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Dear Friends,

It gives us immense pleasure to connect with you again. Our pledge is to continue with the best-in-class products and services in Cement, Ready-Mix Concrete [RMX] and Aggregates. Our vision and values are driven by Integrity, Innovation, Care, Collaboration and Operational Excellence. We believe in emphasizing on quality, innovation and on building trust. Our endeavour through this magazine is to discuss different aspects of construction, but with an effort to bring in new initiatives.

This time we are planning to create a section for you where we expect your queries, suggestions, advice and sharing of construction and design related experiences. We are a strong believer in spreading of innovative and cost effective practices up to the grass-root level. You might have witnessed our recent launch of **Duraguard Microfiber Cement** – The first pre-dosed and pre-homogenized fiber cement for the individual home builders. Usage of fiber technology in concrete and mortar was so far restricted to non-trade projects and the RMX segments. We also have plans to include other innovative products in the portfolio. We hope that you enjoy reading this issue as much as we enjoyed putting it together. Wishing you, your family and associates a very Happy New Year.

## Agilia - Advanced Self-compacting Concrete

Agilia is a concrete that is free flowing, self compacting high quality and Value Added Product from Nuvoco (formerly Lafarge India Ltd).

When Pei Cobb Freed & Partners the principal architect of Lodha World One designed the iconic project situated in downtown Mumbai they wanted concrete which will be able to meet all the above challenges. After much deliberations and trials Nuvoco was selected as the preferred concrete partner and Agilia™ as the solution.

Even the structural engineers Leslie E. Robertson Associates (L.E.R.A) were consulted before closing the concrete vendor. The site also houses two other towers World View and World Crest.

## World One Tower

World Tallest Residential Tower

Agilia met the following challenges

- 442 meters high
- 117 floors
- more than 300 apartments
- 150,000 square meters of floor area

Grades:

M95

M75

Raft:

M60, M40

HPC:

M95+

Core Wall:

M95+



**Agilia™ is a self-compacting, self-leveling concrete** that provides solutions and opportunities for design and placement. Agilia is a fluid concrete that flows freely around congested steel reinforcement. Due to its fluidity, it eliminates the sound from the vibration, thereby reducing worksite noise levels. Agilia™ provides excellent consistency and aesthetic qualities as per the architect's need. With its unique curvilinear shape, World Towers forms a stunning sculpture of glass and steel. Situated in Mumbai which is a coastal place, the velocity of wind is higher and with a height of 442 meters from the ground wind was a major factor that had to be taken into consideration while deciding the concrete. To answer this problem Nuvoco suggested Mega™ High Strength concrete of M95 grade which can withstand wind velocity at such heights. Altogether 45000 cum

of High Strength concrete was supplied for the core walls. But World One's iconic status cannot only be attributed to the sheer scale of its structure. Till date, approximately 8 lakh cum of concrete has been supplied, which included various types of concrete apart from Agilia™. The entire concrete for both the towers has been supplied by Nuvoco. The scope of work included raft, shear walls, core walls, slabs, columns and beams. The raft of this majestic structure alone took more than 12,000 cum of different grade concrete along with temperature control. The raft were so huge that the pour had to be divided into three days to achieve the desired results. With proper planning and site coordination all the pours were successfully completed as per client requirement and satisfaction.

## Fiber reinforced Concrete

The use of fibers to reinforce construction materials is a well-known concept. It has been practiced since ancient times, with straw mixed into mud bricks and horsehair included in mortars. Concrete cracking is normal. Portland cement concrete is considered to be a relatively brittle material and is prone to crack in the plastic as well as the hardened stage. Plastic shrinkage occurs when the evaporation of water from the surface of concrete is greater than the rising bleed water. As concrete is very weak in tension in its plastic stage, a volume change causes the surface to crack. As it hardens, the water present in the pores of concrete begins to evaporate. This causes the concrete to shrink due to the volume change, which is restrained by the sub grade and reinforcement. This results in a tensile stress being developed in hardened concrete, again causing the concrete to crack. Cracks lead to negative perception of quality, durability and serviceability. However in most cases they become only aesthetic problems. Cracks also results in disputes between the owner, Architect, design Engineer and contractor which results in job delays and the cost increases due to work stoppages and evaluation which is more severe than the actual consequences of cracking. One of the solutions to this problem is the addition of fibers to concrete. An attempt has been made in this article to provide the

advantages and benefits of using fiber reinforced concrete for a variety of applications. The use of fibers help in modifying properties of concrete both in the plastic and hardened stage and thus, results into a more durable concrete. Incorporating Micro fibers helps to reduce thermal and shrinkage cracks. Addition of steel fibers enhances the ductility performance, post-crack tensile strength, fatigue strength and impact strength of concrete structures.

### What is Fiber

#### Reinforced Concrete (FRC)?

FRC is Portland cement concrete reinforced with more or less randomly distributed fibers. In FRC, thousands of small fibers are dispersed and distributed randomly in the concrete during mixing, thus improving concrete properties in all directions. Fibers help to improve the pre-crack tensile strength, post peak ductility performance, fatigue strength, impact strength and minimize thermal and shrinkage cracks. The process of adding fibers during mixing often give rise to segregation and flocculation and the expected benefits are not achieved and is also not possible to adopt for domestic concrete. To mitigate this constraint Nuvoco, for the first time in India, introduced pre-dosed and pre-homogenised fiber cement for all types of usage.

## How do fibers work in early (Plastic) stage of concrete?

Early age volume changes in concrete causes weak planes and results in the formation of cracks, because the stress developed in the body of concrete exceeds its tensile strength at that specific time. The growth of these micro shrinkage cracks is inhibited by the mechanical blocking action of both synthetic and steel fibers. The internal support system of

the fibers inhibits the formation of plastic settlement cracks. The uniform distribution of fibers throughout the concrete discourages the development of large capillaries, caused by bleed water migration to the surface. Fibers thus lower the permeability of concrete through the combination of plastic crack reduction and reduced bleeding characteristics.

## Advantages and benefits of Fibers in concrete.

- Fibers inhibit and controls the formation of intrinsic cracking in concrete caused both in the plastic and hardened stage of concrete, thus ensuring a more durable concrete construction.
- Fibers reinforce concrete against impact forces, thereby improving the toughness hardened concrete.
- Fibers enhance the hardness of the surface of concrete against material loss due to abrading forces caused by frequent movement of wheel loads. This enhances the service life and safety of concrete pavements.
- Fibers help in reducing the permeability and water migration in concrete, which ensures protection of concrete due to the ill effects of moisture.
- Fibers reduce plastic shrinkage and settlement cracking when concrete is still green, thus enhancing the overall life of the structure and reducing the maintenance cost.
- Macro fibers like steel fibers can replace the secondary reinforcement or crack control steel used in grade slabs, thereby reducing the overall cost of the structure.
- Fibers enhance cohesion, thereby segregation in concrete & mortar

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