METCON STEEL update

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What cost quality?

There are ways to ensure quality of concrete. And it is not very costly!

London bridge is falling down...
falling down....

Remember the nursery rhyme? The original London bridge that fell in 1013 was a wooden one but most structures we have around us are made of concrete. Every single constituent of it - steel, sand, water and cement - plays a significant role in ensuring its quality, and hence long life. How to go about ensuring quality? Find a guideline here.

Steel

Plain concrete, which is a mixture of sand, concrete and water, has very poor tensile and bending strength. Steel reinforcement bars, known as rebars, make up for this and hence the mixture is called reinforced cement concrete (RCC).

Steel critically influences the structural behaviour of all other ingredients of concrete and ensures that they play their assigned roles effectively.

Rebars should offer high strength, good bonding with cement, easy bendability, good weldability and protection against fire, corrosion and earthquake. The two key factors in selecting the rebars are the mechanical properties and the metallurgical characteristics. In simple words, a user must check for the type of the steel, and how each bar is produced.

The three main types of rebars available are mild steel (MS) bars, cold-twisted deformed (CTD) bars and thermo-mechanically treated (TMT) bars.

Plain MS bars

Plain MS bars are frequently employed where nominal reinforcement is called for, like one way slabs. Low strength is also preferred in cases where deflections and crack widths need to be controlled or where excessive ductility is required.

CTD bars

The market was once flooded with the CTD bars, which are now on a decline. CTD bars are produced by cold twisting of ribbed bars of special profile, to develop required strength level as per the standards.

The CTD bars have high proof strength but have two weaknesses: their carbon content is high and so have poor weldability and ductility. The twisting subjects the bars to torsional stresses, affecting their resistance to corrosion.

TMT steel

The thermo-mechanical treatment process involves rapid quenching of hot bars through a series of water jets after the bars come out of the last rolling mill stand. The short residence time in the water jacket provides intensive cooling of the surface layer, transforming it into a hardened structure. The bars are then cooled in the atmosphere so that the temperature between the core which is still hot and the cooled surface layer is equalised. The heat extracted from the core tempers the peripheral hardened structure, while the rebar core cools down slowly to turn into a ferrite-pearlite aggregate. The strength of the bars is carefully controlled by optimizing the water pressure for their

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TMT rebar

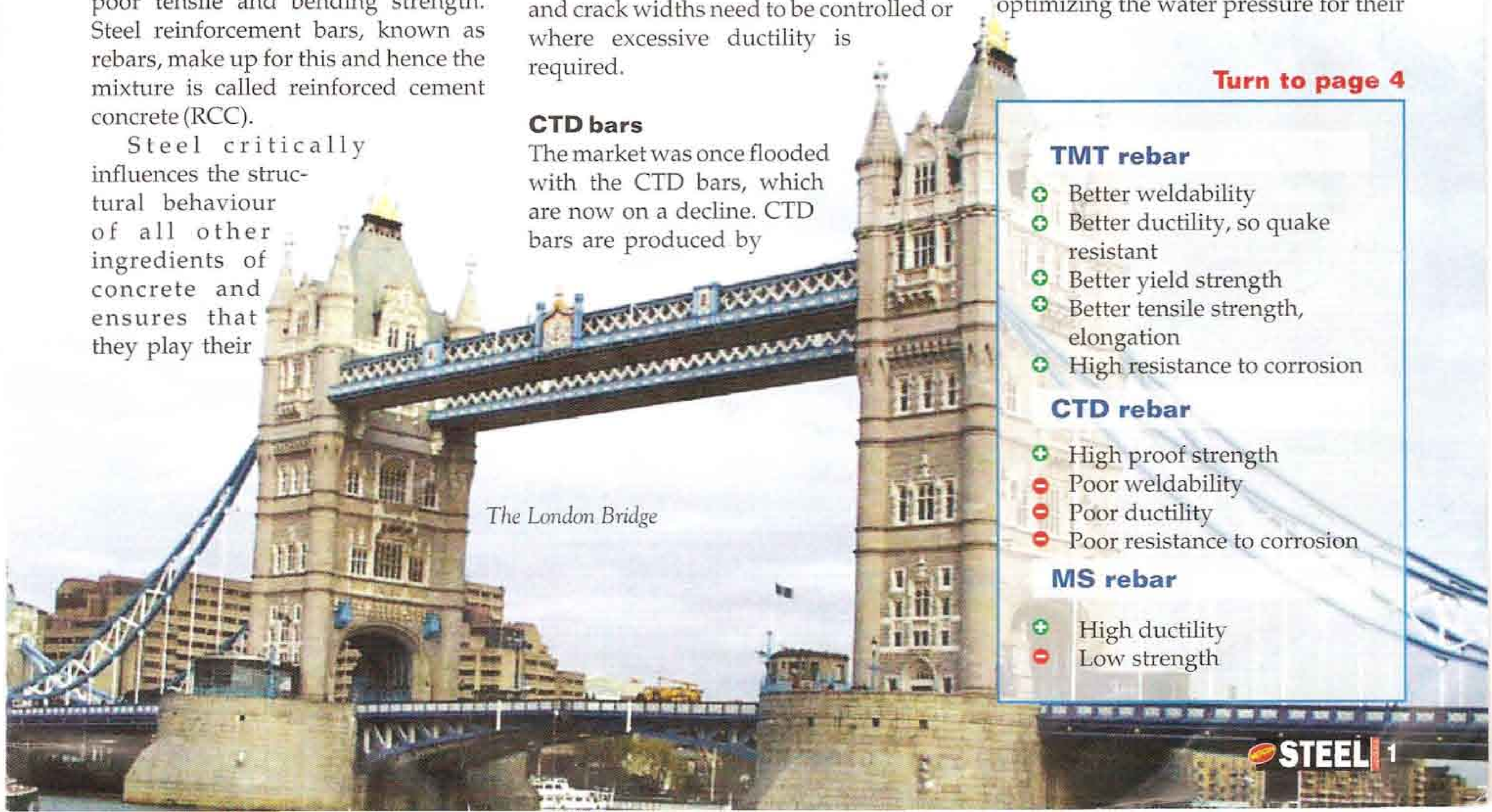
- ⊕ Better weldability
- ⊕ Better ductility, so quake resistant
- ⊕ Better yield strength
- ⊕ Better tensile strength, elongation
- ⊕ High resistance to corrosion

