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DEPARTMENT OF THE ARMY FIELD MANUAL

TRANSPORTATION RAILWAY UNITS AND OPERATIONS

HEADQUARTERS, DEPARTMENT OF THE ARMY
MARCH 1967

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FOREWORD

This manual provides interim guidance to commanders, staff officers, and other personnel concerned with transportation railway support under the TASTA–70 concept of organization and operation. This information can be utilized to facilitate reorganization under the TASTA concept. Firm information on the organizational structure and composition of units will be as contained in TOE when published. Although the basic TASTA–70 study has been approved by Department of the Army, detailed doctrine contained in this test field manual is under continuing development and review.

Readers are encouraged to submit comments and recommendations for changes that will improve the clarity, accuracy, and completeness of the manual. Comments should be constructive in nature and reasons should be provided for each recommendation to insure understanding and to provide a valid basis for evaluation. Each comment should be keyed to a specific page, paragraph, and line of the text. Comments should be forwarded directly to the Commanding Officer, U.S. Army Combat Developments Command Transportation Agency. An information copy of recommendations that propose changes to approved Army doctrine may be sent, through command channels, to the Commanding General, U.S. Army Combat Developments Command, Fort Belvoir, Virginia 22060, to facilitate review and evaluation.

FIELD MANUAL
No. 55–2–1 (TEST)

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *29 March 1967*

TRANSPORTATION RAILWAY UNITS AND OPERATIONS

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CHAPTER 1

INTRODUCTION

1. Purpose and Scope

a. This manual provides a guide for commanders and staffs at all command and operating levels for the organization and operation of a transportation railway service in a theater of operations.

b. This text is applicable without modification to nuclear and nonnuclear conflicts.

2. Transportation Railway Service in a Theater of Operations

a. The transportation railway service is the overall organization of the transportation railway units assigned and attached to the transportation command, theater army support command (TASCOM). It consists of those transportation railway command and supervisory units, operating and maintenance units, and service units required to operate trains, to maintain rail lines of communication, and to perform organizational and direct support maintenance on motive power, rolling stock, and power transmission facilities. General support maintenance is provided by units assigned to the supply and maintenance command (para 3*c*).

b. The military railways operated by the transportation railway service include all railway facilities in a theater which are employed in support of military operations. Management, construction, operation, and maintenance may be performed by military personnel or by civilian personnel under military direction.

c. The operation of military railways may be accomplished in three phases:

(1) The phase I operation is conducted exclusively by military personnel. The phase I operation normally is employed during (1) the early stages of a military operation when the employment of civilian rail personnel is not practical and (2) in or near the combat zone of a theater where restrictions on the employment of civilians and the press of military necessity and security require that railway operations be conducted by railway troops under a unified command.

(2) The phase II operation is conducted jointly by military and civilian personnel under direct military supervision. The phase II operation is normally instituted in the communications zone as combat forces move forward and the communications zone becomes relatively stable and secure. It implements the transition of control of the railroads from military (phase I) to civilian (phase III).

(3) The phase III operation is conducted by civilian personnel with a minimum of military supervision. The phase III operation is normally instituted in the rearward areas of a stable and secure communications zone. It provides for the release of the maximum number of military personnel and units for redeployment as required.

d. Although these phases normally progress in sequence, this does not preclude the inauguration of a phase II or III operation without progression through the preceding phase; nor does it preclude a similar regression of phases to meet military demands. However, the ultimate aim is to reduce requirements for military personnel and units to operate the railways. Since the phase III operation fulfills this aim and provides for the most economical employment of military units and personnel, it is, when it meets the military requirement, the most desirable phase of operation; every effort is made to inaugurate this operational phase as quickly as possible.

e. A prime consideration in the establishment of phase II and phase III operations is the availability of skilled local labor.

3. Organization of the Transportation Railway Service

a. The transportation railway service under the supervision and direction of the railway transport branch, assistant chief of staff, movements, transportation command, TASCOM, may be composed of the following type units organized as illustrated in figure 1 and discussed in paragraph 5.

(1) *Supervisory and command.*

(*a*) General headquarters, transportation railway service.

(*b*) Headquarters and headquarters company, transportation railway brigade.

(*c*) Headquarters and headquarters company, transportation railway group.

(*d*) Headquarters and headquarters company, transportation railway battalion.

(2) *Operating and maintenance.*

(*a*) Transportation railway engineering company.

(*b*) Transportation railway equipment maintenance company

(*c*) Transportation railway operating company.

(*d*) Transportation railway workshop (mobile).

(*e*) Transportation electric power transmission company.

b. Transportation service teams (para 17 and 18) organized under TOE 55–500 may be attached to the transportation railway service to provide additional support as required and as approved by the transportation command, TASCOM.

c. Two general support maintenance units which provide maintenance support on locomotives and rolling stock of the transportation railway service—the transportation railway car repair company and the transportation railway diesel-electric locomotive repair company —are assigned to, and operate under supervision and control of, the supply and maintenance command, TASCOM, and the appropriate field depot. In view of the single-user nature of the support provided by these units, they may be attached to the transportation railway service; in such cases, their daily operations may be controlled and supervised by the supported railway unit. One each of these units normally is required to support a transportation railway group with its attached units. The missions of these units dictate that they be located so as to provide convenient and efficient support to the railway group.

d. Military police units of the area support command provide security required beyond the capability of organic or attached military police. Depending upon the tactical and guerrilla situation, combat troop support may be required for protection of rail lines of communication. This support is requested through channels by the railway service as required.

4. Classification of Military Railways

Railways are classified by gage as standard (56½ inches), broad (60, 63, and 66 inches), and narrow (42 and 39⅜ inches and smaller). It is anticipated that in military railroading any gage of rail may be used; however, in an area offering a choice of gages, standard will be used wherever possible.

CHAPTER 2

TRANSPORTATION RAILWAY UNITS

Section I. GENERAL

5. Introduction

a. The theater army support command (TASCOM) transportation railway service is composed of the necessary mix of railway units required to supervise, operate, and maintain the theater military railway system to provide efficient and timely railway support to U.S. forces in the theater. The number and type of operating and maintenance units and supervisory organizations employed in the railway service depend upon the scope of the military railway support which must be provided.

b. The senior supervisory unit of the transportation railway service in a theater of operations is assigned to and operates under the command and supervision of the transportation command, TASCOM. Subordinate transportation railway units are assigned to the transportation command, TASCOM, and are further attached, for operation and control, to a railway unit at the appropriate level of command in the transportation railway service.

c. Normally, the general headquarters, transportation railway service, and the headquarters and headquarters company, transportation railway brigade, will be employed in the transportation railway service only when land forces exceed the 12-division force concept. Operation of the transportation railway groups—the senior units under the 12-division force concept—is supervised and coordinated by the transportation command. If operations expand and more than two groups are required, the transportation railway brigade will be interposed in the organizational structure (fig. 1) as a supervisory and command headquarters between the groups and the transportation command. On a continental landmass or in a theater with widely dispersed operational areas, it may be necessary to further interpose the general headquarters into the organizational structure (fig. 1) as a headquarters between brigade and transportation command levels. Conversely, military operations of limited scope may necessitate the tailoring of this organization to reduce it to the scale required to meet operational demands.

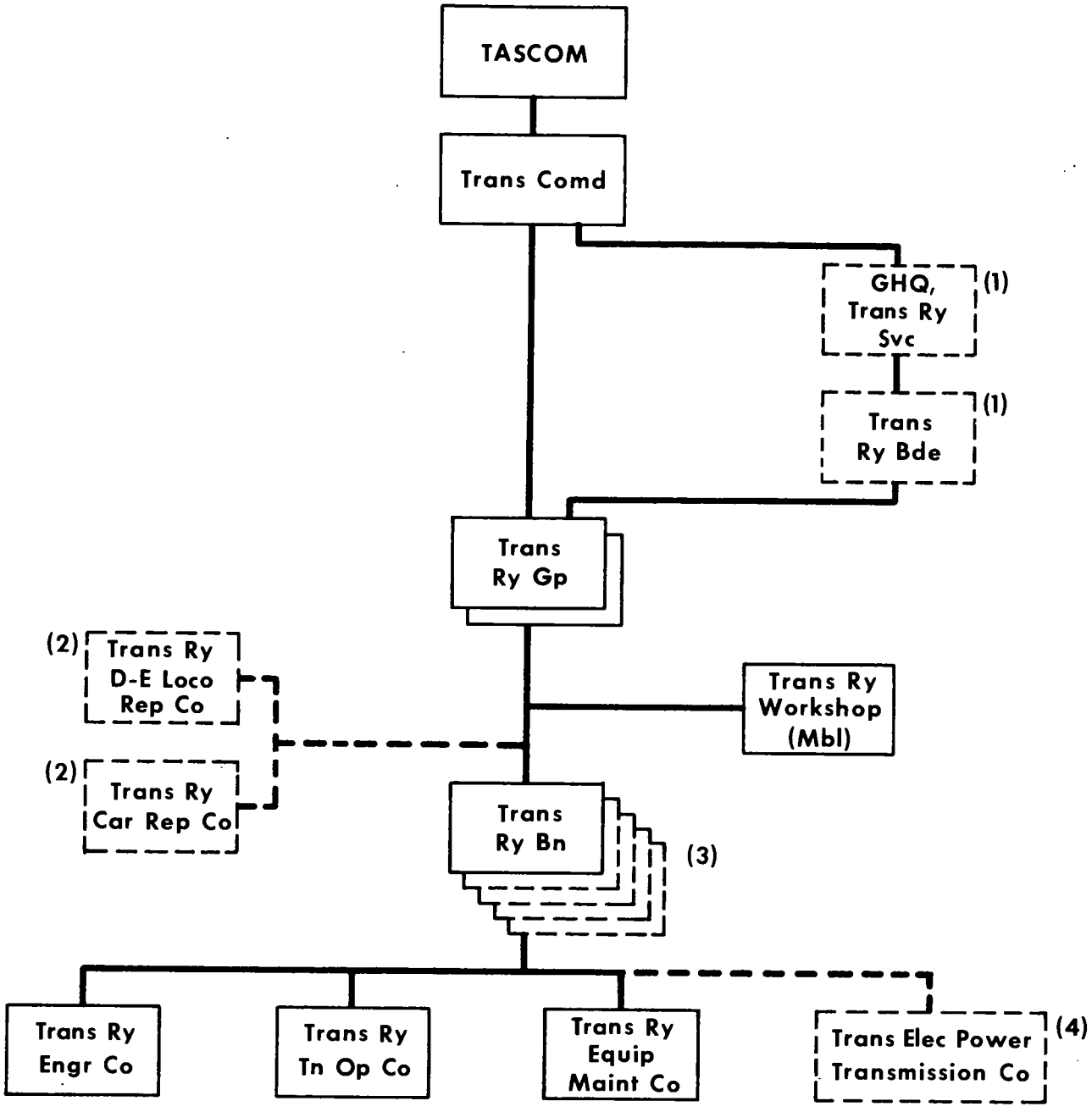
d. Each of the transportation railway supervisory and command units is capable of supervising and operating a railway service within the stated capability of the unit. This provides flexibility in organizing a transportation railway service since theater requirements may be met by an organization ranging from that requiring a general headquarters as the senior railway unit down to a limited operation in which a battalion, as the largest railway unit, would operate a system of 90–150 miles (145–242 kilometers) in length.

6. Command and Control

Command and operational control over the entire transportation railway service is exercised by the transportation command, TASCOM, regardless of the extension of this service through other commands or territorial jurisdictions in the communications or combat zones. Commanders of area support commands or areas within the combat zone influence rail operations by coordination through command and technical channels as required.

7. Concept of Employment (12-division force)

a. The transportation railway units constituting the transportation railway service operate the main rail systems in a theater of operations. Included in each system are the main line and the yards, sidings, and spur



Notes:

1. The brigade is interposed in this organization above group if three or more groups are assigned to TASCOM. If the operation expands to require two or more brigades, the general headquarters is interposed between brigade and transportation command.
2. May be attached from the supply and maintenance command.
3. Number of battalions (two to six per group) is dependent upon the scope of the railway operation.
4. When required for electrified operations.

Figure 1. Type transportation railway service organization.

tracks required to connect the various installations to that line.

b. The transportation railway groups are assigned to and operate directly under the transportation command, TASCOM. Each commands, administers, and supervises the operation of one main rail route up to 600 miles long. The groups report directly to the transportation command, which coordinates the efforts of the groups in accomplishing the theater rail mission. In addition to its attached battalions, each group normally has attached one transportation railway workshop (mobile); additional workshops may be attached as required.

c. General support maintenance of motive power and rolling stock is provided to the group by the car repair company and the diesel-electric locomotive repair company as indicated in paragraph 3*c*.

d. The transportation railway battalion is the basic operating organization of the transportation railway service. It is the operating organization for the smallest self-contained railway segment, the railway division. The battalions are assigned to the transportation command, TASCOM and are further attached to a railway group. The group designates the geographical limits of the division which the battalion will operate. Units which may be attached to the battalion for normal railway operations are—

(1) Transportation railway equipment maintenance company.
(2) Transportation railway train operating company.
(3) Transportation railway engineering company.
(4) Transportation electric power transmission company.

Section II. SUPERVISORY AND COMMAND UNITS

8. General Headquarters, Transportation Railway Service (TOE 55–200)

a. Mission. The mission of the general headquarters is to plan and direct the operation and maintenance of railways used for military purposes in a large theater of operations and to command all troops attached to carry out the mission.

b. Assignment. The general headquarters normally is assigned as the senior railway transport unit to the transportation command, theater army support command (TASCOM), of a theater army having two or more transportation railway brigades (para 5*c*).

c. Capabilities. The general headquarters is capable of commanding two or more transportation railway brigades. It provides overall supervision and direction in the operation and maintenance of all railroads under military control in a theater of operations and commands all troops attached to the transportation railway service.

d. Characteristics. The general headquarters is administratively self-sufficient. Organic transportation is provided for administrative, logistic, and supervisory missions. This unit cannot move itself with its organic motor transportation.

e. Organization. The general headquarters is composed of a railway headquarters; administrative, transportation, engineering, security, equipment, supply, and judge advocate sections; and a company headquarters.

f. Concept of Employment. The general headquarters, transportation railway service, is subordinate to the transportation command, TASCOM, and is the senior command echelon of the transportation railway service. It provides the essential unity and continuity of command and operational procedures and, through the coordination of effort of its attached brigades and subordinate railway units, the flexibility of railway support required for effective and economical utilization of transportation railway units in fluid situations.

9. Headquarters and Headquarters Company, Transportation Railway Brigade (TOE 55–201)

a. Mission. The mission of the railway brigade is to provide operational planning, supervision, coordination, and control of the activities of transportation railway groups.

b. Assignment. The brigade is assigned to the transportation command, TASCOM; it may be attached to a general headquarters, transportation railway service, when the general headquarters is the senior railway service unit.

c. Capabilities. The brigade is capable of commanding and supervising two or more transportation railway groups and provides—

(1) Command of, staff planning for, and supervision of operations.

(2) Supervision and assistance in matters of administration and supply.

(3) Planning for and supervision of security of all buildings, structures, and equipment and of all supplies in transit by rail.

(4) Technical control over train movements; operation of terminals, railway shops, and enginehouses; maintenance of track and structures; car distribution; and allocation of motive power.

(5) Allocation of maintenance-of-way supplies and equipment.

d. Characteristics. The railway brigade is administratively self-sufficient. Organic transportation is provided for administrative, logistic, and supervisory missions. This unit cannot move itself with its organic motor transportation.

e. Organization. The railway brigade is composed of a brigade headquarters; administrative, transportation, equipment, security, and supply sections; and a company headquarters.

f. Concept of Employment. The transportation railway brigade is subordinate to the TASCOM transportation command. In the provision of an interzonal service, it may operate throughout the communications zone and into the combat zone. It is comprised of adequate supervisory, operating, and maintenance units required to operate trains, to maintain rail lines of communications, and to perform organizational and direct support maintenance on motive power, rolling stock, and power transmission facilities. When the brigade is the senior command echelon of the transportation railway service, it operates and controls the entire military railway system. When the brigade is subordinate to the general headquarters, it operates a segment of the system.

10. Headquarters and Headquarters Company, Transportation Railway Group (TOE 55–202)

a. Mission. The mission of the railway group is to command, administer and supervise the operation of transportation railway battalions, transportation railway workshops (mobile), and other attached units.

b. Assignment. The group is assigned to the transportation command, TASCOM; it may be attached to a transportation railway brigade, or it may operate directly under the transportation command, TASCOM.

c. Capabilities. The group is capable of commanding two to six transportation railway battalions and other attached units as required. It provides—

(1) Command of, staff, planning for, and supervision of operations.

(2) Supervision and assistance in matters of administration and supply.

(3) Planning for and supervision of security of all buildings, structures, and equipment and of all freight in transit by rail.

(4) Technical control over train movements; operation of terminals, railway shops, and enginehouses; car distribution; maintenance of track and structures; and allocation of motive power.

d. Characteristics. The railway group is administratively self-sufficient. Organic transportation is provided for administrative, logistic, and supervisory missions. This unit cannot move itself with its organic motor transportation.

e. Organization. The railway group is composed of a group headquarters; administrative, supply, transportation, security, equipment, and engineering sections; and a company headquarters.

f. Concept of Employment. The headquarters and headquarters company, transportation railway group, commands the transportation railway battalions with attached units, plus one transportation railway workshop (mobile) and

other attached units. The battalions are positioned along the approximate 600 miles (965 kilometers) of main line operated by the group at the most desirable points from which they can perform their mission. The mobile workshop is situated and utilized so that it can best support the battalions.

