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English Version

Use of k-value concept, equivalent concrete performance concept and equivalent performance of combinations concept

Utilisation du concept de coefficient k, concept d'équivalence de performance et concept d'équivalence de performance en combinaison

k-Wert-Ansatz, Prinzipien des Konzepts der gleichwertigen Betonleistungsfähigkeit und Konzept der gleichwertigen Leistungsfähigkeit von Kombinationen aus Zement und Zusatzstoff

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Foreword

This document (CEN/TR 16639:2014) has been prepared by Technical Committee CEN/TC 104 “Concrete and related products”, the secretariat of which is held by DIN.

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0 Introduction

0.1 General

This report outlines the current understanding of the use and application of three concepts used within EN 206:2013 for Type II additions to concrete. These are the k-value concept, the Equivalent Concrete Performance Concept (ECPC) and Equivalent Performance of Combinations Concept (EPCC).

Within 5.2.5 of EN 206:2013 k-values are given for fly ash and silica fume and a recommended k-value for GGBS as well as general principles for the ECPC and the EPCC concepts. It is also stated in EN 206:2013 that modifications to the rules of application of the k-value concept are permitted if 'suitability is established'. As stated within EN 206:2013 the establishment of suitability should result from provisions valid in the place of use of the concrete. In order to further explain the three concepts and to give guidance to the regulation writers and users of these concepts, this report provides background information and an overview of these concepts and rules of application as used within Europe.

0.2 Task Group 5

CEN/TC 104/SC 1 created Task Group 5 (TG 5) "Use of Additions" and assigned them the task to update EN 206-1:2000, 5.2.5 as part of the revision of EN 206-1. Because of the publication of product standard EN 15167-1 for ground granulated blastfurnace slag (GGBS), TG 5 was also asked to include rules for GGBS. CEN/TC 104/SC 1 passed various resolutions instructing TG 5 that it should implement the EPCC and ECPC concepts and the existing k-value concept for use of additions at the concrete mixer.

The rules for the use of type II additions in concrete according to EN 206:2013 are given in 5.2.5 "Use of additions". For two additions, fly ash and silica fume, specific requirements for their use with k-values are given. In this prescriptive k-value concept for concrete mix design, the defined rules are on the safe side and cover all possible variations for the possible permutations of cement and addition. An alternative option is the use of ECPC and EPCC concepts. Their principles are described in EN 206:2013, 5.2.5.3 and 5.2.5.4 while examples for the assessment using these concepts are given in this CEN/TR. The rules for these performance concepts should also be safe and lead to a more efficient use of additions.

0.3 *k*-value concept

With respect to the k-value concept in EN 206:2013, it was agreed that for fly ash and silica fume prescriptive k-values and cement substitution rates will be given which are proven to be on the safe side. Although the k-value concept for GGBS is included in some national regulations (see /2/) only a recommended value is given in EN 206:2013 due to limited practical experience. In national provisions, however, modifications to the rules of the k-value concept may be applied where their suitability has been established, e.g. higher k-values, increased proportions of additions, other additions (including type I), combinations of additions and other cements than those normally permitted. In this report the derivation of the prescriptive k-value approach is explained. The report also describes how the k-value concept should be applied by users such as the concrete producers.

0.4 ECPC and EPCC

The equivalent performance concepts, ECPC and EPCC, for the use of additions may be applied where suitability has been established. In countries where ECPC and EPCC are applied, nearly always, GGBS as addition to concrete is used under these concepts. This report describes how the ECPC and EPCC are applied in some European countries.

1 Scope

This Technical Report provides more detailed information on the k-value concept principles of the equivalent concrete performance concept (ECPC) and the equivalent performance of combinations concept (EPCC) in accordance to EN 206:2013, 5.2.5.