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From the Desk of Executive Director

It gives me great pleasure in placing in your hands the 3rd issue of *RMC Techbeat*. I am happy to note that this newsletter has found acceptance among our entire Customers - the architect community and the people associated with the construction industry.



We at RMC Readymix (India) have a strong bond with Concrete, which is the most

versatile building material. The world of concrete is seeing a lot of innovations which will make it more useful to the community at large. This particular issue has some interesting articles on the products so dear to us.

We will be happy to hear from you on areas needing improvements or more coverage.

Venugopal Panicker

Executive Director,
RMC Readymix (India)
A Division of Prism Cement Ltd.

Company News

Easycrete™ and Elitecrete™ : Growing Market Acceptance

While the valued-added special products of RMC Readymix (India) are receiving growing acceptance in the market, two of these products, namely, Easycrete™ and Elitecrete™, seem to have climbed up the ladder of customer acceptance rapidly.

The enhanced fresh and hardened properties of Easycrete™ have been attractive for customers. Traditionally, placing, consolidation and finishing of concrete are often carried out with the involvement of semi-skilled and unskilled labour, which has an increased potential for human error. Such errors are reflected in the finished concrete in the form of various defects – voids, honeycombing, cracks, surface undulations, etc. The fact that the use of Easycrete™ minimizes these errors is being increasingly realised. Further, savings in labour cost, excellent finish, improved durability, accelerated project schedule, reduced noise and improved safety of operations are other additional advantages, all of which are beneficial to the contractor/builder/owner.

However, the design and production of self-levelling Easycrete™ need special expertise. Further, careful controls also need to be exercised in the quality control and quality assurance of the product. Based on the long

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Forum

RMC Readymix (India)'s Kochi Plant: First Indian Unit to Receive QCI Certification

RMC Readymix (India) – a Division of Prism Cement Ltd has achieved the distinction of being the first Indian company to implement the Quality Council of India's (QCI's) Scheme at its ready mixed concrete manufacturing units. The Company was the first recipient of Quality Certification from ICMQ India – the agency accredited by QCI for this purpose. It has now geared up to complete similar audits at its other ready mixed concrete manufacturing units too.

The QCI Scheme for ready-mixed concrete in India was launched in New Delhi on May 17, 2013. The scheme has been painstakingly formulated and documented by high-level multi-stakeholder committees, with major contribution coming from Central PWD, Building Materials & Technology Promotion Council (BMTPC), Ministry of Housing & Urban Poverty Alleviation and the Ready Mixed

Concrete Manufacturers' Association (RMCMA). The other stakeholders in the committees include central government ministries like the Ministry of Housing, Ministry of Roads Transport and Highways (MORT&H); central public sector undertakings like the National Highway Authority of India (NHAI), Airport Authority of India (AAI), user bodies like the Builders Association of India (BAI), Construction Federation of India (CFI), professional bodies like the Indian Concrete Institute (ICI), Association of Consulting Civil Engineers (ACCE), consulting engineers like Mahendra Raj, Tandon Consultants Pvt Ltd and certifying bodies like the Bureau Veritas, ICMQ, etc. Thus, the scheme is owned by elite and diverse groups from the construction industry. In fact, an attempt has been made to involve representatives all those who matter in the sphere of structural concrete in India.

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Around the World

Growth to gather momentum in USA

According to the latest forecast from the Portland Cement Association (PCA), USA, cement consumption will increase a modest four percent in 2013, but will approach double-digit growth in 2014 and 2015, with 9.7 percent consumption increases in both years.

According to PCA's scenario consumer and business attitudes are expected to increasingly focus on the positive economic fundamentals rather than potentially adverse political uncertainty.

PCA's chief economist predicts an increase in local spending on public construction beginning in fiscal 2016. This is key to cement consumption recovery as road construction accounts for the largest area of public cement consumption. An 11 percent consumption gain is forecasted for 2016.

Source: PCA News

Stiffer pavements can reduce fuel use

Researchers at the Massachusetts Institute of Technology (MIT) have found that a pavement property called deflection could save more than \$15 billion in annual fuel costs in the USA and reduce greenhouse gas emissions.

The report, titled *Where the Rubber Meets the Road: Estimating the Impact of Deflection-Induced Pavement-Vehicle Interaction on Fuel Consumption*, focuses

on pavement deflection. Deflection refers to the small dent in the pavement that a car creates as it moves down the road. This dent creates a slight but constant uphill climb, which burns more fuel. The effect is similar to walking on sand. With each step, your feet sink and create a dip.

