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**TESTING CONCRETE - PART 4:  
DETERMINATION OF ULTRASONIC PULSE  
VELOCITY**

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English version

## Testing concrete - Part 4: Determination of ultrasonic pulse velocity

Essais pour béton dans les structures - Partie 4:  
Détermination de la vitesse de propagation du son

Prüfung von Beton - Teil 4: Bestimmung der  
Ultraschallgeschwindigkeit

This European Standard was approved by CEN on 26 February 2004.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



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## Foreword

This document (EN 12504-4:2004) has been prepared by Technical Committee CEN/TC 104 "Concrete and related products", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2005, and conflicting national standards shall be withdrawn at the latest by February 2005.

A draft standard was submitted in 1998 to CEN enquiry as prEN 13296. It was one of a series of individually numbered test methods for fresh or hardened concrete. For convenience it has now been decided to combine these separate draft standards into three new standards with separate Parts for each method, as follows:

- Testing fresh concrete (EN 12350)
- Testing hardened concrete (EN 12390)
- Testing concrete in structures (EN 12504)

This series, EN 12504, includes the following Parts where the brackets give the numbers under which particular test methods were submitted to CEN enquiry:

EN 12504, *Testing concrete in structures*

*Part 1: Cored specimens — Testing, examining and testing in compression (former prEN 12504:1996)*

*Part 2: Non-destructive testing — Determination of rebound number (former prEN 12398:1996)*

*Part 3: Determination of pull-out force (former prEN 12399:1996)*

*Part 4: Determination of ultrasonic pulse velocity (former prEN 12396:1998)*

This European Standard is based on ISO/DIS 8047 "Concrete hardened — Determination of ultrasonic pulse velocity". It is recognised that the ultrasonic pulse velocity determined using this standard is a convention in as much that the path length over which the pulse travels may not strictly be known.

The measurement of pulse velocity can be used for the determination of the uniformity of concrete, the presence of cracks or voids, changes in properties with time and in the determination of dynamic physical properties. These subjects were considered to be outside the scope of this standard, but some information is given in Annex B and more information can be found in the technical literature. The measurement may also be used to estimate the strength of in-situ concrete elements or specimens. However, it is not intended as an alternative to the direct measurement of the compressive strength of concrete.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

## EN 12504-4:2004 (E)

### 1 Scope

This document specifies a method for the determination of the velocity of propagation of pulses of ultrasonic longitudinal waves in hardened concrete, which is used for a number of applications.

### 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 206-1:2000, *Concrete — Part 1: Specification, performance, production and conformity*.

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 206-1:2000 and the following apply.

#### 3.1

##### **transit time**

time taken for an ultrasonic pulse to travel from the transmitting transducer to the receiving transducer, passing through the interposed concrete

#### 3.2

##### **onset**

leading edge of the pulse detected by the measuring apparatus

#### 3.3

##### **rise time**

time for the leading edge of the first pulse to rise from 10 % to 90 % of its maximum amplitude

### 4 Principle

A pulse of longitudinal vibrations is produced by an electro-acoustical transducer held in contact with one surface of the concrete under test. After traversing a known path length in the concrete, the pulse of vibrations is converted into an electrical signal by a second transducer and electronic timing circuits enable the transit time of the pulse to be measured.

### 5 Apparatus

#### 5.1 General

The apparatus consists of an electrical pulse generator, a pair of transducers, an amplifier and an electronic timing device for measuring the time interval elapsing between the onset of a pulse generated at the transmitting transducer and the onset of its arrival at the receiving transducer. A calibration bar is provided to provide a datum for the velocity measurement.

Two forms of the electronic timing apparatus are available:

- a) an oscilloscope on which the first front of the pulse is displayed in relation to a suitable time scale.
- b) an interval timer with a direct reading digital display.

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