FM 55-15

DEPARTMENT OF THE ARMY FIELD MANUAL

TRANSPORTATION CORPS REFERENCE DATA

HEADQUARTERS, DEPARTMENT OF THE ARMY

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CHAPTER 1
GENERAL

1.1 Purpose and Scope

a. This manual is both a planning guide for staff and unit officers and a digest of operational data for use as a reference by operators and users of transportation when unit or staff libraries are not readily available.

b. This manual gives characteristics of typical transportation equipment and facilities and methods for estimating the capabilities of, or requirements for, transportation equipment, facilities, and troop units. Personnel and equipment data for the modes of transportation and for transportation terminals are presented as well as data for computing requirements for staff, supervisory, and control activities. Factors concerning administrative support requirements are included. It also contains report formats and examples of orders and standing operating procedures. Loading data for water, rail, motor, and air movements; tables on weights, measures, and conversion factors; and miscellaneous data of general usefulness are included.

1.2 Application

The material presented herein is applicable to nuclear and nonnuclear warfare.

1.3 Changes and Revision

All interested agencies are requested to submit recommendations for changes to or revision of this manual to the Commandant, U.S. Army Transportation School, Fort Eustis, Va.

CHAPTER 2

AIR

Section I. ORGANIZATION

2.1 Organization

Unit	*TOE*	*Mission and/or capability*	*Assignment*
Headquarters and headquarters detachment, transportation transport aircraft battalion.	55–56	To provide command control, staff planning, and administrative supervision for 2 to 7 transport aircraft companies.	To field army.
Transportation light helicopter company.	55–57	To provide air transport to expedite tactical operations and logistical support in forward areas of combat zone. As maximum, can move 31.5 tons within 50-mile radius in 1 lift.	To field army or separate corps.
Transportation medium helicopter company.	55–58	To provide air transport to expedite tactical operations and logistical support in combat zone. As maximum, can move 80 tons externally or 46.4 tons internally within 50-mile radius in 1 lift.	To field army.
Transportation aircraft maintenance detachment (division).	55–79	To provide direct-support field maintenance (third echelon) to aircraft organic to a division.	To infantry or armored division.
Transportation aircraft repair battalion.	55–445	To provide backup support to field army maintenance and supply units, depot supply, fifth-echelon repair of aircraft and aircraft components, and aircraft standardization and modification programs directed for accomplishment in theater of operations for the support of 1 field army.	To logistical command or other appropriate command in theater of operations.

Unit	*TOE*	*Mission and/or capability*	*Assignment*
Headquarters and headquarters detachment, transportation aircraft maintenance and supply group.	55-452	To provide command control, staff planning, and administration for 2 to 7 attached battalions of transportation aircraft maintenance and supply units.	To field army.
Headquarters and headquarters detachment, transportation aircraft maintenance and supply battalion.	55-456	To provide command control, staff planning and administration for 3 to 7 transportation aircraft maintenance and supply companies.	To field army or independent corps.
Transportation aircraft direct support company.	55-457	To provide supply and third-echelon maintenance and recovery support for aircraft operating within army other than divisional aircraft or aircraft assigned to transportation transport aircraft battalions. Can provide this service for aircraft operating in corps or army service area.	To field army or independent corps.
Transportation transport aircraft maintenance company.	55-468	To provide third-echelon field maintenance, supply, and recovery support for 16 transport airplanes and 16 medium transport helicopters.	To field army or independent corps.
Transportation transport helicopter maintenance company.	55-469	To provide third-echelon field maintenance, supply, and recovery support for 3 companies of light helicopters.	To field army or independent corps.
Transportation general support aircraft supply company.	55-477	To receive, store, and issue Transportation Corps air items of supply for all aircraft assigned to units constituting field army. Can receive, store, and issue 29,000 line items per month.	To field army.
Transportation general support aircraft maintenance company.	55-478	To provide a continuation of airplane field-maintenance support up to the designated limits of depot maintenance for all airplanes in a field army.	To field army.

Unit	*TOE*	*Mission and/or capability*	*Assignment*
Transportation general support helicopter maintenance company.	55–479	To provide a continuation of helicopter field maintenance support up to the designated limits of depot maintenance for all helicopters in a field army.	To field army.
Helicopter teams and aircraft field maintenance teams.	55–500	To provide personnel and equipment for the following purposes: To supplement TOE units where additional trained personnel are required in number less than TOE strength. To perform Transportation Corps functions as part of a larger unit where the need for the activity is less than a similar TOE unit. To operate as a separate organization where no TOE unit is provided.	Teams may be attached or assigned as required to higher echelon units or may be organized into service units to perform functions as required by existing conditions.

Section II. AIRCRAFT

2.2 General

Performance standards of aircraft are affected by many variables: range, altitude, temperature, humidity, existing weather, and pilot proficiency. The weight-lifting capabilities of all aircraft are particularly dependent on air density or density altitude, which is composed of three variables; altitude, temperature, and humidity. As air density decreases, lift capability decreases. A qualified pilot should be consulted for accurate, detailed computations to meet specific requirements. The performance data in this section are based on National Aeronautics and Space Agency (NASA) standard atmospheric conditions (29.92 inches Hg, 59° F, 0 mph wind).

2.3 Characteristics of Army Aircraft

(figs. 2.1–2.11)

(See FM 101–10 for operating data, passenger and cargo loads, etc.)

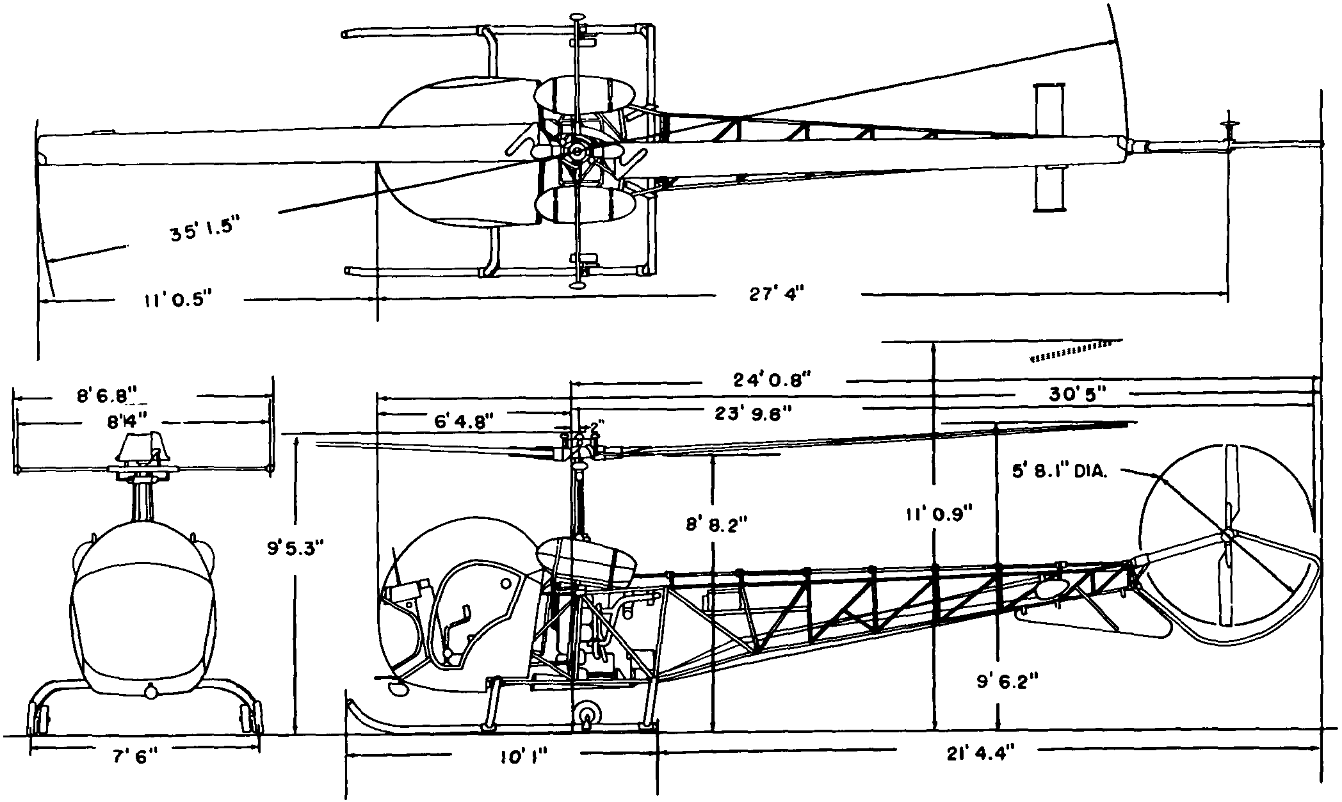


Figure 2.1. *H–13H (Sioux).*

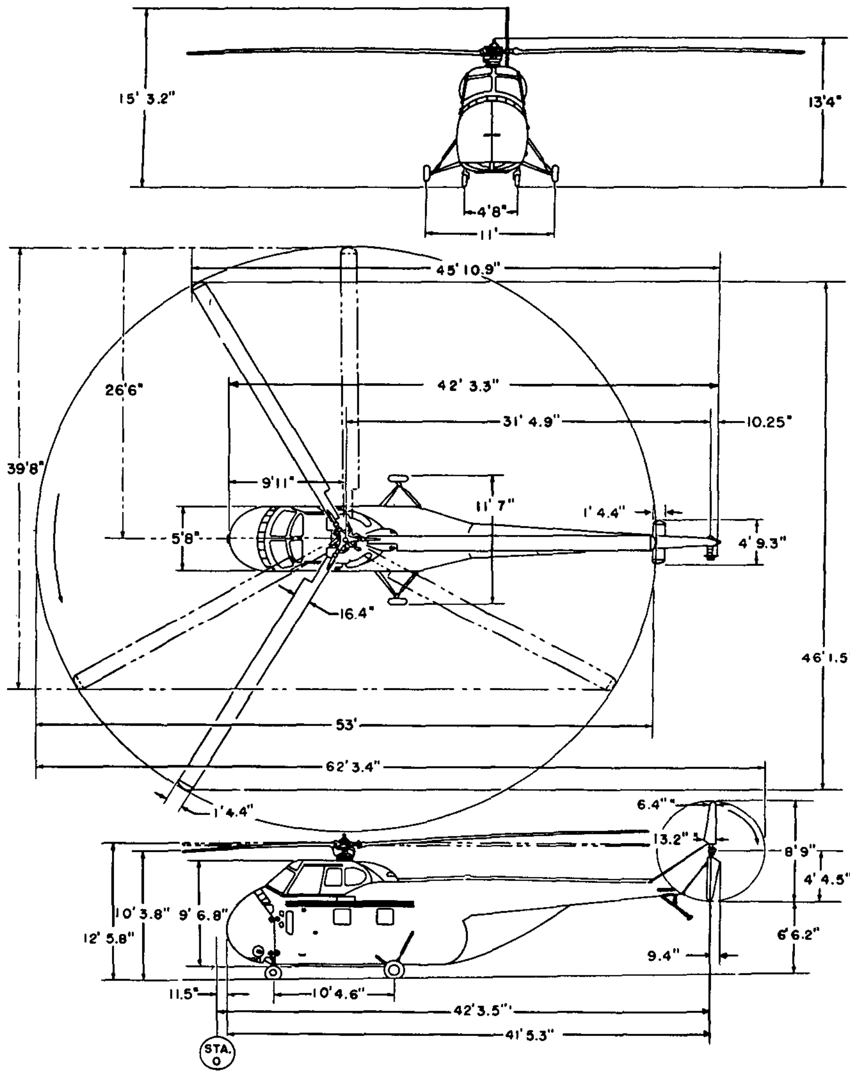


Figure 2.2. H–19D (Chickasaw).

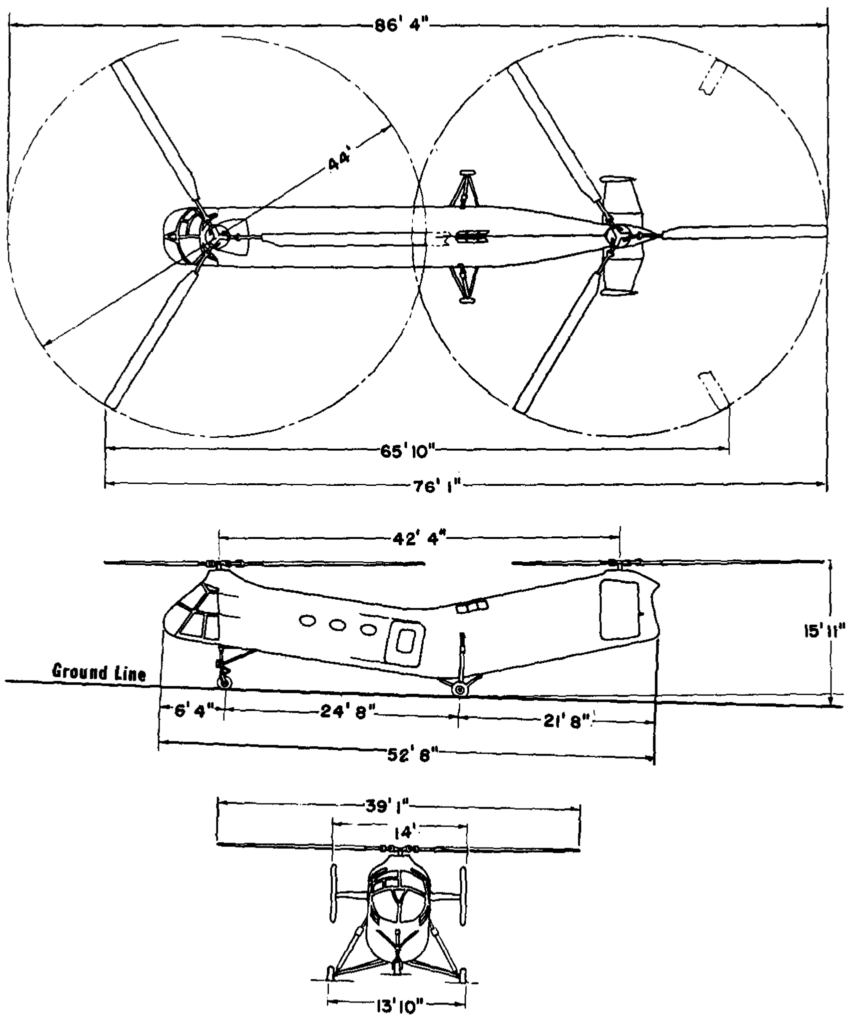


Figure 2.3. H–21C (Shawnee).

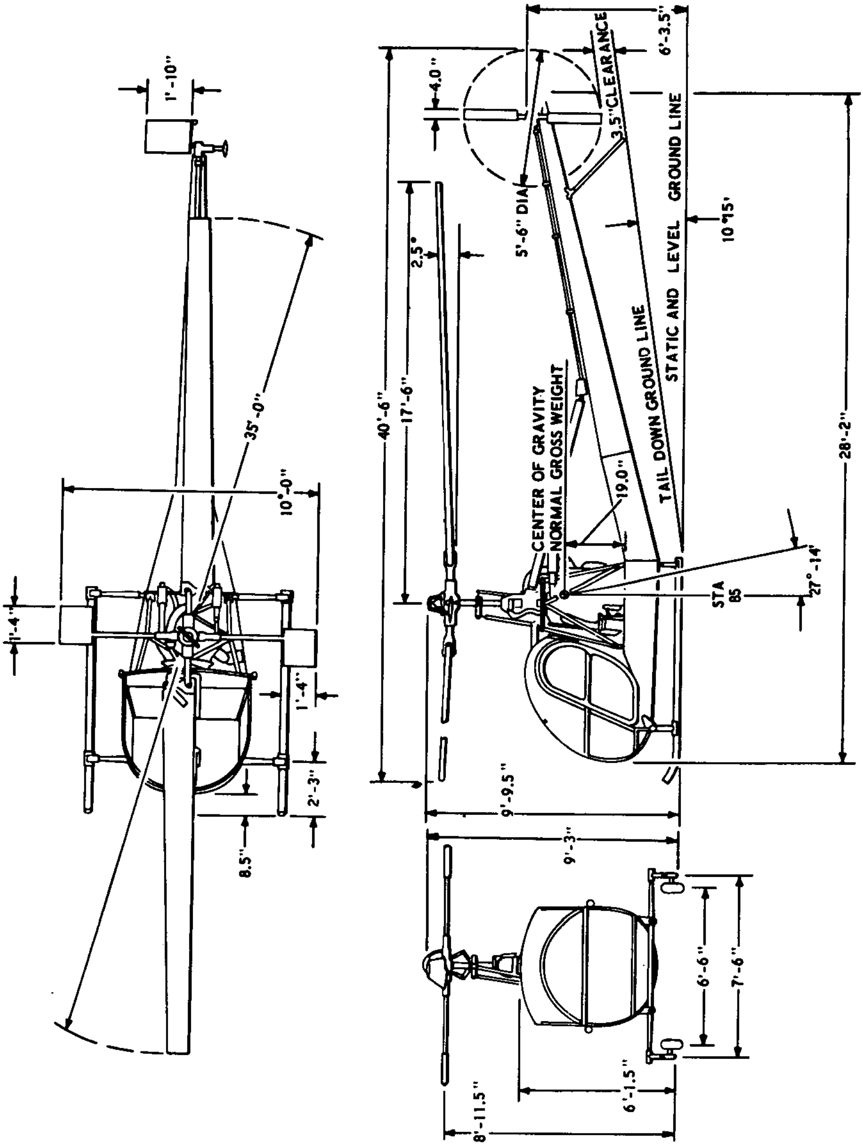


Figure 2.4. H–23D (Raven).

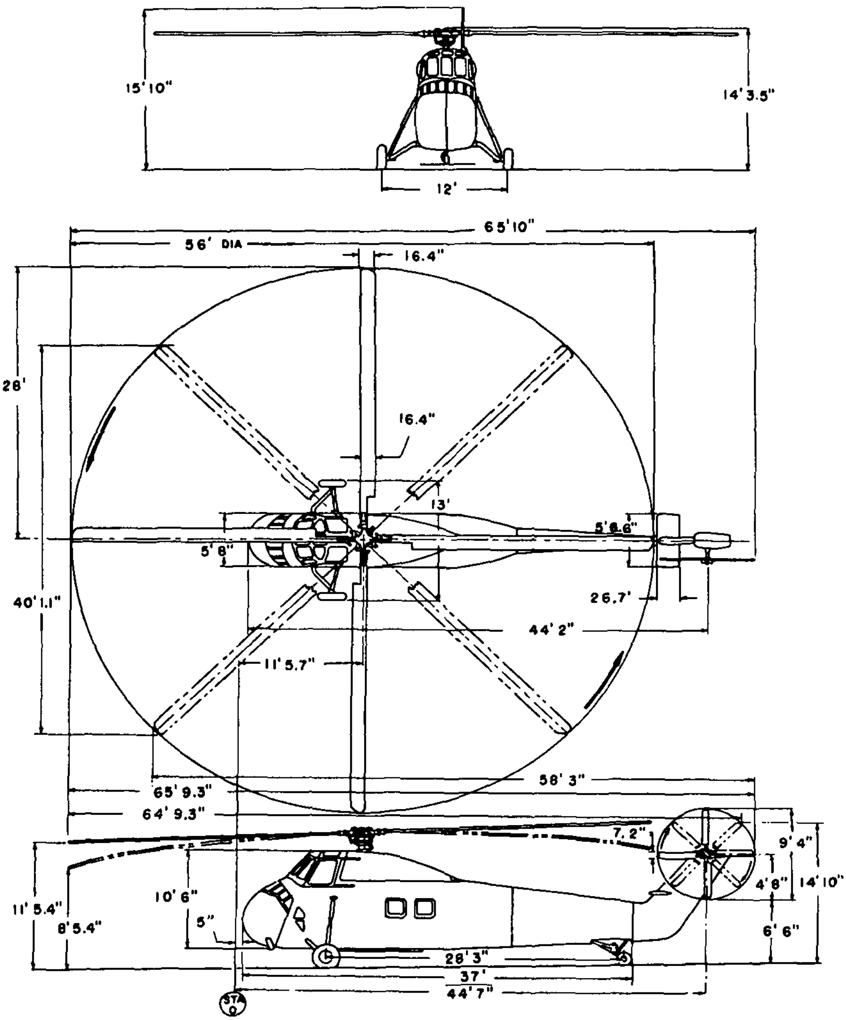


Figure 2.5. H–34A (Choctaw.)

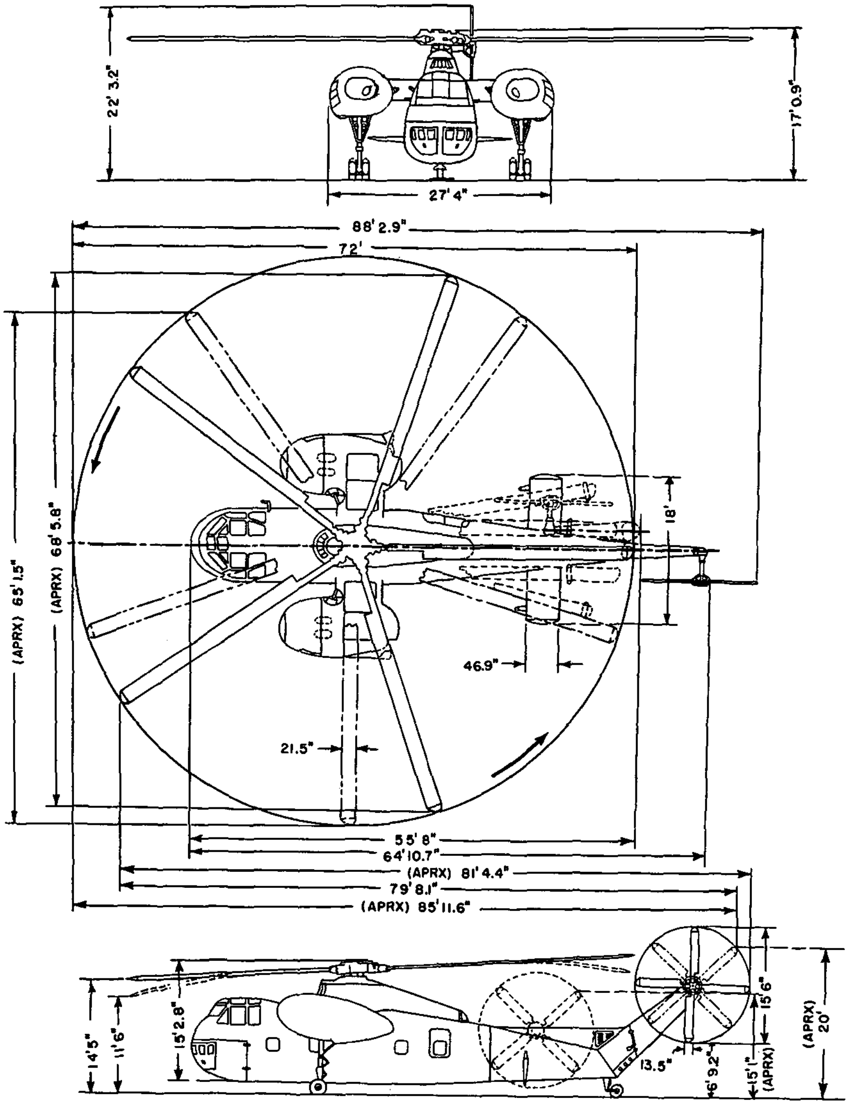


Figure 2.6. H–37A (Mojave).

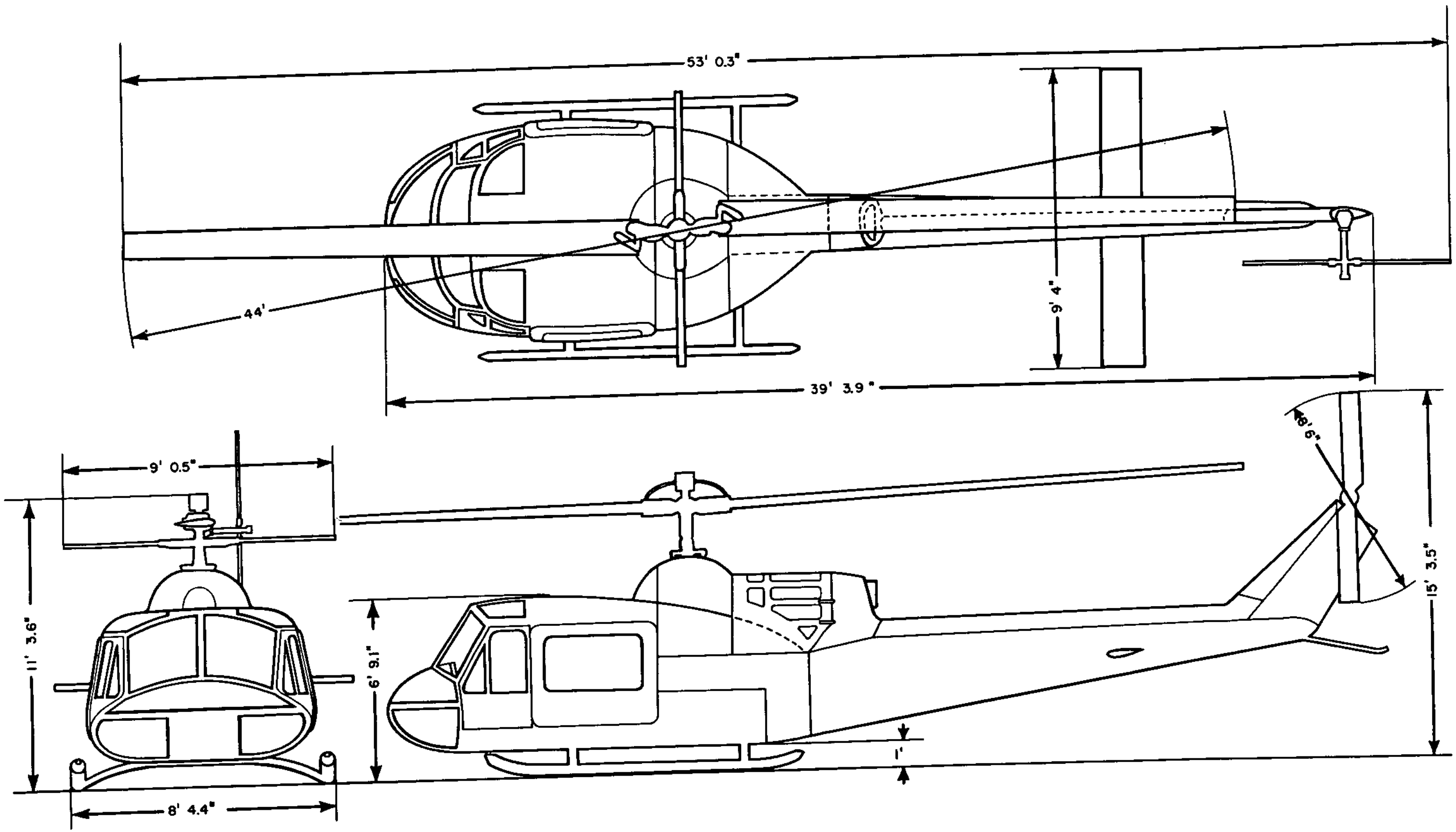


Figure 2.7. H–U1A (Iroquois).

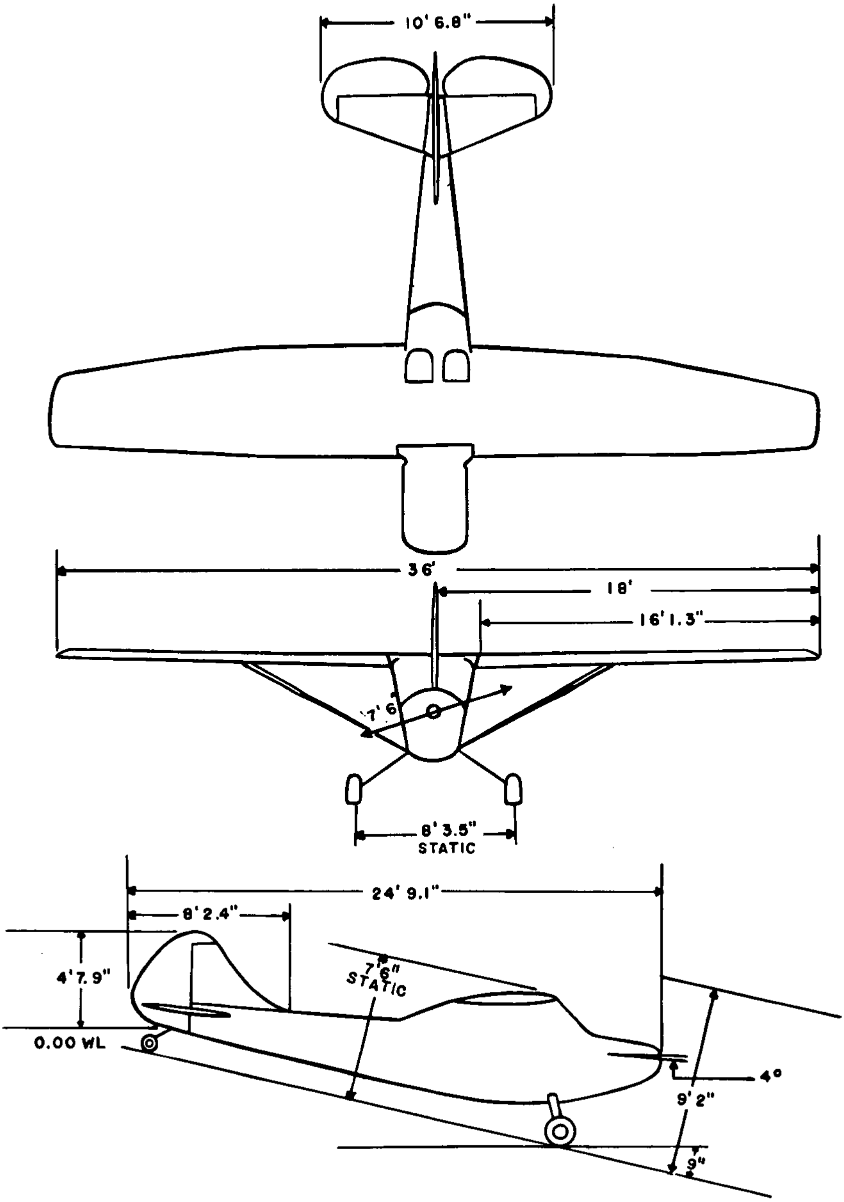


Figure 2.8. L–19E (Bird Dog).

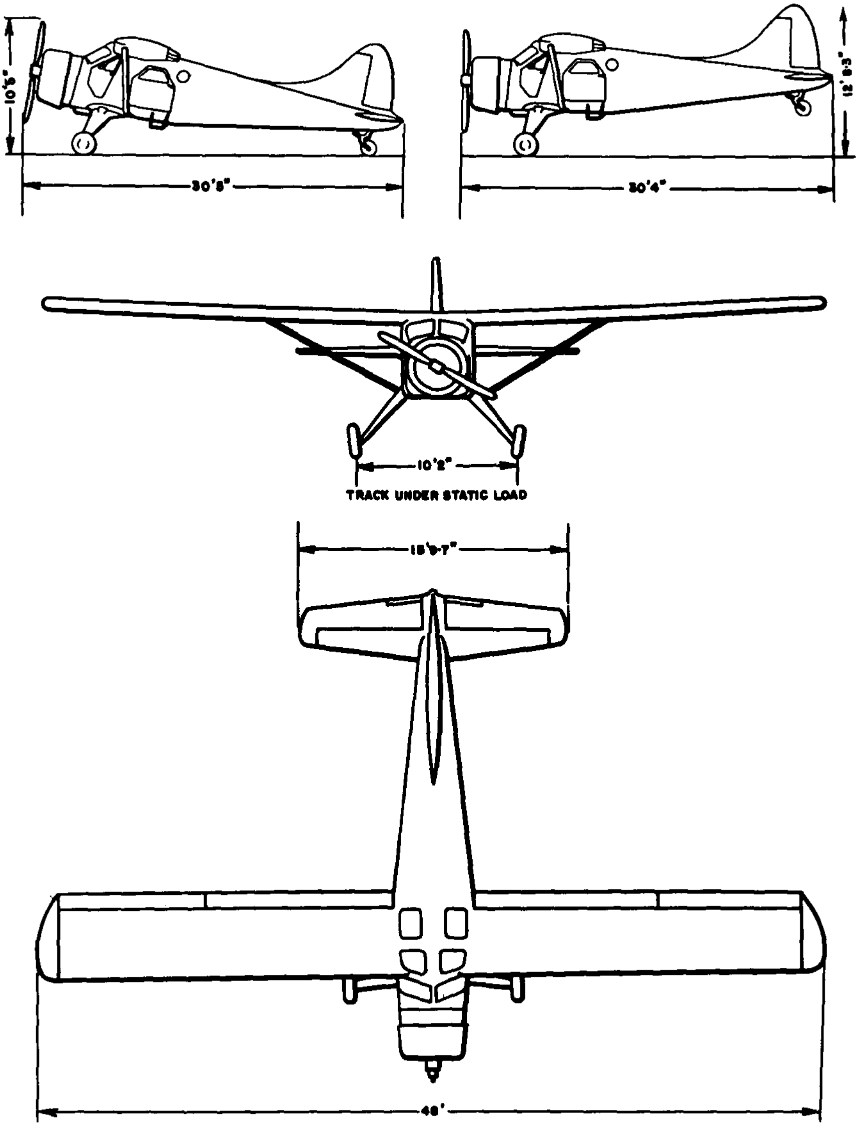


Figure 2.9. L–20A (Beaver).

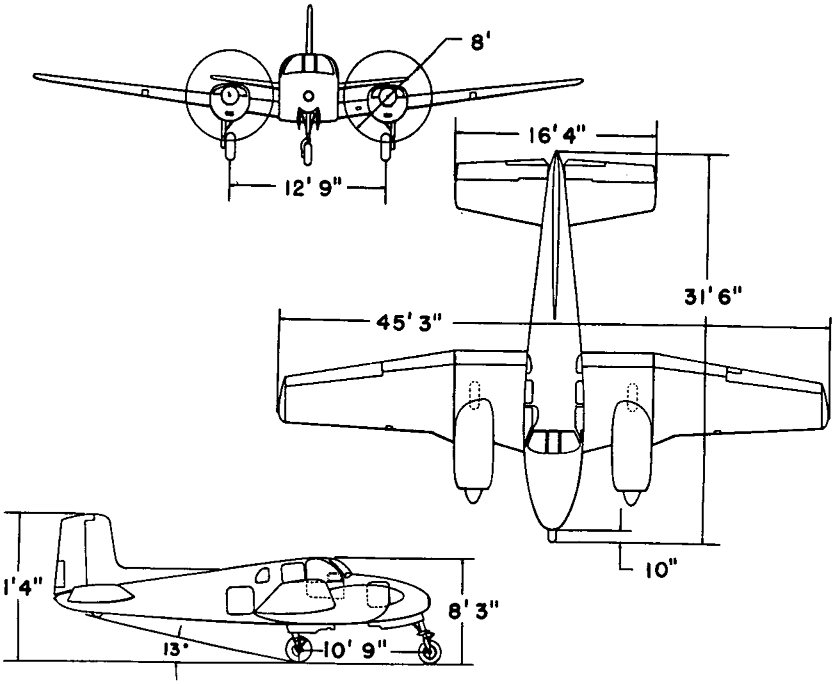


Figure 2.10. L–23D (Seminole).

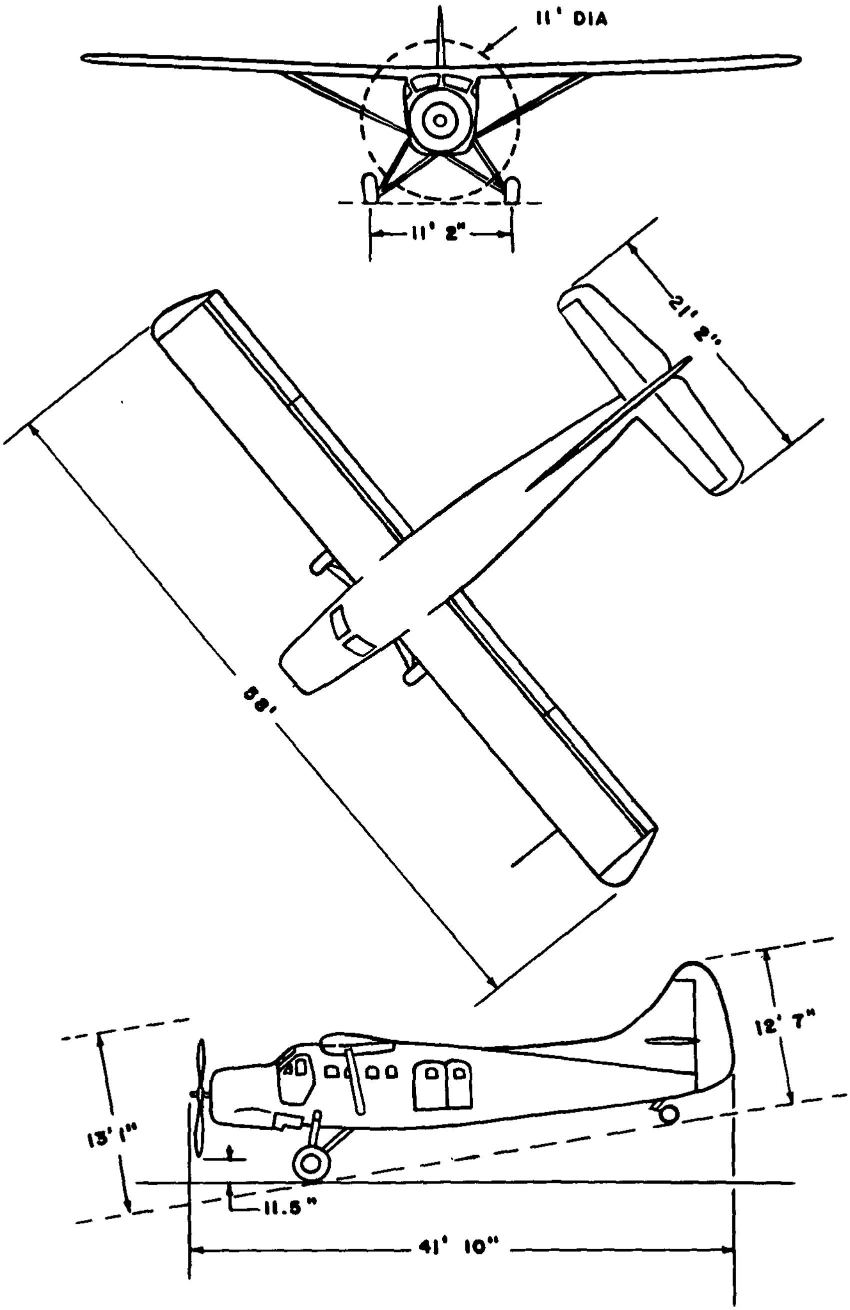


Figure 2.11. U–1A (Otter).

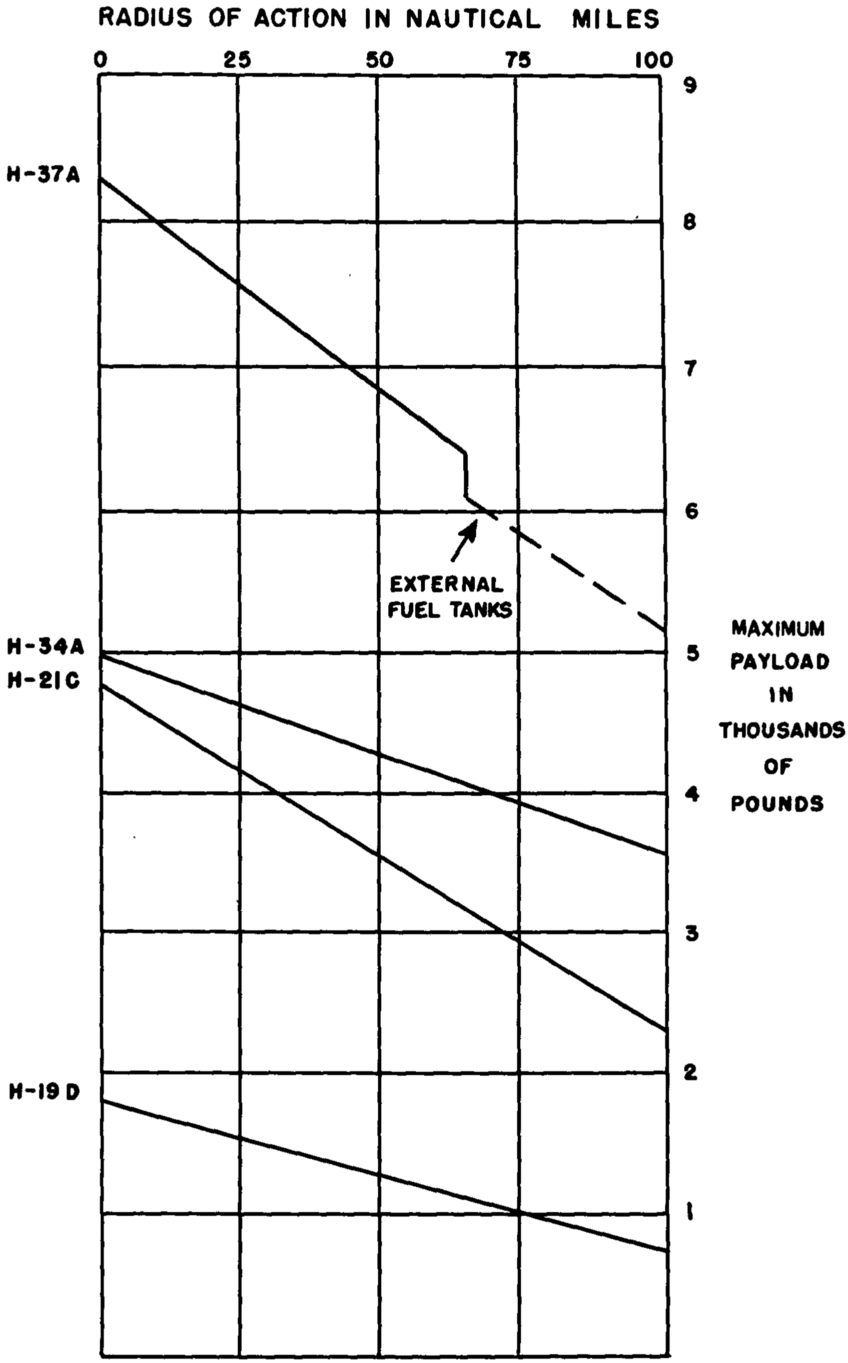


Figure 2.12. Payload versus range of transport helicopters.

2.4 Army Transport Helicopter Payloads

Payload is the weight of passengers and cargo that an aircraft can carry, usually expressed in pounds. As the distance to be flown is increased, the fuel required is increased and the payload is decreased. Payload for various ranges may be computed for transport helicopters by using figure 2.12.

2.5 Characteristics of Air Force Transport Aircraft

a. Passenger, Cargo-Load, and Flight Capabilities.

	C-54B	C-97A	C-119B	C-123	C-124A	C-130A	C-130B	C-133A
Pe sonnel								
Crew, normal	5	5	5	3	9	4	4	[a] 4
Paratroops	0	0	42	46	112	64	64	0
Troops	49	130	62	60	200	92	92	[b] 128
Litter positions	36	83	35	50	136	74	74	[b] 54
Avg cargo load (lb) versus range								
500 miles	20,000	42,000	16,302	14,452	38,375	35,000	35,000	115,418
1,000 miles	20,000	35,000	11,832	11,652	38,375	35,000	35,000	115,418
1,500 miles	18,900	28,500	7,832	10,296	38,375	30,000	35,000	100,000
2,000 miles	15,700	22,000	6,020		31,875	25,000	35,000	88,000
2,500 miles	12,500	16,000			23,875	10,000	30,000	74,000
3,000 miles							26,000	60,000
3,500 miles							19,000	47,000
4,000 miles								20,000
Cruise speed								
Knots	188	190	142	156	197	286	300	266
Mph	217	218	163	180	227	330	346	307

[a] Relief crew—3 additional.
[b] On auxiliary deck with cargo on main deck.

b. Special Aircraft Equipment.

C-54B	C-97A	C-119	C-123	C-124A	C-130A & B	C-133
Boom hoist	Ramp Monorails: capacity 85 300-lb or 15 1,500-lb A-22 containers Floor level conveyors: drop capacity limited only by allowable cargo load	Ramp Monorail: capacity 20 500-lb containers	Ramp	Ramp: 10,000-lb single-wheel load, 20,000-lb single-axle load Loading pulleys: 40,000-lb Elevator: 9,300-lb hoisting system	Ramp Roller conveyors Portable winch	Ramp Conveyors Winch system Hoisting system

c. Floor Loading Limitations.

Aircraft	*Pounds per square inch*
C–54B	1. 4
C–97	1. 4
C–119	1. 4
C–123	1. 4
Treadway	48. 0
Outer walkway	15. 6
Inner walkway	31. 2
C–124A	1. 4
Ramp	80. 0
Treadway	80. 0
Floor outside treadways	30. 0
C–130A & B	7. 08
C–133A	[1] 2. 08

2.6 Air Force Transport Cargo Capacities

a. C–54G (Navy Equivalent: R–5D–5).

(1) *Capacities.*

Cargo sections	*Width (in.)*	*Length (in.)*	*Cargo capacity (cu ft)*
C	103. 2	59. 5	155. 1
D	103. 2	61. 0	156. 2
E	103. 2	58. 5	153. 4
F	103. 2	61. 5	159. 9
G	103. 2	59. 0	154. 8
H	103. 0	61. 0	156. 0
I	101. 0	59. 375	153. 3
J	101. 0	61. 625	[2] 78. 3
K	92. 8	64. 125	[2] 68. 1

Belly compartment (cu ft)	
Forward	126
Aft	126
Boom hoist (lb)	2, 000

(2) *Clearances.*

Main compartment (ft)		Main loading door (ft)	
Length, overall	49. 7	Height	5. 6
Width, max	8. 6	Width	7. 9
Height, max	7. 8	Height from ground	8. 8

b. C–97.

(1) *Capabilities.*

Compartments	*Total volume (cu ft)*	*Total area (sq ft)*
Main	4, 309	599
Lower	1, 618	222

Electric hoist (lb)	
With snatch block	5, 000
With hoisting block	2, 500
Loading ramps	2 treads
Treadways, single-axle load (lb)	12, 000

[1] 4,000 lb per axle off treadway; 20,000 lb per axle on treadway.

[2] Reduced capacity caused by reserving left half of cargo section for passageway and liferaft storage.

(2) *Clearances (ft).*

Main cabin		Main loading door	
Height	8	Length	14. 3
Length	63. 6	Width	
Width, floor level	8. 8	Fore	9. 3
Cargo door, right side		Aft	6. 4
Height	6. 5	Height from ground	
Width	6. 7	Fore	7. 8
		Aft	9. 6

c. C–119F & G (Navy Equivalent: R4Q–2).

(1) *Capacities, main compartment.*

Floor area (sq ft)	353
Max volume (cu ft)	3, 150

(2) *Clearances (ft).*

Main compartment		Main cargo door	
Length, overall	36. 9	Height	8. 0
Width		Width	
Max	9. 8	Max	9. 8
Min	9. 2	Min	9. 2
Height		Height from ground	4. 0
Max	8. 0		
Clear under trolley	7. 7		

d. C–123B.

(1) *Capacities, main compartment.*

Usable volume (cu ft)	3, 570
Floor area (sq ft)	450

(2) *Clearances (ft).*

Main compartment		Main cargo door	
Length, overall	36. 7	Height	8. 2
Width	9. 2	Width	9. 2
Height	8. 2	Height from ground	2. 6

e. C–124A & G.

(1) *Capacities.*

Main cabin, volume (cu ft)	10, 000
Ramp (lb)	
Either treadway, single-wheel load	10, 000
Both treadways, single-axle load	20, 000
Loading pulleys, at aft fuselage (ultimate lb)	40, 000
Elevator hoist (lb)	16, 000
Limited by elevator-platform floorload limit to	9, 300

(2) *Clearances (ft).*

Main cabin		Main loading door	
Height, usable	11. 6	Height	11. 6
Length, overall	77. 0	Width	11. 3
Width, floor level	11. 3	Height from ground	8. 2

Elevator well	
Length	13. 3
Width	7. 7
Ground to fuselage	13. 0

(3) *Ramp data.*

Type------ Split in 2 treadways, hydraulically operated, stowed in nose, folded.

Incline ---------- 17°

f. C–130A & B.

(1) *Capacities, main compartment.*

Usable volume (cu ft) ---------- 6, 154

Floor area (sq ft) ---------- 676

(2) *Clearances (ft).*

Main compartment		Aft cargo door	
Length	50. 0	Height	9. 0
Width	10. 2	Width	10. 0
Height	9. 1	Height from ground	3. 4

Forward cargo door

Height ---------- 6. 0

Width ---------- 6. 7

Height from ground ---------- 3. 4

g. C–133A.

(1) *Capacities.*

Main compartment		Maximum load (lb)	
Usable volume	13, 000 cu ft	Single axle	20, 000
Floor area	1, 121 sq ft	Dual axle	44, 000
		Tracked	76, 000

(2) *Clearances (ft).*

Main compartment		Aft cargo door	
Length, overall	97. 3	Height	12. 0
Width	11. 8	Width	12. 1
Height, usable	13. 3	Height from ground	4. 2

Side cargo door

Height ---------- 8. 0

Width ---------- 8. 8

Height from ground ---------- 4. 2

(3) *Ramp data.*

Type ---------- Hydraulically operated

Incline ---------- 9°

Toe incline ---------- 15°

Section III. AIRCRAFT OPERATIONS

2.7 Outline Standing Operating Procedure For Air Movements

a. General. Amplification of command policies on use of air transportation (intratheater and intertheater), including responsibilities, utilization, and procedures in the employment of organic aviation units; responsibilities for coordination with Air Force aerial ports.

(1) *Submission of requirements.* Responsibilities for, timing, format, procedures, and policies affecting submission of advance and firm requirements for air movement of supplies and personnel.

(2) *Air tonnage allocations.* Controlling agency; procedures for application, allocation, and use of allocations; formats.

(3) *Air priorities system.* Controlling agency; procedures and responsibilities for application, determination, dissemination, and use of priorities; implementation of command policies and directives.

(4) *Aerial port calls.* Responsibilities and procedures for the issue of port calls for supply and personnel movements, implementation and execution of such calls.

(5) *Special movement control actions.* Special actions required to integrate movement control of air transportation with other applicable modes of transportation.

(6) *Loading and unloading of aircraft.* Policies, responsibilities, and procedures for loading and unloading troops, accompanied supplies, and equipment at aerial ports.

(7) *Diversions and reconsignments.* Authority, procedures, and channels prescribed for effecting and executing diversions or reconsignments

b. Supply Movements.

(1) *Designation for air movement.* Authority for, responsibilities, how accomplished and disseminated, actions to be taken.

(2) *Special packing requirements.* Special instructions for packing or preparing supplies for air movement. Responsibility for packing and inspecting before air movement.

(3) *Special marking.* Types, responsibilities for applying marking on containers and for obliterating old markings.

(4) *Documentation.* Responsibilities and procedures for preparing and distributing established documents.

(5) *Aerial supply.* Amplification of command policies and directives on packaging and delivery responsibilities, methods and procedures for obtaining and accomplishing aerial supply, methods and responsibilities for marking landing or drop zones.

(6) *Records and reports.* Responsibilities and methods of maintenance of specific records, and reference to reports to be submitted.

c. Personnel Movements.

(1) *Preparation for air movement.* Command policies and directives on procedures and requirements for preparing units and individuals for air movement.

(2) *Movement to aerial ports.* Procedures and responsibilities for the movement of units and individuals to aerial ports for air movement.

(3) *Documentation.* Preparation, distribution, and uses of established flight forms and documentation.

(4) *Records and reports.* Responsibilities and methods for maintenance of specific records, and reference to reports to be submitted.

2.8 Outline Standing Operating Procedure For Air Transport Service (Air Force and Army Aviation)

a. General. Policies involved in control, operation, and maintenance of facilities, equipment, and installations; command responsibility; technical supervision required and agencies involved; responsibility for operational control.

b. Mission. Service to be provided by organic aviation units when made available for administrative movements, Air Force troop carrier units, and other aircraft in direct support; extent of operation.

c. Functions.

(1) Scheduled and nonscheduled operations.

(2) Maintenance of equipment: responsibilities, procedures, facilities, inspections.

d. Operational Planning. Personnel, equipment, and supply requirements; capabilities and capacities; communication procedures.

e. Operations. Operational procedures and control; utilization of personnel, equipment, and facilities; priorities; coordination; documentation; records and reports; service to be given personnel and cargo; liaison established between aviation and user units.

f. Maintenance. Responsibilities and procedures for maintenance, regulations, reports, and records.

g. Supply. Responsibilities, authorized levels, procedures and accounting methods for the Air Force.

h. Intelligence. Responsibility for collection, collation, evaluation, and dissemination of air transportation intelligence.

i. Security. Responsibilities, disaster and defense plans, and equipment and supply security.

j. Records and Reports. Responsibilities: technical, operational, personnel, and stock records and reports.

k. Training. Responsibilities: unit and technical training.

2.9 Weight and Balance Terms

a. Aircraft Balance Limits. The maximum forward and maximum aft permissible locations of the aircraft center of gravity expressed as station numbers or as percentages of the mean aerodynamic chord (MAC). If these limits are exceeded, the aircraft will have unsatisfactory flight characteristics.

b. Center of Gravity (CG). The point about which an object would balance if supported at that point; or the point at which the weight of an object or group of objects can be considered concentrated.

c. Reference Datum Line. An imaginary vertical line at or near the nose of the aircraft from which all horizontal distances are measured. Aircraft diagrams show this line as structural station zero.

d. Station Number. A number, generally marked on the interior of an aircraft, indicating a plane extending across the fuselage of the aircraft parallel to the reference datum line and representing the distance from it in inches.

e. Arm. The horizontal distance in inches from the reference datum line to the center of gravity of an object.

f. Moment. The product of a quantity multiplied by its arm. Moments may be expressed in inch-pounds or foot-pounds; for example, 2 pounds (weight) $\times$ 10 inches (arm) $=$ 20 inch-pounds (moment).

g. Allowable Cargo Load. The amount of cargo and troops, determined by weight, cubic displacement, and distances to be flown, which may be transported by aircraft.

h. Basic Weight. The weight of the aircraft, including its operating equipment, but excluding crew, oil, fuel, and cargo. The basic weight varies with modifications and changes in operating equipment.

i. Basic Operating Weight. Basic weight of the aircraft plus minimum crew but excluding fuel and cargo.

j. Ready-for-Loading Weight. Total aircraft, crew, oil, and fuel weight; or the gross weight less cargo; or the basic weight plus crew, oil, and fuel.

k. Normal (Design) Gross Weight. The gross weight on which the aircraft design is based. It is the maximum weight at which the aircraft can be flown and still meet the load and safety factors established by design specifications.

l. Maximum (Alternate) Gross Weight. A gross weight in excess of the design gross weight. The maximum alternate gross weight is normally used in combat operations, but does not afford any margin of safety.

2.10 Calculating Safe Placement of Aircraft Loads

a. The general rules for determining the placement of a given load so as to cause the center of gravity of the aircraft to fall within safe limits are as follows:

(1) Establish a reference datum line.

(2) Determine the center of gravity of each item involved in the loading. This will be required for computations in (7) below.

(3) Select from design data the desirable center of gravity at which the loaded aircraft should balance.

(4) Compute the desired load moment (the ready-for-loading weight of the aircraft and its load multiplied by the distance between the desirable center of gravity and the reference datum line).

(5) Subtract the moment of the ready-for-loading aircraft from the moment of the loaded aircraft.

(6) Obtain the arm (station number) at which to place the load in the aircraft, by dividing the weight of the load into the

difference between the gross moment and the ready-for-loading moment.

(7) The arm thus obtained will apply to the point at which the load is concentrated. It must be borne in mind that for multiple-piece loads the moment which applies to the point of load concentration is equal to the sum of the moments for each piece.

(8) Verify that the load will fit into the aircraft at the desired station.

b. For accurate weight and balance determination, see TM 1-series (–5, Basic Weight Checklist and Loading Data) for the appropriate aircraft.

2.11 Air Movement Designator

ET—US—3R—5671—GF—6

Destination .... Month of shipment
Origin .... Shipping agency
Priority .... Serial number
General classification

2.12 Cargo Priorities

Number	*Type*	*Description*
1	Emergency	Need so acute that precedence should be given over all other traffic.
2	Urgent	Essential to national security.
3	Important	Necessary in interest of national security.
4	Qualifies	Qualifies for air transportation.

2.13 Lashing Terms

a. Applied Load. The total stress or load imposed upon one cargo tiedown fitting. The applied load equals the tensile strength of all the cargo tiedown devices attached to one cargo tiedown fitting.

b. Cargo Tiedown Pattern. The location and spacing of the cargo tiedown fittings in the floor, ceiling, or walls of an aircraft.

c. Load Spreader. Wooden planks or similar material placed on the cargo compartment flooring of an aircraft to distribute the load reactions of the cargo over a greater area and reduce the floor bearing pressure.

d. Rated Strength. The safe-load capacity of a cargo tiedown fitting or lashing with an applied safety factor. In many cases, the rated strength of a cargo tiedown fitting is restricted by the angle of application of the load.

2.14 Lashing Strengths

All lashings should be secured at an angle of 45° with the cargo floor and 45° in the direction of expected thrust (fig. 2.13) or with the long axis of the cargo compartment, except for assault-type aircraft. Cargo in the C–123 and C–130 aircraft should be secured at an angle of 30° with the cargo floor and 30° in the direction of the expected thrust. The strength of tiedown fittings must be kept in mind. The strongest lashing is no stronger than the fitting to which it is attached. *If a lashing is stretched to its breaking point,* the fitting is stressed an amount equal to the *full tensile strength* of the lashing.

a. Flexible lashings secured at angles of 45° with the cargo floor and in the direction of expected thrust will hold approximately 70 percent of their rated tensile strength against forward and rearward thrusts, 70 percent of their rated tensile strength against vertical thrusts, and 0 percent of their rated tensile strength against sideward thrusts.

b. Flexible lashings secured at angles of 45° with the cargo floor and 45° with the main axis of the cargo compartment will hold approximately 50 percent of their rated tensile strength against forward or rearward thrusts, 50 percent of their rated tensile strength against sideward thrusts, and 70 percent of their rated tensile strength against vertical thrusts. In this type of lashing arrangement only the lashings for forward and rearward thrusts need be computed. The lashings used to hold the equipment against forward and rearward thrusts are more than enough to secure the load against sideward and vertical thrusts.

c. Flexible lashings secured at angles of 30° with the cargo floor and 30° with the main axis of the cargo compartment will hold approximately 75 percent of their rated tensile strength against forward and rearward thrust, 50 percent of their rated tensile strength against vertical thrust, and 43 percent of their rated tensile strength against

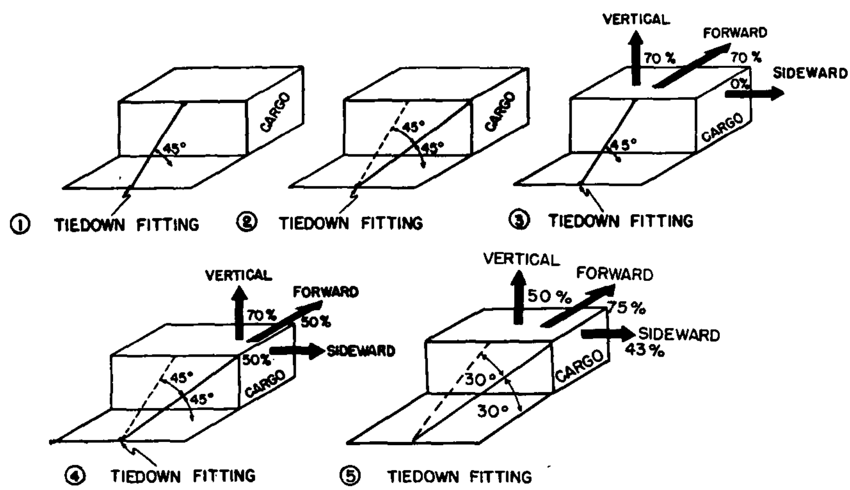


Figure 2.13. Lashings at 45° and 30° angles.

sideward thrust. Lashings computed at 30° angles need only be computed for sideward thrust because the lashings used to hold the equipment against sideward thrust are enough to secure the load against forward, rearward, and vertical thrusts.

2.15 Lashing Constants and Formulas

a. Restraint Constants Per 1,000 Pounds of Cargo.

Strength of tiedown system	Angle of tie								
	45°–45°							30°–30°	
	Restraint safety factors							Restraint safety factors	
	1.5G	2.0G	2.25G	3.0G	4.0G	4.5G	8.0G	2.0G	8.0G
25,000-lb (D–1 or MB–2 device).									
25,000-lb fitting	0.12	0.16	0.18	0.24	0.32	0.36	0.64	0.11	0.43
10,000-lb (C–2 or MB–1 device).									
10,000-lb fitting	.3	.4	.5	.6	.8	.9	1.6	.27	1.1
7,000-lb (C–2 or MB–1 device).									
7,000-lb fitting	.5	.6	.7	.9	1.2	1.3	2.3		
5,000-lb (B–1 or MC–1 device).									
5,000-lb fitting	.6	.8	.9	1.2	1.6	1.8	3.2	.53	2.1
2,000-lb (½-in. rope).									
5,000-lb fitting	1.5	2.0	2.3	3.0	4.0	4.5	8.0	1.3	5.3
1,250-lb (A–1 device).									
1,250-lb fitting	2.4	3.2	3.6	4.8	6.4	7.2	12.8		
1,150-lb device and fitting	2.7	3.5	4.0	5.3	7.0	7.9	14.0		

This table was derived from the formula:

$$\frac{1{,}000 \times G \times 100}{R \times \%\ \text{effectiveness of lashing system}} = \text{constant per 1,000 lb of load}$$

where

G = gravitational pull
R = rated tensile strength of lashing

b. Formula for Computing Number of Lashings Required.

$$\frac{\text{Weight of cargo} \times K}{1{,}000} = \text{number of lashings required}$$

where

K = constant found in table in *a* above.

2.16 Tiedown Devices

The following table gives the number of tiedown devices, by type, which the Air Force will furnish on each aircraft listed.

Type	C–46, C–47	C–54	C–74	C–97	C–119	C–121	C–123	C–124	C–130A, C–130B	C–133A
Tiedown cargo strap A1A, 1,250-lb cap	15	40	60	60	25	25	20	60	10	0
Tiedown cable B–1, 5,000-lb cap	5	5	15	12	10	5	10	50	0	0
Tiedown chain C–2, 10,000-lb cap	0	8	20	20	28	0	35	24	24	(*)
Tiedown chain D–1, 25,000-lb cap	0	0	0	0	0	0	0	24	14	(*)
Tiedown device MC–1, 5,000-lb cap	0	0	0	0	0	0	0	0	10	(*)
Tiedown device MB–1, 10,000-lb cap	0	0	0	0	0	0	0	0	24	(*)
Tiedown device MB–2, 25,000-lb cap	0	0	0	0	0	0	0	0	14	0
Cargo net, steel cable, A2, 10,000-lb cap	0	0	0	0	0	0	0	0	3	0

*Must be requisitioned from Squadron Supply for each specific mission.

2.17 Typical Loads

See TM 57–210 or TM 1-series (–9, Loading Instruction) for the applicable aircraft for typical loads. Cargo having dimensions which approach cargo-door dimensions should be measured carefully. Five-inch clearance should be allowed for cargo that may have to be put through the door at an angle because of ramp loading.

2.18 Standard Parachutes and Carrying Capacities

Parachute	*Diameter (ft)*	*Recommended load weight (lb)*
G–1, G–1A	24	300
G–12	64	2, 200
G–13	32. 4	500
G–11, G–11A	100	2, 500

2.19 Aerial Delivery Containers and Typical Loads

In the following table the G–12D or G–13 parachute is used.

Container	*Average safe load (lb)*	*Typical load*
A–5	60–300	Packaged fragile and nonfragile supplies
A–7	60–300	Packaged nonfragile supplies
A–7A	100–500	Packaged nonfragile supplies
A–21	100–500	Fragile and nonfragile supplies
A–22	500–2, 200	Fragile and nonfragile supplies

2.20 Loading or Unloading Time for Army Aircraft

a. Rotary-Wing Aircraft.

(1) Troops—3 minutes.
(2) Casualties—10 minutes.
(3) Cargo, in fuselage—5 minutes.
(4) Cargo, external load—30 seconds.
(5) Refueling:
(*a*) Observation (H–13 and H–23)—7 minutes.
(*b*) Utility (H–19 and H–U1)—10 minutes.
(*c*) Light transport (H–21 and H–34)—15 minutes.
(*d*) Medium transport (H–37)—20 minutes.

b. Fixed-Wing Aircraft.

(1) Troops—approximately 2 to 3 minutes, depending on aircraft.
(2) Casualties—10 minutes.
(3) Cargo, in fuselage:
(*a*) Load—10 to 30 minutes, depending on cargo.
(*b*) Unload—5 minutes.
(4) Cargo, external load:
(*a*) Load—10 minutes.
(*b*) Air-landed—10 minutes.
(*c*) Parachute—30 seconds.
(*d*) Free fall—10 seconds.
(5) Refueling:
(*a*) Observation, light (L–19)—5 minutes.
(*b*) Utility (L–20)—8 minutes.
(*c*) Transport (U–1A)—15 minutes.
(*d*) Staff transport (L–23)—10 minutes.

2.21 Maximum Ground Times for Air Force Aircraft

The following information may be used for general planning purposes.

a. All Cargo Flights. Maximum ground time at point of origin is 3 hours; 2 hours is maximum time at en route bases. At destination bases where only off-loading is done, 2.5 hours is ground time.

Aircraft	*On-load bases (hours)*	*Destination bases (off-loading and reloading) (hours)*
C–54	2. 5	3
C–97	4. 5	6
C–119	2. 5	3
C–123	2. 5	3
C–124	4. 5	6
C–130 A & B	3. 5	4
C–133A	4. 0	5

b. All Passenger Flights. All Air Force aircraft have maximum ground times of 2.5 hours at on-load bases and 3 hours at destination bases for off-loading and reloading.

2.22 Aircraft Landing Sites

(See FM 57-35, FM 1-100, and TM 5-251.)

Section IV. AIRCRAFT MAINTENANCE AND SUPPLY

2.23 Availability of Army Aircraft

Availability factors for Army aircraft are operational targets developed by the Chief of Transportation. These operational targets will be revised as more experience is accumulated in aircraft operation, maintenance, and attendant availability factors. The appropriate supply bulletin should be consulted for the latest availability factors.

2.24 Maintenance Man-Hour Requirements per Flying Hour

Type aircraft	*Organizational maintenance* [1]	*Field maintenance* [2]	*Total*
H-13 (Sioux)	4	5	9
H-19 (Chickasaw)	7	9	16
H-21 (Shawnee)	10. 8	10	20. 8
H-23 (Raven)	4	5	9
H-34 (Choctaw)	10. 8	13	23. 8
H-37 (Mojave)	15. 6	18	33. 6
H-U1 (Iroquois)	6	9	15
L-19 (Bird Dog)	3	2	5
L-20 (Beaver)	4	3	7
L-23 (Seminole)	6	4	10
U-1 (Otter)	6	4	10

[1] See SR 310-30-15 for current aircraft maintenance man-hour requirements.

[2] Field maintenance will normally be 80 percent third echelon and 20 percent fourth echelon.

2.25 Direct Productive Maintenance Man-Hour Analysis for a Given Period

The following examples show a direct productive maintenance man-hour analysis for a given period. A period of one month is used for purposes of this manual.

a. Determination of man-hour requirement, where—

20 = number of aircraft
3 = organizational maintenance man-hours required to produce 1 flying hour
26 = monthly programed flying hours
$20 \times 3 \times 26 = 1{,}560$ minimum maintenance man-hours required per month

b. Determination of maintenance man-hours available, where—

8 = number of direct maintenance personnel available
8 = hours per workday
20 = workdays per month
24 = percent of time off due to leave, KP, guard, sickness, etc. (based on local situation and specific period of time)
$8 \times 8 \times 20 = 1{,}280$ maintenance man-hours per month
$0.24 \times 1{,}280 = 973$ maintenance man-hours available

c. Comparison of maintenance capability with maintenance workload, using results computed in *a* and *b* above.

$973-1{,}560=-587$, which shows a deficit, or shortage, in the number of man-hours available

d. Computation of direct maintenance personnel requirements, using the following formula.

$$\text{Direct maintenance personnel required}=\frac{\text{No. of acft}\times\text{man-hours per flying hour}\times\text{ monthly programed flying hours}}{\text{maintenance hours available per man per month}}$$

Example: Determine the number of direct maintenance personnel working a 6-day week, 12 hours per day, to perform field maintenance on 20 H–34 (Choctaw) aircraft flying 40 programed hours per month, using 26 workdays per month, and 13 man-hours per flying hour (par. 2.24). Assume 24 percent time off due to leave, KP, etc.

$$\text{Direct maintenance personnel}=\frac{20\times13\times40}{12\times26\times.24}=44$$

2.26 Helicopter Planning Factors

a. Hours of Operation. Four hours per 24-hour day. Twenty hours a day required for terminal service.

b. Operating Speed. Number of statute miles traveled in 1 hour equals normal cruising speed less 15 miles per hour. This allows for reduction in speed prior to landing and immediately after takeoff.

CHAPTER 3
MOTOR TRANSPORT

Section I. ORGANIZATION

3.1 Organization of Motor Transport Units

Unit	*TOE*	*Mission and/or capability*	*Assignment*
Headquarters and headquarters company, transportation highway transport command.	55–11	To command, perform operational planning and supervision, coordinate, and control the activities of transportation motor transport groups (3–7), and other assigned or attached units as required.	Normally 1 per logistical command, or may be assigned to an army or higher headquarters.
Headquarters and headquarters company, transportation truck group.	55–12	To command transportation truck battalions (3–7).	To an army, logistical command, or zone of the interior as required.
Headquarters and headquarters company, transportation truck battalion.*	55–16	To provide command and supervision of units engaged in all types of motor transport operations (including amphibious truck) (3–7 companies).	To a transportation truck group, highway transport command, logistical command; or may operate separately under supervision of appropriate staff transportation officer.
Transportation light truck company.*	55–17	To provide transportation for movement of personnel and general cargo by motor transport.	To logistical command or field army, transportation truck battalion, or may operate separately under supervision of appropriate staff transportation officer.
Transportation medium truck company.*	55–18	To provide truck transportation for the movement of general cargo, bulk petroleum products, refrigerated cargo, and missiles.	To a logistical command or field army, transportation truck battalion, or may operate separately under supervision of appropriate staff transportation officer.

*May be adapted to use non-U.S. personnel; see type B column of appropriate TOE.

Unit	TOE	Mission and/or capability	Assignment
Transportation car company.	55–19	To transport personnel and light cargo by motor vehicles.	To a transportation truck battalion, a theater headquarters, an army, logistical command, or may operate separately under the supervision of appropriate transportation officer.
Transportation cargo carrier company (tracked).	55–27	To transport personnel and cargo in tactical or logistical operations in arctic regions where conventional vehicles cannot be used.	To an infantry division for arctic operations, or to field army or logistical command as required.
Transportation heavy truck company*	55–28	To provide truck transportation for movement of heavy or bulky vehicles and/or outsized cargo.	To a transportation truck battalion, or may operate separately under supervision of appropriate staff transportation officer.
Headquarters and headquarters detachment, transportation tactical carrier battalion.	55–46	To provide command and administration for transportation tactical carrier companies.	To a corps or field army (normally 2 per corps).
Transportation tactical carrier company.	55–47	To provide protected tactical mobility, resupply or evacuation of casualties in direct support of combat elements of divisions or special task forces.	To a corps or field army, normally in a transportation tactical carrier battalion, or may operate separately under the supervision of the appropriate staff transportation officer.
Transportation battalion, infantry division.	55–75	To provide tactical mobility to assault elements of an infantry division for pursuit, exploitation, and other tactical task-force type requirements.	Organic to infantry division, TOE 1–7T ROCID (1 per division).
Headquarters and headquarters company, transportation battalion, infantry division.	55–76	To provide command and administration for assigned units.	To transportation battalion, infantry division, TOE 55–75 ROCID (1 per battalion).

See footnote 1 on page 33.

Unit	TOE	Mission and/or capability	Assignment
Truck company, infantry division.	55–77	To provide transportation for the tactical and logistical movement of personnel and cargo of an infantry division.	Organic to transportation battalion, infantry division, TOE 55-75 ROCID (1 per battalion).
Armored carrier company, infantry division.	55–78	To provide certain combat elements of the infantry division protected tactical mobility with armored personnel carriers.	Organic to transportation battalion, infantry division, TOE 55–75 ROCID (2 per battalion).
Transportation amphibious truck company.	55–137	To provide amphibious transportation for movement of cargo and personnel from ship to shore or shore to shore.	To theater of operations (attached to transportation terminal battalion) or to a transportation truck battalion, or may operate separately under supervision of appropriate staff transportation officer. Usually 1 allocated per 720 ST cargo to be moved daily by amphibious vehicles.
Team GF, trailer transfer point, operating.	55–500	To operate a trailer transfer point in conjunction with a line-haul operation (250 12-ton trailer units in-and-out per day).	To transportation highway transport command (1 per each trailer transfer point in operation).
Team GG, highway regulation point.	55–500	To operate a highway regulation point on a 24-hour-per-day basis to avoid congestion and conflict of traffic and to enable changes in convoy orders at any time to conform to changes in destination, routing, and priorities.	To a logistical command or field army, with attachment to transportation truck group. Normally 1 team assigned for each 30 to 40 miles of road net along which highway regulation is maintained.

Section II. ORGANIC VEHICLES AND EQUIPMENT

3.2 Vehicle Characteristics

Type (Normally assigned to U.S. or allied motor transport units)	Combination[1]	Bridge class	Dimensions (in.)			Net weight (lb)	Pax and eqp[2]	Shipping dimensions (uncrated)			Fuel loaded (mpg)	Fuel tank cap. (gal.)
			Length	Width	Height (max)			Cu ft	Sq ft	MT		
Automobile, sedan, lt, Chev		2	197	74	66	3,220	4	550	100	13.7	14	16
Automobile, sedan, med, Buick		2	204	80	64	3,786	4	596	112	14.9	13	19
Bus, 37-pax, 4 x 2, M37RC		13	411	96	120	16,300	37	2,740	274	68.5	4	75
Carrier, 1½T, cargo, amph, T46E1		6	193	98	104	8,813	8	1,180	132	29.5	2.3	70
Carrier, pers, tracked, armd, M59		19	221	129	94	38,700	11	1,520	186	38.1	1	135
Station wagon, 8-pax, M2119		2	198	74	70	3,580	8	593	102	14.8	12	16
Stlr, 6T, cargo, 2W, M118	10–13	11	276	93	133	7,140		1,559	184	39		
Stlr, 6T, tanker, 2W, M30	10–13	9	240	96	93	6,750		1,790	161	44.7		
Stlr, 6T, van, 2W, M119	10–13	11	275	93	104	7,180		2,023	184	50.5		
Stlr, 10T, S&P, 2W, SKD2361	10–13	14	307	96	108	9,430		1,785	204	44.7		
Stlr, 12T, tanker, 4W, M131	11–13	22	353	96	109	14,850		2,203	235	55		
Stlr, 12T, S&P, 4W, M127	11–13	25	345	97	109	13,500		2,096	232	52.2		
Stlr, 12T, low-bed wrecker, 4W, M270	11–13	23	591	97	121	17,500		1,770	393	44.3		
Stlr, 45T, transporter, 8W, M15A1	14–16	49	462	150	105	42,370		3,490	398	87.5		
Tlr, ¼T, amph, cargo, 2W, M100	1	N/A	109	57	42	565		149	43	3.7		
Tlr, ¾T, cargo, 2W, M101	2,3	N/A	147	74	83	1,340		520	75	13		
Tlr, 1T, cargo, 2W, T6	4–8	N/A	146	72	73	1,300		437	72	11		
Tlr, 1½T, cargo, 2W, M104	4–8	6	166	83	100	2,400		462	96	11.6		
Tlr, 1½T, water tank, 2W, M106	4–9	4	167	93	80	2,280		700	105	17.5		
Trk, ¼T, 4 x 4, util, M38A1	1	N/A	133	62	74	2,625	3	266	57	6.7	12	13
Trk, ½T, 4 x 2, pickup, Chev, M3104		N/A	197	75	76	3,330	1	650	103	16.2	11	17½
Trk, ¾T, 4 x 4, ambulance, M43		4	199	74	92	7,150	¾	790	104	19.8	9	24
Trk, ¾T, 4 x 4, cargo, M37	2	4	190	74	90	5,917	9	503	95	12.6	9	24
Trk, 1T, 4 x 4, pickup, M4-73-4WD	3	5	184	75	75	3,240	1	591	96	14.8	17	15
Trk, 1½T, 4 x 2, cargo, S&P, Chev, M4409		8	265	88	88	5,675	2	1,181	161	29.5	8	17½
Trk, 1½T, 4 x 4, cargo, G7127		8	296	86	106	8,150	20	1,282	177	32	6	30
Trk, 2½T, 4 x 2, S&P, M-K7		9	316	96	89	8,337	1	1,552	210	38.8	9	31
Trk, 2½T, 6 x 6, cargo, LWB, M35	4	11	262	96	111	12,465	20	1,610	174	40.2	5	50

Trk, 2½T, 6 x 6, cargo, SWB, CCKW352	5	11	245	88	93	10, 350	16	1, 136	147	28. 5	5	40
Trk, 2½T, 6 x 6, cargo, LWB, w/w, M35	6	11	275	96	111	12, 880	20	1, 690	183	42. 4	5	50
Trk, 2½T, 6 x 6, cargo, wo/w, M135	7	11	267	88	105	12, 330	20	1, 425	163	35. 7	4	56
Trk, 2½T, 6 x 6, shop van, CCKW353	8	7	256	96	118	10, 100	1	1, 690	171	42. 4	5	40
Trk, 2½T, 6 x 6, tanker, water, CCKW353	9	8	254	90	95	11, 913	1	1, 260	159	31. 5	5	40
Trk, 4-5T, 4 x 4, tractor, M444T	10	10	204	95	113	11, 660	1	1, 260	135	31. 4	3	60
Trk, 5T, 4 x 2, tractor, M426	11	6	200	98	107	12, 100	1	1, 182	136	29. 6	3	80
Trk, 5T, 6 x 6, cargo, M54	----------	14	299	97	116	19, 230	22	1, 945	201	48. 7	2. 5	78
Trk, 5T, 6 x 6, cargo, LWB, w/w, M54	----------	14	310	97	116	19, 945	22	2, 046	211	51. 2	2. 5	78
Trk, 5T, 6 x 6, dump, M51	----------	20	267	97	111	21, 981	1	1, 657	179	41. 3	2. 5	110
Trk, 5T, 6 x 6, tractor, M52	12	11	258	97	102	18, 996	1	1, 500	174	37. 5	2. 5	110
Trk, 5T, 6 x 6, tractor, wrecker, LWB, w/w M246	13	25	353	100	132	32, 830	1	2, 626	238	65. 9	3. 5	78
Trk, 5T, med wrecker, w/w M62	----------	21	310	97	103	33, 675	----------	2, 486	234	62	2. 5	78
Trk, 6T, 6 x 6, wrecker, M1A1	----------	20	348	100	117	30, 000	----------	1, 900	195	47. 5	2	100
Trk, 10T, 6 x 6, tractor, M123	14	18	280	114	112	32, 250	1	2, 070	163	51. 8	1. 8	166
Trk, 12T, 6 x 6, tractor, M26	15	28	306	131	123	48, 895	----------	2, 957	278	74	1	120
Trk, 15T, 8 x 8, tractor, M194	16	48	338	124	109	45, 000	----------	2, 500	291	62. 5	----------	--------

[1] Trailers and semitrailers will form combinations with trucks with the same number.

[2] Does not include crew.

[3] Litters.

Type (Normally assigned to U.S. or allied motor transport units)	POL for 100 miles (loaded)				Towed loads (lb)		Payloads (lb)		Cargo carrying dimensions (in.)			Loading height (in.)	Cruising range loaded (miles)
	Fuel (gal.)	Oil (gal.)	Lube (lb)	Grease (lb)	Hwy opns	Inferior roads	Hwy opns	Inferior roads	Length	Width	Height		
Automobile, sedan, lt, Chev	7.2	0.2	0.1	0.1			800						224
Automobile, sedan, med, Buick	7.7	0.2	0.1	0.1			750						247
Bus, 37-pax, 4 x 2, M37RC	25.0	0.6	0.3	0.4			8,700						300
Carrier, 1½T, cargo, amph, T46E1	50.0	2.8	1.9	0.9		6,000		3,000					161
Carrier, pers, tracked, armd, M59	100.0	2.0		2.0				3,100					135
Station wagon, 8-pax, M2119	8.3	0.2	0.1	0.1			1,400						192
Stlr, 6T, cargo, 2W, M118							16,200	12,000	266	88	48	48	
Stlr, 6T, tanker, 2W, M30							12,200						
Stlr, 6T, van, 2W, M119							16,200	12,000	266	87	55	47	
Stlr, 10T, S&P, 2W, SKD2361							22,000	20,000	300	87	48	53	
Stlr, 12T, tanker, 4W, M131							30,540	19,620					
Stlr, 12T, S&P, 4W, M127							36,000	24,000	335	88	48	61	
Stlr, 12T, low-bed wrecker. 4W, M270							40,000	24,000	480	96		49	
Stlr, 45T, transporter, 8W, M15A1							90,000		292	150		40	
Tlr, ¼T, amph, cargo, 2W, M100							750	500	72	38	18	42	
Tlr, ¾T, cargo, 2W, M101							2,250	1,500	96	65	48	35	
Tlr, 1T, cargo, 2W, T6							3,000	2,000	96	46	44	31	
Tlr, 1½T, cargo, 2W, M104							5,500	3,000	110	74	60	40	
Tlr, 1½T, water tank, 2W, M106							3,335						
Trk, ¼T, 4 x 4, util, M38A1	8.3	0.2	0.2	0.2	2,000	1,500	1,200	800					156
Trk, ½T. 4 x 2, pickup, Chev, M3104	9.2	0.2	0.2	0.2	2,000	1,500	1,270		78	50	16	30	192
Trk, ¾T, 4 x 4, ambulance, M43	11.1	0.2	0.3	0.3	3,000	1,000	1,400					34	216
Trk, ¾T, 4 x 4, cargo, M37	11.1	0.2	0.3	0.3	6,000	4,000	2,000	1,500	78	64	55	30	216
Trk, 1T, 4 x 4, pickup, M4-73-4WD	5.9	0.2	0.3	0.3	3,000	2,000	2,060		78	48	13	28	255
Trk, 1½T, 4 x 2, cargo, S&P, Chev, M4409	12.5	0.2	0.3	0.3	5,000	2,000	6,825	3,000	141	80	38	49	140
Trk, 1½T, 4 x 4, cargo, G7127	16.6	0.2	0.3	0.3	8,000		4,800	3,350	180	70	59	47	180
Trk, 2½T, 4 x 2, S&P, M-K7	11.1	0.4	0.3	0.4	6,000	3,000	7,000	5,000	192	90	42	46	279
Trk, 2½T, 6 x 6, cargo, LWB, M35	20.0	0.4	0.8	0.4	10,000	6,000	10,000	5,000	147	88	60	51	250
Trk, 2½T, 6 x 6, cargo, SWB, CCKW352	20.0	0.4	0.8	0.4	10,000	6,000	10,000	5,350	120	81	64	48	200
Trk, 2½T, 6 x 6, cargo, LWB, w/w, M35	20.0	0.4	0.8	0.4	10,000	6,000	10,000	5,000	147	88	60	51	250
Trk, 2½T, 6 x 6, cargo, wo/w, M135	25.0	0.4	1.6	0.4	10,000	6,000	10,000	5,000	147	80	60	45	224
Trk, 2½T, 6 x 6, shop van, CCKW353	20.0	0.4	0.8	0.4	10,000	6,000	9,200	5,350	144	81	64	48	200

Trk, 2½T, 6 x 6, tanker, water, CCKW353	20.0	0.4	0.8	0.4	10,000	6,000	----------	5,350	----------	----------	----------	----------	200
Trk, 4-5T, 4 x 4, tractor, M444T	33.2	0.6	0.3	0.4	20,000	10,000	9,350	----------	----------	----------	----------	----------	180
Trk, 5T, 4 x 2, tractor, M426	33.2	0.6	0.3	0.4	30,000	15,000	15,400	13,000	----------	----------	----------	----------	240
Trk, 5T, 6 x 6, cargo, M54	40.0	0.8	0.4	0.5	30,000	15,000	20,350	10,350	168	88	60	54	195
Trk, 5T, 6 x 6, cargo, LWB, w/w, M54	40.0	0.9	0.4	0.5	30,000	15,000	20,350	10,350	168	88	60	54	195
Trk, 5T, 6 x 6, dump, M51	40.0	0.8	0.4	0.5	30,000	15,000	20,350	10,350	125	82	23	58	275
Trk, 5T, 6 x 6, tractor, M52	40.0	0.6	0.9	0.8	30,000	15,000	25,000	15,000	----------	----------	----------	----------	275
Trk, 5T, 6 x 6, tractor, wrecker, LWB, w/w M246	28.7	0.8	0.4	0.5	46,000	37,500	16,000	12,000	----------	----------	----------	----------	273
Trk, 5T, med wrecker, w/w M62	40.0	0.8	0.4	0.5	30,000	20,000	12,000	7,000	----------	----------	----------	----------	195
Trk, 6T, 6 x 6, wrecker, M1A1	50.0	0.8	0.4	0.5	60,000	40,000	8,000	----------	----------	----------	----------	----------	200
Trk, 10T, 6 x 6, tractor, M123	55.0	1.5	0.9	1.1	100,000	----------	35,000	30,000	----------	----------	----------	----------	300
Trk, 12T, 6 x 6, tractor, M26	100.0	1.5	0.9	1.1	117,500	----------	60,000	----------	----------	----------	----------	----------	120
Trk, 15T, 8 x 8, tractor, M194	----------	1.7	1.1	1.3	150,000	125,000	51,000	43,000					

3.3 Typical Truck Equipment for Motor Transport Units

a. On-Vehicle Material. Equipment listed is typical but subject to change. For exact quantities the latest authorizations must be checked.

Items	*Truck* ¼T	¾T	2½T	5T
Bag, tool	1	1	1	1
Bracket, drum, flammable	1	1	1	1
Bracket, tool, pioneer equip	----	1		
Chain, tow, 7/16 in. × 16 ft	----	----	*1	
Chain, tow, 5/8 in. × 16 ft	----	--	----	1
Handle, wheel stud nut	1	1	1	1
Hose, tire inflation	----	----	1	1
Jack, 1½-ton cap	1			
Jack, 3-ton cap	----	1	1	
Jack, 8-ton cap	----	----	----	1
Pliers, comb, slip joint, 8-in	1	1	1	1
Screwdriver, common, hv duty, 4-in	----	1		
Screwdriver, common, hv duty, 6-in	1	----	1	
Screwdriver, common, hv duty, 9-in	----	----	----	1
Screwdriver, Phillips, No. 1	----	----	1	
Screwdriver, Phillips, No. 2	----	----	1	
Screwdriver, Phillips, No. 3	----	1		
Wrench, adj, 8-in	1	1	1	1
Wrench, plug, straight bar	1	1	1	1
Wrench, wheel stud nut	1	1	1	1

* Issued on truck with winch.

b. TOE Material. The issue of this material varies with each type truck. It includes—

- Axe, chopping, single bit
- Flashlight, MX–991 U
- Goggles, M–1944
- Mattock, pickhandled
- Mount, ring
- Shovel, hand, GP, D-handle
- Tube, flexible nozzle

c. Special Material. The following material is issued as required:

Chains, tire, pair	As required by local weather conditions
Extinguisher, fire CCl_4, 1-qt	As authorized by AR 385–55
Kit, deepwater fording Kit, winterization	When authorized by theater of operations commander

Section III. OPERATIONS

3.4 Outline Standing Operating Procedure for Motor Transport Movements

a. General. Policies and factors involved in movements via highway.

(1) *Highway regulations.* Purpose, application or scope, responsibilities, methods and procedures for accomplishment.

(2) *Convoy clearance.* Minimum vehicle requirements, convoy symbols, and procedures; format for requesting and furnish-

ing clearance; routing; halts; convoy composition; restrictions on tracked or outsized vehicles.

(3) *Highway regulation points.* Purpose, establishment basis, responsibilities and procedures for operation, required records

(4) *Traffic control.* Responsibilities, relationship to highway regulation, coordination measures effected with provost marshal.

(5) *Return loads.* Policies, methods, and procedures for securing and reporting.

(6) *Convoy commanders.* Appointment, responsibilities and functions, relationships with transportation personnel, instructions to be furnished.

(7) *Halts.* Types, policies, procedures, and responsibilities for establishment and conduct of halts, area policing.

(8) *Security.* Responsibilities and methods of conducting defensive measures.

(9) *Records and reports.* Responsibilities and methods for maintenance of required records, reference to reports to be submitted.

b. Supply Movements.

(1) *Releases.* When required, methods of obtaining, formats, dissemination, actions required.

(2) *Diversions and reconsignments.* Authority to effect diversions with consideration for various command areas, procedures for initiating requests, and execution.

(3) *Records and reports.* Types of records required to be maintained on supply movements, reference to reports to be submitted.

3.5 Outline Standing Operating Procedure for Motor Transport Service

a. General. Policies involved in control, operation, and maintenance of facilities, equipment, and installation; command responsibility; technical supervision required and agencies involved.

b. Mission. Service provided, extent of operation.

c. Functions.

(1) Scheduled and nonscheduled operations.

(2) Maintenance of equipment—responsibilities, procedures, facilities, and inspection practices.

d. Operational Planning. Computation of troop and equipment requirements, capability estimate, communication procedure and requirements, rehabilitation requirements.

e. Operations. Operational procedures and controls, pooling and utilization of equipment.

f. Maintenance. Responsibilities and procedures for maintenance, regulations and reports.

g. Supply Procedure. Responsibilities for supplies, authorized levels, requisitioning procedures, accounting methods, disposal of excesses.

h. Intelligence and Reconnaissance. Responsibility for collection, collation, evaluation, and dissemination of highway transportation intelligence and reconnaissance information.

i. Security. Responsibilities, plans—disaster and defense, convoy and cargo security, equipment and facilities.

j. Records and Reports. Responsibility, operational and personnel status reports, technical reports, miscellaneous.

k. Training. Responsibility—unit and technical training.

3.6 Operation Order Outline

Operation order for highway movement should contain the type of information outlined below.

a. Heading. The headquarters preparing the order, the location, date, hour, order number, and the task unit.

b. Situation. State "No change" or give additional information.

c. Mission.

(1) Request No. ______________ Date and hour ______________

(2) By rank and name ______________________________

Orgn ______________________________ Phone ______________

(3) To transport ______________________________

(Tonnage) (Type of cargo) (No. personnel)

Cube ______________________

Cargo peculiarities ______________________________

(Height, width, odd shape, etc.)

No. and type vehicle required ______________________________

(4) Capabilities.

Origin ______________________ Loading time ______________

Destination ______________________ Unloading time ______________

d. Execution.

(1) Report to ______________________________

(Rank, name and title)

Location (point of origin) ______________________________

Time and date (spot) ______________________ Phone ______________

Time and date (move) ______________________________

(2) On arrival at destination report to ______________________________

(Name and rank)

Location ______________________________

Time and date ______________________ Phone ______________

(3) Operations.

One-time ______________ Recurring ______________ If recurring operation:

From ______________________ Through ______________________

(4) Pertinent road information ______________________________

____

(5) Shipment (has) (has not) been coordinated with both consignor and consignee.
(6) It (is) (is not) an emergency movement. If emergency, authorized by ______________________
(Name and rank) (Organization)
______________________ Phone ________
(7) Pickup, movement, and delivery schedule (trailers):
Bn (spot) (pickup) trailer(s) at origin ____________
Bn move trailer(s) from ____________ to ____________
By date and hour ______________________
Bn move trailer(s) from ____________ to ____________
By date and hour ______________________
Bn move trailer(s) from ____________ to ____________
Bn deliver trailer(s) to destination for (unloading) (return loads) and/or (return) ______________________

e. Administrative and Logistical Matters.
(1) Class I______________________
(2) Class III______________________
(3) Billets and/or meals: Origin__________ Dest.__________
(4) Other information______________________
____

f. Command and Signal.
(1) Report to this headquarters, by phone, departure and arrival dates and times.
(2) Coordination of highway movement will be in accordance with BaLog Comd SOP No. 6, Highway Regulation, 195–.
(3) Special instructions pertaining to operation, if any:

s/

Authentication:
Distribution:

3.7 Circulation Maps
(fig. 3.1)

a. Circulation maps are used to indicate a road net or system of routes, and to give necessary information and traffic restrictions pertaining thereto.

b. The circulation map establishes one-way, two-way, and alternating routes of traffic flow. Care must be taken to insure that routes are available for a circuitous flow in the required directions. A one-way route normally requires a compensating route in the opposite direction for the return of vehicles. Adequate access and egress routes must be provided along all routes. Where the balance between main routes and access-egress routes is not maintained, the capability of main routes may be limited to the capability of the access or egress facilities.

c. Circulation maps show such information as open, supervised, express, dispatch, and reserved routes; light lines; area boundaries;

mileage between important points; bridge and other weight limitations; restrictions on speed, density, etc.; and location of dumps, depots, highway traffic control posts, and highway regulation points. Road information shown on circulation maps applies throughout the length of road between points shown by heavy dots or crossbars.

d. Circulation maps frequently consist of a standard map and an overlay which together give the needed information. If the necessary information is too much to put on one overlay, separate overlays may be used to show different types of information.

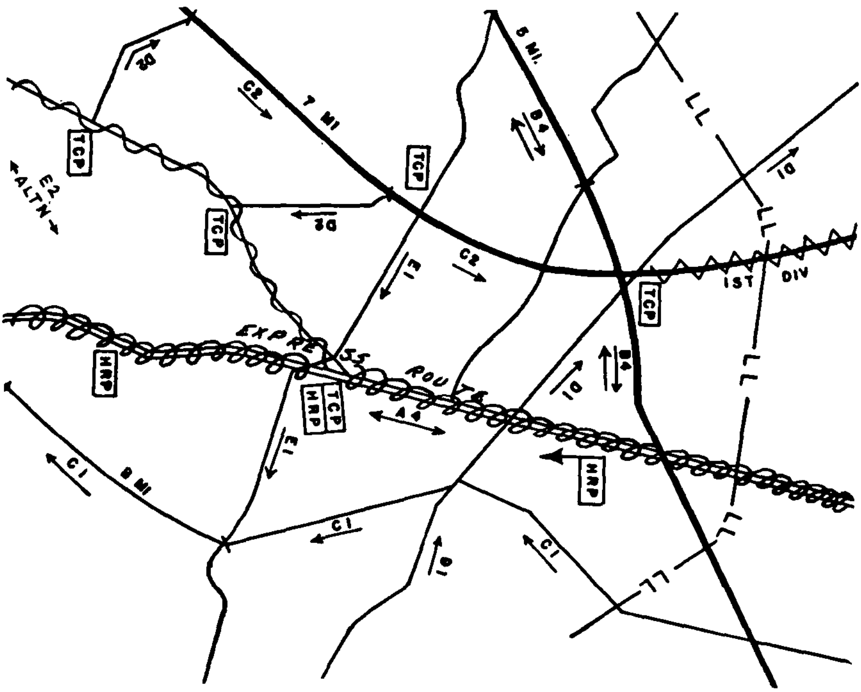


Figure 3.1. Traffic circulation map.

3.8 Bivouac Defense, Truck Company

a. Standard Pattern. Company standing operating procedure gives a standard pattern that can be modified to suit the situation and terrain. Upon arriving at the bivouac site, each platoon takes its predetermined position in the perimeter, without orders. Company headquarters and the maintenance section occupy the center as a reserve. Wherever possible, advantage is taken of streams, marshes, cliffs, etc., to secure one or more flanks. Figures 3.2 and 3.3 show typical temporary bivouac areas for a light truck company. Figure 3.2 illustrates a situation where there is no guerrilla activity and emphasis is placed upon passive defense. Figure 3.3 depicts a situation in which a light truck company, organized primarily for

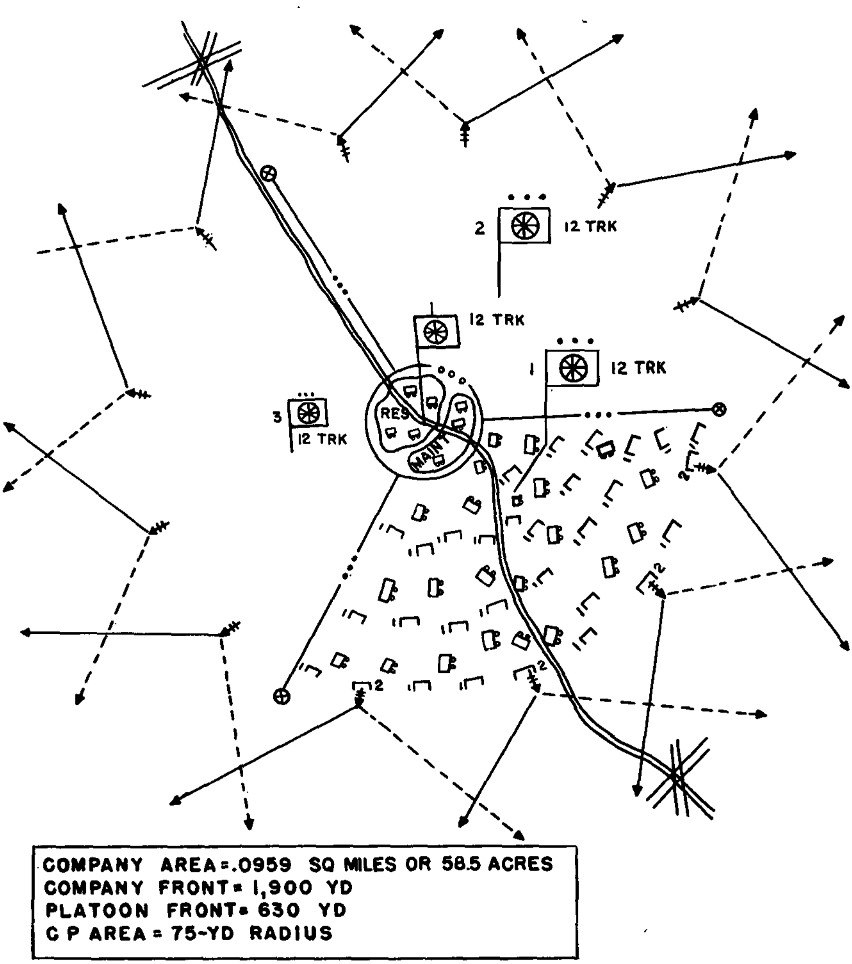


Figure 3.2. Schematic diagram, typical bivouac area, light truck company—passive defense emphasized.

ground defense to provide some dispersion for defense against air attack, has modified its area to fit the situation and terrain. In both situations dispersion and camouflage serve as the primary defense against air attack.

b. Conduct of Defense. The unit commander will place on the perimeter the minimum number of men required to maintain reasonable security. The number of men on the perimeter will depend upon the probability of attack by regular troops or guerrillas and also upon the terrain and weather—including visibility. The unit commander will keep himself informed on the nearness and activity of enemy forces. He will gain this information from his next higher headquarters, from the unit he is supporting or to which he is attached, and/or from friendly adjacent troops. When ground attack is imminent, men occupy the two-man foxholes. If required, one man

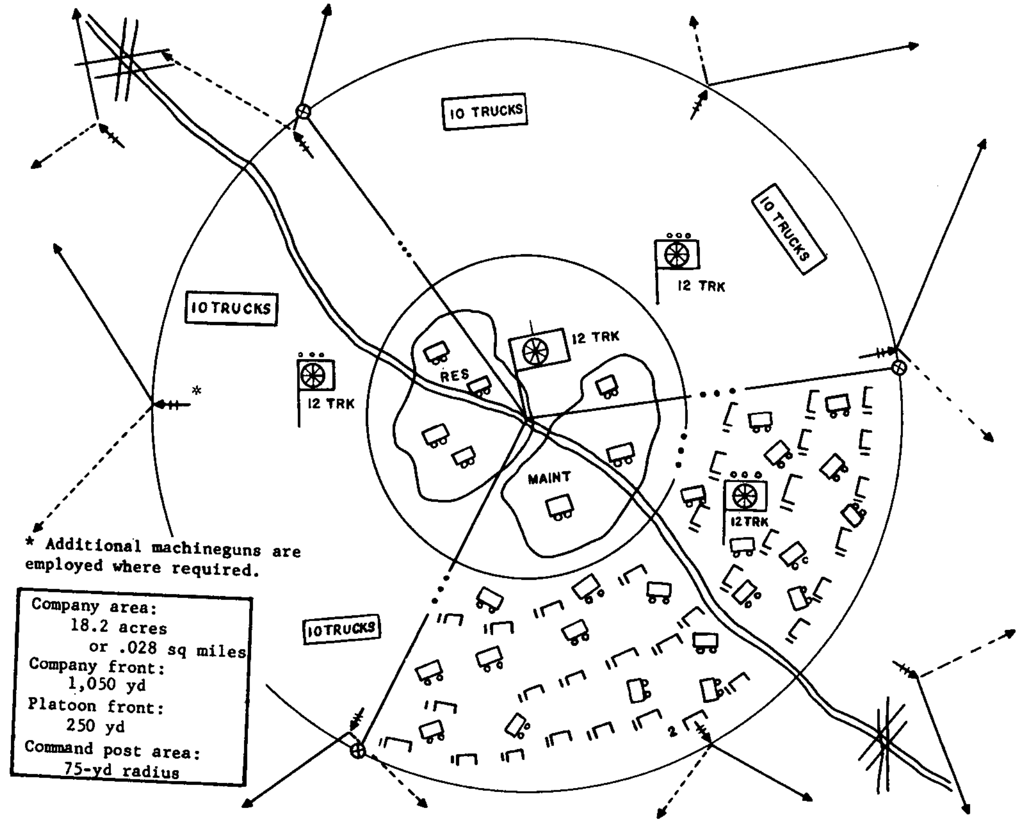


Figure 3.3. Schematic diagram, typical bivouac area, light truck company—organized primarily for ground defense.

stays alert while the other man sleeps. Each squad is given a sector. The squad leader and assistant squad leader occupy positions in rear of their squads. At all times the platoon leader and the squad leaders must know exactly where their men are and be prepared to alert them immediately.

c. Trucks. Trucks may be dispersed individually or in small groups, with about 100 yards between trucks or groups. Trucks are camouflaged and parked facing nearest exit road.

d. Mines and Flares. If available and authorized, a protective minefield consisting of antipersonnel mines and trip flares is placed around the outer rim of the perimeter, about 200 yards in front of the foxholes and machinegun emplacements (FM 20–32). One trailer in each platoon may carry numbered mines. These are placed in a standard sequence in every bivouac—mine No. 1 at 12 o'clock, then clockwise. The protective minefield can be installed quickly, and all mines can be located promptly and recovered when bivouac is cleared.

e. Grenade Launchers and Machineguns. Grenade launchers are used to protect areas most likely or suitable for enemy mechanized attack. Machineguns are placed to secure interlocking fires on the perimeter.

f. Defense Against Nuclear Weapons and Air Attacks. The unit commander must continuously stress passive defense measures to be employed against possible enemy nuclear weapons or air attacks. All personnel should construct foxholes with adequate overhead cover immediately after occupying a bivouac area. Exposed personnel, even in rear areas, should be limited to the minimum number required to provide security and perform other necessary duties in the bivouac area.

3.9 Typical Truck Terminal

Figure 3.4 shows a typical truck terminal. Arrangement of facilities may deviate from the illustration, but the facilities indicated should be considered the minimum.

3.10 Road Reconnaissance Report

A road reconnaissance report should contain information about the subjects listed below.

a. Date and Time of Reconnaissance.

b. Type and Condition of Road(s).

(1) Character of road surface(s).

(2) Number and dimensions of usable lanes.

(3) Width of shoulders.

(4) Curves.

(5) Grades.

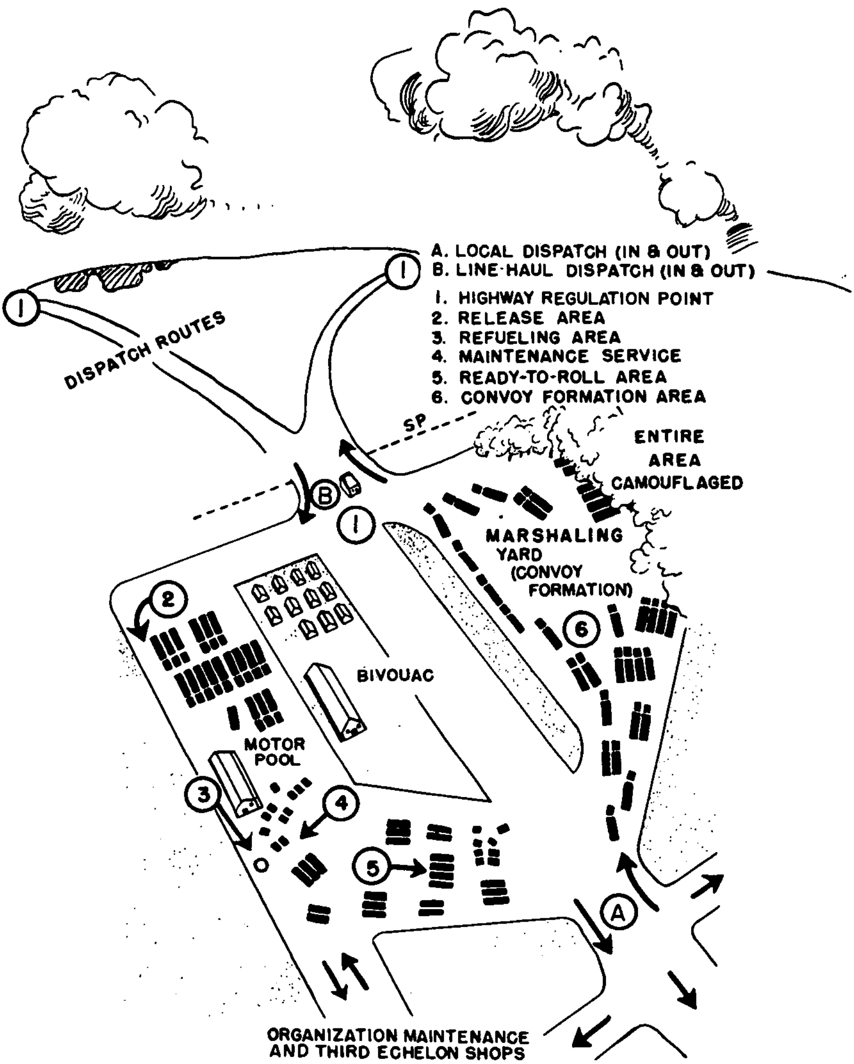


Figure 3.4. Typical truck terminal.

c. *Road Repairs or Improvements Necessary.*
   (1) Location.
   (2) Description.

d. *Traffic and Load Capacity.*
   (1) Maximum vehicle density.
   (2) Maximum loads permissible.

