This is a Project Report of one month Summer Training Program held in a Steel Company which undergoes Modernization bcoz of the old age of existing plant.

Modernization consists of building a totally new plant to increase the production to 2.5 mtpa previously which is less than 1 mtpa.

In Modernization 15 different construction company of India and 3 companies from foreign involved with 0ne consultant company to built theses:-

Blast Furnace, Coke oven Battery: 02, by product plant, Sinter plant, Coal & coke Handling plant, Ore handling plant, Wagon tippler: 03, Track hopper: 01, Silos, Converter, Pipe conveyor, Rolling mills & a no of conveyor and conveyor tracks.

The costs of these are estimate as 12742.77crs of Indian rupees but it is exceeded as 17,000crs. during middle age of completion.

Some important details are listed below:-

All Foundations are **Piles** (more than 30,000 piles).

The average depth of one pile is within 25 mtr to 30 mtr.

**Project Duration** 26 Months

**Contractual Start Date** 7th Mar-2008

**Contractual Finish Date** 6th May-2010

**Major Production Units –**

* 1 x 7 M Tall Green Coke Oven Battery (74 Ovens).
* 2 x 204 M2 Sinter Machines (For 80% Sinter Charge).
* 1 x 4060 M3 (Useful Volume) Blast Furnace with Top Pressure Recovery Turbine.
* 3 x 150 Ton Basic Oxygen Furnace Converter.
* 2 x 6 Strand Billet Casters.
* 1 x 4 Strand Beam Blank / Bloom Caster.
* 1 x 0.6 Mtpa Heavy Section Mill.
* 1 x 1.25 Mtpa Wire Rod & Bar Mill.
* Pipe conveyor of length app. 1.5 km
* 12 blending bunkers of dia. 12 mtrs.
* 3 wagon tippler and one track hopper.

***This project contains:***

* Project Details : Details of packages, contractual information, material requirement etc.
* Work Method : Explain how construction works proceeds
* Manufacturing of Concrete : Explain the procedure of concrete manufacturing.
* Foundation : information regarding foundation, especially about piles.
* Site visited :-
  + - * Pipe conveyor
      * Blending Bunkers
      * Wagon tippler
      * Track Hopper
      * Sinter Plant
      * Coke oven & By-product plant
      * Blast furnace

*Project details*

**1.** ***PROJECT DETAILS***

The steel company has envisaged enhancement of crude steel production capacity by 2.5 MTPA.

In the 2.5 MPTA new stream expansion, all raw material required for the Blast Furnace, Sinter Plant, Coke Ovens, Lime/Dolomite calcinations plant as well as interplant transportation of finished sinter, coke, fines generated in coke ovens & Blast Furnaces etc shall be covered in the following four packages:

1. Package - 01A: Ore Handling Plant (OHP)
2. Package – 01B: Coal & Coke Handling Plant
3. Package – 01C: Base Mix Preparation Plant (BMP)
4. Package - 01D: RMHS yard Machines

**01.** *Package - 01B: Coal & Coke Handling Plant and Pipe Conveyors (CHP):* Stacking, Reclaiming and conveying coal to Coal Blending Silos, coal preparation and transportation to coal tower top, transportation to CDI coal storage silos, coke sorting plant and transportation of coke to BF stock house. Additionally two nos. pipe conveyors, one for transportation of coke from existing plant and the second for transportation of raw material to existing plant.

**02.** *Package - 01C: Base Mix Preparation Plant (BMP) for Sinter Plant:*  base mix preparation for sinter plant, with emergency sinter storage and transportation of sinter to BF stock-house. Additionally collection of fines from BF stock-house, coke area (with storage for same) and handling of other fines/ flue dust/ mill scales is included.

The contract include complete turnkey execution of the job covering the design, engineering, manufacture, supply, handling, storage, erection, painting, testing, commissioning of plant & equipment complete with civil, structural, electrical & process control, compressed air & water facilities, Fire fighting facilities, dust suppression/extraction, ventilation & air-conditioning, various facilities like sub-storage, area-repair shop, welfare/canteen buildings, electrical sub-stations and control rooms, workers rest rooms and office complex etc. and demonstrations of performance guarantee parameters of the RMHS complex in a co-ordinated and integrated manner.

**Contract Value** Coal & Coke Handling Package - 579.00Cr

Base Mix Handling Package - 528.07Cr

**Price Brea Up** : All values in Crores

|  |  |  |
| --- | --- | --- |
| **Description** | **Coke and Coal**  **(Pkg-1B)** | **Base Mix**  **(Pkg-1C)** |
| Design & Engineering | 7.5 | 8.00 |
| Supply of Plant & Spares | 251.52 | 228.21 |
| Civil Engg. Works Inc. Supply | 158.64 | 98.08 |
| Supply and Erec. Of Building Str. | 123 | 175.53 |
| Equipment erec. & Commissioning | 35 | 15 |
| Training Charges | 0.2 | 0.2 |
| Insurance | 3.14 | 3.05 |
| Total (INR Crs) | 579.00 | 528.07 |
| Guranteed VAT/Cenvat INR (Crs) | 74.46 | 70.57 |

