At the core of any construction, apart from its design, lies the materials used, and hence are one of the most crucial components of any structure. Dating back to 400 BC, building materials have come a long way. During the pre-historic days where structures like houses, roads, dams, bridges etc were built using natural resources like sticks, stones, animal hide and even large leaves. At the time of the Industrial Revolution, which is also called the revolution of architecture, newer, stronger materials were introduced, including metals and steel.

As a result of extensive research and a highly competitive global market, the construction material sector has undergone a massive facelift and has introduced high performing materials, capable of producing world class structures. These developments come at a time when there is increasing emphasis and growing awareness on green constructions and building structures that can withstand harsh weather conditions like rain, wind, snow and hail. Besides, these new products are also gaining popularity for their versatility and features that have never been seen before.

The industry is facing a shortage of raw materials and to combat the shortage of coarse and fine aggregates, the technology of sintering fly ash has already been developed and is in place. Within the ever evolving industry, the need is felt now more than it has ever been to consciously use this in lower grades of concretes, which can liberate the natural aggregates for higher grades of concretes. The role of regulatory bodies like National Council for Cement and Building Materials (NCCBM), Bureau of Indian Standards (BIS) and National Building Code (NBC) is integral at this stage for standardisation of this development for widespread manufacturing and use.

**Recycling**

Recycle has been the buzzword for a while now and a big opportunity for the construction sector to make optimum use of, is recycling building debris, just by simple controlled crushing and subsequent screening to different fractions. By promoting this concept among smaller real estate developers at local consumption point levels, this small ripple can create big waves. Pollution levels have risen significantly over the past decade and by recycling debris, not only will it help the local administration to keep the towns and cities free of debris. Additionally, it will also minimise long distance hauls for delivering transport and saving fossil fuel and the associated risks of road accidents, traffic congestion, etc. Although this supporting technology is very basic and simple, its implementation requires honest and sensible facilitation from the local civic bodies.

During previous decades, safety was not as big a concern as it is today. In areas where ‘safe and sufficient’ technologies are concerned, there is huge scope for development. The basic premise of which, is playing with the design aspects, for example, keeping the capacity same, engineers are now skilled to improvise on the shape and configuration of a RCC.
column and bring in economic material consumption by leveraging section moduli properties.

**Ferrocement**

Another breakthrough in the evolution of the construction world is the use of ferrocement, which is a material comprising wire meshes and cement mortar. Besides bringing in considerable savings in material consumption safety by judiciously using it in building components, its applicability is vast due to low weight and non-requirement of a framework.

With the right use of ferrocement, it also offers pleasing aesthetics. But before we can apply this widely in the industry, this improvised, but scientific technology needs to be validated and vetted by BIS, NCCBM for better assurance and large scale acceptance. Precast technology with ferrocement improvisation will also open a new horizon in rural housing with the following distinct advantages:

- Safe and strong components.
- Faster construction.
- Flexible adoption – when using ferrocement, people can opt for a strong and stable frame only, while elements such as walls, roof and partitions may be completed with locally available materials like bamboo, timber, stone lamina etc.
- Sleeker structures with highest properties, prevention of wastage of materials.

As an example of the use of ferrocement in roofing systems, precast roofing slabs of 1000 mm x 500 mm size are 30 mm thick, cast with 1:4 sand-cement, latex modified mortar, 4 x 5mm bars at the periphery and two at the centre along the shorter span and chicken wire mesh at the mid depth, weighing around 67kg, when fully dried. During load trial over a period of one month each slab of 0.5 m² area withstood around 470 kg of live load, apart from its self load. Such innovative designs can not only save coarse aggregates and steel to a great extent, but also provide higher load carrying capacity safely. The scope and opportunity of playing around with the shapes and configurations are unlimited and can be economised in mass and centralised constructions.

**Innovative approach**

Another important innovation in the construction sector, has been the use of high performance concrete as complex building and infrastructure projects can greatly benefit from this. Due to this, we are able to delve deeper into the complexities of cement, binder, aggregates, water, admixture and other materials, to develop a base that is customised to the nature and requirements of the structure. At present we are pumping C95/M120 Self Compacting Concrete with minimal creeping and shrinkage to the 118th floor of a premium property in Lower Parel, as well as production of M50 high early strength concrete for tunnel segments of the upcoming Mumbai Metro with a corrosion free life of up to 150 years.

For many years, architects and structural engineers have demanded the best construction materials, which has led to out-of-the-box thinking and development of complex design tools. As a result, self compacting, levelling and filling concrete was created, which gives engineers and architects the confidence to design their dream projects with ease.

In previous decades, a common problem faced by builders was that of having to purchase excessive concrete, which fell as a burden to them. Using cutting edge innovation in material chemistry and rheology studies to understand the local and small volume needs, the first wet mix concrete was created. This unique product is aimed at the growing affordable housing and redevelopment sectors, which guarantees quality assurance and sustainable construction where low volumes of concrete are required. The product is also a prime example of disruptive innovation in the repair segment, which has been dominated by dry mix products.

Another interesting development in the construction segment, has been the evolution of fibres. Since Biblical times, fibres have been used to strengthen brittle matrices, but it was only during the 1960s, that steel fibres were proposed as a dispersed reinforcement for concrete. Since then, the material has developed considerably, so has our knowledge of the material, based on theoretical solutions and experimental findings. We have seen that test methods, which have been transferred from high-strength composites are very effective, however, due to compatibality issues, practical applications are few. To address this, microfiber pre-blended cement has been made available in the Indian markets, which acts as a binding agent and ensures stronger structures, with significantly reduced water seepage.

3D printing, is gaining momentum and has been making waves in several other industries. The technology has now entered the real estate sector and is highly acclaimed as the future of construction. Some of its key benefits are speed, design freedom, flexibility, accuracy and we are already working with students and professionals to develop high speed 3D printable materials like mud, mortar and concrete.

During the process of construction, plastering has been one of the main and most challenging activities for centuries due to several reasons including shortage of skilled manpower and plastering sand across locations. To solve this problem, wet plastering system has now been implemented. This is a very high quality plaster with low water absorption and permeability along with a high bond strength against the host surface. By using this in construction, builders are now able to enjoy high productivity, reduce their dependency on labour, maintain consistency and ensure minimal wastage of raw materials.

The construction industry has definitely come a long way from where it began, with more and more innovations coming into the fore. This however, is not sufficient for the industry to grow. If we are to grow, the onus is on each and every stakeholder to ensure these advancements are used optimally and we work towards sustainability in our operations.

Viewpoint

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