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THE USE OF THE CONCEPT OF CONCRETE FAMILIES FOR THE PRODUCTION AND CONFORMITY CONTROL OF CONCRETE

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The use of the concept of concrete families for the production and conformity control of concrete

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1. INTRODUCTION

The use of concrete families for the production and conformity control of concrete is well established in many parts of Europe. In some CEN Member States it has been used for over a decade. The exact ways in which the concrete family systems are applied varies widely and they reflect local conditions and needs. The ready-mixed concrete industry have, in general, pioneered these developments, but the systems are equally applicable to site made concrete and concrete for use in precast elements.

1.1 Introduction to production control

In production control, samples are taken at random from the production and tested for the relevant properties to confirm that the control of constituent materials, plant, batching etc. is working as expected. These data are analysed for significant, real changes in properties. By combining these data into concrete families, changes in concrete quality can be detected more rapidly and consequently, appropriate action can be taken more rapidly.

The concrete family system when used for production control does not rely on any particular control system. It is applicable to the most basic systems e.g. strength/ date charts as well as to the most sophisticated computer based systems. Production control is solely the responsibility of the concrete producer and therefore the size and contents of any family used for production control should be the producers choice. However, the producer is warned that by attempting to include concretes with unreliable relationships to the Reference Concrete, production control will be much more difficult and the standard deviation will increase significantly.

1.2 Introduction to conformity control

The 28-day compressive strength and other test data used for production control may also be used for conformity control. All the test data obtained during an assessment period is checked for conformity to the conformity criteria given in the concrete standard e.g. EN 206-1: *Concrete - Part 1: Specification, performance, production and conformity* [1]. As the system of conformity control, which is operated by the producer, must have the full confidence of users and purchasers, the concrete family used for conformity control must be based on consensus.

The CEN Member States with the more complex and sophisticated concrete family systems arrived at these over time by developing confidence in smaller families. EN 206-1 has taken a pragmatic approach to families in that it sets the principles for family membership and then introduces a check to verify that all the individual concretes belong to the family.
It should be noted that the family system in EN 206-1 requires every single result to be checked against the individual criterion of $f_{ci} \geq f_{ck} - 4$ i.e. criterion 2 in **8.2.1.3** of EN 206-1.

An essential element in maintaining the confidence and credibility of the concrete family system is that the system, the relationships between members of the family and the functioning of the system are approved and regularly audited by a third party certification body that has expertise in concrete technology and production. For site made concrete where there is no third party involvement, the second party should take on this role using personnel with appropriate experience and expertise.

1.3 EN 206-1

The provisions for concrete families in EN 206-1: *Concrete - Part 1: Specification, performance, production and conformity* [1] were developed over a number of years. They are a consensus on what represents effective and practical conformity control for a family of concretes. EN 206-1 defines and delimits the concept of concrete families and permits their use for the production and conformity control of concrete. Concretes may be grouped into families and the relationships between members within a family have to be established by initial testing, existing production data and/or theory. Results of tests on samples taken at random within a family are pooled for production control purposes by converting them to equivalent values of the Reference Concrete. Control of the Reference Concrete is a strong indication that all members of the family are under control.

EN 206-1 defines a concrete family as a group of concrete compositions for which a reliable relationship between relevant properties is established and documented. Guidance on the selection of a family is given in Annex J. High strength concrete is excluded from the family concept for conformity control and high strength is defined as > C55/67 or > LC55/60. Lightweight concretes cannot be included into a family with normalweight concretes, but they may form their own family.