

Ready mix concrete assignment



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ASSIGNMENT CONSTRUCTION METHODS AND TECHNOLOGY READY MIX
CONCRETE SUBMITTED TO: SUBMITTED BY: PROF. SACHIN JAIN SONABH

DHARIWAL VARUN GOEL [pic] INTRODUCTION: Ready-mix concrete is a type of concrete that is manufactured in a factory or batching plant, according to a set recipe, and then delivered to a worksite, by truck mounted transit mixers. This results in a precise mixture, allowing specialty concrete mixtures to be developed and implemented on construction sites.

The first ready-mix factory was built in the 1930s, but the industry did not begin to expand significantly until the 1960s, and it has continued to grow since then. Ready-mix concrete is sometimes preferred over on-site concrete mixing because of the precision of the mixture and reduced worksite confusion. However, using a pre-determined concrete mixture reduces flexibility, both in the supply chain and in the actual components of the concrete.

Ready Mixed Concrete, or RMC as it is popularly called, refers to concrete that is specifically manufactured for delivery to the customer's construction site in a freshly mixed and plastic or unhardened state. Concrete itself is a mixture of Portland cement, water and aggregates comprising sand and gravel or crushed stone. In traditional work sites, each of these materials is procured separately and mixed in specified proportions at site to make concrete. Ready Mixed Concrete is bought and sold by volume - usually expressed in cubic meters. RMC can be custom-made to suit different applications.

Ready Mixed Concrete is manufactured under computer-controlled operations and transported and placed at site using sophisticated equipment and methods. Concrete's natural color is gray. Its favored uses are utilitarian. Its very ubiquity causes it to blend into the background. But ready-mix concrete does have one remarkable characteristic: other than manufactured ice, perhaps no other manufacturing industry faces greater transport barriers. The transportation problem arises because ready-mix concrete both has a low value-to-weight ratio and is highly perishable—it absolutely must be discharged from the truck before it hardens.

These transportation barriers mean ready-mixed concrete must be produced near its customers. For the same reason, foreign trade in ready-mixed concrete is essentially nonexistent. This article is an introduction to the basics of the market for ready-mix concrete, focusing mainly on its consumers and its producers in the United States, but with occasional comparisons to other countries when contrasts are useful. **INDUSTRY HISTORY AND BACKGROUND:** Ready-mixed concrete's ubiquitous use as a building material is largely because of two advantages. It is cheap.

It also allows great diversity in design and function, because in its fluid form, it can be poured into molds of any shape. Concrete's weakness, quite literally, is that while it is reasonably strong when bearing compressive (pushing) loads, it is an order of magnitude weaker in its ability to bear tensile (pulling) forces. Concrete was regularly used as a building material throughout the twentieth century, but when the National Ready Mixed Concrete Association was founded in 1930, only a handful of ready-mixed plants operated in the United States.

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The standard practice at the time was for construction firms to mix their own concrete at the job site using bagged cement and aggregates the contractors purchased themselves. (This practice remains common in developing countries.) However, with the wartime industrial and government building during the 1940s and the housing and highways building boom that followed, demand for ready-mixed rose sufficiently to take advantage of the scale economies of specialized offsite concrete mixers.

By 1958, the first year in which the industry was considered a separate four-digit manufacturing industry in the Standard Industrial Classification system, there were 3, 657 ready-mixed concrete plants. Since that time, the industry has continued to grow, albeit with occasional recessionary setbacks. Over the past 30 years, the industry has been shifting from one dominated by single-plant firms to one where multi-plant operations are becoming increasingly common. In 1958, about 3, 100 firms owned the 3, 657 ready-mixed plants.

By 2002, the number of industry plants had increased to 5, 570, but the number of industry firms had fallen below 2, 600 (U. S. Census, 1963 and 2006a). This consolidation is reflected in the industry concentration measures seen in Table 1. In 1958, the largest four firms in the industry accounted for only 4 percent of output, and the largest 50 firms a mere 21 percent. The analogous values for 2002 were respectively 11 and 42 percent, still low compared to most manufacturing industries, but substantially higher than earlier values.

However, these national concentration measures understate concentration within individual geographic markets, which because of the high transportation costs of concrete, better reflects the competitive environment industry producer's face. A TYPICAL READY-MIXED CONCRETE PLANT: The manufacturing process for ready-mixed concrete can be crudely analogized to making mud pies, except a typical batch of "batter" weighs 20-40 tons and the output is delivered to customers in \$150, 000 vehicles. The plants where these pies are made are typically Spartan affairs, even as manufacturing facilities go.