(3) Restrictions.
(4) Peak load periods.

e. Bridges; Culverts; Underpasses, Overpasses, or Bypasses.
(1) Location.
(2) Dimensions (length, width, etc.).
(3) Capacity (approximate).
(4) Condition.
(5) Type of construction (steel, concrete, etc.).

f. Toll Bridges, Ferries, and/or Tunnels.
(1) Location.
(2) Charges or fares.
(3) Capacity.
(4) Condition.
(5) Schedules.
(6) Dimensions.

g. Alternate Routes.

h. Critical Points.
(1) Points of conflict.
(2) Bottlenecks (potential or existing).
(3) Points of access.
(4) Railroads.
(*a*) Crossings.
(*b*) Railheads, etc.

i. Communication Facilities.
(1) Location(s).
(2) Type(s).
(3) Condition.
(4) Restrictions.

j. Adjacent Area(s).
(1) Halt sites.
(2) Bivouac sites.
(3) Dump sites.
(*a*) Condition of terrain.
(*b*) Size of area.
(*c*) Drainage.
(*d*) Other.

k. Additional Information. Include information of value to other services, special items, weather conditions at time of reconnaissance, etc.

3.11 Road Classification

a. Condition—Rating Symbols.

Rating	Condition	Symbol
Alinement:		
Good	Flat gradients and easy curves	*A* in numerator.
Fair	Steep gradient (in excess of 6 percent)	*Ag* in denominator.
Fair	Sharp curves with radius less than 150 feet.	*Ac* in denominator.
Bad	Steep gradients and sharp curves	*Agc* in denominator.
Drainage:		
Good	Adequate crown or superelevation with adequate ditches; culverts in good condition.	*D* in numerator.
Bad	Inadequate crown or superelevation; ditches or culverts blocked or otherwise in poor condition.	*D* in denominator.
Foundation:		
Good	Stabilized, compact material of good quality.	*F* in numerator.
Bad	Unstable, loose, or easily displaced material.	*F* in denominator.
Surface:		
Good	Free of potholes, bumps, or ruts likely to reduce convoy speed.	*S* in numerator.
Bad	Bumpy, rutted, potholed, or excessively cracked to an extent likely to reduce convoy speed.	*S* in denominator.

b. Symbols for Length and Width of Road and Types of Road Surfaces.

Symbol	Meaning
mi in denominator	Preceded by a numeral indicates length of road in miles between two points indentified by dots on the map or overlay.
km in denominator	Preceded by a numeral indicates length of road in kilometers.
ft in numerator	Preceded by a numeral indicates width of traveled way in feet at the narrowest point.
m in numerator	Preceded by a numeral indicates width of traveled way in meters at the narrowest point.
k in numerator	Concrete.
b in numerator	Bituminous surface treatment. The symbol *b* may be used with any of the other surface symbols to denote a waterproof bituminous skin. For example: *rb*—bituminous macadam; *kb*—bituminous concrete.
p in numerator	Paving brick or stone.
r in numerator	Crushed rock, coral, or waterbound macadam.
gl in numerator	Gravel or lightly metaled surface.
n in numerator	Natural or stabilized soil, sand, clay, shell, cinders, disintegrated granite, or other selected material.
v in numerator	Various other surfaces not itemized above.

c. *Example of a Classification Fraction.*

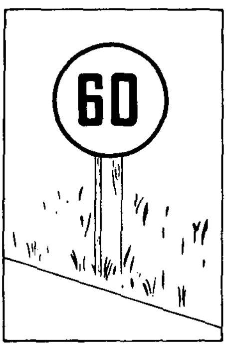
FD 20 ft rb
Agc S 6.4 *mi*

This fraction describes a stretch of road 6.4 miles long and 20 feet wide at the narrowest point in the traveled way. The road has a good foundation and drainage system, but bad alinement, with grades in excess of 6 percent and sharp curves with radii less than 150 feet. The road also has a bituminous macadam surface in bad condition. When factors cannot be determined, their symbols are omitted. When the road classification fraction is transmitted electrically, the numerator must be separated from the denominator by a slant; for example: *FD* 20 *ft rb*/*Agc S* 6.4 *mi*

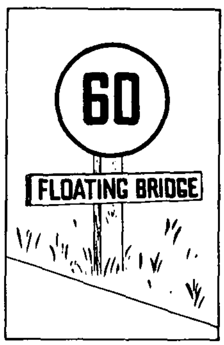
3.12 Bridge Signs

a. *Circular Signs* (*figs. 3.5 and 3.6*). These are placed at bridges to indicate the bridge classification. The signs have a yellow background with 1½-inch black border; the bridge classification and appropriate symbols are in black.

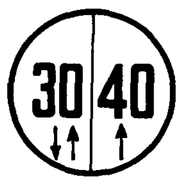
b. *Rectangular Signs* (*figs. 3.7 and 3.8*). These signs give additional instructions and technical information. Minimum size is 16 inches high or wide. They have a yellow background and 1½-inch black border.



For single-lane fixed bridge.



For single-lane floating bridge.



Two-way sign limiting vehicle classes on a two-lane bridge when used as a two- or as a single-lane bridge.

Figure 3.5. Typical bridge-class and information signs.

3.13 Bridge and Vehicle Weight Classification

a. *Posting Bridges.* Every military bridge is posted with a number indicating the highest vehicle weight class that can cross safely. Vehicles of higher weight class are barred except for special crossings. Fixed bridges are also marked with the length in feet of the span to which the posted capacity applies.

b. *Marking Vehicles.* Self-propelled vehicles in class 3 or higher and towed vehicles in class 1 or higher are marked to indicate the

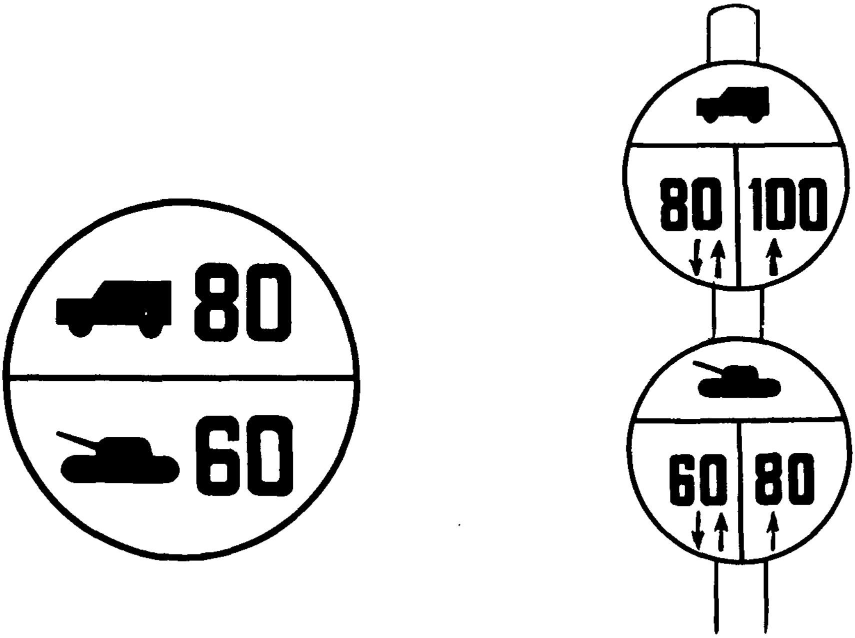


Figure 3.6. Typical dual-class bridge signs.

class, except that prime movers are marked with either their own class or the class of the normal combination of prime mover and trailer or semitrailer. Markings on the front of trucks should be on the right front fenders between blackout marker light and radiator brush guard. Examples of vehicle markings are shown in figure 3.9.

c. Determining Vehicle Classes. The class of each standard vehicle and combination will be found in FM 5–36 and other Department of the Army publications on the subject, such as training circulars and technical bulletins.

3.14 International (Geneva Convention) Road Signs

The road signs discussed in this paragraph were agreed upon at the United Nations Conference on Road and Motor Transport in 1949. Although these signs are not military, Army personnel should be familiar with them.

a. Dimensions of Signs. Dimensions of various signs are standardized in each country to insure maximum uniformity. In general, two sizes are used for each type of sign—a standard size and a reduced size for use where conditions do not permit or the safety of road users does not require erection of the standard size. In exceptional circumstances, a small sign may be used inside built-up areas or for repetition of the main sign.

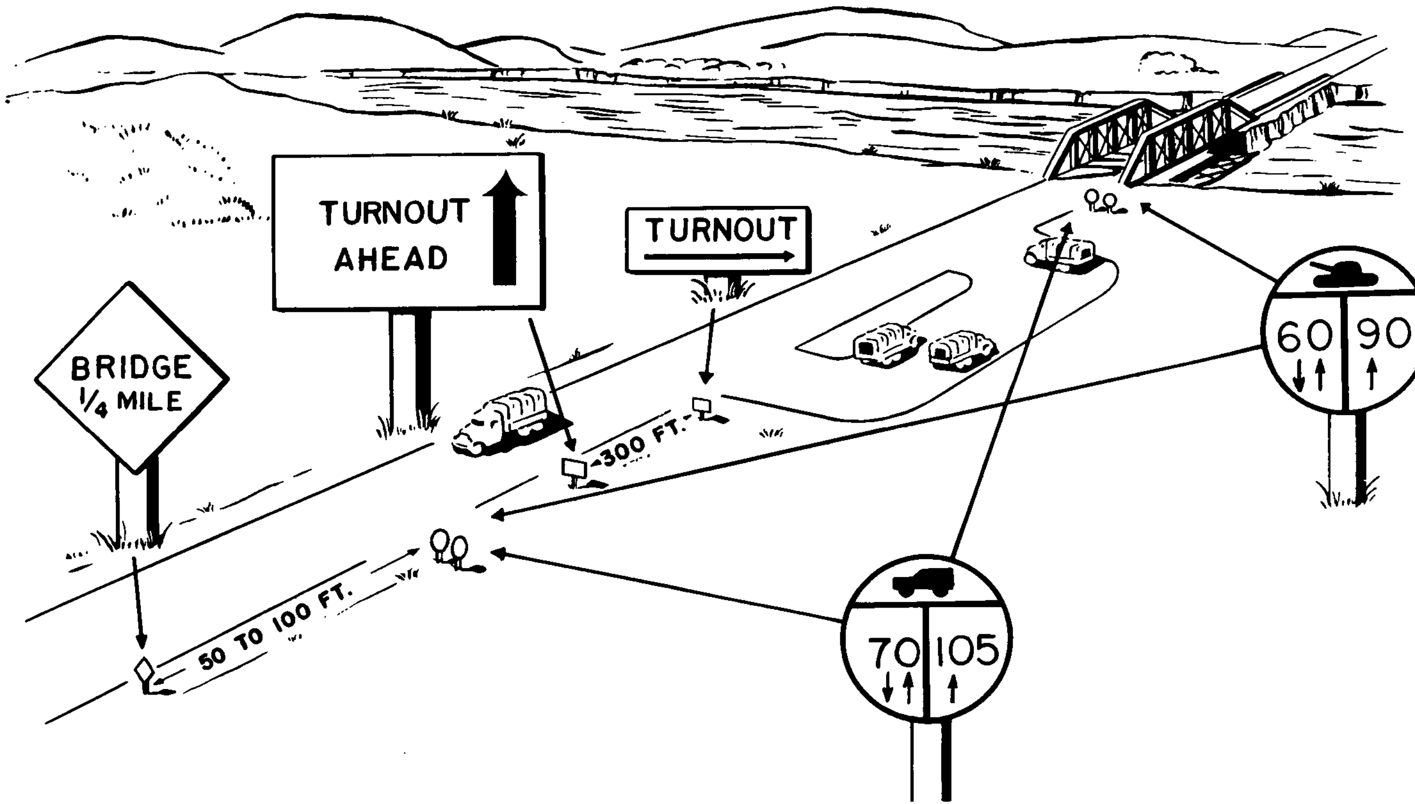


Figure 3.7. Typical arrangement of road-guide, information, and two-lane bridge-class signs.

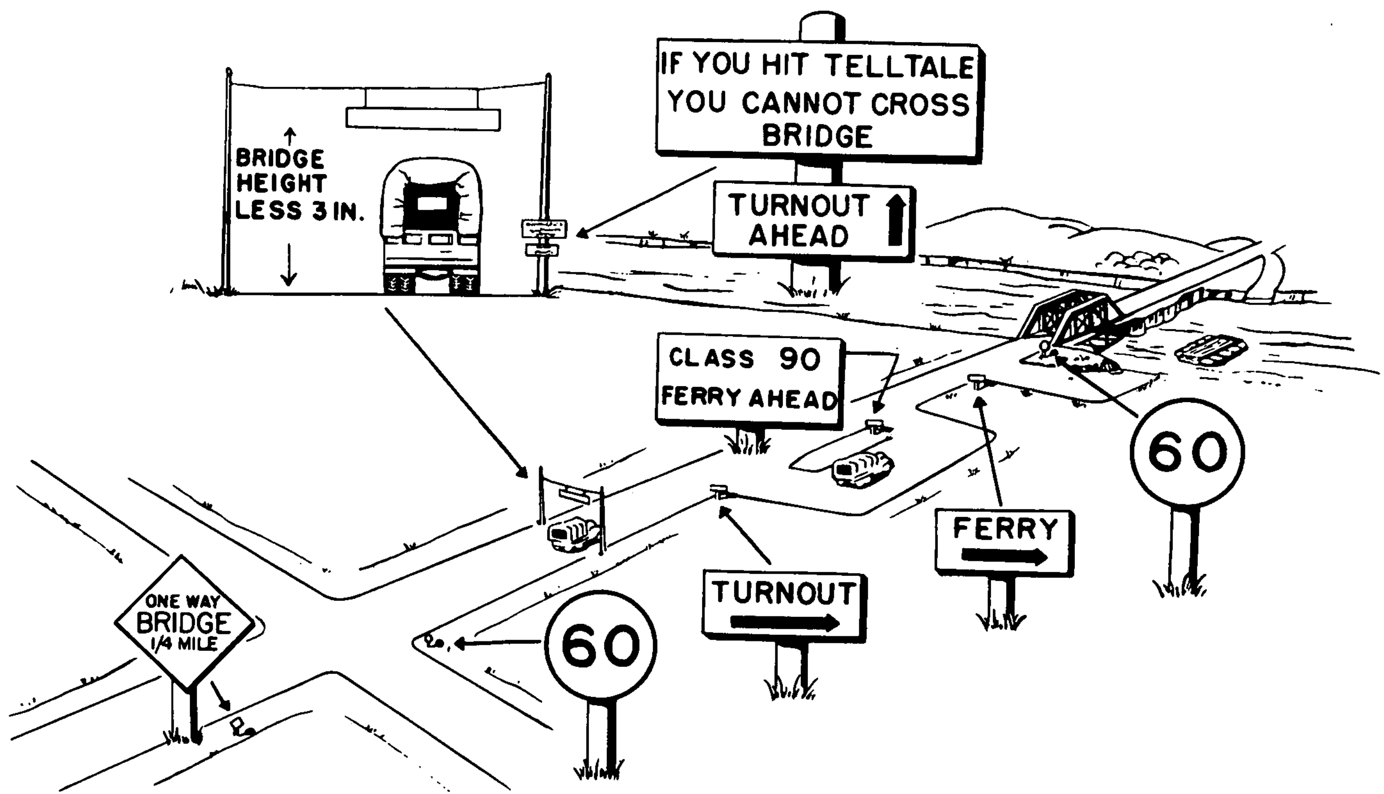


Figure 3.8. Typical arrangement of road-guide, information, single-lane bridge-class signs.

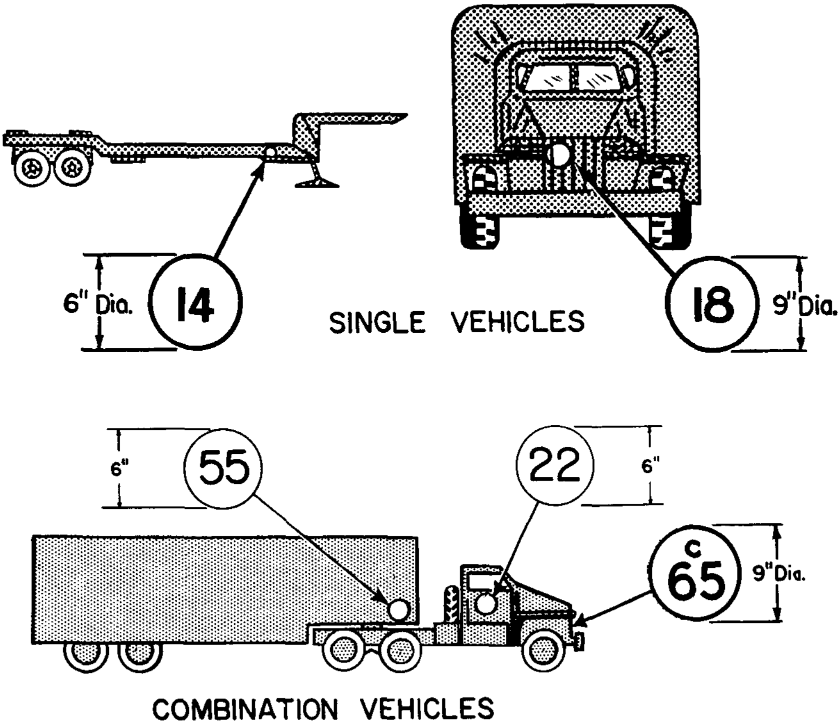


Figure 3.9. Vehicle weight classification marking.

b. Danger Signs (Class I) (fig. 3.10). Danger signs are in the shape of an equilateral triangle with one point upward, except in the case of the sign PRIORITY ROAD AHEAD which has one point downward. These signs have a red border with white or yellow background. Symbols are black or of some other dark color. For signs of standard size, the length of each side of the triangle is not less than 2 feet 11.4 inches (0.90 of a meter), and for the reduced size, not less than 1 foot 11. 6 inches (0.60 of a meter). Signs are not more than 7 feet 2.6 inches (2.20 meters) above the ground at the highest point. Away from built-up areas, they are not less than 1 foot 11.6 inches (0.60 of a meter) above the ground at the lowest point. Signs are so placed that they are clearly visible, but do not impede pedestrians.

c. Signs Giving Definite Instructions (Class II). The signs of this class indicate an order, which may be either in the nature of a prohibition or an obligation (fig. 3.11). They are circular with a diameter of at least 1 foot 11.6 inches (0.60 of a meter) for signs of standard size, and at least 1 foot 3.7 inches (0.40 of a meter) for signs of reduced size. They are placed in the immediate vicinity of the point where the prohibition or obligation begins and at intervals along the route. They are not more than 7 feet 2.6 inches (2.20 meters) above the ground at the highest point, and not less than 1 foot 11.6 inches (0.60 of a meter) above the ground at the lowest point.

(1) *Prohibitory signs* (*Class II A*). These signs are white or light yellow with a red border, and the symbol is black or some other dark color. Examples of signs in this category are:

(*a*) Prohibitions for all traffic.

(*b*) Prohibitions for certain classes of vehicles.

(*c*) Restrictions on the dimensions, weight, or speed of vehicles.

(2) *Mandatory signs* (*Class II B*). These signs are blue with a white symbol. Examples of mandatory signs are:

(*a*) A direction to be followed.

(*b*) Where cyclists must ride.

d. Informative Signs (*Class III*). Signs of this class are rectangular. Where the colors are not specifically prescribed, red does not dominate.

(1) *Indication signs* (*Class III A*). Signs of this type are used to indicate such places as parking areas, hospitals, first-aid stations, telephones, filling stations, and priority roads (fig. 3.12). These signs have a blue background, except those indicating priority roads, which are white with a black or dark rim on the outside and have a yellow center. Priority road signs are square with one point downward. The side of the square is at least 1 foot 11.6 inches (0.60 of a meter) for the standard size, and at least 1 foot 3.7 inches (0.40 of a meter) for the reduced size. For signs repeated within built-up areas, the side of the square is 9.8 inches (0.25 of a meter).

(2) *Advance direction signs and direction signs* (*Class III B*). The size of these signs is such that the indication can be understood easily by drivers in time to enable them to comply. They have either a light background with dark lettering or a dark background with light lettering. Advance direction signs are placed at a distance of between 328 feet (100 meters) and 820 feet (250 meters) from the intersection on normal roads. On special roads, e.g., concrete multilane roads, this distance is increased to 1,640 feet (500 meters). Direction signs are rectangular with the longer side horizontal and end in an arrowhead. Names of places lying in the same direction may be added to the sign. Colors of these signs are the same as for advance direction signs. When distances are indicated, the figures giving distance are inscribed between the name of the place and the arrowhead.

(3) *Place identification signs* (*Class III C*). Signs indicating a locality are rectangular with the longer side horizontal. They are of such size and location that they are visible at night. They have either a light background with dark

Figure 3.10. International road signs—danger.

lettering, or a dark background with light lettering. They are placed before the beginning of a built-up area, and at other points necessary to indicate place locations.

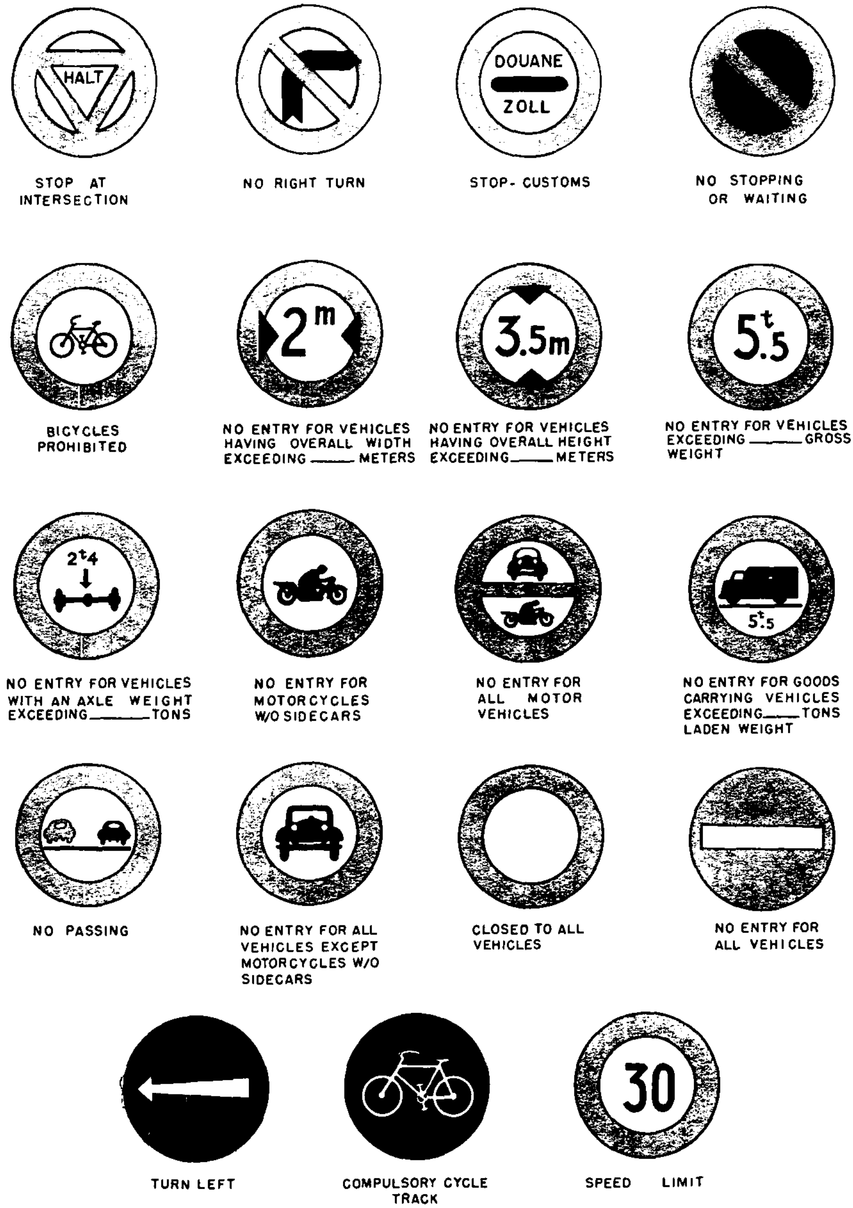


Figure 3.11. International road signs—definite instructions.

3.15 North Atlantic Treaty Organization Military Road Signs

To facilitate the movement of armed forces of the North Atlantic Treaty Organization (NATO) in any territory controlled by operational military command or a national authority, a standard system of military route signs has been adopted by member governments. This system includes signs which the Geneva Convention already pre-

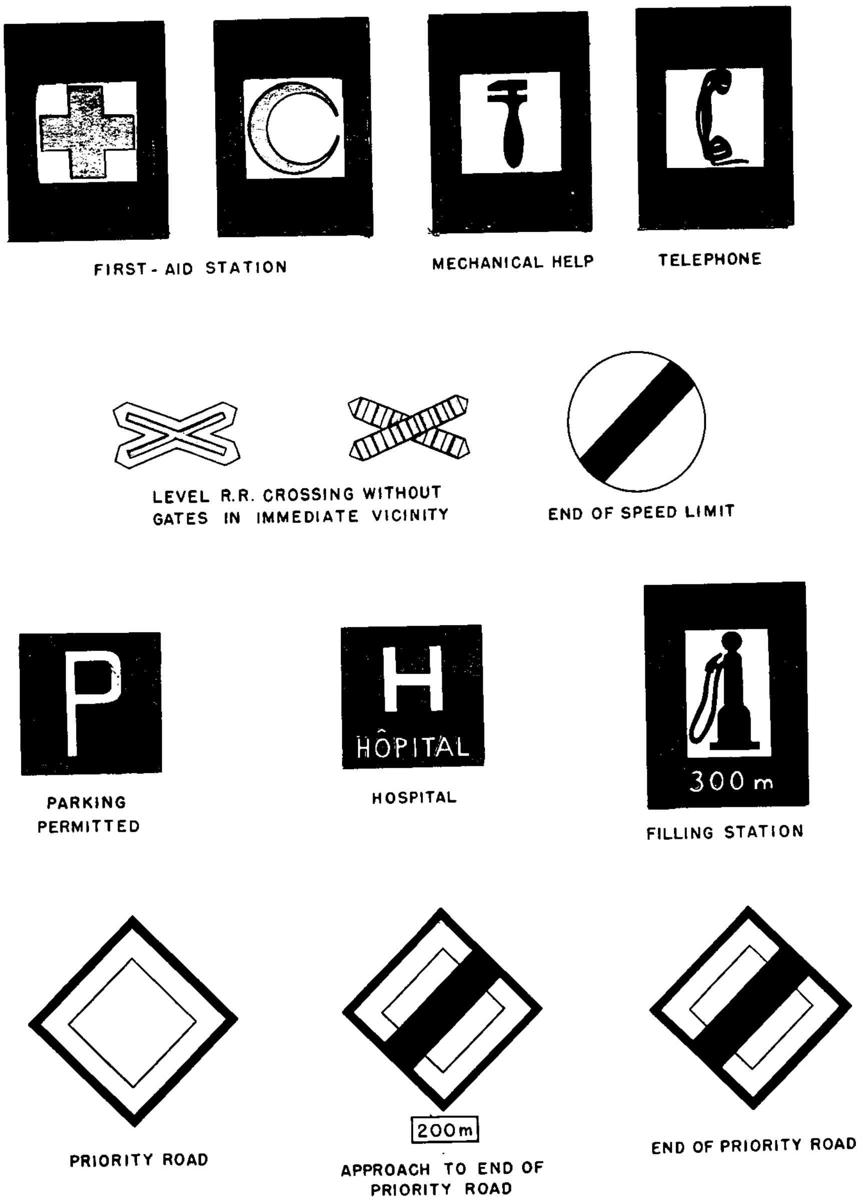
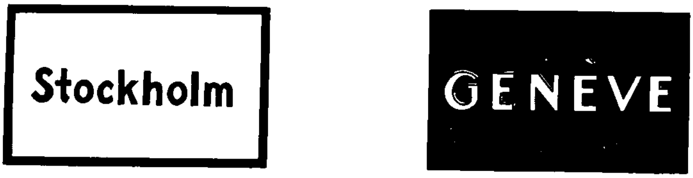
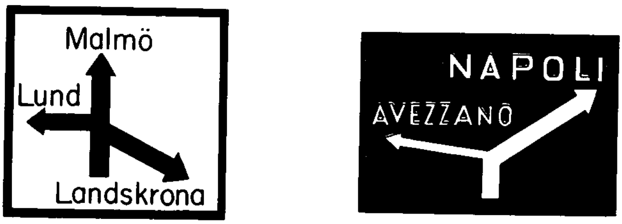


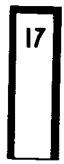
Figure 3.12. International road signs—informative.

DISTANCE SIGNS



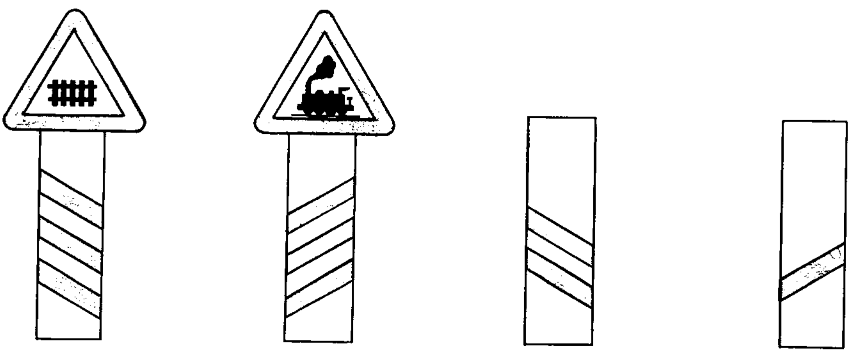
LOCALITY SIGNS





DIRECTION SIGNS

MILESTONE



A B C D

SUPPLEMENTARY RAILWAY SIGNS

IF SIGN A OR SIGN B IS DISPLAYED, IT MUST BE FOLLOWED BY SIGN C AND THEN SIGN D, INDICATING 2/3 AND 1/3 OF THE DISTANCE TO THE DESIGNATED POINT DESCRIBED IN THE ORIGINAL SIGN.

Figure 3.12—Continued.

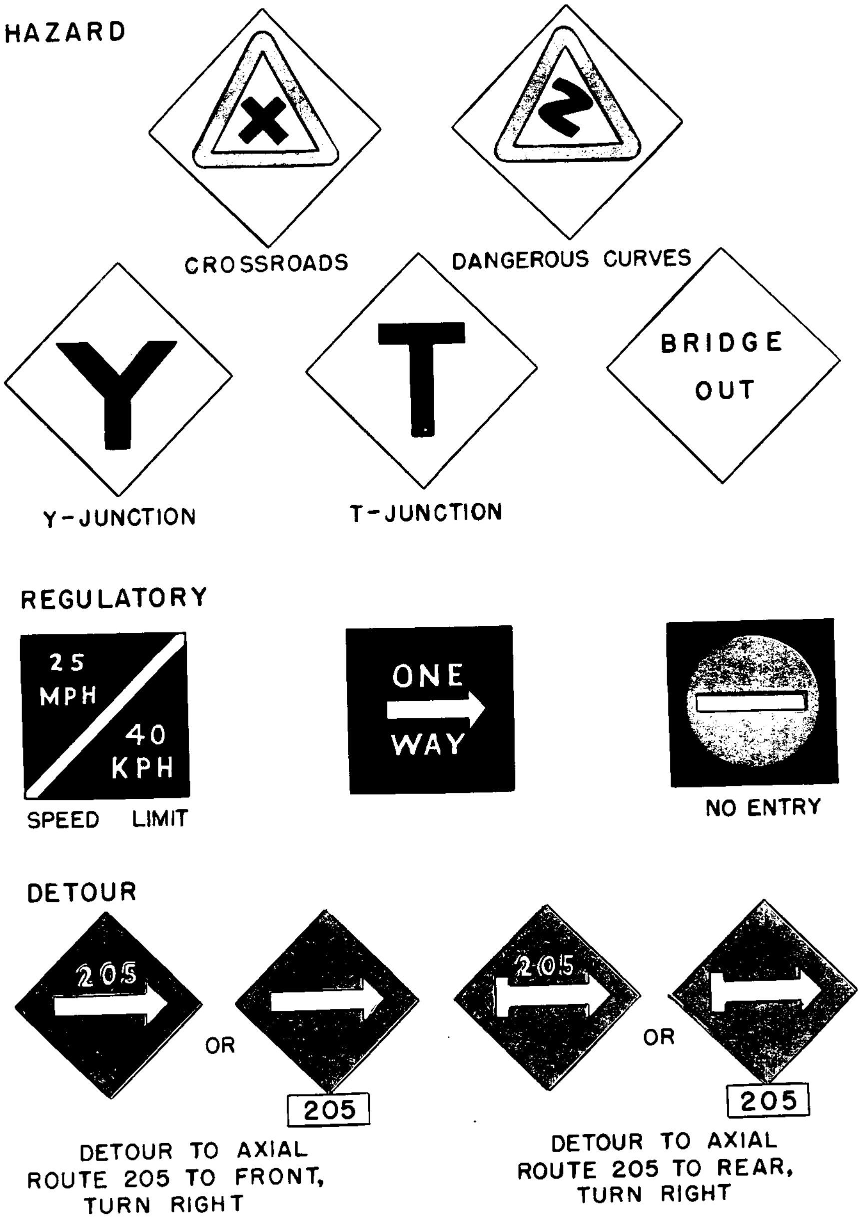


Figure 3.13. NATO military road signs.

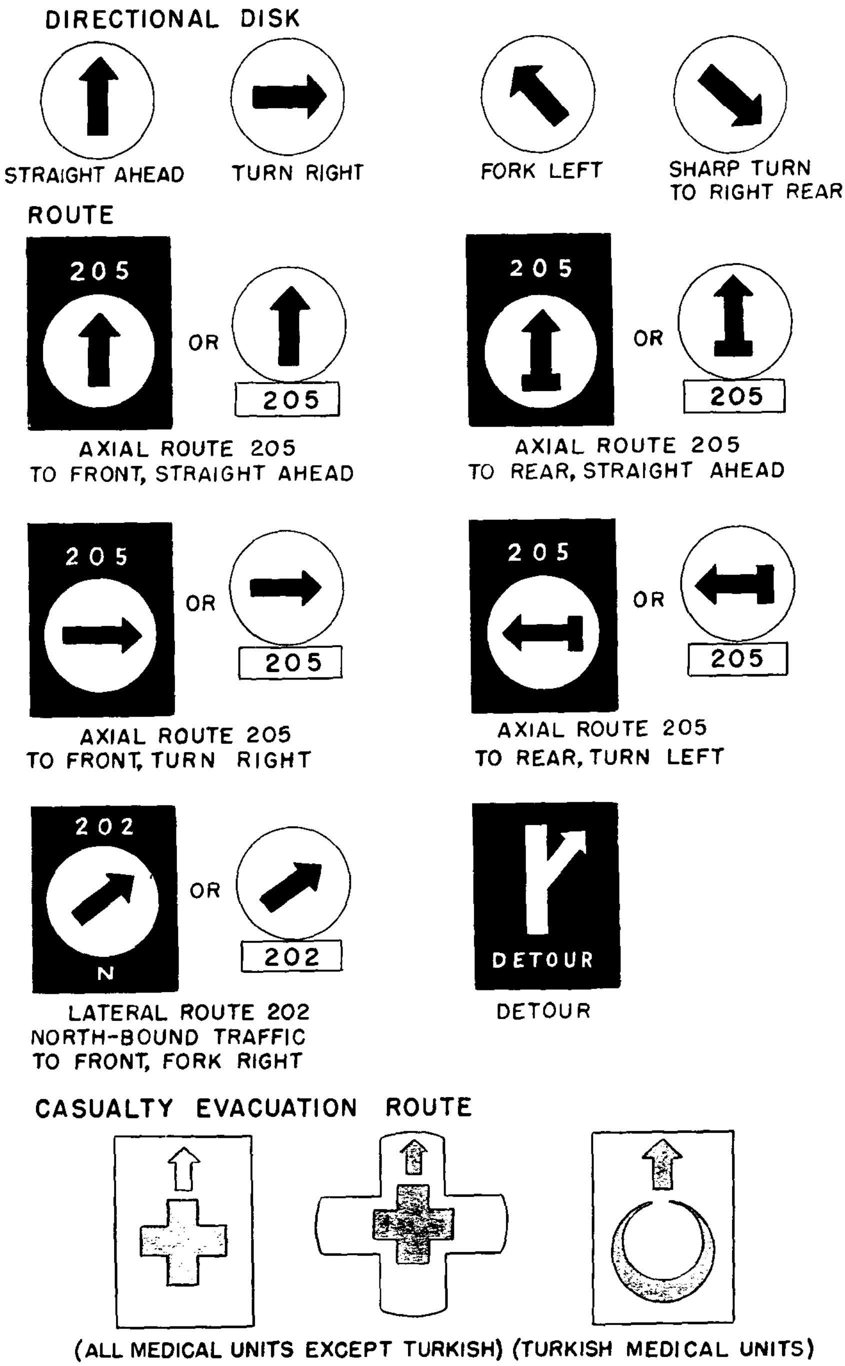


Figure 3.13—Continued.

scribes (par. 3.14) and others not included in the Geneva Convention. Standard signs include hazard signs, regulatory signs, and guide signs. Examples are shown in figure 3.13.

a. Hazard Signs. These signs indicate traffic hazards and are normally used only in areas under military authority. Hazard signs will be square and will be placed with one corner pointing downward. A purely military sign not included in the International (Geneva Convention) or host country's system will have a yellow background with the legend or symbol superimposed in black. In the case of a sign included in the International or host country's system, the International or host-country sign will be superimposed on the same yellow background.

b. Regulatory Signs. These signs are used to regulate and control traffic. Regulatory signs will be square. They will have a black background on which the legend will be superimposed in white with the following exceptions: bridge classification signs, stop signs, no-entry signs, and signs erected by the military for the control of civilians under specified circumstances.

c. Guide Signs. Guide signs are used to indicate locations, distances, directions, routes, and similar information.

(1) Guide signs for routes will be rectangular with the long axis vertical. The legend or symbol and route number will be superimposed in white on a black background. Odd-numbered routes are axial, and even numbers describe lateral routes.

(2) Directional disks will be used as a supplement to other guide signs to indicate the direction of a route or as an appendage to any major unit sign to indicate the route to that unit. The disk will be less than 16 inches in diameter and will bear a black arrow, with or without bar, on a white background. Eight equally spaced holes around its circumference allow the disk to be nailed with the arrow pointing in any direction. Battalions and lower units are not permitted to install directional disks.

(3) Guide signs for casualty evacuation routes will be either rectangular or cross-shaped with symbols in red on a white background.

(4) Detour signs will have a white arrow, barred or not, on a blue square; they will be placed with one corner pointing downward.

3.16 NATO Marking for Military Vehicles

a. General. The armed forces of the North Atlantic Treaty Organization have agreed to use the standard markings for vehicles described below. The markings listed are not necessarily used at all times, but when they are used, vehicles are marked in accordance with the following paragraphs. The rear of a trailer is marked in the same way as its prime mover; there is no need to mark the front of a trailer.

b. Security. When necessary for security reasons, vehicle marking may, by direction of the field commander or his superior authority, be covered or removed.

c. Registration Numbers. The marking of vehicles for registration is as required by the nation concerned. Registration markings consist of numbers or a combination of letters and numbers.

d. National Distinguishing Symbols. National symbols are used to identify the vehicles of each country. As a minimum, symbols are shown front and rear. Service symbols may be superimposed upon the national distinguishing symbols or shown separately by an additional symbol.

e. Speed Limit Markings. Speed limit markings are placed on vehicles as directed by the nation concerned.

f. Tactical Markings. Tactical markings serve in general as identification markings within units; they consist of stripes and geometrical figures or combinations thereof and may also include a name. Colors may be used. Markings should be large enough to make ground-to-ground identification of vehicles possible: they are used primarily for easy battlefield recognition. The design and position of these markings are prescribed by the field commander directing their use. They are removed when vehicles are permanently released from the jurisdiction of the commander who prescribed their use.

g. Air-Ground Recognition Markings. Equipment for these markings consists of red and yellow fluorescent panels. Each panel is equipped with tie cords. Panel dimensions are approximately 6 feet by 2 feet 3 inches (1.80m by 0.68m). Panels are draped on vehicles in a standard, unchanging pattern that differs from the displays prescribed for other recognition purposes (front lines, targets, etc.). Theater commanders prescribe the arrangement of panels and the conditions under which they will be used.

h. Special Markings. Military police traffic control vehicles and vehicles used in traffic regulation are identified, front and rear, with the prescribed markings. Ambulances and other vehicles used exclusively for medical purposes are marked in conformity with the rules of the Geneva Convention. Such markings consist of one red cross or crescent on a square white background painted on the side body panels, roof of body, roof of driver's cab, and rear door(s) or panel.

i. Bomb Disposal Units. Vehicles of bomb disposal units have all mudguards painted red.

j. Danger Markings. A red flag flown from any vehicle indicates DANGER.

k. Priority Vehicles. Any vehicle which for any reason (special liaison officers, signal vehicles carrying priority dispatches, damage assessment personnel, etc.) requires priority over all other vehicles may be so marked by any commander having area responsibility. Such priority markings are valid only in the area of the commander concerned. The marking consists of an equilateral triangle with red borders and symbols on a white background displayed on the front and rear of the vehicle (fig. 3.14). A single priority sign may be used if visible from both front and rear. The size of a priority sign should be as large as the dimensions of the vehicle permit. The symbol inside the triangle indicates the commander authorizing use of this priority sign. This sign must be removable in order to avoid misuse and normally is used only on direct orders of the commander concerned.

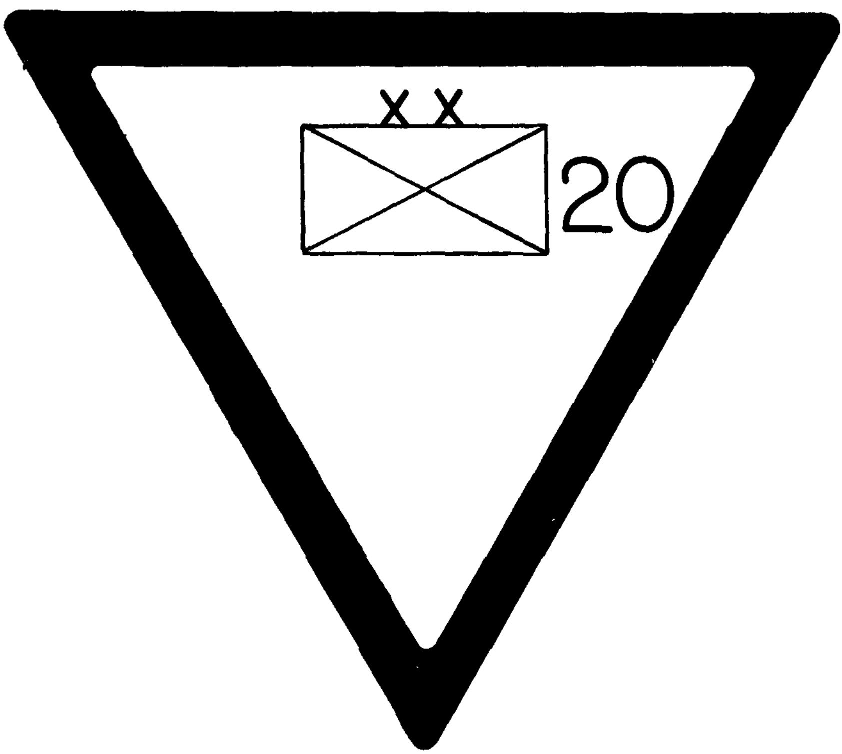


Figure 3.14. Vehicle priority sign.

l. Marking of Movement Serials.

(1) A movement serial is an element or group of elements within a series which is given a numerical or alphabetical designa-

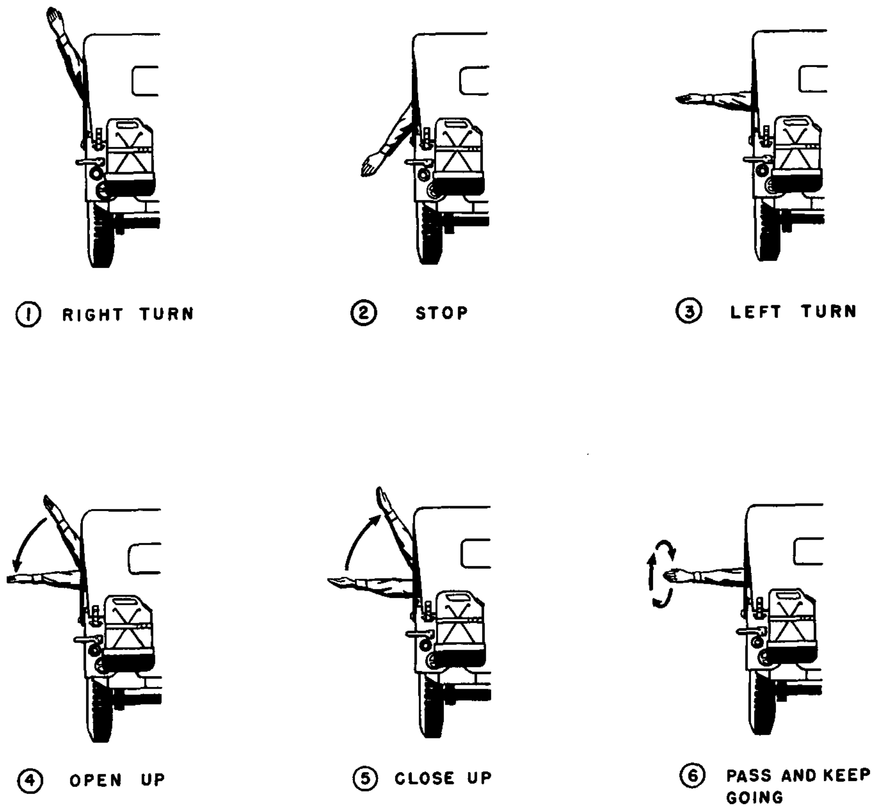


Figure 3.15. Driver arm and hand signals.

tion for convenience in planning, scheduling, or controlling vehicle movements.

(2) The leading vehicle of each movement serial carries a blue flag.

(3) The rear vehicle in the movement serial carries a green flag.

(4) The vehicle of a movement serial commander displays a flag that is bisected by a diagonal—the upper triangle is white, the lower black.

(5) In areas where vehicles drive on the left side of the highway, the flags are mounted on the right side of the vehicle; otherwise, they are mounted on the left side.

(6) Flags are approximately 12 inches by 18 inches (30 cm by 45.7 cm).

(7) The number or letter assigned to a movement serial is marked on the front and on both sides of each vehicle in the serial. The marking is placed so that it is clearly visible from the ground and does not interfere with other prescribed markings.

m. Illumination of Vehicle Markings. The condition under which military traffic will move at night is determined by the local command. The enemy threat and, so far as possible, the regulations of the host country are considered when deciding whether the illumination will be normal, reduced, or blacked out. Under normal lighting conditions, the military registration or identification number at the rear of a motor vehicle or trailer is so illuminated that it is readable at a minimum distance of 20 yards. The local commander prescribes either reduced lighting or blackout when necessary.

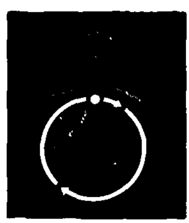
3.17 Arm and Hand Signals

a. The safe operation of motor vehicles often depends upon the driver knowing and using the arm and hand signals shown in figure 3.15.

b. The current concept of tactical operations requires that vehicle drivers must be trained to operate their vehicles under blackout conditions and to recognize operational night hand signals (fig. 3.16). These signals provide a means of control at night or when radio silence and security requirements are at a maximum.

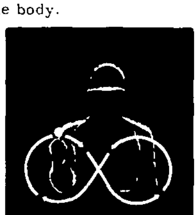
c. The arm and hand signals illustrated in figure 3.17 are the common means for transmitting visual messages within administrative and tactical units of the Armed Forces. They must be memorized and practiced until they become second nature. Visual signals are useless

① Go; or Forward; or Move out; or Increase speed; or Double time. The light is moved several times vertically in front of the body.

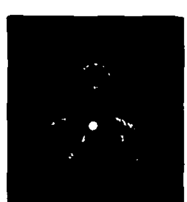


② Turn right. The light is rotated clockwise (from the individual giving the signal).

③ Turn left. The light is rotated counterclockwise (from the individual giving the signal).



④ Start engine(s). The light is so moved as to describe the figure 8 (on its side) in a vertical plane in front of the body of the individual giving the signal.



⑤ Move in reverse. The light is held at shoulder level and blinked several times toward the vehicle.

⑥ Stop; or Stop engine(s). The light is moved horizontally back and forth several times across the path of approaching traffic to stop traffic. The same signal is used to stop engines.

Figure 3.16. Night hand signals.

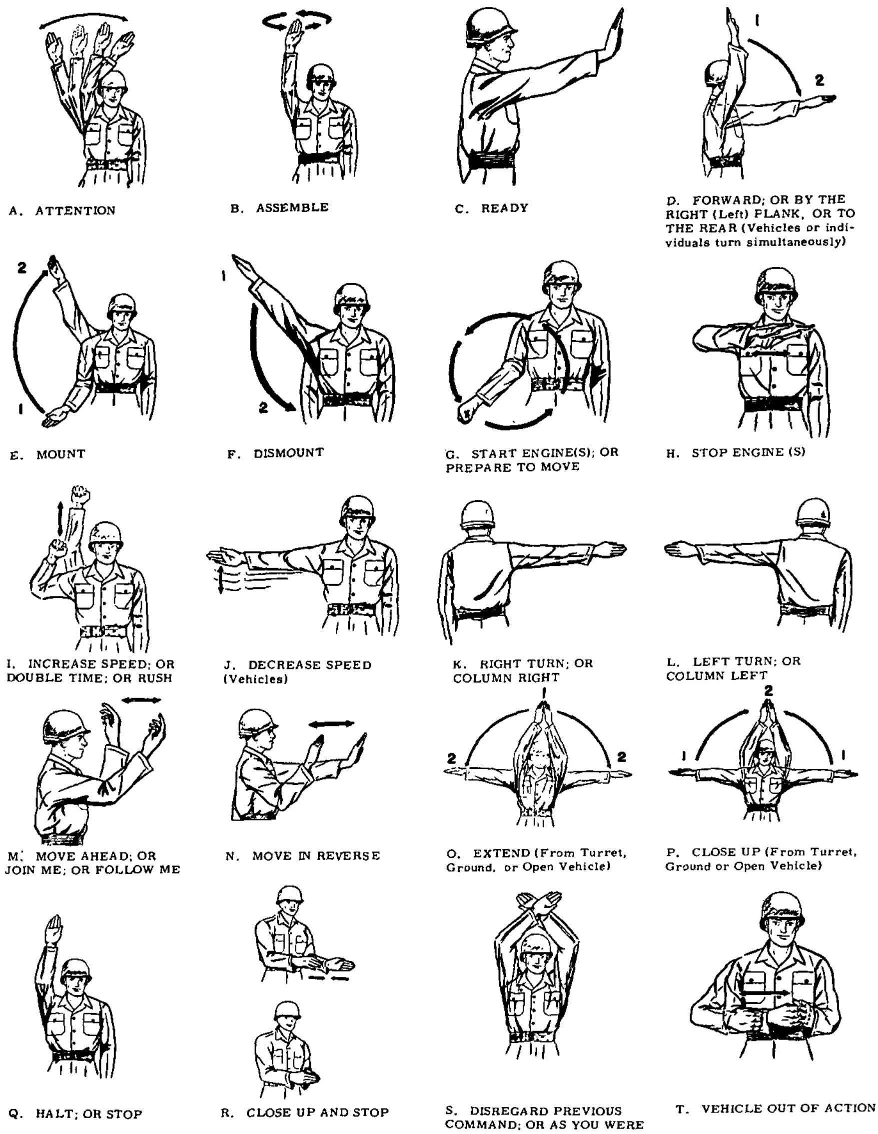


Figure 3.17. Motor march hand and arm signals.

if not correctly and distinctly interpreted. The signals illustrated with a single-headed arrow indicate the signal is a single action which may be repeated until acknowledged or executed. Signals illustrated with a double-headed arrow are continuous until acknowledged or executed.

3.18 Basic March Formulas [1]

a. General. There are three basic march factors: distance (D), rate (R), and time (T). When two are known, the third can be found by

[1] For time and space definitions, see FM 25–10.

using the following formulas:

$$R=\frac{D}{T} \qquad T=\frac{D}{R} \qquad D=RT$$

Any of the distance factors (length, gap, lead, or road distance) may be substituted in the equation if the corresponding time factors are also substituted. Corresponding units of measure must be used throughout.

b. Rate Factors.

Rate (yd per min) = length (yd) ÷ time length (min)

Rate (miles in the hour (mih)) = road distance (miles ÷ time distance (hr))

c. Time Factors.

Time length (min) = length (yd) ÷ rate (yd per min) + EXTAL [1]

Time lead (min) = lead (yd) ÷ rate (yd per min)

Time space (hr) = road space (miles) ÷ rate (mih)

Time distance (hr) = road distance (miles) ÷ rate (mih)

d. Distance Factors.

Gap (yd) = rate (yd per min) × time gap (min)

Lead (yd) = rate (yd per min) × time lead (min)

Distance (miles) = rate (miles in the hour) × time distance (hr)

e. Time-Distance Factors (fig. 3.18). When the speed of a convoy in miles per hour is known, the time in minutes or the distance in miles traveled can be quickly determined from a time, distance graph (fig. 3.19). For example, the distance traveled by a convoy moving at a speed of 15 miles per hour for a 2-hour period can be determined by:

(1) Locating the oblique line marked 15 mph.

(2) Locating the horizontal line, indicated in the left margin, for the 2 hours traveled.

(3) Determining the point where these two lines intersect and reading the distance in miles traveled by the convoy from the scale along the lower margin of the graph. The miles traveled in this example would be 30.

f. Conversions.

(1) The following factors may be converted into distance, rate, or time by arithmetic:

Length + gap = lead

Time length + time gap = time lead

Distance (miles) × 1,760 = distance (yd)

Time (hr) × 60 = time (min)

Rate (mih) × 30 = aprx rate or speed (yd per min)

---

[1] An extra time allowance (EXTAL) is included in the time length of a column. The time allowance between serials is determined and allocated by the staff responsible for the movement. Within serials of 25 or more vehicles, an extra time allowance of 1 minute is allowed for each 25 vehicles or major fraction thereof.

(2) These factors are substituted in the basic formulas in *a* through *d* above. For example:

$$\text{Time length (min)} = \frac{\text{miles} \times 1{,}760}{\text{mih} \times 30} + \text{EXTAL}$$

$$\text{Speed (yd per min)} = \frac{\text{miles} \times 1{,}760}{\text{hr} \times 60}$$

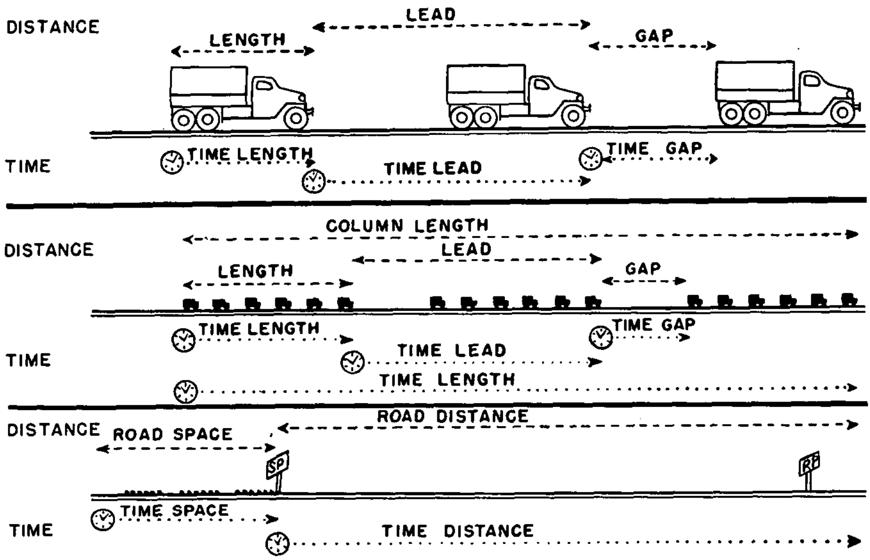


Figure 3.18. Space and time factors.

3.19 Basic Road Spaces

Ten yards is the average road space for a vehicle. Increase size of spaces if greater dispersion is required because of the weather or road condition, or enemy air or mechanized attack capabilities.

3.20 Road Movement Graph

a. Definition. A road movement graph (fig. 3.20) is a time-space diagram used in controlling both foot and road marches and in preparing or checking road movement tables. The graph helps the planner to foresee possible conflicts and discrepancies in planning.

b. Uses. Road movement graphs may be used to indicate:

(1) Position of various mixed traffic on a route at a particular time.

(2) Scheduled passing of various elements of traffic at a particular point.

(3) Conflicts between various elements of traffic at junctions, intersections, bridges, and defiles.

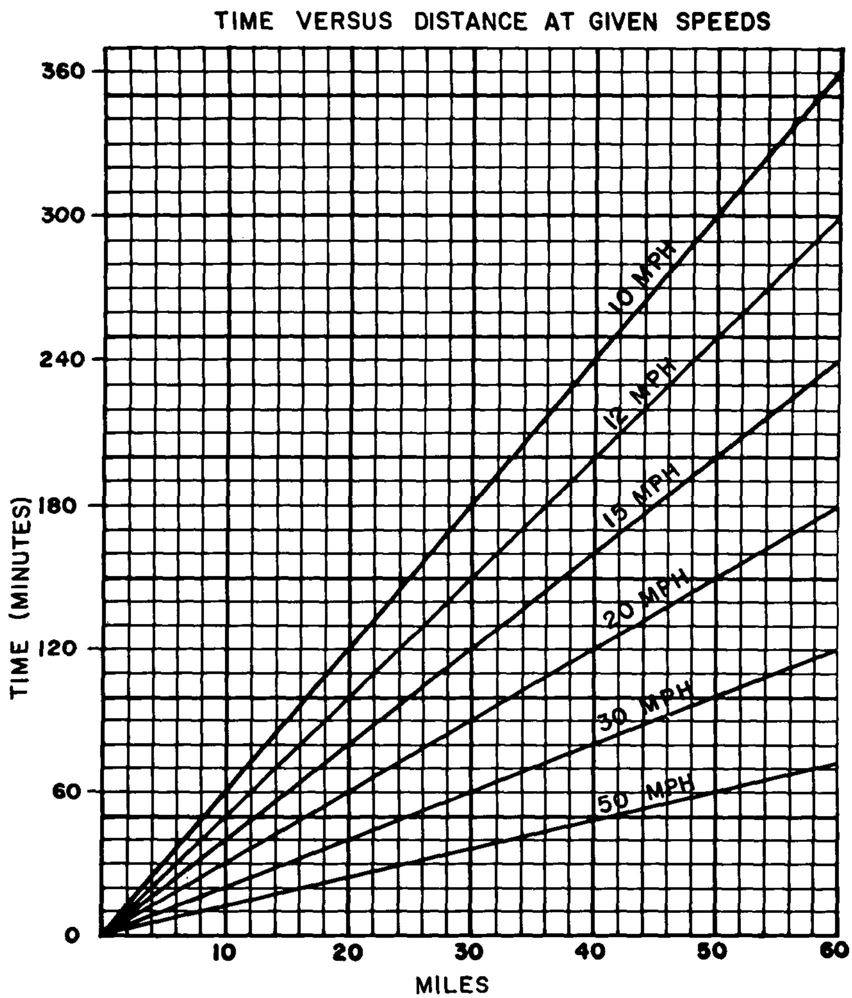


Figure 3.19. Time-distance graph.

(4) Deviations of columns from prescribed schedule, making it possible to anticipate conflicts before they occur.

(5) Reversing directions of march, either by simultaneous turn of all elements of a column or by circling about.

(6) Two-way traffic over a route and alternating traffic through defiles.

(7) Variations in actual running speeds and in the traffic flow and traffic density of a route.

c. Making a Road Movement Graph.

(1) Analyze the route on the map. Note important points such as cities, towns, road junctions, bottlenecks, etc., to be

passed through and the distance between major points along the route.

(2) Select graph paper with enough squares to plot distance and time involved. Across bottom, left to right, place scale of time. In left margin, from bottom to top, place scale of distance.

(3) If the origin and destination, rate of march, and time of departure of a movement are known, schedule the head of the column as follows:

(*a*) Assume that a unit is to march from Mount Royal (25 miles on the vertical scale), leaving 0700 hours and proceeding at 15 miles in the hour to a point 5 miles beyond Tavistock. The distance is 60 miles. At 15 miles in the hour, it will require 4 hours to cover the 60 miles.

(*b*) Place a dot at the point where the line representing the place of departure (Mount Royal at 25 miles on the vertical scale) intersects the line representing the hour of departure (0700 hours on horizontal scale).

(*c*) Place a second dot at the point where the line representing the destination (5 miles past Tavistock at the 85-mile mark on the vertical scale) intersects that of hour of scheduled arrival of the head of the column at the destination (1100 hours on the horizontal scale or 0700 plus 4 hours).

(4) Unless the unit is very small, usually it is desirable to show the schedule of the tail of the column as well as the head. After charting the schedule of the head, schedule the tail if the time length of the column is known or can be computed. Assuming that the time length of the column, including extra time allowance, is 30 minutes, a line drawn from the point representing the clearance of the column at origin (0730) and at the destination (1130) will be shown the schedule of the tail of the column past all points en route.

(5) To determine what time the column must start to complete the movement and arrive at the destination at a certain hour, reverse the above procedure.

d. Analysis of Graph. Length, time length, rate of march, and other factors may be determined from the road movement graph as follows:

(1) *Length of column.* A vertical line connecting the head and tail lines, measured by the scale of miles or kilometers, will show the planned length of the column on the road at the prescribed rate of march at any hour during the movement, provided that the extra time allowance, if any, converted to miles is subtracted from the measurement.

Example: When the head of the column is at Stevens (45 miles on vertical scale), the tail will be at approximately the 38-mile mark.

(2) *Time length.* A horizontal line connecting the head and tail lines, measured by the scale of hours, will show the planned time length, including EXTAL, of the column as it passes any point on the road.

Example: If the head of the column arrives at Tavistock at 1040 hours, the tail will not clear that point until half an hour later, at 1110 hours.

(3) *Rate of march.* The diagonal line of the graph indicates the rate of march.

Example: The distance (mile scale) between the intersection of the diagonal line with any two vertical lines spanning a 1-hour period (time scale) indicates the miles in *that* hour.

e. Multiple Movements.

(1) A number of serials or columns over the same route can be scheduled by using a road movement graph. The commander of a large unit or the highway regulation officer can keep accurate records of the location of each serial by having information sent to him as each serial reaches or clears highway regulation points along the route of march. This information is indicated by filling in the space between the lines representing the scheduled head and tail of each column with color or tape. This enables the headquarters to see at a glance the location of each serial, to follow the progress of each movement, to correct situations which may cause congestion and delay, and to know where each serial can be reached in order to issue new orders if necessary.

(2) Colored pencils, crayons, ink, or adhesive tape may be used to indicate various schedules, the relative priority of movements or to plot movements in progress. For example; the head and tail schedule may be outlined by black lines, progress of each serial may be filled in with green, and failure to adhere to the schedule may be shown in red.

(3) Figure 3.21 shows the plotted progress of serials scheduled in figure 3.20. Note the changes and adjustments in schedules that had to be made. This is what happened:

(*a*) *Serial A.* Went through as scheduled.

(*b*) *Serial B.* Change in orders required that serial B continue on to Dundalk. It continued on schedule, and the head of the column arrived at its new destination at noon.

(*c*) *Lateral movement.* Because of a change of orders for serial B, arrangements had to be made to hold the lateral movement at McLean. It made its noon halt and crossed the route 3 hours behind its original schedule, not clearing until 1830.

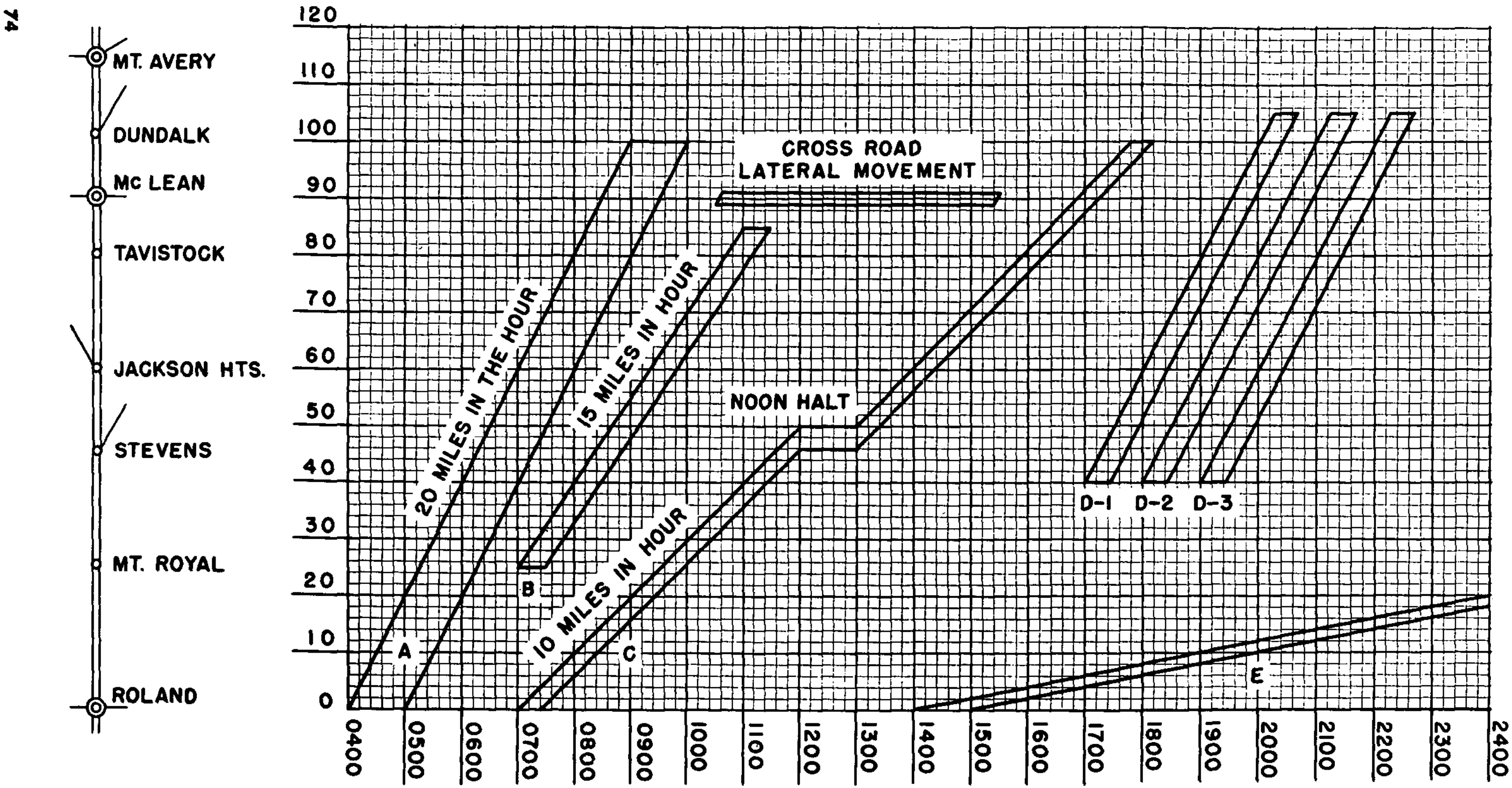


Figure 3.20. Road movement graph.

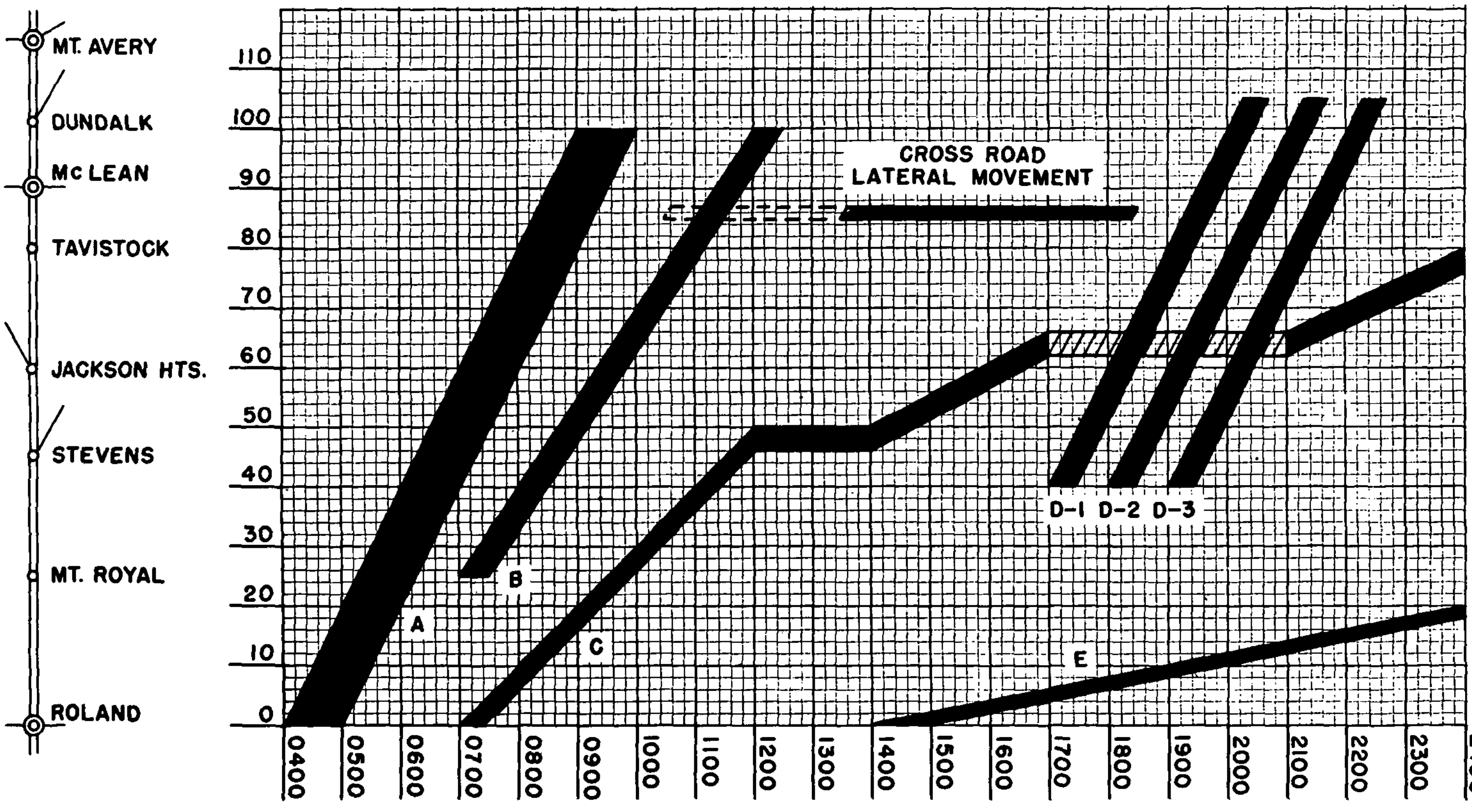


Figure 3.21. Deviations from schedules.

(*d*) *Serial C.* At 1200 it became obvious that if serial C continued on schedule it would conflict with the delayed lateral movement at about 1730. Serial C also had lost priority, because of the arrival of serial B at Dundalk with critically needed supplies. Therefore serial C was halted for 2 hours (1200–1400). It continued at a slower rate of march until 1700, when it was halted again to let serial D pass.

(*e*) *Serial D (D–1, D–2, D–3).* All elements went through on schedule.

3.21 Traffic Density

a. Traffic density is the number of vehicles occupying a unit length of roadway at a given instant. Usually, it is expressed in vehicles per mile. It can be determined by the following formula:

$$\frac{\text{Vehicle per hour}}{\text{Speed in miles per hour}}=\text{density in vehicles per mile}$$

b. Any traffic density desired for dispersion or to maintain the maximum capacity of a route may be arrived at by the formula:

$$\frac{\text{1 mile in yards}}{\text{Desired intervehicular space in yards}}=\text{density}$$

Example: If vehicles are dispersed every 100 yards, density would be:

$$\frac{1{,}760\text{ yd}}{100}=17.6\text{ vehicles per mile}$$

c. The traffic density may be determined when the speed and speedometer multiplier are known by using the following formula:

$$\frac{\text{1 mile in yards}}{\text{Speed in miles per hour}\times\text{speedometer multiplier}}=\text{density}$$

Example: If the speed of the column is 20 miles per hour and a speedometer multiplier of 2 is used, the traffic density would be:

$$\frac{1{,}760}{20\times 2}=44\text{ vehicles per mile}$$

3.22 Road Movement Table

a. Road movement tables provide a convenient means of transmitting to subordinates information about schedules and other essential details pertaining to a road movement. This is particularly so if the inclusion of such details in the body of the operation order would tend to complicate it or make it unduly long. Tables frequently require a wider distribution than a normal operation order because copies are issued to convoy operating personnel, traffic regulating personnel, and traffic control posts. For security reasons, it may not be desirable to include dates or locations. Security classification will be given in accordance with contents of the table; it will not necessarily be the same as that of the operation order. If the table is issued by itself and not as an annex to a more detailed operation or administrative order, it must be signed and/or authenticated in the same manner as other orders.

b. The beginning of the table includes general information common to two or more serials, e.g., security classification, maps, average speed, traffic density, halts, main routes to the start and release points, and information about other critical points. Information concerning the routes and critical points is normally described by grid references, codewords, etc., and, if necessary, may be numbered or lettered for ease of reference to the columns in the table. The remainder of the table includes information concerning each individual serial and is arranged in tabular form. A sample road movement table is shown below.

3.23 Combined Order, Log, and Strip Map

(fig. 3.22)

In some situations it may be advantageous to combine on one sheet an operation order, a log of road movement, and a strip map.

3.24 Convoy Commander's Checklist

If each item listed below is checked and acted upon carefully by the convoy commander *before* departure time, the chances of neglecting some important arrangement will be minimized.

1. Where is start point? ______ Release point? ______
2. What route is to be used? ______
3. Has reconnaissance been made? ______
4. Can bridges and defiles safely accommodate all loaded and/or tracked vehicles? ______
5. Are critical points known and listed on strip maps?______
6. Has the size of serials been determined?______
7. Has the size of march units been determined?______
8. What will be the rate of march?______
9. What is the vehicle interval on open road?______ In built-up areas?______ At halt?______
10. Type of column______
11. Has provision been made for refueling, if required?______
12. Has a suitable bivouac site been selected, if required?______
13. Have suitable rest and mess halt areas been selected?______
14. Is road movement table needed?______ Prepared?______ Submitted? ______

(SECURITY CLASSIFICATION)

Annex____to____(Formation/Unit)
Operation Order No.________
Dated________

Maps________

1. Average speed
2. Traffic density
3. Halts
4. Routes (between start points and release points may be indicated by code—red, green, etc.)
5. Critical points [1]
   a. Start points
   b. Release points
   c. Other critical points
6. Main routes to start points
7. Main routes from release points

These routes and points are here described by grid references, codewords, etc., and, if necessary, numbered or lettered for ease of reference in the columns below.

Serial [2]	Date	Unit/Formation	Number of vehicles	Load class of heaviest vehicle	From	To	Route	Route to start point	Critical points [1]			Route from release point	Remarks [3]
									Location	Due (hr)	Clear (hr)		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)
1	1 Sep	1st BG, 86th Inf (Motor elements, close column).	142	21	Alfa	Bravo	Red	71	RJ 620 (SP) CR 212 CR 427 CR 442 (RP)	0001 0021 0041 0118	0019 0039 0059 0136	11	None

[1] Critical points are selected points along the route used for reference in giving instruction. These points include start point, release point, and other points along the route where interference with the movement may occur or where timing is critical.

[2] A movement serial is defined as an element or group of elements within a series and in this table has a numerical designation for convenience in planning, scheduling, or control of movement.

[3] Information which is common to two or more serials will be given in the beginning of the table, items 1–7.

OpnO 1
Map: Strip map.
Cl No. 5-080109
1. (a) No change.
(b) 400TT bn displ vic Melun.

2. 2420TTCo displ vic Melun & Mo cl I and V sup FWD.
3. (a) See log of march.
(b) 1st plat loaded w/ cl I.
(c) 2d plat loaded w/ cl I.
(d) 3d plat loaded w/ cl V.
(e) Max speed 35.
(f) SP-100724 Mar CR 108.
4. (a) SOP.
(b) Medics atchd trail.
5. (a) SOP.
(b) CP head 2d plat

Acknowledgment: Whitt, Capt.

2420 Trans Co
Sees
091115 Mar 1958

Log of road movement

Highway clearance No. 5-080109 Mar

Route	Check point	Miles from check point	Miles from SP	Time of arrival	Remarks
	Sees (SP)	0	0	0724	DEPART.
	CR 108				
N-138	Q203	12	12	0800	2 hr loading.
	Alencon	1	13	1003	
N-155	Nogent	38	51	1157	1 hr lunch halt.
N-23	Chartres	33	84	1436	
N-188	Ablis	17	101	1527	
N-191	Etampes	18	119	1621	
N-837	Fontainbleau	29	148	1748	
	Melun (RP)	11	159	1821	Contact adv detail.

Rate of march: 20 mih.

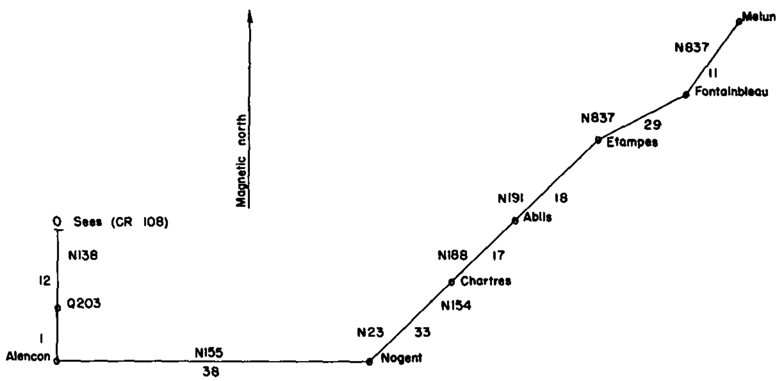


Figure 3.22. Sample combined order, log, and strip map.

15. Have convoy clearances been obtained?________ What number?________ What date?________
16. Is escort required and has it been requested?________
17. Are spare trucks available for emergencies?________
18. Are vehicles fully serviced, clean, and ready for loading?________
19. Is load proper, neat, and balanced?________
20. Are drivers fully and properly briefed?________ By whom, when?________ Strip maps furnished?________
21. Is convoy marked, front and rear of each march unit?________
22. Are guides in place?________ Have arrangements been made to post guides?________

23. Are blackout lights functioning?____________
24. Are maintenance services alerted?____________
25. Is maintenance truck in rear?__________ Are medics in rear?__________ Plan for casualties?______
26. Are all interested parties advised of ETA?__________
27. Is officer at rear of convoy ready to take necessary corrective action, such as changing loads, investigating accidents and unusual incidents?__________ Who is trail officer?____
28. Is there an entrucking plan?______ Who is responsible?____
29. Is there a detrucking plan?______ Who is responsible?____
30. Has a plan been made for feeding personnel?__________
31. Have times been established for loading or entrucking?______
32. Has time been established for formation of convoy?______
33. Have times been established for detrucking and/or unloading? ____________________
34. Has time been established for releasing trucks?__________ Who is responsible?________________
35. Is there a carefully conceived plan known to all personnel in the convoy that can be used in case of attack?__________

3.25 Convoy Commander's Report

This report is prepared by a convoy commander after a move has been completed. It is normally submitted to his immediate superior officer. A sample report which may be used as a guide is given below.

FORWARD LOAD

420 Trans Bn (Trk)		*4401 Trans Co(Lt Trk)*
7A26FEB23	*Twelve 2½-ton*	*16 Feb 58*
(Convoy No.)	(No. and type of task vehicles)	(Date)

TIME:

Convoy departed SP	0621	
Convoy departed loading point	0800	
Convoy arrived at loading point	0630	
At loading point		1 hr 30 min.
Arrived at HRP (destination)	1200	
Departed HRP	1205	
Departed unloading point	1245	
Arrived at unloading point	1212	
At unloading point		33 min.
Time returned to motor pool	1654	
Total round trip time		10 hr 33 min.

SUPPLIES OR PERSONNEL:

Cargo (short tons)	50. 2
Class of supplies	I
Personnel	0

MILEAGE:

Speedometer reading of lead vehicle (destination)	21, 363
Speedometer reading of lead vehicle (origin)	21, 322
Total miles (forward)	41
Total miles (round trip)	82

REMARKS:

SP—Company area, RJ 124/167

RETURN LOAD

TIME:

Departed loading point	1300	
Arrived at loading point	1245	
At loading point		15 min.
Departed unloading point	1415	
Arrived at unloading point	1400	
At unloading point		15 min.

SUPPLIES OR PERSONNEL:

Cargo (short tons)	10
Class of supplies	I
Personnel	0

MILEAGE:

Speedometer reading of lead vehicle (destination)	21, 404
Speedometer reading of lead vehicle (origin)	21, 363
Total miles (return load)	41

REMARKS:

s/Thomas A. Young
Convoy Commander

2d Lt. 4401 Trans Co (LtTrk)
(Rank/Grade and Organization)

3.26 Convoy Clearance Request

Convoy clearance requests are usually required from units or organizations that are planning a move by convoy. The information required varies according to local SOP's and regulations. A sample request which shows the information usually required by any authority that issues road clearances is given below. In a field army, the transport services division will normally determine routes to be used and issue road clearances through the medium of highway regulating points.

From: S41429TTBn. Phone: Rennes 1440. Time and date: 260930 Oct 58. Authority for movement: MO 341, Hq, TALOG Comd, dated 19 Oct 58. (a) Convoy No. 12B (b) Unit name or serial No. 1429TTBn (c) Personnel 4 off 98 EM (d) No. of vehicles 51 trks, 31 tlrs (e) Type of vehicles 38 ¼-ton trks, 25 ¼-ton tlrs, 1 ¾-ton trk, 4 1½-ton trks, 8 2½-ton trks, 6 1-ton tlrs (f) Cargo and tonnage 36 tons baggage and organizational equipment (g) Outsized or overweight dimension None (h) Elements and time gap 3 serials, 10 min (i) SP Rennes (j) Time and date of departure 290700 Oct 58 (k) Proposed route Rennes, Laval, Le Mans, Nogent, Chartres (l) Destination Chartres (m) Time and date of arrival 291900 Oct 58 (n) Rate of march 20 mph (o) Intervehicular gap 60 yards, 20 yards through towns (p) Halts—15 min Laval, Nogent; 1 hr Le Mans (q) Bivouac None Arrive____________ Depart____________ (r) POL points*

____________________ (s) Highway regulation*__________

Critical point (HRP)	ETA	ETD	Actual time Arrived	Actual time Departed	Cleared by

(t) Remarks: Advised Sgt Harris in office of Staff Transportation Officer at 261015 Oct 58. Clearance granted by Lt. Brown, office of Staff Transportation Officer at 261230 Oct 58.

Note.—Unit commanders will insure strict compliance with all SOP's and with all highway regulation and control procedures issued by competent authority.

3.27 Traffic Headquarters

a. Mission. The traffic headquarters regulates traffic that is moving into and out of the corps and division areas. It coordinates routes and schedules in order to obtain schedules to pass convoys into the army rear. Lateral traffic is coordinated by the traffic headquarters involved. The higher headquarters settles disputes in any schedule conflict.

b. Functions. The traffic headquarters is responsible for coordinating the movement of all units assigned or attached; coordinates with traffic headquarters of higher and lower commands; prepares the traffic circulation plan and the motor transport portion of other plans and orders issued by the headquarters; and prepares and maintains up-to-date road movement tables to support army, corps, or division emergency plans.

c. Organization. The transportation officer at army headquarters has staff supervision and operational control of the army traffic headquarters. Transportation officers at corps and division levels have staff supervision and operational control over their respective traffic headquarters, and each is under the supervision of the appropriate higher headquarters. The traffic headquarters is organized as a special staff function at all three levels.

*Determined by staff transportation officer.

3.28 Highway Scheduling Request

This type request is submitted by a unit desiring to use certain parts of the highway at specified times. Clearances are normally issued by post transportation officers, and highway regulation is not required. A sample request that lists the information usually required is given below.

1. FOR (UNIT) 4401st Trans Company (Light Truck)
2. ORIGIN Fort Eustis, Va. DESTINATION Camp A. P. Hill, Va.
3. DESTINATION INSTALLATION Moss Neck area
4. VEHICLES BY TYPE

Wheeled				Tracked	Total
Smaller than 2½-ton	2½-ton	5-ton	Larger than 5-ton		
5	45	None	1	None	51

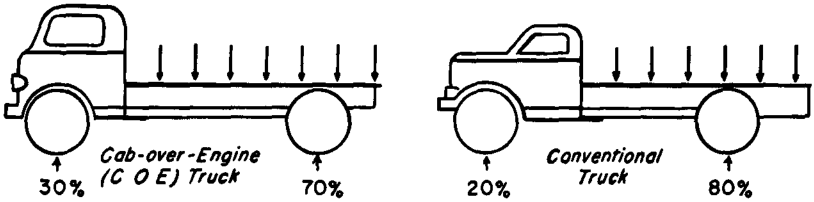
REMARKS: Vehicle larger than 5-ton is a truck, 6-ton, 6 x 6, wrecker

5. LIMITATIONS (SPECIAL SCHEDULING): (a) LGTH N/A (b) WIDTH N/A (c) HGT N/A (d) WGT N/A
6. (a) No. SERIALS 3 (b) INTERVAL 5 min (c) No. MARCH UNITS 9 (d) INTERVAL 2 min (within serials) (e) TIME LENGTH 28 min (f) RATE OF MARCH 20 mih (g) TYPE CARGO None (training mission) (h) TONS None
7. CONVOY COMMANDER 1st Lt James E. Brown
8. ROUTE AND SCHEDULE

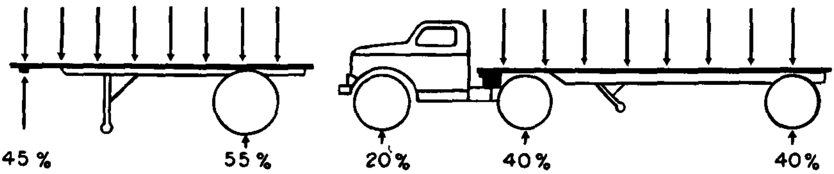
(a) Critical Points	(b) Arrive	(c) Clear	(d) Route	(e) MP escort required	(f) Remarks
Main Gate, Ft Eustis, Va.	210600 May 58	210628 May 58	Rts 60, 238, 168, North	Yes	
RJ Routes 168 and 30	210700 May 58	210728 May 58	Rts 30 and 33, East	No	
RJ Routes 33 and 17	210800 May 58	210828 May 58	Rt 17, North	No	

9. PERSONNEL IF LOGISTICAL SUPPORT REQUIRED: (a) OFF None (b) EM None (c) OTHER None
10. TYPE SUPPORT REQUIRED None

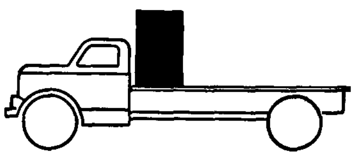
REQUESTED BY Maj John P. Doe
DATE 16 May 1958 TIME 0800
MOVEMENT No. 23-2-58
ORGANIZATION 23d Transportation Group (Truck)
RECEIVED BY Lt Brown (Transportation Office)



Tires, axles, frame, etc, are designed to carry a load distributed as above.

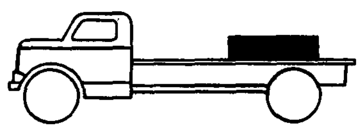


Distribute trailer loads equally between the rear tires and the fifth wheel. This transfers the load to the tractor.



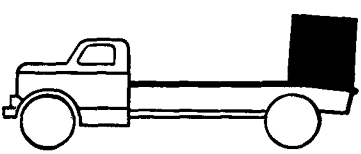
WRONG

This will bend the frame, overload front tires, making steering harder.



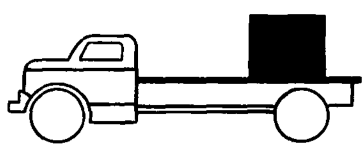
RIGHT

Place heavy part of load near rear axle for proper tire loading and to keep frame from bending.



WRONG

This kind of weight distribution bends the frame, overloads rear tires, and makes steering almost impossible.



RIGHT

Set a concentrated load just ahead of the rear axle with, if possible, the longest side on the floor

Figure 3.23. How to load a truck.

3.29 Vehicle Loading

a. Responsibility. The driver is responsible for his vehicle being loaded properly.

b. Rules for Loading (fig. 3.23).

(1) Place heavy supplies at the bottom of the load and distribute evenly over cargo floor.

(2) Place the load so it won't shift; distribute the weight equally.

(3) Do not distribute load loosely or build it up too high. High, loosely distributed loads cause swaying, make the vehicle difficult to handle, and increase the danger of losing the cargo or overturning the vehicle.

(4) If the truck has an open body, put a tarpaulin, when practicable, over the cargo to protect it against sun, dust, or rain.

(5) If possible, place barrels and drums on their sides—parallel with the length of the truck—brace, and pyramid them. If the possibility of leakage does not permit this placement, set the drums upright. This latter arrangement does not permit the loading of as many drums in the same space.

(6) Combine boxed, crated, and packaged cargo, as far as possible, with like items or items of combining shapes.

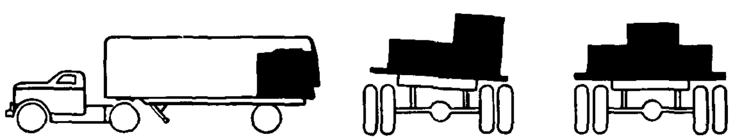
(7) Load sacked cargo separately, or so as not to risk its being punctured by odd-shaped or sharp-edged items; stack it in overlapping layers to prevent shifting.

3.30 Vehicle Capacities and Capabilities

The figures below should be used for planning purposes only. They are based upon experience gained in the field, and are averages for

WRONG RIGHT

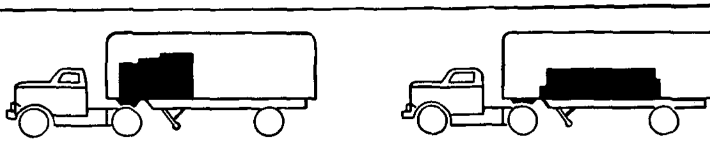
The right vehicle for the right job.



WRONG — This overloads trailer rear wheels, brakes won't brake properly, rubber scuffs away. Distribute the load over the full trailer floor.

WRONG — This overloads one spring and set of tires. Brakes lock on the light side, cause skids.

RIGHT — Nothing overloaded, frame won't twist and loosen cross-member rivets.



WRONG RIGHT

This overloads and shortens tire life, bends the truck rear-axle housing. Applying the trailer brakes may lock the wheels, cause flat spots and skidding.

Figure 3.23—Continued.

the various makes and models of the equipment listed. Weather, roads, terrain, and tactical situation must also be considered.

a. Local and Line Hauls.

Type of equipment	Avg load per veh trip	Loading and unloading time (hr)	Local hauls [1]		Line hauls	
			Avg miles forward	Round trips per veh per day	Miles in the hour [2]	Avg daily mileage capability [3]
Truck, cargo						
2½T, 6x6	4 tons	2½	15	4	15	125
5T, 6x6	6 tons	2½	15	4	15	125
Semitrailer						
12T, S&P	12 tons	2½	15	4	15	125
Gas tank, 12T, 4W	5,000 gal	2½	15	4	15	125
Refrg. 7½T, 2W	6 tons	2½	15	4	15	125
12T, 4W, low-bed wrecker	1 missile	2½	15	4	15	125
Tank trans, 50T	50 tons	2½	15	4	11	90

[1] Includes port and beach clearance.
[2] Increase miles in the hour to 20 for short-range planning.
[3] Figures are for long-range planning, multiply by 4/3 or 1.33 for short-range planning quantities.

b. Payload Capacities.

Type of equipment	Maximum cargo loads		Men w/indiv equipment [a]
	Off road	Highway	
Truck, cargo			
2½T, 6x6	2½ tons	5 tons	16
5T, 6x6	5 tons	10 tons	18
Semitrailer			
12T, S&P	12 tons[b]	18 tons	[c] 50
Gas tank, 12T, 4W	3,000 gal	5,000 gal	NA
Refrg, 7½T, 2W	6 tons[b]	7½ tons	NA
12T, 4W, low-bed wrecker	1 missile	1 missile	NA
Tank trans, 50T	40 tons[b]	50 tons	NA

[a] Does not include driver. For distance greater than 75 miles, the figure should be reduced.
[b] Not generally used for this type operation.
[c] Recommended for emergency use only.

c. Vehicle Availability. In advance highway transport planning, availability means the average number, or percent, of vehicles in a unit that can be operated continuously for 20 hours during each 24-hour period. The table below gives planned availability figures. Availability figures are greater than those shown in the table for a longer daily operation or for a specific task, such as a short one-lift haul. The planning figure must not be confused with actual availability, which is obtained from vehicle records and reports.

Unit	Task vehicles assigned	Vehicle availability		
		Advance planning [1]	Target [2] (24-hour/day)	Spot tasks
Trans light trk co	60	45	50	57
Trans med trk co	60	45	50	57
Trans hvy trk co	24	18	20	23
Trk pools	Any number	75%	83%	95%

[1] Also used when involved in particularly rigorous operations remote from adequate maintenance, or when actual operating conditions cannot be determined.

[2] With well-trained and disciplined personnel, good operating conditions, and adequate maintenance support.

d. Capabilities of Truck Companies.

Type of equipment	Type haul	
	Local (ST daily)	Lines (ST miles daily)
Truck, cargo		
2½T, 6x6	720	22,500
5T, 6x6	1,080	33,750
Semitrailer		
12T, S&P	2,160	67,500
Gas tank, 12T, 4W	900,000 gal.*	84,375
Refrg, 7½T, 2W	1,080	33,750
Low-bed wrecker, 12T, 4W	40 large missiles*	20 large missiles.*
Tank trans, 50T	3,600	78,750

*Tonnage figures not applicable.

3.31 Vehicle Unitized-Load Capacities

Load	Vehicle			
	2½T cargo truck[a]		10T stake and platform trailer	
	Sides in place, crane-loaded	Sides removed, fork-lift-loaded	Sides in place, crane-loaded	Sides removed, fork-lift-loaded
Cargo net	3	Not recommended	6	Not recommended.
Cargo transporter, type 2.	1 lengthwise	1 lengthwise	3 lengthwise	4 crosswise.[b]
Stevedore pallet	2 crosswise	4 lengthwise	6 crosswise	8 lengthwise: 2 rows of 4.[c]
Unitized pallet	3 crosswise	5: 4 lengthwise; 1 crosswise.	7 crosswise	10 lengthwise: 2 rows of 5.[c]
Warehouse 4x4 pallet	3	3	6	12: 2 rows of 6.

[a] Some 2½-ton, 6x6 cargo trucks have fender wells which project into the cargo space. In such cases, a level platform for the storage of a unitized cargo can be obtained by fitting a frame of 2 by 4 or 4 by 4 timbers flat in the cargo bed between the fender wells.

[b] May be loaded by crane.

[c] Increase by one for 12-ton stake and platform trailer.

3.32 Motor Vehicle Shipments of Hazardous Cargo

a. The following measures must be enforced to prevent fire:

(1) Smoking must be prohibited within 50 feet of a vehicle loaded with explosives or flammable liquids. Open flames, such as those produced by striking matches and using cigarette lighters, torches, etc., must be prohibited within 100 feet of any motor vehicle loaded with explosives or gasoline.

(2) Two fire extinguishers, properly filled, should be provided, one inside the cab and one outside, on the driver's side.

(3) All personnel should be instructed in the proper use of fire extingushers and, where practicable, the instruction should be supplemented by demonstrations.

(4) If a truck catches on fire, all trucks should be moved away from the vicinity of the fire and all traffic stopped. Every effort should be made to warn inhabitants living in the vicinity of the danger.

(5) When loading or unloading trucks, explosives must not be placed in the vicinity of the exhaust.

(6) Ignition and lighting systems should be properly insulated, and inspected frequently to insure that danger from short circuits is eliminated.

(7) Every effort should be made to prevent leaks in gasoline tanks, fuel lines, and carburetors. When a leak is discovered, the truck should be unloaded and moved to a safe distance before repairs are made.

(8) Oil and grease thrown from moving parts should not be allowed to accumulate on the truck body, engine, or other places where a fire hazard would result.

b. Motor vehicles transporting explosives or gasoline must not be driven past fires of any kind until it has been ascertained that the fire can be bypassed safely.

c. Advance reconnaissance and contact with civilian traffic officials are essential. Routes selected, if possible, should avoid heavy traffic and large cities.

d. Loitering should not be permitted in the vicinity of a vehicle in convoy.

e. When a truck breaks down it should be moved off the road or as far to the side as possible and, pending the arrival of an empty truck or repair party, left in charge of a guard.

f. Fuzes and detonating devices must not be carried in the same truck with other explosives (fixed and semifixed ammunition is an exception).

g. The interior of the truck body should be lined so that every portion of the lining with which a container may come in contact will be of wood or other nonsparking material.

h. Loads should be braced and stayed to prevent shifting.

i. Trucks loaded with explosives or gasoline must never be towed or pushed by another truck except to move a disabled truck to the side of the road.

j. Hourly halts should be made to inspect loads and vehicles.

k. Motor vehicles transporting explosives on public roads or highways must be marked with placards bearing the word EXPLOSIVES in letters at least 8 inches high. The placards must be prominently located on each side, and on the front and rear of the truck.

l. A motor vehicle transporting explosives or gasoline must not be left unattended upon any public street or highway.

m. The motor must not be running when loading or unloading a truck hauling explosives or gasoline.

n. When a truck has an open body, a tarpaulin must be used to protect the cargo from rain or the direct rays of the sun.

o. The entire cargo of explosives or ammunition must be transported within the body of the truck. The truck tailboard or tailgate must be closed and secured.

p. Cargo such as dynamite and certain other explosives must be protected from intense cold, which can cause the explosive to deteriorate or become dangerous. Freezing characteristics of the cargo must be determined before transporting in temperatures below 32° F. If necessary insulated vans must be used.

3.33 Vehicle Missile-Loading Capabilities

The missile-loading capabilities of certain types of vehicles that are normally found in highway units are given below. In each case either weight or volume is the limiting factor. The loads given do not exceed the width dimensions of the vehicles except in some cases for low-bed and flat-bed trailers.

a. Transportation Light Truck Company (TOE 55–17).

[A = maximum number of packaged missiles one task vehicle can transport
B = number task vehicles required to transport one packaged missile]

Task vehicle authorized	Nike Ajax		Nike Hercules		Honest John		Little John		Dart		Sergeant		Corporal		La Crosse		Redstone		Jupiter	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Trailer:																				
Cargo, ¼T, 2W, M100	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-
Cargo, 1T, 2W	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-
Cargo, 1½T, 2W, M104	-	-	-	-	-	-	-	-	8	1	-	-	-	-	-	-	-	-	-	-
Flat-bed, guided missile, M261, 3,245-lb cap.	1	1	-	-	-	-	2	1	15	1	-	-	-	-	-	-	-	-	-	-
Truck:																				
2½T, 6x6, cargo, M35	2	1	-	-	-	-	3	1	12	1	-	-	-	-	1	1	-	-	-	-
2½T, 6x6, cargo, M135	2	1	-	-	-	-	3	1	12	1	-	-	-	-	1	1	-	-	-	-
5T, 6x6, cargo, M54	5	1	-	-	-	-	6	1	14	1	-	-	-	-	2	1	-	-	-	-

b. Transportation Medium Truck Company (TOE 55–18).

[A = maximum number of packaged missiles one task vehicle can transport
B = number task vehicles required to transport one packaged missile]

Task vehicle authorized	Nike Ajax		Nike Hercules		Honest John		Little John		Dart		Sergeant		Corporal		La Crosse		Redstone		Jupiter	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Semitrailer:																				
5T, 2W, S&P, M516	5	1	----	3	----	----	6	1	16	1	----	2	----	----	2	1	----	----	----	----
6T, 2W, S&P, M118	6	1	----	3	1	1	6	1	22	1	----	2	----	----	3	1	----	----	----	----
Van, 6T, 2W, utility, MGSW4.	6	1	----	3	1	1	6	1	22	1	----	2	----	----	2	1	----	----	----	----
Cargo van, 6T, 2W, M119	6	1	----	3	1	1	3	1	11	1	----	2	----	----	2	1	----	----	----	----
Van, 6T, 2W, MSKD 2270	6	1	----	3	1	1	6	1	20	1	----	3	----	----	2	1	----	----	----	----
10T, 2W, S&P	6	1	----	2	1	1	6	1	24	1	----	2	----	----	4	1	----	----	----	----
Van, 11T, 2W	6	1	----	2	1	1	12	1	28	1	----	2	----	----	2	1	----	----	----	----
Cargo, 12T, 4W, M127	6	1	1	1	2	1	12	1	28	1	----	2	----	----	4	1	----	----	----	----
Low-bed, wrecker, 12T, 4W, M269.	12	1	1	1	2	1	15	1	51	1	1	1	----	----	5	1	----	----	----	----
Low-bed, wrecker, 12T, 4W, M270.	12	1	1	1	2	1	15	1	84	1	1	1	1	1	5	1	----	2	----	----
Low-bed, 25T, 4W, M172	16	1	1	1	3	1	30	1	80	1	1	1	----	----	9	1	----	----	----	----
Jupiter-missile transporter (less nose cone).	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1	1
Jupiter-missile transporter (nose cone).	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1	1

3.34 Computing Vehicle Requirements

a. One-Lift Hauls. To determine the number of truck companies required to move a given number of tons in one lift, use the following formula:

$$\frac{\text{Tons to be lifted}}{\text{Tons per veh} \times \text{veh availability per co}} = \text{truck companies required}$$

Example: Determine number of light truck companies required to move 2,700 tons in one lift.

Assuming: 4 = tons per 2½-ton, 6x6 truck
45 = vehicle availability per company

Substitute in the formula:

$$\frac{2{,}700}{4 \times 45} = 15 \text{ companies}$$

b. Sustained Forward Hauls (Continuous Operation). In sustained forward hauls trucks return for additional loads, and it is necessary to consider turnaround time and the daily operating time. To determine the number of truck companies required to move a given forward tonnage daily, use the formula below.

$$\frac{\text{Daily forward tonnage} \times \text{turnaround time}}{\text{Tons per veh} \times \text{veh available per co} \times \text{operating time in hours (daily)}}$$
$= \text{truck companies required}$

Example: Determine the number of medium truck companies equipped with semitrailers, 12-ton, stake and platform, required to move an average tonnage of 4,800 short tons daily for a round-trip distance of 435 miles.

Assuming:
- 12 = tons per vehicle
- 45 = vehicle availability per company
- 20 = hours operating time daily
- 2.5 = loading and unloading time
- 10 = miles in the hour
- 1 = hours for each relay terminal operation (average 1 terminal per 125 miles).

First compute turnaround time:

$$TT = \frac{\text{round trip distance}}{\text{rate of March}} + \text{loading and unloading time} + \text{relay terminal time}$$

$$= \frac{435}{10} + 2.5 + 2 = 48 \text{ hours}$$

Then substitute in the formula:

$$\frac{4{,}800 \times 48}{12 \times 45 \times 20} = 21.3 \text{ or } 21 \text{ companies}$$

3.35 Motor Movement in Snow

Depth of snow (inches)	*Special measures required for movement*
3	None.
6	Rear chains.
6–18	Chains all around; traction devices on leading vehicles (to break the trail).
18 or more	Snowplow required.

3.36 Time Elements in Supply Operations

The time elements given below represent an approximated average under combat conditions and should be used as a guide only when actual-experience figures are not available.

	Minutes	
	Daylight	Darkness
Class I		
Division of 1 ration into 3 meals at kitchens	15	20
Kitchens to be taken off trucks, set up, and ready to begin cooking or vice versa	20	20
Kitchens to cook and prepare for serving a hot meal, includes loading on kitchen truck	120	150
Kitchens to prepare a cold noon meal: preparation and issue is usually at same time as preparation and serving of breakfast and requires no additional time. Times here apply only when a cold meal is prepared separately	60	90
Class II and IV*		
To load 2½-ton trucks at distributing or supply points:		
Class II and IV	30	30
Fortification materials, class IV	50	50
To load 1½-ton trailers:		
Class II and IV	12	12
Fortification materials, class IV	30	30
Class V*		
To load 2½-ton trucks at ammunition distributing or supply points	30	50
To load 1½-ton trailers	12	30
To unload 2½-ton ammunition vehicles	15	30
To unload 1½-ton trailers	6	12

*When trucks and trailers are overloaded, increase the time by the percentage of the overload.

3.37 Water Supply Data

a. Water Requirements. Values given are for planning purposes in temperate zones. For extremes of heat or cold, requirements vary considerably.

Truck	Terrain	Gallons per day
2½-ton, 6x6	Level, rolling	½.
	Mountainous	½ to 1
5-ton, 6x6	Level, rolling	1
	Mountainous	1 to 2

b. Vehicle Carrying Capacities. A full 5-gallon water can weighs 50 pounds; the volume of the can is 1.4 cubic feet.

Vehicle	Carrying capacity, full 5-gal. can	
	Off highway	On highway
¼-ton trailer	10	15
1½-ton trailer	60	110
2½-ton truck, M35	100	200
2½-ton truck, M135	100	200
5-ton truck, M54	207	366
12-ton semitrailer, M127	480	590

3.38 Highway Capacity Estimates

a. The following table may be used as a guide in the absence of more accurate data for estimating the supply support tonnage capabilities of highways under varied conditions, assuming operations are sustained, adequate road maintenance is provided, and each road bears two-way traffic. In using the table of reductions when more than one limiting factor is involved, apply the narrow roadway factor first; then to the new capability apply the suitable terrain factors; finally, to the latter adjustment apply the weather factor if the estimate is for a sustained period.

