage of cement within the plant premises.

From the silos, cement shall be transported to the packer with the help of a set of air slides and bucket elevators. 2 nos. bulk loading system is also provisioned to meet the bulk cement loading requirement.

4.6.6 Cement Packing Loading & Dispatch

Cement from the cement silo shall be transported to the packers with the help of a set of air slides and bucket elevator.

The required packing system capacity based on 3 shift (5 hours) operation per day and 360 days working with 25% design margin works out to:

$$= \frac{2{,}000{,}000 \times 1.25}{(360 \times 15)}$$

~ 463 tph

say **2 x 240 tph**

Packing system consisting of **2 x 240 tph**, 16 spout electronic roto packer has been considered with **6 nos. semi automatic truck loaders** for loading bags onto trucks. From the packer outlet upto loading of the packed bags into the trucks, suitable system with flat belts and diverters has been considered. 2 nos. bulk loaders have also been considered.

4.6.7 Equipment And Storage Capacities

The capacities of the major equipment and storages have been worked out and are enclosed in **Annexure 4.1** and indicative material flow diagram as **Annexure 4.2**.

The storage capacities for various materials envisaged in this report are as following:

Material	Approx. days of storage	Proposed storage capacity, t
Clinker Silo (RCC)	7	1 x 25,000
Gypsum Stockpile (Covered Yard)	8	1 x 3,000
Pond Ash (Covered, Provision)	6	1 x 2,500
Fly Ash (RCC)	2.5	1 x 5,000
Cement Silos (RCC)	2	2 x 5,000

Table 4.7 | Details of storage capacities for grinding unit

In addition to the installation of grinding system, the installation of Pulse jet bag filters for pollution control is envisaged.

For weighing of inbound and outbound material,**4 nos** Weigh Bridges shall be installed.

4.7 PLANT LAYOUT AND FLOW SHEETS

Based on the technical concept, the plant layout and process flow sheets are enclosed:

Plant layout : **Drawing no.** 22173-04-GU-1-01
Flow sheets : **Drawing no.** 22173-04-GU-1-02 to 22173-04-GU-1-09
Power Distribution Scheme : **Drawing no.** 22173-04-GU-1-10
Control System Configuration: **Drawing no.** 22173-04-GU-1-11

4.8 QUALITY CONTROL

4.8.1 Quality Control Plan

To produce good quality cement, it is imperative that sampling & testing of various raw materials and the final product is carried out regularly at the required intervals for taking timely corrective actions.

To ensure consistent product quality and to permit trouble free and cost effective operation, the quality control plan for sampling & testing of raw materials and the final product is suggested and is given in **Annexure 4.3**.

While proposing the methods and procedures for quality control, the following aspects have been taken into account:

- Requirements and norms, particularly in cement testing.
- Corrective measures to be undertaken as quickly as possible in the process operation.
- Desired degree of automation.
- Available raw materials and process equipment.

The quality control department at the proposed plant shall have the following facilities:

4.8.2 Laboratory

Laboratory shall be accommodated in the Central Control Room (CCR) building. The laboratory shall have the provision of chemical and physical testing facilities for cement, clinker, gypsum, fly ash, etc.

For Chemical Analysis

Bench Top X-Ray Fluorescence

Cement is a blend of several minerals. It is critical to control the elemental composition to control properties like strength, setting time etc. For this purpose, Bench top XRF is proposed to be used to analyze both Ca and S in gypsum, besides analyzing incoming clinker, and finally finished cement.

Conventional, Chemical analysis equipment

For Physical Analysis

Facilities/ apparatuses shall be provided for testing physical properties like sieve analysis, setting time, soundness, fineness, CCS, grindability, moisture content, lime reactivity & drying shrinkage, etc.

Particle Size Distribution (PSD)

For determining the particle size distribution of cement, etc. a laser diffraction type PSD analyzer may be installed having typical particle size range of 0.3 mm - 400 micron.

4.8.3 Sampling Station

An auto sampler shall be provided before cement silo and packing plant for taking samples and analyzing the same.

4.9 UTILITY SYSTEMS

4.9.1 Power System

This has been dealt with in detail in **para 4.11**, Electrical Engineering.

4.9.2 Water Supply

The water requirement for the proposed Grinding Unit has been estimated as 400 m3/ day including about 300 m3/ day for plant process, 25 m3/ day for office & canteen and 50 m3/ day for landscaping. Additionally, provision of 500 m3 water storage has been kept for firefighting purpose.

Water requirement is envisaged to be met from underground sources by means of borewells. Appropriate statutory clearances for the same shall be obtained from regulatory authorities for utilizing ground water for industrial purposes.

Water distribution system shall include:

- Process Water Circuit
- Cooling water (required for machine cooling)
- Make-up water shall be provided while re-circulating water shall be in a close loop
- Potable Water (for drinking, etc.)

Water shall be stored in overhead (OH) tanks. For plant equipment, water shall be recirculated after cooling to avoid any wastage and only losses shall be made up from fresh water.

Water Treatment, Storage and Distribution System

The water storage and distribution system at the cement grinding unit shall essentially be designed to fulfill requirements of plant process and cooling, Fire fighting system, Potable drinking water supply to various locations in plant premises, Water supply for sanitation purpose, Horticulture and Cleaning etc.

Waste Water Handling System

Industrial Waste Water

Wastewater from workshop, laboratory and other various process units shall be separated for lead and other pollutants.

Waste Water from Humans

Washrooms and toilets shall be provided in all department offices, CCR, workshop, administrative offices like office buildings, canteen, clinic etc. Waste water from these areas shall be collected in soak pits and septic tanks.

4.9.3 Compressed Air Supply

Centralized compressor and blower room have been envisaged for the sake of overall economy, effectiveness and ease of operation and maintenance. The compressed air is required mainly for dust collection equipment and operation of pneumatic valves. Blowers shall be used for aeration of silos.

A centralized compressor room is proposed, for cement grinding, storage and packing section. Blowers may be suitably accommodated under buildings/ silos near points of utility.

4.9.4 Central Control Room (CCR)

A CCR building cum Technical and Administrative office is envisaged to be constructed. Operation of the cement mill and packing plant shall be carried out from this control room.

4.9.5 Fire Fighting System

A complete fire fighting system shall be provided comprising of:

- A suitable high-pressure system of fire hydrants consisting of suitable number of fire hydrants.
- A complete separate fire fighting water piping network for feeding the hydrants.
- Heavy-duty ABC powder type fire extinguishers shall be hung at particularly important electrical equipment areas.
- Portable CO_2 extinguishers shall be provided throughout the plant.
- Automatic fire extinguishing system-using water shall be considered for empty bags store in the packing plant.

4.9.6 Auxiliary Infrastructural Facilities

Workshop

Workshop is not envisaged at this stage of the project. However, basic tools and tackles for maintenance of plant and equipment shall be provisioned near the general store or any other suitable place in the proposed plant.

Machinery Stores

A store building needs to be constructed for storing tools, spare parts, consumables, etc. Open area to be earmarked for storing machinery and construction materials for the proposed plant.

Cranes, Monorails and Pulley Blocks

Adequately sized maintenance cranes/ hoists, monorails and pulley blocks to be provided at all suitable locations at the plant for ease of maintenance and operation.

Time, Security, Project and Cement Dispatch Offices

At the entrance of the plant, a time office and a security office shall be constructed. A separate unit shall be provided for the managing the movement of material trucks. A project office shall also be constructed, which shall be used during the execution of the project, and later during plant operations as well.

Weighbridges

Four nos. electronic weighbridges are envisaged for the project.

Dispensary

A small dispensary with first aid facilities should be provided in the plant premises.

Bags Godown

Space shall be provided in the packing plant area for the storage of bags.

Parking

Adequate parking space shall be provided within and at the periphery of the plant premises for the parking of light and heavy vehicles.

Canteen

Separate canteens for the employees, workers and truckers are envisaged.

Colony

Considering options for staff housing in nearby villages and Prayagraj City, a dedicated colony is not envisaged in the project concept.

4.9.7 Environment Protection

The plant design shall be carried out taking cognizance of prevalent environmental laws and the importance to maintaining environmental standards.

Protection From Dust Pollution

Efficient collection of dust at sources, their dedusting with efficient filters and recycling the dust to the process is the prime objective.

The cement-grinding unit shall be provided with bag filters capable to contain the dust content in the exhaust air to less than 30 mg/ Nm^3.

Sewage And Effluent Treatment

The grinding unit shall have a provision of a sewerage system for the collection and disposal of sewage from the cement works. Individual soak pits and sewerage chambers are envisaged.

There are no process effluents in the cement grinding plant.

Plant Landscape and Green Belt

Due care has to be taken to keep-up the natural settings/ greenery in and around the plant. For the purpose of landscaping, it is intended to provide a green belt with trees and bushes wherever possible at the plant.

Pollution Control Equipment

As described in this chapter, the installation of following pollution control equipment is foreseen:

- Cement mill bag filter
- Bag filters for dedusting of storages and auxiliaries at different sections
- Bag filters for dedusting of all the feeding/ transfer points

Pollution Monitoring Equipment

- Offline dust emission monitoring kit

Noise Emissions

All equipment considered in technical concept shall be designed to operate within the prescribed noise levels as defined by relevant standards. Where necessary special sound enclosures shall be considered, por the buildings shall be designed with noise protection.

Roads

All roads and paved places planned for traffic movement within the proposed Cement Grinding Unit shall have the surface concrete paved or tarred in order to reduce dust generation and protect the roads against damage.

Rainwater Harvesting

JCL shall practice rainwater harvesting at priority level. The plant shall have the required network of pipes to collect the rainwater from the plant building area. The collected rainwater shall be diverted to the proposed rainwater harvesting pits for recharging the ground water.

4.10 CIVIL ENGINEERING CONSIDERATIONS

4.10.1 Introduction

This section briefly deliberates on the prevailing site conditions and general design criteria envisaged towards the execution of civil and structural works for the proposed project.

Site conditions

Topography

The land for the proposed grinding unit is largely flat, marked with minor undulations and sporadic rocky outcrops at certain localized patches in the earmarked land parcel.

Indicatively estimated lump sum amount has been considered towards land and site grading, leveling and overall development in the investment cost estimate.

Corrosion

There is not much evidence of a harsh corrosive environment in plant site region. The possibility of chemical attack by soil on foundation concrete has also not been envisaged for the time being in the Civil cost estimates. However, presence of corrosive elements if identified during detailed soil investigations shall be taken care of during the detailed Engineering.

Subsurface Condition

Site-specific geotechnical investigations are yet to be carried out at the proposed site. However, based on the collected information of the proposed plant site and general inferences drawn from nearby areas during the site visit, it is broadly estimated that the overall safe bearing capacity at nominal depths (of the order of 3 to 4 m under the existing natural ground level) shall be relatively high due to presence of dense to rocky sub-strata.

Near-normal soil conditions are envisaged to prevail at moderate depths (of the order of 3 to 6 m, and down) below the average natural ground level thereby allowing normal foundation system to be adopted at those minimum foundation depths for the proposed plant. However, the exact spectrum of the subsurface shall be known only upon conducting the detailed soil investigation studies. For the purpose of cost estimates, a safe bearing capacity (SBC) of minimum 70 to 75 t/ sqm has been assumed at an average depth of 3 to 5 m and down below the average natural ground level. Accordingly, a normal foundation system is envisaged for the plant structures and buildings in absence of site-specific geotechnical investigation inputs. Rock anchoring for some of the foundations might also be required, where hard rocky sub-strata is encountered, which need not be excavated by controlled blasting or by use of jack hammer/ compressor system.

Piling has not been considered at this stage for any of the structure. However, detailed soil investigation of the plant site shall have to be carried out to ascertain the soil's actual safe bearing capacity. In case it is ascertained after detailed soil investigations that piling is unavoidable in whole or in part, the respective civil cost may increase to the extent of 10 to 20% depending upon the type, numbers, dimensions, depth and related details of the piles required.

Seismicity

The proposed plant – site region falls in Seismic Zone III (low damage risk zone) for which the zone factor is 0.16 [as per IS 1893 (Part I): 2002]. This aspect shall be considered while designing the structures.

4.10.2 General Design Criteria

General Design Principle

In general, the civil design and construction of structures in the plant have to meet the site conditions, load data conditions and functional requirement as stipulated by the main machinery supplier.

Considering prevalent construction practices adopted in the region where the proposed plant is envisaged to be set up, most of the structures and buildings are envisaged to be primarily designed in reinforced cement concrete (RCC) with suitable masonry and/or metal sheet roofing and cladding, as required. Extensive structural steel usage shall mainly be limited to sheds, conveyor galleries, duct supports and working platforms or where flexibility of stage-wise constructions is constrained.

As such, the plant structures, non-plant and office buildings are envisaged to be built following the 'moderate-finish-low-cost model' of construction practices. As such, the structures and buildings are envisaged to be designed and constructed with ordinary to moderate finishes only. The linear storages are envisaged to be steel gantries primarily with simple corrugated galvanized iron roofing and minimal cladding/ louvers. Infrastructural elements like the roads, drains, etc. are also envisaged to be of all-weather type constructions that may be augmented suitably to concrete roads in due course once the plant starts production and generating its own revenues.

Loads & Impacts

All the relevant loading and impact details like wind load, earthquake load & level, static loads, loads from machinery & equipment, dynamic loads, hoist loads, other calculated loads, etc. shall be duly taken into consideration during the detailed plant design and engineering process.

Codes of Practice and Standards

Indian Standards shall be used for all design and detailing work unless otherwise specified.

4.10.3 General Construction Methodology

Earthworks

Excavation levels shall be requirement specific as per design and should have additional adequate working space for construction purpose. Mechanised means shall be employed for most of the excavation purposes barring excavation towards final level-dressing of the foundations, or small footings, or any other requirement-specific condition, etc. Any excavation, if inadvertently is carried out below the required design level(s) under any circumstances, shall be filled and made good with plain cement concrete fill.

For backfilling, good quality excavation products of soil can be used after objectionable materials are removed from therein. Back filling material should be free of like bigger sized boulders, organic materials, clay balls, any kind of constructional or non-constructional debris, and other objectionable inorganic matter, etc. Back filling should be done in layers of not more than maximum 300 mm and each layer should be well watered and compacted

by mechanized and manual means. The boundary of any compacted back-fill material shall extend at least 1.00 m (0.50 m from each side) beyond the foundation footprint.

Substructure & Superstructure elements

Isolated, combined and/ or raft foundations of shallow-to-moderate depth are envisaged depending upon the type, height, loading and other design parameters of the plant and non-plant structures.

The depth and size of the foundations shall however depend upon numerous design parameters like loading data and conditions; type & height of structure; wind, earthquake and other related forces acting upon various structure elements. The structures shall be framed (tied) with rigid RCC tie beams to connect isolated footings.

In general, the dimensions of isolated footings should at least be 300 mm more than that of RCC column cross-sectional dimensions from all sides. The minimum size of RC Footing shall be 1,000 mm and the thickness should not be less than either 400 mm or the minimum acting column dimension.

Basement or tunnels walls must be designed with reinforced concrete and flexible joints to be provided in the tunnel footing connections. The reinforced concrete skeleton buildings shall have plain cement concrete floors over well-compacted sub-base for ground floors and shall generally be 150 mm thick. The floor at higher levels shall either be of RCC or structural steel depending upon the design criteria and other work progress related factors.

Columns and structural elements exposed to vehicular traffic and vulnerable to breakage shall be provided with edge protection up to a minimum height of about 1.8m from the finished ground level by providing embedded edge angles.

Finishing and Aesthetics

The proposed plant shall have all the basic industry-prevailing facilities and infrastructure. The aesthetics and type of finishes for the superstructure are envisaged to be contemporary but of moderate scale so as to keep the project cost optimised.

Health, Safety and Environment (HSE)

All necessary measures towards maintaining high standards of Health, Safety and Environment during entire construction period must be enforced by the plant owners and adhered to by all the contracting agencies.

4.10.4 Civil Cost Estimates

Based on the plant technical concept, input data gathered during the site visit, and data inferred from **HOLTEC** database, the civil cost estimates have been worked out.

The major work-item and the basic material rates for plant structures assumed for costing purpose are as given in the tables following hereunder:

Sn	Item of work	Unit	Unit Rate (Rs.)
1	Earthworks (ordinary soils)	cum	300
2	Earthworks (hard soils, soft rocks)	cum	700
3	Earthworks (hard rocks)	cum	1,200
4	Concrete works with PCC M10	cum	4,400
5	Concrete works with PCC M15	cum	4,650
6	Concrete works with RCC M20	cum	5,100
7	Concrete works with RCC M25	cum	5,550
8	Concrete works with RCC M30	cum	5,850
9	Concrete works with RCC M35 / M40	cum	6,300
10	Plain formwork	sqm	900
11	Slip, conical & special formwork	sqm	900
12	Reinforcement steel work	t	69,500
13	Structural steel work	t	1,00000
14	GI sheeting work (corrugated, plain)	sqm	1,100
15	Brick masonry work	cum	5,600
16	Stone masonry work	cum	5,600
17	Deck sheeting work (2mm thick)	t	1,25,000

The item rates mentioned above are the average prevailing rates of complete item works and are inclusive of the basic material cost.

The average basic cost of the three major materials, considered in consultation with **JCL** on as landed at plant site gate basis, are as given below:

Sn	Major Material	Average Unit Rate (Rs./ t)
1	Cement	5,000
2	Reinforcement steel (various types & diameters)	60,000
3	Structural steel (various types & sections)	65,000

The civil cost has been estimated considering broad quantity estimates of major civil & structure work items that have been worked out based on overall plant technical concept, local site conditions.

4.11 ELECTRICAL ENGINEERING

4.11.1 Power Requirement and source

The maximum power demand for the proposed Grinding Unit has been estimated as about 12 MW based on specific power consumption of 31.5 kWh/ t of PPC including power requirement for material handling, clinker grinding, packing, lighting & utilities.

Power is envisaged to be sourced from the 132/33 kV grid substation of U.P. Power Transmission Corporation Limited, located near Shankargarh spanning a distance of about 5 km from the proposed plant site. For receiving power, transmission line, switchyard and main receiving substation shall be constructed and the same has been considered in the capex estimates.

The grid tariff has been estimated as about Rs 7.70 per kWh.

To meet the emergency power requirement, a DG set of about 1 MW capacity has been envisaged in the investment cost estimate.

4.11.2 Power Distribution

Medium Voltage (6.6kV) Distribution System

Plant MV loads have been envisaged at 6.6 kV. The single bus switchboards in the load centers shall be fed from the Main Sub station.

The power to plant loads shall be distributed via Load Centers, located close to the electrical loads in the process department.

The power at 6.6 kV shall be stepped down to 415 V at these load centers through 6.6/ 0.433 kV distribution transformers and connected to LT switchboards to cater to LT loads of the plant. 6.6 kV motors shall be fed directly from 6.6 kV boards located at the respective Load Centers.

The power to plant loads shall be distributed via Load Centers, located close to the electrical loads in the different process departments as shown in the Drawing no. **22173-04-GU-1-10**.

6.6 kV MV Switch Boards

The MV Switchboard and distribution transformers shall be located in the following departmental substations:

- Main Substation.
- Cement mill sub-station

The MV switchboards shall be assembled in a line up of factory fabricated; metal clad cubicles with draw out type SF_6/ Vacuum circuit breakers. Each switchgear shall have necessary metering, protection and control functions to suit the application through multifunction composite microprocessor based numeric relay having serial bus connectivity with plant DCS based Control and Automation system.

Low Voltage (415 V) Distribution System

The power supply at 6.6 kV shall be stepped down to 415 V by the distribution transformers at the departmental substation and fed to the Low Voltage (LV) loads of the respective sections through the LV Distribution boards and Motor Control Centres (MCCs). The entire low voltage power distribution system shall be designed to guarantee selective fault isolation and isolating a faulty circuit from the main electrical system.

6.6/ 0.433 kV Distribution Transformers

3 Phase Dyn11 vector group mineral oil natural air natural (ONAN) copper wound distribution transformers complete with off load tap changer and all necessary accessories have been considered to feed the low voltage loads at the MCCs.

To attain transformer standardisation, the transformers shall have 1,600 kVA and 2,000 kVA sizes. The transformer capacity shall be selected within the above-mentioned standard sizes and shall not be less than the total installed kW capacity of all LV loads connected to it.

Motor Control Centers (MCCs)

Intelligent MCCs, controlling a group of interconnected and simultaneously operated loads during the process are envisaged and shall be located in centralised electrical room in the substation/ plant building.

Each feeder module of the MCCs shall incorporate a mini-processor for serial bus connectivity, and shall be connected to the CPU through daisy-chain serial data link. Further, the MCCs shall comprise of all equipment for a safe remote control of the different plant sections and consist of process power feeders only.

4.11.3 Power Factor Correction

For maintaining a high overall power factor, static power factor improving capacitors of suitable KVAR rating and voltage grades shall be considered.

In the envisaged scheme, suitably sized capacitors shall be directly connected across the stator switch terminals of respective 6.6 kV MV motors. For compensation of LV loads, multi step automatically controlled capacitor banks integral to the LV Board or the respective MCCs to improve the power factor to 0.95 or above would be provided.