They include facilities for handling raw materials, usually including steel cement silos (cement must be protected from moisture in the air, lest it harden prematurely), open piles of aggregate (sand, gravel and rock) sorted by size, a pay loader and conveyor system for moving aggregate, and a water source. There is also often a structure with limited office space and rooms that house controls for the batcher—the equipment that weighs and feeds the various ingredients into the mixing bin. The bin sits in an elevated structure to allow drivers to pull the mixer trucks, which are the other key pieces of capital equipment found at ready-mixed plants, underneath for loading. Numbers from the 2002 Census of Manufactures, the latest for which comprehensive data are available, offer a sense of the economic scale of a typical ready-mixed plant. The average value of raw materials inventory on hand at a plant was \$81, 000. The average book value of its capital stock (both structures and equipment) was \$2. million, and mean annual sales were \$3. 9 million. This typical plant had 18 employees, 14 of whom were considered production workers (which include truck drivers). FIRM

STRUCTURE: Construction industry was benefited by Ready-mix Concrete right from its inception during the late 40's. This technology has since then grown in a big way in Europe and USA, consuming more than 60% of the cement produced. In the coming years, Ready-mix Concrete industry in India is likely to consume more than 5% of the cement produced.

Despite the industry's move toward consolidation, hundreds of ready-mixed firms are still single-plant operations. In 1997, the most recent year for which such data were available, these producers accounted for 44 percent of industry plants and 80 percent of its firms. Ready-mixed concrete plants, whether in single-plant firms or not, are usually highly specialized. Plants in the industry fabricate few precast concrete products; despite similarities in precast concrete's production process and that the ultimate buyers in the construction industry are often the same.

Well over 90 percent of ready-mixed plant revenues come from ready-mixed sales, meaning single-plant firms in the industry derive the vast majority of their revenues from their primary product. Plants making prefabricated concrete products are similarly specialized in those products, with less than 10 percent of their revenues accounted for by ready-mixed sales (U. S. Census Bureau, 2006b). Multi-plant firms with ready-mixed concrete operations tend to be more diversified, but their diversification comes through owning plants in other industries. These can be prefabricated concrete operations, cement plants, or sand and gravel mines.

In 1997, about half of the ready-mixed plants that were owned by multi-unit firms were owned by firms that also operated plants in other industries

besides ready-mixed concrete. Thus, diversification among larger firms is not universal, since the other half of plants in multi-unit firms are owned by businesses that are ready-mixed specialists. TECHNOLOGICAL CHANGE: The basic process for making ready-mixed concrete has not changed for the past 60 years: dry raw materials are measured, loaded into a bin, mixed, placed into a truck, and water is added (sometimes the order of the last two steps is interchanged).

The modest technological advances that have occurred in the industry have come in five areas. The first change is automated batching systems. Batching—the process of weighing and mixing the raw materials before they are loaded on the truck—was once a manual operation. An operator would mechanically control the hopper gates that regulated the flow of raw materials into the central mixing bin, weighing each component while proceeding, often by eye on an analog scale.

Automated batching systems, where an operator inputs the “ recipe” for a ready-mixed batch into an electronic control system that handles the weighing and mixing operations automatically, began diffusing through the industry during the late 1970s and early 1980s. A second change is the substantial increase in the capacity of concrete trucks. A 1953 standards publication described certified mixing trucks ranging in capacities from 2.5 to 7.5 cubic yards (National Ready Mixed Concrete Association, 1953), with standard capacities at the time being 3.0 to 4.0 cubic yards.

Today, the typical truck capacity is 10 cubic yards, with some able to carry as many as 12. However, because a cubic yard of concrete weighs

approximately two tons, the gross weight of a fully-loaded 12-yard truck could be upwards of 38 tons. This comes close to states' legal limits, which are uniformly 40 tons (some allow overages with a special permit, but most do not have exceptions when the cargo is divisible like concrete). A third change is a continuing expansion in the variety of chemical admixtures that can be added to a concrete batch to affect its properties in useful ways.

For example, admixtures can affect workability (how easily the concrete can be formed into shapes), curing times, color, porosity, and other attributes. This flexibility in the physical attributes of the final product has increased the range of uses of ready-mixed concrete. A fourth change involves improvements in logistical coordination gained through the move toward centralized delivery dispatch. Ready-mixed concrete producers are not just manufacturers, they are logisticians: they deliver, typically on short notice, a perishable product to time-sensitive buyers in multiple locations.

Owning several plants in a local area and coordinating their deliveries through a central office offers potential productivity gains by consolidating overhead (one dispatcher handles deliveries from several plants that would each have their own dispatcher in single-unit firms) and allowing more efficient use of available resources through cross-plant substitution of production and deliveries. Hortacsu and Syverson (2007) find evidence of these productivity gains among ready-mixed plants whose owning firms are vertically integrated into cement.

Non production workers account for a lower fraction of employment at these plants, consistent with a reduction in overhead labor from moving to central

dispatch. Firms' plant location choices also reflect attempts to harness such efficiency benefits. For example Lafarge (2005), an integrated cement and concrete producer, states in its 2004 20-F filing that, " We aim to place our ready mix concrete plants in clusters in each micro market in which we operate in order to optimize our delivery flexibility, capacity and backup capability. ³ While Hortacsu and Syverson look specifically at vertically integrated firms, the findings suggest that the logistical efficiencies do not rely on vertical structure per se. What appears instead to be important is the total size of the firm's ready-mixed operation in the local market. That is, while plants in vertically integrated firms are more productive on average than unintegrated plants in the same market, they do not have significantly different total factor productivity levels than plants in unintegrated firms with similar local concrete sales.

