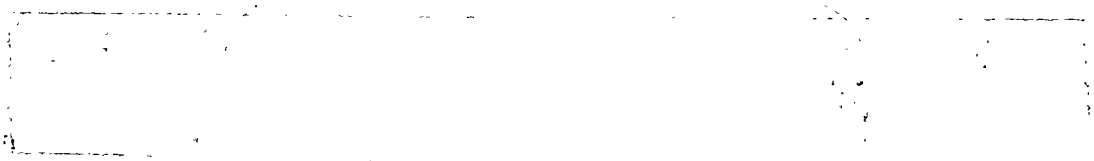
FIELD MANUAL

ROUTE RECONNAISSANCE AND CLASSIFICATION

HEADQUARTERS, DEPARTMENT OF THE ARMY
JANUARY 1970



CHANGE
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HEADQUARTERS
DEPARTMENT OF THE ARMY
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FIELD MANUAL

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FM 5-36, 20 January 1970, is changed as follows:

1. Significant changes are:

   a. Tables D-1 through D-7 in Appendix D are updated to add available new weight and vehicle class information on vehicles that have been adopted or modified since publication of the original tables in 1970.

   b. A new appendix E, Reporting Engineer Information in the Field, has been added to implement STANAG 2096, same title.

2. New or changed material is indicated by a star.

3. Remove old pages and insert new pages as indicated below:

Remove pages	Insert pages
i	i
D-9 through D-23	D-9 through D-27
	E-1 through E-9

4. File this change sheet in front of the publication for reference purposes.

By Order of the Secretary of the Army:

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Chief of Staff

Official:

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Brigadier General, United States Army
The Adjutant General

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*FM 5-36

FIELD MANUAL
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HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *20 January 1970*

ROUTE RECONNAISSANCE AND CLASSIFICATION

* This manual supersedes FM 5-36, 14 May 1965, including all changes.

CHAPTER 1

GENERAL

Section I. INTRODUCTION

1–1. Purpose

As one of the principles of war, maneuver is an essential ingredient of combat power. The ability to move forces and material to any point in an area of operations is often decisive to the outcome of combat operations. Maneuver is dependent on adequate lines of communication within the area of operations, and maneuver plans are dependent on adequate intelligence concerning routes of communication. This manual establishes doctrine for the collection, evaluation, and reporting of terrain data concerning surface routes of communication. Instructional and reference material applicable to technical classification of routes to support military traffic is also furnished.

1–2. Scope

a. This manual describes the influence of the operational environment in reconnaissance operations, the intelligence aspects and fundamentals of route reconnaissance, and methods of reconnoitering and classifying routes for military use. Emphasis is placed on natural and manmade characteristics of routes which influence traffic flow. The interruption of movement by enemy action, an equally important consideration in route reconnaissance, is discussed in general terms only; specific details are not within the scope of this manual although thoroughly discussed in field manuals appropriate to the mission and organization of the reconnoitering force (see app A). Route reconnaissance as presented by this manual is divided into two categories: hasty reconnaissance and deliberate reconnaissance. Hasty reconnaissance provides limited route information necessary for planning and executing normal military movement and is a prerequisite of tactical maneuver. Deliberate route reconnaissance, on the other hand, provides essential and additional engineer data which form the basis for technical classification and thorough analysis of routes throughout an area of operation. The remaining portion of the text discusses special types of terrain reconnaissance and route marking. Traffic control reconnaissance although a form of ground reconnaissance, is not considered in this text but is discussed in detail in FM 19–25.

b. This manual is in consonance with applicable International Standardization Agreements. In each appropriate paragraph throughout the text, they are identified by type of agreement and number. A compilation of all applicable agreements is included in appendix A.

c. The material presented herein is applicable to:

(1) General war, to include a consideration of the employment of and protection from nuclear munitions and chemical, biological, and radiological agents; and operations in nuclear, chemical, or biological environments.

(2) Limited war.

(3) Cold war, to include stability operations.

d. Users of this manual are encouraged to submit recommendations to improve its clarity or accuracy. Comments should be keyed to the specific page, paragraph, and line of the text to which they refer. Reasons should be provided for each comment to insure understanding and permit complete evaluation. Comments should be prepared using DA Form 2028 (Recommended Changes to Publications) and forwarded directly to the Commanding Officer, U.S. Army Combat Developments Command Engineer Agency, Fort Belvoir, Virginia 22060. Originators of proposed changes which would constitute a significant modification of approved Army doctrine may send an information copy, through command channels, to the Commanding General, U.S. Army Combat Developments Command, Fort Belvoir, Virginia 22060 to facilitate review and followup.

1–3. Combat and Engineer Intelligence

Combat intelligence is evaluated information of the enemy, weather, and geographic features of

the terrain required by a commander to plan and conduct tactical operations (FM 30–5). *Engineer intelligence is also concerned with information regarding terrain features and the effects of weather and terrain on engineer activities within an area of operations* (FM 5–30). Since both require terrain intelligence, both conduct route reconnaissance to collect the necessary information. Close cooperation between engineer intelligence agencies and other intelligence agencies is, therefore, essential to avoid duplication in the overall collection effort. Additionally, standard methods of reporting route reconnaissance data as presented by this manual facilitate the exchange of information and aid in the wide and timely dissemination of route intelligence.

1–4. Definitions (AR 310–25)

a. Lines of communication (logistic routes) are all routes, land, water, and air which connect an operating military force with a base of operations and along which supplies and reinforcements move.

b. A route of communication is a network of roads, etc., over which supplies are carried and combat movements are made. Routes of communication include navigable waters, aircraft landing facilities, and rail facilities.

c. A route is the road or roads, including tracks and bridges, used when moving from one place to another. It includes those roads, bridges, tunnels, fords, and other terrain features affecting traffic flow selected for military movement.

d. Route reconnaissance is the careful survey of a route for military purposes, often by aerial vehicle. The purpose of route reconnaissance is to collect, evaluate, and report information which will aid in the selection of a route or routes to be used for the movement of troops, equipment, and supplies in military operations.

1–5. Systems of Measurement (STANAG 2015, CENTO STANAG 2015, and SOLOG 53)

Velocities and linear distances of a tactical nature are expressed in the metric system throughout the text. Tabular data and structural dimensions, however, may be given in the English system for ease in mathematical computations. In reporting the results of route reconnaissance, either the metric system or the English system or both may be used to fit the requirements of the command. Webster's standard abbreviations such as "km" (kilometers), "m" (meters), "ft" (feet), and "mi" (miles) must be used to clearly identify measurement units. When operations are in conjunction with allies and if only one measurement system is used, the reporting headquarters prepares a table or diagram showing the relationship between the two systems to accompany the report. Tables for ease in converting from one system of measurement to the other are included in appendix B.

Section II. INFLUENCE OF THE OPERATIONAL ENVIRONMENT ON RECONNAISSANCE

1–6. General

The operational environment is composed of the conditions and circumstances which influence the employment of military forces and which consequently, bear on the decisions of the commander. Major elements comprising the operational environment include: The national and military objectives of the operation; the terrain and climatic features of the area of operations; the characteristics and attitudes of the local population; the nature of the conflict to include the weapons systems employed or threatened; and the composition and missions of the opposing forces. The combination of these variable elements creates a wide range of conditions and circumstances within which military forces must be capable of operating effectively.

1–7. Mission

The mission of the command is the single factor of the operational environment that dominates reconnaissance operations. Reconnaissance is conducted to assist in the production of intelligence necessary to support the military plan. Information is collected, evaluated, and interpreted for its significance in relationship to the accomplishment of the mission. Thus, a knowledge and understanding of the overall unit mission is desirable to insure that personnel engaged in reconnaissance do not overlook important information. *Reconnaissance is continuous and does not cease in the absence of specific missions.* Logical missions are assumed, and reconnaissance continues in the anticipation of an assignment.

1–8. Characteristics of the Area of Operations

Terrain and weather are important factors in military operations. Route reconnaissance is frequently employed to gather terrain information and to determine the effects of climatic variations on specific terrain features within an operational area.

a. Terrain.

(1) *Observation and fire.* The effect of observation on both friendly and enemy operations is considered. High ground that affords line-of-sight observation and good fields of fire are of particular importance.

(2) *Concealment and cover.* Concealment is protection from observation. Cover is protection from fire. Every advantage afforded to friendly forces by the terrain and conditions of visibility to provide concealment and cover is exploited.

(3) *Obstacles.*

(*a*) The effect of obstacles, either in restraint or in support of operations, is considered.

(*b*) Obstacles may be natural, manmade, or combinations thereof to include obstacles created by chemical and nuclear fires.

(*c*) Obstacles are employed by both friendly and enemy forces to strengthen a defense, to deny use of key terrain for observation and defensive positions, to assist in economy-of-force measures, and to protect the flank of a moving force. Obstacles are also used to separate attacking echelons such as dismounted infantry from tanks.

(*d*) Nuclear weapons can create the following obstacles: areas of induced and fallout radiation, craters, rubble, fires, and tree blowdown.

(4) *Key terrain.* Key terrain is any locality or area the control of which affords a marked advantage to either combatant. Key terrain is seized, neutralized, or controlled by other means in order to deny its use by the enemy or permit its subsequent use by friendly forces.

(5) *Avenues of approach.*

(*a*) Likely avenues of approach are analyzed in accordance with the availability of observation and fire, concealment and cover, obstacles, key terrain, space for dispersion and maneuver, trafficability, and the effects of nuclear weapons.

(*b*) In analyzing avenues of approach for airmobile operations, the major concern is achieving or avoiding tactical surprise. Favorable air routes provide adequate airspace and defilade to limit the enemy's detection and interception capability. Heavily forested and swampy areas provide good routes since ground troops have little opportunity to see or fire at low-flying aircraft. Ridges reduce the possibility of detection by radar. However, steep defiles or canyons are avoided because possible downdrafts may affect the control of aircraft.

b. Weather. Weather conditions have an important bearing on reconnaissance and are a vital consideration in operational planning. Weather primarily affects mobility and visibility, both on the ground and aloft, and is of special importance in the conduct of operations that include nuclear, chemical, and biological warfare. Fallout, chemical, and biological cloud travel is channeled by weather conditions. Meteorological elements which have a significant influence on operations are wind directions and speed, temperature, humidity, cloud cover, precipitation, and atmospheric stability. Weather intelligence provided by weather teams at the tactical operations center (TOC) contains forecasts for these meteorological elements and light data such as beginning morning nautical twilight (BMNT), sunrise, sunset, and end evening nautical twilight (EENT), moonrise, and moonset.

1–9. Civil Population

The attitude, actions, and capabilities of the civil population significantly affect reconnaissance operations. A friendly populace confers valuable assistance in the collection of intelligence data. Time is saved in the collection of terrain information through the interrogation of friendly civilians who have intimate knowledge of the local area. High water levels and similar seasonal data are, at times, only available from local interrogations. Conversely, a hostile population makes reconnaissance operations more difficult. Bridge classification and route directional signs, for example, may be removed or altered; misleading information may cause delay; and reconnaissance parties may expect continual harassment by unfriendly civilians. Regardless of the civil attitude, however, care must be exercised in evaluating all data obtained from civilian sources.

1–10. Nature of the Conflict

The same general requirements for terrain information exist under all forms of warfare. The nature of the conflict, however, may change the emphasis placed on the various aspects of reconnaissance.

a. Cold War. Under the conditions of cold war, reconnaissance requirements are influenced by the preparation of military forces for conflict. Without active enemy opposition, terrain intelligence is emphasized. Reconnaissance of routes within probable areas of operation is made to meet contingencies that may arise during open warfare.

b. Stability Operations. In stability operations, route reconnaissance is essential for the conduct of counterguerrilla warfare and those nonmilitary activities employed to win the support of the populace. Subversive insurgency movements are generally associated with developing countries, and insurgents usually establish operational bases in remote and relatively inaccessible areas of the country. Characeristically, roads in such areas are poor. Trails, rivers, and canals are used for military operations and commerce. Route reconnaissance may be required to provide information for the construction of roads and airlanding facilities to support military and other aspects of internal defense and internal development operations.

c. Limited War. In limited conventional war, route reconnaissance considers not only terrain features but also the likelihood and effect of the disruption of lines of communications by enemy action or adverse weather. The immediate emphasis is determined by the requirement to support the existing operational situation; reconnaissance personnel must, however, be prepared to quickly assume greater responsibilities resulting from an expansion of the conflict. In limited nuclear war, reconnaissance requirements vary in accordance with the severity and type of nuclear exchange.

d. General War. Nuclear warfare is characterized by relatively sudden and drastic changes in the tactical situation. Dispersion, mobility, decentralization of control, rapid exploitation, and the reduction of reaction time are characteristic. Under this type of environment, route reconnaissance assumes even greater importance. Not only will more routes be required to support military operations, but reconnaissance personnel must be ever alert to recognize widespread areas of contamination created by mass destruction weapons.

1-11. Friendly and Enemy Forces

a. Friendly Forces. In general, intelligence operations are oriented on characteristics of the operational environment which are external to the command; that is, the terrain, weather, and enemy. However, route reconnaissance is further affected by the mission, composition, organization, and size of the unit for which routes are being reconnoitered. Reconnaissance personnel must be completely familiar with vehicular specifications and limitations. If route reconnaissance is conducted by other than organic elements, it is desirable that liaison agents accompany the supporting reconnaissance element.

b. Enemy Forces. Although not within the scope of this manual, reconnaissance personnel must be trained to recognize, reconnoiter, and counter enemy action. Enemy influence along a route may vary from nuisance mining to stubborn defensive resistance. A route, regardless of location, is always vulnerable to interdiction by enemy air and missile or artillery attack. Reconnaissance personnel must avoid drawing undue attention to their operations especially in likely target areas such as bridges, road junctions, and defiles. As reconnaissance parties are usually small in number and generally operate in areas remote from friendly forces, the threat of attack is ever present whether close to the FEBA or in rear areas where infiltrators or irregular forces may stage ambushes or establish road blocks. Regardless of the reconnaissance mission, the threat of enemy interference must be considered at all times, and reconnaissance personnel constantly prepared to take positive steps to overcome opposition, or take other action. See paragraphs 1-22, 1-23, and 1-24.

Section III. INTELLIGENCE ASPECTS OF RECONNAISSANCE

1-12. Intelligence Requirements

a. General. Intelligence requirements are those variable factors concerning the weather, terrain, and enemy which, when known, materially assist in the execution of a unit's mission. Because of the ever changing operational environment, intelligence requirements are not consant. A commander relies on his intelligence staff officer (S2/G2) for the production of intelligence. The intelligence officer, in turn, requests or directs appropriate individuals or organizations that collect intelligence information—henceforth referred to as collection agencies—to provide data in support of the intelligence effort. In accordance with their capabilities, agencies employ various methods in collection. Those most common in acquiring terrain information are: interrogation, observation and lis-

tening posts, ground and aerial surveillance devices, air and ground reconnaissance, and radiological monitoring and survey. Collection capabilities, however, are rarely sufficient to satisfy all intelligence requirements simultaneously. Therefore, collection resources within the command are directed toward definite intelligence objectives in priority of need. To facilitate the establishment of priorities, intelligence requirements are categorized *as essential elements of information and other intelligence requirements.*

b. Essential Elements of Information. Essential elements of information (EEI) are the critical items of information regarding the enemy and his environment needed by the commander by a particular time to relate with other available information and intelligence in order to assist him in reaching a logical decision. These decisions are of the type which involve the mission of the command and the choice of a course of action to accomplish the mission. The nature and number of EEI will vary with the type of operation, the phase of the operation, and the extent and accuracy of the available information and intelligence. When the available information and intelligence are complete enough to satisfy the commander in making a decision with confidence, he establishes no outstanding priorities; however, at no time is the available information or intelligence so complete that additional requirements do not exist.

c. Other Intelligence Requirements. Other intelligence requirements are derived from command and staff requirements which are important but do not qualify as EEI. After the allocation of means to collect information necessary to satisfy the EEI, the remaining means are used for the collection of information that also affect the mission.

1–13. Sources of Intelligence

Sources of information are the actual origin from which information concerning the operational environment is obtained. An important consideration by collection agencies is the selection of proper sources. A knowledge of sources and type of information which each can provide is essential in planning reconnaissance missions. The more common sources applicable to reconnaissance operations are: friendly troops; enemy activity; prisoners of war; local civilians; recovered friendly military personnel; imagery; maps; captured documents; weather forecasts; and studies, reports, and other reference material of intelligence value.

1–14. Friendly Troops

All units have capabilities which contribute to the collection of intelligence information. Combat and combat support units are especially useful for supplying information of enemy and terrain in forward areas. Some units such as armored cavalry units and long-range reconnaissance patrols are specifically organized for ground reconnaissance operations. Target acquisition and surveillance units collect information by ground and aerial observation. Combat support and combat service support units acquire significant amounts of terrain data during the conduct of normal operations. Military police units are valuable sources of information concerning physical characteristics of areas occupied by friendly forces. Civil affairs units are capable of gaining much information about the area of operations by close liaison with the indigenous population and through perusal of civil records and files.

1–15. Enemy Activity

Enemy activity is also a source of terrain information; however, the volume and type of information concerning enemy activities are limited by the capabilities of available detection and observation equipment and the measures taken by the enemy to conceal his activities. For example, intelligence reports concerning the type and size of enemy vehicles utilizing a bridge provide an estimate of the bridge's capacity. In addition, information that the enemy is not engaged in certain activities is often of great significance. For example, negative reports of enemy movement along a route apparently suitable for military traffic may indicate the presence of mines or other obstacles barring travel.

1–16. Prisoners of War, Civilians, and Recovered Personnel

a. Prisoners of war are valuable sources of information, particularly of the immediate battle area. Maximum information is obtained through skillful handling of prisoners of war from the time of capture until interrogation is completed. Personnel conducting interrogations are carefully briefed on the desired information and are provided with appropriate aids such as maps and aerial photos.

b. Civilians who have been within enemy-controlled areas may be valuable sources of information and often give information readily. Such

sources can provide information on terrain in enemy-controlled areas and may provide information of enemy installations and activities. Civilians are particularly valuable sources of information in cold war operations.

c. Military personnel recovered from enemy-controlled areas are sources of information of the area of operations and enemy dispositions and activities. Interrogation of recovered military personnel is conducted in accordance with regulations prescribed by the theater headquarters.

1–17. Imagery

a. Permanent imagery obtained by ground and aerial sensors is an excellent source of graphic information for terrain evaluation. Current types of image-producing sensors are the camera, infrared detector, and radar. Each of these types of image-producing sensors operates in a different portion of the electro-magnetic spectrum and each detects and records different data.

b. Imagery obtained by airborne sensors, manned or unmanned, is particularly useful in reconnaissance planning. If properly employed, it is an excellent means for collecting information to assist in—

(1) Locating enemy offensive and defensive installations; supply installations and lines of communications; and armored, motorized, and personnel concentrations.

(2) Analyzing terrain.

(3) Confirming or denying intelligence information obtained from other sources of agencies.

(4) Preparing target folders.

(5) Assessing damage.

(6) Preparing mosaics and panoramas for planning purposes.

(7) Correcting maps and making map supplements.

1–18. Maps and Geodetic Data

Maps provide a basic source of terrain information. The reliability of a map is determined by the data used in preparation, and the date of production or revision is generally included as a part of the marginal data. Maps are supplemented by aerial or ground photographs and other permanent imagery means, sketches, visual observation, trig lists, and gazetteers. Trig lists are publications containing the exact location and elevation of bench marks and other survey points together with a complete description of their characteristics. Trig lists are of particular value to artillery, missile, and engineer units and are required for locating and orienting certain surveillance devices. Special maps and overlays are designed for specific purposes, such as trafficability, transportation facilities, and soils, and may be of particular value in terrain evaluation. The classification of U.S. maps by type and scale is described in AR 117–5.

1–19. Captured Documents

Enemy documents may provide great assistance in the field of terrain intelligence. Compilations of route data by the enemy and captured maps can considerably reduce the collection effort. However, the possibility that a document has been purposely planted to deceive intelligence personnel concerning enemy activities and terrain is ever present.

1–20. Weather Forecasts

Weather information in the field army consists of weather forecasts, weather observations, both surface and aloft, and weather summaries. Weather forecasts are provided by the Air Weather Service (AWS) of the Air Force. These forecasts are based on the weather observations provided within the field army by AWS observing teams and artillery meteorological sections supplemented by observations from other units. Weather summaries of past weather conditions are compiled as required by both army and air force units.

1–21. Reports, Studies, and Reference Material

a. General Sources. Valuable terrain information can be found in a wide variety of both technical and nontechnical books, periodicals, and reports published by governmental and private agencies, universities, and technical schools. These include trade journals, economic atlases, tide tables, pilots' handbooks, tourist guides, and similar publications. Unpublished systematic records covering meteorological, hydrological, and similar scientific data prepared by governmental agencies, engineering firms, private societies, and individuals also contribute valuable terrain information. While utilized chiefly for terrain studies made at higher headquarters, material of this type, when locally available, can be of considerable value to lower echelons.

b. Intelligence Reports.

(1) *Strategic intelligence studies.* Strategic intelligence studies prepared at the National level

by the Department of Defense (DOD) or by overseas commands provide detailed information concerning major geographical areas. Such studies include—

(*a*) *National intelligence surveys.* These studies present a concise digest of the basic intelligence required for strategic planning and the operations of major units. Each study describes the pertinent terrain characteristics of a specific area, supported by descriptive material, such as maps, charts, tables, and bibliographies.