4.11.4 110 V DC System

The control voltage for the MV Switchgears shall be 110 V DC to be obtained from Nickel-Cadmium alkaline batteries and solid state battery charger. The battery charger panel shall have regulated boost & float output.

4.11.5 Electrical System Component

Drives

The type of drives considered are based on following requirements:

- Speed/ torque characteristics of the driven equipment
- Enclosure protection depending upon the work environment
- Performance characteristics, i.e. high power factor and efficiency at operating points
- Accuracy and range of speed control required for specific application.

All motors, generally above 200 kW shall be connected at 6.6 kV and motors below 200 kW at 415 V.

Illumination

An energy efficient illumination scheme for plant premises shall be provided. The illumination shall be arranged by use of energy efficient Sodium Vapour/ Metal Halide luminaries suitable for High Bay mounting. Adequate lux level shall be maintained for safety and ease of plant operation.

Sufficient numbers of lighting distribution boards are considered for automatic control of lighting fixtures at the various locations of the plant.

Cabling

Following type of cables shall be used in the plant:

Power (MV)	:	6.6 kV (UE) PVC sheathed XLPE insulated copper cables
Power (LV)	:	1.1 kV PVC sheathed XLPE insulated copper cables
Control	:	1.1 kV PVC sheathed PVC insulated copper cables 1.5 and 2.5 mm^2
Instrumentation	:	0.6 kV screened PVC insulated copper cables, 0.5 and 1.0 mm^2

For main cable routing outside plant process buildings, Overhead cable gallery has been envisaged. Inside the process buildings the cables shall be routed in the cable trenches or along the columns/ beams.

Earthing/ Lightning Protection

System and Equipment earthing are considered for safety of operating man and machinery as well as for the stability of the electrical system. The MV system shall be effectively earthed through resistance.

Copper rod earth electrodes connected together with strip shall form the main earth mat, which shall be interconnected for each building.

Earth continuity conductor shall be run along with major cable routes to provide grounding to the equipment. Tall structures like storage silos shall be protected against lightning by use of horizontal mesh of conductors and vertical spikes. All the lightning rods, lightning mesh wires and down conductors shall be of stranded copper.

A separate electronic earth mat and network interconnected with the above earthing network shall be considered for DCS and other associated control panels.

4.12 CONTROL AND INSTRUMENTATION

Distributed control system comprising of programmable controllers and operator stations with peripherals are considered for remote operation of plant from a central control room.

4.12.1 Plant Control System

For sequential control of drive and supervision of various process variables, distributed microprocessor based control system has been considered.

An elaborate instrumentation comprising of field sensors, transducers, etc. shall be set up for monitoring of processes.

The Control system envisaged shall incorporate following essential features for safe operation of plant & machinery and provide necessary operating data to evaluate the plant performance and fault monitoring:

- Client/ server configuration for easy configuration and maintenance.
- Programmable controllers for sequence interlocking and automatic closed loop control through PI and PID action.
- Serial bus connectivity for MCC, Drives, Sub-controls and MV Drives.
- Operator stations with colour graphic and alphanumeric display with equipment fault monitoring system and plant remote control.
- Process optimization system to achieve improved process stability.
- An engineering station, which shall provide engineering tools to update PLC, programmes.
- An energy management system for control and monitoring of electrical energy.

- MIS station which shall generate reports and provide process mimics as well.

For control and instrumentation of the Cement grinding plant, the control system configuration is shown in enclosed drawing bearing reference as **22173-04-GU-1-11**.

The control system shall be structured as under:

Level – I (Field level)

At Field level the instruments and sensors are installed in accordance with process requirements. For certain systems e.g. lubrication, silos, weighing systems etc. sub-control systems are also allocated in the field. Serial communication with plant DCS has been considered for field instruments and sub control systems.

Level – 2 (Department Control level)

Programmable controllers with input/ output devices shall ensure safe operation of machines and supervise production processes.

Level – 3 (Supervisory level)

In the Central Control Room, an operator station with supervisory processor visual display unit, keyboard, etc. for efficient man/ machine interface for the remote operation of the plant has been envisaged.

The functions of operator level PC are:

- Sequential interlocks for group starting and stopping
- Analog signal processing by real time acquisition of plant process parameters for monitoring of process and safety of equipment.

4.12.2 Process/ Instrumentation

Necessary field sensors shall be installed to monitor process variables like pressure, temperature, flow, level, speed etc. The sensors shall be linked to Plant Control System through field transmitters/ transducers to display the parameters on Operation Station and exercise the desired controls. The broad technical features of sensors and instruments are described below:

Temperature, Pressure, Diff. Pressure, Flow and Level Transmitter

Transmitters shall be employed for measuring of pressure, temperature and flow at various locations in the cement grinding plant.

Smart Transmitters shall be used which shall be configured, calibrated, and tested from the Control Room itself. Transmitters shall provide very high accurate values and shall have robust field housing. The transmitter shall preferably have serial bus connectivity for interface with plant DCS system.

Level Sensors

Special designed level sensors shall be deployed for monitoring and control of material level in clinker discharge hoppers.

RF admittance type sensors for point level control and for continuous level ultrasonic/ electromechanical type of instruments shall be used. For continuous level measurement of silo level RADAR type level sensor shall be deployed. Level Sensors may also be of laser type.

Speed Switches

These shall be deployed to achieve zero speed protection for various equipments. The unit chosen shall have built in initial by-pass time delay and designed to operate over a range of speed. The primary sensor shall be non-contact type designed to achieve unlimited number of operation. The unit as well as sensor shall have a high degree of environment protection.

4.12.3 Intercommunication Equipment

Public Address System with paging and party facility for CCR operator to contact the field operator and vice versa has been considered in order to facilitate plant operations.

For administrative purpose and interdepartmental communication, a telephone exchange is considered which shall also supplement the public address system.

4.12.4 Fire Alarm and Detection System

For detection of fires in electrical buildings, cable cellars, switchgear rooms, and control rooms etc., suitable designed detectors shall be installed. Multizone type fire alarm panel shall be deployed for audio-visual alarm.

4.12.5 Uninterrupted Power Supply

Each location housing automation equipment shall have its own UPS and shall also provide power to microprocessor-based sub controls, process instruments etc. The capacity of UPS shall be chosen to cater to such loads and to have some spare capacity as well. The battery bank shall be Ni-Cd alkaline type to provide adequate backup time.

Annexure 4.1

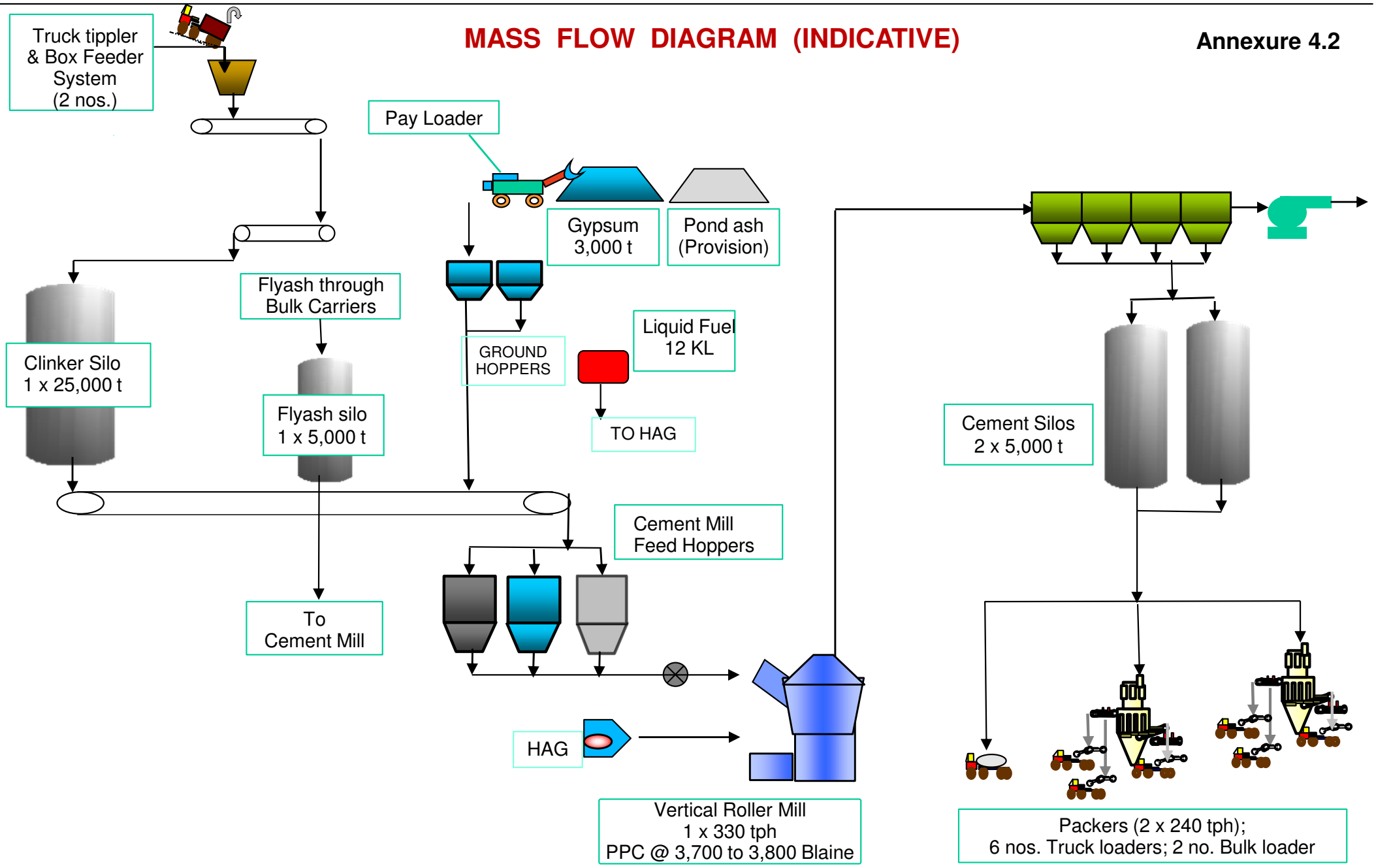
CAPACITIES OF MAJOR EQUIPMENT & STORAGES

Operation	Equipment/ Storage	Unit	Basis	Capacity for TEFR consideration
Cement Grinding	Clinker storage	t	Clinker requirement per day x no. of storage days	1 x 25,000
	Gypsum Stockpile	t	(Cement production per annum/ annual working days x gypsum % in product+clinker consumption per annum x % gypsum in rawmix) x (100-moisture in dry gypsum)/(100-moisture in gypsum) x (1/(1-% loss/100)) x Storage days	3,000
	Flyash Storage	t	PPC production per annum/ annual working days x flyash % in product x (100-moisture in dry flyash)/(100-moisture in flyash) x (1/(1-% loss/100)) x Storage days	1 x 5,000
	Pond Ash Storage	t	PPC production per annum/ annual working days x Pond Ash % in product x (100-moisture in Dry pondash)/(100-moisture in Pondash) x (1/(1-% loss/100)) x Storage days	2,500 ##
	Cement Grinding	tph	(Cement production per annum/ Annual grinding mill hrs) x Design safety factor	Vertical Roller Mill 1 x 330 tph PPC (at about 3,800 Blaine)
	Cement Silos	t	(Cement production per annum/ working days per annum) x Storage days	2 x 5,000 # (as silo storage within GU; rest of batch quantity in warehouses)
Packing & Despatch	Packing	tph	(Cement production per annum/ Packer's available hrs per annum) x % bagging x Design safety factor	2 x 240

Storage capacity envisaged by JCL
Indicative storage capacity (as future provision only)

MASS FLOW DIAGRAM (INDICATIVE)

Annexure 4.2



Annexure 4.3

SUGGESTED QUALITY CONTROL PLAN FOR SAMPLING AND TESTING OF VARIOUS RAW MATERIALS, INTERMEDIATE PRODUCTS AND FINAL PRODUCT

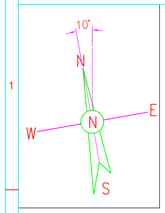
Sn	Material	Sampling point	Sampler	Sampling frequency	Control parameters	Remarks
A	**Clinker**					
1	Clinker	Clinker silo inlet	Manual	Batch wise	Complete chemical analysis, Free lime	
				Composite daily sample	Free lime, Complete chemical analysis	
B	**Additives**					
1	Additives	Storage inlet	Manual	Batch wise	Size fraction analysis, moisture	Three samples from each batch at 01 hour frequency to be analysed
C	**Cement**					
1	Cement Grinding	Mill Outlet	Manual	hourly	Fineness (Blaine, residues), MgO, SO3, Setting time, if necessary	
				Composite daily sample	All physical and chemical testings as per relevant standards	
2	Cement Dispatch	At Silo Extraction	Manual	1 per shift	Fineness (Blaine, residues), SO3, Setting time, if necessary	
				Composite daily sample	All physical and chemical testings as per relevent standards	
3	Pilot Cement Mill (Laboratory Mill)	-	Manual	Composite daily sample of clinker + Flyash/ Slag + Gypsum	All physical and chemical testings as per standards	

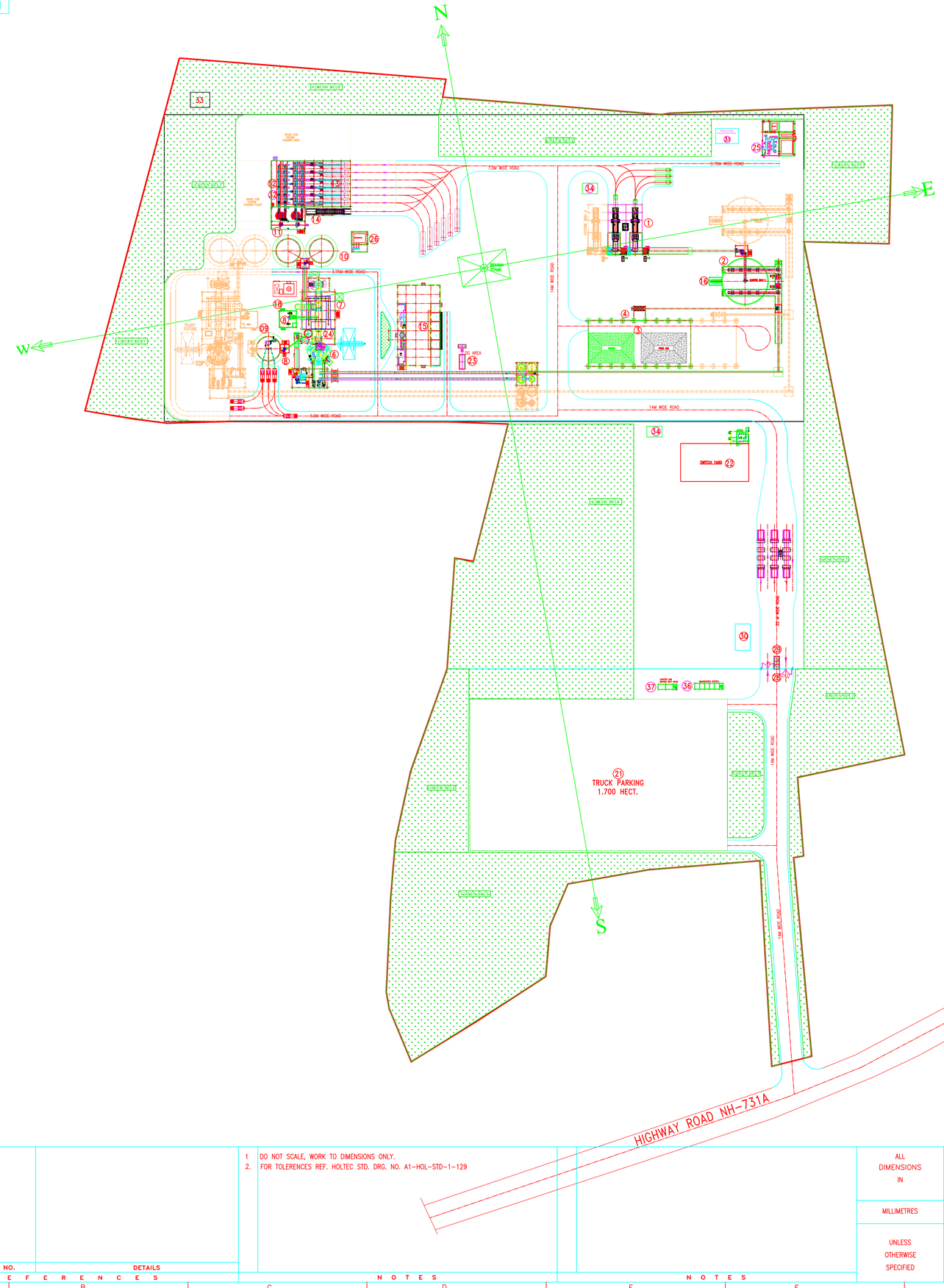
Note :

- Complete chemical analysis shall cover: CaO, SiO_2, Al_2O_3, Fe_2O_3, MgO, SO_3, LOI

DRG. NO. 22173-04-GU-1-01

IF IN DOUBT ASK





LEGEND

S.NO.	GENERAL PLANT DESCRIPTION	±0.000M FFL CORRESPONDS TO (METER)	REMARKS
1.	BOX FEEDER FOR CLINKER		
2.	CLINKER SILO		
3.	ADDITIVE AND COAL STORAGE SHED		
4.	ADDITIVE DUMP HOPPER		
5.	CEMENT MILL HOPPERS		
6.	CEMENT MILL BUILDING		
7.	CEMENT MILL BAGHOUSE		
8.	HAG BUILDING		
9.	FLYASH SILO		
10.	CEMENT SILOS		
11.	PACKING PLANT		
12.	EMPTY BAGS GODOWN		
13.	TRUCK LOADING PLATFORM AND TARPULIN SHED		
14.	CEMENT BULK LOADING		
15.	CCR + LOAD CENTER + LAB + ADMIN BLDG.		
16.	DOZER ENTRY IN CLINKER SILO		
17.	EMERGENCY DUMP HOPPER FOR CLINKER FEEDING		
18.	OIL STORAGE TANK FOR HAG		
19.	ROAD WEIGH BRIDGE		
20.	WEIGH BRIDGE CABIN		
21.	WEIGH BRIDGE FOR MATERIAL HANDING		
22.	SEB RECEIVING SUB STATION & METERING ROOM		
23.	SPACE FOR DG		
24.	COMP. ROOM BELOW CM BAG HOUSE		
25.	RAW WATER TANK AND WTP.		
26.	RECIRCULATION WATER TANK		
27.	AIR QUALITY MONITORING		
28.	MAIN GATE		
29.	SECURITY AND OUTGOING LOGISTIC OFFICE		
30.	PROJECT OFFICE		
31.	RAIN WATER COLLECTION POND		
32.	STORE HOUSE		
33.	STP		
34.	SANITARY BLOCK (2 NOS)		
35.	TRUCK PARKING 1 AND 2		
36.	TRANSPORTER OFFICE		
37.	CANTEEN AND DRIVERS REST ROOM		

LEGEND

PLANT	
FUTURE PLANT	
BOUNDARY WALL	
PLANT ROAD	
GREEN BELT	

REV	01	DATE	04	DATE
CONCURRENCE				

REFERENCES

REFERENCE NO.	DETAILS

NOTES

1. DO NOT SCALE, WORK TO DIMENSIONS ONLY.
2. FOR TOLERENCES REF. HOLTEC STD. DRG. NO. A1-HOL-STD-1-129

ALL DIMENSIONS IN MILLIMETRES

UNLESS OTHERWISE SPECIFIED

ONLY THE LATEST VERSION OF THIS DRG. AS INDICATED IN REVISION COLUMN IS VALID. THE PREVIOUS DRG. SHALL BE MARKED SUPERSEDED AND REMOVED FROM SITE OF WORK.

