CHAPTER 6

REINFORCED RIGID PAVEMENTS

6-1. Application. Under certain conditions, concrete pavement slabs may be reinforced with welded wire fabric or deformed bar mats arranged in a square or rectangular grid. The advantages in using steel reinforcement include: (a) a reduction in the required slab thickness usually is permissible; (b) wider spacing between the transverse contraction joints may be used; (c) the width of crack opening is controlled, with the result that load transmission is maintained at a high level at these points and objectionable material is prevented from infiltrating the cracks; and (d) differential settlement due to nonuniform support and/or frost heave is reduced materially. Guidance relative to the use of reinforced pavement is discussed in the following subparagraphs.

a. Subgrade conditions. Reinforcement may be used to control cracking in rigid pavements founded on subgrades where differential vertical movement is a definite potential (for example, foundations with definite or borderline frost susceptibility that cannot feasibly be made to conform to conventional frost design requirements as given in EM 1110-3-138).

b. Nonreinforced pavements. In otherwise nonreinforced rigid pavements, steel reinforcement should be used for the following conditions:

(1) Odd-shaped slabs. Odd-shaped slabs should be reinforced using a minimum of 0.06 percent of steel in directions normal to each other over the entire area of the slab. An odd-shaped slab is considered to be one in which the longer dimension exceeds the shorter dimension by more than 25 percent or a slab which essentially is neither square nor rectangular.

(2) Mismatched joints. A partial reinforcement of slab is required where the joint patterns of abutting pavements or adjacent paving lanes do not match, and when the pavements are not positively separated by an expansion or slip-type joint. The pavement slab directly opposite the mismatched joint should be reinforced with a minimum of 0.06 percent of steel in directions normal to each other for a distance of 3 feet back from the juncture, and for the full width or length of the slab in a direction normal to the mismatched joint. Mismatched joints normally will occur at intersections or pavements or between pavement and fillet areas.

6-2. Design procedure.

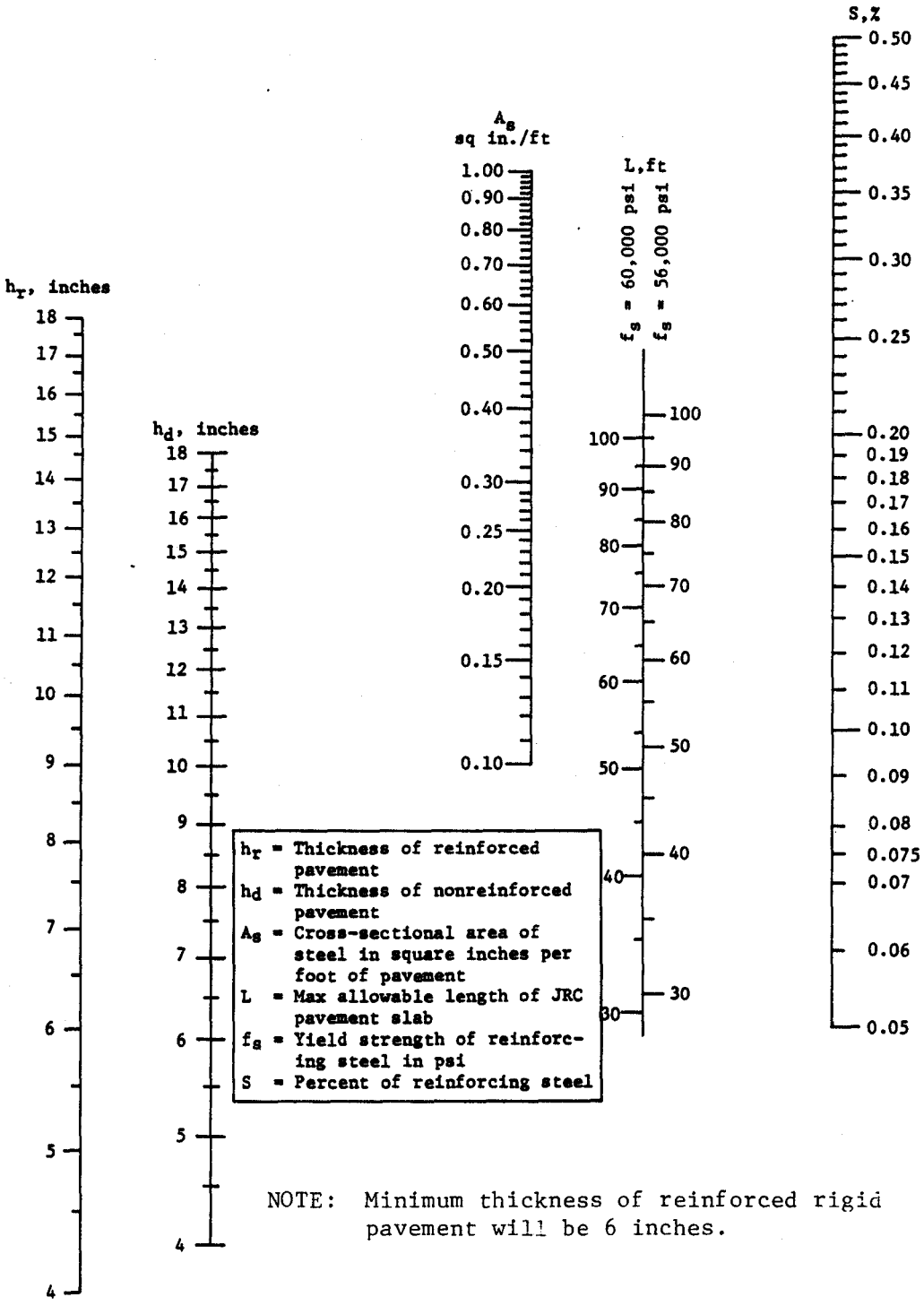
a. Thickness design on unbound base or subbase. The design procedure for reinforced rigid pavements presented herein utilizes the

