"DESIGN AND PLANNING OF RMC PLANT"

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Abstract— Ready Mix Concrete is a ready-to-use material which is a mixture of Cement, Sand, Aggregate and Water. RMC is a type of Concrete which is mixed in a batching plant according to the specification of the customer and delivered to the site by the use of transit mixer as it is away from the construction site. RMC is a new concreting concept in the Indian Construction industry introduced before one decade. It was initially not adopted by the contractors because it is costly due to its large equipment's and machineries and also due to high tax on RMC and easy availability of manpower at cheaper rate but as time elapsed they understood that in large or medium scale project it is cheaper as it requires less time, less manpower and high strength as compared to Site mix concrete. So, ultimatelyit is time saving and cheaper. RMC is also eco-friendly as it reduces the noise and air pollution because mixing is done in closed chamber as compare to site mix concrete.

I. Introduction

The ready mix concrete plant is used to manufacture ready-mix concrete which is used in all the construction projects. The ready-mix concrete is also known as RMC is a mixture of cement, water, sand and aggregates. It is manufactured in a batching plant as per the required specifications of a construction project. RMC (ready mix concrete) commonly refers to the concrete which is freshly pre-mixed and delivered in unhardened state which can form any shape. It is prepared by mixing cement, gravel, crushed stone, sand, water etc., which depends on the type of the construction project. After the preparation of ready mix concrete, it is then delivered to the construction site through truck or transit mixer which is capable of mixing the ingredients of the concrete while travelling. Manufacturing ready mix concrete and deliveringthrough a transit mixer enables the implementation of precise concrete in the construction project making it sturdy, strong and long lasting.

Fig no.1.1 Layout of RMC plant

What is ready mix concrete?

As the name indicates, Ready Mixed Concrete (RMC) is the concrete which is delivered in the ready- to-use manner.

RMC is defined by the American Concrete Institute's Committee 116R-90

"Concrete that is manufactured for delivery to a purchaser in a plastic and unhardened state".

The Indian Standard Specification IS 4926:2003 defines RMC

"Concrete mixed in a stationary mixer in a central batching and mixing plant or in a truck- mixer and supplied in fresh condition to the purchaser either at the site or into the purchaser's vehicles".

In India, concrete has traditionally been produced on site with the primitive equipment's and use of large labour force. Ready mixed concrete is an advanced technology, involving a high degree of mechanization and automation. A typical RMC plant consists of silos and bins for the storage of cement and aggregates respectively, weigh batchers for proportioning different ingredients of concrete, high efficiency mixer for thorough mixing of ingredients, and a computerized system controlling the entire production process. The quality of the resulting concrete is much superior to site-mixed concrete.

History

Ready mix concrete was first patented in Germany in 1903; its commercial delivery was not possible due to lack of transportation needs. The first commercial delivery was made in Baltimore USA in 1913.The first revolving drum type transit mixer was developed in 1926. In 1931, a RMC plant was set up for the construction of Heathrow airport, London. In the mid 90's there were about 1100 RMC plants in UK consuming about 45% of cement produced in that country. In Europe in 1997 there were 5850 companies producing a total of 305 million cusecs of RMC. In USA by 1990, around 72% (more than 2/3rd) of cement produced was being used by various RMC plants. In Japan first RMC plant was set up in 1949. By 1992 Japan wasthe then largest producer of RMC, producing 18196 million tons of concrete. In many other countries of the world including some of the developing countries like Taiwan, Malaysia etc, RMC industry is well developed.

Development in India

In India RMC was first initially was used in 1950 during the construction sites of Dams like likeBhakraNangal, Koyna. At the construction the transportation of concrete is done by eithermanually or mechanically using ropeways &buckets or conveyor systems. RMC at Pune in theyear 1991. However, due to various pit falls and problems this plant did not survive for long and was closed. Within a couple of months in the year 1993, two RMC plants were set up in Mumbai to commercially sell RMC to the projects where they were installed. Unitech Construction set up one plant at Hiranandani Complex and Associated Cement Companies set up another plant at Bharat Diamond Bourse Commercial Complex. The first concrete mixed off site and delivered to a construction site was effectively done in Baltimore, United States in 1913 just before the First World War. The increasing availability of special transport vehicles,supplied by the new and fast growing automobile industry, played a positive role in the development of RMC industry.

Advantages of Using Ready Mix Concrete Plant

Ready mix concrete plant being on-site concrete mixing plant, enables precision of the mixture and reduces worksite confusion. Before, the concrete was prepared manually, but now it is being prepared using computer controlled operations which is known as ready mix concrete plan having many advantages, some of them are given below:-

1. Facilitates speedy construction through programmed delivery at site and mechanized operation with consequent economy.
2. The ready mix concrete plant decreases labour, site supervising cost and project time. Italso helps in proper control and economy over the raw material used which results in savings.
3. As the ready mix concrete plant is totally computerized, it guarantees the delivery of consistent ready mix concrete. The concrete mixed in ready mix concrete plant is not only consistent but accurate in quality and is manufactured as per the proportion of water and other material specified.
4. The ready mix concrete plant minimizes the cement wastage as it manufactures concretein bulk quantity.
5. The ready mix concrete plant is a centrally located factory on site and so can maintain dust free atmosphere which prevents pollution.

II. LITERATURE REVIEW

A. *Paper 1:*

Title of the paper: Criteria for production control of RMC.

Authors: Building Materials & Technology Promotion Council, etal (2012).

The document includes Requirements for the Production Control of Ready-mixed Concrete. The criteria follow the provisions in various Indian Standards on cement, concrete and other material ingredients. The criteria shall be applicable to jobs following specifications of Bureau of Indian Standards as also those of the Indian Roads Congress and Indian Railways Standards. The requirements completely exclude operations such as placing, compaction, finishing and curing of concrete, which usually come under the jurisdiction of the contractor/builder.

Findings: This paper gives various controls on quality of incoming raw material and its proper selection.

B. *Paper 2:*

Title of the paper: Costing of doing business for RMC

Author: Emory Martin, etal (2015).

The major objective of any business is to realize a profit. One of the most important aspects offinding these profits is to keep an accurate account of all costs incurred in the plant operation.In the concrete business, not only are plans needed for the activity of production, the sequence of operations, the quality and quantity of the product, the method and place of performance of labor, but also equally adequate plans are required for the important costs to be incurred. Not only is it necessary to plan production, delivery and administrative functions, operation by operation, but it is also necessary to plan costs, operation by operation.

Findings: This includes cost of associated with each phases of operations i.e. production, delivery and general administration.

C. *Paper 3:*

Title of the paper: A review paper on factor affecting RMC delivery pattern

Authors: Sohail Afzal, Zishan Raza Khan, etal(2018).

When concrete is ready in plant, the next step is its transportation. For transportation, concrete mixes are collected in the trucks. To deliver concrete mix on time one has to plan the routing and scheduling for the trucks. Delays and hauls caused by traffic conditions, long distance, time split and other factors results in loss of concrete. As soon as the truck is loaded it should be immediately dispatched to the site. RMC delivery is also affected by skill of the crew especially the driver. To perform a successful delivery of concrete persons involved at each level of production, dispatching and transportation should be in proper sync

Findings: It includes factors that affect delay in transportation along with shoulders.

D. Paper 4:

Title of the paper: Costing of the production and delivery of RMC

Authors: Al-Araidah,A-Mamani,N-Mandhavi,R-Fouad, etal(2012).

The paper presents a model for costing production and transportation of ready-mix-concrete (RMC) based on type of the mix and customer site information. The on-floor cost of the mix is based on the type of concrete and is estimated using activity based costing (ABC). The cost of transporting RMC to customer's site is obtained as a function of traveling distance, traffic factor, and demand. Volume based discounts, penalty for late delivery, and cost of mix spoilage are considered. Moreover, the paper provides a cost ground for improving the RMC production system using activity based management (ABM) to improve the financial performance of the company or project.

Findings: This paper presents a model for costing of production and transportation of RMC.

E. Paper 5:

Title of the paper: Best feasible transport route analysis for delivering RMC

Authors: Meghna Jadhav,Karthik Nagarjun,Raju Narwade, etal(2019).

From past few decades, research shows that, to fulfill the client's demand for RMC, along with concrete properties, its delay in transportation affect the project economy. Hence a pre-planned well effective and efficient route analysis is the client's requirement. To overcome these drawbacks, the objective of this research is to identify the best feasible route in that region to optimize the RMC travel time. To achieve this target, data collection and simulation of variousroutes from RMC plant to construction site is carried out with the application of using top sheet, satellite image, shape files etc. This research gives an effective solution in a satellite view format and in-depth analysis to identify best possible route, considering various RMC delay causing parameters.