REVISIONS

REV No	DATE	BY	CHKD	APPD	DETAILS

0			
REV	DATE	ISSUED FOR	BY

HOLTEC CONSULTING PRIVATE LIMITED

HOLTEC CENTRE, A BLOCK, SUSHANT LOK, GURGAON-122001 HARYANA, INDIA

CUSTOMER : JayKayCem (Central) Limited

DES.	RJK	22.10.22
DRN.	RJK	24.10.22
CHKD.	SUA	25.10.22
APPD.	PAS	25.10.22

PROJECT : 22173 (PRAYAGRAJ-UP) CAD FILE :22173GU101

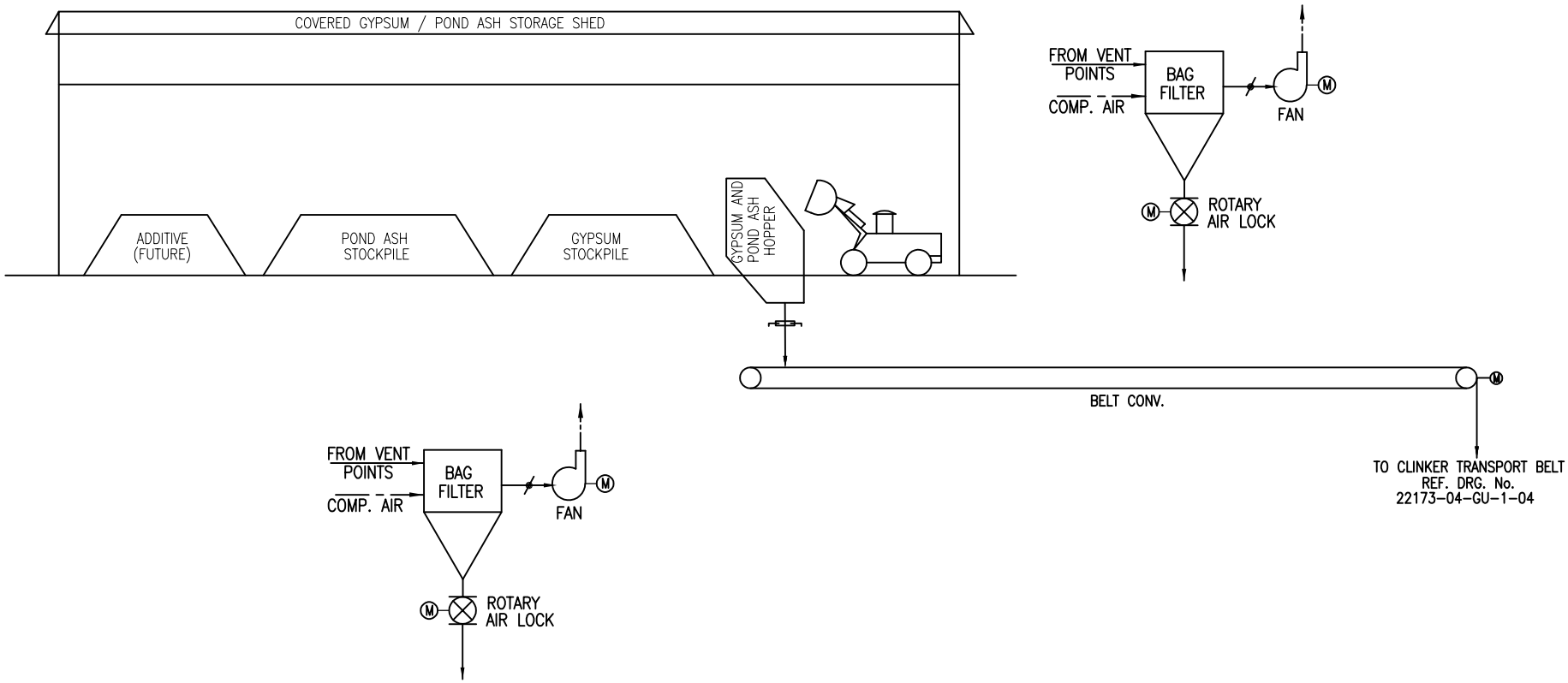
PLANT LAYOUT

2.0 MTPA GRINDING UNIT

SCALE : 1:750

DRG.NO. 22173-04-GU-1-01 REV. 0

CAD FILE :- 2217304GU102R0



FOR FEASIBILITY REPORT

CUSTOMER: JayKayCem (Central) Limited

PROJECT : 22173 (PRAYAGRAJ-UP)

FLOW SHEET FOR
GYPSUM AND PONDASH
STORAGE AND CONVEYING

HOLTEC CONSULTING PRIVATE LIMITED

HOLTEC CENTRE, A BLOCK, SUSHANT LOK, GURGAON-122001 HARYANA, INDIA

DRN.	CHKD.	APPD.	DATE	DRG.NO.	REV.
RJK	SUA	PAS	20.10.22	22173-04-GU-1-02	0

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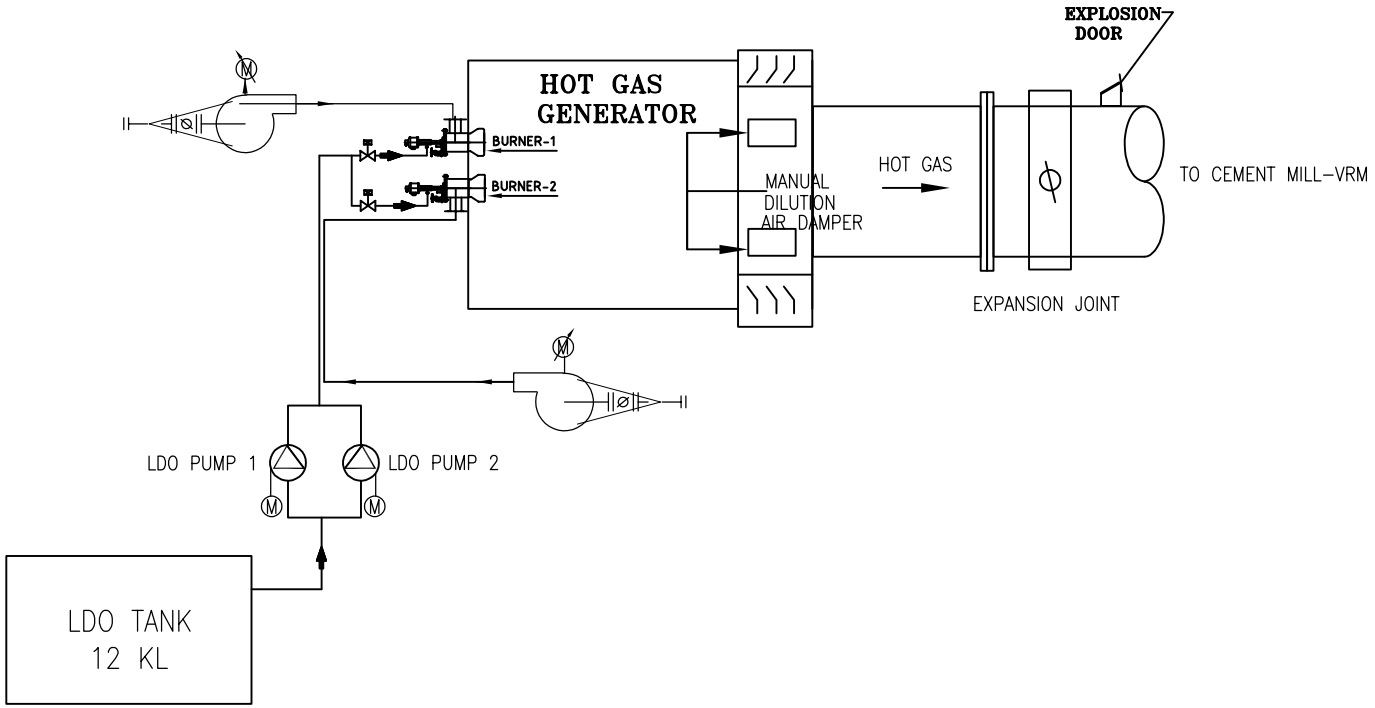


FOR FEASIBILITY REPORT

CUSTOMER: JayKayCem (Central) Limited

PROJECT : 22173 (PRAYAGRAJ-UP)

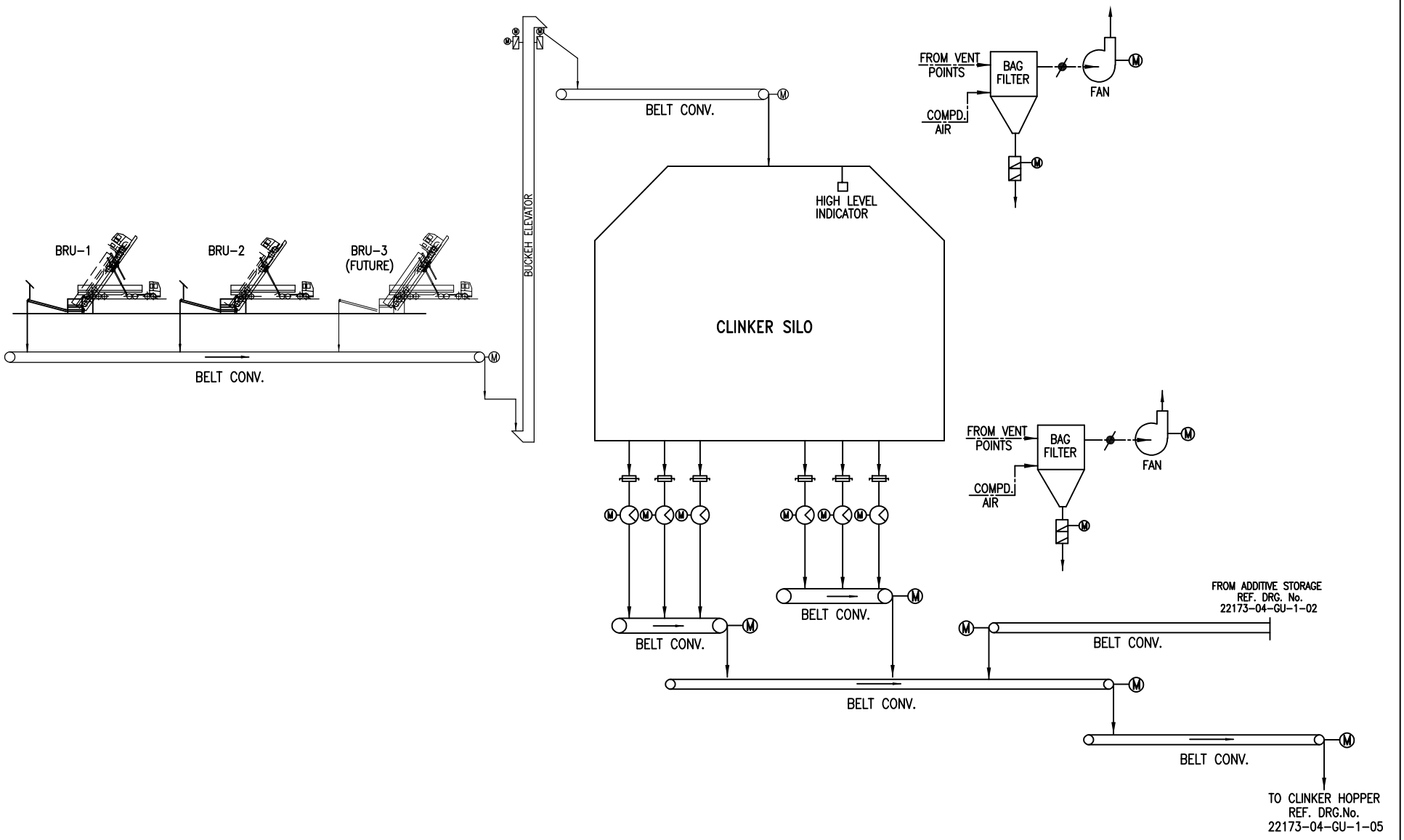
FLOW SHEET FOR HAG
HOT AIR GENERATOR

HOLTEC CONSULTING PRIVATE LIMITED

HOLTEC CENTRE, A BLOCK, SUSHANT LOK, GURGAON-122001 HARYANA, INDIA

DRN.	CHKD.	APPD.	DATE	DRG.NO.	REV.
RJK	SUA	PAS	20.10.22	22173-04-GU-1-03	0

CAD FILE :- 2217304GU104R0



FOR FEASIBILITY REPORT

CUSTOMER: JayKayCem (Central) Limited

PROJECT : 22173 (PRAYAGRAJ-UP)

FLOW SHEET FOR
CLINKER STORAGE & CONVEYING

HOLTEC CONSULTING PRIVATE LIMITED

HOLTEC CENTRE, A BLOCK, SUSHANT LOK, GURGAON-122001 HARYANA, INDIA

DRN.	CHKD.	APPD.	DATE	DRG.NO.	REV.
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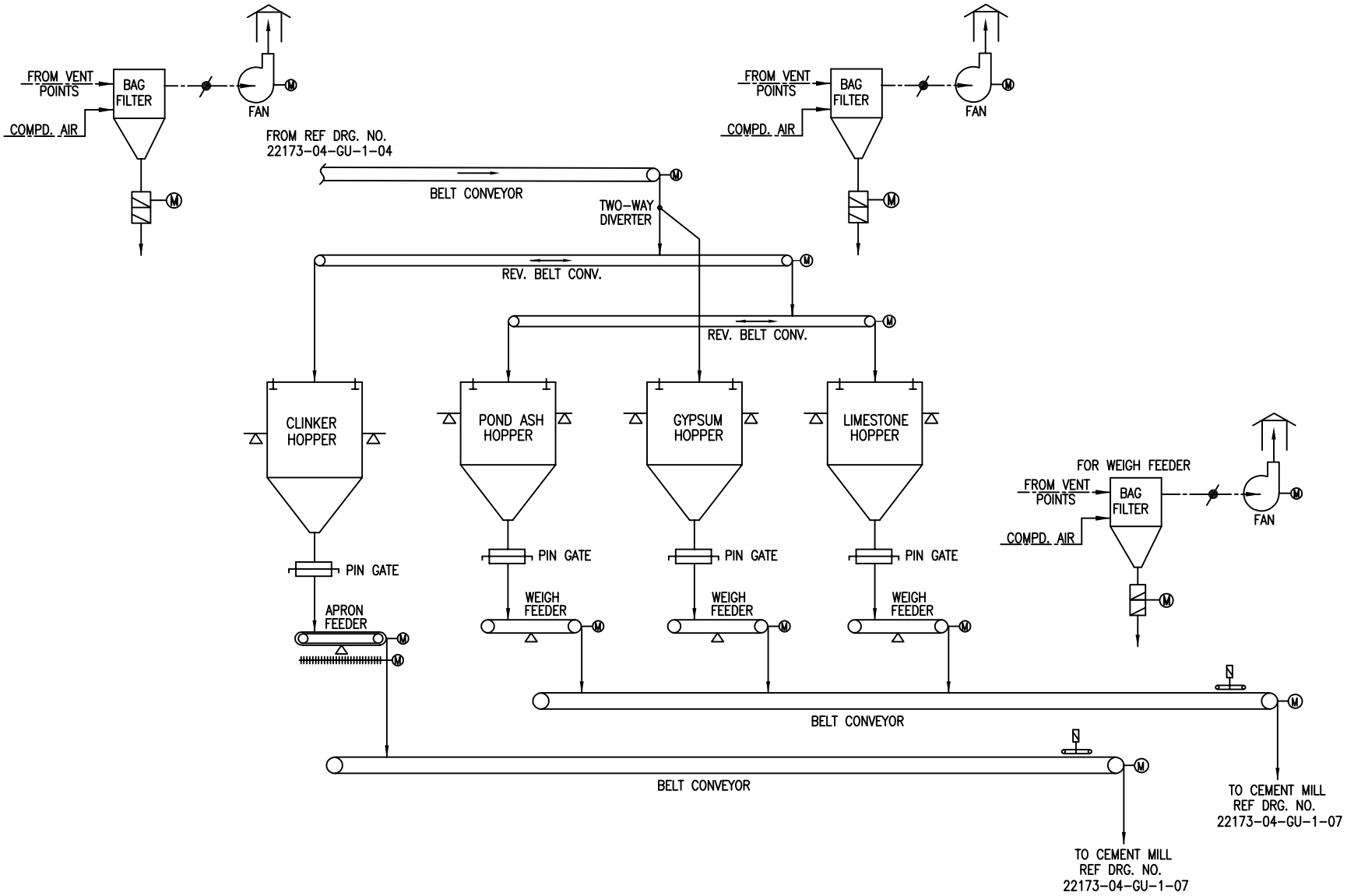
CAD FILE :- 2217304GU105R0



FOR FEASIBILITY REPORT

CUSTOMER: JayKayCem (Central) Limited

PROJECT : 22173 (PRAYAGRAJ-UP)

FLOW SHEET FOR CEMENT MILL HOPPERS

HOLTEC CONSULTING PRIVATE LIMITED

HOLTEC CENTRE, A BLOCK, SUSHANT LOK, GURGAON-122001 HARYANA, INDIA

DRN.	CHKD.	APPD.	DATE	DRG.NO.	REV.
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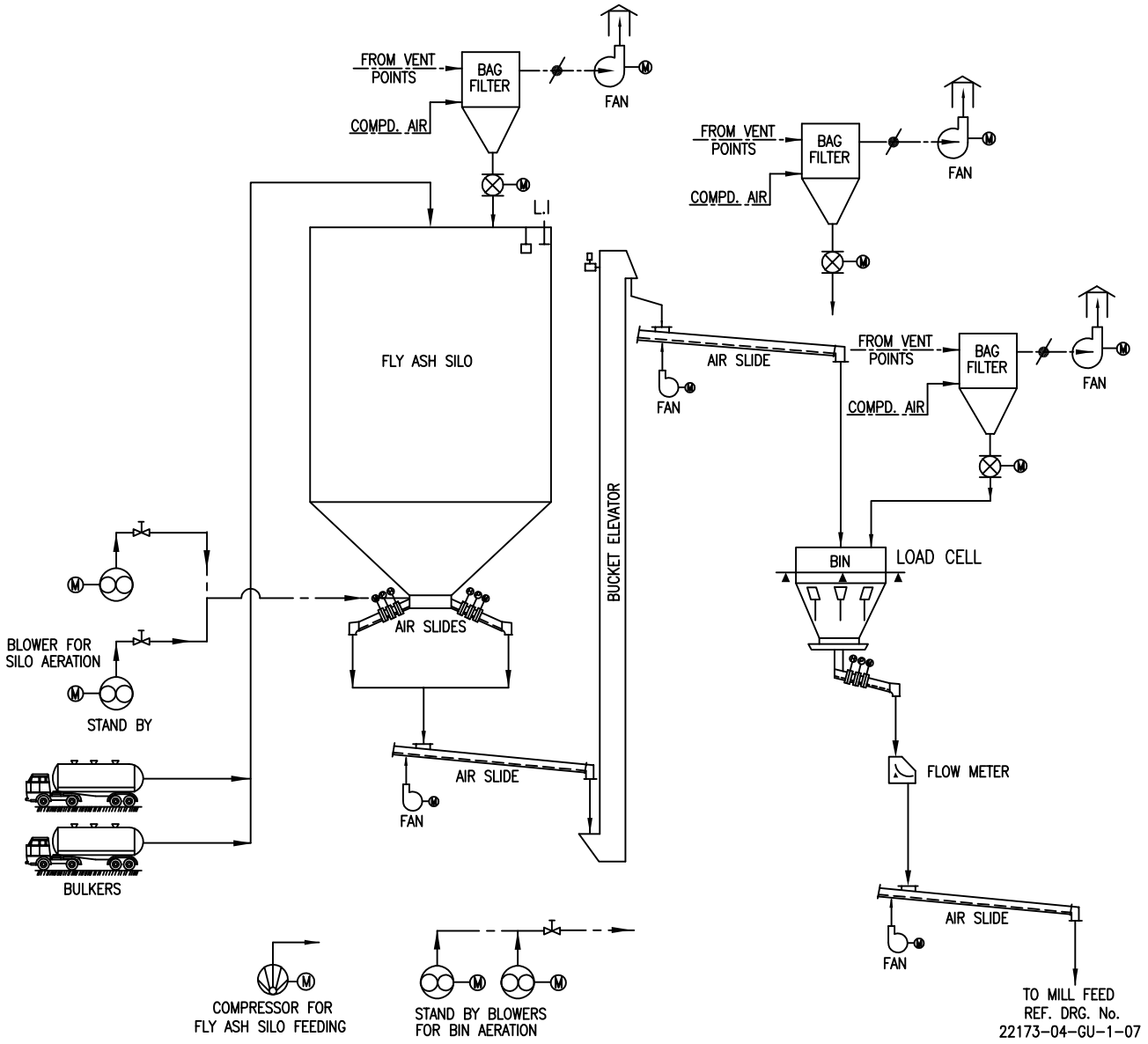

FOR FEASIBILITY REPORT

CUSTOMER: JayKayCem (Central) Limited

PROJECT : 22173 (PRAYAGRAJ-UP)

