17-00- Concrete and Mortar

17-01 Concrete Specifications

a. The requirements for the concrete grades shown in the Specification are for Class DS-1 conditions in accord with Table 2 of the BRE Special Digest 363 (2005). Where other than Class DS-1 conditions are encountered then the mix shall reflect the requirements of Table 2 of the above Digest. All concrete references relate to BS 8500 & BS EN 206.

b. Aggregates shall comply with BS EN 206 including the option to utilise all-in aggregates. The stated size shall be 20 mm unless otherwise stated.

c. The ratio of the combined or all-in aggregate to the cement for the most basic mixes shall be not more than 1:8 by volume or 1:10 by mass. No account needs to be taken of bulking of materials.

d. The concrete shall be batched mixed to meet the requirements of the crushing strengths as detailed within this specification. The use of hand mixes shall not be permitted in any works offered to the Local Highway Authority for adoption.

e. The surface finish of the installed material shall comply with Clause 2602 Ss9 of the SHW.

f. The Engineer may require the developer to undertake compressive strength testing of Standard and Prescribed mixes. When testing is required, the strength target shall be as signified by the grade of concrete being assessed. In such circumstances all testing shall be in accordance with the relevant sections of BS EN 12390-1 & BS EN 12390-2.

g. Air entrained concrete – Where requested by the Engineer air entrained concrete shall be a designated mix reference PAV1 or PAV 2 to BS EN 206 -1. It shall have a 20 mm nominal size coarse aggregate and a 75 mm slump. It shall be delivered to site ready mixed.

h. The as placed concrete shall be compacted by hand or mechanical vibration means.

i. All formwork and reinforcement shall be free from dirt, standing water, snow or ice.

j. Concrete shall not be placed until approval of formwork or the foundation has been given by the Engineer. Concreting shall then be started within 24 hours or further approval must be sought. Fresh concrete shall not be placed against in-situ concrete which has been in position for more than 30 minutes. Concrete shall be laid and compacted as specified within 30 minutes of its discharge from the mixer and unless otherwise agreed by the Engineer shall not be dropped into place from a height exceeding 2 metres.

k. Concrete curing - Concrete shall be protected for seven days against the harmful effects of weather including rain, wind, sun and frost and from drying out. The method of protection used shall be subject to the written approval of the Engineer.

l. Construction Joints - the joint shall be formed by introducing a lath 25 mm square against the face of the formwork. The joints shall be raised as before and sealed. The remaining depth of concrete shall be roughened in order that the two faces adhere.

m. Surface finish - the surface finish of the installed material shall comply with Clause 2602 Ss9 of the SHW.

n. Round bar reinforcement Carbon steel for reinforcement shall comply with BS 4449.

o. Mesh reinforcement Steel wire mesh shall comply with BS 4483. Where required as a bottom reinforcement in surface water drain trenches it shall be 5.55kg/m^2 ref C636.

p. Tying wire shall be 1.2 mm diameter (no 18 gauge) stainless steel wire.

q. Waterproof underlay shall be approved 125µm impermeable plastic sheeting. Where an overlap of plastic sheeting is required, it shall be at least 300mm.

r. Formwork shall include all temporary or permanent forms required for forming concrete, together with all temporary supports. It shall be so constructed that there shall be no loss of material from the concrete. After hardening, the concrete shall be in position and of the shape, dimensions and surface finish required by the Engineer

s. Testing Compressive strength testing of Standard and Prescribed mixes shall not normally be required unless directed by the Engineer or his Representative. Where testing is required, the strength target shall be as signified by the grade of concrete being assessed. In such circumstances all testing shall be in accordance with the relevant sections of BS 1881-108.

t. Concrete mix comparison To BS 8500-1:2015 & BS EN 206

TABLE 17-01

Mix Type	Description
ST	Standardised Prescribed Concrete
C	Strength mix description
Gen	General Purpose Concrete
PAV	Paving Concrete
RC	Reinforced Concrete
Foam Concrete	Trench fill or Haunch fill concrete

TABLE 17-02

Mix type (as Table 17-01)						Strength at 28 days N/mm^2
ST	C	Gen	PAV	RC	Foam	
					Foam rapid setting	2 to 4 at 24 Hours
1	6/8	0				8
2	8/10	1				10
3	12/15	2				15
4	16/20	3				20
5	20/25			20/25		25
				25/30		30
			1	28/35		35
			2	32/40		40
				35/45		45
				40/50		50

u. Standardised prescribed concrete mixes are a defined list of concretes within BS 8500 which are made to a prescribed quantity of materials as required by British standard. These concretes are fairly basic mixes.