Type of road	Daily tonnage forward (ST)			Reductions applicable to various conditions (%)				
	Optimum dispatch route only	Supply traffic*	Supply traffic combat zone	Narrow roadway	Rolling terrain	Hilly with curves	Mountainous	Seasonal bad weather
Concrete	50,000	30,000	10,000	25	10	30	60	20
Bituminous	32,000	19,200	6,400	25	10	30	60	30
Bituminous-treated	18,000	10,800	3,600	25	20	40	65	40
Gravel	8,000	4,800	1,600	25	20	50	70	60
Earth	2,000	1,200	400	25	25	60	80	90

*Communications zone.

b. Planned tonnage movement should not exceed the capability of any portion of the road net to be used, unless reconstruction or heavy maintenance is provided to increase the capability of the section of highway or bridge to meet the demands; otherwise, alternate routes must be selected to distribute the load. If no alternate route is available and the indicated tonnage is not reduced, the highway or bridge can be expected to deteriorate rapidly and disrupt any sustained operation. It should be kept in mind that maintenance vehicles and personnel on a road may also interfere with the flow of traffic and thereby limit capability.

Section IV. MAINTENANCE AND SUPPLY

3.39 Automotive Maintenance

a. Organization for Maintenance.

Category	Definition	Echelon	Scope	Performed by	Responsible officer
Organizational.	Work authorized for, performed by, and the responsibility of the using unit.	1st	Care taken of and work done on equipment to keep it in a standard condition of serviceability. Consists of inspecting, cleaning, servicing, and tightening.	Operator or crew.	Company commander.
		2d	Consists of servicing, inspecting, adjusting, minor repair, and minor replacement.	Unit mechanics.	Company commander.
Field	Work performed by mobile or semimobile technical service units in direct support of using units.	3d	Repair and/or replacement of major parts, components, and assemblies; done by units in direct support.	Supporting army ordnance units.	Army commander.
		4th	Repair and/or replacement of major parts, components, and assemblies; done by units for a geographical area.		
Depot	Work performed by permanent installations, using extensive equipment.	5th	Major overhaul or complete rebuild.	Depot units	Chief of Ordnance.

b. Preventive Maintenance.

(1) *Scope.* Preventive maintenance is the systematic care, inspection, and servicing of equipment to maintain it in serviceable condition and to detect and correct incipient failures before expensive and time-consuming repairs or re-

placements are required. Preventive maintenance services are performed by vehicle operators and organizational maintenance personnel. Proper operation and use of equipment is just as important a part of preventive maintenance as prescribed inspections and services.

(2) *Intervals.* To insure that all important parts of equipment are checked systematically, two types of recorded preventive maintenance services are prescribed. The first type is a daily service which is performed by the operator or crew each day the vehicle is operated. The second is a quarterly, or Q, service, which is performed by second echelon maintenance personnel assisted by the operator or crew. The Q service is scheduled either on the basis of every 3 calendar months or a certain accumulated mileage, whichever occurs first. The mileage is 3,000 miles for wheeled vehicles and 750 for tracked. Operation under adverse conditions such as extreme temperatures, dust, or mud, may require that these services be performed more frequently. Commanders are authorized to reduce the intervals between the preventive maintenance services when conditions indicate the need. During combat, field exercises, maneuvers, or whenever mileage is accumulated at rapid rates, commanders will prescribe the appropriate preventive maintenance services to be performed. A unit alerted for combat normally performs the Q service on each tactical vehicle before action. When the unit is relieved from combat, or when the opportunity occurs, Q service is performed again. Immediately following operation in water, mud, or loose sand, the vehicle should be lubricated and the brakes checked and cleaned of any foreign matter, without waiting for the next scheduled service. Lubrication not normally included as a part of the Q service is performed on a mileage basis (every 1,000 miles for wheeled vehicles and 250 for tracked vehicles) unless the vehicle lubrication order prescribes a more frequent lubrication service.

3.40 Recommend Tire Pressures

Recommended tire pressure is given on the vehicle identification plate or listed in the technical manual for the vehicle. In soft sand, snow, or mud, tire pressure may be reduced to 10 pounds per square inch to increase flotation (bearing surface). Proper pressure should be restored as soon as practicable.

3.41 Vehicle and Motor Park Checklist

	Score (percent)
a. General.	
(1) Is the general appearance of the motor park satisfactory?	____________
(2) Are gasoline dispensing areas properly maintained?	____________
(3) Are dirty wiping rags and waste or similar flammable materials lying around?	____________
(4) Are sufficient fire extinguishers provided?	____________
(5) Are fire extinguishers accessibly located?	____________
(6) Are lubricant containers covered, and lubricants kept clean?	____________
(7) Are lubricant dispensers clean and properly maintained?	____________
b. Maintenance Shop and Records.	
(1) Are tools and equipment properly cleaned, serviced, and secured when not in use?	____________
(2) Are regulations regarding flammable materials and fuels being enforced?	____________
(3) Are all preventive maintenance inspections properly supervised?	____________
(4) Are Department of the Army lubrication orders on hand and being used?	____________
(5) Are appropriate technical manuals and bulletins on hand and readily available?	____________
(6) Are technical manuals used in the performance of preventive maintenance inspections and services?	____________
(7) Are adequate road tests performed on each vehicle as a part of preventive maintenance and inspection services?	____________
(8) During scheduled preventive maintenance inspections, does the unit diagnose deficiencies correctly and initiate proper corrective action promptly?	____________
(9) Does the unit attempt to perform higher echelon maintenance to the detriment of that required in its own echelon?	____________
(10) Are authorized tools on hand, or on order, and in serviceable condition?	____________
(11) Are unserviceable tools turned in?	____________

Score (percent)

(12) Are air compressors and auxiliary engines properly serviced and maintained? ________
(13) Are lubricants properly stored, identified, and secured from contamination? ________
(14) Are repair parts utilized discriminately as substantiated by the condition of parts which have been replaced? ________
(15) Is welding and cutting equipment properly maintained? ________
(16) Is training of maintenance personnel adequate? ________
(17) Does the unit maintain Department of the Army Form 460 (Preventive Maintenance Roster)? ________
(18) Are all vehicles, auxiliary engines, and trailers entered on the roster? ________
(19) Are all vehicles scheduled for preventive maintenance services indicated by U.S. Army registration number? ________
(20) Are all entries for scheduled services made in pencil on advance basis and inked over when preventive maintenance service is completed? ________
(21) Are the proper symbols or letters used in posting the preventive maintenance roster? ________
(22) Are the preventive maintenance services properly distributed throughout the month? ________
(23) Are all forms on hand or on requisition that are needed to properly implement the Army system of maintenance? ________
(24) Are DD Forms 110 (Vehicle and Equipment Operational Record) properly filled out? ________
(25) Is DD Form 110 used for daily preventive maintenance checks and services? ________
(26) Are DD Forms 110 retained on file for the required period? ________
(27) Are all vehicles dispatched entered on DA Form 55-169 (Daily Dispatching Record of Motor Vehicles)? ________
(28) Are the appropriate entries made in each column of DA Form 55-169? ________

	Score (percent)
(29) Do all drivers have Standard Form 46 (U.S. Government Operator's Identification Card)?	______
(30) Are Standard Forms 46 properly made out?	______
(31) Is there a DA Form 478 (Organizational Equipment File) maintained for each vehicle?	______
(32) Are all the authorized publications on requisition or on hand and available for ready reference?	______
(33) Are required maintenance services up to date?	______
(34) Does the maintenance shop maintain a modification work order (MWO) file?	______
(35) Is the ordnance section of the organization and/or installation property book properly maintained and up to date (AR 735-35)?	______
(36) Do registration numbers of vehicles, serial numbers of other major items, and quantities of all major items actually on hand agree with those in organization property book?	______
(37) Do quantities of major items shown as authorized in organization property book agree with appropriate TOE, TA, or other competent authorizations?	______
(38) Are invalidated property issue slips maintained in a suspense file until validated copies are received from issuing agency?	______
(39) Are locator and inventory cards established for all repair parts?	______
(40) Do quantity and location of repair parts on hand agree with locator and inventory card?	______
(41) Is the interchangeability of repair parts noted?	______
(42) Are repair parts properly stored, tagged, and preserved?	______
(43) Are used repair parts accounted for by by major item registration or serial number?	______
(44) Are stock number changes posted to date in supply records and catalogs?	______

Score (percent)

(45) Have parts required for equipment out of commission been requested? ______

(46) Is followup made on outstanding requests for repair parts? ______

(47) Are all required supply publications on hand? ______

(48) Is strict supply economy practiced in the use of parts and supplies? ______

(49) Are supply personnel adequately trained in use of supply publications procedures? ______

(50) Are unserviceable recoverable parts and assemblies promptly returned to supporting ordnance unit? ______

(51) Is a jacket file of hand receipts maintained for property loaned to another unit, organization, activity, or individual? ______

c. Vehicle Inspection.

(1) Is the general appearance of the vehicle satisfactory? ______

(2) Are registration and unit markings in accordance with current directives? ______

(3) Are engine compartments clean? ______

(4) Are cab compartments clean? ______

(5) Is cargo space clean? ______

(6) Is vehicle free of rust? ______

(7) Are door glasses present, unbroken, and clean? ______

(8) Do door glass regulators operate properly? ______

(9) Do door latches operate properly? ______

(10) Do lights operate properly? ______

(11) Is condition of canvas, upholstery, and fastenings satisfactory? ______

(12) Are footbrakes adjusted for proper pedal reserve? ______

(13) Are handbrakes adjusted properly? ______

(14) Is battery electrolyte at proper level? ______

(15) Is engine oil clean and at proper level? ______

(16) Is cooling system filled to proper level? ______

(17) Is there a copy of Standard Form 91 in each vehicle? ______

(18) Is there a copy of DD Form 518 in each vehicle? ______

(19) Are all on-vehicle material (OVM) tools present and in good condition? ______

	Score (percent)
(20) Does driver seem adequately trained?	________
(21) Is driver properly licensed?	________
(22) Is driver interested in his job?	________
(23) Is there a copy of the current technical manual and lubrication order in each vehicle?	________

Section V. MISCELLANEOUS

3.42 Anchoring Methods

(fig. 3.24)

a. Holdfasts. Natural anchorage should be used whenever possible. Sound wooden pickets, 3 inches in diameter and driven at least 3 feet into dry, undisturbed earth, should stand the following pulls:

Type picket	*Pounds*
Single	700
1–1 holdfast combination	1, 400
1–1–1 holdfast combination	1, 800
2–1 holdfast combination	2, 000
3–2–1 holdfast combination	4, 000

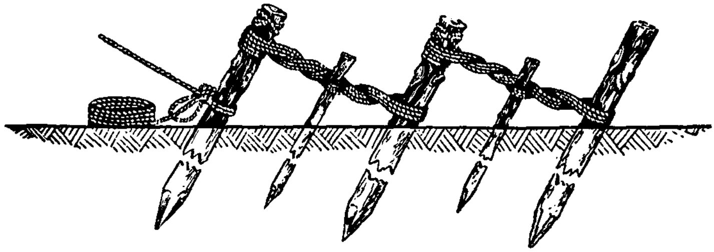
For wet earth, the holding power should be multiplied by the following factors:

Clay and gravel mixture	0. 9
River clay or sand	0. 5

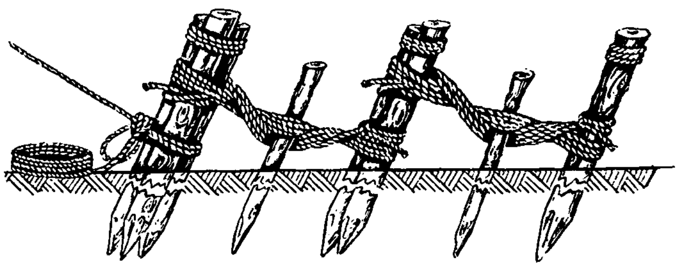
b. Deadman. The deadman is a log, railroad tie, or similar object sunk into the ground in such a manner as to afford anchorage for a line. The holding power of a deadman depends upon the bearing area and holding power of the earth. To determine the necessary bearing surface, divide the total stress by the values given below for the depth and cable inclination selected.

Mean depth of deadman in ordinary earth	Inclination of pull (vertical to horizontal) and safe resistance in pounds per square foot				
	Vertical	1 to 1	1 to 2	1 to 3	1 to 4
3 feet	600	950	1, 300	1, 450	1, 500
4 feet	1, 050	1, 750	2, 200	2, 600	2, 700
5 feet	1, 700	2, 800	3, 600	4, 000	4, 100
6 feet	2, 400	3, 800	5, 100	5, 800	6, 000
7 feet	3, 200	5, 100	7, 000	8, 000	8, 400

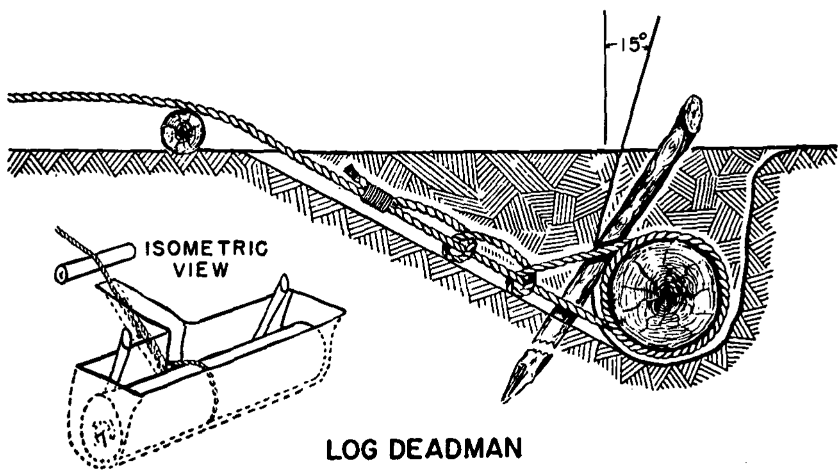
c. Installation of Deadman. To obtain the best results when installing a deadman, the following procedure should be used.



PICKET HOLDFAST



3-2-1 COMBINATION PICKET HOLDFAST



LOG DEADMAN

Figure 3.24. Picket holdfast and deadman.

(1) *Position.* The best position for the deadman is behind a natural crest or mound where as much surface of undisturbed earth as possible may be used. It should be placed far enough away from the vehicle being winched or towed so that it will not interfere when the vehicle clears the obstacle. If the deadman is too close to the vehicle, an upward pull may cause the anchorage to become dislodged.

(2) *Digging.* Dig a trench deep enough to place the top of the deadman a foot or so below the ground surface, and long and wide enough to hold the deadman. Undercut the bank in the direction of pull at an angle of about 15° from the vertical. Clear the bottom of the hole at a right angle to this bank. To help to strengthen the top edge of the hole in the direction of pull, drive two stakes on each side of the cable at a slightly greater angle to the vertical than the angle made by the bank and flush with the slanted bank near the top. Cut a trench for the cable from the hole through the crest of the hill or mound. This should be slightly deeper than the bottom of the hole at the beginning and should continue out in an ascending slope.

(3) *Cable attachment.* Attach the cable or chain so that the largest area of the deadman is against the forward bank, and so that any tendency of the deadman to rotate acts downward and not upward.

3.43 Improvised, Unmounted A-Frame

(fig. 3.25)

An improvised A-frame is a field expedient that provides both a lift and a tow. It is useful for lifting a vehicle out of or over a ditch or hole, or for recovering a badly mired heavy vehicle. It can be made with two poles, approximately 12 feet long, and chains, cables, or ropes. The chains are used for lashing the poles together and for towlines. The poles are locked together to form a shears. The legs of the shears are placed in two holes that are dug about 6 inches deep and 6 feet

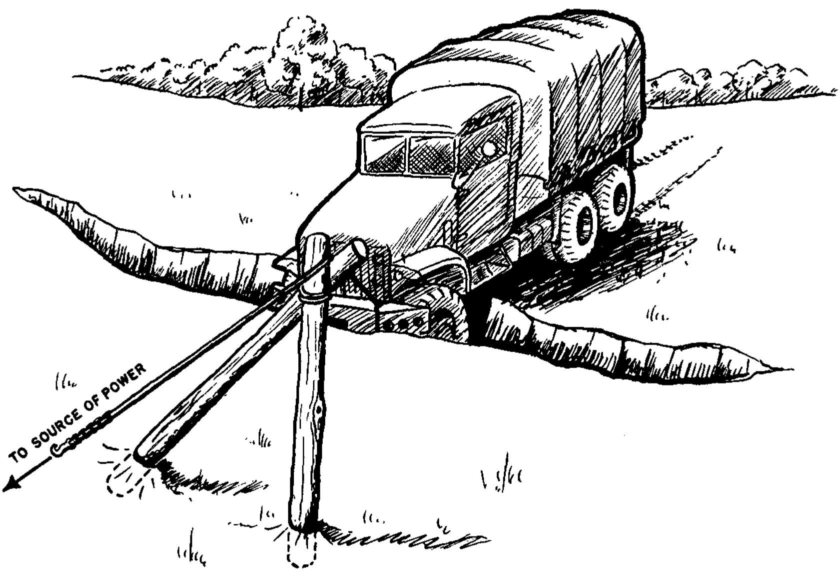


Figure 3.25. A-frame.

apart; a line is strung across the top of the A-frame between the power source and the vehicle to be moved. The legs of the A-frame must be placed far enough away from the vehicle that is to be moved to keep them from damaging it when it is lifted up and forward. After the front wheels have been lifted out of the ditch, the vehicle must be moved slightly forward and the ditch filled or bridged to allow the rear wheels to cross.

3.44 Winch

a. Using the Winch.

(1) When used properly, the winch installed on Army vehicles furnishes great lifting and pulling power. Improper use or careless handling, however, results in inefficient performance and possible breakdown of the winch mechanism.

(2) A vehicle may be taken across an obstacle with the assistance of its own winch by attaching the winch cable to a deadman or tree. The power of the drive wheels should be used whenever possible to assist the winch. Transmission gears should be so selected that the speed of the vehicle's wheels as they move over the ground will be the same as that of the winch cable as it is wound on the winch drum.

(3) After the vehicle with winch has crossed an obstacle with the assistance of its own winch, it may be used to help other vehicles without winches over the obstacle by either straight towing or winching operations. The winch cable may be extended and attached to the other vehicle, the winch mechanism locked, and the truck used as a towing vehicle; or the winch truck may be halted and blocked, and the winch alone used.

(4) When pulling a vehicle with the winch of another, the towed vehicle should assist with its maximum traction. The best power combination generally results if the winch is operated in the highest gear that will give sufficient power and the truck being winched is pulling in lowest gear.

(5) When the winch is used on a difficult pull, the winch truck may be held in place by using the brakes and wheel blocks, or by anchoring to a tree or deadman. When the load is not too heavy, traction devices will assist in holding the vehicle in place. A snatch block may be used to increase the mechanical advantage of the winch when pulls are too heavy for the winch alone (fig. 3.26).

(6) Overturned vehicles cannot always be righted by manpower alone. When necessary, a rigging similar to that shown in figure 3.27 may be used. Parking brakes on the overturned vehicle should be applied before the vehicle is righted. Any towing or winching method may be used to pull on the

rope. A holding bridle, placed opposite to the bridle shown in the figure, should be used to prevent the vehicle from being damaged by settling too rapidly. Also, to prevent damage to bridles and the body of the vehicle, padding (rags and/or small boards) should be used between points of contact.

b. Safety Precautions.

(1) Certain precautions are necessary in the proper use of the winch cable. Whenever the winch cable is slipped over abrasive surfaces (concrete, asphalt, etc.), it should be protected by placing pieces of wood under it. Power must be applied to the cable gradually. Kinks and twists must always be removed. Cables should not be tied in knots, except for emergency repair. They should not be rigged around an angle in such a manner as to bend them. Vehicles with metal tires should not be permitted to run over the cable.

(2) Most winches have a shear pin which is designed to break off under any strain which might snap the cable. Nevertheless, when a steel cable is tightened, it may break and snap back with enough force to kill or seriously injure a man. Personnel should stand clear before the cable is tightened. Makeshift shear pins should not be used.

(3) The cable should be wound evenly on the drum when in use under load and when being rewound after use. To wind the cable evenly, at least a light load is necessary to prevent kinking. Otherwise, the cable may become tangled or damaged, resulting in sharp burrs which can cause serious injury.

(4) Personnel handling winch cables should always wear work gloves, preferably with leather palms, to protect themselves

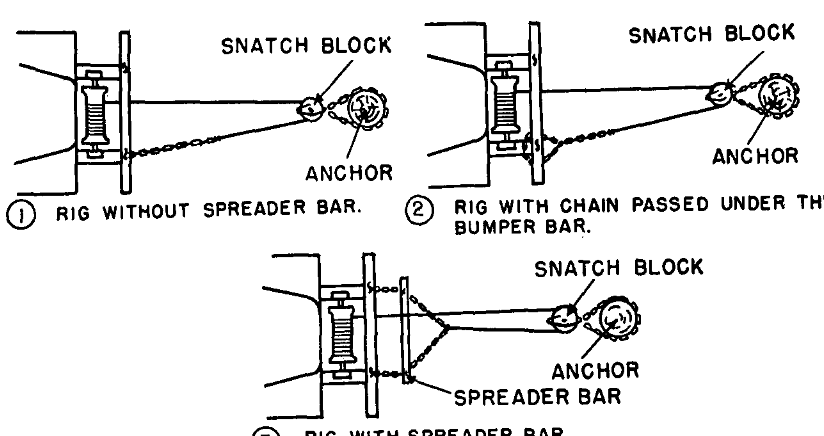


Figure 3.26. Use of winch and snatch block.

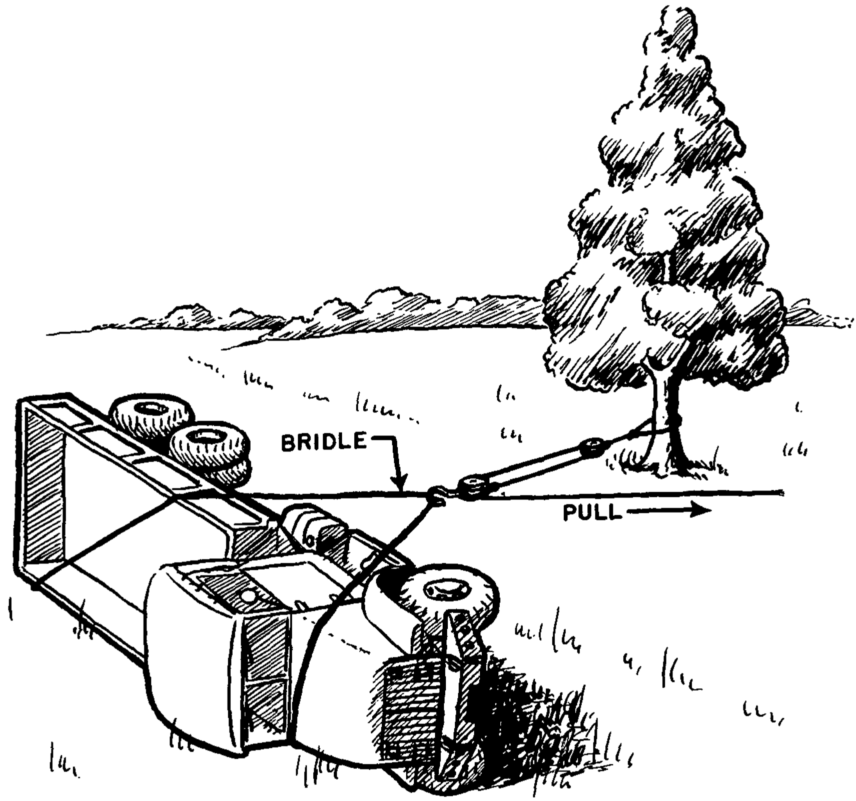


Figure 3.27. Using a winch to right an overturned vehicle.

from cuts and scratches caused by broken strands in the cable.

3.45 Chespaling Mats: Expedient Surface for Muddy or Soft Areas

a. Chespaling mats (fig. 3.28) are useful in providing a temporary hard surface in soft sand, mud, or swampy areas. They may be made of small saplings or bamboo rods approximately 6 feet long and about 1½ inches in diameter. The saplings or rods are placed about 3 inches apart and wired together with chicken-wire mesh or smooth wire strands. If saplings are used, they should be kept wet to preserve springiness in the wood and to prevent them from splitting or breaking. A 12-foot mat of this type weighs about 75 pounds.

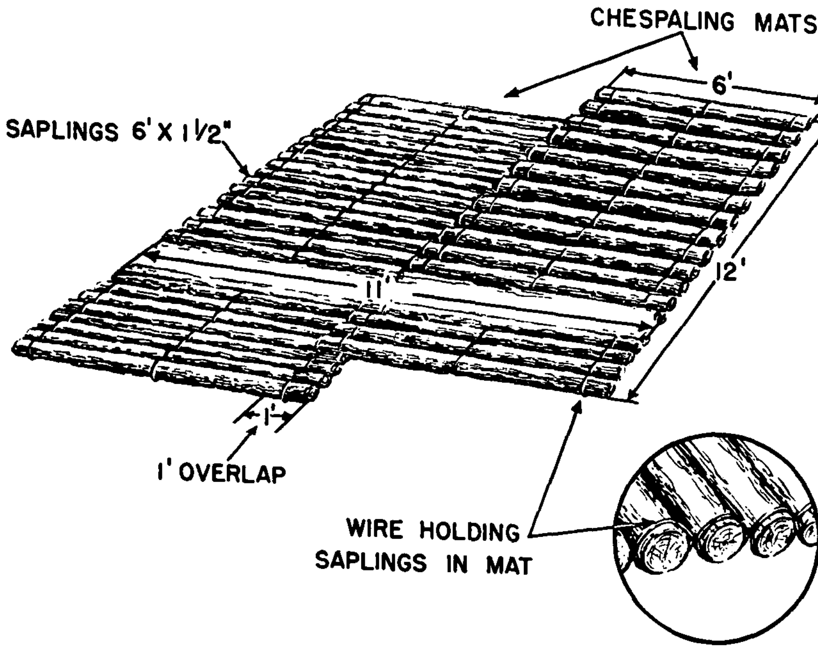


Figure 3.28. Chespaling mats.

b. To construct a chespaling road, two mats are laid lengthwise with a 1-foot overlap in the center. If more mats are added, a 1-foot overlap is made on the ends. Pickets may be used to hold the mats down on curves. A mat road of this type should remain serviceable for 3 to 4 months, depending upon the condition of the surface over which it is laid. Approximately 1,500 vehicles may pass over such a road before replacement is needed.

3.46 Truck-Mounted Forklift

The truck-mounted forklift is particularly suitable for transferring palletized cargo and fuel drums. To mount the forklift truck, bolt it to the rear of the bed of a 6 x 6 truck (fig. 3.29). Place a counterweight of about 750 pounds at the forward end of the cargo floor. Remove the finger lift of the forklift truck and install an overhead 5-foot arm with a hook at its outer end.

3.47 Weights, Volume, and Conversion Factors for Packaged and Bulk Petroleum Products

Product	Packaging	Weight (lb)	Cubic ft		Conversion factors		Gallons per			Bbl [1] per LT	Packages per			Capacity of vehicles for carrying filled containers [2]							
														Trailer		Truck			Semitrailer		
			Actual	Planning factor	Gal. to lb	Lb to gal.	ST	LT	MT		ST	LT	MT	1-ton	1½-ton	1½-ton	2½-ton	Cargo 5-ton	10-ton	12-ton	25-ton
Aviation gasoline	Bulk				5.90	.169	339	380		9.04											
	55-gal. drums [3]	373	9.03	11	6.91	.145	289	324	188		5.36	6	3.48	5	8	8	13	26	53	64	134
	55-gal. drums [4]	389	8.8	11	7.20	.139	278	311	193		5.14	5.76	3.57	5	7	7	12	25	51	62	128
	55-gal. drums [5]	364	9.2	11	6.90	.145	290	325	181		5.49	6.15	3.42	5	8	8	13	27	51	66	137
	5-gal. can [6]	40.5	.81	1	8.0	.125	250	280	200		49.4	55.3	40.0	49	74	74	124	248	495	594	1,239
83 octane gasoline	Bulk				6.11	.164	327	367		8.73											
	55-gal. drums [3]	384	9.03	11	7.11	.141	281	315	188		5.21	5.83	3.48	5	7	7	13	26	52	62	130
	55-gal. drums [4]	400	8.8	11	7.41	.135	270	302	193		5.0	5.60	3.57	5	7	7	12	25	50	60	125
	55-gal. drums [5]	376	9.2	11	7.09	.141	282	316	181		5.32	5.96	3.42	5	8	8	13	26	53	64	133
	5-gal. can [6]	41.6	.81	1	8.32	.120	240	269	200		48.1	53.8	40.0	48	72	72	120	240	480	576	1,200
Kerosene	Bulk				6.80	.147	294	329		7.84											
	55-gal. drums [3]	421	9.03	11	7.80	.128	256	287	188		4.75	5.32	3.48	4	7	7	12	23	47	57	119
	55-gal. drums [4]	437	8.8	11	8.09	.124	247	277	193		4.53	5.13	3.57	4	6	6	11	22	46	55	114
	55-gal. drums [5]	351	9.2	11	6.62	.151	302	338	181		5.70	6.38	3.42	5	8	8	14	28	57	68	142
	5-gal. can [6]	45	.81	1	9.0	.111	222	249	200		44.4	49.8	40.0	44	66	66	111	222	445	534	1,110

Diesel fuel	Bulk	----	----	----	6.99	.143	286	321	----	7.63	----	----	----	----	----	----	----	----	----	----	----
	55-gal. drums [3]	432	9.03	11	8.0	.125	250	280	188	----	4.63	5.19	3.48	4	6	6	11	23	46	55	116
	55-gal. drums [4]	448	8.8	11	8.30	.120	241	270	193	----	4.46	5.00	3.57	4	6	6	11	22	45	53	112
	55-gal. drums [5]	430	9.2	11	8.11	.123	247	276	181	----	4.65	5.21	3.42	4	7	7	11	23	46	55	116
	5-gal. can [6]	46	.81	1	9.20	.109	317	244	200	----	43.5	48.7	40.0	43	65	65	109	217	436	522	1,090
Lubricating oils	Bulk	----	----	----	7.60	.132	263	295	----	7.02	----	----	----	----	----	----	----	----	----	----	----
	55-gal. drums [3]	472	9.03	11	8.58	.117	233	261	191	----	4.24	4.75	3.48	4	6	6	10	21	42	51	106
	55-gal. drums [4]	488	8.8	11	8.87	.113	226	253	196	----	4.10	4.59	3.57	4	6	6	10	20	41	49	102
	55-gal. drums [5]	462	9.2	11	8.56	.117	234	262	185	----	4.33	4.85	3.42	4	6	6	10	21	43	52	108
	5-gal. can [6]	49	0.81	1	9.80	.102	204	229	181	----	40.8	45.7	40.0	40	61	61	102	,204	410	489	1,020
	Cases of 1-qt cans (12/case)	35	.88	1	----	----	----	----	----	----	58.0	64.9	40	57	85	85	143	286	572	687	1,430
	Cases of 1-qt cans (24/case)	60	1.6	2	----	----	----	----	----	----	33.4	37.3	20	33	50	50	83	166	333	400	835
	Cases of 5-qt cans (6/case)	77	1.9	2	----	----	----	----	----	----	26.0	29.1	20	26	39	39	65	130	260	312	660
Greases	25-lb pails	29	.95	1	----	----	----	----	----	----	69.0	77.2	40.0	69	103	103	173	345	692	827	1,720
	5-lb cans (6/case)	44	1.1	2	----	----	----	----	----	----	45.4	50.9	20.0	45	68	68	114	227	455	545	1,140

[1] For ocean shipping, storage, and pipeline computations, bulk petroleum products usually are measured in barrels of 42 gallons each instead of 55 gallons.

[2] Based upon authorized off-highway loads in short tons. *When overloads are authorized*, these quantities may be increased to the cubic capacity of the vehicle or to 100 percent overweight, whichever limit is reached first.

[3] 18-gage standard, weighs 54 pounds empty, holds 54 gallons of light products and 55 gallons of heavy products. Federal Specification PPP–D–729, Amendment 1.

[4] 16-gage standard, weighs 70 pounds empty, holds 54 gallons of light products and 55 gallons of heavy products. Federal Specification PPP–D–729, Amendment 1.

[5] 18-gage limited standard, weighs 52 pounds empty, holds 53 gallons of light products and 54 gallons of heavy products. Federal Specification PPP–D–729.

[6] For planning purposes, weight of gasoline may be taken as 42 pounds and weight of lubricating oil for engines at 50 pounds per 5-gallon can, including weight of can. An empty 5-gallon can weighs approximately 11 pounds.

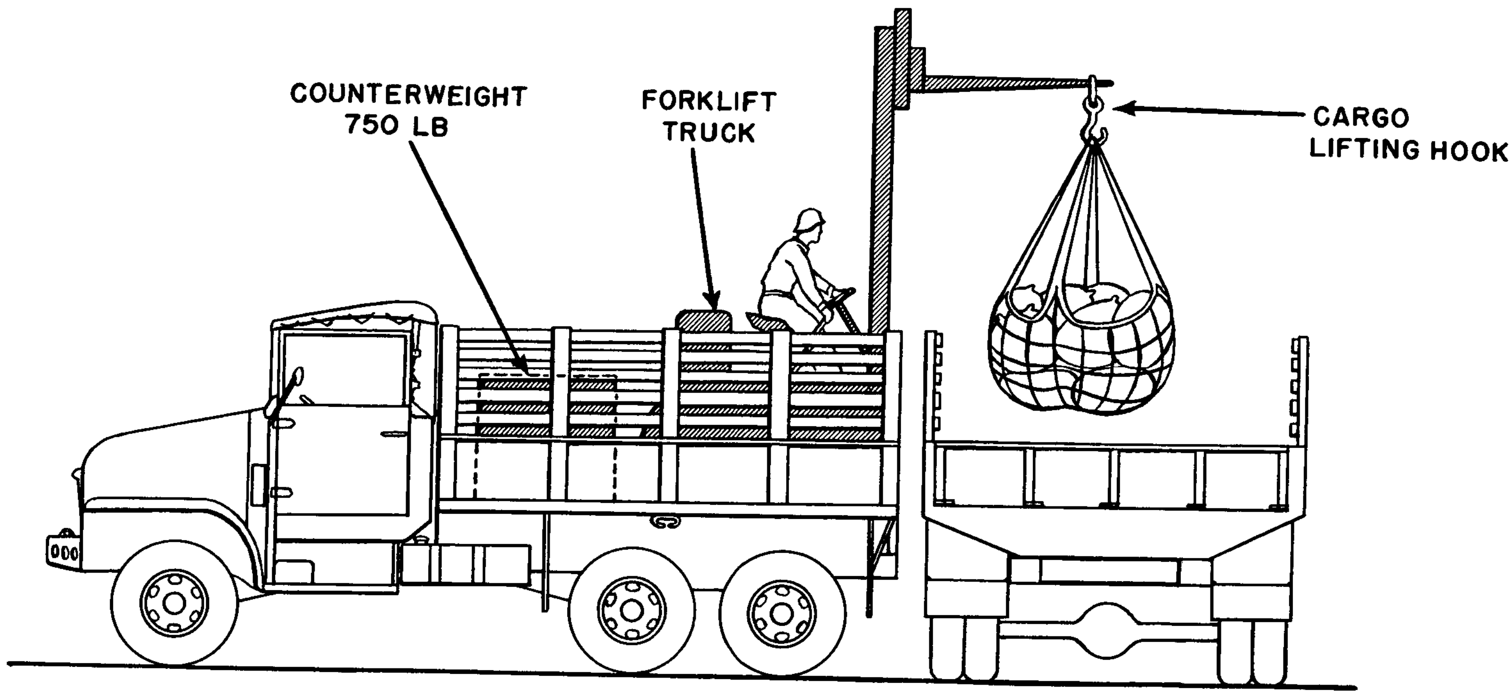


Figure 3.29. Forklift mounted on 6 x 6 truck.

3.48 Volume of Barracks Bags

Barracks bags packed to capacity average 4.4 cubic feet. The following capacities can be used for planning purposes. Quantities are based upon cargo space of vehicles, and can be increased by loading above sideboards for vehicles without closed top. Figures are based upon the assumption that the bags do not average over 50 pounds each. Should this weight be exceeded, appropriate adjustments must be made.

Vehicle	*Body cargo space (cu ft)*	*No. barracks bags*
Truck		
½-ton, pickup, 4x2, Chev	37	8
¾-ton, cargo, M37	160	30
1½-ton, cargo 4x4, Chev	258	60
2½-ton, 6x6, LWB, M36	630	100
2½-ton, 6x6, M135	408	87
2½-ton, 6x6, COE, 15 ft	475	100
2½-ton, 6x6, M35	456	99
2½-ton, 6x6, COE, 17 ft	540	100
5-ton, 6x6, cargo, M54	515	112
Trailer		
¼-ton, 2-wheel, M100	28	6
¾-ton, cargo, M101	175	30
1-ton, cargo, 2-wheel	113	20
1½-ton, cargo, M104	283	59
Semitrailer		
5-ton, S&P, 2-wheel	515	112
6-ton, van, 2-wheel, MGSW4	1, 096	240
10-ton, S&P, 2-wheel	730	161
12-ton, M127	830	184

3.49 Vehicle Size and Weight Limits by States

The table below may be used as a planning guide. Size and weight limits are changed periodically in the various states as a result of road and bridge construction. Planners must check with local military and/or civilian agencies to verify local limits and methods of clearance or exemption before putting vehicles on the road.

State	Size restrictions							Gross weight limits (pounds)		
	Width (inches)	Height (inches)	Length (feet)			Number of tlr (Stlr=½ tlr)	Min tandem axle spacing	Per inch of tire width	In thousands	
			Single unit	Tractor stlr	Other combinations				Per axle	Per tandem axle, 4 feet apart
Alabama [a] [b] [c]	96	[d] 150	[e] 35	50	([f])	½	40	([g])	18	36
Arizona [h]	102	162	40	65	65	1½	40	([g])	18	32
Arkansas [b]	96	162	[e] 35	50	50	([i])	40	([g])	18	32
California [h]	[j] 96	162	[k] [e] 35	60	60	([i])	([g])	[g] [l] [m] 600	18	32
Colorado [c]	[n] 96	150	[k] [e] 35	60	60	2	40	([i])	[o] 18; [p] 16	36
Connecticut [a]	102	150	45	45	([f])	½	([g])	[g] [l] [m] 800	22.4	36
Delaware [h]	96	[d] 150	[e] 35	50	60	1½	48	700	20	36
District of Columbia [b] [h]	96	150	35	50	50	1 or ½	40	([g])	22	38
Florida [h]	96	[d] 150	[k] 40	50	50	1 or ½	40	550	20	40
Georgia	96	162	[e] [q] 39.5	48	48	1 or ½	40	([i])	[o] [q] 20.3 [p] [q] 16	[q] 40.6
Idaho [h]	[n] 96	168	[r] 35	60	65	1½	([g])	[s] 800	18	32
Illinois [t]	96	162	42	50	50	1½	40	800	18	32
Indiana	96	162	[e] 36	50	50	1½	40	800	18	32
Iowa [a] [b]	96	150	[k] [e] 35	45	([f])	½	40	([i])	18	32
Kansas [u]	[n] 96	150	[k] [e] 35	50	50	1 or ½	40	([i])	[o] 18; [p] 16	32
Kentucky [v] [a]	96	150	35	45	([f])	½	42	600	18	36
Louisiana	96	[d] 150	[k] [e] 35	50	60	1 or ½	40	450	[o] 18; [p] 16	32
Maine [b]	96	150	45	45	45	1 or ½	48	600	[w] 22	32
Maryland [c]	96	[d] 150	55	55	55	([i])	([g])	([g])	22.4	40
Massachusetts [h] [a]	[n] 96	([i])	[u] 35	45	([g])	1 or ½	([g])	800	22.4	36
Michigan	96	[d] 150	[e] 35	55	55	1½	42	700	[l] 18; [n] 16	[x] 26
Minnesota [h]	[n] 96	[d] 150	40	45	45	1 or ½	[i] 40	([i])	[l] 18; [m] 10.8	28
Mississippi [h] [y]	96	[d] 150	[k] [e] 35	45	45	1 or ½	40		[o] 18; [p] 16	[x] 28.6
Missouri [h]	96	150	[k] [e] 35	45	45	([i])	40	600	[o] 18; [p] 16	32
Montana [h]	[n] 96	162	[e] 35	60	60	1 or ½	40	([g])	18	32
Nebraska [h]	96	150	[k] [e] 35	50	50	1 or ½	40	([i])	18	32
Nevada [h]	96	([i])	([i])	([i])	([i])	([i])	42	600	18	32
New Hampshire [h]	96	162	[u] 35	45	45	([i])	([g])	600	22.4	[z] 36
New Jersey	96	162	35	45	50	1 or ½	40	800	[aa] 22.4	32
New Mexico [b] [h]	[n] 96	162	40	65	65	1½	40	600	21.6	34.3
New York [c]	96	156	[k] [e] 35	50	50	1 or ½	46	[l] 800; [m] 640	22.4	36
North Carolina [ab]	[n] 96	[d] 150	[k] [e] 35	48	48	1 or ½	48	600	[o] [q] 19; [p] [q] 17	[q] 38
North Dakota [c]	96	150	[k] 40	50	50	1 or ½	40	550	18	30

Ohio [c]	96	[d] 150	[k, e] 35	50	60	(i)	(g)	650	19	[x] 24
Oklahoma [h]	96	162	[e] 35	50	50	1 or ½	40	650	18	32
Oregon [b, h]	96	150	35	50	50	1 or ½	40	550	18	32
Pennsylvania	96	[d] 150	[k, ac] 35	50	50	1 or ½	36	800	22.4	36
Rhode Island	102	150	40	50	50	1 or ½	40	800	22.4	(g)
South Carolina [h]	96	150	[k] 40	50	50	1 or ½	40	(i)	[o] 20; [p] 16	32
South Dakota [h]	96	156	[k, e] 35	50	50	1 or ½	40	600	[o] 18; [p] 16	32
Tennessee [a, h]	96	150	[e] 35	45	45	1 or ½	40	(g)	18	32
Texas [h]	[n] 96	162	[e] 35	45	50	1 or ½	40	[o] 650; [p] 600	[o] 18; [p] 16	32
Utah [h]	96	168	45	60	60	2	40	(g)	[l] 18; [m] 13.5	33
Vermont	96	150	50	50	50	1 or ½	40	600	(i)	(i)
Virginia [b]	96	[d] 150	[e] 35	50	50	1 or ½	40	650	18	32
Washington [h]	96	150	[ad] 35	60	60	1½	42	500	18	32
West Virginia [h]	96	[d] 150	[k, e] 35	45	45	1 or ½	40	(i)	18	32
Wisconsin [b, e]	[j] 96	[d] 150	[e] 35	50	50	1 or ½	40	800	[ae] 18; [af] 12	[q] 32
Wyoming [h]	[j] 96	162	40	60	60	2	40	(g)	18	32

[a] With the following exceptions full trailers are permitted the same gross weight as other single units: Alabama, Connecticut, Iowa, Kentucky—full trailers prohibited; Massachusetts—trailer and load limited to 3,000 pounds; Tennessee—trailer and load limited to 3,500 pounds.

[b] Solid tires prohibited.

[c] States where gross weight is determined by formula.

[d] Automobile transporters allowed 13½ feet (also covered vans in Washington; baled hay or straw carriers in Maryland; hay, straw, or small-boat carriers in Michigan).

[e] Buses of 40 feet may be permitted in Virginia; 42 feet in Delaware; 45 feet in Oklahoma; 45.2 feet in Georgia.

[f] Not permitted.

[g] Not specified.

[h] States where gross weight is determined by table of axle spacing.

[i] No restrictions.

[j] 104 inches for urban buses.

[k] Vehicles over 35 feet in length must have three axles, except buses in Florida and South Carolina.

[l] Pneumatic tires.

[m] Solid tires.

[n] 102-inch buses permitted subject to the following restrictions; Idaho, Montana, and Wyoming—only on highways at least 20 feet wide; New Mexico—only on designated highways; Kansas, Massachusetts, Minnesota, North Carolina, and Texas—only in designated urban areas.

[o] Permissible on baloon tires.

[p] Permissible on other than baloon tires.

[q] Including tolerance.

[r] 40-foot, two-axle vehicles permitted on highways designated by Board of Highway Directors.

[s] Graduated according to width.

[t] Limits shown are permissible on designated highways; otherwise limited to 16,000 pounds on any one axle. Two-axle truck limited to 32,000 pounds under registration law.

[u] Buses with three axles permitted 40 feet on designated highways, subject to 18,000-pound limit per axle.

[v] Limits shown are permissible on designated highways; otherwise limits are: truck height—11½ feet, truck length—26½ feet; semitrailer combination length—30 feet; gross weight 18,000 pounds.

[w] Axles less than 10 feet apart limited to 16,000 pounds per axle.

[x] Michigan—32,000 pounds on one set of tandem axles in a combination on designated highways; Mississippi—32,000 pounds on designated highways; Ohio—31,500 pounds on axles spaced over 4 feet but less than 8 feet apart.

[y] Gross weight limits shown are permissible on designated highways. On other highways gross weight limits are graduated from 28,650 pounds (axle spacing of 4 feet) to 52,650 pounds (axle spacing of 30 feet or more).

[z] Except on three-axle single units.

[aa] Applies to vehicles registered after March 1, 1950.

[ab] North Carolina—Gross weight limit on most secondary highways is 16,000 pounds for two axles and 24,000 pounds for three axles.

[ac] 30-inch tolerance permitted auto-transporter semitrailers.

[ad] Director of highways may allow three-axle buses 40 feet on designated highways.

[ae] Permissible on class A highways.

[af] Permissible on class B highways.

CHAPTER 4
RAIL

Section I. ORGANIZATION

4.1 Organization of the Transportation Railway Service
(fig. 4.1)

Unit	*TOE*	*Mission and/or capability*	*Assignment*
General headquarters, transportation railway service.	55–201	Provides executive, supervisory, and administrative personnel for overall supervision and direction of the railroads in a theater of operations.	1 normally assigned to a theater having 2 or more headquarters and headquarters companies, transportation railway command.
Headquarters and headquarters company, transportation railway command.	55–302	Exercises command and supervision over 2 or more railway groups. Capable of overall supervision and direction of a large railway system in a theater of operations.	To a theater of operations. It is the highest echelon in the theater if there is no general headquarters, transportation railway service.
Headquarters and headquarters company, transportation railway group.	55–202	Exercises command and supervision over railway operating battalions (2 to 6), and railway shop battalions (1 or 2), plus attached military police, signal, and other service units. In a theater of limited operations, it may be the highest echelon.	To a headquarters and headquarters company, transportation railway command. If there is no transportation railway command in a theater, the group may operate separately under operational control of the theater transportation officer.
Transportation railway operating battalion.	55–225	Operates and maintains a military railway division in a theater of operations. Can operate 40 locomotives per day in road and yard service over 90 to 150 miles of railroad, and can inspect and maintain maintenance of way for this mile-	Normally 2 to 6 to a railway group.

Unit	TOE	Mission and/or capability	Assignment
Transportation railway operating battalion.—Con.		age. It can also inspect condition, and make organizational and field maintenance repairs on 40 locomotives and 800 railroad cars per month.	
Headquarters and headquarters company transportation railway operating battalion.	55–226	Supervises and coordinates the operations of a railway operating battalion. Provides one operating battalion with the necessary supply, administration, and train dispatching service. Distributes rolling stock and locomotives as directed, and operates railway stations and towers.	1 per railway operating battalion.
Company A (railway engineering), transportation railway operating battalion.	55–227	Maintains and repairs right-of-way tracks and structures of military railroads (approximately 90 to 150 miles).	Organic to railway operating battalion (normally 1 per battalion).
Company B (railway equipment), transportation railway operating battalion.	55–228	Inspects, services, and makes running repairs to locomotives and railway cars (approximately 40 locomotives and 800 railway cars), plus running inspections for 2,000 railway cars per day.	Organic to railway operating battalion (normally 1 per battalion).
Company C (train operating), transportation railway operating battalion.	55–229	Operates locomotives and trains. Provides train crews to operate 40 locomotives per day over 90 to 150 miles of railroad.	Organic to railway operating battalion (normally 1 per battalion).
Company D (electric power transmission).	55–217	Provides and maintains electric power transmission facilities for train operation on an electrified division of a military railway (200 miles of electrified railway). Can maintain a catenary or third-rail system with substations, but cannot actually generate the required power.	To railway operating battalion when required.

Unit	TOE	Mission and/or capability	Assignment
Transportation railway shop battalion.	55-235	Provides depot maintenance on locomotives, cars, and equipment. Capable of supporting 2 to 4 operating battalions, up to 100 steam locomotives, 200 diesel-electric locomotives, and 2,500 railroad cars.	Normally 1 or 2 to a railway group.
Headquarters and headquaters company, transportation railway shop battalion.	55-236	Commands and furnishes technical supervision and plant maintenance for the railway shop battalion, plus administration, mess, and supply of companies organic to the railway shop battalion.	1 per railway shop battalion.
Company A (erecting and machine shop), transportation railway shop battalion.	55-237	Performs depot maintenance involving erecting and machine shop work for a military railway using steam locomotives and/or diesel-electric locomotives (in support of 100 steam locomotives, 200 diesel-electric locomotives, and 2,500 railway cars).	Organic to railway shop battalion (normally 1 per battalion).
Company B (boiler and smith shop), transportation railway shop battalion.	55-238	Performs boiler and blacksmith repairs to locomotives and rolling stock, in support of 100 steam locomotives, 200 diesel-electric locomotives, and 2,500 railway cars.	Organic to railway shop battalion (normally 1 per battalion).
Company C (car repair), transportation railway shop battalion.	55-239	Performs heavy repairs on freight and passenger cars for 2 to 4 railway operating battalions (in support of approximately 2,500 cars).	Organic to railway shop battalion (normally 1 per battalion).
Company D (diesel electric locomotive repair), transportation railway shop battalion.	55-247	Performs depot maintenance in support of 200 diesel-electric locomotive units. Also performs inspections on this type of locomotive.	Organic to railway shop battalion (normally 1 per battalion).

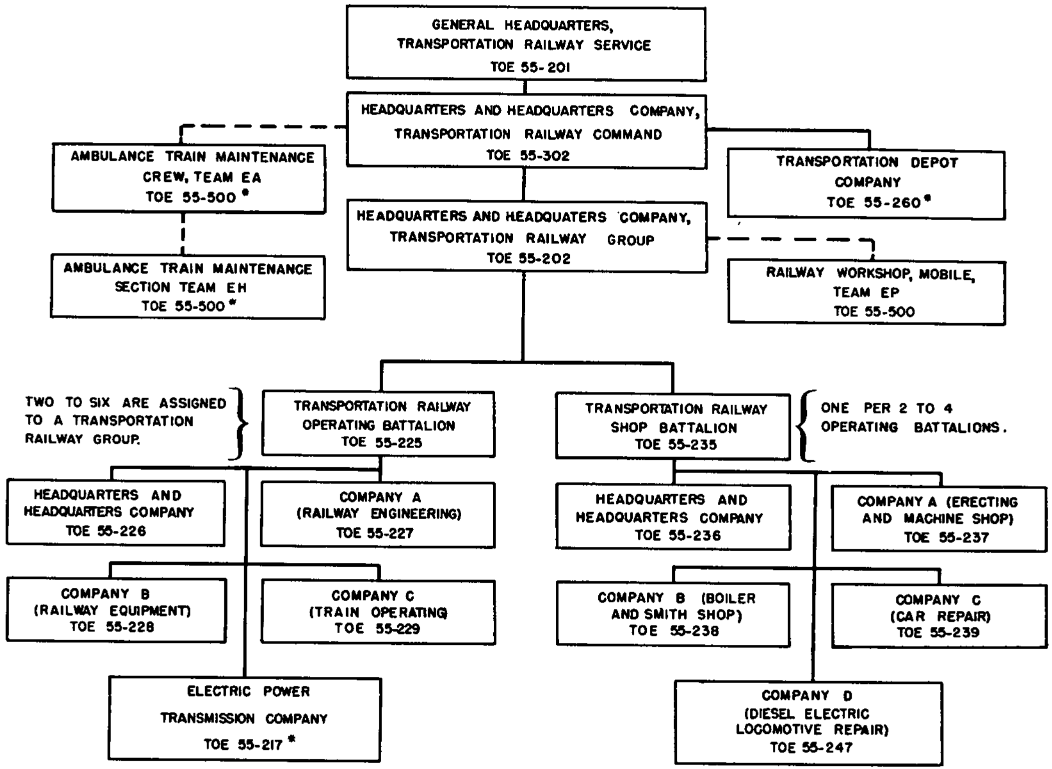
Unit	*TOE*	*Mission and/or capability*	*Assignmen*
Transportation depot company.	55–260	Receives, stores, and issues all Transportation Corps items of supply (up to 100 tons per day).	To a logistical command or as the Transportation Corps section of a general depot. Normally 1 depot per 35,000 troops in a theater of operations. If required, may be assigned to a railway command.
Team EA, ambulance train maintenance crew.*	55–500	Performs running repairs on railway cars of one ambulance train.	As required to headquarters and headquarters company, transportation railway command; or to senior transportation railway unit in a theater of operations.
Team EH, ambulance train maintenance section.*	55–500	Performs field maintenance repairs on ambulance trains (up to 4 trains).	Same as Team EA, above.
Team EP, railway workshop, mobile.*	55–500	Performs field maintenance of steam and diesel-electric locomotives and rolling stock in forward areas where stationary facilities are inadequate (15 diesel, electric locomotives, 5 steam locomotives, and 100 railway cars daily).	Normally to headquarters and headquarters company, transportation railway group.

*See TOE 55–500 for additional railway service teams.

Section II. MAJOR ITEMS OF EQUIPMENT

4.2 Whyte Classification System of Locomotives

The locomotives described in this section are classified according to the Whyte system. In this system locomotives are classified according to the arrangement of their wheels. A series of numerals separated by hyphens is used to designate the total number of wheels on the axle of each type of locomotive truck—the front (leading) truck, driving wheel group, and rear (trailing) truck, respectively. The figures always describe the locomotive's wheels from front to



* ASSIGNED AS REQUIRED.

Figure 4.1. Organization of the transportation railway service.

rear; the wheels in the locomotive tender are not counted in the classification. For example, a Whyte classification of 2–8–2 indicates one pair of leading wheels, four pairs of coupled driving wheels, and one pair of trailing wheels. The absence of any of the three types of wheels is always denoted by a zero; thus a 2–8–0 locomotive has no trailing wheels. Diesel locomotives are also classified by this system: figures such as 0–6–6–0 indicate no leading or trailing wheels and two sets of three driving wheels each, or a total of 12 driving wheels.

4.3 Characteristics of Railway Equipment

a. Locomotives.

(1) *Steam.*

Type	Gage (in.)	Weight, loaded (lb)			Tractive force	Drawbar pull (lb)	Curvature, min radius (ft)	Fuel capacity	Water capacity
		Locomotive	Tender	On drivers					
82-ton, 2-8-0.	56½, 60, 63, 66.	165,000	133,575	143,000	34,000 lb (85% boiler pressure).	42,000 (aprx).	231	11-ton coal or 2,000-gal. oil.	7,500-gal. tender.

(2) *Diesel-electric.*

Type	Gage (in.)	Weight locomotive (lb)	Tractive force	Horsepower (total engine)	Curvature, min radius (ft)	Fuel capacity (gal.)
120-ton, single engine, 0-4-4-0, domestic service.	56½	240,000	Continuous at 10 mph, 35,000 lb. Starting effort, 72,000 lb at 30% adhesion.	1,200	193	750
120-ton, single engine, 0-6-6-0, foreign service.	56½, 60, 63, 66.	246,000	Continuous at 10 mph, 45,000 lb. Starting effort, 72,000 lb at 30% adhesion.	1,600	193	*1,600
120-ton, single engine, 0-4-4-0, domestic service.	56½	240,000	Continuous at 8.3 mph, 34,000 lb. Starting effort, 72,000 lb at 30% adhesion.	1,000	75	700
80-ton, dual engine, 0-4-4-0, domestic service.	56½	161,000	Continuous at 5.2 mph, 21,000 lb. Starting effort, 48,000 lb at 30% adhesion.	420 to 500	75	300 to 400
60-ton, single engine, 0-4-4-0, foreign and domestic service.	56½, 60, 63, 66.	122,000	Continuous at 7.28 mph, 15,680 lb. Starting effort, 36,000 lb at 30% adhesion.	400	75	500
48-ton, single engine, 0-4-4-0, foreign service.	36, 39⅜, 42.	115,000	Continuous at 7.28 mph, 15,680 lb. Starting effort, 34,500 lb at 30% adhesion.	400	75	500
25-ton, single engine, 0-4-0, foreign service.	42	50,000	Continuous at 6.2 mph, 6,200 lb. Starting effort, 15,000 lb at 30% adhesion.	150	50	75
25-ton, single engine, 0-4-0, domestic service.	56½	50,000	Continuous at 6.2 mph, 6,200 lb. Starting effort, 15,000 lb at 30% adhesion.	150	40	75

*Reduced to 800 if equipped with Clarkson vapor heater.

(3) *Gasoline-mechanical.*

Type	Gage (in.)	Weight (lb)	Drawbar pull (lb)	Horse-power (total engine)	Curvature, min radius (ft)	Fuel capacity (gal.)
5-ton, single engine, 0-4-0, foreign and domestic service.	36	11,000	2.7 mph—2,500 12 mph—875.	34	20	15

b. Boxcars.

Type	Gage (in.)	Capacity		Inside			Door dimensions
		(lb)	(cu ft)	Length	Width	Height	
8W, narrow gage, foreign service.	36, 39⅜, 42.	60,000	1,588	34′ 5½″	7′ ¾″	6′ 4″	7′ 10¼″ wide. 6′ 1/16″ high.
8W, domestic service	56½	100,000	3,975	40′ 6″	9′ 2½″	10′ 6″	6′ wide, clear opening. 8′ high, clear opening.
8W, broad gage, foreign service.	56½, 60, 63, 66.	80,000	2,520	40′ 6″	8′ 6″	6′ 9⅝″	8′ 3¼″ high. 6′ 8¾″ wide.

c. Open-Top Cars.

(1) *Flatcars.*

Type	Gage (in.)	Nominal capacity (lb)	Platform length	Platform width*	Platform height above rail
8W, narrow gage, foreign service	36, 39⅜, 42	60,000	34′ 8½″	7′ 2″	3′ 7″
12W, domestic service	56½	200,000	54′	10′ ¼″	4′ 1¼″
8W, domestic service	56½	140,000	49′ 11½″	10′ 3¼″	3′ 8½″
80-ton, 12W, broad gage, foreign service	56½, 60, 63, 66	160,000	46′ 4″	9′ 8″	4′ 2⅞″
12W, domestic service (passenger train service).	56½	200,000	54′	10′ 6¼″	4′ 5⅜″
8W, domestic service	56½	100,000	43′ 3″	10′ 6″	3′ 8″
8W, broad gage, foreign service	56½, 60, 63, 66	80,000	40′ 9″	8′ 7¼″	3′ 6 15/16″

*Side sills of flatcars must be considered in determining ability to carry tracked vehicles, such as tanks, where the total loaded weight is resting on the outer edge of the car deck.

(2) *Gondolas.*

Type	Gage (in.)	Capacity		Inside dimensions		
		(lb)	(cu ft)	Length	Width	Height
High side, 8W, narrow gage, foreign service.	36, 39⅜, 42	60,000	940	34′ 5″	6′ 10½″	4′
Low side, 8W, narrow gage, foreign service.	36, 39⅜, 42	60,000	356	34′ 6″	6′ 10½″	1′ 6″
High side, 8W, broad gage, foreign service.	56½	80,000	1,680	40′	8′ 3¾″	4′
Low side, 8W, broad gage, foreign service.	56½, 60, 63, 66	80,000	500	40′ 4½″	8′ 3¼″	1′ 6″
Low side, 8W, drop ends, domestic service.	56½	100,000	1,184	41′ 6″	9′ 6⅛″	3′

(3) *Hopper car.*

Type	Gage (in.)	Nominal capacity (lb)	Inside dimensions		
			Length	Width	Height
8W, domestic service	56½	100,000	33′	9′ 5½″	9′ 7″

d. Tank Cars.

Type	Gage (in.)	Length over tank heads	Nominal capacity (gal.)*	Inside diameter (in.)	
				Tank	Dome
Nickel-clad, ICC-103-AW, 8W, domestic service	56½	31′ 11″	7,500	78, aprx	45
ICC-103, ICC-103-W, 8W, domestic service	56½	34′, aprx	10,000	87, aprx	59⅜, aprx
Caustic soda, ICC-103-W, 8W, domestic service	56½	34′, aprx	10,000	88, aprx	64
Petroleum, 8W, narrow gage, foreign service	36, 39⅜, 42.	38′ 4⅞″	6,000	62½	54
Petroleum, 8W, broad gage, foreign service	56½, 60, 63, 66.	38′ 5⅜″	10,000	80¾	66½
Nitric acid, ICC-103-W, 8W, domestic service	56½	33′ 7½″	7,800	78, aprx	35⅜
Phosphorus, ICC-103-W, 8W, domestic service	56½	34′ 8¼″	8,000	78, aprx	64

* Specific gravity of a liquid should be checked before it is loaded to avoid exceeding weight capacity of car.

e. Refrigerator Cars.

Type	Gage (in.)	Nominal capacity (lb)	length inside end lining	Width inside side lining	Ice capacity (lb)	Dimensions of doors
8W, disassembled, foreign service	56½	80,000	38′ 9¼″	6′ 11″	11,000	4′ wide 7′ high
8W, disassembled, broad gage, foreign service.	56½, 60, 63, 66.	80,000	32′ ½″	7′ 8″, aprx.	11,000	4′ wide 7′ high
8W, mechanical, foreign service	56½, 60, 63, 66.	80,000	40′ 9″, equipment compartment.	7′ 6″, aprx.	None	6′ wide 7′ high

f. Special Purpose.

Type	Gage (in.)	Weight (lb)		Over end sills		Height above rail	Remarks
		Light	Loaded	Length	Width		
Car, amb unit, 8W, domestic service.	56½	157,000	167,300	78′ 11″	10′	13′ 6″	Capacity: 27 patients, 6 corpsmen, 1 nurse, 1 doctor.
Car, kitchen, troop/amb, 8W, domestic, service.	56½	100,160	--------	*54′ 2½″	9′ 5¾″	13′ 6″	Width, side door openings: 6′.
Car, kitchen, dining, and storage, amb train, 8W, foreign service.	56½, 60, 63, 66.	111,400, avg.	--------	63′ ¼″	9′	13′	Seat capacity: 24
Car, ward, amb train	56½, 60, 63, 66.	111,400, avg.	--------	63′ ¼″	9′	13′	Berth capacity: 30
Car, personnel, amb train.	56½, 60, 63, 66.	111,400, avg.	--------	63′ ¼″	9′	13′	Berth capacity: 15 EM's 4 doctors, 2 nurses.

* Includes couplers.

g. Cranes.

Type	Gage (in.)	Weight (lb)	Boom length (ft)	Boom height (down)
Wrecking, steam, 75-ton, broad gage, foreign service.	56½, 60, 63, 66.	191,000	25, 2-piece, curved	12′ 3¾″
Locomotive, diesel-mechanical, 25-ton, broad gage, domestic and foreign service.	56½, 60, 63, 66.	148,000	50, 2-piece, straight	13′ 6″ max
Locomotive, diesel-mechanical 40-ton broad gage, foreign service.	56½, 60, 63, 66.	210,000	50, 2-piece, straight	13′ 6″ max
Locomotive, diesel-mechanical, 25-ton, narrow gage, foreign service.	36, 39⅜, 42.	161,000	40, 2-piece, straight	10′ 10″

4.4 Dimensions, Weight, and Capacities of Typical U.S. Freight Cars

There are no standard dimensions for commercial cars. The figures given are for types in common use. The 40-ton stock car comes in many lengths, varying from 35′ 7″ to 41′ 10″. All types have similar variations in capacity and dimensions.

Type	Capacity				Weight empty (tons)	Dimensions, inside (feet)		
	Tons	Men (8 sq ft per man and equipment)	Animals (horses, mules, oxen—avg. width, 22″)	Cubic feet		Length	Width	Height
Automobile	40	45	22	3,100	20	40.5	8.5	9
	50	53	27	3,850	25	50.5	8.5	9
Baggage					45	60	9.1	8
Box	30	38	20	2,750	18	36	8.5	9
	40	43	22	3,100	20	40.5	8.5	9
	50	43	22	3,100	24	40.5	8.5	9
Caboose					20	27.5	8.2	7
Diner					90	78.5	8.5	8.5
Flat	40				18	40	9	
	50				20	45	9	
	70				25	50	9	
Gondola	50			1,570	22	40	9.9	4
	70			1,920	25	48	10	4
Refrigerator	[a] 30			2,570	28	40.5	8.2	7.2
	[b] 40			2,570	30	40.5	8.2	7.5
Stock	30		20	2,625	20	36	8.5	8.5
	40		20	2,625	22	36	8.5	8.5
Tank	[c] 40				20	33	6.6 dia	
	[d] 50				24	33	7.2 dia	

[a] Ice capacity, 4 tons.
[b] Ice capacity, 5 tons.
[c] 8,000 gal.
[d] 10,000 gal.

4.5 Capacity of Standard U.S. Passenger Cars

	Day coach [1]	*Tourist sleeper*	*Standard sleeper* [2]
Length in feet	65–75	65–75	65–80
Number of sections	None	13–16	12–16
Maximum seating:			
2 men to each double seat	60–70	52–64	53–64
3 men to each 2 double seats	45–48	39–48	40–48
Sleeping capacity:			
2 men per berth (maximum)	None	52–64	53–64
3 men per section	None	39–48	40–48
1 man per berth	None	26–32	27–32

[1] Limited number of steel coaches, 70 feet long or over, available.
[2] Standard sleeper—12 sections and 1 drawing room or 16 sections and no drawing room.

Section III. RAIL OPERATIONS

4.6 Planning Requirements

In planning for the most effective use of a railway system, detailed information about items *a* through *z* below is essential. FM 55–8 and DA Forms 55–170 (Railroad Line Characteristics and Facilities), 55–171 (Locomotive Characteristics and Inventory), and 55–172 (Freight Equipment Characteristics and Inventory) provide information on evaluating existing facilities.

a. Length of line.
b. Condition of roadbed and track.
c. Gage of track.
d. Single, double, or multiple track.
e. Weight of rail.
f. Type of ballast and depth.
g. Type of ties (if wood, treated or untreated).
h. Tie spacing.
i. Axle-load limitations (track and bridge).
j. Profile of line showing location and length of ruling grade.
k. Alinement of lines showing location and length of minimum-radius curves.
l. Location and description of bridges and tunnels.
m. Location and length of passing tracks.
n. Location, type, and quantity of fuel supply.
o. Location, quantity, and quality of water supply.
p. Location and capacity of yards.
q. Location and capacity of car repair shops and enginehouses.
r. Type and availability of motive power.
(1) Weight in working order.
(2) Expected working tractive effort.
(3) Age.
s. Type and availability of rolling stock.
(1) Capacity and dimensions.
(2) Age.
t. Allowable drawbar pull.
u. Diagrams showing minimum structure, maximum unrestricted loading, and equipment gages.
v. Signal system.
w. Dispatching facilities.
x. Route junctions.
y. Availability of new equipment and repair parts.
z. Local labor resources.

4.7 Outline of Standing Operating Procedure for Rail Movements

a. *General.* Policies and factors involved in selecting and accomplishing movements via rail.

b. Supply Movements.

(1) *Releases.* When required, methods of obtaining, formats, dissemination, action required.

(2) *Routing.* Responsibilities and procedures for determination, coordination, and accomplishment.

(3) *Diversions and reconsignments.* Authority to effect diversions, but with regard for the various command areas; procedures for initiating requests and execution thereof.

(4) *Records and Reports.* Responsibilities and methods for the maintenance of specific records; appropriate references to reports to be submitted.

c. Personnel Movements—Troops.

(1) *Military authority index numbers (MAIN).* Purposes, composition, methods, and procedures for assignment and use; marking on and eradicating from trains.

(2) *Halts.* Types of halts; policies, procedures, and responsibilities in the establishment and conduct of halts.

(3) *Travel warrants.* Types, forms, authority, and responsibilities for issue, distribution, and usage.

(4) *Troop-train commanders.* Appointment, responsibilities and functions, relationship with transportation personnel; instructions to be furnished.

(5) *Rations and water.* Responsibilities and procedures for securing, furnishing en route, and disposition at destination.

(6) *Discipline of troops.* Responsibilities and command policies, police of rail equipment, sanitation.

(7) *Diversions.* Authority for ordering, responsibilities and procedures for effecting, reference to reporting.

(8) *Records and reports.* Responsibilities and methods for the maintenance of specific records and appropriate references to reports to be submitted.

4.8 Outline of Standing Operating Procedure for Transportation Railway Service

a. General. Policies and procedures for:

(1) Integration of rail transportation in the theater transportation net.

(2) Operational control.

(3) Coordination with adjacent commands for use of rail capacity and support of operating units.

(4) Coordination of the theater rail plan for selection, rehabilitation, and operation of rail lines in support of theater strategic plans.

b. Mission. Rail net and facilities operated, terminals, installations, and commands supported.

c. Organization. Operating units available, location, and operating limits.

d. Functions. Responsibilities for operation and maintenance of military railways; equipment; and freight, passenger, and special trains.

e. Planning.

(1) Long-range planning responsibility and procedures; selection of rail primary and alternate routes; determination of line capacity, troop equipment, and supply requirements; rehabilitation and project requirements; communications and security requirements; demolition plans.

(2) Current operational plans; current rail line capacity and requirements; phases of operation; selection and rehabilitation of new or additional railheads, yards, and installation facilities.

f. Operations. Procedures for dissemination and implementation of movement programs; coordination with transportation movements officer; priorities for and utilization of rail equipment; responsibility for preparation and compilation of operational and situation reports; procedures for ordering and documentation of cars; responsibilities for scheduling special trains; responsibility and methods of loading, blocking, bracing, and inspecting loaded cars.

g. Maintenance. Responsibility, procedures, inspections, reports, and standards for maintenance of military and utility railway facilities and equipment, including organizational, field, and depot maintenance.

h. Supply. Responsibility and procedures for requisitioning, stocking, distributing, maintaining levels of, disposing of excess, and accounting for railway operating and maintenance supplies; requirements and priorities for major items, including locomotives and rolling stock.

i. Intelligence and Reconnaissance. Responsibility and procedures for collecting, processing, and using rail intelligence.

j. Security. Procedures, responsibility, coordination, and requirements for security of supplies en route by rail and security of trains and rail line-of-communication facilities; defense and demolition plans.

k. Records and Reports. Responsibility and procedures for reports: railway operation, situation, personnel status, equipment maintenance and inspection, equipment status, and project.

l. Training. Responsibility: unit and technical training.

4.9 Maximum Bulk Loading of Typical U.S. Freight Cars

The rated capacity of a car does not mean that the car can carry the rated tonnage of all items.

a. Heavy Bulk Items. Freight cars loaded with heavy bulk items have the same rated and actual capacities. Heavy bulk items are ammunition, barbed wire, cement, flour, gravel, corrugated iron, rails, rifles in chests, sand, stone, sugar, telephone wire, and engineer tools.

b. Lighter Bulk Items. Some items for which the actual capacity of a car is less than the rated capacity are listed below.

Car Capacity in Short Tons			
Rated	30	40	50
Actual, by items:			
Blankets, baled	27	32	40
Bread	19	24	30
Canned goods in boxes	30	36	45
Clothing, baled	27	32	40
Hay, baled	15	20	25
Meat	15	24	35
Motor vehicle parts	24	28	40
Oats	18	24	30
Sandbags	21	24	30
Tentage	15	20	30
Ties, railroad	19	26	32

4.10 Clearances—General

Overhead clearances and platform heights are measured from top of rail; side clearances from centerline of track. Clearances below those specified are dangerous, and protection must be provided by appropriate warning signs or devices. For example, telltales must be used for overhead clearances ranging between 18 to 22 feet. Unless local conditions require greater clearances, the standard minimum clearances are as follows:

a. Overhead.

Wires:	
High voltage	28′ 0″
Other	27′ 0″
Structures	22′ 0″

b. Side.

Buildings	8′ 6″
Canopies:	
Up to 15′ 6″ high	8′ 6″
Higher than 15′ 6″	5′ 6″
Platforms:	
3′ 9″ high	6′ 2″
4′ high	5′ 0″
Refrigerator platforms:	
3′ 2″ high	6′ 2″
4′ 7″ high	8′ 6″

c. Enginehouse Entrance.

Overhead	17′ 0″
Side	6′ 6″

d. Bridge and Tunnel. Standard single-track bridge and tunnel clearances are shown in figure 4.2.

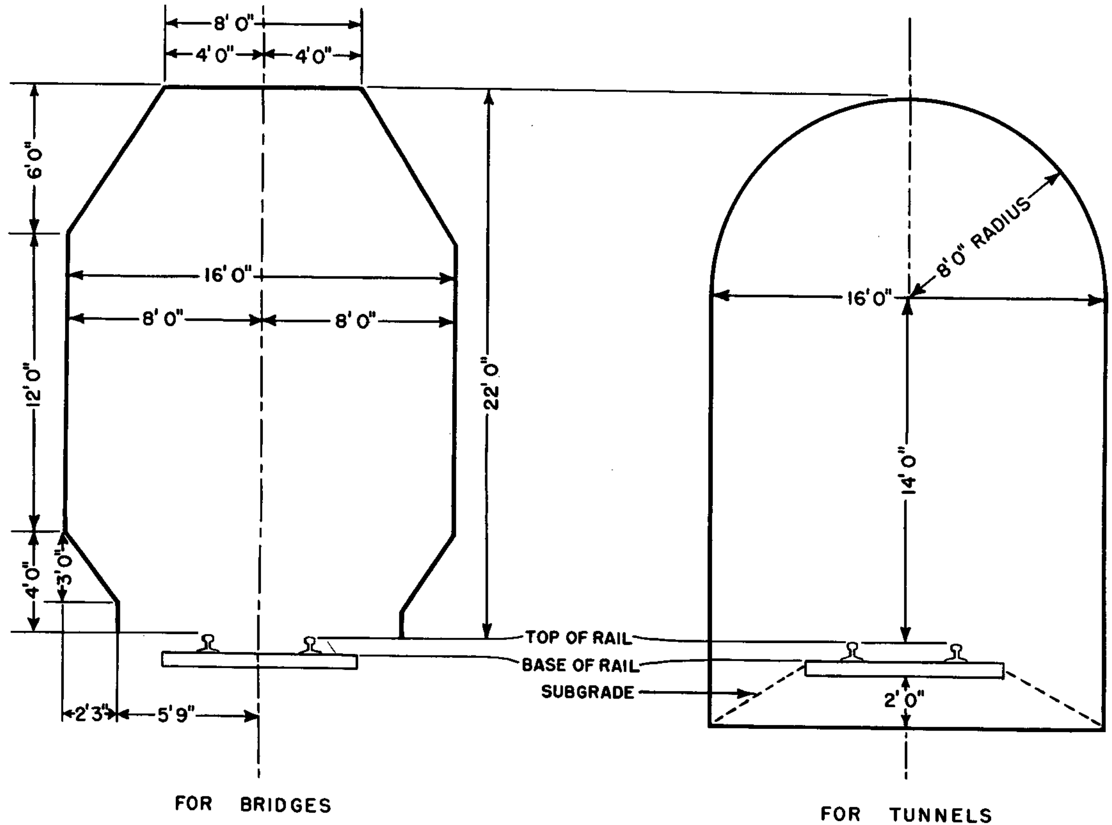


Figure 4.2. *Standard single-track bridge and tunnel clearances.*

4.11 Railway Gages (in inches) by Area

a. *Africa.*

Algeria	57⅛, 56½, 41 9/16, 39⅜
Belgian Congo	42, 39⅜, 24
Eritrea	37
Ethiopia	39⅜
French Equatorial Africa	42
French West Africa	39⅜
Ghana	42
Kenya	39⅜
Libya	37 7/16
Madagascar	39⅜
Morocco	56½
Nigeria	42, 30
Nyasaland	42
Portuguese East Africa	42,30
Portuguese West Africa	42, 39⅜, 24
Reunion	39⅜
Rhodesia	42
Sierra Leone	30
Sudan	42
Tanganyika	39⅜
Tunisia	56½, 39⅜
Uganda	39⅜
Union of South Africa	42, 24
United Arab Republic	
Egypt	56½, 39⅜, 30, 29½
Syria	*See* Asia

b. *Asia.*

Borneo	39⅜
Burma	39⅜
Ceylon	66
China	56½
Formosa	41½, 30, 24
India	66, 39⅜, 30, 24
Indonesia	56½, 42, 30
Iran	60, 56½
Iraq	56½, 39⅜
Israel	56½
Japan	56½, 42
Jordan	41¼
Korea	56½, 30
Lebanon	56½, 41¼
Malaya	39⅜
Pakistan	66, 40, 39⅜
Saudi Arabia	56½, 41¼
Syria	56½, 41¼
Thailand	39⅜
Turkey	60, 56½, 41½, 39⅜, 29½
USSR	60, 39⅜
Vietnam	39⅜

c. *Europe.*

Austria	56½, 39⅜
Belgium	56½, 39⅜

Bulgaria	56½, 30, 23⅝
Czechoslavakia	56½
Denmark	56½
Estonia	60
Finland	60
France	56½, 39⅜
Germany	56½, 39⅜, 30
Greece	56½, 39⅜
Hungary	56½
Ireland	63
Italy	56⅞, 56½, 37⅝
Latvia	60, 56½, 29½, 23⅝
Lithuania	60, 56½, 29½, 23⅝
Luxembourg	56½, 39⅜
Netherlands	56½
Norway	56½, 42
Poland	60, 56½, 29½
Portugal	66, 39⅜
Rumania	56½, 36
Spain	66, 39⅜, 36
Sweden	56½, 42, 35
Switzerland	56½, 39⅜
Turkey	56½
USSR	60, 39⅜
United Kingdom	63, 56½
Yugoslavia	56½, 39⅜, 30

d. Central America and West Indies.

Costa Rica	42
Cuba	56½
Dominican Republic	40, 30
Guatemala	36
Haiti	40, 30
Honduras	42, 36
Jamaica	56½
Nicaragua	42
Panama	60, 36
Puerto Rico	39⅜
Salvador	36
Trinidad	56½

e. North America.

Canada	56½, 36
Newfoundland	42
Mexico	56½, 36
United States	56½
Alaska	56½, 36
Hawaii	*See* Pacific Ocean

f. South America.

Argentina	66, 56½, 39⅜, 29½
Bolivia	39⅜
Brazil	63, 39⅜, 30, 24
British Guiana	56½
Chile	66, 56½, 42, 39⅜, 30, 24
Colombia	39⅜, 36

Dutch Guiana	39⅜
Ecuador	42, 30
Paraguay	56½
Peru	56½, 39⅜, 36
Uruguay	56½
Venezuela	56½, 42, 39⅜, 36, 30, 24

g. Pacific Ocean.

Australia	63, 56½, 42, 30
Hawaii	56½, 36
New Caledonia	39⅜
New Zealand	42
Philippines	42

4.12 Clearances and Gages by Countries

a. The clearance diagrams shown in figures 4.3 and 4.4 are composites incorporating the smallest dimensions of all similar dimensions of the countries named; therefore, all the limiting clearances shown in the composites will not exist simultaneously on any particular rail line. A clearance diagram for the rail line(s) over which operations are to be conducted must be obtained or made. In the diagrams horizontal distances shown should not be confused with the track gage. Examples of the use of the diagrams are given below.

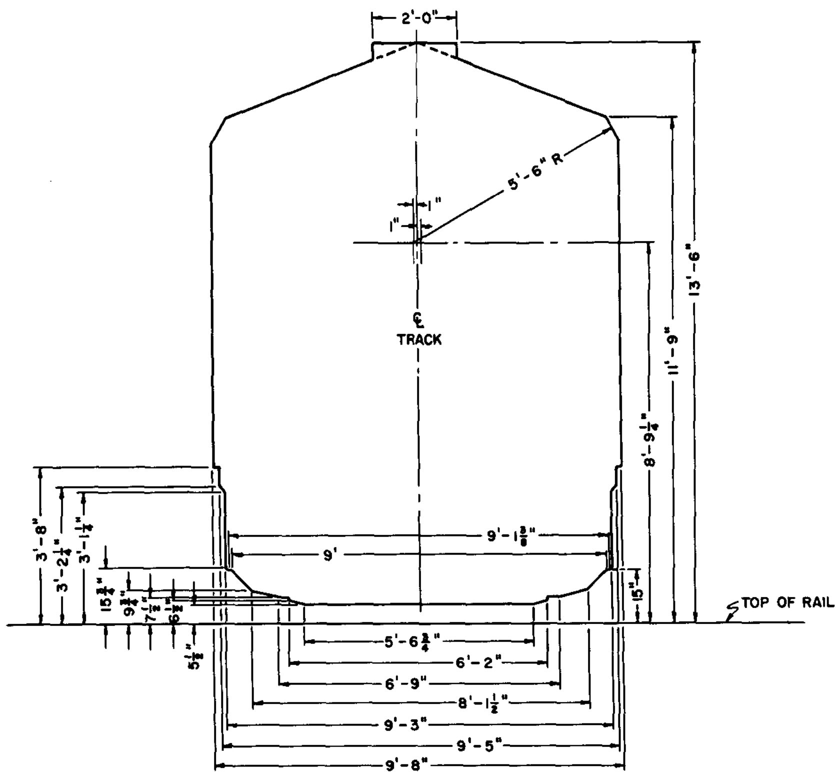
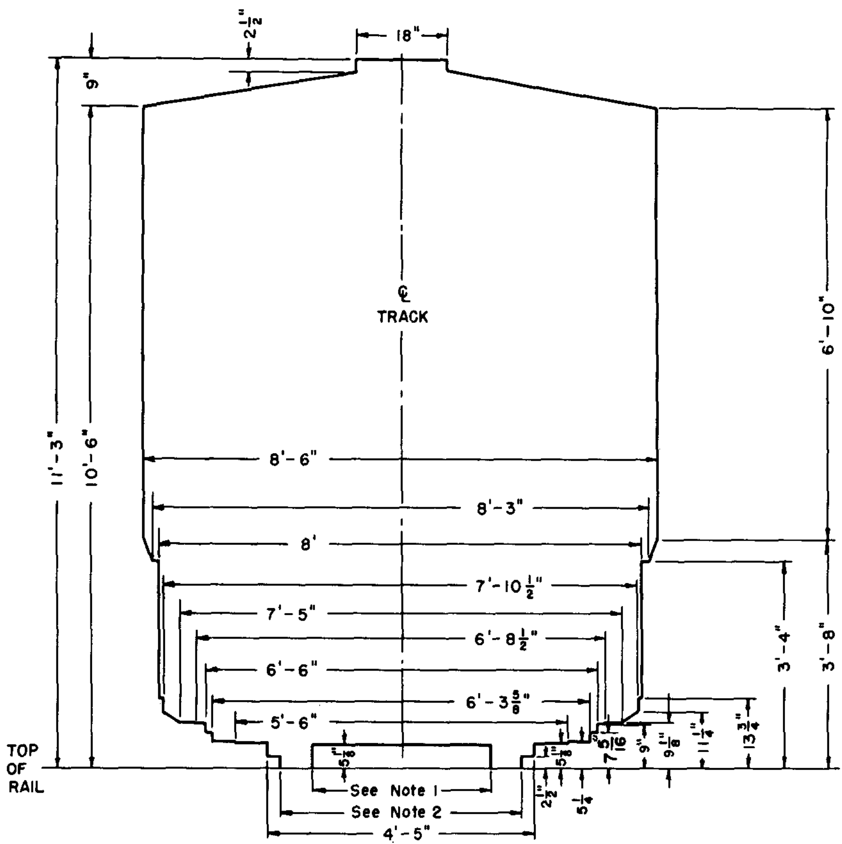


Figure 4.3. A composite clearance diagram: 56½-, 60-, 63-, and 66-inch gages.



Note1: 2'-8¾" for 36-inch track gage
3' for 39⅜-and 42-inch track gage

Note2: 4' for 36-and 39⅜-inch track gage
4'-5" for 42-inch track gage

Figure 4.4. A composite clearance diagram: 36-, 39⅜-, and 42-inch gages.

(1) In figure 4.3, a vertical clearance of 3 feet 8 inches can be depended upon for a width clearance which is at least 9 feet 8 inches. In the same figure, a vertical clearance of 9¾ inches can be depended upon if the width clearance is not less than 8 feet 1½ inches.

(2) In figure 4.4, a vertical clearance between 13¾ inches and 3 feet 4 inches can be depended upon when the width clearance is not less than 8 feet.

b. The composite clearances in figure 4.3 show minimum clearances for broad-gage operations. Countries with broad-gage track are listed below.

(1) *56½-inch gage.*

Algeria
Argentina
Australia
Austria
Belgium
British Guiana
Bulgaria
Canada
Chile
China
Cuba
Czechoslovakia
Denmark
Egypt
France
Germany
Greece
Hungary
Indonesia
Iran
Iraq
Israel
Italy
Jamaica
Japan
Korea
Latvia
Lebanon
Lithuania
Luxembourg
Manchuria
Mexico
Morocco
Netherlands
Norway
Paraguay
Peru
Poland
Rumania
Saudi Arabia
Sweden
Switzerland
Syria
Trinidad
Tunisia
Turkey
United Kingdom
United States
Uruguay
Venezuela
Yugoslavia

(2) *60-inch gage.*

Denmark
Estonia
Finland
Iran
Latvia
Lithuania
Manchuria
Panama
Poland
Turkey
USSR

(3) *63-inch gage.*

Australia
Brazil
Ireland
United Kingdom

(4) *66-inch gage.*

Argentina
Ceylon
Chile
India
Pakistan
Portugal
Spain

c. Figure 4.4 shows clearances for narrow-gage rail operation. Countries with narrow-gage track are given in (1) through (5) below.

(1) *36-inch gage.*

Alaska	Panama
Canada	Peru
Columbia	Rumania
Guatemala	Salvador
Hawaii	Spain
Honduras	United Kingdom
Ireland	Venezuela
Mexico	

(2) *37-inch gage.*

Eritrea	Libya

(3) *39⅜-inch gage.*

Algeria	Luxembourg
Argentina	Madagascar
Austria	Malaya
Belgian Congo	New Caledonia
Belgium	Pakistan
Bolivia	Peru
Borneo	Portugal
Brazil	Portuguese West Africa
Burma	Puerto Rico
Chile	Reunion
Columbia	Spain
Dutch Guiana	Switzerland
Egypt	Tanganyika
Ethiopia	Thailand
France	Tunisia
French West Africa	Uganda
Germany	USSR
Greece	Venezuela
India	Vietnam
Iraq	Yugoslavia
Kenya	

(4) *41¼-inch gage.*

Jordan	Saudi Arabia
Lebanon	Syria

(5) *42-inch gage.*

Australia
Belgian Congo
Chile
Costa Rica
Ecuador
Formosa
French Equatorial Africa
Ghana
Honduras
Indonesia
Japan
Korea
Newfoundland
New Zealand
Nicaragua
Nigeria
Norway
Nyasaland
Philippines
Portuguese East Africa
Portuguese West Africa
Rhodesia
Sudan
Sweden
Union of South Africa
Venezuela

4.13 Bridge Capacity

a. Cooper's E Rating. Each driving axle of a locomotive carries a proportionate part of the total weight loaded on the driving wheels. For example, the rating for a bridge to carry a 2–8–0 locomotive weighing 140,000 pounds on drivers is determined as follows:

A 2–8–0 locomotive has four driving axles.

140,000÷4=35,000 pounds, the amount each driving axle carries. A bridge designed to carry this locomotive safely must have a Cooper's E-rating of at least E–35.

b. Steel I-Beam Bridge (fig. 4.5). The table below refers to bridges already constructed with two, four, six or more steel stringers or girders of equal dimensions. To estimate the capacity of a railway bridge with this type construction, the width and thickness of the lower flange of one stringer are measured at the center of the span length; the depth and length of the stringer are also measured. Using the table given below, the steel stringer that is nearest to these dimensions is selected, and the corresponding E-rating of the bridge is read. The rating is reduced according to the age and condition of the bridge. The quantity of reduction must be determined by qualified personnel, normally from the Corps of Engineers.

Stringer dimensions (inches)			Span length (feet)													
Lower flange		Stringer depth	10	11	12	13	14	15	16	17	18	19	20	22	24	26
Thickness	Width															
3/8	8 3/8	18	E–42	E–41	E–41	E–41										
3/8	10 3/8	24		E–59	E–48	E–40	E–35	E–31	E–27							
1/2	10 3/8	30				E–61	E–59	E–51	E–46	E–41	E–37	E–33	E–30	E–27		
1/2	12 1/2	30						E–62	E–56	E–50	E–45	E–41	E–37	E–31	E–26	
1	14	36								E–60	E–58	E–55	E–54	E–51	E–48	E–43
1/2	12 3/8	42										E–60	E–54	E–45	E–39	E–34
1 1/8	14	42											E–63	E–60	E–57	E–54
			28	30	35	40	44	50	54	60	64	70	74	80	84	90
1	14	36	E–39	E–34	E–26											
1/2	12 3/8	42	E–30	E–26												
1 1/8	14	42	E–51	E–45												
1 1/8	16	42	E–60	E–54	E–42	E–32										
1 1/2	16	48		E–59	E–52	E–47	E–43	E–33								
1	16	48	E–66	E–57	E–45	E–35	E–30									
1 5/8	14	54			E–54	E–43	E–36	E–28								
1 3/4	14	60				E–60	E–54	E–43	E–37	E–30	E–27					
1 1/2	14	60				E–57	E–48	E–38	E–33	E–27						
2 1/8	15	66						E–57	E–54	E–46	E–41	E–34	E–31	E–26		
2	14	66						E–56	E–48	E–40	E–35	E–30	E–26			
2	14	72						E–62	E–54	E–44	E–39	E–32	E–29	E–25		
2 1/2	15 1/2	72								E–55	E–51	E–43	E–38	E–33	E–29	
2 1/8	14	78							E–64	E–52	E–46	E–39	E–35	E–30		
2 1/2	16	84									E–64	E–54	E–49	E–41	E–38	E–30
2 11/16	20	96													E–59	E–51

c. Wooden Bridge (fig. 4.6). For bridges with wooden stringers, the width of each stringer is measured under one track at the center of the length span and added to obtain total width. The depth and length of one stringer are also measured. The following table is used with the same procedures as the table in *b* above.

Stringer dimensions (inches)		Span length (feet)						
Width	Depth	10	12	14	16	18	20	22
18	12	E–16	E–12					
18	14	E–22	E–18	E–10				
18	16	E–28	E–20	E–15	E–10			
18	18	E–38	E–26	E–18	E–14	E–12		
20	12	E–18	E–12					
20	14	E–25	E–17	E–12				
20	16	E–33	E–23	E–16	E–12	E–10		
20	18	E–43	E–29	E–21	E–16	E–13	E–10	
24	12	E–22	E–15	E–11				
24	14	E–30	E–21	E–14	E–11			
24	16	E–40	E–28	E–20	E–15	E–12		
24	18	E–52	E–36	E–25	E–19	E–15	E–12	E–10
36	12	E–34	E–23	E–17	E–12	E–10		
36	14	E–47	E–32	E–23	E–17	E–14	E–11	
36	16	E–62	E–43	E–30	E–23	E–19	E–15	
36	18	E–78	E–53	E–39	E–30	E–24	E–20	E–16
40	12	E–38	E–26	E–19	E–14	E–11		
40	14	E–52	E–36	E–26	E–20	E–16	E–12	
40	16	E–69	E–47	E–35	E–26	E–21	E–17	
40	18	E–87	E–60	E–44	E–34	E–27	E–22	E–18
48	12	E–46	E–31	E–23	E–17	E–13		
48	14	E–63	E–43	E–31	E–24	E–19	E–15	
48	16	E–83	E–57	E–41	E–32	E–26	E–21	
48	18	E–105	E–73	E–53	E–41	E–33	E–27	E–22
54	12	E–52	E–35	E–27	E–19	E–15		
54	14	E–72	E–49	E–35	E–22	E–18		
54	16	E–94	E–65	E–46	E–36	E–29	E–24	
54	18	E–119	E–82	E–60	E–46	E–38	E–30	E–25
60	12	E–58	E–40	E–30	E–22	E–17		
60	14	E–79	E–55	E–39	E–30	E–35	E–20	
60	16	E–104	E–72	E–52	E–40	E–33	E–27	
60	18	E–132	E–92	E–67	E–52	E–42	E–34	E–28

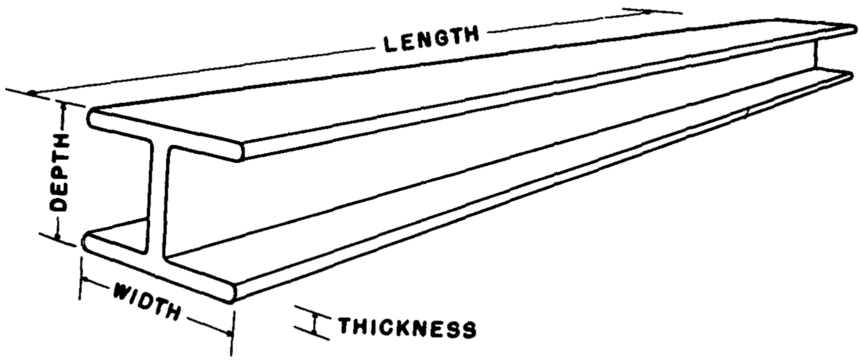


Figure 4.5. Measuring a steel stringer.

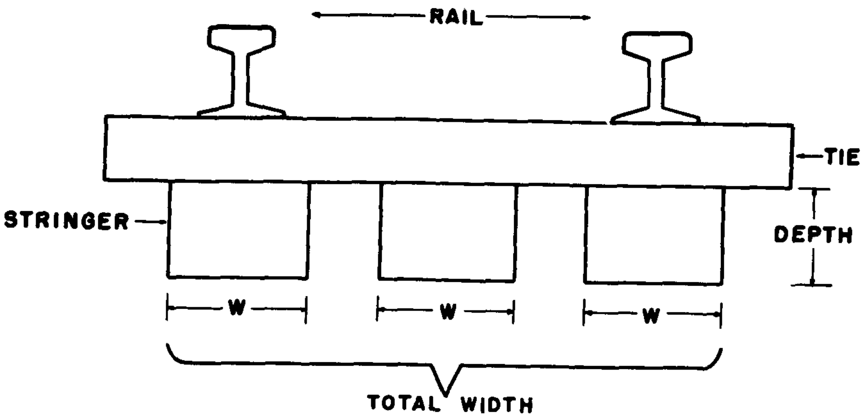


Figure 4.6. Measuring a wooden stringer.

4.14 Loading Open-Top Cars

Military equipment loaded on U.S. Army cars traveling over the lines of common carriers and on cars belonging to common carriers within the continental United States must meet the loading standards of the individual railroad and those of the AAR (Association of American Railroads). Cars loaded on foreign lines should meet the blocking and lashing standards of the area involved. The standards for and methods of blocking, nailing, and bracing for some typical military loadings are given in this paragraph. The regulations of AAR Pamphlet MD–7 and its supplement No. 1, *Rules Governing the Loading of Department of Defense Material on Open-Top Cars,* should be followed. The following examples apply only to the loading of flatcars; and/or composite gondolas with wooden floors with the equipment listed in *a* through *d* below and illustrated in figures 4.7 through 4.10. The letters in the item column refer to the letters shown in the illustrations. In all examples, brake wheels have the clearances shown in figure 4.11. The various wooden blocks, cut to specific patterns and numbered, are illustrated in figure 4.12.

a. Six-Wheel Truck (fig. 4.7). [1]

Item	No. of pieces	Description
A		Brake-wheel clearance (fig. 4.11).
B	8	Blocks, pattern 16 (1, fig. 4.12). Locate 45° portion of block against front and rear of front wheels, in front of outside intermediate wheels, and in back of outside rear wheels. Secure heel of block to floor with three 40-penny nails and toenail that portion under tire to floor with two 40-penny nails before items D and E are applied. Substitute, if desired, at each location, blocks, pattern 17 (2 fig. 4.12), or blocks, pattern 18 (3 fig. 4.12).
C	8	2 by 4 by 12 inches. Locate against block pattern 18 (3 fig. 4.12) lengthwise of car, and secure to floor with four 30-penny nails. Not required when blocks, patterns 16 (1, fig. 4.12) and 17 (2, fig. 4.12), are used.
D	1 each outside wheel.	Suitable material, such as waterproof paper, burlap, etc. Locate bottom portion under items E, top portion to extend 2 inches above items E.
E	6	Each consisting of two pieces of wood 2 by 4 by 36 inches. Secure lower piece to floor with four 30-penny nails and top piece to one below in like manner.
F	2 each axle	1-inch, No. 14 Birmingham wire gage, hot-rolled steel, with anchor plates, pattern 19 (4, fig. 4.12). Locate over axle, springs, or spring shackles, and secure each plate to floor with eight 20-penny, cement-coated nails. Substitute, if desired, at each location, four strands of No. 8 gage, black annealed wire. Pass over axle, springs, spring shackles, underneath and around item G and twist taut after item G has been nailed in place.
G	1 each item F	2 by 4 by 18 inches. Secure to floor lengthwise of car, with four 30-penny nails. Not required when steel straps are used, pattern 19 (4, fig. 4.12)
H	4 each unit	Four strands of No. 8 gage, black annealed wire. Attach to each corner of machine and to stake pockets. Not required for units loaded in gondola cars.

See notes on page 145.

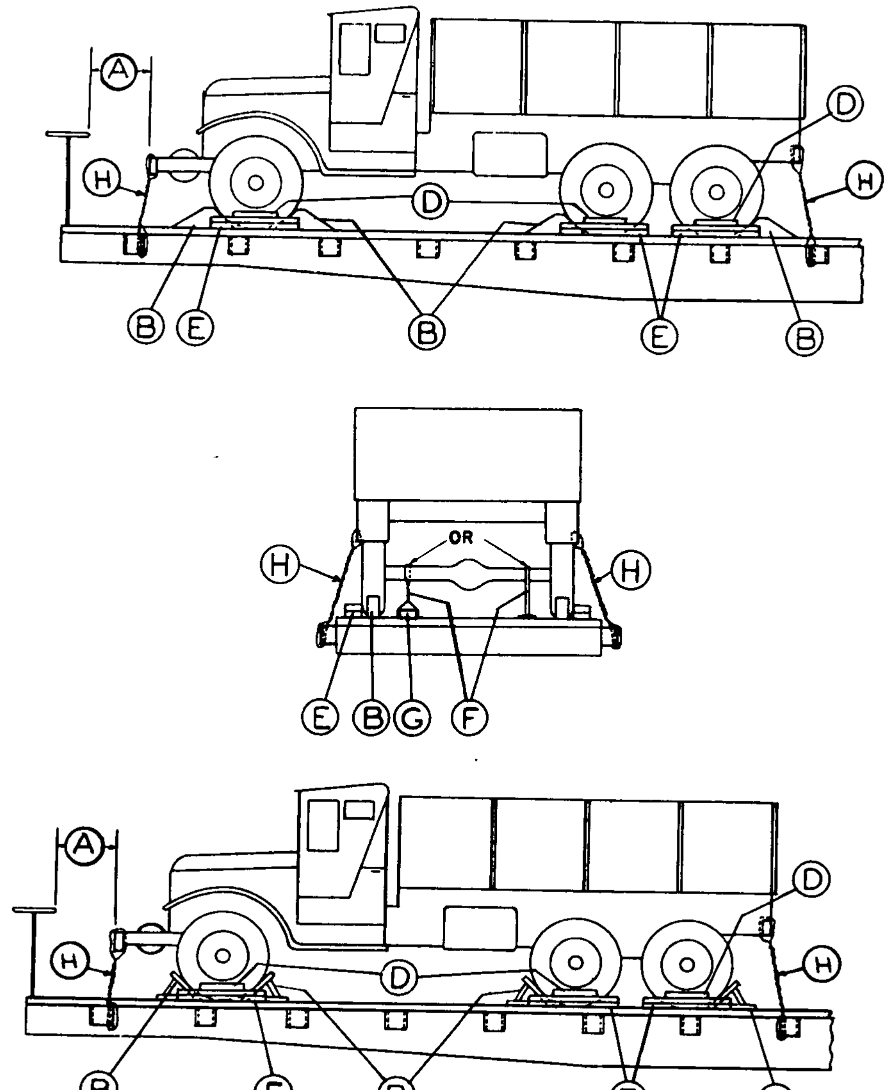


Figure 4.7. Loading a six-wheel truck on an open-top car.

b. Landing Vehicle, Wheeled, 2½-ton, 6X6 (DUKW) (fig. 4.8).[1]

Item	No. of pieces	Description
A-------	----------------	Brake-wheel clearance (fig. 4.11).
B-------	8--------------	Blocks, pattern 24 (5, fig. 4.12). Locate in front and rear of front wheels, in front of intermediate wheels, and back of rear wheels, and secure to floor with five 30-penny nails in each.
C-------	8--------------	2 by 4 by 20 inches. Secure upper end to item B and lower end to floor with two 30-penny nails at each location.
D-------	8--------------	2 by 4 by 12 inches. Locate against bottom of item C and secure each to floor with three 30-penny nails.
E-------	6--------------	Suitable material, such as waterproof paper, burlap, etc. Locate bottom portion under items F, top portion to extend 2 inches above items F.
F-------	6--------------	Each consisting of two pieces of 2 by 4 by 36 inches. Secure lower piece to floor with four 30-penny nails and top piece to one below in like manner.
G-------	2 each axle-----	1-inch, No. 14 Birmingham wire gage, hot-rolled steel, with anchor plates, pattern 19 (4, fig. 4.12). Locate over axle, springs, or spring shackles, and secure each plate to floor with eight 20-penny, cement-coated nails. Substitute, if desired, at each location, four strands of No. 8 gage black annealed wire. Pass around item H and twist taut after item H has been nailed in place.
H-------	1 each item G---	2 by 4 by 18 inches. Secure to floor, lengthwise of car, with four 30-penny nails. Not required when steel straps are used, pattern 19 (4, fig. 4.12).
J-------	2--------------	1-inch, No. 14 Birmingham wire gage, hot-rolled steel, with anchor plates, pattern 19 (4, fig. 4.12). Pass through towing clevises and secure each plate to floor with eight 20-penny cement coated nails. Substitute, if desired, at each location, four strands of No. 8 gage black annealed wire. Pass through towing clevises, underneath, and around item K and twist taut after item K has been nailed in place. Not required when steel straps are used, pattern 19 (4, fig. 4.12).
K-------	1 each item J---	2 by 4 by 18 inches. Secure to floor, lengthwise of car, with four 30-penny nails. Not required when steel straps are used, pattern 19 (4 fig. 4.12).
L-------	1--------------	Four strands of No. 8 gage, black annealed wire. Loop around towing hook and through opposite stake pockets. Not required for units loaded in gondola cars.

See notes on page 145.

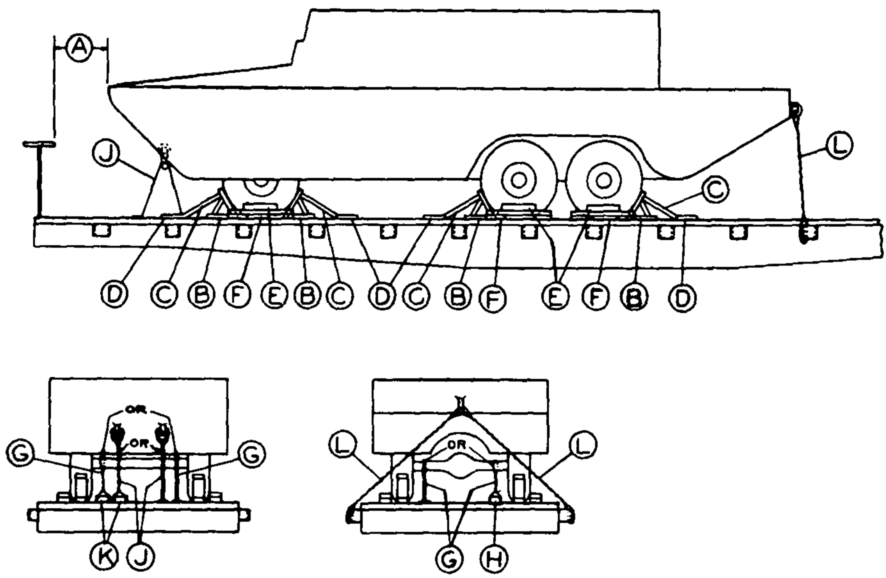


Figure 4.8. Loading a 2½-ton wheeled landing vehicle on an open-top car.

c. *37, 40, 75, 90 and 105mm Mounted Gun or Howitzer (fig. 4.9).*[1 2]

Item	No. of pieces	Description
A		Brake-wheel clearance (fig. 4.11).
B	4	Blocks, pattern 16 (1, fig. 4.12). Locate 45° portion of block in front and rear wheels. Secure heel of block to floor with three 40-penny nails and toenail that portion under tire to floor with two 40-penny nails before items C are applied.
C	2	Each consisting of two pieces of 2 by 4 by 36 inches. Secure lower piece to floor with three 40-penny nails and top piece to one below in like manner.
D	2	Support, pattern 62 (8, fig. 4.12), length ¼ inch longer than the distance between point of support on gun carriage and floor. Place between floor and gun carriage to partially relieve weight on tires. Secure each to floor with six 40-penny nails.
E	2	Four strands of No. 8 gage, black annealed wire. Pass through holes in wheels and secure to stake pockets.
F	2 for single spade, 4 for double spade.	6 by 8 by 24 inches, cut to fit contour of spade. Locate in front and rear of spade. Toenail to floor with five 40-penny nails.

See notes on page 145.

c. 37, 40, 75, 90 and 105mm Mounted Gun or Howitzer (fig. 4.9.)[1] [2]—
Continued

Item	No. of pieces	Description
G	2 each item F	Each consisting of two pieces of 2 by 4 by 12 inches. Secure lower piece to floor, against item F, with three 40-penny nails and top piece to one below in like manner.
H	2	2 by 4 by 12 inches. Locate against each side of spade and secure to floor with three 40-penny nails.
J	1 pair	Stakes or green saplings. Locate ⅓ distance from end of gun trail to center of wheels.
K	1	Six strands, No. 8 gage, black annealed wire. Loop around and over top of rear end of gun trail and secure to opposite stake pockets. Substitute, if desired, 2-by .050-inch high-tension bands, or ½-inch steel cables.