Findings: This paper helps to locate ideal location of RMC plant and best feasible route.

F. Paper 6:

Title of the paper: A ready mixed concrete: a resource efficiency action plan

Author: Dr. Andrew Dunster, etal (2014).

The REAP is aimed at assisting and supporting the wider construction industry, especially the organizations involved with the specification, procurement, manufacture, distribution, installation, maintenance and deconstruction of ready-mixed concrete components. This will play a part in enabling the industry to make the best use of materials, water and energy over the whole lifecycle of built assets to minimize embodied and operational carbon. The aim is to:

• Minimize materials consumption and waste. • Minimize waste to landfill. • Reduce environmental impact (water and CO2) in production and use.
• Maximize reuse, recycling and recyclables.

Findings: It gives various techniques to minimize the waste to landfill and increases reuse andrecycle.

III. OBJECTIVES

1. *To find area of study in proposed project.*

As the requirement of RMC is increasing with rapid growth in construction industries. Hence it is necessary to find area where the RMC plant is required to workout cost-benefit ratio.

2. *Analysis demand for RMCAnalysis of demand of RMC*

plant can be done by visiting developing areas where the large amount of concrete is required and also Ready-mixed concrete is used in construction projects where the construction site is not able or willing to mix concrete on site.

3. *Selection of site*

Selected site should have enough are to setup a RMC plant and site should also be consideredas per different parameters such as environmental, technical, geological and economical.

4. *Selection of RMC plant*

As RMC plant comes in very different types so it is necessary to select proper type of plant considering usage and cost to be required.

5. *Preparation of site layout*

As per the capacity of RMC plant site layout should be prepared for suggesting proper place for different units to increase effectiveness and decrease wastage of place.

6. *Selection of Material*

There are different kinds of material comes in market for preparation of RMC plant. Hence selection of proper material is required to achieve required strength with the minimum cost.

7. *Preparation of mix design*

Mix-design is very essential part of RMC plant. Appropriate amount of material along with mixing techniques helps to achieve required strength.

8. *Cost Analysis*

Cost analysis will gives rough idea for the inflow and outflow of cash. Benefits obtained fromthe RMC plant can be identified. Thus cost analysis will helps to arrange initial investment forsetting up plant in proposed area.

FLOW-CHART OF METHODOLOGY

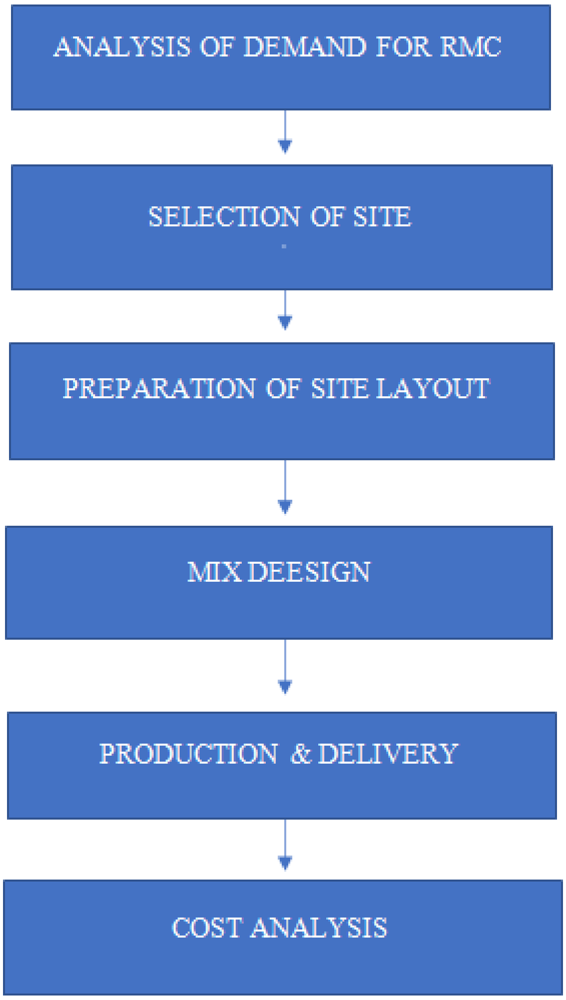

Fig no. 3.1 Flow-chart of Methodology

IV. ANALYSIS OF DEMAND FOR RMC

General : Demand analysis is a research done to estimate or find out the demand for aproduct or service in a particular market. Demand analysis covers both future and retrospective analysis so that they can analyse the demand better and understand the product/service's past success and failure too.

A Survey was carried out for this project, at under developed area in Ambernath.

Purpose of Survey:

Following are the purposes of Survey carried out:

- To determine the number of under construction project in selected area.
- To obtain information regarding the building.
- To calculate the total amount of concrete to be required for the successfully completionof the project.
- To obtain information about existing supply of RMC.
- To find out the problems and delays due to existing supply of RMC and ensuring theirimprovement in the proposed project.

Methodology of Survey

Ambernath is the area under consideration for the survey of this project.

Site survey war carried out in order to obtain information regarding the number of constructions going on in selected area, total amount of concrete requirement, obtain information about existing supply of RMC and problems faced by the site engineers.

Selection of area

From the survey we have found that inside ambernath there is no ready-mix plant existed and the nearest ready-mix concrete plant is at shahad kalyan. Causing sometimes delay in concretesupplies and hence affects in quality of concrete.

Survey Report

NAME OF BUILDING	NO OF BUILDING	NO OF STOREY	FLOOR TO FLOOR HEIGHT (mm)	SLAB THICKNESS (mm)	CONCRETE (cu.m)
PATEL PRESTIGE	3	10	2.8	120	9900
SHIVSHAKTI GREENS	4	10	2.8	150	14500
LANDSCAPE HERITAGE	2	7	3	130	6700
THARWANI MONTANA	4	7	3	150	12000
ROYAL CASTLE	3	6	2.8	130	8500
NEELKANTH ROYALPALMS	2	6	2.8-3.0	120	6000
OM RUSHIKESH	1	5	3	150	1800
BAGARI BUILDERS	2	8	3	130	8500
PATEL RPL REALITY	2	5	2.8-3.0	120	4700

Table no 4.1 Survey Report

Calculation to work out requirement of concrete batchingand mixing plant

Calculation is done as per IRC:SP:96-2012 to work out requirement of concrete batching andmixing plant.

Quantity of concrete required = 72600 cum

Approximate time completion of the project say 24 months.

Assume number of working months = 16 months

Number of working days per month = 20 days

Number of working hours per day = 10 hours

Total working hours of plant = 16x20x10 = 3200

Quantity of concrete required to be produced per hour = 72600/3200 = 22.69 cum

Assuming the efficiency of the plant is 80%

Quantity of concrete required to be produced per hour = 22.69/0.80 = 28.36 cum

Next available capacity of Concrete Batching and Mixing Plant = 30 cum/hr.

Hence, there will be requirement of one number concrete batching and mixing plant of capacity

30 cum/hr for producing concrete of 72600 cum for the project.

V. TECHINICAL DETAILS OF READY-MIX CONCRETE PLANT

General: Technical specification contains all the technical details of all the Ready-mixconcrete plant components including mixer, storage, silos, conveyor etc.

Information from the various RMC plant suppliers we visited.(As per the requirement of the concrete required plant size is 30 cum/hr)

Name of supplier	New Engineering Works	Jayem MFG. Co.(P) Ltd.	Amruta Infrateh Pvt. Ltd.	Maxmech	KI Conequip
Location	Navi Mumbai,Maharashtra	Ahmedabad,Gujrat	Bhatinda,Pujab	Noida,Delhi	Ambernath,Maharashtra
Mixer type	Twin Shaft Mixer	Pan Mixer	Twin Shaft Mixer	Twin Shaft Mixer	Twin Shaft Mixer
Weight Hopper	4 nos. of 7.5 m^3 each	4 nos. of 4 m^3 each	4 nos. of 4 m^3 each	4 nos. of 4 m3 each	4 nos. of 7.5 m^3 each
Silos	Cement and flyash silos of 100MT each	Cement and fly ash silos of 100 MT each	Cement and fly ash silos of 100 MT each	Cement silo of 100 MT	Cement silo of 100 MT
Conveyor	Screw Conveyor Output Capacity:60 TPH	Screw Conveyor Output Capacity:40 TPH	Screw Conveyor Output Capacity:60 TPH	Screw Conveyor Output Capacity:50 TPH	Screw Conveyor Output Capacity:40 TPH
Cabin	Prefabricated Insulated control cabin 5ft x 6ft x 6.25ft	Prefabricated Insulated control cabin 5ft x 6ft x6.25ft	Prefabricate d Insulated control cabin 5ft x 6ft x 6.25ft	Prefabricate d Insulated control cabin 5ft x 6ft x 6.25ft	Prefabricated Insulated control cabin 5ft x 6ft x 6.25ft
Control system	PLC Based Automatic Panel System with Fully Computerized Printing Facilities.	PLC Based Automatic Panel System	Fully automatic control system HMI	PLC Based Automatic Panel System	PLC Based Automatic Panel System
Total Price	32,40,000 + 18% GST +Transportation charges	30,00,000 + 18% GST +Transportation charges	35,00,000 + 18% GST +Transportation charges	38,00,000 + 18% GST +Transportation charges	50,00,000 + 18% GST +Transportation charges

Table no. 5.1 Quotation of RMC for 30 cum/hr capacity from different suppliers

Selection of supplier: From the above quoted rates **New Engineering Works** is selected asplant supplier for the following reasons.