Coordination and its possible efficiency gains are therefore not exclusive to vertically integrated firms, but rather are available to any firm with the necessary scale (and the operational ability to manage such operations). A final technological advance affected the concrete industry, although it actually occurred for the most part outside of the industry. Concrete pumps are used to place concrete on a job site by pumping it through tubes suspended from a boom. These concrete pumps are typically owned and operated by construction contractors or specialty firms, rather than by the ready-mixed producer.

Pumps allow virtually uninterrupted placement of concrete and make it easy to change the location where concrete is poured. (The alternative process is to load bucket after bucket with wet concrete, move the buckets one load at

a time into place with a crane, and pour the contents into the mold.) Certain admixtures mentioned earlier increase the flow ability of wet concrete, improving pumping performance. Pumping is limited in practical terms only by the power of the pumps, which can be quite large.

The 92-floor Trump Tower in Chicago, for instance, is being built with the help of a 680-horsepower concrete pump able to lift 3,000 pounds 1,000 feet in one minute (Sleets and Klaxton, 2006). ENVIRONMENTAL CONCERNS: Ready-mixed concrete plants can emit both waterborne and airborne pollutants. The former include spilled oil or fuel, as well as fine and coarse particles of aggregates and cement, which can be inherently detrimental as well as raise the alkalinity of runoff water to toxic levels.

Airborne emission concerns primarily involve dust from the concrete mixing process itself or from trucks driving on unpaved portions of plants. Plants typically monitor potential pollutants and control them as required. Runoff water is often captured in settling ponds that allow solids to be separated before the water is either discharged or recycled. Dust is controlled by hooding mixing facilities and either paving or occasionally spraying-down unpaved areas of the plant. THE NATURE OF DEMAND:

This section discusses factors that influence ready-mixed concrete demand: who the customers are, how one might define a market within the industry, the nature of the product, and its common substitutes. Ties to Local Construction The ready-mixed industry's fortunes are closely tied to the level of activity in the construction sector. The sector buys the vast majority of ready-mixed output: 94 percent, according to the 2002 Benchmark Input-

Output Tables. Bureau of Labor Statistics annual employment data over 1973 to 2005 show a simple correlation of 0. between the employment growth rates of the ready-mixed concrete industry and the construction sector. The combination of the industry's high transport costs and its reliance on the construction sector imply that the ready-mixed " market" is not a singular, nationwide unit, but instead a collection of quasi-independent local geographic markets. Data from the 2002 Commodity Flow Survey indicate that the average shipment distance for the detailed product category of which ready-mixed comprises the majority of shipments (" no refractory mortars and concretes") is only 32 miles.

By way of comparison, the average distance for all commodities is 546 miles. The basic demand conditions faced by ready-mixed producers in any given local market therefore depend on how robust construction activity is in that same market, not elsewhere. Moreover, this variation in market demand is likely to be exogenous to the nature of competition among local ready-mixed concrete plants. This is because construction projects require intermediate materials from a wide array of industries, making the cost share of ready-mixed small.

Looking at the 2002 Benchmark Input-Output Tables again, ready-mixed concrete accounted for only 3 percent of the construction sector's intermediate materials costs. Therefore a shock to the competitiveness of the local ready-mixed industry (that lowers average concrete prices, say) is unlikely to cause a construction boom. Causation thus travels from construction demand to concrete competitiveness, not in the reverse direction. Relationship Capital Ready-mixed concrete is physically quite

homogenous. While concrete can be differentiated along some dimensions (like compressive strength or cure time) by varying the cement-to-water ratio or including chemical admixtures, these differentiations are minor in scope relative to those seen within many manufacturing industries (automobiles or household audio and video equipment, for instance). Moreover, the differentiation in attributes of concrete output across plants is likely to be smaller still. Because of transport constraints, every plant typically produces the entire spectrum of ready-mixed concrete varieties, rather than some plants specializing in certain types of concrete and others in different types.

Despite its physical uniformity, a source of non-spatial differentiation does exist in the industry. This entails the “relationship capital” built between specific suppliers and their customers. Long-run buyer-supplier ties, whether driven primarily by business or personal bonds, are common in the industry. While their influence is difficult to quantify, anecdotal evidence is plentiful. Substitutes Ready-mixed concrete faces potential competition from various substitute products.

In building construction, prefabricated concrete is the most likely outside option. Concrete block can be used for walls and pre-stressed structural concrete slabs (complete with embedded reinforcing bars) for floors. Recall that prefabricated concrete products are typically made at plants that do not also make ready-mixed, so such substitution does not simply imply buying a different product from the same producer. Another option is to use steel, wood, or stone as building materials. In road construction, asphalt is a popular alternative.

Asphalt is physically akin to concrete; it is also comprised of aggregate mixed with a binding agent, except in asphalt the binder is bitumen, a product of petroleum refining, rather than the hydrated cement in concrete. However, most firms making either product do not make both. While variations in the local relative prices of ready-mixed concrete and these substitutes do lead to modest differences in construction practices across geography, there has been no noticeable time trend, at least in the Benchmark Input-Output Tables, in the aggregate intensity of ready-mixed use relative to its substitutes.

