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Guide for Cellular Concretes above 50 lb/ft^3 (800 kg/m^3)

Reported by ACI Committee 523

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This guide addresses the materials, properties, design, production, and placement of cellular concretes with as-cast densities greater than 50 lb/ft^3 (800 kg/m^3). The usual density range of cellular concrete is 20 to 120 lb/ft^3 (320 to 1920 kg/m^3). Cellular concretes in the lower portion of this range are used for many applications, such as roof thermal insulation and geotechnical fills. Cellular concretes in the higher density range are used for cast-in-place, precast applications and nonstructural floor fills.

Keywords: cellular concrete; compressive strength; fire resistance; insulating concrete; lightweight concrete; mixture proportioning; modulus of elasticity; precast concrete; recyclability; shear properties; splitting tensile strength; structural design; sustainability; thermal conductivity.

CONTENTS

ACI 523.3R-14 supersedes ACI 523.3R-93 and was adopted and published April 2014.

CHAPTER 1—INTRODUCTION AND SCOPE

1.1—Introduction

This guide includes cellular concretes with as-cast densities in the range of 50 to 110 lb/ft³ (800 to 1760 kg/m³). Applications include, but are not limited to, insulating or geotechnical fills and cast-in-place and precast elements. A wide range of applications is possible by controlling the as-cast density and mixture proportioning that influence the main physical properties, such as strength, modulus of elasticity, and thermal conductivity. Commercial uses include cast-in-place, nonstructural floor fills; precast or cast-in-place elements such as wall panels; architectural applications such as annular pipe fills (Fig. 1.1a); and pipeline abandonments (Fig. 1.1b).

Cellular concretes referenced in this guide contain stable gas cells uniformly distributed in a cementitious mixture (Fig. 1.1c). Typically, macroscopic bubbles are added at the mixer as stable preformed foam metered from a calibrated nozzle and thoroughly blended into the slurry. This guide does not cover the addition of an in-place-foam admixture that may require vigorous mixing to entrap air. Cellular concretes in the density range covered by this guide may contain natural or manufactured aggregates.

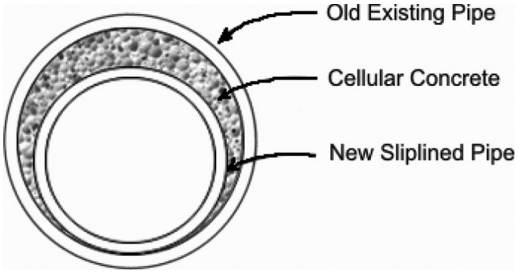

Fig. 1.1a—Sliplined pipe.

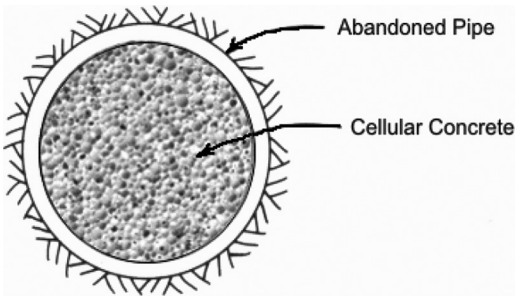

Fig. 1.1b—Pipeline abandonment.

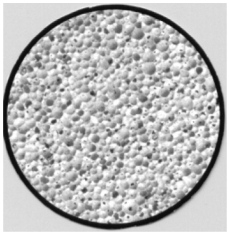

Fig. 1.1c—Typical cell structure of cellular concrete.

1.2—Scope

This guide applies to cellular concretes with cast densities greater than 50 lb/ft³ (800 kg/m³). Precast and cast-in-place cellular concretes are within the scope of this guide. Compressive strengths may vary widely and are specified based on a particular application. To assist in selection, proportioning, and production of cellular concretes, the available material property information and applications of cellular concretes are also addressed.

CHAPTER 2—NOTATION AND DEFINITIONS

2.1—Notation

A = dry mass of aggregate, lb/yd³ (kg/m³)
A_v = air content, percentage
C = mass of cement, lb/yd³ (kg/m³)
D = oven dry density, lb/ft³ (kg/m³)
d = diameter of test specimen, in. (mm)
E_c = static modulus of elasticity of concrete, ksi (MPa)
F = resistance to freezing and thawing, cycles
f_c' = specified compressive strength of concrete, psi (MPa)
f_{ct} = splitting tensile strength of concrete, psi (MPa)
G_c = specific gravity of cement