1. Supplier is near to the site so transportation charges will be less.
2. If there will be any problem in the equipment it will be easy to contact supplier
3. Cost quoted by the supplier are appropriate as per the planning.
4. Supplier is working from many years and have reputation in batching plant industry.

Details of Supplier: NEW ENGINEERING WORKS

Specialist in Designing & Manufacturing of Concrete Batching Plants, Brick Plants, Cement Silos, Belt Conveyors, Material Handling Systems, Bucket Elevator, Transit Mixer and Other ConstructionMachineries.

Email: newengineeringworks@rediffmail.com

Plot No: L-84, MIDC Taloja, Navi Mumbai -410208

Tel- 02227411239/59

Specifications

Capacity	30m3/h
Mixing system	Twin-shaft concrete mixer
Aggregate feeder	Belt conveyor
Discharging height	4200mm

Table no. 5.2 Specifications

Batching Plant

Discharging volume	500L
Charging volume	750L
Mixing cycle	60s
Max. mixing size	Φ100/80mm

Table no. 5.3 Batching Plant

Aggregate batching machine

Storage bins quantity	4 sorts
Aggregate scale hopper	800L
Aggregate feeding to mixer by	Belt conveyor

Table no. 5.4 Aggregate batching machine

Cement storage and feeding system

Cement silo capacity	10t
Cement silo capacity	100t
Screw conveyor diameter	Φ291mm

Table no. 5.5 Cement storage and feeding system.

Technical Details and Specifications

Mixer:

Twin Shaft Mixer: A twin shaft mixer has two parallel horizontal shafts with end scrappers. The mixing technique is similar to single shaft mixer, but due to high degree of turbulence developed in the intersection zone of the two mixing circles, better mixture homogeneity is effectively achieved with minimum mixing time. Additionally, due to the design of the twin shaft mixer and build-up of the mix between the shafts, wear is considerably reduced as compared to single shaft horizontal mixer and pan type mixer. Because the mixing occurs in free space above the mixer floor, the wear on the liner plates are very low. Only thirty percentof the tiles or liners are subjected to wear. Hence maintenance cost is low. The powerful twin-shaft mixer, with counter rotating shafts, delivers fast and homogeneous mixing action, and rapid, complete discharge and handles mix designs with coarse aggregates may be up to 150 mm size. Twin shaft mixers are used for production of large quantities of concrete in a very short time period. They are also commonly used for mixing high strength concrete. Twin shaftmixers up to 240 cum per hr. are available.

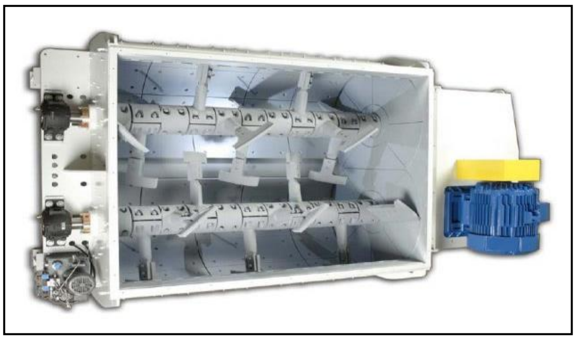

Fig no. 5.1 Mixer

Specifications

Vibrated yield 500 litres per cycle with hydraulically operated discharge door with mixing blades in anti wear steel (hardox) with scraper blades in anti wear steel (hardox) with bottom liners (hardox) with lateral liners (hardox) mixing motor power hp/kw 2x12.4/ 2x9.3 hydraulicpower pack voltage 415v, 3 ph ,50hz electrovalve coil voltage 24v dc mixing blade, 12 scraperblade, 2+2 reduction gears 2 arms at 90 degree sandblasting, undercoat primer and finish paint.

Godown and Storage

Godown Storage: In godown storage type cement is stored in bags. The cement is sent to the cement weighing hoppers using manual feeding through screw conveyor or bucket elevators. There are 4 no. of storage for cement,sand,10mm aggregates and 20 mm aggregates.

Aggregate Storage bins : 4 No. Capacity 7.5 Cum Each

a. Aggregate Bins fabricated with M.S. 5 MM thick Plates with M.S. Channel for thestructures.
b. All Aggregate Bins will be provided with Pneumatic Cylinders and Solenoid Valvesand Cylinder (230v AC).
c. Total capacity of 4 Bins will be 30 Cum.
d. Bottom of Bin for sand / C sand 0.25 Hp vibrators will be provided.
e. The Weigh Hopper will be mounted on 4 Load Cells for weighing Four Aggregates.
f. [River Sand, Crush Sand, 10 MM, 20 MM] Bottom of the Weigh Hopper will beprovided discharge gate, operated with help of
g. Pneumatic Cylinders and Solenoid Valves.
h. The Load Cells will be of Sensortronic make S Type

Fig. no. 5.2 Aggregate storage bins

Silo:

100 MT capacity Cement Silo

Diameter 3200mm with Cone Plate 8mm and one Shell Plate of 6mm &remaining 5mm complete with Monkey Ladder, Railings and round Stiffeners ismc 100x50, vertical also Leg Support Will Be of 8” Nb “C” Class Pipes and cross bracing will be of 4” Nb Pipes bottom legheight 2mtr With feeding & ventilation pipe line with monkey ladder with safety case 1 coat of zinc primer & 2coat enamel painting.

100 MT capacity Fly Ash Silo

Diameter 3200mm with Cone Plate 6mm and one Shell Plate of 5mm &remaining 5mm complete with Monkey Ladder, Railings and round Stiffeners ismc 100x50, vertical also Leg Support Will Be of 8” Nb “C” Class Pipes and cross bracing will be of 4” Nb Pipes bottom leghight 2mtr With feeding & ventilation pipe line with monkey ladder with safety case 1 coat of zinc primer & 2coat

enamel painting.

Fig no. 5.3 silos

Silo Accessories

I. **Butterfly Valve** : 4nos
   a. Model No.: NEW-TECH ISA030BVAB
   b. V2FS 300 MM with Sliding Handle.
   c. Body Type: Aluminum Body.

II. **Aeration Pads** : 4sets
   a. Model No.: NEW-TECH ISA4AP
   b. Pneumatic Aeration Devices to Loosen the Material inside Silo for free flow.

III. **Safety Pressure Valve** : 4nos
   a. Model No.: NEW-TECH ISASTSPV
   b. Silo top pressure relief valve for Safety while Loading.

IV. **Silo Common Dust Filter** : 1 set
   a. Model No.: NEW-TECH ISA25DF
   b. Filter to arrest Residual Dust Max. 25mg/Cum of Air which is Escapes from Silo whileloading & prevents the losses.
   c. Control panels and switch gears for Top filter Vibrator.

Conveyor

Load Out Belt Conveyor to Mixer

a. Capacity 100 TPH.
b. Conveyor Length approx 18 meter
c. Belt Width: 800 MM.
d. Angle of Inclination: 30 Degree.
e. Drive: 5 Hp with gear box.

Fig no. 5.4 Conveyor

Cement Screw Conveyor

a. Screw Conveyor Output Capacity:60 TPH
b. Screw Length: 10 meter.
c. Drive: 9.2 kw Geared Motor.
d. dia screw conveyor 219mm
e. Quantity: 1 Nos.

Fly Ash Screw Conveyor

a. Screw Conveyor Output Capacity:60 TPH
b. Screw Length: 6 meter.
c. Drive: 9.2 kw Geared Motor.
d. dia screw conveyor 219mm
e. Quantity: 1 Nos.