(*b*) *Engineer intelligence studies* (EIS). These are a series of documents describing in detail those natural and manmade features of an area that affect the capabilities of military forces. These studies are being supplemented and in some cases superseded by DOD and command initiated lines of communications, port, and terrain type studies.

(*c*) *Lines of communication* (*LOC*) *studies.* These studies, prepared on either medium scale maps or single small scale foldup sheets, contain an analysis of transportation facilities with general information on railroads, inland waterways, highways, airfields, pipelines, ports and beaches.

(2) *Route reconnaissance reports.* Most important for terrain information at lower levels are local reports which summarize data obtained by physical route reconnaissance. Such reports are of particular value in providing current, detailed information about routes of communication. The preparation of these reports is discussed throughout this text.

Section IV. RECONNAISSANCE OPERATIONS

1–22. General

Reconnaissance is a mission undertaken to obtain, by visual observation or other detection methods, information about the activities and resources of an enemy or potential enemy; or to secure data concerning the meteorological, hydrographic, or geographic characteristics of a particular area. This information is used to produce intelligence. The resulting intelligence seeks to reduce the unknown aspects of the enemy and the area of operations. It contributes to the accuracy of evaluating risks and the successful application of combat power. *Reconnaissance is a continuing responsibility of each commander and every soldier.* Unit training, standard operating procedures, and the commander's instructions to subordinates must emphasize the importance of timely and accurate reports of both positive and negative information of the enemy and operational area.

1–23. Fundamentals of Reconnaissance

Reconnaissance operations vary with the operational environment; with the assigned mission; and with the size, type, and composition of the reconnaissance element. Ground reconnaissance operations are performed in conformance with the following fundamentals:

a. Orient on the Location or Movement of the Intelligence Objectives. Units engaged in reconnaissance operations maneuver according to the location or movement of the intelligence objective rather than the location or movement of friendly forces. The objective may be enemy troops, a terrain feature, or a locality. To effectively perform reconnaissance, commanders of reconnaissance elements are allowed maximum freedom of action commensurate with the mission.

b. Report All Information Accurately. Reconnaissance is conducted to obtain information to be used in the production of intelligence. All items of military significance are reported. Moreover, to be of value, reconnaissance reports must be complete, timely, and accurate.

c. Avoid Decisive Engagement. Units performing reconnaissance obtain information by stealth whenever possible; combat is conducted only when necessary to gain the desired information and in self-defense. The reconnaissance mission must not be jeopardized by unnecessary combat.

d. Maintain Contact with the Enemy. In the performance of a reconnaissance mission to obtain information of an enemy force, visual or electronic contact with the enemy is gained as soon as possible. Once contact has been made, it is maintained and is not voluntarily broken without proper authority. Contact may be maintained either by ground or aerial surveillance.

e. Develop the Situation. When enemy contact is made or an obstacle is encountered, the situation is developed rapidly. To determine the location, composition, and disposition of the enemy force or obstacle, the following actions are taken on contact:

(1) Deploy and report.

(2) Reconnoiter.

(3) Choose a course of action.

(4) Report.

1–24. Types of Reconnaissance Missions

There are three types of ground reconnaissance missions: route, zone, and area. The type to be employed is determined after considering the nature and urgency of the information desired, the operational environment, and the composition of the reconnaissance force.

a. Route Reconnaissance.

(1) Route reconnaissance is directed in order to obtain information of the enemy; obstacles including chemical or radiological contamination; route conditions; and critical terrain features along a specific route.

(2) The techniques employed and the requirements of route reconnaissance are less time consuming and are, consequently, performed more rapidly than other types of reconnaissance.

b. Zone Reconnaissance.

(1) Zone reconnaissance is the directed effort to obtain detailed information of all routes; obstacles, including chemical or radiological contamination; key terrain; and enemy activity in a zone established by definite lateral boundaries. Zone reconnaissance is more thorough and time consuming than other reconnaissance missions.

(2) When the enemy's location is in doubt or if it is desired to locate suitable routes or determine conditions of cross-country trafficability, zone reconnaissance may be directed. The width of the zone assigned to reconnaissance elements is determined by the road net, terrain type, information desired, anticipated enemy action, troops available, weather, visibility, and time allotted to accomplish the mission.

c. Area Reconnaissance.

(1) Area reconnaissance is the directed effort to obtain detailed information of all routes; obstacles, including chemical or radiological contamination; and enemy forces within any clearly defined area. Area reconnaissance is the most thorough and time consuming of the three types of reconnaissance.

(2) Area reconnaissance is performed to gain information of definite geographical areas such as towns, woods, or stream-crossing sites. An area may be reconnoitered for enemy activity or to determine an area's suitability for use by friendly forces as an assembly area, defensive position, or other purposes. Reconnoitering techniques employed are similar to those prescribed for zone reconnaissance.

1–25. Reconnaissance in Force

A reconnaissance in force differs from a route, zone, or area reconnaissance in that it is a limited objective offensive operation by a considerable force to discover and test the enemy's dispositions and strength or to develop other intelligence. Route reconnaissance teams are often included in reconnaissance in force operations to assist in gathering terrain information. Although the primary aim of a reconnaissance in force is to gain intelligence information, it may discover weaknesses in the enemy disposition which, if exploited promptly, may enhance tactical success. A reconnaissance in force normally develops information more rapidly and in more detail than other reconnaissance methods.

1–26. Reconnaissance of Suspect Areas

a. In reconnoitering areas along a route which are likely to be defended by enemy detachments such as bridge approaches, defiles, or built-up areas, reconnaissance should commence from the flanks or rear. Detailed observation precedes actual reconnaissance; and approach routes are checked for mines, boobytraps, and signs of ambush.

b. When time is available, dismounted personnel are first sent forward covered by the remaining elements of the unit. The number of dismounted personnel depends upon the size of the objective and upon available approaches, cover, and concealment. If the dismounted patrols find that the near edge of the area is clear, the remainder of the unit moves quickly forward. The dismounted patrols then continue the reconnaissance, overwatched and followed closely by the remainder of the unit.

c. In conducting a mounted reconnaissance, part of the unit remains mounted and moves forward cautiously but rapidly, overwatched by the remaining mounted elements. If the near edge of the area is clear, the overwatching elements move forward quickly and the advance continues.

1–27. Reconnaissance by Fire

a. Reconnaissance by fire is accomplished by firing on likely or suspected enemy positions in an

attempt to remove camouflage and to cause the enemy to disclose his presence by movement or return fire. During reconnaissance by fire, positions being reconnoitered must be observed continuously so that enemy activity can be quickly and definitely located.

b. Reconnaissance by fire may be employed by route reconnaissance teams as a security measure when time is critical and the loss of surprise is not essential.

c. If the enemy returns the fire, the situation is further developed. If the fire is not returned, the reconnaissance continues. However, caution should be exercised, for reconnaissance by fire often fails to disclose the presence of a well-disciplined enemy.

1–28. Reconnaissance at Night

Route reconnaissance operations are slower and less effective at night. Night reconnaissance is limited usually to electronic surveillance devices, dismounted patrolling, observation of routes, and the use of listening posts. Only against light enemy resistance and upon favorable terrain can vehicular reconnaissance be employed without being preceded by dismounted patrols. Use of night vision devices are often helpful; and when employed, their use is integrated into the overall reconnaissance and security plan.

1–29. Reconnaissance by Aircraft

a. General. Aerial reconnaissance is a valuable aid in route reconnaissance. Aerial reconnaissance has the capability of covering enemy lines of communication such as roads, air landing facilities, railroads, and waterways. This is accomplished by means of visual and airborne sensor systems. Aerial reconnaissance may be conducted by medium range aircraft of the division aerial surveillance and target acquisition platoon, other army aircraft, or aircraft of the air force. *Visual aerial reconnaissance* is normally employed in fluid situations to obtain *general* information concerning enemy movements and locations and the condition of roads, bridges, terrain features, and waterways. *Photographic reconnaissance* is employed to deny or confirm, in detail, information obtained by visual reconnaissance or other means. Reports from photography provide information on the condition, surface material, and width of roads and trails; the condition, type, classification, length, width, and construction material of bridges; and information concerning fording sites, bypasses, and obstacles.

b. Army Aviation. Battlefield surveillance by army aircraft supplements and, in some cases, replaces ground reconnaissance. To fulfill reconnaissance requirements, commanders not having organic aircraft request aerial support through intelligence channels (see FM 30–20). Army aircraft may be employed in conjunction with and in close support of ground reconnaissance parties. Aircraft are useful in selecting routes for ground reconnaissance and in locating enemy forces which may delay or endanger ground reconnaissance elements. Aircraft may also confirm and obtain additional information of activities and installations initially detected by other means. Often, it is possible to combine reconnaissance capabilities by placing ground reconnaissance teams aboard army aircraft. This procedure permits ground elements to be dropped off at terrain features which require detailed inspection while the aircraft continues more general battlefield surveillance. Under nuclear warfare conditions, aircraft are effective in conducting radiological surveys and, subsequently, locating routes through or around contaminated areas. The aerial infrared detector and side looking aerial radar (SLAR) have the capability of providing surveillance during periods of reduced visibility. The sensor carrying aircraft has, in addition, a night photographic capability.

c. Coordination. The value of visual aerial surveillance lies in the quantity and speed with which information can be relayed to friendly units. Visual observation from aircraft bridges the gap between ground reconnaissance and data gathered by aerial photography and other means of permanent imagery. Coordination of ground and aerial reconnaissance activities to include communication between cooperating elements must be specified in the overall reconnaissance plan. Aerial reconnaissance personnel require detailed briefings similar in nature to those received by ground collection agencies to insure that reconnaissance missions are understood and effectively executed. Methods for expeditiously processing and disseminating the great bulk of intelligence data that is normally acquired from aerial reconnaissance are mandatory. Imagery interpretation personnel, who are located at division and higher headquarters, should be called upon to assist in the analysis of route imagery coverage. In most cases, these personnel, by virtue of their training, are more capable of quickly interpreting imagery than the

staff of the supported unit. Therefore, to expedite reconnaissance reports and insure completeness, written reports, not photographic prints, are normally sent to the supported unit.

d. Techniques. In aerial battlefield surveillance, identification of objects on the ground is simplified when observed from several lines of view. An additional aid in aerial observation is to view ground objects with the sun to the rear; this procedure relieves eye-strain for personnel in the aircraft; whereas, enemy ground observers, who must continually look into the sun, become quickly fatigued. Area search supplemented by route reconnaissance is the normal method of conducting aerial battlefield surveillance although specific search may be instituted in densely populated areas or where observation of a limited number of terrain features will satisfy intelligence requirements (see FM 1–80).

e. Limitations. Terrain orientation is difficult for the inexperienced observer; however, practice soon overcomes initial confusion. Much information can be collected by a trained and experienced observer even though observation is limited by the speed and vibration of the aircraft, the altitude from which observation is made, enemy air defense and concealment measures, and conditions of adverse weather and visibility. Specific limitations of inflight visual observation applicable to route reconnaissance are—

(1) Strength data of bridges and similar structures can only be estimated and confirmation is usually required by ground reconnaissance or aerial photography.

(2) Terrain surface types are easily misinterpreted.

(3) Mined and boobytrapped areas are difficult to locate.

(4) The load-carrying capacity of roads and cross-country routes are difficult to establish.

(5) Stream depths, bottom conditions, and current velocities can only be estimated.

(6) Critical dimensions such as stream widths and vehicular overhead and horizontal clearances cannot be accurately measured.

1–30. Route Reconnaissance Planning

EEI and other intelligence requirements provide the framework for collection. Orders and requests for specific intelligence information are sent to the collection agencies. Upon receipt of a mission, reconnaissance agencies commence planning. Sources of information are first checked for data already available concerning the reconnaissance target (see para 1–13). Reconnaissance plans are drawn up and completed sufficiently early to give executing units time to make their own preparations, conduct the reconnaissance, and report results in sufficient time to be of use. (For a suggested organization of a route reconnaissance patrol, see app C.) Reconnaissance instructions are complete and include exactly what information is to be obtained, the time by which the information is to be reported, where the information is to be sought, action to be taken upon enemy contact, and when the mission is to be executed. Essential details include:

a. Pertinent known information of the enemy, friendly troops, and the area of operations.

b. Proposed plans of higher commands, to include anticipated traffic flow (single or double) along the route and types of vehicles to be employed.

c. Specific information desired.

d. Route or routes to be reconnoitered.

e. When, where, and how information is to be reported.

f. Time of departure.

g. Appropriate control measures.

h. Action to be taken when the mission is completed.

i. Special equipment requirements.

1–31. Coordination and Control During Reconnaissance Operations

a. To insure maximum results from collection and to avoid unnecessary duplication, reconnaissance is coordinated at all levels of command. Coordination is accomplished primarily by the assignment of one specific mission to each reconnaissance element. Route and time schedules may be employed to assist in coordination of reconnaissance elements.

b. Commanders of reconnaissance elements normally employ radio as the primary means of control. Phase lines, checkpoints, contact points, boundaries, routes, objectives, and time limitations provide further assistance in directing reconnaissance units. Liaison personnel, staff officers, messengers, and aircraft are also employed to transmit reconnaissance instructions and relay reports.

CHAPTER 2

RECONNAISSANCE AND CLASSIFICATION OF EXISTING ROUTES

Section I. ROUTE CLASSIFICATION

2–1. General

a. The ability of an army to carry out its mission depends heavily upon available lines of communications and, in particular, the land routes. Vehicular routes supplement rail and air transportation and may be called upon to assume the entire movement burden when other routes are disrupted by enemy action or adverse weather. Therefore, reconnaissance and classification of existing vehicular routes are of great importance to the success of the tactical plan.

b. Hasty route reconnaissance is conducted to determine the immediate military trafficability of a specified route. Such information is vital to all units engaged in planning and executing vehicular movement. It is limited to critical terrain data which is necessary for route classification and which meets the intelligence requirements of the situation. Full appreciation of a route's capability cannot be determined until each factor affecting traffic flow is separately analyzed. The report of hasty route reconnaissance usually consists of a map overlay supplemented by additional reports (dependent on the detail required) concerning various aspects of the terrain. The route reconnaissance overlay is accurate, clear, and concise. Standard topographic (FM 21–31), military (FM 21–30), and route reconnaissance symbols are employed to insure that route reconnaissance reports are universally understood. The route reconnaissance overlay, discussed in the following section, includes a summary of pertinent reconnaissance symbols.

c. Deliberate route reconnaissance is made when sufficient time and qualified personnel are available. It provides necessary data for a thorough analysis and classification of significant terrain features along a route to include, when required, repair or demolition procedures. Deliberate reconnaissance, therefore, by its very nature is detailed. Deliberate route reconnaissance reports differ from hasty reconnaissance reports only in the degree and completeness of reported information. Usually, an overlay is employed to point out the exact map location of each reconnoitered terrain feature. Inclosures are attached to the overlay which describe in detail each terrain feature covered by the report. The use of DA Reconnaissance Report forms as inclosures establishes a permanent record and insures that sufficient detail is included concerning important route characteristics.

2–2. Terrain Considerations

Factors of terrain which are important in route reconnaissance and require consideration, when applicable, are—

a. Existing routes and their physical characteristics.

b. Gradients and radii of curvature.

c. Bridges.

d. Vehicular fording, ferrying, and swimming sites.

e. Tunnels, underpasses, and similar obstructions to traffic flow.

f. Artificial obstacles such as areas of chemical, biological, and radiological contamination, roadblocks, craters, and minefields.

g. Rock falls and slide areas.

h. Drainage.

i. Other natural or manmade features, such as wooded and built-up areas, which may affect movement.

2–3. Military Route Definitions (NATO and CENTO STANAG 2151)

a. A *basic military road network* includes all routes designated in peacetime by the host nation to meet anticipated allied and national military movements, and transportation requirements. A basic network has sufficient capacity and is

equipped with the necessary facilities to support normal military movements.

b. A *military road maneuver network* is the road system required by a commander to conduct a specific military operation including logistical support. The network is formed around the existing basic military road network within the area of operations. It may be modified, if required, to meet the military situation. The military road maneuver network is designated and controlled by the military commander exercising local territorial responsibility.

c. An *axial route* is part of a military road maneuver network which leads to and runs generally perpendicular to the FEBA. It is identified by an odd number and is depicted on military maps and overlays by a solid line.

d. A *lateral route* is part of a military road maneuver network which runs generally parallel to the FEBA and leads into or across axial routes. It is identified by an even number and is depicted on military maps and overlays by broken lines.

e. Road capacity expressed in vehicles or tons varies in accordance with the amount of traffic. The maximum capacity of a route expressed either in vehicular flow or tonnage is essential in transportation planning (see FM 55–15).

(1) The *road capacity in vehicles* is the maximum number of vehicles that can pass over a given road in one direction, in a given time. It is usually expressed in vehicles per hour (vph). The road capacity in vehicles of a specific route is limited to the maximum traffic flow at its most restrictive point.

(2) The *road capacity in tons* is the maximum number of tons which can be moved over a particular route in one direction in a given time. It is generally expressed in tons per hour and is the product of the number of vehicles per hour (vph) and the average payload of the vehicles using the route. (For example: 200 vph x 5 tons per vehicle = 1000 tons per hour.)

(3) *Existing conditions* determine the amount and type of traffic flow. These conditions include—

(*a*) Route characteristics (terrain, type of surface, width of traveled way, maintenance requirements, and load capacities).

(*b*) Military traffic regulations (density, speed limit, and traffic direction).

(*c*) Types of vehicles employed.

(*d*) Light and weather conditions.

f. A *movement credit* is the time allocated for one or more vehicles to move over a controlled route. Movement credits are issued by the appropriate highway traffic headquarters in the operational area.

g. A *controlled route* is a route subject to traffic or movement restrictions. Controlled routes include the following:

(1) A *supervised route* is a route over which control is exercised by means of traffic control posts, traffic patrols, or both. A movement credit is required for convoys of 10 or more vehicles or by individual vehicles of exceptional size or weight.

(2) A *dispatch route* is a road over which full control, both priority and regulation of traffic movement, is exercised. A movement credit is required by individual vehicles as well as by groups of vehicles regardless of number or type.

(3) A *reserved route* is a route which is:

(*a*) Allocated exclusively to a particular command or unit. (For example, a route reserved exclusively for the 10th Division), or

(*b*) Intended to meet a particular requirement. (For example, a route reserved exclusively for evacuation.)

h. An *open route* is a route for which no movement credit is required.

i. A *one-way route* is a route on which vehicles move in one direction only.

j. A *signed route* is a route along which a unit has placed unit directional signs on its own initiative, for its exclusive use, and under the conditions prescribed by the command or maneuver regulations.

k. A *route where guides are provided* is a route upon which a unit has placed guides on its own initiative and under the conditions prescribed by the command or maneuver regulations; these guides direct personnel and vehicles of their own unit but do not direct other units.

l. A *prohibited route* or a *prohibited section of route* is one over which all traffic is prohibited.

m. A *blocked route* is a route on which the flow of traffic has become temporarily impossible because of a material obstruction.

2–4. Route Classification System (NATO and CENTO STANAG 2015 and SOLOG 53)

The route classification system is designed to assist in planning and executing military movement. Normally, classification is actually carried out during hasty route reconnaissance. When technical difficulties are encountered, however, and if adequate time is available, thorough route classification is accomplished by military engineers whose findings are based on the information contained within route reconnaissance reports. Basic route classification is established for favorable conditions of light and weather. Conditions other than favorable, such as blackout movement, require special considerations; if reconnaissance personnel are to adequately fulfill their mission, reconnaissance instructions must include circumstances other than normal by which movement is contemplated. *Routes are classified according to the factors of minimum width, worst route type, least bridge military load classification, and obstructions to traffic flow.*

2–5. Route Widths (NATO and CENTO STANAG 2151)

The width of a route including bridges, tunnels, roads, and other constrictions is the narrowest width of the traveled way expressed in meters or feet.

a. Route widths are illustrated in figure 2–1.

b. The number of lanes of a given route is determined by the width of the traveled way. The average width of a lane required for the movement of one column is established at 3.50 meters (11½ ft) for wheeled vehicles and 4 meters (13 ft) for tracked vehicles. Single lanes accommodate vehicular traffic in one direction only with no overtaking in the same direction or passing in the oncoming direction.

c. Traffic flow is determined by the number of lanes (table 2–1).