11. Headquarters and Headquarters Company Transportation Railway Battalion (TOE 55–226)

a. Mission. The mission of the railway battalion is to exercise command, control, and supervision over attached units and, with its attached units, to operate and maintain in a theater of operations a railway division of approximately 90–150 miles (145–242 kilometers).

b. Assignment. Normally, the battalion is assigned to the transportation command, TASCOM, and is further attached to a transportation railway group; it may be assigned to and operate directly under the transportation command, TASCOM.

c. Capabilities.

(1) The battalion provides command, staff planning, administration, control, and supervision of the operations of attached units.

(2) It dispatches all trains operated by the battalion, supervises all rail operations, and operates railway stations and signal towers which are the responsibility of the battalion.

d. Characteristics. The railway battalion is administratively self-sufficient. Organic transportation is provided for administrative, logistic, and supervisory missions. This unit cannot move itself with its organic motor transportation.

e. Organization. The railway battalion is composed of a battalion headquarters; operations, administrative and personnel, train movement, and maintenance and supply sections; and a company headquarters.

f. Concept of Employment.

(1) The headquarters and heaquarters company of a transportation railway battalion plans, supervises, coordinates, and controls operations of the units attached to the battalion. It dispatches all trains operated by the battalion, assigns and distributes motive power, distributes the rolling stock as directed, and operates the railway stations and signal towers of the battalion.

(2) As the basic unit of the military railway service, the transportation railway battalion assumes responsibility for operation of a railway division. A railway division may contain main line and belt line tracks, sidings, terminals, enginehouses, car repair tracks, and structures. Attached units of the railway battalion perform normal roadway maintenance and organizational and direct support maintenance to motive power, rolling stock, and railway signals and communications.

(3) The railway mileage assigned to the railway battalion will vary from 90–150 miles (145–242 kilometers); however, if military necessity dictates, the divisions may be extended. For planning purposes, a battalion is capable of operating an average of 15 trains daily in each direction on a single main line between terminals of the railway division.

(4) Personnel of the headquarters and headquarters company are assigned to duties at locations as required for efficient operation of the railway division and according to the facilities available. Normally, the division will serve at least one large terminal. Station personnel and towermen are assigned to points along the railroad. The number of personnel at any station depends upon the amount of traffic to be handled. Personnel assignments are flexible to permit the reassignment of station agent-operators to handle any increase in traffic along any point of the division.

(5) The units normally attached to the transportation railway battalion are as follows (para 12–14):

(a) Transportation railway engineering company (TOE 55–227).
(b) Transportation railway equipment maintenance company (TOE 55–228).
(c) Transportation railway train operating company (TOE 55–229).
(6) A transportation electric power transmission company (para 16), (TOE 55–217) is required to operate an electrified system and will be attached to the battalion when the catenary system and power system of an electrified line are intact.

Section III. MAINTENANCE AND OPERATING UNITS

12. Transportation Railway Engineering Company (TOE 55–227)

a. Mission. The mission of the railway engineering company is to maintain and repair railroad track, bridges, buildings, and railway signals and communications within a railway division.

b. Assignment. The railway engineering company is assigned to the transportation command, theater army support command (TASCOM), and normally is attached to a transportation railway battalion.

c. Capabilities. The railway engineering company is capable of providing the maintenance and repair requirements for the railway tracks, bridges, buildings, and railway signals and communications for a railway division of 90–150 miles (145–242 kilometers) operated by the transportation railway battalion to which it is attached. This unit depends upon appropriate signal construction elements of the U.S. Army Strategic Communications Command (Theater) for new construction and major reconstruction and rehabilitation of railway communications landlines.

d. Characteristics. The railway engineering company is administratively self-sufficient. Organic transportation is provided for administrative, logistic, and supervisory missions. This unit cannot move itself with its organic motor transportation.

e. Organization. The railway engineering company consists of a company headquarters and four operating platoons: two track maintenance platoons, one bridge and structure maintenance platoon, and one communications and railway signal maintenance platoon.

f. Concept of Employment. The railway engineering company normally is attached to and operates under the command and supervision of a transportation railway battalion; normal attachment is one company to a battalion. It repairs and maintains the railway facilities of the railway division operated by the battalion to which it is attached, to include repair and maintenance of the roadbed, ditches, track, switches, bridges, culverts, water lines and tanks, fueling structures, buildings, signal and communications facilities, and all roadway and property maintenance not expressly delegated to other agencies. This unit is not responsible for new construction or major maintenance of military railways. These functions, including stockage of construction materials in a theater of operations, as planned for and requested by the senior railway service unit in the theater, are the responsibility of the engineer command. However, the railway engineering company cooperates closely with engineer units and may, under definite plans and arrangements, aid engineer units in accomplishing required tasks.

13. Transportation Railway Equipment Maintenance Company (TOE 55–228)

a. Mission. The mission of the railway equipment maintenance company is to provide organizational and direct support maintenance on motive power and rolling stock.

b. Assignment. The equipment maintenance company is assigned to the transportation command, TASCOM, and normally is attached to a transportation railway battalion.

c. Capabilities. The equipment maintenance company is capable of performing organizational and direct support maintenance to approximately 40 diesel-electric locomotives and 800 railway cars and can perform organizational (running) inspection on 2,000 cars. It

performs light repairs on tools and limited repairs on special mechanical equipment within the battalion.

d. Characteristics. The equipment maintenance company is administratively self-sufficient. Organic transportation is provided for administrative, logistic, and supervisory missions. This unit cannot move itself with its organic motor transportation.

e. Organization. The equipment maintenance company consists of a company headquarters and two operating platoons: one car repair platoon and one diesel-electric locomotive repair platoon.

f. Concept of Employment. The railway equipment maintenance company is attached to and operates under the command and supervision of a transportation railway battalion; normal attachment is one company to a battalion. Upon entry into a theater of operations, equipment maintenance personnel inspect captured or liberated motive power and rolling stock and estimate the time required to replace them in service; equipment requiring repairs beyond the capability of the unit is evacuated to the general support units for repair. Personnel of the railway equipment maintenance company also inspect enginehouses, shops, fueling and watering stations, and other facilities used in rolling stock maintenance. During subsequent operations, motive power and railway cars are kept in proper operating condition by performance of organizational and direct support maintenance as required. Personnel of this unit operate a wreck train to clear the tracks and to repair or salvage derailed or wrecked motive power and cars. This unit also maintains the necessary level of diesel fuels and other supplies of lubricants, oils, solvents, and repair parts for organizational and direct support maintenance on motive power and rolling stock and operates fueling, watering, and lubricating facilities. When necessary, this unit implements the battalion demolition plan for the destruction of shop equipment, motive power, and railway cars.

14. Transportation Railway Train Operating Company (TOE 55–229)

a. Mission. The mission of the train operating company is to provide road and yard personnel for the operation of railway locomotives and trains.

b. Assignment. The train operating company is assigned to the transportation command, TASCOM, and normally is attached to a transportation railway battalion.

c. Capabilities. The train operating company is capable of providing 40 train crews daily in either road or yard service, operating over a division of 90–150 miles (145–242 kilometers).

d. Characteristics. The train operating company is administratively self-sufficient. Organic transportation is provided for administrative, logistic, and supervisory missions. This unit cannot move itself with its organic motor transportation.

e. Organization. The railway train operating company consists of a company headquarters and two operating platoons; each platoon contains 25 train crews.

f. Concept of Employment. The train operating company provides train crews for operating freight and passenger trains over a main line and yard engines in service in rail yards. Main line operations are normally limited to one division; if required, they may extend over several divisions. Operational control of the train crews is exercised by the dispatcher and yardmaster.

15. Transportation Railway Workshop (Mobile) (Team EI, TOE 55–500)

a. Mission. The mission of the railway workshop (mobile) is to perform direct support maintenance on motive power and rolling stock in areas where static facilities are either inadequate or nonexistent.

b. Assignment. The mobile workshop is assigned to the transportation command, TASCOM, and normally is attached to a transportation railway group.

c. Capabilities. The mobile workshop is capable of inspecting and performing direct support maintenance on 20 locomotives and 100 railway cars.

d. Chracteristics. The mobile workshop must rely on the unit to which it is attached for mess and administration. Organic transpor-

tation is provided for administrative, logistic, and supervisory missions. When the workshop equipment is mounted on trucks or rail cars, the unit is 100 percent mobile.

e. Organization. The mobile workshop is a team provided by TOE 55–500. Normally it is organized with a shop superintendent's office and two sections: a diesel-electric locomotive repair section and a railway car repair section.

f. Concept of Employment. The railway workshop (mobile) is attached to and operates under the command and supervision of a transportation railway group; normal attachment is one shop to a group. The shop is dependent upon the unit it supports for either railway cars or motor transport in which to mount its organic shop equipment.

(1) This unit can provide sufficient support during the initial stages of an operation so that rail operations may be initiated before the arrival of a diesel-electric locomotive repair company in the theater or the area.

(2) It provides mobile shop facilities which can be deployed as necessary to facilitate the rapid expansion of a railway service.

(3) During normal operations, this unit performs sufficient repairs in forward areas to restore damaged equipment to service or to permit removal of such equpiment to a railway backshop. It repairs and maintains operable equipment to avoid the return of such equipment over long distances to a railway backshop.

(4) The mobile shop provides the power and machine tools necessary to operate a railway shop in an area in which fixed facilities are damaged or unavailable.

16. Transportation Electric Power Transmission Company (TOE 55–217)

a. Mission. The mission of the electric power transmission company is to maintain and repair electric power transmission facilities.

b. Assignment. The electric power transmission company is assigned to the transportation command, TASCOM, and normally is attached to a transportation railway battalion.

c. Capabilities. The electric power transmission company is capable of maintaining and repairing power transmission facilities, including substations and catenary, for up to 200 miles (320 kilometers) of electrified railway.

d. Characteristics. The electric power transmission company is administratively self-sufficient. Organic transportation is provided for administrative, logistic, and supervisory missions and provides the unit with a 15-percent mobility capability.

e. Organization. The electric power transmission company consists of a company headquarters and two electric power platoons.

f. Concept of Employment. The electric power transmission company normally is attached to a transportation railway battalion. It is employed only when an electrfied system is to be operated and when such operation cannot be accomplished by using local civilian personnel. The unit is responsible for the operation and organizational and direct support maintenance of the electrical power systems of an electrified railway, including maintenance and repair of catenary and substations. However, it is not responsible for the generation of power for the system; this is provided by the engineer command.

Section IV. TRANSPORTATION SERVICE TEAMS

17. General

Transportation service teams organized under TOE 55–500 are available for employment within the transportaton railway service. These teams are employed to increase the capabilities of railway service operating and maintenance units to meet requirements which exceed the capabilities of such units but are not sufficient to warrant the assignment of additional TOE units to the railway service.

18. Type Railway Transportation Service Teams (TOE 55–500)

In addition to team EI, transportation railway workshop (mobile) (para 15), the following teams are available to provide additional operating and maintenance support to the transportation railway service:

Team	*Capabilities*
Ambulance train maintenance crew (team EA)	Performs organizational maintenance (running repairs) on one ambulance train.
Railway station detachment (team EB)	Provides a detachment to operate a small or medium-size on-line railway station facility in a depot or other installation served by the transportation railway service.
Railway terminal detachment (team EC)	Operates a rail terminal with a capacity of 10 trains per day.
Diesel-electric locomotive maintenance crew (team ED).	Performs direct support maintenance for 7 diesel-electric locomotives and 50 railway cars at an outlying installation.
Steam locomotive maintenance crew (team EE)	Performs direct support maintenance for 7 steam locomotives.
Railway car repair crew (team EF)	Inspects and performs direct support maintenance on 300-350 railway cars.
Ambulance train maintenance (augmentation) (team EG).	Provides refrigeration and supply specialists for direct support maintenance of 4 ambulance trains (augments team EF).
Railway yard operating detachment (team EH)	Operates a railroad yard on a 24-hour basis when yard train crews are provided and when not more than 2 receiving and classification yards, including humps, are to be operated; inspects and performs running repairs on rolling stock transiting the yard and inspects or secures loads on cars passing through the yard.

CHAPTER 3

TRANSPORTATION RAILWAY OPERATIONS

19. Establishment of Rail Operations

The establishment of railway operations in a theater of operations is generally accomplished in the manner described in *a* through *f* below and is dependent upon the rehabilitation of the rail system; some of the steps outlined may be accomplished simultaneously. Limited rail operations may be instituted within a few hours after rail personnel and equipment become available in an area.

a. Railway units are moved to and concentrated in the theater; this is accomplished in three echelons—

(1) Advance party.
(2) Main body.
(3) Rear echelon.

b. All rail lines, facilities, and equipment are reconnoitered. This reconnaissance must produce sufficient intelligence of the rail line, the condition of existing facilities and equipment, and the availability of civilian railway personnel on which to base requirements for personnel and equipment for operation of the rail system.

c. The capabilities and limitations of the rail line are evaluated.

d. Subordinate rail units are oriented concerning the characteristics of the rail lines and the type of operation planned.

e. Subordinate rail units are deployed throughout the rail net.

f. Rail operations are initiated.

20. Methods of Operation

a. The existing railway facilities in a theater will be operated as required to support the military operations. It may be expected that communications and railway signal facilities, to include any form of centralized traffic control, electrically operated interlocking plants, and automatic block signal systems, will be damaged, destroyed, or inoperative. The introduction of U.S. radio-equipped locomotives will assist greatly in rail operations before the restoration of damaged or destroyed signal communications.

b. The methods by which trains will be operated in the theater include fleet, block (positive or permissive), train order, and timetable operations or a combination of these methods.

(1) Fleet operation entails the forward movement of loaded trains only during a given period (4-, 8-, 12-, or 24-hour period) and the return movement of empty trains only during a succeeding like period over the same track or route. Fleet operation also may entail the movement of loaded trains over one route and the return of empty trains over another route.

(2) Block operation may be positive or permissive. In positive block operation, a train may not enter a block that is aready occupied by another train. In permissive block operation, more than one train may occupy the same block at the same time.

(3) Train order operation is employed when communications are adequate and dependable and sufficient sidings are available. In train order operation, the train dispatcher controls train movements by issuing train orders.

(4) Timetable operation is employed when rail traffic in a theater becomes generally stabilized. The timetable is the authority for movement of regular trains subject to the rules. It contains the classified schedules of regular trains with special instructions relating thereto.

21. Operating and Safety Rules

a. Operating Rules.

(1) Train operations are governed by current railway operating technical manuals based on the Standard Code of Train Rules issued by the Association of American Railroads (TM 55–200). The rules will be modified to apply to conditions found in a theater of operations.

(2) The correct interpretation, proper application, and observance of these operating rules are of primary importance in the efficient and safe operation of the railroad.

b. Safety Rules. Safety rules applicable to transportation railway service personnel in the performance of duties are published in appropriate military publications (DA Pam 55–1). Every member of the transportation railway service is required to familiarize himself with these rules and to obey them.

22. General Types of Trains

The two general types of trains that are normally operated are classified by the nature of their cargo and in some instances by their equipment.

a. Passenger trains move personnel, mail, and express on through (long) or local runs.

b. Freight trains operate as long-haul freight carriers, local freight carriers, or work trains.

23. Operation of Ambulance and Other Special Trains

a. Ambulance trains (utility cars, ward cars, and kitchen cars) authorized by TOE 8–520, and two-car diesel consists when available, are medical property but are maintained by the transportation railway service. Ambulance trains will be stabled where they can be maintained as complete 10-car consists and where they may be best serviced and deployed by both medical facilities and the transportation railway service. Special stabling areas, sidings, and spurs may be required. Train commanders of ambulance trains normally are officers of the Army Medical Service. Engineers, train crews, and locomotives are provided by the transportation railway service.

b. The transportation railway service is responsible for the movement and maintenance of ambulance trains. Schedules are prepared by the transportation railway service to meet the requirements of the medical command theater army support command (TASCOM).

(1) *Priority.* Ambulance trains normally take priority over all other trains except those being run under emergency conditions for the express purpose of supporting a force in actual combat.

(2) *Immunity.* Red Cross markings, displayed in accordance with the Geneva Convention agreements, afford the train immunity from enemy action. This agreement also specifies who (normally noncombatants) may ride ambulance trains. Generally, riders are restricted to train operating crews, medical staffs, and patients.

(3) *Limits of operation.* Ambulance trains normally operate from a railhead or collecting point in the army area to an evacuation port or to hospitals in the rear of the army area, depending upon the theater evacuation policy and instructions of the medical regulating officer, medical command. They may, when required, operate as far forward as the division rear.

(4) *Coordination.* The medical command makes requests and indicates requirements for the movement of ambulance trains. The locations of train stabling points are determined by coordination between the medical command and the transportation railway service.

c. Other special trains are operated as required. They include the following:

(1) Ration trains.
(2) Leave trains.
(3) Refugee trains.
(4) Prisoner of war trains.
(5) American Red Cross trains.
(6) Special trains for civilian purposes.

24. Speed of Train Movements

In the initial stages of an operation, trains operate at slow or moderate speeds. Safe arrival at destination is the primary consideration in railway operations. As the theater expands, as facilities and equipment are improved, and as operating personnel become familiar with the areas in which they are operating, train speeds may be increased.