**Duration** 26 Months

**Contractual Start Date** 7th Mar-2008

**Contractual Finish Date** 6th May-2010

**Defect Liability Period** 12 Months from Contractual Finish date

**1.2 Major Qty** :

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Description** | **Unit** | **Package:1B Qty** | **Package:1C Qty** | **Total**  **Qty** |
| Earth work | Cum | 190000 | 105725 | 295725 |
| Back filling | Cum | 108533 | 87396 | 195929 |
| Disposal | Cum | 46291 | 18264 | 64555 |
| PCC | Cum | 16444 | 5894 | 22338 |
| RCC | Cum | 32010 | 28209 | 60219 |
| Grade slab | Sqm | 14917 | 25787 | 40704 |
| Shuttering | Sqm | 92420 | 90911 | 183331 |
| Reinforcement | MT | 11654 | 583 | 17387 |
| Brick work | Cum | 3788 | 4786 | 8574 |
| Inserts & Foundn Bolts | MT | 434 | 298 | 732 |
| Piling (750 and 550 dia) | Nos | 3621 | 3329 | 6950 |
| Structural Steel Work | MT | 9714 | 17240 | 26954 |
| CGI Sheeting | Sqm | 69123 | 69529 | 138652 |
| Equipment Works | MT | 5380 | 5547 | 10927 |

**1.4 Broad Scope of Work:**

|  |  |  |
| --- | --- | --- |
| **Description** | **Quantity** | |
| **Package 1B** | **Package 1C** |
| Transfer Points | 24 | 26 |
| Process Buildings | 7 | 7 |
| W/T Complex | 1 | - |
| Belt Conveyors | 6343 M long 55 Nos. | 6648 M long 57 Nos. |
| Pipe Conveyor, 600 TPH Ore | 1320 M long. 1 No. | - |
| Pipe Conveyor, 200 TPH, Coke | 1450 M long, 1 No. | - |
|  |  |  |
| **Description** | **Pkg-1B** | **Pkg-1C** |
| Double Conveyor | O/G 450M, O/H 850 M | O/H 1388 M, O/G 500 M |
| Single Conveyor | O/G 400 M, O/H 2750 M | O/H 3539 M, O/G 603 M |
| Pipe Conveyor | 1450 M long | - |
| Tall TPs | 4 | 10 |
| Small TPs | 26 | 16 |
| S/R Foundation | 5 x 335 M long | 2 x 225 M long |
| B/R Foundation | - | 2 x 225 M long |
| W/T Complex | 1 No. | - |
| Bunker Buildings | 3 | 5 |
| Crusher House | 2 | 2 |
| Screen House | 2 | 1 |

*WORK METHODS*

Work Methods is the methods or a schedule according to which any construction work takes place. This can be divided in following categories:

1. Survey and setting out
2. Excavation
3. Cast in-situ piling works
4. Reinforced Cement concrete
5. Back filling
6. Structural base grouting
7. Plain cement concrete

**1. Survey and setting out**

1. The site shall be cleared from all temporary obstacles which may hinder the progress of survey.
2. Initial survey will be conducted including closing of transverse and coordinates will be marked on top of grid pillars of permanent nature which will be constructed at site at suitable locations.
3. A layout plan for grid pillar shall be made.
4. Benchmark will also be shifted from reference grid pillar at suitable points (of permanent nature) near the location of work to facilitate the work.
5. A detail for the same will be prepared.

**2. Excavation**

1. In case of mechanical excavation, care shall be taken to keep the level of excavation suitably 150 mm above desired level. This is required not to disturb the soil ground lying underneath. The final level is achieved by manual dressing.
2. Proper slope shall be maintained in the sides to hold the face of earth.
3. Care shall be taken to protect underground pipelines, electrical cables, drains and other existing utilities.
4. Dumping of excavated soil shall not be made within 1m from edge of excavation.
5. If required, dewatering shall be done. Area barricading, area lighting, suitable warning signs, proper approach ways shall be made.
6. After excavation, correct bottom level shall be checked as per the drawing and shall be recorded.

**3. Cast in-situ piling works**

1. Casing pipe driving
   1. Pile points are to be fixed on the ground by surveyor as per approved drawing.
   2. Site engineer will check the point with reference to adjacent pile points
   3. The rig is centered properly in line with pipe point vertically.
   4. Boring is done over pile point with regular use of water.
   5. When the first casing is installed the horizontal displacement and verticality of casing pipe is checked.
   6. As boring progresses, different lengths of casing pipes are fixed.
2. Reinforcement
   1. Check reinforcement cage be as per the drawing.
   2. The pile bore shall be free from slush.
   3. Stiffener ring and laps shall be welded.
   4. Reinforcement cage shall be lowered in the pile bore.
   5. 40mm PVC pipe of required number are fixed with the reinforcement during cage lowering. It is ensured that water is filled in it.
3. Pile Concrete
   1. Concrete with details – M25, w/c ratio of 0.5, 400kg/cum is used.
   2. Concreting is done by tremie pipe.
   3. Casing/Tremie shall be extracted in stages by push & pull method followed by moderate tapping of it after attaining sufficient height of concrete in the casing. Care shall be taken that concrete shall not exceed the 25% of pile length.
   4. Check the theoretical and actual volume of concrete poured.
   5. Concreting shall be stopped until it reaches 750 mm above cut-off level.
4. The balance depth to be filled by slag.

