

If Concrete Can Speak

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My new identity was introduced to Singapore on 9 October 2009. My previous identity tracing way back to the 1930's included CP 114, The Structural Use of Reinforced Concrete in Buildings, Road Note No. 4, Concrete Mix Design, CP 110, The Structural Use of Concrete, DOE Mix Design, BS 8110, Structural Use of Concrete (Singapore Standard, CP 65) and BS 5328, Methods for Specifying Concrete, including Ready-mixed Concrete (Singapore Standard, SS 289). My new identity is linked to SS EN 1992, Eurocode 2: Design of Concrete Structures, SS EN 206-1, 2009, Concrete – Part 1: Specification, Performance and Conformity, and SS 544, 2009 (Parts 1 and 2), Complementary Singapore Standard to SS EN 206-1.

My new status will be further enhanced by the latest BCA announcement that production of concrete (me!) will be certified by Certification Bodies (CB's) after a RMC plant (my producer) has been assessed by appointed RMC inspectors with satisfactory findings submitted to a CB.

Although I am still made up of cement, water, aggregates and often also chemical admixtures, but now I can be made from 27 types of common cements (SS EN 197-1: 2008) and with aggregates

(SS EN 12620: 2008) from other than natural sources, e.g. recycled concrete aggregate, RCA. When you see me labelled as C25/30, it does not mean that I am a Grade 25 concrete with 30 mm maximum size aggregate. It means my characteristic strength is 25 MPa if my compressive strength is determined by testing a cylinder specimen, but 30 MPa by testing a cube specimen. I no longer have to be as big as a 150 mm cube but I can be just a 100 mm cube.

My compressive strength will be treated at bar for both sizes. My bigger size (150 mm = 6 inches) is needed only to achieve a ratio of four for maximum aggregate size of 40 mm (1½ inch back in the 1930's) but of course more than adequate for the commonly used 20 mm maximum aggregate size. Over the years, this original choice for convenience has unwittingly led to accepting only 150 mm cubes in specifications. When my compressive strength reaches higher levels, e.g. over 80 MPa, often available testing machines do not have the capacity to crush me (my bigger size needs 2¼ times the load)! Of course, researchers of high strength concrete adopt my smaller size. Hence, it becomes rather embarrassing for specifications to require the bigger me for normal strength concrete but accept my small size in high strength concrete. It seems there is apparent failure to recognise 100 mm is already five times maximum aggregate size of 20 mm!

Respectfully I hope my small size will be appreciated not only for savings in materials and energy in crushing (environmental friendly) but also reduction in volume of materials for disposal after testing (cost saving). Many more of my small size can fit into the same curing tank and also easily handled with one hand. Perhaps, my smaller size may even earn a couple of merit points in the promotion of sustainable construction (for green building award). **SCI**

(For more information, please see write-up on page 18-19)

Standardisation in the Building and Construction Industry

SPRING is the national standards body in Singapore. Under the national standardisation programme, SPRING Singapore helps companies and industry to meet international standards and conformity requirements by creating awareness of the importance of standardisation to enhance competitiveness and improve productivity, co-ordinating the development and use of Singapore Standards and setting up an information infrastructure to educate companies and industry on the latest developments.



The Building and Construction Standards Committee (BCSC) champions the development, promotion and implementation of relevant building and construction standards to improve the quality, safety and productivity of the construction industry in Singapore. The BCSC develops, maintains, promotes and facilitates the use of Singapore Standards, including those referred to by the National Productivity and Quality Specifications (NPQS).

It supports the government agencies in enhancing safety and productivity at construction work sites, as well

as, in legislation related to building design, durability and maintainability of buildings. It also supports national efforts in environmental sustainability. The BCSC closely monitors the industry trends, such as reviewing of Eurocodes, to develop relevant standards.

To ensure adequate representation of all viewpoints in Singapore Standards development, all committees consist of representatives from various interest groups that include government agencies, professional bodies, tertiary institutions and consumer, trade and manufacturing organisations. **SCI**

- More information on the Standardisation Programme at www.standards.org.sg
- Sign up for update me on standards issues: <http://www.standards.org.sg/Forms/UpdateMe.cfm>
- Purchase Standards: www.singaporestandardseshop.sg
- BCSC Secretariat: james_choo@spring.gov.sg
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Singapore Standards For Concrete and Constituent Materials

The Singapore Standard SS EN 206-1: 2009, together with the two complementary Singapore Standards, SS 544: Part 1: 2009 and SS 544: Part 2: 2009, specify requirements for concrete for use in buildings and civil engineering structures. The concrete may be produced on site, in ready-mixed concrete plant or in a plant for precast concrete products. There are many changes and advancement in the new standard. Some of the changes related to specification and design of concrete for various exposure classes are highlighted below.