25. Yard and Terminal Operations

In general usage, a yard is a system of tracks used in breaking up, classifying, storing, and making up trains. Yards will be located at ports, interchange points, large depots, and forward railheads. A rail terminal includes, in addition to yard tracks, facilities for repair and servicing, and for accommodation of railway crews. Terminals are located at originating and terminating points of trains and at sites which mark the limits of the operating divisions. They may consist of one or more yards.

a. In a yard or in a terminal consisting of one yard, specific tracks are designated for receiving inbound trains, for classification of cars, and for preparing outbound trains. In a terminal consisting of several yards, specific yards may be designated as follows:

(1) The receiving or inbound yard clears trains from the main line to avoid blocking the line.

(2) In the classification yard, trains are broken up, cars are classified according to commodity and destination, and new trains are made up.

(3) In the outbound or forwarding yard, trains are made ready for departure after being classified.

b. In addition to the yards designated in *a* above, a terminal may contain the following special purpose tracks or yards:

(1) Storage tracks or yards.
(2) Coach tracks or yards.
(3) Repair tracks or yards.
(4) Stock tracks or yards.
(5) Industrial tracks or yards.
(6) Team tracks or yards.
(7) Scale tracks or yards.
(8) Shop tracks or yards.
(9) Engine tracks or yards.
(10) Caboose tracks or yards.

26. Assignment of Motive Power and Rolling Stock

a. Road Engines. Road engines are assigned to the transportation railway group at a ratio of approximately 40 engines per attached battalion. This number may be increased or decreased based upon the number and type of trains to be operated; the physical characteristics of the division; and the water, fuel, and servicing facilities available.

b. Switch Engines. Switch engines are assigned to yards and terminals according to the following general criteria:

(1) Installations and depots—one per 67 cars dispatched and received per day.
(2) Railheads—one per 67 cars dispatched and received per day.
(3) Intermediate yards and handling terminals—one per 100 cars passing or handled per day.

c. Rolling Stock. Rolling stock is assigned to the transportation railways groups and will be used over the entire system. Work equipment may be assigned to transportation railway battalions as required for use on their divisions.

27. Interruptions to Rail Traffic

a. The transportation railway service is responsible for clearing all interruptions to rail traffic as quickly as possible. Assistance, as required, may be obtained from the engineer command, communications personnel, and local civilians. Major interruptions to rail traffic must be reported immediately to the commander, transportation railway group or brigade, so that required adjustments may be made in the traffic flow.

b. Major causes of rail traffic interruptions are as follows:

(1) Enemy action, including aerial bombing and artillery fire utilizing either conventional or nuclear weapons and guerrilla activity.

(2) Human failure, including improper train operation, violation of rules, and

improper inspection and maintenance of equipment.

(3) Equipment or facility failure due to unforeseen or unpredictable equipment faults or defects.

(4) Natural causes, including floods, slides, washouts, lightning fires etc.

c. Types of interruptions are indicated by their major cause and derivatives thereof and include but are not limited to—

(1) Major derailments.
(2) Minor derailments.
(3) Washouts.
(4) Floods.
(5) Slides.
(6) Tunnel cave-ins.
(7) Guerrilla action.

28. Use of Equipment

a. Effective and adequate transportation railway support of military operations in a theater requires efficient utilization of railway rolling stock and motive power. Commanders responsible for loading and unloading cars must supervise closely to insure that railway rolling stock is released promptly.

b. Passenger equipment frequently is limited to use in leave trains, military casual personnel trains, and ambulance trains.

c. Special equipment includes not only specially designed rolling stock for handling unusual cargo, but also railway work equipment and ambulance cars. If standard Department of the Army ambulance cars are not furnished in a theater of operations, passenger equipment may be converted to ambulance cars.

d. When the volume permits, refrigerator or tank cars are handled in solid trains and given a high movement priority from origin to destination and return.

29. Operational Control by Higher Headquarters

a. The transportation command exercises control over the movement by rail of troops and supplies within the theater of operations.

b. The transportation command exercises control over the allocation and utilization of rail equipment used in the movement of troops and supplies within the theater of operations.

30. Personnel Movements

a. General. Programed and unprogramed troop movements generally create a heavy demand for rolling stock; therefore, sufficient lead time should be allowed to the railway service to permit ordering and assembling equipment for such operations. Normally, troop movements are made from selected entraining areas, generally in the vicinity of a troop staging or training area, to prevent congestion of rail facilities required for supply movements. When troop movements are made in freight equipment and long distances are involved, arrangements will be made through the transportation movements office to select and schedule stopover points en route for messing and relief of the troops. For large troop moves, movements personnel will, where possible, schedule the departure over several days. This minimizes requirements for concentration of troops and equipment and permits reuse of the same railway equipment in a shuttle movement.

b. Authorization for Rail Travel. Normally, the movement control center (MCC) receives information on troop arrivals in the theater and on intratheater troop movements. Based upon priorities established by the theater commander, the MCC prepares a troop movement program for issue by the TASCOM commander. This program is a directive for the accomplishment of troop movements during a specific period of time and includes the directives for the rail portion of the movement program.

c. Troop Movement Procedures. The normal procedure for troop movement by rail is as follows.

(1) Orders directing the movement are delivered to the local transportation movements officer by the commander of the unit directed to move.

(2) The local transportation movements officer obtains the following information from the commander and transmits it to the passenger branch, movement control center:

(*a*) Authority for the move.
(*b*) Number of personnel.
(*c*) Point of origin.

(*d*) Destination.
(*e*) Date of departure or date due at destination.
(*f*) Quantity of baggage and/or unit equipment.

(3) Based upon the above information, the MCC is provided the following information by the railway service:
(*a*) Route.
(*b*) Schedule.
(*c*) Type and quantity of rail equipment to be provided.
(*d*) Time and place of entraining.
(*e*) Transfer points, if required.
(*f*) Time and place of detraining.
(*g*) Rest stops, if required.

(4) The MCC assigns a military authorization identification number (MAIN) international code number, STANAG 2158) to identify the movement and transmits, through movement control channels, details of the itinerary to the unit being moved.

(5) The railway service transmits details of the itinerary to all transportation railway service activities concerned and insures that rail equipment is made available when required and that trains are operated as scheduled.

31. Supply Movements

a. Authority for Movements. The authority for movement of supplies by rail is contained in the transportation movement program. This program also provides the authority for shippers to request transportation from the local transportation movements officer.

(1) *Transportation movement program.* This is a directive, normally prepared by the TASCOM MCC and issued in the name of the TASCOM commander, for the accomplishment of movements during a specific period of time. This program provides the means by which shippers, receivers and transport services are advised of movement priorities, designated transport modes, and schedule of movements. It enables them to prepare to carry out shipments at the time and in the order specified.

(2) *Material release order.* The inventory control center (ICC) normally issues a material release order to shippers concerned with movements, with a copy furnished to the MCC by computer-to-computer link. The material release order contains details on what is to be shipped and the origin and destination of shipment. It assists personnel by providing information not contained in the movement program or by clarifying information included in the program.

(3) *Transportation movement release (TMR).* This is the release issued by the movement control organization to identify a particular shipment. Normally it is issued after the consignor has requested transport and the capability of the transport mode to move the shipment has been determined.
(*a*) TMRs are issued on all release-lot shipments; these are shipments which, by command criteria, may be offered to the movement management organization for shipment. Normally, the criteria for such shipment is established as one which is either over a specific weight or occupies the total visible capacity of the transport mode carrier, or any shipment which is outsized or overweight.
(*b*) Shipments of less than release-lot criteria may either be consolidated by the shipper to meet release-lot criteria or, if there is insufficient material for a single destination to meet such criteria, they may be offered to the nearest consolidation and distribution (C&D) point for movement.
(*c*) TMRs are issued for both programed and nonprogramed shipments.

(4) *Military authorization identification number.* MAIN numbers are assigned for freight movements in the

same manner as the passenger movements (par 30c(4)).

b. Ordering Rail Transport.

(1) Shipping agencies place their requirements for rail transport through their local transportation movements officer or, when authorized, through the local railway operating representative, a minimum of 24 hours before loading time. This affords a more economical use of switch engines and rolling stock in the car spotting and switching operations involved.

(2) For requirements placed by the medical regulating officer, medical command, for movement of ambulance trains, the 24-hour minimum time factor does not apply.

c. Loading Rail Cars.

(1) The using agency must load rail cars to the maximum capacity consistent with safe tonnage or with space limitations.

(2) Blocking and bracing of loads is accomplished by the shipper.

(3) Inspection of lading of open-top cars for safety of movement is a responsibility of the transportation railway service.

(4) When loads approach or exceed the size of the average boxcar, clearance standards for the route to be traveled will be checked.

(5) A great percentage of foreign-manufactured cars are designed for uniform floor loads. When concentrated loads such as battle tanks are to be transported, care must be exercised by the railway service to insure that the proper types of cars are furnished.

CHAPTER 4

OPERATIONAL CONSIDERATIONS IN A THEATER OF OPERATIONS

32. General

The military forces will use all available operational railways existing in the theater. Since railways are extremely vulnerable to continued damage and destruction by hostile aircraft, guerrilla action, and sabotage, an adequate rail system, to include alternate routes and means of bypassing obstructions to provide a continuous service, should be planned.

33. Location

The location of existing railway lines will be of great strategic importance. Main line routes, together with required yards, sidings, and short spur tracks required to connect the various installation with the main lines, will be selected. Railways in the rear of the main line of resistance and parallel to it will be used where possible for lateral movement of troops and supplies.

34. Desirable Characteristics

a. The following are important considerations when selecting railways:

(1) Proper location of terminals, yards, and shop facilities.
(2) Double or multiple tracks.
(3) Seasoned roadbed, good ballast, and heavy rail.
(4) Light grades and curvature.
(5) Adequate yards, sidings, spurs, and other tracks.
(6) Bridges of sufficent strength and clearance for military loads.
(7) Tunnels of sufficient clearance for military loads.
(8) Loading and unloading facilities where needed.
(9) Adequate refueling points.
(10) Adequate signal system.
(11) Gage of track.
(12) Length of line.

b. Adequate terminal facilities are vital. An increase in terminal capacity may be secured by adding side tracks and vehicular roads to permit additional loading and unloading areas.

c. Maximum utilization of existing rail facilities and plants requires that cars be loaded and unloaded promptly.

35. Undesirable Characteristics

When railways are selected for military use, care must be taken to select lines that are least vulnerable to traffic interruption. Potential bottlenecks which are vulnerable to enemy action or natural forces are—

a. Tunnels.

b. Long, high bridges or bridges over deep streams or valleys.

c. Deep cuts and high fills.

d. Limited access terminals or yards.

e. Track located immediately adjacent to banks of streams and dry washes subject to the erosive action of flood waters.

f. Restrictive clearance points.

g. Tracks running through cuts where land and rock slides are common.

36. Facilities

a. Loading and Unloading.

(1) For the loading and unloading of supplies and equipment, railways must have certain facilities, such as spur, house, team, and yard tracks; platforms; end and sided loading ramps; cranes, hoists; and pumping facilities for loading and unloading liquids.

(2) Personnel, light vehicles, and light artillery may be loaded at most railway stations. Other items, such as heavy trucks or equipment, may require special loading and unloading facilities.

(3) Points selected for loading and unloading should have easy access to adjacent highways and roads.

b. Entraining or Detraining Points. The terms entraining point and detraining point are used to designate the locations at which troops are to be loaded or unloaded. If required, sidings which normally are used for the passage of trains, main lines, or any other available facilities may be used to entrain or detrain personnel.

37. Use of Existing Facilities

a. Existing trackage and facilities are used to the fullest extent. Construction of new main track in the theater will be avoided whenever possible. However, if required, new facilities will be provided and existing facilities expanded to meet requirements. These facilities may include, but are not restricted to, yards, sidetracks, fuel and water stations, signal systems (including telephone, telegraph, and radio means), and enginehouses.

b. As advances are made, captured enemy rail lines will be rehabilitated as required. Availability for immediate service rather than permanency will be the controlling factor in the type and character of rehabilitation.

c. The following general policies govern the construction or rehabilitation of facilities in the theater:

(1) *Yards and sidings.* Care must be taken in the location and plan of track layouts to include facilities required by current operations. In the construction or rehabilitation of these facilities, necessity governs. The general track surface will normally be good enough to meet minimum requirements for safe operations.

(2) *Water and fuel stations.* Water and fuel stations will consist of any suitable facilities which are available or which can be adapted or improvised.

CHAPTER 5

RELATIONSHIP WITH OTHER AGENCIES

38. General

a. Tact and cooperation are essential in all dealings between units and personnel of the transportation railway service and using agencies or military commands. In the field, the railway groups and battalions are more closely associated with the actual users of transportation than is the transportation command. Because of this close association, the railway units are able, through advice and assistance in solving transportation problems, to make the using units more knowledgeable of transport matters, thus affording a greater utilization of the rail transport capability.

b. Operation of trains is a function of the transportation railway service. Operational safety prohibits interference by other personnel.

39. Higher Headquarters

a. The placement of railway group headquarters and the railway battalions will logically come in natural sequence as the railway service is developed. However, the deployment of such units will be coordinated with the assistant chief of staff, movements, theater army support command, through the transportation command.

b. The commander of the highest echelon of the transportation railway service in the theater is the advisor of the transportation command commander on all matters pertaining to railway operations in the theater. He provides information on rail capabilities so that determination may be made as to the employment of these capabilities in the theater movement program. He informs the commander of any factors which may significantly affect the programed movement of supplies, and he provides railway information, plans, operating reports, and supply estimates as required.

40. Area Commands and Support Brigades

Transportation railway units are provided certain types of combat service support by units other than the transportation command and the supply and maintenance command. In the army area, this support is provided by the support brigade of the field army support command; in the communications zone, such support is provided by the area support groups of the area support command. Examples of this support include provision of clothing and rations, chemical and communications equipment, motor vehicle repair and supply, and personnel accounting.

41. Combat Forces

The principal contact that the transportation railway service has with the combat forces is with these forces in the role of users of rail transportation. However, combat forces may be employed to provide security for trains and rail lines when requirements exceed the capability of organic, attacher, and area support command units.

42. Other Services

The transportation railway service cooperates with and assists other services whenever possible. For instance, the railway groups and battalions often assist the services in locating dump and depot sites and they locate rail sidings for hospital units to load and unload casualties. Although equipped primarily to repair standard railway equipment, the railway battalion may coordinate with other organizations in making emergency repairs to other equipment. The battalions may also assist in handling heavy lifts with their locomotive cranes.

CHAPTER 6

TRANSPORTATION RAILWAY MAINTENANCE AND SUPPLY

43. General

a. Transportation railway maintenance in a theater encompasses the maintenance of rail lines and facilities and of locomotives and rolling stock. It ranges from rehabilitation of rail systems and major repairs on locomotives and rolling stock to those minor repairs accomplished in units during the performance of daily inspections and services.

b. Transportation railway supply may become relatively complex since it may entail the support of not only standard U. S. Army equipment, but also of foreign squipment used in support of military operations.

44. Maintenance of Way

a. New Construction, Rehabilitation, and Major Repairs.

(1) The engineer command is responsible for construction, rehabilitation, and major repairs of roadbed and structures for military railways, including stockpiling of construction material as planned for and requested by the transportation railway service.

(2) In accordance with the overall theater plan and with instructions received through normal command channels, the transportation railway battalion make the necessary reconnaissance and develops information for new construction and major maintenance projects. The battalion commander, the maintenance-of-way superintendent, and all railway personnel cooperate fully with the engineer command elements in all new construction and in any major maintenance projects on the military railroad. In some instances and under definite plans and arrangements, such work will be accomplished jointly by the engineer command and the transportation railway service.

b. Organizational and Direct Support Maintenance.

(1) After the railway is prepared and turned over to the transportation railway service for operation, organizational and direct support railway maintenance to the forward limit of traffic is the responsibility of the transportation railway service.

(2) The battalion commander has overall responsibility to insure that his division of the railway is properly maintained. The maintenance-of-way superintendent, who reports to the battalion commander, is directly responsible for the maintenance of track and structures, for the proper supervision of all maintenance work and procedures, and for the necessary inspection of track and structures on the division operated by the battalion.

c. Maintenance Standards. The railway division operated and maintained by a battalion may consist of a newly constructed line or one that has been rehabilitated by the engineer command and turned over to the battalion, or it may be a line which sustained little or no war damage. Military traffic will be planned and operated to permit reaching line capacity as promptly as possible; this necessitates maximum maintenance efforts. The command maintenance standards are specified by the engineer section of the headquarters and headquarters company of the senior railway unit. Major attention is required on tracks, bridges, and tunnels to prevent interruptions to train operations from maintenance failures.

d. Materials. Maintenance and emergency

repair materials will be stockpiled in adequate quantities at various strategic points along the rail line to be immediately available for emergencies.

45. Roadway, Track, and Structure Maintenance

a. Roadway Maintenance. Roadway maintenance is the work performed to keep that part of the right-of-way on which track is constructed in good condition. It includes excavations, embankments, slopes, shoulders, ditches, and diversions of roads and streams.

b. Track Maintenance. Track maintenance is the work performed to maintain the track in safe and operable condition. It includes inspections and repair to insure proper gage, surface, alinement, and dress of the track. Constant inspection is required to locate damage resulting from hostile action or the elements.

c. Structural Maintenance.

(1) In a theater, structures essential to railway operation must be maintained in accordance with the standard of maintenance prescribed. These structures include bridges, culverts, tunnels, and fueling and watering facilities. Minimum clearance to be observed at all structures are prescribed by the Berne clearance system and other similar guidance systems.

