Preliminary Report on Erection of a New Cement Plant In Iraqi Kurdistan

1: Introduction

Erection of a cement production plant has been one of highest aspiration in this region for many years, which caused suitable background to perform many efforts in this realm since few years ago.

Prospecting for raw materials and defining fair zones with opulent reservoirs of limestone and marl and also primary determination of erecting possibilities are some of these activities.
These efforts had no positive results due to govern condition on performing procee of SCR 986.

Following freedom of Iraq and generation of a new political condition that reveal the outlook of development of prosperity activities in region,it is necessary to attend this subject again.

This brief report describes the essential aspects, performance stages and necessary investment of such plants.

This budget is issued to estimate the investment required to establish a new cement plant somewhere in the north of Kurdistan of Iraq.
Due to absence of available data, several assumption hare been done, which the main ones are as following;

- *Suitable raw material reservoirs for a 50 years production at a distance of 1000 meters from the site.*
- *Additive materials such as gypsum and Iron ore available in site.*
- *For the purpose of centering the level of the investment, the capacity of the plant has been fixed on the base of optimum capacity.*

This budget is produced to estimate the investment level with a margin of 12% on the indicated figure.

If actual data on the available local raw materials and site conditions could be provided, more exact figures will be obtained.

2: Economic Condition and Optimum Capacity

There is an optimum capacity for every plant, which depends the profitability boundary and depends on the basis of numerous parameters such as market price of product, consumption rate, production expenditures, investment, raw materials cost, energy cost and etc.

Optimum capacity of cement manufacturing plant has increased from 90's and the latest investigation has marked the optimum capacity of cement manufacturing around 5000 tpd for northern America, 4500 tpd for Europe and 3000 tpd for Middle East countries such as Iraq and Iran.

In other words, erection of a new cement plant with capacity less than 3000 tpd isn't economical and the investment will be pernicious.

It should be noted, some experiences have been performed in Iran to installed small scale cement plant with capacities around 500 to 1000 tpd by using the Chinese machinery and equipments, which had no success with regard to technical problems and also low quality production.

Finally, the optimum capacity of new cement plants should be fixed around 3000 tpd in Kurdistan region and this amount can be calculated for feasibility study of new plants.

3: The Major Sections of Cement Plants

The scope of primary estimation covers the following chapters|

A): Quarry (limestone and Marl)

- Extraction
- Crushing Installation
- Auxiliary Installation
- Transport equipment

B): Cement Plant

- Storage and blending
- Cement raw material building
- Row meal transportation
- Silos for raw meal
- Pre-heater, calcinatory, Rotary kiln
- Clinker cooler
- Clinker transformation
- Cement silos
- Cement bulk delivery
- Cement packing
- Laboratory
- Auxiliary Installations
- Offices

The typical flow sheet of cement manufacturing plant has been enclosed.

4: Brief Description and Necessary Machinery

Cement manufacturing consists of many complex processes including mechanical activities and chemical reaction on raw materials. In the following, necessary machines and procedure divisions has been described.

4-1): Quarries

The raw material mix, is basically composed by limestone and marl in proportion that varies with the chemical composition in the range of 40% to 60% of these components. The fire loss due to chemical changes and water loss is of 56% of the raw material

In addition, to feed the cement plant for the production of 3000 tons of cement per day, we have to consider the time scheme of plant production.

The plant will work non-stop for 350 days per year, whereas the quarry, will work only one shift of 8 hours per day and about 250 days of work per day.

Once all these factors considered, we end with a recommended production capacity of 600tph of limestone and same amount marl.

The quarries have been designed for the said 600tph production capacity with a granulometry of 0 to 50 mm.

4.1.1): Limestone Quarry

Due to not being of necessary data to establish a detailed plan, the required machinery has been listed an moderate exploitation condition.

Two track drills to perforate the rock and allow the explosives to blast the limestone, wich will be loaded by one 6m3 excavator and two 6m3 wheel loaders into two 40mt dump trucks feeding the limestone crushing installation.

A set consisting hoppers, metallic conveyors, disc pre- screener, impact crusher, vibrating screens and rubber conveyors will reduced the limestone to less than 50mm size.

4.1.2): Marl Quarry

Marl Quarry exploitation plan comprises both extraction and crushing systems will out put capacity of 1,200,000tpy (600tph).

Two track drills, one 6m3 excavator, two 6m3 wheel loaders and two 40 ton dump trucks have been estimated for extraction and material transportation to crushing unit.

A set consisting hoppers, metallic conveyors, disc pre-screener, impact crusher, vibrating screens and

rubber conveyors will reduced the marl to less than 50mm size.

4.1.3): Material Transportation

To deliver the crushed limestone and marl to the raw material yard at cement plant, the transportation conveyor has been chosen amongst the several methods and possibilities.

The distance between Quarries to plant yard has been assumed 1,000meters, and using of two 1,000mm wide rubber belt conveyors would allow the transportation of required materials.

