Guide for Use of Volumetric-Measuring and Continuous-Mixing Concrete Equipment

Reported by ACI Committee 304

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This guide includes a short history of and information on the basic design and operation of equipment, frequently called mobile mixers, used to produce concrete by volumetric measurement and continuous mixing (VMCM). Definitions, applications, and quality assurance testing are discussed. The use of this equipment is compared with weigh-batch-mixing equipment to highlight some of the limited differences.

Keywords: batcher; continuous mixer; flowing (self-consolidating) concrete; fresh concrete; grout; high-early-strength concrete; latex; mixer; no-fines (pervious) concrete; overlay; precast concrete; shotcrete.

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CHAPTER 1—INTRODUCTION AND SCOPE

1.1—Introduction

This document offers guidance on volumetric-measurement and continuous-mixing (VMCM) concrete production. The original and most common use of VMCM equipment is as mobile (either truck- or trailer-mounted) equipment. Because of its compact size, ability to produce mixed concrete, and versatility, a significant number of stationary units have been produced. This configuration provides a free-standing base and is typically powered by electrical circuits normally found in a precast plant or other industrial facility. Unless specifically noted, the information in this document applies to all VMCM equipment.

1.2—Scope

This guide contains background information to be considered when using the VMCM method. A discussion of other types of continuous-measurement equipment (conveyor belt scales or weigh-in-motion scales) is outside the scope of this report.

1.3—History

Volumetric measurement and continuous mixing have a long history in the production of concrete. For many years, the concept of "one shovel of cement, two shovels of sand, and three shovels of stone" was used to produce concrete. Patents on continuous mixers date back at least to 1913. It was not until volumetric measurement and continuous mixing were successfully combined in the early 1960s that general field use of this type of equipment began. The first commercial unit was delivered in 1964. Because of the detail of original patents, there was only one manufacturer of VMCM units until the early 1980s, when other manufacturers began to offer this type of equipment for concrete production.

By the mid-1970s, there were over 4000 VMCM machines in operation in the United States that were generally used to produce small volumes of concrete. During the late 1970s and early 1980s, specialty concretes needed for bridge-deck renovation and highway repair, which were difficult to produce in conventional transit mixers, were produced successfully with VMCM equipment. This application gave the equipment credence by proving that it could consistently produce close-tolerance, high-quality concrete. VMCM equipment was previously thought to be limited to producing special mixtures or small volumes; however, VMCM may be suitable for almost any concrete requirement.

Standards activities related to concrete produced by VMCM equipment have been increasing as the field units increase. In 1971, ASTM developed C685, and now maintains ASTM C685/C685M. The American Association of State Highway and Transportation Officials covers VMCM equipment in M 241. In 1993, ACI published ACI 548.4, "Standard Specification for Latex Modified Concrete (LMC) Overlays," which lists mobile mixers as the equipment used to produce this product, and designates ASTM C685/C685M as the standard by which these units are defined. In 1999, a group of VMCM equipment manufacturers approached the National Ready Mixed Concrete Association (NRMCA) for assistance in forming the Volumetric Mixer Manufacturer Bureau (VMMB). The VMMB was formed, and in 2001 published VMMB 100-01, which defines the volume of ingredients needed to produce a cubic yard of concrete, and references ASTM C685/C685M uniformity requirements as the measure of accuracy in this type of equipment.

CHAPTER 2—DEFINITIONS

measuring, volumetric—dispensing an ingredient based on volume, either in discrete quantities or by continuous flow.

mixing, continuous—producing concrete by continuously blending ingredients in fixed proportions. The discharge of the concrete mixture may be started or stopped as required.

CHAPTER 3—EQUIPMENT

3.1—Materials storage and measurement

Measurement of material by volume can be accomplished by a variety of means. Rotary vane feeders (both horizontal and vertical axis), screw conveyors (both adjustable and fixed speed), drag chains, calibrated gate openings, variable-volume sliding compartments, and vibrating plate feeders