FLOW SHEET FOR FLYASH STORAGE & CONVEYING

HOLTEC CONSULTING PRIVATE LIMITED

HOLTEC CENTRE, A BLOCK, SUSHANT LOK, GURGAON-122001 HARYANA, INDIA

DRN.	CHKD.	APPD.	DATE	DRG.NO.	REV.
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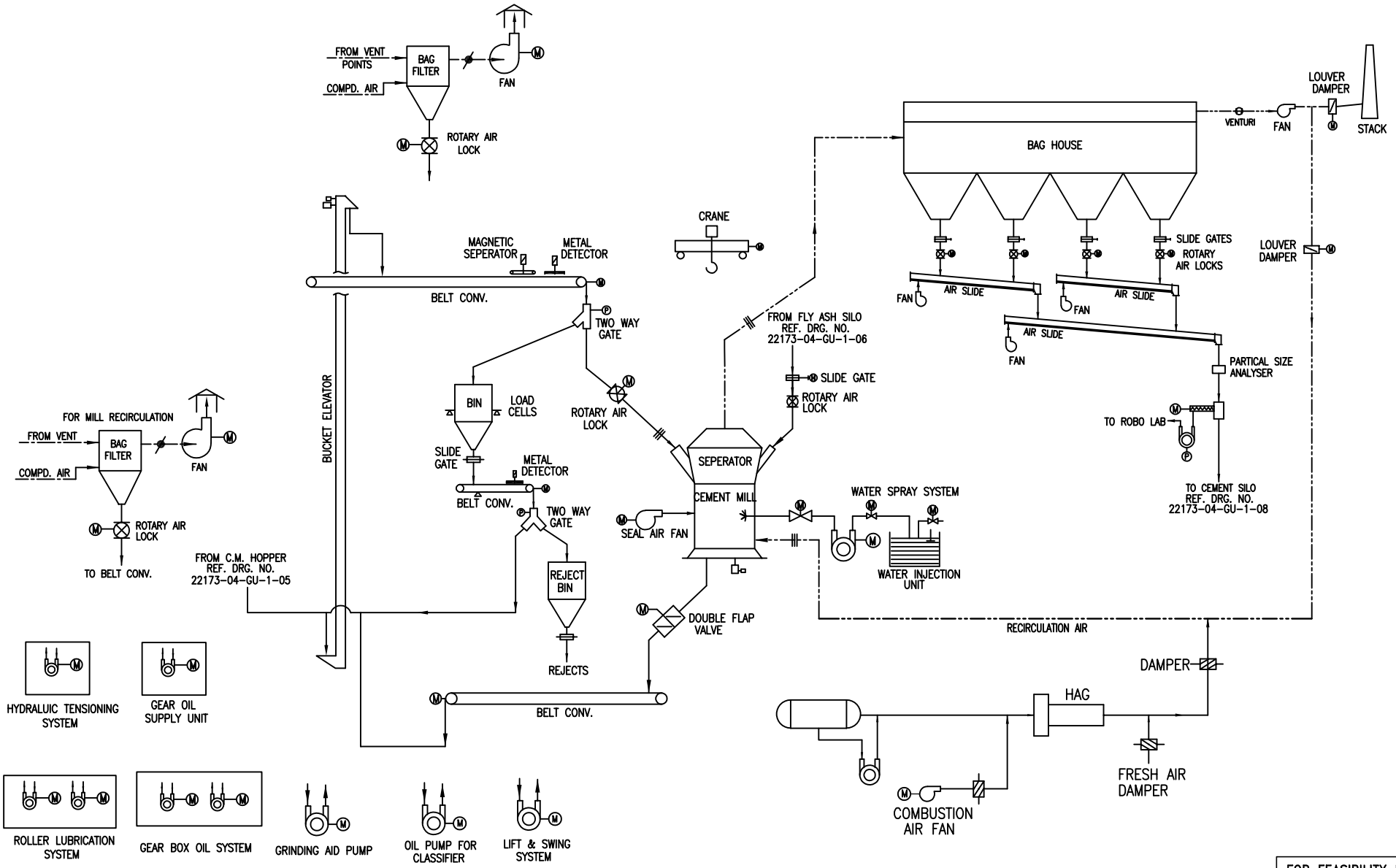

FOR FEASIBILITY REPORT

CUSTOMER: JayKayCem (Central) Limited

PROJECT : 22173 (PRAYAGRAJ-UP)

FLOW SHEET FOR CEMENT MILL (VRM)

HOLTEC CONSULTING PRIVATE LIMITED

HOLTEC CENTRE, A BLOCK, SUSHANT LOK, GURGAON-122001 HARYANA, INDIA

DRN.	CHKD.	APPD.	DATE	DRG.NO.	REV.
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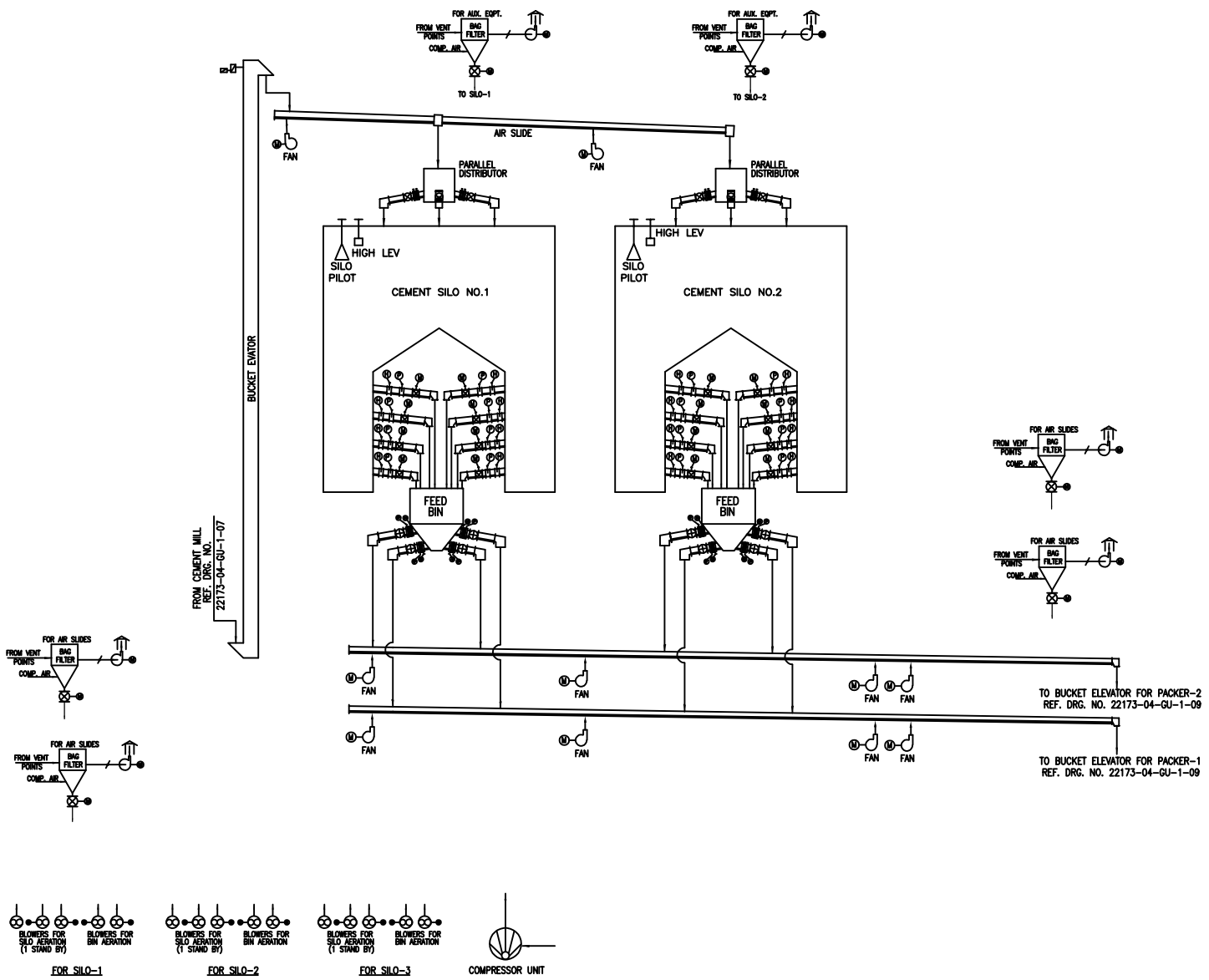

FOR FEASIBILITY REPORT

CUSTOMER: JayKayCem (Central) Limited

PROJECT : 22173 (PRAYAGRAJ-UP)

FLOW SHEET FOR CEMENT SILOS

HOLTEC CONSULTING PRIVATE LIMITED

HOLTEC CENTRE, A BLOCK, SUSHANT LOK, GURGAON-122001 HARYANA, INDIA

DRN.	CHKD.	APPD.	DATE	DRG.NO.	REV.
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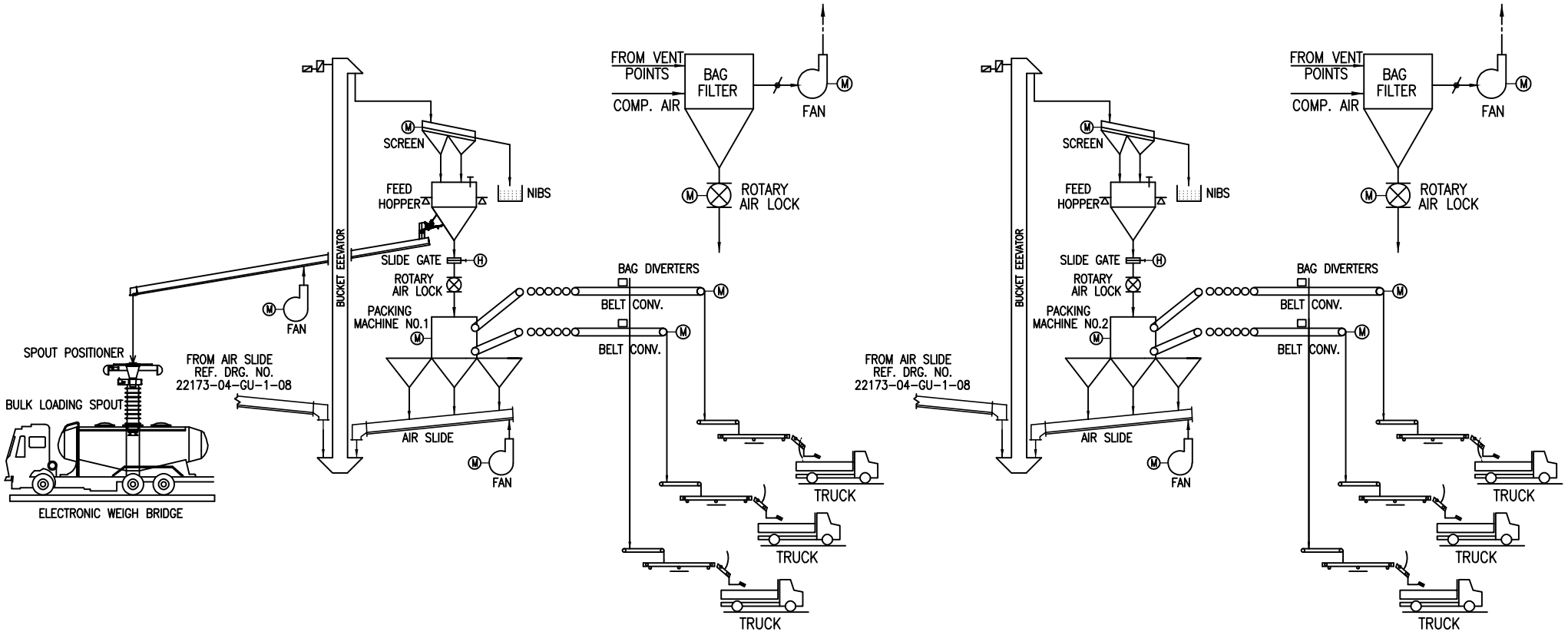


FOR FEASIBILITY REPORT

CUSTOMER: JayKayCem (Central) Limited

PROJECT : 22173 (PRAYAGRAJ-UP)

FLOW SHEET FOR
CEMENT PACKING & LOADING

HOLTEC CONSULTING PRIVATE LIMITED

HOLTEC CENTRE, A BLOCK, SUSHANT LOK, GURGAON-122001 HARYANA, INDIA

DRN.	CHKD.	APPD.	DATE	DRG.NO.	REV.
RJK	SUA	PAS	20.10.22	22173-04-GU-1-09	0

DRG. NO. 22173-04-GU-1-10

IF IN DOUBT ASK

33 KV POWER
FROM SUB STATION

11 KV BOARD
FOR CEMENT GRINDING,
PACKING & DESPATCH
AT LC.1
ITEM NO.2

11 KV SWITCHYARD
(ITEM NO.1)

11 KV/ √3 6.60V/ √3 6.60V/ √3

1600/1-1A

2000A

11 KV, 3PH, 3W, 50Hz

1 2 3 4 5

2000A 2000A 2000A 2000A

CEMENT MILL-VRM

TRAFO.

CEMENT MILL FAN

AUX.TRAFO.-4
6.6/0.415KV
Dyn6.6

BUS DUCT

SPARE

LT BOARD FOR
CEMENT GRINDING,
PACKING & DESPATCH
AT LC-1
ITEM NO.3

415V/ √3 6.60V/ √3 6.60V/ √3

2000A

415 V, 3PH, 4W, 50Hz

1 2 3 4 5 6 7 8 9

1250A 1250A 1250A 1250A 1250A 1250A 1250A

MCC GYPSUM HANDLING & CLINKER TRANSPORT TO CEMENT MILL

CLINKER GRINDING & TRANSPORT TO CEMENT SILO

SPARE

AUX. POWER DISTRIBUTION BOARD AT CEMENT MILL ELECTRICAL ROOM

MCC CEMENT SILO EXTRACTION PACKING TRUCK LOADING

MCC PACKING PLANT

CAPACITOR

SPARE

LEGEND

- POTENTIAL TRANSFORMER
- CURRENT TRANSFORMER
- SF6 CIRCUIT BREAKER
- POWER/DISTRIBUTION TRANSFORMER
- MOULDED CASE CIRCUIT BREAKER
- SWITCH FUSE UNIT
- VFD — VARIBLE FREQUENCY DRIVE
- SLIPRING MOTOR WITH LIQUID ROTOR STARTER
- CAPACITOR
- SQUIRREL CAGE MOTOR
- DC MOTOR
- THREE WINDING CONVERTER TRAFO.
- MVAC DRIVE
- THYRISTOR DRIVE

FOR FEASIBILITY REPORT

REFERENCE NO. | DETAILS — REFERENCES

NOTES

1. * – ELECTRICAL AND MECHANICAL INTERLOCK

NOTES

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE SPECIFIED

REV No	DATE	BY	CHKD	APPD	DETAILS

REVISIONS

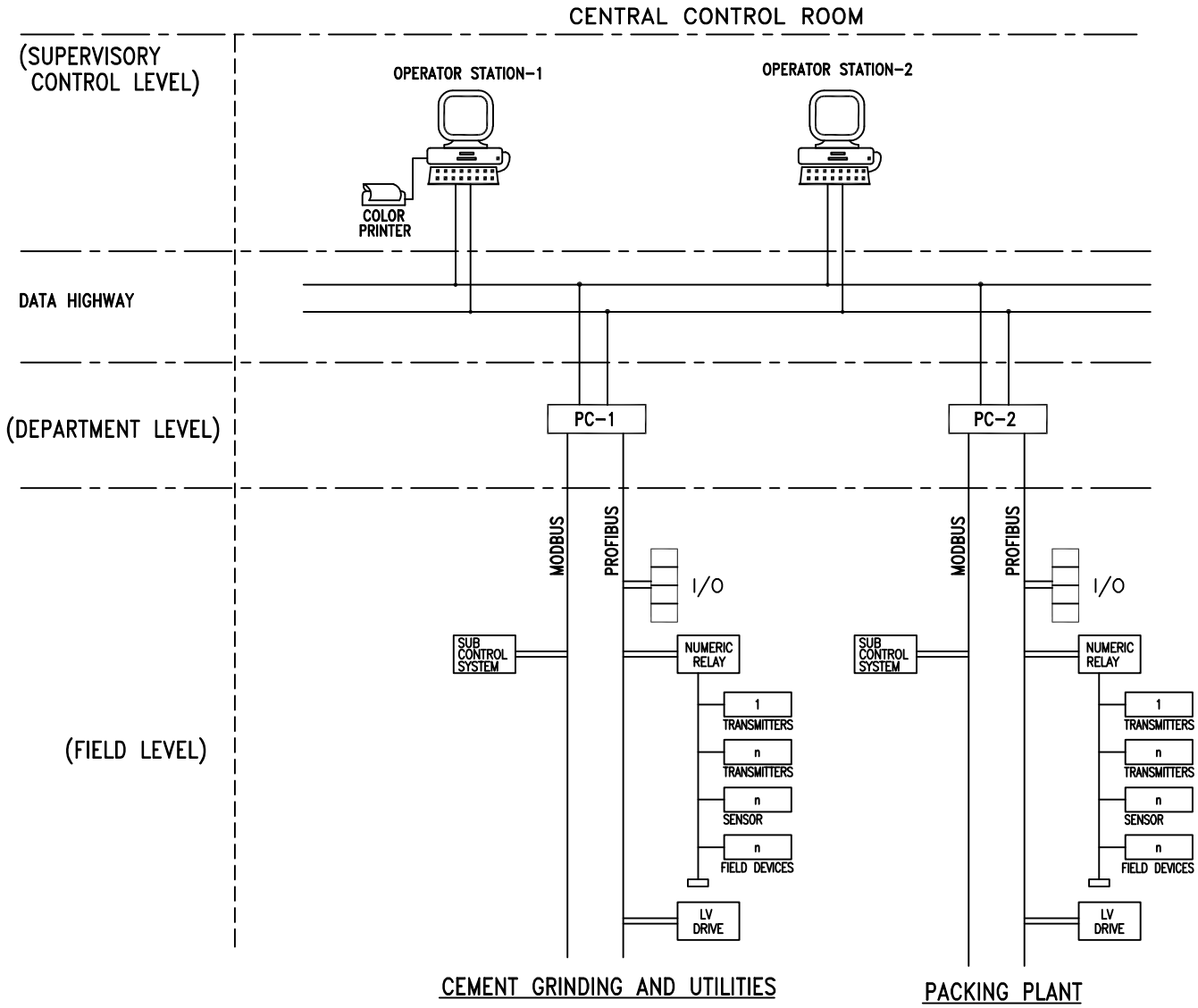
HOLTEC CONSULTING PRIVATE LIMITED
HOLTEC CENTRE, A BLOCK, SUSHANT LOK, GURGAON-122001 HARYANA, INDIA

CUSTOMER: JayKayCem (Central) Limited

DES.	RJK	21.10.22	PROJECT : 22173	CAD FILE : 2217304GU110R0
DRN.	RJK	21.10.22	POWER DISTRIBUTION SCHEME (GRINDING UNIT-PRAYAGRAJ)	
CHKD.	SUA	25.10.22		
APPD.	AHM	25.10.22		
SCALE : NTS			DRG.NO. 22173-04-GU-1-10	REV. 0

DRG. NO. 22173-04-GU-1-11

IF IN DOUBT ASK



NOTES:-

1. DUAL HIGHWAY SHALL BE 100MB BUS WITH OPEN ARCHITECTURE TO PROVIDED CONNECTIVITY TO OTHER CONTROL SYSTEM IN THE FUTURE.
2. WHEREAS DEPARTMENT LEVEL CONTROLLERS AND I/O PANELS SHALL BE PROPRIETARY, WORK STATIONS & OPERATOR STATIONS SHALL BE INDUSTRIAL PENTIUM COMPUTERS WITH WINDOW NT-SOFTWARE
3. SUB CONTROL SYSTEM SHALL BE LINKED WITH PLANT PROCESSOR THROUGH DATA BUS NECESSARY HARDWARES CARDS & INTERFACING CABLE SHALL BE CONSIDERED

LEGEND:-

I/O - INPUT/OUTPUT
SCS=SUB CONTROL SYSTEM
PC=PROGRAMMABLE CONTROLLER

FOR FEASIBILITY REPORT

REFERENCES

REFERENCE NO.	DETAILS

NOTES

1. AC DRIVE, SCS PANELS, TRANSMITTERS, RELAYS ETC. SHALL BE CONNECTED AT BUS LEVEL.
2. OPTIC FIBRE CABLE BETWEEN FIELD & CONTROLLER
3. LOAD MANAGEMENT AND ENERGY MONITORING WILL BE ON A SEPARATE CONTROLLER.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE SPECIFIED

REVISIONS

REV No	DATE	BY	CHKD	APPD.	DETAILS

HOLTEC CONSULTING PRIVATE LIMITED
HOLTEC CENTRE, A BLOCK, SUSHANT LOK, GURGAON-122001 HARYANA, INDIA

CUSTOMER: JayKayCem (Central) Limited

DES.	RJK	22.10.22	PROJECT: 22173	CAD FILE: 2217304GU111R0
DRN.	RJK	22.10.22	CONTROL SYSTEM CONFIGURATION (GRINDING UNIT-PRAYAGRAJ)	
CHKD.	SUA	25.10.22		
APPD.	PAS	25.10.22		

SCALE:- NTS

DRG.NO. 22173-04-GU-1-11 REV. 0

CHAPTER 5 | HUMAN RESOURCE

5.1 INTRODUCTION

This chapter covers the details of human resources required for the proposed **JCL** project. The suggested details of human resources have been given separately for the following two phases:

- Project implementation phase
- Plant operation phase

5.2 BASIS

The actual manpower requirement in any plant would depend on the following:

- Size & location of the plant
- Technological status of the plant, viz., plant layout, type and number of equipment, etc.
- Type of automation, control & instrumentation
- Management and administration control philosophy
- Outsourcing of certain services (On contract) like, security, maintenance, packing, etc.
- HR policies of the company and other statutory requirements

The suggested estimates of human resources are based on the following considerations:

- Project technical concept
- Smooth and efficient plant operation
- Effective inter-departmental co-ordination
- Optimum organization with well-defined job responsibility
- Optimum utilization of different levels of workmen and supervisory staff
- Training needs of the personnel, wherever required, will be taken care of by **JCL**
- Manpower requirement for marketing office and facilities like guesthouse etc. have not been included and shall be taken care of by **JCL**
- Manpower requirement in certain categories like fitters, welders, khalasis, helpers, peons, canteen staff, etc. can be met through contractor(s)
- Certain activities shall be assigned to specialized agencies/ contractors. These shall include loading unloading, plant cleaning job, packing, security for plant, maintenance, etc.
- Unskilled/ semiskilled manpower can be sourced from nearby areas, and skilled mapnpower can be sourced through contractors and pan India as well.