principle of allowing a reduction in the required thickness of nonreinforced rigid pavement due to the presence of the steel reinforcing. Essentially, the design method consists of determining the percentage of steel required, the thickness of the reinforced rigid pavement, and the maximum allowable length of the slabs. A graphic solution for the design of reinforced rigid pavements is presented in figure 6-1. Since the thickness of a reinforced rigid pavement is a function of the percentage of steel reinforcing, the designer may: (a) determine the required percentage of steel for a predetermined thickness of pavement, or (b) determine the required thickness of pavement for a predetermined percentage of steel. In either case, it is necessary first to determine the required thickness of nonreinforced rigid pavement in accordance with the method outlined previously in paragraph 5-2 for nonreinforced pavements. The exact thickness (to the nearest 0.1 inch) of nonreinforced pavement, h_d, is used to enter the nomograph in figure 6-1. A straight line is then drawn from the value of h_d to the value selected for either the thickness of reinforced rigid pavement, h_r, or the percentage of reinforcing steel, S. It should be noted that the percentage or reinforcing steel, S, indicated by figure 6-1, is the percentage to be used in the longitudinal direction only. For normal designs, the percentage of nonreinforcing steel used in the transverse direction will be one-half of that to be used in the longitudinal direction. Examples of reinforced rigid pavement design are given in appendix A. Once the pavement thickness and percentage of reinforcing steel have been determined, the maximum allowable slab length, L, is obtained from the intersection of the straight line and the scale of L. A provision also is made in figure 6-1 for adjusting L on the basis of the yield strength, f_s, of the reinforcing steel. Difficulties may be encountered in sealing joints between very long slabs because of large volumetric changes caused by temperature changes.

b. Thickness design on stabilized base or subgrade. To determine the thickness requirements for reinforced concrete pavement on a stabilized foundation, it is first necessary to determine the thickness of nonreinforced concrete pavement required for the design conditions. This thickness of nonreinforced concrete pavement is determined according to procedures set forth in paragraph 5-3. Figure 6-1 is then entered with the exact thickness of nonreinforced concrete pavement and the thickness of reinforced pavement and the percent steel determined as discussed in paragraph 6-2.a. above.

6-3. Limitations. The design criteria for reinforced rigid pavement for Army roads and streets are subject to the following limitations:

a. No reduction in the required thickness of nonreinforced rigid pavement should be allowed for percentages of steel less than 0.06 percent.



NOTE: Minimum thickness of reinforced rigid pavement will be 6 inches.

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FIGURE 6-1. REINFORCED RIGID PAVEMENT DESIGN

b. No further reduction in the required thickness of nonreinforced rigid pavement should be allowed over that indicated in figure 6-1 for 0.50 percent steel, regardless of the percentage of steel used.

c. The maximum length, L, of reinforced rigid pavement slabs should not exceed 75 feet regardless of the percentage of steel, yield strength of the steel, or thickness of the pavement.

d. The minimum thickness of reinforced rigid pavements should be 6 inches.

6-4. Reinforcing steel.

a. Type. The reinforcing steel for rigid pavements may be either deformed bars or welded wire fabric.

b. Placement. The following criteria regarding the maximum spacing of reinforcement should be observed: (1) for welded wire fabric, the maximum spacing of the longitudinal wires and transverse wires should not exceed 6 inches and 12 inches, respectively; and (2) for bar mats, the maximum spacing of the longitudinal bars and the transverse bars should not exceed 15 inches and 30 inches, respectively.

6-5. Design details. Typical details for the design and construction of reinforced rigid pavements for Army roads and streets are shown on Standard Mobilization Drawing No. XEC-007.