Concrete pavements, inherently stiffer than asphalt, can reduce a car's "footprint" and gas costs. By reducing the environmental footprint of pavement systems, MIT researchers hope to achieve a more sustainable national infrastructure.

Source: web.mit.edu/cshub/news.

Mobile App stores coming to construction?

Use of mobile technology is a growing trend in the industry and a group is working to develop an application store for the construction industry. MobiCloud, a project supported by the European Commission, which aims to develop a European corporate application store accessible via connected devices, which can connect to corporate systems via the cloud. The project was developed by a consortium which includes such companies as Appear Networks; Kista, Sweden; and Costain Group, Maidenhead, England. According to Martin Wilson, vice president at Appear Networks, there are many challenges; however, construction-specific applications could be used, among other tasks, to support different project processes, ensure compliance with site procedures, and manage incident reports.

Source: http://www.constructech.com/news

Milestone in RMC Safty Nine Plants Receive National Safety Awards

The fact that RMC Readymix (India) meticulously follows top-most safety standards in the operations of its plants located across the country is vindicated recently. As many as nine plants of the Company won recognition from the National Safety Council of India (NSCI). While one plant received the silver trophy, four received bronze trophy and the remaining four got appreciation award. The award winning plants are listed below.

Suraksha Puraskar (Bronze Trophy)

- RMC Readymix (India), Ambernath, Thane, Maharashtra
- RMC Readymix (India), Hingana MIDC, Nagpur, Maharashtra
- RMC Readymix (India), Medchal, Ranga Reddy, Andhra Pradesh
- RMC Readymix (India), Sonnappanahalli, Bangalore North, Karnataka

Prashansa Patra

- RMC Readymix (India), Chinhat, Lucknow, Uttar Pradesh
- RMC Readymix (India), Asoj, Vadodara, Gujarat
- RMC Readymix (India), Manipal, Udupi, Karnataka
- RMC Readymix (India), Mangalapuram, Thonackal, Trivandrum, Kerala

These prestigious awards were given by Mr. Arun Kumar Sinha, Additional Secretary, Ministry of MOEF, Government of India during a function at Scope Complex in New Delhi on October 4th, 2013.



Shreshtha Suraksha Puraskar (Silver Trophy)

- RMC Readymix (India), Dhumaspur, Gurgaon, Haryana

Concrete Innovations and Trends

Concrete Car and Aircraft: A Reality?

Do you think a real car and aircraft can be made of concrete? Incredible? Not for some young students, engineers, academicians and concrete technologist!

Canoes made of lightweight concrete have been popular for a long time with civil engineering community. However, students from Albert Einstein School and Karlsruhe University of Applied Sciences, Germany, were not satisfied with concrete canoes. They wanted to make a working car from concrete! Around a decade back, they designed and built a working BMW model in concrete!

Recently, students from South Dakota School of Mines & Technology (SDSM&T), USA, went a step ahead. They created an astonishing aeronautical history! This small group of innovators were not only successful in making a remote-controlled miniature aircraft from concrete but also accomplished a remarkable feat by making it fly! It will be interesting to highlight the available information on these two innovative projects. While the information on the concrete car project is extracted from an international journal, the one of concrete aircraft is obtained from online search^{1, 2}.

For creating the concrete car, the students of the Albert Einstein School selected the BMW sports car model. Initially they made wooden formwork of BMW's body shell. Once this was satisfactorily done, formwork with glass fibre-reinforced plastic was prepared. Simultaneously, the students developed a fibre-reinforced, cement-based high strength mortar for the body. This was hardened with

To cope with the dynamic forces created by both the engine and movement, the car floor was designed as prestressed concrete slab having an area of 2m x 0.6m and a thickness of only 80mm. High performance concrete (HPC) having compressive strength in excess of 120 MPa was utilized for the slab. The use of HPC and adoption of prestressing technique ensured that no cracks develop in the slab even when subjected to high stresses.

While the concrete skeleton was being made ready, the steering linkages, axle casing, engine mountings, seat and other parts were assembled separately. The last step was to build in the components and the motor and then the concrete body was mounted.