(2) Maintenance of structures involves maintenance of bridges including track fastenings; track alinement, gage, and surface; bridge ties, bolts, and guardrails; and bridge members such as floor stringers, beams, tie rods, and expansion bearings. Regular inspections are necessary to insure that bridges are kept in good condition at all times.

46. Maintenance of Motive Power and Rolling Stock

a. General. This paragraph discusses generally the maintenance responsibilities of the transportation railway service in the performance of organizational and direct support maintenance on locomotives, rolling stock, and special equipment and outlines briefly the maintenance responsibilities of the supply and maintenance command with respect to this equipment.

b. Maintenance of Motive Power. On motive power, maintenance by the railway service includes performance of organizational and direct support maintenance services and periodic inspections. These inspections are as listed in the current reports of inspections and repairs, to include those performed daily (or per trip), monthly, quarterly, and semiannually. Annual inspections are performed by units of the supply and maintenance command.

c. Maintenance of Rolling Stock. The types of maintenance services performed by railway follows:

(1) *Organizational Maintenance.* Organizational maintenance is performed by the operating units and by car inspectors at the train originating point and at inspection points en route to insure safe movement. It includes inspection of airbrakes, running gear, and other parts and examination and lubrication of journal boxes. On ambulance trains and cars, both before train departure and en route, ambulance train maintenance sections and crews are responsible for the following maintenance in addition to the above:

(*a*) Stocking of other than medical supplies, and such as fuel, water, ice, and electrical supplies.

(*b*) Placing cars on, and removing cars from, standby precooling or heating facilities at loading or unloading points

(*c*) Operating and controlling heating, air conditioning, and car lighting equipment.

(*d*) Replacing light bulbs and fuses.

(*e*) Checking batteries.

(*f*) Reporting all defects and failures.

(2) *Direct support maintenance.* Direct support maintenance is provided by the railway equipment maintenance company and the mobile workshop

and consists of maintenance required for the safe operation of freight equipment and the safe and comfortable operation of passenger and hospital cars. It may or may not require that rolling stock be taken out of service.

(*a*) Services which do not require removal of equipment from service and which are performed by car inspectors at the originating point of a train and at inspection points en route include the following: replacing brakeshoes; installing new airhose; adjusting brakes; applying journal brasses; repacking journal boxes; applying oil in journal boxes; and repairing draft gear, trucks, air conditioning, heating, or lighting equipment. Any of these services may be requested by the train conductor or train commander.

(*b*) Services which require the removal of equipment from service for short periods and which are performed by maintenance personnel at home terminals or at designated maintenance facilities include changing defective wheels, journals, side frames, couplers, draft gear, and airbrake parts and repairing trucks, piping, and car bodies. In addition, on passenger equipment and hospital cars, such service includes daily, weekly, monthly, semiannual, and annual inspections; cleaning equipment; changing filters, deodorizing and cleaning evaporators; lubrication; repair to air conditioning, heating, and lighting equipment; charging batteries; maintaining water systems and coolers; and repairing and replacing hardware.

(3) *General support maintenance.* General support maintenance is provided by the diesel-electric locomotive repair company and the car repair company of the supply and maintenance command. In addition to supporting the maintenance overflow from direct support, general support maintenance includes heavy maintenance involving stripping, assembling, erecting, and painting railway cars and assembling and inspecting knocked-down new equipment brought into the theater.

d. Maintenance of Special Equipment. The maintenance of special equipment includes those maintenance services and repairs performed on wreck train equipment, wreck cranes, and other cranes of the battalion; heavy roadway equipment; tools and enginehouse machinery; and other similar equipment.

e. Maintenance of Captured or Liberated Railway Equipment. Captured or liberated equipment taken over for operation may have sustained extensive damage or, because of operational pressure and a shortage of supplies, may be in poor state of repair. Transportation railway personnel will insure that all equipment taken over for operation is repaired and serviced before being placed in operation.

47. Railway Supply

Railway supplies are those supplies required for the operation and maintenance of railways. Direct support supply is normally the responsibility of the transportation railway battalion; general support supply is the responsibility of the car repair company of the supply and maintenance command.

CHAPTER 7

TRANSPORTATION RAILWAY COMMUNICATIONS

48. Communications Responsibilities

a. The U.S. Army Strategic Communications Command (Theater) is responsible for furnishing communications for railway operation. This responsibility includes the major construction of new wire circuits and the reconstruction and rehabilitation of former railway communications landlines. The U.S. Army Strategic Communications Command (Theater) normally provides landline communications (open-wire, cable, etc.) as the primary means of communication for train operations, in the theater of operations. Other means of communication may be employed to provide backup facilities or as a primary means when installation of landlines is not practicable.

b. The transportation railway service is responsible for—

(1) The operation and maintenance of railway communications circuits used exclusively for operation and administration of the transportation railway system, except for automatic data processing equipment.

(2) The installation, using TOE equipment, of organizational communications such as local switchboards, telephones, and teletypewriters in yards, way stations, shops, and dispatchers' offices for normal administrative and operational communications.

c. Installation, operation, and maintenance of organizational communications for administrative use are accomplished by the transportation railway battalion. The unit responsible for performing these functions for the battalion is the railway engineering company.

49. Wire Communications System for Train Operation

The railway battalion employs open-wire facilities as one of its primary means of communication to dispatch trains in the theater of operations.

a. Three communications circuits are provided for operations within each railway division: the dispatcher's circuit, the message circuit, and a teletypewriter circuit.

(1) The train dispatcher's circuit is used exclusively for train movements by train order and for control of trains through towermen and station agents within a division. It is a selective-ringing type voice circuit. The division dispatcher may call each way station independently or all stations simultaneously. The division dispatcher monitors the line at all times, using a loudspeaker or headset. Way station personnel may talk to the dispatcher on this circuit without signaling.

(2) The message circuit (station-to-station circuit) is used for block system operation within a division. It is also used for operational supervision and control, daily and special reports, car distribution, dissemination of movement orders to operating personnel, and operational matters between stations. This is a manual, local battery, code-ringing, party-line voice circuit. Way stations are connected to each other and to the division dispatcher. Any station may contact another station through code signaling.

(3) A teletypewriter circuit joins a division dispatcher with the adjacent division dispatcher. It is used for written transmission of train consists, operational orders, movement programs, general instructions, and miscellaneous message. This circuit may

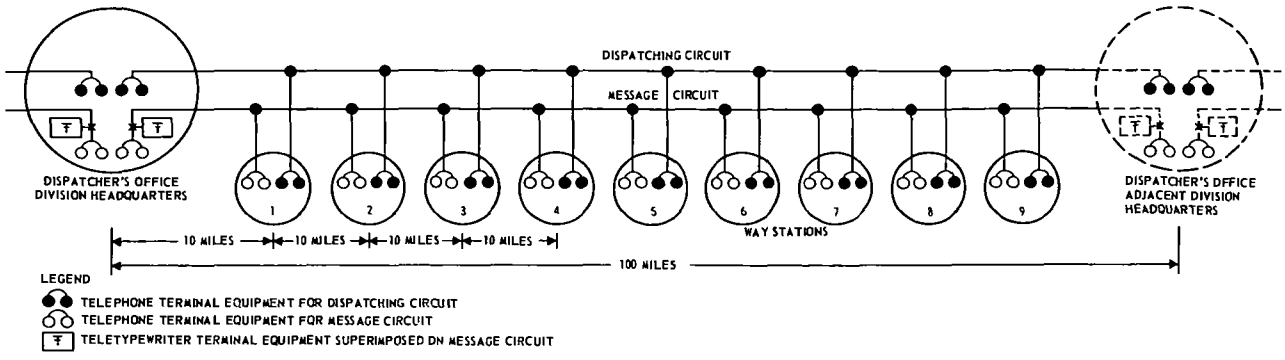


Figure 2. Military railway communications system.

be superimposed upon the message circuit.

b. The table of organization and equipment for the transportation railway engineering company (TOE 55–227) provides the terminal equipment for the communications system in support of the division dispatch office and the way stations of a railway division.

c. Figure 2 shows a type communication system for a railway battalion operating over a track distance of 100 miles.

d. Since every rail installation is different, communications systems must be planned on a project basis. This requires close coordination between the transportation and signal staff elements sufficiently far in advance to insure that the signal officer will have the necessary personnel and material on hand when required.

50. Signal Radio Communications System

Where land communications lines are inoperable, signal units, when authorized by the theater army commander, will provide radio relay or other supplementary communications as required. Teams from TOE 11–500 are provided and allocated to the railway battalion for the installation, operation, and maintenance of this system.

51. Organizational Radio Communications

The application of mobile and fixed radio communications to railway operations increases the efficiency, control, coordination, and safety of train movements. Radio equipment is organic to the railway operating units, and its use is a normal part of railway operations. Radio sets may be employed in yard, main track, and other operations. Whenever possible, locomotives containing radio equipment will be utilized on ambulance trains.

a. Yard Operation. Radio communication is used in yard operation for increased efficiency and for better coordination of yard activities. The use of radio communication in yard operation has the following advantages:

(1) Train crews can notify the yardmaster upon completion of assignments and receive new assignments immediately.

(2) Delays at the interlocking plant can be eliminated by knowledge of train location.

(3) Special movements, such as hospital trains, can be expedited.

(4) Delays caused by derailment or damage to cars or cargo can be reported immediately.

(5) Time of arrivals can be determined more accurately through communication with incoming trains.

(6) Changes in train movements or orders can be rapidly disseminated.

b. Main Track Operation. Organizational radio communication equipment mounted in road engines and in way stations extends communications from the way station to the moving train. This extension is not intended to take the place of any communications system for which signal units are responsible on a planned project basis. Main track radio communications afford contact between trains and way

stations and between stations. Application of the equipment has these advantages:

(1) In an emergency, the train engineer can call the way station operator. Also, if the train has to stop, other trains within range of radio frequency can be advised to take necessary precautions.

(2) Speed of trains can be regulated to insure proper meetings at passing points.

(3) Derailments can be reported immediately, and repair crews can be dispatched quickly.

(4) Crossing accidents can be reported and military police and medical assistance can be expedited.

(5) Train crews can request fuel or other supplies before arrival, thus reducing time at stops.

(6) The train engineer can be informed of the condition of the tracks as a result of snow and rock slides, flash floods, and bridge washouts.

(7) Guerrilla operations, sabotage attempts, and air attacks can be reported promptly by train crews.

c. Organizational Radio Equipment. Requirements for radio communication equipment authorized by TOE are based on the fact that an average railway division is approximately 90–150 miles (145–242 kilometers) long, that it consists of approximately two large terminals or yards, and that it contains nine way stations spaced approximately 10–15 miles (16–24 kilometers) apart. In actual operations, the requirements for radio sets may vary, depending upon the tactical situation, the terrain, the facilities available, and the local circumstances. The types of organizational radio equipment available are as follows:

(1) *Radio sets AN/VRC–53.* These are installed on road and yard locomotives. In order to maintain control and accountability and since the locomotives on which the radio sets are mounted are assigned to the group, these sets are assigned to the headquarters and headquarters company, transportation railway group. The sets are for mounting on diesel-electric road locomotives. They enable the train engineer and the way station operators to communicate with each other. Further, communication is possible between the yardmaster and the engineer of a train approaching a yard. These sets are also mounted in switch engines to permit communication between the switch engine crew and the yardmaster to coordinate the activities of the yard operations. Since the AN/VRC–53 radio operates on 24-volt direct current, an adapting device may be required when the set is installed and operated in road or yard locomotives.

(2) *Radio sets AN/VRC–46.* These are employed in the way stations where generators are used to provide the power. Since open-wire communication terminates at the way station, radio equipment must be provided as a means to communicate with a moving train which may be between two stations. With radio-equipped engines and radio sets in way stations, this means is provided. This system extends communications to the train crew and provides the train engineer with a means of contact at all times with the dispatcher through the way station and the normal dispatcher's circuit. One set is provided for the dispatcher to communicate with trains within the frequency range of his radio set, and one is provided for use by the yardmaster to supervise the movement of switch engines in the yard.

CHAPTER 8

TRANSPORTATION RAILWAY SECURITY

52. General

a. In the theater, the security of military and Government-sponsored supplies and equipment is of extreme importance and necessitates the use of military personnel in addition to that security provided by a host government. Security elements of the transportation railway service maintain liaison and coordination with security units having area responsibility to insure an integrated security effort.

b. Military action causes much destruction and confusion in cities and ports and along lines of communication. Existing railways are especially vulnerable to this type of action. Further, military operations require logistical support which often exceeds the normal capacity of the existing ports, lines of communications, and supply support. These demands necessitate the use of temporary and improvised facilities, thus increasing the problems of safeguarding cargo, equipment, and installations against vandalism, pilferage, and black-market activities.

c. Guerrilla activities, sabotage, and hostile air action further add to the loss of cargo and railway equipment and to the degree of vigilance required. In aggravated situations, guerrilla activities may cause significant interruptions and may require extensive security measures in order to continue operations.

53. Responsibility for Security

a. General. Security is a function of all levels of command. The protection or safeguarding of Government property is the responsibility of every officer and enlisted man in the military establishment. Combat and communications zone commanders are responsible for the security of their areas, including defense against enemy air or ground attack and against sabotage of lines of communication, installations, and Government property.

b. Military Police Units.

(1) Military police battalions, railway guard, are attached to the transportation command on the basis of one battalion for each transportation railway operating group. Military police companies are assigned to the military police battalion on the basis of one company for each transportation railway battalion.

(2) Additional security support may be made available to the railway service by the area support command.

(3) Military police officers are provided on the staff of the senior railway service unit to advise and recommend on military police and physical security matters.

54. Security of Supplies Moving by Rail

a. The transportation railway service's security responsibility for supplies, mail, and other cargo moving by rail begins when the loaded cars are accepted from the shipper and ends when these cars are delivered to the ultimate rail consignee.

b. An essential element in providing adequate security for railway shipments is a competent system of documentation and records; in addition, proper loading and sealing of cars and prompt loading and unloading aid materially in reducing pilferage.

c. Military police units attached to the transportation railway service provide train guards for cars and trains en route and for cars and trains in the process of movement in rail yards. When bad order cars (cars requiring repair) are set out, a member of the guard crew remains with the cars until properly relieved. Guard crews check car seals and documentation and must be particularly alert for damaged or inferior cars that are subject to pilferage.

Train guard reports indicate deficiencies or action taken and are used as a basis for coordinated action by the military police and the transportation railway service.

d. FM 101–40 establishes the requirement for a technical safety escort of hazardous chemical and biological shipments. This function is performed by a munitions safety control detachment whose duties include escorting and guarding shipments in transit, protecting personnel handling the shipment, disposing of damaged munitions, and decontaminating objects and areas accidentally contaminated during shipment. Close coordination between the safety control detachment and transportation railway service personnel is maintained at all times.

55. Security of Railway Installations

Security of static installations, such as buildings, tunnels, bridges, yards, and shops, against enemy air or ground attack and sabotage must be provided for in local security and damage control plans.

56. Security of Trains Against Enemy Ground or Air Attack

a. Ground Attack or Guerrilla Warfare. It may be necessary to operate and maintain rail lines in areas subject to guerrilla activity or in areas where pockets of resistance have been bypassed during rapid advances. In such situations, any of the following actions may be necessary:

(1) Armored trains may be used to patrol track in open country. Since the mission of these trains differs from that of regular trains, a dual responsibility for their operation exists: the trains operate under orders of the appropriate military commander in coordination with the transportation railway service. The commander responsible for furnishing security provides the security personnel to man weapons and provides a striking or retaliatory force. The transportation railway service is responsible for the technical operation of the trains and provides specially selected crews to insure instant response in a tactical situation. The activities of armored trains must be coordinated with other train movements, and their movement in response to a tactical need must be facilitated.

(2) Various methods may be used to prepare cars for railway defense; among these are piling sandbags on floors and against the sides and mounting machineguns, mortars, rockets launchers, and other weapons in the cars.

(3) The use of fixed- or rotary-wing aircraft for aerial reconnaissance and patrols along a rail line provides additional security measures. These aircraft may also be employed to provide close fire support for armored trains.

(4) On a single-track rail division subject to ground attack, the positive block method of operation should be employed. In this method of operation, a following train is not permitted to enter a block until the preceding train has cleared that block. This permits the train in the block, if attacked, to back up if necessary.

(5) The primary mission of train personnel and combat or security troops is to get the train through to destination. As long as this mission is being accomplished and the train continues to move, control of the train remains with the train crew. However, if a firefight develops and the train is unable to disengage by forward or backward movement, the senior member present takes command and undertakes defense of the train with all personnel available.

b. Enemy Air Attack.

(1) Defense against hostile air action is conducted by security force units supporting the train. Antiaircraft weapons are provided on cars spaced throughout the train as required.

(2) Trains that are attacked by enemy aircraft should continue to move, if possible; however, when visibility is poor and the physical characteristics

of the rail lines are favorable, it may be possible to conceal the train in tunnels, deep cuts, or heavily wooded areas.

(3) Measures taken by train operating personnel for protection against chemical agents delivered by enemy aircraft (spray munitions) include wearing protective clothing and masks; employing chemical agent detector kits to check locomotives, rolling stock, and cargo transported in open cars for contamination; and performing decontamination within their capability.

