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NIRMAN CONCRETE
THE COMPLETE CONCRETE SOLUTION

Promising solution for the future with Light weight concrete and Pervious concrete

The company's sole focus is to curate products that are beneficial to our customers as well as environment friendly. Using the latest available technology, we have created a range of special products to meet various demands of our customers. Among them, Light weight concrete? and Pervious concrete ? are the most promising solution as they focus on cooling and water harvesting respectively.

Light weight concrete ?

Light weight concrete ? is a light weight concrete with density varying from 800 to 1800kg/m³. Its paramount application is thermal and sound insulation coupled with light weight. Typically a 4 inch thick layer of Light weight concrete? over a roof slab will help in considerably reducing the load on air conditioning systems. Thus, it supports energy savings, and also significantly reduces dead load over the structure. Traditionally, Brickbat Coba was being used in combination with waterproof mortars to serve the purpose of thermal insulation and waterproofing respectively. Light weight concrete? definitely works as a superior alternative to Brickbat Coba. It comes with numerous advantages. It is an excellent product for thermal and sound insulation especially for roofs & floors.

Pervious concrete?

Pervious concrete? is a special category of modified concrete that permits rain water runoff to percolate through rather than flood surrounding areas or storm water drains and always keep the top surface ?Dry?. Its unique filter action removes pollutants from rain run-offs and allows the sun's heat to evaporate volatiles, leaving behind the remaining solids to be consumed by microbial action. This permeated water replenishes ground water table and aquifers; hence, can also be termed as 'Rain Water Harvesting Concrete'. It is one of the best solutions for Playgrounds, Walkways and Parking areas. While it is necessary to cater to the increasing demands, it is also important to meet these demands in a way that it is a win-win situation for clients and the environment. With unique attributes, our special products stand apart, breaking the clutter and creating environmental friendly solutions.

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Concrete Innovations & Trends

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Durability Testing: Is RCPT the Right Choice?

A number of reinforced concrete structures in our cities and metropolitan areas, located especially in the vicinity of the coastal zone and industrial belts are showing signs of premature deterioration. These are mostly the structures constructed during the site-mixed concrete era, immensely lacking in quality in view of inherent shortcomings associated with site-mixed concrete. Poor quality of site-mixed concrete accompanied with near-total disregard for durability has taken a heavy toll on some of the structures constructed during 1960s to 2000.

With the arrival of ready-mixed concrete, mainly in the urban centres, the quality and consistency of concrete have vastly improved. However, the tendency to rely too much on the compressive strength of concrete ? a legacy of site-mixed concrete era - is still widespread amongst many customers. The mother code of construction ? IS 456 - in its revision done in the year 2000 specified certain indirect provisions to ensure durability of concrete. These included provisions of minimum grade of concrete, minimum cementitious content and maximum water-binder ratio for five different exposure classes. Many customers do not adhere with some of these provisions, including the minimum provisions relating with the relevant exposure classes. For example, for quite a few structures being constructed in the coastal zone in South India, M20 grade of concrete is still being specified as against the minimum of M30 grade needed for the “severe” exposure class as specified by the IS 456. Further, there is a strong resistance to permit increased use of supplementary cementitious materials like fly ash, granulated blast-furnace slag, etc. in concrete, which in fact, have the potential to impart higher durability characteristics to concrete.

Of course, there is some silver lining to this otherwise disappointing scenario. There are some specifiers, although in minuscule minority, who strictly abide by the provisions of IS 456 and specify concrete in accordance with the requirements of exposure classes. Also, it is noteworthy that the infrastructure sector in the country is showing awareness about the durability aspect of concrete. This reflected in the stipulation of certain durability-related tests in the concrete specification of some major bridges, and some of the ongoing metro rail projects. Similar trend is also discernible in a few high-rise building projects being executed in major metropolitan cities. This trend is certainly a welcome development.

Tests for Assessing Durability of Concrete

According to Prof Mehta, major causes of deterioration of concrete - in order of their decreasing importance - are: corrosion of reinforcing steel owing to chloride attack and/or carbonation, sulphate attack, alkali-aggregate reaction, acid attack, freezing and thawing etc. The rate of ingress of aggressive agents within concrete is dependent upon a host of factors. The quality and thickness of concrete in the cover region governs the rate of ingress.

Durability is one of the most extensively researched topics in concrete technology. A large number of durability-centric tests have been developed by a number of researchers. These test methods address specific transport mechanism and/or type of aggressive agent, namely, liquid, gas, or ionic species (e.g. chloride). A recent paper2 provides a compilation of some of the widely used methods. It can be seen from this compilation that a total 42 test methods are now available to determine durability of concrete.