(1) A route is *single flow* when it allows a column of vehicles to proceed and, in addition, *individual* oncoming or overtaking vehicles to pass

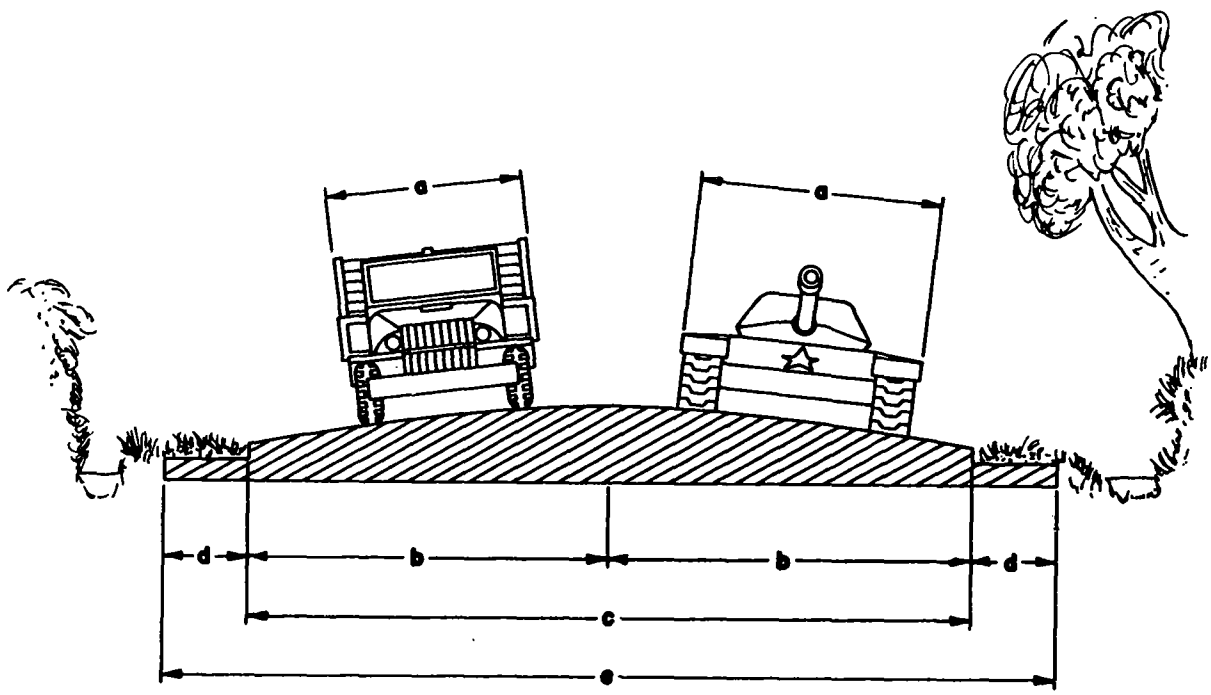


Figure 2–1. Route Widths.

Table 2–1. Route Widths

Flow Possibilities	Width for Wheeled Vehicles	Width for Tracked Vehicles
Isolated vehicles of appropirate width only and in one direction only.	At least 3.5m (11.5 ft)	At least 4m (13 ft)
Generally one way only; no overtaking or passing in opposite direction.	3.5m to 5.5m (11.5 ft to 18 ft)	4m to 6m (13 ft to 19.5 ft)
Single flow	5.5m to 7m (18 ft to 23 ft)	6m to 8m (19.5 ft to 26 ft)
Double flow	Over 7m (23 ft)	Over 8m (26 ft)

at predetermined points. It is desirable that the width of a single flow route be equal to at least 1½ lanes.

(2) A route is *double flow* when it allows two columns of vehicles to proceed simultaneously either in the same or opposite direction. It is essential that the width of a double flow route be equal to at least two lanes.

(3) If reconnaissance personnel are to perform hasty route reconnaissance, instructions should indicate if the anticipated traffic is to be single or double flow and whether the route is for the use of wheeled vehicles or tracked vehicles. In other words, those conducting reconnaissance are informed of what traveled way widths are to be considered and reported as width obstructions. By referring to table 2–1 it can be seen that a width obstruction for single flow, wheeled traffic does not exist until the traveled way is reduced below 5.50 meters; whereas this minimum width must be increased to 6 meters to accommodate single flow, tracked vehicles. For double flow traffic, a width obstruction is not present for wheeled vehicles until the traveled way is reduced below 7 meters; whereas for tracked vehicles, the width is critical below 8 meters. In the absence of instructions, routes are reconnoitered and reported based on the minimum traveled way width for double flow, tracked vehicles (8 meters). On the other hand, if a route is to be reconnoitered to determine the type of vehicles the route will accommodate, procedures of deliberate road reconnaissance (para 3–21—3–28) are undertaken to ascertain critical widths.

2–6. Route Type

For the purpose of classification, routes are designated by their ability to withstand the effects of weather. Route type is determined by the worst section of the route. Routes as classified by type are—

a. Type X—All-Weather Route is any route which with reasonable maintenance is passable throughout the year to traffic never appreciably less than maximum capacity. The roads which form this type of route normally have waterproof surfaces and are only slightly affected by precipitation or temperature fluctuations. At no time is the route closed to traffic by weather effects other than temporary snow or flood blockage.

b. Type Y—All-Weather Route (Limited Traffic Due to Weather) is any route which with reasonable maintenance can be kept open in all weather but sometimes only to traffic considerably less than maximum capacity. The roads which form this type of route usually do not have waterproof surfaces and are considerably affected by precipitation or temperature fluctuations. Traffic may be completely halted for short periods. Heavy unrestricted use during adverse weather may cause complete collapse of the surface.

c. Type Z—Fair-Weather Route is any route which quickly becomes impassable in adverse weather and cannot be kept open by maintenance short of major construction. This category of route is so seriously affected by weather that traffic may be brought to a halt for long periods.

2–7. Military Load Classification

a. General. The military load classification system is a load capacity rating system which considers a vehicle's weight and type and its effect on routes and bridges. The classification system is represented by whole numbers assigned to vehicles, bridges, and routes. (For detailed discussion, see para 3–12—3–20.) Most allied military vehicles are externally marked with their respective classification number (see para 2–53). Bridges and routes are assigned military load classifications based on their safe load capacity and physical dimensions.

b. Route Classification. Normally, *the lowest bridge military load classification number regardless of vehicle type or conditions of traffic flow determines the military load classification of a route.* By selecting the lowest bridge classification number, it is assured that the route

is not overloaded. In those cases where vehicles bear a higher military load classification than the route, the route reconnaissance overlay is checked or a special reconnaissance is initiated to determine if a change in traffic control procedures, such as a single flow crossing, may permit utilization of the route by heavier traffic. If no bridge is located on the route or if roads are particularly bad, the worst section of road governs the route's classification (see para 3–2—3–28).

c. Classification of Military Road Maneuver Networks. The class of a military road maneuver network is fixed by the minimum route classification of the network. To facilitate movement, individual routes included in a low class network but over which heavier equipment can be moved, are grouped and identified in broad categories (NATO and CENTO STANAG 2151):

(1) Average traffic routes: Class 50

(2) Heavy traffic routes: Class 80

(3) Very heavy traffic routes: Class 120

Whenever possible, the basic military road network is composed of average routes (Class 50) and includes a number of heavy traffic routes (Class 80) and a few very heavy traffic routes (Class 120).

2–8. Obstructions to Traffic Flow

Route obstructions are factors which restrict the type and amount or speed of traffic flow. Route obstructions with the exception of bridge capacities, which are reported separately as a military load classification, are indicated in the route classification formula (para 2–9) by the abbreviation (OB). Moreover, reconnaissance symbols are used to describe the nature of each obstruction on the route reconnaissance overlay (see fig. 2–2). Obstructions to be reported include—

a. Overhead obstructions such as bridges, tunnels, underpasses, overhead wires, and overhanging buildings whose overhead clearance is less than 4.3 meters (14 ft).

b. Reduction in traveled way widths which are below standard minimums prescribed for the type of traffic flow (single or double, wheeled or tracked, see table 2–1). Examples are bridges, tunnels, craters, lanes through mined areas, and projecting buildings or rubble.

c. Gradients (slopes) of 7 percent or greater.

d. Curves with a radius of curvature less than 30 meters (100 ft).

e. Ferries.

f. Fords.

2–9. Route Classification Formula

The route classification formula is developed from notations expressed in the *standardized sequence* of minimum traveled way width, route type, lowest military load classification, and an obstruction or obstructions if present. The formula briefly describes a specific route and is used together with a route reconnaissance overlay. If an obstruction(s) appears in the route classification formula it is necessary to refer to the route reconnaissance overlay in order to determine the exact nature of the obstruction(s). The overlay may also show bypass possibilities (para 2–60*g*). Illustrative formulas are shown below:

a. 20ft Z 10. This example formula describes a fair-weather route with a minimum traveled way of 20 feet and a military load classification of 10. This route, based on its minimum width of traveled way (see table 2–1), accommodates both wheeled and tracked, single flow traffic without obstruction.

b. 20ft Z 10 (OB). This example formula describes a route with similar characteristics as in example *a* above, but with an obstruction(s). This obstruction(s) could consist of one or more of the following:

(1) Overhead clearances of less than 4.25 meters (14 ft).

(2) Grades of 7 percent or greater.

(3) Curves with radius less than 30 meters (100 ft).

(4) Fords and ferries.

(5) It should be noted that 20 feet of traveled way limits this route to single flow traffic without a width obstruction. If the route is to be used for double flow traffic, however, 20 feet of traveled way constitutes an obstruction and is indicated in the formula as an obstruction (OB).

c. 7m Y 50 (OB). This example formula describes a limited all-weather route with a minimum traveled way of 7 meters, a military load classification of 50 and with obstruction(s).

Note. For *double flow, wheeled traffic* the traveled way width is adequate; however, the route's width is not suitable for double flow, tracked vehicles. This width constriction would be indicated as (OB) in the route classification formula if the route were to be used for both types of vehicles.

d. 10.5m X120 (OB). This example formula describes an all-weather route with a minimum traveled way width of 10.5 meters, which is suitable for double flow traffic of both wheeled and tracked vehicles, a military load classification of 120 with an obstruction(s).

2–10. Special Conditions

a. Snow Blockage. The effects of snow are not normally considered as an obstruction to traffic flow in route classification since vehicular movement is determined by the depth of the snow and the availability of snow removal equipment. In those cases, however, where snow blockage is regular, recurrent, and serious, the formula for classifying a route is followed by the symbol (T), for example:

(1) 20ft Y 50 (T).

(2) 7m Y 50 (OB) (T).

b. Flooding. The effect of flooding on traffic flow is also not normally considered in route classification except where flooding is regular, recurrent, and serious. In such cases, the formula for classifying a route is followed by the symbol (W), for example:

(1) 20ft Y 50 (W).

(2) 7m Y 50 (OB) (W).

Section II. ROUTE RECONNAISSANCE OVERLAYS

2–11. General

This section provides guidance in the preparation of route reconnaissance overlays used in hasty and deliberate reconnaissance. A summary of route reconnaissance symbols used in overlay preparation is included. The route reconnaissance overlay is an accurate and concise report of the conditions affecting traffic flow along a specified route and is the preferred method of preparing a route reconnaissance report. An overlay normally satisfies the requirements of hasty route reconnaissance. If, however, more detail is required to support the reconnaissance, the overlay is supplemented with written reports describing critical route characteristics in more detail. An example of a route reconnaissance overlay is shown in figure 2–2.

2–12. Route Reconnaissance Symbols

Figure 2–3 provides a summary of standard route reconnaissance and related symbols. In addition, references which explain the symbol in greater detail, are provided for each entry.

2–13. Route Reconnaissance Checklist

To insure that critical terrain data during route reconnaissance are not overlooked and to aid in the preparation of reconnaissance reports, a checklist based on the characteristics of the area of operations is recommended. General items for consideration are—

a. Identification and location of the reconnoitered route.

b. Distances between easily recognized points both on the ground and map.

c. The percent of slope and length of grades which are 7 percent or greater.

d. Sharp curves whose radius of curvature is less than 30 meters (100 ft).

e. Bridge military load classifications and limiting dimensions to include suitable bypasses.

f. Locations and limiting data of fords and ferries.

g. Route constrictions, such as underpasses, which are below minimum standard and, if appropriate, the distances such restrictions extend.

h. Locations and limiting dimensions of tunnels to include suitable bypasses.

i. Suitable areas for short halts and bivouacs which offer drive-off facilities, adequate dispersion, cover, and concealment.

j. Areas of rock falls and slides which may present a traffic hazard.

2–14. Reporting of Opened and Closed Routes (STANAG 2096, SEASTAG 2096, and SOLOG 107)

Reconnaissance personnel may often find themselves required to report the closure of *axial* or *lateral routes* or a portion of such routes due to enemy action, climatic conditions, or other reasons. In addition to reporting the closure of a route, it is usually necessary to reconnoiter and report suitable bypasses or detours. Conversely, when routes are again opened, a report to this effect is also

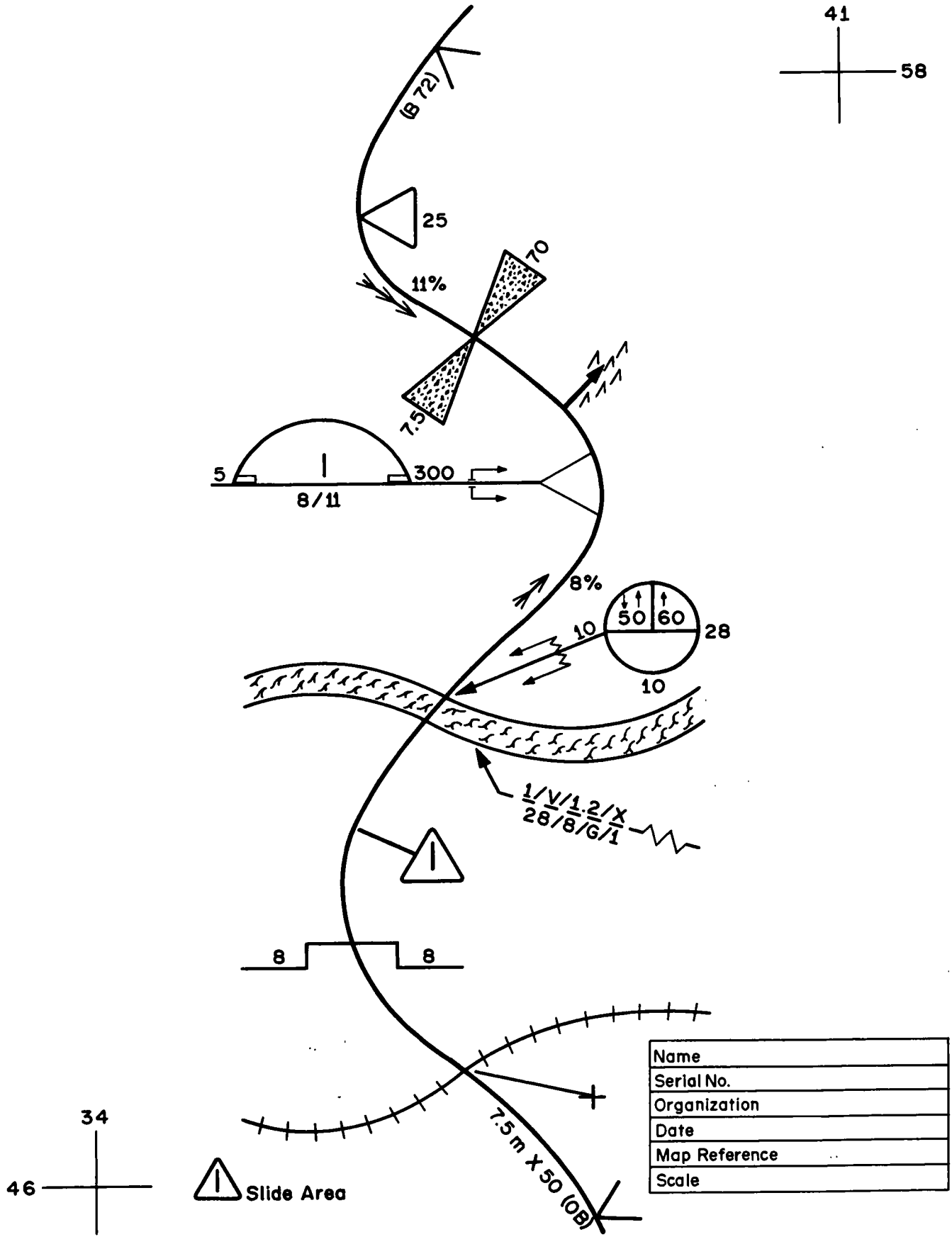


Figure 2-2. Example of a route reconnaissance overlay.

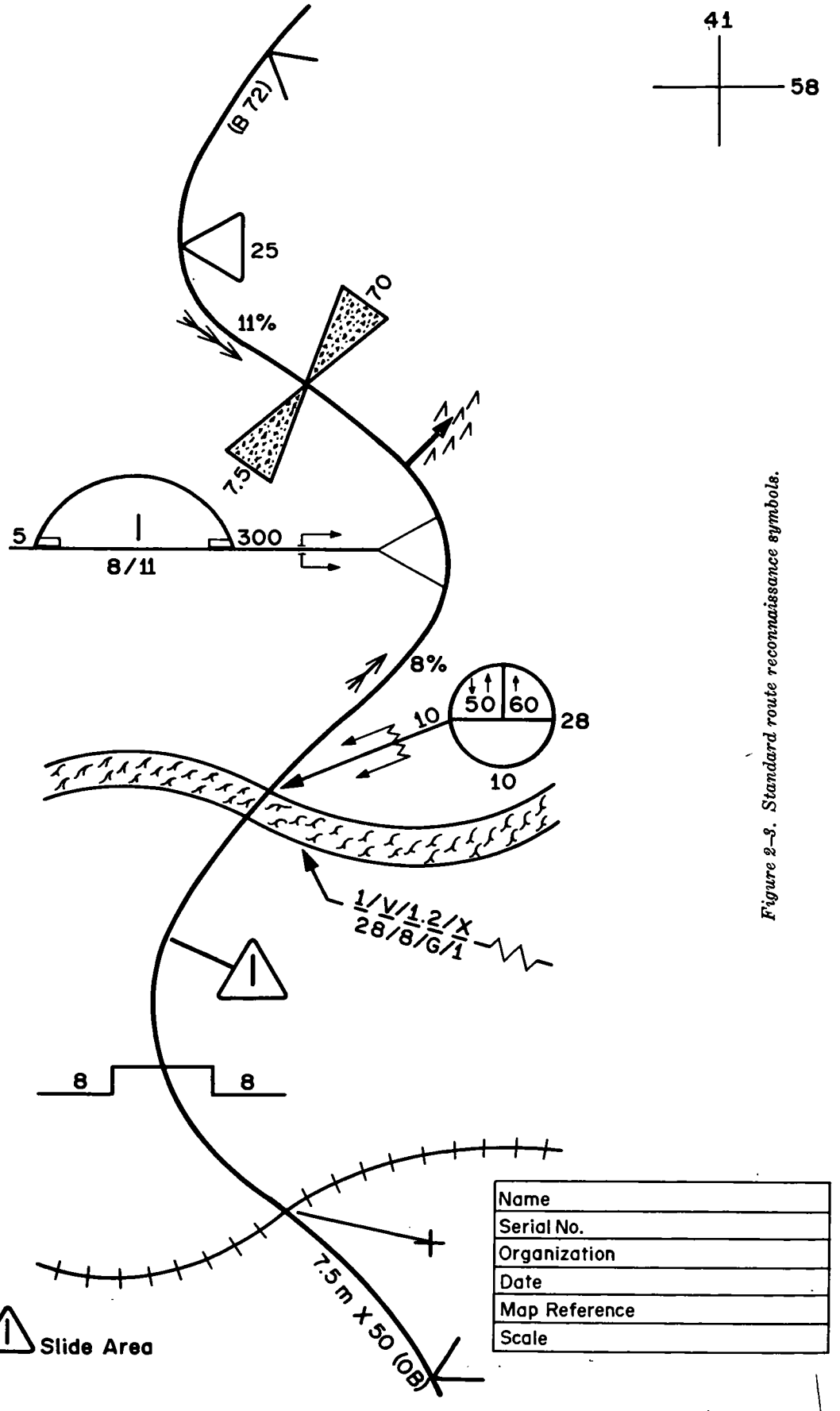


Figure 2-3. Standard route reconnaissance symbols.

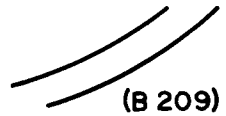
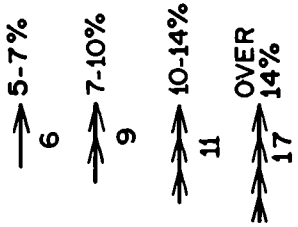
Serial No.	Explanation	Symbol	Remarks	Reference
1.	Civil or military route designation		Designation written in parentheses along route.	STANAG 2253 SOLOG 96
2.	Critical point		To be numbered and described in legend. Critical points may be used to point out features not adequately covered in other reconnaissance symbols.	STANAG 2253 SOLOG 96
3.	Limits of sector		Limits of reconnoitered sector of route.	STANAG 2253 SOLOG 96
4.	Route classification formula	10.5mX 120 6mZ 8 (OB) 9mY 20 (OB)(W)	Expressed in order of: width, type, military load classification, obstructions, if present, and regular flooding or snow blockage: X - all weather route Y - all weather route (limited traffic) Z - fair weather route (T) - regular snow blockage (W) - regular flooding	FM 5-36 (Sec I, Ch 2) NATO and CENTO STANAG 2015 SOLOG 53
5.	Grades		Arrows point in uphill direction; to the right of symbol is shown the actual percent of slope; length of arrow represents length of grade if map scale permits.	FM 5-36 (Sec III, Ch 2) STANAG 2253 SOLOG 96

Figure 2-3—Continued.