57. Employment of Nonair Defense Weapons Against Aircraft

a. General. Commanders at all levels must recognize that not only do the trains, equipment and railroad facilities of the transportation railway service offer favorable targets for hostile aircraft, but also that there exist the threat of airmobile operations, enemy close air support, interdiction, and reconnaissance against any unit in a theater of operations. They must further recognize the potential effect of the large volume of small arms fire that can be furnished by organic weapons against low-flying aircraft and the fact that the low altitude air threat faced by units in the combat theater may be partially countered by aggressive use of this large volume of fire which nonair defense weapons can deliver.

(1) Exercise of the individual and collective right of self-defense against hostile aircraft, which include all attacking aircraft and those positively identified enemy aircraft which pose a threat to the unit, will be emphasized. Exercise of this right does not demand specialized use of communications and is independent of theater air defense rules for engagement and air defense control procedures.

(2) Indiscriminate use of nonair defense weapons must be prevented because of the danger to friendly aircraft and troops and of the requirement to place in proper perspective the technique of withholding fire to preclude disclosure of position.

(3) Situations may arise where the exercise of the right of self-defense should be temporarily suppressed, or where the freer use of nonair defense weapons against aircraft should be encouraged. The former case involves a local decision that prevention of position disclosure is paramount; notice of such restriction is disseminated through command channels. The latter case should be based on a theater-level decision.

(4) Use of a single rule for engagement, "Engage hostile aircraft," is based on the knowledge that commonsense interpretations of the rule will be correct. For example, any aircraft attacking a unit or any enemy aircraft performing operations such as forward air control, reconnaissance, surveillance, or dropping or landing troops are clearly hostile aircraft.

b. Rule for Engagement. In the absence of orders to the contrary, individual weapons operators will engage attacking aircraft; engagement of all other hostile aircraft will be on orders issued through the unit chain of command and will be supervised by unit leaders. Nothing in this rule is to be interpreted as requiring actions prejudicial to accomplishment of the primary mission of the unit.

c. Aircraft Categories. To simplify engagement procedures, aircraft are divided into two categories.

(1) *Low-speed aircraft.* This category includes helicopters and liaison, reconnaissance, and observation fixed-wing propellor aircraft.

(2) *High-speed aircraft.* This category includes all other propellor aircraft and all jet fixed-wing aircraft.

d. Techniques of Fire. The following techniques will maximize the destructive and/or deterrent effect against aircraft:

(1) *Engagement of low-speed aircraft.* In accordance with the rule for engagement, low-speed aircraft will be en-

gaged with aimed fire, employing maximum weapon rate of fire. Aerial gunnery techniques (less lead) generally applicable to all small arms and automatic weapons are contained in FM 23–65.

(2) *Engagement of high-speed aircraft.* In accordance with the rule of engagement, low-speed aircraft will be engaged with maximum fire aimed well in front of the aircraft and above its flight path to force it to fly through a pattern of fire. This technique is not unaimed barrage fire but requires a degree of aimed fire. It does not, however, call for careful estimation of aircraft speed and required lead.

(3) *Use of tracer ammunition.* Automatic weapons should utilize the highest practical proportion of tracer ammunition to enhance the deterrent or disruptive effect of fire.

(4) *Massed fire.* Units should employ a massed fire technique when using small arms and automatic weapons in and air defense role.

e. Standing Operating Procedures (SOP). Command and supervisory headquarters will prepare detailed SOP for the identification of aircraft and engagement of aircraft, to include how identification is accomplished, weapons to be employed, techniques of fire to be used, rule for engagement, and controls to be exercised. Company-level SOP will include but is not limited to—

(1) *Applicability.* Operators of designated weapons.

(2) *Relation to primary mission.* Primary mission is never prejuced.

(3) *Relation to passive air defense.* The necessity for aggressively engaging hostile aircraft is balanced with the requirement to place in proper perspective the tactic of withholding fire to preclude disclosure of position.

(4) *Authority to engage.* Authority to engage attacking aircraft is delegated to individual weapons operators, all other hostile aircraft are engaged on orders through unit chain of command, subject to rule for engagement and rules for withholding fire.

(5) *Rule for engagement.* Normally, self-defense only against all attacking aircraft and those positively identified aircraft which pose a threat to the unit.

(6) *Rules for withholding fire.* When ordered, when not positive that aircraft are actually attacking or otherwise hostile, when friendly aircraft or troops are endangered.

(7) *Position selection* (FM 44–1). Applicable only to weapons specifically assigned an air-defense role; for example, designated single-barrel, caliber–50 machineguns.

(8) *Firing techniques.* Lead and superelevation; massed fire; maximum rate of fire; maximum use of tracer ammunition.

(9) *Unit training requirements.* Motivation and discipline, gunnery; aircraft recognition.

f. Individual Training. Individual training will stress aircraft recognition, techniques of firing at aerial targets, and response to control methods.

58. Demolition Plans

a. The extent of demolition of rail equipment and facilities is based on the commander's estimate of the situation and is of two types:

(1) Total destruction of locomotives, rolling stock, track, structures, and facilities is undertaken when the situation is such that the facilities and equipment will be of no further use and the territory being lost is not expected to be recovered for an extended period of time.

(2) When it is anticipated that the lost territory will be regained in a relatively short time, immobilization of equipment and facilities by removing and saving essential and similar parts of locomotives and rolling stock and partially demolishing selected bridges or tunnels will temporarily deny the use of tracks, equipment, and facil-

ities to the enemy. The fact that the enemy may completely destroy the equipment and facilities upon his retreat is a calculated risk which must be accepted.

b. Units of the transportation railway service will maintain current demolition plans for each type of demolition to indicate the following:

(1) Company and unit teams responsible for implementing demolition plans.
(2) Quantities of demolition materials required and locations at which stored.
(3) Plan to implement demolition.
(4) Demolition procedures (STANAG 2113).

c. Demolition and alert plans will be consolidated by the railway group or railway brigade and coordinated with the transportation command or the commander designated to order implementation of the demolition plans.

d. Destruction of ambulance trains or cars is governed by the law of land warfare as given in FM 27–10, which contains the provisions of the Geneva Convention of 12 August 1949.

CHAPTER 9
PLANNING

Section I. GENERAL

59. Planning Considerations

The overall staff and planning functions of the transportation railway service are the responsibility of the commander of the highest echelon of the transportation railway service unit in a theater. Planning is necessary to determine the adequacy and effective use of rail transportation facilities in any given area. For effective and efficient planning essential information should be available concerning the basic characteristics of the line to be operated and the nature of the country in which an operation is planned. By combining this information with basic assumptions, estimates can be made of railway capacity and of requirements for personnel, supplies, and equipment needed to operate the line.

60. Conditions Affecting Planning

a. The transportation railway service initially operates and uses the existing rail lines, equipment, and facilities available in a theater. Only that equipment and construction material necessary to support military operations is brought into the theater to supplement existing facilities.

b. Operating conditions affecting military railways may vary widely. The problems presented by one short single-track railway will be quite different from those presented by a network of railway tracks. Therefore, instructions and information contained in this text are stated in general terms and should be so construed.

Section II. RAILWAY LINE CAPACITY DETERMINATION

61. General

a. Since the direction of military supply movements is primarily forward, military rail line capacity estimates are generally based on net tonnage moved in one direction. However, total capacity of a rail line is based on train density and must take into consideration movements of trains in both directions. When the railway net under consideration is composed of several divisions and branch lines, separate estimates should be made for each rail division and branch line.

b. In estimating railway line capacity in terms of payload hauled, limiting factors are the power of the locomotive and the resistances offered by the grade, the curve, the locomotive, the cars, the lading, and the weather.

c. The formulas and factors presented in paragraphs 62 through 73 are listed in the order in which they should be considered. Appendix B is an illustrative example giving step-by-step procedures for determining rail line capacity. Tables 1 through 9, appendix C, contain many of the factors to be considered.

62. Weight on Drivers

Weight on drivers is expressed in short tons and is that weight which is supported by the coupled driving wheels of a locomotive when they rest on straight and level track. It does not include any of the remaining portion of the locomotive's weight. The weight on drivers of some locomotives used by the Department of the Army will be found in table 1; for those not listed in this table, specifications issued by the purchaser, the using railroad, or the manufacturer must be consulted.

63. Tractive Effort

Tractive effort is the horizontal force, expressed in pounds, that a locomotive can exert on straight and level track, provided the wheels do not slip. A locomotive's tractive effort is included in the data supplied by the manufacturer. The tractive effort of some locomotives

used by the Department of the Army is contained in table 1. Where such data are not available, tractive effort may be determined as indicated in *a* and *b* below.

a. Starting Tractive Effort (TE).

(1) Starting tractive effort is the effort required to start a locomotive and the load that it is hauling from a dead stop. It is closely correlated to the adhesion which the drive wheels maintain at the rails. If the tractive effort expended exceeds this adhesion factor, the driving wheels will slip. Normally, the adhesion factor when the rails are dry is 30 percent of the weight on drivers; when the rails are wet, this factor is reduced to 20 percent. For planning purposes, 25 percent is used.

(2) For a steam locomotive a close approximation of the starting tractive effort may be computed using the simple formula:

TE= Weight on drivers (lbs) $\times$ 0.25 (25% adhesion factor)

(3) For a diesel-electric locomotive tractive effort cures are furnished by locomotive manufacturers (table 1, app C). If such curves are not available, starting TE can be approximated by use of the same formula.

Example: For a locomotive weighing 80 tons;

$$TE = 160{,}000 \times .25$$
$$= \frac{160{,}000}{4}$$
$$= 40{,}000 \text{ lbs}$$

b. Continuous Tractive Effort (TE_c). Continuous tractive effort is the effort required to keep a train rolling after it has been started. As the momentum of a train increases, the tractive effort necessary to keep the train moving diminishes rapidly. Since a diesel-electric locomotive cannot continue to exert the same force while pulling a load as was attained in starting that load, the continuous tractive effort of a diesel-electric locomotive is rated as approximately 50 percent of its starting tractive effort. For a diesel-electric locomotive weighing 80 tons, or 160,000 pounds on the driving wheels, the continuous tractive effort is computed as:

$$TE_c = \frac{TE}{2}$$
$$= \frac{40{,}000 \text{ lbs}}{2}$$
$$= 20{,}000 \text{ lbs}$$

64. Drawbar Pull (DBP)

a. Drawbar pull is the actual pulling power of a locomotive, less the effort necessary to move the locomotive. Various actual tests have indicated that 16 to 20 pounds of pull per ton are required to start the average locomotive or freight car on straight, level track under favorable weather and temperature conditions; for railway planning, 20 pounds per ton is used. Resistance drops after equipment starts rolling, but to establish pulling power (drawbar pull) available for starting and pulling a train, 20 pounds per ton of locomotive weight is subtracted from the continuous tractive effort of the locomotive. For a diesel-electric locomotive weighing 80 tons and have a continuous tractive effort of 20,000 pounds, the drawbar pull is computed as:

$DBP = TE_c$ – (total weight of engine in STONs x 20 lbs per STON)
$= 20{,}000 - (80 \times 20)$
$= 20{,}000 - 1{,}600$
$= 18{,}400$ lbs

b. Maximum drawbar pull can be exerted only at lowest speeds—up to about 10 miles per hour; at higher speeds diesel-electric locomotive drawbar pull diminishes rapidly.

65. Rolling Resistance (RR)

The force components acting on a train in a direction parallel with the track which tend to hold or retard the train's movement constitute rolling resistance. The components of rolling resistance are friction between the rail heads and the treads and flanges on the wheels, resistance due to undulation of track under a moving train, internal friction of rolling stock, and resistance in still air. There is no absolute figure to be used as rolling resistance but experience indicates that safe average values to use in the theater of operations for rolling resistance are as shown in table 2.

66. Grade Resistance (GR)

Grade resistance is the resistance offered by

a grade to the progress of a train. It is caused by the action of gravity, which tends to pull the train downhill. For military railway planning, the factor of 20 pounds per ton of train per percent of grade is used.

67. Curve Resistance (CR)

Curve resistance is the resistance offered by a curve to the progress of a train. No entirely satisfactory theoretical discussion of curve resistance has been published; however, engineers in the United States usually allow from 0.8 to 1 pound per ton of train per degree of curve. In military railway planning, the factor of 0.8 pound per ton of train per degree of curve is used.

68. Weather Factor (W)

a. The weather factor reflects, by percentage, the effect of adverse cold and wet weather on the actual hauling power of a locomotive. Experience and tests have proved that whenever the outside temperature drops below 32° F., the hauling power of a locomotive is decreased. Table 3 indicates the weather factor (percent) for varying degrees of temperature.

b. Ordinarily, wet weather is regarded as local and temporary and is considered absorbed by average figures. However, in countries having extended wet seasons (monsoons, fogs, etc.), the loss of tractive effort due to slippery rail may prove serious if sanding facilities are lacking or inadequate. The applicable reduction is a matter of judgment, but in general, tractive effort will not be reduced to less than 20 percent of the weight on drivers.

69. Gross Trailing Load (GTL)

a. Gross trailing load is the maximum weight or load in short tons that a diesel locomotive may safely pull behind it under given conditions of curvature and grade or a level track. It is determined by combining the factors discussed in paragraphs 64 through 68. The formula for gross trailing load is as follows:

$$GTL = \frac{DPB \times W}{RR + GR + CR}$$

where

GTL =gross trailing load
DBP =drawbar pull
W =weather resistance
RR =rolling resistance
GR =grade resistance
CR =curve resistance

b. When multiple unit diesel locomotives or pushers are used, the gross trailing load is equal to the sum of the gross trailing load for all locomotives used.

c. For foreign or captured locomotives for which little or no information is available, the gross trailing load is obtained by actual test as quickly as track and cars become available.

70. Net Trainload (NTL)

Net trainload is the payload carried by the train. The total weight of the cars under load is gross weight; the lightweight, or weight of the cars empty, is tare. The difference between these two is the net trainload (payload) of the train. For military railway planning purposes, the net trainload is 50 percent of the gross trailing load.

$$NTL = GTL \times .50$$

71. Train Density (TD)

a. General.

(1) The term train density is used to denote the number of trains that may be operated safely over a division in each direction during a 24-hour period. (Work trains are not included in computing train density, However, their presence on divisions and the amount of time they block the main track can reduce the density of a rail division. Train density may vary greatly over various divisions owing to the condition and length of the main line; number and locations of passing tracks; yard and terminal facilities; train movement control facilities and procedures; and availability of traincrews, motive power, and rolling stock.

(2) On single track lines, passing tracks are generally 6 to 8 miles apart. Multiple tracks (three or more) are generally considered as double track since it is often necessary to remove a portion or all of the third and fourth tracks to maintain a double track line.

(3) The capacity or operating turnover of cars and trains into and out of terminal yards must be considered, either from definite experience and intelligence factors or by interference from related information.

(4) The rule-of-thumb and the formula given in *b* and *c* below are primarily designed to determine freight train density; however, they will be reasonably accurate on lines having 20 percent passenger trains included.

b. Rule-of-Thumb for Determining Train Density. In the absence of sufficient intelligence upon which to evaluate the potential train density of a rail line, a train density of 10 for single track and 30 for double track is used for planning.

c. Formula for Determining Single Track Train Density. When sufficient intelligence is available, the following formula and factors may be used in determining train density for a specified railway division. In determining the number of passing tracks, those less than 5 miles apart should not be included. Passing tracks selected generally should be uniformly spaced throughout the division.

$$TD = \frac{NT + 1}{2} \times \frac{24 \times S}{LD}$$

where

$TD =$ train density
$NT =$ number of passing tracks
$1 =$ constant (number of trains that could be run if there were no passing tracks)
$2 =$ constant to convert to one direction
$24 =$ constant (number of hours per day)
$S =$ average speed (table 4)
$LD =$ length of division

When the computation for train density results in a fraction, the result is raised to the next higher whole number.

72. Net Division Tonnage (NDT)

Net division tonnage is the tonnage in short tons, or payload, which can be moved over a railway division each day. It includes railway operating supplies, which must be programed for movement the same as any other supplies. Net division tonnage is determined by multiplying the net trainload by the train density of the particular division.

$$NDT = NTL \times TD$$

Net division tonnage is computed separately for each division.

73. End Delivery Tonnage (EDT)

In military operations, the end delivery tonnage is the through tonnage, in short tons, of payload which may be delivered at the end of the railway line (railhead) each day. In an all-rail movement, the end delivery tonnage is the same as the net division tonnage of the most restrictive division.

$EDT = NDT$ of most restrictive division

Section III. RAILWAY YARD CAPACITY DETERMINATION

74. General

a. Railway yards, like other component elements of a railway, are designed to meet the requirements of normal operations of the area they serve. However, they may be required within reasonable limits, to handle a traffic load varying from average peacetime traffic to peak wartime traffic requirements, but efficiency of operation may decrease when the traffic exceeds the efficient operational capacity of the yards.

b. Railway yard operational capacity has a definite relation to the number of trains that can be forwarded to or received from the main lines. Thus, although the potential train density of a main line may be 30 trains per day, the actual or operating train density may be less because of limitations of the yards.

c. Railway terminals may include the following:

(1) Receiving yards.
(2) Classification yards.
(3) Forwarding yards.
(4) Other yards such as holding yards, repair yards, interchange yards, and storage yards.

d. In railway operations, during peak traffic

requirements, the classification yard is most likely to become the bottleneck since there are many variables which will affect the number of cars per hour that may be switched.

e. See paragraph 25 for additional information on types of yards.

