CHAPTER 1
INTRODUCTION

1-1. Purpose.

This manual provides criteria for the design of pavements for roads, streets, walks, and open storage areas at U.S. Army and Air Force installations.

1-2. Scope.

This manual provides criteria for plain concrete, reinforced concrete, flexible pavements, and design for seasonal frost conditions. These criteria include subgrade and base requirements, thickness designs, and compaction requirements, criteria for stabilized layers, concrete pavement joint details, and overlays.

1-3. References.

Appendix A contains a list of references used in this manual.

1-4. Selection of Pavement Type.

Rigid pavements or composite pavements with a rigid overlay are required for the following areas.

a. Vehicle Maintenance Areas.

b. Pavements for All Vehicles with Nonpneumatic Tires.

c. Open Storage Areas with Materials Having Nonpneumatic Loadings in Excess of 200 psi.

d. Covered Storage Areas.

e. Organizational Vehicle Parking Areas.

f. Pavements Supporting Tracked Vehicles.

g. Vehicle Wash Racks.

h. Vehicle Fueling Pads.

Except for architectural or special operational requirements, all other pavements will be designed based upon life-cycle cost analysis.

1-5. Basis of Design.

a. Design Variables. The prime factor influencing the structural design of a pavement is the load-carrying capacity required. The thickness of pavement necessary to provide the desired load-carrying capacity is a function of the following five principal variables-

(1) Vehicle wheel load or axle load.

(2) Configuration of vehicle wheels or tracks.

(3) Volume of traffic during the design life of pavement.

(4) Soil strength.

(5) Modulus of rupture (flexural strength) for concrete pavements.

b. Rigid Pavements. The rigid pavement design procedure presented herein is based upon the critical tensile stresses produced within the slab by the vehicle loading. Correlation between theory, small-scale model studies, and full-scale accelerated traffic tests have shown that maximum tensile stresses in the pavement occur when the vehicle wheels are tangent to a free or unsupported edge of the pavement. Stresses for the condition of the vehicle wheels tangent to a longitudinal or trans-verse joint are less severe because of the use of load-transfer devices in these joints to transfer a portion of the load to the adjacent slab. Other stresses, because of their cyclic nature, will at times be additive to the vehicle load stresses and include restraint stresses resulting from thermal expansion and contraction of the pavement and warping stresses resulting from moisture and temperature gradients within the pavement. Provision for those stresses not induced by wheel loads is included in design factors developed empirically from full-scale accelerated traffic tests and from the observed performance of pavements under actual service conditions.

c. Flexible Pavement. The design procedure used by the Corps of Engineers and the Air Force to design flexible pavements is generally referred to as the California Bearing Ratio (CBR) design procedure. This procedure requires that each layer be thick enough to distribute the stresses induced by traffic so that when they reach the underlying layer they will not overstress and produce excessive shear deformation in the underlying layer. Each layer must also be compacted adequately so that traffic does not produce an intolerable amount of added compaction. Use ASTM D 1557 compaction effort procedures to design against consolidation under traffic.

1-6. Computer Aided Design.

In addition to the design procedures presented herein, computer programs are available for determining pavement thickness and compaction requirements for roads, streets, and open storage areas. These programs are contained on the floppy disk appendix E located in pocket to cover 3.

a. Development. Computer programs have been

developed to aid in the design of pavements for roads, streets, and open storage areas. The programs were developed on an IBM PC-AT using FORTRAN 77 as the development language with Microsoft's FORTRAN Compiler (version 3.2) and MS-DOS (version 3.1) as the operating system. Normally, the programs will be furnished as a compiled program which can be executed from floppy diskettes or hard drives. Thus far all the programs have been run on IBM PC-AT or IBM compatible microcomputers containing a minimum of 512K RAM.

b. Use of programs. In development of the computer programs, an effort was made to provide a user friendly program requiring no external instructions for use of the programs. Aside from instructions for initiating execution, which is standard for any executable program, the user is lead through the design procedure by a series of questions and informational screens. The input data required for pavement design by the program are identical to the data required by the design manual, and the results obtained from the pro- gram should be close to the results obtained from the design curves. Because the computer program recalculates data and approximates certain empirical data, there may be some minor differences in results from the program and from the manual. If significant difference are obtained contact HQUSACE (CEMP-ET).

c. Program names. The flexible pavement road design program is FRD 904, and the rigid pavement design program is RRD 805. The numbers in the name refer to the date of the program. The first digit is the year of the revision. The last two digits of the program name is the month of the re- vision. Thus, the program FRD 904 is the flexible road design program that was revised in April 1989. Care should be taken that the latest version of the computer programs is being used. If there is doubt concerning a program, contact HQUSACE (CEMP-ET).