The industrial partner of the concrete car project was Bilfinger Berger AG, Germany. Team of engineers and staff from the Company provided active support to the students to complete their project successfully. Finally, a working concrete car could see the light of the day! (Fig 1)

The job of the students from SDSM&T, USA, was more difficult. This was because in aviation a high strength and lightweight material is always preferable, while concrete possesses exactly the opposite properties! First attempt to create concrete aircraft at the Embry-Riddle Aeronautical University in Daytona Beach, Florida – a prestigious flight school – was not successful as the concrete plane was destroyed when it crashed. Therefore the main goal of the students of SDSM&T was to make a concrete aircraft which can take off and survive landing.



*Fig 1 BMW Z4 sports car made of concrete
(Source: Concrete Plant International, August 2004)*

plastic additives to enhance the deformation capacity, so that the body could be fabricated with a wall thickness of only 3 to 8 mm!

Three seniors from SDSM&T, namely, David Haberman and Tyler Pojanowski, both mechanical engineers and Seth Adams, a civil and environmental engineer, worked together on the project for a year. They created an aircraft with a wing span of about 1000mm. The concrete was made with carbon fibre reinforcement. The wings were built hollow around a foam core.

The weight of the concrete aircraft was 8.16 kg (18 lb), as against 1.8-2.25 kg usually used for conventional remote-controlled models. Thus, it was a challenging task to make the four-times heavier concrete aircraft fly and land safely. The SDSM&T team successfully accomplished this task. On landing, the plane sustained a crack in the fuselage and wing but otherwise

remained intact. The press release of SDSM&T states, "Flight was quick and wobbly with the landing equally erratic, but it was enough for the record books."

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Concrete Innovations and Trends

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Unfortunately, not much information is available on the type of concrete and the ingredients used in making the car and the aircraft. Possibly, recent innovative developments in ultra high performance concrete on the one hand and fibre-reinforced plastics on the other would have been useful for the groups involved in the concrete car and aircraft projects.

At this stage, it is hard to postulate whether concrete cars and aircrafts would be commercially viable and would be available in the market in the near future. Yet, both accomplishments vividly demonstrated the versatile nature of the wonderful material - that is called concrete!

References

1. A car made of concrete – and it works!, *Concrete Plant International, August 2004, pp.33-34.*
2. ___ <http://www.avweb.com/avwebflash/news/concrete>.



Fig 2 The first-ever successful flight and landing of the concrete aircraft made aeronautical history (Source: <http://www.popsci.com>)

RMC Specials



- **Aquaresistcrete™** • **Coastcrete™** • **Dycrete™**
- **Easycrrete™** • **Environprotectcrete™** • **Elitecrete™**
- **FRCcrete™** • **Highdensecrete™** • **Megacrete™**
- **Perviouscrete™** • **Thermocrete™**

Forum

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The advent of ready-mixed concrete industry in India in the late nineties brought both speed and quality in concrete construction – so vital for the growth of infrastructure and housing in the country. (Incidentally, RMC Readymix (India) happens to be one of the pioneers of ready-mixed concrete in India.) The growth of the industry commenced with metropolitan cities and then it spread its wings to other major cities. During the past one-and-a-half decade, the industry established foothold in more than 60 cities of the country. However, this growth brought in its wake certain problems too. One of the major problems faced by the industry is the entry of a large number of unorganized players, leading to unhealthy fragmentation. Ready-mixed concrete production, transport and placement require high technical inputs, which are lacking in many unorganized players as they usually adopt low automation controls, employ inadequately-trained manpower and do not strictly follow the BIS Standards. As a result, quality of concrete produced by many unorganized RMC players falls short of many desired parameters.

Realizing the urgent need to evolve quality standards for RMC, it was the Ready Mixed Concrete Manufacturers' Association (RMCMA), which took the lead to formulate the first indigenous Quality Scheme for Ready Mixed Concrete. Two quality manuals were prepared with the help of experts from the construction industry. The outstanding features of the RMCMA Quality Scheme were – incorporation of the best practices from advanced countries and strict adherence to BIS standards. The scheme was launched December 2008. With the help of around three dozen well-trained external auditors, more than 240 RMC plants were certified under the RMCMA Scheme.



QCI Scheme

The evolution of the QCI Scheme took more than one-and-a-half year. This was obvious because of the need to accommodate views and concerns of different

stakeholders/owners of the scheme. More than a dozen meetings of the expert committees were required to finalize the following painstakingly-prepared manuals of the scheme:

- Criteria for Production Control of RMC
- Certification Process for Ready Mixed Concrete Production Control Scheme (RMPCPS)
- Provisional Approval for CBs for RMPCPS.

