

Table 2.1

Limits for Physical, Chemical and Mechanical Properties of Aggregates for Normal Concrete

Item No.	Requirement	Test Methods			Permissible Limits	
		BS / EN	ASTM	GSO	Fines	Coarse
1.	Grading	933	C136		Standard	Standard
2.	Material finer than 0.075 mm. Natural, Uncrushed/Crushed	933	C117 & C136		3% max	2% max
	Crushed Rock				5% max	2% max
or	Material finer than 0.063 mm. Natural, Uncrushed/Crushed or used for foundations, retaining structures and structure elements exposed to the weather.				3% max	1.5 % max
	Crushed Rock or used for structure elements not exposed to the weather.				5% max	1.5 % max
3.	Clay lumps and friable particles		C142		2% max	2% max
4.	Lightweight pieces		C123		0.5% max	0.5% max
5.	Organic impurities for fine aggregates		C40		Colour standard not darker than plate No. 3 ¹	
6.	Water absorption (saturated surface dry)	1097-6	C128/ C127		2.3% max	2.0% max
7.	Sand Equivalent	EN 933	D2419		Min 70%	N.A
8.	Specific gravity (apparent) for normal weight concrete Used for reinforced concrete	1097-6	C128/ C127		2.6 min	2.6 min
	<u>Used for non-reinforced concrete</u>				2.4 min	<u>2.4 min</u>
9.	Shell Content:	933-7			3% max	3% max
10.	Particle shape:	933-3	D4791			
	<u>Flakiness index</u> Used for reinforced concrete					30% max
	Used for plain or non-reinforced concrete					40% max
	<u>Elongation index</u> Used for reinforced concrete					35% max
	Used for plain or non-reinforced concrete					45% max
11.	Acid-soluble chlorides:	1744				
	A. Reinforced concrete with SRPC				0.06% max	0.03% max
	OPC and MSRPC				0.06% max	0.03% max
	B. Mass concrete with SRPC				0.06% max	0.03% max
	OPC/MSRPC				0.06% max	0.03% max

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	C. Prestressed concrete and steam cured structural concrete				0.01% max	0.01% max
12.	Acid-soluble sulphate ²	1744			0.4% max	0.3% max
13.	Loss by magnesium sulphate Soundness (5 cycles) Loss by Sodium Sulphate		C88		15% max 12% max	15% max
14.	Mechanical Strength:					
	10% fines value (dry condition) ³	812- 111				150 kN min ⁵
	Aggregate Impact value ⁴	1097-2				25% max
	Loss by Los Angeles abrasion	1097-2	C131/C5			30% max
	Aggregate Crushing Value	812- 110	35			
15.	Drying shrinkage	1367-4				0.075% max
16.	Potential reactivity:					
	• Of aggregates:		C289 C586		Not reactive	
	alkali-silica reaction				6 month expansion 0.10% max	
	alkali-carbonation reaction					
	• Of cement-aggregate Combination		C227		6 month expansion 0.10% max	

Notes:

- 1- Use of a fine aggregate failing in the test is not prohibited, provided that:
 - a- The discoloration is due principally to the presence of small quantities of coal, lignite, or similar discrete particles.
 - b- When tested for the effect of organic impurities on strength of mortar, the relative strength at 7 days, calculated in accordance with ASTM C87, is not less than 95 %.
- 2- Air-cooled blast-furnace slag aggregate shall meet the requirements in BS EN 12620:2002 for acid-soluble sulfate category AS1,0. In accordance with BS PD 6682-1 and BS EN 12620, air cooled blast-furnace slag shall be free from dicalcium disintegration and from iron disintegration when tested in accordance with BS EN 1744-1
- 3- The limit of 10% fines value (dry condition) is for 20 mm aggregates. Reference BS 812-111.
- 4- AIV The impact test can be used as an alternative to the Los Angeles test but a correlation with the Los Angeles test should first be established to avoid double testing and ensure mutual recognition of results. The Los Angeles test (reference method) should be used in cases of dispute
- 5- It is applicable only for 20mm aggregates, for high strength concrete using 10 mm aggregates the 10% fines value will be at least 100 KN

2.4 FINE AGGREGATE FOR CONCRETE AND MORTAR

- 1 Fine aggregate consist of natural clean sand, stone screenings or a combination and can be produced from natural disintegration of rock or gravel and/or by the crushing of rock or gravel or processing of manufactured aggregate or artificial, conforming to the requirements of physical and chemical properties complying with table 2.1 and subject to Engineer's acceptance.
- 2 The gradation of fine aggregate for concrete and mortar shall be in accordance with the gradation designations in EN 12620 with BS PD 6682, EN 13139 , EN 998-1 , EN 998-2,