See notes on page 145.

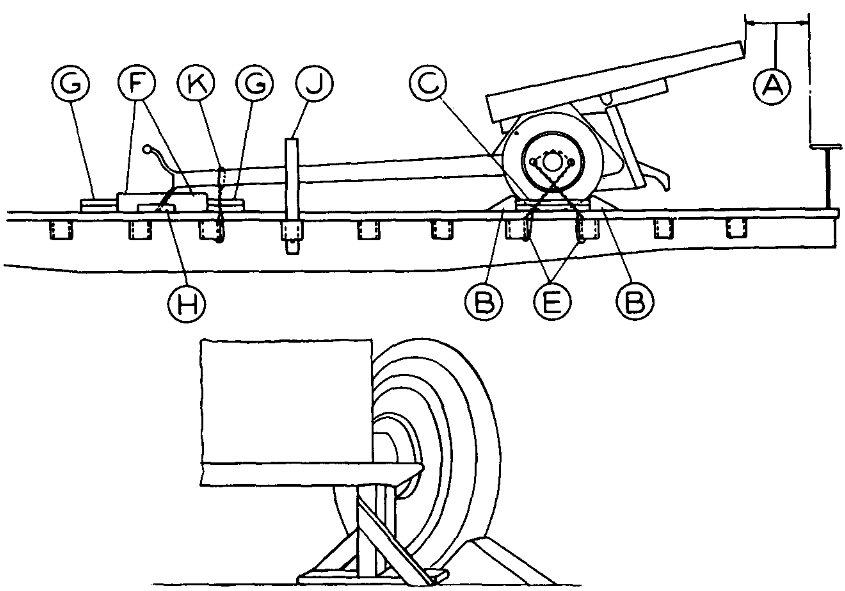


Figure 4.9. Loading a 37mm to 105mm mounted gun or howitzer on an open-top car.

d. Tanks and Similar Units, From 60,000 to 100,000 Pounds (fig. 4.10).[1 2]

Item	No. of pieces	Description
A-------	----------------	Brake-wheel clearance (fig. 4.11).
B-------	2-------------	Blocks, pattern 31 (7, fig. 4.12). Locate one against each rear crawler tread.
C-------	2-------------	Blocks, pattern 30 (6, fig. 4.12). Locate one against each front crawler tread.
D-------	1 each items B and C.	2 by 4 by 20 inches. Locate one on inside of items B and C and secure to floor with six 20-penny nails.
E-------	2 each items B and C.	Each consisting of two pieces of 2 by 4 by 12 inches. Locate against ends of items B and C. Secure lower piece to floor with four 20-penny nails and top piece to one below in like manner.
F-------	2 each unit-----	Each consisting of two pieces of 2 by 4 by 14 inches. Locate on floor against inside of each crawler tread, and secure lower piece to floor with twelve 30-penny nails and top piece to one below in like manner.
G-------	3 each unit-----	Each consisting of two pieces of 2 by 4 inches long enough to fill space between items F. Locate one near center and one near each end of items F. Secure lower piece to floor with four 30-penny nails and top piece to one below in like manner.
H-------	6-------------	Each consisting of two pieces of 6 by 6 inches, length to suit, cut to fit contour of bogie wheels. Locate one piece between inside and outside wheels of each bogie assembly.
J-------	6-------------	Each consisting of two pieces of 4 by 4 inches, length to suit. Locate against bogie wheels on top of item H.
K-------	6-------------	Each consisting of two pieces of 4 by 4 inches, long enough to fill space between items H. Toenail each to items H with two 30-penny nails.
L-------	12-------------	Each consisting of two strands No. 8 gage, black annealed wire. Pass under crawler tread and around items H and J. Substitute, if desired, at each location, one ¾- by .035-inch high-tension band. Use staples or nails bent over to retain bands or wires in position.

See notes on page 145.

d. Tanks and Similar Units, From 60,000 to 100,000 Pounds (fig. 4.10).[1] [2]—Continued

Item	No. of pieces	Description
M	4	1½-inch diameter rods. Attach to lifting lugs and pass through stake pockets and ½- by 4- by 10-inch plates underneath stake pockets on opposite sides of car. Substitute, if desired, ⅞-inch steel cable, doubled.

[1] Set handbrake and wire, or block, lever. When tiedown rods are found slightly loose in transit, they need not be tightened.

[2] Place turret gun in straight forward position, and wire turret-lock handwheel and elevating-mechanism handwheel to prevent rotating. When unit is not equipped with build-in gun brace, apply two ¾-inch high-tension bands, securing gun barrel to unit at each side. Rock a tracked vehicle forward and backward under its own power to take the slack out of the tracks and thus secure the vehicle to the blocks.

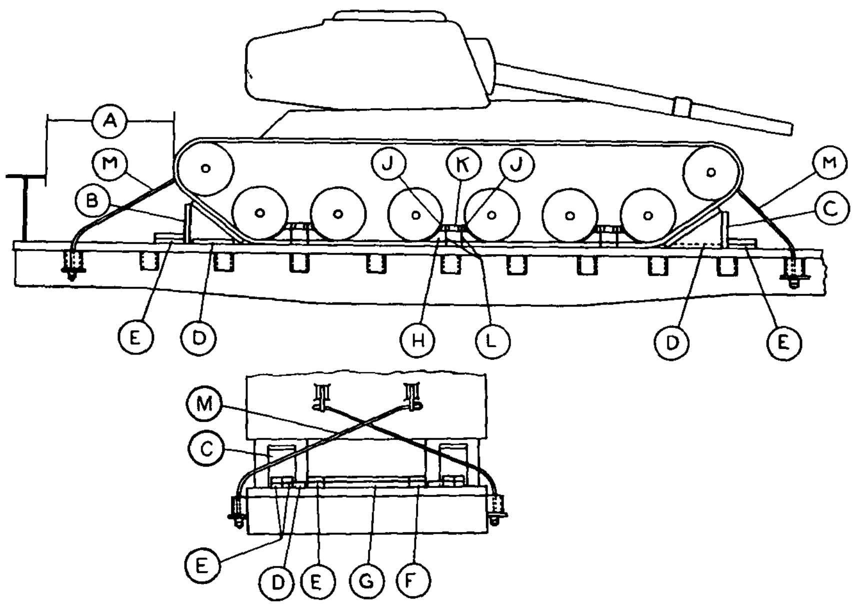
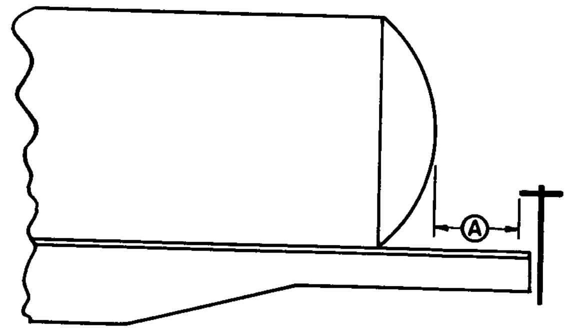


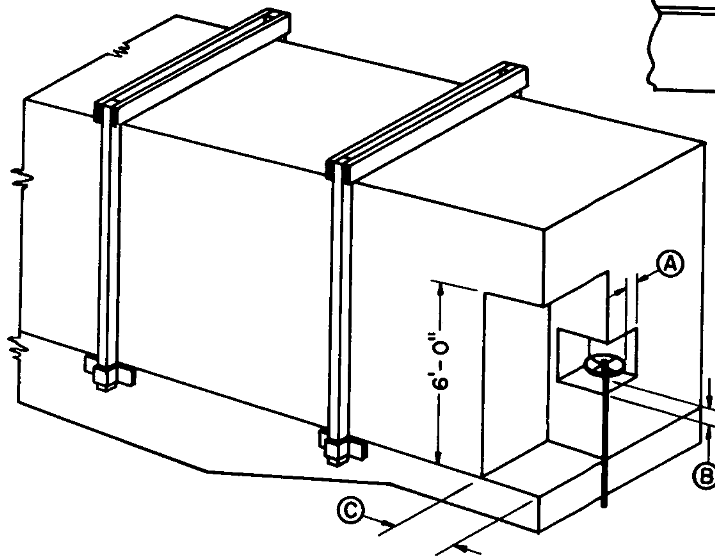
Figure 4.10. Loading a tank or similar unit, 60,000 to 100,000 pounds, on an open-top car.

4.15 High and/or Wide Loads

a. Cars with high and/or wide loads create an operating hazard: both the cargo and the personnel working on the line are endangered. Every possible effort must be made to reduce such hazards.

b. The transportation officer initiating a high and/or wide load is responsible for coordinating the shipment with the shipping agency to effect the maximum reductions possible; for example, the removal of spotlights and tool kits, the lowering of booms, and the depressing of gun barrels.





Item	Description
A--6-in. clearance in back, on both sides of and above brake wheel, except as shown for tanks and similar shapes in one piece.	
B--1-in. clearance underneath brake wheel.	
C--12-in. minimum clearance from end of car to load, extending from center of brake wheel to side of car and 6 ft above car floor. On gondola cars this space may be used from floor of car to 4 in. below bottom of brake wheel, item B.	

In the loading and hauling of long commodities requiring more than 1 car, handbrakes may be omitted on all save 1 of the cars while they are thus combined. Brake-wheel clearance should be increased as much as consistent with proper location of load.

Figure 4.11. Brake-wheel clearance.

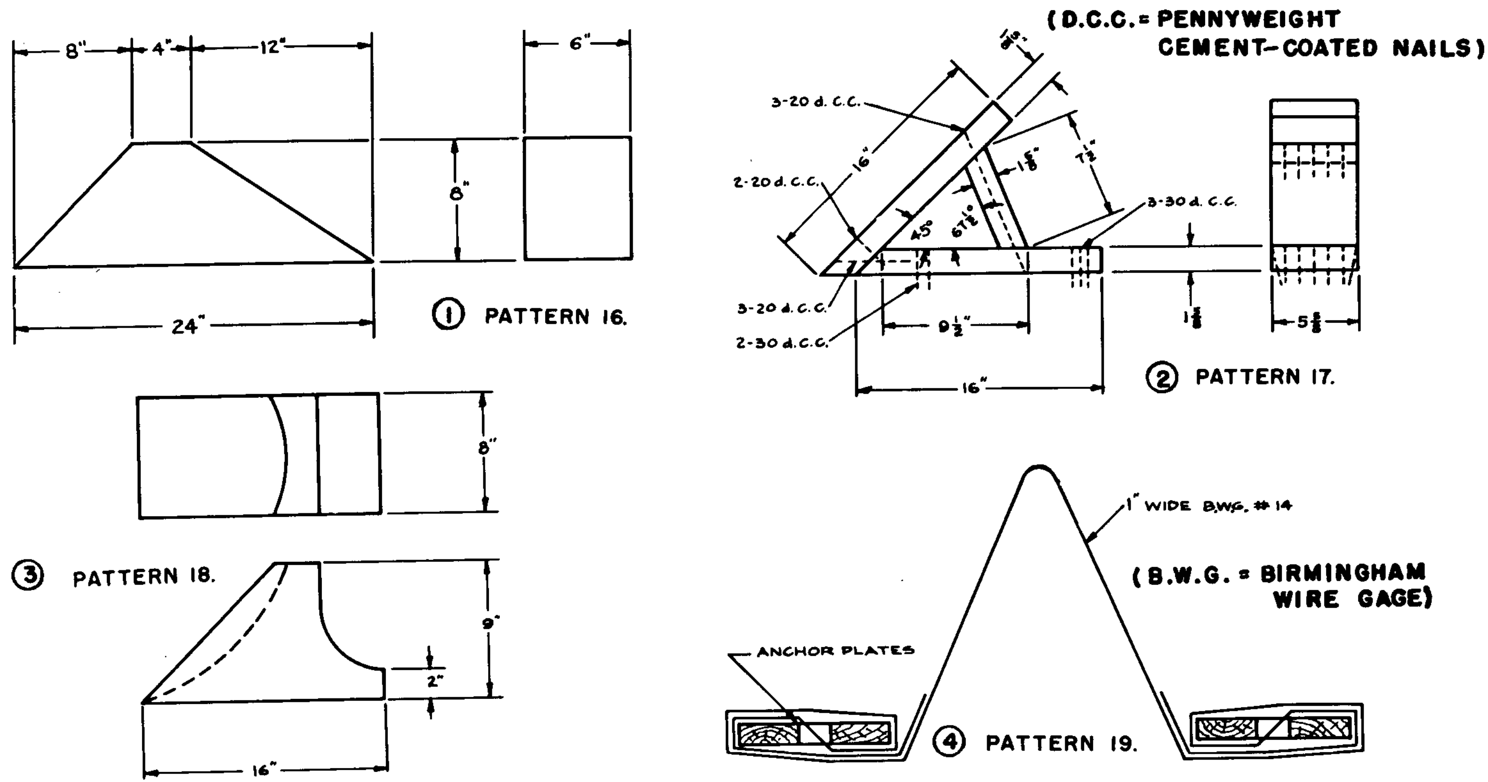


Figure 4.12. *Chocks with dimensions and pattern numbers of the Association of American Railroads.*

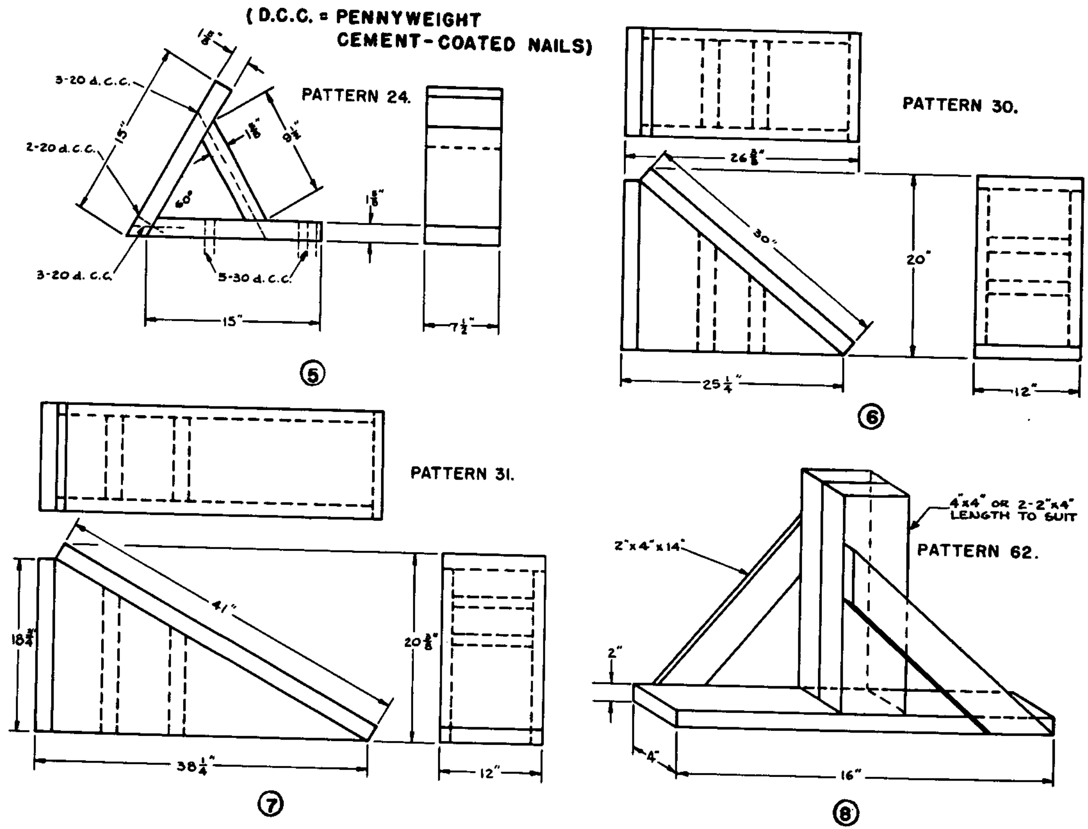


Figure 4.12—Continued.

c. When the movement of a high and/or wide load is unavoidable, a scale drawing should be given the serving carrier to determine rail transportability and if transportable, to make necessary routing instructions.

d. It is essential that the dimensions provided the carrier be accurate and that they reflect the absolute minimum that can be achieved by the shipping agency. (The consignee's ability to reassemble dismantled equipment must be considered.)

e. Whenever possible, an item of equipment should actually be measured to determine its shipping cube. Dimensions from supply manuals, TM's, FM's, etc., should not be used without verification. Incorrect dimensions can be very dangerous and costly.

f. Trains containing high and/or wide loads must be operated at reduced speeds; everyone concerned must be informed of the situation.

4.16 Loading Explosives and Other Hazardous Cargo

For detailed information about handling explosives, see regulations of the Interstate Commerce Commission and pamphlets issued by the Bureau of Explosives, Association of American Railroads. Basic precautions are:

a. Lost space in loading packages in a car should be avoided by pressing each package firmly toward the end of the car as it is loaded.

b. High pressures on small areas must be avoided. The largest possible area of a package must be used to resist pressures. Bevel-edged boards must be nailed to the car floor to cover defects in the floor or projecting pieces of metal or nails. Cars with corrugated or pressed metal ends, not lined, and cars with bowed ends must be boarded up at the inside of the ends to the height of the load.

c. Placing a large shipment in one end of a car must be avoided. A shipment in excess of 12,000 pounds must not be loaded in one end of a car unless other freight is to be loaded in the other end to balance it. Failure to do this may cause the car to leave the track.

d. Bracing and blocking must be of sound lumber, free from cross grain, knots, knotholes, checks, or splits which impair the strength of the material or interfere with proper nailing.

e. Nails should be used plentifully and in the proper places.

(1) Balanced nailing is important. All nails should be of such length as to have the necessary holding power and ample penetration into car walls, floors, or other bracing and blocking. To obtain the greatest holding power, nails must be long enough to nearly penetrate but not protrude through the timber holding the point of the nail. Nails must not be large enough to cause splitting; they should not be placed along one grain of the wood. Whenever possible, nails should be driven straight—not toenailed. Brass or

copper hammers should be used to nail braces around packages of explosives.

(2) The lining of cars is only three-quarters or seven-eighths of an inch thick and has little holding power for large nails. Sidewall blocking therefore should be nailed so that the nails are driven into the heavy uprights supporting the lining.

f. The following must not be used:

(1) Cars with end doors.

(2) Cars with automobile loading devices unless the loading device is attached to the roof of the car so that it cannot fall.

(3) Refrigerator cars except when—

(*a*) Authorized by the carrier or owner.

(*b*) Ice bunkers are protected by solid bracing.

(*c*) Unfixed floor racks are removed.

g. When heavy loads are handled in and out of cars on lift trucks, a temporary steel plate or other floor protection of suitable size must be used to prevent the truck from breaking through the floor.

h. When loading in closed cars, the following safety rules must be followed:

(1) Lading must be so secured that it will not come in contact with side doors, or roll, or shift in transit.

(2) Adequate stripping must be placed across each door opening to prevent lading from falling, rolling out of a doorway, or coming in contact with a door while in transit.

(3) Load must be so placed in the car that there will not be more weight on one side than on the other. One truck must not carry more than one-half the load limit stenciled on the car. Cars should be loaded as heavily as possible up to, but not exceeding, the load limit stenciled on the car. Loads should be placed in cars as shown in figure 4.13. The distances shown in the figure represent lengths of different loads. Relative position on the car of each load is also shown.

(4) Material loaded between truck centers and ends of car must not exceed 30 percent of the stenciled load limit (15 percent each end) when both ends are loaded, and 10 percent when only one end is loaded. The percentage of stenciled load limits shown in figure 4.13 must not be exceeded for loads located between truck centers, measured lengthwise of car, except when car owner designates otherwise.

i. The following instructions apply in loading and blocking ammunition in cloverleaf packages. Less-than-carload shipments may be loaded and braced in the same manner as the partial shipment shown in figure 4.14. All space between sides of car and rows of bundles

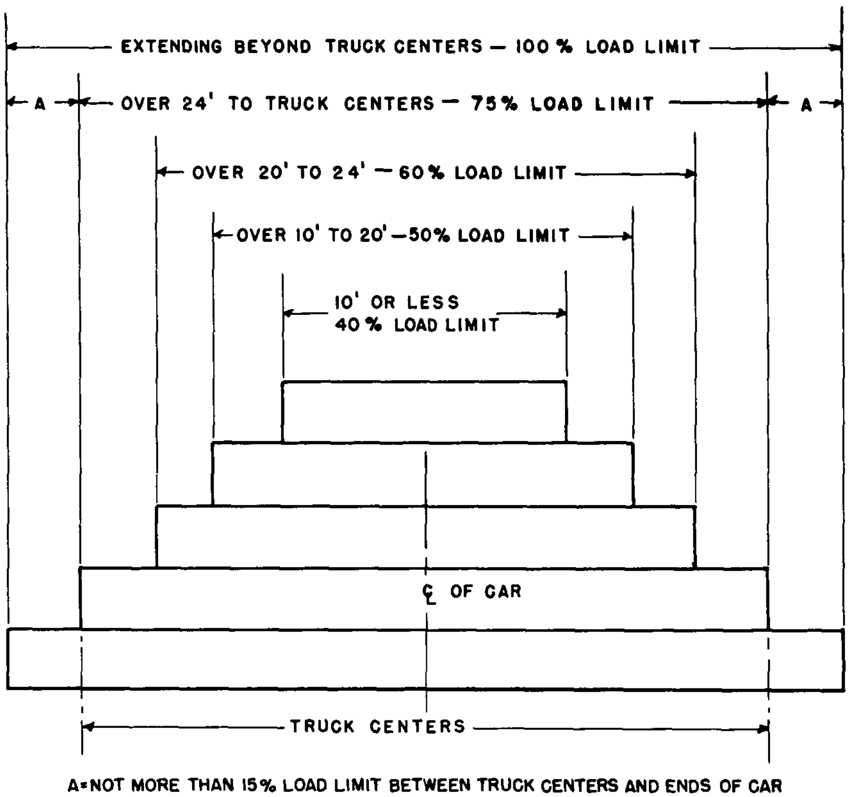


Figure 4.13. Load limits for explosives.

must be filled. All bundles must be tightly wedged in place at time of loading. Bulkhead braces for partial layers must be long enough to permit nailing to upright braces behind car lining. Length will vary, depending on weight of lading supported. The filler strips nailed to the sides of the car must be extended across the doorway. No other doorway protection is required.

4.17 Marking Dangerous-Cargo Cars

a. Loaded Cars. Closed cars and tank cars containing dangerous ladings are marked with placards giving the contents. These cards, usually 10 to 14 inches square and printed with large red and black lettering, indicate the contents of a placarded car and give special handling instructions. The placards are usually tacked to placard boards bolted to the outside of the car—one at each end, and one on each door on each side of the car. Cars of all-steel construction often have a framed card pocket, one each in the four locations enumerated, into which the printed placards are slipped.

b. Empty Cars. Empty tank cars and boxcars are often placarded with notices that warn of lingering gases and fumes after being unloaded. These warning cards on cars stress that care must be used in switching the cars as well as in unloading their contents.

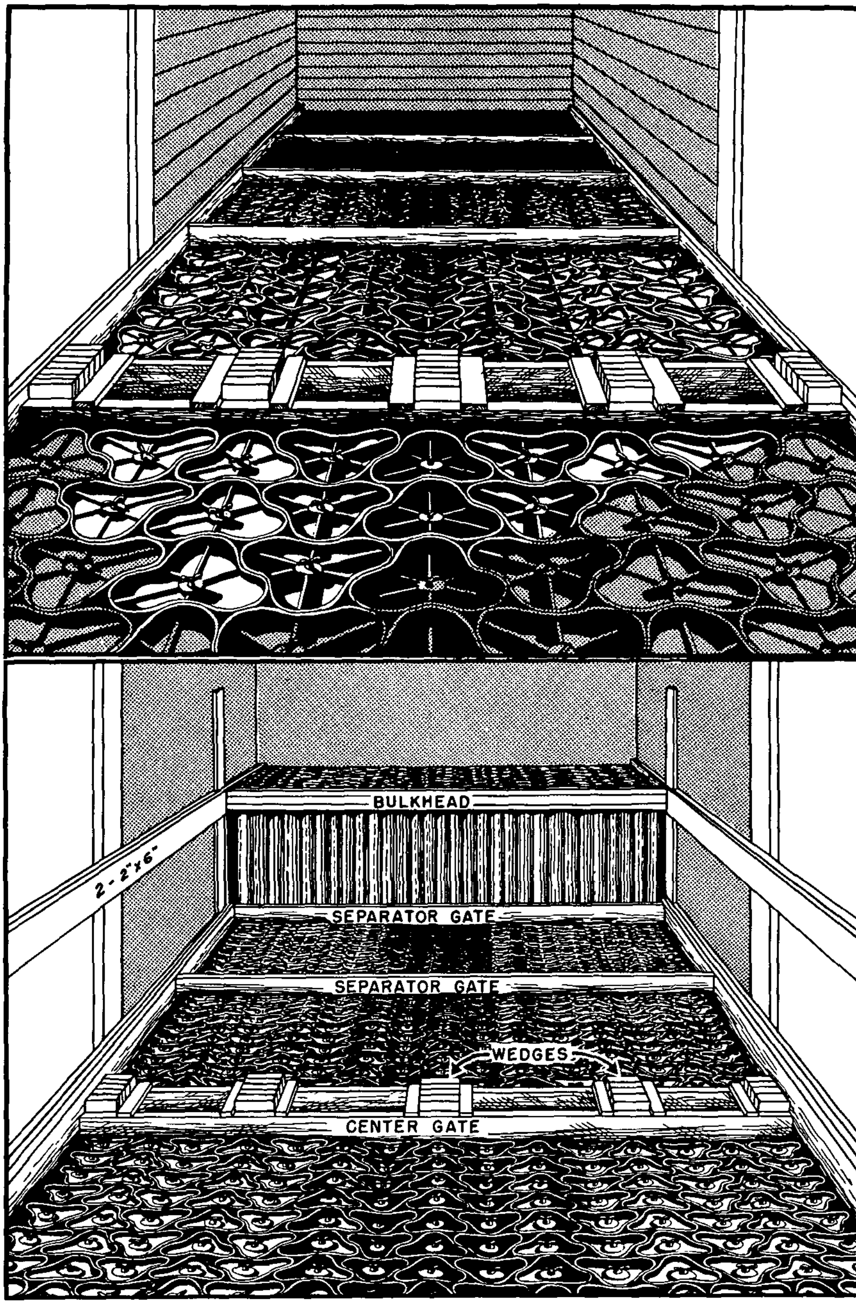


Figure 4.14. Loading and blocking ammunition in cloverleaf packages.

c. Examples. Typical car placards used on commercial and military railroads in the United States are shown in figure 4.15, and four-language placards for use by the Army in Europe are shown in figure 4.16.

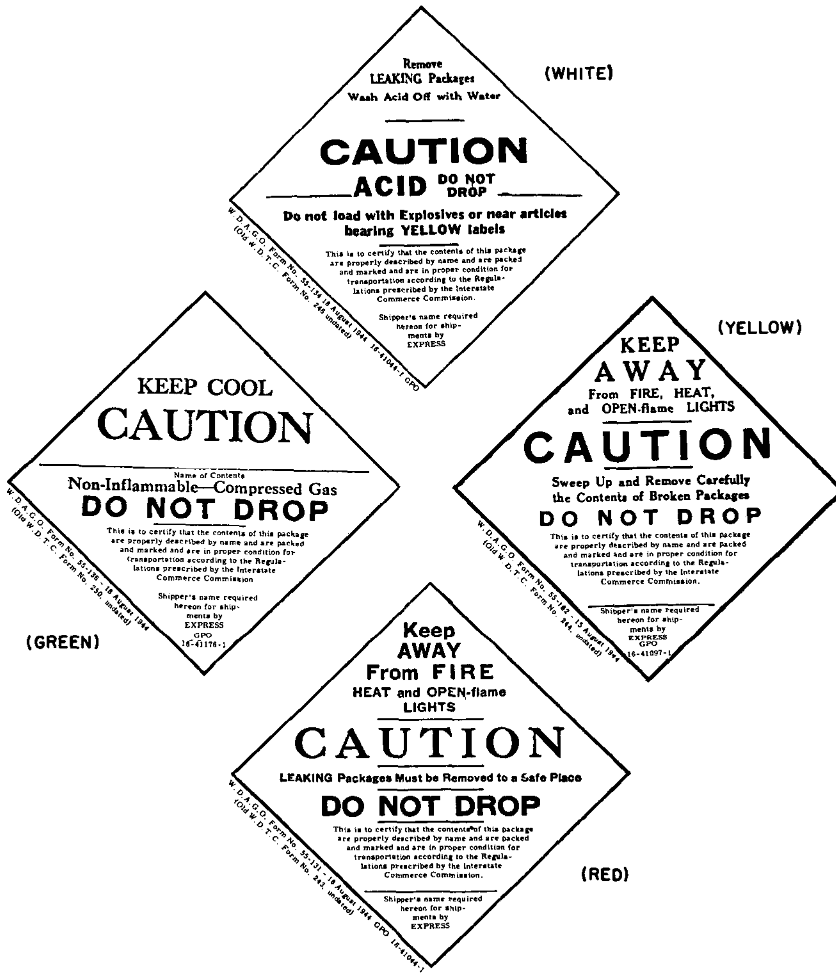


Figure 4.15. Examples of domestic labels for hazardous cargo.

4.18 Cargo Security

a. At Origin.

(1) The shipper is responsible for the security of carload freight until the car is coupled to an engine or train for movement. *The shipper must be fully aware of this responsibility.*

(2) Before loading, the shipper should inspect the car thoroughly to insure that it meets security requirements. Cars that have holes or damaged places in floors, roofs, or sides, or insecure doors must be repaired before they are used.

(3) The shipper is responsible for properly loading and bracing the load and for closing and sealing the car. Improperly stowed or braced loads may be damaged in movement and invite pilfering.

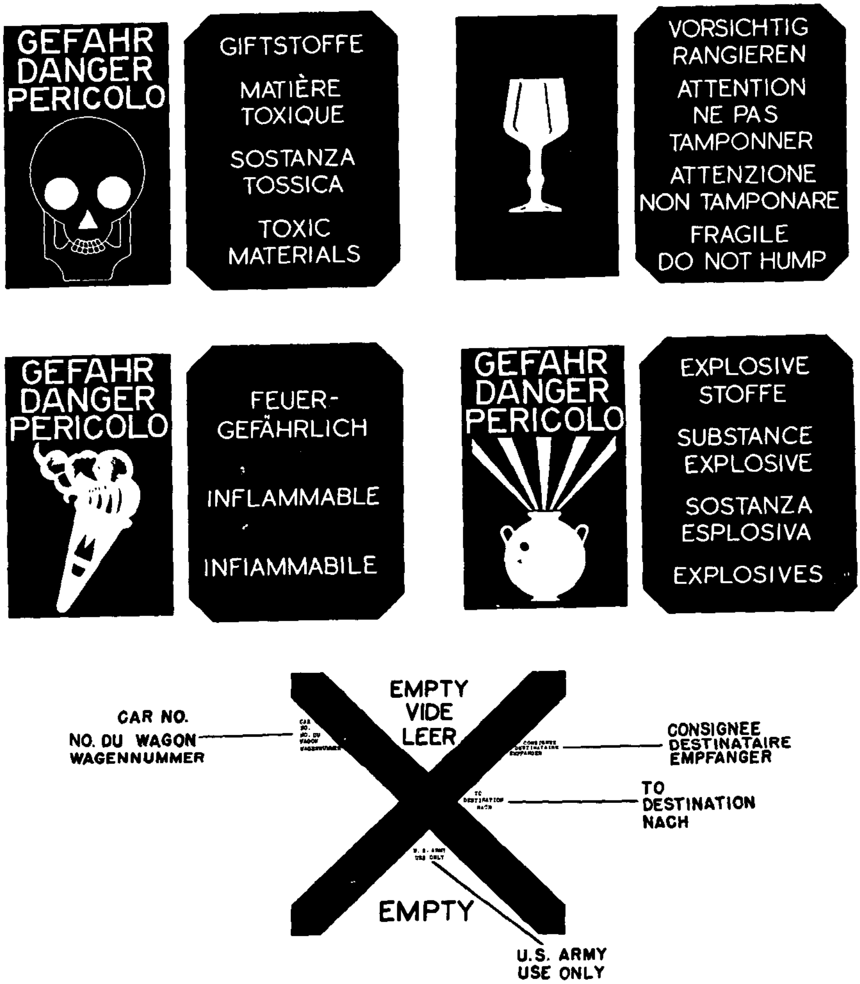


Figure 4.16. Railway car labels, U.S. Army Europe.

(4) Loading should conform to the standards necessary for safe movement under existing operating conditions. In sealing closed cars, the best protection is provided by tightly twisting a 10-inch length of heavy-gage wire through the locking eyes and snubbing off the wire ends closely. Usually No. 8- or 10-gage wire is used. Zero-gage may be necessary when the pilferage or sabotage threat is acute. The door hasps of closed cars are always sealed with a thin, metallic seal on which a serial number is stamped. This seal is broken easily and provides little protection against pilferage. The absence or breakage of a seal indicates tampering. Shipments in open cars should be covered with securely fastened tarpaulins if required by nature of shipment. Small items

shipped on flatcars should be fastened securely to the car floor.

(5) The shipper prepares an accurate list of contents, prepares the waybills, and affixes placards to the cars. After a car is loaded, sealed, and documented, it should be moved as quickly as possible.

(6) Railway personnel must inspect all open-top cars before movement to insure they are loaded properly and meet clearance requirements.

b. In Transit.

(1) Transportation railway service is responsible for the security of all carload freight in transit from the time the car is moved from its loading point until it is placed at the designated unloading point. Transportation railway service prepares all car records, train documents, and other records required to insure prompt movement and to prevent loss of cars en route. When operating conditions permit, cars containing freight subject to pilferage are grouped to permit economy in the use of guards. Special handling is given to mail or high-priority traffic of a classified nature.

(2) Train guards are provided by military police or other units assigned or attached to transportation railway service for security duties. These units also guard cars and trains during movement in railroad yards. Sensitive supplies may be guarded by personnel assigned to the car by the loading agency. Yardmasters advise the dispatcher on receipt of cars with special guards. They note the receipt on the train consist that is transmitted to yards and terminals to insure that all railway personnel avoid delays in transit and expedite placement at the destination.

(3) Guard crews check car seals and inspect trains for cars that are not secure. They prepare a record, by car number, of all guarded cars in trains, noting any deficiencies or incidents en route. When a relief guard takes over, the crews make a joint inspection and sign this record.

(4) When a bad-order car containing supplies subject to pilferage is set out, a member of the guard crew should remain with the car until he is properly relieved. Guard crews must be alert at all times, particularly when the train has stopped, and when it is passing through tunnels, cuts, and villages at slow speed.

c. At Destination.

(1) The consignee becomes responsible for carload freight when it is placed at the depot, siding, or track he designates. Cars should be unloaded as quickly as possible to lessen chances for pilferage.

(2) In removing wire seals from closed cars, care must be taken to avoid breaking latches on the car door. Wire cutters are recommended for this purpose.

4.19 Troop Movements

a. Space Requirements. For planning purposes, the following capacity data may be used when loading troops on U.S. equipment:

(1) *Sleeping cars (average).* Thirty-two troops with individual equipment.

(*a*) Officers and warrant officers are moved in standard pullmans, 2 per section, and are listed by number of sections; for example, 14 officers are shown as 7 sections. Officers and warrant officers of all units in one train will be grouped in one or more pullman cars as required.

(*b*) Enlisted men move in tourist pullmans, usually two per section. NCO's of the first five grades are entitled to separate berths. Space must be provided for personnel attached from medical units and men detached as guards on freight cars.

(2) *Coaches (average).* Fifty-five troops with individual equipment.

(3) *Passenger trains (long-distance moves, average).* Eleven sleeping cars, 2 kitchen cars, 1 or 2 baggage cars; 350 troops per train is typical.

(4) *Freight trains.* For troop-unit moves, including such heavy equipment as tanks, artillery, and engineer equipment, trains seldom exceed 65 cars (650 short tons) for infantry divisions; 55 cars (1,200 short tons) for armored divisions.

(5) *Mixed trains.* Desirable from a tactical and organizational standpoint, since they carry all personnel with their vehicles, artillery, and equipment. Not economical when passenger equipment is in short supply because they move at freight speed. In mixed trains, boxcars should be substituted for baggage cars.

(6) *Kitchen-baggage cars.* Furnished on the basis of 1 per 250 men or fraction thereof. Requirements per train depend upon how transportation is grouped. For tentative estimates, allow one per unit.

(7) *Flatcars.* Number required is computed on the basis of maximum utilization of each car, regardless of length. Computation is not restricted to cars of one length. Twelve inches is left clear at one end of each car for brake-wheel clearance.

b. Organizational Equipment.

(1) Amount of headquarters, kitchen, and maintenance equip-

ment varies somewhat in all units. For planning, allow 20 short tons per company or equivalent unit.

(2) Organizational equipment is usually loaded in unit transportation; loading it separately requires more boxcars. Checkable baggage up to 150 pounds is carried free; generally, this is loaded in a baggage or boxcar. When transportation groupings permit, checkable baggage for two companies or similar units may be loaded in one boxcar.

c. Foreign Railways.

(1) Few foreign railways are capable of moving complete troop units by rail at the same time the rail net is supplying a major force. Accordingly, tracked vehicles and foot troops may move by rail while wheeled vehicles with their normal towed loads move on highways.

(2) For planning, the following capacities may be assumed:

(*a*) *Freight cars.*	
Well flatcars	50 short tons
Medium flatcars	25 short tons
Small flatcars	12 short tons
Boxcars	10 short tons or 25 troops
(*b*) *Passenger cars.*	
Coaches	40 troops
Sleeping cars	32 troops

4.20 Instructions for Troop-Train Commanders

a. Determining Troop-Train Commander.

(1) A troop-train commander is appointed or detailed for all troop trains. He is usually senior officer commanding troops.

(*a*) If only one unit is involved, he may be detailed by headquarters of unit ordered to move.

(*b*) If more than one unit is moving, he may be appointed by transportation movements officer.

(2) If the troops are of mixed nationalities, the senior officer commanding troops, regardless of nationality, is troop-train commander; in cases of equal senior rank, the commander of largest number of troops served will be the troop-train commander.

(3) He serves until journey is completed, regardless of officers boarding train en route.

b. Duties of Troop-Train Commander.

(1) *Administration.*

(*a*) May appoint one or more officers as assistant. When troops of other nationalities are traveling on same train, officers of the nationalities concerned will be appointed as assistants.

(*b*) Complies with instructions received en route from Transportation Corps.

(*c*) Ascertains details of loading baggage, vehicles (if any), and personnel from transportation movements officer, station master, or port commander if moving from a port.

(*d*) Submits troop-movement order to transportation movements officer.

(*e*) Makes location of troop-train commander's headquarters on train known to all troops.

(*f*) Gives order of entrainment; directs entrainment, noting location of various units and their baggage.

(2) *Discipline.*

(*a*) Responsible for the protection, discipline, and conduct of all troops aboard the train.

(*b*) Directs that separate accommodations be provided for all females traveling. Details an officer to any car in which separate compartments are occupied by male and female personnel to insure observance of proprieties.

(*c*) Issues orders prohibiting:

1. Discussing the move with unauthorized persons.

2. Detraining without orders.

3. Throwing rubbish out of windows.

4. Leaning out of windows.

5. Damaging railway property.

6. Marking or writing on sides of cars.

7. Violating blackout.

8. Wasting water in lavatories.

9. Riding on trains except where authorized.

10. Using intoxicants.

11. Using train latrines while in stations.

(3) *Sanitation.* The troop-train commander is advised by train crew of:

(*a*) Approximate time of rest stops to be made during a long journey.

(*b*) Whistle signal to be used for notification of such stops.

(*c*) Duration of stops.

(4) *Air Defense.* The troop-train commander will:

(*a*) Interrupt movement program only if assault is specifically directed against the destination station.

(*b*) Be prepared to assist local antiaircraft after consultation with transportation movements officer.

(*c*) Enforce blackout.

Section IV. RAILWAY CONSTRUCTION, MAINTENANCE, AND SUPPLY

4.21 Construction Requirements

a. *New Construction.*

(1) For planning purposes, a railroad division includes 100 principal-route miles of main line, single or double track, with its terminal operating and maintenance facilities, fueling and watering facilities as required, and the necessary signaling equipment or interlocking facilities for safe operation. Passing sidings on single-track lines, crossovers on double-track lines, and stations are located at intervals as required by traffic. Normally, at least one spur or siding is provided at each station. The Corps of Engineers has the responsibility for new rail construction and for large-scale rehabilitation. Transportation Corps personnel, however, may be required to assist Engineer personnel in the latter work.

(2) The following table shows the materials and net effective man-hours required for new construction of 1 mile of standard-gage (56½-inch), single-track railroad.

	Short tons	*Measurement tons*	*Man-hours*
Grading, includes clearing average wooded terrain			5, 000
Ballast delivered (bank run material), 5-mile average haul			2, 500
Track laying and surfacing, allows 400 man-hours per mile for placing ties, delivered at site			3, 400
Bridging: 70 linear feet per mile	128	111	3, 200
Culverts: 7 per mile, 280 linear feet	8	7	1, 400
Ties: 2,900	218	300	
Rail: 85 pounds per yard	150	42	
Fastening (based on 39-foot rail)	33	10	
Total	537	470	15, 500

b. *Rehabilitation.* The following table reflects the rehabilitation requirements that can be anticipated for a 100-mile, standard-gage, single-track division extending inland from a port, using average percentage of demolition over the entire division. For further information, see FM 55–21.

Items	Quantity per 100 miles	Demolition percentage	Rehabilitation quantity	Material [1]		Man-hours [1] (1,000's)
				ST	MT	
Main line	100 miles	13	13 miles	2,380	675	68
Port trackage [2]	3 miles	100	3 miles	1,440	1,098	14
Passing sidings [2]	4.5 miles	80	3.6 miles	1,730	1,320	17
Station sidings [2]	3 miles	80	2.4 miles	1,150	880	12
Railway terminal [2] [3]	1	75	0.75	7,100	6,800	160
Regulating station [2] [4]	1		1	6,530	7,340	230
Water stations	3	100	3	135	210	9
Fuel station	1	100	1	21	18	1
Bridging	7,000 lin. ft	70	4,900 lin. ft	8,950	7,770	224
Culverts	195,000 lin. ft	15	29,400 lin. ft	120	105	21
Grading						35
Ballast						44
Ties, main line		6	6 miles	1,310	1,800	3
Total				30,866	28,016	838

[1] Tunnels require special consideration. To repair, by timbering, a 50-foot demolition at each end of a single-track tunnel (100-foot total per tunnel), allow 70 short tons or 87 measurement tons and 3,000 man-hours.

[2] Estimate includes ties, rails, fastenings, turnouts, and track laying and surfacing. It is assumed that ballast is available at work sites.

[3] Includes replacement of all buildings, 30 percent of ties, and 85 percent of rail and turnouts.

[4] Provides replacement of minimum building requirements, 100 percent of rail and turnouts, and 85 percent of ties. Man-hour requirements are same as for new constructions.

4.22 Maintenance Responsibilities

a. After railways are constructed and turned over to the transportation railway service for operation, minor railway maintenance in the communications zone and in the combat zone to the forward limit of traffic is the responsibility of the transportation railway service.

b. The transportation railway service is responsible for the maintenance of the railway communications circuits that are used exclusively for the operation and administration of the railways. This responsibility becomes effective when all the circuits on the line have been turned over to the transportation railway service for administration and operation. The transportation railway service is responsible for the operation and for the organizational and field maintenance of railway block signals, of interlocking plants, and of centralized train control devices. It is also responsible for the construction, maintenance, and operation of organizational communications within railway groups, battalions, and lower echelon units.

c. The transportation railway system is normally divided for maintenance and operation into a number of divisions. Each division is assigned a railway operating battalion; each battalion includes personnel from the railway engineering company to perform necessary maintenance of tracks and structures.

d. The battalion commander has overall responsibility for railway maintenance, including maintenance work, instructions, and procedures. The maintenance-of-way superintendent is directly responsible for the maintenance of tracks and structures, for the proper supervision of all maintenance work and procedures, and for the necessary inspection of track and structures on the division. Platoon and section leaders are charged with the proper supervision of assigned maintenance operations.

4.23 Maintenance Categories

a. General. Army maintenance is divided into three categories and five echelons: organizational (first and second echelon), field (third and fourth echelon), and depot (fifth echelon).

b. Locomotives.

(1) First echelon maintenance consists primarily of preventive maintenance and includes inspection of visible moving parts, lubrication, and making minor adjustments. The rail equipment company of the operating battalion performs first echelon maintenance before and after operations. During operations, first echelon maintenance is the responsibility of the train operating company of the operating battalion.

(2) Second echelon maintenance consists of preventive maintenance which includes repairs to, or removal of, parts whose condition might interfere with the efficient operation of the equipment. The railway equipment company of the operating battalion is responsible for second echelon maintenance and the accomplishment of required records and reports.

(3) Third echelon maintenance repairs are performed by the mobile railway workshop in the forward area and by the railway equipment company of the operating battalion in the rear areas. When the repairs are not too extensive, the locomotive is repaired and put back into service. If the repairs are beyond the capabilities of the railway equipment company and the mobile railway workshop, only those repairs will be made that are necessary to move the locomotive to a fixed installation for repair.

(4) Fourth and fifth echelon maintenance is normally performed by the transportation railway shop battalion. In a theater of operations, it may be both feasible and necessary for some heavy maintenance to be performed by the transportation railway operating battalion.

(5) On diesel-electric locomotives, maintenance by the railway operating battalion includes the making of periodic inspections (using DA Form 55–230), of running repairs, and of current reports of inspections and repairs. The transportation railway operating battalion does not attempt to replace major parts, such as diesel engines and main gen-

erators, unless directed by proper authority. Components, such as air compressors and auxiliary generators, may be replaced.

c. *Rolling Stock.*

(1) Normally the railway operating battalion's train maintenance sections and crews perform the first three echelons of repair: this includes running repairs and inspection of rolling stock. The railway shop battalion is responsible for fourth and fifth echelon maintenance. Fourth and fifth echelon repairs usually require over 40 man-hours of labor per car.

(2) First echelon maintenance is performed by car inspectors at the train originating point and at inspection points en route to insure safe movement of the car and its lading.

(3) Second echelon maintenance is performed at the originating point of the train and at inspection points en route by military car inspectors or civilian railroad personnel. It consists of making running repairs necessary for the safe operation of freight equipment and the safe and comfortable operation of passenger cars. Second echelon repair does not require taking cars out of service.

(4) Third echelon maintenance is performed by maintenance personnel, either military or civilian, at the home terminals of the cars or at a prescribed location. It consists of running and emergency repairs that necessitate taking the car out of service for a short time.

(5) Repair-track installations (rip tracks) are normally set up at main terminals. They are also usually necessary at other points on the division, such as junction points or heavy loading centers, to take care of repairs that cannot be made at the loading installation and to avoid moving the cars into the main terminal. The master mechanic is responsible for the operation of the repair-track installation.

4.24 Inspection and Maintenance of Steam Locomotives

a. *Basic Principles.*

(1) Suitable inspection pits and facilities must be provided for inspection, repair, and adjustment of parts.

(2) The engineer is responsible for the equipment he operates; this responsibility is primarily first echelon.

(3) The fireman is responsible for maintaining the proper water level and steam pressure. He receives instructions from the engineer, his immediate superior.

(4) Each locomotive must be inspected daily, and DA Form 55–226 must be completed.

(5) Each locomotive must be inspected monthly, and DA Form 55–227 completed.

(6) In addition to the daily and monthly inspections, each locomotive must be inspected quarterly, semiannually, and annually.

b. Enginehouses. The two general types of enginehouses are turnaround and maintenance. The turnaround enginehouse is small and is only equipped with facilities for performing minor repairs and services. Work done in this enginehouse usually requires only 1½ to 3 hours. The maintenance enginehouse has facilities for making major as well as minor repairs; here the division locomotives are maintained in good operating condition and kept at maximum availability.

4.25 Maintenance of Way

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

b. Track. In a theater of operations, the track must be maintained in operable condition at all times. The four primary considerations in track maintenance are gage, surface, alinement, and dress. The roadbed and track must be inspected frequently to avoid delays in operation resulting from damage caused by sabotage, enemy action, or weather.

c. Structures. In a theater of operations, the structures essential to the railway operation must be maintained in accordance with the standard maintenance prescribed. Structures include bridges, culverts, tunnels, and fueling and watering facilities. When repairing structures, minimum clearances must be observed at all times.

4.26 Curve Resistance

Curve resistance is the resistance offered to motion along a curved track in excess of that offered by a straight track. Curve resistance is developed in terms of pounds per ton of train. A constant factor of 0.8 pound per ton of train for each degree of curve is used in all capacity determination formulas. The continual passing of trains around a curve eventually moves the track, which disturbs alinement and distorts the curve. The track should be restored to its correct curvature after determining if any distortion exists. This should be done by Corps of Engineer personnel. A field expedient for determining the curvature of a track is the string method (par. 4.27).

4.27 Determining Curvature by String Method (fig. 4.17)

If a surveying instrument is not available, the degree of simple curvature (arc of a circle) of a track may be computed by the string method. Although this method is not an absolutely exact one because of the uncertainty of how much the string used has stretched, the degree of error is insignificant. To determine the degree of curvature of a track by the string method—

a. Select a portion of track well within the main body of the curve.

b. Measure a chord-distance of 62 feet along the inside of the high rail (*A* to *B* in fig. 4.17).

c. Stretch a string or strong cord very tightly between points *A* and *B*, and measure the distance *M* at the midpoint of the cord. The distance in inches is approximately equal to the degree of curvature. In the example shown in figure 4.17, if *M* is 5 inches, the central angle is 5°. (As a curve gets sharper, the distance *M* increases. A 10° curve is sharper than a 5° curve.)

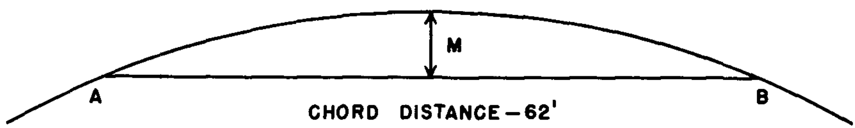


Figure 4.17. Determination of degree of curvature, using the string method.

4.28 Railway Supply

a. Railway supplies, as distinguished from organizational supplies, are expendable supplies required for the operation and maintenance of railway divisions.

b. Whenever possible, local sources of supply should be used to ease transportation requirements. In a theater of operations, supplies may be procured from military stocks, firms that are in or near the theater, foreign railways, captured enemy material and equipment, parts and assemblies manufactured or repaired by the railway shop battalion, and transfers from other railway operation units.

c. All operating units must submit reports of supplies on hand at the beginning of operations to facilitate supply control.

d. The battalion supply officer serves as fuel agent for the railway transportation operating battalion; he is responsible for the operating agencies of the transportation railway service receiving sufficient locomotive fuel—regardless of source. Requisitions for fuel and lubricants are made through normal supply channels.

e. Tables of allowances and supplies are prepared by the supply officer of the highest transportation railway echelon for all units within the command. A workable stock level allowance must be determined for each unit to insure uninterrupted operation at all times. Normally, stock levels for the railway division are determined from past requirements.

4.29 Transportation Depot Company

The basic organization for supply in the Transportation Corps is the transportation depot company. Its mission is to provide for the receipt, storage, and issue of all Transportation Corps items of supply and equipment.

4.30 Requisition Procedure

a. The normal procedure for requisitioning a Transportation Corps item of supply is as follows. The company commander submits a request to the battalion supply officer. The battalion supply officer consolidates requests, makes lateral transfers of transportation supplies when necessary, prepares a formal requisition, and forwards it to the railway group supply officer. The supply officer of the railway group determines if the item or items requested are available in one of the other units assigned to the railway group. The item or items are transferred if they are available; if they are not available, the requisition is processed and forwarded to the assistant general manager, supply (G4). The assistant general manager, supply, may then direct the transfer of the requisitioned item or items from one railway group to another. If the items cannot be obtained from another railway group, he passes the requisition to the transportation depot company for issue. If no depot company is assigned to the transportation railway service, the requisition is forwarded to the proper supply agency.

b. When the railway group is the highest echelon of the transportation railway service in the theater, the group supply officer discharges the responsibilities of the assistant general manager, supply. When the railway operating battalion is not operating as a part of a railway group, the battalion supply officer is authorized to handle supply matters directly with supply agencies. The highest transportation railway service headquarters in the theater may authorize the battalion supply officer to requisition certain transportation items of routine supply directly from the transportation depot company without the approval of the next higher echelon. Items in short supply may be controlled as necessary, depending on the stock level in the depot. The battalion supply officer may be permitted, by the same headquarters, to requisition routine items from the depots of the other technical services.

c. The railway group may authorize the operating battalion supply officer to deal directly with the railway shop battalion for parts and assemblies manufactured or repaired by the railway shop battalion.

d. To obtain supplies from outside sources—industry, railway stocks, and railway supply channels—the battalion supply officer prepares purchase orders or requisitions in accordance with the policy established in the particular theater. Normally, purchase orders or requisitions are forwarded to the railway group supply officer for further action; however, the railway operating battalion commander may be delegated the authority to approve purchase orders and requisitions for specified quantities of particular supplies. In such cases, the battalion procures the supplies locally and sends information copies of the transaction to the railway group supply officer. When the company commander is authorized to make local purchases, information copies of each transaction must be sent to the battalion supply officer. It is essential that accurate records be maintained of all transactions in order to protect the U.S. Government from fraudulent claims.

e. All captured enemy material and equipment must be recorded and accounted for.

CHAPTER 5

TERMINAL AND WATER TRANSPORT

Section I. TERMINAL ORGANIZATION

5.1 Terminal Units: Capabilities and Assignment

Unit	TOE	Mission and/or capability	Assignment
Headquarters and headquarters company, transportation terminal command A.	55–131	Supervises and directs units required in— Beach operations: working up to 4 ships, unloading up to 86,000 ST cargo, and debarking 25,000 personnel; or loading up to 60,000 ST cargo and embarking 12,500 personnel per month. Wharf operations: working up to 6 ships, unloading up to 130,000 ST cargo, and debarking 37,500 personnel; or loading up to 90,000 ST cargo and embarking 18,750 personnel per month.	Normally assigned to a logistical command or other appropriate command in a theater of operations.
Headquarters and headquarters company, transportation terminal command B.	55–121	Supervises and directs units required in— Beach operations: working from 5 to 8 ships, unloading 108,000 to 172,000 ST cargo, and debarking 50,000 personnel; or loading 75,000 to 120,000 ST cargo and embarking 25,000 personnel per month. Wharf operations: working from 7 to 12 ships, unloading 151,000 to 260,000 ST cargo, and debarking 75,000 personnel; or loading 105,000 to 180,000 ST cargo and embarking 37,500 personnel per month.	Assignment same as above.
Headquarters and headquarters company, transportation terminal command C.	55–111	Supervises and directs units required in— Beach operations: working from 9 to 16 ships, unloading from 194,000 to 346,000 ST cargo, and debarking 100,000 personnel; or loading from 135,000 to 240,000 ST cargo and embarking 50,000 personnel per month. Wharf operations: working from 13 to 24 ships, unloading from 280,000 to 520,000 ST cargo, and debarking 150,000 personnel; or loading from 195,000 to 360,000 ST cargo and embarking 75,000 personnel per month. Other terminal operations: unloading, or transferring from one mode to another, 280,000 to 520,000 ST cargo and debarking 150,000 personnel; or loading 195,000 to 360,000 ST of cargo and embarking 75,000 personnel per month.	Assignment same as above.
Headquarters and headquarters detachment, transportation terminal battalion.	55–116	Commands and provides administrative supervision of— Four company-size units. Any combination, not exceeding equivalent of 4 companies of—terminal service companies, boat companies, harbor craft units, staging area companies, or amphibious truck companies.	Normally attached to a terminal command, a logistical command, or an engineer amphibious support command, or may operate separately under the supervision of the appropriate staff transportation officer.

Unit	TOE	Mission and/or capability	Assignment
Transportation terminal service company.	55-117	At an established terminal or in a beach operation can— Discharge 1 ship at rate of 720 ST general cargo daily, or Load 1 ship at rate of 500 ST general cargo daily, and Sort cargo by technical service and load cargo on initial mode of transport from wharf and/or at waterline in beach operation, and Prepare transportation documents for all cargo loaded or unloaded, and Account for cargo handled. When operating at reduced strength, can discharge 360 ST cargo or load 250 ST cargo daily (working one 5-hatch ship) and clear unloading site of equivalent tonnages. When reinforced with other modes of transport and other technical and administrative services, can conduct terminal operations at an isolated location involving discharge of 1 ship at the rate of 720 ST cargo per day.	Normally assigned to a terminal battalion, a terminal command, or may operate separately under the supervision of the appropriate staff transportation officer.
Headquarters and headquarters company, transportation boat battalion.	55-126	Commands and coordinates the operations and supervises the organizational maintenance of 3 to 7 light boat companies, medium boat companies, heavy boat companies, or any combination thereof. Commands and supervises the operations of boat maintenance teams and harbor craft cellular teams from TOE 55-500 when necessary. Provides and operates landing craft for combat and logistical support in amphibious operations and for moving supplies and troops from ship to shore, shore to ship, and shore to shore.	Normally assigned to a terminal command or to a logistical command or attached to an engineer amphibious support command.
Transportation light boat company.	55-127	Transports 1,440 ST of general cargo daily in logistical over-the-shore operations with each of the 24 available landing craft making 4 round trips with an average load of 15 ST each. With 32 landing craft available, the maximum one-time lift capability for cargo having a high density is 1,088 ST cargo, or 3,840 combat-equipped troops for a 7-hour trip.	Normally assigned or attached to a boat battalion, a terminal battalion, a terminal command, a logistical command, or an engineer amphibious support command.
Transportation medium boat company.	55-128	Based on maintenance factor of 25 percent, provides 12 task LCM(8)'s daily for sustained 24-hour, day-to-day operations. With 12 landing craft available, transports daily— 2,400 ST of outsize, heavy lifts, based on an average load of 50 ST per landing craft, each craft making 4 round trips. 720 ST of general cargo, based on an average load of 30 ST per craft, each craft making 2 round trips.	Normally assigned or attached to a boat battalion, a terminal battalion, a terminal command, a logistical command, or an engineer amphibious support command.

Unit	TOE	Mission and/or capability	Assignment
Transportation medium boat company—Con.		With 16 task landing craft available, the maximum one-time lift capability with high density cargo is 960 ST or 3,200 combat-equipped troops for short distances.	
Transportation heavy boat company.	55–129	Transports an average of 16,000 troops with individual equipment, or 2,160 ST of vehicles, or 6,000 ST of tanks. Transports an average of 1,440 ST of general cargo. Transports in a one-time maximum lift 1,800 ST of cargo or 4,800 troops with individual equipment.	Normally assigned or attached to a boat battalion, a terminal command, a logistical command, or an engineer amphibious support command.
Transportation amphibious truck company.	55–137	Maximum one-time lift— *Cargo (lb)*— Condition: *Ideal* / *Favorable* / *Difficult* Per vehicle: 9,000 / 7,500 / 5,000 Per platoon: 108,000 / 90,000 / 60,000 Per company: 324,000 / 270,000 / 180,000 *Personnel*— Per vehicle: 25 / 15 / 10 Per platoon: 350 / 180 / 120 Per company: 900 / 540 / 360 At full strength operating two 10-hour shifts, transports an average of 720 ST cargo daily assuming availability of 30 vehicles, each vehicle carrying 3 tons per trip and making 8 trips per day.	Normally assigned to a terminal battalion, or may operate separately under the supervision of an appropriate staff transportation officer.
Transportation staging area company.	55–147	Provides mess and billeting for 3,600 troops daily. Operates 4 dispersed staging areas, each capable of staging an infantry battalion or its equivalent.	Normally assigned to a terminal command or a terminal battalion.
Transportation floating craft depot maintenance company.	55–157	Provides depot maintenance on a 24-hour basis for approximately 100 self-propelled craft and all associated nonpropelled craft.	Normally assigned to a terminal command.
Transportation aerial tramway company.	55–187	To operate and maintain aerial tramway systems for transportation of cargo from ship-to-shore, shore-to-ship, shore-to-shore, or over land in logistical support operations. At full strength, with 4 cargo cars operating over 2 tracks during a 20-hour day, this unit can— Transport approximately 1,440 short tons daily over a distance of 1 linear mile in ship-to-shore operations. Transport approximately 1,000 short tons of cargo daily over a distance of 1 linear mile in shore-to-ship operations. Move approximately 120 short tons of cargo per hour over a distance of 1 linear mile in shore-to-shore or overland operations. Handle any type of cargo within the dimensions of 9 feet wide by 10 feet high not exceeding a gross weight of 10 short tons per cargo car. Perform organizational maintenance on all organic equipment and field maintenance on transportation corps equipment peculiar to the tramway system.	To a communications zone, logistical command, or other appropriate command in a theater of operations. May be attached to a transportation terminal command headquarters or may operate separately under appropriate staff transportation officer.

Unit	TOE	Mission and/or capability	Assignment
Floating craft crews, floating craft maintenance teams, terminal service teams.	55-500	Provides personnel and equipment for the following purposes— To supplement TOE organizations where additional trained personnel are required in numbers less than TOE strength. To perform Transportation Corps functions as part of a larger organization where the need for the activity is less than a similar TOE organization. To form an organization where no TOE unit is provided or where a number of small cells of diversely trained personnel are required for the proper functioning of an organization.	Teams may be attached or assigned as required to higher echelon units or may be organized into service units to perform functions as required by existing conditions.

5.2 Assigned or Attached Units

Terminal commands may have any combination of these units assigned or attached as required to perform their mission.

a. Transportation Corps Units.

TOE	*Unit*
55–16	Headquarters and Headquarters Company, Transportation Truck Battalion, Army or Communications Zone.
55–17	Transportation Light Truck Company, Army or Communications Zone.
55–18	Transportation Medium Truck Company.
55–19	Transportation Car Company, Army or Communications Zone, or Airborne Transportation Car Company, Airborne Corps.
55–28	Transportation Heavy Truck Company.
55–116	Headquarters and Headquarters Detachment, Transportation Terminal Battalion.
55–117	Transportation Terminal Service Company.
55–126	Headquarters and Headquarters Company, Transportation Boat Battalion.
55–127	Transportation Light Boat Company.
55–128	Transportation Medium Boat Company.
55–129	Transportation Heavy Boat Company.
55–137	Transportation Amphibious Truck Company.
55–147	Transportation Staging Area Company.
55–157	Transportation Floating Craft Depot Maintenance Company.
55–500	Transportation Service Organizations.

b. Other Units.

TOE	*Unit*
5–329	Engineer Port Construction Company.
5–500	Engineer Service Organization.
8–500	Medical Service Organization.
9–348	Ordnance Motor Vehicle Assembly Company, Communications Zone.
9–500	Ordnance Service Organization.
10–67	Quartermaster Service Company.
10–500	Quartermaster Service Organization.
11–500	Signal Service Organization.
12–605	Army Postal Unit, General Assignment.
14–500	Finance Service Organization.
19–55	Military Police Battalion.
19–57	Military Police Company.

Section II. VESSEL CHARACTERISTICS AND DATA

5.3 Characteristics of Transportation Corps Vessels

Type of vessel	Designation	Length	Beam	Light displacement (LT)	Maximum draft (aft)	Fuel capacity (gal.)	Fuel consumption (gal. per hour)	Speed, loaded (knots)	Cruising range, loaded (nautical miles)	Crew	Capacity: Cargo	Capacity: Passengers
Supply, diesel, steel, 176′, design 381	FS	176′ 6″	32′	465	12′	21,000	69	12.5	3,800	24	340 LT 21,462 cu ft	9 berth 75 deck
Dry cargo, SP, diesel, steel, 210′, design 7013	FS	222′ 9½″	38′	1,068	14′ 6″	54,100	96	12	6,750	32	1,260 LT 56,400 cu ft	
Liquid cargo, SP, diesel, steel, 210′, design 7014	Y	222′ 9½″	38′	797	17′	58,670	96	12.7	7,700	29	462,000 gal.	
Refrg cargo, SP, diesel, steel, 210′, design 7015	FSR	222′ 9½″	38′	1,246	15′	62,000	96	12	7,700	29	1,000 LT 40,920 cu ft	

5.4 Boat Characteristics

Type of boat	Designation	Length	Beam	Light displacement (LT)	Maximum draft (aft)	Fuel capacity (gal.)	Fuel consumption (gal. per hour)	Speed, loaded (knots)	Cruising range, loaded (nautical miles)	Crew	Capacity: Cargo	Capacity: Passenger	Remarks
Utility, diesel, plastic, 26′, design 6009.	J	26′ 6″	8′ 1″	3.04	4′	80	4	10	200	2	1 LT	12 to 15.	Can be transported in cradle on freight vessels.
Picket, diesel, wood, 36′ 6″, design 234-B.	J	36′ 6″	10′ 7″	6	4′	300	10	15	450	4	----	----	Can be crated and stowed on deck or in hold of freight vessel. Bow reinforced for beaching.
Picket, diesel, steel, 46′, design 4003.	J	46′ 4½″	12′ 3″	9.8	3′ 6″	370	18	16	328	3	----	----	
Picket, diesel, wood, 65′, design 4002.	Q	64′ 11″	15′ 11″	31	6′	900	25	14	500	6	4 LT	5	Replaces design 416.
Passenger and cargo, diesel, steel, 65′, design 2001.	T	65′ 6″	17′ 8″	66	7′	1,150	19	10.5	635	4	24 LT 1,800 cu ft.	24	Normally deckloaded on large cargo ship. Under good conditions, can proceed overseas under own power.
Aircraft rescue, gasoline, wood, 85′, design 379.	Q	85′	20′ 3″	31.5	4′ 8″	3,840	153 (main) 14 (auxiliary).	Cruising: 6.2 Continuous: 24 Top: 34.	1,700 at 6.2 knots, 600 at 24 knots.	14	----	8	

5.5 Tug Characteristics

Type of tug	Designation	Length	Beam	Light displacement (LT)	Maximum draft (aft)	Fuel capacity (gal.)	Fuel consumption (gal. per hour)	Speed w/o tow (knots)	Cruising range (nautical miles)	Crew	Remarks
Harbor, diesel, 200-hp, steel, 45′, design 320.	ST	45′ 2¼″	12′ 5¼″	25.2	6′	900	12	10	750	5	
Harbor, diesel, 600-hp, steel, 65′, design 3004.	ST	70′	19′ 6″	100	8′ 3″	5,850	41	12	1,700	6	Capable of short ocean passages under own power. Normally transported overseas on larger vessel.
Harbor, diesel, 1,200-hp, steel, 100′, design 3006.	LT	107′	26′ 6″	295	12′ 2″	20,768	83	12	3,000	16	
Oceangoing, diesel-electric, 1,530-hp, steel, 143′, design 377–A.	LT	143′ 5″	33′	566	14′	58,131	130	11.5	5,100	46	

5.6 Floating Crane Characteristics

Type of crane	Desig-nation	Length	Beam	Light displace-ment (LT)	Maxi-mum draft (aft)	Fuel capacity (gal.)	Fuel con-sumption (gal. per hour)	Crew	Cargo handling equipment
Barge, diesel-electric, revolving, steel, 60 LT, design 413–D.	BD	142′	58′	1,000	5′ 6″	1,350	16	8	Main hoist capacity: 60 LT Main hoist radius: 73′ Aux. hoist capacity: 15 LT Aux. hoist radius: 100′
Barge, diesel-electric, revolving, steel, 89 LT, design 264–B.	BD	140′	70′	1,407	6′	15,000	25	14	Main hoist capacity: 89 LT Main hoist radius: 80′ Aux. hoist capacity: 15 LT Aux. hoist radius: 122′ 6″ Aux. reach below waterline: 25′

5.7 Characteristics of Self-Propelled Barges

Type of barge	Desig-nation	Length	Beam	Light displace-ment (LT)	Maxi-mum draft (aft)	Fuel capacity (gal.)	Fuel con-sumption (gal. per hour)	Loaded speed (knots)	Cruising range (nautical miles)	Crew	Cargo capacity (LT)	Remarks
Liquid-cargo, self-propelled, diesel, steel, 6,500 bbl, 182′, design 294–A.	BSP	182′ 6″	30′	476	11′ 6″	10,946	43	8	2,000	17	Dry: 49, Liq: 770 (273,000 gal.)	
Inland waterways, self-propelled, diesel, steel, 55′, design 3011.	BSPI	56′ 2″	15′	42	5′ 6″	1,750	22	8	675	3	20	Can push 3 hopper barges (55′) loaded to 5′ 6″ at 8 knots. Can be disassembled for rail shipment.

5.8 Characteristics of Nonpropelled Barges

Type of barge	Designation	Length	Beam	Light displacement (LT)	Maximum draft (aft)	Crew	Cargo capacity	Remarks
Deck cargo, nonpropelled, steel, 570 tons, 110′, design 7005.	BC	110′	32′	120	8′	NA	570 LT	Conversion kit 7006 makes it into a covered barge. Can be towed overseas.
Deck, cargo, nonpropelled, steel, 585 tons, 120′, design 231-A.	BC	120′	33′	175	8′	NA	585 LT	Can be towed overseas. Good hull design for relatively high-speed towing.
Refrigerated cargo, nonpropelled, steel, 14,200 cu ft, 120′, design 7010.	BR	120′	33′	230	6′	5	315 LT, 14,200 cu ft	Can cool full cargo of frozen commodities in any or all of 4 compartments from 27° to 12° F. within 48 hours after loading with outside temperature of 120° F. and sea-water temperature at 90° F.
Deck or liquid cargo, nonpropelled, steel, 21 tons, 45′, design 218-E, knockdown.	BG	45′ 5″	18′	13	2′	NA	21 LT, 10,450 gal.	Two sections, each 9′ x 45′ 5″ x 3′, weighing approximately 5.8 LT. Can be moved overseas in sections, deckloaded on larger vessel.
Deck or liquid cargo, nonpropelled, steel, 578 tons or 4,160 bbl, 120′, design 231-B.	BG	120′	33′	175	8′ 8″	NA	585 LT, 174,720 gal.	Can be towed overseas at full load, provided maximum draft does not exceed 8′.
Liquid cargo, nonpropelled, steel, 13,000 bbl, 235′, design 7004.	BG	235′	40′	350	8′ 6″	NA	1,395 LT, 546,000 gal.	Can be towed overseas.
Pier, nonpropelled, steel, 150′, design 380, knockdown.	BP	150′	50′	249	7′	NA	1,170 LT	Used as a floating pier to accommodate vessels and heavy vehicles in discharging and loading cargo. May also be used as deck cargo barge in protected waters.
Repair shop, floating, marine equipment, nonpropelled, steel, 210′, design 7011.	FMS	210′ 5″	40′	1, 160	8′	22	NA	Repair shops include electrical, carpentry, engine repair, battery, fuel injector, blacksmith, and machine. Can be towed overseas.
Deck cargo, nonpropelled, steel, 81′, design 7001, sectionalized, nesting.	BK	81′	22′	57. 5	5′	NA	105 LT	Can be assembled in sheltered water with few handtools and unskilled labor, but requires lift of 9- to 13.5-LT capability to place pontons and tilt for bottom connections. Two sections can be shipped nested on larger vessels. Conversion kit 7007 makes into liquid-carrying barge, and kit 7012 into refrigerated barge. Can carry two 35-ton tanks on deck.

5.9 Characteristics of Landing Ships

Type	Length	Beam	Light displacement (LT)	Draft loaded		Speed loaded (knots)	Operating range (nautical miles)	Capacity		Cargo space
				Fwd	Aft			Cargo (LT)	Troops	
Landing ship, dock (LSD) (1 through 27)	458′	72′	4,428	18′, dry; 27′, flooded	18′, dry; 27′, flooded	15	13,000	1,233, combat	266	338′ x 44′ plus 56′ x 24′
Landing ship, dock (LSD) (28)	510′	84′	6,143	19′, dry; 30′, flooded	19′, dry; 30′, flooded	15+	13,000	2,410, combat	341	396′ x 50′
Landing ship, tank (LST) (1171 class)	442′	62′ 1″	4,150	5′ 8″	13′ 11″	14	6,048	500, landing condition	634	Tank deck 10,700 sq ft Main deck 7,613 sq ft
LST (1156 class)	384′	55′ 7″	2,309	4′ 2″	9′ 11″	12	6,000	446, landing condition	395	Tank deck 274′ 9″ x 32′ 1″ Main deck 187′ x 47′ 8″
LST (1153 class)	382′	55′	2,009	3′ 4″	11′ 3″	10.4	7,706	446, landing condition	197	Tank deck 280′ x 30′ 5″ Main deck 160′ x 46′
LST (542 class)	328′	50′	1,589	4′ 4″	9′ 3″	8.5	19,200	446, landing condition	141	Tank deck 222′ 6″ x 24′ Main deck 100′ x 45′
Lighter, beach discharge [a]	338′	65′	1,549	4′, landing; 7′ 8″, ocean	10′, landing; 13′ 8″, ocean	11	4,800	[b] 2,300	[c] 200	15,000 sq ft

[a] Figures are for prototype design.
[b] Designed primarily to be a vehicle carrier.
[c] Vehicle drivers.

5.10 Landing Craft Characteristics

Type	Length	Beam	Light displacement (LT)	Draft loaded		Speed, loaded (knots)	Operating range, nautical miles (loaded)	Fuel consumption (gal. per hour)	Crew	Capacity		Cargo space dimensions
				Fwd	Aft					Cargo (LT)	Troops	
Landing craft, utility (LCU) (501 class).	119′	32′	150	3′ 4″	4′	6.5	700	34	12	133.0	300 (min)	47′ 6″ x 14′ plus 36′ x 26′ plus 18′ 2¼″ x 12′ 6″
Landing craft, utility (LCU) (1466 class).	115′	34′	180	3′	4′	6.5	700	34	12	160.0	300 (min)	52′ x 30′ plus 24′ x 14′
Landing craft, mechanized, Mark VI (LCM(6)).	56′	14′	28	3′	4′ 8″	8.0	128	28	4	32.0	120	28′ x 9′ 6″
Landing craft, mechanized, Mod. I (LCM(6)).	56′	14′	28	3′	4′ 8″	8.0	128	28	4	32.0	120	37′ 6″ x 10′ 11″
Landing craft, mechanized, Mark VIII (LCM(8)).	73′ 8″	21′	60	3′	5′ 6″	10.2	284	41	6	53.5	200	42′ x 14′ 6″
Landing craft, vehicle, personnel (LCVP).	36′	10′ 5″	8	2′ 2″	3′	10.5	135	15	4	3.5	36	17′ 3″ x 7′ 5″

5.11 Amphibious Vehicle Characteristics

Type	Length	Beam	Light displacement (LT)	Draft loaded		Speed, loaded	Operating range, loaded (miles)	Fuel consumption (gal. per hour)	Crew	Capacity		Cargo space dimensions
				Fwd	Aft					Cargo (LT)	Troops	
Landing vehicle, wheeled (DUKW).	31′	8′ 2⅞″	6.4	3′ 6″	4′ 3″	5 knots, water 50 mph, land	30, water 250, land	8	3	Normal 2.2 Maximum 4.5	25	12′ 5″ x 6′ 10″
Lighter, amphibious, 60-ton (BARC).	62′ 6¾″	26′ 7″	87	8′ 8″	8′ 8″	7 knots, water 14 mph, land	105, water 210, land	40	8	Normal 53.6 Emergency 89.3	Normal 125 Emergency 200	38′ 3″ x 14′
Landing vehicle, tracked, Mark V, (LVTP).	29′ 8″	11′ 8½″	31.2	5′ 3″	5′ 3″	6.7 knots, water 27.8 mph, land	45, water 187. land	47	3	Water 6.0 Land 9.0	34	15′ 2″ x 7′ 9″ x 5′ 3″

5.12 Navy Transport Vessel Characteristics

Type	Number of ships in class	Class	Type	Length	Loaded draft	Troop capacity	Cargo capacity (LT)	Cargo space	Boat capacity	Cruising range (nautical miles)
Amphibious force flagship (AGC).	16	----	C-2	459′	24′	[a] 600	----	----	8 LCVP's	30,000
Attack transport (APA).	57	Haskell	----	455′	24′	1,565	446	13,000 sq ft 110,000 cu ft	2 LCM(6)'s 22 LCVP's	9,800
Attack transport (APA).	6	Bayfield	----	492′	27′	1,647	446	15,000 sq ft 160,000 cu ft	4 LCM(6)'s 23 LCVP's	11,630
Attack cargo ship (AKA).	35	Montague	C-2A	459′	24′	212	1,335 to 1,600	31,858 sq ft 291,706 cu ft	8 LCM(6)'s 16 LCVP's	12,000
High speed transport (APD).	21	----	EX-DDE	306′	13′	162	45	3,730 cu ft	4 LCVP's	5,100
Transport submarine (ASSP).	2	Sea Lion	----	312′	----	85	26.7	----	20 rubber landing boats	----
Roll-on, roll-off, vehicle ship (T-AK) [b]	1	Comet	C-4	499′	22′	----	4,000 (375 vehicles)	[c] 60,000 sq ft [d] 176,500 cu ft	----	13,000

[a] Includes Navy staff.
[b] MSTS vessel.
[c] Vehicle parking space.
[d] In addition to vehicle parking space.

5.13 Maritime Administration Vessel Classification System

a. Method. The classification system established by the United States Maritime Administration is based upon three groups of letters and numbers. The first group (prefix) indicates the type of vessel, such as cargo or passenger, and its approximate size. The second group (intermediate) indicates the type of machinery, number of screws, and passenger accommodation. The third group (suffix) indicates the particular design of the type of vessel and modifications. For example: C2–S–AJ1 describes a cargo ship between 400 and 450 feet long (C2); single screw, steam machinery (S), and the AJ design (AJ), in its original version (1).

b. Prefix Designations.

(1) *Other than emergency and Victory types.*

Single letter	Class of vessel	Length designation (load waterline in feet)						
		1	2	3	4	5	6	7
C	Cargo, unlimited service, under 100 passengers.	Under 400	400–450	450–500	500–550			
P	Passenger, unlimited service, over 100 passengers.	Under 500	500–600	600–700	700–800	800–900	900–1,000	Over 1,000
B	Barge	Under 100	100–150	150–200	200–250	250–300		
L	Great Lakes tankers (ore, grain).	Under 400	400–450	450–500	500–550	550–600	600–650	
N	Coastwise cargo	Under 200	200–250	250–300	300–350	350–400	400–450	450–500
R	Refrigerator	Under 400	400–450	450–500	500–550			
S	Special	Under 200	200–300	300–400	400–500	500–600	600–700	
T	Tanker	Under 450	450–500	500–550				
V	Towing vessels	Under 50	50–100	100–150	150–200			
Z	Conversion*							

*For conversions of established types, "Z" is prefixed to original designation with new final number in some cases.

(2) *Emergency and Victory types.*

Double letter	Class of vessel	Length designation (load waterline in feet)			
		1	2	3	4
EC	Emergency cargo (Liberty ship).	Under 400	400–450	450–500	500–550
ET	Emergency tanker	450			
VC	Victory cargo	Under 400	400–450	450–500	500–550

(3) *Older designs.* The following older designs have prefixes similar to those in (1) above, but do not follow the same system for the intermediate and suffix portions. The letters or words after the hyphen are simply distinguishing characters.

C1–A	C2–Seas shipping	C3–E
C1–B	C2–SU	C3–IN (P&C)
C2–Diesel	C2–SU Reefers	C3–M
C2–F	C2–T	C3 (P&C) Diesel
C2–G	C2–Turbine	C3 (P&C) Turbine
C2–Modified	C3–A (P&C)	C3–P (P&C)
C2–S	C3–Diesel	C3–Turbine

c. Intermediate Letter or Group.

Type of machinery	*Type of propeller*	*Under 12 passengers*	*Over 12 passengers*
Steam	Single	S	S1
Motor	Single	M	M1
Turboelectric	Single	SE	SE1
Diesel-electric	Single	ME	ME1
Gas turbine	Single	G	G1
Gas Turboelectric	Single	GE	GE1
Steam	Twin	ST	S2
Motor	Twin	MT	M2
Turboelectric	Twin	SET	SE2
Diesel-electric	Twin	MET	ME2
Gas turbine	Twin	GT	G2
Gas turboelectric	Twin	GET	GE2
Steam	Stern wheel	SW	SO
Motor	Stern wheel	MW	MO

d. Suffix. The third group, or suffix, identifies the particular design and indicates the approximate time the design originated. The alphabetical letters are assigned in series. Therefore, if there is only one letter, this indicates that the design originated earlier than one having two letters. The figure following the letter or letters in the suffix indicates that it is either the original design of that particular alphabetical designation or a modification thereof. The original design is always numbered 1.

5.14 Commercial Vessels

Type	*Description*
B7	Concrete hull, cargo barge, nonpropelled.
C1–A	Designed for general cargo in world trade; steam-turbine and motor-propelled (four modifications).
C1–B	Designed for general cargo in world trade; steam-turbine and motor-propelled (four modifications).
C1–M	Designed for general cargo; motor-propelled.
C1–S	Concrete barge designed for cargo purposes; steam reciprocating engine propelled.
C2	Designed for general cargo in world trade; steam-turbine propelled (several modified types). Those prefixed by the symbol "Z" were in operation during World War II. Modified types were used mostly as hospital ships.
C3	Combination passenger and cargo ship; steam-turbine propelled (several modified types).
C3–S	Designed for cargo; steam-turbine propelled.
C4	Designed for cargo; steam-turbine propelled (two modifications).
C4–S–1a	Mariner class. Recently developed by Maritime Administration in cooperation with the Department of Defense to provide modern high-speed commercial vessel that can readily be converted for wartime shipping.
EC2	Liberty type designed for general cargo; steam reciprocating engine propelled. Several modified types, prefixed by the symbol "Z," were designed as tank carriers and later modified as plane carriers.
L6	Specially designed for coal or grain trade on the Great Lakes; steam reciprocating engine propelled.
N3	Cargo carrier designed for coastal trade; steam reciprocating engine propelled.
P1	Specially designed passenger type vessel; steam-turbine propelled.
P2	Designed to carry troops. Two types: turbine-electric propelled, steam-turbine propelled.
T1	Designed for tanker service in coastal and inland waters; diesel propelled (five modifications).
T2	Designed to carry bulk oil in world trade; turboelectric propelled (two modifications).
T3	Designed to carry bulk oil in world trade; steam-turbine propelled (three modifications).
V4	Large diesel-powered oceangoing tug.
VC2	Victory type designed to carry cargo in world trade. Three types, one with 6,000-hp engine, two with 8,500-hp engines. All three are steam-turbine propelled.

5.15 Characteristics of Commercial Cargo Ships

Type	Length	Beam	Loaded draft	Dead-weight tonnage (LT)	Gross tonnage	Capacity (cubic feet)			Liquid cargo capacity	No. of hatches	Speed (knots)	Cruising range (nautical miles)
						Bale	Grain	Reefer				
C1-B	417′ 9″	60′	28′ 8⅞″	8,777	6,711	451,624	505,877	----------	----------	5	14	24,440
C1-M-AV1	338′ 8″	50′	21′ 1″	5,087	3,805	227,730	249,835	9,830	----------	4	11	25,130
C2-S-AJ	459′ 1″	63′	27′ 7⅞″	10,828	8,258	542,824	582,845	----------	----------	5	15	16,200
EC2 (Liberty)	441′ 6″	56′ 10¾″	27′ 8⅞″	10,865	7,191	499,573	562,608	----------	----------	5	11	17,000
VC2 (Victory)	455′ 3″	62′	28′ 6″	10,805	7,612	456,525	528,325	----------	----------	5	15	23,000
C3-S-A2	492′	69′ 6″	28′ 6″	12,258	7,886	736,850	813,020	----------	----------	5	16.5	11,950
C4-S-A4	522′ 10½″	71′ 6″	32′ 9⅞″	14,941	10,685	672,243	808,154	----------	----------	7	17	15,870
C4-S-B5	520′	71′ 6″	32′ 9⅞″	15,014	10,780	711,580	829,310	----------	----------	7	18	18,380
C4-S-1a (Mariner)	563′ 7¾″	76′	29′ 10″	13,420	9,216	736,723	837,305	30,254	----------	7	20	21,660
T2-SE-A2	523′ 6″	68′	29′ 11½″	16,590	10,461	----------	----------	----------	140,721 bbl	----------	16.5	18,165

5.16 Hold Hatch, and Boom Data

Vessel	No. of cargo holds	No. of booms	Boom capacity (LT)	Hatches w/hv lift booms	Hv-lift capacity (LT)
C1-B	5	15	5	2	30
C1-M-AV1	4	14	1½, 5	2, 3	30
C2-S-AJ	5	17	5	3	50
EC2 (Liberty)	5	12	5	2, 4	[a] 50–15
VC2 (Victory)	5	16	5	3, 4	50, 30
C3-S-A2	5	21	5, 10	5	30
C4-S-A4	7	25	5	6	50
C4-S-B5	7	24	5	4, 5	50
C4-S-1a (Mariner)	7	26	5, 10	4, 6	60
FS Freighter [b]	2	5	5	2	15

[a] Liberty ships have either a 30- or a 50-ton boom at No. 2 hatch and a 15- or a 30-ton boom at No. 4 hatch.

[b] The FS is the 176-foot supply vessel built for the Army. It is an oceangoing vessel, but, because of its small capacity, is used principally as an interisland carrier.

5.17 Below-Deck Capacities

Vessel	Hatch No.	Hatch dimensions	Cargo capacities (MT)			
			Upper 'tween	Lower 'tween	Hold	Deep tanks
C1-B	1	29′ 3″x20′	481	398	862	
	2	31′ 6″x20′	750	742	1, 438	
	3	31′ 6″x20′	845	779	1, 222	
			[a] 102	--------	--------	
	4	31′ 6″x20′	780	1, 229	--------	480
	5	31′ 6″x20′	574	608		
Total	------	-----------------	3, 532	3, 756	3, 522	480
C1-M-AV1	1	20′ 1½″x19′ 11″	--------	601	616	
	2	40′ 5″x19′ 11″	--------	982	1, 378	
	3	40′ 5″x19′ 11″	--------	901	1, 179	
	4	9′x8′	--------	[b] 169	113	
Total	------	-----------------	--------	2, 653	3, 286	
C2-S-AJ	1	26′ 10″x19′ 10″	602	519	947	
	2	32′ 4″x19′ 10″	804	805	1, 405	
	3	34′ 10″x19′ 10″	908	968	1, 514	
	4	29′ 10″x19′ 10″	902	932	1, 483	
	5	29′ 10″x19′ 10″	722	--------	1, 056	
Total	------	-----------------	3, 938	3, 224	6, 405	
EC2 (Liberty)	1	33′ 7″x19′ 10″	--------	983	902	416
	2	34′ 10″x19′ 10″	--------	1, 065	2, 300	
	3	19′ 10″x19′ 10″	--------	597	1, 495	613
	4	34′ 10″x19′ 10″	--------	742	1, 315	
	5	34′ 10″x19′ 10″	--------	771	1, 290	
Total	------	-----------------	--------	4, 158	7, 302	1, 029
VC2 (Victory)	1	24′ 11″x22′ 3″	551	595	698	
	2	23′ 11″x22′ 3″	675	545	698	
	3	35′ 11″x22′ 3″	1, 139	945	1, 321	
	4	35′ 11″x22′ 3″	1, 230	--------	1, 277	
	5	23′ 11″x22′ 3″	1, 091	--------	648	
Total	------	-----------------	4, 686	2, 085	4, 642	

See footnotes at end of table.

Vessel	Hatch No.	Hatch dimensions	Cargo capacities (MT)			
			Upper 'tween	Lower 'tween	Hold	Deep tanks
C3-S-A2	1	35′ 9½″x19′ 9½″	812	1, 130	1, 079	
	2	29′ 9½″x23′ 9½″	830	1, 381	1, 396	
	3	37′ 3½″x23′ 9½″	1, 244	1, 553	2, 002	
	4	29′ 9½″x23′ 9½″	1, 164	1, 255	1, 419	
	5	39′ 9½″x23′ 9½″	1, 009	1, 704	212	
Total			5, 059	7, 023	6, 108	
C4-S-A4	1	17′ 9″x16′ 8″	[c] 496	[d] 340	141	
	2	26′ 10″x17′ 9″	[c] 1, 139	[d] 1, 258	772	
	3	26′ 10″x17′ 9″	798	651		[e] 1, 084
	4	26′ 10″x17′ 9″	803	[d] 1, 533	994	
	5	26′ 10″x17′ 9″	765	[d] 1, 515	1, 017	
	6	26′ 10″x17′ 9″	795	782	1, 636	
	7	17′ 9″x17′ 1″	[f] 583	[f] 454		
Total			5, 379	6, 533	4, 560	1, 084
C4-S-B5	1	20′ 0″x18′ 0″	608	293		
	2	27′ 6″x20′ 0″	1, 160	1, 128	704	
	3	27′ 6″x20′ 0″	702	641	603	837
	4	30′ 0″x20′ 0″	[g] 1, 626	764	1, 047	
	5	30′ 0″x20′ 0″	[g] 1, 623	772	1, 055	
	6	30′ 0″x20′ 0″	[g] 1, 540	794	998	
	7	20′ 3″x18′ 0″	95	482	358	
Total			7, 354	4, 874	4, 765	837
C4-S-1a (Mariner)	1	19′ 6″x17′ 9″	402	453	305	
	2	29′ 10″x23′ 10″	731	865	637	
	3	39′ 10″x29′ 10″	1, 050	1, 454	1, 284	
	4	39′ 10″x29′ 10″	1, 006	1, 500	1, 528	
	5	39′ 10″x29′ 10″	1, 044	410	401	953
	6	39′ 10″x29′ 10″	965		1, 646	298
	7	29′ 10″x24′ 10″	1, 627		856	
Total			6, 825	4, 682	6, 657	1, 251
FS Freighter	1	20′ 0″x16′ 0″			251	
	2	28′ 0″x16′ 0″			285	
Total					536	

[a] Special cargo locker on upper 'tween level between hatches Nos. 3 and 4.
[b] Includes 36 MT in trunked hatch.
[c] Includes upper deck and second deck.
[d] Includes third deck and first platform.
[e] Liquid cargo space.
[f] Includes refrigerated cargo space.
[g] Includes main 'tween deck.

5.18 Vehicle-Loading Capacities of Typical Vessels

These figures reflect general loading conditions and by no means represent the maximum vehicle capacities of the vessels. With the exception of crated vehicles, no allowance has been made for stacking or double decking. All below-deck stowage is fore and aft except in the case of ¼-ton trucks and 1½-ton trailers, which are stowed both fore and aft and athwartship.

a. C4–S–1a (Mariner).

Hatch No.	Location	Trailer, cargo, 1½-ton	Truck, utility, ¼-ton	Truck, cargo		
				¾ T 4x4	2½ T 6x6 LWB	5 T 6x6 LWB
1	On deck	20	20	11	7	4
	'Tween deck:					
	Upper	16	20	12	6	4
	Lower	10	14	9	4	0
	Hold	5	9	6	3	0
2	On deck	23	33	20	10	7
	'Tween deck:					
	Upper	23	37	22	11	7
	Lower	21	26	15	9	7
	Hold	11	15	9	5	2
3	On deck	42	52	30	20	10
	'Tween deck:					
	Upper	48	61	38	25	13
	Lower	44	52	32	21	13
	Hold	32	36	22	14	9
4	On deck	36	52	26	18	10
	'Tween deck:					
	Upper	46	69	38	20	14
	Lower	46	69	38	20	14
	Hold	44	56	30	16	12
5	On deck	36	54	28	20	12
	'Tween deck:					
	Upper	56	72	42	18	14
	Lower	58	74	44	18	14
	Hold	56	72	42	16	12
	Deep tank	28	36	14	6	2
6	On deck	40	54	30	20	12
	'Tween deck	47	65	36	18	14
	Hold	30	34	20	12	9
	Deep tank	4	10	0	0	0
7	On deck	27	37	22	12	7
	'Tween deck	33	42	23	11	7
	Hold	9	10	6	4	0

b. C1–B.

Hatch No.	Location	Trailer, cargo, 1½-ton	Truck, utility, ¼-ton	Truck, cargo		
				¾ T 4x4	2½ T 6x6 LWB	5 T 6x6 LWB
1	On deck	14	14	12	5	7
	'Tween deck:					
	Upper	18	21	12	6	4
	Lower	18	21	12	6	5
	Lower hold	13	14	9	4	4
2	On deck	21	25	18	12	7
	'Tween deck:					
	Upper	37	46	25	13	12
	Lower	37	42	25	15	12
	Lower hold*	36	34	21	13	11
3	On deck	21	23	14	10	5
	'Tween deck:					
	Upper	42	44	30	17	12
	Lower	42	41	28	13	12
	Lower hold*	42	41	28	13	9
4	On deck	21	21	14	10	7
	'Tween deck:					
	Upper	41	39	26	14	12
	Lower	37	36	24	12	10
5	On deck	18	16	12	7	5
	'Tween deck	23	23	15	7	5
	Hold	10	10	12	6	6

*Number of vehicles (except 5-ton, 6x6) can be doubled by flooring over one layer of vehicles and loading a second layer directly on top. The depth of only these two holds will permit such double decking.

c. EC2 (Liberty).

Hatch No.	Location	Trailer, cargo, 1½-ton	Truck, utility, ¼-ton	Truck, cargo		
				¾ T 4x4	2½ T 6x6 LWB	5 T 6x6 LWB
1	On deck	22	22	14	9	6
	'Tween deck	27	28	23	12	8
	Lower hold	24	28	18	10	5
2	On deck	36	41	20	13	8
	'Tween deck	44	54	30	21	12
	Lower hold	42	48	*30	*18	12
3	On deck	14	22	10	6	4
	'Tween deck	28	36	25	14	6
	Lower hold	28	32	*22	12	6
4	On deck	20	31	16	11	8
	'Tween deck	37	41	27	16	8
	Lower hold	15	20	18	10	2
5	On deck	22	31	14	11	6
	'Tween deck	34	44	25	16	9
	Lower hold	11	20	20	6	2

*Based on no centerline bulkhead, which may or may not be standard equipment.

d. VC2 (Victory).

Hatch No.	Location	Trailer, cargo 1½-ton	Truck utility, ¼-ton	Truck, cargo		
				¾ T 4x4	2½ T 6x6 LWB	5 T 6x6 LWB
1	On deck	12	14	6	5	4
	'Tween deck:					
	Upper	16	15	9	5	0
	Lower	18	16	9	6	3
	Hold	13	15	8	4	3
2	On deck	16	18	12	7	4
	'Tween deck:					
	Upper	26	29	17	10	4
	Lower	24	25	17	10	5
	Hold	21	21	14	8	3
3	On deck	29	25	18	13	8
	'Tween deck:					
	Upper	48	48	29	17	12
	Lower	46	46	30	18	12
	Hold	46	44	30	18	8
4	On deck	25	23	18	13	8
	'Tween deck	48	49	34	16	14
	Hold	49	49	31	18	13
5	On deck	25	25	17	6	4
	'Tween deck	31	30	20	12	6
	Hold	19	20	12	7	3

*e. C1-M-AV1.**

Hatch No.	Location	Trailer, cargo, 1½-ton	Truck, utility, ¼-ton	Truck, cargo		
				¾ T 4x4	2½ T 6x6 LWB	5 T 6x6 LWB
1	On deck	14	20	13	7	4
	'Tween deck	23	30	16	10	3
	Hold	13	16	7	4	2
2	On deck	24	30	18	10	8
	'Tween deck	46	51	28	19	10
	Hold	45	51	28	19	10
3	On deck	22	28	14	10	6
	'Tween deck	37	44	27	17	9
	Hold	37	44	26	15	9

*No. 4 hatch is not large enough for vehicle loading.

5.19 United States Navy Ship and Service Craft Designators

a. Combatant Vessels.

(1) *Warships.*

BB	battleship
BBG	guided missile capital ship
CA	heavy cruiser
CAG	guided missile heavy cruiser
CG	large cruiser
CBC	large tactical command ship
CG	guided missile cruiser
CL	light crusier
CLAA	antiaircraft light crusier
CLC	tactical command ship
CLG	guided missile light crusier
CVA	attack aircraft carrier
CVE	escort aircraft carrier
CVHE	escort helicopter aircraft carrier
CVL	small aircraft carrier
CVS	antisubmarine support aircraft carrier
DD	destroyer
DDC	corvette
DDE	escort destroyer
DDG	guided missile destroyer
DDR	radar picket destroyer
DL	frigate
DLG	guided missile frigate
SS	submarine
SSG	guided missile submarine
SSK	antisubmarine submarine
SSR	radar picket submarine

(2) *Amphibious warfare vessels.*

AGC	amphibious force flagship
AKA	attack cargo ship
APA	attack transport
APD	high-speed transport
ASSP	transport submarine
CVHA	assault helicopter aircraft carrier
DEC	control escort vessel
IFS	inshore fire support ship
LPH	amphibious assault ship
LSD	dock landing ship
LSFF	flotilla flagship landing ship
LSIL	infantry landing ship (large)
LSM	medium landing ship
LSMR	medium landing ship (rocket)
LSSL	support landing ship (large)
LST	tank landing ship

(3) *Mine warfare vessels.*

DM	minelayer, destroyer
DMS	minesweeper, destroyer
MCS	mine warfare command and support
MHC	minehunter, coastal

MMA	minelayer, auxiliary
MMC	minelayer, coastal
MMF	minelayer, fleet
MSC	minesweeper, coastal
MSC(O)	minesweeper, coastal (old)
MSF	minesweeper,.fleet (stl hull)
MSO	minesweeper, ocean (nonmag)

(4) *Patrol vessels.*

DE	escort vessel
DER	radar picket escort vessel
PC	submarine chaser (173′)
PCE	escort (180′)
PCER	rescue escort (180′)
PCS	submarine chaser (136′)
PF	patrol escort
PGM	motor gunboat
PR	river gunboat
PY	yacht
SC	submarine chaser (110′)

b. *Auxiliary Vessels.*

AD	destroyer tender
ADG	degaussing vessel
AE	ammunition ship
AF	store ship
AG	miscellaneous
AGB	icebreaker
AGP	motor torpedo boat tender
AGS	surveying ship
AGSC	coastal surveying ship
AG(SS)	auxiliary submarine
AH	hospital ship
AK	cargo ship
AKD	cargo ship, dock
AKL	light cargo ship
AKN	net cargo ship
AKS	general stores issue ship
AKV	cargo ship and aircraft ferry
AN	net laying ship
AO	oiler
AOG	gasoline tanker
AOR	replenishment fleet tanker
AO(SS)	submarine oiler
AP	transport
APB	self-propelled barracks ship
APC	small coastal transport
AR	repair ship
ARB	battle damage repair ship
ARC	cable repairing or laying ship
ARG	internal combustion engine repair ship
ARL	landing craft repair ship
ARS	salvage vessel
ARSD	salvage lifting vessel
ARST	salvage craft tender

ARV	aircraft repair ship
ARVA	aircraft repair ship (aircraft)
ARVE	aircraft repair ship (engine)
AS	submarine tender
ASR	submarine rescue vessel
ATA	auxiliary ocean tug
ATF	fleet ocean tug
ATR	rescue ocean tug
AV	seaplane tender
AVD	advanced aviation base ship
AVM	guided missile ship
AVP	small seaplane tender
AVS	aviation supply ship
AW	distilling ship
IX	unclassified miscellaneous

c. Service Craft.

AFDB	large auxiliary floating drydock
AFDL	small auxiliary floating drydock
AFDM	medium auxiliary floating drydock
APL	barracks ship (nonpropelled)
ARD	floating drydock auxiliary
LCU	utility landing craft
MSA	minesweeper auxiliary
MSB	minesweeping boat
MSI	minesweeper inshore
PT	motor torpedo boat
PYC	coastal yacht
SST	target and training submarine
X	submersible craft
XFU	harbor utility craft
XMAP	sweeper device
YAG	miscellaneous auxiliary
YAGR	ocean radar station ship
YC	open lighter
YCF	car float
YCK	open cargo lighter
YCV	aircraft transportation lighter
YD	floating derrick
YDT	diving tender
YF	covered lighter (self-propelled)
YFB	ferryboat or launch
YFD	yard floating drydock
YFN	covered lighter (nonpropelled)
YFNB	large covered lighter
YFND	covered lighter (used with drydock)
YFNG	covered lighter (special purpose)
YFNX	lighter (special purpose)
YFP	floating power barge
YFR	refrigerated covered lighter (self-propelled)
YFRN	refrigerated covered lighter (nonpropelled)
YFRT	covered lighter (range tender)
YFT	torpedo transportation lighter

YFU	harbor utility craft
YG	garbage lighter (self-propelled)
YGN	garbage lighter (nonpropelled)
YHB	houseboat
YM	dredge
YMP	motor mine planter
YMS	auxiliary motor minesweeper
YNG	gate vessel
YO	fuel oil barge (self-propelled)
YOG	gasoline barge (self-propelled)
YOGN	gasoline barge (nonpropelled)
YON	fuel oil barge (nonpropelled)
YOS	oil storage barge
YP	patrol vessel
YPD	floating pile driver
YPK	ponton stowage barge
YR	floating workshop
YRB	submarine repair and berthing barge
YRBM	submarine repair, berthing and messing barge
YRDH	floating drydock workshop (hull)
YRDM	floating drydock workshop (machine)
YRL	covered lighter (repair)
YSD	seaplane wrecking derrick
YSR	sludge removal barge
YTB	large harbor tug
YTL	small harbor tug
YTM	medium harbor tug
YTT	torpedo testing barge
YV	drone aircraft catapult control craft
YW	water barge (self-propelled)
YWN	water barge (nonpropelled)

5.20 Transportation Corps Marine Fleet Classification System

Each vessel in the Transportation Corps marine fleet bears an individual serial number, preceded by one of the following applicable prefixes.

BARC	lighter, amphibious (BARC), self-propelled, diesel, steel, 60-ton, 61-foot, design 2303
BC	barge, dry cargo, nonpropelled, medium (100 feet through 149 feet)
BFC	railroad car float barge
BCI	barge, dry cargo, inland waterways, nonpropelled, medium (100 feet through 149 feet)
BCLI	barge, dry cargo, inland waterways, nonpropelled, large (150 feet and over)
BCS	nested barge
BD	crane, floating
BDL–IX	lighter, beach discharge
BG	barge, liquid cargo, nonpropelled
BGI	barge, liquid cargo, inland waterways, nonpropelled
BK	barge, dry cargo, nonpropelled
BKI	barge, dry cargo, inland waterways, nonpropelled
BPL	barge, pier, nonpropelled

BR	barge, refrigerated, nonpropelled
BRI	barge, refrigerated, inland waterways, nonpropelled
BSP	barge, self-propelled
BSPI	barge, self-propelled, inland waterways
BT	barge, training, nonpropelled
F	fireboat
FB	ferryboat
FD	drydock, floating
FMS	repair shop, floating, marine repair, nonpropelled
FS	freight and supply vessel, large (140 feet and over)
FSM	freight and supply vessel, medium (100 feet through 139 feet)
FSR	freight and supply vessel, refrigerated cargo
J	boat, work and inspection, small (50 feet and under)
LCM	landing craft, mechanized (Mark VI, Mark VIII)
LCU	landing craft, utility
LCVP	landing craft, vehicle, personnel
LT	tug, large (100 feet and over)
LTI	towboat, large, inland waterways (100 feet and over)
Q	boat, work and inspection, large (over 50 feet)
R	rowboat
ST	tug, small (99 feet and under)
STI	towboat, small, inland waterways (99 feet and under)
T	freight and supply vessel, small (under 100 feet)
Y	vessel, liquid cargo, self-propelled

5.21 Vessel Deadweight Scale

a. Purpose. The vessel deadweight scale (fig. 5.1) is designed to furnish vessel tonnages and the effects of these tonnages on the mean draft of the vessel.

(1) Column A represents the number of long tons that may be carried in the vessel, including fuel, stores, water, dunnage, and cargo, or any material that may be placed in the vessel, excluding equipment and machinery necessary for operation of the vessel.

(2) Column B represents the vessel's mean draft in feet and inches. This scale is graduated from the least possible draft of 8 feet to a maximum draft of 29 feet.

(3) Column C (displacement tonnage in salt water) represents the weight of the ship plus any material in or on the vessel.

(4) Column D (tons per inch immersion) denotes the number of long tons required to lower the vessel 1 inch with any given draft.

b. Use. The deadweight scale is used by the cargo planner to determine the long tons that may be placed in a vessel to reach the required draft. For example, a vessel loaded with 9,000 long tons will have a mean draft of 25 feet 4½ inches at the beginning of the voyage and, using 50 long tons of fuel, stores, and water per day at sea, will have used 500 long tons through a period of 10 days, thus reducing the mean draft to 24 feet 6 inches. From these figures,

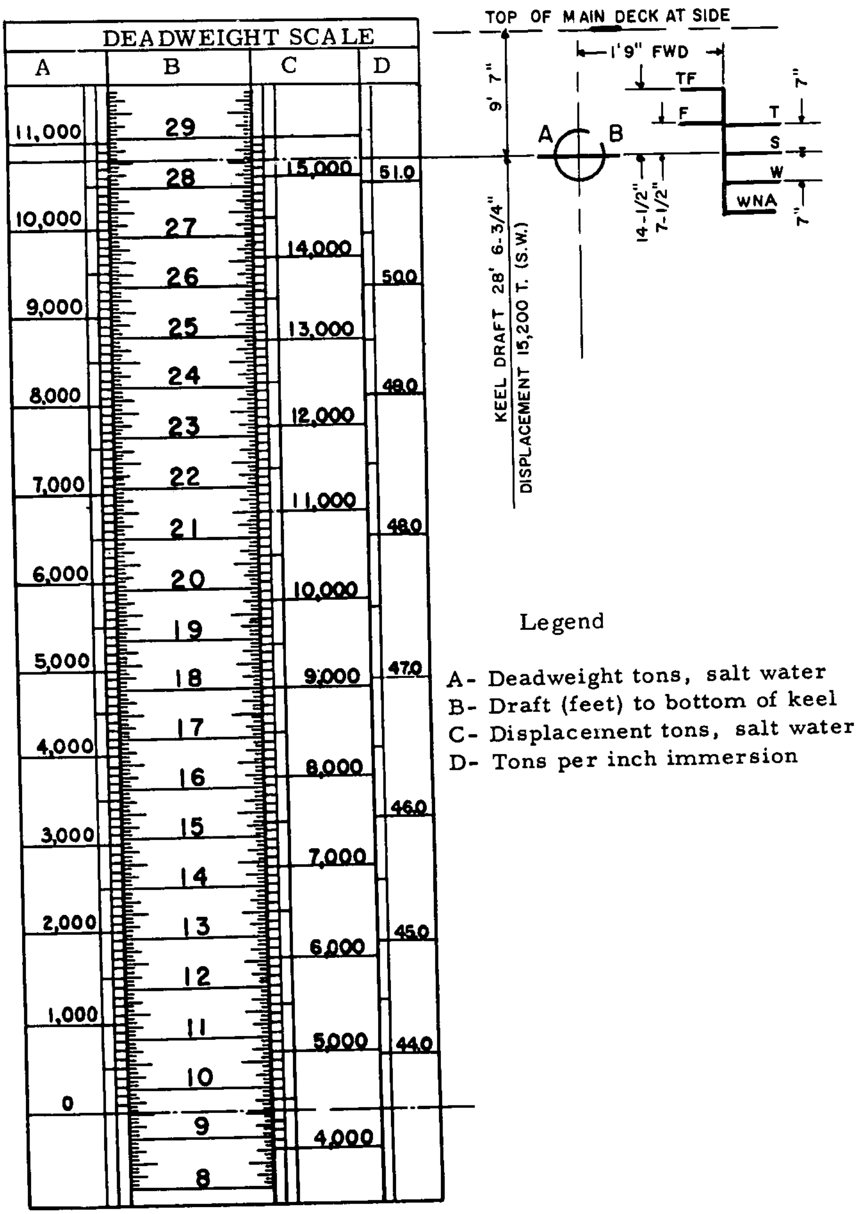


Figure 5.1 Deadweight scale for a Victory ship.

the cargo planner can determine the vessel's draft at the completion of the trip, and he will know whether the draft is correct for the type of harbor where the cargo will be discharged.

c. Cargo Deadweight Tonnage.