The QCI Scheme offers two options of certifications, namely,

- RMC Capability Certification
- RMC 9000+ Certification



The RMC Capability Certification is plant-specific. For getting this certificate, it is mandatory for each RMC plant to successfully undergo a thorough audit based on an extensive check list included in the Criteria for Production Control of RMC. The second option includes most of the features of the quality management system of ISO 9001, and of course, all features of the capability certification. Thus, to get certified under the second option, each plant must fulfil all requirements under the first option and also follow the quality management system.

The QCI Scheme is made more stringent than the erstwhile RMCMA Scheme. Besides the audit of the plant and machinery and the control mechanism adopted by the producer, the audit under QCI scheme also embodies laboratory testing facilities, technical skills of the human resources, the controls exercised on the quality of different concrete ingredients, mix design and the final product.

The QCI Scheme thus signifies advancement over the RMCMA Scheme. Two remarkable features of the QCI Scheme will be appreciated by the customers - first, it has a multi-stakeholder ownership as highlighted above and

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second, it possesses a truly independent character! Both features should instil sufficient confidence about the precision of systems and processes followed by certified plants amongst the buyers of ready-mixed concrete – owners, specifiers, consultants, architects etc.

In recent years, the technology of concrete has witnessed great strides. Concrete is no longer a mixture of just cement, aggregates and water – but a mixture of other additives that are added to further improvise concrete properties to meet various needs! The other additives include a variety of chemicals and also mineral additives such as fly ash, blast-furnace slag, silica fume, etc. The incorporation of these admixtures vastly improves a host of properties of concrete, including its long-term strength and durability. However, with this the design of concrete mixes becomes a complex job, requiring up-to-date and in-depth technical expertise and skills. Usually, the unorganised ready-mixed concrete producers lack this expertise. The quality of the finished ready mixed concrete depends upon the optimized proportions of the ingredients mentioned above as well as the expertise of the manufacturing units and adoption of proper quality measures.

The successful implementation of QCI scheme will hopefully go a long way in upgrading the industry standards. However, this is possible, only when all manufacturers in the ready mixed concrete sector, including the unorganised players whole-heartedly embrace the scheme. Alternatively, the specifiers/customers should make it mandatory, in that they should specify that concrete supplied from QCI-certified plants will only be acceptable. As far as RMC Readymix (India) is concerned, the Company is voluntarily

committed to implement the QCI Scheme at all its manufacturing facilities in a phased manner by 2015.

Commenting on the successful completion of the QCI audit certification at its Cochin unit, Mr Venugopal Panicker, Executive Director, RMC Readymix Division - Prism Cement Limited said *“The QCI audit process and certification for our Cochin unit is a progressive step towards providing customers the best quality ready mixed concrete in the market. We are now preparing for the implementation of the QCI Scheme at our other manufacturing units too. The potential of ready-mixed concrete in our country is enormous and it has to move from being a metropolitan city phenomenon to the smaller cities & towns. However, quality being the key, needs to be perfect. Hence, the mandatory adoption of the QCI scheme by the ready mixed concrete units will ensure that appropriate quality of concrete gets dispensed from all the players including the unorganised ones.”*

With the Government expected to provide greater impetus to infrastructure development through investment of US\$ 1 trillion in infrastructure development over the next 5 years, the QCI scheme can help the ready mixed concrete industry in creating conformity of manufacturing processes as well as product quality. The QCI scheme should also be made mandatory for all infrastructure projects, in which the component of concrete is substantial.

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Customer Awareness Initiative

RMC Readymix (India) - a Division of Prism Cement Limited is a customer-centric organization. The Company's technical and marketing personnel always respond promptly to the service and other needs of its customers.

Recently, the Company has taken one more initiative of coming closer to the customers. It involves conducting tailor-made seminars/workshops/demonstration for creating awareness amongst customers. The initiative commenced with a workshop on concrete mix design principles and special concretes in the Company's NABL-accredited lab in Bengaluru on August 3rd 2013 (Reported in *RMC TechBeat* Vol.1, No.2). This program was followed by two recent initiatives, one at Pune and the second at Mumbai.