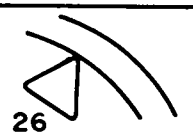
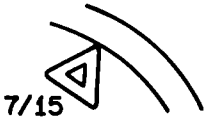
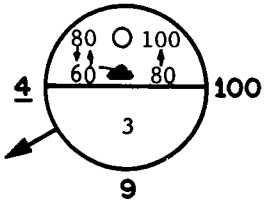
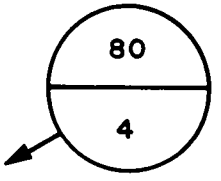
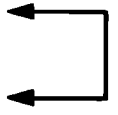
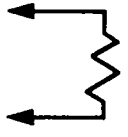
Serial No.	Explanation	Symbol	Remarks	Reference
6.	Sharp curve		Vertex of triangle points to map location of curve. Figure indicates radius in meters.	FM 5-36 (Sec II, Ch 2) STANAG 2253 SOLOG 96
7.	Series of sharp curves		Left figure indicates number of curves; right figure the radius in meters of the sharpest curve.	FM 5-36 (Sec II, Ch 2) STANAG 2253 SOLOG 96
8.	Full bridge symbol		Arrow extends to map location of bridge; minimum width is placed below, overhead clearance to the left, and overall length to the right of basic symbol. Lower portion of symbol indicates bridge serial number; upper portion, military load classification data. Underlined values are those below minimum standard. All linear distances are in meters.	FM 5-36 (Sec VII, Ch 2) DA Form 1295 STANAG 2096 STANAG 2253 SOLOG 96 SOLOG 107 SEASTAG 2096
9.	Abbreviated bridge symbol		Arrow extends to map location of bridge. Lower portion of symbol indicates bridge serial number; upper portion, military load classification. Class number must be underlined if width or overhead clearance is below minimum standard.	FM 5-36 (Sec VI, Ch 2) DA Form 1294 STANAG 2096 STANAG 2253 SOLOG 96 SOLOG 107 SEASTAG 2096
10.	Bypass easy		Used in conjunction with bridge and tunnel reconnaissance symbols.	FM 5-36 (Sec VII, Ch 2) STANAG 2253 SOLOG 96
11.	Bypass difficult		Used in conjunction with bridge and tunnel reconnaissance symbols.	FM 5-36 (Sec VII, Ch 2) STANAG 2253 SOLOG 96

Figure 2-3—Continued.

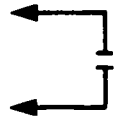
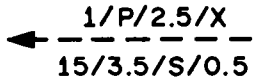
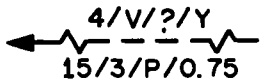
Serial No.	Explanation	Symbol	Remarks	Reference
12.	Bypass impossible		Used in conjunction with bridge and tunnel reconnaissance symbols.	FM 5-36 (Sec VII, Ch 2) STANAG 2253 SOLOG 96
13.	Ford	 	Arrow extends to ford location. Data above the line expressed in order of serial number, ford type, stream velocity, in meters per second, and seasonal limitations. Data below the line expressed in order of length (meters), width (meters), bottom type, and depth (meters). Question marks indicate unknown information. Difficult approaches are represented by zigzag lines corresponding in position to shore where approach is located. FORD TYPE: V-vehicular, P-pedestrian SEASONAL LIMITING FACTORS: X-none, Y-significant BOTTOM TYPE: M-mud, C-clay, S-sand, G-gravel, R-rock, P-artificial paving	FM 5-36 (Sec V, Ch 2) DA Form 1251 STANAG 2096 STANAG 2253 SOLOG 96 SOLOG 107 SEASTAG 2096

Figure 2–3—Continued.

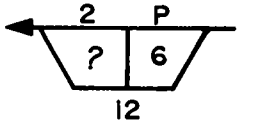
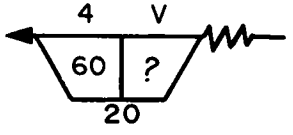
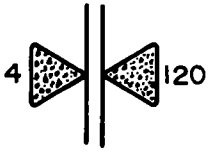
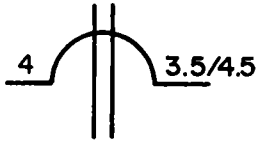
Serial No.	Explanation	Symbol	Remarks	Reference
14.	Ferry	 	Arrow extends to map location. Data above symbol is expressed in order of ferry serial number and ferry type. Data inside symbol is expressed in order of military load class of deck and dead weight capacity in tons; data below symbol is turn around time in minutes. Question mark indicates unknown information. Difficult approaches are represented by zigzag lines corresponding in position to shore where approach is located. FERRY TYPE V-vehicular P-pedestrian	FM 5-36 (Sec V, Ch 2) DA Form 1252 STANAG 2096 STANAG 2253 SOLOG 96 SOLOG 107 SEASTAG 2096
15.	Width constriction		Route constriction. The figure to the left indicates the width of the constriction; that to the right the total constricted length; both dimensions are in meters.	FM 5-36 (Sec IV, Ch 2) STANAG 2253 SOLOG 96
16.	Arch underpass constriction		Width to left of symbol, overhead clearance to the right, both in meters. Both minimum and maximum overhead clearances, if different, will be given.	FM 5-36 (Sec V, Ch 2) STANAG 2253 SOLOG 96

Figure 2-3—Continued.

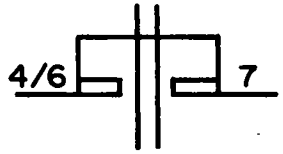
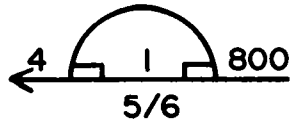
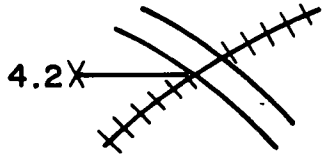
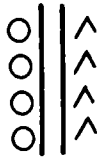
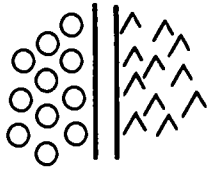
Serial No.	Explanation	Symbol	Remarks	Reference
17.	Rectangular underpass constriction with sidewalks		Width of traveled way followed by total width including sidewalk to left of symbol, overhead clearance to right, dimensions in meters.	FM 5-36 (Sec IV, Ch 2) STANAG 2253 SOLOG 96
18.	Tunnel with sidewalks		Arrow extends to map location. Serial number is placed inside the symbol. The width of the travelled way followed by total width including sidewalks (in meters) is placed below the symbol. Overhead clearance is placed to the left of the symbol and total tunnel length to the right, both in meters. A question mark represents unknown information. Bypasses are shown by standard symbol notations.	FM 5-36 (Sec IV, Ch 2) DA Form 1250 STANAG 2096 STANAG 2253 SOLOG 96 SOLOG 107 SEASTAG 2096.
19.	Railroad grade crossing		Level crossing; passing trains will interrupt traffic flow. The figure indicates height, in meters of power line (if any) above the ground.	STANAG 2253 SOLOG 96
20.	Concealment		Road lined with trees; deciduous trees (left) and evergreen (right).	STANAG 2253 SOLOG 96
21.	Concealment		Woods bordering road; deciduous trees (left), evergreen trees (right).	STANAG 2253 SOLOG 96

Figure 2-3—Continued.

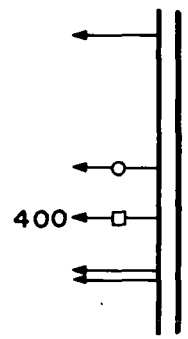
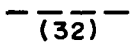
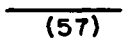
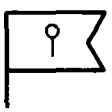
Serial No.	Explanation	Symbol	Remarks	Reference
22.	Possibility of driving off road. The symbol may be amplified as follows: a. Wheeled vehicle b. Tracked vehicle c. A length of road exceeding 1 km where driving off is possible		Arrow indicates direction of turnoff. The figure indicates the length in meters of the turnoff.	STANAG 2253 SOLOG 96
23.	Roadblock, craters, and blown bridges a. Proposed b. Prepared but passable c. Completed		Center of the symbol indicates position of block.	FM 21-30 NATO and CENTO STANAG 2019 SOLOG 28 SEASTAG 2019
24.	Lateral route		Broken lines; identified by even number.	FM 5-36 (Sec I, Ch 2) NATO and CENTO STANAG 2151
25.	Axial route		Solid line; identified by odd number.	FM 5-36 (Sec I, Ch 2) NATO and CENTO STANAG 2151
26.	Unknown or doubtful information			FM 21-30 NATO and CENTO STANAG 2019 SOLOG 28 SEASTAG 2019
27.	Parking area			FM 21-30 NATO and CENTO STANAG 2019 SOLOG 28 SEASTAG 2019
28.	Traffic control post			FM 21-30 NATO and CENTO STANAG 2019 SOLOG 28 SEASTAG 2019
29.	Traffic control headquarters			FM 21-30 NATO and CENTO STANAG 2019 SOLOG 28 SEASTAG 2019

Figure 2-3—Continued.

required. Standardized formats for both situations (figs. 2–4 and 2–5) have been developed. Although primarily designed for electrical transmissions in conjunction with standard message forms (DD Form 173 and DA Form 11–170), the formats, which are reproduced locally, may also be used to supplement overlay or map reconnaissance reports. The originator completes only those parts of the format which are applicable or for which information is available. Each item of the report, however, must be accompanied by the appropriate letter designation from the format to establish the correct category of information. Messages are preceded by the term, ROUTECLOSEDREP or ROUTEOPENREP, whichever applies, or an identifying codeword.

ROUTECLOSEDREP[a]					
Explanation	Letter designation	(1)[b]	(2)[c]	(3)[c]	(4)[c]
Map sheet(s)	ALPHA				
Date and time information was collected	BRAVO				
From grid reference (* * *)	CHARLIE				
To grid reference (* * *)	DELTA				
Reason for road closure	ECHO				
Estimated duration	FOXTROT				
Detour from grid reference (* * *) to grid reference (* * *) including if possible, military load classification of detour, width, type surface, gradual or sharp curves, and gentle or steep grades.	GOLF				
Cross-country bypass permitted for (* * *) (vehicle types and military load classification number).	HOTEL				
Additional information	INDIA				

Notes. [a]. Applicable for axial and lateral routes only.
[b]. First route in report; report by serial number if assigned.
[c]. Additional routes in report.

Figure 2–4. Route closed report.

ROUTEOPENREP[a]					
Explanation	Letter designation	(1)[b]	(2)[c]	(3)[c]	(4)[c]
Map sheet(s)	ALPHA				
Date and time route is opened	BRAVO				
From grid reference (* * *)	CHARLIE				
To grid reference (* * *)	DELTA				
Military load classification number of route	ECHO				
Minimum widths	FOXTROT				

Notes. [a]. Applicable for axial and lateral routes only.
[b]. First route in report; report by serial number if assigned.
[c]. Additional routes in report.

Figure 2–5. Route open report.

Section III. SLOPE AND RADIUS OF CURVATURE

2–15. Percent of Slope (STANAG 2253)

The rise or fall of a ground form is known as slope. Slope can be expressed as steep or gentle, but these terms are too general for reconnaissance purposes. The speed at which vehicles or personnel can move is seriously affected by the slope of the ground, and all vehicles have limitations as to the steepness of slope which can be negotiated. A more exact manner in which to describe slope, therefore, is required to indicate the effect a given slope will have on traffic flow. To meet this requirement, reconnaissance personnel compute and report the percent of slope for critical gradients. Percent of slope is the ratio of the change in elevation (vertical distance) to horizontal ground distance multiplied by 100 (fig. 2–6). Percent of slope is used to describe slopes which rise or fall. If not shown by symbol, a rising slope *in the direction of travel* is preceded by a plus (+) sign, and a fall-

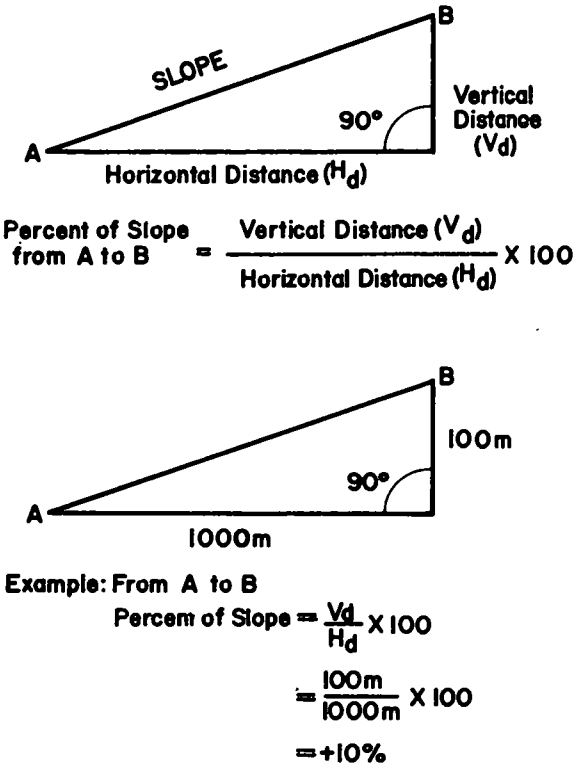


Figure 2–6. Determining percent of slope.

ing slope, by a minus (—) sign. Important to remember in computing percent of slope is that the *vertical distance and the horizontal distance must always be expressed in the same unit of measure.*

2–16. Methods for Determining Percent of Slope

a. Clinometer. An instrument for directly measuring percent of slope is known as a clinometer. This instrument is organic equipment for most engineer units.

b. Map. An approximate means of determining percent of slope is accomplished with a large scale map of the area. Once the slope has been identified on the map, the difference in elevations between the top and bottom of the slope is found by reading the elevation contours or spot elevations. Then, the horizontal distance (usually road distance) is measured and converted to the same unit of measurement as the elevation difference. The vertical distance and the horizontal distance are substituted in the percent of slope formula, and the percent of slope is computed (fig. 2–7). This method is not suitable, however, where cuts or fills have been employed to reduce the gradient of the route.

c. Line of Sight and Pace. An expedient method of estimating percent of slope is based on the line of sight of a man and the measurement of ground distance by use of the pace. The eye level of the average man is 1.75 meters (5 ft, 7 in) above the ground. The pace of the average man is .75 meter (30 in).

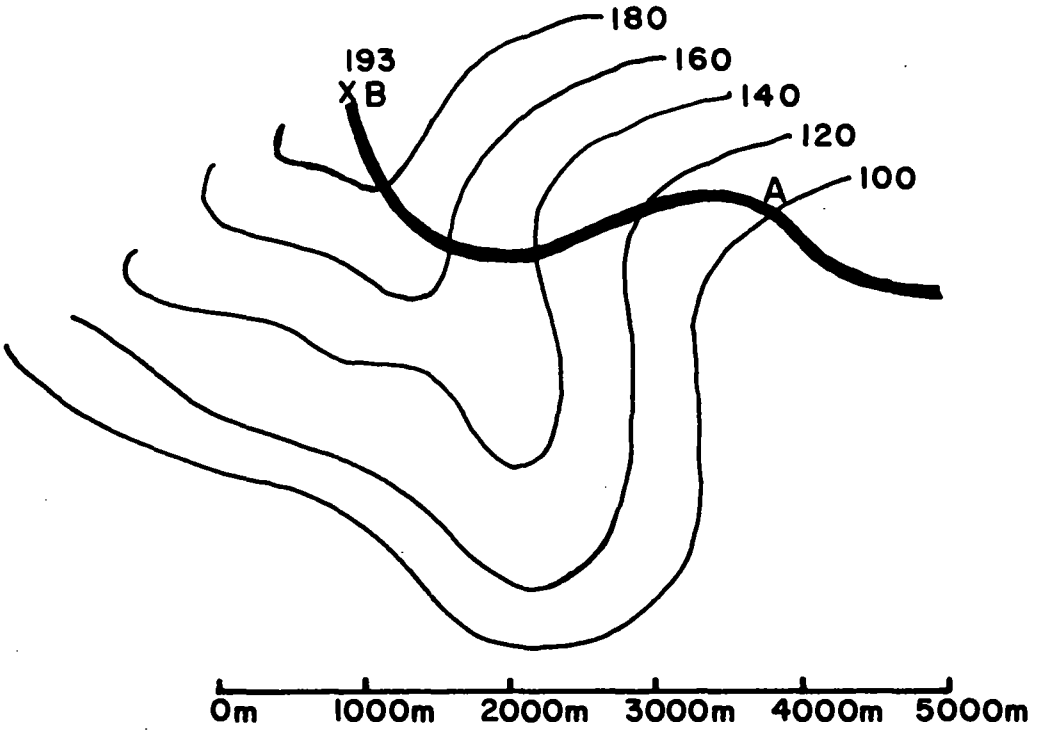
Note. These measurements should be accurately determined for each member of a reconnaissance team.

To determine percent of slope, the individual, who stands at the bottom of the slope and keeps his head and eyes level, sights on a spot up the slope. This spot should be easily identifiable or, if not, another member of the team may be sent forward to mark the location. The individual making the sighting then walks forward to the marked spot recording the number of paces. This procedure is repeated until the top of the slope is reached—fractions of an eye level height must be estimated. Vertical distance is then computed by multiplying the number of sightings by the eye level height. Horizontal distance is computed by totaling the number of paces and *converting to meters by multiplying by the factor, .75.* Percent of slope can then be calculated by substituting the values into the percent of slope formula (fig. 2–8). Because this method considers horizontal ground distance and include distance as equal, reasonable accuracy may be obtained only for slopes less than 30 degrees. Moreover, *this method requires considerable practice to achieve acceptable accuracy.*

d. Angle of Slope. Another method of determining percent of slope is to first measure the angle of slope by means of an elevation quadrant, aiming circle, M2 compass, or binoculars with standard reticle. If the instrument of angle measurement is mounted above ground level, *care must be taken that the entire angle of slope is measured;* compensation is made for a difference in height by siting above the slope a corresponding distance to that of the instrument above the ground. It is also important that angle measurement be conducted at the base of the slope. Then, by referring to table 2–2 and entering the column corresponding to the measured angle of slope, the percent of slope may be read directly (fig. 2–9).

2–17. Methods of Recording Percent of Slope (STANAG 2253 and SOLOG 96)

Most vehicles which are required to negotiate slopes of 7 percent or greater for any significant distance will be slowed down. Route reconnaissance, therefore, is required to locate such obstruc-



Find: Percent of slope along road Section A to B.

Answer:

Spot Elevation B	=	193 m
Spot Elevation A	=	100 m
Difference in Elevation (Vd)	=	93 m

Road distance A to B using a piece of paper and graphic scale (see FM 21-26) = 3720 m

$$\text{Percent of slope} = \frac{Vd}{Hd} \times 100$$

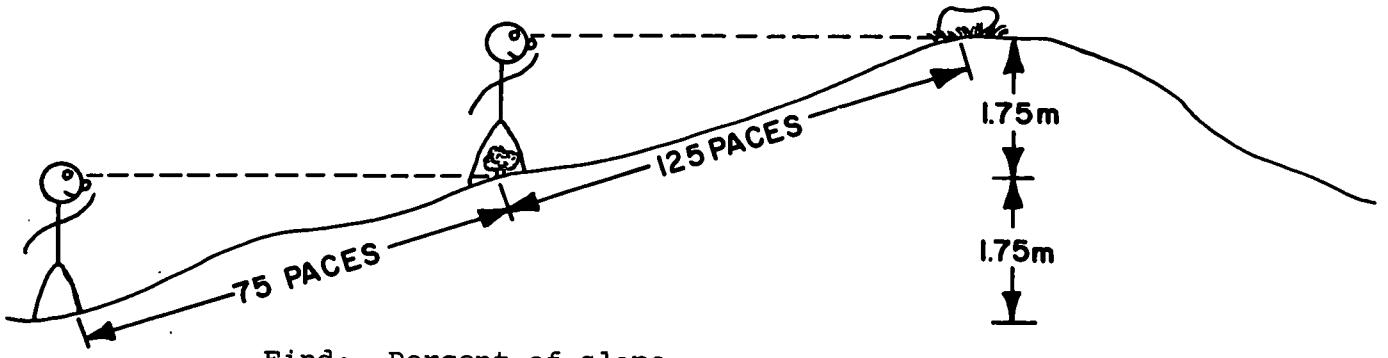
$$= \frac{93}{3720} \times 100$$

$$= + 2.5\ \%$$

NOTE: When map elevation and contour interval are stated in feet, the vertical distance must first be converted to meters (app. II).