BCA has announced that it will implement the Singapore Accreditation Council Accreditation Scheme for Ready-Mixed Concrete (RMC) Certification as a mandatory requirement in the Building Control Regulations in 2010. Under this SAC scheme, accredited certification bodies will certify Ready Mixed Concrete based on SS EN 206 and SS 544 Parts 1 & 2.

Implementation of SS EN 206-1 and SS 544 will result in higher technical performance and contribute to the overall efficiency in the concrete production and construction chain. **SCI**

CONCRETE	
New	Replacing
<ul style="list-style-type: none"> • SS EN 206-1:2009 Concrete Part 1: Specification, performance and conformity • SS 544:209 Complementary Singapore Standard to SS EN 206-1 Part 1: Methods of specifying and guidance for the specifier Part 2: Specification of constituent materials and concrete • EN Testing Methods (see Chart 1) 	<ul style="list-style-type: none"> • SS 289:2000 Part 1: Guide to specifying concrete Part 2: Methods for specifying concrete mixes Part 3: Specification for the procedures to be used in producing and transporting concrete Part 4: Specification for the procedures to be used in sampling, testing and assessing compliance of concrete • SS 78 Testing series

CONCRETE		
CLASS DESCRIPTION	CLASS DESIGNATION	
No risk of corrosion or attack (XO class)	<ul style="list-style-type: none"> • For concrete without reinforcement or embedded metal: all exposures except where there is freeze-thaw, abrasion or chemical attack. • For concrete with reinforcement or embedded metal: 	
Corrosion induced by carbonation (XC classes) (where concrete containing reinforcement or other embedded metal is exposed to air and moisture)		
XC1	Dry or permanently wet	Minimum nominal cover for various concrete classes has been defined
XC2	Wet, rarely dry	
XC3 and XC4	Moderate humidity or cyclic wet and dry	
Corrosion induced by chlorides from sea water (XS classes)		
XS1	Exposed to airborne salt but not in direct contact with seawater	
XS2	Permanently Submerged	
XS3	Tidal, splash and spray zones	
Chemical attack (XA classes)		
XA1	Slightly aggressive chemical environment according to Table 2, SS EN 206-1	
XA2	Moderately aggressive chemical environment according to Table 2, SS EN 206-1	
XA3	Slightly aggressive chemical environment according to Table 2, SS EN 206-1	
SS 554: Part 1: 2009 provides more specific guidance for exposure to chemical attack		

CEMENT	
New	Replacing
<ul style="list-style-type: none"> • SS EN 197-1: 2008 CEMENT Part 1: Composition, specifications and conformity criteria for common cements Part 2: Conformity criteria Part 4: Composition, specifications and conformity criteria for low early strength cements • SS EN 15167: 2008 Ground granulated blast furnace slag for use in concrete, mortar and grout Part 1: Definitions, specifications and conformity criteria Part 2: Conformity evaluation • EN Testing Methods (see Chart 1) 	<ul style="list-style-type: none"> • SS 22:2000 Specification for Portland cement • SS 476:2000 Specification for high slag blastfurnace cement • SS 476:2000 Specification for Portland blastfurnace cement • SS 397 Testing series



A Seminar on SS 'Concrete Specifications and Assessment' organized by SPRING Singapore on 9 Oct 09. Over 300 industry participants from 120 enterprises attended the 1/2 day seminar



ADMIXTURES	
New	Replacing
<ul style="list-style-type: none"> • SS EN 934-1: 2008 Admixtures for concrete, mortar and grout Part 1: Common requirements Part 2: Definitions, requirements, conformity, marketing and labeling (Erratum 1:2009) Part 4: Admixtures for grout for prestressing tendons – Definitions, requirements, conformity, marking and labelling Part 6: Sampling, conformity control, and evaluation of conformity • EN Testing Methods (see Chart 1) 	<ul style="list-style-type: none"> • SS 320:1987 Concrete admixtures

AGGREGATES	
New	Replacing
<ul style="list-style-type: none"> • SS EN 12620: 2008 + Amendment 1 (2009) Aggregates for concrete • Testing Methods (see Chart 1) 	<ul style="list-style-type: none"> • SS 31:1998 Aggregates for natural sources for concrete • SS 73 Testing series



