# Feng Waterproof Concrete Mix 1 Mix Design

A summary of the constituent ranges specified in the Feng Waterproof Concrete Mix 1 mix design can be seen in Table 1 below.

*Table 1: Feng Waterproof Concrete Mix 1 Constituents and Accepted Composition Ranges*

| **Constituent** | **Low Range** | **High Range** |
|---|---|---|
| **Cement** | 350 kg | 375 kg |
| **Fine Aggregate** | 650 kg | 870 kg |
| **Coarse Aggregate** | 1000 kg | 1300 kg |
| **Magnesium Oxide (Dry)** | 10 kg (2.5% of cement weight) | 24 kg (2.5% of cement weight) |
| **Water** | 120 L | 170 L |
| **Standard Water** | 110.4 L (92% of total water weight ) | 156.4 L (92% of total water weight) |
| **Non-standard Water** | 9.6 L (8% of total water weight) | 13.6 L (8% of total water weight) |
| **Acti-gel (slurry)** | 0.77 kg (8% total non-standard water weight) | 1.09 kg (8% total non-standard water weight) |
| **E5 Colloidal Silica** | 0.11 L/45.35 kg of cement | 0.11 L/45.35 kg of cement |
| **Basaltic Fibers** | 3.0 kg/$m^3$ | 6.0 kg/$m^3$ |

The above mix design yields a concrete with a strength of 30 MPa, having a total dry constituent weight of 2400 kg. Acceptable Cement: Sand: Aggregate ratios include 1:1.5:2.5, 1:2:2.5, 1:2:3.

**Notes:**

- Standard size for sand which is also called fine aggregate: 0.1 to 1 mm.
- Standard size for coarse aggregate or stones: ¾”.
- Preferable stone types: limestone, pea stone or standard crushed stone.

**Constituent Notes:**

1. **Magnesium Aluminosilicate – Palygorskite/Attapulgite ore**
    a. Self-dispersing hydrated magnesium aluminosilicate acting as a binder, thixotrope, reinforcement additive, anti-settling agent and rheology modifier.
    b. Ideally added to the mix last but can be introduced at any point in the process with similar performance.
    c. Use can be either as Slurry or in Dry form.

2. **Magnesium oxide blend**
    a. Expansion agent that counteracts the tensile forces across the concrete body during the initial setting state.
    b. Always added in the dry state to concrete mix.
    c. There is naturally occurring CaO present in the MgO blend which comprises about 2 to 6% of the composition.

3. **Colloidal silica solution**
    a. This is a colloidal solution comprised of 15% to 30% wt. amorphous silica in 85% wt. water where the silica particles should conform to the size 1 to 100 nm and surface area of 300 to 900 $m^2/g$ where the most preferred ranges are particle size of 1-50 nm and surface area of 500-600 $m^2/g$.
    b. Enables internal hydration and curing, early strength acceleration, increased workability by binding to the cement particles.
    c. Only added to the mix in slurry form at the very last.

4. **Basaltic Fibers**
    a. Use of basaltic fibers is to avoid all forms of internal cracking and limit the width of cracks when our invention is to be used in extreme weather conditions.