Paving and Surfacing Operations

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Distribution Restriction: Approved for public release; distribution is unlimited.

*This publication supersedes Technical Manuals (TMs) 5-331D, 21 April 1969; 5-337, 21 February 1966; and 5-337-1, 29 March 1971.
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Preface

Field Manual (FM) 5-436 provides essential information to military personnel who are engaged in or responsible for bituminous and concrete operations for roads and airfields. It contains information on construction materials and equipment and the mix design, production, placement, and repair of concrete and bituminous pavements.

Emphasis is primarily placed on the duties and responsibilities of engineer platoon sergeants, platoon leaders, company commanders, and staff personnel during bituminous and concrete operations. In addition, technical engineering specialists (military occupational specialty [MOS] 51T) are involved in quality control of bituminous and concrete operations.

FM 5-436 is a companion publication of FMs 5-410, 5-430-00-1, and 5-430-00-2. It completes the process of road and airfield construction.

Appendix A contains a metric conversion chart.

The proponent of this publication is HQ TRADOC. Forward comments and recommendations on Department of the Army (DA) Form 2028 to Commandant, United States Army Engineer School, ATTN: ATSE-TD-D, Fort Leonard Wood, Missouri 65473-6650.

Unless this publication states otherwise, masculine nouns and pronouns do not refer exclusively to men.
Introduction

CONSTRUCTION PRINCIPLES

The advent of devastating weapons and the increased mobility of modern warfare make it possible for combat sites to be located anywhere. Constructing roads and airfields must proceed even against tremendous difficulties. The durability of construction and other standards may require the modification of plans based on

- The immediate tactical or strategic situation.
- Urgent factors.
- The availability of manpower, materials, and equipment.
- Continuous enemy attack.

Understanding construction principles helps engineers attain the best construction possible using the materials available. Construction principles include making a sound plan for the route, clearing the right-of-way, evening out the roadbed, and making improvements to the surface.

STAGE CONSTRUCTION

Stage construction is the planned expansion (width or depth) of a road. Roads can be expanded (upgraded) using a minimum amount of time, manpower, and materials. Stage construction in depth is a vital consideration when planning combat-zone (CZ) roads. Flexible pavements lend themselves to this task. For example, an unsurfaced road was originally constructed in a CZ. As the combat area moves forward, surfacing the road with road-mix pavement increases the traffic capacity. When the road is part of the rear area, engineers pave it with a hot or cold plant mix if increased durability is necessary or they treat the surface if increased surface smoothness is needed. The road could then handle the high volume and heavy loads of rear-area traffic, assuming the base and subbase are adequate. Engineers must ensure that all layers are completely bonded.

As the load or amount of traffic increases, the road may need to be widened. During the planning stage of an original road construction, engineers should include widening allowances. For example, they plan for wide cuts and fills to allow for later road widening. (Most military widening operations are less than one lane width.)

SAFE CONSTRUCTION

Engineers must rigidly observe safety precautions and procedures during paving operations and when heating bitumens, especially if flammable materials are being used. They must also observe proper traffic maintenance procedures.
TYPES OF PAVEMENTS AND SURFACES

This manual addresses the following types of paving and surfacing operations:

- Bituminous pavements and surfaces (Part One).
- Concrete pavements (Part Two).
- Expedient operations (Part Three).

NOTE: The term concrete in this publication refers to portland-cement concrete unless specified otherwise.

Selecting the types of pavements and surfaces to construct is based on traffic conditions; the availability of equipment, manpower, and materials; time allotted; climatic and weather conditions; and expected subgrade deformations. Engineers are not limited to using the expedient methods discussed in this manual. Sound engineering principles and imagination often lead to improved expedient methods.

A pavement is the end result of an operation that contributes to the overall load-bearing capacity of a structure:

- Bituminous pavement is usually more than 1 inch thick, and concrete pavement is usually more than 6 inches thick.
- Flexible pavement gives or flexes under loads. Ideally, the load is distributed over a surface area that is proportional to the distance of the area from the surface.
- Rigid pavement, such as concrete, deflects slightly under a load and distributes it over a large area while bridging small weak spots in the base.

A surface retains and waterproofs a load-bearing course. Bituminous surface treatments and membranes are usually less than 1 inch thick and do not contribute to the load-bearing capacity of a base.