75. Planning Factors for Classification Yards

The factors listed below are based on day and night operation and may be used for planning purposes. Where two or more main line railways intersect at a major terminal, the facilities will have to be duplicated accordingly.

a. Flatyard switching capacity is 30 car per locomotive per hour. This includes time for switch engines to push cars into the yard (based on foreign equipment).

b. Hump yard switching capacity is 45 cars per locomotive per hour.

c. The number of cars in a classification yard at any given time should not exceed 60 percent of the yard's capacity. When it exceeds this figure, switching room lessens and operating efficiency is sacrificed.

d. A typical breakdown of classifications tracks required for loaded cars could be as follows: Ordnance V, two; Quartermaster I, II, and IV, two; Quartermaster III, two; Engineer, two; Chemical, one; Signal, Medical, and Transportation, one; Air Force, two; empties, two. In heavy traffic areas, an additional track factor of 25 percent may be added for rotation.

e. Length of track in a classification yard is generally one train length, plus 20 percent, plus 300 feet. The length of tracks and/or trains will vary with local terrain characteristics, railway equipment, and requirements.

f. The number of switch engines per shift that may be employed in the operation of the loaded freight classification yard may vary from 1 to 3, depending on the yard layout. Thus, 1 switch engine may handle 30 to 60 cars per hour and 3 switch engines may handle 90 to 180 cars per hour.

(1) The breakdown of functions would be as follows:

(*a*) One switch engine at the head end of the receiving yard preparing cut of cars for switching.

(*b*) One switch engine with cut of cars switching cars into the classification yard.

(*c*) One switch engine at the opposite end of the classification yard coupling cars and making switching room.

(2) During slack traffic periods, one switch engine may be used for all the above functions.

(3) It must be understood that the switch engine requirements being discussed are for use in the classification yard proper and do not include those engaged in supporting other terminal operations.

g. The average time a car remains in the classification yard is 8 hours.

h. Classification yard traffic turns over an average of three times per day. (Some cars may be held 48 hours, while others may clear in less than 8 hours.)

i. Cars should be classified by commodity—that is, POL trains, refrigerator trains, ammunition trains, or ration trains—for one destination where possible. Where solid classified trains are not operationally feasible, the number of blocks per train should average three classes of commodities and/or destinations. When trains are built up for two or more destinations, the blocks must be in proper setoff order to prevent delay if blocks are to be set off en route.

76. Planning Formulas for Classification Yards

The following formulas may be used to determine classification yard requirements and capabilities:

a. Required Length of Yard Tracks. The length of yard tracks is determined by the following computation:

$$LT = ACT \times LC \times 1.2 + 300 \text{ ft}$$

where

LT = length of track
ACT = average cars per train
LC = length of car (average)
1.2 = operational factor. (To allow for overall length of car coupler rather than car length.)

300 ft = clearance distance at each end of track from point of switch to clearance

b. Minimum Number of Tracks Required. The following computation is used to determine minimum tracks required.

$$NTR = \frac{TDs}{3} \times 1.6$$

where

NTR = number of tracks required
TDs = sum of train densities of using divisions
3 = turnover per day
1.6 = 60 percent factor of static capacity

When computing a terminal yard, the result obtained in this formula must be doubled. The formula does not necessarily apply to railheads since classification of cars is not always necessary at railheads.

c. Static Yard Capacity. Static yard capacity is determined as follows:

$$SYC = ACT \times NT$$

where

SYC = Static yard capacity (in cars)
ACT = Average cars per train
NT = number of tracks of the length which has been determined in *a* above.

Daily yard capacity is equal to 1.6 times static yard capacity. This figure takes into account that the number of cars in a yard at any given time will not exceed 60 percent of the static capacity.

77. Planning Factors for Terminals With and Without Receiving and Forwarding Yards

a. With Receiving and Forwarding Yards. Where trains are operated into and out of terminals at 48-minute intervals, there should be a minimum of six tracks plus one runaround track in both the receiving and forwarding train yards to handle empty and loaded trains. In general, the number of tracks required equals the train density divided by 5, plus 1.

$$\frac{TD}{5} + 1$$

b. Without Receiving and Forwarding Yards. Normally the receiving and forwarding train yards will be in balance with classification and main line capacity. However, some railways dispense with receiving and forwarding yards and operate all trains directly into and out of classification yards. In such cases, the classification yard daily capacity will be reduced by approximately 25 percent.

c. Two-Way Tonnage Traffic in Terminals. In large terminals where tonnage traffic is two-way, the various yards are normally designed with yards for each direction; that is, northbound receiving, classification, and forwarding yards; and southbound receiving, classification, and forwarding yards.

Section IV. RAILWAY EQUIPMENT REQUIREMENTS

78. General

a. Availability of equipment in liberated or occupied territory will depend upon inventories, extent of destruction, condition of equipment, types of fuel and local availability, availability of spare parts, types of coupling devices, and many other such factors. Allowances for use of captured or locally available equipment should be based on judgment after evaluation of the many factors involved.

b. Technical data concerning railway equipment may be found in strategic surveys, special transportation studies based on intelligence reports, reports of governments or railways in peacetime, and sometimes in publications such as *Railway Gazette* (British) and *Railway Age* (American).

c. Equipment requirements to be considered in planning fall into three categories.

(1) Rolling stock consisting of boxcars, gondolas, flatcars, tankcars, and refrigerator cars.

(2) Road engines, the motive power used to pull trains between terminals or division points.

(3) Switch engines, the motive power used to switch cars within yards or at division terminals.

d. Appendix B (third and fourth computations) provides an illustrative example of step-by-step procedures for determining railway equipment requirements.

79. Rolling Stock

a. Freight.

(1) Requirements are computed separate- for operations between major supply installations or areas on each rail system as follows:

$$\text{Total cars required} = \frac{EDT \text{ (by type car)}}{\text{avg tons per type car}} \times \text{turn-around time} \times 1.1$$

(2) The first factor of this formula is ob-

$$\frac{EDT \text{ (by type car)}}{\text{avg tons per type car}}$$

tained from that part of the computation for 1 day's dispatch (1 DD) which determines the number of cars by type required to transport all or a given portion of the end delivery tonnage of a rail system. An illustration of the application of this factor to the above stated formula is contained in appendix B, (third computation).

(3) Turnaround time is the estimated number of days required for a car to make a complete circuit of the rail system. It is the days elapsed from the time the car is placed at the point or origin for loading until it is moved to its destination, unloaded, and re-returned to its point of origin. Such time may be computed as follows: 2 days at origin, 1 day at destination, and 2 days transit time for each division, or major portion thereof, which the cars must traverse (1-day forward movement, 1-day return movement). This method, rather than an actual-hour basis, is used to incorporate delays due to terminal and way station switching as well as in-transit rehandling of trains.

(4) The 1.1 factor is used to express a 10 percent reserve factor which provides for a cushion of extra cars to meet operational peaks, commitments for certain classes of cars, and bad order cars.

(5) Planning factors for net load per freight car are as follows:

Standard gage to broad gage:

U.S. equipment	20 tons
Foreign equipment	10 tons
Narrow gage:	
U.S. equipment	15 tons
Foreign equipment	7½ tons

(6) Tank car requirements are computed separately, based on bulk POL requirements, tank car capacities, and computed turnaround time.

b. Passenger. Passenger car requirements will vary depending upon troop movement policies, evaluation policies, and rest and recuperation policies. Theater passenger car requirements are normally fulfilled by acquisition of local equipment, with the exception of equipment required for hospital cars or trains.

c. Disposition of Rolling Stock. Table 6 shows the disposition of rolling stock for the operation of a railway system.

d. 1 Day's Dispatch (1 DD). The term 1 day's dispatch is the number of cars dispatched in a day from the base of operations. For planning purposes, the number of cars dispatched from a division terminal, railhead, or other dispatch point is considered the same as the number dispatched from the base of operations. The following formula is used to determine the rolling stock for 1 day's dispatch:

$$1\ DD = \frac{EDT \text{ (for type car)}}{\text{avg payload for type car}}$$

Computations are made for each type of car to be used (boxcars, gondolas, flatcars) and the sum of the results for all the types of cars computed is 1 day's dispatch (third computation, app B).

80. Road Engines

The number of road engines required for operation over a given railway division may be determined by the following formula (fourth computation, app B):

$$\text{Road engines required} = TD \times \frac{(RT + TT)^* \times 2 \times 1.2}{24}$$

where

TD = train density

*$\frac{RT + TT}{24}$ expresses the time during a 24-hour period in which a road engine is in service; it is called the "engine factor." This factor provides for motive power which may make more than one trip per day over a short division.

RT = running time (length of division divided by average speed)
TT = terminal time (time for servicing and turning locomotive) (table 7)
24 = number of hours per day
2 = constant for two-way traffic
1.2 = constant allowing 20-percent reserve.

81. Switch Engines

a. No two port, division, or terminal railheads are alike in design or operation; however, the functions of the main yards in each are essentially the same. Receiving cars from whatever sources and classifying and reassembling them for delivery or forward movement constitute the main functions of any yard. The type of motive power used for this portion of the railroad is the switch engine.

b. The number of switch engines required at a terminal is based on the number of cars dispatched and received at, or passing through, the terminal per day. When the number of cars has been computed, that figure is applied to the factors contained in table 8 to determine the number of switch engines required at each terminal.

c. When the total number of switch engines required for the railway line has been computed, add 20 percent as a reserve to allow for maintenance, operational peaks, etc. (fourth computation, app B).

Section V. RAILWAY PERSONNEL AND UNIT REQUIREMENTS

82. General

a. Basically, the requirements for transportation railway service units and personnel are based upon the following factors:

(1) *Number of divisions in the system.* This provides a guide to determine the number of battalions required for operation.

(2) *Number of train operating crews required to operate road and switch engines.* This provides a guide to determine the number of train operating companies required in the system.

(3) *Maintenance requirements for right-of-way, locomotives, and rolling stock.* This provides a guide to determine the number and type of maintenance units and personnel required.

b. On the basis of these factors, unit and organiaztion capabilities and normal employment procedures can be used to organize a command structure and to determine support requirements.

83. Road Crews

a. In computing the number of road crews required for each division, the time a road crew is on duty must be considered. This time includes—

(1) A 2-hour call period at the originating terminal for the crew to report for duty, receive orders and instructions, move the locomotive from the roundhouse to the outbound yard, couple to the train, test the air, and check the train consist.

(2) Running time involved, which is computed by dividing the length of the division by the average speed of the train. If data are not available to compute the speed, average speed in a theater may be assumed to be 8 miles per hour.

(3) A 1-hour period at the final terminal to place a train on the designated track, move the locomotive to the roundhouse, and submit necessary reports.

b. Normally, the sum of the call period, the running time, and the period at the final terminal should not exceed 12 hours in order to allow sufficient time for the crews to rest. This combined time can be exceeded for short periods in emergencies, although experience shows that safety and efficiency factors decrease when when crews have to work continuous daily shifts of longer than 12 hours. It is possible, however, to work shifts of 16 to 18 hours, provided the crews have a sufficient period of rest before reporting for another run. Sometimes, it will be necessary to designate longer hours because of the length of the division involved. In such cases, enough time off between runs

should be permitted to limit the average daily shift to 12 hours.

c. The following formula may be used in determining the number of road crews needed per division (fifth computation, app B):

$$\text{Number of road crews} = TD \times 2 \times \frac{RT + 2}{12} \times 1.25$$

where

TD = train density
2 = factor to concert to two-way traffic
RT = running time (length of division divided by average speed)
3 = time allowed for 2-hour call period plus 1-hour period at the final terminal
12 = 12-hour shift per road crew per day
1.25 = constant factor to allow for ineffectives

84. Switch Crews

To determine the number of switch crews required, the number of switch engines in use at each terminal must be known. Two crews are required per switch engine per day. The following formula may be used to determine the number of switch crews required for each terminal (do not compute crews for reserve switch engines) (fifth computation on app B):

$$\text{Number of switch crews} = SE \times 2 \times 1.25$$

where

SE = number of switch engines
2 = two crews per engine
1.25 = constant factor to allow for ineffectives

85. Railway Unit Requirements

Although guidelines are provided in unit capabilities, length of railway divisions and types of operations may vary; thus all factors of rail operations must be considered in establishing an organizational structure. Normally, the transportation railway service is organized as illustrated in figure 1, and units are attached in accordance with their capabilities and functions (para 8–18).

Section VI. RAILWAY SUPPLY REQUIREMENTS

86. General

Generally, railway supply tonnages are quite large. Experience has shown that approximately 5 to 10 percent of the tonnage hauled over the second and third divisions of a railway and 15 percent of the tonnage hauled over each succeeding division are railway operating supplies. Paragraphs 87 through 89 demonstrate the method of arriving at specific supply requirements; namely, fuel, lubricants, and spare parts.

87. Fuel Consumption of Diesel-Electric Locomotives

Table 9 contains an estimated average rate of diesel fuel oil consumption in gallons per train-mile for diesel-electric road locomotives and in gallons per hour of operation for switch engines. For planning purposes, the operation of switch engines is assumed to be 20 hours per day. The method of determining fuel oil requirements in gallons for road locomotives and switch engines is as follows:

a. Road Locomotives (Sixth Computation, app B).

(1) Multiply the train density of the first division by 2 (for two-way travel), then multiply the result by the length of the division; this result is the train miles per day for the division.
(2) Repeat this procedure for each division of the system.
(3) Total the daily train miles for all divisions.
(4) Multiply the total daily train miles by fuel consumption factor (table 9) to get the daily fuel requirement.
(5) Multiply the daily fuel requirement by 30 to obtain the monthly fuel requirement.
(6) Add 5 perecnt to this computed total to provide a reserve for contingencies.

b. Switch Engines (Sixth Computation, app B).

(1) Multiply the total number of switch

engines required (do not include reserve engines) by 20 to determine the total hours per train day of operation.

(2) Multiply the total hours per train day of operation by the fuel consumption factor of the engine concerned (table 9); this result is the daily fuel requirement in gallons.

(3) Multiply the daily fuel requirement by 30 to obtain the monthly fuel requirement.

(4) Add 5 percent to this computed total to provide a reserve for contingencies.

88. Lubricants (Sixth Computation, app B)

Lubricants must be used on all moving parts of railway tools, appliances, and machinery and on all motive power and rolling stock. However, for planning purposes only the lubricants necessary for the operation of motive power and rolling stock will be considered. Lubricating oil and grease requirements for motive power and rolling stock are based on an estimate of 1,000 pounds per month for each train moving in either direction over each division in one day. The following method is used to determine the amount of lubricants required;

a. Multiply the train density of the first division by 2 (for two-way travel), and multiply the result by 1,000 to find the amount in pounds of lubricants required per month for the division.

b. Repeat this procedure for each division of the system.

c. Total the pounds of lubricants for all divisions to determine the grand total in pounds required per month for the railroad.

89. Spare Parts (Sixth Computation, app B)

In a theater, supplies and spare parts will seldom be found in the number and of the kind necessary to maintain the motive power and the rolling stock used by the transportation railway service. For planning purposes, only the spare parts necessary for the maintenance of motive power and rolling stock are considered. An estimate of spare parts required is based on a factor of 1.5 short tons per month for each train moving in Sixth C direction over each division in one day. The following method is used to determine spare parts required:

a. Multiply the train density of the first division by 2 (for two-way travel), and multiply the result by 1.5 to get the total amount in short tons of spare parts required per month for the division.

b. Repeat this procedure for each successive division of the system.

c. Total the amounts to determine the grand total of short tons required per month for the entire railroad.

APPENDIX A

REFERENCES

1. Field Manuals

FM 5–34	Engineer Field Data.
FM 5–35	Engineers' Reference and Logistical Data.
FM 5–162 (Test)	Engineer Command, TASCOM.
FM 8–10	Medical Service, Theater of Operations.
FM 19–3–1 (Test)	Military Police Service, TASCOM.
FM 19–30	Physical Security.
FM 19–45–1 (Test)	Rear Area Protection.
FM 21–40	Chemical, Biological, and Nuclear Defense.
FM 21–41	Soldier's Handbook for Defense Against Chemical and Biological Operations and Nuclear Warfare.
FM 23–65	Browning Machineguns, Caliber .50, HB, M2.
FM 24–18	Field Radio Techniques.
FM 24–20	Field Wire and Field Cable Techniques.
FM 27–10	The Law of Land Warfare.
FM 30–5	Combat Intelligence.
FM 30–10	Terrain Intelligence.
FM 54–5–1 (Test)	Supply and Maintenance Command, TASCOM.
FM 54–6–1 (Test)	Area Support Command, TASCOM.
FM 54–8 (Test)	The Administrative Support, Theater Army.
FM 44–1	U.S. Army Air Defense Employment.
FM 55–4	Transportation Movements in Theaters of Operation.
FM 55–4–1 (Test)	Transportation Movements in a Theater of Operations.
FM 55–6	Transportation Services in Theaters of Operation.
FM 55–8	Transportation Intelligence.
FM 55–10	Transportation Movements Services, Field Army.
FM 55–15	Transportation Reference Data.
FM 55–21–1 (Test)	Transportation Service, TASTA–70.
FM 55–55–1 (Test)	Transportation Terminal Operations.
FM 100–5	Field Service Regulations—Operations.
FM 100–10	Field Service Regulations—Administration.
FM 101–5	Staff Officer's Field Manual—Staff Organization and Procedure.
FM 101–10–1	Staff Officer's Field Manual—Organizational, Technical, and Logistical Data; Unclassified Data.
FM 101–10–2	Staff Officer's Field Manual—Organizational, Technical, and Logistical Data; Extracts of Tables of Organization and Equipment.
FM 101–40	Armed Forces Doctrine for Chemical and Biological Weapons Employment and Defense.