The program in Pune was organized specially for the benefits of officials of Maharashtra Housing & Area Development Authority (MHADA) on October 11, 2013, in which 22 engineers from their organization participated. While Er. Uttam Bhandare and Er Ms Ashwini Deshpande made presentations in the workshop, lab demonstration and plant visit were led by Er Ms Sonal Lakde and Mr. Kundan Dwivedi.

The second workshop was held for the members of VJTI Alumni Associates on October 19, 2013 in which 55-60

engineers participated. The main speakers from the Company were Er. Uttam Bhandare and Er. Ms Ashwini Deshpande. In this program Mr. Trivikram Shenvi from JSW also spoke on use of GGBS for durable concrete.



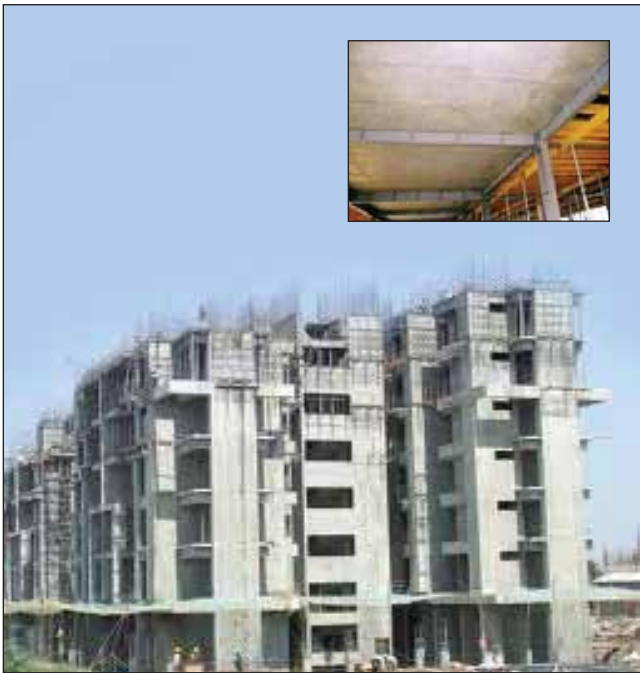
Workshop for VJTI Alumni Associates

Company News

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experience and the expertise of its technical personnel, RMC Readymix (India) has now mastered the art of controlling the variations and producing robust mix of Easycrete™.

Easycrete™ applications have hitherto been limited to concrete elements having congested reinforcement and those having unusual shape, where it is difficult to place and compact concrete.



Easycrete™ for MIVAN formwork application (Inset-inside view of finished concrete surface)

Recently, Easycrete™ application has been found suitable for a housing project using tunnel form construction (Mivan technology). This type of construction is becoming quite popular now – mainly because of the higher speed of construction, elimination of the need of plaster and the resulting economy. However, pouring of concrete in the 3-m high x 0.15m wide wall elements (having window and door cut outs) proved to be a difficult job using conventional high slump concrete, as it often resulted in honeycombing, voids, etc. The use of Easycrete™ in the tunnel form shuttering has drastically minimized these problems.

For certain housing projects in Pune RMC Readymix (India) is now supplying Easycrete™ and the customer is happy for achieving faster construction cycle and good surface finish.

Elitecrete™

Traditionally, brick-bat coba has been used in buildings as a thermal insulation sandwich layer between the top slab and waterproofing treatment. RMC Readymix (India) has developed Elitecrete™, which besides being light, has highly enhanced thermal insulation property. While the reduction in dead load from around 2000 kg/m³ (for brick-bat coba) to anywhere around 300 to 1200kg/m³ (for Elitecrete™) would be beneficial and welcomed by the structural designer, who would be in a position to save substantial quantity of reinforcement. Further, besides the

faster and hassle-free construction, the real advantage of Elitecrete™ is in its enhanced thermal insulation capability which is nearly 3 to 4 times higher than brick-bat coba! This will reduce energy consumption during the entire service life.



Sequence of Elitecrete™ construction

In view of its lightweight nature, pumping of Elitecrete™ at higher elevation needs special expertise. RMC Readymix (India) has acquired proficiency in this operation. The company recently completed three large pours of Elitecrete™ at Pune, Ludhiana and Nasik.

MAIL Box

Q.: We need around 500 m³ of M30 grade of concrete with 100 mm slump for our site from the next week onward. There is no time to conduct lab trails and wait for 28-day compressive strength. During discussions with your representative, he requested us to offer you the freedom of adopting your own mix recipe. If we allow you such freedom, how do you assure us about the quality parameters of the final product?