5.3 PROJECT IMPLEMENTATION PHASE

For the project implementation phase, the total requirement of human resources for the proposed Grinding Unit is estimated as **30**.

The details of human resources suggested for this phase have been furnished under **Annexure 5.1**

5.4 PLANT OPERATION PHASE

Total number of persons for Operation Phase is estimated as **204** out of which about 67 persons in general shift and remaining 137 in shift operations have been envisaged. Of the total 204 personnel, 93 persons may be taken on contractual basis.

The details of suggested manpower for this phase have been given at **Annexure 5.2**

5.5 SALARY AND WAGES (IMPLEMENTATION & OPERATION PHASE)

Remuneration for the human resources including the salaries and various other benefits as may be offered by the Company to the personnel has been computed and shown in **Table 5.1 and Table 5.2** below:

- **Implementation Phase**

Sn	Category	No. of Staff	CTC /month (Rs.)	Total HR cost per month (Rs.)
1	Top management	1	7,50,000	7,50,000
2	Senior management	2	4,00,000	8,00,000
3	Middle management	10	3,00,000	30,00,000
4	Specialist/ Engineer/ Officers	7	2,00,000	14,00,000
5	Supervisors/ Foreman/ Staff	6	50,000	3,00,000
6	Workmen/ Labor	4	20,000	80,000
	Total	**30**		**63,30,000**

Table 5.1 | Indicative Cost to Company for manpower during Implementation Phase

Total wages considered for a phased recruitment for Implementation period of 18 months has been estimated as:

(Rs.63,30,000 per month x 18 months implementation period x 60% recruitment factor) = **Approx. Rs.680 to 700 Lakhs**

- **Operation Phase**

Sn	Category	No. of Staff	Salary Per Person (Rs/ Month)	Gross Salary (Rs. / Annum)
1	Top management	1	7,50,000	90,00,000
2	Senior management	2	4,00,000	96,00,000
3	Middle management	8	3,00,000	2,88,00,000
4	Specialist/ Engineer/ Officers	16	2,00,000	3,84,00,000
5	Supervisors/ Operators/ Foremen	62	50,000	3,72,00,000
6	Attendants/ Technicians	62	30,000	2,23,20,000
7	Workmen/ Labor	53	20,000	1,27,20,000
	Total	**204**		**15,80,40,000** **Say, 1580 Lakhs**

Table 5.2 | Indicative Cost to Company for manpower during Operation Phase

5.6 SUMMARY

A summary of the manpower requirement for the cement grinding unit is furnished in **Table 5.3** below:

Unit	Manpower		
	General shift	Shifts	Total (A + B)
	(A)	(B)	
Implementation Phase	30	-	**30**
Operation Phase	67	137	**204**

Table 5.3| Summary of Manpower Requirement

Annexure 5.1

ESTIMATED MANPOWER REQUIREMENT (IMPLEMENTATION PHASE)

Sn.	Department	Manpower	Persons required
1	Plant	Unit head (Overall)	1
1.2	Technical	Technical head	1
1.2.1	Mechanical	Manager	1
		Engineer	1
1.2.2	Electrical	Manager	1
		Engineer	1
1.2.3	Instrumentation	Manager	1
		Engineer	1
1.2.4	Process	Manager	1
		Engineer	1
1.2.5	Quality control	Manager	1
		Chemist	1
1.2.6	Civil	Manager	1
		Engineer	1
1.3	Commercial	Commercial head	1
1.3.1	Stores and Purchase	Manager	1
		Staff	1
1.3.2	Personal and Administration	Manager	1
		Officer	1
		Staff cum Receptionist	1

Sn.	Department	Manpower	Persons required
1.3.3	EDP	Manager	1
		Staff	1
1.3.4	Accounts	Officer	1
		Staff	1
1.3.5	Secretaries	Staff	2
1.3.6	Security	Guards	4
1.3.7	Dispensary	Doctor	-
		Staff	-
1.3.8	Telephone exchange	Operator	On contact
Total			**30**

Note:
It is envisaged that the personnel for Plant Implementation shall be hired in a phased manner during the span of the execution of the proposed Project.

Annexure 5.2

ESTIMATED MANPOWER REQUIREMENT (OPERATION PHASE)

Sn	Department	Manpower	No of persons		Remarks
			General shift	Shift	
1	Plant	Unit head (Overall)	1	-	
1.1	Technical				
1.1.1	Mechanical	General Manager	1	-	
		Manager	1	-	
		Engineer	1	1	
		Foreman	1	3	
		Draftsman/ designer	1	-	
		Fitter	2	3	On Contract
		Utility operator	-	3	On Contract
		Welder	2	3	On Contract
		Workshop operator	2	-	
		Khalasi	2	3	On Contract
		Crane operator	1	-	
1.2.2	Electrical & Instrumentation				
1.2.2.1	Electrical	General Manager	1		
		Manager	1		
		Engineer	1	1	
		Foremen	1	3	
		Power distribution foreman	-	3	
		Electrician	2	3	On Contract
		Helper	1	3	On Contract
1.2.2.2	Instrumentation	Engineer	1	1	
		Foreman	1	3	
		Mechanic	-	3	On Contract
1.2.3	Process & Quality control				
1.2.3.1	Process	Manager	1	-	
		Engineer	1	3	
		CCR operator	3	6	
		Mill attendant	1	3	
		Pay Loader operator	1	3	
		BRU/ Truck Tippler operator	2	6	

		BRU/ Truck Tippler attendants	-	6	On Contract
		Helper	-	3	On Contract
1.2.3.2	Quality control	Chemist	1	3	
		Analyst	-	3	
		Sampler	-	3	
1.2.4	Civil	Manager	1	-	
		Engineer	1	-	
		Mason	-	1	On Contract
		Carpenter	-	1	On Contract
		Plumber	-	1	On Contract
1.2.5	Packing Plant	Manager	1	-	
		Supervisor	1	2	
		Tally checker	2	4	
		Operator	-	12	On Contract
		Truck & Bulk Loaders	-	21	On Contract
1.3	Commercial				
1.3.1	Stores and Purchase	Manager	1	-	
		Officers	1	-	
		Staff	2	-	
1.3.2	Personnel and Administration	Manager	1	-	
		Officer	1	-	
		Staff	3	-	
1.3.3	EDP	Officer	1	-	
		Staff	1	-	
1.3.4	Excise	Officer	1	-	
		Staff	1	-	
1.3.5	Accounts	Manager	1	-	
		Officer	2	-	
		Staff	3	-	
1.3.6	Secretaries	Staff	3	-	
1.3.7	Security	Officer	1	-	
		Guards	-	12	On Contract
1.3.8	LMV	Driver	2	4	On Contract
1.4	Safety	Officer	1	2	
1.5	Logistics	Officer	1	2	
		Sub-Total	**67**	**137**	
		Total	**204**		

CHAPTER 6 | IMPLEMENTATION SCHEDULE

6.1 KEY FACTORS/ STRATEGY

The key factors that would facilitate successful and timely project implementation are:

- Proper choice of technology and machinery suppliers.
- Adequate diligence in formulating the technical concept and system design/ selection of the plant.
- Proper choice of contractors for civil construction and erection of equipment.
- Formulation of an effective project team led by an experienced Project Manager.
- Establishment of an efficient system for project planning & monitoring including reporting procedures for progress review & co-ordination.
- Customization of project execution plan to suit the promoter's profile.

The benefits of recognizing and addressing the above-mentioned key factors have been successfully demonstrated in most cement projects executed in the recent past/ currently under implementation.

Learning from the implementation strategies adopted in successful projects have been developed with the profile of the respective promoters in order to evolve the most appropriate implementation strategy for the proposed project. The salient features of the proposed strategy are summarized below:

6.2 IMPLEMENTATION STRATEGY

Typically, any project has four core dimensions, viz.:

- Engineering: this directly impacts the smooth operations of the plant over its entire life.
- Procurement: is critical on account of the impact that it has on investment and performance benchmarks and also in ensuring the choice of appropriate technology.
- Construction: is critical in terms of its impact on completion quality and the duration of the project phase.
- Project Management: other than its obvious impact on project timeliness it also contributes to risk minimization for the promoter.

"Zero date" for a project is generally reckoned as the date on which the contract for "main plant and machinery" becomes effective.

The plant & machinery for a project can be procured in four modes:

- Turnkey
- Semi-turnkey
- Package
- Shopping

The four procurement modes are broadly described below:

Turnkey — In the Turnkey mode, one single contractor is responsible for all project activities concluding with the handing over of the plant to the owner. The role of the owner is limited to appointing the turnkey contractor and making payments (for details refer **Annexure 6.1**).

Semi Turnkey — A variant of turnkey is the Semi-turnkey mode. In this case there are usually two agencies, one the supplier and the other the contractor. The supplier is responsible for all activities that occur offshore, i.e., outside the country/ project site. The contractor is responsible for all activities that occur on shore i.e., within the country/ project site (for details refer **Annexure 6.2**)

Package — In this case the plant is split up into functional process departments and procured accordingly. Several main suppliers are responsible for the detailed engineering, manufacture, and supply. Similarly, multiple contractors are appointed for carrying out on shore activities (for details refer **Annexure 6.3**)

Shopping — In this case the client/ consultant formulates the basic design for the project and specify & procure equipment by discipline/ type (for details refer **Annexure 6.4**).

The salient pros and cons of these modes are described in **Annexure 6.5** and summarized in **Table 6.1** below:

Sn	Characteristics	PROCUREMENT MODES		
		Turnkey/ Semi-turnkey	Package	Shopping
1	Efforts on Co-ordination	Low	Medium	High
2	Execution Period	Low	Medium	High
3	Project Cost	High	Medium	Low
4	Project Cost Control	High	Medium	Low

Sn	Characteristics	PROCUREMENT MODES		
5	Supplier Responsibility	High	Medium	Low

Table 6.1 Characteristics of modes of procurement

For this proposed project, the **Package mode of procurement** for project execution is envisaged with an assumption that an in-house project team shall be constituted which shall function with due assistance from a professional Project Management agency having relevant cement industry background.

The proposed solution shall help **JCL** in optimizing project investment and minimizing risk on the front of able technical assistance.

6.3 PLANNING

It is proposed that pre-project activities be taken up till the orders for main plant and machinery are awarded. These activities include:

- Acquiring plant land (including all relevant clearances, if deemed required)
- Obtaining industry and other statuary clearances
- Development of Infrastructure at the site
- Site Studies viz. geotechnical, hydrological, etc.
- Organization of “enabling works”
- Appointment of “Consultant”

6.4 IMPLEMENTATION SCHEDULE

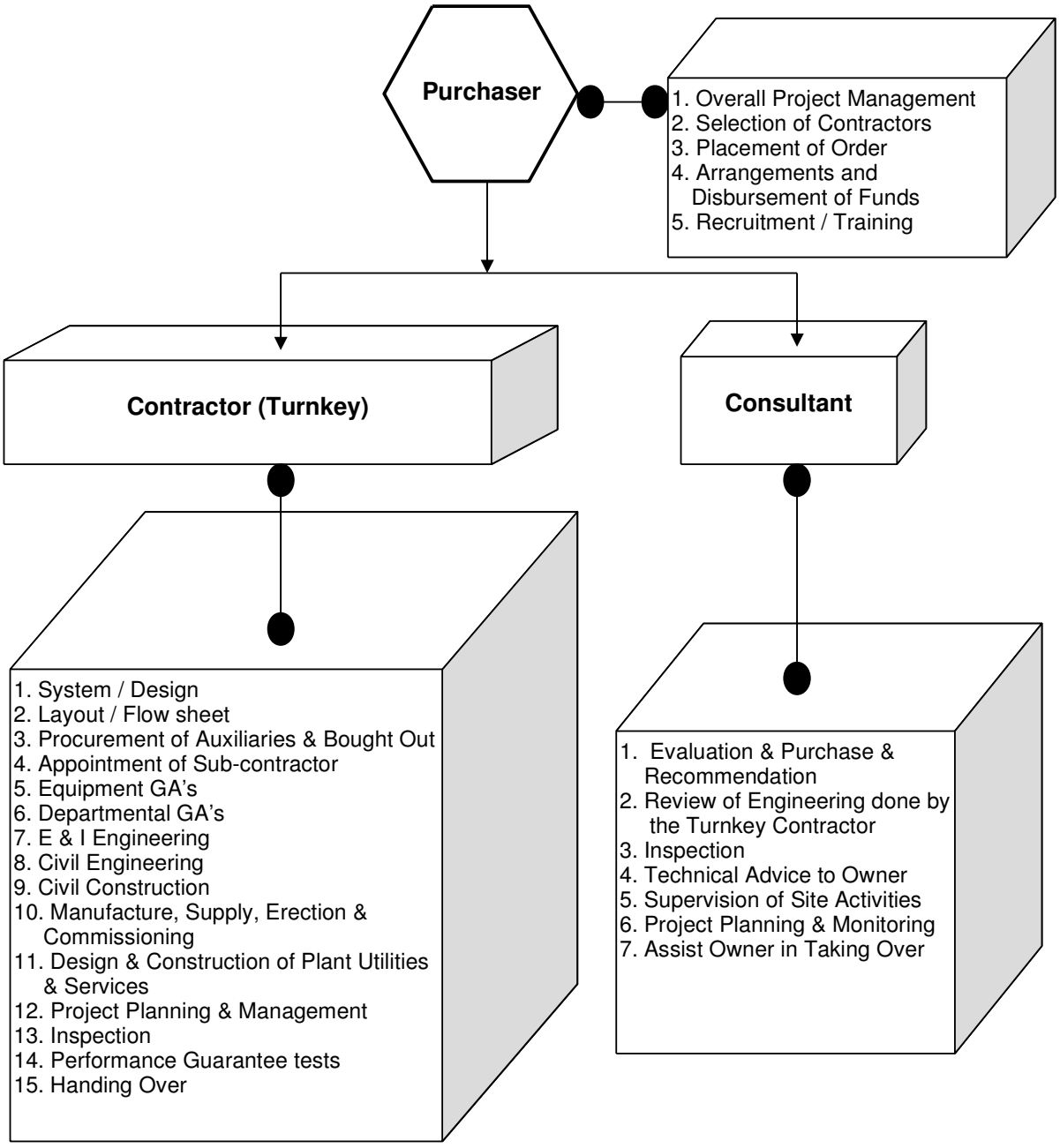
Going by the current cement industry scenario, the typical implementation schedule for similar sized clinker Grinding Units is between 15 to 24 months from the date of signing/ effectiveness of the main equipment supply contract.

For a player like **JCL**, implementation period of **18 calendar months** is envisaged for this project from the date of signing/ effectiveness of the main equipment supply contract. This is broadly in line with the present industry scenario with respect to the Equipment Suppliers’ perspective too who are willing to provide the Plant’s equipment if the main orders are placed well in time.

The broad implementation schedule for project activities after main machinery order placement is enclosed as **Annexure 6.6**