**4. Reinforced Cement concrete**

1. Survey
   1. Centre line and edge line of foundation shall be transferred over base concrete from already established reference along with reference reduced level.
2. Reinforcement
   1. Reinforcement shall be as per BBS, which is prepared as per AFC drawing.
   2. Before concreting, dia of bars, spacing between bars, correct bends, proper laps, curtailment of bars, type of binding wire, chairs kept in proper position, fixing of adequate number of cover blocks are to be checked and necessary details are to be entered in format.
   3. Reinforcement shall be free from dirt, rust, mud and oil.
3. Staging and form working
   1. Staging where required will rest on firm ground and will be well anchored.
   2. Formwork will be designed so as to take the load of concrete poured.
   3. Formwork shall be in line level and plumb and shall be free of holes and gaps.
   4. Approved shuttering oil will be applied before placing of reinforcements.
   5. Embedded items like foundation bolts and inserts will be fixed/welded to proper line and level as per AFC drawing.
   6. Top level (finished) of concrete will be marked with leveling instrument.
4. Concreting
   1. Mix design is to be established beforehand as per drawing, specification and relevant IS codes and approved by client.
   2. Concrete of required grade and workability would be poured within specified time.
   3. For placing concrete in a slope placing will start at the bottom and move upwards.
   4. The vibrator needle should penetrate the layer of concrete vertically and into the under lying layer previously placed and vibrated if possible.
   5. Vibrator will be withdrawn slowly so as to fill up the pocket resulting from insertion.
   6. Vibrator will be stopped when the concrete flattens and takes glistening shape.
   7. Top level of the concrete will be ensured and finished suitably.
   8. Fresh concrete will be sampled for workability and cube testing.
   9. Pour card is to be maintained for each pour.
5. Removal of formwork
   1. Formwork will be removed after minimum period as per IS 456.
   2. All blemishes and defects if any will be suitably rectified.
6. Curing
   1. Potable water will be used for curing.
   2. Curing will be carried out as per IS 456
   3. For formed surfaces curing will start as soon as formwork is removed.

**5. Back filling**

1. Material used for earth filling will be free from clods greater than 75mm in any direction, organic matter and other deleterious materials.
2. All clods of filling material shall be broken or removed if the filling material shall contain deleterious materials and the same shall not be used.
3. The spaces all around the foundation will be cleared of all debris, bricks etc
4. Filling shall be done in layers and each layer shall be moisture conditioned and consolidated using mechanical means.
5. Wherever vibro-hammer cannot be put to use due to space constrain, hand ramming with crow bar shall be carried out at each layer of filling.
6. The surface of consolidated surface shall be dressed to required level and slope.
7. Compaction shall be done as per specification.
8. Field compaction test may be done by core cutter test method.

**6. Structural base grouting**

1. Before grouting concrete pedestal should be rough, clean and made thoroughly wet.
2. All pockets for anchor bolt shall be clean and excess water removed.
3. After mechanical clearance, free flowing grouting mixture shall be poured continuously till required thickness is obtained as per the drawing.
4. Remove the formwork after 24 hrs and cure surface.

**7. Plain cement concrete**

1. Preparation of bed and maintaining the level and line as per drawing and specification.
2. Fixing of side shutters to required height and checking the centreline of the foundation.
3. Maintaining PCC top-level as per drawing/checking with levelling instrument/and maintaining the required thickness of PCC.
4. The concrete shall be made by adopting nominal concrete mix with proportions of materials as specified in customer’s specification
5. Placing the concrete in specified area and tamping with metal/wooden tamping tool and finishing with trowel.
6. Checking the final finish level and maintaining the record as per the spec.
7. Curing shall be done later.

*STAGES OF MANUFACTURE OF CONCRETE*

***STAGES OF MANUFACTURE OF CONCRETE:-***

1. BATCHING
2. MIXING
3. TRANSPORTING
4. PLACING
5. COMPACTING
6. CURING
7. FINISHING

*a)* ***BATCHING*** - Measurement of different materials for making concrete is known as Batching

*METHODS OF BATCHING*

1. Volume Batching – In this method the materials are measured by it’s volume.
2. Weigh batching – In this method the materials are measured by it’s weight.

*NOTE:*

For most of the purposes weigh batching is preferred over volume batching because of the following reasons

1. It is difficult to measure granular material in terms of volume.
2. Volume of a moist sand in a loose condition weighs much less than the same volume of compacted sand.
3. Amount of solid granular material in a cubic meter is indefinite.

***AUTOMATED BATCHING PLANT***

In this plant operator has to press only one or two buttons to put into motion the weighing of all the materials, the flow of each one can be cut off when the correct weight of material is reached. These automated plants are electrically operated on a punched card system. In some of weighing batching equipments, recorders are fitted which graphically record the weight of each material, which are further delivered to a batch.

* Water is measured by installing water meters to the main line to the mixer through which exact quantity is supplied.
* In modern batching plants sophisticated automatic microprocessor
* Controlled weigh which measures both aggregate and water.

**b) MIXING:-**

*MACHINE MIXING*

In most of the batching plants machine mixing is used ie for mixing machine is used.

They are classified as -

1. Batch mixers
2. Continuous mixers

Difference b/w them is that batch mixers produce concrete batch by batch whereas continuous mixers produce concrete continuously.