With such a wide spectrum of tests being available to assess durability, the specifier faces three main dificulties ? which is the appropriate test for durability suitable for the given application, what should be the frequency of testing and finally what should be the acceptance criteria. The ensuing discussion will try to address these issues.

As mentioned earlier, the practice for specifying durability test for qualifying the concrete mixes began in India with the infrastructure sector ? mainly for bridges. It was the water penetration test (DIN 1048- part V) which was specified for few bridge projects ? mainly the bridges on the Konkan Railway. This test was also included in the specifications of road bridges of the Ministry of Road Transport & Highways (MORT&H). However, many experts believe that this test cannot serve as the stand-alone tool to determine durability.

Considering the fact that corrosion of reinforcing steel in concrete is one of the most serious phenomena threatening the long-term durability of concrete, use of a reliable test method to determine the resistance of concrete to chloride ingress is obviously more crucial. As many as 16 test methods are now available to determine the penetration resistance of chloride in concrete. One of the important limitations of these methods is that they are very time-consuming and tedious and hence impractical for use as a tool for quality control. With a view to overcome these limitations, accelerated test methods were evolved. Amongst these methods, the Rapid Chloride Ion Permeability test (RCPT) has become a widely used test in North America and many other countries.

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RCPT Method

The RCPT is performed using 51-mm long, 95-mm diameter cylindrical specimens cut from cores (Fig 1). Alternatively, the test can be performed using 95-mm

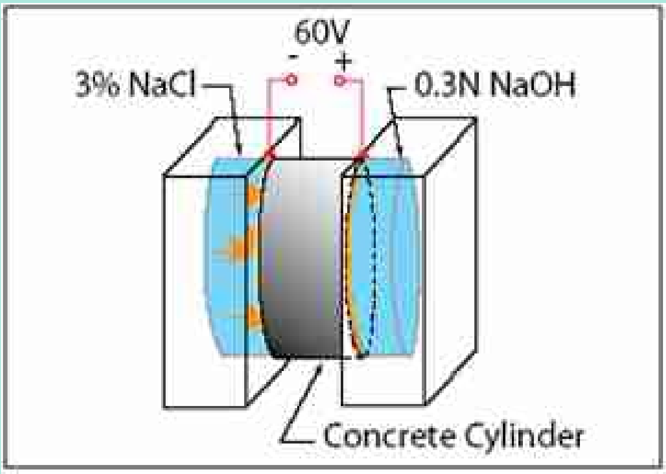

Fig 1 RCPT Test set up

ASTM C 1202 provides a qualitative relationship between the results of the test and the chloride ion permeability,

Table 1.

Charge passed (coulombs)	Chloride ion permeability
> 4000	High
2000-4000	Moderate
1000-2000	Low
100-1000	Very low
<100	Negligible

Table 1: Chloride ion permeability based on charge passed

Contrary to what the name indicates, RCPT does not measure the permeability or chloride diffusion in concrete. The test measures ionic movement. It was observed that the application of the test induces change in pore structure and resistivity of concrete specimens tested3. Hence, it can be considered to be simply a conductivity or inverse resistivity test4. Initial work by researchers found good correlation between the Coulomb values of RCPT and the results of ponding test performed on specimens of the same mixture for a wide variety of concretes 5,6. Thus, RCPT values provide a good indication of the degree of penetrability of concrete.

RCPT has been used extensively in North America and many other countries and has been incorporated in the national specification of Canada (CSA A23.1.04)7. In North America, it has been specified for diameter cast cylinders.

evaluating the quality of supplied and in-place concrete for highway bridges, parking structures, tunnel liners, etc. Therefore, as stated by Hearn et al, “in spite of other developments, it is likely that this (RCPT) test will remain as an index test for permeability for many years to come”.

Considering the wider acceptance of RCPT as a reliable durability test method, it is heartening to note that the Indian Roads Congress (IRC), has recently included RCPT in its latest revision of bridge code, that is IRC- 112. The IRC specification provides the limiting values for three exposure conditions as given in Table 2. RCPT is usually conducted at 56 or 90 days so as to benefit from the pozzolanic and/or hydraulic properties of supplementary cementitious materials like fly ash and/or GGBS.