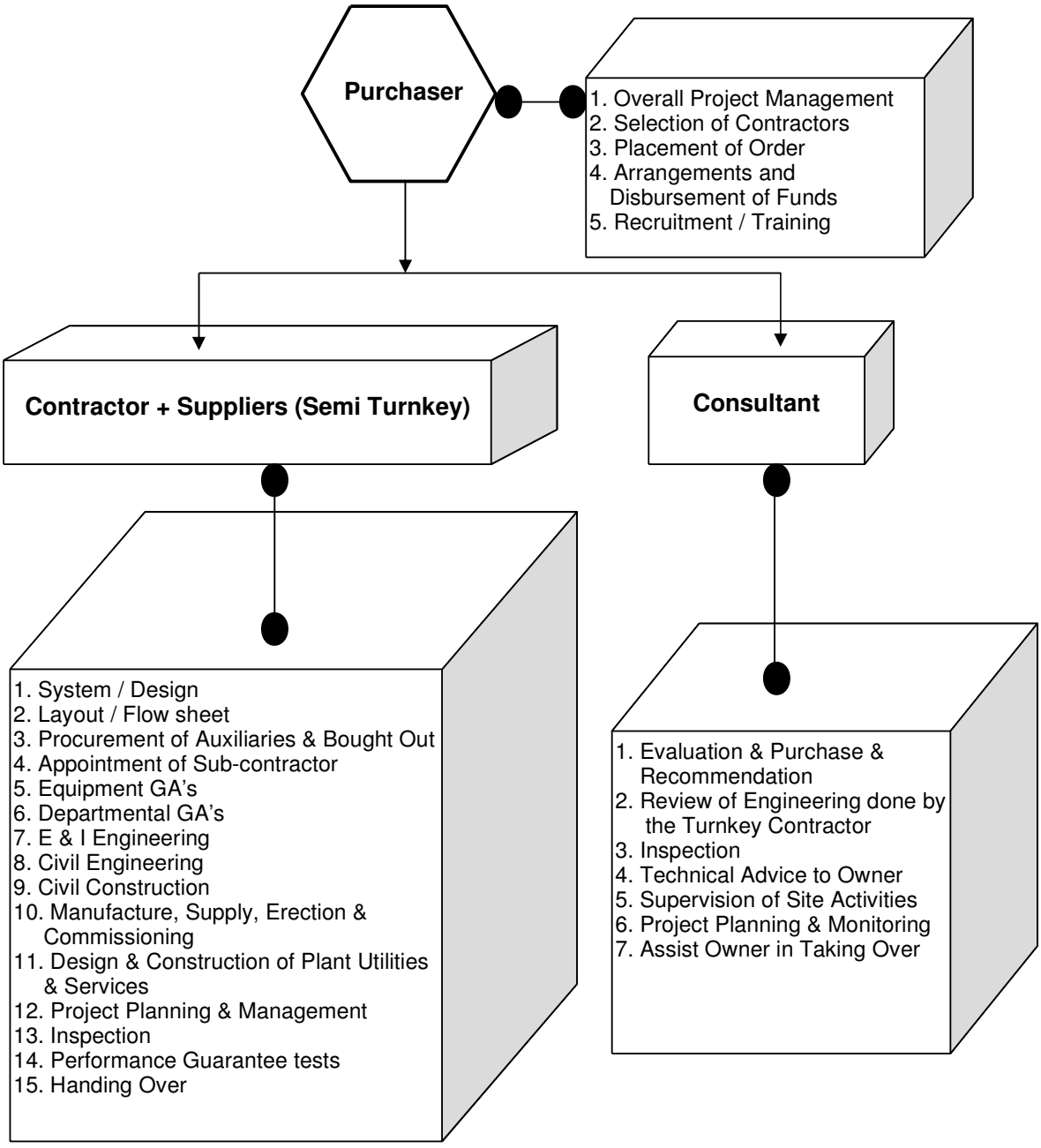
Annexure 6.1

PROJECT EXECUTION: TURNKEY



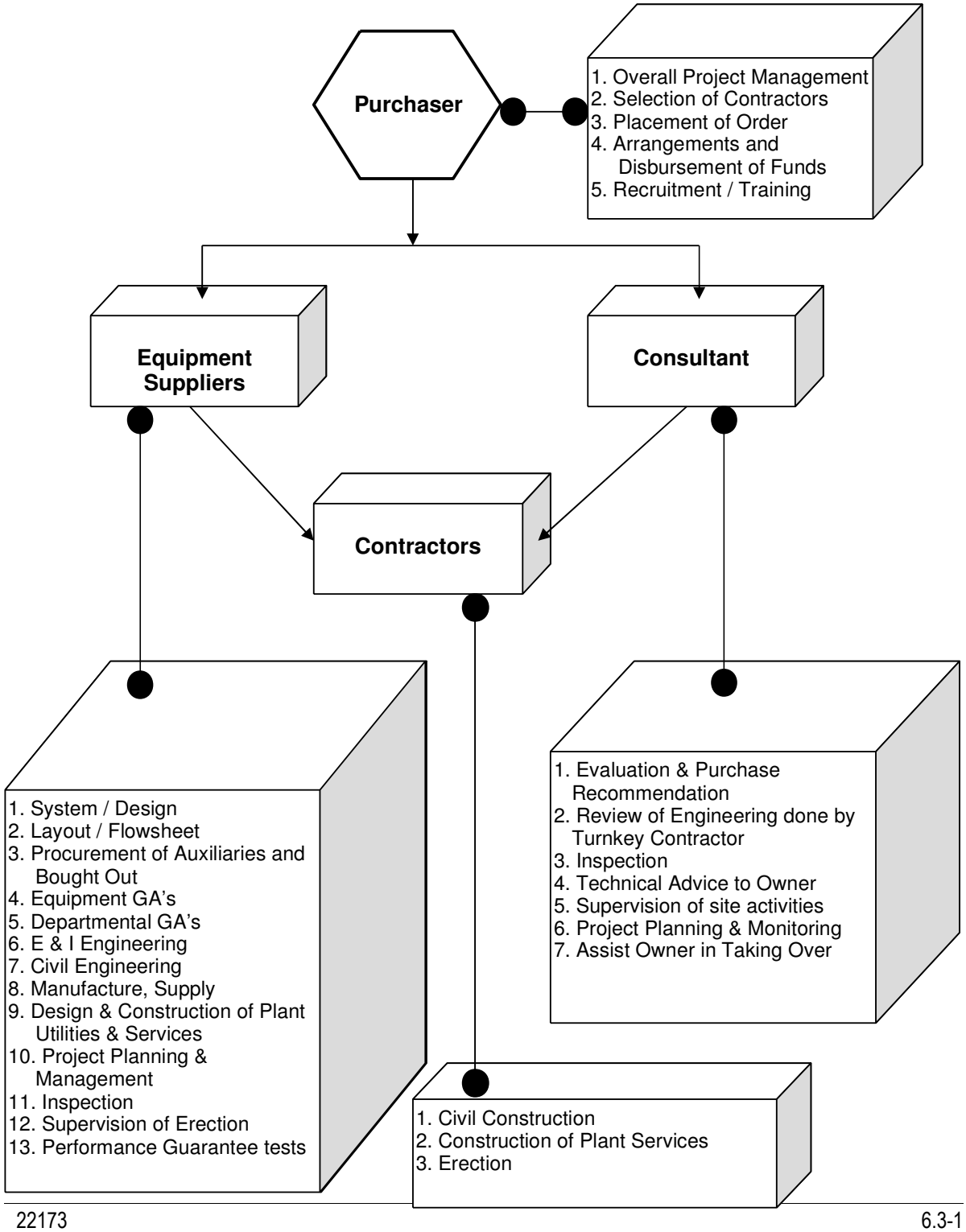
Annexure 6.2

PROJECT EXECUTION: SEMI – TURNKEY



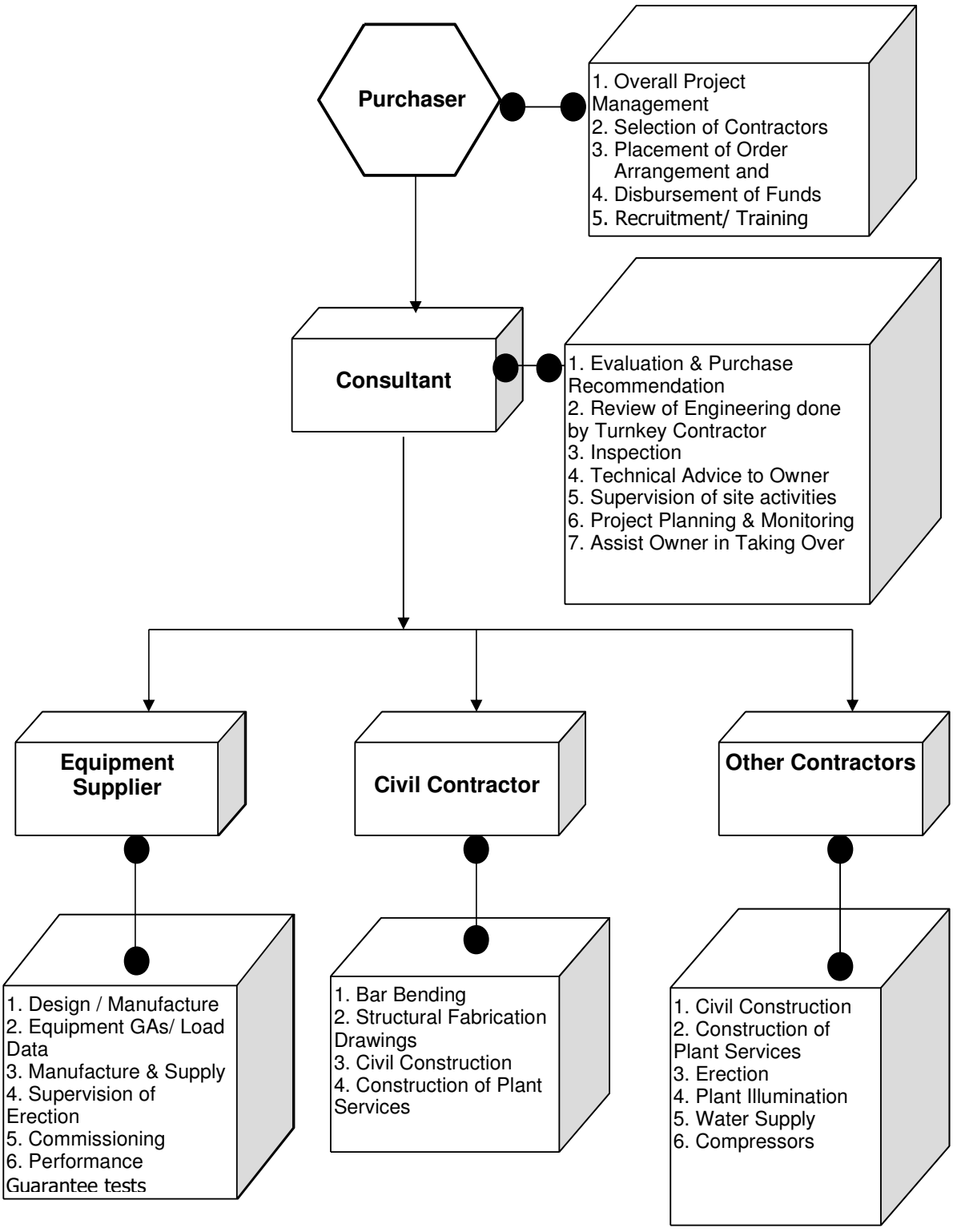
Annexure 6.3

PROJECT EXECUTION: PACKAGE



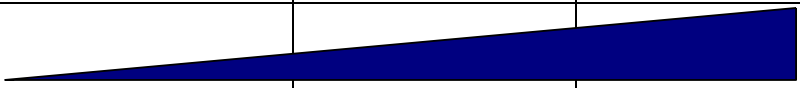
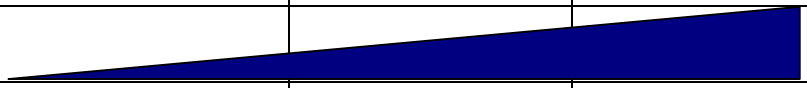
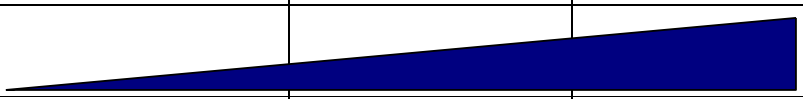
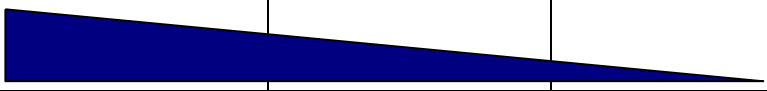
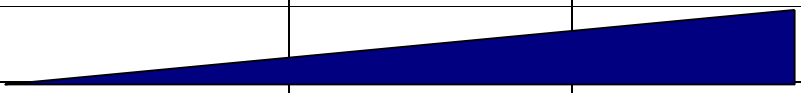
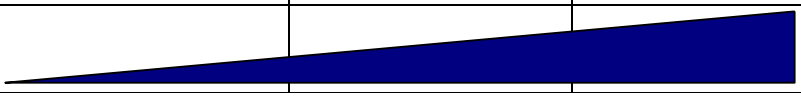
Annexure 6.4

PROJECT EXECUTION: SHOPPING



Annexure 6.5

COMPARATIVE: PROCUREMENT OPTIONS

Element	Turnkey / Semi Turnkey	Package	Shopping
Choice of Optimum Process Equipment	Limited depending upon Contractor	All main equipment, limited for auxiliaries	Free Choice
Total Investment Costs			
Total Duration			
Performance Guarantee	Entire Plant	By Department	By Department / single machine
Warranty	Undivided	By Package	By Individual machine or group
Execution Responsibility	Undivided	By Package	Consultant, contractor(s), client
Client's Risk			
Final Costs Known	At signing	After last package	During execution or final at commitment
Risk of Cost Overrun			
Risk of Time Overrun	Moderate	Medium	Medium
Overall Risk			
Ability to obtain Insurance			
Client's remedy against Performance Failure	Claims based on total contract value	Limitation by counter claims of each package supplier	Limitation by counter claims of each package supplier
Client's Involvement			
Need to change Organization			
Requirements for Project Management			
Overall			

Annexure 6.6A

INDICATIVE PROJECT SCHEDULE (PRE-PROJECT ACTIVITIES)

Sn	Project Activity	Months					
		1	2	3	4	5	6
	PROJECT ACTIVITIES AFTER TECHNO ECONOMIC FEASIBILITY						
1	Making financial arrangement for project						
	On site activities						
2	Statutary clearances from authorities such as environment, industry, etc.						
3	Finalisation of Plant Layout & Infrastructure plan						
4	Initial reconnaissance of the site						
5	Site investigations (Topographical, Geotechnical, Hydrological)						
6	Site development works (general grading & preparation)						
7	Enabling Works (Road & basic drainage network)						
	Off site activities						
8	Preparation of tender document						
9	Receipt of offer from bidder						
10	Offer evaluation and ordering						

Summary

Task

Annexure 6.6B

INDICATIVE PROJECT IMPLEMENTATION SCHEDULE
(PROJECT ACTIVITIES AFTER MAIN MACHINERY ORDER PLACEMENT)

Sn	Project Activity	Months																	
		M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18
1	**PROJECT ACTIVITIES AFTER MAIN MACHINERY ORDER**																		
2	Main plant and machinery order																		
3	Load data/ GA drawing from suppliers (main plant and machinery)																		
4	Procurement of auxiliary equipment																		
5	Load data/ GA drawing for auxiliary equipment																		
6	Departmental GA drawings																		
7	Civil design and construction drawings																		
8	Civil construction																		
9	Inspection/ delivery of main plant and machinery																		
10	Inspection/ delivery of auxiliary equipment																		
11	Mechanical erection																		
12	Electrical erection																		
13	Instrumentation erection																		
14	Trial runs and commissioning of plant																		

Summary

Task

Milestone

CHAPTER 7 | FINANCIAL APPRAISAL

7.1 INTRODUCTION

This chapter addresses the financial feasibility for the project, encompassing:

- Estimates of Investment Cost
- Estimates of Operational Cost
- Financial statements including Profit and Loss Statement, Projected Cash Flow Statement, etc.
- Financial viability based on the following indicators:
  - Internal Rate of Return on Investment
  - Break Even Point
  - Payback Period
  - Risk and Sensitivity Analysis

Jaykaycem (Central) Limited's proposed grinding unit at Prayagraj (Uttar Pradesh) is planned to have a rated cement production capacity of **2.0 mio tpa**.

7.2 INVESTMENT COSTS & MODE OF FINANCING

The total capital cost estimate for the proposed project is indicatively estimated to be around **Rs. 49,216 Lakhs (approx. Rs.492 Crores)**. The estimated Investment Cost for the project has been based on the requirement of fixed and non-fixed assets.

The summarized details of total investment are furnished in **Table 7.1** below, which also indicates the suggestive mode of financing. The allied breakup of costs under various heads, and the process of derivation of total estimated capex are furnished under **Annexure 7.1 through Annexure 7.5** of this chapter. The estimated workings towards project's financial analyses are furnished under **Annexures 7.6 to 7.14**, which have taken into cognizance the major guidelines stipulated under the U.P. State's Industrial Investment and Employment Promotion Policy 2017 (**IIEPP-2017**).

The financing of the project has been considered on the basis of Equity and Term Loans from Financial Institutions. The debt : equity ratio works out to around **1.66 : 1**.

Interest on Term Loan as well as Working Capital Loan has been considered at 7.25% pa.

Term Loan has been assumed to be repaid over 8 years including a moratorium of 1 year after the commissioning of the plant.

Contingency margin of 5% has been considered on the overall estimated capex for carrying out the financial analyses of the project.

Figures in Rs. Lakhs

Sn	Description	Estimated Cost (inclusive of GST components)
1	Land and Site Development	4,000
2	Civil Works, Buildings and Structures	11,632
3	Plant and Machinery	22,061
4	Expenses on technical know-how & training	450
5	Miscellaneous Fixed Assets	5,125
6	Pre-Operative Expenses (including Interest During Construction & Finance charges)	2,960
7	Contingency (@5%)	2,229
8	Margin Money for Working Capital	759
	Estimated Total Project Cost	**49,216**
Sources of Funds		
1	Debt	30,714
2	Equity	18,502
	Total	**49,216**

Table 7.1 | Estimated total investment & Project financing mode

7.3 OPERATING COSTS

The operational costs have been worked out considering the following assumptions:

7.3.1 Raw Materials & Consumables

The cost of raw materials is given in **Table 7.2**.

Raw materials	Unit	Amount
Clinker	Rs/ t	4,100
Dry Fly ash	Rs/ t	550
Gypsum	Rs/ t	5,500
Consumables	Rs/ t	40

Table 7.2 | Cost of input raw materials

JCL proposes to produce 100% PPC and the indicative proportioning ratios of the various raw materials are furnished in **Table 7.3** below:

Raw materials	Indicative % Proportions for PPC
Clinker	63%
Gypsum	5%
Dry Fly ash	32%

Table 7.3 | Proportioning ratios of raw materials

7.3.2 Utilities

- Specific power consumption has been estimated as 31.5 kWh/ t for PPC at around 3,800 blaine.
- The cost of electricity, sourced from grid, has been considered @ Rs.7.70 / kWh.
- The expense on water supply, treatment and distribution has been considered as Re.1.00/ t of cement.

7.3.3 Manpower

The total operations manpower cost has been estimated as Rs 1,580 Lakhs pa.

7.3.4 Other Costs

Packing expenses have been considered as Rs.220/ t of cement. Sales & Distribution expenses have been considered as Rs.250/ t of cement. Factory overhead and Administration expenses have been considered as Rs.50/ t and Rs.40/ t of cement, respectively.

7.3.5 Ex-factory Realisation

The average realizations per ton of cement (PPC), as estimated in the Market Chapter, are given in **Table 7.4**:

Figures in Rs per bag

Particulars	Amount
Price	378
GST	83
Margin	25
Freight	38
Average Net Realization (Rs. per bag), approx.	**233**
Average Net Realization (Rs. per t)	**4,656**

Table 7.4 | Ex-factory Realisation

7.3.6 Capacity Utilization

As highlighted in the Market Section (Chapter-2), **JCL** may be able to achieve 100% capacity utilization from year 4 onwards of start of commercial operations. However, for the purpose of financial analyses in this chapter, the plant's capacity utilization is considered (capped) as following:

Year	Volume (mio ton)	Capacity Utilization (approx.)
Year 1	0.4	20%
Year 2	1.2	60%
Year 3	1.4	70%
Year 4	1.6	80%
Year 5 Onwards	1.7	85%

Table 7.5 | Capacity Utilization considered for financial analyses

The plant is envisaged to start commercial operation on 1st August 2024.

7.3.7 Envisaged Commercial Operation Date

JCL envisages the commercial operation date as 1st October 2024. The implementation period of the project has been considered accordingly and is envisaged to be achievable.

7.4 RESULTS

Based on the investment and operational costs, financial workings have been projected for the first 15 years of operation.

Workings & Results of Financial Appraisal

The capex estimates and financial appraisal details are furnished under following annexures as part of this Chapter-7:

Annexures 7.1 – 7.5 detail the estimated Capital Expenditure (CAPEX) for the project

Annexures 7.6 – 7.14 detail the following:

- Annexure 7.6 : Unit cost of production
- Annexure 7.7 : Interest calculations and repayment schedule for Term Loan
- Annexure 7.8 : Working results & profitability computations
- Annexure 7.9 : Working Capital requirements
- Annexure 7.10 : Projected Funds Flows
- Annexure 7.11 : Projected Balance Sheets
- Annexure 7.12 : Internal Rate of Return on Total Investment
- Annexure 7.13 : Internal Rate of Return on Equity
- Annexure 7.14 : Break Even Point & Indicators of Performance (DSCR)

7.4.1 Incentives Assumed for Financial Considerations of this Project

The project envisages to utilize the incentives available under 'Industrial Investment and Employment Promotion Policy of Uttar Pradesh 2017 (IIEPP 2017).

For the purpose of project's financial appraisal at this planning stage, only the major contributor: 70% State GST (SGST) exemption, has been taken into account, which is permitted to go up to 300% of the proposed Fixed Capital Investment over a period of 10 years.

As per the policy, this benefit would be limited to an annual ceiling of:

- 20% of capital investment or actual tax deposited, whichever is lower

7.5 FINANCIAL ANALYSIS

The financial appraisal, considering the envisaged incentives, reveals the following performance indicators, as tabulated in **Table 7.6** below:

Indicator	Results
IRR on Total Investment	23.8%
IRR on Equity	33.2%
Net Present Value @ 10% (Rs. Lakhs)	63,724
Payback Period	4 years 6 months
Average Debt Service Coverage	2.84

Table 7.6 | Project's salient performance indicators

7.6 SENSITIVITY ANALYSIS

The sensitivity of project break-even to variations in certain key operating parameters has been tested in order to determine operating flexibility.

The parameters considered, and the break-even points thus arrived, are summarized under **Table 7.7** below:

Case	Description	Project			DSCR	BEP	
		IRR Inv	IRR Equity	NPV	Avg.	Proj.	Cash
	Base Case	23.8%	33.2%	63,724	2.84	68%	51%
I	5% Increase in Project Cost	22.8%	31.6%	61,794	2.73	70%	52%
II	5% Increase in Variable Cost	22.5%	30.7%	56,432	2.69	74%	55%
III	5% Increase in Fixed Cost	23.3%	32.2%	61,164	2.79	71%	53%
IV	5% Decrease in Sales Price	20.7%	27.6%	47,316	2.49	82%	61%
V	1% Increase in Interest Rate	23.8%	32.3%	63,843	2.73	71%	54%

Table 7.7 | Sensitivity Analysis

7.7 CONCLUSION

The project exhibits an **Internal Rate of Return on Total Investment of 23.8%**. and Average Debt Service Coverage Ratio **(DSCR) of 2.84**, having considered the SGST related incentive offered under the guidelines of U.P. State government's IIEPP 2017, as mentioned in the earlier section of this chapter.

In view of the acceptable level of returns, the project is **financially viable**.

