

# Sustainable Civil Engineering

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## Innovative statistical process control and clean development mechanism for ready mixed concrete

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Statistical process control helps in systematic reduction of variability in key quality characteristics of a product. Clean development mechanism (CDM) can act as an effective instrument for mitigating climate change by effectively reducing the emission of CO<sub>2</sub> and other green house gases (GHG). In this paper, an innovative attempt has been made to apply some of the advanced and modified process control charts like CUSUM (Cumulative Sum) and Exponentially Weighted Moving Average (EWMA) control charts which can be effectively applied for quality monitoring of Ready Mixed Concrete (RMC). A proactive approach enabled to detect the causes leading to the variations associated with the production process at a much early stage of the process. This would result in prevention of unnecessary usage of more cement by the commercial RMC plants which would result in reduced emission. Also, reduction in emission of CO<sub>2</sub> can be achieved by about 35% by the usage of more flyash in the concrete mix. Thus the cost of quality involved in bringing the process within control can also be minimized. These control charts can be used as daily / weekly monitoring tool, which can improve the efficiency of the production process. Case studies of commercial batching plants in two metro cities of an emerging economic nation in South Asia have been considered for this research work. It has been observed that, though both the charts are sensitive to small process shifts, CUSUM technique along with V-mask appear to be a better tool for quality monitoring of RMC.

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## 8R-MAT- Environmental protection for sustainable riverbank, slope and erosion control

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Recycled tyre have been a disposal problem and continue to accumulate throughout the world today. Utilization of recycled tyres as Rubberized mat would minimize environmental impact and maximize conservation of natural resources. 8R-MAT is an innovative product for ground improvement technique and uniquely design to suit its function for construction of retaining wall, embankment, slope protection and soil erosion control. By the use of the recycled tyre, it will assist in sustainable environment and protect the earth from pollution and disaster. There are five functions in the application of engineering construction namely (1) Reinforcements (2) Separations (3) Barrier (4) Drainage (5) Filtration. These stated functions are useful for prevention and mitigation for ground improvement and stabilization techniques. The maximum tensile strength recorded from a single rubberized 8R-MAT is 20kN. This makes the product more reliable for Earth Retaining Structure especially when constructed on site for protection. The advantages of this invention are low cost, non bio-degradable, easy to handle, minimize time of construction, improve soil stability for short term and long term measures in various applications. It has been tested and monitored on field for two different sites. It were approved by Drainage and Irrigation Department authority to use it for riverbank protection and by Public Work Department to use it for Slope Protection.

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