(1) In the deadweight column of the scale, the figure 0 is listed directly opposite the light ship weight. The figures above 0 indicate weight added to the vessel in the form of fuel, stores, and cargo. All weight placed in the vessel will increase the ship's mean draft and, by adding 10,805 long tons to the light ship, the vessel will be forced down in the water to a maximum mean draft of 28 feet 6¾ inches for sailing in summer salt water.

(2) Certain complications may be involved in determining the cargo deadweight tonnage of the vessel. For instance, the ship may have a fixed ballast that is not entered in the deadweight scale. In such an event, the ship's officers will add this to the number of tons of fuel, stores, and water that are on board. Also, they will note the location of the ballast in the ship. This must be deducted from the deadweight tonnage, together with the fuel, stores, and water, to give a correct cargo deadweight tonnage. When the vessel is at a mean draft of 28 feet 6¾ inches, summer salt water, it is in a condition known as displacement loaded, and, should weight in excess of 10,805 long tons be loaded in a light ship, it would be forced down in the water below the legal loadline for summer zone and would not be allowed to sail.

(3) To prevent overloading the vessel, the weight of the fuel, stores, and water should be determined and deducted from the vessel deadweight tonnage to determine the maximum number of tons of cargo that may be placed in the vessel to bring it down to its marks.

Section III. TERMINAL AND WATER TRANSPORT OPERATIONS

5.22 Elements of Terminal Planning

a. In the planning data for terminal and related water transport operations, the basic period of time is a 20-hour working day. This is generally considered a complete round-the-clock working day for terminal operations: it is based on two 10-hour shifts. The remainder of the day is taken up in mealtime and shift changes. In forward areas, where enemy action may cause additional delays, 15 hours per day should be used as a planning figure. For general planning purposes, a transportation terminal service company (TOE 55–117) or its equivalent is considered capable of discharging 720 short tons per 20-hour working day.

b. The three elements normally considered in terminal planning are:

(1) Estimation of the existing terminal capacity or the total tonnage and personnel that can be received, processed, and cleared through the terminal in a day.

(2) Determination of the terminal workload required to support the particular operation, expressed as target cargo tonnage and number of personnel per day.

(3) Estimation of base development requirements necessary to increase the terminal capacity to meet the target tonnage, including requirements for construction, equipment, and personnel.

5.23 Terminal Capacity

a. Terminal throughput capacity is determined by three major factors. In all instances one of these will be the limiting and thereby the determining factor. Each of the three factors may be expressed in terms of short tons per day for planning purposes. All three factors should be accurately estimated even though the limiting factor may be obvious. These estimates will indicate the facilities where improvement effort will yield the greatest return in terms of tonnage-movement capability. The three major factors are:

(1) Terminal reception capacity: the number and type of ships that can be moved into the harbor or coastal area of the terminal per day.

(2) Terminal discharge capacity: the number of ships that can be discharged in the terminal per day.

(3) Terminal clearance capacity: the amount of cargo and personnel that can be moved through and out of the terminal per day.

b. A checklist for terminal capacity estimation is given below. Further information and procedures for estimating terminal capacity are provided in FM's 55–8, 55–51, and 101–10.

Terminal Capacity Estimation Checklist

Collect these data:	*Compute these factors:*	*To determine:*
Channel depths Obstructions Enemy air activity Enemy surface activity Enemy submarine activity Climate Weather Minefields or contaminated areas Our own capabilities in combating obstacles.	(1) Evaluate to determine water terminal reception capacity.	Water terminal throughout capacity.
Tactical dispersion requirements Wharf facilities Beach capabilities Discharge rates ashore Discharge rates in the stream Anchorage area Extent of destruction or contamination. Climate and seasons Weather and tide characteristics Cargo-handling equipment available. Floating craft and equipment available. Transit sheds and areas Availability of local labor Space reserved for local economy Enemy activity	(2) Evaluate to determine water terminal discharge (input) capacity.	
Capacity of rail facilities Capacity of highway facilities Capacity of inland waterway facilities. Capacity of pipeline facilities Capacity of air facilities Enemy activity	(3) Evaluate to determine water terminal clearance (output) capacity.	

5.24 Determination of Terminal Workload

The terminal workload is assigned by the theater commander and is the mission of a particular terminal. The mission assignment is a target tonnage based on the terminal's throughput capacity. Target tonnage consists of initial and anticipated tonnages. Initial tonnage is the amount of cargo the terminal organization is expected to handle before its capability is increased by base development. Anticipated tonnage is the amount of cargo required at a future specified date to support a particular operation and to build up a reserve supply for the support of future operations. When the target tonnage assignment is made, the terminal commander makes an estimate of the construction, equipment, and personnel required to increase the terminal capacity to handle the anticipated tonnage.

5.25 Wharf Facilities and Anchorage Areas

a. General. For planning purposes, there are two methods of ship discharge—discharge directly onto the wharf from vessels berthed alongside and discharge by lighterage from vessels anchored in the stream. General planning must consider wharf facilities on the basis of both of these methods. Deep-draft wharfage must be provided wherever alongside discharge is contemplated. Shallow draft wharfage and anchorage areas must be given joint consideration when lighter discharge is contemplated. Basic planning information on wharf facilities and anchorage areas is given below.

b. Berth Classifications.

Class of general berths	Size vessel berthed		Class of tanker berths	Size vessel berthed	
	Length (ft)	Draft (ft)		Length (ft)	Draft (ft)
A	500 and over	30	T–A	600 and over	33
B	460	28–24	T–B	525	30
C	350	21–17	T–C	450	25
D	250	16	T–D	250	13
E	200	12	T–E	Under 250	Under 13
F	Under 200	Under 12			

c. Wharf Length. For planning purposes, 100 feet of wharf is required for each hatch and/or each lighter to be discharged. The discharge rate (par. 5.26) for ships and coasters is reduced 20 to 25 percent for each 100-foot reduction in wharf length under the minimum required. In determining lighterage facilities, length over 100 feet but less than the next 100-foot unit is disregarded. For example, a 150-foot wharf will accommodate only one lighter, a 250-foot wharf will handle two lighters, etc.

d. Wharf Width. A 60-foot minimum wharf working area is necessary for proper cargo handling and shipside clearance when discharging from only one side of a wharf. A pier must be at least 90 feet wide to accommodate vessels on both sides.

e. Wharf Height. Generally, a wharf should be at least 5 feet above high tide level.

f. Anchorage Berths.

(1) *Anchorage berth diameter formulas.* The following formulas are used to find the diameter for anchorage berths:

$7D+2L$=radius in feet

$\frac{2R}{3}$=diameter in yards

where

D=depth of water in feet

L=length of vessel in feet

R=radius in feet

(2) *Standard classification system.*

Class	*Diameter*	*Depth of water*	*Type of vessel*
I------	Over 800 yards------	Over 38 feet------	Capital naval ship or large passenger ship
II-----	500 to 800 yards----	30 to 38 feet------	Standard oceangoing vessel
III----	Under 500 yards----	Under 30 feet-----	Destroyer or small cargo vessel.

5.26 Discharge Rates

The following discharge rates are based on average sizes of the types of vessels indicated. For planning purposes, the average ship is considered 450 feet long and 60 feet wide with five hatches, the average coaster 350 feet long and 35 feet wide with four hatches, and the average lighter 100 feet long and 35 feet wide. This excludes landing craft and amphibians. The figures given for ships and coasters in the stream indicate tonnage discharged from the ship or coaster into lighters. The limiting factors are the number of lighters available and the wharf space provided for their discharge. Number of lighters required is based upon the number of hatches, the size of the lighters, and the turnaround time.

(1) Average ship, alongside or in stream—720 short tons or 643 long tons per 20-hour day.

(2) Average coaster, alongside or in stream—500 short tons or 446 long tons per 20-hour day.

(3) Average lighter alongside wharf—180 short tons or 160 long tons per 20-hour day.

5.27 Temporary Storage Areas

To plan for temporary storage areas for cargo, use the figures given below.

a. Open Storage. Approximately 10,000 square feet of open storage area is required for each 560 short tons, or 500 long tons, or 1,000 measurement tons of cargo. Average stack height should be 6 feet.

b. Covered Storage. Approximately 8,000 square feet of covered storage area is required for each 560 short tons, or 500 long tons, or 1,000 measurement tons of cargo. Average stack height should be 8 feet. Generally, 10 percent of 1 day's target tonnage will require covered storage.

5.28 Personnel and Equipment Requirements

For planning purposes, one terminal service company (TOE 55–117 or its equivalent in personnel and equipment is required for each ship berth in a water terminal or for each 720 short tons of the terminal's daily capacity. Paragraph 5.25 lists the factors for determining ship berth space.

5.29 Estimating Water Terminal Capacity

The following example demonstrates the recommended procedure for estimating water terminal capacity based upon the steps and data outlined in the preceding paragraphs and using the harbor chart shown in figure 5.2.

a. Wharf Facilities.

Wharf No.	*Length (ft)*	*Width (ft)*	*Minimum depth alongside (ft)*
1	1, 060	80	32
2	490	60	30
3	580	90	30
4	535	100	34, each side
5	125	54	8
6	295	60	15
7	450	75	22
8	210	60	16

b. Anchorage Areas.

(1) There is sufficient area inside the harbor to anchor three ships where they can be worked continuously.

(2) In good weather, two vessels can be anchored and worked outside the breakwater.

(3) Winds, swells, tides, and tidal currents present no unusual problem.

c. Discharge Tonnage.

(1) *At deep-draft wharfage.*

Wharf No.	*Victory ship-berths*	*Discharge rate (ST per day)*
1	2	2x720=1, 440
2	1	1x720= 720
3	1	1x720= 720
4	2	2x720=1, 440
Total		4, 320

(2) *At lighterage wharfs.*

Wharf No.	*Lighter berths*	*Discharge rate (ST per day)*
5	1	1x180= 180
6	*3	3x180= 540
7	4	4x180= 720
8	2	2x180= 360
Total		1, 800

*Wharf No. 6 is only 295 feet long. In the lighter-wharfage table (par. 5.25c), three ships require 300 feet. However, the 5-foot shortage will not affect operations appreciably and three lighters are docked here.

d. Rate of Discharge From Ships at Anchor to Lighters. According to the chart, three ships can be anchored inside the breakwater, and

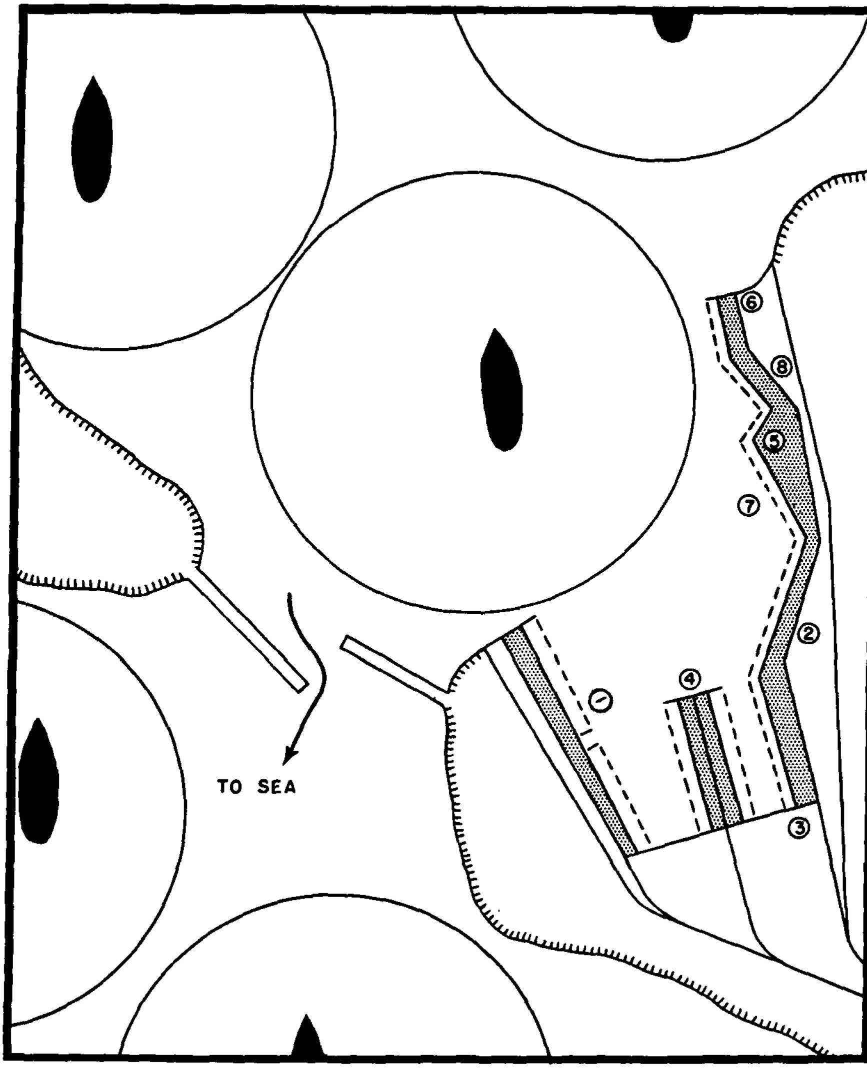


Figure 5.2. Harbor chart for terminal capacity estimation.

two can be anchored and worked outside the breakwater in good weather. Therefore, in good weather, cargo can be discharged from ships to lighters at the rate of $(3+2)\times 720=3{,}600$ short tons per day.

e. Summary of Daily Terminal Capacity.

(1) Discharged alongside deep-draft wharfs—4,320 short tons per day.

(2) Discharged from lighters to wharfs—1,800 short tons per day.

(3) Transferred from ships to lighters—3,600 short tons per day.

(4) The maximum discharge per day is 1,800 short tons because lighter wharfage is the limiting factor (par. 5.23*a*). There-

fore the total daily terminal capacity is 6,120 short tons: 4,320 short tons alongside; 1,800 short tons by lighter.

f. Personnel and Equipment Requirements. Personnel and equipment requirements to maintain the above daily tonnage figure may be determined by dividing 6,120 short tons by 720 short tons (daily terminal service company discharge capability). Therefore, nine terminal service companies (TOE 55–117) or their equivalent in personnel and equipment and the necessary lighterage support will be required to maintain the discharge capacity of this terminal.

g. Weather Considerations. Advance study must be made to determine the probable effect of bad weather on the rate of discharge and other factors in water terminal capacity. Continuous records of daily discharge plotted against weather and surf conditions prove valuable in planning future discharge at the same and similar terminals.

5.30 Inland Waterways Service

a. The use of inland waterways for military purposes is normally envisaged only in underdeveloped areas in which alternate modes are either lacking or insufficient. These waterways are to be used principally for civilian traffic and for the restoration of the local economy. Further, it is assumed that rehabilitation of these waterways will be undertaken by local authorities and that a minimum of military effort will be diverted for the purpose, except where designated for immediate military use and equipment salvage.

b. When required, an inland waterways service may be formed to control and operate a waterway system, to formulate and coordinate plans for using inland waterway transport resources, and to provide for the integration and supervision of local civilian facilities used in support of military operations. This operational organization may vary in size from a single barge crew to a complete inland waterways service, depending upon the requirements. It may be composed entirely of military personnel or may be manned by local civilians supervised by military units of the appropriate transportation staff section.

c. The service is organized by teams from TOE 55–500. Although the organization will normally be composed of harbor craft units, it may be supplemented by transportation boat units as shown in figure 5.3.

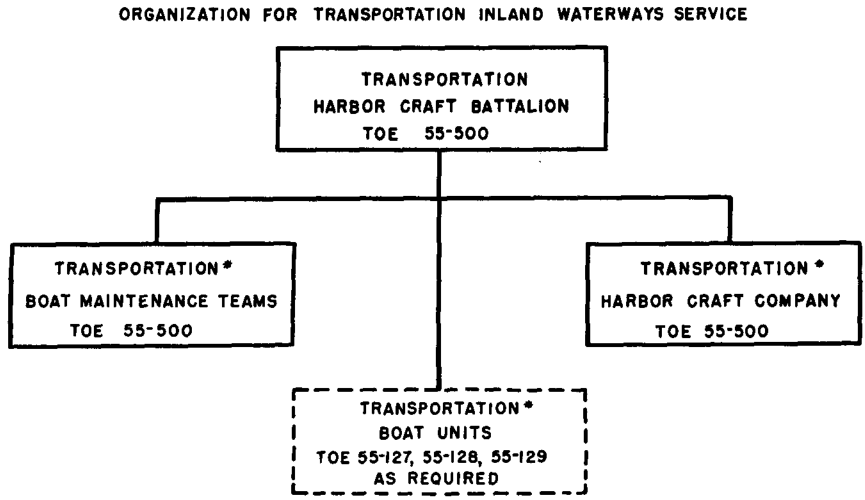
5.31 Estimating Capabilities of an Inland Waterway

When determining the capability of an inland wateıway, the following must be considered:

a. Restricting widths and depths of channel.

b. Vertical and horizontal clearance of bridges.

c. Location of dams or other bars to navigation.



* TYPE B OR CADRE ORGANIZATIONS AND LOCAL EQUIPMENT MAY BE SUBSTITUTED.

Figure 5.3. Organizational chart, transportation inland waterways service.

d. Location of locks; dimensions, timing, method of operation, and other limiting factors.

e. Frequency, duration, and effect of seasonal floods and droughts.

f. Normal freezeup and opening dates.

g. Navigation hazards—rapids, falls, etc.

h. Speed and fluctuation of current.

i. Waterway maintenance requirements.

j. Changes of channel.

k. Availability of civilian and/or military craft.

l. Availability of skilled bargemen, pilots, and tugboat operators from civilian and/or military sources.

m. Number of terminals.

n. Terminal facilities, including wharves, cranes, materials handling equipment, marine maintenance shops, and port clearance.

5.32 Inland Waterway Capacity Formulas

a. To compute the capacities of an inland waterway, the planner must first determine the waterway turnaround time. This is the time required for a craft to be loaded, move to its destination, unload, and return to its home terminal again ready to be loaded. It includes time for resupplying and refueling unless these activities are carried on concurrently with loading and unloading. The component factors of turnaround time are: travel time, loading and unloading time, time consumed in locks on each trip, and hours of operation per day.

(1) *Travel time.* Travel time is computed by dividing the length of haul by the speed of the craft involved, making necessary allowances for the effects of current and/or tide.

(*a*) *Length of haul.* Length of haul is the distance between loading and unloading points.

(*b*) *Speed of craft in still water.* The speed of inland waterway vessels varies; however, an average figure of 4 knots may be used if more accurate figures are not available.

(*c*) *Speed and direction of current.* Speed and direction of current can often be discounted because the resistance encountered when traveling in one direction will be balanced by assistance from the current when traveling in the other direction. However, this does not always apply. In fast streams the speed downstream may have to be reduced because of the need to stop or maneuver quickly. Also, in tidal areas speed may be influenced by the strength and direction of the tide.

(2) *Loading and unloading time.* Loading and unloading time is the total time required to load the craft at origin and unload it at destination.

(3) *Time consumed in locks on each trip.* This is the time taken by a craft and its tow to transit a lock.

(4) *Hours of operation per day.* The normal two-shift, 20-hour day is used in all cases.

b. Turnaround time is computed by adding loading time, travel time, unloading time, locking time, and refitting time, and dividing this figure by hours of operation per day.

c. After establishing turnaround time for the waterway, the planner must then compute the number of tons the waterway can handle per day or the number of barges required to sustain a given daily tonnage. In all cases, one of these factors will be known. If the tonnage figure is assigned, the planner must determine the number of barges required to move the tonnage; or if a given number of barges is assigned, the planner must determine the number of tons the barges can transport over the waterway each day. In addition, the planner will have to determine the number of tugs and towboats required to move the available barges. The formulas listed below are used to make these determinations.

(1) When the daily tonnage requirements are known, the following formula can be used to determine the number of barges required to sustain this tonnage.

$$\frac{\text{Daily tonnage} \times \text{turnaround time (hours)}}{\text{Tons per barge} \times \text{daily operating hours}} = \text{number of barges required}$$

(2) When the number of barges is known, the following formula can be used to determine the number of tons these barges can move over the waterway each day.

$$\frac{\text{Number of barges} \times \text{tons per barge} \times \text{daily operating hours}}{\text{Turnaround time in hours}} = \text{tons per day}$$

(3) Since a single tug or towboat can normally be used to tow more than one barge, and loading time is not a consideration in tug or towboat availability, it follows that fewer tugs than barges will be required in most situations. The following formula can be used to determine the number of tugs or towboats required to move the available barges.

$$\frac{\text{Number of barges} \times \text{tug turnaround time (days)}}{\text{Number of barges per tow} \times \text{barge turnaround time (days)}} = \text{number of tugs or towboats}$$

5.33 Inland Terminal Capacity

Checklist for Estimation of Inland Terminal Throughput Capacity.

Collect these data where applicable:	*Compute these factors:*	*To determine:*
Channel depths Obstructions Capacity of rail facilities Capacity of highway facilities Capacity of pipeline facilities Capacity of air facilities Enemy air activity Enemy surface activity Climate Weather Contaminated areas Our own capabilities in combating obstacles.	(1) Evaluate to determine inland terminal reception capacity.	Inland terminal throughput capacity.
Tactical dispersion requirements Wharf and/or platform facilities Discharge rates Unloading rates Loading rates Extent of destruction or contamination. Climate and seasons Weather and tide characteristics Materials-handling equipment available. Cargo-handling equipment available. Floating craft and equipment available. Airfield capabilities Transit sheds, yards, and areas Local labor available Space reserved for local economy	(2) Evaluate to determine loading and/or unloading or transfer capacity.	
Capacity of rail facilities Capacity of highway facilities Capacity of inland waterway facilities. Capacity of pipeline facilities Capacity of air facilities	(3) Add to determine clearance capacity.	

5.34 Amphibious Operations

a. Each amphibious landing differs in climatic, hydrographic, and topographic conditions as well as in the military situation. These variable factors make it impractical to develop detailed logistical planning data applicable only to beaches and their capacity to receive troops and cargo; however, certain general planning data can be developed.

b. Beach capacity is the amount of cargo that can be discharged over a given beach length within a stated interval of time. During the initial phases of an amphibious operation, beach capacity is limited to the beach or beaches over which the assault landing is being made; later, if necessary, overall capacity may be increased by the consolidation of beaches for more efficient operation and for the opening up of sheltered unloading points in rivers or bays. Experience has indicated that, during the assault phase of an operation, cargo can be landed and moved across beaches as follows, using (1) and/or (2) in appropriate combination:

(1) Average short tons of cargo per day per mile of beach—3,000. Average per 1,000 yards of beach—1,680.

(2) Average number of vehicles and personnel landed simultaneously per day per mile of beach—675 vehicles, 4,725 personnel.

5.35 Estimating Wheeled Landing Vehicle Requirements

a. The combat payload of the 2½-ton, 6x6 wheeled landing vehicle (DUKW) ranges from 5,000 to 9,000 pounds, depending on the operating conditions. For planning purposes, the combat payload of the DUKW is 9,000 pounds under ideal operating conditions, 7,500 pounds under favorable conditions, and 5,000 pounds under difficult conditions. Very unfavorable conditions of wind, waves, or obstacles will possibly prevent even a payload of 5,000 pounds or cause operations to cease entirely. The various factors influencing operating conditions are shown in the table below.

Factors affecting operating conditions	Operating conditions		
	Ideal	Favorable	Difficult
Wind	10 mph or less	10 to 15 mph	Over 15 mph.
Waves	Less than 1 ft	1 to 3 ft	Over 3 ft.
Beach	Gentle slope Hard sand.	Abrupt slope Soft sand.	Construction required. Mud.
Obstacles	None	Some	Prevalent.
Area behind beach	Good road net	Trails	Favorable hinterland.

b. Estimating wheeled landing vehicle requirements for an operation requires computation of turnaround time. The accepted average turnaround time factors used for planning purposes are listed below. Whenever possible, data derived from actual operating experience should be substituted for these average factors. When estimating requirements, allowance should be made for the tactical situation and for possibly adverse navigation, weather, and road conditions.

Loading time	8 to 10 minutes
Unloading time	8 to 10 minutes
Water speed	5 miles per hour
Land speed	10 to 20 miles per hour

c. Turnaround time for wheeled landing vehicles may be estimated by using the following formula:

$$TT=\frac{W\times 60}{R}+\frac{L\times 60}{R'}+a+b+c$$

where

TT=turnaround time in minutes
W=water distance (round trip)
L=land distance (round trip)
R=speed on water in miles per hour
R'=speed on land in miles per hour
a=loading time in minutes
b=unloading time in minutes (not to exceed loading time)
c=known delays in minutes

d. For continuous operations, a planning factor of 75 percent availability of assigned amphibians is assumed because of maintenance requirements. To estimate the number of operational vehicles required for a particular mission, use the formula given below.

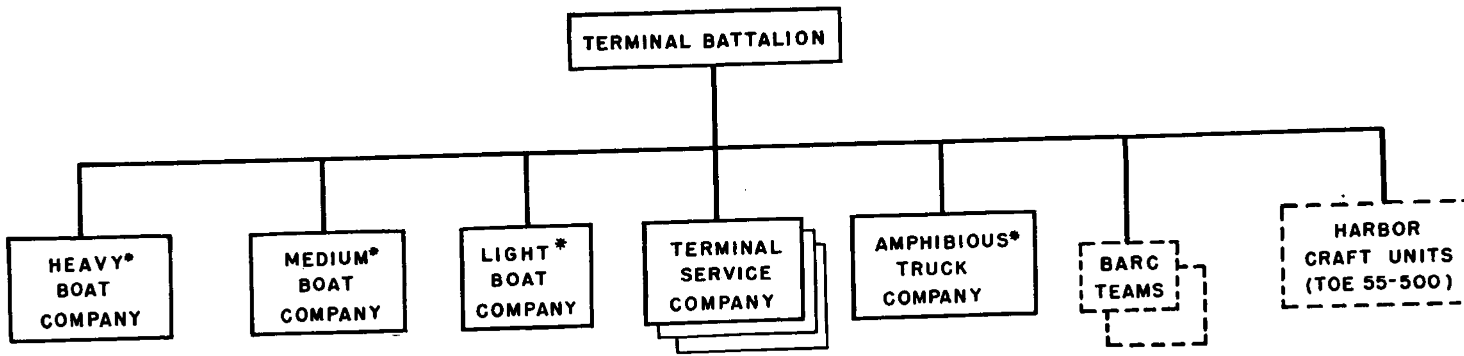
$$V=\frac{H\times TT}{X}$$

where

V=number of operational vehicles
H=number of hatches to be worked
TT=turnaround time in minutes
X=most restrictive factor (a, b, or c, whichever is greatest in solution of turnaround time in subparagraph c above)

5.36 Logistical Over-the-Shore (LOTS) Operations

a. In other than amphibious operations, LOTS operations provide for the movement of cargo and personnel over the shore between ocean transportation and shoreside facilities. Beaches and other more difficult shore lines are used to the extent required. Figure 5.4 shows a typical transportation terminal battalion organization for LOTS operations.



* ASSIGNED OR ATTACHED IN WHOLE OR IN PART TO TERMINAL BATTALION AS REQUIRED.

----ATTACHED AS REQUIRED.

Figure 5.4. A typical transportation terminal battalion organized for a LOTS operation.

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b. LOTS operations include:

(1) Unloading cargo and personnel from ships into landing craft and/or amphibians.

(2) Moving cargo and personnel by landing craft and/or amphibians from ships to shore.

(3) Unloading landing craft at beaches.

(4) Unloading amphibians at transfer points.

(5) Moving cargo from landing craft to temporary storage and/or segregation areas or to destination.

(6) Unloading at storage areas or transfer points.

c. Planning factors for LOTS operations are essentially the same as those for fixed terminal operations. Using ships' gear and stevedore labor provided by the forces offshore, ships normally can discharge cargo into special landing equipment as fast as beaches can receive and clear the loaded landing craft and amphibians. In an amphibious operation, the site selections for subsequent LOTS operations are included in the base development plan. Where LOTS operations are established independently, the selection of possible beach sites is made by the terminal commander, in consultation with the proper naval authorities, by an extensive study of maps and hydrographic charts. Final determination of the feasibility of operations at possible sites is made by a detailed ground and water reconnaissance. The information is complied on DA Form 55–178 (Characteristics of Beaches and Landing Areas—Transportation Intelligence) as shown in figure 5.5. This completed form is accompanied by a detailed profile sketch of the beach and landing area as shown in figure 5.6.

5.37 Hydrographic Markings for Landing Operations (fig. 5.7)

a. Hydrographic markings have been developed for use in beach operations in areas not otherwise suitably marked. They are normally installed by personnel of the Transportation Corps concerned or by shore party personnel. They are not related to the aids to navigation maintained by the Coast Guard.

b. During the day, a pennant with alternate red and black vertical stripes is fastened to a buoy or stake to show the location of rocks, shoals, or submerged obstacles. This pennant is replaced at night by a white light over a red light, both blinking.

c. Hydrographic markings for channels consist of the following:

(1) A red pennant by day and a steady red light at night mark the starboard side of the channel for boats coming from seaward.

(2) A black pennant by day and a blinking white light by night mark the port side.

(3) A black and white vertically striped pennant by day and a blinking green light at night mark a fairway.

CHARACTERISTICS OF BEACHES AND LANDING AREAS - TRANSPORTATION INTELLIGENCE (FM 55-8)	NAME OF FACILITY	PREPARED BY	HEADQUARTERS	PAGE NUMBER	NUMBER OF PAGES
	Marlin Area Beaches	J. B. MORTON, Major, TC	55th Transportation Intelligence Detachment (Strategic)	3	7

BEACH NUMBER AND LOCATION	LENGTH OF BEACH		WIDTH OF BEACH		BEACH GRADIENTS		APPROACH (Bottom gradients, water depths, winds, reefs, etc.)	SURF AND TIDAL RANGE	MATERIAL AND FIRMNESS	DESCRIPTION OF TERRAIN IMMEDIATELY BEHIND BEACH	EXITS AND COMMUNICATIONS INLAND
	OVERALL LENGTH	USABLE LENGTH	LOW WATER	HIGH WATER	LOW WATER TO HIGH WATER	HIGH WATER ZONE					
No. 22. Centered 600 yds NE of Leander and 8.6 mi SW of Ocean View at 11°12' N, 22°22' E	2,000 yds	All usable	Aprx 30 yds	Aprx 20 yds	Aprx 1 on 30	1 on 20	Near shore bottom slopes flat; 2.4-to 4.6-ft depths 30 yds offshore; 6.8-ft depth 400 yds SW end 700 yds off SE end of beach. Approach from NW and bay generally clear over shoal depth with some rocky patches. Approach flanked on SE by small islands, reefs, and rocks, which extend for about 2 miles NW of Leghorn. Bottom mud and sand; weedy close to shore.	Surf rough with prevailing northerly winds; tidal range 1.0 ft, springs.	Sand: soft and fine; firm only in wetted area.	Soft, sandy backshore generally unsuitable for wheeled vehicles, backed by a sea wall and 900 yds of sand hummocks 4.6 ft high covered with brush; all on a flat, open plain.	Across 900 yds sandy terrain by narrow one-lane road to a primary road and railroad leading to Leander.
No. 12. Seaview to Lakeland; centered 22°26'N, 33° 36'E. On sandspit terminated on W by entrance channel into Lake Yerba	5.2 miles	4.6 miles usable	Aprx 85 yds	Aprx 50 yds	Aprx 1 on 50	1 on 50	Near shore bottom slopes mild to flat; 6-ft depth generally 160 yds off beach except at W end where 400 yds off-shore; 18-ft depth 2.0 miles offshore; approach clear over gradually shoaling sand and mud bottom; anchorage in 30 ft, 4.0 mi offshore E of breakwater. Bottom hard sand.	Surf rough with onshore winds; tidal range aprx 1.6 ft, springs.	Sand and sandstone--believed to be firm.	Low sand dunes backed by hilly sandy terrain as high as 40 ft and completely covered with vegetation; terrain directly back of beach flanked on E and W with vast salt marshes.	A primary road parallels the shore about 2.0 miles inland; railroad parallels the shore 3 mi from beach. Cross-country exit across dune area to network of minor roads or trails connecting with secondary road, connecting with primary road at Hilldale.

REMARKS

None

NOTE: Beach lengths and distances along the coast and inland are expressed in statute miles; distances across water are expressed in nautical miles except when referring to beach locations.	DATE	TYPED NAME AND GRADE	SIGNATURE
	27 June 1956	B. C. DALTON, Lt. Colonel, TC, Commanding	B.C. Dalton

DA FORM 1 JUN 56 55-178

Figure 5.5. Sample report, characteristics of beaches and landing areas.

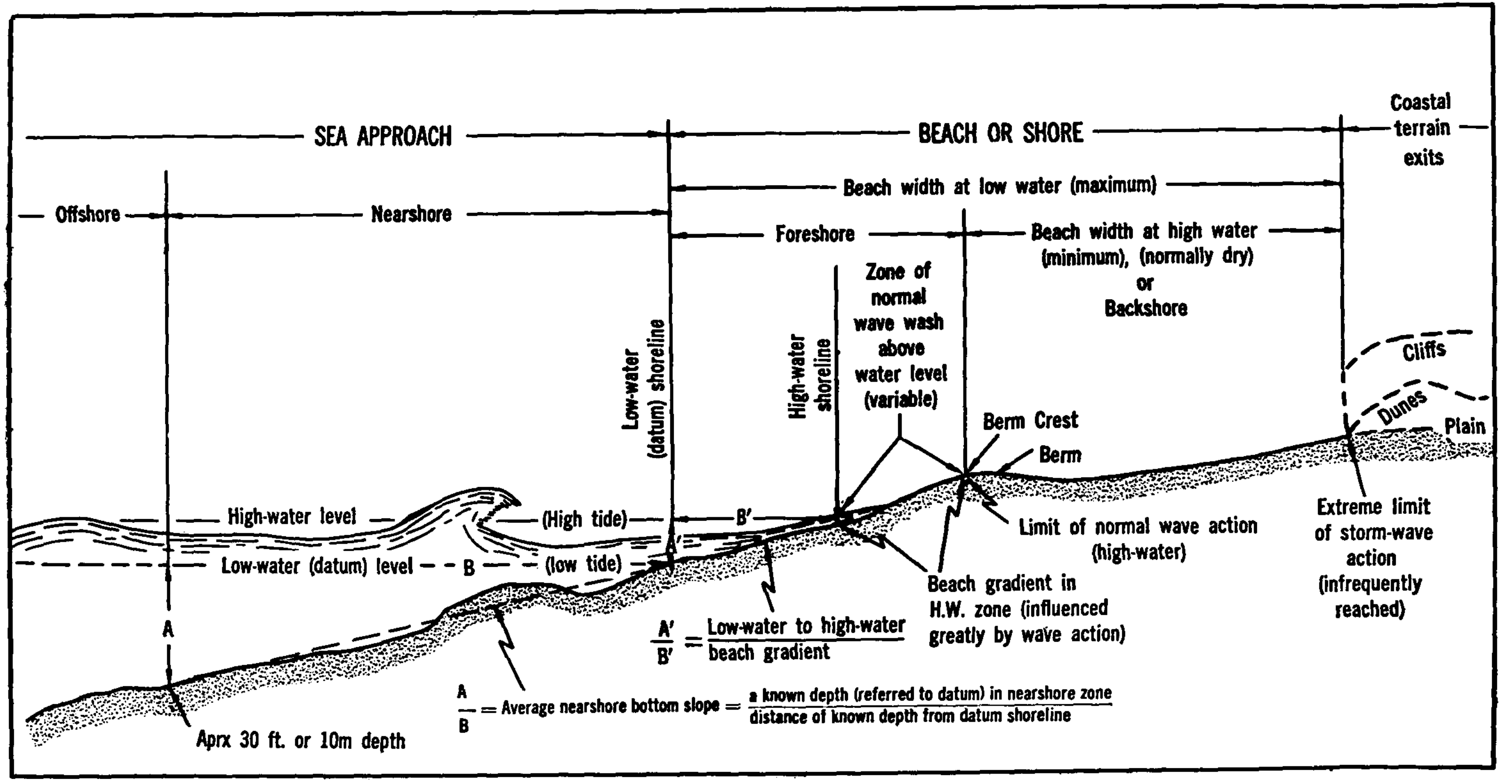


Figure 5.6. General beach profile diagram.

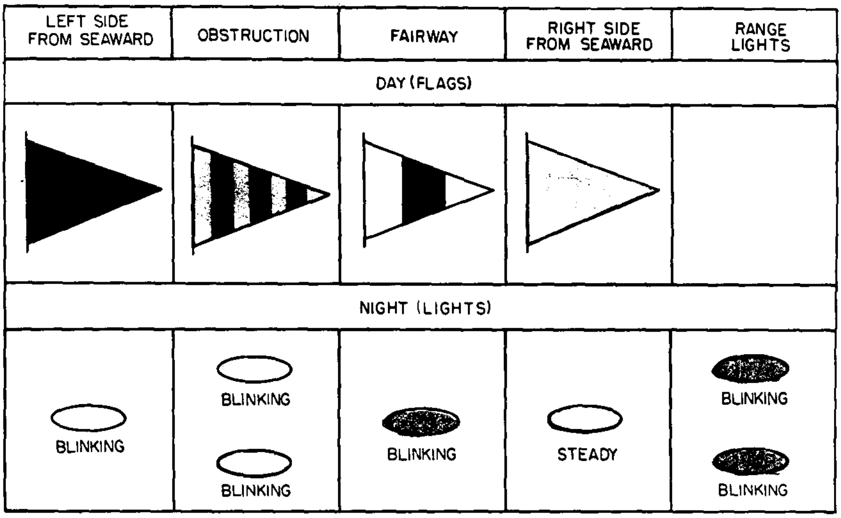


Figure 5.7. Hydrographic markings for landing operations.

(4) Two blinking green lights, one over the other, indicate a range (TM 55–508).

5.38 Beach and Debarkation Point Markers
(fig. 5.8)

a. During the process of beach organization, debarkation points for various categories of supply and equipment are selected on each beach where they best support the tactical plan. Beach markers and debarkation point markers are erected by shore party personnel as soon as possible after the initial assault of an amphibious landing has been made.

b. Beach markers are large pieces of cloth secured to supports and held aloft. Beaches under attack are given a color designation, such as Red Beach, Green Beach, etc., and beach markers are constructed in corresponding colors. The center of a beach is marked by a large square of cloth with the color facing seaward. The left flank of the beach, as seen from the sea, is denoted by a horizontal rectangle of the same color; the right flank is marked by a vertical rectangle, also of the same color. Debarkation point markers are set up to indicate to the craft crews where the various types of cargo are to be landed.

Section IV. ROPE, CHAIN, AND SLING DATA

5.39 Strength of Rope

a. The safe working capacity in tons for any size of manila rope is approximately equal to the square of the diameter in inches if a safety factor of 4 is used. In exceptional cases the rated safe working load

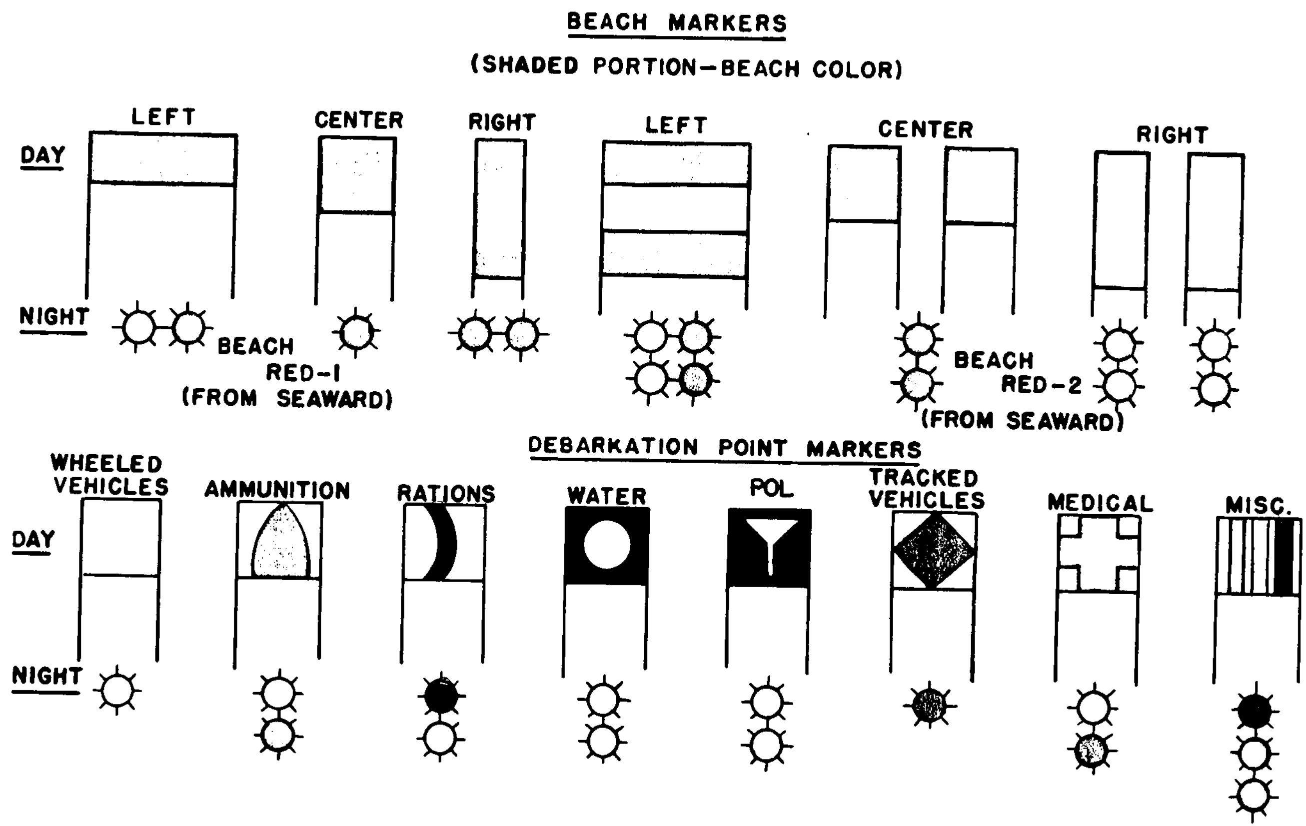


Figure 5.8. Beach and debarkation point markers.

may be exceeded, but under no circumstances should rope be loaded to more than twice its safe working capacity.

b. A rope sling over a hook is reduced in strength by approximately 20 percent. Sharp bends over corners further reduce the strength of the rope. Sand or grit between the fibers or exposure to heat will destroy the fibers and rapidly reduce the strength of the rope.

5.40 Properties of Manila Rope

The following table is for new manila rope used under favorable conditions. As rope ages or deteriorates, progressively reduce safe loads to one-half of values given. To determine the safe working load of sisal rope, deduct one-third from the safe working load of manila rope of the same size.

Nominal diameter (inches)	Circumference (inches)	Weight per 100 feet (pounds)	Breaking strength (pounds)	Safe load (pounds)*
1/4	3/4	2.0	600	150
3/8	1 1/8	4.10	1,350	335
1/2	1 1/2	7.50	2,650	660
5/8	2	13.3	4,400	1,100
3/4	2 1/4	16.7	5,400	1,350
7/8	2 3/4	22.5	7,700	1,920
1	3	27.0	9,000	2,250
1 1/8	3 1/2	36.0	12,000	3,000
1 1/4	3 3/4	41.8	13,500	3,380
1 1/2	4 1/2	60.0	18,500	4,620
1 3/4	5 1/2	89.5	26,500	6,625
2	6	108.0	31,000	7,750
2 1/2	7 1/2	167.0	46,500	11,620
3	9	242.0	64,000	16,000

*Safety factor of 4.

5.41 Knots, Bends, and Hitches

Knots, bends, and hitches used to work lines aboard a vessel and in terminal operations are shown in figure 5.9.

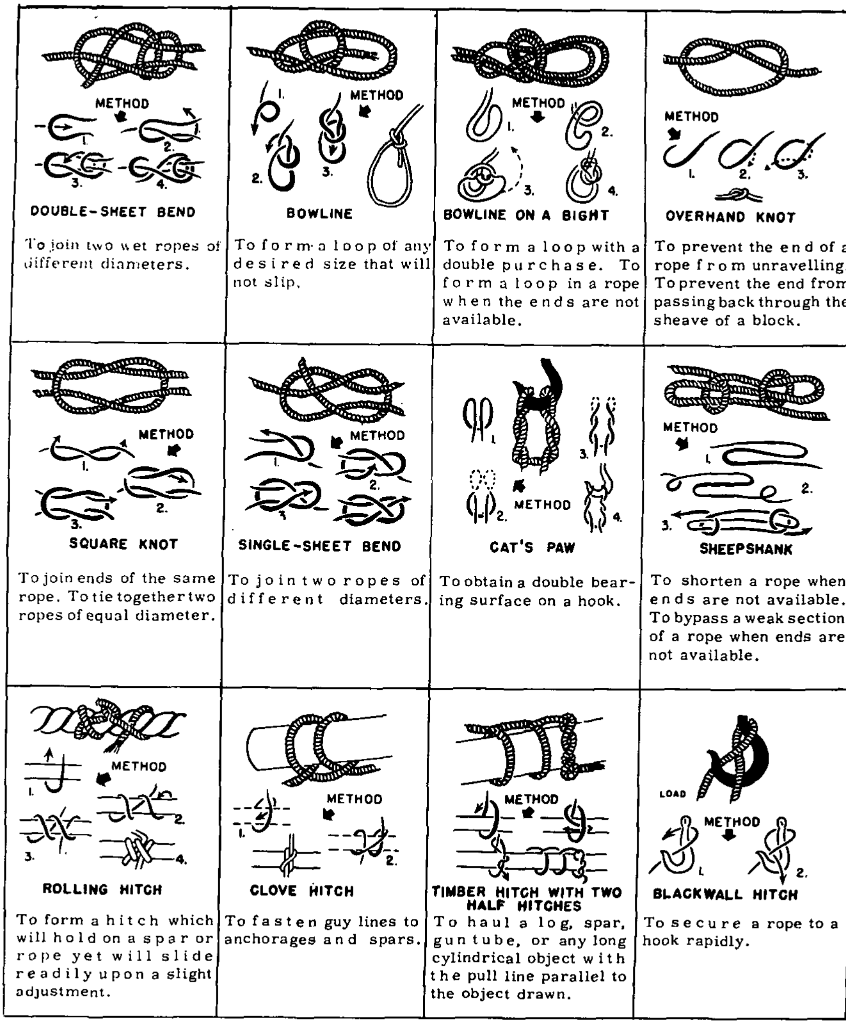


Figure 5.9. Knots, bends, and hitches.

5.42 Breaking Strength of 6 by 19 Standard Wire Hoisting Rope

The following table is for rope of 6 strands of 19 wires each. The strength of wire rope varies slightly with the strand construction and number of strands. The maximum allowable working load is the breaking strength divided by the appropriate safety factor (par. 5.43).

Diameter (inches)	Approximate weight per 100 feet (pounds)	Breaking strength (short tons)		
		Mild plow steel	Plow steel	Improved plow steel
¼	10	2. 07	2. 39	2. 74
⅜	23	4. 6	5. 3	6. 1
½	40	8. 5	9. 4	10. 8
⅝	63	12. 6	14. 4	16. 6
¾	90	18. 0	20. 6	23. 7
⅞	123	24. 3	28. 0	32. 2
1	160	31. 6	36. 5	42. 0
1⅛	203	39. 8	46. 0	53. 0
1¼	250	48. 8	56. 5	65. 0
1½	360	69. 6	80. 5	92. 5

5.43 Wire Rope Safety Factors

Type of service	Minimum safety factor	Type of service	Minimum safety factor
Track cables	3. 2	Haulage ropes	6. 0
Guys	3. 5	Derricks	6. 0
Miscellaneous hoisting equipment.	5. 0	Small electric and air hoists.	7. 0
		Slings	8. 0

5.44 Properties of Chains

Normal size (diameter in inches)	Approximate weight per 100 feet (pounds)	Safe working load			
		Common iron (pounds)	High-grade iron (pounds)	Soft steel (pounds)	Special steel (pounds)
⅜	160	2, 700	2, 980	3, 500	5, 100
7/16	210	3, 460	3, 800	5, 000	6, 600
½	280	4, 500	4, 960	6, 000	8, 200
⅝	430	6, 940	7, 620	9, 000	11, 500
¾	630	10, 140	11, 160	12, 000	16, 200
⅞	840	14, 000	15, 400	20, 250	28, 660
1	1, 100	18, 600	20, 460	24, 900	36, 400

5.45 Safe Working Loads of Slings

The following tables list the safe working loads of rope, chain, and wire rope slings under various lift conditions. The angles in each table are measured from the horizontal.

a. Manila Rope. This table is for standard, three-strand manila rope slings with a splice in each end.

Size		Single rope sling	Double rope sling		
Circumference (inches)	Diameter (inches)	Vertical lift (pounds)	60° angle (pounds)	45° angle (pounds)	30° angle (pounds)
2¼	¾	970	1, 670	1, 370	970
3	1	1, 620	2, 800	2, 290	1, 620
3¾	1¼	2, 430	4, 200	3, 430	2, 430
4½	1½	3, 330	5, 760	4, 700	3, 330

b. Chain Slings. This table is for new wrought iron chains.

Diameter of link stock (inches)	Single sling	Single or double rope sling		
	Vertical lift (pounds)	60° angle (pounds)	45° angle (pounds)	30° angle (pounds)
¼	1, 000	1, 800	1, 500	1, 000
⅜	2, 300	4, 100	3, 300	2, 300
½	4, 200	7, 300	6, 000	4, 200
⅝	6, 600	11, 400	9, 300	6, 660
¾	9, 500	16, 500	13, 500	9, 500

c. Wire Rope. These data are for new improved plow steel wire rope.

Diameter (inches)	Single sling	Single or double rope sling		
	Vertical lift (pounds)	60° angle (pounds)	45° angle (pounds)	30° angle (pounds)
⅜	2, 500	4, 300	3, 600	2, 500
½	4, 300	7, 400	5, 800	4, 300
⅝	6, 600	11, 400	9, 400	6, 600
¾	9, 400	16, 200	13, 000	9, 400
⅞	12, 800	22, 100	17, 400	12, 800
1	16, 000	27, 700	23, 200	16, 000
1⅛	21, 200	36, 700	29, 700	21, 200
1¼	26, 000	45, 000	36, 200	26, 000
1⅜	31, 400	54, 300	43, 500	31, 400
1½	37, 000	64, 000	52, 200	37, 000

5.46 Safe Loads on Hooks

The data in the following table are keyed to figure 5.10.

Diameter of metal *A* (inches)	Inside diameter of eye *B* (inches)	Width of opening *C* (inches)	Length of hook *D* (inches)	Safe load on hook (pounds)
11/16	7/8	1 1/16	4 15/16	1,200
3/4	1	1 1/8	5 13/32	1,400
7/8	1 1/8	1 1/4	6 1/4	2,400
1	1 1/4	1 3/8	6 7/8	3,400
1 1/8	1 3/8	1 1/2	7 5/8	4,200
1 1/4	1 1/2	1 11/16	8 19/32	5,000
1 3/8	1 5/8	1 7/8	9 1/2	6,000
1 1/2	1 3/4	2 1/16	10 11/32	8,000
1 5/8	2	2 1/4	11 27/32	9,400
1 7/8	2 3/8	2 1/2	13 9/32	11,000
2 1/4	2 3/4	3	14 13/16	13,600
2 5/8	3 1/8	3 3/8	16 1/2	17,000
3	3 1/2	4	19 3/4	24,000

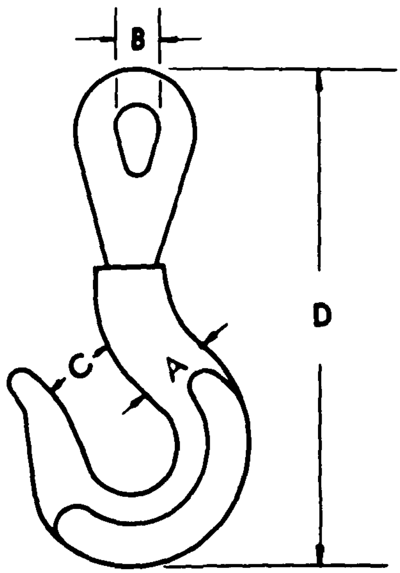


Figure 5.10. Cargo hook: critical dimensions.

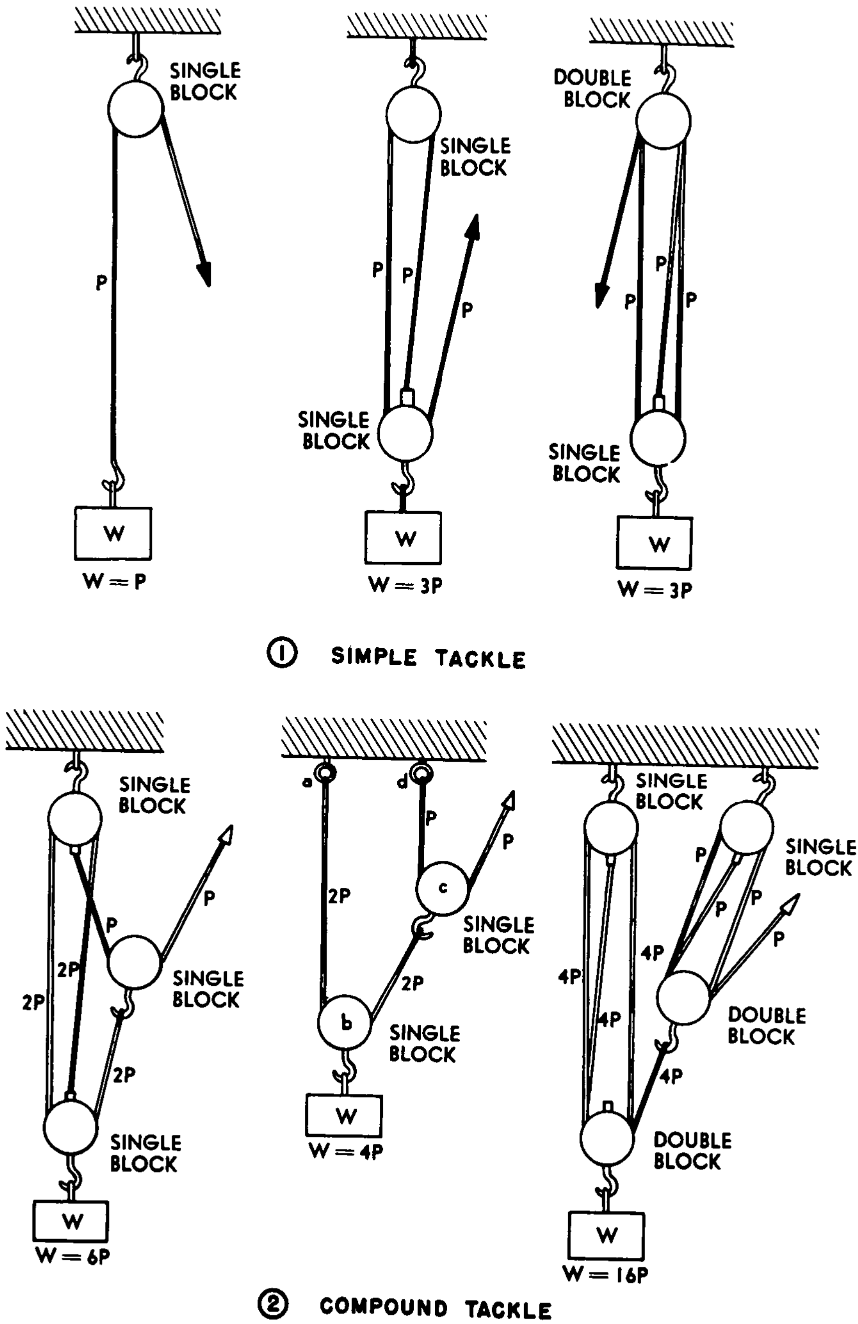


Figure 5.11. Examples of simple and compound tackle.

5.47 Minimum Groove Diameter of Sheaves and Drums

Rope diameter (inches)	Minimum groove diameter in inches for given rope constructions*			
	6x7	6x19	6x37	8x19
1/4	10 1/2	8 1/2		6 1/2
3/8	15 3/4	12 3/4	6 3/4	9 3/4
1/2	21	17	9	13
5/8	26 1/4	21 1/4	11 1/4	16 1/4
3/4	31 1/2	25 1/2	13 1/2	19 1/2
7/8	36 3/4	29 3/4	15 3/4	22 3/4
1	42	34	18	26
1 1/8	47 1/4	38 1/4	20 1/4	29 1/4
1 1/4	52 1/2	42 1/2	22 1/2	32 1/2
1 1/2	63	51	27	39

*Rope construction is in strands times wires per strand.

5.48 Blocks and Tackle

a. Blocks and tackle consist of sheaves (blocks) and ropes arranged so as to obtain a mechanical advantage. As shown in figure 5.11, the force P applied to the lifting end of the rope is much smaller than would be required to lift weight W without using block and tackle. P represents the pull on the rope that supports an equal part of the weight acting on the whole tackle.

b. Figure 5.12 depicts sample block and tackle riggings for manila and wire rope. Single-, double-, and triple-sheave blocks are shown. Numbers on the illustration indicate the number of lines in the rigging.

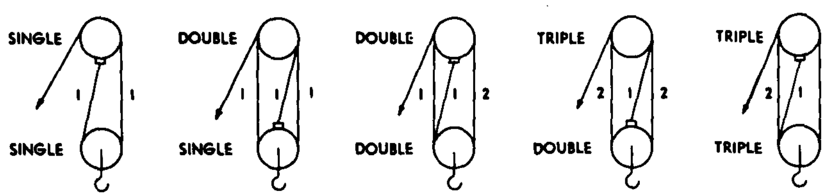


Figure 5.12. Sample block and tackle rigging for manila and wire rope.

(1) *Block and tackle rigging for manila rope.* Permissible rope diameters are for new rope used under favorable conditions and normally with a safety factor of 3. As rope ages or deteriorates, the safety factor must be increased progressively to 8 when determining the size rope to be used. The smallest permissible rope diameter is given in inches and the lead line pull in pounds.

	Total number of sheaves in blocks					Load to be lifted (in tons)
	2 single	1 single, 1 double	2 double	1 double, 1 triple	2 triple	
Rope	1/2	7/16	3/8	3/8	3/8	1/2
Pull	540	380	280	220	185	
Rope	3/4	5/8	1/2	1/2	1/2	1
Pull	1, 100	740	560	445	370	
Rope	7/8	3/4	5/8	5/8	1/2	1 1/2
Pull	1, 600	1, 100	840	670	560	
Rope	1 1/8	7/8	3/4	5/8	5/8	2
Pull	2, 200	1, 500	1, 120	890	745	
Rope	5/16	1 1/8	1	7/8	3/4	3
Pull	3, 300	2, 220	1, 670	1, 330	1, 110	
Rope	1 1/2	1 1/4	1 1/8	1	1	4
Pull	4, 400	2, 960	2, 220	1, 780	1, 480	
Rope	--------	1 1/2	1 5/16	1 1/4	1 1/8	6
Pull	--------	4, 450	3, 330	2, 670	2, 220	
Rope	--------	--------	1 5/8	1 1/2	1 5/16	8
Pull	--------	--------	4, 450	3, 560	2, 970	

(2) *Block and tackle rigging for plow steel wire rope.* Permissible rope diameters are for rope in good condition, and not excessively worn or frayed. A safety factor of 6 is used. The smallest permissible rope diameter is given in inches and the lead line pull in pounds.

	Total number of sheaves in blocks					Load to be lifted (in tons)
	2 single	1 single, 1 double	2 double	1 double, 1 triple	2 triple	
Rope	3/8	3/8	3/8	3/8	3/8	1
Pull	1, 100	740	560	445	370	
Rope	1/2	3/8	3/8	3/8	3/8	2
Pull	2, 200	1, 480	1, 100	880	740	
Rope	5/8	1/2	1/2	3/8	3/8	4
Pull	4, 400	2, 960	2, 200	1, 780	1, 480	
Rope	3/4	5/8	5/8	1/2	1/2	6
Pull	6, 600	4, 440	3, 400	2, 660	2, 220	
Rope	7/8	3/4	5/8	5/8	5/8	8
Pull	8, 900	5, 940	4, 450	3, 560	2, 970	
Rope	1	7/8	3/4	5/8	5/8	10
Pull	11, 100	7, 410	5, 550	4, 450	3, 710	
Rope	1 1/8	1	7/8	3/4	3/4	15
Pull	16, 640	11, 100	8, 350	6, 670	5, 550	
Rope	1 1/2	1 1/8	1	7/8	7/8	20
Pull	22, 200	14, 800	11, 100	8, 900	7, 400	

c. Recommended Sizes of Tackle Blocks. The largest diameter of sheave for a given size of rope is preferred, when available, except that for 6 x 37 (6 strands, each with 37 wires) wire rope, the smallest diameter of sheave indicated below is suitable.

Wire rope		Manila rope	
Rope diameter (inches)	Outside diameter of sheave (inches)	Rope diameter (inches)	Length of block (inches)
3/8	6 to 8	1/2	4
1/2	8 to 10	5/8	6
5/8	10 to 12	3/4	6 to 7
3/4	12 to 16	7/8	7 to 8
7/8	14 to 18	1	8 to 10
1	14 to 20	1 1/8	8 to 10
		1 1/4	10 to 12
		1 1/2	12 to 14
		1 3/4	14 to 16

Section V. TERMS

5.49 Stowage

a. Bale Cubic Capacity. The space available for loading cargo, measured in cubic feet to the inside of the cargo battens on the frames and to the underside of the beams. This measurement is used to compute the space available for general cargo.

b. Broken Stowage. The space lost in the hold because of the contour of the ship and the shape of the cargo containers. A typical well-balanced general cargo vessel will have from 10 to 15 percent broken stowage; a complete load of vehicles will use only 60 to 70 percent of the available cargo space.

c. Grain Cubic Capacity. The maximum space available for cargo measured in cubic feet to the inside of the shell plating and to the underside of the deck plating of a ship. This measurement is used to compute cubic space available for loading bulk commodities.

d. Stowage Factor. The figure that denotes the number of cubic feet required to stow 1 long ton of cargo. This factor is obtained by dividing 2,240 pounds by the weight, in pounds, of a cubic foot of the commodity to be loaded.

5.50 Vessel

a. After Perpendicular. The vertical line through the intersection of the afterside of the sternpost with the load water plane.

b. Base Line. The intersection of the central longitudinal vertical plane of the ship with a horizontal plane through the top of the keel at the midship section. In some cases the keel line and base line are the same.

c. Center of Buoyancy. The center of the molded volume of the vessel below the waterline. It is at the center of gravity of the displaced volume of water. It shifts its position, both vertically and horizontally, as the floating vessel tips. The total upward pressure of the water may be regarded as concentrated through the center of buoyancy, about which it balances. The center of buoyancy and the center of gravity of a ship floating in equilibrium in still water must be in the same vertical line.

d. Down by the Head and Down by the Stern. A vessel is *down by the head* when the bow draft is greater than the stern draft. When the stern draft is greater than the bow draft, the vessel is said to be *down by the stern.*

e. Draft and Draft Marks. Draft marks are 6-inch numerals painted on the bow and stern of a vessel to indicate the depth to which the bow and stern are submerged. The bases of the numerals mark the even foot marks.

f. Drag. When the stern is deeper in the water than the bow, the vessel is said to have a drag. The number of feet that the stern is lower is the amount of drag. (This is not to be confused with design drag.)

g. Forward Perpendicular. The vertical line through the intersection of the forward side of the stem with the load water plane.

h. Freeboard. The vertical distance measured on the vessel's side amidships from the load waterline to the upper side of the freeboard deck or a point corresponding to it.

i. Full and Down. A vessel is said to be full and down when all available cubic space has been utilized (full) and sufficient weight is aboard to submerge the vessel to her legal loadline (down).

j. Hogging. A vessel is said to be hogging when the weight at both the bow and the stern is greater than at the midships section, thus making the vessel tend to arch up or "hog" amidships.

k. Keel Line. The line of the fore and aft member running along the centerline of the ship at its lowest part.

l. Load Waterline (L.W.L.). The line, viewed horizontally, that represents the intersection of the ship's form with the plane of the surface of the water (load water plane) when the ship is floating with her designed load on board.

m. Loadline or Plimsoll Mark. The loadline or Plimsoll mark is placed amidships on the hull of a vessel to denote the maximum draft to which the vessel may be loaded for a particular voyage, depending upon the area to be traveled and the season of the year. The top of the line *AB* in figure 5.13 indicates the summer loadline.

n. Midship Section . The intersection of the ship's form with a transverse vertical plane midway between the forward and after perpendiculars.

o. Sagging. The opposite of hogging. A vessel is said to be sagging when the midships portion has a tendency to sink below the bow and the stern. Sagging is caused by excessive weight amidships and insufficient weight in the bow and stern.

p. Stiff Ship. A ship is said to be "stiff" when it has excessive weight in the lower hold and insufficient weight in the 'tween decks. A stiff ship has a tendency to snap back from a roll in a sudden, jarring manner.

q. Tender Ship. A vessel with excessive weight in the 'tween decks and insufficient weight in the lower hold. A tender ship has a long, slow roll and a tendency to capsize.

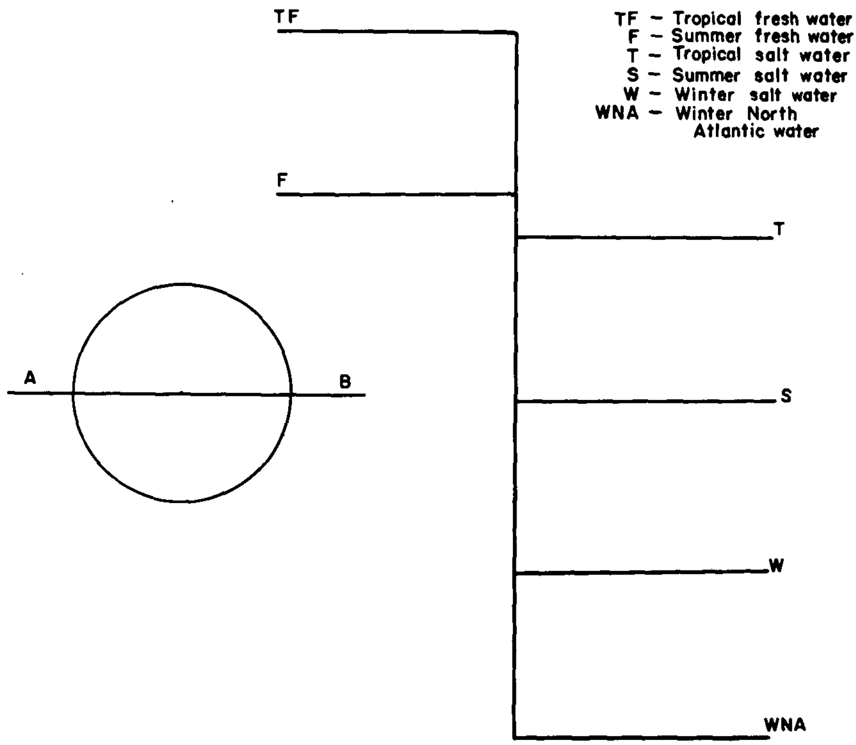


Figure 5.13. Loadline or Plimsoll mark.

5.51 Tonnage

a. Canal Tonnage (Panama or Suez). Derived from formulas of measurement prescribed by the respective canal authorities for the assessment of tolls. Space exemptions allowed are not uniform for the two canals, and, as a consequence, ships must carry a certificate for each.

b. Cargo Deadweight Tonnage. The total cargo and passenger capacity of a ship expressed in long tons. The figure is computed by deducting the weight of the fuel, water, stores, dunnage, and other items necessary for a voyage from the deadweight tonnage of the vessel.

c. Deadweight Tonnage. The carrying capacity of a ship in long tons. It represents the difference between the displacement light and the displacement loaded to the maximum draft allowed by law.

d. Displacement Ton. A unit of weight equal to the volume of a long ton of sea water (35 cu ft). Used in computing the displacement of vessels.

e. Displacement Tonnage, Light. The weight of the ship in long tons excluding cargo, passengers, fuel, water, stores, dunnage, and other items necessary for use on a voyage.

f. Displacement Tonnage, Loaded. The weight of the ship in long tons, including cargo, passengers, fuel, water, stores, dunnage, and such other items as necessary for use on a voyage.

g. Equipment Tonnage. This is the tonnage arrived at from certain dimensions which take into consideration the exposed surfaces of the vessel both above and below water. It very closely approximates the gross tonnage in a vessel of ordinary construction. Equipment tonnage is used primarily to determine the size of anchors, chains, hawsers, and other ship's gear.

h. Gross Ton. A unit of capacity of 100 cubic feet (2.8317 cubic meters) used for ascertaining the legal or registered tonnage of vessels. Also called a *register* or *vessel ton.*

i. Gross Tonnage. The entire internal cubic capacity of a ship expressed in gross tons. Also referred to as gross register tonnage.

j. Long Ton. A unit of weight, 2,240 lb avoirdupois (1016.106 kg), usually divided into 20 hundred-weight (112 lb).

k. Manifest Ton. The unit at which cargo is billed or manifested when the carrier has the option to assess freight charges on the basis of a ton weight, or a ton measurement, whichever affords the greater revenue. Also known as a *revenue ton.*

l. Measurement Ton. A unit of volume for cargo computed at 40 cubic feet. Also called a *freight ton* or *stevadore ton.*

m. Net Tonnage. The payload spaces remaining after deduction from the gross tonnage of space for the crew, powerplant, fuel, and operation of the vessel. Net tonnage is expressed in gross tons, and is sometimes referred to as net register tonnage.

n. Short Ton. A unit of weight of 2,000 lb (907.2 kg).

5.52 Shipping

a. Bareboat Charter. A charter in which the bare ship is chartered without crew; the charterer, for a stipulated sum, taking over the vessel with a minimum of restrictions. Also called demise charter, barepole charter, or barehull charter.

b. Berth Terms. A form of charter under which the carrier is responsible for loading and unloading the cargo; these terms apply almost universally to partial cargoes.

c. Charter Party. An agreement by which a shipowner agrees to place an entire ship, or a part of it, at the disposal of a merchant or other person for the conveyance of goods, binding the shipowner to transport them to a particular place, for a sum of money which the merchant undertakes to pay as freight for their carriage. Sometimes referred to simply as charter. Charters are either time, voyage, or demise (bareboat).

d. Free Alongside Ship (FAS). Trade term which implies that the goods should be placed by the shipper within reach of the ship's tackle in a condition fit for shipment. The exact meaning of the word "alongside" is sometimes determined by the custom of the port, but is generally a pure question of fact.

e. Free In and Out (FIO). A chartering term that means that the owner who charters his ship is responsible for all the usual costs of ship management with the exception of loading and discharging cargo and of putting the vessel in drydock if required to do so by the charterer.

f. Free of Address (FOA). A chartering clause which means that no address charges shall be made on the freight at the port of discharge.

g. Free of Turn. A chartering term which means that a steamer's time will commence to count for loading or discharging from her arrival, whether there is a berth available or not.

h. Free on Board (FOB). A mercantile expression used in sale contracts which denotes that the goods have to be delivered by the shippers on board the vessel at a particular place, free of all charges.

i. Free Time. Chartering term which denotes the duration of time between the moment that the notice of readiness has been handed to the charterers and the beginning of lay days.

j. Freight Forward. A term which denotes that under the transportation agreement freight is payable by the consignee at port of destination. The opposite of *freight prepaid.*

k. Lay Days. Days allowed by charter party for loading and/or discharging cargo.

l. Space Charter. Agreement made between the chartering party and the owner of a vessel which provides that a specified number of cubic feet of shipping space is allocated by means of voyage commitment orders for use on specified voyages from and to designated ports.

Section VI. MISCELLANEOUS

5.53 Approximate Sailing Distances in Nautical Miles

Distance from—	Distance to—						
	Boston	New York	Charleston	New Orleans	Los Angeles	San Francisco	Seattle
Caribbean and South America:							
Argentina, Buenos Aires	5, 800	5, 900	5, 800	6, 300	[a] 8, 300	[a] 8, 700	[a] 9, 600
Brazil, Rio de Janeiro	4, 700	4, 800	4, 700	5, 200	[a] 7, 200	[a] 7, 600	[a] 8, 400
Chile, Valparaiso	[a] 4, 800	[a] 4, 600	[a] 4, 200	[a] 4, 100	4, 800	5, 100	5, 900
Panama, Panama	2, 200	2, 000	1, 600	1, 400	2, 900	3, 200	4, 000
Puerto Rico, San Juan	1, 500	1, 400	1, 100	1, 500	[a] 3, 900	[a] 4, 300	[a] 5, 100
Trinidad, Port of Spain	2, 000	1, 900	1, 700	2, 100	[a] 4, 100	[a] 4, 400	[a] 5, 300
Europe:							
Belgium, Antwerp	3, 200	3, 400	3, 800	4, 800	[a] 7, 700	[a] 8, 000	[a] 8, 800
France:							
Bordeaux	3, 000	3, 200	3, 700	4, 700	[a] 7, 600	[a] 7, 900	[a] 8, 700
Brest	2, 900	3, 100	3, 500	4, 500	[a] 7, 400	[a] 7, 700	[a] 8, 500
Le Havre	3, 000	3, 200	3, 600	4, 600	[a] 7, 500	[a] 7, 800	[a] 8, 600
Norway, Oslo	3, 900	4, 100	4, 400	5, 300	[a] 8, 200	[a] 8, 600	[a] 9, 400
United Kingdom:							
Belfast	2, 900	3, 000	3, 400	4, 400	[a] 7, 200	[a] 7, 500	[a] 8, 300
Liverpool	3, 000	3, 200	3, 700	4, 700	[a] 7, 600	[a] 7, 900	[a] 8, 700
Southhampton	3, 000	3, 200	3, 600	4, 600	[a] 7, 500	[a] 7, 800	[a] 8, 600
Far East:							
China, Shanghai	[a] 10, 800	[a] 10, 600	[a] 10, 800	[a] 10, 000	5, 700	5, 400	5, 100
Formosa, Keelung	[a] 10, 932	[a] 10, 750	[a] 10, 339	[a] 10, 176	5, 858	5, 570	5, 310
Hong Kong	[a] 11, 400	[a] 11, 200	[a] 10, 800	[a] 10, 600	6, 400	6, 000	5, 700
Japan, Yokohoma	[a] 9, 900	[a] 9, 600	[a] 9, 500	[a] 9, 100	4, 800	4, 500	4, 200
Korea, Pusan	[a] 10, 547	[a] 10, 365	[a] 9, 954	[a] 9, 791	5, 229	4, 914	4, 649

India-Burma-Pakistan:							
Burma, Rangoon	[b] 9, 600	[b] 9, 800	[b] 10, 200	[b] 11, 200	9, 000	8, 600	8, 200
					[a] [b] 13, 900	[a] [b] 14, 200	[a] [b] 15, 000
India:							
Bombay	[b] 8, 000	[b] 8, 200	[b] 8, 600	[b] 9, 500	[a] [b] 12, 200	[a] [b] 12, 600	[a] [b] 13, 400
					10, 300	9, 800	9, 500
Calcutta	[b] 9, 600	[b] 9, 800	[b] 10, 200	[b] 11, 200	[a] [b] 13, 900	[a] [b] 14, 200	[a] [b] 15, 000
					9, 500	9, 000	8, 700
Pakistan, Karachi	[b] 7, 800	[b] 8, 200	[b] 8, 400	[b] 9, 300	10, 700	10, 200	9, 900
					[a] 12, 000	[a] 12, 400	[a] 13, 200
Mediterranean:							
Algeria, Algiers	[b] 3, 400	[b] 3, 600	[b] 4, 000	[b] 5, 000	[a] [b] 7, 700	[a] [b] 8, 000	[a] [b] 8, 800
France, Marseilles	[b] 3, 700	[b] 3, 900	[b] 4, 300	[b] 5, 300	[a] [b] 8, 000	[a] [b] 8, 200	[a] [b] 9, 000
Greece, Piraeus	[b] 4, 500	[b] 4, 700	[b] 5, 100	[b] 6, 100	[a] [b] 7, 800	[a] [b] 8, 100	[a] [b] 8, 900
Italy:							
Leghorn	[b] 3, 900	[b] 4, 100	[b] 4, 500	[b] 5, 500	[a] [b] 8, 200	[a] [b] 8, 400	[a] [b] 9, 200
Naples	[b] 4, 000	[b] 4, 200	[b] 4, 600	[b] 5, 600	[a] [b] 8, 300	[a] [b] 8, 500	[a] [b] 9, 300
Lebanon, Tripoli	[b] 4, 100	[b] 4, 300	[b] 4, 700	[b] 5, 700	[a] [b] 8, 400	[a] [b] 8, 600	[a] [b] 9, 400
Strait of Gibraltar	3, 000	3, 200	3, 600	4, 600	[a] 7, 300	[a] 7, 500	[a] 8, 300
Middle East:							
Aden	[b] 6, 300	[b] 6, 500	[b] 6, 900	[b] 7, 900	[a] 10, 600	[a] 10, 900	[a] 11, 700
Egypt, Port Said	[b] 4, 900	[b] 5, 110	[b] 5, 500	[b] 6, 500	[a] 9, 200	[a] 9, 500	[a] 10, 300
Iraq, Basra	[b] 8, 300	[b] 8, 500	[b] 8, 900	[b] 9, 800	[a] 12, 600	[a] 12, 900	[a] 13, 700
Turkey, Istanbul	[b] 4, 800	[b] 5, 000	[b] 5, 400	[b] 6, 400	[a] 9, 100	[a] 9, 400	[a] 10, 200
Middle Pacific:							
Hawaii, Honolulu	[a] 6, 900	[a] 6, 700	[a] 6, 300	[a] 6, 100	2, 200	2, 100	2, 400
Marianas Islands, Guam	[a] 10, 200	[a] 10, 000	[a] 9, 600	[a] 9, 400	5, 600	5, 100	4, 900
Marshall Islands, Kwajalein	[a] 9, 200	[a] 9, 000	[a] 8, 600	[a] 8, 400	4, 200	4, 410	4, 500
North Atlantic:							
Bermuda, Hamilton	700	700	800	1, 700	[a] 4, 600	[a] 4, 900	[a] 5, 800
Greenland, Ivigtut	1, 700	1, 900	2, 400	3, 400	[a] 6, 500	[a] 6, 800	[a] 7, 600
Iceland, Reykjavik	2, 300	2, 500	3, 000	4, 000	[a] 7, 100	[a] 7, 400	[a] 8, 200
Newfoundland, St. Johns	900	1, 100	1, 700	2, 600	[a] 5, 700	[a] 6, 000	[a] 6, 800

See footnotes at end of table.

Distance from—	Distance to—						
	Boston	New York	Charleston	New Orleans	Los Angeles	San Francisco	Seattle
North Pacific:							
Alaska, Dutch Harbor	[a] 7, 400	[a] 7, 300	[a] 6, 900	[a] 6, 700	2, 400	2, 100	1, 700
Southwest Pacific:							
Australia:							
Brisbane	[a] 9, 900	[a] 9, 600	[a] 9, 300	[a] 9, 100	6, 300	6, 200	6, 500
Melbourne	[a] 10, 100	[a] 9, 900	[a] 9, 500	[a] 9, 400	7, 000	7, 000	7, 300
Indonesia, Djakarta	[b] 10, 200	[b] 10, 400	[b] 10, 800	[a] 12, 000 [b] 11, 800	8, 100	7, 600	7, 300
Malaya, Singapore	[b] 9, 900	[b] 10, 100	[b] 10, 500	[b] 11, 500	7, 900	7, 500	7, 100
New Guinea, Finschafen	[a] 10, 200	[a] 10, 000	[a] 9, 600	[a] 9, 400	6, 100	5, 900	6, 000
Philippines, Manila	[a] 11, 600	[a] 11, 300	[a] 11, 000	[a] 10, 800	6, 600	6, 300	6, 100
Union of Soviet Socialist Republics:							
Archangel	4, 000	4, 200	4, 800	5, 800	[a] 8, 800	[a] 9, 200	[a] 10, 000
Murmansk	3, 700	3, 800	4, 400	5, 400	[a] 8, 500	[a] 8, 900	[a] 9, 700
Vladivostok	[a] 9, 500	[a] 9, 300	[a] 8, 900	[a] 8, 700	5, 000	4, 600	4, 400
United States:							
Boston		200	900	2, 000	[a] 5, 100	[a] 5, 400	[a] 6, 200
Charleston	900	600		1, 200	[a] 4, 500	[a] 4, 900	[a] 5, 600
Los Angeles	[a] 5, 100	[a] 4, 900	[a] 4, 500	[a] 4, 300		400	1, 100
New Orleans	2, 000	1, 700	1, 200		[a] 4, 300	[a] 4, 700	[a] 5, 500
New York	200		600	1, 700	[a] 4, 900	[a] 5, 300	[a] 6, 000
San Francisco	[a] 5, 400	[a] 5, 300	[a] 4, 900	[a] 4, 700	400		800
Seattle	[a] 6, 200	[a] 6, 000	[a] 5, 600	[a] 5, 500	1, 100	800	

[a] Via Panama Canal.
[b] Strait of Gibraltar.

5.54 United States Buoyage System

(fig. 5.14)

a. Buoys are wooden or metal floats of various shapes, sizes, and colors anchored to the bottom of harbors, bays, rivers, and channels. They are the road markers of the sea. The primary function of a buoy is to warn the mariner of some danger, obstruction, or change in the contours of the sea bottom, and to delineate the channels leading to various points, so that he may avoid the dangers and continue his course safely. The different types of buoys are identified by size, shape, coloring, numbering, and the signaling devices with which they are equipped. They are marked on charts so that the mariner can plot his course to avoid the potential hazards indicated.

b. The buoyage system used in United States waters employs a simple arrangement of colors, shapes, numbers, and light characteristics to show the side on which a buoy should be passed when proceeding in a given direction. The characteristics are determined by the position of the buoy with respect to the navigable channels as the channels are entered from seaward. As all channels do not lead from seaward, arbitrary assumptions have been applied at times in order to keep the system consistent, and the operator should consult the aids shown on his chart to determine the seaward direction of a channel. The principal types of buoys are described below:

(1) Spar buoys are usually large logs, trimmed, and appropriately painted; they are also constructed of steel plates, joined to form a slim cylinder. The shape of spar buoys has no significance: they are used for any purpose. Coloring reveals the particular meaning of the buoy.

(2) Can buoys are constructed of steel plates and their shape is similar to that of an ordinary tin can. They are normally used to designate the port side (entering from seaward), but they may be used to mark the middle of a channel, a junction, or an obstruction. Color indicates the particular meaning. Can buoys are never used on the starboard side of a channel.

(3) Nun buoys are also constructed of steel plates and have a conical top. They are normally used to mark the starboard side of the channel, but may also be used for mid-channel, junction, or obstruction marking; the color denotes the particular purpose. Nun buoys are never used on the port side of a channel.

(4) Lighted buoys are metal floats on which are mounted short skeleton towers with a lantern at the top. They have no shape significance; their purpose is indicated by color.

(5) Bell buoys, gong buoys, and whistle buoys are metal floats with sound equipment installed. No special significance is attached to their shapes.

c. All United States buoys are painted with distinctive colors to indicate their purpose or the side on which they should be passed when entering from seaward.

(1) Black buoys mark the port side of a channel, or the location of obstructions which must be passed by keeping the buoy on the portside of the vessel when entering from seaward. They display white or green lights at night.

(2) Red buoys mark the starboard side of a channel, or the location of obstructions which must be passed by keeping the buoy on the starboard side. They display white or red lights at night.

(3) Red and black horizontally banded buoys mark junctions in the channel or obstructions which may be passed on either side. If the topmost band is black, the preferred channel will be followed by keeping the buoy on the port side when proceeding from seaward; if the topmost band is red, the preferred channel will be followed by keeping the buoy on the starboard side. They may have white, red, or green lights.

(4) Black and white vertically striped buoys mark the fairway or midchannel, and should be passed close to, on either side. They display a white light at night.

(5) Special-purpose buoys have distinctive colors and are usually spar buoys. They reveal the locations of anchorage areas, dredging operations, etc.

(6) Buoys used on the Intracoastal Waterway are similar to the preceding ones, but are characterized by a yellow border, and are discussed and illustrated in CG–193.

(7) Some mariners use the expression "red right returning" to keep in mind the proper position of these buoys in relation to their vessels.

d. Buoys indicating the starboard side are marked with even numbers; those indicating the port side are marked with odd numbers. Midchannel, junction, and special-purpose buoys are not numbered, but may be lettered for identification. An example is the East Rockaway Inlet Bell Buoy, which carries black and white vertical stripes and the letters ER—ER standing for the station name.

e. Usually only buoys in key spots have lights; some unlighted buoys have reflectors which may be white, red, or green, and have the same significance as lights of the same colors. Black buoys have green or white lights; red ones have red or white lights. Midchannel buoys use white only, while obstruction (junction) buoys use the appropriate color to reveal the preferred channel. Channel buoy lights are usually slow flashing (not over 30 flashes per minute). If they mark important turns or dangerous areas, they will be quick flashing with 60 or more flashes per minute. Red and black horizontally banded buoys have interrupted quick flashing lights—a series of quick flashes with dark intervals of about 4 seconds between series. Midchannel buoys have short-long flashing lights—groups consisting of a short flash and a long flash repeated at the rate of about eight per minute.

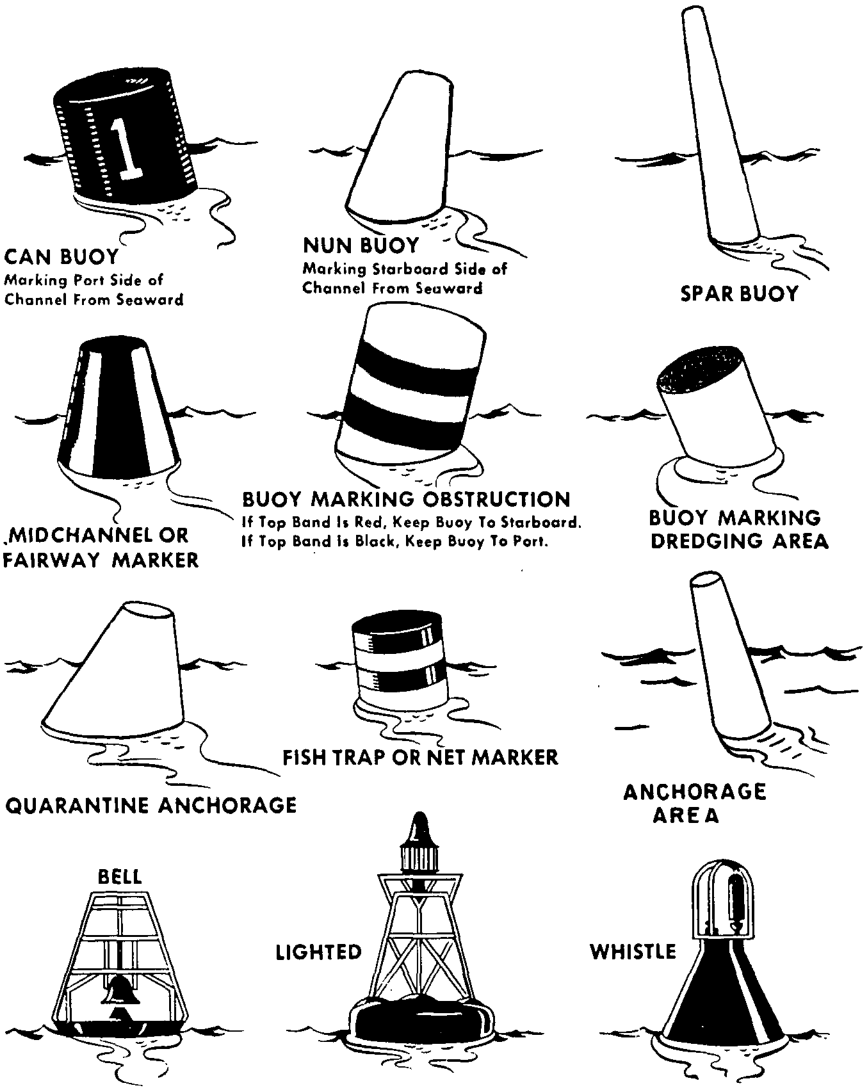


Figure 5.14. Buoyage system used in United States waters.

5.55 Storm Warning Signals
(fig. 5.15)

a. Small Craft Warning. One red pennant displayed by day or a red light over a white light at night indicates winds up to 38 miles an hour (33 knots) and/or sea conditions dangerous to small craft operations.

b. Gale Warning. Two red pennants displayed by day or a white light above a red light at night indicate winds ranging from 39 to 54 miles an hour (34 to 48 knots).

c. Whole Gale Warning. A single square red flag with a black center displayed during daytime or two red lights at night indicate winds ranging from 55 to 73 miles an hour (48 to 63 knots).

d. Hurricane Warning. Two square red flags with black centers displayed by day or a white light between two red lights at night indicate winds 74 miles per hour (64 knots) and above.

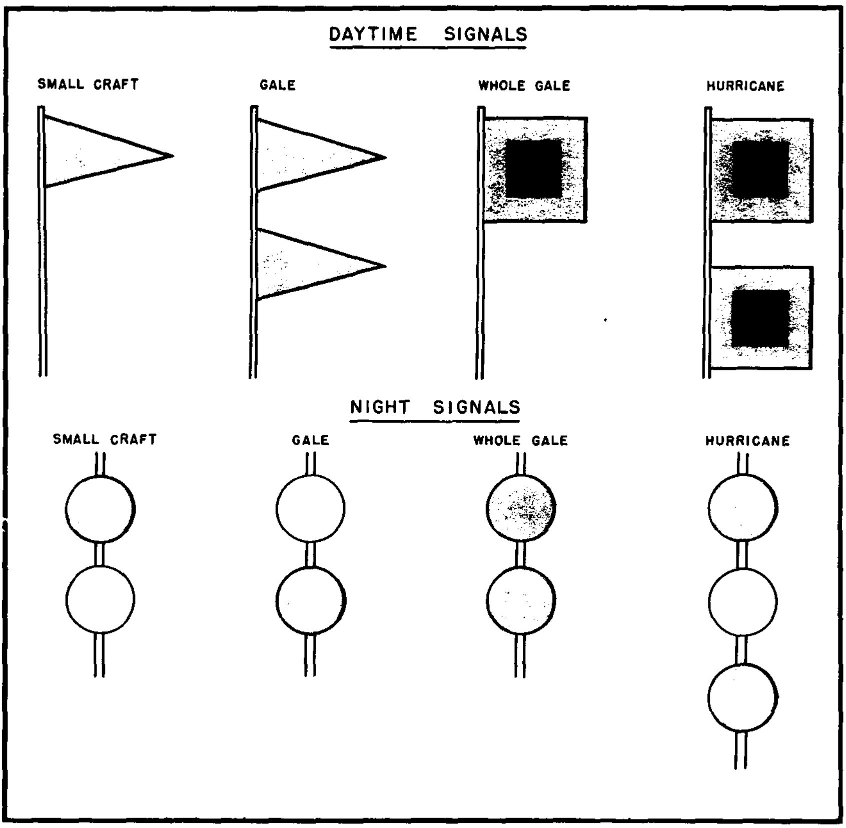


Figure 5.15. Storm warning signals.

CHAPTER 6
PLANNING

The formats included in this chapter are to be used as guides, and normally will apply only in the initial stages of planning. For more detailed information, see FM 101–5.

Section I. ORDERS AND STANDING OPERATING PROCEDURES

6.1 Operation Order

COPY No.______________
Issuing headquarters
Place of issue (may be in code)
Date-time group of signature
Message reference number

Operation order: Type and serial number (note 1).
References: Maps, charts, and relevant documents.
Time zone: Used throughout the order; if necessary, omit.
Task organization: List here, when appropriate, the task subdivisions or tactical components which will make up the command, together with the names and ranks of the commanders. When a task organization is not listed, this information is included in paragraph 3 or in an annex.

1. SITUATION. Such information of the general overall situation as may be essential for subordinates to understand the current situation.

a. Enemy forces. Composition, disposition, location, movements, estimated strength, identifications, and capabilities.

b. Friendly forces. Pertinent information of own forces, other than those covered by the operation order, which may directly affect the action of a subordinate.

c. Attachments and detachments. When not shown under task organization, list here units attached to or detached from the issuing unit together with the time they are effective. When shown under task organizations, list here an appropriate reference.

2. MISSION. A clear, concise statement of the task which is to be accomplished by the commander and its purpose.
3. EXECUTION. In the first subparagraph give the concept of the operation (note 2). In separate lettered subparagraphs give the specific tasks of each element of the command charged with

the execution of tactical duties, including the organization for combat if not already given under task organization. In the final subparagraph titled "Coordinating instructions," give details of coordination and control measures applicable to the command as a whole and instructions applicable to two or more elements which are necessary for coordination or the general conduct of the operation, the repetition of which in the other subparagraphs of paragraph 3 would be cumbersome.

4. ADMINISTRATION AND LOGISTICS. A statement of pertinent administrative instructions and the way administrative support is to be provided for the operation, including the allocation of critical supply items, such as nuclear weapons. If an administrative order is in effect or is being issued separately, make reference to it. Include such subparagraphs as are required and follow the sequence of the administrative order.
5. COMMAND AND SIGNAL. Instructions concerning signal and command, including reference to a standard plan or annex—rendezvous, location, and movements of commander and command posts, statement of command relationship, axis of signal communication recognition and identification instructions, electronic policy, code words, code names, and liaison, as appropriate. Acknowledgment instructions.

____
Commander

Annexes
Distribution
Authentication

Notes: 1. The type of operation order is usually indicated in combined or joint operations. Within a single service, the type of operation order is normally omitted. When required, a code title may also be included.

2. The concept of operation includes the commander's general plan for development and phasing of the operation, use of fire support means available, instructions on preparatory fires, and designation of the unit making the main effort in those operations where appropriate.

6.2 Logistics Annex to Operation Order

COPY No. ____________
Headquarters
Place
Date and time
Message reference number

Annex ________ (logistics) to Operation Plan ________

References: Maps, charts, and relevant documents.

1. GENERAL SITUATION. Such information of the overall situation as may be essential to the understanding of the logistical plan.

a. Enemy forces. Pertinent information regarding composition, disposition, location, movements, estimated strengths, identifications, and capabilities.

b. Friendly forces. Pertinent information on the responsibilities of commanders of friendly forces which has a bearing on the logistical plan.

c. Attachments and detachments. List here units attached to or detached from the issuing unit, together with the times attachments are effective.

d. Assumptions. Assumptions used as a basis for this plan; normally applicable only to higher planning echelons.

2. MISSION. A clear, concise statement of the task which is to be accomplished by the command and its purpose.
3. TASKS FOR SUBORDINATE UNITS. In separate lettered subparagraphs, give the specific task or responsibility of each subordinate command.
4. MATERIEL AND SERVICES.

a. Supply.

(1) *Installations.* Instructions to installation commanders about missions; issue and collection of supplies and material; locations of installations, and when applicable, time of opening or closing; operating units; supported units; stocks and levels; credits; and type of storage.

(2) *Requirement.* General statement about tonnage requirements, levels of supply to be achieved during different periods, and special information on certain items, such as water supply in an area where water is scarce.

(3) *Requisition and procurement.* Information on requisitioning and on local procurement where applicable.

(4) *Distribution.* Instructions about receipts, shipments, and issues.

(5) *Civilian supplies.* Instructions for issuing supplies to civilians.

(6) *Salvage.* Instructions on collection, classification, and disposition of salvage.

(7) *Captured supplies.* Instructions on reports, collection, segregation, and disposition of captured materials.

(8) *Responsibilities.*

b. Transportation.

(1) *General.* General information on policies.

(2) *Highways.* Traffic regulation and control.

(3) *Rail.* Locations, facilities, and restrictions on use.

(4) *Water.* Ports and beaches in use and to be placed in use; facilities and restrictions on shipping. (Separate subparagraphs for ocean, coastal, and inland waterways.)

(5) *Pipelines.* Locations, sizes, capacities, and restrictions.

(6) *Air.* Policies, airfields, and capacities available.

(7) *Transportation movements.* Instructions for management of the movement capability.

(8) *Responsibilities.*

c. Services.

(1) *Organization.* Changes in composition of service groups, trains, and depots, and bivouacs and movement of unit trains. Include assignment or attachment of service units to subordinate units or commands.

(2) *Technical services.* List under each subparagraph pertinent service installations, stating location, operating units, and assignments to supported units. In addition, special missions, priorities, schedules, and limitations not covered in other orders may be assigned to service units in these subparagraphs. In some cases the subject technical services may be divided more simply by types (maintenance, construction, utilities, and real estate).

(*a*) *Chemical.* Decontamination, impregnation, and maintenance.

(*b*) *Engineer.* Construction, fire fighting, maintenance, procurement, real estate, reproduction, and utilities.

(*c*) *Medical.* Medical, dental, and veterinary service; laboratory service, spectacle service; special hospitalization, preventive medicine, health, and sanitation.

(*d*) *Ordnance.* Bomb disposal, inspection, maintenance, procurement, and waterproofing.

(*e*) *Quartermaster.* Bathing and fumigation, labor, laundry maintenance, personal effects service, procurement sales, remount service, and responsibility for salvage.

(*f*) *Signal.* Signal communication service, construction photography, and maintenance.

(*g*) *Transportation.* Procurement, supply, and maintenance, including Army aviation.

(3) *Labor.* Policies pertaining to the use, restriction, and priorities for use of civilian (U.S. and non-U.S.) and prisoner-of-war personnel are included in this paragraph.

5. MEDICAL: EVACUATION AND HOSPITALIZATION.

a. Evacuation. List dispensaries and clearing stations, when indicated, stating opposite each its location, time of opening or closing, operating units, and units supported. Policies, estimated rates, and channels for evacuation of injured, sick and wounded. Cover personnel, including prisoners of war and civilians.

b. Hospitalization. General instructions, policies, locations, and capacities of hospitals. Cover all personnel, including prisoners of war and civilians.

c. Responsibilities.

6. MISCELLANEOUS.

a. Boundaries. Locations—present and proposed.

b. Headquarters. Locations of headquarters and instructions for movement if required.

c. Security. Instructions, protection and defense of installations, and priorities for protection of installations and facilities.

d. Reports. Types of reports required, time due, and subject matter covered.

e. Conservation of supplies. General instructions to all commanders to insure safeguarding, utilization, and maintenance of supplies to impress troops with the necessity for conservation.

f. Effective date of plan.

g. Responsibilities.

Acknowledgment instructions.

____
Commander

Appendixes
Distribution
Authentication

6.3 Administrative Order

(See FM 101–5.) (Subparagraphs not pertinent should be omitted.)

CLASSIFICATION

COPY No. __________
Issuing headquarters
Place of issue
Date-time group of signature
Message reference number

Administrative order: Type and serial number.
References: Maps, charts, and relevant documents.
Time zone: Used throughout the order; if unnecessary, omit.

1. GENERAL. This paragraph should include an outline of the administrative plan; any orders that are not suitably covered by succeeding paragraphs, e.g., location of administrative area in a divisional order (may be issued as an annex or overlay); and traffic circulation plan (may be issued as an annex or overlay).
2. MATERIEL AND SERVICES. This paragraph should include supplies (normal daily requirements) listed either by types of supply or by branches of service, transport, transportation services, repair and recovery (maintenance), construction, other services, allocation of labor, etc., in the order suitable to the staff procedures of the army concerned.

a. Supply. List installations concerned with the issue and collection of supplies and material, stating opposite each the location and, where applicable, time of opening or closing, operating units, supported units, stocks and levels, and credits. Also when pertinent, give instructions about submission of nonroutine reports or temporary changes regarding the submission of routine reports concerning the particular supplies listed; the removal, collection, and disposition of, and reports concerning excess, salvage, and captured supplies; overall levels of supply; and methods or schedules of supply distribution. Use one of the following methods or a combination thereof to organize the contents:

Class of supply	*Branch of supply*	*Type of installations*
(1) Class I	(1) Chemical	(1) General depot
(2) Class II	(2) Engineer	(2) Branch depot
(3) Class III	(3) Medical	(3) Supply point
(4) Class IV	(4) Ordnance	(4) Railhead
(5) Class V	(5) Quartermaster	(5) Truckhead
(6) Maps	(6) Signal	(6) Miscellaneous
(7) Water	(7) Transportation	
(8) Special	(8) Miscellâneous	
(9) Excess		
(10) Salvage		
(11) Captured materiel		

b. Transportation. For each pertinent item state terminals and installations (rail stations, airfields, ports, and beaches), operating units, schedules (march tables, time tables, and entraining tables), control measures (traffic regulation and control, allocations, priorities, restrictions, route markings, and regulating points). Items listed in this subparagraph cover the entire transportation field and are not necessarily restricted to Transportation Corps operations.

(1) Ocean
(2) Inland waterway
(3) Coastal
(4) Motor
(5) Rail
(6) Pipeline
(7) Air
(8) Miscellaneous

c. Services.

(1) *Organization.* Changes in composition of service groups, trains, and depots; location of bivouac areas and movement of unit trains. Include assignment or attachment of service units to subordinate units or commands.

(2) *Technical services.* List under each subparagraph pertinent service installations, stating location, operating units, and assignments to supported units. In addition, special missions not covered in other orders may be assigned to service units in these subparagraphs.

(*a*) Chemical
(*b*) Engineer
(*c*) Medical
(*d*) Ordnance
(*e*) Quartermaster
(*f*) Signal
(*g*) Transportation

d. Labor. Policies pertaining to the use, restriction, and priorities for use of civilian (non-U.S. and U.S.) and prisoner-of-war personnel are included in this paragraph.

3. MEDICAL: EVACUATION AND HOSPITALIZATION.

a. Evacuation. List dispensaries, collecting stations, and clearing stations, when indicated, stating opposite each its location, time of opening or closing, operating units, and units supported. State routes, means and schedules of evacuation, responsibilities therefor, and evacuation and treatment policies.

b. Hospitalization. List hospitals (evacuation, station, general, field, convalescent), giving for each the location, time of opening or closing, and units supported.

4. PERSONNEL. Include personnel matters such as reporting procedures, replacements, discipline, prisoners of war, provost, burials, morale, welfare, civilian employees, etc., in the order suitable to the staff procedures of the headquarters concerned. List under each subparagraph or specific personnel activity the following when applicable: the operating installation, service, or depot, with location and hour and date of opening or closing, where pertinent; the units operating the installation; attachment or assignment of operating personnel; the units or areas served; credits or quotas allocated to units; unit responsibility for movement or administration of personnel; reports required; requisitions or plans concerning personnel activities; references to previous orders, instructions, or standing operating procedure when necessary.

a. Strengths. Pertinent instructions for data of interest to the commander.

b. Replacements. Requirements, present and anticipated; requisitioning; allocating; processing and moving replacements; the location and stockage of replacement units; and location of unit replacements.

c. Discipline, law, and order. Troop conduct and appearance, control and disposition of stragglers, administration of military justice, and relations with civilians.

d. Prisoners of war. Collection, safeguarding, processing, evacuation, utilization, treatment, and discipline.

e. Recovery and disposition of remains. Cemeteries, evacuation, personal effects, and ceremonies.

f. Morale and personnel services.

(1) *Morale.*

(2) *Personnel services.* Leaves, rest and recreational facilities, decorations and awards, postal and finance services, religious activities, personal hygiene, special service activities, Army exchanges, welfare activities, and legal assistance.

g. Personnel procedures. Classification, assignment, promotion, transfer, reclassification, demotion, elimination, retirement, separation, training, rotation, and personnel economies.

h. Interior management. Movement, internal arrangement, organization, and operation of the headquarters; allocation of shelter in the headquarters area for troops and for the headquarters.

i. Civilian personnel. Sources, procurement, utilization, administration, control, relation to military government, and relation to troops.

j. Miscellaneous. Personnel matters not specifically assigned to another general staff section.

5. CIVIL AFFAIRS. Covers the allocation of civil affairs detachments, control of refugees, and feeding and treatment of civil population.
   - a. *Governmental affairs.*
     - (1) *Public safety.* Proclamations, laws, ordinances, notices, directives; custody of arms and war implements; communications equipment; maintenance of civilian law and order; controls.
     - (2) *Civil information.* Safeguarding, use, and control of civil information media.
     - (3) *Fine arts, monuments, archives.* Protection and control.
     - (4) *Legal.* Control of courts and legal instruments, safeguarding of court records and archives; court jurisdiction.
     - (5) *Education.* Care, preservation, and control.
     - (6) *Civil administration.* Establishment of proclamations, laws, directives, notices, and necessary control.
     - (7) *Public finance.* Safeguarding and control.
     - (8) *Property control.* Safeguarding and control.
   - b. *Civil relief and supply.*
     - (1) *Public health and welfare.* Maintenance of civilian health and welfare institutions; health supplies; burial of civilian dead; rehabilitation of water supply, public utilities, and sanitation.
     - (2) *Displaced persons—refugees.* Organization of centers, collecting, rationing, medical and other supply, census.
     - (3) *Civilian supply.* Requisitions for emergency supplies, report of excess stocks for civilian supply, continuance of activities.
     - (4) *Civilian evacuation.* Measures, controls.
     - (5) *Local resources.* Use, control, etc.
   - c. *Economics and natural resources.*
     - (1) *Public works, utilities, communications, and housing.* Rehabilitation, requisitioning, safeguarding, restrictions, continuance.
     - (2) *Labor.* Recruitment and control of civilian labor.
     - (3) *Trade and industry.* Protection, use, and control.