Exposure Class	RCPT @ 56 days
Severe	1500
Very severe	1200
Extreme	800

Table 2: Limiting values of RCPT specified in IRC 112

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One of the main problems of durability testing is the large variations observed in the results of various tests. The specifier faces the dilemma as to how much variation should be allowed in the test values in the specifications. In this context, it is interesting to note that a round-robin testing of selected durability tests was recently conducted in nine renowned labs under the auspices of the Durability Committee of the Indian Concrete Institute (ICI)8. Amongst the five durability tests conducted under the round-robin testing, it was observed that RCPT showed the least variation, which ranged from 25 to 40% (see Table 3).

Test method	COV (%)
Rapid chloride permeability test (ASTM C 1202)	25 - 40
Chloride migration test (NT Built 492)	50 - 75
Sorptivity test (ASTM C 1585)	50 - 80
Water penetration test (DIN 1048 part V)	55 - 80
Water absorption test (ASTM C 642)	25 - 60

Table 3: Variability observed in Selected Tests on Durability

The inference that one can draw from the round-robin testing is that the specifier needs to keep a margin of 40-50% when specifying RCPT test. For example, if the specifier has specified the RCPT value of 1000 Coulombs for the concrete mix during the qualification stage, he also needs to specify 1500 Coulombs when the RCPT is being conducted as a quality control test on the same mix in a third-party lab.

Summarizing the discussion, we would like to emphasize that in addition to the 28-day compressive strength, there is an urgent need to start specifying durability test such as RCPT as one more qualifying parameter to assess the quality of hardened concrete. Such practice would be a first step towards our march from the age-old prescriptive specifications to performance-based specifications. Prism RMC, on its part, has already made a beginning in this direction by offering to conduct RCPT for its special product Marinecrete

Around the World

Researchers develop Earthquake-resistant Concrete

A new seismic-resistant, fibre-reinforced concrete developed at the University of British Columbia will see its first real-life application shortly as part of the seismic retrofit of a Vancouver elementary school.

The material is engineered at the molecular scale to be strong, malleable, and ductile, similar to steel ? capable of dramatically enhancing the earthquake resistance of a seismically vulnerable structure when applied as a thin coating on the surfaces.

Researchers subjected the material, called eco-friendly ductile cementitious composite (EDCC), to earthquake simulation tests using intensities as high as the magnitude 9.0-9.1 earthquake that struck Tokyo, Japan in 2011.

“We sprayed a number of walls with a 10 millimetre-thick layer of EDCC, which is sufficient to reinforce most interior walls against seismic shocks,” says Salman Soleimani-Dashtaki, a PhD candidate in the department of civil engineering at UBC. “Then we subjected them to Tohoku-level quakes and other types and intensities of earthquakes- and we couldn't break them.”

EDCC has been added as an official retrofit option in B.C's seismic retrofit program, and the team will be working with contractors in the next couple of months to upgrade Dr. Annie B. Jamieson Elementary School in Vancouver.

EDCC combines cement with polymer-based fibres, flyash and other industrial additives, making it highly sustainable, according to UBC civil engineering professor Nemy Banthia, who supervised the work.

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Fig 1 Seismic-resistant, fibre-reinforced concrete that can be sprayed onto masonry walls is being tested at UBC (Photo courtesy: https://www.arch2o.com)

Fig 1 Ultra-thin curved roof using novel formwork system

The research was funded by the UBC-hosted Canada-India Research Centre of Excellence IC-IMPACTS, which promotes research collaboration between Canada and India. IC-IMPACTS will make EDCC available to retrofit a school in Roorkee in Uttarakhand, a highly seismic area in northern India. Other EDCC applications include resilient homes for First Nations communities, pipelines, pavements, offshore platforms, blast -resistant structures, and industrial floors.

Ultra-thin Concrete Structure constructed with Novel Formwork System

Materials researchers from the Block Research Group at the ETH Zurich, together with architects Supermanoeuvre, have revealed a prototype for an ultra-thin, curved concrete roof system with an average thickness of just 50 mm ! Using digital design and fabrication technologies, the team was able to calculate and construct a self-supporting shell structure using the minimal necessary material. This was facilitated through the use of a novel formwork system consisting of a net of steel cables and a polymer fabric stretched into a reusable scaffolding structure.

The self-supporting, doubly curved shell roof has multiple layers: the heating and cooling coils and the insulation are installed over the inner concrete layer. A second, exterior layer of the concrete sandwich structure encloses the roof, onto which thin-film photovoltaic cells are installed. Eventually, thanks to the technology and an adaptive solar façade, the residential unit is expected to generate more energy than it consumes!

The researchers, also developed a proprietary spraying technique that allows the concrete to be viscous enough to stick to the formwork while staying liquid enough to be sprayed through a nozzle.

