

# No fines concrete: a practical guide

## 1. Introduction

No-fines concrete (NFC) consists of coarse aggregate and cement paste. In the hardened state, aggregate particles are covered by a thin layer of cement paste and are in point-to-point contact with each other. At each contact point the paste forms a small fillet; these fillets hold the particles together and give strength to the concrete.

NFC therefore has large interconnected voids and a much lower density than conventional dense concrete. The structure of NFC makes it ideal for use as a drainage layer under reservoir and basement floors. It can also serve as an insulating layer and as a damp-proofing material. NFC is NOT suitable for drainage purposes where the water is soft or aggressive to concrete.

## 2. Materials

### 2.1 Cement

Common cement that complies with masonry cements should not be used for No Fines Concrete.

### 2.2 Water

Water that is suitable for making ordinary concrete should be used.

### 2.3 Aggregates

Clean, single-sized concrete stone should be used. The use of flaky aggregates should be avoided. The most commonly used aggregate is 19 mm crushed stone, but smaller stone may be used. Mixes made with smaller stone are easier to handle and place but consume substantially more cement.

## 3. Mix proportions

For most applications, mix proportions range from 200 to 300 l of aggregate per bag (50 kg) of cement. The water content of the mix is critical: if the paste is too dry it will not coat the aggregate properly; if it is too wet it will run off the aggregate particles and possibly block the voids at the bottom of the pour. Experience has shown that the water content should be between 18 and 22 l of water per bag of cement.

## 4. Quantities

A cubic metre of compacted NFC requires about 1,05 m<sup>3</sup> of stone, measured in the loose state; cement content is between 260 and 180 kg depending on mix ratio.

## 5. Manufacture

NFC should be machine mixed. Hand mixing is difficult and laborious. If hand mixing is unavoidable, it is best to mix the cement-water paste in a container prior to mixing the paste with the stone. When mixing the paste, mix the cement into the water rather than the other way round.

## 6. Placing and compaction

NFC must be placed and compacted as soon as possible after mixing as it tends to dry out rapidly because of its open structure. Compaction is achieved by rodding the concrete; vibration must not be used, and heavy tamping is not necessary.

## 7. Protection and curing

Again because of its open structure NFC must be protected from drying out and must be thoroughly wet cured for at least seven days unless it is plastered, screeded or covered before that time.

## 8. Plastering walls

NFC has a rough surface texture for plastering. Normal plaster mixes are used, and the surface of the NFC must be dry when applying the plaster. Plastered NFC walls have some excellent qualities, but one drawback is that neither conventional wall plugs, nor masonry nails can be used for attaching fixtures.

## 9. Screeding

When used in underfloor drainage, roof insulation and domestic floors, NFC should be screeded within 72 hours of placing. Particular attention must be paid to wet curing the screed.

Normal screed mixes of 100 to 130 l of concrete sand per bag of cement should be used with enough water to produce a mix of plastic consistence.

## 10. Strength of NFC

NFC has negligible flexural or tensile strength. Compressive strength is usually between 5 and 10 MPa at 28 days for mixes in the range mentioned previously.

Higher strengths may be obtained by including 50 kg of fine sand per bag of cement. This increases the size of the fillets (see section 1), and hence the strength, but reduces the voidage and increases the density correspondingly.

## 11. Further reading

Owens G. R. ed. **Fulton's concrete technology**, 9th edition. Midrand: Cement and Concrete Institute, 2009, pp. 375-380.