(4) *Food and agriculture.* Safeguarding, surveys, requisition, supply, and continuation of activities.
(5) *Price control and rationing.* Continuance, establishment, prevention of hoarding and black marketing; control of requisitions and purchases by the military.
(6) *Natural resources.* Preservation and control.
(7) *Transportation.* Rehabilitation, continuance, control, use.

d. Miscellaneous. Instructions, measures, troop indoctrination, etc.

6. MISCELLANEOUS. Any special instructions not covered above, e.g., headquarters, protection, special reports called for, and other administrative and logistical matters.
   a. Boundaries.
   b. Headquarters.
   c. Protection.
   d. Special reports called for.
   e. Other administrative matters.

Acknowledgment instructions.

____
Commander

Annexes
Distribution
Authentication

Note. Type of administrative order is usually indicated in combined or joint operations. Within a single service, the type of administrative order is omitted normally. When required, a code title may also be included.

6.4 Outline for Transportation Corps Standing Operating Procedure for Major Commands

1. PURPOSE. Outline the purpose of the SOP.
2. SCOPE. State the application and coverage of the SOP.
3. UNIT PROCEDURES. Direct the action required by subordinate units in preparation of unit SOP, including a definite statement that SOP procedures of subordinate units will be based on and conform to the SOP procedures of the issuing command.
4. RECISIONS. List any publications superseded or rescinded by the SOP, including fragmentary SOP's, orders, memorandums, bulletins, or other directives.
5. REFERENCES. Refer to publications which should be used in conjunction with the SOP.
6. DEFINITIONS. Define, as required, all terms or phrases used in the SOP to insure understanding and interpretation by all recipients.
7. TRANSPORTATION ORGANIZATION. Unless published elsewhere, show missions, organizations, functions of:
   a. Office of the transportation officer:
   (1) Transportation officer.
   (2) Deputy transportation officer or executive officer.

(3) Staff sections.

(4) Liaison officers: United States Air Force, Military Sea Transportation Service, Army, allied, and others.

b. *Field installations:*

(1) Water terminals.

(2) Transportation Corps supply depots.

(3) Transfer points and other special transportation activities.

(4) Transportation movements branch and other transportation organizations.

8. ADMINISTRATION.

a. *General.* Application and implementation of command policies and directives.

b. *Correspondence.*

(1) *Types.* Types of correspondence, with instructions for preparing, forwarding, and handling; paper economy measures.

(2) *Classified documents.* Types of classification and authority to classify; handling, delivery, and receipting methods and procedures; security measures and responsibilities.

c. *Personnel.*

(1) *General.* Application and implementation of command policies and directives.

(2) *Local civilian labor.* Implementation of command policies and administrative procedures for procurement, utilization, and pay; application of provisions of Geneva Convention.

(3) *Prisoners of war.* Implementation of command policies and administrative procedures for procurement as labor; utilization, treatment, handling, and security; application of provisions of Geneva Convention.

(4) *Replacements.* Responsibilities and procedures for requisitioning Transportation Corps replacements; implementation or elaboration of command policies and directives.

d. *Reports.* Types and number of administrative reports to be submitted; method and frequency of submissions (samples to be appended); application of reports control procedures.

9. INTELLIGENCE.

a. *General.* Purpose and importance of transportation intelligence, transportation intelligence mission, types of intelligence, application of command directives.

b. *Collection of information.* Collection agencies, essential elements of information, sources, coordination, collection plan, methods, reporting and disposition of captured enemy material for intelligence purposes.

c. *Processing information.* Responsibilities and procedures for recording, evaluating, and interpreting information, including flow charts if applicable.

d. Dissemination. Policies, methods, criteria, security classification, transmission, time considerations.

e. Usage. General application of intelligence to transportation operations and planning; precautions against enemy counterintelligence.

f. Counterintelligence. Objectives, responsibilities, and application to the transportation service.

g. Reconnaissance. Purpose and responsibility.

10. PLANS.

a. Transportation requirements. Responsibilities for maintaining current lists of transportation requirements for movement of the unit or its elements by rail, truck, inland waterway, and air.

b. Transport availability. Responsibility for maintaining current lists of available transportation—organic, assigned, or attached to the unit, including local civilian transportation.

c. Entrucking plans. Responsibility of subordinate units for maintaining current entrucking plans; designation of vehicles to transport personnel, supplies, and organizational equipment.

d. Traffic circulation plans. Statement that traffic circulation plans will be coordinated with traffic circulation plan of this headquarters.

e. Special operations. For example, river crossings, pursuit, and retrograde movements. Statement that transportation aspects of subordinate troop plans for special operations will be coordinated with this headquarters.

f. Plans by reserve units. Statement that plans by units in reserve for forward or lateral movement will be coordinated with this headquarters.

g. Pooling organizational transportation. Procedures for pooling organizational transportation—availability reports, unit responsibilities for furnishing commissioned and noncommissioned officers, maintenance of equipment, and administrative support of personnel.

h. Civil aid. Statement that services and subordinate units will submit plans in advance for movement of civilians and civil aid supplies, but that plans will not be implemented without prior approval.

i. Main supply routes and supply and service installations. Responsibilities and procedures for maintaining up-to-date plans for recommending main supply routes and service installations.

11. TRAINING.

a. Responsibilities and procedures for preparing and supervising training programs of transportation units.

b. Responsibilities and procedures for exercising technical supervision over transportation training throughout the command.

12. DEFENSE AND DISPERSION. Implementation of command policies and directives; responsibilities of corps transportation units for area of defense; defense against airborne, bacteriological, nuclear, or

chemical attack; defense against sabotage; measures against infiltration and guerrilla warfare; reporting procedures of enemy activity. Action to be taken with respect to local civilian personnel employed at transportation activities.

13. AMPHIBIOUS OPERATIONS.

a. General. This SOP standardizes normal procedures in the preparation and execution of amphibious operations. It will apply unless otherwise prescribed.

(1) Subordinate units issue SOP to conform.

(2) References.

b. Planning. Consideration must be given to the following:

(1) Requirements of the tactical plan and the scheme of maneuver.

(2) Availability of landing craft and ships by type, size, cargo, and/or personnel capacity.

(3) Establishing and maintaining close liaison with the Navy, the Air Force, and task force commanders.

(4) Tables to be submitted by task force commanders indicating the landing force embarkation and tonnage and the breakdown of equipment and supplies.

(5) Arranging and coordinating through channels for training appropriate personnel in unit loading and embarkation.

(6) Movement to the embarkation areas and delivery of equipment and supplies to include waterproofing, marking, and palletizing.

(7) Supervision within the embarkation area.

(8) Buildup period for supplies and ship turnaround time.

(9) Alternate logistical procedures or an entire alternate plan to support alternate tactical plans being considered.

c. Movement to the staging area.

(1) Warning orders.

(2) Method of movement—rail, highway, air, water.

(3) Control of movement.

d. Staging area.

(1) Reception.

(2) Spot delivery of equipment.

(3) Control points to control flow of equipment and personnel to embarkation points or assembly areas.

(4) Assembly areas for temporary storage of equipment and supplies to be loaded on transports.

(5) Transportation to haul supplies and equipment from assembly areas to the ship.

(6) Areas where final waterproofing can be completed.

(7) Facilities to prepare cargo not already processed for loading.

e. Embarkation of troops.

(1) Movement to embarkation point or assembly areas.

(2) Control of movement to vessel.

f. Movement to objective area. In accordance with naval directives.

g. Ship-to-shore movement.

(1) Debarkation of equipment, supplies, and service troops at the proper time to support tactical operation.

(2) Control and landing of emergency supplies.

(3) Evacuation of casualties by water.

h. Beach organization.

(1) Transportation Corps reconnaissance party.

(2) Consolidation of supplies and transportation for subsequent logistical support of the landing force.

(3) Control.

(*a*) Vehicular traffic.

(*b*) Transfer operations (buildup area).

(4) Communication between beach organization and control vessel and ship.

14. INSPECTIONS.

a. Reference to SOP of higher headquarters relative to inspections.

b. Purpose.

c. Policy.

d. Type of inspections to be conducted: vehicle utilization, transportation training, quality of maintenance and maintenance support, efficiency of operations, records system.

e. Frequency of inspections.

f. Procedures prior to making an inspection.

g. Procedures upon completing an inspection.

h. Reports to be rendered on findings from inspections, including a sample format, number of copies, and distribution.

15. AIRBORNE OPERATIONS. Implementation of command policies and directives in establishing responsibilities and procedures for Transportation Corps participation in airborne operations as prescribed.

16. COMMUNICATIONS.

a. Communications net for coordination of transportation.

b. Method of ground-to-air contact for airdrops to provide for coordination with land transportation.

c. Cross reference to communications-net diagram.

6.5 Outline for Transportation Corps Unit Standing Operating Procedure

STANDING OPERATING PROCEDURE

____
(Unit)

TABLE OF CONTENTS

Section I. GENERAL

1. APPLICATION. Operations to which SOP applies.
2. PURPOSE.
3. REFERENCES. FM's, TM's, SOP's of higher headquarters, etc.
4. RESPONSIBILITY FOR PREPARATION, CHANGES, REVISIONS.
5. EFFECTIVE DATE.

Section II. COMMAND, STAFF, LIAISON

6. ORGANIZATION.
   a. Normal.
   b. Special internal attachments and organization.
   c. Normal and special external attachments and support.
7. COMMAND POSTS.
   a. Normal location in relation to next higher headquarters.
   b. Reporting change of location—coordinates and time.
   c. Forward command posts.
      (1) Situation for which required.
      (2) How organized.
      (3) Personnel and equipment.
8. STAFF DUTIES.
   a. Special or additional duties of staff officers.
   b. Duties for special staff officers.
9. LIAISON.
   a. Duties of liaison officers.
   b. Responsibilities for liaison—higher, lower, and adjacent units.
10. PLANNING RESPONSIBILITY.

Section III. ADMINISTRATION

11. GENERAL CHANNELS.
12. REPORTS.
   a. Routine reports.
   b. Special reports.
   c. Information concerning submission of reports.
      (1) Title and reports-control symbol.
      (2) Form of report.

(3) Date due.
(4) Number of copies.
(5) Negative report required or permissible.

13. PROMOTION POLICIES.
 a. Officer.
 b. Enlisted.
 c. Battlefield.

14. COURTS-MARTIAL.
 a. Location jurisdiction.
 b. Procedure for submitting cases.

15. MAIL.
 a. Handling of official mail.
 b. Handling of personal mail.

16. LEAVES AND PASSES.
 a. Policy of command—conduct, VD control.
 b. Authority to grant.

17. JOURNALS AND HISTORY.
 a. Responsibility for unit journal and history.
 b. Maintenance of staff section journals.

18. DISTRIBUTION OF MILITARY PUBLICATIONS.

19. HANDLING OF PRISIONERS OF WAR.
 a. Reference to FM 19–40 and FM 27–10.
 b. Special instructions for capturing unit.

20. AWARDS AND DECORATIONS.
 a. Channels.
 b. Form.
 c. Presentation.

21. ORDERS (FM 101–5).

22. BILLETS AND BIVOUACS.
 a. Policies—occupation and clearance.
 b. Billeting party.

Section IV. MOVEMENT

23. GENERAL (SOP OF HIGHER HEADQUARTERS).

24. MOTOR MOVEMENT (FM 25–10).
 a. Preparation of vehicles.
 b. Motor marches.
  (1) Strip maps
  (2) Route reconnaissance.
  (3) Messing and refueling.
  (4) Night marches.
  (5) Makeup of march units and serials.
  (6) Distances to be maintained.

(7) Speed and rate of march.

(*a*) Rate of march for column.

(*b*) Speed of lead vehicle.

(*c*) Permissible speed to catch up.

(*d*) Time length of march unit or serial.

(8) Posting of traffic guards during halt.

c. Movement by infiltration.

d. Conduct of personnel during movement.

(1) Passengers.

(2) Drivers.

25. VEHICLE AND EQUIPMENT OPERATIONS.

a. Motor pool.

(1) Dispatch.

(2) Service.

(3) Maintenance.

b. Regulations for administrative vehicles.

26. RAIL MOVEMENTS.

a. Action by S1.

(1) Movement policy.

(2) Troop list.

(3) Transportation movements personnel.

b. Action by S2.

(1) Reconnaissance report.

(2) Security.

c. Action by S3.

(1) Determination of rolling stock required.

(2) Coordination of loading plan.

(3) Preparation of loading schedule and areas.

d. Action by S4.

(1) Initiation of transportation request.

(2) Provision for troop and guard mess.

(3) Procurement of blocking and dunnage.

(4) Preparation of shipping documents.

27. AIR MOVEMENT.

a. Action by S1.

b. Action by S2.

c. Action by S3.

(1) Determination of craft required.

(2) Coordination of loading plan.

(3) Preparation of loading schedule and areas.

(4) Explanation of air-transportability technique.

d. Action by S4.

(1) Initiation of transportation request.

(2) Determination of availability of tiedown devices or material.

(3) Preparation of weight-of-equipment data for loading computation.

(4) Preparation of shipping documents.

28. WATER MOVEMENT.

a. Action by S1.

b. Action by S2.

c. Action by S3.

(1) Determining shipping required.

(2) Coordination of loading plan.

(3) Preparation of loading schedule and areas.

d. Action by S4.

(1) Initiation of transportation request.

(2) Provision for troop mess.

(3) Preparation of shipping documents.

Section V. SECURITY

29. GENERAL: POLICIES AND RESPONSIBILITIES.

30. SECURITY DURING MOVEMENT.

a. Air guards.

b. Manning of vehicular weapons.

c. Camouflage during halts.

d. Advance, flank, and rear guards.

e. Action to be taken in case of attack.

(1) Air.

(2) Mechanized.

(3) Troops and guerrillas.

(4) Nuclear, bacteriological, chemical.

31. SECURITY IN BIVOUAC.

a. Camouflage.

b. Mines and boobytraps.

c. Placement of weapons in case of attack.

(1) Air.

(2) Mechanized.

(3) Troops and guerrillas.

(4) Nuclear, bacteriological, chemical.

d. Joint security.

e. Security plans.

f. Sentry posts and outposts.

32. SECURITY WARNING SIGNALS.

a. Air attack.

b. Airborne attack.

c. Mechanized attack.

d. Gas attack.

e. Nuclear, bacteriological, chemical attack.

33. FIRE SAFETY AND FIRE FIGHTING.

a. Plans.

b. Fire personnel and duties.

c. Safety rules (motor pool, kitchen, etc.).

34. ALERT PLANS.

a. Unit plan.

b. Alert roster.

c. Armament and equipment.

d. Phase system for alert warnings.

35. DESTRUCTION OF EQUIPMENT.

Section VI. COMMUNICATIONS

36. TYPES USED.

37. COMMUNICATION BETWEEN UNITS.

a. Radio net.

b. Telephone system.

c. Teletypewriter system.

d. Responsibility for installation.

38. COMMUNICATION PROCEDURE.

a. Radiotelephone voice procedure.

b. Signal security.

c. Citation of SOI and SSI of higher headquarters.

39. MAINTENANCE RESPONSIBILITY OF COMMUNICATIONS OFFICER.

Section VII. RECONNAISSANCE AND INTELLIGENCE

40. RECONNAISSANCE. Essential elements of information.

41. COMBAT INTELLIGENCE.

a. Definition of "spot reports."

b. "Spot reports" required:

(1) Initial contact with enemy.

(2) Marked changes in enemy disposition or situation.

(3) Attack by armored, air, or airborne forces.

(4) New units identified.

(5) Enemy strength, composition, and movements.

(6) Location of enemy installations.

(7) Use of chemicals or new weapons.

(8) New materials or equipment.

42. COUNTERINTELLIGENCE.

a. Mail censorship.

b. Blackout discipline.

c. Information to be given if captured.

d. Signs and countersigns.

e. Destruction of classified documents.

f. Civilian control.

g. Secrecy discipline.

h. Information to press representatives.

Section VIII. SUPPLY AND MAINTENANCE

43. CLASS I SUPPLY.
    a. Ration pickup.
    b. Daily ration return and ration cycle.
    c. Reserve rations carried.
        (1) By unit.
        (2) By individual.
    d. Responsibility for attached units.
44. WATER.
    a. Authorized source.
    b. Purification by expedient methods.
    c. Water economy.
45. CLASS II AND IV SUPPLY.
    a. Requisition days for various services.
    b. Pickup procedure.
    c. Salvage turn-in procedure.
    d. Droppage by battle loss certificate.
46. CLASS III SUPPLY.
    a. Resupply.
    b. Fuel reserve.
47. CLASS IIIA SUPPLY.
    a. Resupply.
    b. Fuel reserve.
48. CLASS V SUPPLY.
    a. Method of requisitioning.
    b. Forms used and certificates required.
    c. Basic load.
    d. Salvage.
49. MAINTENANCE OF VEHICLES AND EQUIPMENT.
    a. Echelon of maintenance.
    b. Responsibility of maintenance officer.
    c. Forms used.
    d. Priorities.
50. REPAIR PARTS.
    a. Method of requisitioning.
    b. Maintenance of stock levels.
    c. Inspections of maintenance and levels.
    d. Parts and equipment record.
51. EVACUATION CHANNELS FOR VEHICLES AND EQUIPMENT.

By order of ____________________

____
Adjutant

Authentication:

Distribution

Annexes. (May include Wearing of the Uniform, Reports Formats, Destruction of Classified Documents, Duties of Staff Officers, Staff Section SOP's, Loading Plans, Alert Plan, etc.).

6.6 Division Embarkation Plan or Order

CLASSIFICATION

Issuing unit
Place of issue
Hour and date

File No.______________

Embarkation Plan No.______________

Maps: (Those needed for understanding the plan.)
References: (SOP's, operation order, administrative order, and other written material needed for an understanding of the plan.)

1. ORGANIZATION FOR EMBARKATION.

a. Troop list for each embarkation group. May be issued in form of annex.

b. Assignment of each embarkation group to shipping, schedule showing berthing of ships, date and hour loading will begin, and date and hour embarkation will be completed by each embarkation group. Such other information as is pertinent to the embarkation schedule may be included. May be issued in form of annex.

c. Advance parties.

(1) Composition.

(2) Functions.

(3) Movement to embarkation point. Reference may be made to SOP if covered therein.

2. SUPPLIES AND EQUIPMENT TO BE EMBARKED.

a. Amounts and types of supplies and equipment to be embarked.

b. Preparation of supplies and equipment for embarkation. Reference may be made to appropriate SOP.

c. Allocation of division supplies and equipment to cargo assembly areas. Information in this paragraph may be issued in the form of an annex with appendixes, if desirable.

3. EMBARKATION POINTS AND CARGO ASSEMBLY AREAS.

a. Assignment of embarkation points and cargo assembly areas for loading. May be in the form of a map, sketch, or overlay, and issued as an annex.

b. Preparation of embarkation points and cargo assembly areas for loading. Construction or improvement of exits and facilities in the embarkation area.

c. Assignment of mechanical loading devices, such as forklift trucks, cranes, roller conveyors, warehouse pallets, etc.

4. CONTROL.

a. Establishment and functions of embarkation control office. Functions may be covered in SOP.

b. Traffic circulation and control system. In embarkation area and between embarkation area and base camp.

c. Establishment of security posts. For prevention of fire, sabotage, and pilferage in cargo assembly and deck areas.

d. Communications for embarkation. References may be made to SOI.

5. MOVEMENT AND EMBARKATION OF PERSONNEL.

a. Schedule and method of movement from base camp.

b. Schedule and instruction for embarkation.

6. MISCELLANEOUS.

a. Embarkation responsibilities and tasks. Responsibility of embarkation group commanders and tasks of officers, such as supply officer, motor transport officer, unit loading officer, etc.

b. Special loading instructions. Stowage of certain type cargo, handling of fragile or dangerous items, etc.

c. Miscellaneous instructions not covered elsewhere.

By Command of Major General____________________

s/Colonel, U.S.
Chief of Staff

Annexes:

ALPHA—Organization of Embarkation Groups—Assignment of Shipping.
BRAVO—Loading Schedule.
CHARLIE—Supplies and Equipment to be Embarked.
DELTA—Embarkation Points and Cargo Assembly Areas.
(Others as necessary.)

DISTRIBUTION:

OFFICIAL: __________________________

s/Lt. Col., U.S., ACofS, G4

Section II. TRANSPORTATION

6.7 Transportation Intelligence

a. Transportation intelligence is information concerning air, land, and water transportation systems and facilities of actual or potential theaters of operations. It includes data concerning the characteristics, condition, development, organization, material, operation, maintenance, and construction of such facilities.

b. It provides data essential to strategic, tactical, and logistical planning and furnishes the basis for estimates of military transportation capacities and capabilities.

c. The DA Forms 55–170 through 55–185 are used for recording transportation intelligence data. Examples of these forms and detailed information pertaining to transportation intelligence can be found in FM 55–8. See appendix I for a list of these forms with titles.

6.8 Transportation Estimate

CLASSIFICATION

____
Transportation Section (Unit)

____
(Location)

____
(Date-time group)

TRANSPORTATION ESTIMATE

Maps: Indicate sheet name, number, scale, and unit of measure series.

1. MISSION. State the mission of the command and of the Transportation Corps in support of the tactical and logistical mission of the command. May be obtained from orders from a higher headquarters or deduced from instructions or knowledge of the situation. May be expressed in terms of personnel and/or tons to be transported, discharged, and/or outloaded.
2. THE SITUATION AND CONSIDERATIONS.
   a. Intelligence situation.
   (1) Refer to pertinent intelligence estimate.
   (2) Characteristics of area of operations.
      (*a*) *Weather.* Indicate temperatures, wind conditions, rainfall, tide and river conditions, and a complete aeronautical weather forecast. Indicate possible effect on the capabilities of each mode of transportation.
      (*b*) *Terrain and hydrography.* List critical terrain features, any obstacles known or suspected, soil trafficability, offshore gradient of beaches, surf, etc. Indicate effect of terrain conditions upon each mode of transportation.
      (*c*) *Lines of communication.* List all lines of communication available (include aircraft landing sites) and indicate their capacity. Discuss the condition of each, stressing damage which has been done to each and the amount of repair work necessary to render usable. Keynote all possible bottlenecks, such as bridges or tunnels, ruling grades, etc.
   (3) Enemy strength and dispositions.
      (*a*) Refer to intelligence estimate.
      (*b*) Cite the limitations which the above place on full utilization of various lines of communication.
   (4) Enemy capabilities.
      (*a*) Current intelligence estimate can be cited for the enemy's capabilities to attack, defend, delay, withdraw, or rein-

force, together with probable areas involved, strengths, etc.

(*b*) Indicate how the transportation mission could be affected by each capability of the enemy. Include such items as lines of communication apt to be lost or gained through enemy's use of each capability and increase or decrease in tonnage capability. This could be done as an annex listing probable effect of each capability on each mode.

b. Tactical situation.

(1) Refer to current operation order.

(2) Present and planned disposition of major friendly tactical elements, with emphasis on those units defending lines of communication or Transportation Corps units and operations. Effect of planned troop moves on Transportation Corps operations.

(3) Possible courses of action. List all possible courses of action open to the command to accomplish the assigned mission.

(4) Projected operations. State the concept of projected operations once the immediate mission is accomplished.

c. Logistical situation.

(1) Refer to current administrative order or overlay.

(2) List the status of supplies and equipment in all Transportation Corps organizations of the command, highlighting any inadequacies.

(3) Indicate any projected developments likely to affect the ability of Transportation Corps units to perform their mission from the logistical standpoint.

(4) Indicate the status of supplies and equipment in other technical service units to be employed in logistical support of Transportation Corps operations which might adversely affect accomplishment of the mission.

(5) Logistical courses of action. State all possible logistical courses of action, and the effects of each on possible friendly tactical courses of action.

d. Personnel situation.

(1) Refer to current administrative order or overlay.

(2) Indicate status of personnel in all Transportation Corps units, including state of morale and any other considerations likely to have a bearing on their performance.

(3) Indicate status of personnel in other technical service units to be employed in logistical support of Transportation Corps operations which might adversely affect accomplishment of mission.

e. Assumptions. Logical assumptions may be made when a sufficient amount of factual information is not available for the preparation of the estimate.

f. Transportation situation. This subparagraph will be the heart of the transportation estimate and should indicate in as great detail as possible all known information about each mode or Transportation Corps activity.

(1) *Transportation Corps situation by modes.* The format shown in (*a*) below should be modified as required for (*b*) through (*k*).

(*a*) Rail. Tabulate as shown.

Unit	*Location*	*Strength Auth—Actual*	*Facilities Actual—Required*	*Equipment lacking*	*Capability Actual—Potential*

(*b*) Highway.

(c) Inland waterway.

(*d*) Army aviation.

(*e*) Water terminals and transfer points.

(*f*) Movement control.

(*g*) Staging areas.

(*h*) Transportation Corps depots.

(*i*) Transportation Corps technical intelligence units.

(*j*) Pipeline (even though not operated by Transportation Corps).

(*k*) Troop carrier space.

(2) *Transportation Corps courses of action.* State all courses of action open to the Transportation Corps for each possible logistical course of action set forth in *c*(5) above.

g. Special factors. State here any other factors which might have a bearing on choice of a course of action or ability to perform mission, both from the transportation standpoint and the overall view of the mission. All pertinent policies should be included.

3. ANALYSIS. In this paragraph, the effects of each logistical course of action listed in paragraph 2*c*(5) on each mode of transportation must be stated and analyzed.

a. Course of action.

*Mode of activity**	*Effect on personnel*	*Effect on equipment*	*Effect on facilities*	*Effect on capabilities*

b. Alternate course of action. If an alternate course or courses of action are possible, outline them.

4. COMPARISON.

a. List the dominent transportation factors and modes most likely to be used.

b. Using the information in paragraph 3, compare the various logistical courses of action as to their effect on each mode and the capabilities thereof. This weighing of advantages and disadvantages will permit determination of the most favorable course of action from the transportation standpoint.

c. Discuss the feasibility of the use of the various lines of communication, ports, and beaches in comparison with enemy capabilities, weather, terrain, etc.

*Same modes of activity as 2*f*(1).

5. CONCLUSIONS.

a. Indicate whether the mission (par. 1) can be accomplished from the standpoint of Transportation Corps support.

b. Indicate which of the possible logistical courses of action can *best* be supported from the Transportation Corps standpoint.

c. Bring to the attention of the commander any considerations required should alternate courses of action be chosen.

(1) Indicate the number and type of Transportation Corps units required over and above those presently available for each course of action if mission cannot be supported.

(2) Indicate any personnel and/or mission equipment shortages in existing units which would prevent accomplishment of mission.

(3) Indicate any repairs or construction work essential to successful accomplishment of the mission from the Transportation Corps standpoint.

(4) State any other transportation considerations which should be brought to the attention of the commander.

/s/ ____________________
Transportation Officer

Annexes

6.9 Transportation Plan

CLASSIFICATION

____
Transportation Section (Unit)

____
(Location)

____
(Date-time group)

TRANSPORTATION PLAN ____________
(Number)

Maps and references: Show sheet name, number, scale, and unit of measure series for all maps. Other references should include city plans, navigation charts, other plans bearing on the transportation plan, etc.

Task organization: Annex A, Task Organization.

1. SITUATION.

a. Enemy forces. State here all capabilities of the enemy to hinder, disrupt, or otherwise affect the operations of the Transportation Corps units and other elements of the command. Include such items as damage to lines of communications, use of mass destruction weapons, etc. (Annex B, Intelligence).

b. Friendly forces. Indicate units to be supported, their location and strength, with particular emphasis on those units engaged in protection of lines of communication and transportation units or activities. Should cover higher, adjacent, and supporting units of both U.S. and allied forces.

c. Characteristics of the area of operations.

(1) *Weather.* Indicate temperatures, wind conditions, rainfall, tide and river conditions, aeronautical weather information, etc.

(2) *Terrain and hydrography.* List critical terrain features, soil trafficability, beach gradients, any known obstacles, and indicate their effect on the transportation modes.

(3) *Lines of communication.* List all lines of communication, indicating physical condition.

d. Attachments and detachments. If any, so state.

e. Assumptions and policies. Report here any pertinent policies and logical assumptions which are needed in preparing the plan; for example, proposed locations of major unit boundaries, troop strengths to be supported in different phases of the operation, etc.

2. MISSION. State briefly the mission of the Transportation Corps in support of the command.

3. EXECUTION.

a. Concept of operation. The transportation officer's overall concept of the operation should be stated here and should include probable increases in supported units, additional territory to be supported, etc. (Annex C, Concept of Operations.)

b. Rail. This paragraph should indicate the specific tasks assigned rail units. Projected loads, schedules, facilities, lines of communication, etc., are best submitted in the form of an annex to the plan.

c. Highway.

d. Inland waterways.

e. Army aviation.

f. Water terminals and transfer points.

g. Movement control. Mention pipeline mission even though not Transportation Corps responsibility.

h. Staging areas.

i. Transportation Corps depots.

j. Troop carrier support. Although Transportation Corps does not assign tasks, proposed use of air capacity allocated to the command should be mentioned. As indicated in *b* above, similar information for each mode of transportation is best submitted in the form of an annex to the plan, the format of which should parallel that of the plan itself insofar as practical.

k. Coordinating instructions.

(1) *Defense and security.* Refer to appropriate SOP or defense plan.

(*a*) Individual.

(*b*) Facilities.

(*c*) Lines of communication.

(*d*) Shipments.
(*e*) Censorship.
(*f*) Communications.

(2) *Counterintelligence.* Annex B, Intelligence.

(3) *Technical intelligence.* Annex B, Intelligence.

(4) *Effective time and date.*

4. ADMINISTRATION AND LOGISTICS.

a. Administration.

(1) *Policies.* Refer to paragraph 1*c*.

(2) *Procedures.* Cite SOP's and related guides of higher headquarters not covered elsewhere in the plan.

(3) *Required reports.*

b. Logistics.

(1) *Transportation Corps supply.* The following items should be covered by reference to current SOP's when applicable.

(*a*) Levels of supply.
(*b*) Replacement factors and consumption rates.
(*c*) Requisition procedures and cycles.
(*d*) Emergency requisition procedures.
(*e*) Local procurement.
(*f*) Controlled items.
(*g*) Surplus material.
(*h*) Captured material.
(*i*) Salvage and scrap.
(*j*) Interservice supply.
(*k*) Class IV equipment.
(*l*) Equipment deadlined for parts (EDP) procedures.

(2) *Supply support of transportation mission by other services.*

(3) *Transportation Corps maintenance.* Indicate maintenance facilities by mode, showing shop locations, and a statement of the responsibilities of each maintenance unit.

c. Personnel.

(1) *Policies.*

(*a*) Use of local civilian labor.
(*b*) Use of POW's.
(*c*) Use of U.S. civilian personnel.

(2) *Strengths.*

(3) *Replacements.*

(4) *Procedures.*

5. COMMAND AND SIGNAL.

a. Signal, Annex --, Signal.

b. Command.

(1) Location of CP's of major commands.

(2) Location of transportation movements branches.

Acknowledge.

ABLE
Brig. Gen.

Annexes:

A—Organization

B—Intelligence

C—Concept of Operation

(Others as required)

Distribution: B

OFFICIAL

/s/ Baker

BAKER

G3

Note. Any of the above paragraphs and subparagraphs may consist wholly, or in part, of references to appropriate annexes, and the annexes in turn may be amplified by properly referenced appendixes. Each transportation mode should have a separate annex.

6.10 Feasibility Test for Transportation Plan

1. GENERAL.

a. This test is prepared to enable transportation staff planners to check the feasibility of a transportation plan (annex to administrative order, letter of instructions, etc.) after the plan has been prepared.

b. The test has been prepared in checklist form with paragraph 2 giving general considerations which apply to all modes of transportation; the remaining paragraphs list items which apply to a specific mode. Some items which appear in the remaining paragraphs may appear to belong under the general paragraph; however, these items represent abnormal conditions which may have a drastic effect on that mode.

c. In using the checklist, consider the items listed in paragraph 2 for each mode in addition to the paragraph that applies to that mode.

2. GENERAL CHECKLIST ITEMS.

a. Calculated risks. What calculated risks are involved in the plan? How can these affect the mission? What are the governing factors?

b. Weather and terrain. General consideration of weather and terrain. Will weather and terrain in the area of operations have a favorable or adverse effect on the mission?

c. Enemy action. Consideration of enemy guerrilla action, clandestine action, etc.

d. Political and economic situation. Will the plan interfere with the local economy? Is the attitude of the civil population friendly or unfriendly to our forces?

e. Transportation net. Are the elements of the transportation net integrated? Are portions of the net reserved for civilian use? What emergency procedures are in effect for joint civil-military use? Does the engineer construction service support the present net and is it directed toward future operations?

f. Allocation and utilization of modes. Is optimum utilization of transport capacity achieved? Are supporting services' capacities utilized? Have the modes been allocated tasks commensurate with their capabilities and equipment? Are provisions for retrograde cargo adequate?

g. Logistical support of operations. Can the mode(s) be supported in sufficient quantity and time to accomplish the mission; e.g., POL products, repair parts, etc?

h. Task organization.

(1) Are command relationships, missions, and functions clearly defined?

(2) Do the troop list assignments consider:

(*a*) Strength?

(*b*) Training?

(*c*) Morale?

(*d*) Available transport equipment?

i. Local civilian and POW labor. Is civilian labor available in the skills required? Will mobile civilian labor units be required for phase II and III operation? If so, is their administrative and logistical support adequate?

3. HIGHWAY.

a. Check requirements versus capabilities.

b. Traffic circulation plan:

(1) Will road net support planned traffic?

(2) Will additional highway regulation personnel be required?

(3) Is road repair and road maintenance support adequate?

(4) Are routes designated (restricted, dispatch, etc.)?

(5) Is joint use of road net possible; i.e., can both combat forces (U.S. and/or allied forces) and civilian traffic use it simultaneously?

(6) Are hardstand, maintenance areas, truck parks, relay stations, transfer points available?

(7) Are routes marked or will marking signs be available?

4. RAIL.

a. Check requirements versus capabilities.

b. Unusual weather or terrain factors:

(1) Are heavy rains due that may cause washouts, floods, or landslides?

(2) Is extreme subfreezing weather due?

c. Is engineer maintenance and construction support available for rehabilitation or for major repair of rail line?

d. Are facilities such as yards, roundhouse, repair shops available?

e. If steam locomotives are to be used, are suitable water and fuel supplies available?

f. Limiting factors considered:

(1) Bridge, weight, and clearance limitations.

(2) Tunnel clearance.
(3) Roadbed and trackage.
(4) Rolling stock—condition, power, gage.
(5) Locomotives—condition, power, gage.
(6) Train operations communications.

5. INLAND WATERWAYS.

a. Check requirements versus capabilities.

b. Weather and terrain. Freezeup or flood periods, tidal ranges, currents, fogs.

c. Obstructions. Low bridges, types of drawbridges. Natural obstructions such as heavy weeds that might foul propellers.

d. Locks. Who controls the locks—assigned permanent personnel or the individual inland waterway craft? Size of locks, time to pass through.

e. Channels. What maintenance is required? Size, depth, and width.

f. Navigational aids. Are sufficient fixed or mobile navigational aids available for full utilization, day and night?

g. Are intermediate transfers necessary?

h. Condition of available craft.

i. Is marine inland-waterway repair and maintenance support available?

j. Are inland-waterway facilities, docks, cranes available?

6. PORTS AND BEACHES.

a. Check requirements versus capabilities.

b. Port facilities:
(1) Floating cranes for heavy lifts.
(2) Piers, docks, warehouses, open ground areas.
(3) Road and/or rail net.
(4) Navigational aids.
(5) Protected anchorage areas.
(6) Utilities available: electricity, etc.
(7) Harbor craft available.
(8) Berth space: lengths and depths.

c. Beach facilities:
(1) Anchorage areas.
(2) Routes of ingress and egress.
(3) Road and/or rail nets.
(4) Hardstand and open ground areas.
(5) Equipment available: forklifts, cranes, etc.

d. Weather and terrain:
(1) Ports:
(*a*) Tides and currents.
(*b*) Underwater obstructions.
(2) Beaches:
(*a*) Tides, currents, surf, gradient, tidal range.

(*b*) Underwater obstructions.

7. TRANSPORTATION MOVEMENTS.

a. Will sufficient teams be available to accomplish transportation movements mission?

b. Is transportation movements plan adequate to accomplish the mission? Is it flexible or too rigid?

c. Are teams located properly to accord maximum utilization?

d. Are documentation procedures established to insure accomplishment of mission?

8. STAGING AREAS.

a. Are staging areas capable of processing planned workloads?

b. Are adequate facilities available at staging areas?

9. TRANSPORTATION CORPS DEPOTS.

a. Will the depots be able to support the mission?

b. Are adequate facilities available at the depots?

10. ARMY AVIATION.

a. Check requirements versus capabilities.

b. Marginal weather:

(1) Low ceilings.

(2) Low visibility.

(3) Ice conditions (on ground) determining maintenance and time required to melt, plus closed hangar area.

(4) Temperatures to be encountered.

c. Terrain: Altitudes to be encountered (temperature and altitudes affect lift capabilities).

d. Navigational aids:

(1) Will day and night operations be possible?

(2) Ground stations:

(*a*) Ground controlled approach (GCA).

(*b*) Radio range.

(*c*) Instrument landing systems.

(*d*) Omnidirectional range (Omni range).

(*e*) Radar plotting station.

(3) Is airborne navigational equipment available?

e. Communications: Are unit communications sufficient or will they require augmentation?

f. Restrictions to flight:

(1) Maintenance of established air routes, including consideration of fire lanes.

(2) Degree of air superiority.

(3) Have arrangements been made for weather reports from Air Force?

g. Adequacy and location of landing sites or airfields, plus facilities at such locations.

h. Maintenence:

(1) Condition of aircraft (number of hours previous operation).

(2) Maintenance units available.

(3) Repair parts available.

(4) Location and stock of depot support. Can depots support?

i. Degree of training of supported units in use of logistical air support.

11. After consideration of all the factors as applied to each mode, is the plan flexible enough to have alternate methods used and still accomplish the mission?

a. Provision for rerouting or diversion?

b. Interchange points?

c. Transfer points?

d. Substitution of one mode for another?

e. Capable of handling emergency transportation tasks?

CHAPTER 7

MISCELLANEOUS

Section I. CAPABILITIES OF TRANSPORTATION MEDIUMS

7.1 Highway, Rail, Pipeline, Water Terminal, and Beach

Medium	*Tons per day* ST	*Tons per day* LT	*Adequate to maintain (aprx: use as guide only)*
Highway:[1]			
Gravel	1, 600	1, 430	1 division
Medium condition	3, 600	3, 220	3 divisions
First-class	10, 000	8, 900	7 divisions
Railway, each way:			
Single track	4, 000	3, 570	3 divisions
Double track	12, 000	10, 700	9 divisions
Gasoline pipeline:[2]			
6-inch	2, 000	1, 790	5 to 8 divisions
4-inch	930	830	3 divisions
Water terminal discharge rate:			
Average cargo ship	720	643	½ division
Across beach:			
Per 1,000 yards of beach	1, 680	1, 500	1 division plus[3]

[1] Daily forward tonnage, assuming sustained operations, adequate road maintenance, and two-way traffic.

[2] The capacities of pipeline systems vary, depending on the size of pipe, gradient, location and size of pumps, and type of construction. Welded commercial pipelines can be operated at much greater pressures than standard military lines, which have flexible couplings. The capacities given may be used for planning purposes.

[3] Water terminal discharge rate of 1,440 ST per day required to adequately maintain 1 division slice.

7.2 Dog Transport Capabilities

a. Trained dogs may be used individually or in teams to transport cargo in arctic and subarctic areas. They also have limited use in temperate zones to carry messages and small packages of mail, usually in regions inaccessible to other means of transport. Dogs should be permitted to rest 10 minutes in each hour and should not be worked continuously for more than 16 hours per day. For planning purposes, towed loads should not exceed 100 pounds per dog although the heavier breeds are capable of loads of 200 pounds per dog on a flat surface with good traction. The dog most commonly used in the arctic and subarctic is the Eskimo or husky. The German shepherd is usually used in temperate zones. The figures in *b* and *c* below are for normal operating conditions. Extremes of weather and terrain will cause them to vary widely.

b. On packed snow with good traction, an individual dog in a sled team has the following cargo-carrying capabilities. On soft snow, load and speed must be reduced 50 percent.

Terrain	*Pounds of load per dog* [1]	*Miles in hour* [2]
Flat	50	6
Hilly	50	3
Mountainous	50	1

[1] Includes weight of sled.
[2] Reduce 50 percent when load is doubled.

c. On hard surfaces with good traction, an individual dog has the following capabilities for carrying cargo packs, messages, and mail.

Terrain	Pounds of load per dog		Miles in hour	
	Cargo pack	Messages or mail	Cargo pack	Messages or mail
Flat	35	5 percent of dog's weight.	2	15
Hilly	30		2	10
Mountainous	25		1	5

7.3 Pipeline Estimates

a. Rate of Discharge. The quantity of fluid passing through a pipe in a unit of time is termed the capacity or rate of discharge of the pipe and may be determined from the equation

$$Q = A \times V$$

where

Q=rate of discharge in cubic feet per second
A=cross-sectional area of the pipe in square feet
V=mean velocity of fluid in feet per second

(1) If the rate of discharge is given in terms of U.S. gallons, these may be converted to cubic feet by multiplying the given number of gallons by 0.13368. Cubic feet may be converted to U.S. gallons by multiplying the number of cubic feet by 7.4805.

(2) The cross-sectional area of the pipe in square feet is determined by using the equation

$$A = 0.7854D^2$$

where

A=cross-sectional area of the pipe in square feet
D=inside diameter of the pipe in feet

(3) The mean velocity of a fluid varies according to the size, hydraulic gradient, and physical condition of the pipe through

which it flows. Economical pipeline velocities are ordinarily in the range of 3.5 to 5.5 feet per second.

b. Example. Determine the rate of discharge of a 8-inch pipeline in which gasoline is flowing at a velocity of 3 miles per hour.

$D = 8/12$ or 0.67 foot

$A = 0.7854 \times (0.67)^2 = 0.3525$ square foot

$$3 \text{ mph} = \frac{3\text{mph} \times 5{,}280 \text{ feet per mile}}{60 \text{ minutes per hour}} = 264 \text{ feet per minute}$$

264 feet per minute $\times$ 0.3525 square foot = 93.1 cubic feet per minute

93.1 cubic feet per minute $\times$ 7.4805 gallons per cubic foot = 696.43 gallons per minute.

c. Increasing Capacity. The volume of liquid which can be transported through a given pipeline may be increased by longer operation and/or increased pressure. These methods may be used individually or in combination; however, they should be used only on a short-term basis. If increased capacity is desired over a considerable period of time, it is usually better to construct an additional pipeline.

(1) *Hours of operation.* Normal capacity of a pipeline is based on an operating time of 20 hours per day.

(2) *Differential pressure.* Increasing the differential pressure of all pumping stations will increase the capacity of a given pipeline. To increase the differential pressure of a pumping station increase—

(*a*) The differential pressure on each pump in the pumping station.

(*b*) The number of pumps operating in series at the pumping station.

d. Capacity of Standard Military Light-Weight Steel Tubing.

Inside diameter of line (in.)	Normal design capacity (bbl per hr)	Emergency capacity (bbl per hr)	Safe working pressure (psi)	Maximum working pressure (psi)	Gallons per day*	Short tons per day
4	355	393	600	750	294, 000	930
6	785	1, 000	600	750	630, 000	2, 000
8	1, 355	1, 730	450	600	1, 135, 000	3, 500
12	7, 150	11, 400	300	530	6, 000, 000	18, 000

*Computed for an average of all products at normal design capacity, using a 20-hour operating day.

7.4 Pack and Draft Animals

a. Characteristics, Pack Mules.

(1) Height: 59 to 62 inches.

(2) Weight: 1,000 to 1,200 pounds.

(3) Rate of march: 3.5 to 4 miles per hour.

(4) Capacity: 200 to 250 pounds.
(5) Movement of casualties: 1 litter or 2 sitting casualties.
(6) Forage: 10 pounds of oats and 14 pounds of hay per day. May be reduced for short periods up to 10 days without impairing capacity.
(7) Water: 10 gallons per day.
(8) Noneffective rate: 3.2 percent.
(9) Average daily distance:
(*a*) Mountainous terrain—12 miles.
(*b*) Rolling or flat terrain—24 miles.
(10) Gradeability:
(*a*) Rate of ascent—1,650 vertical feet per hour.
(*b*) Rate of descent—1,000 vertical feet per hour.

b. Transportability.

Vehicle	*Capacity (horses or mules)*
Trailer, 2-horse van	2
Truck, 1½-ton, cargo	2
Truck, 2½-ton, cargo	4
Semitrailer, 6-ton, combination animal and cargo	8
Railroad stock car, 40-foot	25, approximately
Railroad stock car, 36-foot	20 to 22, approximately
Airplane, cargo transport	4 to 6*

*May be transported at altitudes up to 18,000 feet with no ill effects.

c. Horse-Drawn Carts. Capable of traveling 20 miles per day drawing a payload of 1,000 pounds.

7.5 Human Bearers

For planning purposes, the following may be assumed:

a. Average Cargo Loads.
(1) Male bearer—80 pounds.
(2) Female bearer—30 to 35 pounds.

b. Personnel Loads. 8 to 12 bearers per litter team.

c. Rate of March. 12 miles per day, average conditions.

d. Overloading and Speed-Up. Overloading and speeding up operations increase the sick rate and cause desertion.

e. Noneffective Rate. Approximately 30 percent.

f. Close Supervision. Close supervision is required to prevent pilferage.

Section II. DIMENSIONS AND WEIGHT DATA

7.6 Transportation Unit Equipment

Listed below are principal items of unit equipment pertaining to one or more types of Transportation Corps units. This information, when applied to authorized quantities of the listed items, will aid planners and operators in the formulation of loading plans. When preparing the loading plan, this information should be used in conjunction with equipment characteristics to be found elsewhere in the manual.

Item (Uncrated unless otherwise noted.)	Length (in.)	Width (in.)	Height (in.)	Cu. ft.	Weight (lb.)
CHEMICAL:					
Breathing apar, oxygen-generating				2.2	40
Decontaminating apar, ptbl, 3-gal	22.5	7 (dia)		8.7	75
Kit, chemical agent detector				0.2	4
Mask, protective, field				0.47	4.1
Respirator, paint spray				0.05	0.4
Tool set, gas-mask rep				0.1	4
ENGINEER:					
Adapters, piledriver lead, for crane shovel, 10T				1.46	175
Backhoe for crane shovel, 10T				417	6,400
Book set, celestial navigation				.72	29
Boom for crane shovel, 10T, 35-ft	420			319	2,450
Breaker, paving, pneu, 80 psi, 1¼- x 6-in. chuck				3.17	112
Bucket, clamshell, ¾ cu yd				585	4,850
Bucket, dragline, ¾ cu yd				210	6,125
Carpenter set No. 1, engr sqd				17	330
Carpenter equip set No. 2, engr plat				8	230
Carpenter equip set No. 3, engr	38	24	11	5.8	132
Compressor, air, gas, 105 cfm, skid-mtd	120	90	74	463	6,605
Compressor, air, set No. 1, 55 cfm, airborne	60	48	39	65	1,358
Compressor, air, tlr-mtd, 315 cfm	180	84	84	735	12,000
Compressor, tlr-mtd, 500 cfm, diesel	184	85	98	940	14,400
Crane, revolving, tractor-mtd, 7,500-lb, 35-ft boom				1,395	9,785
Crane, shovel, crawler, 10T, Gasoline, ¾ cu yd	137	116		1,760	44,000
Crane, shovel, trk-mtd, 20T, ¾ cu yd, gasoline	387	108	138	3,350	54,000
Crane, shovel, crawler, 40T, 2 cu yd, diesel	196	147		3,619	88,000
Crane, tractor, wheeled, 40,000-lb, 20-ft boom				3,045	48,000
Diving equip, 2 persons, 200-ft depth				234	8,219
Diving equip, 2 persons, 100-ft depth	48	30	36	29	711
Drafting set, GP				13	225
Drill, pneu, ptbl, rock, 55 psi, 1- x 4¼-in. hex chuck				2	42
Drill, pneu, ptbl, rotary, steel, No. 3 Morse taper, 1¼-in. cap				3.75	115
Drill, ptbl, rotary steel, No. 3 Morse taper, 1¼ in. cap					[a]28
Extinguisher, fire, CO_2, 15-lb cap				2.8	71
Extinguisher, fire, CO_2, wheeled 50-lb cap				27	385
Fire and salvage equip set, marine				2,630	45,000
Floodlighting set No. 2, ptbl				126	1,900
Generator, gas, skid-mtd, 1.5-kw					114
Generator, ptbl, gas, skid-mtd, 5-kw					1,300
Generator, ptbl, skid-mtd, diesel, 15-kw	84	30	54	73	3,455
Generator, ptbl, skid-mtd, diesel, 30-kw	108	36	69	156	5,000
Grinder, ptbl, rotary, 8- x 1-in. wheel	15	12	15	1.5	90
Hoist, chain, 3T				1.09	48.5
Lamp, elec, ptbl, CP, set No. 1	31	20	16	5.8	180
Light set, gen illumination, 25-outlet				53.1	880
Light set, gen illumination, 15-kw				240	5,950
Lubricator, mtd on M105E3 tlr	147	69	69	405	3,150
Metalizing set				23	650
Pioneer equip set, engr plat				221	2,705
Pioneer equip set, engr sqd				26	752
Power control unit, cable, 1 drum, front mounting, 12,000- to 17,000-lb DBP				23.4	1,430
Pump, centrifugal, gas, 55 gpm, 50-ft head				14.2	250

See footnotes at end of table.

Item (Uncrated unless otherwise noted.)	Length (in.)	Width (in.)	Height (in.)	Cu. ft.	Weight (lb.)
ENGINEER—Continued					
Pump, centrifugal, gas, 2-in. disk, 2-in. suction, 166 gpm, 80-ft total dynamic head				32.7	685
Pump, centrifugal, tlr-mtd, 500 gpm, 20-ft total dynamic head				151.6	1,980
Pump, centrifugal, gas, base-mtd, 500 gpm, 90-ft total dynamic head				173.4	2,510
Pump, centrifugal, gas, tlr-mtd, 1,000 gpm, 80-ft total dynamic head				556	8,335
Pump, sump, 175 gpm at 25-ft head, 2½-in. discharge				3	190
Reproduction set, black and white process				10	230
Reproduction set, gelatin process				3.4	104
Saw, circular, wood, ptbl, 10-in	13	9	11	.75	11
Semitrailer, low-bed, 20T, front loading	435	115	76	2,145	23,900
Sheetmetal handset No. 1				65	2,600
Shop equip, base maint elec rep				224	5,720
Shop equip, mach shop, base maint				3,590	75,000
Shop equip, GP rep, stlr-mtd				1,910	22,700
Shop equip, org rep, lt-trk-mtd	318	94	129	2,230	22,120
Shop equip, set No. 8, welding				320	6,250
Shovel, front, for crane, crawler, 10T				433	6,700
Sign painting set				9	268
Supplementary equip, hv shop co				545	47,100
Supplementary equip, maint co				523	17,650
Surveying set, GP				28	474
Tool kit, blacksmith, gen				29	1,160
Tool kit, diesel injector rep, fld maint				2.6	62
Tool kit, mason and concrete finishers				7.6	103
Tool kit, pipefitters, gen				7	200
Tool kit, pipefitters, supplemental				9	45
Tool kit, precision inst rep				11	308
Tool kit, rigging, wire	34	16	10	3.5	167
Tool kit, sheetmetal workers, hand				7	176
Tool set No. 6, engr machinist's	20	8	11	1	20
Torch outfit, cutting and underwater welding	48	36	57	57	1,120
Torch outfit, cutting and welding				50	1,300
Tractor, whl, gas, 3,725- to 5,175-lb DBP	116	58	73	261	3,282
Tractor, crawler, diesel, 12,000- to 17,000-lb DBP, w/bulldozer	190	95	73	764	22,800
Tractor, tracked, diesel, w/angle dozer, 17,000- to 24,000-lb DBP	219	98	80	995	35,600
Tractor, tracked, diesel, w/bulldozer, 24,100- to 32,000-lb DPB	240	104	90	1,300	40,000
Trailer, 4W, tandem, 10T, flat-bed	150-330	93	48	1,188	7,200
Truck, crash, Army acft, w/firefighting equip	294	96	106	1,740	21,000
Welding shop, tlr-mtd, 300 amp				420	4,900
Wheelbarrow, 3 cu ft (when heaped)				6.8	74
MEDICAL:					
Candler, egg, aluminum				.167	2.08
Comparator, color, hydrogen, chlorophenol red				.187	6
Dispensary, medical set, field				2	70
Egg insp kit, vet				1	25
Food insp kit, fld vet				1	20
Food insp kit, vet				1.33	50
Litter, folding, aluminum pole	49	8.4	6	[b] 1.43	23
Medical fld set, supplemental sup				2.3	45
Medical kit, indiv, crated	15	8	6	.41	8
Stove, gasoline, 2-burner, crated	15	6	8	.48	16.3
Tester, milk-sediment, King				1.13	12

See footnotes at end of table.

Item (Uncrated unless otherwise noted.)	Length (in.)	Width (in.)	Height (in.)	Cu. ft.	Weight (lb.)
ORDNANCE:					
Carbine, cal .30	35.6				5.6
Carrier, cargo, M29C	192	67	71	403	4,800
Carrier, lt wpn, inf, ½T, 4x4, M274	118.25	49	27.5	81	900
Demolition equip set No. 2, plat [c]				4.6	85
Dolly, 10T, 2W, M365	114	96	54	340	3,400
Grinder, bench, hand-powered, 6- x 1¼-in. wheel				.36	11.3
Jack, hydraulic, 10T				12.7	338
Launcher, rocket, 3.5-in., M20A1	60			.8	43
Machinegun, cal .30, BRG, M1919A				.8	34
Machinegun, cal .50, AN-M3, Acft, basic				1.7	78
Machinegun, cal .50, BRG, M2, hv bbl	65				82
Mount, AA, MG, cal .50, M63					144
Mount, pedestal, MG, cal .50, M65	82				825
Mount, tripod, MG, cal .50, M3					44
Pistol, auto, cal .45	8.6				2.4
Pistol, pyrotechnic	8				2.13
Recovery vehicle, medium	234	106	108	1,880	61,700
Rifle, U.S., cal .30	43.6				9.5
Semitrailer, cargo, 6T, van, 2W, MSKD 2181	248	96	130	1,797	7,170
Semitrailer, van, 7½T, refrg, 2W, lightweight	275	96	130	1,980	6,600
Semitrailer, cargo van, 12T, 4W	344	97	109	2,102	13,800
Semitrailer, 12½T, 4W	600	97	93	3,116	13,000
Semitrailer, low-bed, 25T, 8W	404	116	64	1,711	13,000
SigC rep shop, trk-mtd, 2½T, 6x6, M185	254	96	117	1,651	15,270
Sled, cargo, 1T, M14A1	116	51	50	169	600
Sled, cargo, 10T	288	96	36	575	10,000
Submachinegun, cal .45				.47	13
Tool set, armorer's				1.1	57
Tool set, auto fuel and elec				.67	18
Tool set, electrician's No. 2				.5	10
Tool set, gen mechanic's				1.24	42.2
Tool set, 2d ech, No. 1, common				47.5	959
Tool set, 2d ech, No. 1, supplemental				1.4	51
Tool set, 2d ech, No. 2, common				139.5	2,715
Tool set, 2d ech, No. 2, supplemental				131	3,076
Tool set, 2d ech, No. 4, block and tackle				1.84	89.5
Tool set, machinist's				1.2	42
Tool set, metal body rep				1.25	39.6
Tool set, welder's				1	31
Trailer, fuel, svc, 600-gal	151	89	71	622	3,000
Trailer, 2T, 4W, generator	199	96	63	694	4,000
Truck, command, ¾T, 4x4, M42	185	74	90	695	6,000
Truck, gas tank, 2½T, 6x6, 750-gal	254	91	93–82	1,242	10,800
Truck, shop van, 2½T, 6x6, M535	256	96	118–94	1,340	10,000
Truck, dump, 2½T, 6x6	249	85	104	1,270	13,800
Truck, dump, 2½T, 4x2	220	91	92	1,070	8,200
Truck, wrecker, 2½T, 6x6	288	91	119	1,805	16,000
Truck, 5T, 4x2, S&P	292	96	90	1,266	10,450
Truck, tractor, 8T, 6x4 [d]	285	86	104	1,476	14,300
QUARTERMASTER:					
Adding and subtracting mach, elec or hand-operated, 10-col				2.16	48
Adding and subtracting mach, hand, 8-col				3.1	65
Bag, canvas, water, w/ropes and cover				.52	11.3
Burner, oil-stove, tent				2.29	59.4
Can, gasoline, 5-gal				.95	9.5
Can, water, 5-gal				1.4	8
Chair, folding, metal				.99	11.5
Conveyor, gravity roller, 45° curve, 18 in. wide, 10-ft sec [e]	120	18	3	8	165
Desk, field, empty, fiber, co				2.7	39

See footnotes at end of table.

Item (Uncrated unless otherwise noted.)	Length (in.)	Width (in.)	Height (in.)	Cu. ft.	Weight (lb.)
QUARTERMASTER—Continued					
Desk, field, M-1945				4.3	68
Fly, tent, wall, large, w/o pins and poles	258	173		[b] 1.6	50
Heater, immersion				6.2	72
Heater, tent, gasoline, 250,000 Btu				57.9	596
Lantern, gasoline				.28	2.7
Machine, calculating, nonlist, elec, 8-col				2.73	75
Machine, computing, list, 10-col cap				8.3	50
Machine, duplicating, stencil, hand-operated				5.2	80
Organ, folding, chaplain, w/case				6.14	109
Outfit, cooking, 1 burner				.11	4.6
Outfit, cooking, small detachment				4.33	123
Outfit, off mess				2	45
Parachute				1.79	31
Paulin, duck, OD, 17- x 12-ft	204	144		[b] 2.3	57
Paulin, duck, OD, 40- x 20-ft	480	240		[b] 6.7	250
Pump, bbl, rotary, kerosene or gas w/6-ft hose and nozzle			58	2.44	50
Pump, gas, ptbl, gas-eng drive, 50 gpm	29	22	44	25.6 (crated)	380
Safe, field, comb. lock				3	150
Stove, cooking, gasoline, 1 burner				8.87	185
Tank, fuel, skid-mtd, 750-gal., 2-compartment	72	72	56	237 (crated)	1,100
Tent, CP, w/pins and poles	165	120	108	[b] 9.9	257
Tent, GP, med, w/pins and poles	396	192	120	[b] 19	455
Tent, kitchen, w/pins and poles	216	144	108	[b] 26	419
Tent, maint, w/frame and pins	322	218	164	[b] 84.3	1,255
Tent, wall, small, w/pins and poles	106	110	102	[b] 7.5	115
Tent, wall, large, w/pins and poles	174	168	132	[b] 8.9	275
Trailer, whse, 4,000-lb, 36- x 84-in. caster steering	84	36	14	24.5	1,000
Truck, fork, gas, 2,000-lb, 130-in. lift	69	33	86	117	4,800
Truck, fork, gas, 6,000-lb, rough terrain [f]	195	84	122	1,160	16,600
Truck, fork, gas, 10,000-lb, rough terrain [f]	216	102	131	1,660	26,300
Truck, hand, 2W, w/folding wing	52	18		5.9	18
Truck, hand, platform, 2,500-lb, 36- x 72-in	72	36	30	45	200
Truck, oxyacetylene, 2W				16.7	170
Typewriter, nonptbl				2.5	50
Typewriter, ptbl				1.5	35
SIGNAL:					
Antenna equip, RC-292					[g] 48
Axle, RL-27					[g] 8
Converter, M-209	40	1	.5	[g] .01	[g] 32.5
Detector set, AN/PRS-3	28	13	9.25	[g] 4.75	[g] 110
Dispenser, MX-306A/G					[g] 25
Emergency switchboard, SB-18/GT				[g] .2	[g] 5
Lantern, MX-290/GV	3.3	3.3	6.5	[g] .02	[g] 3.5
Lineman equip, TE-21				[g] .7	[g] 45.8
Multimeter, AN/PRM-15	8.75	4.75	5.8	.14	
Multimeter, TS-297/U (packaged)	8.5	6	5	.15	5.3
Multimeter, TS-352/U	11.3	8	6	[g] .31	[g] 20.8
Power unit, PE 75	36	19	24.5	9.7	325
Public address set, AN/TIQ-2 (packaged)				55	585
Radar set, AN/SPN-11Z				128	1,835
Radiac set, AN/PDR-27				.8	46
Radiac set, AN/PDR-39	10.4	6.2	8	.3	11
Radio set, AN/ARC-27				11.2	199
Radio set, AN/ARC-44					[g] 36.75
Radio set, AN/GRC-7				28	215
Radio set, AN/GRC-9				12.6	256
Radio set, AN/GRC-19					[g] 254
Radio set, AN/GRR-5 (packaged)	27	15	46	11	110

See footnotes at end of table.

Item (Uncrated unless otherwise noted.)	Length (in.)	Width (in.)	Height (in.)	Cu. ft.	Weight (lb.)
SIGNAL—Continued					
Radio set, AN/PRC-8, -9, -10				4.5	62
Radio set, AN/TRC-34					[g] 172
Radio set, AN/URC-4					[g] 5.75
Radio set, AN/VRC-7					[g] 65
Radio set, AN/VRC-9, -10 (crated)				14	[h] 299
Radio set, AN/VRC-18				18	429
Radio set, AN/VRC-19				8.5	113
Radio set, AN/VRC-19X				10.8	240
Radio set, AN/VRC-29					130
Radio set, AN/VRQ-2 (packaged)				8.4	427
Radio set, AN/VRQ-3				23	502
Radio set, AN/VRR-7					[g] 50
Radio teletypewriter set, AN/GRC-46					[g] 1,126
Reel unit, RL-31 (crated)					[i] 60
Switchboard, SB-22/PT					[g] 28.25
Switchboard, SB-86/P					[g] 170
Telephone set, TA-43/PT	10.5	6	4	1.46	
Telephone set, TA-312/PT					[g] 8.4
Teletypewriter, AN/PRC-1, in case	25	21	17	4.8	43
Term telegraph-telephone, AN/TCC-14	15.8	11.5	25.75	2.68	70
Tool equip, TE-33				.07	2.2
Tool equip, TE-41	21	7	8	[g] .68	[g] 29.4
Tool equip, TE-113				2	40
Trailer, V-13/GT	185	88	60	565	2,400
Vibrator pack, PP-68/U	8	8	10	[g] .37	[g] 70
Wrench equip, TE-9				.1	4
TRANSPORTATION:					
Airplanes (See ch 2.)					
Barge, deck cargo, steel, 570T, 110-ft	1,320	360	110	30,000	344,000
Boat, diesel, plastic, 26-ft	312	97	72	1,260	6,810
Boat, patrol, diesel, wood, 36½-ft	438	127	112	3,602	13,600
Boat, patrol, diesel, wood, 63-ft	779	191	192	16,512	69,400
Boat, work, diesel, steel, 65-ft	786	212	252	24,318	132,000
Book, reference library, rail set, No. 7				5.5	98
Book, reference library, rail set, No. 8				3	55
Cargo set, cleaning, in gear box	72	50	61	125	1,610
Cargo set, coopering and shoring, in gear box	72	48	61	123	2,148
Cargo set, drum handling, in gear box	72	48	72	144	3,780
Cargo set, hatch, 5T, in gear box	72	50	61	126	3,140
Cargo set, hv lift, 50T, in gear box	81	48	72	162	4,250
Cargo set, lighting, in gear box	73	51	61	132	1,780
Cargo set, plate handling, in gear box	36	30	31	19.2	378
Cargo set, riggers', in gear box	72	50	44	92	
Cargo set, timber handling, in gear box	72	36	27	41	1,037
Cargo set, vehicle handling, in gear box	130	31	29	67	880
Cargo transporter (box, metal, shipping, steel, cap. 295 cu ft, max load 9,000 lb)	102	75	83	366	1,500
Crane, floating, diesel elec, steel, 60T	1,704	696	144	98,400	1,800,000
Drier, sand, external grating, 7T to 10T		52 (dia)	56	87.6	1,137
Fender, marine, rubber-filled	24	7 (dia)			
Forge, blacksmith, ptbl, w/blower, 40½- x 37- x 3-in.				130	200
Forge, blacksmith, ptbl, 220V, 42- x 38- x 7-in.				130	200
Forge, riveting, ptbl, 10- x 10- x 5-in. w/burner, oil-fired				3.75	216
Former, slip-roll, bench, hand, 2-in. dia rolls, 36-in. cap., 22 gage				33.7	480
Grinder, bench, 2-spindle, 220V, 3- to 4-in. dia	15	12	15	1.6	90
Grinder, bench, tool and cutter, 220V, 12-in. dia work	18	16	25	4.17	64
Helicopters (See ch 2.)					

See footnotes at end of table.

Item (Uncrated unless otherwise noted.)	Length (in.)	Width (in.)	Height (in.)	Cu. ft.	Weight (lb.)
TRANSPORTATION—Continued					
Landing craft, diesel, steel, Mark VIII, LCM (8), 70-ft	884	252	164	21,090	134,400
Landing craft, diesel, steel, 115-ft	1,380	408	261	85,043	403,200
Lathe, eng, hv dy, 20½-in. swing, 48-in. centers, 16-spd				453	13,730
Locomotive, diesel-elec, 36-, 39⅜-, 42-in., 48T, 0-4-4-0 road switcher	420	102	136	3,380	116,000
Locomotive, diesel-elec, 56½-, 60-, 63-, 66-in., 60T, 0-4-4-0 road switcher	420	102	136	3,380	116,000
Locomotive, diesel-elec, 36½-, 39⅜-, 42-in., 80T, 0-6-6-0 road switcher	504	108	131	4,130	144,000
Locomotive, diesel-elec, 56½-, 60-, 63-, 66-in., 120T, 0-6-6-0 road switcher	642	116	163	3,380	232,400
Locomotive, steam, 36-, 39⅜-, 42-in., 60T, 2-8-2	429	103	136	3,465	104,000
tender	285	103	136	2,285	41,600
Propelling unit, diesel, outboard, 165-hp					[j] 9,300
Pump, reciprocating, 12.5 gpm, 2-in. suction, steam, ¾-in. discharge[k]				8	300
Railway car, push, multigage, 6T, 4W					630
Railway motor car, multigage, 8-man, 4W					2,600
Railway cars, 36-, 39⅜-, 42-in.					
Ambulance, kitchen-diner-storage	735	100	134	5,650	91,000
Ambulance, pers	735	100	134	5,650	90,000
Ambulance, ward	735	100	134	5,650	92,000
Railway car, 56½-, 60-, 63-, 66-in.					
Flat, depressed center, 80T	492	116	40	1,334	76,000
Gondola, high-side, 40T	531	114	105	3,640	35,400
Shaper, metal work, floor, 20-in., std dy				190	5,100
Shear, sheet metal, 52- x 18-in., 16 gage					1,995
Sheet metal mach, cap. 18 gage iron				33.7	480
Tool set, boiler and smith shop co				432	18,238
Tool set, car repair co				169	9,663
Tool set, diesel-elec plat				34	3,117
Tool set, erecting and mach shop				536	22,105
Tool set, railway maint of way, No. 4				334	10,283
Tool set, railway maint of equip, No. 5				1,525	41,645
Tug, harbor, diesel, steel, 600-hp, 65-ft	840	234	273	30,054	224,000

[a] Weight will vary slightly with different makes and models.
[b] Folded.
[c] Less explosives.
[d] 10-ton may be issued.
[e] Data are for one section.
[f] Without forks.
[g] Add 30 percent for crating.
[h] Less components.
[i] Less wire.
[j] Without diesel engine.
[k] In place on 11-gpm pump.

7.7 Packaged Missiles

Missile	Container and contents	Container dimensions (in.)			Gross weight (lb)	Remarks
		Length	Width	Height		
Dart	Complete round	69⅛	24	27 ½	220	
Corporal	Aft body section (metal container).	444	48	48	7, 640	Pressurized, reusable container.
	Fore section (wooden crate)	127	42	39	569	Skid-mounted, sheathed, vibration-isolation-mounted.
	Mounting ring, warhead	33	32	34. 4		
	Warhead, frag (T25E1)	30	30	38	1, 750	Skid-mounted wooden crate—composition B, 180 lb.
	Warhead, frag	33	33	43	1, 741	Skid-mounted wooden crate—composition B, 412 lb.
	Fuzes	16	11	9	48	Hermetically sealed can, 12 cans per box.
	Cylinder, release propellant valve.	17	11	12	65	Fiberboard container, 24 containers per box, No. 6 blasting cap.
	Fuel mixture (aniline furfuryl-alcohol and hydrazine).	Packed in 55-gallon aluminum drums.			498 each	Four containers per wooden box, toxic, noncorrosive, class B, poison; flammability about that of kerosene.

Missile	Container and contents	Container dimensions (in.)			Gross weight (lb)	Remarks
		Length	Width	Height		
Corporal	Oxidizer (inhibited red fuming nitric acid).	Packed in 40-gallon aluminum drums.			510 each	Violently corrosive, very poisonous, not flammable, impact sensitive, drums must be handled in vertical position.
Hawk	Foresection container	87	29	34	700	
	Aft section container	156	29	49	1, 790	Solid fuel propellant.
Honest John (762mm rocket).	Motor	239	39	49	6, 450	JATO, igniter, and JATO cluster (all include propellant charge).
	Head compartment	146	44	53	3, 150	Nose tip, nose shell, and nose base.
	Fin assembly	60	16	50	345	
Jupiter	Semitrailer, missile transporter (loaded) (less nose cone).	698	110	[a] 132	18, 420	
	Container, nose cone (loaded). Unseparated missile	128 [b] 725	90 [b] 105	[a] 94 [b] 105	7, 800 [c] 10, 080	
La Crosse	Warhead Body	88 177¼	26 5/16 41¼	29 5/16 43½	858 3, 360	
Little John (318-mm rocket).	Complete round	161	24	31	1, 625	

Nike-Ajax	JATO with thrust structure and igniter.	174	27	28	1, 979	M13A1 container; explosive-750 lb; solid propellant booster; temperature limitation, 10° to 130° F.
Nike-Hercules	Aft section	222½	54½	61¾	4, 000	
	Sustainer motor, solid fuel	106	43¼	47⁷⁄₁₆	3, 731	
	Clustered JATO	180¾	45¾	51⅝	7, 267	Solid propellant explosive, 3,000 lb.
	Thrust structure	38	38	46	321	
	JATO fins	51	29	51	600	
	Missile fins	146	29	41	960	
	Warhead	98¼	54½	61¾	2, 430	Explosive, 650 lb.
Redstone	Thrust unit	518	96	106	20, 600	Gross weight includes trailer.
	Aft body unit	186	96	105	7, 000	Do.
	Warhead	252	96	105	15, 000	Do.
	Propellants: Hydrogen peroxide	Packed in 86-gallon ICC, 42D drums.			1,091 each	Very dangerous to eyes; highly combustible if brought into contact with combustible materials or their vapors; sealed containers may develop high pressure.

See footnotes at end of table.

Missile	Container and contents	Container dimensions (in.)			Gross weight (lb)	Remarks
		Length	Width	Height		
Redstone	Alcohol	Packed in 55-gallon ICC, 17E drums.			390 each	Toxic; highly flammable.
	Liquid oxygen					Generated on site.
Sergeant	Motor container Guidance container	216 109	50 41	54 52	10, 000 3, 000	
	Warhead container	162	41	49	4, 000	
	Fin container	72	41	48	600	

[a] Road height.
[b] Unpacked dimensions.
[c] Net weight.

7.8 Materials Handling Equipment

The items of materials handling equipment listed below are those normally used by Transportation Corps terminal service personnel. For the most part these items are authorized by TOE or TA. The straddle trucks listed in *f* below are not normally Transportation Corps TOE or TA items, but may be obtained by special authorization when needed. For more complete information, see TM 10–1619.

a. Forklift Trucks. All of the following forklift trucks are gasoline powered and pneumatic tired.

Capacity (lb)	Lift height (in.)	Free lift (in.)	Fork length (in.)	Load center (in. from heel)	Weight (lb)	Dimensions (in.)		
						Height	Length	Width
4,000	144	22	40	24	7, 660	95	104	45
6,000	168	6¾	40	24	10, 375	115	113	68
10,000	210	2	48	24	14, 145	150	136	77
15,000	210	2½	48	24	18, 330	150	152	96

b. Rough Terrain Forklifts.

Capacity (lb)	Lift (in.)	Fork length (in.)	Gradeability (percent)	Turning radius (ft)	Lift tilt (degrees)		
					Forward	Back	Left-right
6,000	144	48	45	15	45	30	10
10,000	144	60	45	17	45	30	10

c. Warehouse Tractors. Both of the following warehouse tractors are gasoline powered and pneumatic tired.

Drawbar pull (lb)	Towing capacity (ton)	Loaded speed (mph)	Weight (lb)	Dimensions (in.)		
				Height	Length	Width
4,000	90	12	5, 220	57	111	66
7,500	200	9. 47	12, 386	72	130	96

d. Warehouse Cranes. Both of the following warehouse cranes are gasoline powered and pneumatic tired.

Capacity (lb)	Sluing range	Loaded speed (mph)	Weight (lb)	Dimensions (in.)		
				Height	Length	Width
10,000	180°	15	20, 800	95	295	94
10,000	180°	12	20, 000	260	273	96

e. Warehouse Trailers.

Capacity (lb)	Tires	Construction	Length (in.)	Width (in.)
4,000	Steel or rubber	Wood	72	36
4,000	Steel or rubber	Wood	84	36
4,000	Steel or rubber	Wood	84	48
6,000	Pneumatic	Wood	108	48
20,000	Solid rubber	Steel	144	72

f. Straddle Trucks. All of the following straddle trucks are gasoline powered and pneumatic tired, and have four-wheel steering.

Capacity (lb)	Loaded speed (mph)	Weight (lb)	Dimensions (in.)		
			Height	Length	Width
30,000	35	12, 500	114	187	92
30,000	35	13, 250	123	187	92
30,000	35	13, 000	124	188	105
30,000	35	14, 800	159	192	96

Section III. ARCTIC AND OTHER COLD WEATHER DATA

7.9 Sled Train

a. Power Vehicle Specifications.

Type	Gross weight (lb)	Cubic feet	Dimensions (in.)			Per-sonnel	Fuel cap. (gal.)	Speed (mph) Gear					Drawbar pull (lb)		Payload towed	Fuel consumption (avg)	Turning radius (ft)	Engine
			Length	Width	Height			1	2	3	4	5	Direct drive	Torque converter				
M29C Weasel	5,971	403	193	67.3	71	4	35	4	7	10	12	20	N/A	None	3,800 lb	5 mpg	12	Studebaker Champion
M76 Otter	12,162	1,180	193	98	103.3	10	60	8 avg	18 avg	28 max	------	------	Cross drive	None	6,000 lb	2.3 mpg	12	Continental Model A01, 268-38
D7 LGP	47,515	1,870	232	132	123.75	1	65	2	3	5	7	10	15,000	None	30 to 40 tons	135 gal. per day	24	Caterpillar D337
D8 LGP M54	58,780	3,360	288	160	126	2	100	2	3	5	7	10	20,000	27,500	30 to 40 tons	135 gal. per day	24	Caterpillar D337
D8 LGP M55	83,000	3,360	288	160	126	2	918	1.5	1.9	2.8	3.8	5.2	32,000	None	30 to 40 tons	135 gal. per day	24	Caterpillar D342

b. Sled Specifications.

Characteristics	1-ton recon. sled		2½-ton farm sled	10-ton ATACO steel skis	10-ton ATACO Micarta skis	Fuel transporter
	1952	1953				
Gross weight (lb)	1,225	1,390	1,375	7,000	7,000	10,271
Cubic feet	75	128	282	1,367	1,460	403.92
Dimensions:						
Length	10′9″	13′10½″	15′8″	22′4″ w/o tongue	22′4″	24′
Width	5′	7′1½″	7′2″	8′6″	8′6″	10′
Height	1′5″	1′4¾″	2′6″	7′3″ to top of stakes	7′8″ to top of stakes	4′6″
Capacity	2,000 lb	2,000 lb	2½ tons	10 tons	10 tons	3,021 gal.

c. Wanigan Specifications.

Characteristics	Command, M54	Passenger, M52	Passenger, M54	Command, M55	Crew, M53	Crew mess, M54	Crew, M55	Mess, M55
Weight, empty (lb)	10,500 (est)	10,500 (est)	11,400 (est)	15,000	16,000 (est)	18,000	19,000	19,000
Cubic feet	1,560	1,560	1,870	2,600	3,310	2,868	3,790	3,790
Dimensions:								
Length	20′	20′	24′	26′	35′	45′	38′	38′
Width	10′	10′	10′	12′	8′7″	8′6″	12′	12′
Height	7′2″	7′2″	8′6″	10′3″	7′8″	7′6″	10′3″	10′3″
Number of persons accommodated.	4	10	12	6	18	16	24	18
Fuel used	Diesel oil	Diesel oil	Diesel oil	Diesel oil	Diesel oil	Coal	Diesel oil	Diesel oil

d. Other Data.

(1) *Fuel consumption per day.*

(*a*) *Coal stove for heating.*

1. 20 pounds of coal or 12 Presto logs for summer operations (10°F or above).

2. 50 pounds of coal or 30 Presto logs for winter operations (10°F or less).

(*b*) *Coal stove for cooking.*

1. 50 pounds of coal.

2. 30 Presto logs if used instead of coal.

(*c*) *Generator fuel consumption.*

1. 5-kw generators burn approximately 20 gallons of gasoline in continual operation.

2. 30-kw generators burn 30 gallons of diesel fuel oil (VVF 800).

3. 45-kw generators consume 35 gallons of diesel fuel oil (VVF 800).

(*d*) Starting motors or pumps, based on an average of 1-hour operation per day, are rated at 0.2 of a gallon of gasoline.

(2) *Lubrication consumption.*

(*a*) Engine oil consumption for large general purpose tractors is rated at 2 gallons per day. The rate is considered equal for OE 30–10–5. The consumption rate for light vehicles is .006 gallon per mile.

(*b*) The rate of gear oil consumption is: .45 gallon per mile for a large general purpose tractor; .006 gallon per mile for light vehicles.

(*c*) GAA is used as an all-purpose grease (also used for water pumps, etc.). Consumption rate is .005 of a pound per mile.

(*d*) Consumption rates for generators, starting motors, and pumps are based on operations listed in (1)(*c*) and (1)(*d*) above.

(3) *Antifreeze.* Each vehicle will have its initial antifreeze put in before embarking on a cold-weather operation. Arctic antifreeze compound, used in all CA–A equipment, must not be diluted with water (par. 7.11*a*).

7.10 Load-Bearing Capacity of Ice

The strength of ice varies with the structure of the ice, the purity of the water from which it is formed, the cycle of formation (freezing, thawing, and refreezing), temperature, snow cover, and water currents. Although the sustaining capacity of ice cannot be determined accurately, experience and tests provide the working-capacity figures for good quality ice given below.

Load	*Minimum thickness of ice (inches)*	*Minimum distance between tracks or elements (feet)*
Single rifleman on skis or snowshoes	1½	16
Infantry columns, single horses, motorcycles, unloaded sleds	4	33
Single light-artillery piece; ¼-ton truck, 4x4	6	49
Light artillery, passenger cars, 1½-ton trucks: light total load of 3 tons	8	65
2½-ton trucks, light loads	10	82
Closed vehicle columns, except those of armored force and heavy artillery	12	98
Armored scout cars, light tanks	14	115
20-ton vehicles	16	131

7.11 Antifreeze Solutions

a. Compound CA–A (antifreeze, arctic winter) is intended for use in arctic regions as coolant in all liquid-cooled, internal-combustion engines. Compound CA–A protects to −70°F. It must not be diluted by adding water or any other substance.

b. Compound, antifreeze, USA 4–116 (ethylene glycol type) (Prestone, Zerex, etc.) is added to water in the following proportions to protect to the temperatures specified.

Temperature (°F)	*Pints required per gallon of mixture*	*Percent compound by volume of mixture*
+30	1	12. 5
+20	1. 5	18. 75
+10	2	25
0	2. 5	31. 25
−10	3	37. 5
−20	3. 5	43. 75
−30	4	50
−40 to −50	4. 5	56. 25
−60 to −70	5	62. 5

c. If the above compounds are not available, methyl alcohol antifreeze compounds (Zerone, Norway, etc.) or plain denatured alcohol may be used. Denatured alcohol evaporates quickly; methyl alcohol compounds evaporate less quickly. Solutions must be checked frequently with an antifreeze hydrometer. Distilled glycerine may be used in an emergency, but if the water evaporates a strong solution of glycerine freezes readily. Not over 60 percent glycerine may be used in solution to protect to −30°F. The following quantities of these compounds are used.

Temperature (°F)	Percent compound by volume of mixture		
	Methyl alcohol compounds	Denatured alcohol	Glycerine
+10	20	30	33
0	25	37	40
−10	30	43	47
−20	40	50	53
−30	50	57	59
−40	54	65	----------
−50	58	72	----------
−60	62	78	----------

Section IV. CARGO CONTAINERS, PALLETS, AND CARGO MARKING

7.12 Reusable Metal Shipping Box and Container Inserts

Figure 7.1 illustrates the two reusable metal shipping boxes (cargo transporters) and one type of cargo marking. To facilitate handling and loading small articles, insert containers may be used with the cargo transporter. The insert container is a cardboard box with a maximum capacity of 1,000 pounds when strapped to a wooden pallet. Six insert containers fit into the standard cargo transporter (type 2) and four in the half-size (type 1). Container inserts may be used to consolidate small TOE items, thus eliminating multiple handling and much protective packaging. If units are to be moved by air, the inserts may be used as the shipping containers; cargo transporters are not necessary.

7.13 General Purpose Pallet

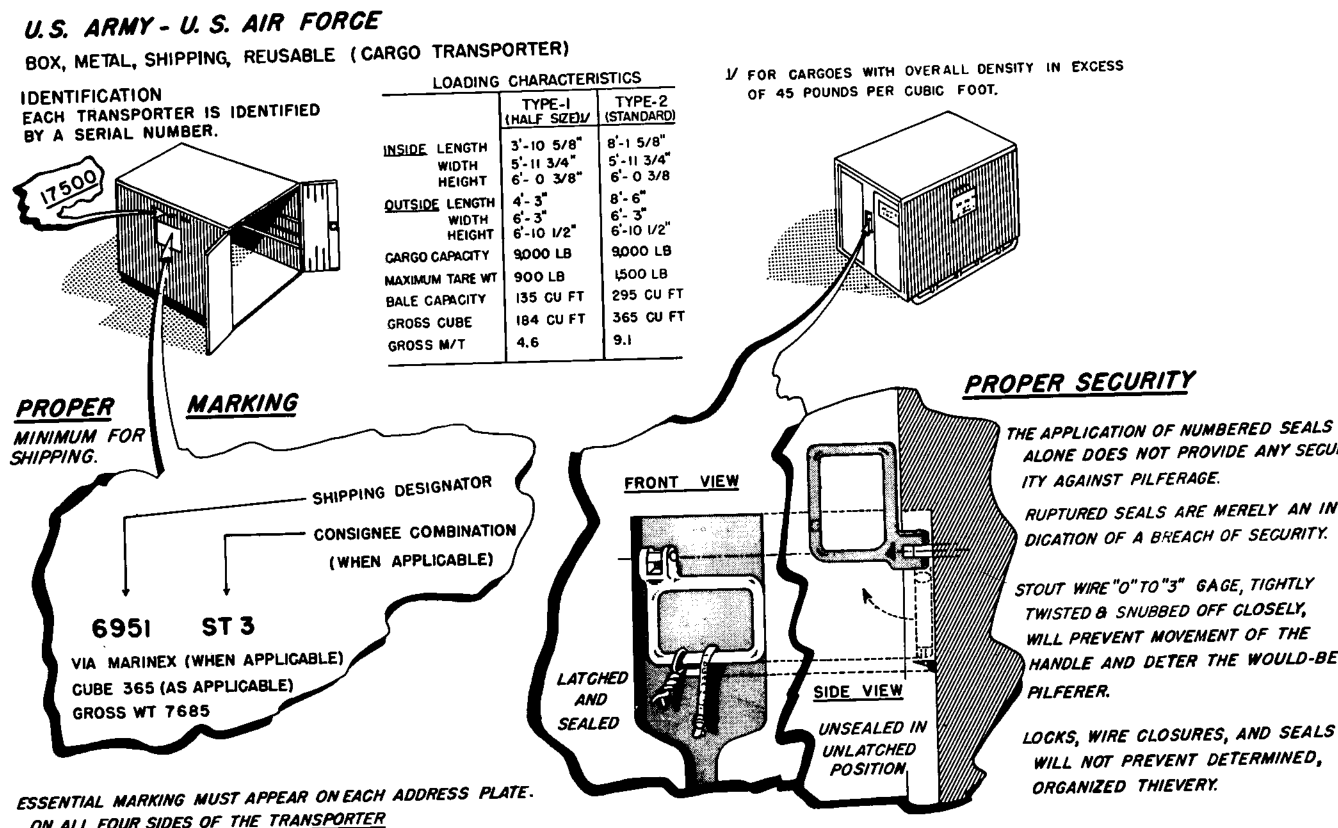
(fig. 7.2)

The general purpose pallet is a four-way-entry, wooden pallet 48 inches long, 40 inches wide, and about 5¼ inches high. It is used primarily for shipping palletized cargo. It may be loaded and shipped from shipper to consignee without the cargo being rehandled. The four-way-entry feature permits easy entrance of the forks of forklift trucks.

7.14 Sled Pallet

(fig. 7.3)

The sled pallet consists of a heavy timbered platform (4 by 6 feet) and runners (4 by 6 inches by 6 feet), upon which 3,000 pounds of supplies and equipment may be secured with steel bands. The pallet alone weighs 200 pounds. Cables are attached to the runners to permit towing. Sled pallets may be moved through any surf or over any beach which may be crossed by LVTP's, wheeled landing vehicles, or similar craft. Rations, water, fuel in 5-gallon containers, and ammunition are the most suitable supplies for pallet loading.



	TYPE-1 (HALF SIZE)1/	TYPE-2 (STANDARD)
INSIDE LENGTH	3'-10 5/8"	8'-1 5/8"
WIDTH	5'-11 3/4"	5'-11 3/4"
HEIGHT	6'- 0 3/8"	6'- 0 3/8
OUTSIDE LENGTH	4'- 3"	8'- 6"
WIDTH	6'- 3"	6'- 3"
HEIGHT	6'-10 1/2"	6'-10 1/2"
CARGO CAPACITY	9,000 LB	9,000 LB
MAXIMUM TARE WT	900 LB	1,500 LB
BALE CAPACITY	135 CU FT	295 CU FT
GROSS CUBE	184 CU FT	365 CU FT
GROSS M/T	4.6	9.1

Figure 7.1. Characteristics, marking, and security of cargo transporters.

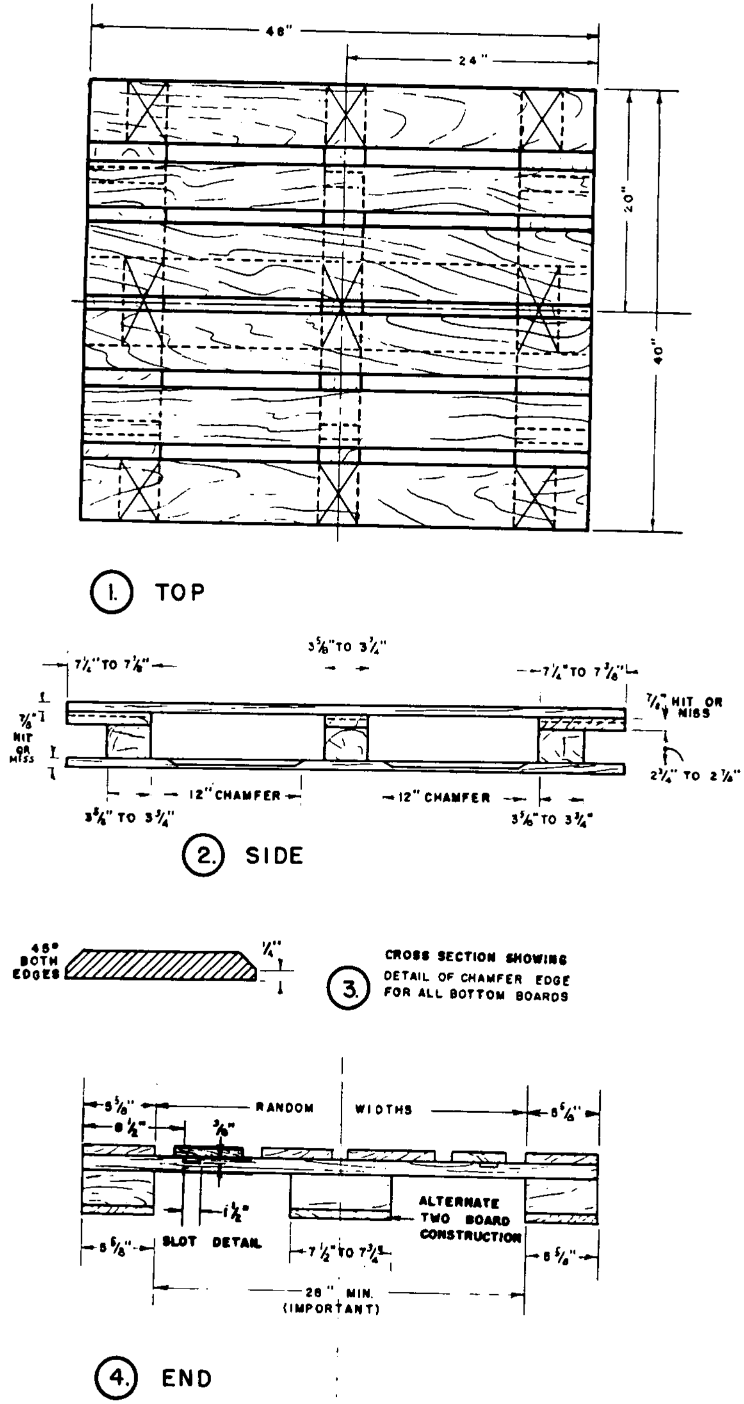


Figure 7.2. Dimensions of general purpose pallet.

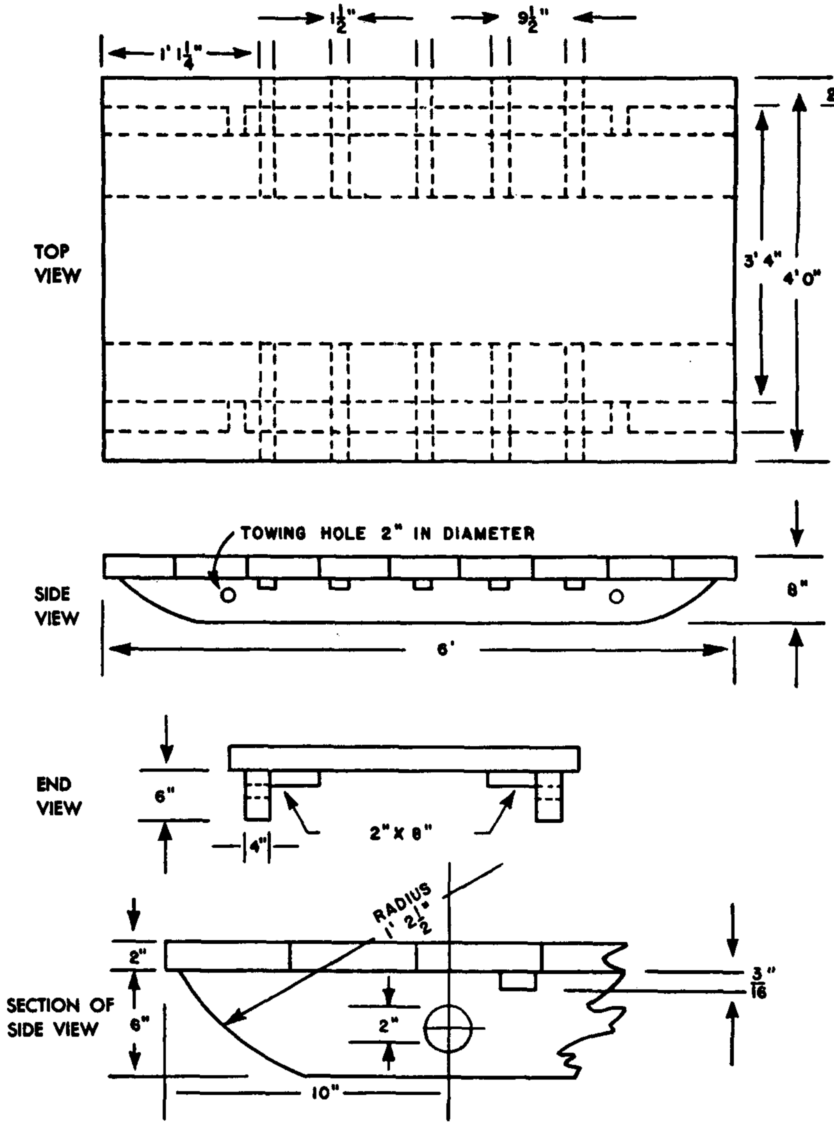


Figure 7.3. Sled pallet dimensions.

7.15 Address Marking

(fig. 7.4)

Address marking identifies the consignee and the ultimate destination of a shipment. The address may be "in the clear", coded, or both. In-the-clear marking is omitted when it is not desirable to reveal the consignee. Code marking may be used to conceal the identity of the consignee, destination of the vessel, and contents of the shipment. General procedures for cargo marking are described below. AR 746-80 gives detailed marking procedures, shipping symbol numbers, and area designators. Address marking is used for both domestic and oversea shipments.

a. CONUS Shipments. On CONUS shipments, address marking consists of:

(1) The in-the-clear name and address of the consignee (not required on Transportation Control and Shipment Detail cards).

(2) Designators that identify the military department initiating the requisition, the designation depot or station, the requesting organization, the date, and the serial number of the requisition.

(3) Shipment digit marking: this gives the required date, the shipper, the shipment serial number, and the total number of packages in the shipment.

b. Oversea Shipments. The in-the-clear address, the coded oversea address, and the digit marking may constitute the oversea address marking. The in-the-clear address may be omitted. The coded oversea address consists of five parts.

(1) The first part is primarily for the use of transportation agencies and is either a shipping designator or a shipment number. The shipping designator indicates the port of debarkation or general destination, the shipment number a particular troop unit.

(*a*) *Shipping designator* ((1), fig. 7.4). The shipping designator is composed of a combination of four numerical symbols: the first three give the specific oversea geographical area of discharge; the fourth shows the military department initiating the requisition. Designators are used when supplies other than those included in troop movement orders are shipped. The same designators are used repeatedly because the first three numerical symbols in the combination represent permanent places. The numerical symbols for the military departments are:

1—Army
2—Navy
3—Air Force
4—Marine Corps
5—Army requisition initiated by CONUS technical services
6—Military Assistance Program

(*b*) *Shipment number* ((2) fig. 7.4). A shipment number consists of three or more digits—for example, 123 or 1234. It is used only once and is assigned to a specific movement of units, casuals, or supplies. A letter may be added to the shipment number to indicate a specific subunit of the parent organization to be moved—for example, 1234B.

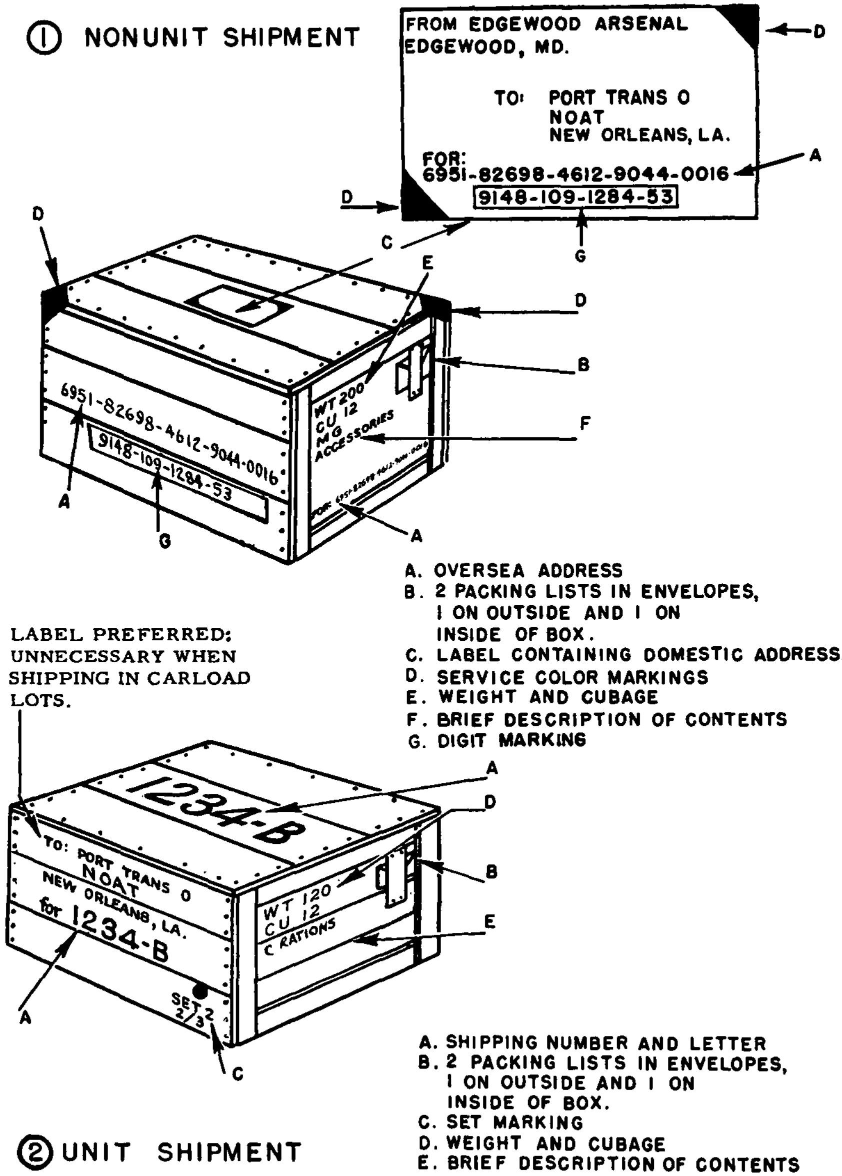


Figure 7.4. Address marking for boxes.

(2) The second part of the address consists of five digits: these stand for the general oversea area location, such as Europe of Japan (first two digits), and the station initiating the requisition (last three digits).

(3) The third part of the address consists of four digits assigned by the oversea command: these identify the requesting or using organization.

(4) The fourth part of the address consists of four digits: these show the date the requisition was prepared. The first digit represents the last digit in the calendar year, the last three digits the numerical calendar day of the year (the number of days since the beginning of the year).

(5) The fifth part of the address has four digits: this is the serial number of the requisition prepared on the day indicated in (4) above.

7.16 Digit Marking

(fig. 7.5)

a. General. Digit marking is a simple and accurate means of identifying packages in a shipment and of checking them against the appropriate documents. The system provides a control for packages from origin to destination and is applicable to practically all service shipments. It also facilitates the use of non-U.S. personnel by circumventing the language barrier.

b. Description. Digit marking is composed of four separate digits or groups of digits separated by dash spacers and enclosed in a black rectangular border on a light surface or a light rectangular border on a dark surface. For example:

9148—109—1284—53

(1) The first series of digits represents the oversea terminal arrival date, assigned by the oversea supply agency. It consists of the last digit of the calendar year followed by the digits that represent the numerical calendar day of the year. The numerals 9148 represent 28 May 1959.

(2) The second series of digits stands for the depot or activity actually making or having the responsibility for making the shipment. The numerals 109 represent Edgewood Arsenal.

(3) The third series of digits is the serial shipment number and is assigned by the shipper to identify the shipment.

(4) The fourth series of digits is the package number. (The package number is the total number of packages in a shipment.) This number is marked on each package, container, or unpacked item in a shipment except for carload or truckload shipments of identical items in identical containers. When a shipment of identical items is being made, the package number is marked on each container only if the shipping order bears the notation MARK EACH CONTAINER.

c. Application.

(1) Each shipper forwarding a shipment overseas through a water or air terminal marks each package with the appropriate digit marking.

(2) The digit marking appears on the package directly below the coded oversea address.

(3) Digit marking, excluding package numbers, enclosed in the prescribed rectangular border is placed directly below the oversea address on all shipping documents and bills of lading. If a shipment has more than one oversea address listed on the bill of lading, the applicable digit marking is entered in the body of the bill of lading in close proximity to the appropriate oversea address. On dock receipts and cargo delivery receipts, the digit marking is entered in the space(s) provided. Package numbers are shown in the appropriate spaces in the pertinent documents.

(4) Each DD Form 1149 (Requisition and Invoice/Shipping Document) that is executed when originating a shipment is the basis for applying a separate digit marking.

d. Exceptions.

(1) The digit system is not used for bulk grain, military impedimenta, lumber, perishables, household goods, personal effects, and parcel post forwarded directly to an oversea address through APO facilities.

(2) The coded oversea address is not shown on individual shipments contained within a cargo transporter originating at the shipping depot and shipped directly to a consignee at final destination. It is indicated on shipments placed within a transporter when the individual shipments are destined for more than one consignee or oversea destination.

e. Packet Shipments.

(1) The digit marking is not limited to the items carried in a single transportation unit being moved by truck or railroad car. It may be applied to a shipment involving several like transportation units, provided the entire shipment so covered is the result of one requisition and will be ready for shipment on the date that the shipper has reported it available for shipment.

(2) To avoid split shipments, care must be taken to keep the number of transportation units in a shipment to a minimum. Five transportation units in any one shipment should be the maximum. A consolidated or master shipping document, annotated to reflect the consolidation, must be forwarded to the interested ports and to the consignee.

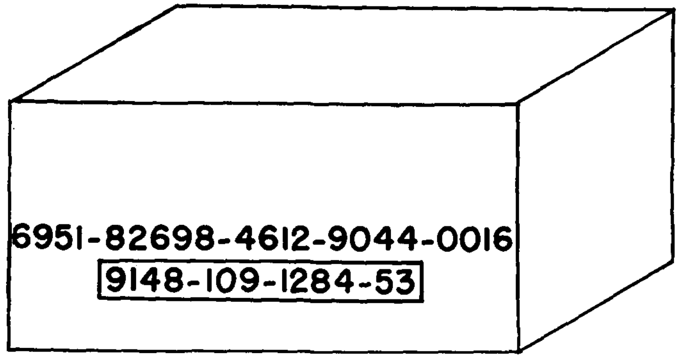


Figure 7.5. Digit marking.

7.17 Service-Color Marking

(fig. 7.6)

Service-color markings are shown on all export shipment containers to facilitate identification of shipments or service and to assist in the dispersion of supplies to the proper oversea depots.

a. Army (Except Signal Corps), Air Force, Navy, and Marine Corps. An equal-size triangle is painted in the prescribed service color on each adjacent face of two diagonally opposite corners of the top of the containers. The altitude of the triangle may vary from 3 to 8 inches and should be in proportion to the size of the container.

b. Army Signal Corps. A signal 2-inch band in the prescribed service color is painted around the smaller perimeter of the container in a location that does not interfere with other markings. A similar line is painted across the two short ends of the container.

c. Assigned Service Colors and Markings. The number in parentheses is the Federal color specification number.

- (1) Army technical services.
  - (*a*) Chemical Corps—dark blue (35044)
  - (*b*) Corps of Engineers—red (11136)
  - (*c*) Medical Service—maroon
  - (*d*) Quartermaster Corps—willow green (14187)
  - (*e*) Ordnance Corps—yellow (13538)
  - (*f*) Signal Corps—orange (12246)
  - (*g*) Transportation Corps—light gray (16376)
- (2) U.S. Air Force—blue (15193)
- (3) Navy—black (37038) except as noted below:
  - (*a*) Naval electronics—green (14187)
  - (*b*) Naval medical supplies—maroon
- (4) Marine Corps.
  - (*a*) Ordnance—yellow (13538)
  - (*b*) Aviation—blue (15193)
  - (*c*) Engineer—red (11136)
  - (*d*) Chemical—dark blue (35044)

(*e*) Electronics—orange (12246)
(*f*) Medical—maroon
(*g*) Quartermaster—willow green (14187)
(*h*) Post Exchange—willow green (14187) with 3-inch X marked above
(*i*) Motor transport—willow green (14187) with 3-inch MT marked above

(5) Army and Air Force Exchange Service—a black X where colored corner markings normally appear
(6) Special Service Division—white triangles with black 2-inch dot in each triangle
(7) Army and Air Force Motion Picture Service—a black MPS where colored corner markings normally appear

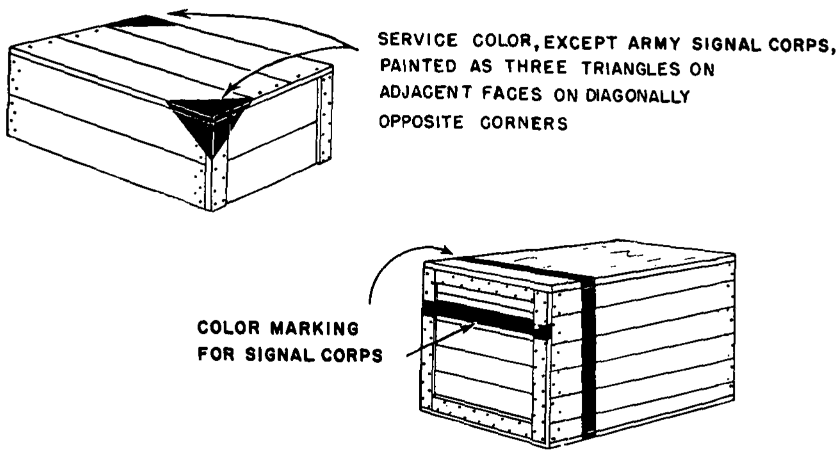


Figure 7.6. Service-color marking.

Section V. COMMUNICATIONS

7.18 Signal Equipment Classification

a. Classification. Signal equipment submitted to a joint Army-Navy board is classified by indicator letters as follows:

AN=joint Army-Navy system numbers. (AN does not mean that the set is used by both services.)
First letter following slash=type of installation.
Second letter following slash=type of equipment.
Third letter following slash=purpose of equipment.
Number following dash=particular set.

b. Example. AN/VRC–18=Army-Navy, ground vehicular radio receiving-transmitting set No. 18.

c. Interpretation.