*STEPS FOR LOADING MIXER*

* Firstly, about half the quantity of coarse aggregate is placed over which half the quantity of fine aggregate is poured.
* On this full bag of cement is poured after this remaining portion of coarse aggregate and fine aggregate is deposited in sequence.This prevents the spilling of cement.
* Before the loading about 25percent of total water required to wet the drum and to prevent any cement sticking to the blade or at the bottom of the drum.
* Immediately on discharging dry material remaining 75 percent water is added to the drum.
* When plasticizer or super plasticizer the procedure could be adopted except that about one liter of water is held back.
* Calculated quantity of plasticizer or super plasticizer is mixed with that one liter of water and same is added to mixer drum.

*MIXING TIME*

* Mixers are generally designed to run at a speed of 15 to 20 revolutions per minute. For proper mixing it is about 25 to 30 revolutions are required.

*NOTE:*

* If the speed is more, than mixing time will decrease than it results in poor quality of concrete and on the other hand if the mixing time is more than it is uneconomical in point of view of rate of production of concrete and fuel consumption.
* Also the quality of concrete in terms of compressive strength will increase with increase in time of mixing, but for mixing the beyond two minutes the increase is not significant.
* Generally mixing time is related to capacity of the mixer. The time varies from 1 to 2 minutes. Bigger the capacity of the mixer more is the time.

**c) TRANSPORTING CONCRETE**

Methods of transportation

1. Mortar pan
2. Wheel barrow, Hand cart
3. Crane, Bucket and Ropeway
4. Truck mixer and Dumpers
5. Belt conveyors
6. Chute
7. Skip and Hoist
8. Transit mixer
9. Pump and Pipeline

*TRANSIT MIXER*

* Most commonly used for transporting concrete in Ready Mix Concrete (RMC).
* They are truck mounted having capacity of 4 to 7 metrics cube. There are two variations. In one, mixed concrete is transported by keeping it agitated all along at speed of 2 to6 rpm.
* In other the concrete is batched in batching plant and mixing is done in truck mixer. Sometimes a small pump is also there on truck carrying transit mixer. This is done to pump the concrete, sometimes placer boom is also a part of transit mixer with the help of this and pump concrete is pumped into formwork of structure

**d) PLACING CONCRETE**

It is important that concrete must be placed properly to get good results. Precautions should be taken for placing concrete for following conditions

* Placing concrete within earth mould (Foundation concrete for column)
* Placing concrete in layers within timber and steel shutters
* Placing concrete within usual form work
* Placing concrete under water

**e) COMPACTION**

Process of expelling the entrapped air from the concrete. Lower is workability higher is the air entrapped. If air does not loose than it will decrease the strength and air voids are left which reduce the strength.

*METHODS FOR COMPACTION*

1. Hand Compaction

* Roding
* Ramming
* Taming

1. Compaction by vibration

* Internal vibrator
* Formwork vibrator
* Table vibrator
* Platform vibrator
* Surface vibrator
* Vibratory roller

1. Compaction by Pressure and Jolting
2. Compaction by Spinning

**f) CURING**

It is defined as the process for keeping the concrete moist and warms enough so that the hydration of cement continues. It may be described as the process of maintaining adequate moisture content and temperature of concrete.

*CURING METHODS*

* Water curing
* Membrane curing
* Application of heat
* Miscellaneous

**g) FINISHING**

It is the final step. Finishing is not required for all the concrete operations like for beam concreting and it is required for flooring, road pavement for these careful finishing is required.

Surface finishes may be classified under as following

1. Formwork finishes
2. Surface treatment
3. Applied finishes

*FOUNDATION*

It is part of structure which transmits the weight of the structure to the ground. All structures are constructed on land is supported by foundation and therefore it may be known as connecting link b/w structure and ground. The foundation should designed such that -

1. Soil below does not fail in shear
2. Settlement is within the safe limits

***CLASSIFICATION OF FOUNDATION:-***

1. *Shallow foundation* – It transmits the loads to the strata at a shallow depth.
2. *Deep foundation* - It transmits the load to a considerable depth below the ground surface.

***TYPES OF SHALLOW FOUNDATION:-***

* *Strip footing* - It is provided for load bearing wall and also provided for row of columns which are closely spaced that their spread footing overlap or nearly touch each other. It is also called continuous footing.
* *Spread or isolated footing* - It is provided to support an individual column. A spread footing may be circular, rectangular or circular of uniform thickness.
* *Combined footing* - It supports two columns .It is used when two columns are very close to each other that their individual footings would overlap. It may be rectangular or trapezoidal. It is also provided when spread footing is ecentrically loaded.
* *Strap or cantilever footing* - It consists of two isolated footings connected with a structural strap or a lever. The strap connects two footings such that they behave as one unit. The strap simply act as connecting beam and does not take any soil reaction. The

strap is designed as a rigid beam. Individual footings are so designed such that their combined line of action passes through the total load.

* *Mat or raft foundations* - It is a large slab supporting a number of columns and walls under the entire structure or a large part of structure. A mat is required when allowable pressure is low or where columns and walls are so close that individual footings would overlap or nearly touch each other.

Mat foundation is useful in reducing the differential settlements on non – homogeneous soils or where there is large variation in the loads on individual columns.

***TYPES OF DEEP FOUNDATION :-***

* *Piers*

*Drilled pier* – it is a large diameter concrete cylinder built in ground. For construction of a drilled pier, a large hole is drilled in the ground and is filled with concrete. A drilled pier is constructed to transfer heavy axial or lateral loads to a stratum below the ground.

