CHAPTER 2

TRACK DESIGN

2-1. Track layouts. Track layouts should allow the movement to be continuous from the interchange yard through the classification yard to the delivery tracks. Each interchange or receiving track should hold the maximum single delivery. The length of classification tracks is determined by the average number of cars in each classification.

2-2. Rail.

a. Function. The function of railroad rail is to provide a smooth, hard rolling surface for railroad rolling stock; to transmit the loading of the rolling stock wheels to the ties; to provide beam strength and stiffness to minimize deflections due to the passage of railroad rolling stock; and to resist lateral loads of railroad rolling stock to maintain gage (distance between the rails).

b. Length. The standard length of rail is 39 feet. Rails are also available in 33 and 78 foot lengths.

c. Type. Rail can be new or relayer (used). New rail is preferred for new construction. However, relayer rail in good condition can be used in many instances especially when new rail may be scarce.

(1) New rail. Two types of new rail are recommended for use: 90-pound ARA-A or 115-pound AREA. The heavier section will be used for main lines and access tracks where rail traffic is heavy and design train speeds are more than 40 miles per hour. Ninety-pound ARA-A sections will be used for yard, industrial, and storage sidings and running and access tracks which do not justify 115-pound rail. If either of the above rail weights are not available, heavier rail sections may be substituted, using the 90-pound and 115-pound sections as minimum weights for the services described above.

(2) Relayer rail. The selection of relayer rail will be based on the predicted rail traffic and design train speed. Relayer rail 115-pound or heavier in good condition may be substituted for new 115-pound rail for tracks bearing heavy rail traffic or tracks with design train speeds in excess of 40 miles per hour if new rail is not available for that service. For service where new 90-pound ARA-A rail is specified, 85-pound or heavier relayer sections may be substituted provided the relayer rail is in good condition. Relayer rail will be of the same section throughout the project for each service listed in paragraph 2-2c(1). Rail sections will be drilled for 6-hole, 36-inch AREA angle bars except that rail sections below 115-pound may be drilled for 4-hole, 24-inch AREA angle bars, or other 24-inch angle bars appropriate for the selected rail section. Drilling patterns will

be the same for all rail of the same section. If both new and relayer rail are used, provide for the preferential use of new rail on main lines, access tracks and running tracks. New and relayer rail should not be intermixed. If possible, each separate track should be laid with either all-new or all-relayer rails.

d. Continuous welded rail. This type of construction should not be considered for use on an Army railroad unless the line under construction is to become part of a continuing transportation system.

2-3. Wood ties. The functions of ties are to secure the two lines of rail in the transverse direction, to interact with the ballast to anchor the track against lateral, longitudinal and vertical movement, and to distribute the wheel load from the rails to the ballast. Railway track ties most widely used are made of treated wood, usually oak, gum, pine, or fir. Ties made from hardwood trees are preferable but other wood ties may be used if necessary. Ties should consist of heartwood since this part of the tree has more desirable characteristics for railroad ties. Tie life depends on the species of wood, treatment, mechanical protection, severity of usage, and climate. Hardwood ties should be provided with antisplitting devices in each end to maintain the structural integrity of the ties. Wood crossties should be prebored for spikes and adzed prior to treatment since cutting or drilling of the wood after treatment will expose untreated surfaces to decay. Seven inch by 9 inch by 8-foot 6-inch crossties are recommended for most Army applications.

2-4. Rail accessories.

a. Joint bars. Joint bars are used to join abutting rail sections together. These bars can be headfree or head contact type. Headfree bars fit into the upper fillet between the web and head of the rails. Joint bars can also be short-toe, long-toe, or toeless. The toe refers to the lower joint bar flange which makes contact with the rail.

b. Compromise joint bars. Compromise joint bars will be used where rail of different sections are connected. The bars will conform to the section and drilling pattern of each rail at the connection. The offset at surface or gage side alinement will not exceed 1/8 inch. Compromise joints will not be located on open deck trestles or bridges, or within the limits of switch ties.

c. Expansion openings. Temperature can severely affect rail construction, so corrective measures must be taken. When laying rails, temperature will be measured by applying a thermometer to the base of the rail in the shade. Shims are used to provide openings for expansion between the ends of rails.

d. Tie plates. Tie plates are used between rail and tie to reduce tie abrasion and to maintain rail gage. Tie plates are used on permanent construction. On low-speed temporary work, they are only required on bridges, trestles, tunnels, through turnouts and crossovers, and on all curves of 3 degrees or more.

e. Rail anchors. Train traffic and thermal expansion have a tendency to move rail lengthwise. Therefore, rail anchors are used to restrain this movement. Traffic essentially can be in one direction or it can be in two directions. As rail creepage is in the direction of traffic, the necessity of anchors is greater with one-way traffic than with two-way traffic using the same track. Normally, for most kinds of ballast, eight forward anchors and two backup anchors are required per 39 foot rail length for one direction traffic. For two-way traffic, eight anchors for each direction, or a total of 16, are required.

f. Rail braces. If tie plates are not used, four braces per rail length are applied to curves 1 degree to 6 degrees; six per rail length for curves 6 degrees to 10 degrees; and every other tie on some curves of 10 degrees and over. When tie plates are used, braces are not necessary on curves under 12 degrees and should be applied to every fourth tie on curves 12 degrees and over.

g. Spikes. Size 6- by 5/8-inch spikes are normally used for all ties. New track spikes will be used for both new and relayer rail.

2-5. Ballast. Ballast forms the foundation part of track construction. The minimum depth of ballast under the ties should be 8 inches. Procedures for determination of ballast thickness are contained in AREA Manual for Railway Engineering. Prepared ballast (stone, gravel, or slag) is preferred to other ballast materials. Transportation problems discourage shipment over great distances, so materials found locally should be investigated for use. Subballast with a minimum depth of 6 inches will be used where roadbed is difficult to drain. The roadbed will be wide enough to provide 18-inch shoulders beyond the toe of ballast. In the selection of roadbed width, provide for: (a) the extra width required for the ballast section on curves with superelevation and (b) subballast (if required). Typical AREA ballast sections are shown on Standard Mobilization Drawing No. XEC-009.

2-6. Railroad layout data. The tables in appendix A, with figures and formulas, provide solutions to problems in railroad track layouts typical for Army installations. Main objectives are minimum track construction and curvature where road power can be safely operated. Computations are based on standard No. 8 turnout with tangents through switch points and frogs to prevent bunching of curvature near turnouts. The dimensions in the tables may be used in planning, revision of existing layouts, and layouts on the ground. The formulas determine

essential dimensions for other curvature or track spacing not in the tables. All radii are to the center line of tracks.