2. Technical Manuals

TM 3–220	Chemical, Biological, and Radiological (CBR) Decontamination.
TM 5–370	Railroad Construction.
TM 5–627	Railway Track Maintenance; Repairs and Utilities

TM 5–700	Field Water Supply.
TM 11–5820–401-series	
TM 11–5820–498-series	
TM 38–750	Army Equipment Record Procedures.
TM 55–200	Railway Operating Rules.
TM 55–202	Operation and Maintenance of Diesel-Electric Locomotives.
TM 55–203	Maintenance of Railway Cars.
TM 55–206	Railway Train Operations.

3. Army Regulations

AR 55–26	Transportation Movements.
AR 55–355	Military Traffic Management Regulation.
AR 55–650	Military Railroads.
AR 310–3	Department of the Army Publications Preparation, Coordination, and Approval.
AR 320–5	Dictionary of United States Army Terms.
AR 320–50	Authorized Abbreviations and Brevity Codes.
AR 345–210	Records Management Files Systems and Standards.
AR 380–5	Safeguarding Defense Information.
AR 380–55	Safeguarding Defense Information in Movement of Persons and Things.
AR 725–50	Requisitioning, Receipt, and Issue System.
AR 735–35	Supply Procedures for TOE and TDA Units or Activities.
AR 746–5	Color and Marking of Army Materiel.
AR 750–1	Maintenance Concepts.

4. Department of the Army Pamphlets

DA Pam 55–1	Transportation Railway Service.
DA Pam 690–80	Administration of Foreign Labor During Hostilities.

5. Tables of Organization and Equipment

TOE 8–520	Ambulance Train (Rail).
TOE 11–500	Signal Service Organization.
TOE 55–200	General Headquarters, Transportation Railway Service.
TOE 55–201	Headquarters and Headquarters Company, Transportation Railway Brigade.
TOE 55–202	Headquarters and Headquarters Company, Transportation Railway Group.
TOE 55–217	Transportation Electric Power Transmission Company.
TOE 55–226	Headquarters and Headquarters Company, Transportation Railway Battalion.
TOE 55–227	Transportation Railway Engineering Company.
TOE 55–228	Transportation Railway Equipment Maintenance Company.
TOE 55–229	Transportation Railway Train Operating Company.
TOE 55–247	Transportation Railway Diesel-Electric Locomotive Repair Company.
TOE 55–248	Transportation Railway Car Repair Company.
TOE 55–500	Transportation Service Organization.

APPENDIX B

RAILWAY PLANNING—EXAMPLE

1. Situation

Plan for the operation of a rail system to move supplies in a theater of operation; target date for initiation of service, 1 December. All rail tonnages originating in the port will be routed to the railhead over the main line of the system illustrated in figure 3.

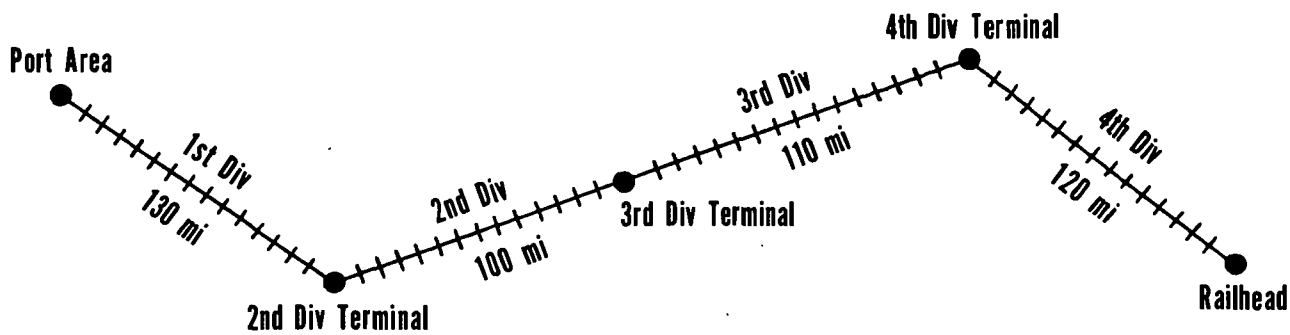


Figure 3. Hypothetical rail system for planning.

2. Planning Data

a. Track.

Number	Single track
Gage	Standard (56½ inches)
Condition	All divisions—good to fair
Ruling grade	All divisions—1.5%
Ruling curve	All divisions—5°
Weather	All divisions— Summer: +60° F to +95° F Winter: +35° F to −20° F Wet weather: Local and temporary
Passing tracks	1st division—15 2nd division—9 3rd division—11 4th division—14

b. Motive Power.

Road engines	U.S. Army 0-6-6-0, 120 tons, diesel-electric locomotive
Switch engines	U.S. Army 0-4-4-0, 60 tons, diesel-electric locomotive

c. Rolling Stock.

Boxcars	40-ton rated capacity
Gondolas	40-ton rated capacity
Flatcars	50-ton rated capacity

d. Operating Personnel. U.S. Army.

3. First Computation

Determine the train density (TD) for each of the four railway divisions (para 71c).

$$TD = \frac{NT + 1}{2} \times \frac{24 \times S}{LD}$$

S = 10 mph (table 4)

a. Step 1. 1st Div:

$$TD = \frac{15 + 1}{2} \times \frac{24 \times 10}{130}$$

$$= \frac{16 \times 240}{2 \times 130}$$

$$= \frac{3840}{260}$$

$$= 14+ \text{ or } 15 \text{ trains}$$

b. Step 2. 2nd Div:

$$TD = \frac{9 + 1}{2} \times \frac{24 \times 10}{100}$$

$$= \frac{10 \times 240}{2 \times 100}$$
$$= \frac{2400}{200}$$
$$= 12 \text{ trains}$$

c. Step 3. 3rd Div:

$$TD = \frac{11 + 1}{2} \times \frac{24 \times 10}{110}$$
$$= \frac{12 \times 240}{2 \times 110}$$
$$= \frac{2880}{220}$$
$$= 13 + \text{ or } 14 \text{ trains}$$

d. Step 4. 4th Div:

$$TD = \frac{14 + 1}{2} \times \frac{24 \times 10}{120}$$
$$= \frac{15 \times 240}{2 \times 120}$$
$$= \frac{3600}{240}$$
$$= 15 \text{ trains}$$

4. Second Computation

a. General. Determine the end delivery tonnage of this rail line, using single engine operation (winter season). To do this—

(1) EDT = NDT of most restrictive division (para 73)

(2) $NDT = NLT \times TD$ (para 72)

(3) $NLT = GTL \times .50$ (para 70)

(4) $GTL = \frac{DBP \times W}{RR \times GR \times CR}$ (para 69)

(5) $DBP = TE^c$ — (total weight of engine in STONs $\times$ 20 lbs per STON) (para 64)

(6) $TE_c = \frac{TE}{2}$ (para 63*b*)

(7) TE = weight on drivers (lbs) $\times$ 25% adhesion factor (para 63*a*)

b. Step 1. Compute the starting tractive effort.

$$TE = \frac{\text{weight on drivers (lbs)}}{4}$$
$$= \frac{240{,}000}{4}$$
$$= 60{,}000 \text{ lbs}$$

c. Step 2. Compute the continuous tractive effort.

$$TE^c = \frac{TE}{2}$$
$$= \frac{60{,}000}{2}$$
$$= 30{,}000 \text{ lbs}$$

d. Step 3. Compute the drawbar pull of the road engine.

$$DBP = TE^c - (\text{total weight of engine in STONs} \times 20 \text{ lbs per STON}$$
$$= 30{,}000 - (120 \times 20)$$
$$= 3{,}000 - 2{,}400$$
$$= 27{,}600 \text{ lbs}$$

e. Step 4. Compute the gross trailing load.

$$GTL = \frac{DBP \times W}{RR + GR + CR}$$

where:

DBP = 27,600 lbs (preceding calculation)

W = 85% (table 3)

RR = 6 lbs per STON of train (table 2)

GR = 1.5% $\times$ 20 lbs per STON of train (para 66)

CR = 5° $\times$ 0.8 lb per STON of train = 4 lbs per STON of train (para 67)

$$GTL = \frac{27{,}600 \text{ lbs} \times .80}{6 \text{ lbs/STON} + 30 \text{ lbs/STON} + 4 \text{ lbs/STON}}$$
$$= \frac{22{,}080 \text{ lbs}}{40 \text{ lbs/STON}}$$
$$= 552 \text{ STONs}$$

f. Step 5. Compute the net train load.

$$NTL = GTL \times .50$$
$$= 552 \times .50$$
$$= 276 \text{ STONs}$$

g. Step 6. Compute the end delivery tonnage of the system by determining the net division tonnage (NDT) of the most restrictive division.

$$NDT = NTL \times TD$$

1st div: $276 \times 15 = 4{,}140$ STONs
2nd div: $276 \times 12 = 3{,}312$ STONs
3rd div: $276 \times 14 = 3{,}312$ STONs
4th div: $276 \times 15 = 4{,}140$ STONs

EDT = NDT of 2nd div (most restrictive)
EDT = 3,312 STONs

5. Third Computation

Determine the rolling stock requirements for this rail system when operating at maximum capacity during winter months, using single engine operation. Each type of freight car will move the following percentages of the end delivery tonnage:

Boxcars—50 percent of EDT
Gondolas—25 percent of EDT
Flatcars—25 percent of EDT

a. Step 1. Compute the portion of the EDT to be moved in each type of rail car:

Boxcars: $EDT \times 50\% = 3{,}312 \times .50 =$ 1,656 STONs

Gondolas: $EDT \times 25\% = 3.312 \times .25 =$ 828 STONs

Flatcars: $EDT \times 25\% = 3{,}312 \times .25 =$ 828 STONs

b. Step 2. Compute rolling stock requirements for 1 day's dispatch (para 79). To do this the following formulas must be applied:

$$\text{Total cars required} = \frac{EDT \text{ (by type car)}}{\text{avg tons per type car}} \times \text{turnaround time} \times 1.1$$

$$1DD = \frac{EDT \text{ (by type car)}}{\text{avg tons per type car}}$$

Note. Average tons per type car $= \frac{\text{rated capacity}}{2}$

Thus 1 day's dispatch for all type cars is computed as follows:

$$1\ DD = \frac{EDT \text{ (by type car)}}{\text{avg payload for type car}}$$

Boxcars: $1\ DD = \frac{1656}{20} - 82+$ or 83 cars

Gondolas: $1\ DD = \frac{828}{20} - 41+$ or 42 cars

Flatcars: $1\ DD = \frac{828}{25} = 33+$ or 34 cars

Total cars in 1 *DD* = 159 cars

Rolling stock requirements are based on a turnaround time of 11 days as shown in figure 4. Thus total rolling stock requirements are computed as follows:

1 DD x turnaround time = cars req'd x 1.1 (reserve factor) = total cars req'd

Boxcars: 11 x 83 = 913 x 1.1 = 1,004+ or 1,005 cars

Gondolas: 11 x 42 = 462 x 1.1 = 508+ or 509 cars

Flatcars: 11 x 34 = 374 x 1.1 = 411+ or 412 cars

Total rolling stock requirements: 1,926 cars

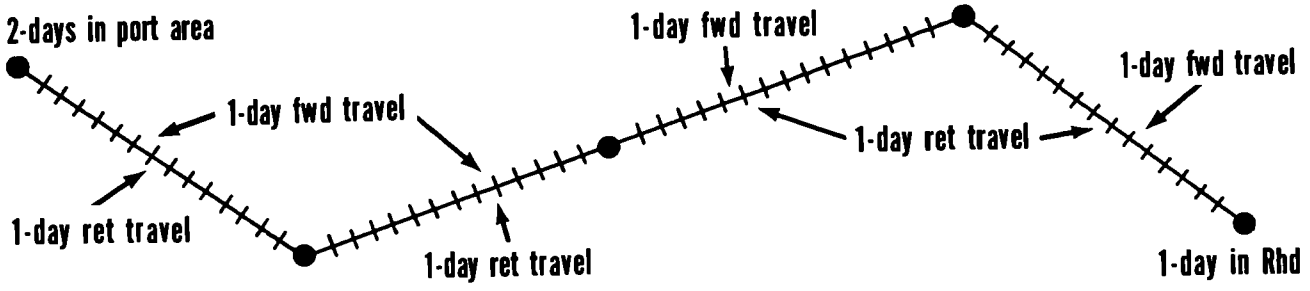


Figure 4. Determination of turnaround time in days.

6. Fourth Computation

Determine the road and switch engine requirements for the operation of this system at maximum capacity during winter months, using single engine operation.

a. Step 1. Compute for road engines required (para 80).

$$\text{Number of road engines} = TD \times \frac{RT + TT}{24} \times 2 \times 1.2$$

(1) Compute for factors.

	TD	*RT* (length of div ÷ avg speed)	(*TT* table 7)
1st div:	15	130 ÷ 10 = 13	3
2nd div:	12	100 ÷ 10 = 10	3
3rd div:	14	110 ÷ 10 = 11	3
4th div:	15	120 ÷ 10 = 12	3

(2) Compute requirements.

1st div: $15 \times \frac{(13 + 3)}{24} \times 2 \times 1.2 = 36 \times \frac{16}{24} = \frac{576}{24} =$ 24 road engines

2nd div: $12 \times \frac{(10 + 3)}{24} \times 2 \times 1.2 = 28.8 \times \frac{13}{24} = \frac{374.4}{24} =$ 15+ or 16 road engines

3rd div: $14 \times \frac{(11 + 3)}{24} \times 2 \times 1.2 = 33.6 \times \frac{14}{24} = \frac{470.4}{24} =$ 19+ or 20 road engines

4th div: $15 \times \frac{(12 + 3)}{24} \times 1.2 = 36 \times \frac{15}{24} = \frac{540}{24} = 22+$ or 23 road engines

Total road engines required = 24 + 16 + 20 + 23 = 83 engines

b. Step 2. Compute for switch engines (para 81).

	Cars dispatched and received per day		*Cars passing per day*		*Computation factor (table 8)*	*Switch engines required*
Port terminal:	159 x 2			÷	67	= 4+ or 5
2nd Div terminal:			159 x 2	÷	100	= 3+ or 4
3rd Div terminal:			159 x 2	÷	100	= 3+ or 4
4th Div terminal:			159 x 2	÷	100	= 3+ or 4
Railhead:	159 x 2			÷	67	= 4+ or 5
					Subtotal	22
			+ 20% reserve (4+ or 5)			5
						27

7. Fifth Computation

Determine the number of train crews required to support this rail system.

a. Step 1. Compute for road crews required (para 83).

$$\text{Road crews} = TD \times 2 \times \frac{RT + 3 \times 1.25}{12}$$

(1) Compute for factors.

	TD	*RT (length of div ÷ avg speed)*
1st div:	15	130 ÷ 10 = 13
2nd div:	12	100 ÷ 10 = 10
3rd div:	14	110 ÷ 10 = 11
4th div:	15	120 ÷ 10 = 12

(2) Compute for road crew requirements.

1st div: $\text{Road crews} = 15 \times 2 \times \frac{13 + 3}{12} \times 1.25$

$= 37.5 \times \frac{16}{12}$

$= \frac{600}{12}$

$= 50$ crews

2nd div: $\text{Road crews} = 12 \times 2 \times \frac{10 + 3}{12} \times 1.25$

$= 30 \times \frac{13}{12}$

$= \frac{390}{12}$

$= 32+$ or 33 crews

3rd div: $\text{Road crews} = 14 \times 2 \times \frac{11 + 3}{12} \times 1.25$

$= 35 \times \frac{14}{12}$

$= \frac{490}{12}$

$= 40+$ or 41 crews

4th div: $\text{Road crews} = 15 \times 2 \times \frac{12 + 3}{12} \times 1.25$

$= 37.5 \times \frac{15}{12}$

$= \frac{562.5}{12}$

$= 46+$ or 47 crews

Total road crews required = 50 + 33 + 41 + 47 = 171 crews

b. Step 2. Compute for switch engine crews required (do not include reserve switch engines) (para 84).

Switch crews = *SE* x 2 x 1.25

Port area:	Switch crews = 5 x 2 x 1.25 = 12+ or 13
2nd Div terminal:	Switch crews = 4 x 2 x 1.25 = 10
3rd Div terminal:	Switch crews = 4 x 2 x 1.25 = 10
4th Div terminal:	Switch crews = 4 x 2 x 1.25 = 10
Railhead:	Switch crews = 5 x 2 x 1.25 = 12+ or 13
	Total switch crews required = 56

c. Step 3. Determine total number of train crews require.

Road crews = 171
Switch crews = 56
Total engine crews req'd = 227

8. Sixth Computation

Determine the monthly engine fuel, lubricants, and spare parts requirements for the operation of this system.

a. Step 1. Compute fuel requirements for road engines (para 87 and table 9).

	TD	x	Two-way travel	x	LD		Train miles per day
1st div:	15	x	2	x	130	=	3,900
2nd div:	12	x	2	x	100	=	2,400
3rd div:	14	x	2	x	110	=	3,080
4th div:	15	x	2	x	120	=	3,600
					Total train miles per day	=	12,980

12,980 train miles per day x 2.5 gal per train mile = 32,450 gal per day
32,450 gal per day x 30 days = 973,500 gal per month
973,500 gal per month
48,675 plus 5% reserve
1,022,175 total gal per month

b. Step 2. Compute fuel requirements for switch engines (para 87 and table 9). (Do not include reserve switch engines.)