* *Caisson* – it is foundation having shape of like hollow prismatic box, which is above ground level and then sunk to required depth as a single unit .It is water tight chamber used for laying foundation underwater. It is of three types

a)open b)neumatic c)floating caisson

* *Pile* – it is a slender structural membrane made of steel, concrete or wood. A pile is either driven into soil or formed in situ by excavating a hole and filling it with concrete.

***CLASSIFICATION OF PILES :-***

1. *End bearing piles* – transmit loads through bottom tips. Such piles act as columns and transmit load through weak material to a firm stratum below
2. *Friction piles* – transmit loads through skin friction b/w embedded pile and surrounding soil. They are used when hard stratum does not exist at reasonable depth.
3. *Combined end bearing and friction piles -* transfer loads by combination of end bearing at bottom of pile and friction along the surface of pile shaft
4. *Bored Cast in situ pile -* pile formed within the ground by excavating or boring a pile within it , with or without the use of a temporary casing and subsequently filling it with plain or reinforced concrete. When casing is done permanently it is known as cased pile and if casing is removed then it is called uncased pile.

***SETUP/INSTRUMENTS REQUIRED IN CONVENTIONAL PILING***

1. Bailer.
2. Winch.
3. Tripod setup.
4. Pile casing.
5. Casing cap.
6. Treme pipe.
7. Treme top.
8. Depth measuring chain.
9. Reinforcement cage.
10. Gas/LPG cutter & welder.
11. Transit Concrete Mixer.
12. Hopper bottom.

***PROCEDURE OF CONVENTIONAL PILING:-***

1. Piling work is done in accordance to the latest revision of IS: 2911 (Part 1/Section 2).
2. First centering is done for the pile & winch is placed properly; thereby the bailer is loaded on the axle.
3. The bailer is dropped from certain height so that the bailer enters the soil and at the same time the casing is also made to enter the soil using the bailer.
4. The bailer has a slush pump below it & has a cutting tool.
5. The casings were of two sizes namely 600mm & 550mm diameter; the casing thickness being 16mm.
6. The casing is entered one after the another using casing cap preventing its damage up to a depth from where it can be lifted up easily & below which side wall doesn’t collapse easily
7. After the underlying weathered rock is reached 3D socketing of the pile is done (where D is the diameter of the pile) within that.
8. Now the reinforcement cage is entered into the pile cavity.
9. Cover blocks are provided on the lateral stirrups which are on the outer face of vertical reinforcements & on the inner face of vertical reinforcements stiffeners are provided in the form of rings.
10. Now the treme pipe is entered within the reinforcement cage for pouring the concrete from the transit concrete mixer.
11. Proper greasing of the thread is done for the treme & casing.
12. The concrete is poured & at the same time the treme pipe is lifted.
13. Concrete required for these types of piles is about 0.2 m3 per meter depth of the pile.
14. Concrete is made to flow above the pile & fresh concrete must be above the pile cutoff level.
15. Dowel bars projecting from piles shall be 100mm beyond the pile cut off level.
16. Now the treme pipe is removed & excavation of the casing should be done preventing necking or shearing of the concrete.
17. Precaution must be taken so that the spacing of the piles is more than 2.5D (where D is the diameter of the pile).
18. Pile cut off level is 50mm above the bottom of the bottom of the pile cap.

***PILE TESTING:-***

*Objective:-*

The Objective of these tests was to ascertain if the piles were well formed and have the desire length.

The following tests are performed on piles -

1. *Pile Integrity Test*:- 10% of the working piles is to be tested for this test. A probe is inserted through the pipe used for ultrasonic testing of the pile. The homogeneity of the concreting & its properties are known from this test. Also the depth is also measured using this test for working piles.
2. *Pile Load Test (As per IS: 2911 Part 4-1985):- Factor* of safety for this test is 1.5.The compressive load to be resisted for each pile is 100KN for 550mm & 120KN for 600mm during working conditions & tested for a factor of safety of 1.5.
3. *Lateral Load Test*:- The lateral load to be resisted for each pile is 5KN for 550mm & 6KN for 600mm during working conditions & tested for a factor of safety of 1.5.
4. *Pull Out Test:-* The lateral load to be resisted for each pile is 30KN for 550mm & 35KN for 600mm during working conditions & tested for a factor of safety of 1.5.

*PIPE CONVEYOR*

We also witnessed the pipe conveyor are which falls under Raw Material Handling System. The following were the *Technical details* of pipe conveyor-

1. Type of Foundation – Piling
2. Total nos of Piles – 168nos
3. Total length of Pipe Conveyor – 1560.941mtr
4. Dia. of Conveyor pipe – 300mm
5. Total RCC – 1091 cubic mtr
6. Thickness of belt :- Top – 06mm

Bottom – 06mm

1. Belt width – 1100mm

Speed – 2.5m/s

Speed – 2.75m/s (for crusher house)

1. Gallery :- 59nos :- span of 20 mtr – 53 nos

span of 16 mtr – 03 nos

span of 12 mtr – 03 nos

1. Bridge :- 04nos :- span of 50mtr [T1-T2]

span of 32mtr [T5-T6]

span of 52mtr [T31-T34]

span of 61mtr [T47-T50]

1. Total no of Trestle :- 64nos

Two Leg Trestle - 39 nos.

