Guide to Roller-Compacted Concrete Pavements

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This guide provides owner-agencies, contractors, materials suppliers, and others with a thorough introduction to roller-compacted concrete (RCC) and its many paving applications. This guide describes RCC and how it works as a paving material, how it compares to concrete pavement, its common uses and benefits, and potential limitations compared to other paving materials. Troubleshooting guidelines are provided, as well as detailed overviews of RCC properties and materials, mixture proportioning, structural design issues, production and construction considerations, and quality control.

Keywords: industrial pavement; inspection and testing; joints; pavement; pavement design; roller-compacted concrete (RCC); RCC mixture proportioning; RCC pavement construction; RCC production.

CONTENTS

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CHAPTER 1—INTRODUCTION

Roller-compacted concrete (RCC) is an economical, fast construction candidate for many pavement applications. Because of its relatively coarse surface, RCC has traditionally been used for pavements carrying heavy loads in low-speed areas. In recent years, however, its use in commercial areas and for local streets and highways is increasing.

This guide is largely based on Harrington et al. (2010). The review panel for the Harrington report was made up largely of ACI Committee 327 members. With the cooperation of the Portland Cement Association, the report was used as the basis for this guide. Extensive changes were made during the committee review, including incorporating material from ACI 325.10R. Additional references and examples have been added.

CHAPTER 2—NOTATION AND DEFINITIONS

2.1—Notation

C = coefficient relating flexural and compressive strength with values ranging from 9 to 11
E = modulus of elasticity, psi (MPa)
f_r = flexural strength (third-point loading), psi (MPa)
f_c' = compressive strength, psi (MPa)
h = slab thickness, in. (mm)
k = modulus of subgrade reaction, psi/in. (MPa/mm)
σ = stress, psi (MPa)
ε = strain, in./in. (mm/mm)

2.2—Definitions

ACI provides a comprehensive list of definitions through an online resource, "ACI Concrete Terminology," http://www.concrete.org/Tools/ConcreteTerminology.aspx. Definitions provided herein complement that source.

curling—out-of-plane deformation of the corners, edges, and surface of a pavement from its original shape due to differential temperature within the pavement.

warping—out-of-plane deformation of the corners, edges, and surface of a pavement from its original shape due to differential moisture within the pavement.

CHAPTER 3—KEY ELEMENTS

3.1—Performance comparison of RCC to conventional concrete pavement

Roller-compacted concrete (RCC) gets its name from the heavy vibratory steel drum and rubber-tired rollers used to compact it into its final form. Roller-compacted concrete has similar strength properties and consists of the same basic ingredients as conventional concrete—well-graded aggregates, cementitious materials, and water—but has different mixture proportions. The biggest difference between RCC and conventional concrete mixtures is that RCC has a higher percentage of fine aggregates that allow for tight packing and compaction.

Fresh RCC is stiffer than typical zero-slump conventional concrete, with a consistency that is stiff enough to remain stable under vibratory rollers, yet wet enough to permit adequate mixing and distribution of paste without segregation.

RCC is typically placed with an asphalt-type paver equipped with a standard or high-density screed, followed by a combination of passes with rollers for compaction. Final compaction is usually achieved within 1 hour of mixing. Unlike conventional concrete pavements, RCC pavements are constructed without forms, dowels, or reinforcing steel. Joint sawing is not required, but when sawing is specified, transverse joints are spaced farther apart than with conventional concrete pavements.

RCC pavements are strong, dense, and durable. These characteristics, combined with construction speed and economy, make RCC pavements an excellent alternative for parking and storage areas including port, intermodal, and military facilities; highway shoulders; streets; and highways. RCC can also be used in composite systems as base material.

The use of RCC in public and private applications has been increasing steadily in recent years (Fig. 3.1), particu-

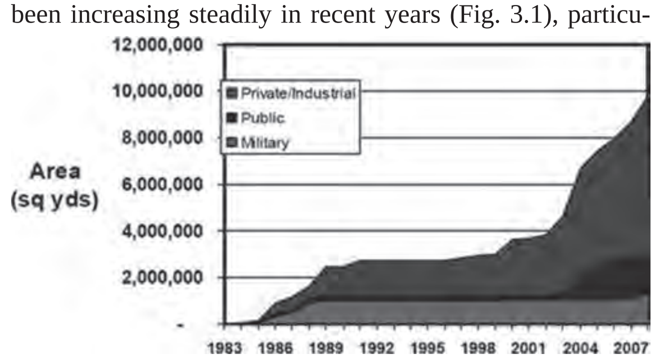

Fig. 3.1—Increasing use of RCC pavements (Pittman and Anderton 2009). (Note: 1 yd^2 = 0.8 m^2.)