No. of switch engines	x	Hrs per day operation	x	Rate of fuel computation (gal per hr per locomotive)	=	Daily requirement (gal)
22	x	20	x	8	=	3,520

3,520 gal per day x 30 days = 105,600 gal per month
105,600 gal per month
5,280 plus 5% reserve
110,880 gal per month

c. Step 3. Compute total fuel requirement.

1,022,175 road engine requirements per month in gallons
110,880 switch engine requirements per month in gallons
1,133,055 total requirements per month in gallons

d. Step 4. Compute monthly lubricant requirement (para 88).

	TD	x	Two-way travel	x	Lubricants (lbs per mo per train per day)	=	Lubricants (lbs per month)
1st div:	15	x	2	x	1,000	=	30,000

2nd div:	12	x	2	x	1,000	=	24,000
3rd div:	14	x	2	x	1,000	=	28,000
4th div:	15	x	2	x	1,000	=	30,000
	Total lubricants required per month					=	112,000 lbs

e. Step 5. Compute monthly spare parts requirement in short tons (para 89).

	TD	x	Two-way travel	x	Spare parts (STONs per mo per train per day)		Spare parts (STONs per month)
1st div:	15	x	2	x	1.5	=	45
2nd div:	12	x	2	x	1.5	=	36
3rd div:	14	x	2	x	1.5	=	42
4th div:	15	x	2	x	1.5	=	45
	Total spare parts per month					=	168 STONs

APPENDIX C

STATISTICS FOR USE IN RAILWAY PLANNING

Table 1. Characteristics of United States Army Locomotives

Type of locomotive	Weight on drivers (STONs)	Starting *TE* at 25% adhesion; (lbs)[1]	Total Weight (STONs)	Minimum Radius Curve (ft)
Standard gage (56 ½-in.) stock No. 2210–554–0786, locomotive, diesel-electric, 131-ton, 0–6–6–0 wheel, domestic and foreign service (1,000–hp)	131	63,100	131	231
Stock No. 2210–270–1354, locomotive, diesel-electric, 127-ton, 0–6–6–0 wheel, domestic and foreign service (1,000-hp)	127	63,100	127	231
Standard gage (56 ½-in.), stock No. 2210–262–0751, locomotive, diesel-electric, 120-ton, 0–4–4–0 wheel, domestic service (1,200-hp)	120	60,000	120	193
Stock No. 2210–554–0785, locomotive, diesel-electric, 120-ton, 0–4–4–0 wheel, domestic service (1,500-hp)	120	60,000	120	150
Stock No. 2210–112–8508, locomotive, diesel-electric, 115-ton, 0–4–4–0 wheel, domestic service (1,000-hp)	115	57,500	115	50
Stock No. 2210–112–8510, locomotive, diesel-electric, 65-ton, 0–4–4–0 wheel, domestic service (40-hp)	65	32,500	65	75
Stock No. 2210–821–1135, locomotive diesel-electric, 45-ton, 0–4–4–0 wheel, domestic and foreign service (380-hp)	45	22,500	45	50
Stock No. 2210–529–9038, locomotive diesel-electric, 45-ton, 0–4–4–0 wheel, domestic service (380-hp)	45	22,500	45	75
Stock No. 2210–820–5602, locomotive, diesel-electric, 44-ton, 0–4–4–0 wheel, domestic service (380-hp)	44	21,800	44	75
Stock No. 2210–262–1366, locomotive, diesel-mechanical, 10-ton, 0–4–0 wheel, domestic service (100-hp)	10	5,555	10	75
Stock No. 2210–820–5451, locomotive, diesel-electric, 80-ton, 0–4–4–0 wheel, domestic service (470-hp)	80	40,000	80	75

[1] For diesel-electric power, the continuous *TE* is one-half the starting *TE*.

Table 2. Average Values of Rolling Resistance

Pounds per ton of train	Condition of track
5	Exceptionally good
6	Good to fair
7	Fair to poor
8	Poor
9 and 10	Very poor

Table 3. Effect of Weather on Hauling Power of Locomotives

Most adverse temperature in °F	Loss in hauling (percent)	Weather factor (percent)
Above +32	0	100
+16 to +32	5	95
0 to +15	10	90
−1 to −10	15	85
−11 to −20	20	80
−21 to −25	25	75
−26 to −30	30	70
−31 to −35	35	65
−36 to −40	40	60
−41 to −45	45	55
−46 to −50	50	50

Table 4. Determining Average Speed Values

Condition of track	Percent of grade	Average speed	
		single track	Double track
Exceptionally good	1 percent or less	12 mph	14 mph
Good to fair	1.5 percent or less	10 mph	12 mph
Fair to poor	2.5 percent or less	8 mph	10 mph
Poor	3 percent or less	6 mph	8 mph

Notes:

1. The most restrictive factor governs the speed selected.
2. In using the table for average speed factor, consider the following:

a. If the condition of track and/or the percent of grade is not known, use an average speed value of 8 mph for single track and 10 mph for double track.

b. Where the most restrictive factor occurs for a comparatively short distance, that is, less than 10 percent of the division, use the next higher average speed.

c. Where average speed falls below 6 mph because of the gradient, reduce the tonnage to increase speed (2-percent reduction in gross tonnage will increase speed 1 mile per hour).

Table 5. Characteristics of U.S. Rolling Stock

Type of car	Gage	Capacity (tons)	Tare weight (tons)	Inside dimensions		
				Length	Width	Height
I. Foreign Service						
Box (30-ton)	Narrow	30	13.6	34'5½"	7'¾"	6'4"
Box (40-ton)	Std to broad	40	18.5	40'6"	8'6"	6'5⅝"
Flat (30-ton)	Narrow	30	10.9	34'5⅞"	7'2"	
Flat (40-ton)	Std to broad	40	14.5	40'9"	8'7¼"	
Flat (80-ton)	Std to broad	80	35.3	46'4"	9'8"	
Flat, depressed center (70-ton)	Std to broad	70	41.5	50'7"	9'8"	
Gondola, high-side (30-ton)	Narrow	30	13	34'5"	6'10½"	4'0"
Gondola, high-side (40-ton)	Std to broad	40	18	40'0"	8'3¾"	4'0"
Gondola, low-side (30-ton)	Narrow	30	12.1	34'6"	6'10½"	1'6"
Gondola, low-side (40 ton)	Std to broad	40	16	40'4½"	8'3¼"	1'6"
II. Tank, POL (6,000-gal.)	Narrow	20	16			
Tank, POL (10,000-gal.)	Std to broad	35	19			
III. Domestic Service						
Box (50-ton)	Std	50	23	40'6"	9'2"	11'0"
Flat (50-ton)	Std	50	25.5	43'3"	10'6"	
Flat (70-ton)	Std	70	27	49'11"	10'3"	
Flat (100-ton)	Std	100	35	54'0"	10'6½"	
Gondola, high-side (50-ton)	Std	50	25	41'6"	9'6"	4'6"
Gondola, low-side (50-ton)	Std	50	23	41'6"	9'6"	3'0"
Tank, POL (10,000-gal.)	Std	50	23			

Note. Average payload for each type of car, except tank cars, is 50 percent of rated capacity in tons.

Table 6. Disposition or Rolling Stock

Disposition	Rolling stock required
At base of operation	3 days' dispatch
Forward traffic	1 day's dispatch per division
Return traffic	1 day's dispatch per division
At the railhead	1 day's dispatch

Table 7. Terminal Time Average Values

Type of motive power	Hours
Diesel-electric	3

Tables 8. Disposition of Switch Engines

Location	Switch engines required
Port or loading terminal	1 per 67 cars dispatched and received per day
Division terminals	1 per 100 cars passing per day
Railhead or unloading terminals.	1 per 67 cars dispatched and received per day

Table 9. Fuel Requirements for Locomotives

Type of locomotive	Type of operation	Estimated average rate of fuel oil consumption	
		Gal per train mile	Gal per hour
Diesel-electric locomotive standard gage:			
0–6–6–0, DE, 120-ton	Road switcher	2.5	11.5
0–4–4–0, DE, 60-ton	Road switcher	.9	8.0
Narrow gage:			
0–6–6–0, DE, 80-ton	Road switcher	1.5	10.0
0–4–4–0, DE, 48-ton	Road switcher	.9	8.0

APPENDIX D

STANAG 2113

DESTRUCTION OF MILITARY TECHNICAL EQUIPMENT

NATO UNCLASSIFIED STANAG 2113

Agreed English/French Texts.

DETAILS OF AGREEMENT (DofA)

DESTRUCTION OF MILITARY TECHNICAL EQUIPMENT

Annex: A(DofA) Priorities for Destruction of Parts of Military Technical Equipment.

AGREEMENT

1. The NATO Army Forces agree:
   a. That it is essential to destroy to the maximum degree possible military technical equipment, abandoned in wartime operations, to prevent its eventual repair and use by the enemy.
   b. To follow the principles and priorities, set forth in this Agreement, in the destruction of their own equipment, when requirement.

PRINCIPLES AND PRIORITIES

2. Detailed Methods. Detailed methods of destroying individual items of equipment are to be included in the applicable technical publications, user handbooks and drill manuals.

3. Means of Destruction. Nations are to provide for the means of destruction for their own equipment.

4. Degree of Damage.
   a. General. Methods of destruction should achieve such damage to equipment and essential spare parts that it will not be possible to restore the equipment to a usable condition in the combat zone either by repair or cannibalization.
   b. Classified Equipment. Classified equipment must be destroyed in such degree as to prevent duplication by, or revealing means of operation or function, whenever possible, to the enemy.
   c. Associated Classified Documents. Any classified documents, notes, instructions, or other written material pertaining to function, operation, maintenance, or employment, including drawings or part lists, must be destroyed in a manner to render them useless to the enemy.

5. Priorities for Destruction.
   a. Priority must always be given to the destruction of classified

equipment and associated documents.

b. When lack of time and/or stores prevents complete destruction of equipment, priority is to be given to the destruction of essential parts, and the same parts are to be destroyed on all like equipment.

c. A guide to priorities for destruction of parts for various groups of equipment is contained in Annex A(DofA) to this STANAG.

6. Equipment Installed in Vehicles. Equipment installed in vehicles should be destroyed in accordance with the priorities for the equipment itself, taking into account the relative importance of the installed equipment and the vehicle itself.

7. Spare Parts. The same priority, for destruction of component parts of a major item necessary to render that item inoperable, must be given to the destruction of similar components in spare parts storage areas.

8. Cryptographic Equipment and Material. The detailed destruction procedure to be followed in order to ensure the rapid and effective destruction of all types of cryptographic equipment and material is to be specified in instructions issued by the appropriate communication security authority.

9. Authorization. The authority for ordering the destruction of equipment is to be vested in the divisional and higher commanders who may delegate authority to subordinate commanders when the situation requires.

10. Reporting. The reporting of the destruction of equipment is to be done through command channels.

IMPLEMENTATION OF THE AGREEMENT

11. This STANAG will be considered to have been implemented when the priorities indicated therein have been incorporated in national documents detailing the method required for destroying the equipment concerned.

PRIORITIES FOR DESTRUCTION OF PARTS OF MILITARY TECHNICAL EQUIPMENT

	EQUIPMENT	PRIORITY	PARTS
1.	VEHICLES (INCLUDING TANKS AND ENGINEER EQUIPMENT)	1	Carburetor/fuel pump/injector/distributor.
		2	Engine block and cooling system.
		3	Tires/tracks and suspensions.
		4	Mechanical or hydraulic systems (where applicable).
2.	GUNS	5	Differentials.
		6	Frame.
		1	Breech, breech mechanism, and spares.
		2	Recoil mechanism.
		3	Tube.
		4	Sighting and fire control equipment (Priority 1 for Anti-Aircraft guns).
		5	Carriage and tires.
3.	SMALL ARMS	1	Breech mechanism.
		2	Barrel.
		3	Sighting equipment (including Infra-red).
		4	Mounts.
4.	OPTICAL EQUIPMENT	1	Optical parts.
		2	Mechanical components.
5.	RADIO	1	Transmitter (oscillators and frequency generators).
		2	Receiver.
		3	Remote control units or switchboards (exchanges) and operating terminals.
		4	Power supply and/or generator set.
		5	Antennae.
		6	Tuning heads.
6.	RADAR AND OTHER ELECTRONIC EQUIPMENT	1	Frequency determining components, records, operating instructions, which are subject to security regula-

EQUIPMENT	PRIORITY	PARTS
		tions, and identification material (Identification Friend or Foe (IFF)).
	2	Antennae and associated components such as radiators, reflectors and optics.
	3	Transmission lines and waveguides.
	4	Transmitter high voltage components.
	5	Control consoles, displays, plotting boards.
	6	Cable systems.
	7	Automatic devices.
	8	Other control panels and generators.
	9	Carriage and tires.
7. GUIDED MISSILE SYSTEMS	1	Battery control centers.
	2	Missile guidance equipment (including homing systems).
	3	Launchers including control circuits.
	4	Missiles.
	5	Measuring and test equipment.
	6	Generators and cable systems.
8. AIRCRAFT AND SURVEILLANCE DRONES	1	Identification (IFF) equipment, other classified equipment, publications and documents pertaining thereto, and other materiel as defined by the national government concerned.
	2	Installed armament (Use subpriorities for Group 2, Guns, or Group 3, Small Arms, as appropriate.
	3	Engine Assembly (Priorities for destruction of magnetos, carburetors, compressors, turbines and other engine sub-assemblies to be determined by national governments, depending on type of aircraft involved and time available for destruction).

EQUIPMENT	PRIORITY	PARTS
	4	Airframe/control surfaces/ undercarriage (Priorities for destruction of propellers, hub-rotor blades, gear boxes, drive shaft, transmissions, and other sub-assemblies (not already destroyed in priority 3) to be determined by national governments, depending on type of aircraft involved and time available for destruction).
	5	Instruments, radios, and electronic equipment (not included in priority 1).
	6	Electrical, fuel, and hydraulic systems.
9. ROCKETS	1	Launcher.
	2	Rocket.
	3	Sights and fire control equipment.

APPENDIX E

STANAG 2158

IDENTIFICATION OF MILITARY TRAINS

NATO UNCLASSIFIED STANAG 2158
(Edition No. 2)

Agreed English/French Texts.

DETAILS OF AGREEMENT (TofA)

IDENTIFICATION OF MILITARY TRAINS

AGREEMENT

1. The NATO Armed Forces have agreed to adopt the international identification code defined below for the identification of military trains.

BACKGROUND

2. a. A different procedure is used by each NATO Nation for the identification of military trains moving within its territory.

b. A national technical code number is used by each civilian railway organization for each individual train. This number, although primarily designed to keep a record of trains, may, however, give some indication as to the train's country of origin. This number is changed when frontiers are crossed and for various reasons it is impossible to contemplate retaining it beyond the frontier of the country of origin.

c. Some countries have thought it necessary, for the benefit of their military authorities, to add a number to the technical code number, indicating thereby the nature of the contents of the train (troops or supplies). This additional number has so far been specially reserved for the use of the military authorities within the nation in question.

3. It was therefore essential that a standardized procedure be defined and that a code number be devised for the use of military authorities, (allied or national), which would remain unchanged throughout the journey across various frontiers and would cause no inconvenience to railway organizations (which would continue to use their technical numbers).

REQUIREMENTS

4. a. The code number, known, as the 'International Identification Code for Use on Military Trains' must show in particular:

(1) Movement execution priority, for which it has been agreed to adopt three classes, priority number one being the highest and being assigned in exceptional cases only.

(2) Country of origin.
(3) Date of departure.
(4) National identification code number; in order to ensure identification of a given train among other trains to which the above information might also apply (as in the case of several trains departing on the same day), a national identification code number (1) should be included at a given position, in the international code.
(5) Country of destination.

b. Because of the complexity of the problem, this procedure will be used only for the identification of complete military trains as opposed to individual trucks or units. If a train is broken up on the final stage of its journey, only its biggest section may, if appropriate, retain the original number.

c. In the planning stage of initial movements the priority and the date of departure will be temporarily replaced in the International Identification Code Number by 0 (zero) and 00 (two zeros) respectively. If the priority is unknown, the index 0 will be used and the movement will take place at the lowest priority. The true date of departure will be given by the movements control agency as soon as it is known.

DEFINITION OF THE INTERNATIONAL IDENTIFICATION CODE FOR USE ON MILITARY TRAINS

5. The code will comprise a series of figures, letters or symbols, arranged as follows:

a. One figure to indicate the movement execution priority.
b. Two letters to indicate the country of origin (letters indicating the nationality as in STANAG 1059).
c. Two figures to indicate the day of departure (in the current month).
d. The national identification code number (1) as assigned by the country of origin.
e. Two letters to indicate the country of destination.

6. For example:

$2 - FR = 436239 = NL$

identifies a military train as follows:

a. Movement execution priority is 2.
b. The country of origin is FRANCE.
c. The date of departure is 7th of the current month.
d. The national identification code number (1) assigned by FRANCE is 436239.
e. The train contains items for shipment to the NETHERLANDS.

NOTE (1) This number may be either the national technical code number assigned by the railway organization in the country of origin or any other number assigned by the military authorities of that country and possibly providing information as to the nature of the load carried.

IMPLEMENTATION OF THE AGREEMENT

7. The STANAG will be considered to have been implemented when the necessary orders/instructions putting the procedures detailed in the Agreement into effect have been issued to the forces concerned.

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:

KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

Distribution:

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