Four Leg Trestle - 25 nos.

1. For iron ore:- total length – 1329mtr

CP3 to KTP2

Capacity - 200tph

1. For coke:- total length – 1450mtr

Cp3 to ktp1

Capacity – 600tph

1. Weight :- Conveyor Gallery – 490.229mt

Trestle - 303.009mt

Portal frame - 101.969mt

Bridge - 205.574mt

*TOTALWT.* - **1100.858**mt

1. Total nos of Idler frame – 4146 nos (without bridge)
2. Total nos of Idler – 24876nos
3. Total nos of welding machine working - 12nos

***Salient Features of Pipe Conveyor:-***

* The pipe conveyor resembles a troughed belt conveyor at its tail end where the material is loaded.
* Thereupon the belt is made to pass over a series of transition idlers of varying troughing angles to form the pipe shape.

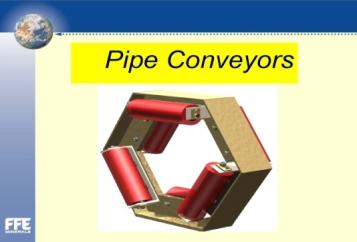
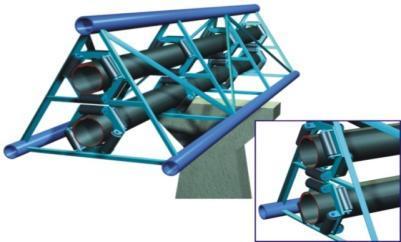
***Advantages and Application of Pipe Conveyor:-***

* + Pipe Conveyor can be used for all application from small, compact units within a plant to long overland conveying systems. Generally a reasonably long Pipe conveyor has the following advantages over conventional conveyors as:
  + Transportation of material over long distance in a single flight thereby eliminating elaborate and costly transfer towers, drives, dust collecting systems & reduce particle degradation.
  + Compact design with low space requirement and minimized foundation needs.
  + Maximum protection of material and environment by almost spillage free transportation.
  + The inherent capability of negotiating vertical and horizontal curves at complex 3-D plane with high angle conveying up to max. 300 uphill side and 100 on down hill side
  + Material transport in the upper and lower strands in both directions at the same time even with different kinds of material.

***USES OF PIPE CONVEYOR :-***

1. For transporting coke from existing plant to new site.
2. Transporting Lump & Flux from new RMHP to existing blast furnace.
3. To reduce fines generation and to tackle rough terrain.

Some Snaps :-



*Blending Bunkers (silos)*

Blending bunkers otherwise known as silos used to temporarily store coal in raw material handling system. This looks same as general bunkers except its foundation start from ground level.

This area also falls under Raw Material Handling System. The following things were seen at silos –

* The main foundation was Pile Foundation.
* Over the pile foundation Pile cap was constructed and the assembly was extended as a Mat Foundation.
* The mat foundation was assumed as a large footing extending over a large area for both practical and design purposes.
* Mat foundation was used because the design indicated high proximity of adjacent columns, i.e. they were almost overlapping.
* The advantage of Mat Foundation here is that it distributes the loads efficiently thereby reducing the differential settlement of the loaded structure.
* Also, the reinforcement was extremely dense and it was tri-layered.

***Technical information:-***

Type of foundation – piling

Total no of piles – 587

Average depth of piles – 22 to 25mtr

Total vol. of concreting (PCC) – 2250 m3

Dia. of rod for PCC – 25mm

Depth of concreting – 1.2mtr

Total no. of columns – 129nos

Dimensions of column – 1m x 1m

Dia of rod used for column – 32mm

Nos of rod used in column – 10 to 12 (each face)

Total nos of circle – 12

Dia of each circle – 10mtr

Column provided at each circle – 06

Capacity of each bunker – 1250T/1570m3

Bulk Density – 0.8T/m3

Material size – (-)50mm

Moisture – 3%

No. of Outlet – one each

Rod used – Sail and Tata Tiscon

Cement used – ACC

Contractor – Larson & Toubro ltd.

Consultant - Mecon

Machine Used – Boom Pressure (Capacity – 85m3/hr.)

Vibrator

Transist Mixture Machine

***Some snaps :-***

*Wagon-tippler*

For coal coke or ore handling plant wagon tippler arrangement is provided in most of the power plants where bottom discharge wagon are not feasible.