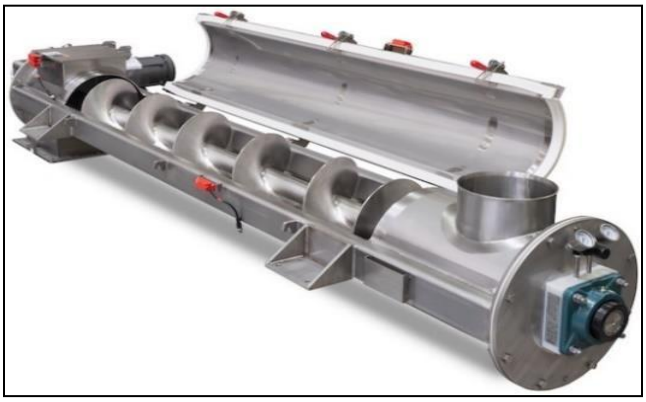

Fig no. 5.5 Screw Conveyor

Admixture Pump with Piping

a. Drive 1 Hp.
b. Add Mixer Jar Cap: 10 Liter with li Pneumatic Valve at the outlet 230v AC.
c. Add Mixer Jar Mounted on Single Load Cell or Pulse Meter.
d. Unit: 1 No.

PLC Based Automatic Panel System with Fully Computerized Printing Facilities.

a. User Friendly PLC System Scada System (Allen Bradely) with all the three mode ofoperation i.e.
   i. Complete Automatic.
   ii. Semi-Automatic.
   iii. Manual Mode of Operation.
b. The accuracy of the system is +/-

1% for Aggregates and 0.5% for Cement Water and Add Mixer.

c. The System is also provided with in-flight corrections and many more additional features.

d. Control Cabin Computer and Printer with Batch Mix Programs will be provided.

PC + PLC Control, vividly display the production process on the screen, so that the Operator can monitor in real time, save the Data of Production Parameters in the Computer, Print Daily, Weekly, Monthly and Yearly Static reports of Production

Other Equipment and MachineryTransit Mixer

Fig no. 5.6 Transit Mixer

Nominal Capacity	6 m3
Geometric Volume	11700 litres
Waterline Volume	7100 litres
Filling Ratio	51.30%
Rotation Speed	0-14 rpm
Length of Mixer	5743 mm
Width of Mixer	2485 mm
Drum Thickness	5 mm
Water tank Capacity	450

Table no.5.6 Details of transit mixer

Wheel Loader

Fig no. 5.7 Wheel Loader

Model	JCB 407
Maximum engine power	48 kW
Shovel capacity	1.0 m^3
Operating weight	4934 kg

Table no.5.7 Details of Wheel Loader

125 kW generator

Fig no. 5.8 125 kW generator

RATING	125 kW
FUEL TYPE	Diesel
MIN-MAX VOLTAGE 1 PH @ 60 HZ	120-240
MIN-MAX VOLTAGE 3 PH @ 60 HZ	208-480
MIN-MAX VOLTAGE 1 PH @ 50 HZ	240
MIN-MAX VOLTAGE 3 PH @ 50 HZ	380-415
GROSS WEIGHT (KG)	3558 kg
NET WEIGHT (KG)	2880 kg
GROSS FUEL (L)	798 L

Lab Equipment

200 T Capacity Compressive Testing Machine : Compression Test machines areuniversal testing machines specially configured to evaluate static compressive strength characteristics of materials, products, and components.

Fig no. 5.9 Compressive Testing Machine

Sieves with Sieve Shaker : Sieve shakers are used for separation and size determination of particles. A typical sieve shaker separates particle by passing them through a series of chambers with mesh filters and agitating the sample in order to obtain complete separation.

Fig no. 5.10 Sieves with Sieve Shaker

Flakiness & Elongation measuring scales : This test is used to determine the particle shape of the aggregate and each particle shape being preferred under specific conditions. The significance of flakiness & elongation index is as follows; The degree of packing of the particles of one size depends upon their shape.

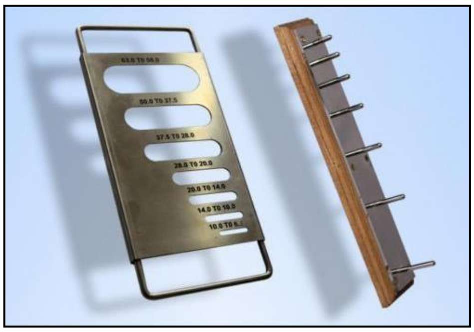

Fig no. 5.11 Flakiness & Elongation measuring scales

30 Kg & 120 Kg Digital weighing scales : A digital weighing scale is the most accurate and precise analog front-end (AFE) instrument that uses force sensors tomeasure the load of an object.

Fig no. 5.12 Digital weighing scales

Sufficient cube Moulds 40 ltr capacity : The cube mould is generally made withcast iron and are used to cast concrete blocks for compression testing. The cube mould is normally made in two halves to facilitate removal of the concrete cube without damage.

Fig no. 5.13 cube Moulds

Accelerated Curing Tank (To get 28 days strength results within 24 hours) : Accelerated Curing Tank is used for concrete testing purposes. Its inner chamber ismade of stainless steel and outer body is made of mild steel which is duly powder coated. It is Suitable for accommodating 6 or 12 cube moulds of 150mm. The temperature can range from 5^{o}C above ambient to 100^{o}C.

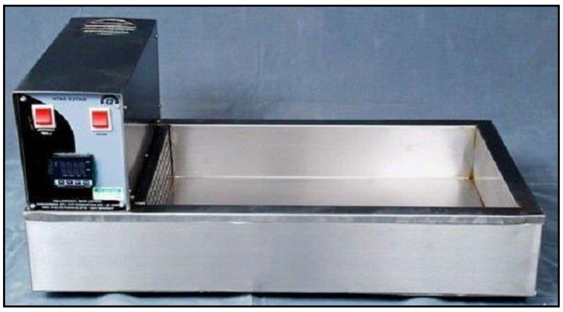

Fig no. 5.14 Accelerated Curing Tank

Penetrometer equipment : Penetrometer equipment used to determine the setting time of the mortar fraction in concrete mixes with slump greater than zero, by testingmortar sieved from mix

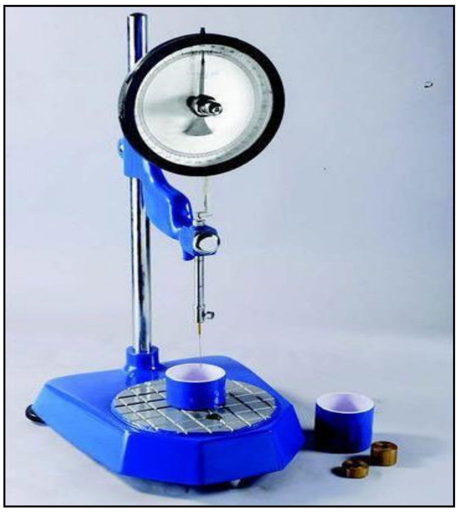

Fig no. 5.15 Penetrometer equipment

Oven : Laboratory ovens are ovens for high-forced volume thermal convectionapplications. These ovens generally provide uniform temperatures throughout. Process applications for laboratory ovens can be for curing, drying.

Fig no. 5.16 Oven

Cement Testing equipment: Cement Testing equipment used to determine the setting time of the mortar fraction in concrete mixes with slump greater than zero, bytesting mortar sieved from mix.

Fig no. 5.17 Cement Testing equipment

Slump cones and tamping rods: The Slump Cone Tamping Rod is used in conjunction with the Slump Cone which is designed to measure the workability of concrete. This is carried out by filling the slump cone with fresh concrete in three layers, tamping each one and levelling to the top of the cone.

Fig no. 5.18 Slump cones and tamping rods

Impact & Crushing Machines for aggregate: Impact & Crushing Machines for aggregate is used to determine aggregate impact value and crushing value of coarseaggregate.

Fig no. 5.19 Impact & Crushing Machines for aggregate

VI. SITE SELECTION

General: Site selection indicates the practice of new facility location for project. Site selection involves measuring the needs of a new project against the merits of potential locations.
For site selection we have referred IRC: SP:96-2012.

Following points should be considered while selecting the site.

a) Availability of aggregates, sand, cement.
b) Presence of electric power source.
c) Depth of water table.
d) Sites for disposal of wastes.
e) Surface drainage.
f) Distance and time of travel between the batch plant site and the work site.
g) Lower congestion- Traffic in and out of the areas at the same time.
h) Area of site.
i) The environmental effect that is noise, vibration, dust, water pollution to prevent any harm to the residents or farm location.
j) Proper water drainage should be provided for smooth functioning of plant.
k) Source of supply of cement and flyash, if specified and its lead.

l) The location should not be flood prone.