Figure 2-7. Determining percent of slope using map method.

tions to traffic flow and to accurately report slope characteristics. Reconnaissance symbols have, consequently, been adopted to symbolically portray gradients (percent of slopes) on maps and overlays. A single headed arrow along the trace of a route pointing in the uphill direction indicates a 5 but less than 7 percent grade; two arrowheads represent a grade 7 or greater but less than 10 percent; three arrowheads represent a grade 10 or greater but less than 14 percent; and four arrowheads represent a grade 14 percent and over (fig. 2-10). The value of the grade in percent of slope



Find: Percent of slope.
Given: Eye level height = 1.75 m
Pace = .75 m

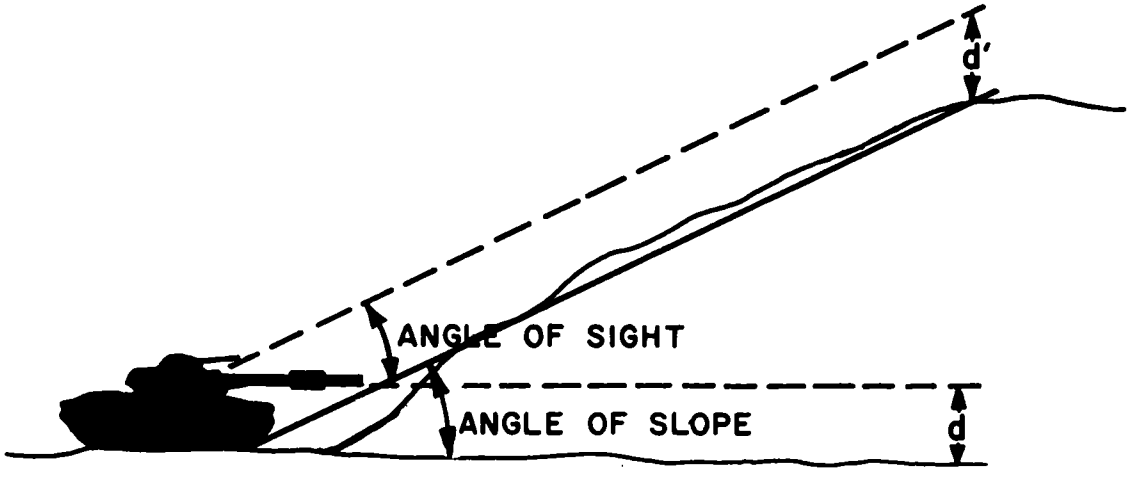
Answer: Vertical Distance = 2 x 1.75 m
= 3.50 m
Horizontal Distance = (75 paces + 125 paces) x .75
= 150 meters

$$\text{Percent of Slope} = \frac{\text{Vertical Distance (Vd)}}{\text{Horizontal Distance (Hd)}} \times 100$$

$$= \frac{3.50}{150} \times 100$$

$$= +2.34\%$$

Figure 2-8. Determining percent of slope using line of sight and pace method.



d' - equal distance above slope to that of elevation quadrant above ground as mounted inside tank.

Figure 2-9. Determining percent of slope using angle of slope.

Table 2–2. Conversion of Degrees and Mils to Percent of Slope

Degrees of Slope	Mils of Slope	Percent of Slope
1	18	1.7
2	36	3.5
3	53	5.2
4	71	7.0
5	89	8.7
10	178	17.6
15	267	26.7
20	356	36.4
25	444	46.6
30	533	57.7
35	622	70.0
40	711	83.9
45	800	100.0
50	889	108.7
55	978	117.6
60	1067	126.7

is written to the right of the arrow. Whenever the map scale permits, the length of the arrow shaft drawn to scale may represent the approximate length of the grade (fig. 2–2). It should be remembered that *slopes of 7 percent or greater are considered an obstruction to traffic flow and are indicated by the abbreviation (OB) in the route classification formula* (para 2–8).

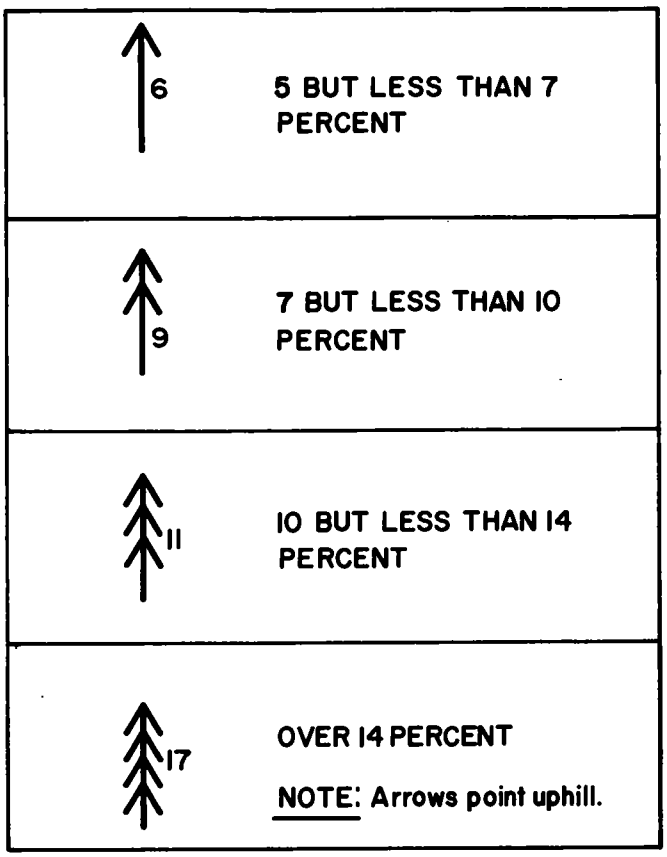


Figure 2–10. Symbolic representation of percent of slope.

2–18. Radius of Curvature

The speed at which vehicles can move along a specified route is also affected by sharp curves. For reconnaissance purposes, curves with a radius of curvature less than 30 meters (100 ft), are reported. *Curves of this nature are considered obstructions to traffic flow and are indicated by the abbreviation (OB) in the route classification formula* (para 2–8).

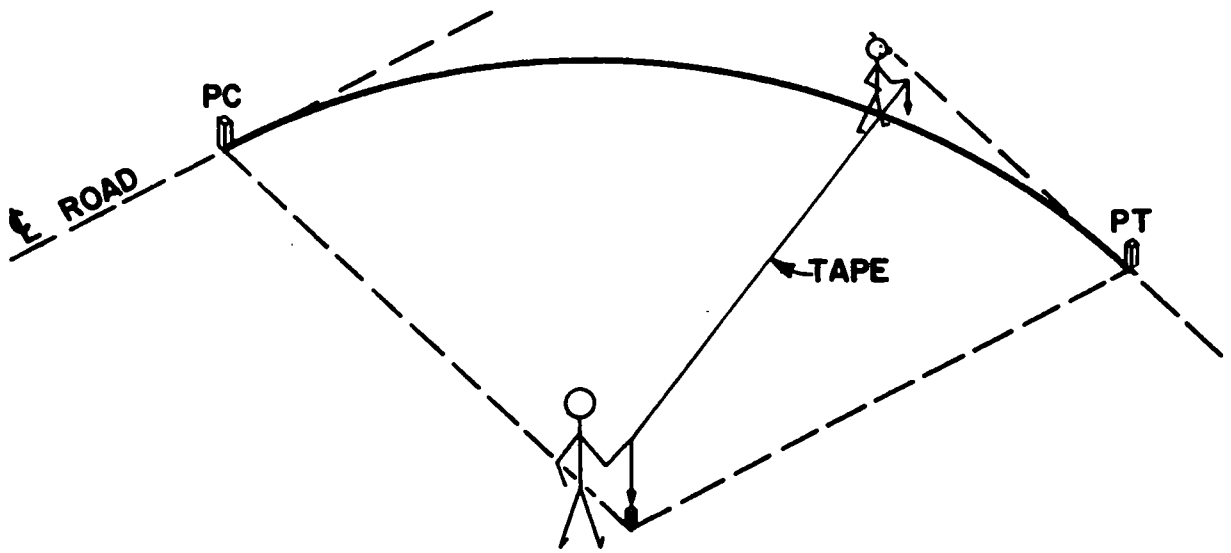


Figure 2–11. Radius of curvature by using tape.

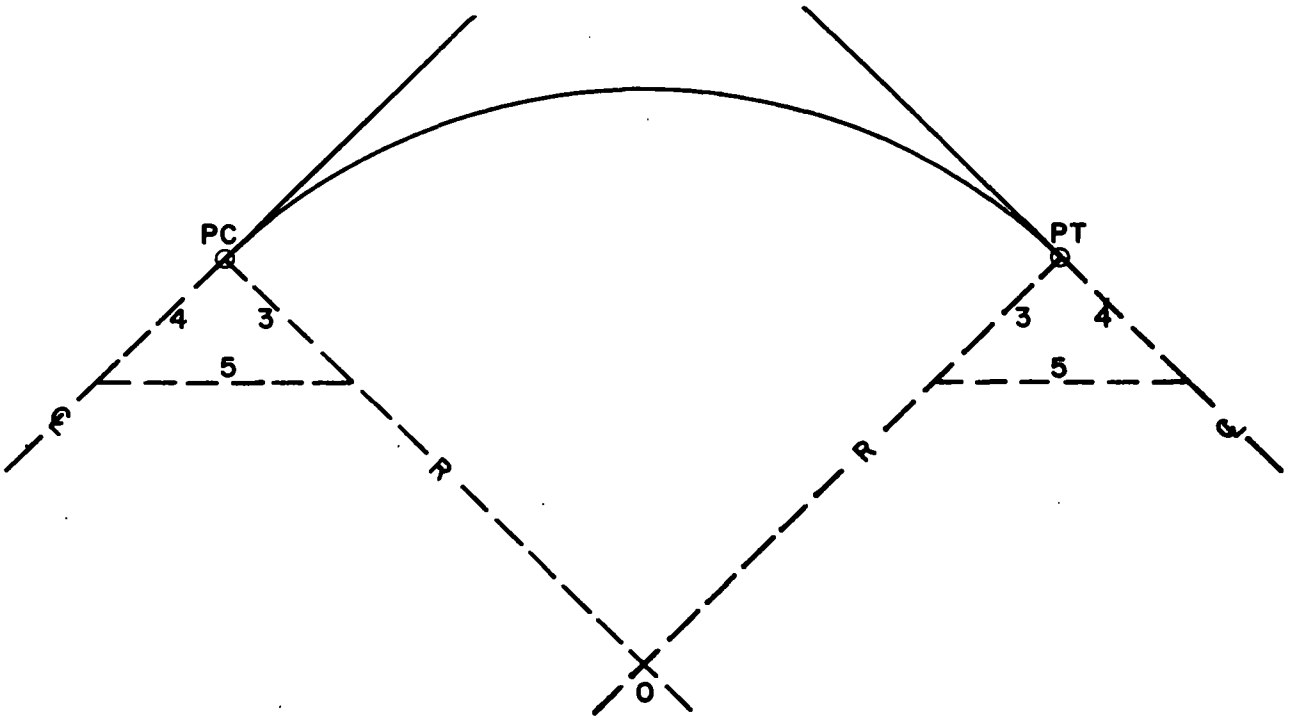


Figure 2–12. Radius of curvature by locating center of circle.

2–19. Methods of Measuring Curves

a. The radius of a very sharp curve may be estimated by using a tape to swing an arc as illustrated in figure 2–11. The curve is inscribed as a part of a circle by swinging an arc with tracing tape from the experimentally located center of a circle. The length of the tape from the center of the circle to its circumference is the radius of the curve. This method is practical for curves having a radius up to 15 meters and located on relatively level ground.

Note. In figures 2–11, 2–12, and 2–13: C = centerline; PC = point of curvature; and PT = point of tangency.

b. Another method for determining the approximate radius of a curve is by laying out right triangles (3:4:5 proportion) at the PC and PT locations as shown in figure 2–12. The intersection, O, formed by extending the base legs of each triangle, represents the center of a circle. Therefore, the distance R from point O to either point PC or PT represents the curve radius.

c. Another method for determining the radius of a curve (fig. 2–13) is based on the formula—

$$R = c^2/8m + m/2$$

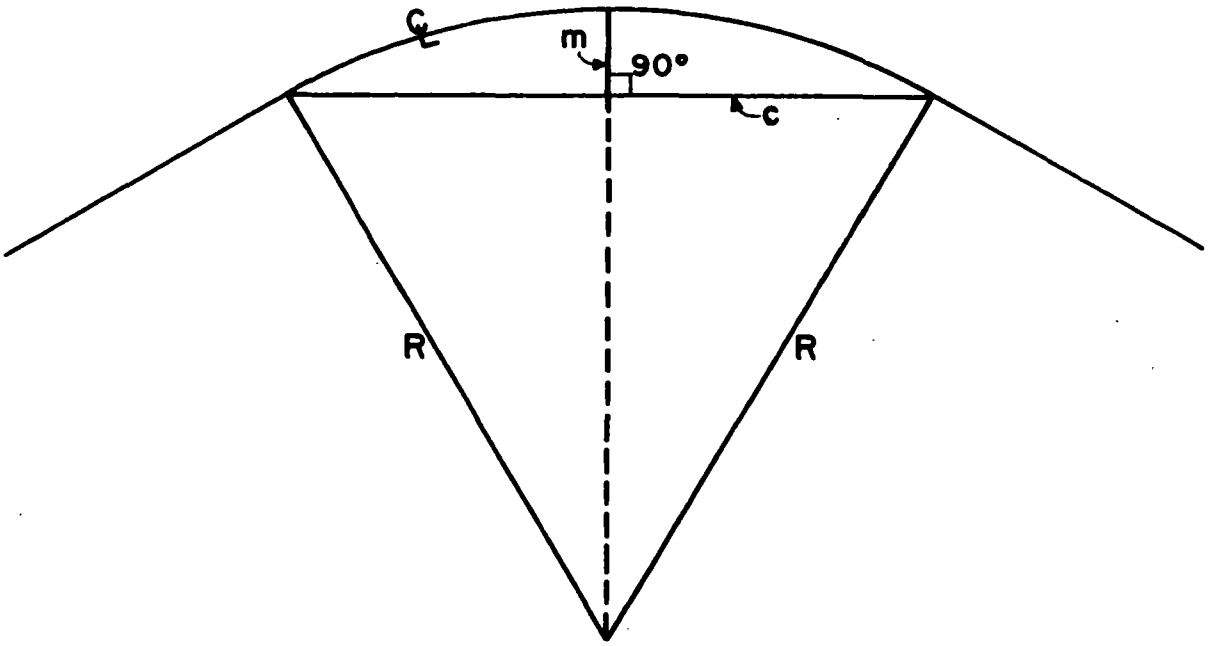
c = length of tape

m = perpendicular distance from the center of tape to the centerline (℄) of road

r = radius of the circle

By fixing m always at 2 meters, the formula becomes—

$$R = c^2/16 + 1$$



In the practical application of the formula, m is measured from the centerline of the curve toward the estimated center of the circle and c is measured perpendicularly to m, making sure that m is at the mid-point of c. For example: If c is measured to be 15 meters and m equals 2 meters, then:

$$R = c^2/8m + m/2$$

substituting $m = 2$

$$R = c^2/16 + 1$$

substituting $c = 15$

$$R = \frac{(15)^2}{16} + 1$$

$$R = 15 \text{ meters}$$

NOTE: When m is equal to 2 meters and R is equal to 30 meters, c equals 21.7 meters. Thus, when measuring c and retaining m fixed at 2 meters, any value greater than 21.7 meters will give a value of R greater than 30 meters, and the curve need not be reported.

Figure 2–13. Radius of curvature by using formula.

2–20. Methods of Recording Radius of Curvature (STANAG 2253 and SOLOG 96)

Sharp curves along a specified route whose radius is less than 30 meters (100 ft) are symbolically represented on maps or overlays by means of a triangle whose vertex points to the exact map location of the curve. In addition, the measured value in meters for the radius of curvature is written next to the triangle (A, fig. 2–14). A series of sharp curves is represented by two triangles, one inscribed within the other. The vertex of the outer triangle points to the location of the first curve. The number of curves and the radius of curvature of the sharpest curve of the series are written next to the triangles (B, fig. 2–14).

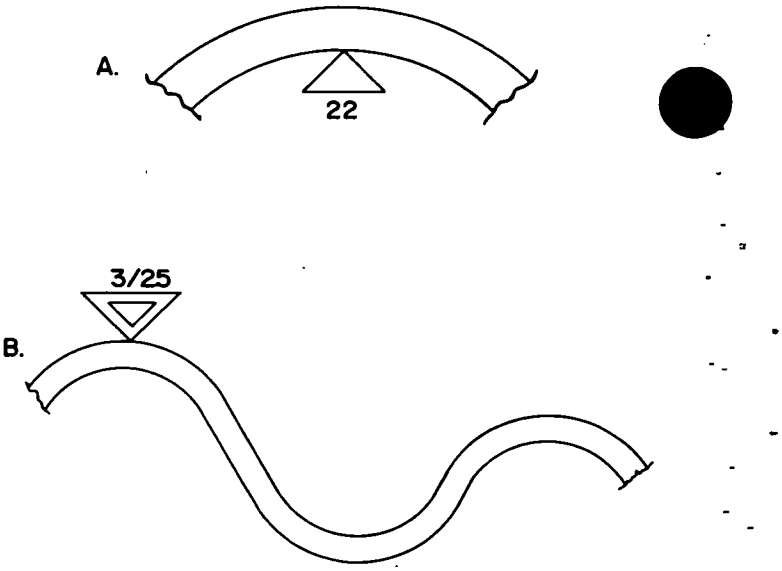


Figure 2–14. Symbolic representation of curves on route.

Section IV. TUNNELS, UNDERPASSES, AND SIMILAR OBSTRUCTIONS

2–21. General (STANAG 2253 and SOLOG 96)

Obstructions to traffic flow which limit the physical dimensions of vehicles utilizing a specific route are also important aspects of route reconnaissance. Reductions in traveled way widths, such as narrow streets in built-up areas, drainage ditches, embankments, and war damage, limit vehicular movement. Moreover, underpasses and other covered traveled ways may restrict traffic flow not only as to width but also as to height.

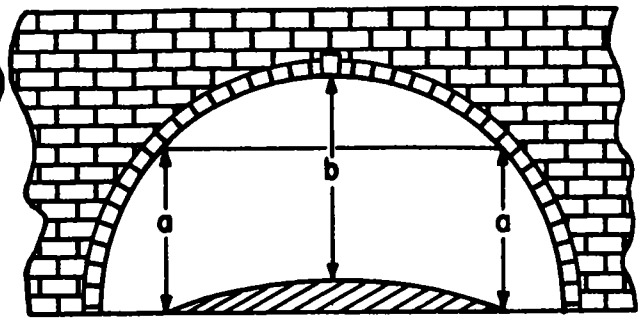
a. Widths. Reduction of traveled way widths below the minimum standards for the type and low of traffic under consideration (table 2–1) are obstructions and are indicated by the symbol (OB) in the route classification formula (para 2–8).

b. Overhead Clearance. Particular care is required in measuring overhead clearances. Overhead clearance is defined as the *least distance between the surface of traveled way and any obstruction vertically above it.* Reconnaissance personnel must, therefore, insure that measurement us made of the minimum clearance as based on careful analysis of each individual structure. Overhead clearance is influenced by the crown of the traveled way, the design of the overhead ceiling, and the percent of slope of the approaches (fig. 2–15). Overhead clearance less than 4.3 meters (14 ft) is considered an obstruction to traffic flow and is indicated by the symbol (OB) in the route classification formula (para 2–8).

2–22. Reconnaissance Symbols for Route Constrictions

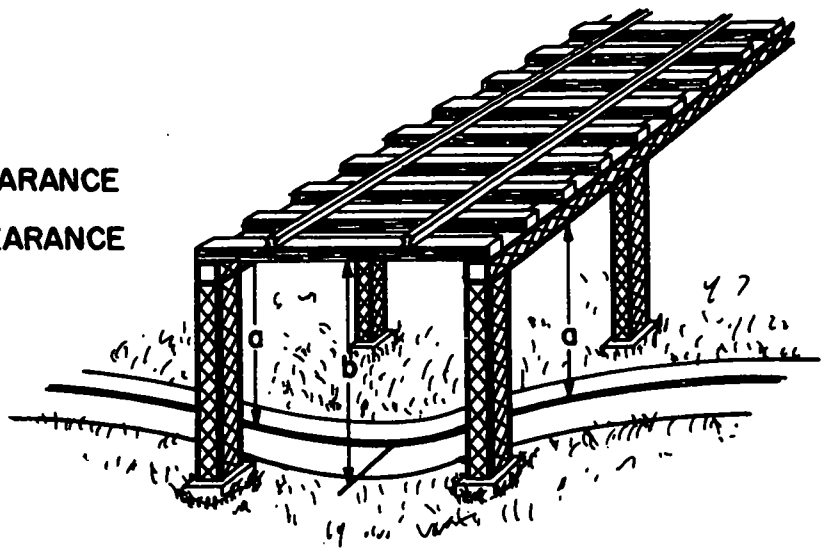
a. Widths. Constrictions in the traveled way width below minimum requirements (table 2–1) are depicted on maps and overlays by two opposing shaded triangles with the width of the usable traveled way in meters written next to the left triangle and the length of the constriction in meters written next to the right triangle (a, fig. 2–16).

b. Underpasses. An underpass is symbolically portrayed on maps and overlays by a figure which typifies the structure's ceiling and is drawn superimposed over the route at the map location. To the left of the constriction symbol is written the width in meters, and to the right, the overhead clearance in meters (b, c, and d, fig. 2–16). If sidewalks permit emergency passage of wider vehicles, the sidewalks are symbolically represented; and the width of the traveled way is first written followed by a slash and the total width including sidewalks of the structure (d, fig. 2–16). Reconnaissance personnel should note, however, that in structures with arched ceilings, an extension of the width does not necessarily mean that the structure will accommodate wider vehicles because of a resulting decrease in overhead clearance. Both minimum



a - MINIMUM OVERHEAD CLEARANCE

b - MAXIMUM OVERHEAD CLEARANCE



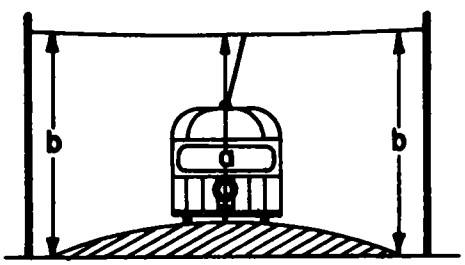


Figure 2–15. Measurement of overhead clearances.