v. General purpose concrete for use on houses and/or similar non-structural applications. The requirements specify a minimum quantity of cement and have low levels of durability. Any GEN mixes shall be Quality assured Plant supplied.

w. Reinforced concrete is a series of designated concretes that are used in concrete that will be reinforced, pre-stressed or contain embedded steel. These are designated concretes and include requirements for maximum water ratios and minimum cement content, these are useful in exposed or highly demanding conditions.

x. Paving concrete, give the concrete the necessary levels of freeze-thaw resistance for conditions experienced in the UK. And are suitable for almost all external domestic and structural roads, pavements and hard standings. These have specified cement and water content. But also require the mix to have a minimum air content. Which varies dependant on the maximum aggregate size used/specified.

y. Foam concrete, most suppliers use own brand names. Generally, 2/4 N/mm^2 has good compressive strength but has limited structural strength and is easy to dig through. It is recommended in HAUC specification for works by Utilities. It is very good at filling voids and needs no compacting.

z. On occasions the use of concrete with a colour pigment may be requested by the Engineer. The mix shall be agreed in writing prior to the work commencing.

17-02 Concreting in Cold Weather

a. Concreting shall stop if the ambient temperature drops below 2°C.

b. Before placing concrete, the Type 1 Sub base and shuttering shall be clear of snow and ice. The Type 1 and the shuttering shall be at a temperature above 0°C before any concrete is poured.

c. The initial temperature of the concrete shall be at least 5°C. And the poured concrete shall be covered to maintain a temp of 5°C until the concrete has reached 5N/mm^2 this usually takes 48 hours. This shall be done by covering the concrete using plastic or hessian, and the use of thermal insulation blankets if the overnight temperature is expected to drop below -2°C. The shuttering shall be left in place for 48 hours if the temperature remains low.

d. The Developer should also consider the use of heated water to ensure the mix is at 5°C and remains at that temperature until first set.

e. Any concrete found to have suffered frost damage shall be removed and replaced by the Developer.

17-03 Water for Concrete or Mortar

a. All water for use in mixing concrete and mortar shall be from the water mains only.

b. Anyone found using water from another unapproved source shall have that work condemned and removed from site.

17-04 Expansion Joints

a. For slabs of concrete in laybys roundabout overruns and other locations. The Developer shall agree with the Engineer the design details in writing prior to works on the slab commencing on site.

b. The design details shall consider the type of construction, the type of joint to be used, continuous mesh or full depth joints, or the use of tie bars together with any other relevant considerations.

c. Slabs shall be no longer than 6.5 metres without an expansion joint. Joints shall be installed at a rate of 30 x the slab thickness, such that a 200 mm thick slab should have joints at 6 metre centres.

17-05 Mortar Specifications

a. All mortar used below ground shall be composed of Sulphate Resisting Portland Cement to BS EN 197-1 and naturally occurring sand complying with the requirements of BS EN codes

b. The ratio of cement to sand shall be 1:3 by volume. No mix shall be dry, it shall have enough water to set at 24 hours. The incorporation of lime to form a cement**:** sand**:**

lime mix ratio of 1**:** 3**:** 0.25 may be used. Allowance shall be made for bulking of the sand in mortars.

c. The mortar shall be mixed by machine to a uniform colour and consistency, with the constituent materials being accurately gauged.

d. Mortar shall be made in small quantities only as and when required. Mortar that has begun to set or which has been mixed for more than two hours shall be discarded. No addition of water shall be permitted for any material after discharge from the mixer.

e. For Section 278 works and roads that are to be surfaced within 7 days, the Developer shall use a pre mixed rapid setting mortar which is HAPAS approved and shall reach first set in no more than 60 minutes. The mortar shall be capable of being trafficked in 2 hours. In some locations a faster set may be requested by the Engineer.

f. For Section 278 works all iron work shall have all voids filled with a rapid setting pre mixed concrete or resin which is HAPAS approved and shall reach first set in 60 minutes or less. The material shall be capable of being trafficked in 2 hours. In some locations a faster set may be requested by the Engineer.

g. Beds for bricks or Ironwork shall be no thicker than 25 mm of standard mortar.

h. Tub mortar shall comply with BS EN 998-2 and shall not have a retardant of more than 24 hours.

17-06 Grout for Cobbles

a. Grout for cobbles shall be 1 part Portland cement to 1 part building sand to 1 part grit sand. The mix shall be free flowing. Any proposed amendments to the prescribed mix shall be agreed in writing with the Engineer prior to grouting works commencing on site.