Location of site: As per IRC: SP:96-2012 recommendations we fix following site by using Google earth.

Fig no. 6.1 selected site

Site Address: Badlapur-katai road, navare nagar, ambernath east, dist. Thane, Maharashtra.(Latitude and longitude: 19°11'19.7"N 73°12'12.0"E)

Site specifications:

- Selected site area is 2000 sqm. i.e. 40mx50m.
- Away from nearby residency so there will not be any environment effect on residents.
- Good road network available for delivery of concrete.
- Presence of electric source.
- Site for waste disposal is nearby i.e. Ambernath municipality open waste disposal.
- Away from traffic congestion.
- Delivery construction sites are within 5km from the selected area.

Preparation of site layout:

It is easy to set up an RMC plant if you have a necessary idea, investment, and location. These are the simple steps you need to consider before installing an RMC plant.

- Plant location: It is very important to choose the location of the batch plant in outskirts of metropolitan cities.
- Climatic conditions: The climate and weather conditions of the location must also be identified.
- Cost: It is important to plan the budget for the project. RMC plant can require a high cost for installation and production. An outline of the cost needed for the project must be designed.
- Transportation: It is very important to choose a location with transportation facility. It must be a city that has all modes of transportation. If it is in a coastal area, then the manufacturing concrete can be sent abroad and the business can be expanded.
- Profit assessment: The amount of money invested must be obtained through profit. It is necessary to assess the investment in plant construction, equipment, labour, and other factors before proposing a project.
- Machinery and equipment: It is very important to choose quality assured machines and other equipment for starting an RMC plant.

Drawings

- **Plan :** A site plan shows a detailed layout of the whole site.
- **Site layout** : A site layout plan shows a detailed layout of the whole site and the relationship of the proposed works with the boundary of the property, nearby roads and neighboring buildings.

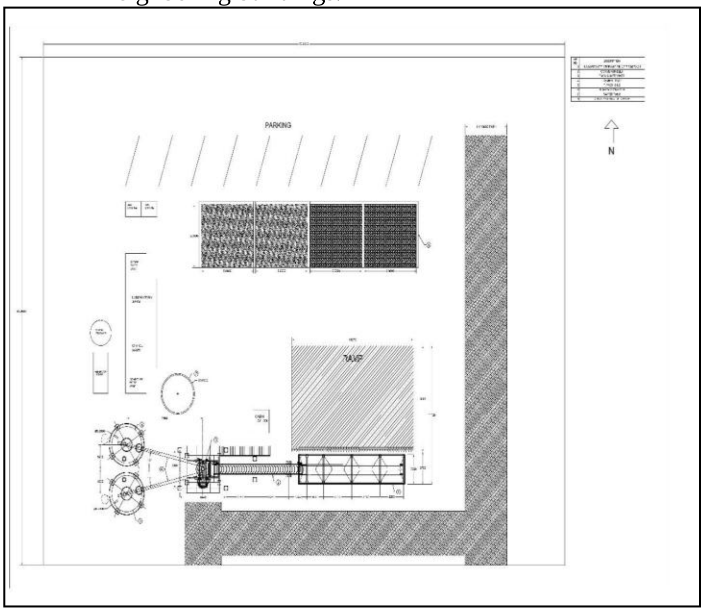

Fig no.6.2 Site Layout Plan

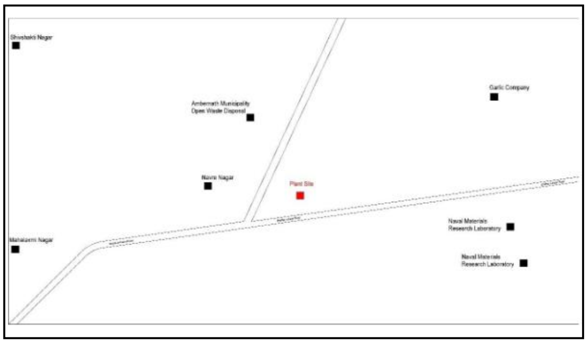

Fig no.6.3 Key Plan

VII. CONCRETE PLANT OPERATIONS AND MAINTANANCE

Principles in Operation of Concrete Batching and Mixing Plant

The following principles govern the operation of modern Concrete Batching and Mixing Plant:

a) The operation should be carefully planned, so that the final product is of a high quality.

b) The operation should be undertaken by a competent manager, and his supporting staff, who are all fully conversant with the plant, its operation and maintenance.

c) The aim should be continuity in operation, avoid break-down and intermittent working.

d) The adequate stock of ingredients must be ensured.

Operations in the Concrete Batching and Mixing Plant

Following are the operations in the Concrete Batching and Mixing Plant:

e) Handling and Storage of the ingredients

f) Batching

g) Mixing

h) Monitoring and controlling the quality parameters through automation

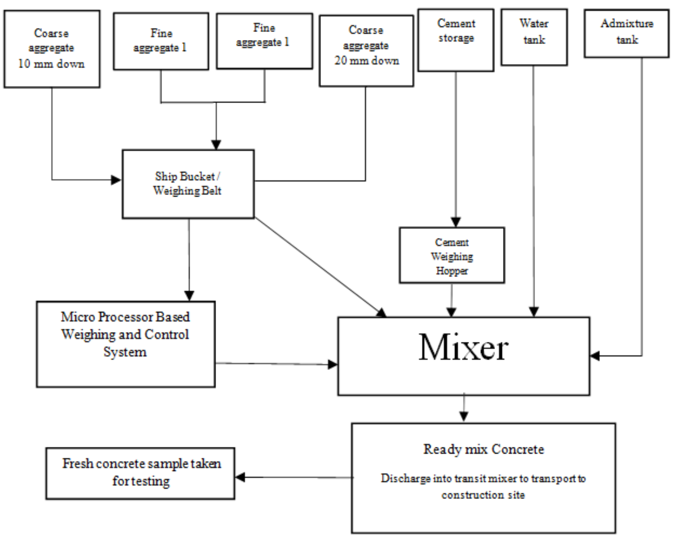

Fig no. 7.1 Flow Chart of Manufacturing Process

Handling and Storage of Ingredients

Proper storage practices are critical to protect material from intermingling, contamination, or degradation, and to maintain consistent aggregate gradation throughout a project. Aggregates have a natural tendency to segregate whenever loaded, natural deposits consist of gravel and sand that can be transported, or otherwise disturbed. Aggregates should be used in concrete after minimal processing. The aggregates should always be handled and stored by a method that minimizes segregation. To produce concrete of high quality, aggregates should be clean, hard, strong, durable and round or cubical in shape. Fine aggregates that are transported over wet, unimproved haul roads can become contaminated with clay lumps. The source of this contamination is usually accumulation of mud between tyres and mud flaps that is dislodged during dumping of the transporting unit. Clay lumps or clay balls can usually be removed from the fine aggregates by placing a scalping screen over the batch plant bin.

The bottom of an overhead charging bin should always slope at least 50 degrees towards the centre outlet. If the slope is less than 50 degrees, segregation will occur as the material is discharged. When a bin is being charged, the material should be dropped from a point directly over the outlet. Material dropped in at an angle or discharged against the sides of the bin will segregate. Since a long drop causes both segregation and the breakage of aggregate particles, the length of a drop into a bin should be kept to a minimum by keeping the bin as full as possibleat ail times. Also, keep storage bins as full as possible to minimize breakage and changes in grading as material is withdrawn. Oversize aggregate should not enter the bin. Oldest cement should be used first. In case, the cement remains in storage for more than 3 months, the cementshould be retested before use and should be rejected if it fails to conform to any of the requirements. Portland cement is a moisture-sensitive material that must be protected from damp air or moisture. Cement not protected when in storage sets more slowly because hydration has already begun; therefore, it has less strength than Portland cement that is kept dry. Cement compartment shall be watertight and provided with necessary air vent; aeration fittings for proper flow of cement and emergency cement cut off gate. Fugitive dust should be controlled during loading and transferring. The dust control system of silo shall be of sufficient size to allow delivery of cement to be maintained at a specified pressure, and shall be properly maintained to prevent undue emission of cement dust and prevent interference with weighing accuracy by the build up of pressure.

Water is generally stored in tanks located close to the plant. An adequate water supply should be provided and when stored on the plant, such storage facilities shall be designed to minimize the risk of contamination.

Most chemical admixtures are delivered in liquid form and should be protected against freezing. If liquid admixtures are frozen, they should be properly blended before they are used in concrete. Long term storage of liquid admixtures should be avoided. Evaporation of the liquid could adversely affect the performance of admixture. Tanks or drums containing liquid admixtures should be clearly labelled for identification purposes and stored in such a way to avoid damage, contamination or effects of prolonged exposure to sunlight (if applicable).

