IN-LB	Inch-Pound Units
SI	International System of Units

Guide for Proportioning Concrete Mixtures with Ground Calcium Carbonate and Other Mineral Fillers

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The use of ground calcium carbonate (GCC) and other mineral fillers can enhance the performance, economy, and sustainability of concrete mixtures. Modifications to the conventional proportioning method in ACI 211.1 are needed to incorporate these materials. This guide describes GCC and dust-of-fracture aggregate mineral fillers, including their properties, characterization, and qualification, and effects on concrete properties and sustainability. Recom-

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mendations are provided for proportioning concrete mixtures with these materials.

Keywords: aggregate mineral filler; dust-of-fracture; ground calcium carbonate; ground limestone; mixture proportioning; paste volume; powder content; proportioning.

CONTENTS

CHAPTER 1—INTRODUCTION

This guide provides recommendations for proportioning normalweight concrete with ground calcium carbonate (GCC) and dust-of-fracture aggregate mineral fillers (AMF). It also provides background information on these materials, techniques for their characterization, and their effects on concrete properties; however, it is not intended to be a comprehensive literature review and the reader should conduct trial batches to evaluate specific materials being used and to confirm concrete performance. It is intended to supplement ACI 211.1 and is for materials meeting ASTM C1797. Proportioning methods for GCC and for dust-of-fracture AMF are discussed separately.

Mineral filler is defined as a finely divided mineral product at least 65 percent of which passes the No. 200 (75 µm) sieve. This definition includes the materials addressed herein; namely, GCC as specified in ASTM C1797 and dust-of-fracture AMF from quarried rock as specified in either ASTM C1797 or ASTM C33/C33M.

GCC, also known as ground limestone, is a manufactured fine product composed primarily of calcium carbonate and with particles sized within narrow ranges. GCC has been used successfully in concrete in Europe for decades, either added to the concrete mixture separately from the cement or interground with clinker to form portland-limestone cement (European Committee for Standardization 2009).

Dust-of-fracture AMF is rock dust created during production, processing, or handling of quarried stone. Such materials can vary in mineral composition and other physical characteristics, depending on the parent stone from which they are derived, the crushing process, and the washing or air separation process. Dust-of-fracture AMF can be provided as a dry bulk powder meeting ASTM C1797 or as part of manufactured sand as described in ASTM C33/C33M.

This guide does not address precipitated calcium carbonate or material finer than the No. 200 (75 µm) sieve in natural sand, nor the use of limestone as a cement ingredient, which is addressed in ASTM C150/C150M, C595/C595M, and C1157. Although GCC typically falls within the definition of AMF, it is dealt with separately in this guide. It is manufactured under controlled conditions to be a consistent product. Dust-of-fracture AMF consisting primarily of calcium carbonate is not considered GCC.

The aggregate suspension mixture proportioning method described in ACI 211.6T has been used to proportion concrete with GCC and dust-of-fracture AMF.

The use of both GCC and dust-of-fracture AMF can improve the sustainability of concrete production. GCC has a lower embodied energy and lower CO_2 emission during its production than an equivalent mass of portland cement. Dust-of-fracture AMF is typically a by-product of the blasting and crushing of aggregate. This guide can facilitate the use of GCC and aggregate mineral fillers as a means of optimizing the powder content of concrete, thereby increasing sustainability.

Applicability of these materials is not limited to a select class or type of concrete but can be considered for use in a wide variety of applications and production methods. The