RMC IN INDIA: Ready Mix Concrete business in India could be best described as an emerging industry which faces number of challenges. Such challenges may be multidimensional in nature encompassing pricing and demand, distribution and logistics, market structure, socio economic issues, capacity utilization and expansion etc. These challenges become more compelling in an uncertain environment caused by uncontrollable variables such as consumer behavior, strategies, legal environment, supply issues etc.

A firm is very much likely to adopt reactive strategies in such uncertainties. The product “ concrete” is considered to be a necessary component for the construction industry. Major thrust on infrastructure will increase the demand for concrete. But the surprising fact is that only 2-4% of the cement production in our country goes into RMC as against 70% of cement for RMC in developed countries. Although the concept of RMC is not new to our country many entrepreneurs and organizations hesitated to set up new RMC units in various parts of the country .

REQUIREMENT OF RMC: Concrete, in its freshly mixed state is a plastic workable mixture that can be casted into virtually & desired shape. The properties of concrete can be customized for almost any application to serve in a wide variety of extreme conditions. Concrete is a very economical building material that can serve its function for several years with minimum maintenance, provided the proper mix related to the application & established construction practices are used.

A wide variety of options with colour, texture & architectural detail are available to enhance the aesthetic quality of the concrete application.

SPECIFICATIONS FOR ORDERING RMC: The key to placing an order for RMC is to provide all the basic detailed information & to keep the requirements as simple as possible & relevant to the application. The RMC producer has several mixer formulations for a wide variety of applications & can help with deciding the required mixture characterizes. Some of the basic requirements to keep in mind while placing concrete are as follows.

Size Of Coarse Aggregate- The important information is the nominal maximum size required, which should be smaller than the narrowest dimension, through which concrete should flow, such as the thickness of section & the spacing of the reinforcing steel if any. For most applications, nominal maximum size of coarse aggregate is ? or 1 inch (19-25mm). Slump- Concrete slump, a measure of its consistency, should be indicated. A stiffer mixer will have a low slump value. Typical slump range for most applications is 75-100mm.

Addition of extra water at the jobsite to increase slump is permitted, provided it is not excessive enough to cause segregation & reduce strength & durability. Entrained Air- Air entrained concrete should be used if concrete is to be exposed to freezing temperatures in service, or even during construction. In many locations, air entrained concrete is the default option. When non air entrained concrete is required, it should be clearly stated at the time of ordering. Target air content depends on the size of the coarse aggregate and the typical range is 4-6% of the typical concrete volume.

The tolerance on air content as delivered is $\pm 1.5\%$. This type of concrete is generally not used in India but it has a wide range of use in European countries. Quality level required- The purchaser specifies the concrete quality in terms of its properties or composition. The preferred method of ordering is by performance requirements, which is generally the concrete strength. Other performance characteristics such as permeability, shrinkage or various durability requirements, may be specified when required. The producer should be made aware of anticipated exposure and service condition of the structure.

The concrete producer is best equipped to proportion, mix and furnish concrete for the desired performance. The strength level is generally dictated by the design of the structure to withstand anticipated loads during construction and in service. A minimum strength of 3500 ensures that the truck mixer has the proper access to the placement location. The concrete truck weighs in excess of 60,000lbs (27000kg) and may not be able to maneuver on loose dirt and residential curbs and pathways. ADVANTAGES

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OF READY MIX CONCRETE OVER SITE MIX CONCRETE: •A centralized concrete batching plant can serve a wide area. The plants are located in areas zoned for industrial use, and yet the delivery trucks can service residential districts or inner cities. •Better quality concrete is produced. •Elimination of storage space for basic materials at site. •Elimination of procurement / hiring of plant and machinery •Wastage of basic materials is avoided. •Labor associated with production of concrete is eliminated. •Time required is greatly reduced. •Noise and dust pollution at site is reduced.

SERVICES: • Reliance ReadyMix Concrete provides customers with unique service quality thanks to: A network of ready-mix plants that is so dense that there is always a ready-mix plant within a radius of 30 km of a worksite. • The availability of a large fleet of concrete mixer trucks that allow delivery rates to be kept under control and optimized. • A whole range of special services for difficult worksites: pumps, conveyors, night deliveries, etc.

QUALITY: • Ready-mix concrete guarantees quality, because: • The materials of which it is made are themselves subject to stringent quality requirements. • Rigorous quality control is carried out throughout the manufacturing and delivery process. The formulation and manufacturing of the concrete are covered by the numerous national quality standards. THE DIVERSITY OF

SOLUTIONS: • Reliance Ready-mix Concrete meets a great variety of needs in terms of technical sophistication, ease of use/assembly and design, thanks to: • The ability of test centers and laboratories to do research into and industrialize ever more innovative concrete that is in tune with the trends in architecture and the construction industry. • The use of multiple combinations of the cement, aggregates and admixtures stored on production plant sites. COMFORT: Deliveries of ready-mix concrete can be

taken directly from the ready-mix plants or the concrete can be delivered to worksites by concrete mixer trucks. • The pace of deliveries can be adapted to the customer's needs and can change from one hour or day to the next. • The use of ready-mix concrete keeps worksite nuisances (dirt, congestion, noise, etc.) to minimum levels. **READY MIX CONCRETE PLANT AND MACHINERY** The major infrastructure needed for RMC industry comprises of central batching and mixing plant, storage system and storage areas, adequate fleet of transit mixers, concrete testing laboratories etc.