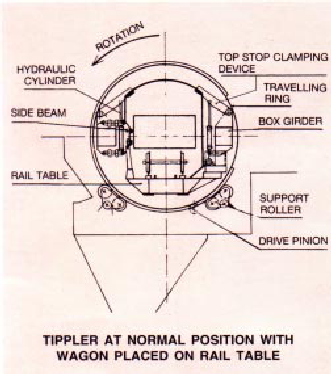
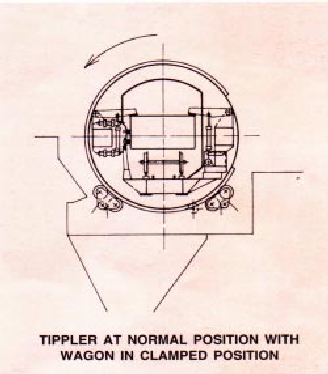
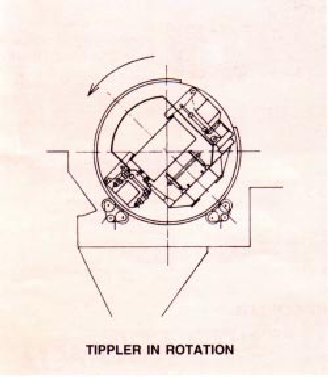
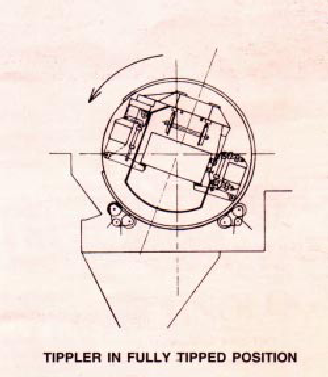
The wagon Tippler designed for unloading broad guage open railway by inverting the wagon to its own centre of gravity through an angle of 1700, thereby discharging its contents into hopper below rail. (The tippler is designed to handle wagons having a gross load up to 110 tones, height from 2,250mm (min) to 3,735 mm (max) and a maximum overall width of 3,500 mm. The tippler ensures handling of wagons, without any damage.

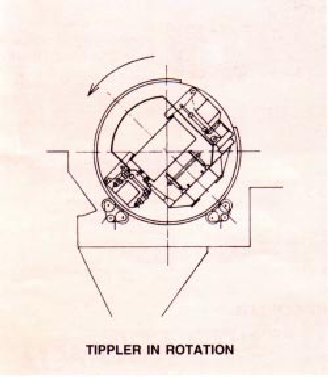
The tippler consists of two circular rings, a platform with travel rails, support rollers, two girders as well as clamping device, which retains the wagon from the top as well as from the side during tippling.

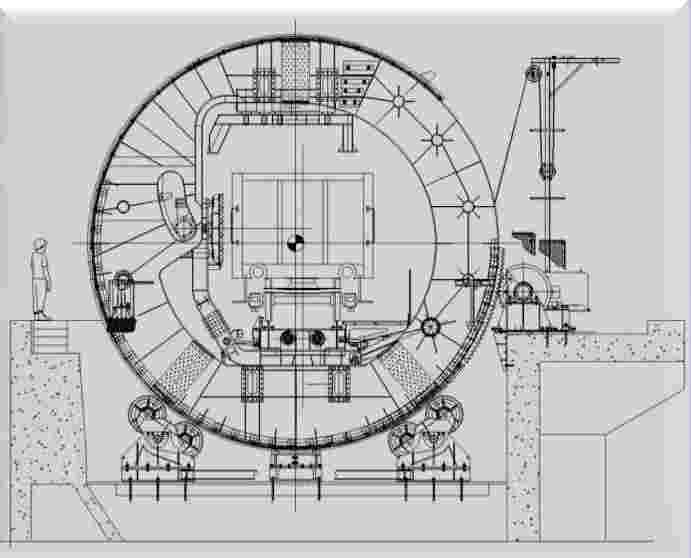
The tippler is driven by a drive unit located on one side of the tippler. The driver unit consists of motor with flexible coupling, thruster operated brake, helical gearbox, pinion and toothed rings. The type of drive is decided on the number of tips/hour required.

The complete hydraulic equipment, including the motor and the oil tank are located on the tippler itself and rotate along with the tippler. Top clamps and side beam are hydraulically operated. Wagon is clamped before tippling operation. The top clamps and side beam are lined with rubber pads throughout the length of the tippler which reduces the pressure on wagon walls.

A loaded wagon is placed on the tippler platform by an in-haul beetle or other means. After correct placement is achieved, the in-haul beetle returns and clears the tippler table. The hydraulic system is now actuated, and the upper and lateral beams rest on the wagon coping and side walls. The hydraulic system incorposrates a pressure relief which balances the pressure of the wagon springs, thus avoiding any damage to the wagon.

The tipping rate can be varied to suit particular plant requirements, up to maximum of about 60 wagons per hour. To achieve a throughput of more than 12 wagons per hour, it is necessary to incorporate integrated wagons handling equipment in the form of a beetle charger.



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*Track hopper*

For coal, coke or ore handling plant Track Hopper arrangement is provided in most of the plants for bottom discharge wagon.

The length of track hopper is 210mtr and depth is approximately 12mtr. There is no pile foundation as the excavation is already approx. 18mtr, so no need to give pile foundation. Two stations named as MB-1 & MB-2 are provided at each end of track hopper to control activities in hoppers. From MB-2 conveyors run to junction house (JO) and rest of the plant.

This complete structure made of concrete is to handle 10,000 tons of Iron Ore Material and to accommodate standing one-third rake of railway wagons (19 wagons).

In this system, the wagons are fitted with automatic gate opening system. The gate operation i.e. opening and closing is actuated by mechanism (rail) along the track. When a wagon content ores or coal enters on track hopper, it’s gate will be opened automatically. Simultaneously, the rack is moving at slow speed. The speed is such that when the wagon travels from entry point to the exit point of track hopper, the contents of the wagon gets discharged automatically by gravity. Thus in this system, the time taken by wagon rack to get unloaded is short.

Below track hopper paddle feeder arrangement will be provided to unload ores or coal from bed to conveyors which is provided just below to bed. Here 4nos of paddle feeder will be provided, two at one end and another two in other end. Each paddle feeder has four wings.

