Bentonite Pellets/Cement Grout
User Manual

Man 171	1.1.0	06/08/2014	John Morrison	Chris Rasmussen	Chris Rasmussen
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Contents

Section 1 : Backfilling Boreholes with Bentonite/Cement Grout

The ideal type of grout should be as deformable as the surrounding ground. A weaker mix of grout will not affect the performance of the instrument provided that the grout is injected correctly into the borehole. A stronger mix, however, may cause the grout column to behave independently to the surrounding ground.

The prime function of the grout is to act as a filler in the borehole. In the case of inclinometers/ extensometers it will help to attach the instruments to the surrounding soil and in the case of piezometers it prevents ground water from entering into the borehole.

Control of grout strengths, particularly for a weak grout is not always easy under field conditions.

Grout properties depend on material proportions, mixing equipment, mixing sequence, temperature etc. Mainly the grout must be sufficiently fluid to allow it to be easily pumped down the hole via a tremie pipe in boreholes full of water.

Most problems in the field arise due to the grout strength being too high rather than too low.

If the grout strength, when set, is less than the surrounding soil, this is not a problem, indeed it is usually desirable. Field control of grout mixes should be tempered with engineering judgement. A simple finger press test may be adequate rather than rigidly enforced cylinder strength tests, especially if unsuitably high strength requirements are specified.

1.01 Handling of Bentonite and Cement Powders

Bentonite is classed as nontoxic. However the powder may irritate the skin as it is alkaline, and gloves and face mask should be worn. (Bentonite is mainly comprised of sodium montmorillonite, and Fullers Earth mainly calcium montmorillonite. Fullers Earth is less irritant and is sometimes used in face packs).

Cement is an irritant and causes the skin to crack. Do not handle wet cement mortar with unprotected hands.

Bentonite requires to be hydrated. It should be added to water to form a slurry, then allowed to stand for a time, before adding cement. This is because the cement “kills” the sodium in the bentonite. 30 minutes is preferred for hydration, 10 minutes is the minimum.

Section 2 : Terms

Confined: Triaxial tests under three different confined pressures. Preferred method of testing because the grout in the borehole is confined.

Unconfined: Tests in a cube to determine compressive (crushing) strength.

Unconfined cube compressive:
Strength = 2 x confined shear strength

Bentonite type: Steetley Civil Engineering Berkbent 163

Cement type: Rugby Portland Class 42.5N

A 15 litre bucket holds 12 kg of loose bentonite powder
A 15 litre bucket holds 21 kg of cement
1 N/m2 = 0.001 kN/m2
1 kN = 1000 N
1 N/mm2 = 1000 kN/m2

2.01 Grout Mixes

Water/Cement ratio	Water litre	Bentonite Kg	Cement Kg	Confined shear strength (Triaxial) kn/m2 7 day	Confined shear strength (Triaxial) kn/m2 28 day	Unconfined compressive strength (cub test) kn/m2 28 day
2:1	100	5	50	180	592	1184
2:1	100	7	50	312	652	1304
3:1	100	7	33	112	316	632
3:1	100	5	33	52	184	368
4:1	100	5	25	8	136	272
4:1	100	7	25	20	136	272
5:1	100	7	20	8	92	184
5:1	100	5	20	48	44	88
5:1	100	6	20	30	100	200
3:1	100	6	33	40	250	500
8:1	100	5	12.5	25	70	140
11:1	100	6	9	14	37	74

2.02 Bentonite Powder

PRODUCT NAME: Berkbent 163

DESCRIPTION: A sodium carbonate activated calcium montmorillonite clay milled and air classified to give a consistent fine powder.

CONTROL PROPERTIES

Moisture Content: (per cent by weight dried at 100-110 C)

Moisture Content: maximum 10 - 14 percent by weight

Viscosity: (Fann viscometer)

Fann viscometer dial reading at 600 rpm and 6% by weight of product in distilled water.

	Immediate Reading	**Aged 12 Hours**
6% mix	20 minimum	35 minimum

10 min Gel Strength (Fann viscometer)

The above samples are left to stand for 10 minutes and the dial reading recorded at 3 rpm.

	Immediate Reading	**Aged 12 - 24 Hours**
6% mix	20 minimum	30 minimum (14N/m2)

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