AN /	V	R	C	18
System indicator	Where it is	What it is	What it does	Model number of a specific type

INSTALLATION

A—Airborne (installed and operated in aircraft)
B—Underwater mobile, submarine
C—Airtransportable (inactivated, do not use)
D—Pilotless carrier
F—Fixed
G—Ground, general ground use (includes two or more ground installations)
K—Amphibious
M—Mobile (installed as operating unit in a vehicle which has no function other than transporting the equipment)
P—Pack or portable (animal or man)
S—Water surface craft
T—Ground, transportable
U—General utility (includes two or more general installation classes, airborne, shipboard, and ground)
V—Ground, vehicular (installed in vehicle designed for functions other than carrying electronic equipment, etc., such as tanks)

TYPE EQUIPMENT

A—Invisible light, heat radiation
B—Pigeon (inactivated, do not use)
C—Carrier (wire)
D—Radiac
F—Photographic
G—Telegraphic or teletype (wire)
I—Interphone and public address
K—Telemetering
L—Countermeasures (inactivated, do not use)
M—Meteorological
N—Sound in air
P—Radar
Q—Sonar and underwater sound
R—Radio
S—Special types, magnetic, etc., or combinations of types
T—Telephone (wire)
V—Visual and visible light
X—Facsimile or television

PURPOSE

A—Auxiliary assemblies (not complete operating sets)
B—Bombing
C—Communications (receiving and transmitting)
D—Direction finder
G—Gun or searchlight directing
H—Recording (photographic, meteorological, and sound)
L—Searchlight control (inactivated, use G)
M—Maintenance and test assemblies (including tools)
N—Navigational aids (including altimeters, beacons, compasses, radar beacons, depth sounding, approach and landing)
P—Reproducing (photographic and sound)
Q—Special or combination of types
R—Receiving
S—Detecting and/or range of bearing
T—Transmitting
W—Remote control
X—Identification and recognition

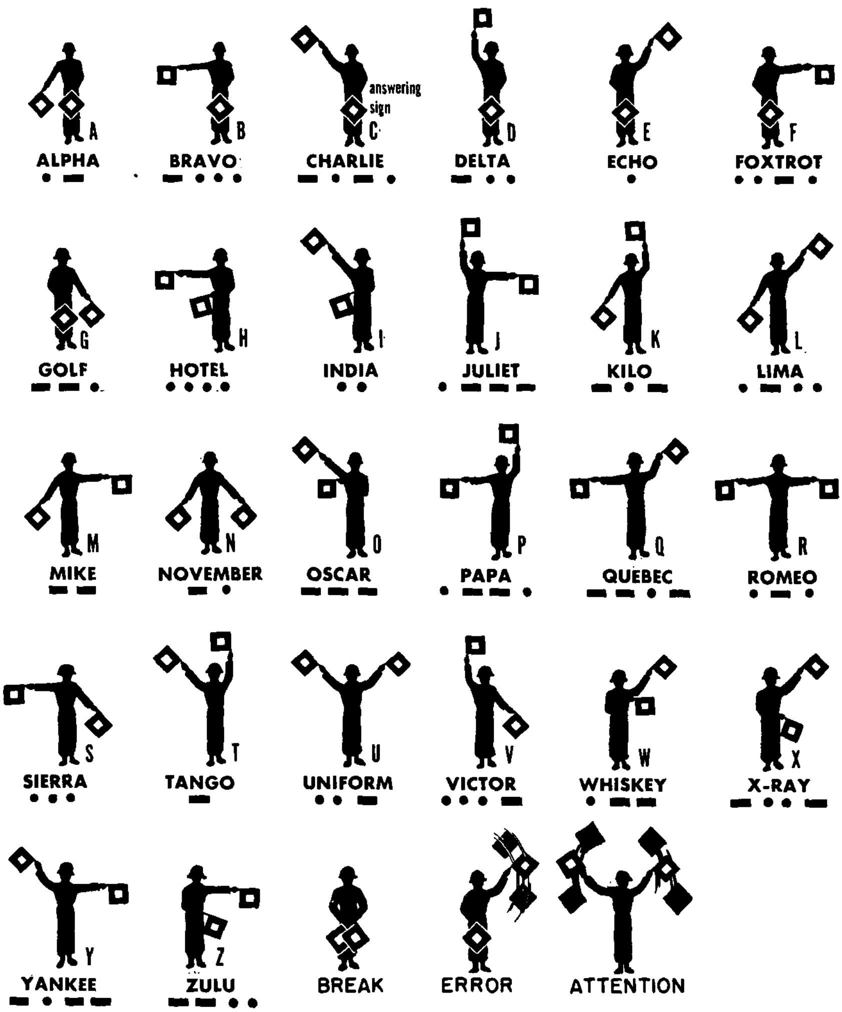
7.19 Semaphore, Phonetic Alphabet, and Morse Code

(fig. 7.7)

a. Semaphore. Signals may be sent by using the semaphore alphabet and two 18-inch square, red-and-white flags. Numerals in the message should be spelled out. All messages end with the ending sign AR. Detailed instructions may be found in H.O. No. 87.

b. Phonetic Alphabet. This is a voice alphabet used over radio

ALPHABET: SEMAPHORE, PHONETIC, AND MORSE



NUMERALS: MORSE AND PHONETIC

1 • — — — —	4 • • • • — (FO-WER)	6 — • • • •	9 — — — — • (NI-NER)
2 • • — — —	5 • • • • • (FI-YIV)	7 — — • • •	0 — — — — — (ZEE-RO)
3 • • • — — (THUH-REE)		8 — — — • •	

Figure 7.7. Semaphore, phonetic alphabet, and Morse code

and wire systems to identify the calling and the called station and to spell difficult or unusual words.

c. Morse Code. Time and position signals necessary to avigation and navigation and radio and wire messages are given in Morse code. AR is the end-of-message signal. For general telegraphic procedures, see FM 24–5. The uses of Morse code in avigation are explained in TM 11–2557 and in navigation in Knight's "Modern Seamanship."

7.20 Ground-to-Air Emergency Messages

Emergency messages may be sent from the ground to aircraft by arranging panels, torn clothing, parachutes, ditches, rocks, logs, brush fires, and other materials and formations in the shapes shown in figure 7.8. The arrangement must be—

a. Large enough to be seen from the air.

b. Of both color and texture in contrast to its background.

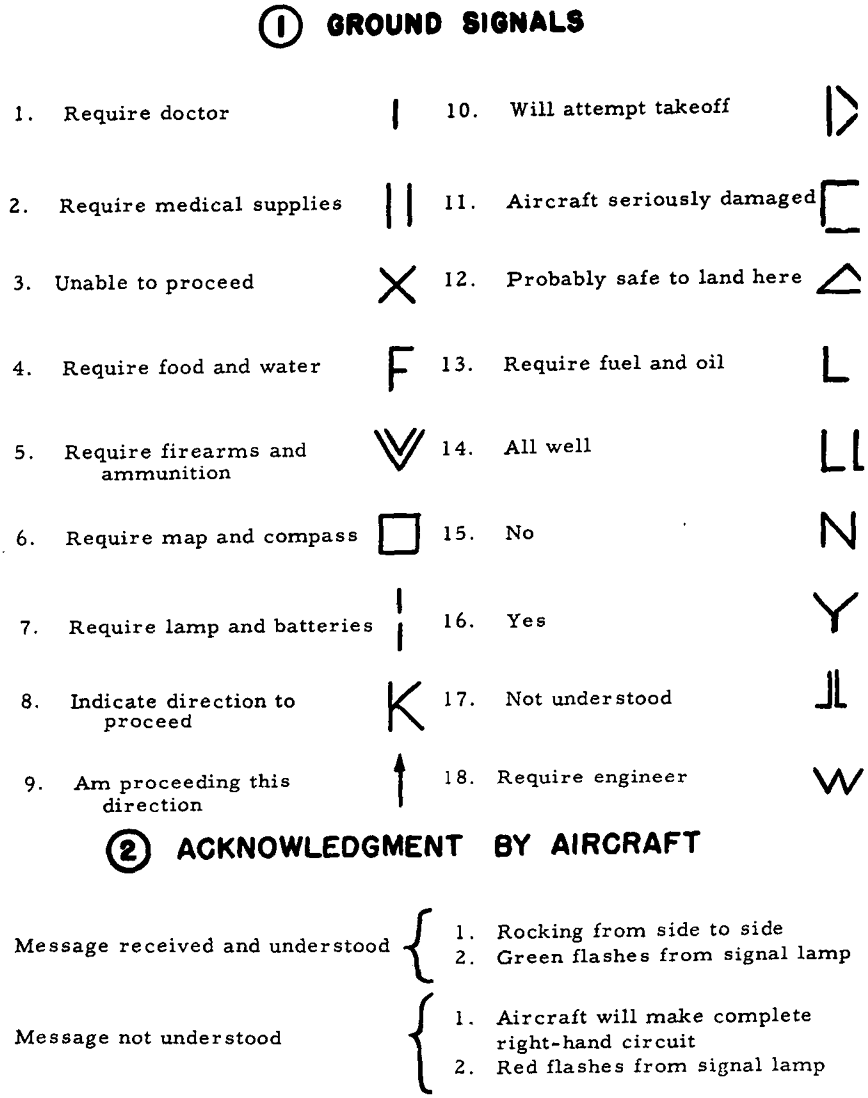


Figure 7.8. Ground-to-air emergency code

7.21 Characteristics of Radio Sets

Radio set	Range (miles)				Modulation	Frequency range (mc)		Emission				Vehicle volt required	Weight (lb)
	Phone		CW [a]			Transmitter	Receiver	Voice	MCW [b]	CW [a]	RTT [c]		
	Stationary	Moving	Stationary	Moving									
AN/GRR-5	No	No	No	No	AM	No	1.5–18.0	No	No	No	No	6, 12, 24	110
AN/GRC-7	15	10	No	No	FM	38.0–54.9	38.0–54.9	Yes	No	No	No	12, 24	541
AN/GRC-7, Set 2	1	No	No	No	FM	47.0–58.4	47.0–58.4	Yes	No	No	No	12, 24	215
AN/GRC-8	15	10	No	No	FM	38.0–54.9	38.0–54.9	Yes	No	No	No	12, 24	190
AN/GRC-9	25	15	75	35	AM	2.0–12.0	2.0–12.0	Yes	Yes	Yes	Yes	12, 24	256
AN/GRC-19	50	No	75	No	AM	1.5–20.0	0.5–32.0	Yes	No	Yes	Yes	24	254
AN/GRC-46	50	No	75	No	AM	1.5–20.0	0.5–32.0	Yes	No	Yes	Yes	24	[d] 1,126
AN/PRC-9	[e] 3–5	[f] 5–12	No	No	FM	27.0–38.9	27.0–38.9	Yes	No	No	No	24	[g] 62
AN/PRC-10	[e] 3–5	[f] 5–12	No	No	FM	38.0–54.9	38.0–54.9	Yes	No	No	No	24	[g] 62
AN/TRC-34	25	No	15	No	FM	152.0–174.0	152.0–174.0	Yes	No	No	No	(a.c.)	[h] 172
AN/VRC-7	1	No	No	No	FM	47.0–58.4	47.0–58.4	Yes	No	No	No	12, 24	65
AN/VRC-9	15	10	No	No	FM	27.0–38.9	27.0–38.9	Yes	No	No	No	12, 24	299
AN/VRC-10	15	10	No	No	FM	38.0–54.9	38.0–54.9	Yes	No	No	No	12, 24	115
AN/VRC-12	25				FM	30.0–70.0	30.0–70.0	Yes				24	90
AN/VRC-19	25	No	15	10	FM	152.0–174.0	152.0–174.0	Yes	No	Yes	No	12	113
AN/VRC-19X	25	No	15	10	FM	152.0–174.0	152.0–174.0	Yes	No	Yes	No	6	240
AN/VRC-29	50	No	75	No	AM	1.5–20.0	0.5–32.0	Yes	No	Yes	Yes	24	
AN/VRQ-2	15	10	No	No	FM	27.0–38.9	27.0–38.9	Yes	[i]	No	No	12, 24	427
AN/VRQ-3	15	10	No	No	FM	38.0–54.9	38.0–54.9	Yes	[i]	No	No	12, 24	502

[a] Continuous wave (radiotelegraph).
[b] Modulated continuous wave (tone).
[c] Radioteletypewriter.
[d] Including shelter.
[e] Short antenna.
[f] Long antenna.
[g] With battery.
[h] Ground mounted.
[i] 1,600-cycle ringing.

Section VI. FIRST AID AND CBR DEFENSIVE AND PROTECTIVE MEASURES

7.22 First Aid

a. General.

(1) Do not move patient until extent of injury is determined.

(2) Make patient as comfortable as possible.

(3) Handle patient gently and keep him warm.

(4) Don't try to do too much. If you don't know procedure for treatment, make the patient comfortable rather than possibly injuring him further by improper treatment.

b. Control of Bleeding.

(1) Most mild bleeding stops naturally by a blood clot forming in the wound.

(2) For severe cases, use the following measures until bleeding stops:

(*a*) Elevate injured member if there is no fracture.

(*b*) Apply direct pressure to wound by hand through cleanest available dressing, bandage, cloth, or part of clothing.

(*c*) If blood is gushing from a limb, exert finger pressure on an artery between the heart and the wound, while a cloth for pressure to wound is being found. The two arterial points are—

1. On the inner half of the arm midway between the elbow and the armpit (for lower-arm bleeding).

2. At the front-inner part of the thigh near the crotch (for leg bleeding).

(*d*) When there is gushing bleeding from an arm or leg, apply a tourniquet between the heart and wound to shut off the blood flow. The tourniquet should not be loosened or removed at any time except by competent medical personnel.

c. Symptoms and Treatment of Ailments.

(1) *Wounds.* Expose wound, apply sterile dressing from first-aid packet, control bleeding, prevent shock, provide medical attention as soon as possible.

(2) *Shock.*

(*a*) *Symptoms.* Trembling, nervousness, loss of color, perspiring, unconscious.

(*b*) *Treatment.* Lay patient on back, with head low and feet elevated. Loosen clothing about neck, chest, and abdomen. Keep patient warm with blankets. If patient can swallow and has no belly injury, give him hot coffee, milk, or water. Never pour liquid down throat of an unconscious person.

(3) *Burns.*

(*a*) *Symptoms. First degree burn:* reddened skin, but no blister; *second degree*, skin blistered; *third degree*, skin destroyed or charred.

(*b*) *Treatment.* Carefully remove or cut clothing away from burned area. Do not open blisters. Cover area with sterile dressing *only*. Keep burned areas apart by separate bandages. Treat for shock.

(4) *Fracture.*

(*a*) *Symptoms.* Pain and tenderness near fracture; partial or complete loss of motion; deformity, swelling, discoloration (blueness about the point of injury).

(*b*) *Treatment.* Handle all persons with fracture or suspected fracture with the greatest gentleness: rough or careless handling causes pain, shock, and damage to blood vessels and nerves. Splint fractures of thigh, hip, or leg. If shock is apparent, treat as described in *c*(2) above. Move the patient only if necessary. Do not attempt to straighten the limb if bent. To do so may cause further damage to the patient. Support the limb on each side of the fracture until a splint is applied. Splints, which should always be padded, must be long enough to reach beyond joints above and below fracture. One method of splinting a broken bone in a leg is to place a folded poncho, blanket, or jacket between the wounded man's legs and tie both legs together above and below the break. In this way the uninjured leg serves as a splint for the injured one.

(5) *Heatstroke.*

(*a*) *Symptoms.* Hot, dry, bright pink skin; stoppage of sweating; spots before eyes; sometimes delirious; headache; high temperature.

(*b*) *Treatment.* Remove patient from sun and take off clothing. Immerse him in or sprinkle him with water. Get medical aid immediately; heatstroke is serious.

(6) *Heat exhaustion.* This is caused by loss of body salts through perspiration.

(*a*) *Symptoms.* Dizziness, nausea, pale face, cramps, cold clammy skin, and weak pulse.

(*b*) *Treatment.* Move patient to shade, treat as for shock, and, if conscious, give cool, salt water (one teaspoonful per pint).

(7) *Frostbite.* This is localized freezing of body surfaces.

(*a*) *Symptoms.* Numbness, grayish or white skin, stinging pain at onset.

(*b*) *Treatment.* Thaw quickly against the body, or immerse in warm water (body temperature). Never rub affected area. Treat for shock.

(8) *Snake and poisonous insect bites.* If bite is on arm or leg, apply tourniquet a short distance above the bite. Tighten the tourniquet just enough to make the veins stand out prominently. Make a cross-cut incision approximately one-quarter inch deep over each fang mark. Massage limb from tourniquet toward wound. Apply suction gently with mouth or any convenient means continuously for at least one-half hour. If the bite is on a part of the body where it is impossible to apply a tourniquet, make the cross-incisions and apply suction. Keep patient prone, quiet, and treat for shock. Get medical aid.

(9) *Nonpoisonous insect bites and stings.* Apply weak ammonia, salt water, or soda.

(10) *Drowning.*

(*a*) *Symptoms.* Breathing will cease. Patient may appear dead but still be alive.

(*b*) *Treatment.* Time is of prime importance. Seconds count. Begin treatment at once. The most important thing is to get air into the victim's lungs immediately. Quickly sweep your fingers through the victim's mouth to clear out froth and debris, and draw his tongue forward. Position body to allow fluids to drain from respiratory passages. Victim's head should be extended, not bent forward, and the chin should not sag. Begin artificial respiration (the back-pressure-arm-lift method is preferable) and continue until victim is breathing naturally or is pronounced dead. If the chest cage is injured and compression of the chest would do further damage, or if upper extremities are fractured, use the mouth-to-mouth or mouth-to-nose technique. Don't wait for mechanical resuscitator, but if one is available without delay, use it. As soon as victim can breathe for himself, loosen his clothing, keep him warm, and treat him for shock.

(11) *Electric shock.*

(*a*) *Symptoms.* Same as for drowning. Shocks may occur through contact with wires, or by lightning.

(*b*) *Treatment.* If person has come in contact with an electric current, turn off switch if it is nearby, but do not waste time looking for it. Use dry wooden pole, dry clothing, dry rope, or some other material that will not conduct electricity to remove person from wire. Do not touch person or wire with bare hands until he is off the wire. Start artificial respiration immediately—the same as for a drowning victim.

(12) *Carbon-monoxide poisoning.* Carbon monoxide is an odorless, invisible gas. Poisoning usually results from breathing vehicle exhaust fumes, or stove fumes in poorly ventilated shelters.

(*a*) *Symptoms.* Dizziness, weakness, headache, vomiting—then unconsciousness.

(*b*) *Treatment.* Get patient to fresh air and start artificial respiration immediately. Keep him quiet.

(13) *Foot ailments.*

(*a*) *Examples.* Athlete's foot, corns, calluses, bunions, ingrown toenails, chafing, excessive perspiration, blisters.

(*b*) *Treatment.* Keep feet clean. After a bath, thoroughly dry the feet, especially between the toes. For itching or redness between toes, apply GI foot powder twice daily. If condition does not improve, see medical officer. Don't cut a corn or callus as this may cause serious infection. Keep toenails clean and short. Cut them straight across. Dust feet with GI powder after bathing and before a march. This absorbs perspiration and prevents chafing. Try to put on clean socks every day. Don't wear socks with holes or poorly darned spots, or those that fit improperly. Break in shoes before wearing on a march. Make sure of proper fit in shoes. To treat a blister, wash spot with soap and water, sterilize a needle with a flame, open blister by sticking it at lower edge, cover with Band-Aid or similar sterile dressing.

(14) *Plant poisoning.*

(*a*) *Descriptions of poisonous plants.* Poison ivy is a creeper with three shiny, pointed leaves on each stem. The veins of the leaves are prominent. Poison oak is a woody vine or low shrub, with three egg-shaped leaflets and greenish white flowers in clusters. Poison sumac is a shrub, growing in swamps, with featherlike, shiny green leaves and greenish flowers succeeded by greenish white berries.

(*b*) *Symptoms.* Skin irritations. Rash starting with redness and intense itching. Later small blisters appear.

(*c*) *Treatment.* Upon exposure, wash affected parts of body promptly and thoroughly with water and strong soap. GI soap is very good. If rash has already started, do not wash it. Avoid scratching, for it will make the condition worse. Get medical attention.

(15) *Unconsciousness.* Often impossible to find out the cause. Bleeding, heatstroke, or head injuries may have been the cause. Treatment—

(*a*) *For known causes.* Give the treatment specified elsewhere in this paragraph.

(*b*) *For unknown causes.* Keep the patient lying on his side or belly with head turned to one side to prevent choking. Do not move him unless absolutely necessary, and then use the utmost care. If he is cold, make him warm. Do not pour liquids into his mouth—this may choke him. Remove from mouth false teeth, chewing gum, or other objects. Take off his equipment. Loosen clothing. Get a medical officer. If the person has merely fainted, he will regain consciousness in a few minutes. Let him lie quietly. Apply a wet, cool cloth to his face. If he is about to faint or has actually fainted while sitting up, lower his head between his knees so that blood may flow to his head. Hold him so that he does not fall and injure himself.

7.23 CBR Defensive and Protective Measures

a. Nuclear Attack.

(1) *Types of nuclear explosions.* Nuclear explosions are classified according to the height of the burst.

(*a*) *Airburst.* A burst in which the fireball does not touch the surface.

(*b*) *Surface burst.* A burst in which the fireball does touch the surface.

(*c*) *Subsurface burst.* A burst in which the weapon is exploded beneath the surface.

(2) *Effects of nuclear explosions.*

(*a*) *Blast.* The blast effects of a nuclear explosion are comparatively localized and differ from the effects of a high explosive blast only in degree. Damage is caused by direct action of the overpressure or by the secondary action of flying debris, collapsing buildings, etc. The secondary actions cause the most injuries to personnel, but the direct action causes the most damage to rigid objects with relatively large surface areas.

(*b*) *Heat.* When a nuclear weapon is detonated, the rapid release of energy produces a high degree of temperature which approaches the interior temperature of the sun. The effects of the heat depend on the height of the burst, the energy yield, and the clarity of the atmosphere.

(*c*) *Radiation.* A nuclear weapon produces initial nuclear radiation and may also produce residual nuclear radiation.

The initial nuclear radiation is given off in the first minute of the explosion. If residual nuclear radiation results from the explosion (if the fireball touches the earth), it will be present in the target area immediately following the explosion and will occur in areas downwind of the target area later. The time at which it occurs in areas downwind of the target area depends to a large extent on the speed and direction of the winds through which the particles must pass during their fall to the ground. This type of residual nuclear radiation is commonly referred to as fallout.

(*d*) *Relative effects of different types of bursts.*

Type of burst	Blast	Heat	Initial nuclear radiation	Residual nuclear radiation contamination (target area and/or fallout)
Air	Extensive	Extensive	Extensive and hazardous (only during explosion).	Negligible except as induced radioactivity in soil in target area following low airburst.
Surface	Concentrated in smaller area than airburst.	Affects smaller area than does an airburst.	Generally less extensive than from an airburst of the same size, but still hazardous.	Generally extensive. Occurs in target area as induced radioactivity in soil and as fallout in target areas and in areas miles downwind of target areas.
Subsurface	Concentrated in a smaller area than airburst or surface burst.	Negligible: most of it is absorbed or deflected by ground or water.	Not considered hazardous.	Generally extensive and more hazardous than from a surface burst of the same size. Occurs as induced radioactivity in soil and as fallout, just as from a surface burst.

(3) *Things to do in a nuclear attack.*

Before burst		If alert is sounded, follow unit SOP. If warned before explosion, pick strongest shelter you can find in a hurry. Underground shelters, basements, deep foxholes, and tanks give good protection.
During and after burst	1 Take cover	If you see BRILLIANT LIGHT, brighter than sunlight, DIVE FAST to put something between you and the explosion. FALL FLAT on ground, face down, if you cannot reach shelter in 1 step. CLOSE EYES. Keep head covered. Protect FACE and HANDS. Stay until blast effect is over or until heavy material has stopped falling.
	2 Stay calm	Be ready for orders and instructions. Help your leaders to reform your unit. Your life and your unit depend on your doing the the right thing at the right time.
	3 Continue mission	The nuclear burst is only one part of the enemy's plan. Be ready for more to come. Expect enemy attack after explosion near your position. Be prepared to attack following an explosion on enemy positions.

(4) *Special equipment and protective clothing for use in radioactive decontamination operations.*

Item	Description and/or use
Headgear:	
Protective hat or helmet	Protects against falling debris or overhead obstruction.
Soft fatigue cap	Used in conditions where no other headgear is worn. Protects hair.
Clothing:	
Waterproof parka and trousers	In wet operations and wet weather.
Heavy jackets and trousers	In cold weather.
Belt	
Undershirt	
Drawers	
Socks	
Coveralls (1-piece) or shirt and trousers.	Coveralls are more satisfactory than shirt and trousers.
Handgear:	
Rubber protective gloves	Wet operations.
Leather gloves	Handling sharp and /or hot debris.
Cotton or canvas gloves	Dry operations.
Footgear:	
Safety shoes	Nonspark, nonskid, and ankle high.
Rubber boots	Safety toe and lining, knee high or thigh high. For wet operations.
Bootees	Canvas, ankle high, to fit over shoes.
Equipment (personnel):	
Protective mask	Protection of eyes and protection against inhalation of radioactive dusts.

See footnote at end of table.

Item	Description and/or use
Goggles	Eye protection.
Respirator	Where radioactive dust exists. Filters should be monitored after each use to see how often they should be changed.
Other equipment:	
Brushes	Scrubbing.
Shovels	Disposal and burial of contaminated objects and materials.
Portable water heater	Heating water for cleaning operations.
Hose, fire and garden	Hosing and scrubbing operations; also used in bulldozer and road grader operations to keep dust down.
Bulldozers	Disposal of contaminated objects; large-scale burial.
400-gallon, power-driven decontaminating apparatus.	Large-scale hosing and spraying operations (large areas, buildings, vehicles, and machinery).
Road graders	Scraping away contaminated surfaces.
Chemical service trucks	Dipping or disposing of small objects.
Swinging-boom crane trucks	Dipping or disposing of large objects.
Scrapers, long-handled	Paint scraping.
Steam jennies	Cleaning greasy or hard-dirt film surfaces and complicated machinery or other equipment.
Detection devices:	
AN/PDR-27A (G-M tube)	Normally 3 per major installation.
IM-9 (B)/PD	Normally 1 per individual entering contaminated area.
IM 108/PD (ion chamber)	Normally 1 per survey party and 3 per major installation.
PP-630 A/PD (charger and reader)	Normally 1 per major installation.
PH-656/PD (radiographic film exposure holder).*	Normally 1 per individual entering contaminated area.
DT-65/PD (radiac detecting element).*	10 per PH-656/PD (10-day supply).

*PH-656/PD and DT-65/PD serve the same purpose as PH-657/PD and DT-77/PD (film holder and badge which may be substituted).

(5) *Radiological decontamination methods.*

Method	Surface	Action	Technique	Advantage	Disadvantage
Abrasive	Nonporous surface	Surface removal	Use conventional procedures (sandpaper, emery cloth, etc.), but keep surface damp to avoid dust hazard. Collect and bury used abrasive.	Activity may be reduced to as low a level as desired.	
Wet sandblasting	Nonporous surface	Surface removal	Use conventional procedures, but keep surface damp to avoid dust hazard. Collect and bury used abrasive.		Impracticable for porous surfaces. Contaminant spread over area must be recovered for disposal.
Vacuum blasting	Porous and nonporous surfaces.	Controlled removal by vacuum suction.	Hold tool flush to surface to prevent escape of contamination.	Controlled disposal	Contamination of equipment.
Acid mixture: hydrochloric or sulfuric with acetates or citrates.	Nonporous surfaces (especially those having porous deposits), circulatory pipe systems.	Dissolving	Apply in same manner as for inorganic acids. Mixture consists of 0.1 gal. hydrochloric acid, 0.2 pound sodium acetate, 1 gal. water.	Dissolving action may reduce contamination by 90 percent in 1 hour (unweathered surfaces).	Weathered surfaces may require prolonged treatment.
Caustic: lye (sodium hydroxide), calcium hydroxide, potassium hydroxide.	Painted surfaces (horizontal).	Strong dissolving power, softens paint (harsh method).	Allow paint-remover solution to remain on surface until paint is softened to the point where it may be washed off with water.	Minimum contact with contaminated surfaces. Easily stored.	Personnel danger (painful burns). Reaction slow. Difficult to apply to vertical or overhead surfaces. Should not be used on aluminum or magnesium.
Trisodium phosphate	Painted surfaces (vertical, overhead).	Mild dissolving power	Remove remaining paint with long-handled scraper. Apply hot 10 percent solution. Use standard wiping technique.	Reduces activity to tolerance in 1 or 2 applications.	Destructive effect on paint.
Complexing agents: carbonates, citrates, oxalates.	Nonporous surfaces, especially unweathered; calcareous surfaces.	Forms soluble complexes with contaminated material.	Solution should contain 3 percent, by weight, of agent. Spray solution on surface. Keep surface moist for 30 minutes by spraying with solution periodically; after allotted time, flush material off with water. Solution may be mixed with mechanical foam for use on vertical and overhead surfaces.	Holds contamination in solution. On unweathered surfaces contamination is reduced 75 percent in 4 minutes. Easily stored. Nontoxic. Noncorrosive.	Requires application for 5 to 30 minutes. Not much penetrating power. Of small value on weathered surfaces.

Detergent	Nonporous surfaces (especially industrial film).	Emulsifying agent, wetting agent.	Rub surface 1 minute and wipe with dry rag; use clean surface of rag for each application. Moist application is all that is needed. Do not allow solution to drip on other surfaces. Solution may be applied with a powered-rotary brush or, from a distance, with a pressure proportioner.	Dissolves industrial film which holds contamination. Contamination may be reduced by 90 percent.	Mild method, not efficient on longstanding contamination.
Inorganic acids: hydrochloric, 9 percent to 18 percent; sulfuric, 3 percent to 6 percent.	Metal surfaces, especially those with porous deposits, rust, or calcareous growths; circulatory pipe systems.	Strong dissolving power on metals and porous deposits.	Dip-bath technique is advisable for movable items. Reaction time on weathered surfaces should be 1 hour; on pipe systems, should be 2 to 4 hours; afterwards surface should be neutralized with an alkaline solution and rinsed with water.	Corrosive action on metal and porous deposits may be moderated by addition of corrosion inhibitors to solution.	Good ventilation required. Corrosive. Sulfuric acid not effective on calcareous deposits.
Organic solvent	Nonporous surfaces (greasy or waxed, paint or plastic finish).	Solution of organic materials (oil, paint, varnish).	Entire unit may be immersed in solvent or solvent may be applied by wiping.	Quick dissolving action. Recovery of solvent possible by distillation.	Requires good ventilation and fire precautions. Toxic. Material bulky.
Steam	Nonporous surfaces, especially painted or oiled surfaces.	Solution and erosion	Work from top to bottom and from upwind; clean surface at rate of 4 square feet per minute. Effectiveness may be greatly increased by addition of detergent.	Steam reduces contamination approximately 90 percent on painted surfaces.	Steam subject to the same limitations as water; waterproof outfit necessary.
Vacuum cleaning	Dry surfaces	Removal of contaminated dust by suction.	Use conventional vacuum technique with efficient filter.	Good on dry, porous surfaces.	Dust must be filtered out of exhaust. Machine may be contaminated.
Water (primary method of radiological decontamination).	Nonporous surfaces (metal, paint, or plastic). Unsuitable on porous material such as canvas, concrete, wood.	Solution and erosion	For heavy contamination, apply water at high pressure from top to bottom and upwind. Optimum operation 15 to 20 feet from surface. Hose vertical surfaces at 30° to 45° angle. Find cleaning rate experimentally, or clean at rate of 4 square feet per minute.	All water equipment may be used. Contamination may be reduced 50 percent. Solutions of other agents may be used in water equipment.	Drainage must be controlled. Porous material absorbs contaminant. Cannot decontaminate oiled surface. Not applicable on dry surface. Spray is contaminated.

(6) *Radiological decontamination of critical items.*

Item	Method	Equipment or decontaminant	Remarks
Clothing	Vacuum clean	Vacuum cleaning machinery.	Dispose of contamination removed by machine filter.
	Wash	Laundry. (See TM 3-220 for details.)	Dispose of water used for washing and rinsing.
Equipment	Depends on nature of surface.		See *b*(3) below.
Buildings	Abrasion, caustics		See *b*(3) below.
Terrain	Decay	None	Wait for natural decay.
Water	Filter.	Filters, stills, and purifiers (engineer equipment).	Must be pronounced safe by medical officer or water specialist.
Food exposed	None. Dispose of, isolate, or shield.	Digging equipment	Not safe or practicable to attempt to remove radiological contamination from exposed or open food.
Food covered	Scrub or wash	Brushes and hose	Must not be unwrapped or peeled until lowering of contamination level is adequate and pronounced safe by medical officer.
Food in cans	Decontaminate container before opening by scrubbing thoroughly.	Brushes, hose, soap	Contamination will only affect outer surface of sealed containers. Under no circumstances may cans be opened before decontamination.
Personnel	Bathing, scrubbing, showering, washing.	Brushes, hose, showers, soap.	Bathing and scrubbing must be continued until contamination is lowered to a safe level. When showering, hold head back in order to prevent runoff from entering eyes, nose, mouth.

b. *Biological Attack.*

(1) *Precautions for defense against biological warfare.*

(*a*) Don't pick or eat fruits or berries.

(*b*) Don't chew grass or leaves.

(*c*) Don't eat native or any other non-U.S. Armed Forces food or drink; even strong liquor may be contaminated.

(*d*) Don't take souvenirs.

(*e*) Don't bathe in lakes or ponds.

(*f*) Don't touch animals.

(*g*) Don't neglect preventive medicine.

(2) *Things to do in a biological attack.*

WHEN	DO THIS	THEN IF	DO THIS
A TOXIC AGENT is suspected— The ALARM sounds— An ATTACK hits your position—	STOP BREATHING. MASK. TAKE COVER—if tactical situation permits.	There is no apparent effect on anyone.	CONTINUE MISSION. Observe disease prevention rules; keep wounds and cuts clean; eat and drink only approved food and water.
for example You are hit by ENEMY BOMBS, SHELLS, or ROCKETS— SPRAY from an AIRPLANE falls on you— A low CLOUD drifts over you—	Give the ALARM. DECONTAMINATE—remove wet spots from skin and clothes. CONTINUE MISSION. REMAIN MASKED UNTIL AREA HAS BEEN DECLARED SAFE.	If later (1 to 10 days), you or your buddies get sick.	Get medical aid and report sickness.

(3) *Biological decontamination methods.*

Item	Method	Remarks
Cotton clothing	Boil in water for 15 minutes: boil water, place items in water and boil 15 minutes after water again reaches boiling point. Rinse immediately. or Immerse in 7 percent bleach solution for 30 minutes and rinse immediately. or Launder or Use methyl bromide vapors in delousing bags.[1] Leave clothing in bag for 12 hours, then aerate for 2 hours to remove vapor.	Destroys or inactivates all but highly resistant spore-forming organisms.
Fine instruments, mask facepieces.[2]	Use methyl bromide vapors in delousing bags.[1] Leave in bag for 12 hours, then aerate for 2 hours to remove vapor.	
Helmets and mess gear	Wash with soap and water, then boil for 15 minutes.	
Leather and rubber items	Use methyl bromide vapors in delousing bags.[1] Leave in bag for 12 hours, then aerate for 2 hours to remove vapor. or Scrub with soap and hot water for 20 minutes.	

See notes at bottom of table.

Item	Method	Remarks
Large items, such as buildings.	Scrub with DANC, or 7 percent bleach. Water rinse or flush after scrubbing. or Fumigate with formalin (37 percent formaldehyde in 10 percent methyl alcohol and water) and steam. Use 1 milliliter of formalin per cubic foot of building space. Seal building before fumigation and thoroughly aerate afterwards. or Spray with formalin or glycerine-formalin. or Use decontaminating apparatus with soap and water. or Weathering.	Decontaminate only if absolutely necessary. Suitable for furniture and interior surfaces of buildings. Suitable for interior of buildings. Sun, wind, and rain eliminate exterior germs within 24 to 48 hours.
Terrain All	Weathering or Wet thoroughly with water	Evacuate contaminated area and allow sufficient time for weathering. Will keep germs on ground.
Porous	Spray with slurry (20 percent bleach solution).	Suitable, to a limited extent, for some types of terrain.
Hard-surfaced roads	Spray or spread oil	Will keep germs on ground.
Vegetation	Burn with flamethrower	Can be used to burn an area or to clear a passageway.
Air (inclosed spaces)	Filter air with filter unit (collective protector).	Will almost free air of germs.
Water [3]	Boil for 15 minutes and use halazone tablets for small emergency water supply.[4] or Chlorinate	Except for small emergency supplies, water purification should not be attempted by untrained personnel. Purification is a function of the Engineer Corps; checking for troop consumption is a function of the Army Medical Service.
Food [5]	Boil for 15 minutes.[4] or Immerse in or spray with decontaminating solution. or Cook thoroughly by other means	Use this method on packaged food and on food which is to be peeled.
Personnel [5]	Bathe with soap and water; shower for 20 minutes.[6]	

[1] Use five times the quantity used for ordinary delousing. Use ethylene oxide when methyl bromide is not available.

CAUTION—ethylene oxide is highly explosive.

[2] To effectively treat facepieces, boil in water, wash in warm soapy water, rinse in clear water, then dry at room temperature. Destroy by burning, those masks contaminated by Mycobacterium tuberculosis or pathogenic spore-forming organisms.

[3] Should not be used until pronounced safe by medical officer.

[4] At high altitudes, boil for 30 minutes.

[5] Minor cuts and abrasions should be treated immediately.

[6] When showering, head should be held back to prevent runoff from passing over eyes, nose, and mouth.

c. Chemical Attack.

(1) *Things to do in a chemical attack.*

WHEN	DO THIS	THEN IF	DO THIS	
A TOXIC AGENT is suspected— The ALARM sounds— AN ATTACK hits your position— for example You are hit by ENEMY BOMB SHELLS, or ROCKETS— SPRAY from an AIRPLANE falls on you. A low CLOUD drifts over you.	STOP BREATHING. MASK Take COVER . . . if tactical situation permits. GIVE ALARM DECONTAMINATE . . . remove wet spots from skin [2] and clothes. CONTINUE MISSION REMAIN MASKED UNTIL AREA HAS BEEN DECLARED SAFE	Your nose starts running suddenly— Your chest feels tight— Your eyesight *gets* dim— Breathing becomes difficult—	Give yourself 1 atropine shot [1] and fasten used tube on shirt or jacket pocket. CONTINUE MISSION.	NERVE GAS
		Your buddy: has difficulty breathing— slobbers, sweats, or vomits— twitches, jerks, or staggers—	Mask your buddy and give him his atropine shot [1] if he has not taken it. Call medic. CONTINUE MISSION.	
		Your buddy: has great difficulty getting his breath or stops breathing—	Same as above, BUT ALSO give him ARTIFICIAL RESPIRATION. CONTINUE MISSION.	
		You feel immediate severe pains in eyes or on skin— You have drops or splashes in eyes or on skin but feel NO immediate severe pain—	Flush eyes with water and decontaminate skin.[2] CONTINUE MISSION.	BLISTER GAS
		You have wet spots on clothes—	Cut away spots and rub skin with protective ointment.[2] CONTINUE MISSION.	
		You begin breathing rapidly or gasping for air—	Move to fresh air if possible. Inhale amyl nitrate.[2]	BLOOD GAS
		You cough or choke. Your chest becomes tight—	Loosen clothing. CONTINUE MISSION. If shortness of breath occurs, keep warm and quiet.	CHOKING GAS

[1] To give atropine shot: (a) Remove needle cover, taking care to keep wire loop in place. (b) Push wire through seal. Gently squeeze tube until 1 drop of liquid appears at end of needle. Pull wire out and discard. (c) Push needle deep into big muscle, injecting through clothing. (d) Squeeze tube empty.

[2] To decontaminate skin: (a) Pinch blot agent from skin. (b) Flush area with water. (c) Rub on protective (M-5) ointment. (d) Wipe off ointment. (e) Rub on second coat of ointment—let it stay.

(2) *Toxic chemical agent decontamination methods.*

Basic material	Used in	Decontaminant (method)		Field expedient
		Primary	Secondary	
Asphalt [1]	Roads, roofing	Bleach [2]	Slurry. (A thick, pastry mixture of bleach and water.)	Cover with earth if suitable.
Brick or stone [1]	Buildings, roads	Bleach [2]	Slurry	Cover with earth if suitable.
Canvas	Cartridge belts, covers, mask carriers, tentage, tarpaulin.	Hot, 5 percent soda solution (1 part sodium carbonate in 20 parts water). Soak for ¼ to 1 hour.	Boiling water [3]	Aerate.
Cotton and wool	Barracks bags, coveralls, field jackets, gloves, hoods, leggings, overcoats, shirts, socks, ties, trousers, underwear.	Boil in water for ½ to 1 hour; [3] water for cottons must be made alkaline—2 oz washing soda per 10 gal. water.	Laundering	Apply protective ointment to small contaminated areas; decontaminate completely as soon as situation permits. Aerate.
Concrete [1]	Buildings, gun emplacements, pillboxes, roads, tank obstacles.	Bleach [2] Slurry	DANC solution [4]	Cover with earth if suitable.
Earth [1]	Bivouac areas, bomb craters, gun positions, pathways, roads.	Bleach [2]	Slurry	Cover with uncontaminated earth. Scrape off 3 to 4 inches of top soil. Allow to weather. Burn.
Glass	Lenses, windows	DANC solution.[4]	Washing [1]	Blot off surfaces.
Grass and low vegetation	Field, open terrain	Bleach.[2] Slurry	Fire	Cover with earth. Scrape off 3 to 4 inches of top soil. Allow to weather.
Impermeable fabrics	Impermeable aprons, gas resistant curtains, impermeable clothing.	Boil in water for ½ to 1 hour [3]	Slurry. Keep bleach off fabric side.	Allow to weather.
Leather	Boots and other items	Soak in 120° F water for 4 hours.	Aeration. DANC solution [4]	Blot off surfaces.
Metals (bare)	Canned rations, mess gear, polished and working parts.	Water	DANC solution.[4] Clean and oil. Solvents.	Aerate.

Painted surfaces	Boxes, buildings, equipment, vehicles	DANC solution [4]	Slurry. Washing solvents	Blot off surfaces.[1]
Plaster [1]	Building interiors	Slurry	Aeration	Allow to weather.
Plastics:				
Opaque [1]	Insulation, panel boards, telephones	Slurry (apply carefully)	Washing. Weathering	Allow to weather.
Transparent [1]	Eyepieces, airplane canopies, helicopter bubbles.	Hot soapy water	Gasoline or kerosene	Blot off surfaces.[1]
Rubber, natural and synthetic.	Boots, gloves, hose, insulation, mats, tires.	Boil in water for 2 to 3 hours [3 5]	Slurry.	
	Facepieces and other rubber articles coming in contact with skin.	Boil in water for 6 to 8 hours [3 5]	Slurry	Apply protective ointment.
Sand	Bleaches, deserts	Bleach	Slurry	Cover with earth. Scrape off 3 to 4 inches of top layer. Allow to weather. Burn.
Undergrowth and tall grass	Forests, jungles, meadows	Slurry.[1] Explosives	Fire. Exploding of bleach drums.	Allow to weather.
Wood	Buildings, boxes, crates, gunstocks, vehicle bodies.	Bleach. Slurry.[1] Boil in water for ½ to 1 hour.[3]	DANC solution [4]	Burn.

[1] Aerate after treatment.
[2] When liquid contaminant is visible and personnel are nearby, dry mix should be used.
[3] Time must be doubled for high altitudes.
[4] Do not use DANC solution for decontamination of G-series of war gases (GA, GB). A concentrated alkaline solution, such as water and GI soap, can be substituted for G-agent decontaminant. Hot water is preferable.
[5] Length of treatment depends on amount of contamination, thickness of rubber, and future use.

7.24 Commonly Used Decontaminants

All personnel should work on upwind side of contaminated area. Gasoline and other petroleum solvents dilute but do not destroy blister gases. Washings remain dangerous and must be decontaminated. Decontaminated areas should be covered with earth or brush to maintain camouflage discipline.

Decontaminating agent	Ingredients	Amounts	Parts by weight	Area covered	Equipment used	Decontaminates
Dry mix [1]	Bleach Earth	2 shovels (10 lb) 3 shovels (30 lb)	1 to 3	1 sq yd per pound of bleach.	Shovels, rakes	Shellholes, open ground, shoe soles.
Paste [1]	Bleach Water	Mix to thickness of paste		1 sq yd per pound of bleach.	Shovels, brushes, paddles	Building walls, tires, rubber parts.
Wet mix (slurry)	Bleach Water	6 shovels (30 lb) 1 standard bucket (14 qt)	1 to 1	1 sq yd per pound of bleach.	Brooms, buckets, 400-gal., power driven decontaminating apparatus.	Buildings, paved roads, runways.
DANC [2]	DANC powder Solvent (liquid)	1 quart (1¼ lb) 6 quarts (19 lb)	1 to 15	Up to 50 sq yd per 3-gal. unit M4, w/3 applications.	Buckets, brooms, mops, swabs, brushes.	Metal tools, weapons, equipment corroded by chloride of lime.

[1] Although flames and concentrated dangerous vapors result, spreading raw bleach will quickly decontaminate pools of liquid blister gas. Proper precautions must be taken.

[2] Decontaminating agent, noncorrosive. Should be used only on metal. Surfaces decontaminated with DANC should be scrubbed with water after the solvent has dried to remove corrosive residue. DANC is toxic to man if proper precautions are not taken. Rubber gloves and protective mask should be worn whenever the agent is used or mixed

Section VII. CAPACITIES OF POL CONTAINERS

7.25 Volume of Liquid in Cylindrical Tanks

a. *Vertical*. The volume of liquid in a vertical cylindrical tank may be computed as follows:

$$\text{Volume (gal.)} = \frac{3.1416 \times r^2 \times h}{231}$$

where

r=the radius of tank in inches

h=the height of liquid in inches

b. *Horizontal*.

(1) When the capacity of a horizontal cylindrical tank is known, the quantity in the tank may be computed by using the scale below.

Part of tank depth filled	*Part of tank capacity filled*
	1. 000
0. 95	. 974
. 90	. 948
. 85	. 904
. 80	. 860
. 75	. 804
. 70	. 748
. 65	. 687
. 60	. 626
. 55	. 563
. 50	. 500
. 45	. 437
. 40	. 374
. 35	. 313
. 30	. 252
. 25	. 196
. 20	. 140
. 15	. 096
. 10	. 052
. 05	. 026

For example, a horizontal tank is 80 inches in diameter. Depth of liquid in tank is 20 inches. Full tank capacity is 8,000 gallons. Find the number of gallons actually in tank.

$\frac{20}{80}$=0.25 (part of tank depth filled)

0.25 (part of tank depth filled)=0.196 (part of tank capacity filled)

$0.196 \times 8{,}000 = 1{,}568$ gallons in tank.

(2) When the capacity of a horizontal cylinder tank is not known, the volume of liquid may be computed as shown below. All measurements are in inches.

L=Length of tank

l=depth of liquid in tank

r=radius of tank

h=distance from top of tank to surface of liquid

a=cross-sectional length of "wet arc" formed by liquid, measured on lower half of tank

a'=cross-sectional length of "dry arc" above liquid, measured on upper half of tank

(*a*) When tank is less than half full:

$$\text{Volume (gal.)}=\left[\frac{ar}{2}-(r-l)\sqrt{2rl-l^2}\right]\times\frac{L}{231}$$

(*b*) When tank is half full:

$$\text{Volume (gal.)}=\frac{r^2L}{147}$$

(*c*) When tank is more than half full:

$$\text{Volume (gal.)}=\left[3.1416r^2-\frac{a'r}{2}+(r-h)\sqrt{2rh-h^2}\right]\times\frac{L}{231}$$

7.26 Dimensions of Pol Containers

Nomenclature	Units in package	Type of package	Size of package (inches)		
			Length	Width or diameter	Height
Drum:					
U.S. 55-gal., 16-gage	1	Drum	0	24⅛	34¾
U.S. 55-gal., 18-gage	1	Drum	0	24⅝	34⅞
Can:					
U.S. 5-gal. (gasoline)	1	Can	13¾	6½	18⅜
U.S. 5-gal. (oil)	2	Case	0	11 15/16	14 3/16
U.S. 5-qt. (oil)	6	Case	0	14	10
U.S. 1-qt. (oil)	12	Case	18	13	6
Pail:					
U.S. 25-lb. (grease)	1	Pail	0	11½	11½

7.27 Bulk Petroleum Capacities

Type carrier	Gallons	Short tons	
		Gasoline, 83 octane (bulk)	Lube oil (bulk)
Barge, coastwise [1]	200,000 to 400,000	614 to 1,228	761 to 1,522
Barge, harbor and canal [2]	15,000 to 30,000	45.9 to 91.8	57 to 114
Barge, Navy ponton type [3]	84,000	257	320
Pipeline:			
4-inch	304,000 per day	930	1,150
6-inch	655,000 per day [4]	2,000	2,500
8-inch	1,135,000 per day	3,500	4,350
Railroad tank car	8,000; 10,000; 12,000	24.1; 30.6; 36.8	30.4; 38.1; 45.7
Semitrailer, 12-ton, 4W	5,000	15.3	19
Ship, large tanker [5]	2.5 to 11 million	7,620 to 33,500	9,480 to 43,800
Ship, small tanker [6]	600,000 to 2 million	1,830 to 6,140	2,280 to 7,610
Tank, bolted-steel	10,500; 42,000; 420,000	32.2; 128; 1,280	39.9; 160; 1,600
Tank, portable, fabric [7]	10,000	30.6	38.1
Tank truck, F-3, fuel or oil	750	2.3	2.9
Tank truck, L-2, oil service	600	1.8	2.3
Trailer, fuel servicing	600	1.8	2.3
Truck tractor and trailer, F-1	4,000	12.2	15.2
Truck tractor and 2 trailers, F-1A	8,000	24.4	30.4
Truck tractor and trailer, F-2	2,000	6.1	7.6
Truck tractor and 2 trailers, F-2A	4,000	12.2	15.2

[1] Molded hulls.
[2] Rectangular hulls.
[3] 6 x 18 ponton barge carrying three 42,000-gallon tanks loaded to two-thirds capacity.
[4] Based on 32,500 gallons per hour for 20 hours of operation. In an emergency it can deliver 30,000 gallons per hour for 24 hours of operation, or 720,000 gallons per day.
[5] The ship tanker most commonly used is the T2-SE-A1, a 5,922,000-gallon tanker. It is 425 feet long and draws 31 feet. Has three 8-flanged discharge outlets and four discharge pumps rated 1,000 gpm at 100 psi.
[6] Draft loaded, 12 to 20 feet.
[7] 40 feet long, 12 feet wide, 3 feet high when filled. When empty, it can be rolled to 20 inches by 12 feet; 10 can be carried in a 6 x 6 truck.

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Section VIII. SUPPLY

7.28 Classes of Supply

Class	Definition	How obtained
I	Articles consumed at an approximately uniform rate, such as rations.	From QM class I distributing points. Basis of issue is the daily report of personnel strength and equipment status submitted through channels.
II	Articles authorized by established allowances, such as tables of organization and equipment, tables of allowances, or special authorizations.	By requisition. Often submitted through channels to army or section special staff officer of the supplying technical service.
III	Fuels, lubricants, fuel oils, coal	Directly from army or logistical command distributing points.
III(A)	Aviation fuels and lubricants	Obtained on credit basis, or by exchanging empty for filled containers.
IV	Supplies and equipment in excess of or not authorized by established allowances, not in any other class, or transferred to class IV because they require special control measures.	By requisition. Submitted as for class III items. Depots normally require staff approval before issue. Critical items require authority of superior headquarters.
IV(A)	Complete aircraft, aircraft equipment, parts, and supplies.	From Transportation Army aircraft maintenance and supply units.
V	Ammunition, pyrotechnics, land mines, and chemicals.	Normally by credit allocations to troop units, authorizing ammunition supply points.

7.29 Shipping Data on Common Items Moved by Transportation Corps

a. Rations.

Type	Package or case			Ration or packet including packaging		Avg calories per ration
	Contents	Weight (lb)	Cu ft	Avg weight (lb)	Avg vol (cu ft)	
Ration:						
Field A[1]				6. 0	0. 183	4, 200
Operational B[2]				6. 0	0. 127	4, 400
Small detachment, 5 persons[3]	5 rations	28. 5	1. 1	5. 8	0. 2	3, 600
Combat, indiv[4]	6 rations	38	1. 2	6. 5	0. 2	3, 600
Trail, frigid, indiv[5]	8 rations	34	1. 6	4. 0	0. 2	4, 400
Supplement, sundries pack (1 pack per 100 men)[6].		47	1. 9			
Indiv, combat, meal type	4 rations	24		4. 8	0. 85	3, 600
Supplement, aid station (205 8-oz drinks).[7]		20	1. 1			
Food packet Assault, indiv[8]	24 packets	29	1. 1	1. 1		800
Survival:						
Arctic, SA[9]	24 packets	34	0. 7	1. 5		2, 000
Tropic, ST[10]	24 packets	36	0. 7	1. 5		1, 700

[1] Basic field ration of approximately 200 items, including such perishables as fresh and frozen meats, vegetables, and fruit. For use primarily under stable conditions and during static phases of military operations when there are normal cooking and refrigeration facilities. Should be issued in preference to any other type of ration whenever circumstances permit its use. Components, weight, and volume vary.

[2] Canned or dry items and staple items; for use whenever mess facilities and personnel are available and no perishable foods are issued. Components, weight, and volume vary. SB 10–495 has information on its breakdown. Ration supplement, spice pack, consists of assorted spices, condiments, and leavening agents to supplement 1,000 operational rations B. The spice pack varies in weight and cubage, being tailormade for different situations and scaled to the B ration.

[3] Nonperishable precooked food which may be eaten hot when organized messing is impossible but feeding in small groups is possible.

[4] Nonperishable precooked food which may be eaten hot or cold, carried and prepared by the individual soldier, for use when the tactical situation is so unstable that messing in small groups is not possible and kitchen facilities are not available.

[5] For use in extremely cold climates by small patrols or trail teams under conditions where resupply is impossible.

[6] Comfort items such as toilet articles, tobacco, and candy as a supplement to ration B, for issue before the establishment of adequate sales facilities.

[7] Special nourishment in the form of hot stimulating beverages for combat zone casualties at aid and clearing stations.

[8] Lightweight, highly palatable food conveniently carried by the individual in the initial assault phase of combat. Not for use for longer periods than 30 hours.

[9] For survival kits aboard aircraft operating over arctic regions, in the emergency kit forming a part of the ejection seat in combat aircraft, and in emergency kits for passengers aboard transport aircraft.

[10] Palatable food of high caloric density carried in survival kits of aircraft operating over the tropics—not a regular ration.

b. Ammunition

Nomenclature	Number per unit	Weight (lb)		Cubic feet		Stowage factor	
		Crated	Uncrated	Crated	Uncrated	Crated	Uncrated
Canister, N2, 37mm, G	20	102		2. 04		45	
Cart., AP, cal .30, in cartons	1, 500	112		1. 5		30	
Cart., AP, cal .30, 8 rd clip	1, 440	112		1. 5		30	
Cart., AP, cal .50, in cartons	300	97		1. 5		35	
Cart., AP, cal .50, in cartons	350	112		1. 5		30	
Cart., AP, 7.62mm, in cartons, grade R	960	72		. 91		28	
Cart., AP, 7.62mm, in cartons, grade R	1, 040	78		1. 28		37	
Cart., AP, 7.62mm, in cartons, grade R	1, 200	86		1. 28		33	
Cart., AP, 7.62mm, in cartons, grade MG	1, 200	86		1. 28		33	
Cart., AP, I&T, cal .30, 1/b	1, 200	101		1. 5		33	
Cart., AP, I&T, cal .50, 1/b	265	103		1. 5		33	
Cart., AP&T, cal .30, w/b, (100 rds)	1, 200	92		1. 5		37	
Cart., AP&T, cal .30, w/b	1, 240	98		1. 5		34	
Cart., AP&T, cal .30, w/b	1, 250	100		1. 5		34	
Cart., AP&T, cal .30, 1/b	1, 200	107		1. 5		31	
Cart., AP&T, w/b, 250 rd mg, chest	1, 000	77		. 9		26	
Cart., API, 7.62mm, in cartons, grade R	1, 200	86		1. 28		33	
Cart., B&T, cal .30, w/b, 250 rd mg chest	1, 000	77		. 9		26	
Cart., B&T, cal .30, web belt	1, 250	96		1. 5		35	
Cart., B&T, cal .30, w/b	1, 200	93		1. 5		36	
Cart., B&T, 7.62mm, 100 rd belt	800			. 91			
Cart., B&T, 7.62mm, 210 rd belt	840			. 91			
Cart., B&T, 7.62mm, 220 rd belt	880			. 92			
Cart., ball, cal .30, carbine	3, 000	100		. 85		19	
Cart., ball, cal .30, carbine	3, 450	107		. 9		19	
Cart., ball, cal .30, 8 rd clip	1, 344	110		1. 5		31	
Cart., ball, cal .30, 5 rd clip	1, 440	117		1. 5		29	

Cart., ball, cal .30, 5 rd clip	1, 500	114	--------	1. 5	--------	29	--------
Cart., ball, cal .30, in cartons	1, 500	111	--------	1. 5	--------	30	--------
Cart., ball, cal .45, in cartons	1, 800	97	--------	. 8	--------	19	--------
Cart., ball, cal .45, in cartons	2, 000	111	--------	1. 0	--------	20	--------
Cart., ball, cal .50, in cartons	350	107	--------	1. 5	--------	31	--------
Cart., ball, 7.62mm, linked, grade MG	880	78	--------	. 92	--------	26	--------
Cart., ball, 7.62mm, in cartons, grade R	960	72	--------	. 91	--------	28	--------
Cart., ball, 7.62mm, in cartons, grade R	1, 200	86	--------	1. 28	--------	33	--------
Cart., grenade, cal .30, M3	2, 000	90	--------	1. 5	--------	37	--------
Cart., inc, cal .50, in cartons	350	108	--------	1. 5	--------	31	--------
Cart., tracer, cal .30, in cartons	1, 500	108	--------	1. 5	--------	31	--------
Cart., tracer, cal .30, 5 rd clip	1, 500	114	--------	1. 5	--------	29	--------
Cart., tracer, cal .30, 8 rd clip	1, 440	117	--------	1. 5	--------	29	--------
Cart., tracer, cal .50, in cartons	350	111	--------	1. 5	--------	30	--------
Cart., tracer, 7.62mm, in cartons, grade R	1, 200	86	--------	1. 28	--------	33	--------
Cart., tracer, 7.62mm, M62 in cartons, grade R	400	28	--------	. 54	--------	43	--------
Cart., tracer, 7.62mm, M62 in cartons, grade R	960	72	--------	. 91	--------	28	--------
Cart., tracer, 7.62mm, M62 in cartons, grade R	1, 040	78	--------	1. 28	--------	37	--------
Cart., 12 ga, No. 00 buckshot	500	62	--------	. 768	--------	28	--------
Cart., 12 ga, No. 7½	500	58	--------	. 768	--------	30	--------
Chg, prop, M1A1 (green bag) 155H	6	67	40	3. 08	1. 91	103	107
Chg, prop, M3 (green bag) 155H	6	82	53	3. 33	2. 68	91	114
Chg, prop, M2 (white bag) 155H	6	82	73	3. 26	2. 63	89	81
Chg, prop, M4 (white bag) 155H	3	79	58	3. 92	2. 5	111	97
Chg, prop, 155G, 1917-17A1-18M1	1	87	--------	3. 0	--------	77	--------
Chg, prop, 155G, M1917-17A1-18M1	3	131	105	4. 96	4. 19	85	89
Chg, prop, 155G, M1917-17A1-18M1	4	191	--------	7. 08	--------	83	--------
Chg, prop, 155G, M1 & M1A1	3	161	127	7. 44	5. 15	104	91
Fuze, PD, M46	50	51	--------	. 89	--------	39	--------
Fuze, PD, M47	50	53	--------	. 89	--------	38	--------
Fuze, PD, M51, M51A1, M55, M55A1	25	83	--------	1. 46	--------	39	--------
Fuze, PD, M.T., M67	25	78	--------	1. 46	--------	42	--------
Fuze, det, M6A2	200	64	--------	2. 50	--------	88	--------
Fuze, ing, M10A2	200	64	--------	2. 7	--------	95	--------

Nomenclature	Number per unit	Weight (lb)		Cubic feet		Stowage factor	
		Crated	Uncrated	Crated	Uncrated	Crated	Uncrated
Grenade, AT, M11A1, prct	50	87	--------	3. 3	--------	85	--------
Grenade, hand, frg, Mk II	25	50	--------	1. 26	--------	57	--------
Grenade, hand, off (unfuzed)	50	50	--------	1. 37	--------	62	--------
Grenade, hand, tug, Mk 1 A1	24	47	--------	. 97	--------	46	--------
Grenade, rifle, M9 and M9A1	10	32	--------	1. 2	--------	83	--------
Grenade, rifle, prct, M11	50	108	--------	2. 8	--------	58	--------
Mine, AP, M2, M2A1	10	93. 4	--------	2. 33	--------	56	--------
Mine, AP, M3	6	75	--------	. 80	--------	24	--------
Mine, AT, M1, prct	5	68	--------	1. 45	--------	48	--------
Mine, AT, M1A1	5	73	--------	1. 45	--------	45	--------
Primer, DTE, M14, 1-sec delay	100	67	--------	1. 01	--------	34	--------
Primer, perc, Mk 11, Mk 11A, Mk 11A1	2, 400	96	--------	1. 56	--------	36	--------
Shell, AP, M112B1, 155G	1	117	--------	1. 34	--------	26	--------
Shell, all other 155mm	1	--------	96	--------	. 83	--------	19
Shell, HE, M1, w/f M48, 105mm H	3	172	154	2. 37	2. 06	31	30
Shell, HE, M43A1, (lt) 81mm, M	6	72	58	1. 65	1. 08	51	42
Shell, HE, M48, w/f M48, 75 GNC	3	82	68	1. 84	1. 03	50	34
Shell, HE, M48, w/f M48, 75 GNC	3	84	70	1. 84	1. 03	50	33
Shell, HE, M48, w/f M48, 75 H	3	80	69	1. 35	. 92	38	30
Shell, HE, M48, w/f M54, 75 GNC	3	82	68	1. 84	1. 03	50	34
Shell, HE, M48, w/f M54, 75 GNC	3	84	70	1. 84	1. 03	50	33
Shell, HE, M48, w/f M54, 75 H	3	80	69	1. 35	. 92	38	30
Shell, HE, M49A2, 60mm, M	18	103	82	3. 23	2. 51	70	69
Shell, HE, M56, (hv), 81mm, M	3	55	42	1. 33	. 91	54	49
Shell, HE, M63, 37mm, G	20	91	--------	2. 04	--------	50	--------
Shell, HE, M71, 90mm, G	4	237	--------	4. 43	--------	42	--------

Shell, HE, N54, 37mm, G	25	99		2. 03		46	
Shell, HE, Mk 1, (Navy), 40mm, G	16	115		1. 80		35	
Shell, HE, Mk 11, 37mm, G	60	114		1. 60		31	
Shell, HE, w/f, M54, 105 H	3	172	154	2. 37	2. 06	31	30
Shell, HE, 3'' AA G	4	153		3. 22		47	
Shell, QF, Mk II, 40mm, G	24	161		3. 13		44	
Shell, prct, Mk II, 37mm, G	40	90		1. 38		34	
Shell, prct, M50A2, 60mm, M	18	103	82	2. 23	2. 51	70	69
Shell, Mk I, unfuzed, 75 G	3	72	57	1. 72	. 96	54	38
Shell, 8'', G	1		386				
Shell, 8'', how	1		253				
Shell, 280mm, G	1		660				
Shot, AP, M78, 3'', AA G	4	153		3. 22		47	
Shot, AP, M51, 37mm, G	20	104		2. 01		43	
Shot, AP, M74, 37mm, G	20	91		1. 01		50	
Shot, AP, M72, 75 G	3	80	66	1. 51	. 83	28	28
Shot, AP, M77, 90mm, G	4	237		4. 43		42	
Shot, APC, M59, 37mm, G	25	99		2. 03		46	
Shot, APC, M61, 75mm, G.S.C	3	83	70	1. 84	1. 03	50	33
Shot, LE, Mk I, 37mm, G	60	105		1. 38		29	
Signal, ground, M17 to M22	61			1. 85			
Signal, Very, red & white, Mk II	31			. 92			
Signal, Very, red & green star, Mk II	103			2. 57			
Smoke, WP, M60, 105 H	3	172	159	2. 37	2. 06	31	29
Smoke, WP, M64, 75 H	3	82	70	1. 66	. 92	45	29
Smoke, WP, M57, 81mm, M	3	55	45	1. 65	. 91	67	45
Smoke, WP, Mk II, unfuzed, 75 G	3	72	57	1. 72	. 96	54	38

c. Petroleum Products.

	Container	No. per unit	Weight (lb)	Cubic feet	Stowage factor
Aviation gasoline.	55-gal. drum, 18-gage steel	1	373	9. 03	54
	55-gal. drum, 16-gage steel	1	389	8. 8	51
	55-gal. drum, 18-gage light steel.	1	364	9. 2	56. 5
	5-gal. drum, 11-lb can	1	40. 5	. 81	44. 8
83 octane gasoline.	55-gal. drum, 18-gage steel	1	384	9. 03	52. 7
	55-gal. drum, 16-gage steel	1	400	8. 8	49. 2
	55-gal. drum, 18-gage light steel.	1	376	9. 2	55
	5-gal. drum, 11-lb can	1	41. 6	. 81	43. 6
Kerosene	55-gal. drum, 18-gage steel	1	421	9. 03	48. 1
	55-gal. drum, 16-gage steel	1	437	8. 8	45. 1
	55-gal. drum, 18-gage light steel.	1	351	9. 2	58. 8
	5-gal. drum, 11-lb can	1	45	. 81	40. 4
Diesel fuel	55-gal. drum, 18-gage steel	1	432	9. 03	47
	55-gal. drum, 16-gage steel	1	448	8. 8	44. 2
	55-gal. drum, 18-gage light steel.	1	430	9. 2	47. 9
	5-gal. drum, 11-lb can	1	46	. 81	39. 5
Lubricating oils	55-gal. drum, 18-gage steel	1	472	9. 03	42. 8
	55-gal. drum, 16-gage steel	1	488	8. 8	40. 5
	55-gal. drum, 18-gage light steel.	1	462	9. 2	44. 6
	5-gal. drum, 11-lb can	1	49	. 81	37. 1
	Cases of 1-qt cans, 12 per case (crated).	12	35	. 88	56. 6

	Container	No. per unit	Weight (lb)	Cubic feet	Stowage factor
Lubricating oils	Cases of 1-qt cans, 24 per case (crated).	24	60	1. 6	60
	Cases of 5-qt cans, 6 per case (crated).	6	77	1. 9	55. 7
Greases	25-lb pails	1	29	. 95	73. 6
	5-lb cans, 6 per case (crated)	6	44	1. 1	56

7.30 Common Annealed Wire

Gage No.	Dia (in.)	Tensile strength (lb)
7	3/16	1, 100
8	11/64	950
9	5/32	800
11	1/8	500

7.31 Rods and Bolts

Dia (in.)	Tensile strength* (lb)
1/2	5, 200
5/8	8, 100
3/4	11, 700
1	21, 100
1 1/8	25, 800
1 1/4	32, 800
1 3/8	38, 600
1 1/2	46, 900

* At root of thread

7.32 Size of Common Nails

Type	Length (in.)
8-penny	2 1/2
9-penny	2 3/4
10-penny	3
12-penny	3 1/4
16-penny	3 1/2
20-penny	4
30-penny	4 1/2
40-penny	5
50-penny	5 1/2
60-penny	6

7.33 High-Tension Bands

Width and thickness (in.)	Tensile strength (lb)
⅝ x 0.050	2, 000
¾ x .028	2, 000
¾ x .030	2, 000
¾ x .035	2, 500
¾ x .037	2, 500
¾ x .050	3, 500
1¼ x .035	4, 000
1¼ x .037	4, 000
1¼ x .050	6, 000
2 x .050	9, 500

7.34 Supply-Planning Terms

a. Consumption Rate. The average quantity of an item consumed or expended during a given time interval, expressed in quantities per applicable basis.

b. Day of Supply. That quantity of supplies estimated to be required for 1 day under the conditions of the operation and for the force stated.

c. Regulated Items. Items over which the chiefs of technical services exercise close issue supervision.

d. Replacement Factor. A number expressed as a decimal which, when multiplied by the total projected quantity of an item in use, gives the quantity of that item required to be replaced during a given period of time.

e. Slice. An average logistical planning factor used to obtain estimates of requirements for personnel and materiel.

Section IX. MAINTENANCE AND SUPPLY SPACE

7.35 Storage

a. Gross Storage Area: Average Ratio of Open to Covered by Classes of Supply.

	Ratios of gross storage area	
	Open	*Covered*
All classes (except bulk POL)	5. 5	1
Classes I, II, III (packaged and solid), and IV	4. 7	1
Classes I, II, III (packaged), and IV	3	1
Class V (including 10 percent of V–A)	12	1

b. Average Stack Height. Figures given are for use of all technical services in theaters of operation. For zone of interior storage, the figures must be increased 25 percent.

(1) Covered storage—8 feet.

(2) Open storage—6 feet.

c. Ratio of Tonnage to Storage Area. The net usable general storage area occupied per short ton in square feet is given below by technical services.

Branch	Type of storage			
	Covered	Open	Igloo and magazine	Open storage ammunition
Adjutant General's Corps	10.0			
Army Medical Service	13.0	16.0		
Chemical Corps	12.5	20.8	7.0	11.0
Corps of Engineers	8.0	13.0		
Ordnance Corps	10.0	18.0	7.0	11.0
Quartermaster Corps	9.0	17.1		
Signal Corps	10.0	16.0		
Transportation Corps	7.0	12.0		

d. Miscellaneous Data.

Ammunition storage per mile of road [1]	1,000 short tons
Ammunition storage per square mile [1]	5,000 short tons
Minimum hardstand requirements for 2,500 vehicles [2]	110,000 square feet
Solid footing for vehicle park for 2,500 vehicles	4,000,000 square feet
Minimum hardstand requirement for artillery and combat vehicles, per item	350 square feet

[1] Refers to temporary storage of ammunition along roadways and in urban fields and forests, such as may be found in combat zones.

[2] Data based on the assumption that hardstand area will not be required for the total number of vehicles at any one time.

7.36 Covered Shop Floor Space Requirements for Ordnance and Transportation Corps Units

	Sq ft
Ordnance:	
Armament rebuild battalion	100,000
Automotive rebuild battalion	100,000
Direct automotive maintenance company	25,000
Direct support company	20,000
Guided missile depot support shop	13,000
Guided missile direct support shop	13,000
Guided missile heavy support shop	13,000
Heavy automotive maintenance company	40,000
Heavy maintenance company, field army	30,000
Motor vehicle assembly company	20,000
Tire repair company	16,000
Transportation:	
Equipment company, TROB	20,000
Heavy truck company	5,100
Light truck company	3,700
Medium truck company	5,600
Railway operating battalion	8,000
Railway shop battalion	40,000

Section X. FIELD ESTABLISHMENTS AND EXPEDIENTS

7.37 Bivouacs and Camps
(fig. 7.9)

Bivouacs are occupied less than 1 week and have temporary sanitation facilities. Camps are occupied more than 1 week and provide better bathing, sanitation, administration, security, and recreational facilities.

a. Size. Fifty square yards allowed per man; 100 square yards per vehicle. If air attack is probable, at least 100 yards is maintained between dispersed vehicles. Dispersion of 50 yards between vehicles requires 2,500 square yards per vehicle; 100 yards between vehicles requires 10,000 square yards per vehicle. No extra allowance is made for personnel.

b. Location.

(1) *Desirable.*

(*a*) Accessible to sufficient amount of good water.

(*b*) Sandy loam or gravel soil, favorable to waste disposal.

(*c*) Firm, grass-covered turf.

(*d*) Elevated, well-drained site.

(*e*) Sufficient space to avoid crowding and to permit wide space between kitchens and latrines.

(*f*) Shade trees for sun protection.

(*g*) Protected slope or trees for windbreaks in cold weather.

(*h*) Firm ground for vehicles.

(*i*) Good road net.

(*j*) Concealment from air observation.

(2) *Undesirable.*

(*a*) Dry beds of rivers, ravines, or depressed areas in rainy country.

(*b*) Clay or loose, dusty soil.

(*c*) Marshy ground or areas near water which may be infested by mosquitoes and subject to mist or heavy dew.

(*d*) Ground water level less than 4 feet from the surface of the ground.

(*e*) Steep slopes.

(*f*) Within a mile of native villages in tropical or subtropical climates.

c. Latrines. Locate on side of camp opposite prevailing wind, at least 100 yards from kitchen, 30 yards from nearest tents, and place so it will not drain toward water supply.

(1) *Straddle trench.* Used for bivouacs only. Dig 1 foot wide by 2½ feet deep by 8 feet long for use of 50 men. Individuals

cover refuse immediately. Oil daily. Close when refuse is within 1 foot of surface or when abandoned.

(2) *Deep pit.* Used for temporary camps. Dig 2 feet wide by 8 feet long by 3 to 10 feet deep. Depth in feet should equal number of weeks' occupation plus 2. Should be equipped with flyproof latrine box.

(3) *Pail latrine.* Used where soil characteristics prevent digging latrine convenient to the camp or bivouac.

(4) *Urinal soakage pit.* Used throughout camps and work areas. A pit 4 feet square by 4 feet deep filled with broken rock or brick serves 200 men indefinitely. Provide funnels on basis of 1 per 20 men.

d. Washing Facilities. Locate between tents and latrines. Ten feet of wash bench should be provided per 100 men. Showers should be provided, where practicable, on basis of one shower head per 25 men; in tropics and in temperate zones during summer, the ratio should be 1 shower head per 20 men. See FM 21–10 for methods of constructing expedient showers.

e. Kitchens. Locate at opposite end of area from latrines. One soakage pit with barrel or baffle grease trap should be provided for each 200 men. If area is occupied more than 2 weeks, a second pit should be installed (FM 21–10).

f. Water Supply. Locate water bags between kitchen and tent areas

Average daily water requirements per man per day

Condition	Gallons per day	Remarks
Combat	½	Absolute minimum for no longer than 3 days. Used for drinking.
	1	Some allowance for cooking and personal hygiene.
March or bivouac	2	Minimum. Enough for drinking and cooking, washing mess and kitchen utensils, washing hands and face.
	5	Should be supplied if possible; permits laundry and possibly some bathing.
Camps	5	Minimum. Does not include bathing or sewerage facilities.
	15	Minimum. Includes bathing.
	30	Permits waterborne sewerage.

g. Closing Camp. Before leaving site, close all sanitary installations, fill in latrines and soakage pits, erect markers indicating CLOSED LATRINE, etc.

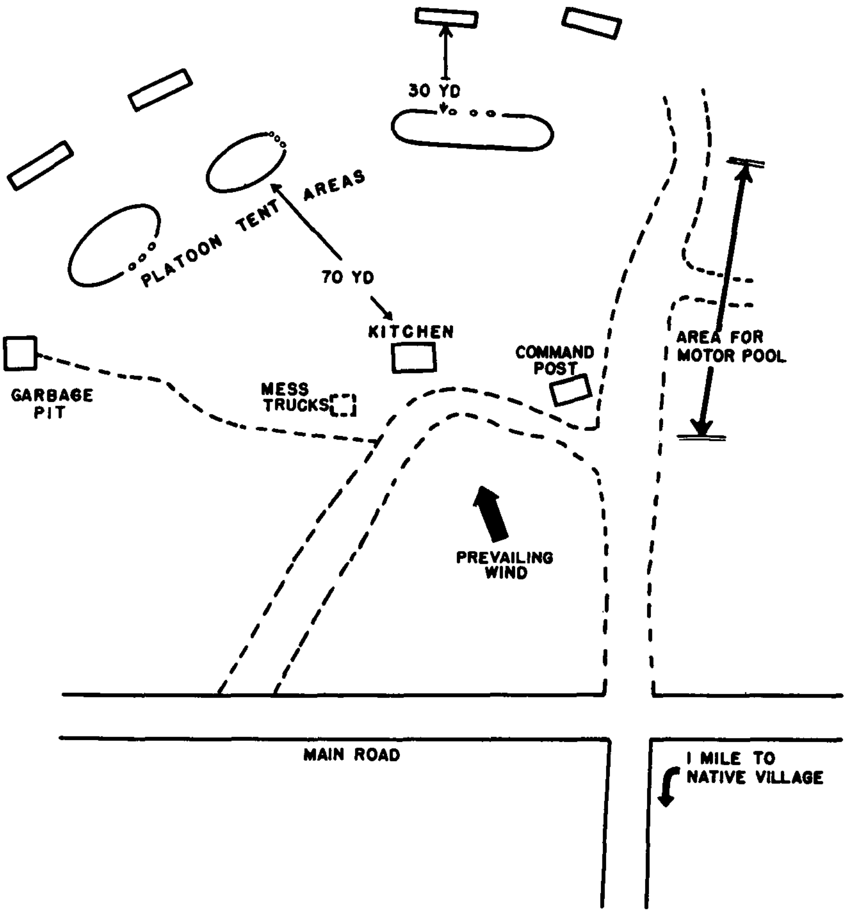

Figure 7.9. Administrative company bivouac area.

7.38 Tentage

Type	Size					Number men accommodated [a]	Total weight (packed) (pounds)	Weight (pounds)		Storage bulk (cu ft)		Total cube (packed)
	Floor dimensions	Height of ridge	Height of side wall	Surface area (sq ft)	Floor space (sq ft)			Tent only	Pins, poles	Tent only	Pins, poles	
Tents:												
Arctic, 10-man	17′ 6″ dia	8′ 6″	3′	315	199	10	76	68	8	7.1	0.2	7.3
Assembly	40′ x 80′	21′	8′	4,965	2,857	80	1,755	1,100	655	23.3	16.9	40.2
CP, M1942	7′ x 11′ 10½″	7′	6′	328	84	2	216	112	104	5.0	3.7	8.7
CP, M1945	10′ x 13′ 9″	9′	5′ 6″	406	124	3	257	165	92	6.3	3.6	9.9
Fly, squad	20′ x 37′ 7½″	12′	5′ 3″	1,673	750	15	252	190	62	4.3	5.0	9.3
Fly, ward, hosp	20′ x 54′	12′	5′ 3″	2,216	1,080	27	326	225	101	7.6	4.5	12.1
GP, large	18′ x 52′	12′	5′ 6″	2,035	936	21	665	[b] 420	245	21.0	7.7	[c] 69
GP, medium	16′ x 3′	10′	5′ 6″	915	528	12	455	255	200	12.7	6.3	19.0
Hexagonal, M1950	13′ 3″ dia	8′ 6″	2′	218	113	5	48	40	8	3.6	0.2	3.8
Hospital, sectional	18′ x 53′	12′	6′	2,170	1,014	24	1,097	770	327	31.5	12.2	43.7
Hospital, ward	16′ x 50′	12′	4′ 6″	2,162	800	20	649	390	259	20.5	9.6	30.1
Kitchen	12′ x 18′	[d] 9′ [e] 12′	6′	831	216	10	420	203	217	14.2	12.0	26.2
Maint shelter	18′ 2″ x 26′ 9½″	13′ 8″	5′ 6″	1,306	486	11	1,255	500	755	26.3	58.0	84.3
Mountain	54″ x 82″	43″	12″	112	31	2	10	6	4	0.5	0.2	0.7
Oper, surgical	16′ x 27′	12′	7′	1,190	432	10	327	252	75	10.3	3.5	13.8
Oper, surgical, hv	18′ x 54′	11′ 1″	6′	2,068	972	22	1,693	817	876	38.8	23.2	62.0
Pyramidal	16′ x 16′	12′	5′ 3″	896	256	6	234	130	94	6.2	3.6	9.8
Pyramidal, lightweight	11′ dia	8′ 6″	2′	182	121	4	39	37	2	2.5	0.2	2.7
Squad, M1942	16′ x 32′	12′	4′ 6″	886	512	12	402	255	147	10.9	5.9	16.8
Squad, M1945	16′ x 32′	12′	4′ 6″	886	512	12	425	275	250	11.1	6.1	17.2
Storage	17′ 10″ x 20′ 1″	13′	5′ 3″	1,008	358	8	402	200	202	9.6	9.2	18.8
Wall, large	14′ x 14′ 6″	11′	4′ 6″	570	203	8	275	230	145	5.8	3.1	8.9
Wall, small	8′ 10″ x 9′ 2″	8′ 6″	3′ 9″	284	81	2	115	55	60	3.4	4.1	7.5

See notes at end of table.

Type	Dimensions	Height of side wall	Surface area (sq ft)	Floor space (sq ft)	Total weight (packed) (pounds)	Weight (pounds)		Storage bulk (cu ft)		Total cube (packed)
						Tent only	Pins, poles	Tent only	Pins, poles	
Paulins:										
Fly, storage	25′ x 20′ 5″	--------	512	------	105	85	20	2.8	0.8	3.6
Fly, wall, small	15′ 6″ x 9′ 2½″	--------	142	------	38	23	15	3.1	0.7	3.8
Large	20′ x 40′	--------	800	------	250	250	------	6.7	------	6.7
Medium	16′ x 32′	--------	512	------	160	160	------	4.2	------	4.2
Screen, latrine	5′ 3″ x 55′	[f] 6′	292	144	32	32	------	0.8	------	0.8
Small	12′ x 17′	--------	204	------	57	57	------	2.3	------	2.3

[a] If used as field billet.
[b] Liner weighs additional 155 pounds.
[c] Includes tent, liner, pins, and poles.
[d] Service section.
[e] Stack section.
[f] Bottom edge of screen normally 10 inches off ground.

7.39 Water Purification

a. Distillation. Stills can be built to produce potable water from impure water by using a source of heat, a method of forming and collecting steam, and some kind of condenser. The still in figure 7.10 has a water-cooled condenser. The efficiency of an expedient still depends on the materials available and the ingenuity of the designer. In expedient distillation, sufficient vapor-separating space must be provided to prevent the carryover of salt in the distillate with the steam. To avoid endangering personnel by the building up of excessive steam pressure, a valve must never be put in the distillate line.

b. Chlorination. The purification of water with chemicals is known as chlorination. Halazone tablets or iodine water purification tablets, chemicals in the Army supply system, may be used as directed on containers. Calcium hypochlorite, with 70 percent available chlorine, may also be used. One ounce per 1,000 gallons of water, allowed to stand for 2 hours, will purify most waters.

c. Filtration. Much of the pollution in water can be removed by filtration, using sand or anthracite coal. The depth of beds for both materials is usually 24 to 30 inches. Dry sand weighs approximately 92 pounds per cubic foot. Wet anthracite coal weighs approximately 60 pounds per cubic foot. Average yield of a sand filter is 2 gallons per minute per square foot of filter surface. Water should be tested for bacteria content after filtration.

d. Boiling. In low altitudes practically all of the bacteria in water can be destroyed by boiling for 10 minutes; at high altitudes, where water boils at a reduced temperature, boiling time should be doubled.

e. Aeration.

(1) Many natural waters are improved by aeration, which is a process whereby the water is broken up and brought into

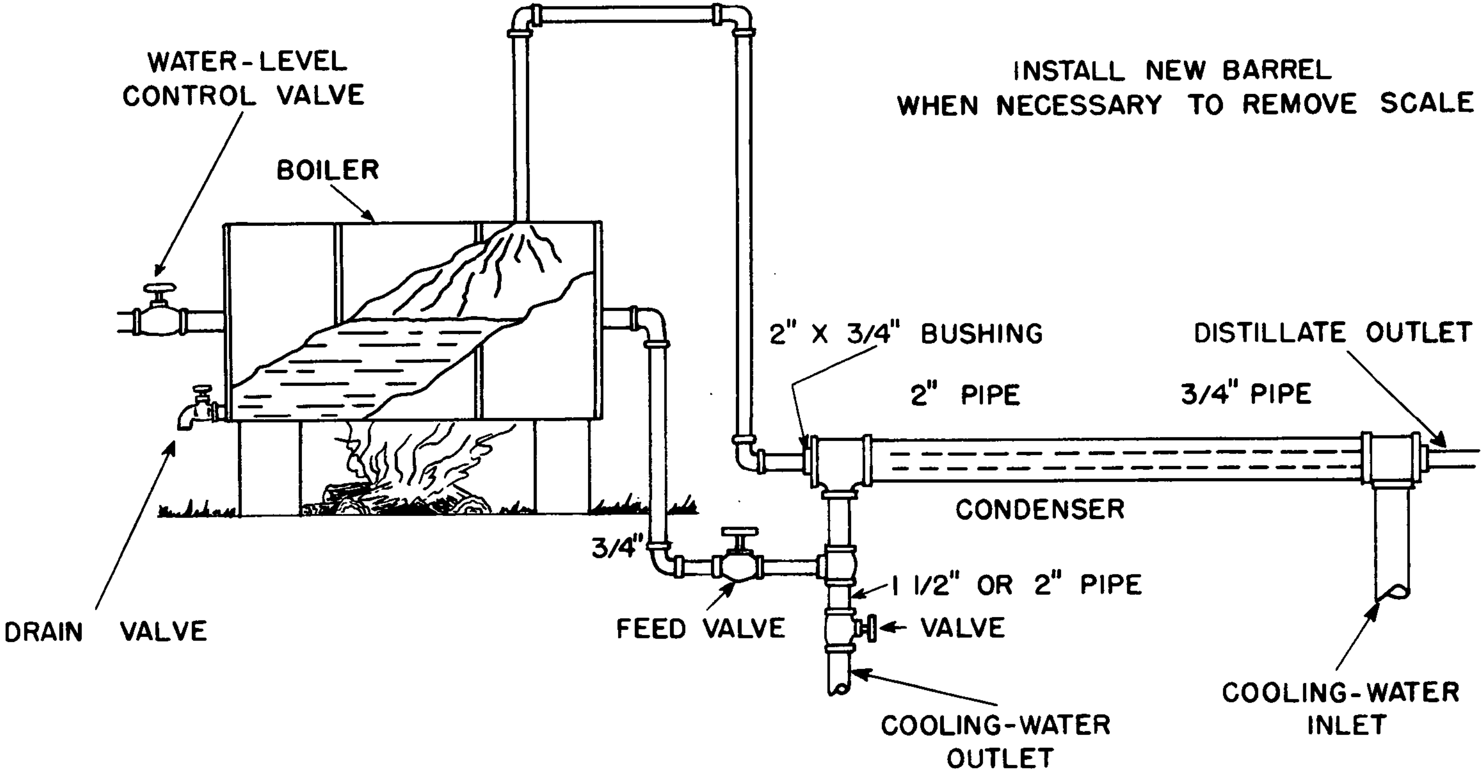

Figure 7.10. Expedient still, water-cooled condenser.

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intimate contact with air. Benefits of the process are listed below.

(*a*) The removal or reduction of undesirable gases, such as carbon dioxide, hydrogen sulphide, excess chlorine, and marsh gas.

(*b*) The addition of oxygen.

(*c*) The removal of odors, such as those caused by decomposition, microscopic organisms, organic matter, and trade wastes.

(*d*) Aid in other water purification processes, such as coagulation, mixing chemicals, removal of iron and manganese, freshening stagnant water, breaking up microscopic organisms.

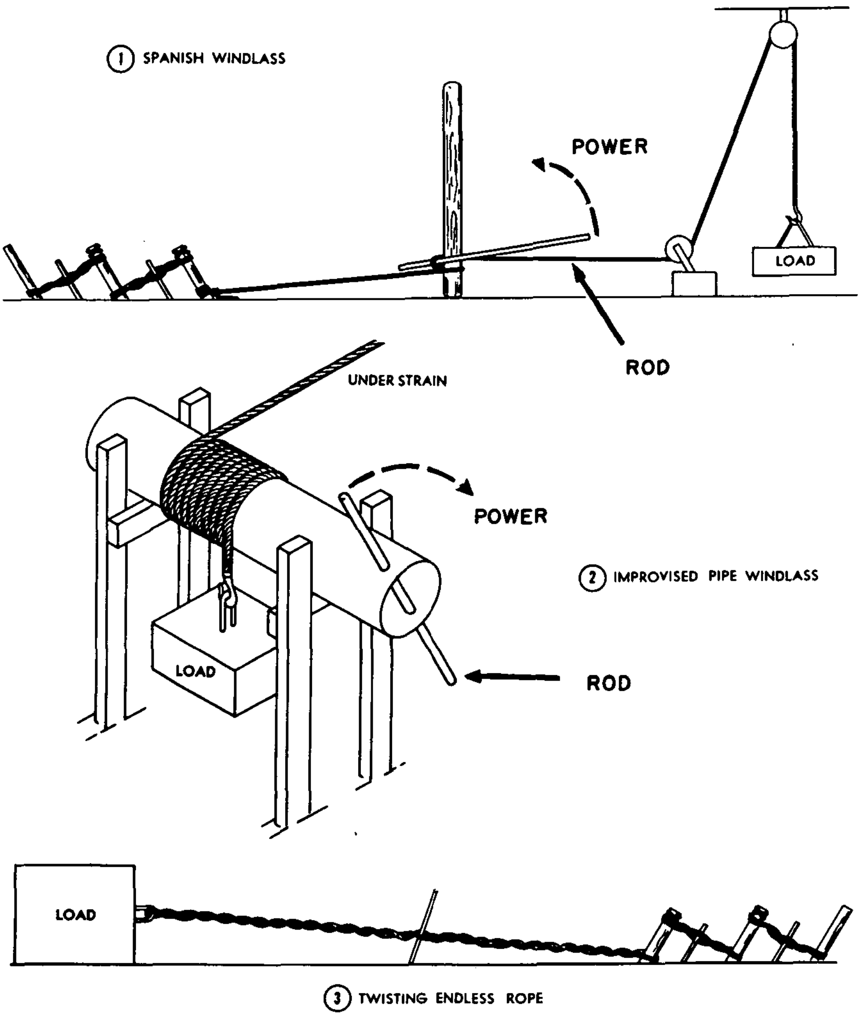

Figure 7.11. Expedient rigging for hoisting.

(2) Aeration methods in order of effectiveness are:
(*a*) Fine spray from nozzles.
(*b*) Cascades over steps, riffles, or weirs.
(*c*) Trickling devices (coke or stone beds).
(*d*) Drawing air into the water or injecting air under pressure by mechanical means.

f. *Sedimentation.* Still water, such as that found in ponds and lakes or in reservoirs, becomes partly clarified and purified by the settling of suspended solids and the bleaching and germ-killing action of sunlight. Time and stillness are the important factors. Surface and internal currents must be avoided; the retention period must be long enough for the water to become purified.

7.40 Hoists

Expedient hoists, such as a windlass or the twisting of an endless rope, can be readily assembled from equipment usually available in the field. Figure 7.11 shows how to move loads a short distance vertically. In (1) figure 7.11, the upright post is not anchored because it must turn when rotary power in a horizontal plane is applied to the rod. In (2) figure 7.11, as rotary power in a vertical plane is applied to the rod, only sufficient tension need be applied at the "under strain" point to cause static friction; therefore there is no slippage between the rope and the pipe. Figure (3) 7.11, illustrates a method of moving heavy loads a short distance horizontally.

7.41 Shears

Shears serve the same purpose as an A-frame, and can be used to support a block and tackle arrangement as illustrated in figure 7.12.

7.42 Gin Pole

A gin pole is an inclined pole that has a sufficient number of guys to hold it in a stationary position. Figure 7.13 illustrates this type of mechanical arrangement in use.

7.43 Cableway

An expedient cableway can be used to transport supplies across a small canyon or stream, or to the top of a ridge. It can be made by using two shears, two pulleys, a cargo hook, a vehicle, ropes, and stakes. Figure 7.14 illustrates one method of erecting an expedient cableway using a ¼-ton truck as the power source. To construct a cableway:

a. Jack up one wheel of a ¼-ton truck and remove the tire.

b. Take a rope about 10 percent longer than twice the straight-line distance between the summit of the ridge and the truck.

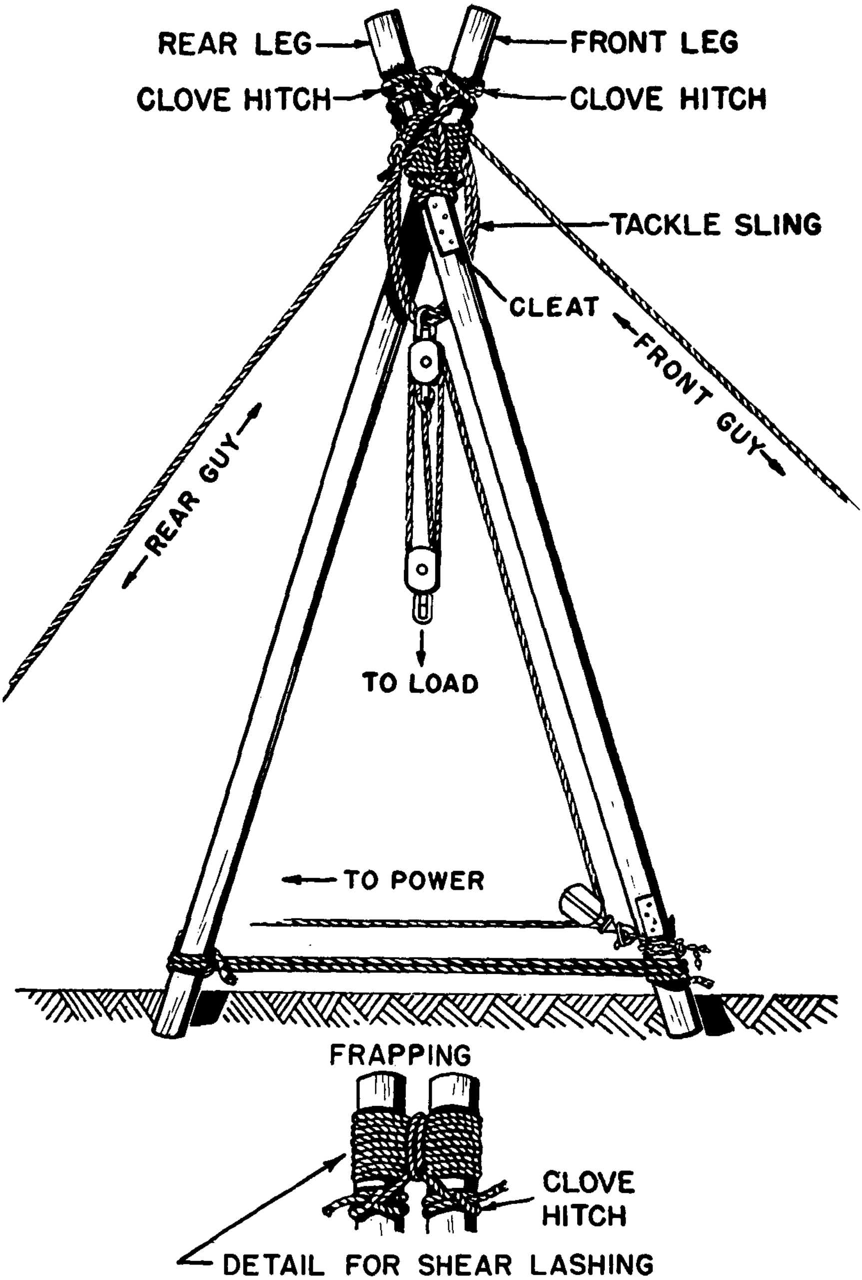

Figure 7.12. Shears.

c. Run the rope through pulleys anchored at both the top and bottom of the ridge, and around the rim of the wheel.

d. Splice the ends of the rope together and suspend a cargo hook from it.

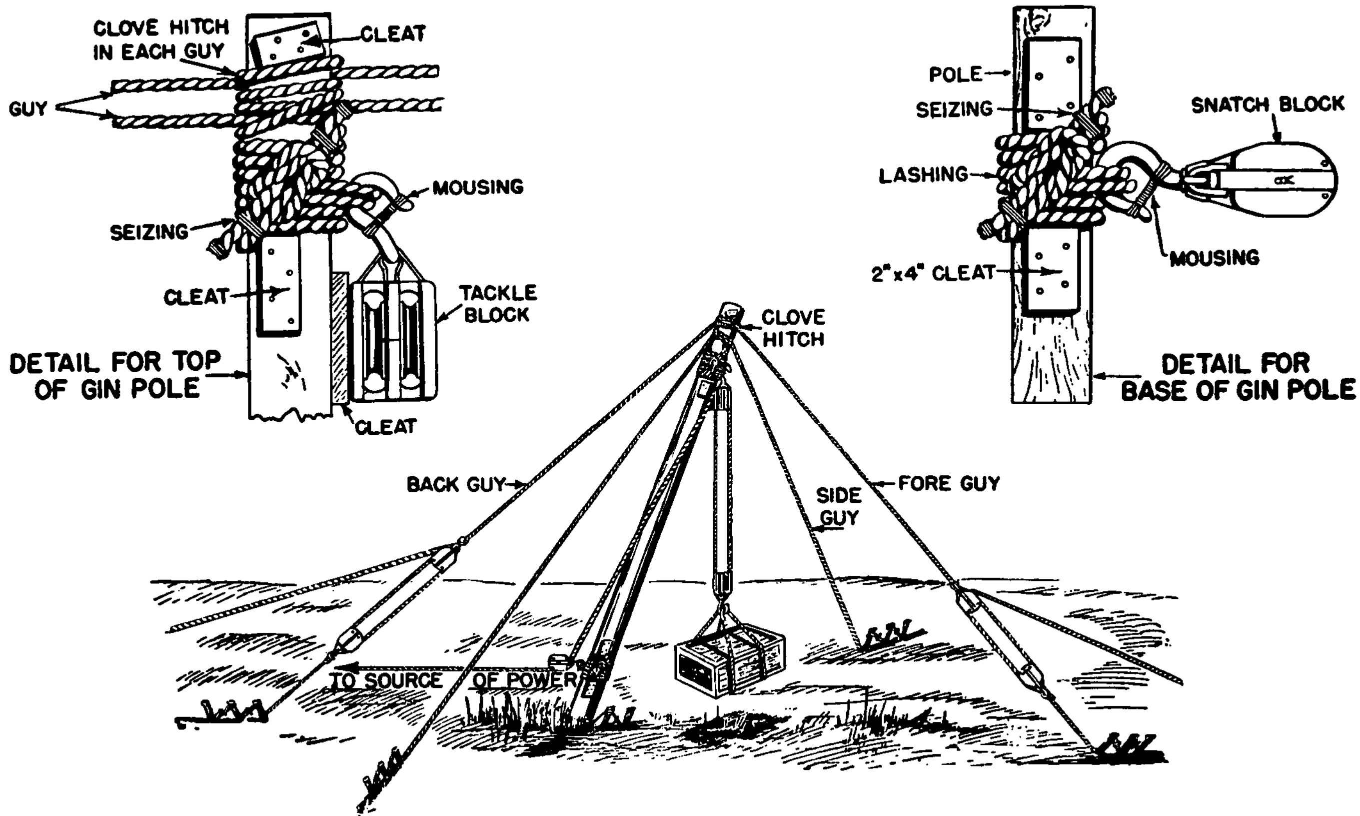

Figure 7.13. Gin pole.

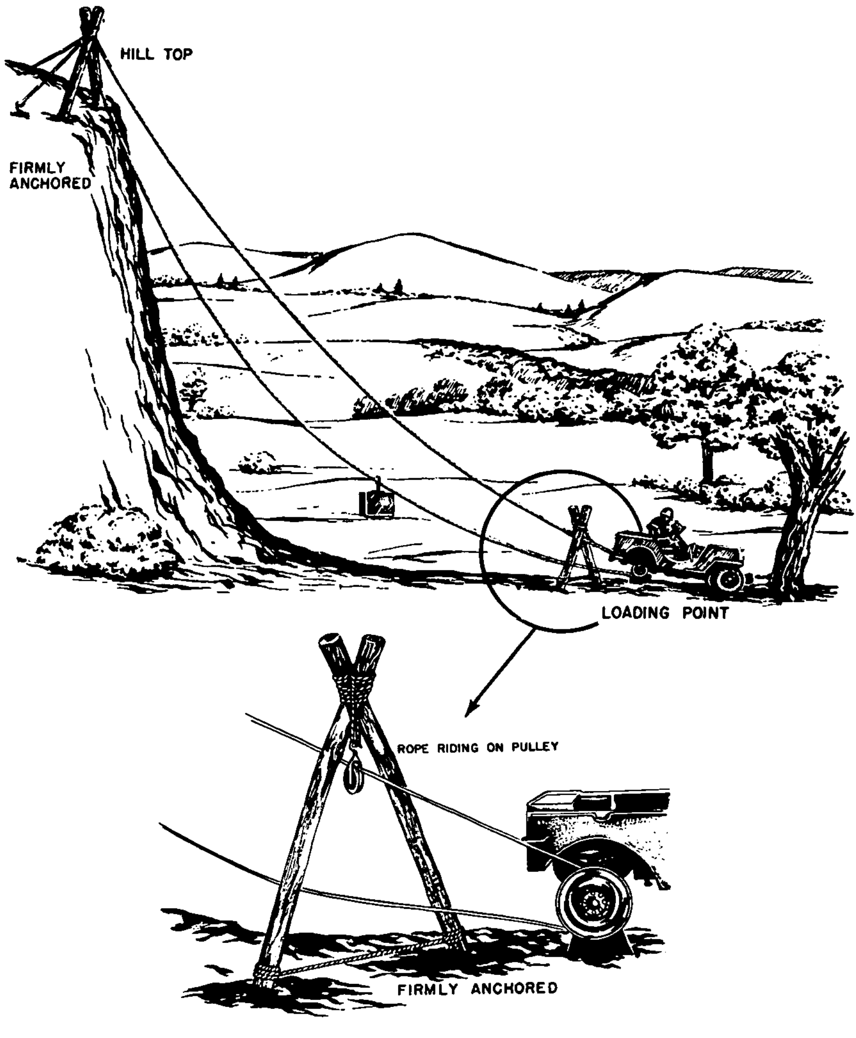

Figure 7.14. Expedient cableway, a ¼-ton truck being used as power source.

Section XI. CONVERSION AND STOWAGE FACTORS, MATHEMATICAL TABLES, AND FORMULAS

7.44 Conversion Factors

a. Linear Measure.

Meters* (m)	Inches (in.)	Feet (ft)	Yards (yd)	Rods (rd)	Chains (ch)	U.S. miles		Kilometers (km)	Cables' lengths	Fathoms (fm)
						Statute	Nautical			
1.0	39.37	3.28083	1.09361	0.19884	0.04971	0.0006214	0.0005396	0.001	0.00454	0.546
.0254	1.0	.0833	.0278	.00505	.00126	.00001578	.00001371	.0000254	.000116	.0139
.3048	12.0	1.0	.3333	.0606	.0151	.0001894	.0001645	.0003048	.00139	.167
.9144	36.0	3.0	1.0	.1818	.04545	.0005682	.0004934	.0009144	.00417	.500
5.0292	198.0	16.5	5.5	1.0	.25	.003125	.002714	.005029	.0228	2.76
20.1168	792.0	66.0	22.0	4.0	1.0	.0125	.01085	.02012	.091	11.0
1,609.35	63.360.0	5,280.0	1,760.0	320.0	80.0	1.0	.8684	1.6094	7.32	879.0
1,853.25	72,962.5	6,080.2	2,026.73	368.497	92.1243	1.15155	1.0	1.85325	8.46	1,010.0
1,000.0	39,370.0	3,280.83	1,093.61	198.838	49.7096	.6214	.5396	1.0	4.56	546.0
219.5	8,640.0	720.0	240.0	43.6	10.9	.1364	.1184	.2195	1.0	120.0
1.829	72.0	6.0	2.0	.363	.091	.00114	.00098	.00183	.00835	1.0

* 1 meter=10 decimeters=100 centimeters=1,000 millimeters

b. Surface Measure.

Square meters	Square inches	Square feet	Square yards	Square rods	Acres	Hectares	Square miles (statute)	Square kilometers
1.0	1,550.0	10.764	1.196	0.03954	0.000247	0.0001	0.000000386	0.000001
.00065	1.0	.0069	.00077	.00000026	.00000016	.000000065	.00000000025	.00000000065
.0929	144.0	1.0	.1111	.00367	.00002296	.00000929	.0000000359	.0000000929
.8361	1,296.0	9.0	1.0	.0331	.0002066	.0000836	.000000323	.000000836
25.293	39,204.0	272.25	30.25	1.0	.00625	.000253	.00000977	.0000253
4,046.8	6,272,640.0	43,560.0	4,840.0	160.0	1.0	.4047	.00156	.00405
10,000.0	15,499,969.0	107,639.0	11,960.0	395.37	2.471	1.0	.00386	.01
2,589,999.0	Sq ft x 144	27,878,400.0	3,097,600.0	102,400.0	640.0	259.0	1.0	2.59
1,000,000.0	Sq ft x 144	10,763,867.0	1,195,985.0	39,537.0	247.1	100.0	.3861	1.0

c. Cubic Measure.

U.S. dry measure: 1 bushel=4 pecks=8 gallons=32 quarts=64 pints
U.S. liquid measure: 1 gallon=4 quarts=8 pints=32 gills=128 fluid ounces. 1 U.S. gallon=.83268 imperial gallon

Cubic centimeters	Cubic decimeters or liters	Cubic inches	Cubic feet	Cubic yards	U.S. quarts		U.S. gallons		U.S. bushels	Measurement tons
					Liquid	Dry	Liquid	Dry		
1.0	0.001	0.061	0.0000353	0.0000013	0.001056	0.000908	0.000264	0.000227	0.000028	0.00000088
1,000.0	1.0	61.023	.0353	.00131	1.0567	.9081	.2642	.227	.0284	.000882
16.39	.01639	1.0	.0005787	.0000214	.0173	.0149	.00433	.00372	.00465	.0000144
28,317.0	28.317	1,728.0	1.0	.03704	29.922	25.714	7.481	6.4285	.80356	.025
764,559.0	764.559	46,656.0	27.0	1.0	807.896	694.279	201.974	173.57	21.696	.677
946.4	.9464	57.75	.03342	.00124	1.0	.8594	.25	.2148	.02686	.000837
1,101.2	1.1012	67.201	.03889	.00144	1.1636	1.0	.2909	.25	.0313	.000975
3,785.4	3.7854	231.0	.13368	.00495	4.0	3.4377	1.0	.8594	.1074	.00335
4,404.9	4.4049	268.803	.15556	.00576	4.6546	4.0	1.1636	1.0	.125	.00388
35,239.3	35.2393	2,150.42	1.2445	.0461	37.237	32.0	9.3092	8.0	1.0	.0312
1,130,000.0	1,130.0	69,120.0	40.0	1.48	1,190.0	1,030.0	298.0	256.0	32.2	1.0

d. Angular Conversions.