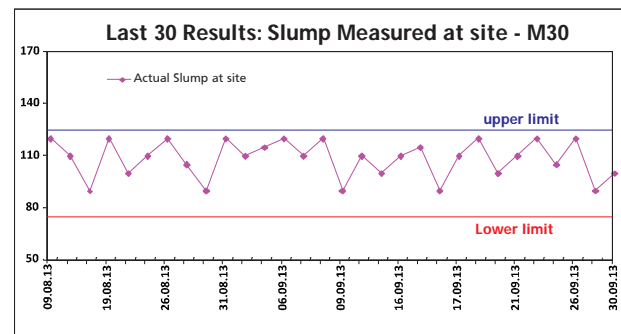
A.: We are indeed thankful to you for allowing us the freedom of choosing our mix recipes. This freedom is exceedingly vital and valuable for us and it is beneficial to you too! While it permits us to use the best combination of available materials to optimize the mix proportions, you will have the benefit of having the services of expert concrete technologist, capable of providing you the best possible mix recipe with desired properties.

As you may be aware, optimization is the crux of the mix design process and our concrete technologists have achieved this proficiency owing to their long practical experienced. Further, our Company has established an infallible system of QA & QC at all our plants, which amongst others, have the following key features:

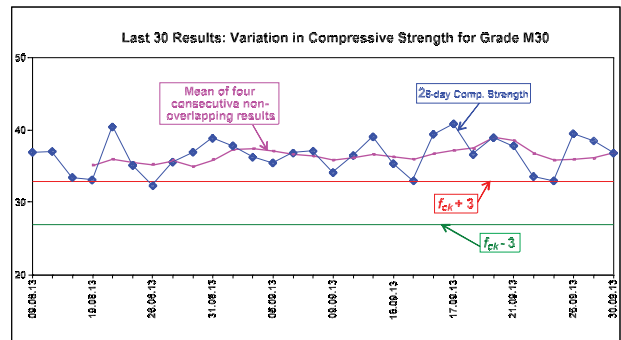
- Provision of well-equipped laboratory attached to the plant for carrying our routine testing
- Strict control on the quality of all input materials used in production through rigorous in-house or third-party testing at specified frequencies, which are more stringent than those specified in BIS Codes
- Stringent process control measures involving thorough inspection, good upkeep of equipment, frequent scale calibration of weighing devices, etc.
- Continuous monitoring of the key properties of concrete in the fresh and hardened states, including their statistical analysis.

Over and above this, our Company has adopted the best practices from the world-renowned Quality Scheme for Ready-Mixed Concrete (QSRMC) from U.K, which involves continuous monitoring on all stages of production and supply i.e. order processing, control on input materials, concrete mix design, process control, sales, delivery and statistical quality control. Another vital feature of our QA

system includes the use of CUSUM (cumulative summation) technique. This technique assists in quick detection of changes in the properties of concrete – mainly its compressive strength. Thanks to the adoption of this technique, we need not wait till 28 days for the strength data. We can reliably detect the trend in the strength well in advance, thus enabling us to take appropriate action to enhance the probability of meeting the customer's specifications.



Past field data on performance of our concrete could be the best guide for you. Our Company believes in transparency as far as guaranteeing the performance of our products is concerned. We shall be glad to provide you the actual data of last 30 results of slump and compressive strength of M30 concrete that you need. Sample data is enclosed here (see two graphs). We are sure that this will provide you sufficient assurance about the quality of our concrete.



Finally, we provide you the guarantee of achieving the desired slump and specified compressive strength at 28 days. Incidentally, we can cite a number of examples of our customers who have provided us the freedom of using our mix recipes and are fully satisfied with our performance. We are sure that you one of them. On our part, we shall be privileged to add your name to this big list of our satisfied customers.

Published by RMC READYMIX (INDIA) - A Division of Prism Cement Limited. (For Private Circulation Only)

Windsor, 7th floor, C.S.T. Road, Near Vidyanagari, Kalina, Santacruz (E) Mumbai-400 098 Tel: 26547000 Fax: 26547111/26547123 Website: www.rmcindia.com
Ahmedabad • Bengaluru • Bhubaneswar • Chandigarh • Chennai • Cochin • Coimbatore • Faridabad • Goa • Hyderabad • Indore • Jaipur • Kolkata • Lucknow • Ludhiana
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TOLL FREE NUMBERS : 180022 3454 | 09769801903

