

## **TEST REPORTS**

Recommendations given by the University of Moratuwa

### 1:1 **PHYSICAL PROPERTIES**

- 01 Although the grading of offshore sands can be variable, they are generally within the BS 882 limits, and can be used for concretes, mortars and plasters.
- 02 Both offshore sand and manufactured sand can be used in concrete mixes. However, the use of offshore sand is more advantageous, as the water content requirement is around 20 kg/m<sup>3</sup> lower, this results in cement contents that are around 30 to 40 kg/m<sup>3</sup> lower for concrete grades from 20 to 30.
- 03 The shell content of offshore sand is within BS 882 limits. The shells larger than 5 mm (which constitute around 2% of the entire sample) can be extracted for sale to lime kilns; this could reduce the harvesting of coral for lime production. The shells do not impair the workability, permeability of other engineering properties of the concrete.
- 04 Both offshore sand and manufactured sand are satisfactory for both mortars and plasters and reasonably acceptable to masons, although they may rank river sand as their first choice.

### 1:2 **INFLUENCE OF CHLORIDES**

- 01 A conservative limit for allowable Cl<sup>-</sup> ions in offshore sand for OPC based reinforced or metal-embedded concrete is 0.075% by weight of the sand. This is based on (1) an allowable Cl<sup>-</sup> percentage of 0.3% by weight of cement (lower than the BS 5328: Part 1 limit of 0.4% to account for warmer Sri Lankan temperatures etc.); (11) an allowance of 0.05% by weight of cement for chlorides in cement (which is the accepted upper limit); (111) a sand: cement ratio of 3.3 which will rarely be exceeded for reinforced concrete); and (1V) the availability of chloride free coarse aggregate.

- 02 Offshore sand saturated with sea water has a CI content of around 0.3% whereas if the seawater is gravity drained, it reduces to around the acceptable 0.075%. Some care has to be taken at the top of the stockpile where the CI% may be higher due to excessive evaporation, and at the bottom of the stockpile, where sea water may be held by capillary action.
- 03 The action of even 80 mm of rain will reduce CI contents to below acceptable levels, even at the top and bottom of a 2 m high stockpile. (The lowest mean monthly rainfall in Colombo is 71 mm in February.)
- 04 The efflorescence and corrosion performance of grade 20 concrete (i.e. the most critical grade) with the allowable CI content of 0.075% in the sand is satisfactory and similar to a chloride free control mix; on the other hand, a mix with 0.3% CI in the sand shows clear evidence of efflorescence and early corrosion.