Circle	Radians	Degrees	Minutes	Seconds	Mils	Right angle	Straight line
1.0	6.2832	360.0	21,600.0	1,296,000	6,400.0	4.0	2.0
.16	1.0	57.3	3,430.0	206,000	1,018.6	.636	.318
.00279	.017453	1.0	60.0	3,600	17.778	.0111	.00556
.0000463	.000289	.0167	1.0	60	.297	.000185	.0000925
.00000078	.0000049	.00028	.0167	1	.00495	.0000003	.00000016
.000157	.000982	.05625	3.375	202	1.0	.000625	.000312
.25	1.535	90.0	5,400.0	324,000	1,600.0	1.0	.5
.50	3.07	180.0	10,800.0	648,000	3,200.0	2.0	1.0

e. Power.

Kilogram-meters per sec	Foot-pounds per sec	Horsepower		Poncelets	Kilowatts	Watts	Thermal units per sec	
		U.S.	Metric				Btu's	Kilocalories
1.0	7.233	0.01315	0.01333	0.01	0.00981	9.80597	0.009296	0.002342
.13826	1.0	.001818	.001843	.001383	.001356	1.35573	.001285	.0003237
76.0404	550.0	1.0	1.01387	.7604	.74565	745.65	.70865	.17812
75.0	542.475	.98632	1.0	.75	.73545	735.448	.69718	.17569
100.0	723.3	1.31509	1.33333	1.0	.9806	980.597	.92957	.23425
101.979	737.612	1.3411	1.35972	1.0198	1.0	1,000.0	.94796	.23888
.10198	.73761	.001341	.001360	.00102	.001	1.0	.000948	.0002389
107.577	778.104	1.41474	1.43436	1.07577	1.0549	1,054.9	1.0	.252
426.9	3,087.77	5.61412	5.692	4.269	4.1862	4,186.17	3.9683	1.0

f. Weight.

Kilograms (kg)	Grains (gr)	Ounces		Pounds		Tons		
		Troy	Avoirdupois (avdp)	Troy	Avoirdupois (avdp)	Short (2,000 lb)	Long (2,240 lb)	Metric (1,000 kg)
1.0	15,432.4	32.1507	35.274	2.67923	2.20462	0.001102	0.0009842	0.001
.0000648	1.0	.002083	.0002286	.0001736	.0001429	.00000007	.00000006	.00000006
.0311	480.0	1.0	1.09714	.08333	.06857	.00003429	.00003061	.0000311
.02835	437.5	.91146	1.0	.07595	.0625	.00003125	.0000279	.00002835
.37324	5,760.0	12.0	13.1657	1.0	.82286	.0004114	.0003674	.0003732
.45359	7,000.0	14.5833	16.0	1.21528	1.0	.0005	.0004464	.004536
907.185	14,000,000.0	29,166.7	32,000.0	2,430.56	2,000.0	1.0	.89286	.90719
1,016.05	15,680,000.0	32,666.7	35,840.0	2,722.22	2,240.0	1.12	1.0	1.01605
1,000.0	15,432,356.0	32,150.7	35,274.0	2,679.23	2,204.62	1.10232	.98421	1.0

g. Speed.

Meters per second	Meters per minute	Feet per second	Feet per minute	Miles per hour	Knots per hour	Kilometers per hour
1. 0	60. 0	3. 28083	196. 8	2. 23693	1. 94254	3. 6
. 0167	1. 0	. 055	3. 3	. 0376	. 0324	. 06
. 30480	18. 2	1. 0	60. 0	. 68182	. 59209	1. 09728
. 00505	. 303	. 0167	1. 0	. 0113	. 0097	. 0182
. 44704	26. 9	1. 4667	88. 0	1. 0	. 86839	1. 60935
. 51479	30. 9	1. 68894	101. 0	1. 15155	1. 0	1. 85325
. 27778	16. 7	. 91134	54. 7	. 62137	. 53959	1. 0

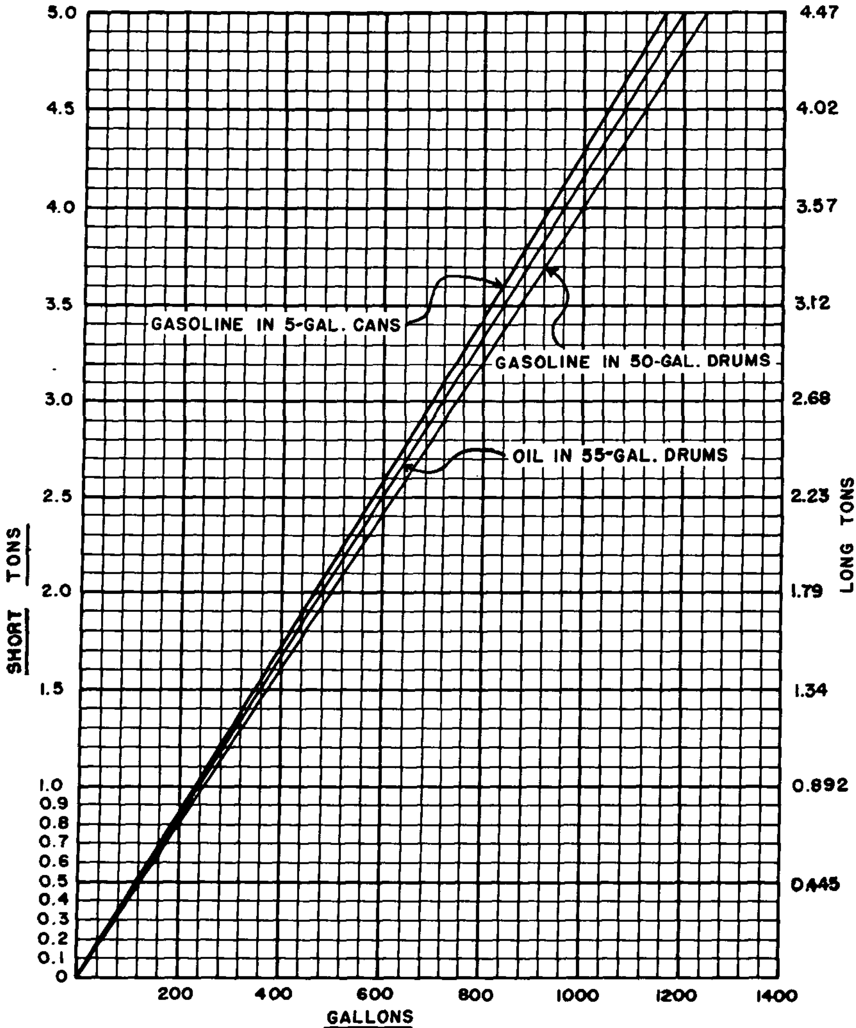

Figure 7.15. Scale for converting gallons of fuel and lubricants to tons.

h. Temperature Conversions.

$$°C=\frac{5}{9}(°F-32)$$

$$°F=\frac{9}{5}°C+32$$

i. Simplified Conversion Factors for Quick Computation: Accurate to Within 2 Percent.

Inches to centimeters	Multiply by 10 and divide by 4.
Yards to meters	Multiply by 9 and divide by 10.
Miles to kilometers	Multiply by 8 and divide by 5.
Gallons to liters	Multiply by 4 and subtract ⅕ of the number of gallons.
Pounds to kilograms	Multiply by 5 and divide by 11.

7.45 Converting Fuel and Lubricants From Gallons to Tons

The scale in figure 7.15 is approximate, and should be used only for rapid computation. For this reason, weights given per unit of volume are slightly heavier than average.

7.46 Petroleum Conversion Factors

(Conversion factors give averages, not exact figures.)

Multiply	By	To obtain
Gallons, gasoline	0. 0027	Long tons.
Gallons, gasoline	. 0026	Metric tons.
Gallons, gasoline	6. 103	Pounds.
Gallons, gasoline	. 0031	Short tons.
Gallons, oil	7. 434	Pounds.
Long tons	367. 21	Gallons, gasoline.
Measurement tons	1. 086	Short tons, gasoline.
Measurement tons	1. 4285	Short tons, gasoline in drums.
Measurement tons	1. 0	Short tons, grease.
Measurement tons	1. 11	Short tons, oil.
Measurement tons	1. 2048	Short tons, oil in drums.
Metric tons	373. 10	Gallons, gasoline.
Pounds	. 1639	Gallons, gasoline.
Pounds	. 1345	Gallons, oil.
Short tons	327. 8	Gallons, gasoline.
Short tons, gasoline	. 9195	Measurement tons.
Short tons, gasoline in drums	. 7	Measurement tons.
Short tons, grease	1. 0	Measurement tons.
Short tons, oil	. 90	Measurement tons.
Short tons, oil in drums	. 83	Measurement tons.

7.47 Map-Distance Conversion

a. Table.

Map distance	Ground distance	1/25,000	1/50,000	1/75,000	1/100,000	1/200,000	1/250,000	1/500,000	1/1,000,000
		Representative fraction (RF)							
One inch	Inches	25, 000	50, 000	75, 000	100, 000	200, 000	250, 000	500, 000	1, 000, 000
	Feet	2, 083	4, 167	6, 250	8, 333	16, 667	20, 833	41, 667	83, 333
	Yards	694	1, 389	2, 083	2, 778	5, 555	6, 944	13, 888	27, 776
	Kilometers	. 635	1. 27	1. 91	2. 54	5. 08	6. 35	12. 7	25. 4
	Miles	. 393	. 790	1. 19	1. 58	3. 15	3. 94	7. 9	15. 76
	Meters	635	1, 270	1, 910	2, 540	5, 080	6, 350	12, 700	25, 400
One centimeter	Inches	9, 843	19, 685	29, 528	39, 370	78, 740	98, 425	196, 850	393, 700
	Feet	820	1, 640	2, 460	3, 281	6, 562	8, 202	16, 404	32, 808
	Yards	273	547	820	1, 094	2, 187	2, 734	5, 468	10, 936
	Kilometers	. 250	. 500	. 750	1. 0	2. 0	2. 5	5. 0	10. 0
	Miles	. 154	. 31	. 465	. 62	1. 24	1. 55	3. 1	6. 2
	Meters	250	500	750	1, 000	2, 000	2, 500	5, 000	10, 000

b. Examples of use.

(1) A map distance of 1 inch is equivalent to a ground distance of 4,167 feet on a map with RF of 1/50,000.
(2) A map distance of 1 inch is equivalent to a ground distance of 3.15 miles on a map with RF of 1/200,000.
(3) A map distance of 1 centimeter is equivalent to a ground distance of 273 yards on a map with RF of 1/25,000.

7.48 Converting Foreign Measures to United States Measures

Country	Weight or measure	U.S. equivalent
Argentina	Arroba	25.32 lb
	Baril	20.077 gal.
	Cuadra	4.2 acres
	Frasco (liq)	2.509 qt (liq)
	Last	58.4 bu
	Libra	1.013 lb
	Pie	0.947 ft
	Quintal	101.28 lb
	Vara	34.094 in.
Australia	Same as United Kingdom	
Austria	Joch	1.422 acres
	Klafter	2.074 yd
Belgium	Last	85.134 bu
Bolivia	Marc	0.507 lb
Borneo	Picul	135.64 lb
Brazil	Arroba	32.379 lb
	Quintal	120.54 lb
Canada	Same as United Kingdom	
Celebes	Picul	135.64 lb
Central America	Centore	4.263 gal.
	Fanega	1.574 bu
	Libra	1.014 lb
	Manzana	1.727 acres
	Vara	32.913 in.
Chile	Fanega	2.753 bu
	Libra	1.014 lb
	Quintal	101.41 lb
	Vara	32.913 in.
China	Catty	1.333 lb
	Ch'ih	12.6 in.
	Li	1,890 ft
	Picul	133.333 lb
	Tael Kuping	575.64 grains (troy)
	Chun	1.26 in.
	Chang	10.49 ft
	Tsun	1.409 in.
	Feng	0.1259 in.
	Hou	0.0013 in.
	Shih tan	110.23 lb
	Shi li	1,889.28 ft
Cuba	Libra	1.014 lb
	Vara	33.386 in.
Denmark	Centner	110.23 lb
	Mil	4.68 miles
	Mil (geographic)	4.61 miles
	Pund	1.102 lb
	Tende (grain)	3.948 bu
	Tondeland	1.36 acres
	Viertel	1.701 gal.
Dutch Guiana	Livre	1.089 lb

Country	Weight or measure	U.S. equivalent
Ecuador	Fanega	1.574 bu
Egypt	Ardeb	5.619 bu
	Cantar	99.05 lb
	Feddan	1.04 acres
	Oke	2.805 lb
	Pic	22.83 in.
France	Tonne	2,204.62 lb
Germany	Klafter	2.074 yd
	Last	4,409.2 lb
Bremer	Centner	127.5 lb
Brunswick	Centner	117.5 lb
Prussia	Centner	113.34 lb
Greece	Drachma (new)	1 metric gr
	Livre	1.1 lb
	Mina (old)	2.202 lb
	Oke	2.82 lb
Guatemala	Fanega	1.53 bu
	Libra	1.014 lb
	Vara	32.909 in.
Honduras	Milla	1.149 miles
	Vara	32.953 in.
Hong Kong	Catty	1.333 lb
	Picul	133.333 lb
Hungary	Joch	1.067 acres
India:		
Bombay	Candy	569 lb
Madras	Candy	500 lb
	Maund (standard)	82.285 lb
	Ser	2.204 lb
	Chittak	900 grains
	Seer (factory)	1.866 lb
	Seer (standard)	2.057 lb
	Tola	0.4114 oz
Indonesia	Buow	1.7536 acres
	Katti	1.36 lb
	Paal	561.16 acres
Java	Paal	1,506 meters
Sumatra	Paal, square	1,852 meters
	Picul	136.16 lb
Iran	Jarib	2.471 acres
Israel	Rottle	6.35 lb
Japan	Bu	0.12 in.
	Catty	1.32 lb
	Cho	2.451 acres
	Ken	5.97 ft
	Koku	5.119 bu
	Kwamme	8.267 lb
	Se	0.024 acres
	Shaku	11.93 in.
	Sho (liq)	1.91 qt (liq)
	Sun	1.193 in.
	Tan	0.25 acres

Country	Weight or measure	U.S. equivalent
Japan—Continued	To	2.05 pk
	Tsubo	35.58 sq ft
	Go	0.19 qt
	Jo	3.31 yd
	Kin	1.323 lb
	Koku	47.65 gal.
	Kwan	8.267 lb
	Momme	0.1333 oz
	Picul	132.3 lb
	Ri	2.44 miles
	Rin	0.012 in.
	Tsunbo	3.953 sq ft
Korea	Chungbo	105.49 sq ft
	Ja	1 ft
	Kwan	3.750 kg or 8.269 lb
	Ri	2.440 miles
	Sok	6.371 cu ft
Luxemburg	Fuder	264.18 gal.
Malacca	Catty	1.36 lb
Malaya	Bongkal	832.0 grains
Malta	Barrel (customs)	11.2 gal.
	Caffisco	5.4 gal.
	Cantaro	175 lb
	Salm	8.2 bu
Mexico	Baril	20.078 gal.
	Fanega	2.577 bu
	Frasco (liq)	2.5 qt (liq)
	Libra	1.014 lb
	Quintal	101.47 lb
	Vara	32.99 in.
Morocco	Artel	1.12 lb
	Cantar	112 lb
Nicaragua	Manzana	1.742 acres
	Milla	1.159 miles
	Vara	33.057 in.
Norway	Centner	110.23 lb
Paraguay	Arroba	25.32 lb
	Cuadra (lin)	94.7 yd
	Cuadra (sq)	1.85 acres
	League	4.633 acres
Peru	Libra	1.014 lb
	Quintal	101.43 lb
	Vara	31.913 in.
Philippines	Picul	139.44 lb
Poland	Garnice	1.056 gal.
	Vloka	41.5 acres
Portugal	Almude	4.422 gal.
	Li'ra	1.012 lb
Spain	Arroba	4.263 gal.
	Fanega	16 gal.
	Pie	0.914 ft
	Quintal	101.43 lb

Country	Weight or measure	U.S. equivalent
Sweden	Centner	93.7 lb
	Last	9,371.3 lb
	Skalpund	0.937 lb
	Tunna	4.5 bu
	Tunnland	1.22 acres
Thailand	Catty, standard	1.333 lb
	Catty	2.667 lb
	Coyan	2,645.5 lb
Turkey	Cantar	124.45 lb
	Oke	2.828 lb
	Pik	27.9 in.
U.S.S.R.	Arshin (lin)	28 in.
	Arshin (sq)	5.44 sq ft
	Berkovets	361.128 lb
	Chetvert	5.957 bu
	Dessiatine	2.699 acres
	Food	36.113 lb
	Funt	0.9 lb
	Last	80.0 cu ft
	Sajene	7 ft
	Vedro	2.707 gal.
	Verst	0.633 mile
	Duim	1 in.
	Foute	1 ft
	Garnetz	2.98 qt
	Milya	4.64 miles
	Pfund	0.903 lb
	Pood or poud	36.11 lb
	Pound	0.903 lb
	Zak	2.368 bu
United Kingdom	Comb	4.128 bu
	Gallon	1.2 gal.
	Last	82.56 bu
	Load (timber)	50 cu ft
	Cwt (hundred wt)	112.0 lb
	Quart (liq)	1.2 qt (liq)
	Quart (dry)	1.3 qt (liq)
	Quarter	8.256 bu
	Sack (flour)	280 lb
	Stone	14 lb
	Wey	41.282 bu
Uruguay	Cuadra	1.82 acres
	Fanega	3.888 bu
	Libra	1.014 lb
Venezuela	Fanega	3.334 bu
	Libra	1.014 lb
Yugoslavia	Wagon	10 metric tons
Zanzibar	Frasila	35 lb

7.49 United States and British Miscellaneous Conversion Factors

Multiply	By	To obtain
Atmosphere	14. 70	Pounds per square inch
Barrels	5. 61	Cubic feet
Barrels	42. 0	Gallons
Barrels	6. 29	Kiloliters
Board feet	144. 0	Cubic inches
Boiler horsepower	33, 475. 0	Btu per hour
Bushels (imperial)	1. 032	Bushels (US)
Bushels (US)	. 969	Bushels (imperial)
Centimeters	. 03281	Feet
Centimeters	. 3937	Inches
Cubic feet	. 1782	Barrels
Cubic feet	. 02832	Cubic meters
Cubic feet	. 01	Tons (register)
Cubic feet per minute	. 1247	Gallons per second
Cubic feet per second	646, 315. 0	Gallons per day
Cubic meters	35. 31	Cubic feet
Cubic meters	1. 308	Cubic yards
Cubic yards	. 7646	Cubic meters
Days	1, 440. 0	Minutes
Drams	1. 772	Grams
Drams	. 0625	Ounces
Feet	30. 48	Centimeters
Feet of water	. 8826	Inches of mercury
Feet of water	62. 43	Pounds per square foot
Feet of water	. 4335	Pounds per square inch
Gallons (imperial)	. 1605	Cubic feet
Gallons (imperial)	1. 201	Gallons (US)
Gallons (imperial)	4. 543	Liters
Gallons (US)	. 8327	Gallons (imperial)
Gallons (US)	. 0238	Barrels
Gallons per minute	. 002228	Cubic feet per second
Grams	15. 43	Grains
Grams	. 001	Kilograms
Grams	1, 000. 0	Milligrams
Grams	. 03527	Ounces
Grams	. 002205	Pounds
Hours	. 04167	Days
Hours	. 005952	Weeks
Horsepower	42. 40	Btu per minute
Horsepower	33, 000. 0	Foot-pounds per minute
Horsepower (boiler)	33, 475. 0	Btu per hour
Horsepower-hours	2, 545. 0	Btu
Hundredweight	112. 0	Pounds
Hundredweight	. 508	Quintals
Inches	2. 540	Centimeters
Inches	25. 4001	Millimeters
Inches	1, 000. 0	Mils
Inches of mercury	. 4912	Pounds per square inch
Inches of water	. 07355	Inches of mercury
Inches of water	. 03614	Pounds per square inch

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Multiply	By	To obtain
Kilograms	1,000.0	Grams
Kiloliters	.159	Barrels
Knots	1.0	Miles per hour (naut)
Links (surveyors)	7.92	Inches
Liters	.2642	Gallons (US)
Liters	1.76	Pint (imperial)
Liters	2.1134	Pint (US)
Liters	1.057	Quart (liquid)
Meters	100.0	Centimeters
Millimeters	.0393	Inches
Mils	.001	Inches
Ounces	28.349	Grams
Ounces (fluid)	1.805	Cubic inches
Pounds	453.6	Grams
Pounds of water	.01603	Cubic feet
Pounds of water	.1198	Gallons (US)
Pounds per square inch	2.307	Feet of water
Pounds per square inch	2.036	Inches of mercury
Quintals	1.97	Hundredweights
Quires	25.0	Sheets (of paper, etc.)
Reams	500.0	Sheets (of paper, etc.)
Square centimeters	.1550	Square inches
Square feet	929.0	Square centimeters
Square feet	144.0	Square inches
Square inches	6.452	Square centimeters
Stones	14.0	Pounds
Temp (° C) plus 17.8	1.8	Temp (° F)
Temp (° F) minus 32	.5556	Temp (° C)
Tons (measurement)	40.0	Cubic feet
Tons (register)	100.0	Cubic feet
Weeks	168.0	Hours

7.50 Stowage Factors by Class and Service

a. Computation of Stowage Factor. The stowage factor is the number of cubic feet required to store 1 long ton (2,240 lb) of cargo. It may be computed by the following formula.

$$\text{Stowage factor (cu ft)} = \frac{\text{cube of cargo (cu ft)} \times 2{,}240}{\text{weight in pounds}}$$

b. Weight-Volume Ratios. Weight-volume ratios are based on average cubage for each item. The measurement tonnage for any item can be found by multiplying its short ton weight by its conversion factor. Weight-volume ratios by classes of supply are given below.

Items [1]	Conversion factor (ST to MT)	Stowage factor
Class I: Rations	2.1	94
Class II:		
Chemical	2.3	103
Engineer	3.3	147
Medical (incl Class I and IV)	2.5	112
Ordnance	1.8	80
Ordnance vehicle replacement	2.2	99
QM clothing and equipage	2.0	89
QM general supplies	2.8	125
Signal (incl Class IV)	3.8	170
Class III:		
Aviation fuel and lubricants (Class IIIA)	1.5	67
Fuel for temperate zone	2.0	89
Gas, oil, grease [2] (less aviation)	1.5	67
Class IV:		
Aviation supply and replacement	4.0	179
Chemical (negligible)		
Engineer construction material	1.5	67
Medical (incl in Class II)		
Ordnance motor maintenance	1.0	45
QM sales items	1.7	76
Signal (incl in Class II)		
Transportation	2.4	108
Class V:		
Ammunition (less aviation)	.9	40
Aviation ammunition	.9	40
Chemical ammunition	1.2	54

[1] Nongas conditions. Figures are based upon average conditions found in European and Pacific theaters. Amounts will vary for polar regions.

[2] Consists of the following: 90 percent gasoline, 4 percent diesel fuel, 3 percent engine oil, 1 percent gear lube, 2 percent greases.

7.51 Average of Stowage Factors by Service

Supply service	*Class of supply*	*Stowage factor*
Chemical	All supplies less Class V	103
Engineer	All supplies	107
Medical	All supplies	112
Ordnance	All supplies less Class V	75
Quartermaster	All supplies	87
Signal	All supplies	170
Transportation	All supplies	108
Chemical	Class V	54
Ordnance	Class V	40

7.52 Rapid Computation of Weight of a Unit for Shipment

For planning purposes the weight in short tons of a unit is the sum of the combined weights of:

a. TOE personnel and individual equipment, assuming average weight of 240 pounds per man.

b. Major items of organizational equipment.

c. Class I supplies for 3 days, assuming 6.6 pounds per ration per man per day.

d. Class III supplies necessary to move unit 100 miles from destination point after arrival, if authorized in shipment.

e. Basic load of class V.

f. Added items that may be authorized by theater commander or CONUS commander.

7.53 Measurement of Surfaces and Solids

Figure	Formula
a. Area of:	
Circle	Square of the diameter times .7854, or square of the radius times 3.1416.
Sector of	Length of the arc times the radius divided by 2, or 3.1416 times square of radius times angle of the sector divided by 360.
Segment of	Area of the sector minus the area of the triangle formed by joining radii.
Cone	One-half of slant height times perimeter of base plus area of base.
Frustrum of	Slant height times sum of circumferences of bases divided by 2 plus sum of the areas of both bases.
Cube	Sum of areas of all the sides.
Cylinder	Area of 2 ends plus length times perimeter.
Ellipse	Long axis times short axis times .7854.
Parallelogram	Base times altitude.
Polygon	Perimeter times apothem divided by 2.
Prism	Area of 2 ends plus length times perimeter.
Pyramid	One-half of slant height times perimeter of base plus area of base.
Rectangle	Base times altitude.
Sphere	Square of diameter times 3.1416.
Square	Base times altitude.
Straight-lined figure of 4 or more unequal sides.	Divide figure into triangles, find area of each triangle, and add areas.
Trapezoid	Altitude times sum of bases dividedby 2.
Triangle	Base times altitude divided by 2.
b. Circumference of:	
Circle	Diameter times 3.1416.
Quadrilateral and polygon	Sum of all sides.

Figure	Formula
c. Volume of:	
Cone	Height times area of base divided by 3.
Frustrum of cone	Height times $\left(\frac{B+B'+\sqrt{B\times B'}}{3}\right)$
Cube	Length times width times depth.
Cylinder	Area of the base times height.
Prism	Height times area of base.
Pyramid	Height times area of base divided by 3.
Frustrum of pyramid	Height times $\left(\frac{B+B'+\sqrt{B\times B'}}{3}\right)$
Sphere	Cube of the diameter times .5236.
Tank, elliptical	Long axis times short axis times .7854 times length.
Irregular figure	Sum of volume of component parts. If possible, immerse figure in water and measure the displacement.

Note

Apothem—perpendicular from center of polygon to any side.
B and B'—area of upper and lower bases, respectively, of frustrum of cone or pyramid.
Frustrum—that part of a pyramid or cone included between the base and a section of the pyramid or cone parallel to the base.
Polygon—closed, straight-lined figure having more than 4 sides.
Quadrilateral—closed, straight-lined figure having 4 sides.
Regular polygon—closed, straight-lined figure having equal sides and equal angles.
Trapezoid—quadrilateral figure having one pair of parallel sides.

7.54 Functions of Numbers

Number	Square	Square root	Cube	Cube root (approximate)	Logarithm
1	1	1. 0000	1	1. 000	0. 00000
2	4	1. 4142	8	1. 261	. 30103
3	9	1. 7321	27	1. 441	. 47712
4	16	2. 0000	64	1. 59	. 60206
5	25	2. 2361	125	1. 712	. 69897
6	36	2. 4495	216	1. 82	. 77815
7	49	2. 6458	343	1. 92	. 84510
8	64	2. 8284	512	2. 000	. 90309
9	81	3. 0000	729	2. 08	. 95424
10	100	3. 1623	1000	2. 16	1. 00000
11	121	3. 3166	1331	2. 225	1. 04139
12	144	3. 4641	1728	2. 29	1. 07918
13	169	3. 6056	2197	2. 35	1. 11394
14	196	3. 7417	2744	2. 41	1. 14613
15	225	3. 8730	3375	2. 47	1. 17609
16	256	4. 0000	4096	2. 52	1. 20412
17	289	4. 1231	4913	2. 57	1. 23045
18	324	4. 2426	5832	2. 62	1. 25527
19	361	4. 3589	6859	2. 67	1. 27875
20	400	4. 4721	8000	2. 71	1. 30103

Number	Square	Square root	Cube	Cube root (approximate)	Logarithm
21	441	4. 5826	9261	2. 76	1. 32222
22	484	4. 6904	10648	2. 81	1. 34242
23	529	4. 7958	12167	2. 84	1. 36173
24	576	4. 8990	13824	2. 88	1. 38021
25	625	5. 0000	15625	2. 92	1. 39794
26	676	5. 0990	17576	2. 96	1. 41497
27	729	5. 1962	19683	3. 00	1. 43136
28	784	5. 2915	21952	3. 04	1. 44716
29	841	5. 3852	24389	3. 07	1. 46240
30	900	5. 4772	27000	3. 11	1. 47712
31	961	5. 5678	29791	3. 14	1. 49136
32	1024	5. 6569	32768	3. 17	1. 50515
33	1089	5. 7446	35937	3. 21	1. 51851
34	1156	5. 8310	39304	3. 24	1. 53148
35	1225	5. 9161	42875	3. 27	1. 54407
36	1296	6. 0000	46656	3. 30	1. 55630
37	1369	6. 0828	50653	3. 34	1. 56820
38	1444	6. 1644	54872	3. 37	1. 57978
39	1521	6. 2450	59319	3. 39	1. 59106
40	1600	6. 3246	64000	3. 42	1. 60216
41	1681	6. 4031	68921	3. 45	1. 61278
42	1764	6. 4807	74088	3. 47	1. 62325
43	1849	6. 5574	79507	3. 50	1. 63347
44	1936	6. 6332	85184	3. 53	1. 64345
45	2025	6. 7082	91125	3. 56	1. 65321
46	2116	6. 7823	97336	3. 58	1. 66276
47	2209	6. 8557	103823	3. 61	1. 67210
48	2304	6. 9282	110592	3. 63	1. 68124
49	2401	7. 0000	117649	3. 66	1. 69020
50	2500	7. 0711	125000	3. 68	1. 69897
51	2601	7. 1414	132651	3. 71	1. 70757
52	2704	7. 2111	140608	3. 73	1. 71600
53	2809	7. 2801	148877	3. 76	1. 72428
54	2916	7. 3485	157464	3. 78	1. 73239
55	3025	7. 4162	166375	3. 81	1. 74036
56	3136	7. 4833	175616	3. 82	1. 74819
57	3249	7. 5498	185193	3. 85	1. 75587
58	3364	7. 6158	195112	3. 87	1. 76343
59	3481	7. 6811	205379	3. 90	1. 77085
60	3600	7. 7460	216000	3. 91	1. 77815
61	3721	7. 8102	226981	3. 94	1. 78533
62	3844	7. 8740	238328	3. 96	1. 79239
63	3969	7. 9373	250047	3. 98	1. 79934
64	4096	8. 0000	262144	4. 00	1. 80618
65	4225	8. 0623	274625	4. 02	1. 81291
66	4356	8. 1240	287496	4. 04	1. 81954
67	4489	8. 1854	300763	4. 06	1. 82607
68	4624	8. 2462	314432	4. 09	1. 83251
69	4761	8. 3066	328509	4. 10	1. 83885
70	4900	8. 3666	343000	4. 12	1. 84510
71	5041	8. 4261	357911	4. 14	1. 85126

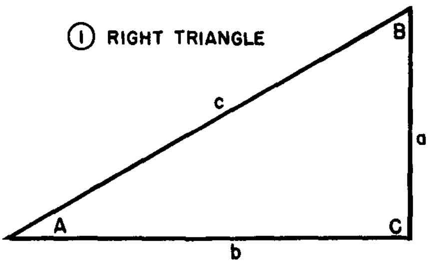
Number	Square	Square root	Cube	Cube root (approximate)	Logarithm
72	5184	8. 4853	373248	4. 16	1. 85733
73	5329	8. 5440	389017	4. 18	1. 86332
74	5476	8. 6023	405224	4. 20	1. 86923
75	5625	8. 6603	421875	4. 22	1. 87506
76	5776	8. 7178	438976	4. 23	1. 88081
77	5929	8. 7750	456533	4. 26	1. 88649
78	6084	8. 8318	474552	4. 28	1. 89209
79	6241	8. 8882	493039	4. 30	1. 89763
80	6400	8. 9443	512000	4. 31	1. 90309
81	6561	9. 0000	531441	4. 33	1. 90849
82	6724	9. 0554	551368	4. 35	1. 91381
83	6889	9. 1104	571787	4. 36	1. 91908
84	7056	9. 1652	592704	4. 38	1. 92428
85	7225	9. 2195	614125	4. 40	1. 92942
86	7396	9. 2736	636056	4. 41	1. 93450
87	7569	9. 3274	658503	4. 43	1. 93952
88	7744	9. 3808	681472	4. 45	1. 94448
89	7921	9. 4340	704969	4. 46	1. 94939
90	8100	9. 4868	729000	4. 48	1. 95424
91	8281	9. 5394	753571	4. 50	1. 95904
92	8464	9. 5917	778688	4. 51	1. 96379
93	8649	9. 6437	804357	4. 52	1. 96848
94	8836	9. 6954	830584	4. 54	1. 97313
95	9025	9. 7468	857375	4. 56	1. 97772
96	9216	9. 7980	884736	4. 58	1. 98227
97	9409	9. 8489	912673	4. 60	1. 98677
98	9604	9. 8995	941192	4. 61	1. 99123
99	9801	9. 9499	970299	4. 62	1. 99564
100	10000	10. 0000	1000000	4. 64	2. 00000

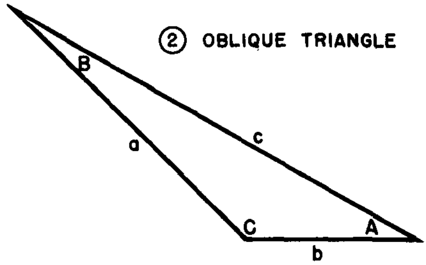
7.55 Decimal Equivalents

Inches							Inches	Millimeters
						1/64	0. 015625	0. 397
					1/32		. 03125	. 794
						3/64	. 046875	1. 191
				1/16			. 0625	1. 588
						5/64	. 078125	1. 984
					3/32		. 09375	2. 381
						7/64	. 109375	2. 778
			1/8				. 125	3. 175
						9/64	. 140625	3. 572
					5/32		. 15625	3. 969
						11/64	. 171875	4. 366
				3/16			. 1875	4. 763
						13/64	. 203125	5. 159
					7/32		. 21875	5. 556
						15/64	. 2344375	5. 953

Inches							Inches	Millimeters
		1/4					.25	6.350
						17/64	.265625	6.747
					9/32		.28125	7.144
						19/64	.296875	7.541
				5/16			.3125	7.938
						21/64	.328125	8.334
					11/32		.34375	8.731
						23/64	.359375	9.128
			3/8				.375	9.525
						25/64	.390625	9.922
					13/32		.40625	10.319
						27/64	.421875	10.716
				7/16			.4375	11.113
						29/64	.453125	11.509
					15/32		.46875	11.906
						31/64	.484375	12.303
	1/2						.5	12.700
						33/64	.515625	13.097
					17/32		.53125	13.494
						35/64	.546875	13.891
				9/16			.5625	14.288
						37/64	.578125	14.684
					19/32		.59375	15.081
						39/64	.609375	15.478
			5/8				.625	15.875
						41/64	.640625	16.272
					21/32		.65625	16.669
						43/16	.671875	17.066
				11/16			.6875	17.463
						45/64	.703125	17.859
					23/32		.71875	18.256
						47/64	.734375	18.653
		3/4					.75	19.050
						49/64	.765625	19.447
					25/32		.78125	19.844
						51/64	.796875	20.241
				13/16			.8125	20.638
						53/64	.828125	21.034
					27/32		.84375	21.431
						55/64	.859375	21.828
			7/8				.875	22.225
						57/64	.890625	22.622
					29/32		.90625	23.019
						59/64	.921875	23.416
				15/16			.9375	23.813
						61/64	.953125	24.209
					31/32		.96875	24.606
						63/64	.984375	25.003
1							1.0	25.400

7.56 Trigonometric Solution of Triangles





$$\text{Sin } A = \frac{a}{c} \qquad \text{Cos } A = \frac{b}{c}$$

$$\text{Tan } A = \frac{a}{b} \qquad \text{Cot } A = \frac{b}{a}$$

$$\text{Sec } A = \frac{c}{b} \qquad \text{Csc } A = \frac{c}{a}$$

$$\text{Area} = \frac{ab}{2} = \frac{a}{2}\sqrt{c^2 - a^2} = \frac{a^2 \text{ Cot } A}{2}$$

$$= \frac{b^2 \text{ Tan } A}{2} = \frac{c^2 \text{ Sin } 2A}{4}$$

$$a^2 = b^2 + c^2 - 2bc \text{ Cos } A$$

$$b^2 = a^2 + c^2 - 2ac \text{ Cos } B$$

$$c^2 = a^2 + b^2 - 2ab \text{ Cos } C$$

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$

where

$$s = \frac{a+b+c}{2}$$

7.57 Natural Trigonometric Functions

Angle°	Sin	Cosec	Tan	Cotan	Sec	Cos	Angle°
0	0.000	--------	0.000	--------	1.000	1.000	90
1	.017	57.30	.017	57.29	1.000	1.000	89
2	.035	28.65	.035	28.64	1.001	.999	88
3	.052	19.11	.052	19.08	1.001	.999	87
4	.070	14.34	.070	14.30	1.002	.998	86
5	.087	11.47	.087	11.43	1.004	.996	85
6	.105	9.567	.105	9.514	1.006	.995	84
7	.122	8.206	.123	8.144	1.008	.993	83
8	.139	7.185	.141	7.115	1.010	.990	82
9	.156	6.392	.158	6.314	1.012	.988	81
10	.174	5.759	.176	5.671	1.015	.985	80
11	.191	5.241	.194	5.145	1.019	.982	79
12	.208	4.810	.213	4.705	1.022	.978	78
13	.225	4.445	.231	4.331	1.026	.974	77
14	.242	4.134	.249	4.011	1.031	.970	76
15	.259	3.864	.268	3.732	1.035	.966	75
16	.276	3.628	.287	3.487	1.040	.961	74
17	.292	3.420	.306	3.271	1.046	.956	73
18	.309	3.236	.325	3.078	1.051	.951	72
19	.326	3.072	.344	2.904	1.058	.946	71
20	.342	2.924	.364	2.747	1.064	.940	70

Angle°	Sin	Cosec	Tan	Cotan	Sec	Cos	Angle°
21	.358	2.790	.384	2.605	1.071	.934	69
22	.375	2.669	.404	2.475	1.079	.927	68
23	.391	2.559	.424	2.356	1.086	.921	67
24	.407	2.459	.445	2.246	1.095	.914	66
25	.423	2.366	.466	2.145	1.103	.906	65
26	.438	2.281	.488	2.050	1.113	.899	64
27	.454	2.203	.510	1.963	1.122	.891	63
28	.469	2.130	.532	1.881	1.133	.883	62
29	.485	2.063	.554	1.804	1.143	.875	61
30	.500	2.000	.577	1.732	1.155	.866	60
31	.515	1.942	.601	1.664	1.167	.857	59
32	.530	1.887	.625	1.600	1.179	.848	58
33	.545	1.836	.649	1.540	1.192	.839	57
34	.559	1.788	.675	1.483	1.206	.829	56
35	.574	1.743	.700	1.428	1.221	.819	55
36	.588	1.701	.727	1.376	1.236	.809	54
37	.602	1.662	.754	1.327	1.252	.799	53
38	.616	1.624	.781	1.280	1.269	.788	52
39	.629	1.589	.810	1.235	1.287	.777	51
40	.643	1.556	.839	1.192	1.305	.766	50
41	.656	1.542	.869	1.150	1.325	.755	49
42	.669	1.494	.900	1.111	1.346	.743	48
43	.682	1.466	.933	1.072	1.367	.731	47
44	.695	1.440	.966	1.036	1.390	.719	46
45	.707	1.414	1.000	1.000	1.414	.707	45

7.58 Speed Conversion Table, Approximate

Miles per hour	Knots	Feet per second	Kilometers per hour	Meters per second
1	0.8684	1.4667	1.6093	0.447
2	1.74	2.94	3.23	.897
3	2.59	4.41	4.83	1.34
4	3.46	5.90	6.45	1.78
5	4.34	7.33	8.05	2.23
6	5.20	8.80	9.65	2.68
7	6.07	10.30	11.30	3.13
8	6.95	11.80	12.90	3.58
9	7.81	13.22	14.50	4.03
10	8.68	14.67	16.09	4.47
11	9.55	16.20	17.70	4.92
12	10.40	17.62	19.30	5.37
13	11.23	19.10	20.90	5.82
14	12.10	20.60	22.60	6.27
15	13.00	22.10	24.20	6.71
16	13.90	23.50	25.80	7.16
17	14.75	25.00	27.40	7.63
18	15.60	26.40	28.90	8.05
19	16.45	28.00	30.60	8.50

Miles per hour	Knots	Feet per second	Kilometers per hour	Meters per second
20	17. 40	29. 30	32. 20	8. 95
21	18. 20	30. 90	33. 80	9. 39
22	19. 10	32. 30	35. 40	9. 85
23	20. 00	33. 80	37. 10	10. 30
24	20. 80	35. 30	38. 60	10. 75
25	21. 70	36. 70	40. 30	11. 15
26	22. 50	38. 20	41. 90	11. 60
27	23. 40	39. 70	43. 50	12. 10
28	24. 30	41. 20	45. 10	12. 50
29	25. 20	42. 60	46. 70	13. 00
30	26. 00	44. 20	48. 30	13. 40
31	26. 90	45. 60	50. 00	13. 90
32	27. 80	47. 00	51. 50	14. 30
33	28. 60	48. 50	53. 00	14. 73
34	29. 50	50. 00	54. 55	15. 20
35	30. 40	51. 50	56. 50	15. 65
36	31. 20	53. 00	58. 00	16. 10
37	32. 00	54. 50	59. 70	16. 50
38	32. 90	56. 00	61. 40	17. 00
39	33. 80	57. 50	62. 80	17. 40
40	34. 60	58. 80	64. 50	17. 83
41	35. 60	60. 50	66. 00	18. 38
42	36. 40	61. 90	67. 70	18. 80
43	37. 30	63. 40	69. 20	19. 20
44	38. 20	64. 80	71. 00	19. 70
45	38. 90	66. 50	72. 50	20. 20
46	40. 00	67. 50	74. 00	20. 60
47	40. 70	69. 10	75. 90	21. 00
48	41. 50	70. 50	77. 50	21. 40
49	42. 40	72. 00	79. 00	21. 80
50	43. 50	73. 80	80. 50	22. 30
51	44. 10	74. 90	82. 00	22. 80
52	45. 10	76. 50	83. 60	23. 20
53	46. 00	78. 00	85. 70	23. 70
54	46. 70	79. 50	87. 00	24. 20
55	47. 50	80. 90	88. 70	24. 60
56	48. 50	82. 20	90. 00	25. 00
57	49. 50	83. 90	91. 90	25. 50
58	50. 10	85. 00	93. 40	25. 90
59	51. 00	86. 80	95. 00	26. 40
60	52. 00	88. 10	96. 70	26. 80
61	53. 00	89. 60	98. 00	27. 20
62	53. 70	91. 10	99. 80	27. 70
63	54. 60	92. 90	101. 70	28. 20
64	55. 60	94. 20	103. 00	28. 60
65	56. 20	95. 30	104. 50	29. 10
66	57. 20	97. 00	106. 00	29. 50
67	58. 00	98. 20	108. 00	30. 00
68	58. 90	100. 00	109. 50	30. 40
69	59. 80	101. 80	111. 00	30. 80
70	60. 70	103. 00	113. 00	31. 30

Miles per hour	Knots	Feet per second	Kilometers per hour	Meters per second
71	61. 60	104. 00	114. 00	31. 70
72	62. 50	106. 00	116. 00	32. 20
73	63. 30	107. 30	117. 30	32. 60
74	64. 20	109. 00	119. 00	33. 10
75	65. 00	110. 00	121. 00	33. 60

7.59 Computing Guy Stress

To compute the stress, or tension, that should be placed upon a guy, the horizontal and vertical distance relationships for upright poles, the weight of the load to be lifted, the weight of the pole, the horizontal distance from base of pole to the guy anchor, and the perpendicular distance from the base of the pole to the guy must be considered. Relationships for computing stress are shown in figure 7.16. 1, figure 7.16 illustrates tension or pull (*P*) for an upright pole when there are known relationships between height of the pole (*H*) and the ground distance from base of the pole to the guy anchor. 2, figure 7.16 shows how to compute guy stress when the pole is inclined.

Section XII. TIME, TIDE, AND LIGHT

7.60 Time and Light

a. Designating Time and Date.

(1) *Time.* Expressed in a group of four digits, ranging from 0000 to 2400. First two digits are the hours after midnight; remaining two indicate minutes past the hour. Where the hour can be expressed as a single digit, it is preceded by zero; for example, 0625 for 6:25 a. m.

(2) *Date.* Day, month, and year expressed in that order—except when necessary to specify a six-digit time group. In a six-digit time group, the first two digits indicate day of month; the next two the hour; the last two, minutes past the hour. For example, 070625 Dec 56 means 6:25 a. m. on 7 Dec 1956. If desired to keep the date secret, dates may be expressed by a letter, such as D plus or minus a numeral in place of the first two digits.

(3) *Greenwich mean time.* Time groups expressing Greenwich mean time are designated by the letter suffix Z immediately following the last digit of the group; for example, 190225Z.

(4) *Expressing natural phenomena.* Indefinite terms, such as first light, last light, daybreak, daylight, darkness, dusk, dawn are avoided. Definite terms are permissible, such as

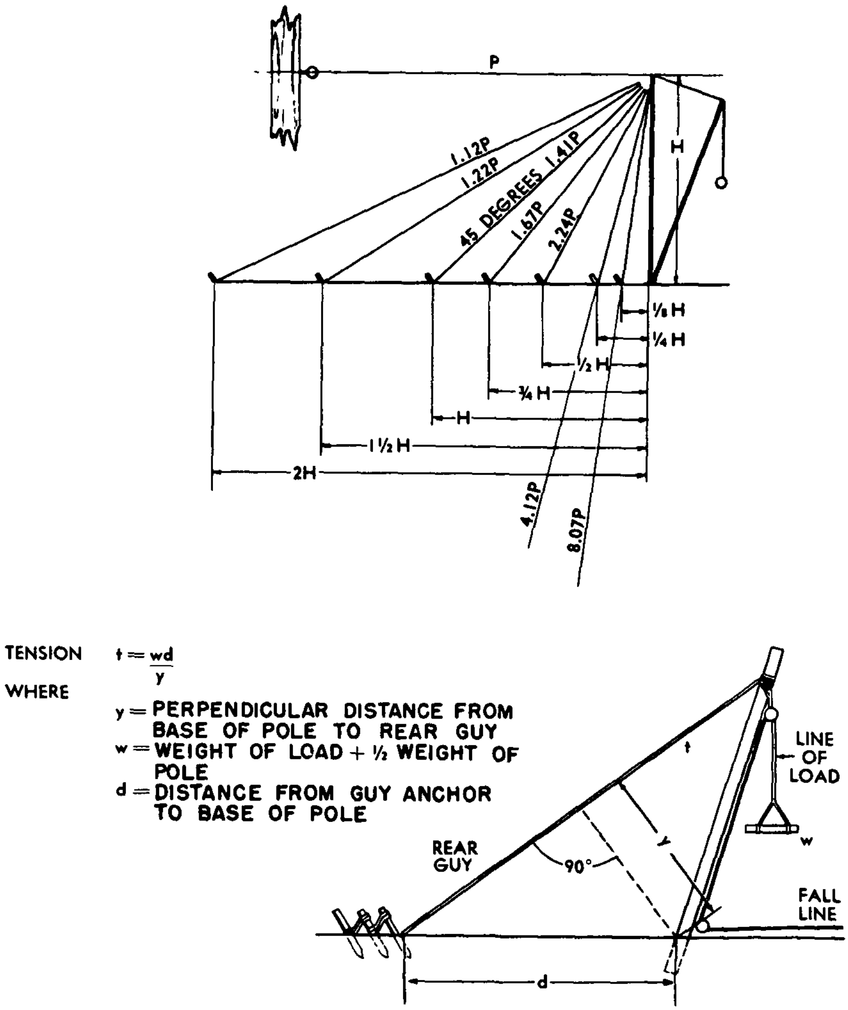


Figure 7.16. Computing guy stress

sunrise, sunset, beginning or end of evening or morning nautical or civil twilight.

b. Time Zone Chart fig. (7.17).

(1) It takes the sun an average of 24 hours of time to make its apparent daily trip around the earth; in other words, the sun travels 360° in longitude in 24 hours. Therefore the surface of the earth is divided into 24 zones 15° wide in longitude—each 1 hour in width. The initial zone is the one which has the meridian of Greenwich running through the middle of it, and the meridians 7½° east of Greenwich and 7½° west of Greenwich marking its eastern and western limits. It is called the "zero zone" because the difference

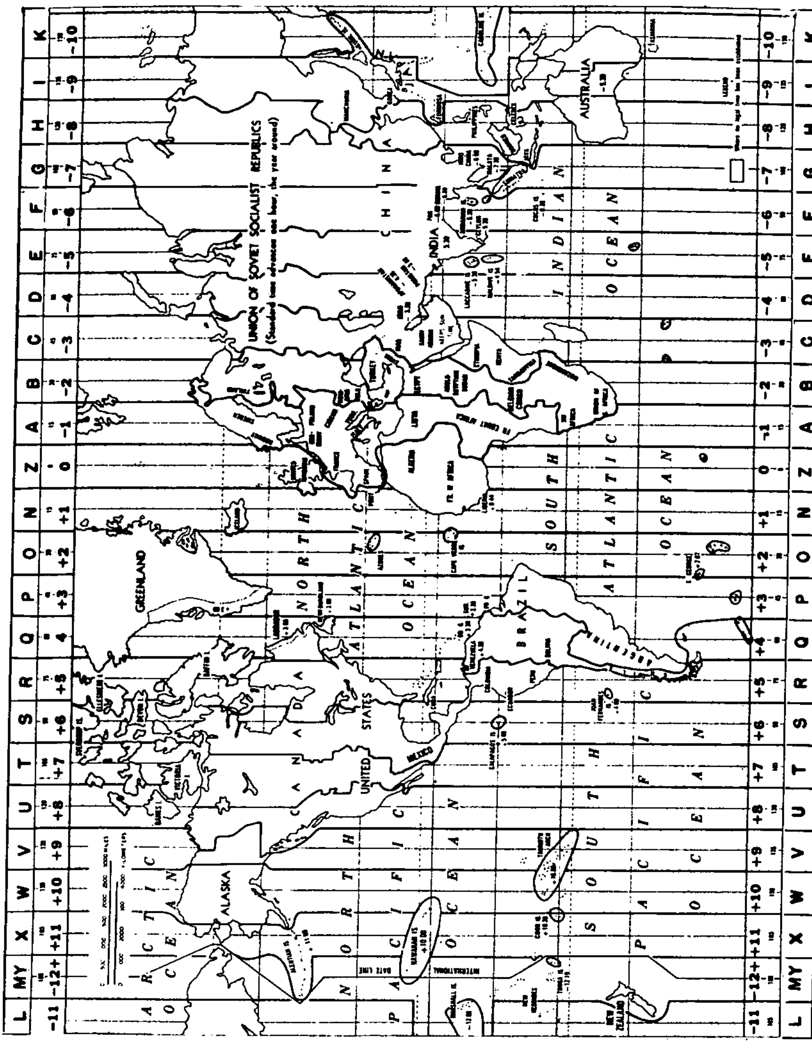


Figure 7.17. Time zone chart.

TIME ZONE	HOURS OF DAY IN LOCAL MEAN TIME																																														
	PREVIOUS DAY												SAME DAY																								NEXT DAY											
0 (Z)	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11
-1 (A)	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12
-2 (B)	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13
-3 (C)	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14
-4 (D)	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
-5 (E)	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
-6 (F)	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
-7 (G)	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18
-8 (H)	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
-9 (I)	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
-10 (K)	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21
-11 (L)	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22
-12 (M)	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
+1 (N)	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10
+2 (O)	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09
+3 (P)	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08
+4 (Q)	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07
+5 (R)	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06
+6 (S)	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05
+7 (T)	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04
+8 (U)	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03
+9 (V)	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02
+10 (W)	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01
+11 (X)	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00
+12 (Y)	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	PREVIOUS DAY																								SAME DAY																							

Figure 7.18. Table for conversion of time throughout the world.

between the standard time of this zone and Greenwich mean time is zero. Each of the zones in turn is designated by a number representing the number of hours by which the standard time of the zone differs from Greenwich mean time. The zones lying in east longitude from the zero zone are numbered in sequence from 1 to 12, and are called minus zones because, in each of them, the zone number must be subtracted from the standard time in order to obtain the Greenwich mean time. The zones lying in west longitude from the zero zones are numbered in sequence from 1 to 12, and are called plus zones because, in each of these zones, the zone number must be added to the standard time in order to obtain the Greenwich mean time. The time kept in any zone is the standard time of its central meridian. The twelfth zone is divided medially by the 180° meridian (the line separating the meridians of east longitude from the meridians of west longitude), and the terms "minus" and "plus" are used in the halves of this zone which lie in the east longitude and west longitude, respectively.

(2) *Use of suffixes.* The suffix letter used after a four- or six-digit time group indicates the number of hours by which the time being expressed differs from Greenwich mean time at the same instant. It does not designate location on the earth's surface (fig. 7.17). For example, Norfolk, Va., is located in the fifth time zone west of Greenwich. For local mean time, the suffix letter would be R.

(3) *Converting time from zone to zone.* The number in the time zone indicates the number of hours or fraction thereof that local time differs from Greenwich mean time. The time zones extend east and west from Greenwich to the 180th meridian. To transpose Greenwich mean time to local time, add the zone number if the zone is east of the prime meridian; subtract it if it is west of the prime meridian. Time conversion for any zone is shown in figure 7.18.

7.61 Tides, Sunlight, and Moonlight

a. Chart. Figure 7.19 shows the type of chart which is issued for each major operation or operational area. These charts are prepared by the Joint Intelligence Study Publishing Board and appear in JANIS (Joint Army-Navy Intelligence Study).

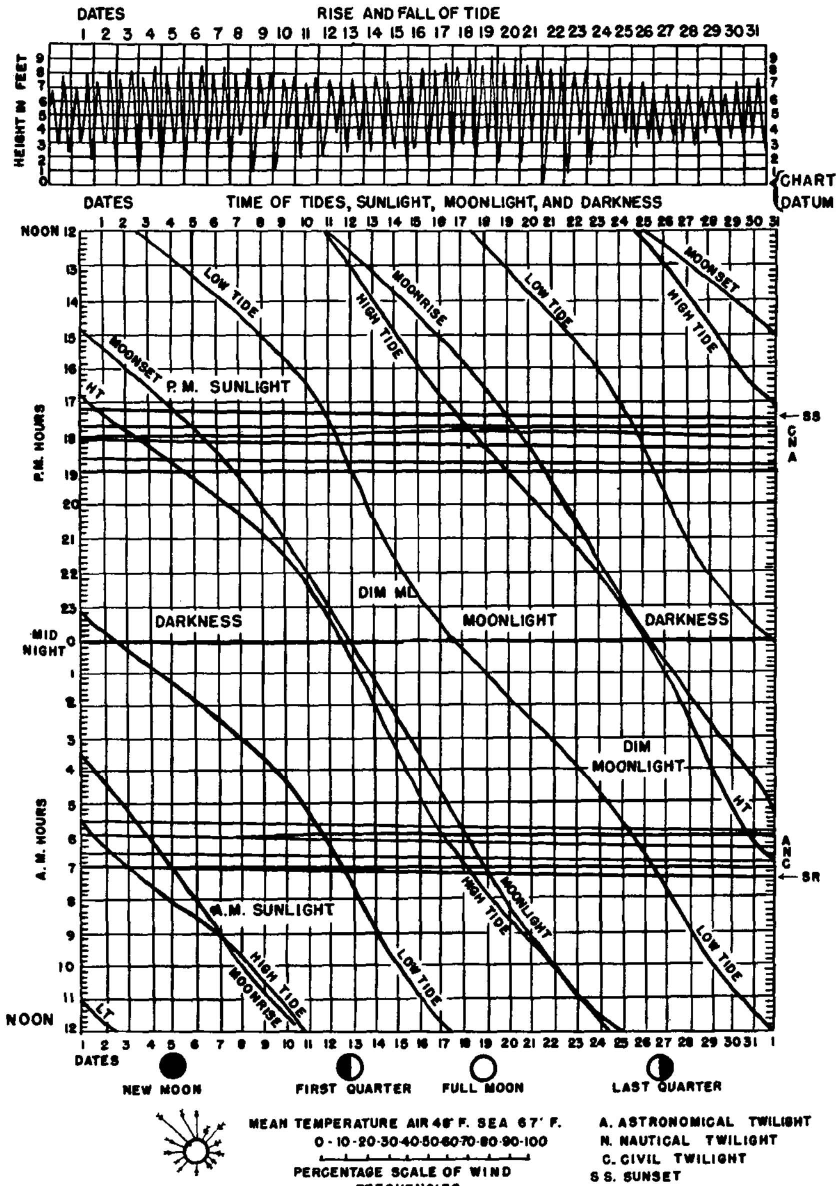
b. Area Covered. Astronomical data are for sea level and do not vary more than 5 minutes over a radius of 60 miles.

c. Time Used for the Time Meridian Indicated in the Heading. When another time meridian is used in the field, the figures representing hours on the left of the large diagram are changed to conform to the new time. If the time meridian to be used is in a zone number east

KAGOSHIMA - WAN, KYUSHU * DECEMBER 1945

LAT 31° 30′ N., LONG 130° 40′ E. TIME MERIDIAN: 135° E.

SUNLIGHT AND MOONLIGHT DATA COMPUTED FOR LAT 31°30′N., LONG 130°40′E.



*THIS DIAGRAM, WITH THE CHANGES INDICATED, IS ALSO APPLICABLE TO THE FOLLOWING PLACES: TOMARI URA — ADD 10 MINUTES TO TIMES OF HIGH AND LOW TIDES, SUBTRACT 1/2 FOOT FROM HEIGHTS OF HIGH TIDES.

ODOMARI-WAN — SUBTRACT 25 MINUTES FROM TIMES OF HIGH AND LOW TIDES, SUBTRACT 1 FOOT FROM HEIGHTS OF HIGH TIDES.

Figure 7.19. Diagram of tides, sunlight, and moonlight.

of the one shown on the diagram, the number is increased by 1 hour for each 15°; if west, the number is decreased by 1 hour for each 15°.

d. Dates. In the upper diagram of figure 7.19, each day from midnight to midnight is represented by a space between two lines. In the lower diagram, the days are represented by vertical lines covering the period from noon of one day to noon of the next. The dates at the bottom of the diagram differ from those at the top because the dates change in passing through midnight.

e. Tides. Times of the tides are shown by curves in the lower diagram. By noting the sequence of the tides during the day, the height of any particular tide can be found by consulting the diagram.

f. Twilights, Morning and Evening (fig. 7.20).

(1) Twilights are the periods of solar illumination before sunrise and after sunset. Both morning and evening twilights are divided into three periods: astronomical, nautical, and civil.

(*a*) *Astronomical.* Offers meager light, if any; for military purposes, considered period of darkness.

(*b*) *Nautical.* Provides enough light to carry on most types of ground movement without difficulty. Visibility limited to 400 yards or less.

(*c*) *Civil.* Offers enough light to carry on normal day activities.

(2) Except for high latitudes, durations of astronomical, nautical, and civil twilights may be considered equal.

(3) First light, a term used by the armed forces of the United Kingdom, includes a slightly greater period of twilight than that defined by civil twilight.

g. Moonlight. For astronomical twilight and solar darkness, periods of moonlight and solar darkness are shown on the lower diagram of figure 7.19. During the period of moonlight the intensity of light will vary between the brightness of the full moon at zenith and about one-third of this value. During the period of dim moonlight, the intensity varies from about one-third to one-tenth of the brightness of the full moon at zenith.

h. Moon's Phases. In figure 7.19 the phases of the moon are shown below the days on which they occur.

i. Effect of Weather on Light. Smog, fog, clouds, refraction, reflection, and precipitation affect the degree of illumination. These factors can be included in the calculations by means of experience tables compiled in the area and from meteorological forecasts for the area.

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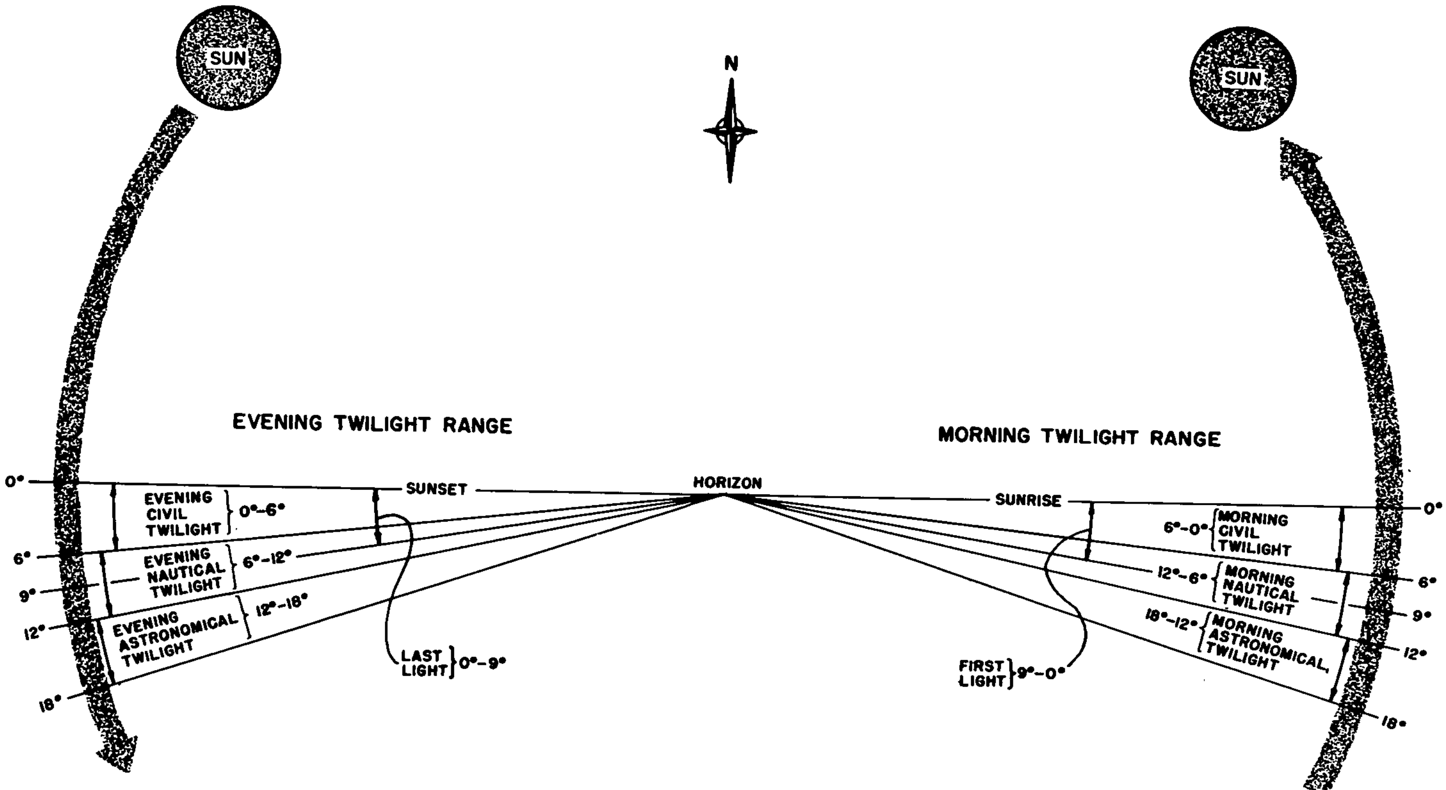

NOTE – Degrees refer to center of sun below horizon.

Figure 7.20. Twilight factors.

7.62 Hours of Daylight

[Time between sunrise and sunset. It is light for approximately 30 minutes before sunrise and after sunset. For latitude south, subtract figure given from 24.]

Latitude north	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
0°	12	12	12	12	12	12	12	12	12	12	12	12
10°	12	12	12	12	13	13	13	12	12	12	12	12
20°	11	12	12	13	13	13	13	13	12	12	11	11
30°	10	11	12	13	14	14	14	13	12	11	11	10
40°	10	11	12	13	14	15	15	14	12	11	10	9
50°	9	10	12	14	15	16	16	14	12	11	9	8
60°	7	9	12	15	17	19	18	16	12	10	9	6
70°	0	7	12	16	23	24	24	18	12	9	4	0
80°	0	0	12	24	24	24	24	24	12	5	0	0

7.63 Calendar: 1940–1983

a. Calendar.

Day of the month					Jan Oct	Apr July Jan*	Sept Dec	June	Feb Mar Nov	Aug Feb*	May	
1	8	15	22	29	A	B	C	D	D	F	G	Monday
2	9	16	23	30	G	A	B	C	D	E	F	Tuesday
3	10	17	24	31	F	G	A	B	C	D	E	Wednesday
4	11	18	25		E	F	G	A	B	C	D	Thursday
5	12	19	26		D	E	F	G	A	B	C	Friday
6	13	20	27		C	D	E	F	G	A	B	Saturday
7	14	21	28		B	C	D	E	F	G	A	Sunday
					-----	*1940*	1941	1942	1943	-----	*1944*	
					1945	1946	1947	-----	1948	1949	1950	
					1951	-----	*1952*	1953	1954	1955	-----	
					1956	1957	1958	1959	-----	*1960*	1961	
					1962	1963	-----	*1964*	1965	1966	1967	
					-----	*1968*	1969	1970	1971	-----	1972	
					1973	1974	1975	-----	*1976*	1977	1978	
					1979	-----	1980	1981	1982	1983	-----	

*In leap years, use the January and February that are italicized. Do not use these for other years.

b. Examples of Use.

(1) Given March 6, 1957, find the day of the week. Under March, opposite 6, is G. In the column in which 1957 appears, Wednesday is found opposite G.

(2) Given Saturday, November ____, 1960, find the possible days of the month that Saturday falls upon. In the column in which 1960 appears, Saturday is found opposite A. Under November, the numbers 5, 12, 19 and 26 are found opposite A.

(3) Given Tuesday, ________________ 6, 1958, find the possible months in which this combination could occur. In the column in which 1958 appears, B is found opposite Tuesday. Opposite 6, B appears under the month of May.

(4) Given Monday, February 29, ______, find the possible year. Under February, opposite 29, is F. Opposite Monday, F is found in the column in which the year 1960 (leap year) appears.

APPENDIX I
REFERENCES

1. Aviation

a. Army Regulations

59–22	Requests for Transportation by Other Than Scheduled Flights of Military Air Transport Service.
59–106	Operation of Air Force Terminals.
59–132	Citation of Open Allotment and Reporting Use of Commercial Air Spaces for PSC travel.
59-, 95-, 96-Series	Air Transportation in General.
96–25	Responsibilities and Policies for Movement of Traffic on MATS Scheduled Aircraft.
725–768	Supply of Transportation Repair Parts Through Army Aircraft Field Maintenance Shops in CONUS.
750–214	Aircraft Field Maintenance Shops Assistance to Supported Units.
750–712	Modification of Army Aircraft and Transportation Air Items.
750–713	Depot Maintenance of Army Aircraft.

b. Special Regulations

55–750–5	Procedures Governing Transportation by Air.
310–30–15	Organization and Equipment Authorization Tables; Personnel.
700–51–146	Logistic Responsibilities for Standard Commodity Classification, Major Group 46, Aircraft.
705–30–10	Limitations on Materiel for Air Transport.
750–95–10	Technical Assistance in Maintenance of Army Aircraft.

c. Field Manuals

1–100	Army Aviation.
57–20	Airborne Techniques for Divisional Units.
57–30	Airborne Operations.
57–35	Army Transport Aviation, Combat Operations.

d. Technical Manuals

1– –5	Basic Weight Checklist and Loading Data.
1– –9	Loading Instruction.
1– –20P	Repair Parts and Special Tool Lists for Organizational Maintenance Allowances.
1– –34P	Repair Parts and Special Tool Lists for Field Maintenance Allowances.

d. Technical Manuals—Continued

1–215	Instrument Flying; Theory and Procedures.
1–250	Principles of Fixed-Wing Flight.
1–260	Principles of Rotary-Wing Flight.
5–251	Army Airfields and Heliports.
11–2557	Jeppesen Airway Manual.
55–401	Army Aircraft Field Maintenance Shop and Supply Operations.
57–210	Air Movement of Troops and Equipment.

e. Technical Bulletins

AVN 2	Recommended and Alternate Grade Fuels, Engine and Transmission Oils for Army Aircraft-Engine Combinations.
AVN 5	Preparation and Processing of DD Form 781, "Aircraft Flight Report and Maintenance Record."
AVN 7	Painting and Marking of Army Aircraft.
AVN 23–3	Use of Paint and Varnish Remover.
AVN 23–4	Aircraft Hoses and Hose Assemblies.
AVN 23–5-series	Unsatisfactory Equipment Report Digest.
AVN 23–7	Depot Maintenance Support of Army Aircraft.
AVN 23–8	Scheduled Depot Maintenance of Army Aircraft.
AVN 23–9	Nonscheduled Maintenance Support of Army Aircraft.
AVN 24–1	Engine Detonation and/or Preignition.
TM 38–250	Transportation, Packaging, and Handling of Dangerous Materials for Military Aircraft.

f. Supply Bulletins

1–1	Army Aircraft Flying Hour Program.
1–2	Army Aircraft Attrition Factors and Obsolescence Rates.
1–15–8	Expendability of Transportation Air Items.
1–15–9	Modification Kits, Department of the Army, Aircraft.
1–15–13	Standard Items of Aircraft Hardware and Bulk Material for Use on Department of the Army Aircraft.

g. Tables of Organization and Equipment

55–56	Headquarters and Headquarters Detachment, Transportation Transport Aircraft Battalion.
55–57	Transportation Light Helicopter Company.
55–456	Headquarters and Headquarters Detachment, Transportation Army Aircraft Maintenance Battalion.
55–457	Transportation Army Aircraft Maintenance Company.
55–458	Transportation Army Aircraft Heavy Maintenance and Supply Company.
55–500	Transportation Service Organization.

h. Table of Allowances

55–15	Transportation Aircraft Test and Support Activity.
55–84	Transportation Corps Army Aircraft Field Maintenance Shop.

i. Supply Manuals

55–1–1510, 20	Aircraft, Fixed-Wing; Aircraft, Rotary-Wing.
55–1–1600	Aircraft Components and Accessories.
55–4-series	Stock List of Components of Sets, Kits, and Outfits (Various Types).

2. Motor Transport

a. Army Regulations

57- and 58-series	Motor Transportation in General.
58–30	Transportation of Dependent School Children.
385–55	Prevention of Motor Vehicle Accidents.
735–35	Supply Procedures for TOE Units, Organizations, and Non-TOE Activities.
754–9130–1	Utilization of Automotive Gasoline.

b. Special Regulations

55–80–1	Highway Requirements for National Defense.
330–40–10	Processing Motor Vehicle Records.
350–355–1	Traffic Management.
700–51–143	Logistic Responsibilities for Standard Commodity Classification, Major Group 43, Motor Vehicles.
705–125–10	Fordability Requirements for Future Tactical Vehicles.
705–325–1	Electrical Systems in Motor Vehicles.

c. Field Manuals

5–36	Route Reconnaissance and Classification.
20–32	Employment of Land Mines.
25–10	Motor Transportation, Operations.
55–10	Movement Control in Theaters of Operation.
55–31	Highway Transportation Service in Theaters of Operation.
55–35	Transportation Truck and Car Companies.
55–37	Transportation Battalion, Infantry Division.

d. Technical Manuals

9–2800	Military Vehicles.
9–2810	Tactical Motor Vehicle Preventive Maintenance, Supply, Inspection, and Training Procedures.

e. Technical Bulletin

PMG 5	Traffic Accident Recording.

f. Supply Bulletins

9–40	Ordnance Motor Vehicle Assemblies.
9–98–1	Vehicle Deficiencies During Warranty Period; General.
10–540	Troop Train and Motor Convoy Menu.

g. Tables of Organization and Equipment

55–11	Headquarters and Headquarters Company, Transportation Highway Transport Command.
55–12	Headquarters and Headquarters Company, Transportation Truck Group.
55–16	Headquarters and Headquarters Company, Transportation Truck Battalion, Army or Communications Zone.
55–17	Transportation Light Truck Company.
55–18	Transportation Medium Truck Company.
55–19	Transportation Car Company, Army or Communications Zone, or Airborne Transportation Car Company, Airborne Corps.
55–27	Transportation Cargo Carrier Company (Tracked).
55–28	Transportation Heavy Truck Company.
55–46	Headquarters and Headquarters Detachment, Transportation Tactical Carrier Battalion.
55–47	Transportation Tactical Carrier Company.
55–75	Infantry Division, Transportation Battalion.
55–76	Headquarters and Headquarters Company, Infantry Division, Transportation Battalion.
55–77	Truck Transport Company, Infantry Division, Transportation Battalion.
55–78	Armored Carrier Company, Infantry Division, Transportation Battalion.
55–500	Transportation Service Organization.
55–137	Transportation Amphibious Truck Company.

h. Tables of Allowances

55–25	Transportation Highway Transport Training Center.

i. Supply Manuals

55–1–2500	Vehicular Equipment Components.

j. Department of the Army Forms

478	Organizational Equipment File (Envelope).
55–169	Daily Dispatching Record of Motor Vehicles.
55–173	Vehicle Characteristics and Inventory—Transportation Intelligence (Cut Sheet).
55–174	Roadway Data—Transportation Intelligence (Cut Sheet).
55–175	Bridge Data—Transportation Intelligence (Cut Sheet).
55–176	Traffic Bottlenecks—Transportation Intelligence (Cut Sheet).

k. Department of Defense Forms

110	Vehicle and Equipment Operational Record.
518	Accident-Identification Card.

l. Standard Forms

46	U.S. Government Motor Vehicle Operators Identification Card.
91	Operator's Report of Motor-Vehicle Accident (Card).

3. Rail

a. Army Regulations

55–125	Troop Train Emergency Supply Points.
55–255	Railroad Equipment.
55–650	Railroads.

b. Special Regulations

55–135–5	Inspection of Dining Cars on Troop Trains.
55–150–21	Operation of Army Prisoner Cars Owned by the Department of the Army.
700–51–141	Logistic Responsibilities for Standard Commodity Classification, Major Group 41, Railroad Transportation Equipment.

c. Field Manuals

55–21	Rail Transportation (Higher Units).
55–22	Transportation Railway Operating Battalion.
55–23	Transportation Railway Shop Battalion.

d. Technical Manuals

55–200	Railway Operating Rules.
55–201	Operation, Inspection, and Maintenance of Steam Locomotives and Locomotive Cranes.
55–202	Fundamentals of Operation and Maintenance of Diesel-Electric Locomotives.
55–203	Maintenance of Railway Cars.
55–205	Railway Communications and Signals.
55–206	Railway Train Operations.
55–270	Operation of Railroads; General Instructions for the Inspection and Maintenance of Locomotives and Locomotive Cranes.
55–289	Operation of Railroads: Standard Painting, Lettering, and Numbering of Railroad Equipment.

e. Supply Bulletins

10–540	Troop Train and Motor Convoy Menu.
55–30–4	Rapid Service Items for Transportation Rail and Marine Equipment.

f. Tables of Organization and Equipment

55–202	Headquarters and Headquarters Company, Transportation Railway Group.
55–225	Transportation Railway Operating Battalion.
55–226	Headquarters and Headquarters Company, Transportation Railway Operating Battalion.
55–227	Railway Engineering Company, Transportation Railway Operating Battalion.
55–228	Railway Equipment Company, Transportation Railway Operating Battalion.
55–229	Train Operating Company, Transportation Railway Operating Battalion.
55–235	Transportation Railway Shop Battalion.

f. Tables of Organization and Equipment—Continued

55–236	Headquarters and Headquarters Company, Transportation Railway Shop Battalion.
55–237	Transportation Erecting and Machine Shop Company.
55–238	Transportation Boiler and Smith Shop Company.
55–239	Transportation Car Repair Company.
55–247	Transportation Diesel-Electric Locomotive Repair Company.
55–302	Headquarters and Headquarters Company, Transportation Railway Command.

g. Supply Manuals

6–1-series	Sets, Kits and Outfits, Rail (Various Types).
7-, 8-, and 9C-series	Railway Cars (Various Types).
7-, 8-, and 9L-series	Locomotives.
7-, 8-, and 9RC-series	Cranes, Railway.
55–1–2200	Railway Equipment.

h. Department of the Army Forms

55–170	Railroad Line Characteristics and Facilities—Transportation Intelligence (Cut Sheet).
55–171	Locomotive Characteristics and Inventory—Transportation Intelligence (Cut Sheet).
55–172	Freight Equipment Characteristics and Inventory—Transportation Intelligence (Cut Sheet).
55–226	Daily Inspection Report—Locomotives and Locomotive Cranes (Cut Sheet).
55–227	Monthly Inspection and Repair Report—Steam Locomotives and Locomotive Cranes (Cut Sheet).
55–230	Monthly Inspection and Repair Report of Locomotives and Locomotive Cranes Other Than Steam (Cut Sheet).

i. Commercial Publication. Association of American Railroads, Pamphlet MD–7, Supplement No. 1, Rules Governing the Loading of Department of Defense Materiel on Open Top Cars, Chicago, Illinois, 1955.

4. Terminal and Water Transport

a. Army Regulations

55–76	Transportation of Privately Owned Vehicles on Government Owned Vessels.
55–107	Policy Governing Transportation of Passengers Aboard Vessels of Military Sea Transportation Service.
55–305	Water Transportation; General Provisions.
55–325	Commanding Officer of Troops; Ship Transportation Officer.
55–445	Debarkation of Troops from Transports.
725–5	Preparation, Processing, and Documentation for Requisitioning, Shipping, and Receiving.
747–30	Processing of Unboxed and Uncrated Equipment for Oversea Shipment.

b. Special Regulations

55–75–5	Responsibility for Outport Operations.
55–167–15	Procedures Governing Personal Baggage of Passengers Embarked on MSTS Vessels.
55–730–1	Passenger Accommodations Aboard United States Army Transports.
55–730–10	United States Army, Navy, and Air Force Joint Ocean Shipping Procedures.
75–70–10	Disposal by Dumping at Sea.
600–10–50	Military Police, Shore Patrol, and Air Police on Public Carriers and in Transportation Terminals.
700–51–144	Logistic Responsibilities for Standard Commodity Classification, Major Group 44, Combat Ships and Landing Vessels.
700–51–145	Logistic Responsibilities for Standard Commodity Classification, Major Group 45, Ships and Other Watercraft, Except Combat Ships and Landing Vessels.

c. Field Manuals

55–8	Transportation Intelligence.
55–26	Transportation Inland Waterways Service.
55–51	Transportation Terminal Commands, Theater of Operations.
55–52	Transportation Terminal Battalion and Terminal Service Company.
55–53	Transportation Amphibious Truck Company.
55–110	Transportation Port Companies Military Stevedoring.
55–130	The Harbor Craft Company.
60–5	Amphibious Operations Battalion in Assault Landings.
60–10	Amphibious Operations: Regiment in Assault Landings.
60–30	Amphibious Operations: Embarkation and Ship Loading (Unit Loading Officer).

d. Technical Manuals

55–335	Operation of Floating Cranes.
55–501	Harbor Craft Crewman's Handbook.
55–505	Amphibious Truck Driver's Handbook.
55–507	Transportation Corps Floating Craft Preventive Maintenance.
55–508	Landing Craft Operator's Handbook.

e. Technical Bulletins

TC 4	Painting of Vessels.
TC 5	Oil-Burning Lamps.
TC 9	Storage of Vessels.
TC 11	Arc Welding on Water-Borne Vessels.

f. Supply Bulletins

55–30–1	Vessel Supply and Property Accounting Procedures; Preparation and Use of Vessel Property Books for Army Marine Floating Equipment.
50–30–4	Rapid Service Items for Transportation Rail and Marine Equipment.

g. Tables of Organization and Equipment

55–9	Transportation Harbor Craft Company, Amphibious Support Brigade.
55–111	Headquarters and Headquarters Company, Transportation Terminal Command C.
55–116	Headquarters and Headquarters Detachment, Transportation Terminal Battalion.
55–117	Transportation Terminal Service Company.
55–121	Headquarters and Headquarters Company, Transportation Terminal Command B.
55–126	Headquarters and Headquarters Company, Transportation Boat Battalion.
55–127	Transportation Light Boat Company.
55–128	Transportation Medium Boat Company.
55–129	Transportation Heavy Boat Company.
55–131	Headquarters and Headquarters Company, Transportation Terminal Command A.
55–137	Transportation Amphibious Truck Company.
55–147	Transportation Staging Area Company.
55–157	Transportation Floating Craft Depot Maintenance Company.
55–217	Transportation Electric Power Transmission Company.
55–557	Transportation Boat Maintenance Company.

h. Tables of Allowances

55–33	U.S. Army Transportation Terminal Command, Arctic.
55–35	Hampton Roads Army Terminal.
55–36	New Orleans Army Terminal.
55–37	Brooklyn Army Terminal.
55–38	Oakland Army Terminal.
55–39	Seattle Army Terminal.

i. Supply Manuals

7-, 8-, and 9-CM-series.	Cranes and Derricks, Floating (Various Types).
7-, 8-, and 9-E-series	Marine Engines (Various Types). Diesel and Gasoline.
7-, 8-, and 9-W-series	Winches and Windlasses.
7–BA–504	Barge, Liquid Cargo, Nonpropelled, 4,280 bbl, 120 ft, Design 231.
7 and 8 BA–522	Landing Craft, Mechanized, Diesel, 56 ft, Design LCM–6, and Landing Craft, Mechanized, Diesel, 50 ft, Design LCM–3.

i. Supply Manuals—Continued

7–BA–527	Barge, Liquid Cargo, Self-Propelled, Diesel, 6,500 bbl, 182 ft, Design 294A.
55–1–2000	Ship and Marine Equipment.
55–6600	FSC Group 66 Instrument and Laboratory Equipment Class 6605, 10, 20, 25, 30, 35, 40, 45, 80.
55–4–3990–MO-series	Cargo Sets (Various Types).
55–4–7610–M-series	Book Sets, Reference Library, Marine (Various Sets).

j. Department of the Army Forms

55–177	Characteristics of Ports and Terminal Facilities—Transportation Intelligence (Cut Sheet).
55–178	Characteristics of Beaches and Landing Areas—Transportation Intelligence (Cut Sheet).
55–179	Characteristics of Wharves, Piers and Quays—Transportation Intelligence (Cut Sheet).
55–180	Crane Characteristics and Inventory—Transportation Intelligence (Cut Sheet).
55–181	Warehouse Data—Transportation Intelligence (Cut Sheet).
55–182	Waterway Craft Census—Transportation Intelligence (Cut Sheet).
55–183	Waterway Physical Characteristics—Transportation Intelligence (Cut Sheet).
55–184	Characteristics of Waterway Locks—Transportation Intelligence (Cut Sheet).
55–185	Characteristics of Inland Waterway Ports—Transportation Intelligence (Cut Sheet).

k. Hydrographic Office Publication

No. 87	International Code of Signals, Volume I, for Visual and Sound Signaling.

l. U. S. Coast Guard Publication

CG–194	Buoys In Waters of the United States.

5. Planning

a. Army Regulations

40–353	Emergency Transportation for Medical Evacuation, Continental United States.
55–11	Agreements Between Army and Air Force.
55–26	Transportation Movements.
55–53	Transportation Requests.
55–355	Military Traffic Management Regulation.
380–55	Safeguarding Defense Information in Movement of Persons and Things.
701–5	Assignment of Responsibilities for Logistic Functions.

b. Special Regulations

55–720–1	Preparation for Oversea Movement of Units.
55–720–2	Movement of Units Within Continental United States.

c. Field Manuals

19–40	Handling Prisoners of War.
38–1	Logistics, Supply Management.
55–6	Transportation Services in Theaters of Operation.
101–5	Staff Officers' Field Manual; Staff Organization and Procedure.
101–10	Staff Officers' Field Manual: Organization, Technical and Logistical Data.

6. Miscellaneous

a. Army Regulations

55–31	Policy Governing Passenger Accommodations Within, to, From or Outside the Continental United States.
55–85	Shipment of Household Goods by Commercial Motor Van Carriers.
(C) 55–203	Movements of Nuclear Weapons Major Assemblies and Nuclear Components (U) (S: NG & USAR: None).
59–30	Revenue Traffic.
(C) 190–60	Physical Security of Atomic Weapons. (U)
320–5	Dictionary of United States Army Terms.
320–50	Authorized Abbreviations and Brevity Codes.
(O) 700–65–1	Atomic Weapons and Atomic Weapons Materiel.
725–5	Preparation, Processing, and Documentation for Requisitioning, Shipping, and Receiving.
735–35	Supply Procedures for TOE Units, Organizations, and Non-TOE Activities.
740–15	Preservation, Packaging, and Packing.
740–20	Preparation for Shipment.
746–80	Marking and Packing of Supplies and Equipment.
750–5	Maintenance Responsibilities and Shop Operation.
750–707	Transportation Corps Technical Assistance Program.
750–725	Maintenance Inspections and Reports (Transportation Corps Equipment).
750–770	Transportation Corps Field Maintenance Shops and Missions.
780–770	Depot; Missions; Transportation Corps.

b. Special Regulations

700–51–149	Logistic Responsibilities for Standard Commodity Classification, Major Group 49, Miscellaneous Transportation Equipment.
715–8–6	Local Procurement of Transportation Corps Supplies and Equipment and General Transport Administrative Vehicle Repair Parts.

c. Department of the Army Pamphlets

8-11	Handbook of Atomic Weapons for Medical Officers.
95-5	Aircraft Accident Investigation.
108-1	Index of Army Motion Pictures, Film Strips, Slides and Phono-Recordings.
310-1	Military Publications: Index of Administrative Publications: (Army Regulations, Special Regulations, Department of the Army Pamphlets, Commercial Traffic Bulletins, Military Traffic Management Bulletins, General Orders, Bulletins, and Circulars).
310-2	Military Publications: Index of Blank Forms.
310-3	Military Publications: Index of Training Publications: (Field Manuals, Reserve Officers' Training Corps Manuals, Training Circulars, Army Training Programs and Mobilization Training Programs, Army Subject Schedules, Army Training Tests, War Department and Department of the Army Posters, and Firing Tables and Trajectory Charts).
310-4	Index of Technical Manuals, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
310-5	Military Publications: Index of Graphic Training Aids and Devices.
310-7	Military Publications: Index of Tables of Organiaztion and Equipment, Tables of Organization, Type Tables of Distribution, and Tables of Allowances.
310-21	Military Publications: Index of Supply Manuals, Signal Corps.
310-22	Military Publications: Index of Supply Manuals, Transportation Corps.
310-23	Military Publications: Index of Supply Manuals, Chemical Corps.
310-25	Military Publications: Index of Supply Manuals, Corps of Engineers.
310-29	Military Publications: Index of Supply Manuals, Ordnance Corps.
310-30	Military Publications: Index of Supply Manuals, Quartermaster Corps.
320-1	Dictionary of United States Military Terms for Joint Usage.
740-1-1	Instructor's Guide for Packaging and Packing Operations, Preservation and Packaging.

d. Field Manuals

3-5	Tactics and Techniques of Chemical, Biological and Radiological (CBR) Warfare.
3-8	Chemical Corps Reference Handbook.
21-5	Military Training.
21-6	Techniques of Military Instruction.

d. Field Manuals—Continued

21–10	Military Sanitation.
21–11	First Aid for Soldiers.
21–26	Map Reading.
21–30	Military Symbols.
21–31	Topographic Symbols.
21–40	Small Unit Procedures in Atomic, Biological, and Chemical Warfare.
21–41	Soldier's Handbook for Nuclear, Biological and Chemical Warfare.
21–76	Survival.
27–10	The Law of Land Warfare.
(C) 30–16	Technical Intelligence. (U)
55–8	Transportation Intelligence.
101–10	Staff Officers' Field Manual: Organization, Technical and Logictisal Data.

e.. Technical Manuals

3–216	Military Biology and Biological Warfare Agents.
3–220	Decontamination.
9–2835	Lubrication.
10–1101	Petroleum Handling Operations.
10–1103	Quartermaster Petroleum Handling Equipment.
10–1619	Quartermaster Materials Handling Equipment.
11–2557	Jeppesen Airway Manual.

f. Supply Bulletins

1–15–2	Requisite of Interchangeability for Substitution Purposes.
10–495	Standard B Ration for the Armed Forces.
55–18	Paints and Related Materials for Use by Transportation Corps.
55–25	Peacetime Replacement Factors, Transportation Corps.
55–26	Wartime Consumption Rates and Replacement Factors, TC.
55–28	Issue of Supplies and Equipment, Transportation Regulated Items.
55–31	Transportation Corps Adopted Items of Materiel.

g. Supply Manuals

55–1–3900	Materials Handling Equipment.
55–1–4000	Rope, Cable, Chain, Fittings.
55–1–4900	Maintenance and Repair Shop Equipment.
55–1–9100	Fuels, lubricants, Oils, Waxes.

h. Department of Defense Form

1149	Requisition and Invoice/Shipping Document.

i. Commercial Publications

Knight, Austin Melvin, Modern Seamanship, 12th edition, New York, D. Van Nostrand Co., 1953.

APPENDIX II

ABBREVIATIONS

(Abbreviations marked with an asterisk are not authorized for electrically transmitted messages.)

Abbreviations	*Meaning*
*A	Army
AA	antiaircraft
AAM	Army aircraft maintenance
abn	airborne
acft	aircraft
actv	activity
AdvLogComd	advance logistical command
ADMIN	administrative instructions
admin	administrate
afld	airfield
ahd	airhead
altn	alternate
alw	allowance
amb	ambulance
AMEDS	Army Medical Service
amph	amphibious
anch	anchorage
anx	annex
apers	antipersonnel
app	appendix; apprehend
apri	air priority
asg	assign
*ASP	ammunition supply point
ASR	available supply rate
*at	antitank
atch	attach
ATTC	Atlantic Transportation Terminal Command
autmv	automotive
*auto	automatic
aux	auxiliary
aval	available
AVGAS	aviation gas
AWS	Air Weather Service
az	azimuth
BaLogComd	base logistical command
BARC	barge, amphibious, resupply, cargo
BART	Brooklyn Army Terminal
bdry	boundary

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Abbreviations	Meaning
BG	beach group; battle group
bhd	beachhead
bn	battalion
BP	base pay; base point; beach party
BRG	Browning
brg	bearing; bridge
bt	boat
BTO	bombing through overcast; branch transportation office(r)
btry	battery
BTW	boat wave
BW	biological warfare
*by	buoy
*cam	camouflage
*cap	capacity
carr	carrier
cbn	carbine
CBR	chemical, biological, and radiological warfare
CBTI	combat intelligence
cft	craft
CG	center of gravity
cgo	cargo
*char	characteristics
cir	circular
cl	class; carload
clnc	clearance
clr	clearing
cmbt	combat
cmdty	commodity
cml	chemical
COE	cab over engine
col	column
coll	collect
*comb	combine
comd	command
coml	commercial
comm	communication
COMZ	communications zone
con	control; conversation; consul; consulate
consol	consolidate
const	constitute; construct
CP	command post
cpbl	capable
cr	crossroads; clinical record
crypto	cryptography; cryptographic
CS	current series; close support; contract surgeon
CTE	Commander Task Element
CVEH	combat vehicle
CW	continuous wave; chemical warfare
CZ	Combat Zone
d	diesel
DANC	decontaminating agent, noncorrosive
DAO	Division Ammunition Officer
DBP	drawbar pull

Abbreviations	*Meaning*
DCSLOG	Deputy Chief of Staff for Logistics
debk	debark
decon	decontaminate
def	defense; defend
dep	depot
destpt	destination point
DIR	depot inspection and repair
dir	direct
dis	distant
disem	disseminate; dissemination
docu	document
DoD	Department of Defense
DOFS	day of supply
DP	displaced person; distribution point; by direction of the President; delivery point
DR	dead reckoning; date of rank
DS	direct support; directing staff
DSCP	division supply control point
DTO	Division Transportation Office(r)
dvr	driver
dy	duty
*eat	earliest arriving time
EDP	equipment deadlined for parts
ech	echelon
EEI	essential elements of information
*elm	element
en	enemy
enr	en route
EP	entrucking point
est	estimate
ETA	estimated time of arrival
ETD	estimated time of departure
ETR	estimated time of return
ETS	expiration term of service
evac	evacuate, evacuation
EXTAL	extra time allowance
FLDO	field officer
FLDTNS	field trains
flt	flight
FSO	Fuel Supply Office
FTRAC	full-tracked vehicle
fxd	fixed
GCM	general court-martial
gnd	ground
GNP	chemical agent, nonpersistent
GP	general purpose
gp	group
GPVEH	general purpose vehicle
grd	guard
GS	General Staff; general support; general service
GTA	graphic training aid
GTTC	Gulf Transportation Terminal Command
*HAM	heavy automotive maintenance
har	harbor

Abbreviations	*Meaning*
HARCFT	harbor craft
HD	Honorable Discharge; harbor defense
hdlg	handling
*HE	high explosive
hel	helicopter
HF	high frequency; harassing fire
*how	howitzer
HRAT	Hampton Roads Army Terminal
HRP	holding and reconsignment point; highway regulation point
HS	hardstand; high school
HV	high velocity
hv	heavy
hyd	hydraulic
hydro	hydrographic
ICC	Interstate Commerce Commission
ICW	intracoastal waterway
I&R	intelligence and reconnaissance
inl	initial
insp	inspect
instl	installation; install
instr	instruct; instructor; instruction
intel	intelligence
intmed	intermediate
intns	in transit
*IRAN	inspection and repair as necessary
iss	issue
IWW	inland waterway
JATO	jet-assisted takeoff
jct	junction
JCS	Joint Chiefs of Staff
JTF	Joint Task Force
LC	line of contact
LCAVAT	landing craft and amphibious vehicle assignment table
lchr	launcher
LCL	less than carload lot
LD	line of departure; line of duty
LE	light equipment; low explosive
ln	liaison
*LO	lubrication order; letter order; liaison officer
loc	location
*log	logistic
LOGEX	logistical exercise
*LOTS	logistical over-the-shore
LTON	long ton
ltr	letter
LWB	long wheelbase
MA	marshaling area; machine accountant; military attaché; mechanical aptitude test
MAAG	Military Assistance Advisory Group
mach	machine
MAM	medium automotive maintenance
MANDR	maintenance and repairs

Abbreviations	*Meaning*
*mat	materiel; material
*MATS	Military Air Transport Service
mbl	mobile
mech	mechanic(al)
MG	machinegun
MHE	materials handling equipment
MLR	main line of resistance
MO	movement orders
MOS	military occupational speciality
mov	movement
msg	message
MSR	main supply route
MSTS	Military Sea Transportation Service
MTON	measurement ton
mtd	mounted
mtr	motor
NA	not applicable
NASA	National Aeronautics and Space Agency
NATO	North Atlantic Treaty Organization
NCS	net control station
NEAC	Northeast Air Command
ni	night
NLT	on or before, but not later than
NOART	New Orleans Army Terminal
nonptbl	nonportable
NRA	no repair action; national rifle association
*O	order; office
obs	obstacle
OIC	officer-in-charge
OL	operation location
OP	observation post
op	operate
opr	operator
ord	ordnance
orgn	organization
plat	platoon
POL	petroleum, oil, and lubricants
POM	preparation for oversea movement (units)
POR	preparation for oversea movement of individual (replacement)
prcs	process
prct	practice
pri	priority
pos	position
pt	point
ptbl	portable
ptl	patrol
PTTC	Pacific Transportation Terminal Command
pty	party
RADLWAR	radiological warfare
RB	road bend; rigid boat
rctg	reciprocating
RD	radarman; readiness date; research and development
reinf	reinforce

Abbreviations	*Meaning*
rep	repair
res	reserve
resc	rescind
RFA	Reserve Forces Act
rfl	refuel
rhd	railhead
RJ	road junction
rkt	rocket
ROCAD	reorganization of the current armored division
ROCID	reorganization of the current infantry division
ROTAD	reorganization of the airborne division
RP	release point (ground traffic)
RS	report of survey; road space; regulating station
rsq	rescue
RTC	replacement training center
RTO	Railway Transportation Office(r)
rwy	runway
S & P	stake and platform
SART	Seattle Army Terminal
SBT	small boat
sked	schedule
SCM	summary court-martial
SE	single engine
sec	security; section; secretary
sh	shop
*SHAPE	Supreme Headquarters, Allied Powers Europe
SHIPDA	shipping data
shpmt	shipment
shpsd	shipside
sho	shore
sig	signal
sipim	request immediate shipment
*sit	situation
smbl	semimobile
SOI	signal operation instructions
SOP	standing operating procedures
SP	self-propelled; start point; shore party
SPCM	special court-martial
spt	support
SSI	standing signal instructions
SSO	Statistical Service Office
sta	station
STANAG	Military Standardization Agency Agreement
std	standard
stf	staff
STGAR	staging area
stlr	semitrailer
STON	short ton
stor	storage
str	strength
subor	subordinate
*sup	supply
SUNEC	supply units, Northeast Command
SUPPT	supply point

Abbreviations	*Meaning*
svc	service
SWB	short wheelbase
swbd	switchboard
T	ton
TA	table of allowance
TAAM	Transportation Army aircraft maintenance
TAAS	Transportation Army aircraft supply
TAHQ	theater army headquarters
TALogComd	theater army logistical command
TB	technical bulletin; troop basis; tuberculosis
TCP	traffic control post
TCR	Transportation Corps release
tfc	traffic
THM	transport helicopter maintenance
THQ	theater headquarters
tk	tank
TL	time length; truckload
tlr	trailer
tn	train
*TOE	table of organization and equipment
tp	telephone
trac	tractor; tracer
TRC	transportation railway command
trk	truck
trkhd	truckhead
TROB	transportation railway operating battalion
TRP	traffic regulating point
trp	troop
TRS	Transportation Railway Service
TRSB	transportation railway shop battalion
TS	transit storage; Top Secret
TT	teletypewriter; technical test
U	unit
UC	under construction
UCMJ	Uniform Code of Military Justice
USAREUR	United States Army, Europe
USARPAC	United States Army, Pacific
util	utility
VCP	vehicle collecting point
veh	vehicle
vert	vertical
ves	vessel
Vet	Veterinary
VPM	vehicles per mile
W	wheel
WABTOC	when authorized by theater of operations commander
wea	weather
wkr	wrecker
wng	warning
wpn	weapon
WS	water supply
WSP	water supply point
xpd	expedite
xplt	exploit

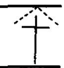
APPENDIX III
MAP SYMBOLS

a. Air.

Aerial port of embarkation 

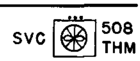
Aircraft: 

Damaged 

Dummy 

Heavy maintenance and supply company 

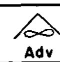
Maintenance and supply units 

Svc Plat, 508th Trans Transport Hel Maint Co 

509th Trans Acft Direct Support Maint Co 

510th Trans General Support Acft Supply Co 

Airfield: 

Advance 

Dummy 

Military, general 

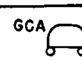
Under construction 

Airport, commercial or municipal 

Airship 

Airstrip for Army aviation units 

Aviation Army units 

Ground control approach station, truck-mounted 

Helicopter: ______

Company ______ HCPTR

Landing area ______

Heliport, improved ______

b. Motor Transport.

Boundary between two sections of road ______

Convoy (Arrow indicates direction; point of arrow indicates position of head of convoy; figures immediately adjacent to arrow indicate time at that position.) ______ 251600

Destination point ______ Destn Pt

Highway regulating point ______ HRP

Impassable section of road ______

Light line (The line beyond which lights are prohibited.) ______ LL

Main supply route ______ MSR

Markers:

Passing possible on one-lane road ______

Road, national and state, respectively ______ 15 41

Route, military ______ 15A

Route:

Dispatch, operated by schedule system ______

Express ______

Reserved, can be used by specified traffic only ______

Start point SP

Traffic:

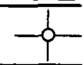
Control post, operated by Military Police TCP

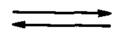
Headquarters 

One-way

One-way, alternate, operated by Military Police 

Post TP

Rotary 

Two-way 

Turnaround location 

Vehicle:

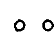
Armored 

Cargo-carrying 

Operational 

Personnel-carrying 

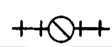
Tracked 

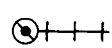
Wheeled 

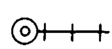
c. Rail.

Coaling station, Transportation Railway Service 

Engine terminal:

Turntable alone 

With turntable (roundhouse) 

Without turntable (engine sheds) 

Rail transportation office ______ RTO

Railroad:

Beneath road ______

Car ______

Grade crossing ______

Hospital train (Numeral indicates number of cars) ______ 10

Locomotive ______

Locomotive and train of 14 cars ______ 14

Over road ______

Passing siding ______ No. of tracks → 1/80 ← Total car capacity

Spur or siding ______ Number indicates car capacity → 20

Track:

Double ______

Nonoperational, single-track ______

Pan ______

Single ______

Three ______

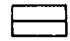
Yard (Sidings and yards are drawn on proper side of the main track.) ______ No. of tracks in yard → 12/600 ← Total car capacity

Railway:

Gun ______

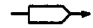
Vehicle ______

d. Terminal and Water Transport.

Amphibious 

Debarkation or Embarkation 

Landing:

Craft or ship 

Vehicle, tracked 

Vehicle, tracked, armored 

Leader gear (Energized cable to aid vessels through free passage in marine mine fields. Show exact location on chart.) 

Marine:

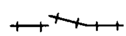
Mines, controlled:

19-mine group, buoyant 

13-mine group, ground 

(Length of either mine group is 1,800 feet, and symbol is drawn to scale, with upper edge seaward.)

Nets:

Antisubmarine, with gate 

Torpedo, with gate 

Port of:

Debarkation 

Embarkation 

Sono-buoys 

Subport of embarkation 

Subport of embarkation ______ SPOE

Terminal command:

A (3d) ______ 3 Term Cmd. A

B (4th) ______ 4 Term Cmd. B

C (5th) ______ 5 Term Cmd. C

Terminal, water ______ W Term

Tower, water, elevated ______ W

Transportation Terminal Battalion (12th Term) ______ 12 Term

Transportation Terminal Service Company (194th) ______ 194 Term Svc

Vehicle:

Cargo, amphibious ______

Truck, amphibious (DUKW) ______

e. Miscellaneous.

Animal ______ ∧ ∧

Booby trap ______

Boundary line:

Advance or base logistical command ______ ○○○

Area command ______ ○○

Battalion ______ II

Company ______ I

Corps ______ XXX

Detachment ______ •••

Division ____ XX

Group, battle group, or air group ____ III

Platoon ____ ●●●

Regiment ____ III

Section ____ ●●

Squad ____ ●

Theater administrative zone or theater army logistical command ____ OOOO

Bridge: ____

Movable ____

Control stations:

Consolidating station ____ C Sta

Holding and reconsignment point ____ HRP

Release or regulating point ____ RP

Culvert ____

Demolition:

Charge, prepared (Point of arrow indicates location.) ____ Dml

Contaminated (Show agents, time and date fired.) ____ YELLOW G H 170400 Jun

Demolitions, general ____

Entanglements:

Barbed wire, general (Depth of wire in feet may be indicated.) ____ XXXXXX

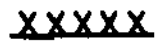
Concertina, multiple ____

Concertina, single ____

Double-apron fence ____ XXXXXX

Double fence ____ XX XX XX

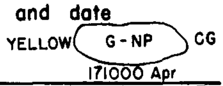
High wire fence 

Low wire fence 

Single fence 

Gas area to be avoided (Show agent and date fired.)

Gas area to be gassed, nonpersistent (Show agent, time, and date to be fired.)



Inundations

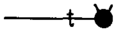
Mine:

Antipersonnel 

Antitank, booby-trapped 

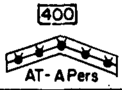
Antitank, double 

Chemical, land

Trip wire type 

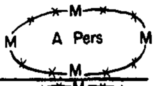
Mine barrier, chemical land (Mine emplaced but not fired, show agent.)

Mine belt (Numerals in rectangle indicate number of mines in belt; letter D in rectangle indicates dummy mine field; boundaries drawn to scale indicate actual extent of belt.)

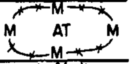


Minefield:

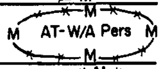
Antipersonnel, or boundary thereof, marked, fenced



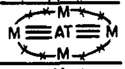
Antitank, or boundary thereof, marked, fenced



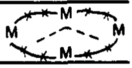
Antitank with antipersonnel mines, marked, fenced

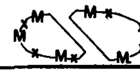


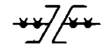
Antitank with three belts, marked, fenced

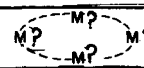


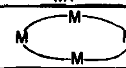
Dummy, marked, fenced



Gap 

Gap, through single-string antipersonnel mines 

Unconfirmed boundary of 

Unfenced, or boundary thereof 

Mines:

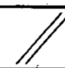
Antipersonnel, string of 

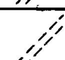
Antitank, single string of 

Obstacle:

General symbols:

Completed 

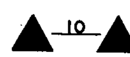
Prepared but passable 

Proposed 

Specific obstacles:

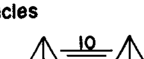
Fixed 

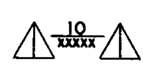
Fixed, prefabricated 

Fixed, prefabricated. (In line; numeral indicates number of obstacles between accurately located points.) 

Movable 

Movable, prefabricated 

Movable, prefabricated (Numeral indicates number of obstacles in each row; lines indicate number of rows.) 

Movable, prefabricated (When used with wire or mines, add appropriate symbol.) 

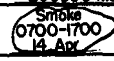
POL facilities 

POL and minor maintenance facilities 

Radioactive areas (Intensity and other characteristics

indicated as required.) 

Roadblock, contaminated (Show agent, time and date fired.) 

Smoke: area to be blanketed by smoke (Show time and date.) 

Snow:

Carrier, cargo, over-snow 

Carrier, personnel, over-snow 

Over snow 

Staging area 

Supply installations:

Classes of:

Class I (rations) 

Class II 1/

Class III (POL) 

Class IIIA (aviation POL) 

Class IV 1/

Class V (ammunition, conventional types) 

Class V (chemical only) 

Occupied 

Unoccupied 

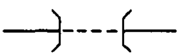
1/ Class II and Class IV are shown by using the symbol for the service or activity which is responsible for the supply of items of these classes of supply.

Transportation office:

Branch 

District 

Zone 

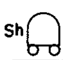
Tunnel 

Unit:

Logistical 

Transportation 

Vehicle:

Shop truck 

Skid or sled 

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