CENTRAL BATCHING AND MIXING PLANT: Central batching and mixing plants are of two types 1. Manual 2. Automated 3. Tower type 4. Plant with dragline scraps

MANUAL BATCHING AND MIXING PLANT: Basic components of this plant are rotary distributor for distributing materials received from inclined belt conveyors to various compartments, storage bunkers, weigh batchers , mixer and wet hopper. This should also include cement handling mechanism.

Salient features • Aggregates and sand can be washed and processed without posing environment nuisance. Capacity of plant can be as high as 360m³ /hr • The plant incorporates hopper whose capacity is equal to that of transit mixer. This will reduce the cycle time. **Disadvantage** • Capital investment is very high when output is restricted to 50m³ /hr. • Larger space is required to install this. • More maintenance. • Storage space is limited.

PLANTS WITH DRAGLINE MIX: This type is simple in nature consisting of pan mixers, aggregate weigh batching unit, skip loader, cement and feeding system and partition walls. The output ranges from 15m³ /hr to 240m³ /hr.

Salient features • It requires less time for erection and commissioning • Lower capital investment • Low cost maintenance • Low operation cost •

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Ample raw material storage capacity. Disadvantage • Due to standardization, loading hopper can not be incorporated. Hence it has more cycle time. • Raw material storage needs to be covered. PRODUCTIONS OF READY MIX CONCRETE: [pic] Fig 1 A. Transit Mixed (or “ truck-mixed”) Concrete In transit-mixed concrete, also called truck mixed or dry-batched, all of the raw ingredients are charged directly in the truck mixer.

Most or all water is usually batched at the plant. The mixer drum is turned at charging (fast) speed during the loading of the materials. There are three options for truck mixed concrete: Concrete mixed at the job site. While travelling to the job site the drum is turned at agitating speed (slow speed). After arriving at the job site, the concrete is completely mixed. The drum is then turned for 70 to 100 revolutions, or about five minutes, at mixing speed. Concrete mixed in the yard. The drum is turned at high speed or 12-15 rpm for 50 revolutions.

This allows a quick check of the batch. The concrete is then agitated slowly while driving to the job site. Concrete mixed in transit. The drum is turned at medium speed or about 8 rpm for 70 revolutions while driving to the job site. The drum is then slowed to agitating speed. (More information on ready mixed concrete trucks can be found in the Delivery section.) B. Shrink Mixed Concrete Concrete that is partially mixed in a plant mixer and then discharged into the drum of the truck mixer for completion of the mixing is called shrink mixed concrete.

Central mixing plants that include a stationary, plant-mounted mixer are often actually used to shrink mix, or partially mix the concrete. The amount

of mixing that is needed in the truck mixer varies in these applications and should be determined via mixer uniformity tests. Generally, about thirty turns in the truck drum, or about two minutes at mixing speed, is sufficient to completely mix shrink-mixed concrete. Ready-mixed concrete is often remixed once it arrives at the jobsite to ensure that the proper slump is obtained. However, concrete that has been remixed tends to set more rapidly than concrete mixed only once.

Materials, such as water and some varieties of admixtures, are often added to the concrete at the jobsite after it has been batched to ensure that the specified properties are attained before placement.

C. Central Mixed Concrete

Central-mixing concrete batch plants include a stationary, plant-mounted mixer that mixes the concrete before it is discharged into a truck mixer. Central-mix plants are sometimes referred to as wet batch or pre-mix plants. The truck mixer is used primarily as an agitating haul unit at a central mix operation.

Dump trucks or other non-agitating units are sometimes be used for low slump and mass concrete pours supplied by central mix plants. About 20% of the concrete plants in the US use a central mixer. Principal advantages include:

- Faster production capability than a transit-mix plant
- Improved concrete quality control and consistency and
- Reduced wear on the truck mixer drums.

There are several types of plant mixers, including:

- Tilt drum mixer
- Horizontal shaft paddle mixer
- Dual shaft paddle mixer
- Pan mixer
- Slurry mixer

The tilting drum mixer is the most common American central mixing unit.

Many central-mix drums can accommodate up to 12 yd³ and can mix in excess of 200 yd³ per hour. They are fast and efficient, but can be maintenance-intensive since they include several moving parts that are subjected to a heavy load. Horizontal shaft mixers have a stationary shell and rotating central shaft with blades or paddles. They have either one or two mixing shafts that impart significantly higher horsepower in mixing than the typical drum mixer. The intensity of the mixing action is somewhat greater than that of the tilt drum mixer.