CTD rebar

- ⊕ High proof strength
- ⊖ Poor weldability
- ⊖ Poor ductility
- ⊖ Poor resistance to corrosion

MS rebar

- ⊕ High ductility
- ⊖ Low strength



The London Bridge

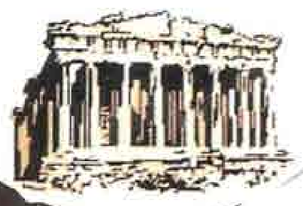
The history of concrete

3000 BC

Egyptians used mud mixed with straw to bind bricks. They used gypsum and lime mortars in the pyramids.

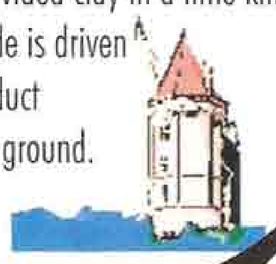
300 BC - 476 AD

Applian way, Roman baths, the colosseum and pantheon used pozzalama cement. Animal fat, milk and blood were used as admixtures.



1793

Joseph Aspdin of England invented Portland cement by burning ground chalk with finely divided clay in a lime kiln until carbon dioxide is driven off. The product was then ground.



1824

John Smeaton used hydraulic lime to rebuild Eddy stone Light house in Cornwall, England

1836

The first systematic test of tensile and compressive strength took place in Germany

1867

Joseph Monier of France reinforced flower pots with wire ushering in the idea of iron reinforcing bars

Building Code to be made mandatory

Engineer's certificate also to be a must

It looks like the days of casual approach to quality construction are over. In a move with far-reaching consequences, the Central government has told the Supreme Court that it will enforce implementation of the National Building Code in all cities to ensure that all newly constructed buildings are earthquake-resistant. It is also contemplating making it mandatory that all constructions are certified by qualified structural engineers.

The government's stand was communicated to the Supreme Court in response to a notice. The Supreme Court issued the notice on a petition seeking a direction to the government to change building by-laws for high rise building in big cities to make them earthquake-resistant. The government also said it was planning to introduce insurance cover for structural damages.

As of now, the code is not mandatory. It is up to the States and their arms, local bodies and other construction agencies to adopt it.

Cyriac's Column

Intelligent spots, independent souls

He had the sketch of a 20-cent rectangular plot when he turned up in my office. The sketch has all the vaastu markings such as agni cone and water spot. He wanted me to design a vaastu-compliant house.