Our Core Businesses:

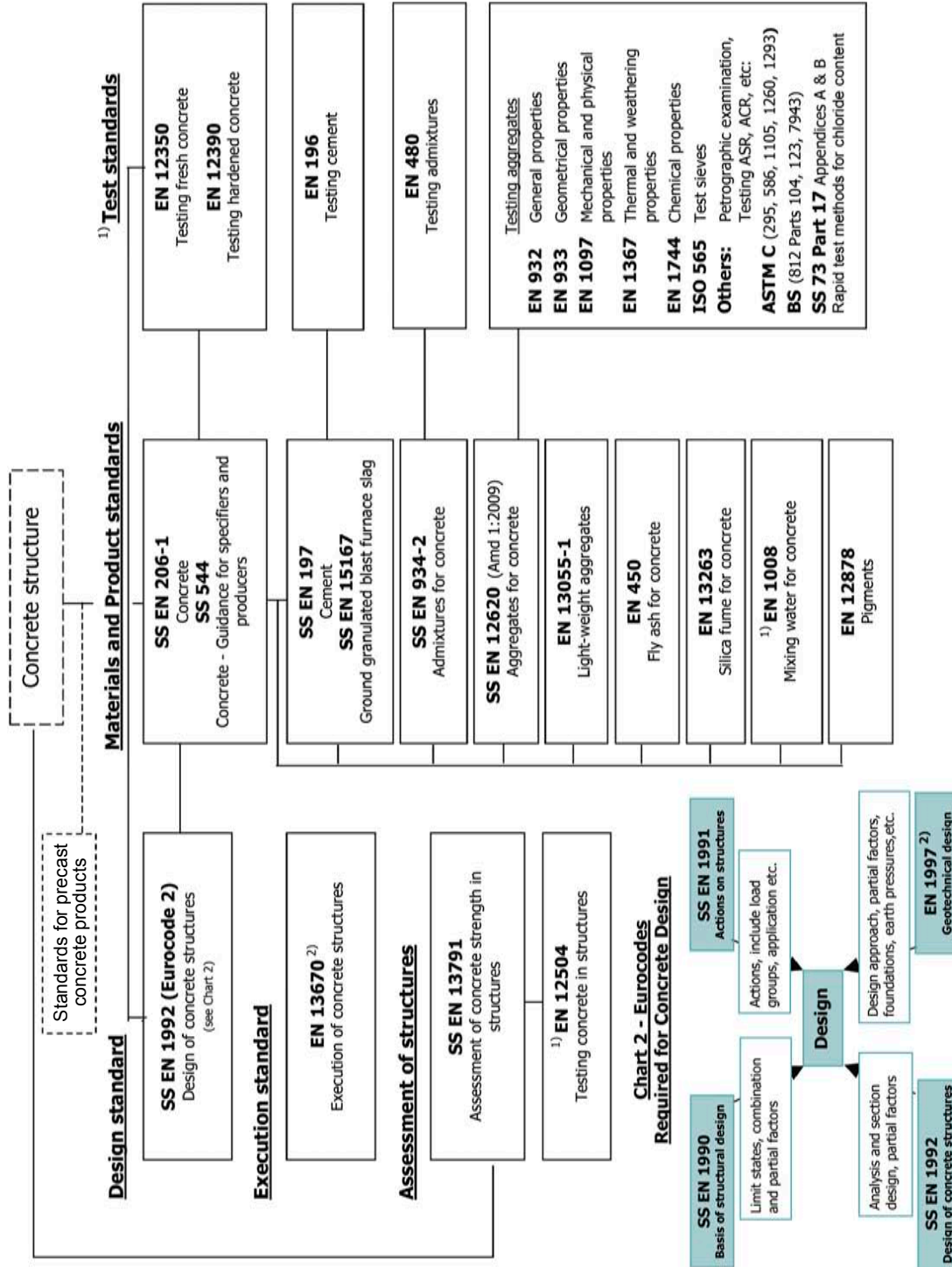
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Chart 1 - Concrete Related Standards



NOTES -

For the design and construction of building structures, the SS / EN Eurocodes are to be used in combination with execution, material, product and test standards.
¹⁾ The test methods listed above have been reviewed for their suitability to be adopted for use in Singapore. Local users are advised to refer to these EN / ASTM / BS directly. See Guidance on Singapore testing temperature in the relevant SS EN.