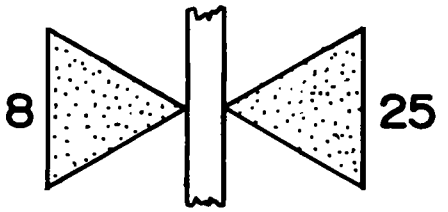
and maximum overhead clearances, if different, will be given.

2–23. Route Constriction Reports

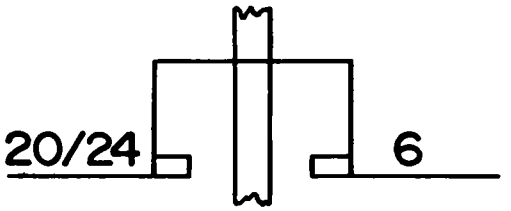
If additional information is required concerning a traffic constriction which cannot be adequately portrayed by symbols, the TUNNELREP (para 2–28) or the Tunnel Reconnaissance Report Form (DA Form 1250), whichever is more appropriate, may be modified and employed.

2–24. Marking of Route Constrictions

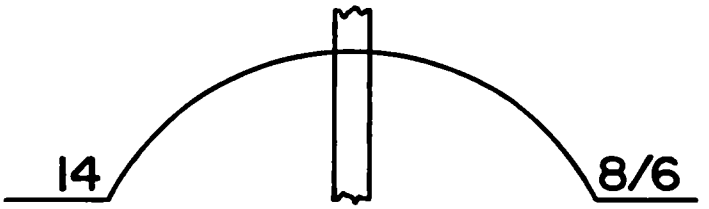
Traffic control information and technical limitations are posted when necessary. Signs are either rectangular in shape and conform to the military specifications outlined in paragraph 2–52 or con-



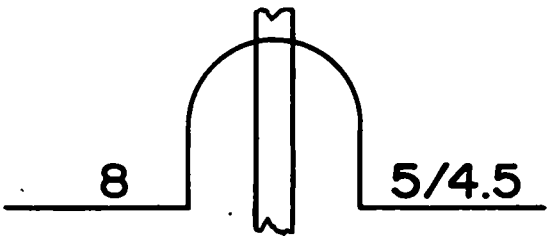
a. Width constriction of 8 meters for a distance of 25 meters.



b. Underpass with sidewalks, traveled way width 20 meters, total width 24 meters, and overhead clearance 6 meters.



c. Arch constriction, traveled way width 14 meters, and overhead clearance 8 meters maximum, 6 meters minimum.



d. Underpass with arched ceiling, width 8 meters, overhead clearance 5 meters maximum, 4.5 meters minimum.

Figure 2-16. Route constrictions.

form to the Geneva Convention (fig. 5–1). Tell-tales indicating overhead clearance restrictions may also be employed (see fig. 2–44).

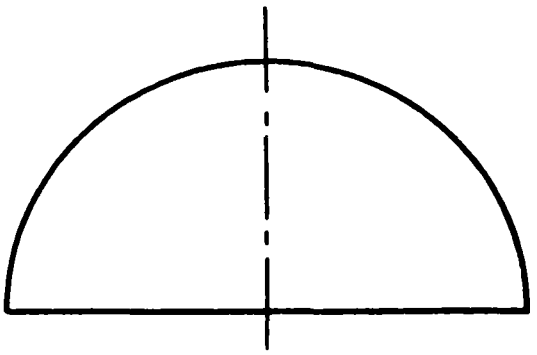
2–25. Tunnel Reconnaissance (STANAG 2253 and SOLOG 96)

a. A tunnel is defined as an underground gallery or section of a road which has been artificially covered (for example, a snowshed) for the passage of a route.

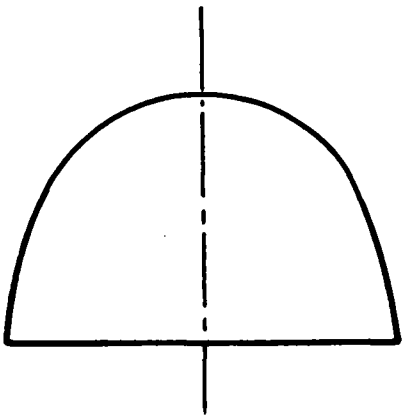
b. Tunnel reconnaissance determines essential information such as serial number, location, type, length, width including sidewalks, bypasses, alinement, gradient, and cross-section.

2–26. Types of Tunnels

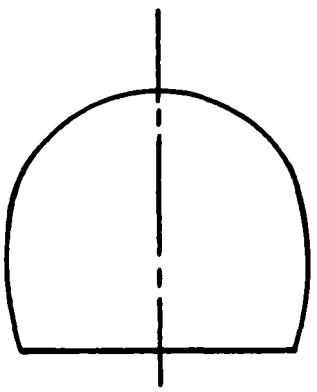
A tunnel consists of a bore, a tunnel liner, and a portal. Common shapes of tunnel bores (fig. 2–17) are semicircular, ellipitcal, horseshoe, and square with arched ceiling. Tunnels may be unlined (fig. 2–18), masonry lined (fig. 2–19), or concrete lined (fig. 2–20). Portals may be constructed of ma-



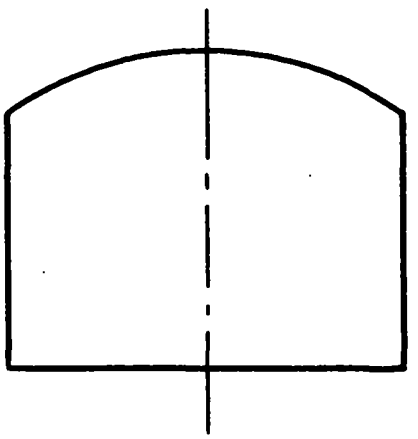
SEMI-CIRCULAR



ELLIPTICAL



HORSE-SHOE



SQUARE WITH ARCHED CEILING

Figure 2–17. Common types of tunnel bores or cross-sections.

Figure 2–18. Typical unlined tunnel.

sonry (fig. 2–21) or of concrete (fig. 2–22). Alinement of tunnels may be straight (fig. 2–23) or curved (fig. 2–24).

2–27. Tunnel Reconnaissance Symbol (STANAG 2253 and SOLOG 96)

Limited tunnel information is recorded on maps or overlays by means of symbols as illustrated in figure 2–25.

a. The geographic *location* of the tunnel entrance is shown by an arrow from the symbol to the location of the entrance on a map or overlay. For long tunnels both tunnel entrance locations are indicated.

b. A serial number is assigned each tunnel for ease in subsequent reference. Serial numbers must not be duplicated within any one map sheet, overlay, or document. The number is recorded inside the symbol.

c. The *length* of the tunnel is shown in meters and is placed to the right of the symbol.

d. The *width* of the traveled way is shown in meters and is placed below the symbol. If sidewalks permit the emergency passage of wider vehicles, the sidewalks are symbolically represented and the width of the traveled way is first written followed by a slash and the total width including sidewalks. Reconnaissance personnel should note, however, that in structures with arched ceilings, an extension of the width does not necessarily mean that the structure will accommodate wider vehicles because of a resulting decrease in overhead clearance.

e. Overhead clearance is shown in meters to the left of the symbol.

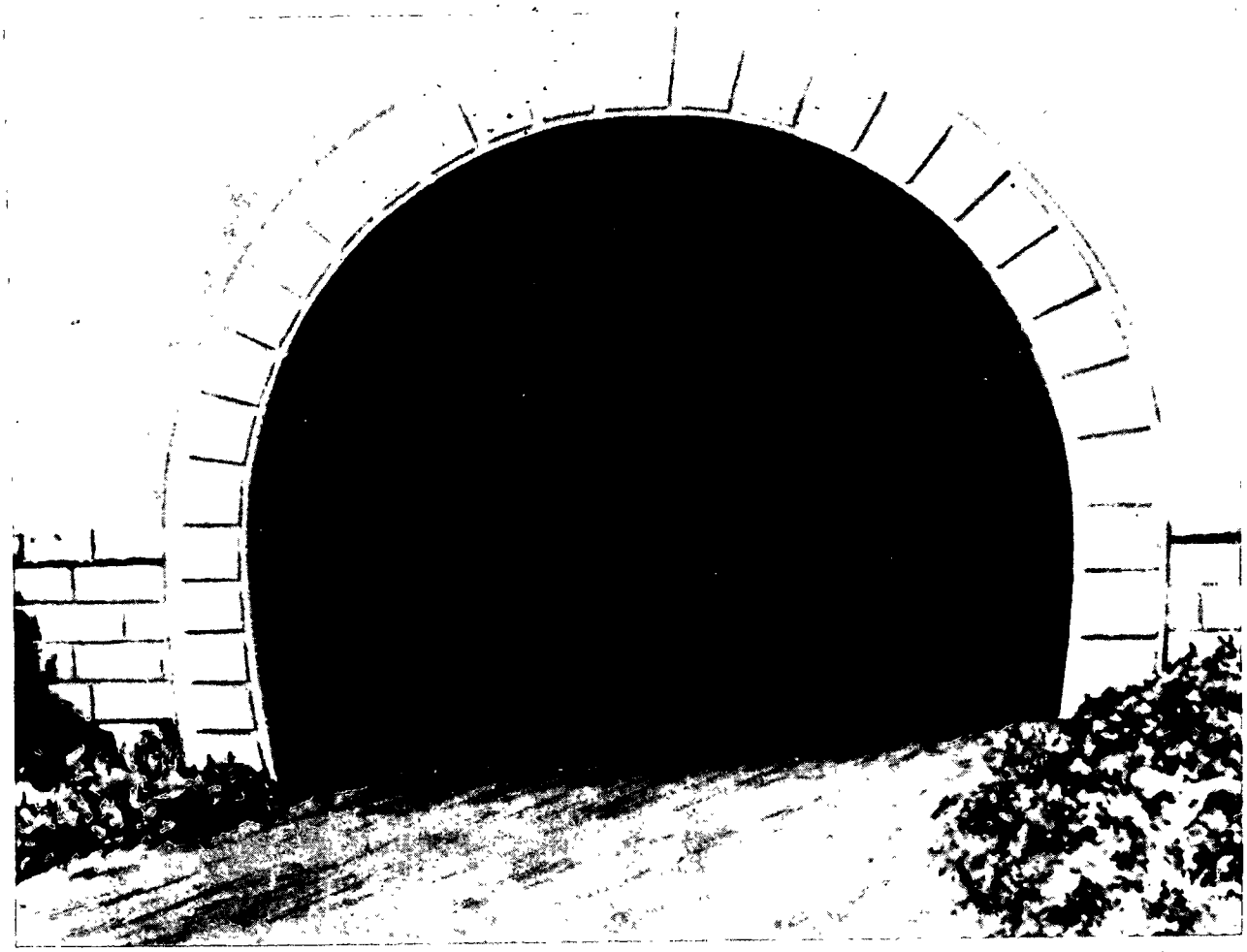


Figure 2–19. Typical masonry-lined tunnel.

f. Bypass possibilities are symbolically indicated on the line extending from the tunnel symbol to the map location using conventional reconnaissance symbols (see para 2–61*g*).

2–28. Format for Electrically Transmitting Tunnel Information (STANAG 2096, SOLOG 107, and SEASTAG 2096)

To provide standardization in reporting essential tunnel reconnaissance data by electrical means, the format shown in figure 2–26 has been adopted. Although primarily designed for electrical transmissions in conjunction with standard message forms (DD Form 173 and DA Form 11–170), the format, which is reproduced locally, may also be used to supplement written route reconnaissance reports especially when more detailed information is required. The originator completes only those parts of the format which are applicable or for which information is available. Each item of the report, however, must be accompanied by the appropriate letter designation from the format to establish the correct category of information. Messages are preceded by the term, TUNNELREP, or identifying codeword.

2–29. Tunnel Reconnaissance Report Form

DA Form 1250 (fig. 2–27) (Tunnel Reconnaissance Report), may be used to report detailed tunnel information and is more commonly used in deliberate reconnaissance. Short forms or worksheets for field work may be designed and produced by the unit making the reconnaissance. Information is entered on the tunnel reconnaissance report form as follows:

a. Identification (items 1–11). Enter all information which establishes positive identification of the tunnel by route number, route location, map series and sheet number, grid reference, tunnel number, type of tunnel, and geographic reference name.

b. Dimensions (items 12–17). Enter overall tunnel dimensions as indicated in figure 2–28. This

Figure 2–20. Typical concrete-lined tunnel.

applies also to tunnels which branch off the main tunnel.

c. Specifications (items 18–21). Enter the type of lining material, type of portal material, type of ventilation, and drainage means. Under item 21, also record any lighting facilities available; if none, so state.

d. Special Considerations (items 22–29). Enter here whether the tunnel is chambered for demolition, the date of completion of the tunnel, and its present condition. Enter also bypass possibilities; the gradient and passability of approaches; in-tunnel restrictions; and any geological information pertinent to maintenance, improvement, or safety.

e. Sketches (items 30–32). Draw a plan and profile, a portal view, and a cross-section of the bore.

(1) The plan includes geographic positioning of the tunnel, approach routes, and terrain features in the immediate area of the tunnel with emphasis on special features which affect possible bypasses. Tunnel alinement is shown including straight sections, angles, and curves. The profile shows the gradient to and from the tunnel, the gradient of the tunnel floor (designating any change in grade), and the relation of the tunnel to the terrain through which it passes.

(2) The portal view shows the mouth of the tunnel, the material of which it is constructed, and its position in relation to the surrounding terrain.

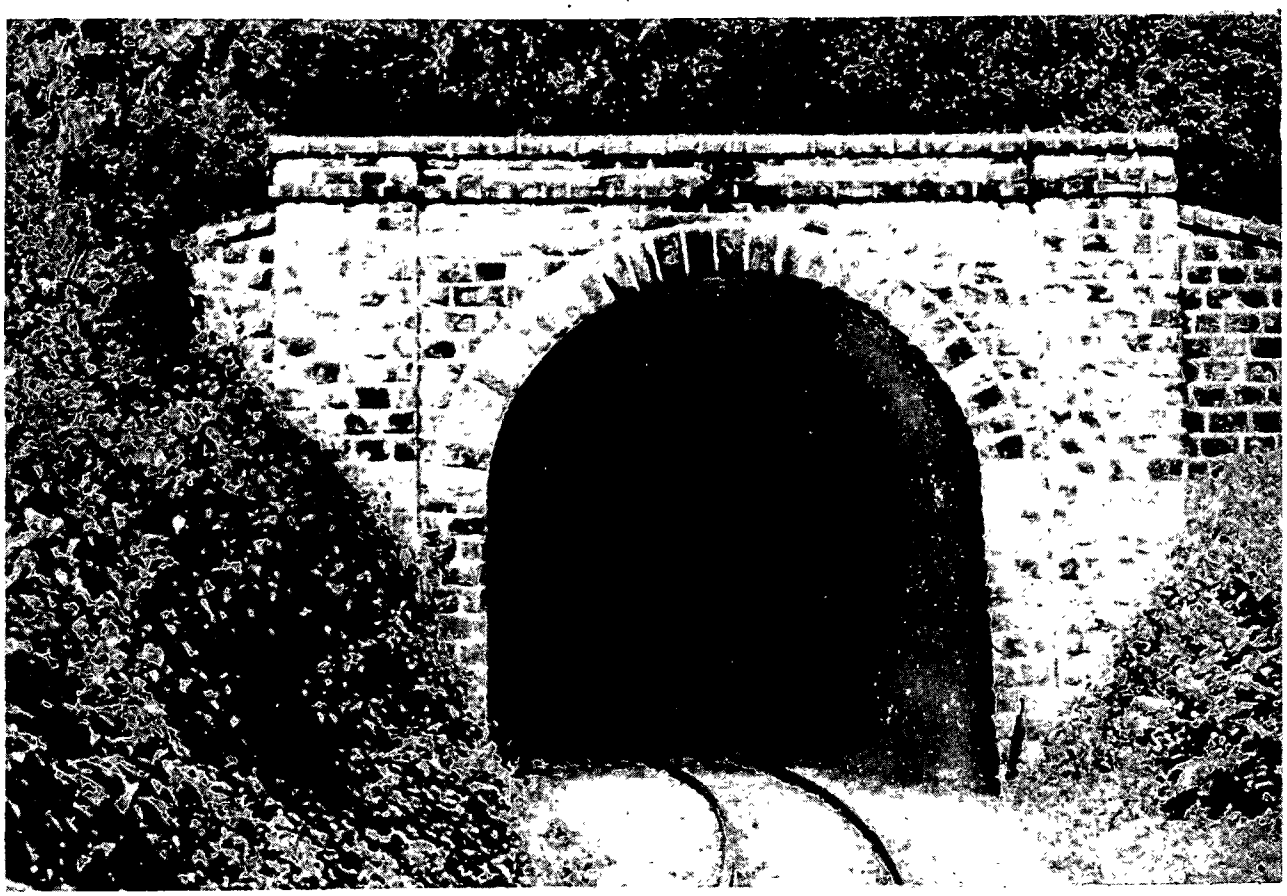


Figure 2–21. Typical masonry portal.

It further shows a limited section of the approach route.

(3) The cross-section of the tunnel bore shows detailed information regarding the allowable traffic width, the shape of the bore as it may affect load heights and widths, and possible man-made or natural obstructions.

f. Remarks (item 33). Include here any pertinent information not mentioned above and attach appropriate photographs if available.

Figure 2–22. Typical concrete portal.

Figure 2–23. Tunnel with straight horizontal alinement.

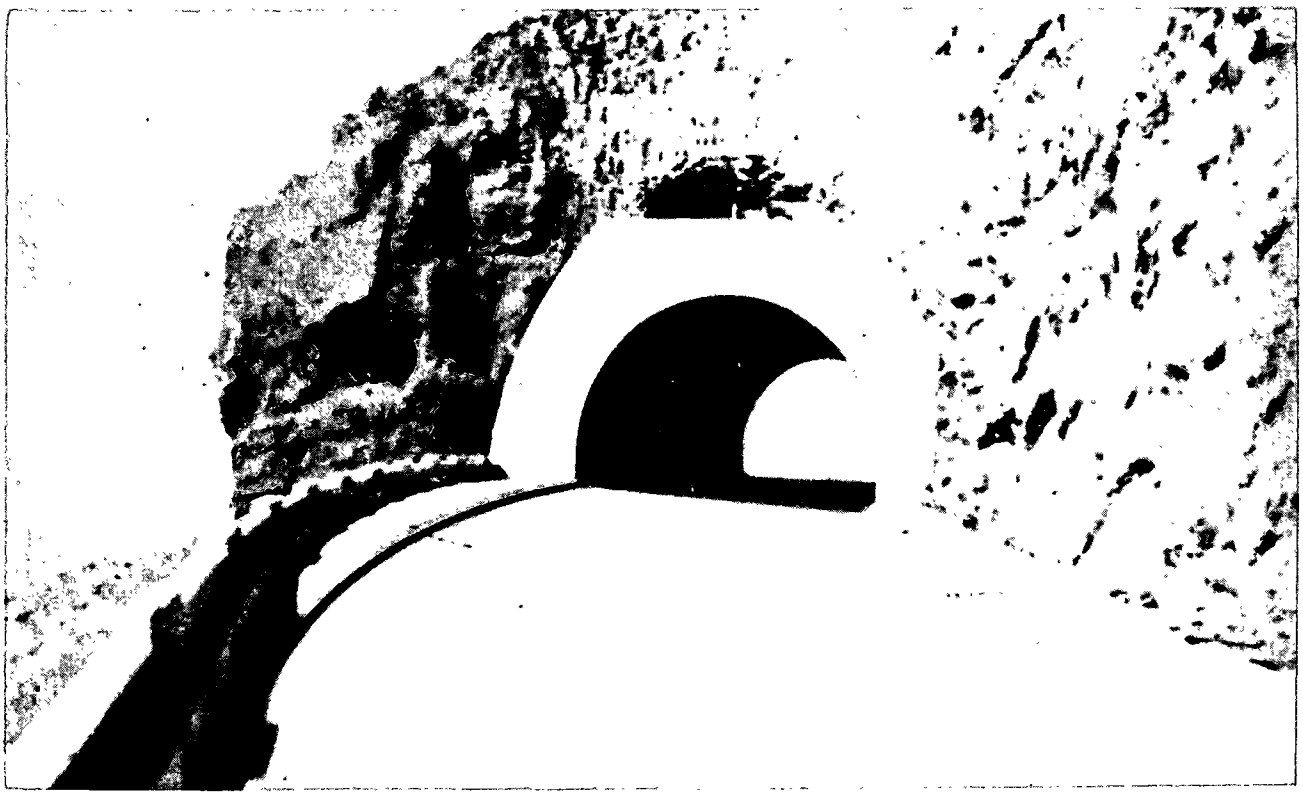
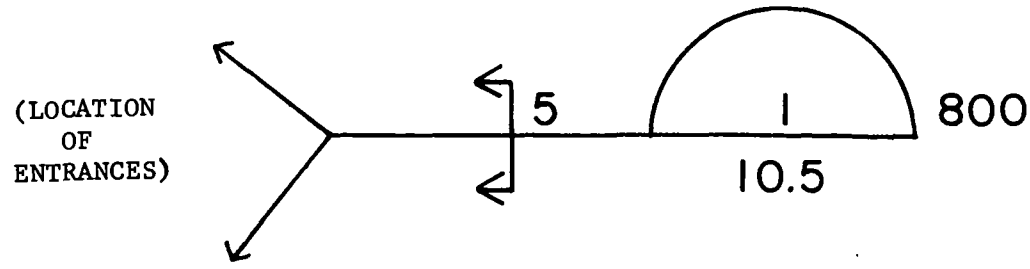
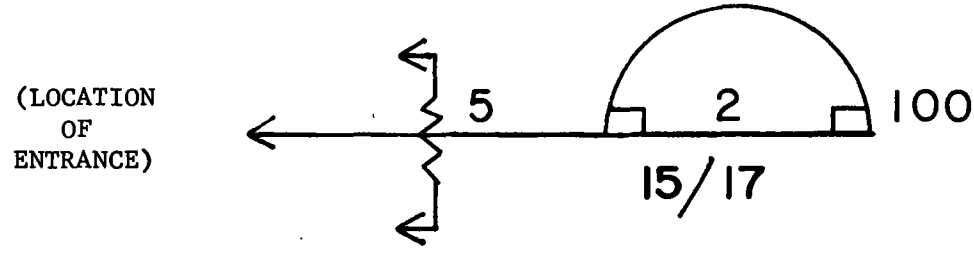


Figure 2–24. Tunnel with curved horizontal alinement.



a. Tunnel number 1, 5 meters overhead clearance, 10.5 meters width of traveled way, 800 meters length, and easy bypass available.



b. Tunnel number 2, 5 meters overhead clearance, 15 meters width of traveled way, 17 meters total width including sidewalks, 100 meters in length, and difficult bypass available.