This high energy is reported to produce higher strength concrete via to thoroughly blending the ingredients and more uniformly coating the aggregate particles with cement paste. Because of the horsepower required to mix and the short mixing cycle required to complete mixing, many of these mixers are 4 or 5 yd³ units and two batches may be needed to load a standard truck or agitator. Pan mixers are generally lower capacity mixers at about 4 to 5 yd³ and are used at precast concrete plants. **SLURRY MIXING:** The slurry mixer is a relative newcomer to concrete mixing technology.

It can be added onto a dry-batch plant and works by mixing cement and water that is then loaded as slurry into a truck mixer along with the aggregates. It is reported to benefit from high-energy mixing. Another advantage is that the slurry mixer reduces the amount of cement dust that escapes into the air. “ Mix Mobiles” - Mobile Volumetric Proportioning Plants: “ Mix Mobile” are truck-mounted, volumetric batching and continuous mixing units. These “ plants-on-wheels” often supply small-volume or specialty pours and offer the convenience of freshly mixed concrete in fairly precise quantities.

The unit consists of a truck with bins of sand, coarse aggregate, cement, water, and admixtures. The aggregate bins have longitudinal belts at the bottom of the sand, and as well as coarse aggregate bins that drag the aggregate to separate adjustable gates at the rear of the bin. The speed of the belts is connected to a feeder in a cement bin, and all three materials drop down into a mixer. Flow meters control the introduction of water and admixtures. PLANT STYLES, ETC: Concrete batch plants come in a variety of styles and configurations designed to accommodate a variety of markets, technical and environmental considerations.

Portable Plants In general, they have a cement silo and an overhead bin for sand or one or two coarse aggregates. Permanent Plants The plant operates from same location for a relatively long period of time. Large quantities of materials of greater variety are stored at the plant. The plant will tend to have larger overhead storage and may have two lanes to permit batching two trucks at the same time. Plants may be also classified as High profile – The traditional stack up plant is a tall plant that has aggregate and cement storage bins that feed into batchers or weigh hoppers by gravity. Low profile – The aggregate weigh hoppers are near the ground with belts to elevate the aggregate to load the mixer. RMC PLANT: [pic] Fig-2 PROCESS DETAILS FLOW CHART: Fig 3 COMPONENTS SILO: [pic] Fig 3 [pic] Fig-4 This is the storage part of a batching plant. Typically this is a hollow cylindrical structure to store cement & fly-ash. At the base, there is a pathway leading to the central mixer through which, the cement/fly-ash is discharged into the central mixer. The bottom of the silo is conical for easy flow of materials. A regulatory valve is there to control the flow.

The capacity of the silo may range from 50-500 tonnes. Cement/ Fly-ash is pumped into the silo for refilling. The typical picture of a central mixer is shown in Fig-2 & 3 MATERIAL STORAGE YARD: [pic] Fig-5 A material storage is used for storing coarse aggregates(20mm, 10mm, 5mm), fine aggregates(river sand, crusher sand). Generally this is an open yard having separations for each materials. Wooden planks & steel plates are used as separating material. A layer of PCC is poured at the base to prevent material wastage as well as mixing of undesirable materials from the soil.

It is also elevated to prevent the ground water from mixing. The size of the storage yard should be sufficient to fulfill the requirement as per the batching plant capacity. Sometimes the storage yard may be a closed yard from which the materials may be transported through a belt conveyor to ensure better quality. The material should be properly laid in the yard so that it ensures easy flow of material from the yard to the auto weight through the gates. A loader is generally placed near the storage yard for the re-arrangement of materials. The typical picture of a central mixer is shown in Fig-6 CENTRAL MIXER : pic] Fig-6 A central mixer is one of the main component of a batching plant. Its function is to mix the materials properly to prepare the proper grade of concrete. The capacity ranges from . 5-3 m³ per batch. After mixing, it discharges the concrete into the transit mixer. The mixing time for concrete may range from 30-60 seconds per batch. There are blades inside the mixer for proper mixing of te concrete. The typical picture of a central mixer is shown in Fig-5 The aggregates are put in the mixer by the auto weight. The water and the admixture is pumped into the mixer by means of pipes connected to the mixer.

There is also another pipe connected with the mixer from which the pumped cement comes in the end for mixing. Type of mixers: • Single shaft mixer • Twin shaft mixer. • Vertical mixer. AUTO WEIGHT: [pic] Fig-7 An auto weight is used for weighing the materials. The gates are connected with the auto weight from which the material is flown into. The auto weight is connected with the central mixer in which it places the material. OPERATING UNIT: [pic] Fig-8 The operating unit is used to drag the materials near the gate by a drag-line. A boom is there which moves over the materials and the unit is generally a human operated system.