Now this naughty thought crosses my mind: If he were to build two houses on that plot, will the water spot of the first one stand next to the agni cone of the second, violating the very principles he holds inviolable?

The dilemma begs the question: can we subject spaces to rules? If we cannot codify the human behaviour, can we codify land's behavoiur? Are they amenable to linear rules? How prescriptive can we get when we design houses?

I believe, a lot of architects believe, that every space has an intelligence of its own, a genius of its own. Their slope, elevation, relatives position... decide their character. They are intelligent spots with independent souls. They are not amenable to soulless rules.

A house is a dwelling space, and so utility is the architect's prime concern. A car is also a dwelling place, and its utility is a car designer's prime concern. Believe me, architects and car designers work on similar principles. Logic is the key word, and not the scripture that offers a linear solution to all problems.

Today the challenge is to design a structure that interacts with the nature, and at the same time, offers the comforts of the old idea. This demands a thorough review of the scriptures, and not a return to them. Because it is dangerous to fix a knowledge concept.

Times change, so are practices. This is true of all branches of knowledge. Archite-cture is no exception.

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Master Innovator

In technology I trust, says Jacob George. He coupled it with innovation and bagged the Inside Outside Designer of the Year 2005 award

When my information changes, I change my opinion. What do you do, sir?
Lord Keynes, the guru of capitalism.

When Jacob George designs houses, one may tend to believe Lord Keynes' theory holds good in architecture, too. The architect who bagged the *Inside Outside* magazine's Designer of the Year 2005 award believes technology and information compel architects to change their opinions and come up with new solutions.

"New materials and new technologies should be explored and embraced," says Jacob, partner of Design Combine in Kochi. "For example, electronic gadgets offer total security at one fifth of the cost of regular measures, like grills." Jacob says one of his clients who had insisted on heavy guage grills dropped the idea after his friend's house was robbed twice despite installing a second layer of grills around his house after the first robbery. Quoting statistics, Jacob says most robbers have no intent to harm the house owner. "They come unnoticed, and leave unnoticed. Electronic gadgets are the best option to tell the robber that his presence is noticed," he says.

Jacob wants Malayalees to change their ideas on low-cost houses. "You do not have to stick to the Baker model. Baker has done wonders for low-cost architecture, no doubt. But now his model is one among the many options."

> The architect suggests ways to cut costs without affecting the looks of your house, or its utility. He practised them while building his own house.

Theories are good, but how practical are they? Jacob's office and the award-winning house he built for himself and his wife Nina Nayar stand testimony to the applicability of his theories. His office has glass walls- "glass is the best option to get the outside in and inside out"-and the bamboo grove and shade netting stands guard against sun rays entering in. For his house, he chose pre-fabricated walls instead of brick and so the finish is fantastic. The major reason why this was done, though was for the ease of installing and maintaining services - the electricals and the plumbing, as everything is readily accessable if the panels are unbolted.

Jacob's almost open house militates against two essential components of the traditional Malayali design: the dingy small rooms with little ventilation hosting darkness, and the looks of a fortress. An open kitchen with no concrete walls, fabricated staircases, steel frames instead of wood for openings, the modular system of bolt-on board based construction, wooden floors, water bodies... Jacob has redefined a futuristic house.

He also opted for flat roofs, with a louvred vent space all around at every wall-slab junction for natural ventilation. This ensures that there is constant movement of fresh air along the bottom of the slabs. To reduce the heat intake, he covered the roof slab with white glazed tiles, and has covered the entire building with a very light but strong steel and cable structure that supports shade netting.

For those who can afford the idea of a change, here is a choice.

WHEN OTHERS build FOR YOU

Most buyers of apartments choose to ignore the quality of concrete while meticulously enquiring about the rest. This is partly because of ignorance and partly because of the trust in the builder. No harm in trusting the builder. No harm in asking him about the ingredients of the concrete either. Your quality consciousness would ensure long and comfortable stay later and reduce maintenance costs.

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specific alloy chemistry and bar diameter.

The hallmarks of TMT steel are low carbon content, and hence better weldability and ductility, better yield strength, tensile strength, and percentage elongation. It also offers easy bendability and has high resistance to loss of strength at higher temperatures and corrosion. It is also available in higher strength levels.

All these qualities are key to the effective functioning of steel as rebar in concrete. And hence it is imperative that when you choose steel, you should choose the best one to support the concrete for longer durability.

Why quality TMT?