Figure 2-25. Tunnel reconnaissance symbols.

TUNNELREP					
Explanation	Letter designation	(1)[a]	(2)[b]	(3)[b]	(4)[b]
Map sheet(s)	ALPHA				
Date and time information was collected	BRAVO				
Location (UTM grid coordinates)	CHARLIE				
Length	DELTA				
Width	ECHO				
Overhead clearance	FOXTROT				
Gradient (percent of slope)	GOLF				
Type of tunnel	HOTEL				
Condition	INDIA				
Bypasses	JULIET				
Other information	KILO				

Notes. [a]. First tunnel in report; report by serial number if assigned.
[b]. Additional tunnels in report.

Figure 2-26. Tunnel report format.

TUNNEL RECONNAISSANCE REPORT (FM 5-36)

DATE: 14 JUNE 1964

TO: (Headquarters ordering reconnaissance): COMMANDING OFFICER, ATTN: S2; 21ST ENGR BN (21ST INF DIV)

FROM: (Name, grade and unit of reconnaissance officer): JOHN H. DOE 1/LT CO A 21ST ENGR BN

1. ROUTE OR LINE		2. FROM (Initial Point)	3. TO (Terminal Point)	4. DATE/TIME (Of signature)
HIGHWAY: VA 617	RAILROAD: N/A	UT 122864	UT 097899	14 1800 JUN 64

5. MAP SERIES NR	6. SHEET NUMBER	7. GRID REFERENCE		8. TUNNEL NUMBER
		TYPE	COORDINATES	
V 734	5561-III	UTM 1:50,000	UT 098888	T-1

9. LOCATION FROM NEAREST TOWN			10. TYPE (Subaqueous, Rock, Soil)
DISTANCE	DIRECTION	NAME OF NEAREST TOWN	
10.0 Km	NORTHWEST	FT BELVOIR, VIRGINIA	ROCK

11. NAME (Mountain or Water feature)	12. LENGTH	13. NUMBER OF TRACKS	14. ROADWAY WIDTH
ACCOTINK MTS.	100 m	N/A	7.5 m

15. CLEARANCE		16. GRADE (Percent)	17. ALINEMENT (Straight or radius of curve)
VERTICAL	HORIZONTAL		
6.0 m	8.0 m	3%	STRAIGHT

18. LINING (Material)	19. PORTALS (Material)	20. VENTILATION (Type)
CONCRETE	STONE	NATURAL

21. DRAINAGE: EXCELLENT

22. CHAMBERED FOR DEMOLITION	23. COMPLETED (Year)	24. CONDITION (Check appropriate box)
☐ YES ☑ NO	1908	☐ EXCELLENT ☑ GOOD ☐ FAIR ☐ POOR

25. BYPASSABILITY: EASY

26. ALTERNATE CROSSING: BACKLICK ROAD TO SHIRLEY HWY

27. APPROACHES: FAIR (4%)

28. IN-TUNNEL RESTRICTIONS: NONE

29. GEOLOGIC DATA: LIMESTONE

DA FORM 1 JAN 68 1250

Figure 2–27. Tunnel reconnaissance report (DA Form 1250).

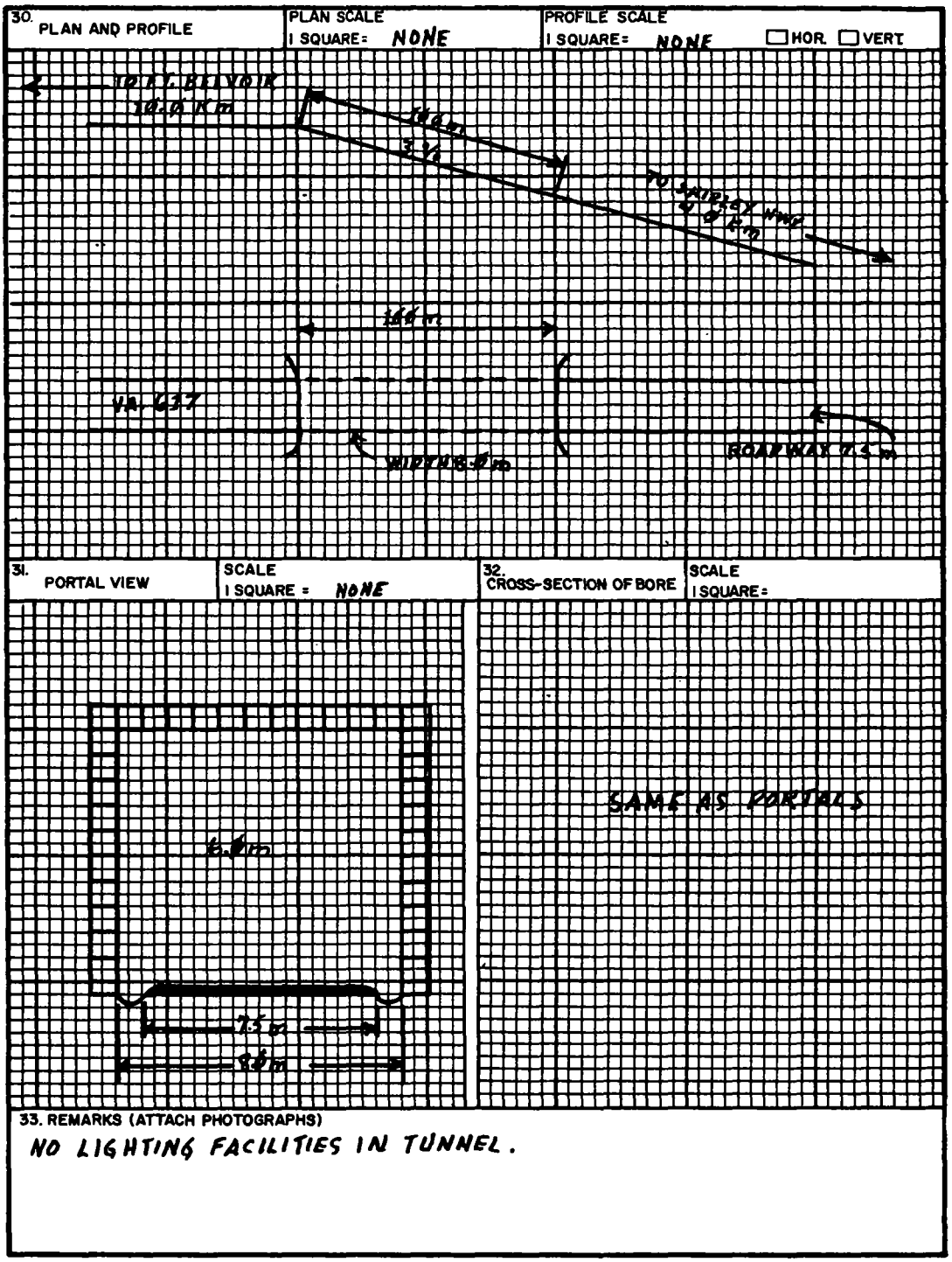
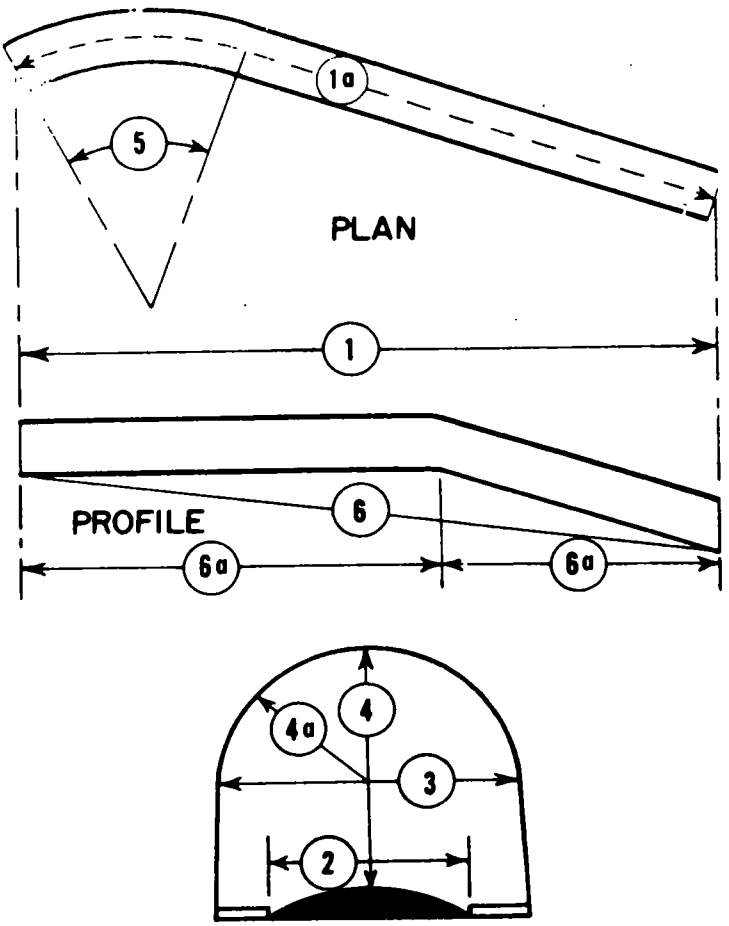


Figure 2–27—Continued.



1. Portal-to-portal length of tunnel.
1a. Centerline distance of tunnel.
2. Effective width of the traveled way, curb-to-curb.
3. Horizontal clearance, is the minimum width of the tunnel bore measured at least four feet above the traveled way.
4. Overhead clearance, is the minimum distance between the top of the traveled way and the lower edge of the tunnel ceiling or any obstruction below the ceiling, such as trolley wires or electric light wires.
4a. Rise of tunnel arch (radius of curved portion).
5. Radius of curvature of the traveled way either measured or estimated.
6. Gradient is the percentage of rise of the traveled way between portals.
6a. Change in gradient within the tunnel (percentage of rise each way from break of grade).

Figure 2–28. Standard dimensional data for tunnels.

Section V. VEHICULAR FORDING, SWIMMING, AND FERRYING OPERATIONS

2–30. General

Modern military vehicles and equipment provide the commander with increased capabilities to conduct vehicular fording, swimming, and ferrying operations. Mass destruction weapons demand dispersion and the reduction of obstructions to traffic which create lucrative targets. It can be expected, therefore, that the employment of the inherent stream crossing characteristics of modern military vehicles will become increasingly more common. Reconnaissance personnel will be required to locate and accurately report suitable stream crossing sites. Considerations of terrain common to fording, swimming, and ferrying operations are: depth of stream, width of stream, approaches to the stream, entrances and exits to the stream, stream velocities, and natural and manmade obstacles (fig. 2–29). *Fords and ferries are considered as obstructions to traffic flow and are indicated by the abbreviation (OB) in the route classification formula* (para 2–8).

2–31. Determining Depth of Stream

Field expedients are usually required such as measured poles or weighted ropes for determining depths. Depth readings are normally taken every three meters. A sluggish stream or river may become a torrent in a few hours or even minutes as a result of sudden heavy rainfall. This is particularly true in tropical and arid regions. Therefore, depths and currents must be checked at frequent intervals to provide warning of such changes. Additional factors which require consideration are upstream locks or dams which may cause floods when opened or destroyed thus temporarily disrupting crossing.

2–32. Determining Stream Width

a. Using a Compass (fig. 2–30). From a point on the near shore and close to the water's edge, the azimuth to a point on the opposite shore is taken and recorded. *Another* point on line at a right angle to the azimuth selected is established on the near shore from which the azimuth to the same point on the far shore is 45° (800 mils) at variance with the previously recorded azimuth. The distance between the two points on the near shore is measured; this distance is equal to the distance across the stream.

b. Using a Surveying Instrument (fig. 2–31).

(1) *Trigonometric relationships.* Using a transit, aiming circle, azimuth indicator, or alidade, the angle between two points a known distance apart on the near shore and a third point directly across the river from one of these points is measured. The distance across the stream is computed using trigonometric relationships (app B and TM 5–232).

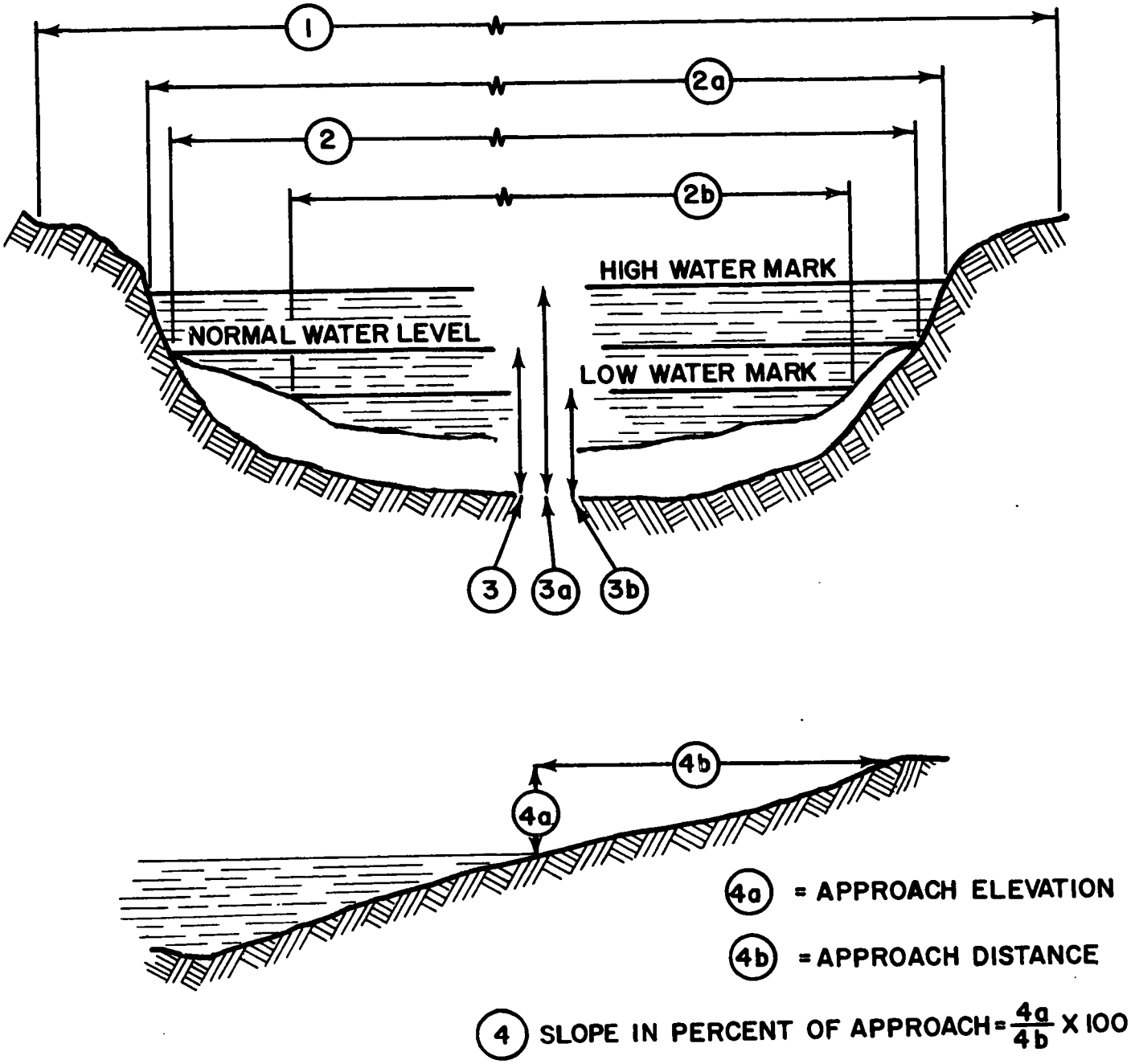
(2) *Using stadia formula.* A man is sent across the stream with either a stadia rod or range pole. Using either a transit or level, the intercept between the stadia hairs is determined and the distance computed using the stadia formula as described in TM 5–232.

c. Short Gaps. In the measurement of short gaps, one member of the reconnaissance team holds an end of a tape or rope on the near bank. Another member of the team crosses to the opposite bank and pulls the tape tight. The length of tape which corresponds to the distance across the gap is then measured. This method is particularly useful during darkness when lights are prohibited. The width of the gap may be indicated on the tape and measured later in an area where lights may be used.

2–33. Determining Stream Velocity

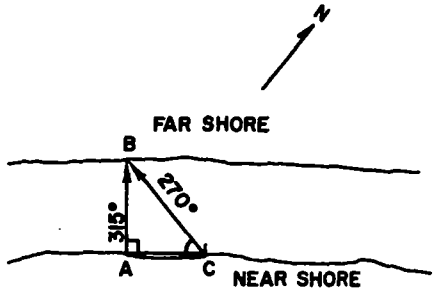
Current velocities vary in different parts of a stream. In general, the current is usually slower near the shore and swifter in the main channel; similarly, the current is slower as the stream widens. To determine the velocity of a stream, a distance is measured along the riverbank. A light object which floats is thrown into the stream, and the time the object requires to float the measured distance is recorded. This procedure is then repeated several times. The average time of the tests is then used in the following formula to determine stream velocity (fig. 2–32):

$$\frac{\text{Measured Distance in Meters (Ft)}}{\text{Average Time in Seconds}} = \text{Stream velocity in meters (ft) per second}$$



1. The width of stream bed from bank to bank.
2. The actual width of the water measured at normal stage. In addition, maximum width 2a and minimum width 2b are estimated, based on local observations or records of high water and low water, and then recorded.
3. The actual depth of the stream at normal water level.
3a. Estimated maximum water depth based on local observations or records.
3b. Estimated minimum water depth based on local observations or records.
4. The slope of the approaches is the slope of the stream banks through which the approach roads are cut.

Figure 2-29. Standard dimensional data for streams.



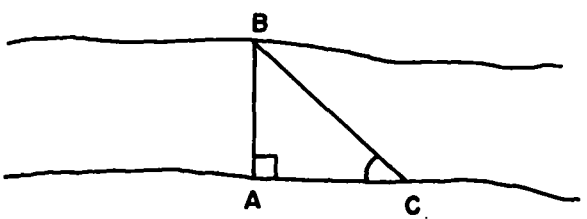
A IS THE POINT ON THE NEAR SHORE
B IS THE POINT ON THE FAR SHORE
AB IS THE DISTANCE TO BE MEASURED
AZIMUTH OF LINE AB IS 315°
AZIMUTH OF LINE CB IS 270°
DIFFERENCE BETWEEN AZIMUTH AB & AZIMUTH CB=45°
DISTANCE ALONG AC EQUALS DISTANCE ALONG AB

Figure 2–30. Measuring stream width with compass.

Once the stream velocity in meters (ft) per second has been determined, this figure may be converted to other units of measurements by using the appropriate conversion factor (see app B).

2–34. Entrances and Exits

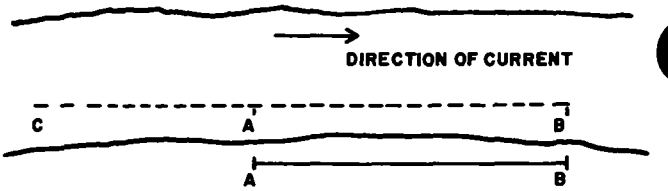
Gentle sloping entrances and exits are desirable for fording and swimming operations. Slope is expressed in percent as described in paragraph 2–16. Vehicle maximum grade capabilities must be considered, although it must be remembered that these figures are for ideal conditions and that a vehicle's capability is significantly reduced in climbing wet, icy, or rutted banks. Even the most gradual slopes may require improvement before crossing operations can commence. Banks can often be improved by use of pioneer tools, bulldozers, combat engineer vehicles, or tank dozers. When reconnaissance personnel have determined that improvements to the banks are required, the amount and type of necessary work is included in the route reconnaissance report.