4.1.4): Auxiliary Installion

To ensure proper function of the quarry, too sets of auxiliary installations is required as following:

- *2 electric energy transforming substation, with out put of 1000kVA at 6000 V and 240/400V.*
- *Water supply installation to ensure conation of 40m3 per day for each quarries.*
- *Water treatment plant for 3-4 m3 per day capacity.*
- *2×20,000 liters Gasoil tanks and delivery installations.*

4.2): Cement Plant

To indicate the different stages of cement production process, the typical flow sheet has been presented here below in the next page.

The different stages and required machines and equipments have been estimated as followings:

4.2.1): Storage and Blending Yard

The raw materials with bulk size of 0-50mm are fed into the longitudinal yard by using of a stacker machine and incoming belt conveyor system, with a capacity of 1200tph.

Two scraper reclaimer machines, each one with a capacity of 250tph will reclaim material from yard to cement raw material hopper through an outgoing bet conveyor system.

The yard is covered with a metallic shed.

4.2.2): Cement Raw Material Mill

To mill raw material, using of vertical roller mill has been designed, with a production capacity of 250tph of raw meal.

The material to be ground, limestone, marl and free corrector, is fed to the rotating grinding table and is then carried by centrifugal force to the rollers.

Mill production is discharged through a rotary classifier, and rejected gross product is fed back to the mill for recovery.

4.2.3): Cement Raw Meal Transportation

The raw meal is transported by the air slide to the bucked elevators, feeding the two raw meal silos.

Each one of the two-bucket elevators has been calculated for a transportation capacity of 250tph.

The height of elevator will be around 58 meters with maximum capacity of 370 mt/h at traveling speed of around 1.5 m/sec.

4.2.4): Silos for the Cement Raw Meal

For a cement plant with capacity of 3000tpd, storing capacity for cement raw meal should be erected around 40.000-45.000mt, divided into two identical silos each.

These silos can be constructed either in concrete or in steel.

Silos are of circular shape, with 1.50-55m high, with funnels formed at the internal base core.

4.2.5):Preheats, Calcinator and Rotary Kiln.

The raw meal is discharged in the preheater system through detached cyclones against the hot gas flow, being partially calcinated.

From the cyclones, it is discharged by airslides into the calcination and from here to the kiln entrance and through the rotary kiln the capacity of the kiln is calculated around 3000mt per day with inside diameter of 4-4.5m and length of 60-70m and rotation velocity of 3.5 to 4 rpm.

4.2.6): Clinker Cooler

To cooling of the clinker living the rotary kiln, an pendulum cooler has been chosen.

Cooler grate surface is formed by small blades and sharp air jets creating high dynamic pressure in the direction of the clinker progression movement.

At the end of the pendulum cooler, there is a roll crusher to reduce large particle size and improve Performance and efficiency of the cement mill.

4.2.7): Clinker Transportation and Clinker Silo

For the transportation of the clinker from the roller crusher to clinker silo, a deep drawn pan convey or has been selected with capacity of 200tph.

Clinker storing capacity has been calculated in 60,000-70,000mt, which can be constructed either in concrete or in steel.

Silo is of circular shape with up to 40m outside diameter and 55-60m height.

4.2.8): Cement Milling Installation

previous to the cement mill, material is stoned in three feeding hoppers, one of for clinker and two smaller to store gypsum additives.

Following dosing and weighing, material is discharged in to feeding belt leading to the cement mill.

A double line of the lube ball mill type of two chambers have been assumed. Each chamber with 90mt capacity with rotating speed of around 15rpm.

The mill be equipped with high efficiency dynamic classifier to separate coarse grains and return to the tube mill. Accepted fines will be finer than Blain 4000 (cm2/gr.).

The accepted fines are feed to the cement silo by means of a 68 meters high ducat elevator.

4.2.9): Cement Silo

Using of ring silo with storage capacity of 20,000-25,000mt has been chosen to store cement. The high of silo will be around 60 meters and at the lower part of the silo, there is a cone discharge system to facilitate cement discharge and load homogenization.

Under the discharge cone, at ground level, four bulk truck loading stations are installed, each one equipped with its corresponding weigh bridges.

4.2.10): Cement Packing Installation

One rotopacker has been selected to packing of cement with Blaine 4000 Cm2/gr at max 0.5% humidity.

The rotapacker will be equipped with 8 filling stations, with total capacity of 2500 units of 50 kg bags per hour.

4.2.11): Laboratory

A laboratory has been planned for Cement palnt, which should be equipped for the complete control pf plant, operation and product quality assessment.

It consists the complete laboratory crushing, grinding and sizing line, and also Mineralogical and Metallurgical Microscopes with grinders, polishers and cutting devices, and ARL and XRF units for cement analysis.

The laboratory also can be equipped with automatic sampling systems in cement mill, cement silos, bag packing machine, clinker mill and raw elevator in order to sampling and air transportation to and frm laboratory.