*SINTER PLANT*

Almost all the work of this is being handled by, three company has been the technology supplier for the purpose.

The Sinter Plant is expected to have the following parameters –

* Grating Area – 2x204m2
* Productivity – 1.62 tonnes/hour
* Foundation type - piles
* Total no of piles – 5445 nos
* Total structure –
* Total concreting -

When we went to visit this area it was at an advanced stage of construction where all the substructure work (like foundation etc) had been completed and shop buildings were being erected.



A view of Sinter Plant

***CHIMNEY***

The basic function of a chimney is nothing but, to vent out the waste gases, smoke etc.

The Chimney which we visited was known to have the following parameters –

* Total no. of chimney for sinter plant – 02 nos.
* The height of the chimney was 85m.
* It was built on a raft foundation.
* For the first 56m above the ground, the inradius of chimney was 4.223m and the outer radius was 4.665m.
* For the next portion, i.e. from 56-85m the inside radius was 3.250m and the wall thickness was 250mm.
* The foundation was pile foundation.
* Above the foundation(pedestal), sand filling was done, above which a RCC slab was constructed.
* Above the slab ring beam was constructed.
* The types of bricks used in construction were acid bricks and a heat and acid resistant paint was to be applied.
* To prevent expansion due to high temperatures being involved glass wool was used.
* A 20mm asbestos rope was used to keep the glass wool in position.
* The whole assembly was constructed using slip form.

*COKE-OVEn*

The coke oven is the unit where coal is converted into coke, which is further used as an ingredient in the blast furnace. In the coke oven area following things were observed –

* The foundation was pile foundation.
* The length of foundation was 25m.
* Above the foundation, there were RCC beams over which rails were laid for rail car, which is used to push the coal into the coke oven from one side.
* There were steel pipes which were being laid on the beam, to convey the flue gas.
* Construction joints(expansion joints) were also witnessed.

***Expansion Joints :-***

Any substance has a thermal coefficient of expansion. That is whenever there is a temperature difference a material expands or shrinks accordingly. So, due to expansion stresses are induced on the adjoining structures which may be deleterious for stability of the structure. This area, where the Expansion Project, was going on had a very vast temperature variation(6-50ºC), so provision of these joints was indispensable. The joints were filled with thermocole till the final setting of concrete.Then they are removed by pouring petrol and the lacunae is left.

***Salient Features of Coke Oven Battery :-***

***Features of CDCP (Coke Dry Cooling Plant) :-***

***Facilities of By-product Plant :-***

* GAS CONDENSATION PLANT WITH CHILLED WATER RECIRCULATION.
* AMMONIA REMOVAL AND RECOVERY.
* H2S REMOVAL THROUGH ELEMENTAL SULPHUR ROUTE BY CLAUS PROCESS.
* NAPHTHALENE REMOVAL AND STRIPPING PLANT.
* GRAVEL FILTERS.
* MECHANISED LOADING OF COAL TAR TO TANKERS.
* ELECTRIC MOTOR-DRIVEN EXHAUSTERS.
* ON-LINE OXYGEN MONITORING AT ETP OUTLET (BEFORE EXHAUSTER).

***Chimney Foundation :-***

**Pile foundation** and **mat foundation** is designed for chimney. Above pile foundation, there is mat foundation ( reinforced continuous casted slab). Above mat foundation, there are layered steel supports, each layer being supported by steel **chairs** before casting. Chairs are of different types like triangular bar, box type, truss, z bars etc.



*A view of Chimney Foundation*

Some Snaps :-

 Coke Oven Battery Under Construction

Pile foundation for coal tower



*BLAST FURNANCE*

***Main Units of Blast Furnace:-***

Blast Furnace Proper – 01

Stoves – 03nos (01 stand-by)

Main Control Room,

Pump house & cooling water tank etc.

***Technical Information:-***

*a) For Stove*

*Function –* The temperature of blast furnace is more than 12000c and raw materials coming from other plant have temperature approx 2500c. To increase the temperature of raw materials for blast furnace we use stove. Here 03 nos of stove have constructed. Hot gas and Oxygen are used as fuel in Blast furnace.

* Total no. – 03nos(01 stand-by)
* Total piles - 200nos
* Depth of concreting – 1.2mtr
* Grade of concrete – M25
* Dia of Rod – 32mm
* Dia of stove - 11.2mtr
* Height of stove - 48mtr
* Input temp. of materials in stove – 2500c(appx.)
* Output temp. of materials in stove – 14000c(appx.)

*b) For Blast Furnace Proper*

*Function –* To convert iron ore into pig iron with use of coke, lime stone, dolomite etc as other raw materials.

* Total no. – 01
* Total piles - 603nos
* Depth of concreting – 4mtr
* Volume of concreting – 6400m3
* Grade of concrete – M25
* Dia of Rod – 32mm
* Height of Blast Furnace – 97mtr
* Capacity - 1400m3

During Concreting as the temperature was very high a massive heat dissipation generates, to avoid this, a special type of cooling system was used in which ice was used as cooling agent with help of pipe from each side. The input temperature of cold water from one side is 100c and output temperature is 390c from other side. The maximum limit of temperature during concreting is 710c. Ice and cold water also use during mixing of concreting at the batching plant. This concreting completed in 06 days.

For supporting the blast furnace 4 poster column are also constructed.

Snaps:-

*Stoves*



*Blast furnace proper*