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

An ACI Standard

Commercial Concrete Parking Lots and Site Paving Design and Construction—Guide

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Concrete parking lots serve many kinds of public facilities, commercial and retail developments, businesses, and multifamily housing projects. They primarily accommodate parked vehicles but may also provide maneuvering areas and access for delivery vehicles. The design and construction of concrete slabs for parking lots and outside storage areas share many similarities with the design and construction of industrial pavements, streets, and highways, but they also have some very distinct differences. A full appreciation of the differences and the modification of design and construction procedures to take these differences into account can result in economical concrete parking lots that will provide satisfactory service for many years with little maintenance.

This guide includes information on site investigation, thickness determination, design of joints and other details, durability considerations, paving operations, and quality-assurance procedures during construction. Maintenance and repair are also discussed.

Information related to the design and construction of concrete site paving for industrial and trucking facilities is in ACI 330.2R.

Keywords: commercial; concrete pavement; curing; finishing; joints; light duty; parking lot; subgrade; thickness; traffic loads.

CONTENTS

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CHAPTER 1—INTRODUCTION AND SCOPE

1.1—Introduction

Concrete parking lots serve many different types of facilities and are generally similar in design and construction to other types of concrete pavements. They differ, however, in that the primary role of a parking lot is typically to accommodate storage of vehicles rather than moving traffic, and the pavement loads and geometry differ accordingly. Parking lots tend to be designed for slower vehicle movement, more random traffic patterns, and fewer design load repetitions than streets, highways, airport runways, intermodal yards, and industrial or trucking facility pavements.

The design of concrete parking lots should follow the generally accepted procedures outlined in this guide. Load-bearing capacity, drainage, crack control, life-cycle cost, constructability, safety, sustainability, and maintainability are important considerations that impact good design.

Concrete parking lots may be designed to accommodate light vehicles, heavy trucks, or a broad spectrum of vehicle loads as appropriate for the application. Where a variety of loads must be accommodated, the use of traffic controls to separate and channel the heavier trucks away from areas designed for automobiles and light trucks will result in a more economical and sustainable design. Facilities intended to serve only light vehicles may have concrete parking lot panels with thicknesses influenced by constructability and environmental effects rather than by the pavement stress created by vehicle loads. Durability-related distress is often the most critical maintenance concern for lightly loaded concrete parking lot pavements, which are subject to the effects of fuels and lubricants leaked from vehicles, precipitation and drainage, deicer salts, and other environmental influences. Vehicles in parking areas usually travel at low speeds, diminishing the importance of smoothness tolerances. Because parking lots must also accommodate pedestrians, designs and geometrics should reflect pedestrian safety considerations, including crosswalks, a slip-resistant surface texture, and night-time illumination.

Concrete parking lots range in size from small, such as at corner convenience stores, to medium, such as at multi-unit housing projects, to large, such as those for shopping centers and office or commercial developments. Most parking areas include driveways, some of which must accommodate relatively heavy loads. Special consideration may be needed if access to garbage trucks, dumpsters, and/or delivery trucks is to be included. Accordingly, concrete parking lots are constructed with a wide variety of construction equipment, ranging from hand tools and vibratory screeds to large highway paving equipment or laser-guided screeds.

The stiffness of rigid concrete pavements distributes wheel loads over larger areas of the subgrade than do flexible asphalt pavements, resulting in lower subgrade stresses. Thus, thinner total pavement structures are usually possible for a given site when concrete is used. Additional benefits of concrete parking lots include the following:

a) Concrete surfaces resist deformation from maneuvering vehicles

b) Concrete surfaces drain well with only minimal slopes

c) Concrete has relatively simple maintenance requirements

d) Traffic-lane and parking-stall markings can be incorporated into the jointing pattern

e) Concrete is minimally affected by leaking petroleum products

f) The light-reflective surface of concrete can be efficiently illuminated with minimal energy requirements

g) Concrete parking lots reduce the impacts of the urban heat island effect relative to those of asphalt parking lots by producing lower surface temperatures, thus providing a cooler urban environment and reducing ozone production.

The sustainable construction benefits of concrete are considerable as compared with other pavement materials. Concrete parking lots typically have service lives of 20 years or more, negating the need for more frequent rehabilitation that would use additional aggregates and other nonrenewable resources. In addition to opportunities for the use of sustainable concrete component materials such as recycled aggregates and supplementary cementitious materials derived from industrial by-products, concrete's light-colored surface helps reduce reflected solar radiation, and its higher reflectivity can reduce illumination requirements considerably. Lower resulting energy requirements are realized throughout the facility's life cycle. Pervious concrete may be useful in reducing storm water runoff from the site (refer to ACI 522R). At the end of the service life, concrete can be recycled into aggregates and pavement subbase materials. These and other attributes of concrete can be useful in obtaining LEED Green Building certification for a project (NRMCA 2014).

1.2—Scope

This guide is based on the current knowledge and best practices for the design, construction, and maintenance of concrete parking lots placed on the ground. Some of these practices differ from those used in the design and construction of streets, highways, floors and other types of pavements and flatwork. This guide is not a standard or a specification, and it is not intended to be included by reference in construction contract documents; ACI 330.1 can be used for these purposes.

Parking lots have most loads imposed on interior slabs surrounded by other pavement. Highway and street pavements carry heavy loads along and across free edges and are subjected to greater deflections and stresses. Streets and pavements are usually designed to drain toward an edge where the water can be carried away from the pavement. Parking lots are usually designed so some of the water is collected internally and is conveyed away through underground systems. In urban areas where rainfall runoff from large impervious surfaces is regulated, parking lots often serve as detention basins (not addressed in this guide). This means that the pavement should store water for a period of time without incurring any damage due to loss of support from a saturated subgrade. Parking lots often accommodate appurtenances, such as lighting standards, drainage structures, traffic islands, and landscaped planting areas. Provisions for these appurtenances should be considered in the design of the jointing system and the layout for construction.

Some design methods for concrete parking lot pavements have been based on methods developed for the design of highway pavements such as the Portland Cement Association (1984a,b) method and the AASHTO (1993) design method. These methods are primarily concerned with limiting stresses in the slab (PCA) and the reductions in serviceability caused by mixed traffic (PCA and AASHTO), including heavy trucks, while parking lots usually serve fewer vehicles either parked or traveling at slow speeds. Additionally, AASHTO (1993) is a purely empirical method where the relevant range of vehicle types, subbase and subgrade materials, and pavement repetitions are generally outside of the relevant range for parking lots. Figure 1.2 presents a typical section through a concrete pavement showing subbase and subgrade layers. For many parking lots intended for only light traffic loads, the need for an extensive design process may be less