Annexure 7.1

SUMMARY OF INVESTMENT COST ESTIMATES
2.0 mio tpa Prayagraj Grinding Unit
(In Lakhs INR Unless Specified Otherwise)

Sn	Description	Estimated Cost (inclusive of GST components)
1	Land and Site Development	4,000
2	Civil Works, Buildings and Structures	11,632
3	Plant and Machinery	22,061
4	Expenses on technical know-how & training	450
5	Miscellaneous Fixed Assets (including Equipment for Distribution of Power)	5,125
6	Pre-Operative Expenses (including Interest During Construction & Finance charges)	2,960
7	Contingency	2,229
8	Margin Money for Working Capital	759
	Estimated Total Project Cost	**49,216**

Annexure 7.2

INVESTMENT COST ESTIMATES
2.0 mio tpa Prayagraj Grinding Unit
(In Lakhs INR Unless Specified Otherwise)

Sn	Description	Total Cost	Remarks
1.0	**Land and Site Development**		
1.1	Capital Cost of procured land for setting up the plant	2,100	Total cost estimated by JCL for about 23 ha of land patch
1.2	Site preparation & development	200	Refer Annexure 7.3
1.3	Site enabling investigations (Topographical, Geotechnical & Hydrological)	80	Lumpsum
1.4	Boundary Wall	160	Refer Annexure 7.3
1.5	Gates, Security Pickets, etc.	30	Lumpsum
1.6	Approach Road to Plant	250	Refer Annexure 7.3
1.7	Plant Internal Roads	555	Refer Annexure 7.3
1.8	Truck Parking & Logistics Office	425	Refer Annexure 7.3
1.9	Plant Drainage	175	Refer Annexure 7.3
1.10	Landscaping and Provision of Green Belt	25	Refer Annexure 7.3
	Sub-total (1.0)	**4,000**	
2.0	**Buildings and other civil structures**		
2.1	Main Factory Buildings	2,335	Refer Annexure 7.3
2.2	Silos, Hoppers, Storages, Covered Gantry, etc.	4,465	Refer Annexure 7.3
2.3	Auxiliary Services	2,000	Refer Annexure 7.3
2.4	Office/ Non-factory buildings	310	Refer Annexure 7.3
2.5	Residential colony & social amenities	0	Refer Annexure 7.3
2.6	Equip. Foundations' (Machine Fnds.) civil cost component	477	Refer Annexure 7.3
2.7	Deep foundations cost provisioning on account of possibility of weaker soil bearing capacity (Soil investigations yet to take place)	0	Refer Annexure 7.3
2.8	Indicative GST componment on civil works	2,045	Refer Annexure 7.3
	Sub-total (2.0)	**11,632**	
3.0	**Plant & Machinery related**		
3.1	Total Cost of Mechanical and Electrical Equipment (Net of GST)	18,941	Refer Annexure 7.4
3.2	GST component on Plant & Machinery (approx. provisioning)	3,120	Refer Annexure 7.4
	Sub-total (3.0)	**22,061**	
4.0	**Expenses on technical know-how & training**		
4.1	Engineering & know-how (various consultants & agencies)	400	Lumpsum provision
4.2	Training & skill upgradation related expenses (technicians & others)	50	Lumpsum provision
	Sub-total (4.0)	**450**	
5.0	**Miscellaneous Fixed Assets (MFA)**		
5.1	Equipment for Distribution of Power (Net of GST)	3,895	Refer Annexure 7.5
5.2	GST component on Power distribution (approx. provisioning)	640	Refer Annexure 7.5
5.3	Office furniture, machinery & equipment	70	Estimated provisioning
5.4	Office gadgetary (computers, printers, LAN peripherals, etc.)	30	- do -
5.5	Generic tools & tackles	50	- do -
5.6	Light motor vehicles for office use	60	- do -
5.7	Laboratory equipment & setup	85	Essential provisioning
5.8	Fire-fighting equipment & hydrant system	40	
5.9	Water treatment system	50	
5.10	Multi-utility equipment (front-end loader, fork lifts, truck-mounted lifting crane)	130	
5.11	Weighbridges	75	
5.12	Railway track/ siding	-	Not envisioned at this stage
	Sub-total (5.0)	**5,125**	
6.0	**Pre-Operative Expenses (including IDC)**		
6.1	Establishment	100	Lumpsum provisioning
6.2	Rent and taxes	50	- do -
6.3	Traveling expenses	50	- do -
6.4	Miscellaneous expenses (post/mail/legal, initial studies, etc.)	200	- do -
6.5	Start-up expenses	75	- do -
6.6	Salaries during implementation period	700	Refer Chapter-5
6.7	Interest charges during construction period	1,645	
6.8	Insurance during construction/ Bank appraisal charges	40	Lumpsum provisioning
6.9	Finance & allied loan processing charges	100	Lumpsum provisioning
	Sub-total (6.0)	**2,960**	
7.0	Contingency	2,229	Estimated provisioning
8.0	Margin Money for Working Capital	759	Estimated provisioning
	Estimated Total Project Cost (1.0+2.0+3.0+4.0+5.0+6.0+7.0+8.0)	**49,216**	

Annexure 7.3

COST OF CIVIL STRUCTURES AND FOUNDATIONS
2.0 mio tpa Prayagraj Grinding Unit
(In Lakhs INR Unless Specified Otherwise)

Sn	Description	Building Cost	Equip. Fnd. Cost (Machine Fnds.)
1.0	**Main Factory Building**		
1.1	HAG supporting structure	260	41
1.2	Cement mill house & dedusting building	1,390	240
1.3	Packing plant, truck loading, bags godown	685	10
	SUB TOTAL (1.0)	**2,335**	**291**
2.0	**Silos, Hoppers, Storages, Covered Gantry, etc.**		
2.1	Additives (Gypsum, Pond ash) covered storage	575	-
2.2	Clinker silo & transport supporting infrastructure	1,890	26
2.3	Support structure for cement mill hoppers (hoppers excluded)	305	10
2.4	Dry Flyash silo	665	10
2.5	Cement silos (2nos. RCC silos)	1,030	10
	SUB TOTAL (2.0)	**4,465**	**56**
3.0	**Auxiliary Services**		
3.1	Switchyard & Main receiving substation	125	37
3.2	CCR, Technical office, Laboratory, etc.	385	-
3.3	MCC rooms & Load centres	270	15
3.4	M&E Workshop (Not envisaged at this stage)	Future	-
3.5	Liquid fuel storage tanks, dyke wall and pump foundations	210	8
3.6	Compressor house (under Packing plant itself)	-	-
3.7	Plant belt conveyor galleries & transfer towers	570	-
3.8	Water storage (UG+OH) & Water treatment plant	100	10
3.9	Weigh bridges & weigh rooms	5	20
3.10	BRU & truck tippler foundations with common ramp for receiving clinker & gypsum	180	40
3.11	Overhead cable galleries	135	0
3.12	Cable tunnels & trenches, etc.	20	0
	SUB TOTAL (3.0)	**2,000**	**130**
4.0	**Office/ Non factory Buildings, etc**		
4.1	Offices (Project, Logistics, Administation, Services)	100	-
4.2	Time, security & dispatch offices block	20	-
4.3	Executives' & workers' canteens	85	-
4.4	General store & yard (Basic povisioning only)	90	-
4.5	Shift units/ washrooms (in general/common areas)	15	-
	SUB TOTAL (4.0)	**310**	**0**
5.0	**Land & Site Development**		
5.1	Site preparation, leveling & grading (presumptive nominal lumpsum provision only)	200	-
5.2	Boundary Wall (approx. 2,000m long; RCC framing with masonry & barbed wire top)	160	-
5.3	Approach Road to Plant (WBM+Concrete; Approx.300m long & 20.5m wide)	250	-
5.4	Plant Internal Roads (WBM & Bituminous+RCC; approx 15,000sqm paved area)	555	-
5.5	Truck parking area (WBM & Bituminous+RCC; (approx. 12,000sqm) & Logistics office	425	-
5.6	Plant drainage network (approx. 2,200m long with varying invert sections)	175	-
5.7	Landscaping & provision of green belt (lumpsum provision)	25	-
	SUB TOTAL (5.0)	**1,790**	**0**
6.0	**Residential Colony & Social Amenities**		
6.1	Not envisaged at this stage	-	-
	SUB TOTAL (6.0)	**0**	**0**
7.0	**Total (1.0+2.0+3.0+4.0+5.0+6.0)**	**10,900**	**477**
8.0	Deep foundations cost-provisioning (Geotechnical investigations not carried out yet, but not envisaged at this stage)	0	0
9.0	Indicative GST component on Civil works (average approx.18% of total civil cost considered for TEFR formulation purpose)	1,960	85
10.0	**Total Civil Works Cost (7.0+8.0+9.0)**	**12,860**	**562**
		13,422	

Annexure 7.4

COST OF MECHANICAL AND ELECTRICAL EQUIPMENT
2.0 mio tpa Prayagraj Grinding Unit
(In Lakhs INR Unless Specified Otherwise)

Sn.	Description	F.O.B.	F.O.R.
1.0	**Mechanical Equipment**		
1.1	Gypsum & Pond ash - handling, storage & transport to mill feed hoppers	-	75
1.2	Gypsum crushing & Pond ash drying - (Not envisaged at this stage)	-	-
1.3	Dry Flyash - pneumatic transport, storage, handling & feeding to mill	-	250
1.4	HAG system; including Liquid fuel (LDO) handling, storage & firing	-	170
1.5	Clinker transport, handling, storage, extraction & feeding system	-	275
1.6	Clinker grinding circuit & feeding to cement silos	2,600	3,900
1.7	Cement mill feeding hoppers' equipment (weigh feeders, level pilots, etc.)	-	60
1.8	Cement mill dedusting system	-	700
1.9	Cement extraction from silos, transport upto feed bin for packers	-	385
1.10	Packing, loading & dispatch (2 packers, 6 truck loaders, 2 bulk loaders)		990
	Sub-total of Main Machinery (1.0)	**2,600**	**6,805**
2.0	**Mechanical Auxiliary Equipment**		
2.1	Structural Steel for sheds, hoppers, conveyors, ducts, chutes, etc. (approx. 2,250 t @Rs.65,000/ t)	-	1,465
2.2	Material receiving system (Bulk receiving units with truck tippler facility, 3 nos.)	-	330
2.3	Material conveying system (approx.800m @Rs.40,000/ m)	-	320
2.4	Insulation (approx.12,000sqm @Rs.1200/ sqm)	-	145
2.5	Refractories for HAG & wear lining of mill exhaust duct (approx 240 t@Rs 31,500 per t)	-	76
2.6	Auxillary bag filters (approx. 15nos.)	-	115
2.7	Lubricants	-	40
2.8	Passenger lift (for CCR)	-	25
2.9	Roots blowers	-	50
2.10	Compressors & dryers	-	85
2.11	Misc. items like water pump & pipeline, compressed air piping, etc.	-	75
2.12	Cranes/Hoists and other miscellaneous items, etc.	-	150
	Sub-total of Mechanical Auxiliary Equipment (2.0)	**0**	**2,876**
	Total of Mechanical Equipment (1.0 + 2.0)	**2,600**	**9,681**
3.0	**Electrical and Instrumentation**		
3.1	HT motors	-	435
3.2	LV & MV AC variable Speed Drives	-	380
3.3	LT motors	-	175
3.4	Table-top XRF	-	100
3.5	Control & Automation	-	1,000
	Total Electrical and Instrumentation (3.0)	**0**	**2,090**
	Total Mechanical and Electrical equipment (1.0+2.0+3.0)	**2,600**	**11,771**
4.0	**Landed cost of equipment**		
4.1	**Imported Equipment**		
4.1.1	F.O.B. Cost		2,600
4.1.2	Provisioning for Ocean Freight, Insurance, etc. (approx.@6% of 4.1.1)		155
4.1.3	Basic Import Duty provision (approx. @7.5% of 4.1.1 & 4.1.2)		205
4.1.4	GST (all taxes assumed to be clubbed under GST, approx.@18% of 4.1.1 to 4.1.3)		535
4.1.5	Clearing/ Loading/ Inland Freight, etc. (approx.@5% of 4.1.1 + 4.1.2)		140
	Sub-total of Imported Equipment (4.1)		**3,635**
4.2	**Indigenous Equipment**		
4.2.1	F.O.R. cost		11,771
4.2.2	GST provisioning on F.O.R. cost (@18% of 4.2.1)		2,120
4.2.3	Provisioning for freight, handling, insurance, etc. (approx.@5% of 4.2.1)		590
	Sub-total of Indigenous Equipment (4.2)		**14,481**
	Total Landed Cost of Equipment (4.1 + 4.2)		**18,116**
5.0	Provisioning for Spares (approx. @5% of F.O.B. & F.O.R. landed cost)		905
6.0	Fabrication of Str. Steel as in 2.1 above (2,250 t @Rs.25,000/ t)		565
7.0	Erection, Comissioning & Supervision Charges (approx.@14% of F.O.R. + F.O.B.)		2,010
8.0	GST on Fabrication, erection & supervision charges (approx.@18% on (6.0+7.0))		465
	Total cost of Mechanical and Electrical equipment		**22,061**
A	**Total landed cost of equipment**		**22,061**
B	**Total landed cost of equipment (Net of GST)**		**18,941**
C	**GST component on Plant & Machinery (approx. provisioning)**		**3,120**

Annexure 7.5

COST OF POWER DISTRIBUTION EQUIPMENT
2.0 mio tpa Prayagraj Grinding Unit
(In Lakhs INR Unless Specified Otherwise)

Sn.	Description	F.O.B.	F.O.R.
1.0	**Power distribution equipment**		
1.1	Transmission line from Grid substation (33kV, approx.5 km)	-	275
1.2	Power transformer 33/6.6 kV and other switchyard equipment (Isolator, CT, PT, etc.)	-	230
1.3	6.6 kV switchboard	-	230
1.4	6.6 /0.433 kV Distribution transformer	-	180
1.5	LT switchboard & trunking	-	230
1.6	MCC & push button Station	-	425
1.7	LV capacitors & control panel	-	175
1.8	Lighting transformer & main lighting distribution board	-	75
1.9	Cables (Power, Control & Instrumentation)	-	630
1.10	Construction power cables	-	50
1.11	Earthing, lighting protection & erection hardware		250
1.12	Plant illumination (Lighting fixures, accessories, etc.)	-	40
1.13	UPS, battery & battery charger	-	45
1.14	Ventilation system for electrical buildings	-	35
1.15	Air conditioning	-	55
1.16	PA system for intercom	-	10
1.17	Fire detection & protection systems	-	30
1.18	DG set for construction & emergency power supply	-	125
1.19	Miscellaneous electricals	-	70
	Sub total (1.0)	**0**	**3,160**
2.0	**Landed cost of equipment**		
2.1	**Imported Equipment**		
2.1.1	F.O.B. Cost		0
2.1.2	Ocean Freight, Insurance, etc. (approx.@6% of 2.1.1)		0
2.1.3	Basic Import Duty (@7.5% of 2.1.1 & 2.1.2)		0
2.1.4	GST (all taxes assumed to be clubbed under GST, approx.@18% of 2.1.1 to 2.1.3)		0
2.1.5	Clearing/ Loading/ Inland Freight, etc. (approx.@5% of 2.1.1 + 2.1.2)		0
	Sub-total of Imported Equipment (2.1)		**0**
2.2	**Indigenous Equipment**		
2.2.1	F.O.R. cost		3,160
2.2.2	GST provisioning on F.O.R. cost (@18% of 2.2.1)		570
2.2.3	Provisioning for freight, handling, insurance, etc. (approx.@5% of 2.2.1)		160
	Sub total (2.0)		**3,890**
	Total Landed Cost of Equipment (2.1 + 2.2)		**3,890**
3.0	Provisioning for Spares (approx. @5% of total landed cost)		195
4.0	Erection, Comissioning & Supervision Charges (approx.@12 % of 2.1.1 + 2.2.1)		380
5.0	GST provisioning on erection & supervision charges (approx.@18% of 4.0)		70
A	**Total landed cost of Power Distribution Equipment (2.0+3.0+4.0+5.0)**		**4,535**
B	**Total landed cost of Power Distribution Equipment (Net of GST)**		**3,895**
C	**GST component on Power distribution (approx. provisioning)**		**640**

Annexure 7.6

UNIT CASH COST OF PRODUCTION

Unit Cash Cost of Production in Year no.: **5**

DESCRIPTION		UNIT	Rs/UNIT	Qty/ Unit (PPC)	Cost (Rs/ t) (PPC)
Raw Materials & Consumables					
a)	Clinker	Rs/ t	4,100	63%	2,583
b)	Gypsum	Rs/ t	5,500	5%	275
c)	Dry Fly ash	Rs/ t	550	32%	176
d)	Consumables	Rs/ t	40	1.0	40
	Total				**3,074**
Utilities					
a)	Power	Rs/ kWh	7.70	31.5	243
b)	Water	Rs/ t	1.00	1.0	1
					244
Wages & Salaries					
a)	Wages	Rs/ t			93
					93
Factory Overheads					
a)	Overheads	Rs/ t			59
					59
Administrative Expenses					
a)	Admin expenses	Rs/ t			47
					47
Selling & Distribution Expenses					
a)	SGA expenses	Rs/ t			250
					250
Packing Expenses					
a)	Packing expenses	Rs/ t			220
		Rs/ t			**3,986**

Annexure 7.7

REPAYMENT AND INTEREST SCHEDULE FOR LOANS

(in Rs Lakhs unless specified otherwise)

Loan Repayment & Interest Schedule

Term Loan 1	YR 1	YR 2	YR 3	YR 4	YR 5	YR 6	YR 7	YR 8	YR 9	YR 10	YR 11	YR 12	YR 13	YR 14	YR 15
	1-Oct-24	1-Jan-25	1-Apr-25	1-Jul-25	1-Oct-25	1-Jan-26	1-Apr-26	1-Jul-26	1-Oct-26	1-Jan-27	1-Apr-27	1-Jul-27	1-Oct-27	1-Jan-28	1-Apr-28
	31-Dec-24	31-Mar-25	#######	#######	#######	#######	30-Jun-26	30-Sep-26	#######	#######	#######	#######	#######	#######	#######
	31-Mar-25	31-Mar-25	#######	#######	#######	#######	31-Mar-27	31-Mar-27	#######	#######	#######	#######	#######	#######	#######
	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Interest Rate	7.25%														
Loan (Outstanding)	30714	30714	30714	30714	30714	29754	28794	27834	26874	25915	24955	23995	23035	22075	21116
Interest	557	557	557	557	548	531	513	496	478	461	444	426	409	391	374
Moratorium	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No
Repayment	0	0	0	0	959.798	959.798	959.7978	959.7978	959.798	959.798	959.798	959.798	959.798	959.798	959.798
Closing Balance	30714	30714	30714	30714	29754	28794	27834	26874	25915	24955	23995	23035	22075	21116	20156
									960						
	31-Mar-25	31-Mar-26	#######	#######	#######	#######	31-Mar-31	31-Mar-32	#######	#######	#######	#######	#######	#######	#######
	0.0	1919.6	3839.2	3839.2	3839.2	3839.2	3839.2	3839.2	3839.2	1919.6	0.0	0.0	0.0	0.0	0.0
	1113.4	2191.9	1948.4	1670.0	1391.7	1113.4	835.0	556.7	278.3	34.8	0.0	0.0	0.0	0.0	0.0
	31-Mar-25	31-Mar-26	#######	#######	#######	#######	31-Mar-31	31-Mar-32	#######	#######	#######	#######	#######	#######	#######

Term Loan 1	**YR 1**	**YR 2**	**YR 3**	**YR 4**	**YR 5**	**YR 6**	**YR 7**	**YR 8**	**YR 9**	**YR 10**	**YR 11**	**YR 12**	**YR 13**	**YR 14**	**YR 15**
Interest Rate	7.25%														
Loan (Outstanding)	30,714	30,714	28,794	24,955	21,116	17,276	13,437	9,598	5,759	1,920	0	0	0	0	0
Interest	1,113	2,192	1,948	1,670	1,392	1,113	835	557	278	35	0	0	0	0	0
Moratorium	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Repayment	0	1,920	3,839	3,839	3,839	3,839	3,839	3,839	3,839	1,920	0	0	0	0	0
Closing Balance	30,714	28,794	24,955	21,116	17,276	13,437	9,598	5,759	1,920	0	0	0	0	0	

Working Capital	**YR 1**	**YR 2**	**YR 3**	**YR 4**	**YR 5**	**YR 6**	**YR 7**	**YR 8**	**YR 9**	**YR 10**	**YR 11**	**YR 12**	**YR 13**	**YR 14**	**YR 15**
Interest Rate	7.25%														
Loan (Outstanding)	2,277	2,278	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279
Interest	165	165	165	165	165	165	165	165	165	165	165	165	165	165	165
Moratorium	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Repayment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Closing Balance	2,277	2,278	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279

Annexure 7.8

ESTIMATES OF WORKING RESULTS AND PROFITABILITY

(in Rs Lakhs unless specified otherwise)