AUTO GATES: [pic] Fig -9 MOISTURE CONTROLLER: [pic] Fig-10 ADMIXTURES: [pic] Fig-11 WATER PUMPING SYSTEM: [pic] Fig-12 CONTROL PANEL [pic]

Control panel controls all the parts of RMC plant. It increases the workability of the plant. It is situated at the control panel room which monitors all the functions. It increases the accuracy of the concrete mix which in turn shows in the strength. Moisture content can also be controlled by the control panel. Different mode of mechanical transportation of concrete is • Transit Mixer • Concrete pump and pipeline. • Tower crane • Ropeways or cableways • Belt conveyors TRANSIT MIXER: pic] Fig-13 [pic] Fig-14 Ready-mixed concrete, by far the most common form of concrete, accounts for nearly three-fourths of all concrete. Ready mixed refers to concrete that is batched for delivery from a central plant instead of being mixed on the job site. Each batch of ready-mixed concrete is tailor-made according to the specifics of the contractor and is delivered to the contractor in a plastic condition, usually in the cylindrical trucks often known as “ cement mixers. ” As early as 1909,

concrete was delivered by a horse-drawn mixer that used paddles turned by the cart's wheels to mix concrete en route to the jobsite.

In 1916, Stephen Stepanian of Columbus, Ohio, developed a self-discharging motorized transit mixer that was the predecessor of the modern ready-mixed concrete truck. Development of improved ready-mixed trucks was hindered by the poor quality of motor trucks in the 1920s. During the 1940s, the availability of heavier trucks and better engines allowed mixing drum capacities to increase, which in turn allowed ready-mixed concrete producers to meet the high demand for concrete that developed as a result of World War.

In case of RMC industries since the demand is spread over a larger geographical area, transit mixers are invariably used for transportation of concrete. Transit mixers are truck mounted drum mixers in which concrete is kept agitated by the continuous rotation of the mixer drum. The transit mixer needs to have a water tank. Speed of rotation of mixer will depend on whether it carries ' central mixed' or ' Transit mixed' concrete. Function of Transit mixer varies from a mixer in case of transit mix concrete to an agitator in case of central mixed concrete.

Depending on function, speed of the drum varies from 2 to 6 rpm for ' Central mixed' concrete to 4 to 16 rpm in case of ' Transit mixed concrete'. Maximum no. of rotation is usually limited to 300. In RMC industry, fleet of transit mixer form a major portion of capital investment. For balancing a capital of 60 to 80m? /day of concrete production, at least 4 transit mixers are required. Generally the time of transit after addition of water is limited to

60-80 minutes. In India transit mixers are being extensively used by project sites having batching plants for concrete production. Manufacture of transit mixers in India is licensed.

Mixers of 2.5 to 7.0 cum capacity are now available on order. An important consideration is the matching of payload of 3.0 to 4.0 cum of concrete i. e. 10 tonnes including the weight of the mixer with a standard chassis of trucks available. While a 10 tonner chassis is common, anything above this calls for change in axial load, traffic restrictions and huge price differential. The annual production capacity is around 50. A concrete pump can be advantageously used in conjunction with RMC. Deployment of a concrete pump would however mean an additional investment of at least Rs. 0 lakhs. The RMC plant in charge should be conversant with operations research techniques for optimum utilization of transit mixers. [pic] Fig 15 RMC PLANT TRANSIT MIXER CYCLE CONCRETE PUMP & PIPE LINE [pic] Fig 16 A concrete pump is a tool for transferring liquid concrete by pumping. There are two main classifications of concrete pumps. The first type of concrete pump is attached to a truck. It is known as a truck-mounted boom pump because it uses a remote-controlled articulating robotic arm (called a boom) to place concrete with pinpoint accuracy.

Boom pumps are used on most of the larger construction projects as they are capable of pumping at very high volumes and because of the labor saving nature of the robotic arm. The second main type of concrete pump is mounted on a trailer, and it is commonly referred to as a trailer pump or line pump. This pump requires steel or rubber concrete placing hoses to be

manually attached to the outlet of the machine. Those hoses are linked together and lead to wherever the concrete needs to be placed.

Trailer pumps normally pump concrete at lower volumes than boom pumps and are used for smaller volume concrete placing applications such as swimming pools, sidewalks, and single family home concrete slabs. There are also skid-mounted and rail mounted concrete pumps, but these are uncommon and only used on specialized jobsites such as mines and tunnels.

TOWER CRANE [pic] Fig 17 A crane is a lifting machine, generally equipped with a winder (also called a wire rope drum), wire ropes or chains and sheaves, that can be used both to lift and lower materials and to move them horizontally.

It uses one or more simple machines to create mechanical advantage and thus move loads beyond the normal capability of a human. Cranes are commonly employed in the transport industry for the loading and unloading of freight, in the construction industry for the movement of materials and in the manufacturing industry for the assembling of heavy equipment. BELT CONVEYORS [pic] Fig 18 A belt conveyor consists of two or more pulleys, with a continuous loop of material - the conveyor belt - that rotates about them. One or both of the pulleys are powered, moving the belt and the material on the belt forward.

The powered pulley is called the drive pulley while the unpowered pulley is called the idler. There are two main industrial classes of belt conveyors; Those in general material handling such as those moving boxes along inside a factory and bulk material handling such as those used to transport

industrial and agricultural materials, such as grain, coal, ores, etc. generally in outdoor locations. Generally companies providing general material handling type belt conveyors do not provide the conveyors for bulk material handling. In addition there are a number of commercial applications of belt conveyors such as those in grocery stores.