Instead of formwork using non-reusable custom-fabricated timber or milled foam, which would be needed to realise such sophisticated form, the researchers used a net of steel cables stretched into a reusable scaffolding structure. This cable net supported a polymer textile that together functioned as the formwork for the concrete. This not only enabled the researchers to save a great deal on material for construction, they were also able to provide a solution to efficiently realise completely new kinds of design. Another advantage of the fexible formwork solution is that during the concreting of the roof, the area underneath remains unobstructed and thus interior building work can take place at the same time.

This new formwork technology will be utilized for the first time in a real-world project in a planned roof-top residential unit called HiLo, built on top of the NEST living laboratory in Dübendorf, Switzerland. This project will integrate insulation and heating and cooling coils on top of the inner concrete layer, upon which a second layer of concrete will be sprayed. The upper surface will then be clad in thin-film photovoltaic cells to allow the residence to be energy-positive

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Mail Box

Question

We have been supplying M30 grade concrete to one of our customers. The consultant of the project has specified only the 28-day compressive strength of concrete (30 MPa) and 100mm slump at pour site. Our own mix design based on the cementitious combination of ordinary Portland cement and fly ash was approved by the consultant and accordingly around 70 m3 concrete was supplied for around a month. The desired workability was achieved at pour site and the 28-day compressive strength of concrete as tested by us and witnessed by customer's representative are satisfactory. However, some cubes tested at third party lab showed that the strengths are closer to boundary line values. The customer is now demanding that the 28-day strengths should be closer to the target strength of 38 MPa, or at least 35 MPa and that 7-day strength should not be less than 70% of the target, that is, 24-25 MPa, without any extra cost to them. Is this a fair demand from the customer? We need your guidance on this issue.

Answer

At the outset, we would like to assure that technically speaking you are on the correct course. This is because you have got the mix design approved by the consultant, concrete's slumps as tested at sitewere okay and that the results of cubes tested by you and witnessed by the client's representative were satisfactory. We are not aware of the exact terms and conditions of your contract with the customer. However, we observe that you have complied with all the standard requirements expected from the ready-mixed concrete producer.

A marginal shortfall is reported in the compressive strength of cubes tested at third-party lab. This could be owing to a host of factors ? use of distorted cube moulds, lack of continuous curing done at customer's site before sending cubes to third-party lab, faulty testing machine, eccentric seating of cubes on machine, incorrect rate of loading, etc ? to mention only a few. The extent of the variations in the strengths on account of some of these factors is quite high and the same is well documented by Dewar and Anderson in the Manual on Ready Mixed Concrete (see Fig 1). This reference may be shared with the customer and you may invite customer to send his representative to the plant again to witness the standard procedures followed by your lab and feld technicians in sampling, cube casting, curing and testing concrete samples.

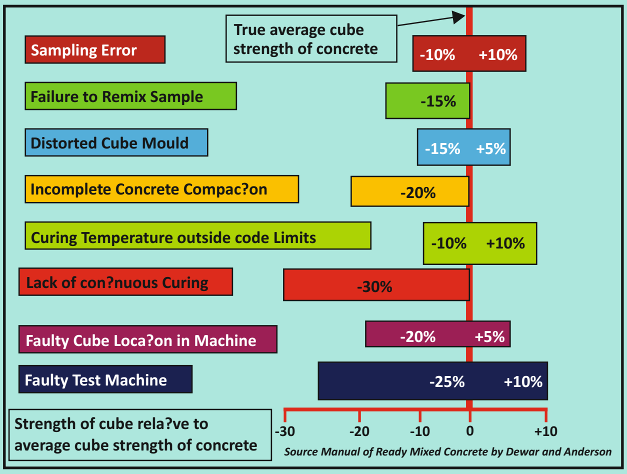

Fig 1 Effect of deviations in sampling, cube filling and testing on measured cube strength

As regards the fresh demand of the customer of supplying him concrete having higher target strength, we are of the firm opinion that the same is highly unjustified. When the customer needs only M30 grade of concrete and you have demonstrated that your concrete has achieved the desired strengths, the demand of providing the “bonus” strength of extra 5-6 MPa strength is certainly not justified and hence not fair.

Here, we suggest that you may once again approach the customer and share the running average chart of the last 30 compressive strength results of M30 concrete you had supplied to various customers to demonstrate that you have consistently supplied desired quality concrete. You may also share the 56-day and 90-day strength data of M30 mix to assure the customer that there is around 10-15% gain in strength at these ages. Such strength records should provide sufficient level of quality assurance to your customer.