Batching

Batching is the process of measuring concrete mix ingredients either by volume or by weight and introducing them into the mixer. Accurate proportioning or batching of these material as per approved mix design is essential to produce concrete with satisfactory properties. The first step to achieve proper proportioning is to have all the weighing and measuring equipment properly calibrated. With the increasing use of computerized batching equipment, it is now possible to have the computer do the subtraction and print the weights of individual material in cumulative batcher including recognition of the zero reading or tare. Use of load cells to support the batchers has the potential to simplify a scale by eliminating much of the lever system and dial scale that has typically been used.

Typical Batching Tolerances

As per IS:4925-1968, the batching tolerances are as under:

Ingredients	Individual Batchers and Cumulative Batchers Batching Tolerances
Cement and other cementitious material	+ 1 Per cent
Aggregates	+ 2 Per cent
Water	+ 1 Per cent
Admixture	+ 3 Per cent

Table no. 7.1 Typical Batching Tolerances

The following points should be given due care while batching the ingredients.

a) Calibration of batching equipment
b) Isolation of Batching Equipment from plant vibration
c) Protection of Batching controls from dust.
d) Frequent checking and cleaning of scales and beam pivot points.
e) The batching sequence in accordance with the specifications.
f) Measurement of all the ingredients within tolerances.
g) Wind protection sufficient to prevent interference with weighing accuracy.

Mixing

The mixing operation consists of rotation or stirring, the objective being to coat the surface of all aggregate particles with cement paste, and to blend all the ingredients of the concrete into a uniform mass; this uniformity must not be disturbed by the process of discharging from the mixer. When it comes to improvements in concrete properties, mixing technology is as important as concrete composition. A concrete is said to be adequately mixed if the samples taken from different portions of a batch will have essentially the same unit weight, air content, slump, and coarse-aggregate content within the permissible errors. It is decisive, that water, cement and admixtures are evenly dispersed and distributed to a fine scale and that agglomerate (jumbled mass) is sufficiently dispersed. Insufficient dispersing or deagglomeration results in inferior concrete properties. Mixing cycle consists of charging of mixer, mixing of all the components and discharging of the concrete.

Charging the mixer consists of transferring all the weighed or measured material from weigh hoppers and silos into the central-mixer. Aggregates are loaded on conveyer belts. There are no general rules on the order of feeding the ingredients into the mixer as this depend on the properties of the mixer and mix.

The particle movement during mixing in power mixers can be divided into a convective and dispersive transport. Convective transport is a forced, directed movement of larger portion of mix, e.g. by the mixing tool (coarse dispersion).

This is superimposed by disruptive transport. Disruptive transport is the random movement ofthe individual particle due to collision between the particles. This leads to a mixing in small areas (fine dispersion), as well as disintegration of agglomerates.

While in case of free fall mixers, the height to which the concrete climbs against gravity overcomes friction and causes it to fall back towards the bottom of the drum depends upon

following two factors:

Linear Velocity: The greater the linear velocity, the higher the break away point of the concrete. However, if the linear velocity is very high break-away is prevented and the spins full circle in contact with the drum.

Workability of concrete: The coefficients of friction both internal and between the concrete and drum surface, increase with reduction in workability. The lower the workability, the higheris the break-away point.

As the concrete breaks away and rolls onto itself, highly efficient local mixing occurs. The efficiency of mixing operation depends upon the shape and size of vanes (blades) fixed inside the drum.

It is important to know the minimum mixing time necessary to produce a concrete of uniform composition, and of reliable strength. Longer mixing time increases the homogeneity of the concrete discharged up to a point. Also, mixing for long periods of time at high speeds, can result in damages to the quality of concrete, tends to grind the aggregate into smaller pieces, increases the temperature of the mix, lowers the slump, decreases air entrainment, and decreases the strength of the concrete. A secondary effect is that of grinding of the aggregate, particularly if soft; the grading thus becomes finer and the workability lower. Of course, shorter mixing times that still obtain an acceptable homogeneity for a given mixture are desired.

This could determine the best mixer for the application, if the loading method is kept constant. Shortening the mixing time may be achieved by increasing the mixing tool velocity. Further, the maximum flowability decreases with increased tool speed due to increase in the temperature of the mix which increases the water demand.

Therefore, the optimum mixing time should be determined for each concrete mixture before starting a large production. Mixing time generally depends on the workability of concrete mix,type of mixer and its size or capacity, working speed etc.

The discharge from the mixer should be arranged so that it increases productivity (fast discharge), and it does not modify (slow discharge) the homogeneity of the concrete. For instance, if the discharge involves a sudden change in velocity—as in falling a long distance onto a rigid surface—there could be a separation of the constituents by size or, in other words,segregation.

Mixer efficiency is defined as the adequacy of a mixer in rendering a homogeneous product within a stated period; homogeneity is determined by testing for relative differences in physical properties or composition of samples extracted from different portions of a freshly mixed batch. In any mixer, it is essential that a sufficient interchange of material occurs between parts of the chamber, so that a uniform concrete is produced. The efficiency of the mixer can be measured by the variability of the samples from the mix.

Check points during mixing:

1. A non-uniform slump or air content in the concrete throughout the discharge is a sign of poor mixing either due to worn lips or blade or due to excessive build-up of hardened concrete inside the drum.
2. For increasing the output, concrete mixers should neither be overloaded nor be speeded up than the designed capacities and speed. For an increased output, the use of a larger mixer or additional mixers are recommended.
3. Blade wear may adversely affect the mixer performance. Extended mixing time and longer discharge of low slump concrete is usually an indicator of excessive blade wear or blades with excessive hardened build-up. Therefore, for

better mixing action the badly worn blades should be replaced to have uniform mixing, as per recommendation of the manufacturer and hardened concrete should be removed preferably after each day of production of concrete.

4. Mixers and agitators should always be operated within the limits of the volume and speed of rotation designated by the equipment manufacturer.
5. The central mixer is equipped with an approved timing device that will not permit the batch to be discharged until the specified mixing time has elapsed.
6. Mixers are free of hardened concrete.
7. All blades are greater than 90 percent of design height.

Monitoring and Measuring Moisture Content Through Automation

Automatic Moisture Measurement

One of the major problems of inconsistency in batching concrete is the ever-varying moisture content of sand and aggregates from one batch to another. Good storage of the sand and aggregates is desirable. Moisture content in stored sand and aggregates can have effects on the water/cement ratio, the aggregate/cement ratio, yield and the colour of the mix. Measuring the moisture content of the raw material can enable the plant controller to adjust water addition into the mix in real time. This enables batch after batch of concrete to be produced of consistentquality.

The installation of moisture measurement sensors into the manufacturing process or entering moisture data into control panel provides the producer with an on-line system that operates in and enables the accurate control of the water/cement or aggregate/cement ratios. Knowing the moisture level of the raw material allows the producer to accurately calculate not only the amount of water to be added to the mix but also the correct amount of cement and aggregates.This will maintain the quality of concrete with reduction in costs and also the level of rejectedbatches.

Benefits of Monitoring and Control of Moisture Content

i. Consistent batch quality
ii. Consistent batch sizes
iii. Reduction in cement use
iv. Reduction in wastage due to incorrect moisture or slump
v. Reduced mix cycle times

The sensors are used for moisture measurement in concrete production, and are built to survive the harsh environment of flowing aggregates and the turbulence of a concrete mixer. Microwave moisture measurement sensors can be installed in a variety of locations depending upon the individual requirements of the plant. Microwave energy is absorbed by moisture in direct proportion to the moisture present in the material. A microwave moisture sensor can be installed either in or underneath an aggregate bin and measures moisture as the raw material exits the bin. Alternatively, it could be mounted above a conveyor and measure the aggregate as it flows past the sensor head. Measurements may be taken 25 times per second as the material passes over or around the sensor head, meaning that the sensor can rapidly detect changes in moisture levels. There are microwave moisture sensors which have been designed to fit level with the floor and measures moisture and temperature in the mixer.

All sensors connect directly to the plant control system using an analogue output or digital communications. For optimum accuracy of the mixer, sensors will also connect to a water control system, allowing precise control of the water in the shortest possible mixing time. This water control system is a unit that can be connected to a batch control system to easily enable the transfer of mix cycle information. With features such as automatic receipe selection and a colour touch screen display, the unit is designed for simplicity of use and integration into existing control systems. Using the reading from a microwave sensor installed inside a mixer, the unit accurately and continuously monitors, displays and adjusts the moisture levels of the material throughout the mix cycle. Using known recipes, this unit automatically calculates and adds the correct amount of water to the mix. This ensures that the required moisture target canbe easily achieved, batch after batch. For optimum control, measurement in the sands and fine aggregates to provide weight correction is also recommended. Measuring only in the aggregates may provide a solution but greater care is required in ensuring the sensors are calibrated.