OPERATING YEARS	YR 1	YR 2	YR 3	YR 4	YR 5	YR 6	YR 7	YR 8	YR 9	YR 10	YR 11	YR 12	YR 13	YR 14	YR 15	YR 16
Total Sales Qty																
PPC	2.00	12.00	14.00	16.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00
Total Cement Sale	**2.00**	**12.00**	**14.00**	**16.00**	**17.00**	**17.00**	**17.00**	**17.00**	**17.00**	**17.00**	**17.00**	**17.00**	**17.00**	**17.00**	**17.00**	**17.00**
Revenue																
PPC	15,120	90,719	1,05,839	1,20,959	1,28,519	1,28,519	1,28,519	1,28,519	1,28,519	1,28,519	1,28,519	1,28,519	1,28,519	1,28,519	1,28,519	1,28,519
Gross Sales	**15,120**	**90,719**	**1,05,839**	**1,20,959**	**1,28,519**	**1,28,519**	**1,28,519**	**1,28,519**	**1,28,519**	**1,28,519**	**1,28,519**	**1,28,519**	**1,28,519**	**1,28,519**	**1,28,519**	**1,28,519**
GST on Cement																
PPC	3,307	19,845	23,152	26,460	28,114	28,114	28,114	28,114	28,114	28,114	28,114	28,114	28,114	28,114	28,114	28,114
Total GST	**3,307**	**19,845**	**23,152**	**26,460**	**28,114**	**28,114**	**28,114**	**28,114**	**28,114**	**28,114**	**28,114**	**28,114**	**28,114**	**28,114**	**28,114**	**28,114**
Net Sales	**11,812**	**70,875**	**82,687**	**94,499**	**1,00,406**	**1,00,406**	**1,00,406**	**1,00,406**	**1,00,406**	**1,00,406**	**1,00,406**	**1,00,406**	**1,00,406**	**1,00,406**	**1,00,406**	**1,00,406**
Expenditure																
Raw Materials & Consumables																
Gypsum	550	3,300	3,850	4,400	4,675	4,675	4,675	4,675	4,675	4,675	4,675	4,675	4,675	4,675	4,675	4,675
Dry Fly ash	352	2,112	2,464	2,816	2,992	2,992	2,992	2,992	2,992	2,992	2,992	2,992	2,992	2,992	2,992	2,992
Clinker	5,166	30,996	36,162	41,328	43,911	43,911	43,911	43,911	43,911	43,911	43,911	43,911	43,911	43,911	43,911	43,911
Consumables	80	480	560	640	680	680	680	680	680	680	680	680	680	680	680	680
Utilities																
Power	485	2,911	3,396	3,881	4,123	4,123	4,123	4,123	4,123	4,123	4,123	4,123	4,123	4,123	4,123	4,123
Water	2	12	14	16	17	17	17	17	17	17	17	17	17	17	17	17
Salaries & Wages																
Wages	790	1,580	1,580	1,580	1,580	1,580	1,580	1,580	1,580	1,580	1,580	1,580	1,580	1,580	1,580	1,580
Factory Overheads																
Overheads	500	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Cost Of Production	**7,925**	**42,391**	**49,026**	**55,661**	**58,978**	**58,978**	**58,978**	**58,978**	**58,978**	**58,978**	**58,978**	**58,978**	**58,978**	**58,978**	**58,978**	**58,978**
Administrative Expenses																
Admin expenses	400	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
Selling Expenses																
SGA expenses	500	3,000	3,500	4,000	4,250	4,250	4,250	4,250	4,250	4,250	4,250	4,250	4,250	4,250	4,250	4,250
Packing expenses	440	2,640	3,080	3,520	3,740	3,740	3,740	3,740	3,740	3,740	3,740	3,740	3,740	3,740	3,740	3,740
Freight	1,500	9,001	10,502	12,002	12,752	12,752	12,752	12,752	12,752	12,752	12,752	12,752	12,752	12,752	12,752	12,752
Channel Margin	1,000	6,000	7,000	8,000	8,500	8,500	8,500	8,500	8,500	8,500	8,500	8,500	8,500	8,500	8,500	8,500
GST Incentive	-	-	1,158	6,946	8,103	8,644	8,644	8,644	8,644	8,644	8,644	8,644	-	-	-	-
EBDITA	**47**	**7,043**	**9,937**	**17,462**	**19,489**	**20,029**	**20,029**	**20,029**	**20,029**	**20,029**	**20,029**	**20,029**	**11,385**	**11,385**	**11,385**	**11,385**
Depriciation	997	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,145
EBIT	**(950)**	**5,169**	**8,063**	**15,588**	**17,615**	**18,155**	**18,155**	**18,155**	**18,155**	**18,155**	**18,155**	**18,155**	**9,511**	**9,511**	**9,511**	**10,240**
Financial Expenses																
Interest on TL 1	1,113	2,192	1,948	1,670	1,392	1,113	835	557	278	35	(0)	(0)	(0)	(0)	(0)	-
Interest on WC	165	165	165	165	165	165	165	165	165	165	165	165	165	165	165	165
Interest Subsidy																
Total Interest	1,278	2,357.1	2,113.6	1,835.3	1,557	1,279	1,000	722	444	200	165	165	165	165	165	165
PBT	**(2,228)**	**2,811**	**5,950**	**13,753**	**16,058**	**16,876**	**17,155**	**17,433**	**17,711**	**17,955**	**17,990**	**17,990**	**9,346**	**9,346**	**9,346**	**10,075**
Tax Payable	-	482.4	1,021.0	2,360.0	2,974	4,063	4,218	4,363	4,497	4,614	4,670	4,712	2,573	2,605	2,632	2,656
PAT	**(2,228)**	**2,329**	**4,929**	**11,393**	**13,084**	**12,813**	**12,936**	**13,070**	**13,215**	**13,341**	**13,319**	**13,277**	**6,773**	**6,742**	**6,714**	**7,419**
ITC	3,307	2,498	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Cash Accruals	**2,076**	**6,701**	**6,803**	**13,267**	**14,958**	**14,687**	**14,810**	**14,944**	**15,089**	**15,215**	**15,193**	**15,151**	**8,647**	**8,616**	**8,588**	**8,564**

Annexure 7.9

SCHEDULE FOR WORKING CAPITAL REQUIREMENTS

(in Rs Lakhs unless specified otherwise)

	No. of Days	YR 1	YR 2	YR 3	YR 4	YR 5	YR 6	YR 7	YR 8	YR 9	YR 10	YR 11	YR 12	YR 13	YR 14	YR 15	YR 16
Storages	330																
A CURRENT ASSESTS																	
Raw Materials & Consumables																	
Gypsum	8	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113
Dry Fly ash	3	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
Consumables	30	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
Clinker	7	931	931	931	931	931	931	931	931	931	931	931	931	931	931	931	931
Other Consumables																	
Power	30	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375
SGA expenses	10	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129
Packing Expenses	10	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113	113
Labour & Factory Overheads																	
Salaries & Wages	30	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
Factory Overheads	30	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91
Finished Goods																	
Cement in Silo	2	357	357	357	357	357	357	357	357	357	357	357	357	357	357	357	357
Bagged Cement	4	770	770	770	770	770	770	770	770	770	770	770	770	770	770	770	770
Accounts Receivable																	
Sundry Debtors	20	1,833	5,498	6,415	7,331	7,789	7,789	7,789	7,789	7,789	7,789	7,789	7,789	7,789	7,789	7,789	7,789
TOTAL CURRENT ASSETS		4,941	8,606	9,523	10,439	10,897	10,897	10,897	10,897	10,897	10,897	10,897	10,897	10,897	10,897	10,897	10,897
B CURRENT LIABILITIES																	
Creditors	30	1,905	5,568	6,484	7,400	7,858	7,858	7,858	7,858	7,858	7,858	7,858	7,858	7,858	7,858	7,858	7,858
Wk Cap requirement																	
Total		3,036	3,038	3,038	3,039	3,039	3,039	3,039	3,039	3,039	3,039	3,039	3,039	3,039	3,039	3,039	3,039
WK Cap Margin Money		759	759	760	760	760	760	760	760	760	760	760	760	760	760	760	760
Wk Cap Borrowings		2,277	2,278	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279
						0	0	0	0	0	0	0	0	0	0	0	0
Increase in Current Assets		3,036	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Increase in WK Cap Borrowings		2,277	1.26	0.31	0	0	0	0	0	0	0	0	0	0	0	0	0

Annexure 7.10

PROJECTED FUNDS FLOW STATEMENT

(in Rs Lakhs unless specified otherwise)

Description	Construction Period		Const+Oper Period	OPERATION PERIOD													
	YR 1	YR 2	YR 1	YR 2	YR 3	YR 4	YR 5	YR 6	YR 7	YR 8	YR 9	YR 10	YR 11	YR 12	YR 13	YR 14	YR 15
	31-Mar-24	31-Mar-25	31-Mar-26	########	########	########	########	########	########	########	########	########	########	########	########	########	########
Sources of Funds																	
Equity	11,939	6,563	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Debt	19,820	10,894	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EBIDTA	-	47	7,043	9,937	17,462	19,489	20,029	20,029	20,029	20,029	20,029	20,029	20,029	11,385	11,385	11,385	11,385
Wk Cap Borrowings	-	2,277	1	0	0	0	-	-	-	-	-	-	-	-	-	-	-
ITC	-	3,307	2,498	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Sources	31,759	23,088	9,541	9,938	17,463	19,489	20,029	20,029	20,029	20,029	20,029	20,029	20,029	11,385	11,385	11,385	11,385
Application of Funds																	
Fixed Asset Purchases	31,759	17,457	(759)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Increase in Wk Cap	-	3,036	2	0	0	0	-	-	-	-	-	-	-	-	-	-	-
Repayment of Term Loan	-	-	1,920	3,839	3,839	3,839	3,839	3,839	3,839	3,839	1,920	-	-	-	-	-	-
Payment of Interest on Term Loan	-	1,113	2,192	1,948	1,670	1,392	1,113	835	557	278	35	(0)	(0)	(0)	(0)	(0)	-
Payment of Interest on Wk Cap	-	165	165	165	165	165	165	165	165	165	165	165	165	165	165	165	165
Taxation	-	-	482	1,021	2,360	2,974	4,063	4,218	4,363	4,497	4,614	4,670	4,712	2,573	2,605	2,632	2,656
Total Application	31,759	21,771	4,002	6,974	8,035	8,370	9,181	9,058	8,924	8,779	6,733	4,836	4,877	2,738	2,770	2,797	2,821
Surplus Deficit	-	1,317	5,540	2,963	9,428	11,118	10,848	10,971	11,105	11,249	13,296	15,193	15,151	8,647	8,616	8,588	8,564
Opening Cash & Bank Balance	-	-	1,317	6,857	9,820	19,248	30,366	41,215	52,185	63,291	74,540	87,836	1,03,029	1,18,180	1,26,827	1,35,443	1,44,031
Closing Cash & Bank Balance	-	1,317	6,857	9,820	19,248	30,366	41,215	52,185	63,291	74,540	87,836	1,03,029	1,18,180	1,26,827	1,35,443	1,44,031	1,52,595

Annexure 7.11

PROJECTED BALANCE SHEET

(in Rs Lakhs unless specified otherwise)

Description	Construction Period		Const+Oper Period	OPERATION PERIOD													
Liabilities	YR 1	YR 1	YR 1	YR 2	YR 3	YR 4	YR 5	YR 6	YR 7	YR 8	YR 9	YR 10	YR 11	YR 12	YR 13	YR 14	YR 15
Equity	11,939	18,502	18,502	18,502	18,502	18,502	18,502	18,502	18,502	18,502	18,502	18,502	18,502	18,502	18,502	18,502	18,502
General reserves	-	(2,228)	101	5,030	16,423	29,506	42,320	55,256	68,326	81,541	94,882	1,08,201	1,21,479	1,28,252	1,34,993	1,41,707	1,49,126
Debt	19,820	30,714	28,794	24,955	21,116	17,276	13,437	9,598	5,759	1,920	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Working Capital Loan	-	2,277	2,278	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279	2,279
Total Liabilities	**31,759**	**49,265**	**49,675**	**50,765**	**58,320**	**67,564**	**76,538**	**85,635**	**94,866**	**1,04,242**	**1,15,663**	**1,28,983**	**1,42,260**	**1,49,033**	**1,55,775**	**1,62,489**	**1,69,908**
Assets																	
Gross Fixed Assets	31,759	49,216	48,457	48,457	48,457	48,457	48,457	48,457	48,457	48,457	48,457	48,457	48,457	48,457	48,457	48,457	48,457
Less ITC	-	3,307	5,805	5,805	5,805	5,805	5,805	5,805	5,805	5,805	5,805	5,805	5,805	5,805	5,805	5,805	5,805
Less Accumulated Dep.	-	997	2,871	4,745	6,619	8,493	10,367	12,241	14,115	15,989	17,863	19,737	21,611	23,485	25,359	27,233	28,378
Net Block	31,759	44,911	39,781	37,907	36,033	34,159	32,285	30,411	28,537	26,663	24,789	22,915	21,041	19,167	17,293	15,419	14,273
Working Capital Assets	-	3,036	3,038	3,038	3,039	3,039	3,039	3,039	3,039	3,039	3,039	3,039	3,039	3,039	3,039	3,039	3,039
Cash Balance	-	1,317	6,857	9,820	19,248	30,366	41,215	52,185	63,291	74,540	87,836	1,03,029	1,18,180	1,26,827	1,35,443	1,44,031	1,52,595
Total Assets	**31,759**	**49,265**	**49,675**	**50,765**	**58,320**	**67,564**	**76,538**	**85,635**	**94,866**	**1,04,242**	**1,15,663**	**1,28,983**	**1,42,260**	**1,49,033**	**1,55,775**	**1,62,489**	**1,69,908**

Annexure 7.12

DISCOUNTED CASH FLOW STATEMENT (TOTAL INVESTMENT)

(in Rs Lakhs unless specified otherwise)

		Construction Period	Const+Oper Period	OPERATION PERIOD														
		YR 1	YR 1	YR 1	YR 2	YR 3	YR 4	YR 5	YR 6	YR 7	YR 8	YR 9	YR 10	YR 11	YR 12	YR 13	YR 14	YR 15
Inflows																		
PAT		-	(2,228)	2,329	4,929	11,393	13,084	12,813	12,936	13,070	13,215	13,341	13,319	13,277	6,773	6,742	6,714	7,419
Add: Depreciation		-	997	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,145
Add: Interest		-	1,278	2,357	2,114	1,835	1,557	1,279	1,000	722	444	200	165	165	165	165	165	165
ADD: ITC		-	3,307	2,498	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Less: Change WC Internal Accrual		-	-	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-
Terminal Value																		36,699
Total Inflows		**-**	**3,355**	**9,057**	**8,916**	**15,102**	**16,515**	**15,966**	**15,810**	**15,666**	**15,532**	**15,415**	**15,358**	**15,317**	**8,812**	**8,781**	**8,753**	**45,429**
Outflows																		
Capex		31,759	17,457	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Outflows		**31,759**	**17,457**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Net Flow																		
Cash Flow		**(31,759)**	**(14,102)**	**9,057**	**8,916**	**15,102**	**16,515**	**15,966**	**15,810**	**15,666**	**15,532**	**15,415**	**15,358**	**15,317**	**8,812**	**8,781**	**8,753**	**45,429**
IRR on Investment	**23.79%**																	
NPV	**63,724**																	

Annexure 7.13

DISCOUNTED CASH FLOW STATEMENT (EQUITY)

(in Rs Lakhs unless specified otherwise)

Description		Construction Period	Const+Oper Period	OPERATION PERIOD														
		YR 1	YR 1	YR 2	YR 3	YR 4	YR 5	YR 6	YR 7	YR 8	YR 9	YR 10	YR 11	YR 12	YR 13	YR 14	YR 15	YR 16
Inflows																		
PAT		-	(2,228)	2,329	4,929	11,393	13,084	12,813	12,936	13,070	13,215	13,341	13,319	13,277	6,773	6,742	6,714	7,419
Add: Depreciation		-	997	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,145
Less: Loan Repayment			-	1,920	3,839	3,839	3,839	3,839	3,839	3,839	3,839	1,920	-	-	-	-	-	-
ADD: ITC		-	1,243	939	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Less: Change WC Internal Accrual		-	-	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-
Terminal Value																		25,827
Total Inflows		**-**	**12**	**3,222**	**2,963**	**9,428**	**11,118**	**10,848**	**10,971**	**11,105**	**11,249**	**13,296**	**15,193**	**15,151**	**8,647**	**8,616**	**8,588**	**34,391**
Outflows																		
Capex		11,939	6,563	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Outflows		**11,939**	**6,563**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Net Flow																		
Cash Flow		**(11,939)**	**(6,551)**	**3,222**	**2,963**	**9,428**	**11,118**	**10,848**	**10,971**	**11,105**	**11,249**	**13,296**	**15,193**	**15,151**	**8,647**	**8,616**	**8,588**	**34,391**
IRR on Equity	**33.16%**																	

Annexure 7.14

BREAK EVEN POINT & INDICATORS OF PERFORMANCE

(in Rs Lakhs unless specified otherwise)

		YR 1	YR 2	YR 3	YR 4	YR 5	YR 6	YR 7	YR 8	YR 9	YR 10	YR 11	YR 12	YR 13	YR 14	YR 15
BEP Calculations																
Net Sales		11,812	70,875	82,687	94,499	1,00,406	1,00,406	1,00,406	1,00,406	1,00,406	1,00,406	1,00,406	1,00,406	1,00,406	1,00,406	1,00,406
Variable Expenses		10,075	60,452	70,527	80,603	85,640	85,640	85,640	85,640	85,640	85,640	85,640	85,640	85,640	85,640	85,640
Contribution		1,737	10,423	12,160	13,897	14,765	14,765	14,765	14,765	14,765	14,765	14,765	14,765	14,765	14,765	14,765
PV Ratio		15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
Fixed Expenses		3,965	7,611	7,368	7,089	6,811	6,533	6,254	5,976	5,698	5,454	5,419	5,419	5,419	5,419	5,419
Fixed Cash Expenses		2,968	5,737	5,494	5,215	4,937	4,659	4,380	4,102	3,824	3,580	3,545	3,545	3,545	3,545	3,545
BEP		26,964	51,756	50,100	48,208	46,315	44,422	42,530	40,637	38,744	37,088	36,851	36,851	36,851	36,851	36,851
BEP in %	68%	228%	73%	61%	51%	46%	44%	42%	40%	39%	37%	37%	37%	37%	37%	37%
Cash BEP		20,186	39,013	37,357	35,464	33,572	31,679	29,786	27,894	26,001	24,345	24,108	24,108	24,108	24,108	24,108
	51%	171%	55%	45%	38%	33%	32%	30%	28%	26%	24%	24%	24%	24%	24%	24%
DSCR Calculations																
PAT		(2,228)	2,329	4,929	11,393	13,084	12,813	12,936	13,070	13,215	6,671					
Depreciation		997	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	937					
ITC		3,307	2,498	-	-	-	-	-	-	-	-					
Total Interest		1,278	2,357	2,114	1,835	1,557	1,279	1,000	722	444	200					
Total		3,355	9,058	8,916	15,102	16,515	15,966	15,810	15,666	15,532	7,808					
Total Interest		1,278	2,357	2,114	1,835	1,557	1,279	1,000	722	444	200					
Total Term Loan Repayment		-	1,920	3,839	3,839	3,839	3,839	3,839	3,839	3,839	1,920					
Total		1,278	4,277	5,953	5,674	5,396	5,118	4,839	4,561	4,283	2,120					
DSCR		2.62	2.12	1.50	2.66	3.06	3.12	3.27	3.43	3.63	3.68					
Average DSCR	2.84															
Minimum DSCR	1.50															

CHAPTER 8 | SWOT ANALYSIS

This section briefly outlines the perceivable Strengths, Weaknesses, Opportunities & Threats (SWOT) in context to the proposed Clinker Grinding Unit of **JCL** planned to be set up in Prayagraj district of Uttar Pradesh.

Key Strengths

- Jaykaycem (Central) Limited (**JCL**) is a wholly owned subsidiary of JK Cement Limited, which in turn, is the Cement manufacturing vertical of the industrial conglomerate JK Organisation. The Company, as such, has a vast and time-tested experience in the Indian cement industry since the time it was established in year 1974.
- Its parent conglomerate and sister concerns have diverse interests and stakes in various highly valued building material in India and overseas. Some of the products enjoy niche market share in the respective regions of their interest.
- JK Cement-- the parent organization-- has good distribution network in various parts of Uttar Pradesh, and neighboring states as well. By expanding the cement production capacity at the proposed grinding unit in Prayagraj (U.P.), the company intends to upscale their growth aspects in this market, where until now, their presence was marginal.
- **JCL** has recently commissioned an integrated cement plant in Panna district of Madhya Pradesh, located about 250 km away from the proposed Prayagraj grinding unit. Clinker for the Prayagraj GU shall be sourced from Panna Cement Plant.
- By virtue of the strategic location footprints and distribution network of its existing mother and sister plants, in conjunction with proposed new capacity addition, **JCL** shall have advantage to be present across all major districts of the region, whereby it envisages to sustain its competitiveness as compared to its peers and competitors.
- By having assured supply of clinker and fly ash / pond ash from reasonably manageable distance from the proposed plant site, the proposed plant shall have advantage to be able to serve its core markets quickly and efficiently.

Possible Weaknesses

- The JK brand holds ‘B’ pricing category in the markets of interest. With capacities coming up/ expanding, **JCL** shall need to keep the ante up so as to maintain its market share in the region for which it shall need to budget more towards advertising and brand building programs amongst retail customers as well as the construction industry trade workers & facilitators.
- The uncertainties in government aided/funded spending on infrastructure related and other projects had witnessed some degree of slowing down and/or getting deferred during the recent Covid-19 pandemic era. Though some of the spendings have had slowly been catching up, any slowing down of projects and government spending on infrastructure, shall result in straining the company’s profitability ledgers and free cash generation prospects to some extent.

Foreseeable Opportunities

- The target markets of Uttar Pradesh are envisaged to witness good growth prospects in terms of demand for cement in the years to come.
- Uttar Pradesh is populous and exhibits high population density, thereby drawing attention of many institutional players in addition to the retail customers, in the State's tier-2 and tier-3 cities.
- The JK Cement brand appears to have a clear opportunity of expanding its footprint in the promising markets of Uttar Pradesh. It has sensed an opportunity to consolidate its presence further, and be able to service their markets of interest in near future, while also be able to compete with their peers and competitors.

Pertinent Threats

- Established and higher category brands in the trade shall pose stiff competition in terms of pricing and demand/supply scenarios.
- Some of the competitors in the targeted region have huge clinker and cement manufacturing capacities. Their limestone mining areas are also not as difficult to economically mine as against the one for which **JCL** has been granted lease for. This may result in having relatively higher unit cost of production of clinker, and thereby the cement at the mother as well as allied daughter plants. This may result on EBIT margins a bit negatively in the initial years of commissioning of the mother and daughter plants.
- A lot of brand awareness campaigns, and launch of newer types of cement variants are being introduced in the market by the competitors. **JCL** shall need to catch up with the technical innovations that shall be adopted by its already established competitors, and match the advertising provisioning too.
- In case cement consumption does not increase in the target markets as per the projections and estimates, or if there is increased competitiveness due to new capacities in the region, in that case **JCL** would have to increase its market share by increasing its market reach further.
- Timeframe risks refer to possibility of occurrence of events leading to delay in project implementation on account of various factors, which may include land procurement related delays, or statutory/regulatory clearances related delays, or construction and project execution related delays. However, **JCL**/JKCL being an established and experienced player in the industry, are expected to get the same resolved, and mitigate any such kind of risk to the project.
- Prices of certain commodities and building material have witnessed an uptick in last few quarters. Prices of fuel, metals, alloys, rubbers, plastics and other semi-finished material rose sharply during FY22, thereby putting pressure on the landed costs of some of the finished works and/or equipment. Although the sharply risen prices have relatively subdued from the peak prices off late, the escalated ordered and landed costs of building material and equipment shall keep putting pressure on the estimated capex for some more time.

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