Concrete chloride class

The European Concrete Standard, BS EN 206[1], states that the chloride content of concrete is derived from the sum of the contributions from the constituents. The maximum chloride content of the constituent may be either; as permitted in the standard for the constituent, or as declared by the producer of each constituent.

In the UK the chloride content class is specified according to the concrete use as set out in Table 1.

Table 1: Concrete use and chloride class

Concrete use	Chloride content class	Maximum chloride content by mass of cement, %
Not containing steel reinforcement or other embedded metal except for corrosion resisting lifting devices. This includes BS 8500-2[2] Designated GEN and CB concretes as well as Standardized Prescribed concretes ST1 and ST2.	Cl 1,00	1.00
Containing steel reinforcement or other embedded metal. This includes BS 8500-2 Designated RC, FND and PAV concretes and Standardized Prescribed concretes ST3, ST4 and ST5[A]	Cl 0,40	0.40
Containing prestressing steel reinforcement in direct contact with concrete[B].	Cl 0,20	0.20

A Excluding concrete made with BS EN 197-1 CEM I SR0 and SR3

B Concrete made with BS EN 197-1 CEM I SR0 and SR3 containing steel reinforcement or other embedded metal, including BS 8500-2 Designated concretes RC, FND and PAV as well as BS 8500-2 Standardized Prescribed concretes ST3, ST4 and ST5

Chloride is present in most cements and additions as well as in some sources of other concrete constituents such as aggregates, admixtures and water.

Cements conforming to BS EN 197-1[3], fly-ash conforming to BS EN 450-1[4], and ground granulated blastfurnace slag conforming to BS EN 15167[5] have a chloride content ≤ 0.10%. Silica fume conforming to BS EN 13263-1[6] may have a chloride content up to ≤ 0.30% but where it is above ≤ 0.10% the upper limit for its characteristic value shall be declared.

Admixtures conforming to BS EN 934-1[7] have a chloride content ≤ 0.10% or a maximum value declared by the manufacturer.

For aggregates conforming to BS EN 12620[8] the requirement for the chloride ion content for natural aggregate is that where required the water-soluble chloride ion content of aggregates shall be declared by the producer.

For concrete containing reinforcement or embedded metal then mixing water conforming to BS EN 1008[9] has a maximum chloride content of 0.10%

An example of chloride class calculation for concrete in accordance with BS 8500-2 is summarized below.

Table 2. Example of concrete chloride class determination

Constituent	Concrete proportions kg/m³	Chloride content of constituents %	Total chloride content kg
Cement, CIIIA	340	0.08	0.272
Fine Aggregate	790	0.04	0.316
Coarse Aggregate	1080	0.01	0.108
Admixture	1	0.10	0.001
Water	169	0.00	0.000
Total	**2380**		**0.697**

From Table 2 the chloride content by weight of cement can be calculated, that is it is equal to 0.697 kg of chloride divided by 340 kg of cement, 0.21%. At 0.21% the concrete chloride class declared would be Cl 0,40.

References

1. BS EN 206: 2013. Concrete — Specification, performance, production and conformity. Incorporating corrigendum May 2014.
2. BS 8500-2:2015+A1:2016. Concrete - Complementary British Standard to BS EN 206. Part 2: Specification for constituent materials and concrete
3. BS EN 197-1: 2011 Cement — Part 1: Composition, specifications and conformity criteria for common cements.
4. BS EN 450-1: 2012. Fly ash for concrete — Part 1: Definition, specifications and conformity criteria.
5. BS EN 15167-1: 2012. Ground granulated blastfurnace slag for use in concrete mortar and grout — Part 1: Definitions, specifications and conformity criteria.
6. BS EN 13263-1: 2005 +A1:2009. Silica fume for concrete — Part 1: Definitions, requirements and conformity criteria.
7. BS EN 934-1: 2005 +A1:2009. Silica fume for concrete — Part 1: Definitions, requirements and conformity criteria.
8. BS EN 12620:2002+A1:2008. Aggregates for concrete.
9. BS EN 1008: 2002 Mixing water for concrete — Specification for sampling testing and assessing the suitability of water, including water recovered from processes in the concrete industry, as mixing water for concrete.

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