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

Use of Normalweight and Heavyweight Aggregates in Concrete—Guide

Reported by ACI Committee 221

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This guide presents information on selection and use of normalweight and heavyweight aggregates in concrete. The selection and use of aggregates in concrete should be based on technical criteria as well as economic considerations and knowledge of types of aggregates generally available in the area of construction. The properties of aggregates and their processing and handling influence the properties of both fresh and hardened concrete. The effectiveness of processing, stockpiling, and aggregate qualitFy control procedures will affect batch-to-batch and day-to-day variation in the properties of concrete. Aggregates that do not comply with the specification requirements may be suitable for use if the properties of the concrete using these aggregates are acceptable, as per Chapter 6. Materials that can be recycled or produced from waste products are potential sources of concrete aggregates; however, special evaluation may be necessary.

Keywords: alkali-silica reaction (ASR); attached mortar; characterization; durability; field performance; fresh concrete; hardened concrete; heavyweight aggregate; normalweight aggregate; quality control; recycled aggregate; specific gravity.

CONTENTS

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CHAPTER 1—INTRODUCTION

The largest constituent of concrete is aggregate. The properties of the aggregates influence the fresh and hardened properties of concrete and may affect the durability of the concrete in service. The processing and handling of aggregates can influence these properties. This guide presents information on the selection and use of normalweight and heavyweight aggregates for concrete. This document was designed to provide a comprehensive overview of the effects of aggregate materials, production, and use on concrete quality that can be used for specification design, quality control, and quality assurance from production to batching. The report is limited primarily to natural aggregates and recycled concrete aggregate (RCA).

This guide is divided into six major parts: 1) properties of hardened concrete influenced by aggregate properties; 2) properties of freshly mixed concrete influenced by aggregate properties; 3) aspects of processing and handling that have a bearing on concrete quality and uniformity; 4) quality control and quality assurance; 5) RCAs; and 6) heavyweight aggregates.

Aggregate selection should be based on technical criteria and economic considerations. When available in sufficient detail, service records are a valuable aid for evaluating and specifying aggregate sources when the structures, concrete proportions, and exposure are similar to those anticipated for the proposed work. Petrographic analysis can be used to determine whether the aggregate to which the service record applies is sufficiently similar to the proposed aggregate for the service record to be meaningful. It also provides useful information on the acceptability of aggregate from a new source.

Tables 1a through 1h lists the test methods for evaluating distinct aggregate properties for use in concrete according to the required performance. Additionally, it is worth noting that only some of these tests are required for acceptance and qualification; consulting the referenced ASTM standards is recommended. In many cases, the aggregate properties and test methods listed are not routinely used in specifications for aggregates. Their use may be needed only for research purposes, for the investigation of new sources, or when aggregate sources are being investigated for a special application.

A summary of data on aggregate properties and their influence on the behavior of concrete is contained in ASTM STP169D and Alexander and Mindess (2005). Information on the exploration of aggregate sources, production, and rock types can be found in Waddell (1974). ASTM C1778 provides guidance on mitigating potential risks due to alkali-aggregate reactions.