TMT rebar is a product of a complex, high technology process. If the manufacturing unit cannot stick to the recipe, the result would be disastrous. For example, if the bars are not adequately quenched it will offer only lower strength than what is required.

Metallurgy of the bar is another key area, which is often ignored. Several products which are available in the market are products of rerolling scrap steel, made available from ship-breaking or used steel rails. "Most rolling mills do not have adequate facilities for quality control and some of them use steel plates from ship breaking industry as the raw material. Reinforcement bars produced from this type of material are not generally suitable for quality construction," according to renowned metallurgist S.R. Mediratta.

Quality rebars can be produced only if the mills have the technology and processes to control the metallurgical qualities of the product. Used rails have a very high percentage of carbon, typically in the range of 0.55-0.68 per cent which makes these rails completely unsuitable for production of good quality ductile steel. The mills should also be able to control other elements such as sulphur, phosphorus, manganese and silicon to ensure that the product can meet the standard norms. This is possible only if they are produced from BIS certified (IS:2830) billets and ingots, made using the electric furnace. But many mills do not go in for this route as it is an energy intensive process and electricity cost a lot! As a result, the rebars do not have the requisite quality which will compromise the life of the structure.

The rhyme rejects iron and steel for rebuilding the London bridge because it will 'bend and bow'. Afterall, there was no TMT steel then!

Ensure quality

How much does it cost to go in for quality steel? We present you a simple estimate for a residential building of 2000 sq ft built up area, at the cost of Rs 20 lakh.

Steel required: 4.5 tonne
Cost of TMT steel:
Rs 1,25,100 @ Rs 27,800 per tonne
Cost of ordinary steel:
Rs 1,16,100 @ Rs 25,800 per tonne

Difference: Rs 9,000

Moral of the story: *All that you pay extra is Rs 9,000 for quality steel which ensures longer, maintenance free life for your house. It forms 0.45 per cet of your total cost! Quality steel with its uniform thickness offers more length per kg compared with ordinary steel. The savings is sometimes up to 15 per cent, which will more than offset your extra cost!*

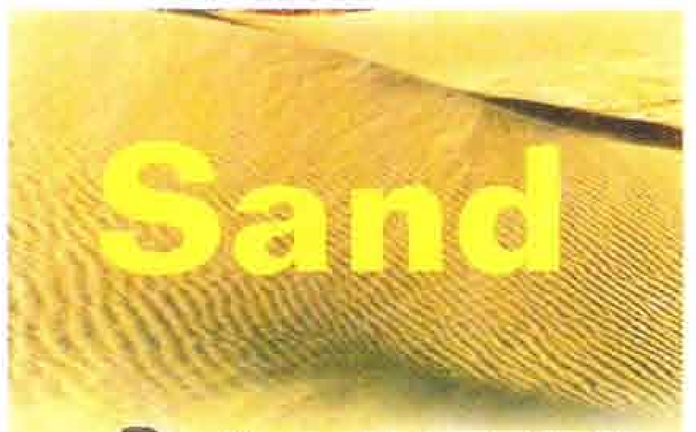
Water

Water for concrete mixing should be of potable quality. Presence of impurities or particles will adversely affect the longevity of the structure. For example, solid particles will remain in the concrete even after the water evaporates. These particles will decay after sometime, forming air holes. When the concrete is exposed to sunlight and heat, the air hole expands and breaks the structure.

Salinity of water is another cause for decay. Most people drill a borewell at the construction site and use the water from it without conducting salinity test. This is another sure recipe for disaster in the longer run.

The fact is that it does not cost you much to test the water for salinity. Compared with the cost of your structures and the life that you expect of them, it is worth testing the water.

Be also careful about the quantity of water used. Often masons add more water to the mix to make their job easy. The result is disastrous: either the strength of the concrete will suffer, or if one were achieve the prescribed strength, then the quantity of cement must go up. Either way, an avoidable waste.



Sand

Quality sand is key to the life of the structure. All that is said of water is applicable to sand as well: it should be free from decaying particles and salinity. Engineers even suggest washing of the sand to remove impurities.

As the river sand becomes scarce, the alternative appears to be Manufactured Sand, made from granite.

"Manufactured sand performed better than river sand at various quality tests such as cube test and mix design test," claims the Poabs group which manufactures and markets the product under the brand name MSand. The group uses the technology developed by the Civil Engineering Department of the College of Engineering, Thiruvanathapuram.

The Manufactured Sand particles come with cubical shape and identical faces, offering better binding strength and saves on cement, water and labour.

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