The belt consists of one or more layers of material they can be made out of rubber. Many belts in general material handling have two layers. An under layer of material to provide linear strength and shape called a carcass and an over layer called the cover. The carcass is often a cotton or plastic web or mesh. The cover is often various rubber or plastic compounds specified by use of the belt. Covers can be made from more exotic materials for unusual applications such as silicone for heat or gum rubber when traction is essential.

Material flowing over the belt may be weighed in transit using a beltweigher. Belts with regularly spaced partitions, known as elevator belts, are used for transporting loose materials up steep inclines. Belt Conveyors are used in self-unloading bulk freighters and in live bottom trucks. Conveyor technology is also used in conveyor transport such as moving sidewalks or escalators, as well as on many manufacturing assembly lines. Stores often have conveyor belts at the check-out counter to move shopping items. Ski areas also use conveyor belts to transport skiers up the hill.

A wide variety of related conveying machines are available, different as regards principle of operation, means and direction of conveyance, including screw conveyors, vibrating conveyors, pneumatic conveyors, the moving

floor system, which uses reciprocating slats to move cargo, and roller conveyor system, which uses a series of powered rollers to convey boxes or pallets. TESTING LABORATORY One of the main features of RMC is uniform and assured quality of concrete. Also the mix is to be designed to produce concrete of desired properties.

This calls for the RMC plant to have full fledged concrete testing laboratory of its own. The testing laboratory should have the following equipment. 1. Concrete cube testing machine 2. Apparatus for sieve analysis 3. Moulds for casting standard cubes 4. Table vibrator 5. Tank for curing cubes 6. Vicat's apparatus 7. Slump cone 8. Weigh balance All necessary tests to ascertain the properties of ingredients are conducted in the laboratory. Various grades of concrete mixes are designed by usual mix design procedure. For each consignment, concrete cubes are made and tested to keep a check on quality of concrete produced.

This will also fulfill the mandatory requirement of concrete testing as laid down by the municipal bodies. NEW METHOD OF PRODUCTION OF RMC A new method for the recycle of sludge generated at ready-mixed concrete plant has been reported at present. This method is able to apply sludge water by adding a retarder for mixing water, without the amendment of mix proportion of concrete due to the use of sludge water, within 3% of sludge content by cement weight since ready mixed concrete made by this method was applied for a building construction.

The growth of RMC is predominantly driven by demand from the metro cities. In cities like Mumbai, the mandatory use of RMC is in construction of flyovers

provided the requisite impetus to growth, according to an ICRA analysis. RMC is particularly useful when the building activity is located in congested sites where little space is available for siting the mixer and for stock piling of aggregates. The use of RMC is also advantageous when only small quantities of concrete are required or when concrete is to be placed only at intervals.

Even as the concept of ready-mix concrete (RMC) is still catching up in the country, cement majors are keenly focusing on entering the new area in a big way. Anticipating huge potential for the product, cement majors, including Associated Cement Companies, Grasim, L&T, India Cements, Priyadarshini Cements, Chettinad Cement and Madras Cements, are foraying into the RMC business and the share of RMC is expected to go up from present levels of around 5 per cent of the total cement production to the global average of 70 per cent, according to industry players.

The teething troubles has been overcome by the RMC Industry and at present there are over 37 RMC plants delivering over one lakh cubic metres of mixed concrete every month. RMC plants are working in Delhi area also. Envisaging higher demand, the 16.4-million tonne cement major, ACC is planning to beef up its existing RMC infrastructure of 11 units with two new RMC units – one at Noida and the other in Mumbai, during the current year.

During the last fiscal, Madras Cements set up two RMC plants near Chennai, with a capacity of approximately 9 lakh cubic metres, while Chettinad Cements installed an RMC facility near Coimbatore. Grasim's RMC business accounted for a turnover of Rs 116 crore during 2003-04, against a turnover of Rs 59.8 crore during the previous year. For growth of the industry,

government bodies, private builders, architects/engineers, contractors, and individuals required to be made fully aware about the advantages of using ready mix concrete, government bodies/consultants needs to include ready mix concrete as mandatory in their specification for execution, government specifications for CPWD and PWD jobs should include Ready mix concrete as a mandatory item. Apart from this tax breaks are required for the growth of RMC and developers/contractors needs to be discouraged from piling up materials like metal, sand etc. on roads/foot paths. metal, sand etc. on roads/foot paths. CONCLUSION: The concept of RMC is catching up in the country and the demand for this is increasing day by day. Anticipating this huge demand for the product many construction majors are entering in to the RMC business.

So the growth rate is expected to rise from the current rate. Still then the product needs more improvement which requires more research and development. Now a days more compact and efficient RMC plants are introduced by various companies which will ensure more productivity and economy which will help in fulfilling the present market demand.

————— ADMIXTURES WATER READY MIX CONCRETE 10 MM AND
20MM CRUSHED METAL CRUSHED/ RIVER SAND FLY ASH SILO CEMENT SILOS