

## Is it the right time to look for m-sand as natural sand substitute?

Natural river sand is the cheapest resource of sand. However, excessive mining of riverbeds to meet the increasing demand for sand in construction industry has led to ecological imbalance in different states. Now the sand available in the riverbeds is coarse and contains high percentage of silt and clay, which reduces the strength of the concrete and retains dampness. Acute shortage and high price for river sand has led to adulteration with salty sea sand, which has raised serious concern among builders. As sand mining permanently damages the aquifer, affects natural recharge to groundwater and also causes ecological imbalance<sup>1</sup>, an alternative is looked for the natural sand. m-sand is manufactured sand, obtained from crushing of hard rock, boulders, etc. using state-of-the-art international technology.

The Bureau of Indian Standards (BIS), stipulates that concrete can be made only with naturally accessed materials, making it impossible for the construction sector to rely on alternatives to sand like m-sand. Copper slag, powdered glass and recycled construction waste among others are increasingly being used in many European nations, Singapore and the US.

Seeking to strike a balance between growing needs of construction industry and environmental concerns to preserve riverbeds amid excessive sand mining, the Government may opt for changing specifications of BIS to ensure substitutes of sand that can be used by builders across the country<sup>1</sup>.

The National Green Tribunal (NGT) had presently restrained sand mining across the country without taking environmental clearance for mine lease area irrespective of its size. The move gave a new impetus to the ongoing debate on how to strike a balance between economic needs of the infrastructure sector and environmental concerns. Such debate has again brought into light the demand for necessary changes in BIS regulations so that substitutes for sand can be used in construction. m-sand is a widely accepted substitute in many countries, which is produced by grinding rock, gravel, boulders, etc. Environmentalists across the globe are in favour of locally available alternatives, while pointing out how sand depletion from river beds is harmful to the aquifer, ecology and safety of settlements along the rivers<sup>2</sup>.

The high strength, uniform shape, proper gradation of fines, smooth surface texture and consistency in production parameter of m-sand provide greater durability and higher strength to concrete by overcoming the deficiencies like segregation, bleeding, honey combing, voids and capillary<sup>1</sup>. In a vast country like India, to meet the need of the construction industry we have to look for alternatives like m-sand and other locally available materials.

1. <http://www.msand.in/comparison.php>
2. Easier norms for sand substitutes? *The Times of India*, 17 August 2013.

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## Earthquake prediction

Bapat's letter on 'Legal aspects of earthquake forecasting'<sup>1</sup> is well written and well balanced. His assessment as to why the Italian seismologists got into big trouble – because of a deterministic 'no earthquake' statement prior to the L'Aquila earthquake – is exactly to the point. It was just plain stupid and unprofessional to make such a statement.

Earthquake prediction (or 'forecast' as I prefer to call it) is similar to certain parts of the weather forecast. Nobody will accuse the National Weather Service, if it issues a tornado warning, but no tornado hits the village or town. On the other hand, no intelligent weather forecaster will deny the progress in sci-

ence that allows tornadoes to be forecast with relatively high probability. Every weather forecaster is aware that it is necessary to rely on all assets in the toolbox of science and engineering to arrive at forecasts with the highest temporal and spatial resolution.

That is what the naysayers among seismologists often forget. They tend to think that only seismologists should be in the business of earthquake science. Everybody has by now accepted the fact that in spite of all the impressive and valuable work seismologists have done over the past hundred years, they cannot do a proper short-term forecast, in reality no forecast, except on timescales of years

and decades. This, however, does not mean that medium- to short-term forecasts are impossible. It just takes more than classical seismology training to develop the necessary science, tools and techniques. For this reason classically trained seismologists have to abandon their closed-door policy and let others come in who know a thing or two about earthquake physics.

1. Bapat, A. V., *Curr. Sci.*, 2013, **105**, 1035–1036.

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