4.2.12): Auxiliary Installation

a. Compressed Air Production and Distribution System

Two 250 CV screw compressors with air pressure storage system and distribution pipes should be installed for plant.

b. Water Storage and Distribution System

A 500,000 to 600,000 liters raw water tank, pumping packs for pressurising the water network and distribution lines to the consumption points, are necessary for plants.
Also, water for refrigeration in closed loop systems requires a separated demineralisation palnt.

c. Electricity Transforming Station

To provide electrical energy to the different points of the plant, it’s necessary the installation of a 15 MVA electrical substation, with two transformers.
The main transformer with 13MVA output reducing the voltage to 6kV to feed main motors, and the minor with 2MVA output, reducing the voltage to 240/380V for the auxiliary and small motors.

d. Fuel Oil Storage and Distribution System

Rotary kiln is fired by Gasoil, and its consumption has been estimated around 350,000to 400,000 liter per day. It’s necessary that a minimum of 6,000 meteric tons fuel oil be stored at the plant in two 3,000tons underground tanks, in optimum distance to the burners in order to supply high oil viscosity at low temeratures.

e. Fire Fighting Installation

A closed net of pressurised water piping and fire hydrants using a 600m3 water tank and two pressure making system shoul be installed. Two pressure systems should be independent one another. One driven by electricity and one by a diesel generator in emergency cases.

f. Waste Water Treatment Plant

Flow of waste water is estimated around 12,000 liters per day. Hence, a small waste watyer treatment plant will be required.

g. Workshop

A suitable workshop for daily maintenance and services shoyl be installed with necessary equipments, tools and kits.

h. Internal Vehicles

Four 2.5 tons lift trucks, two small lorries and one truck crane with capacity of around 300 tons at 20m and 80m lift capacity, and also five vans should be supplied for routine works of plant.

4.3): Offices and Buildings

Total necessary buildings for management offices, official departments, laboratories, services and welfare facilities have been estimated up to 12,000 square meters.

4.4): Site Ground

The necessary ground for erection of plant is estimated about to 50 Acres(20Ha) of square(length/width=1.5/1) flat ground with the soil load capacity min 2 kgs/cm2.

4-5): Training

To ensure the required skill for the staff operating the plant, implementation of a training period and the assistance from skilled people and machinery supplier is necessary during the first six months of operation.

5: Investment Estimation

To install a new cement production plant with capacity of 3000tpd (1,000,000 tpy), the following budget is necessary with a margin error of 12% on the indicated figure, due to insufficient fiel datas (amounts in US $).

a) *Detailed Exploration of raw material deposits:*
2,000,000 ± 10%

b) *Quarries designs and primary feasibility study:*
500,000 ± 5%

c) *Machinery and equipments (Quarries and Plant):*
70,000,000 ± 20%

d) *Civil Works and Silos manufacturing:*
30,000,000 ± 5%

e) *Electric System and Controls:*
35,000,000 ± 10%

f) *Auxiliary Installation:*
25,000,000 ± 5%

g) *Consulting and Detailed Designing:*
7,000,000 ± 5%

h) *Erection and Transportation:*
5,000,000 ± 5%

i) *Training and Trial Run:*
4,000,000 ± 10%

Total Estimated Budget USD 178,500,000 ± 12%

The budget has been estimated on the base of Western and Southern European Suppliers price in mid 2002 and might be decreased by equivalent equipments made by another manufacturers in Eastern Europe or Asia, or increased by manufacturers in Northern and Central europe.

6: Scheduling and Planning of Activities

The necessary duration from initial stag to trial run and production stage is estimated near to **5.5 years** as following:

a) *Budget supplies and stages division:* 6 months
b) *Geological study and Mining Exploration:* 12 months
c) *Feasibility study and locate selection:* 4 months
d) *Tendering and contracting:* 9 months
e) *Project performance:* 30 months
f) *Trial Run and experimental production:* 6 months

6: Conclusion

This preliminary report had been prepared on the the basis of the latest information on erection of cement production plant with attention to dry process technology and with capacity of 3000 mt per day (1,000,000 mt per year).

The necessary infrastructure possibilities to implement a new cement plant in kurdistan consists of the followings:

1. *Suitable deposits of limestone and marl each one with minimum reservoir of 60,000,000 mt.*
2. *20 ha of flat ground near to raw material reservoir.*
3. *Suitable water resources with minimum flow of 100m3/day to supply gypsum with minimum flow of 150 per day.*
4. *Electrical power with minimum output of 17 MVA.*
5. *To supply and allocate USD 180,000,000 to project.*

With respect to cement production technology in the world and especially, the practical experiences in Iraq and neighboring countries, the cement production plants aren't basically profitable, rather are rated among the best strategic and intermediary plants to developing activities and job creation.

Due to high necessary investment, long duration of invest return, complex process of management, high technology and related problems and also manpower difficulties, such plants are settled only on governmental investing domain and private sectors have no interest to invest in this realm.

Due to important economic weight of this plant and its effect on economic growth of region, we suggest that necessary budget be allocated from remained purse of SCR 986.

In the first step, it's necessary to approve about USD 3,000,000 to finish detailed mining exploration on raw materials and also to prepare necessary technical assessments. MRA

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