Activities before Starting the Concrete Batching and Mixing Plant

I. Check all screws for tight fit and retighten, if necessary
II. Check the mixing elements and the locking of the adjusting elements
III. Check oil level of mixer gearing
IV. Lubricate all lubrication points in accordance with the lubrication chart
V. Make sure that there is no foreign matter in the mixer when it is put into operation
VI. Pan mixer may be charged only while the mixer elements are rotating
VII. Re-check the limit switches at the point of discharge for proper functioning
VIII. The machine should be put into operation not before all the safety equipment's havebeen fitted and is properly functioning
IX. In mixers with wearing plate, the bottom of the mixing pan should be cleaned with thecement sludge before putting into operation.

Manufacturing process of Concrete in R.M.C. Plant

Raw Material used to produce Concrete

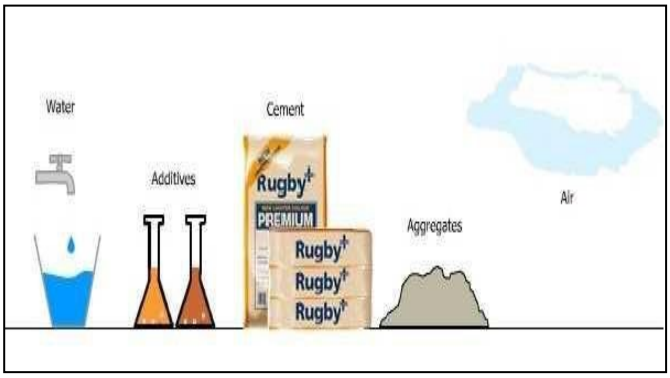

Fig no. 7.2 Raw Material used to produce Concrete

- Ready-mix concrete is made from cement, aggregate and water.
- Aggregate make up majority of the concrete's volume and the cement provides resistance.
- Additives are incorporated into the mix to ensure particular properties such as improved
- durability or shortened hardening times.
- During the mixing phase, we control every step to ensure quality and uniformity.

Raw Materials are:

- Water
- Additives
- Cement
- Aggregate
- Air

Aggregates

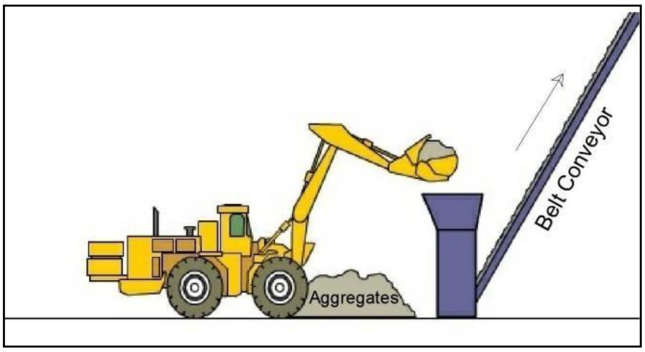

Fig no. 7.3 Aggregates

Aggregates, which make up roughly 60% to 75% of ready mix concrete's volume, are obtained from quarries and aggregate banks.

Additives

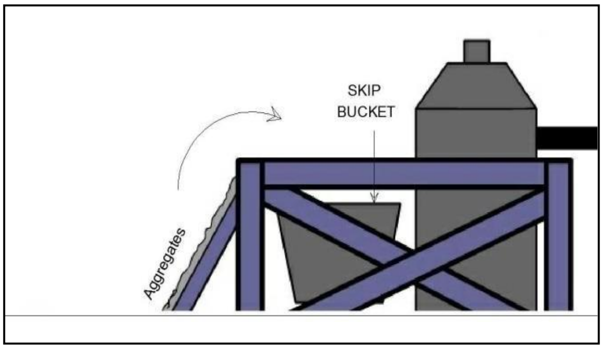

Fig no. 7.4 Additives

- Additives are solid or liquid chemical substance that can be added to ready mix concretebefore or during preparation.
- Most commonly used additives either improve a hardened concrete's durability or reduce a concrete's water content in an effort to shorten setting times.

Water

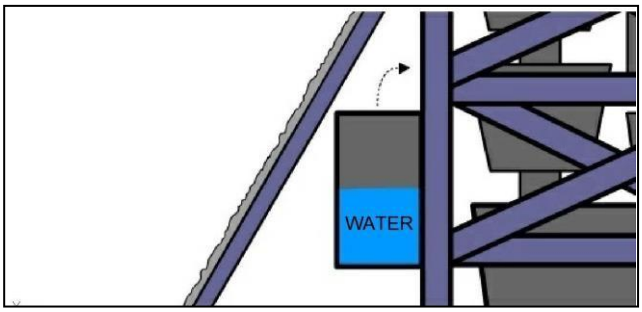

Fig no. 7.5 Water

- This is the mix's vital fluid sets off a chemical reaction when it comes into contact with thecement.

Cement

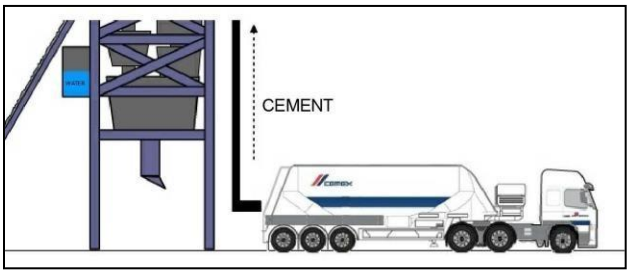

Fig no. 7.6 Cement

- No others material rivals cement's important in the mix; it's the ingredient that gives concrete its strength.
- The most widely used cements are grey Portland type 1 and Pozzolana Portland type 2.

Concrete mixing

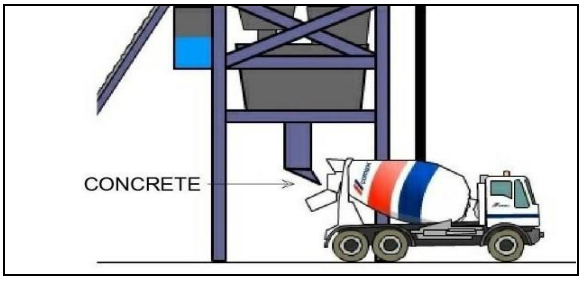

Fig no. 7.7 Concrete mixing

- During the mixing phase, the different components come together to produce a uniformmass of concrete.
- Mixing time is registered from the movement material and water is poured into the cementmixer, and it begins rotating.

Ready to use for site

Fig no. 7.8 Ready to use for site

- While transporting concrete to a site, the cement mixer never stops revolving at a speed oftwo to six rotations per minute.

Maintenance of Plant

The most efficient batch plants produce more concrete with less waste of material, lower repair costs, less downtime, and fewer disruptions in employee productivity. Initiatives such as more thorough quality control, understanding modern needs, and installing and operating concrete recycling systems will reduce waste. Proper maintenance system is to be followed for keeping the plant in efficient condition. The different types of maintenance schedule in concrete batching and mixing plant are as under:

Running Maintenance

- Regular monitoring of the operation of plant/mixer, Conveyor, Feed Gates, DischargeGates, Material transfer points, Batchers
- Spot the problems - Listen the changes in sounds, smell something out of the ordinary,Touch Vibration, Monitor Temperature of Bearings/Reducers
- Housekeeping - Material build up, Access to maintenance points, Clean equipmentmakes repairs easier and quicker
- Safer work environment.
- Earthing of plants to protect load cells

Routine Maintenance

Daily, weekly, monthly, semi annually and annually maintenance are as follows:

Daily Maintenance

- Inspect oil filter on air compressor, drain tank, manifolds and water traps.
- Inspect and fill all oil tanks on plant
- Inspect all V-Belts
- Inspect conveyor belts for alignments and excessive wear
- Check the formation of air pockets
- Check Scales
- Working of Dust Collectors - reclaim material out of dust collectors.
- Requirement of lubricants
- General condition of the equipment
- Inspect all air cylinders
- Drain Pneumatic systems - drain compressor tanks, manifolds and filters.
- Inspect and washout the Mixer

Weekly Maintenance

- Lubricate all bearings including head and tail pulleys on all conveyors, head and tail bearing on cement feeder screws, wheel bearing supports on turn head, aggregate GatePivot Points etc.
- Replace or blow clean air filters on air compressor and aeration blowers
- Inspect and tighten all bolts and bearings, set screws, Pulley- Bushings
- Inspect and/or adjust all belt wipers
- Lubricate packing at the bottom and top ends or the cement feeder screws with oil
- Inspect all bags in cement bag filters
- Maintain all hoppers and doors in clean and efficient working order
- Check mixer blades, paddles or arms for wear and tighten and adjust as necessary
- Remove any cement or concrete build up in the mixer
- Check dust seals on cement hoppers for wear
- Clean load cells on weighing equipment
- Check air lines for leaks
- Check pipe works for leaks and wear
- Check wiring and electrical apparatus for correct operation and overheating
- Routine greasing of bearings and gears
- Check area under plant for spillage and trace the source of spillage
- Clean-up yard, checking whether all drains and traps are clear
- Maintain settlement pits, recyclers and wash down areas in efficient working order
- Check all storage bins and doors for efficient operation
- Check conveyors, boom scrapers and bucket elevators for free running and wear, andadjust as necessary

Monthly Maintenance

- Check Oil Levels in Gear Reducers
- Inspect and tighten Conveyor Belts for wear/tear
- Check hydraulic filters and replace as per manufacturer's instructions or if the conditionof the filter warrants a change
- Change oil in air compressor
- Check calibration of equipment’s for weighing of aggregate, cement, water andadmixture

Semi-Annual/Annual Maintenance

- Change oil in Speed Reducers
- Inspect Dust Collector Bags
- Inspect hanger bearings in feeder screws and replace as needed
- Tighten/Replace V-Belts
- Inspect Auger Flights/Hanger Bearings
- Check Accuracy of Scales/Meters
- Inspect/Clean Structure
- Inspect and/or replace bin aeration pads

Preventive Maintenance (PM)

Preventive Maintenance involves scheduling and performing repair tasks on equipment before it becomes necessary. Preventive Maintenance is required to prevent frequent breakdown of the plant. To attain this objective, the periodicity of the change of spares/minor/major assemblies as recommended by the supplier has to be observed.

Plants where a formalized inspection and maintenance schedule is in place tend to have fewer breakdowns. Preventive Maintenance should be undertaken regularly to identify the condition of bearings, belts, leaky air systems, and filter bags and the defective item may be repaired/replaced before breakdowns interrupt plant operations.

A list of spares for maintenance should be made available at the site. Set up a maintenance programme using Preventive Maintenance software, either stand-alone or as part of batching software. For example, some batch control manufacturers offer an integrated Preventive Maintenance schedule. This provides a very useful way to track parts and equipment and can help with spotting failure trends.

1) *Spare Parts*

- Assessing the inventory of spares/major/minor assemblies
- Follow the recommendation of manufacturer
- Availability of components locally
- Availability of parts at Equipment Manufacturer
- Cost of Parts vs. Cost of Down Time/Overnight Delivery
- Check critical components - Bearings, Load Cells, V-Belts, Solenoid Valves, AirCylinder, Motor Reducers, Electrical Components
- Check running items: Consumable Items, Shrouds, Skirting, Wipers, Filters, and DustCollector Bags

2) *Calibration of Load Cells*

i. The process of calibration is carried out once in a month or as per recommendation of the manufacturer, in the following manner. The calibration is decided based on the per batch capacity. The aim of calibration is to compare the display readings in the digital display unit/computer with standard weights.

ii. There should be sufficient number of standard weights ranging from 1 kg to 50 kg so that there is a sufficient number of incremental weights for aggregate, cement, water oradmixture.

iii. Scales shall have increments as per IS 4926.

iv. 50 percent of the capacity of the weigh batcher has to be added sequentially in a gradual manner. The gradual increase of standard weights should be reflected in the digital display unit/computer.

v. In case of mismatch between the reading of the display unit and the standard weight, calibration of the digital display unit has to be done as per the standard weight loaded.

vi. The process is repeated and the readings rechecked. If there is no match between the readings of the display unit and the standard weights used, then the following points need to be checked.

   a. Installation of the load cells.
   b. Level of weigh batcher.
   c. Free movement of weigh batcher onto the load cell studs,
   d. Proper Input/output voltage of the load cells.

vii. Again, repeat the above process until the correct readings are achieved within the tolerance limits.

viii. Increase the weights from 50 percent to 100 percent of the weigh batcher and repeat the process of incrementally increasing the standard weight and corresponding reading of the digital display unit on the computer screen. The display unit should indicate a zero the moment the standard weights are removed.

Plant Safety

Employees working around conveyors, aggregates and electrical panels are exposed to potential injury, which translates from exposure for the plant operator—to downtime as well as legal liability. Safety features that should be in every plant include emergency pull-cord shutoffs and safety disconnects on conveyor and turn head motors, and confined entry access manholes in aggregate and cement bin compartments. Wherever possible, stairs with handrails are preferred over ladders. Going one step further, certain kinds of automation can keep workers away from harm.

Do's and Don'ts

Do's

- Be familiar with all controls, gauges, instruments.
- Look around before starting the plant and equipment.
- Operate the equipment only from operator's seat/platform.
- Respirators must be worn by all personnel when handling bag or bulk cement.
- Keep operator's platform clean and free from oil and grease.
- The operator must have maximum unrestricted view of the operating area.
- Inspect all cables of plant periodically.
- Ensure mixer motor is turned off before carrying out mixer cleaning or chipping.
- Also turn off the mains power from panel completely
- Check guard on rotating parts and belts.
- Provide additional emergency lightening in case of power failure.
- Check earthling frequently.
- Create awareness regarding safety among staff. Provide proper training to staff onsafety.
- Provide first-aid boxes with adequate supplies.
- Ensure that workers wear personal protection equipment such as helmets, safety belts,goggles, gloves and other items as necessary.
- To handle emergency situations each plant must have siren.
- Use proper tools and tackles.
- Ensure proper and clean platform/pathways for the workers to pass through.
- Provide adequate illumination.
- Provide guards and railings where necessary.
- There should be an emergency switch located at a short distance from the plant, whichwill stop all plant operations in the event of an emergency.
- Lubricate the equipment daily.
- Do keep fast moving parts in store.
- Do ensure that all safety devices are working while the plant is in operation.
- Use antifreeze mixture in the radiator as per the prescribed instructions while workingin frosty conditions.
- Maintain Generator, Monitor Voltage and Frequency.
- Keep the control room clean and remove all unwanted material.
- Keep panel power off while carrying out any welding work in the plant.
- Keep all panels under shelter, water should not enter the panels.
- Remove all material from the plant before shut down.
- Load cell frame should be free during operation and locked when plant is notworking.
- Check the oil level in all gear boxes.
- Proper setting of thrust wheel of drum.
- Greasing of all bearings.
- Ensure belt centre run position.
- Gate opening of all bins should be as per requirement.
- Greasing of bearing and oil checking in all gear boxes.Transit Mixer:
- Caution must be used at the time of reversing the transit mixer.
- Slow speed is recommended when traveling on a construction site. The stability of themixer is greatly reduced with the extra weight of the concrete.
- Caution must be exercised during backing of the transit mixer. Backing should becontrolled by a signalman, positioned so that operator can clearly observe the directions given.
- Secure the discharge chute properly, using the lock provided.

- Make sure the mixer is stopped before making any adjustments.Mobile Concrete Plant:
- Operators must have thorough understanding of the technical manual before operatingthe plant.
- Follow all preventive maintenance procedures.
- Wash out the auger within 20 minutes of the last use.
- Keep the entire body clear from all moving parts.

Don'ts

- Do not permit the operating staff to leave for the day without ensuring daily maintenance so that there is no delay in the start of operation on the next day.
- When hoppers are being charged with a clamshell or loader, personnel should not beclose to the area of falling aggregate.
- Never leave the equipment unattended with its engine running.
- Never permit unauthorized persons to handle the equipment.
- Never operate unsafe equipment.
- Never carry out servicing, adjustment and repairs, when the equipment is running.
- Don't leave the control room, when the equipment is working.
- Avoid loose connections in electrical system.
- Do not overload the engine and the Plant.
- Do not mix various brands of oils.

Mobile Concrete Plant:

- Do not allow any foreign matter in the cement bin.
- Do not allow the waterlines and flow meters to freeze with water in them.
- Do not run the water pump dry.
- Never attempt to repair the machine while in operation (always turn the power sourceoff).
- Never attempt to walk on top of the aggregate bin to cross from the cement bin to thewater tank (use the ladder).
- Never climb inside the aggregate bin (use a small pole to dislodge any aggregate thathas bridged).
- Never enter the cement bin while in operation (there are moving parts inside the bin).

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