THE ANGLE AT A IS 90°
THE ANGLE AT C IS MEASURED

$$\text{TAN C} = \frac{AB}{AC} \qquad AB = \text{TAN C} \times AC$$

Figure 2–31. Measuring stream width using surveying instrument.



DISTANCE AB IS MEASURED
FLOATING OBJECT IS THROWN INTO STREAM AT C
TIME REQUIRED FOR FLOATING OBJECT TO FLOAT DISTANCE A'B' IS DETERMINED

$$V = \frac{AB \text{ (METERS OR FEET)}}{\text{TIME TO FLOAT FROM A' TO B' (SEC)}}$$

Figure 2–32. Method of determining stream velocity.

2–35. Obstacles

Obstacles to river-crossing operations include:

a. Escarpments or high vertical banks.

b. Mines and boobytraps at entrance and exit sites and along likely approaches. Moreover, mines may also be submerged in stream channels or attached to poles and floating logs.

c. Debris and floating obstacles such as large quantities of logs and brush; poles or floating logs with wire attached for fouling propellers and suspension systems; and, in cold weather, ice crusts or ice floes.

2–36. Ford Reconnaissance

A ford is a location in a water barrier where the physical characteristics of the current, bottom, and approaches permit the passage of personnel and/or vehicles and other equipment whose suspension systems remain in contact with the bottom (fig. 2–33). Physical characteristics of a ford are summarized in table 2–3 and explained as follows:

a. Trafficability. Fords are classified according to their crossing potential for pedestrians or vehicles. Fordable depths for vehicular traffic can be increased by suitable waterproofing, or in the case of modern tanks, by the addition of deep water fording kits which permit fording of depths up to 4.3 meters (14 ft).

b. Approaches. Approaches may be paved with concrete or a bituminous surface material, or covered with mat or trackway, but are usually unim-

Figure 2–33. Typical ford crossing.

Table 2–3. Trafficability of Fords

Type of Traffic	Shallow Fordable Depth (Meters)	Minimum Width (Meters)	Maximum Percent of Slope for Approaches [1]
Foot	1 (39″)	1 (39″) (single file) 2 (79″) (column of 3's)	100%
Trucks and truck-drawn artillery	.75 (30″)	3.6 (12′)	33%
Light tank	1 (39″)	4.2 (14′)	50%
Medium tanks [2]	1.05 (42″)	4.2 (14′)	50%

[1] Based on hard, dry surface.
[2] Depths up to 4.8 meters can be negotiated with deep water fording kit.

proved. The composition and the slope of the approaches to a ford should be carefully noted to permit determination of its trafficability in inclement weather and after fording vehicles have saturated surface material.

c. Bottom. The composition of the stream bottom of a ford determines its trafficability. It is important, therefore, to determine if the bottom is composed of sand, gravel, silt, clay, or rock and in what proportions. In some cases, the natural river bottom of a ford may have been improved to increase load-bearing capacity and to reduce the water depth. Improved fords may have gravel or concrete surfacing, layers of sandbags, metal screening or matting, timber (corduroy) or wooden planking. Bottom conditions are determined by checking the stability and composition of the bed. If the water is shallow, this can be accomplished by wading across the obstacle. In deeper water, underwater reconnaissance personnel may be required to determine bottom conditions (see para 2–37).

d. Climatic Conditions. Seasonal floods, excessive dry seasons, freezing, and other extremes of weather materially affect the fordability of a stream. For this reason, the climatic effect to which a ford may be subjected is considered.

e. Current. The velocity of the current and the presence of debris are recorded in order to determine their effect, if any, on the condition and passability of the ford. Current is estimated as swift (more than 1.5 meters per second), moderate (1 to 1.5 meters per second), and slow (less than 1 meter per second).

f. Low Water Bridges. During high water periods, low water bridges may be easily confused with paved fords as both are completely submerged. This type of bridge consists of two or more intermediate supports with concrete decking and located wholly within ravines or gullies. In reconnaissance it is important to differentiate between this type of bridge and a paved ford because of corresponding military load limitations.

2–37. Underwater Reconnaissance

a. Physical reconnaissance and selection of deep water fording sites are conducted by teams trained and equipped for underwater reconnaissance. When the water obstacle is narrow, underwater reconnaissance personnel may enter from the near bank and conduct their reconnaissance by swimming to the far bank. When the distance between banks cannot be easily spanned by swimming personnel, swimming vehicles or reconnaissance boats enter the water once an entrance has been selected and drop off teams at regular intervals. Craft remain in the water during reconnaissance and pick up swimmers when the operation is completed unless the area is under enemy fire or observation. In this case, divers swim to the friendly shore; or if on the far side of a wide obstacle, they signal when ready to be picked up. Helicopters may be used to drop teams in the water or place teams on the far shore if the situation permits.

b. To assist underwater reconnaissance teams in maintaining direction, weighted ropes may be placed across the bottom of the water obstacle. Attached to these ropes are buoys or other floating objects to indicate the area of responsibility of each team. When the current is in excess of 1.3 meters per second (4.25 feet per second), underwater reconnaissance personnel have difficulty maintaining a position along the line selected. To assist swimmers another weighted rope, parallel to the directional rope, may be placed upstream with lateral lines connecting both ropes.

c. During periods of good visibility and when the water is clear, bottom conditions can be easily determined. Under blackout conditions, however, or when the water is murky, reconnaissance is much slower since swimmers must feel their way across. If the tactical situation permits, searchlights and flares may be employed in addition to waterproof lights used by the swimmers.

d. The length of time that underwater reconnaissance personnel can remain in the water depends upon their training, the current, water temperature, and equipment. When conducting a reconnaissance in any current, a swimmer expends more energy, tires more easily, and uses his air supply more quickly. In temperatures between 70° and 85°F, divers can work comfortably in their underwear but chill in 1 to 2 hours if not exercising. In temperatures above 85°F, the diver overheats and the maximum temperature that can be endured, even at a rest, is 96°F. Protective covering is usually needed when the water temperature is below 70°F. In cold water, the sense of touch and ability to work with hands are affected. Air tanks vary in size; the capacity of the tank and working conditions govern how long a diver can operate. Extra tanks should be readily available for underwater reconnaissance teams and recharging equipment located so as to be responsive to team requirements.

2–38. The Ford Reconnaissance Symbol (STANAG 2253 and SOLOG 96)

Limited ford information is recorded on maps or overlays by means of symbols as illustrated in figures 2–2 and 2–34.

a. The geographic *location* of the ford is shown by an arrow from the symbol to the location of the ford on a map or overlay. The symbol may be drawn on either side of the stream.

b. A *serial number* is assigned each ford for ease in subsequent reference. Numbers must not be duplicated within any one map sheet, overlay, or document. The number is recorded to the extreme left and above the arrow leading to the ford.

c. The *type* of ford is placed after the serial number; the letters, V—Vehicle or P—Pedestrian, are used to designate ford type.

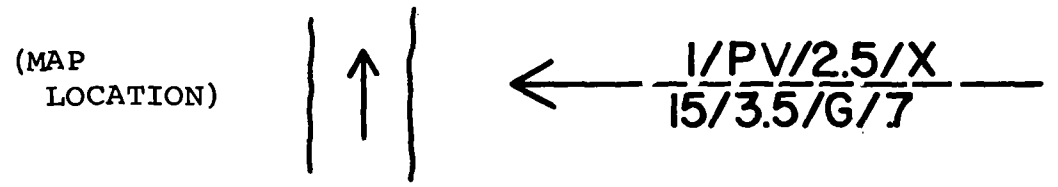
d. Normal *velocity of stream* expressed in meters per second is placed after the ford type.

e. Seasonal limiting factors follow the stream velocity notation and are shown by the letters—

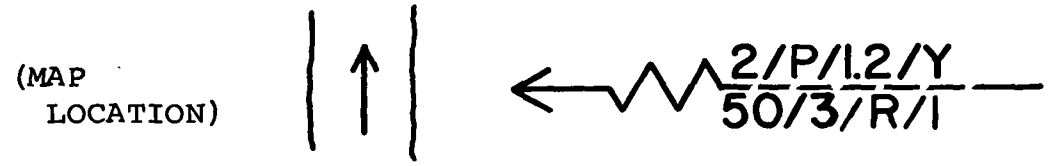
X—no seasonal limitation except for sudden flooding of limited duration.

Y—significant seasonal limitations.

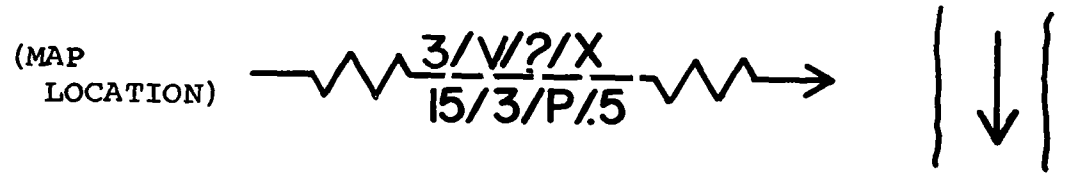
f. Length of the ford is expressed in meters and is recorded to the extreme left and *below* the arrow leading to the ford.



Ford Number 1, pedestrian and vehicular stream velocity 2.5 meters per second, no seasonal limitation, 15 meters long, 3.5 meters wide, gravel bottom, .7 meters in depth without difficult approaches.



Ford Number 2, pedestrian, stream velocity 1.2 meters per second, seasonal limitations, 50 meters long, 3 meters wide, rock bottom, 1 meter in depth with difficult approach on the left bank.



Ford Number 3, vehicular ford, stream velocity unknown, no seasonal limitations, 15 meters long, 3 meters wide, artificial paving, .5 meters in depth with difficult approaches on both banks.

Figure 2-34. Examples of the ford symbol.

g. Width of the ford is also expressed in meters and follows the ford length notation.

h. The nature of the bottom is shown after the ford width by the most appropriate letter symbol—

M—mud
C—clay
S—sand
G—gravel
R—rock
P—artificial paving

i. The *normal depth* of water at the deepest point is expressed in meters and is placed below the arrow immediately after the symbol expressing the type of bottom.

j. A *difficult approach* is shown by irregular lines placed on the corresponding side of the basic

symbol. The left and right bank of a stream is ascertained by looking in the direction of the current (downstream). Attention must be paid to the direction of the stream flow in drawing this portion of the symbol.

k. All elements of the ford symbol are separated by slashes (/).

l. If any item of the ford symbol is unknown or undetermined a question mark (?) is substituted therefor.

2–39. Format for Electrically Transmitting Ford Information (STANAG 2096, SEASTAG 2096, and SOLOG 107)

To provide standardization in reporting essential ford reconnaissance data by electrical means, the format shown in figure 2–35 has been adopted. It is primarily designed for electrical transmissions in conjunction with standard message forms (DD Form 173 and DA Form 11–170). However, the format, which is reproduced locally, may also be used to supplement route reconnaissance reports especially when more detailed information than can be depicted by the ford reconnaissance symbol is required. The originator completes only those parts of the format which are applicable or for which information is available. Each item of the report, however, must be accompanied by the appropriate letter designation from the format to establish the correct category of information. Messages are preceded by the term, FORDREP, or identifying codeword.

2–40. Ford Reconnaissance Report Form

When more detailed information is required concerning a specific ford, especially when conducting deliberate reconnaissance, DA Form 1251 (Ford Reconnaissance Report) is used to provide a permanent record of ford information (fig. 2–36). If required, short forms or worksheets for rapid field work may be designed and produced for reconnaissance purposes. Details to be entered on the Ford Reconnaissance Report are as follows:

a. Identification (*items 1–10*). Enter all data which establishes positive identification of the ford as to route, map sheet, grid reference, ford serial number, geographic location, and name of stream or crossing.

b. Characteristics of Crossing (*item 11*). Record the width and depth of the crossing and the velocity of the stream at present water level and at low, mean, and high level. Also give data, season, or month(s) for each of these. Figure 2–29 illustrates the dimensions to be recorded at each water level.

c. Description (*items 12–17*). Record the composition of the steam bottom, composition and percent of slope of approaches, type of pavement (if any) of approaches and ford, usable width of approaches and ford, and any hazards such as flash floods or quicksand which would affect the trafficability of the ford.

d. Remarks (*item 18*). Enter here any other pertinent data not recorded elsewhere on the report. This should include description of approach

FORDREP					
Explanation	Letter designation	(1)[a]	(2)[b]	(3)[b]	(4)[b]
Map sheet(s)	ALPHA				
Date and time information was collected	BRAVO				
Location (UTM grid coordinates and ford type)	CHARLIE				
Minimum width	DELTA				
Maximum depth	ECHO				
Stream velocity	FOXTROT				
Type of bottom	GOLF				
Maximum percent of slope on bank exits and entrances.	HOTEL				
Military load classification	INDIA				
Other information	JULIET				

Notes. [a]. First ford in report; report by serial number if assigned.
[b]. Additional fords in report.

Figure 2–35. Ford report format.

FORD RECONNAISSANCE REPORT (FM 5-36)

DATE: 14 JUNE 1964

TO: (Headquarters ordering reconnaissance): COMMANDING OFFICER, ATTN: S2 21ST ENGR BN (21ST INF DIV)

FROM: (Name, grade and unit of reconnaissance officer): John H. Doe / JOHN H.DOE 2/LT CO A 21ST ENGR BN

1. ROUTE NUMBER	2. FROM (Initial Point)	3. TO (Terminal Point)	4. DATE/TIME (Of signature)
VIRGINIA 617	UT 122864	UT 097899	14 1800 JUN 64

5. MAP SERIES NUMBER	6. SHEET NUMBER	7. GRID REFERENCE TYPE	7. GRID REFERENCE COORDINATES	8. FORD NUMBER
V734	5561-III	UTM 1:50,000	UT 100886	1

9. LOCATION FROM NEAREST TOWN: DISTANCE	DIRECTION	NAME OF NEAREST TOWN	10. CROSSING (Name of stream or other body of water)
11.9 Km	SOUTHEAST	FT. BELVOIR, VIRGINIA	ACCOTINK CREEK

11. CHARACTERISTICS OF CROSSING

WATER LEVELS	WIDTH	DEPTH	VELOCITY	DATE	SEASON OR MONTH(S)
TODAY	7.3m	0.5m	1.5mps	14 JUN 64	SPRING
LOW	6.1m	0.3m	1.1mps	07 AUG 64	SUMMER
MEAN	7.3m	0.5m	2 mps		
HIGH	8.9m	1.8m	2.2 mps		

12. BOTTOM: ☐ SAND ☑ GRAVEL ☐ STONE ☐ OTHER (Specify):

13. APPROACHES: ☐ FIRM ☐ SOFT ☑ PAVED

14. SLOPE RATIO: 10%

15. TYPE OF PAVEMENT	16. USABLE WIDTH	17. HAZARDS (Flash floods, quicksand, etc.)
BITUMINOUS	8.2 m	UNKNOWN

18. REMARKS (Description of Approach Roads, Guide Markers, Depth Gages, etc.)

NO DEPTH GAGE

DA FORM 1 JAN 55 1251

Figure 2–36. Ford reconnaissance report (DA Form 1251).

roads, guide markers, depth gages, availability of and distances to bypasses and alternate crossings, and any other information which may assist in the classification of the ford.

e. Sketches (items 19 and 20). Draw sketches of the ford showing both a profile and a site plan.

(1) The profile sketch indicates the water level and the elevation of the stream bottom and approaches.

(2) The site plan gives the alinement of the ford and its approaches with appropriate dimensions. Terrain and other site features in the imme-

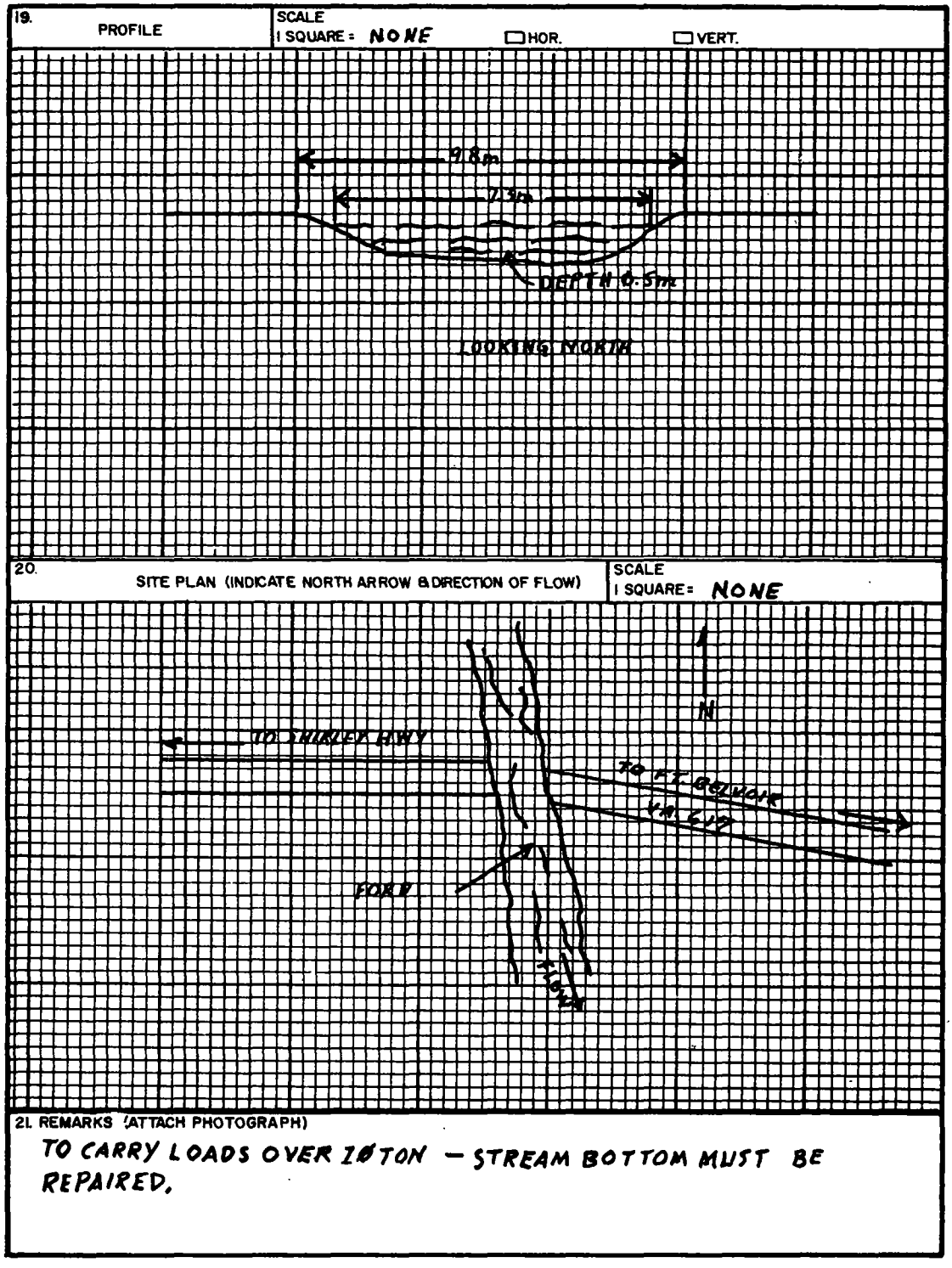


Figure 2–36—Continued.

diate area of both banks are shown. Also the north arrow and the direction of flow of the stream are indicated.

f. Remarks (item 21). Include here any pertinent information not mentioned above. Additionally, whenever a ford is reconnoitered, it is photographed if possible. Photographs should show the banks, the approaches, and the stream in one view. The photograph should be taken while a military vehicle is crossing to give an indication of water depth and the location of the ford.

2–41. Marking of Fords

Instructions for fording and swimming vehicles will be indicated by standard bridge signs (para 2–52). A circular bridge classification sign is employed if the ford is classified as to load-bearing capacity. In addition, rectangular signs are employed to indicate crossing instructions such as maximum permissible crossing speeds, reminders of wet brakes, depth of ford, etc. Provisions should also be made to indicate the trace of the ford across the water barrier. Marking may be accomplished by poles protruding above the water or by ropes supported by buoys. Consideration should also be given to marking the ford under conditions of limited visibility. Shielded electric lamps may be used in a manner similar to that prescribed for marking lanes through minefields.

2–42. Reconnaissance in Support of Vehicular Swimming Operations

For purposes of reconnaissance, vehicular swimming operations are considered as a special type of ford reconnaissance (fig. 2–37). Most details of ford reconnaissance are pertinent to swimming operations including depth and bottom characteristics of the crossing site, especially stream entrance and exits, as well as sandbars and other obstructions that may exist in the stream channel. The ford reconnaissance symbol, the format for electrically transmitting ford data, and DA Form 1251 (Ford Reconnaissance Report) are applicable when modified with the notation that the site is appropriate for swimming vehicles only. Of particular significance to this type of reconnaissance are—

a. Geographic location.

b. Serial number.

c. Stream velocity.

d. Seasonal limiting factors.

e. Length of ford.

f. Depth limitations.

g. Approaches into the water until the vehicle is waterborne. Additionally, landing sites must be sufficiently wide to allow vehicles to exit although subjected to the lateral force of the stream current.

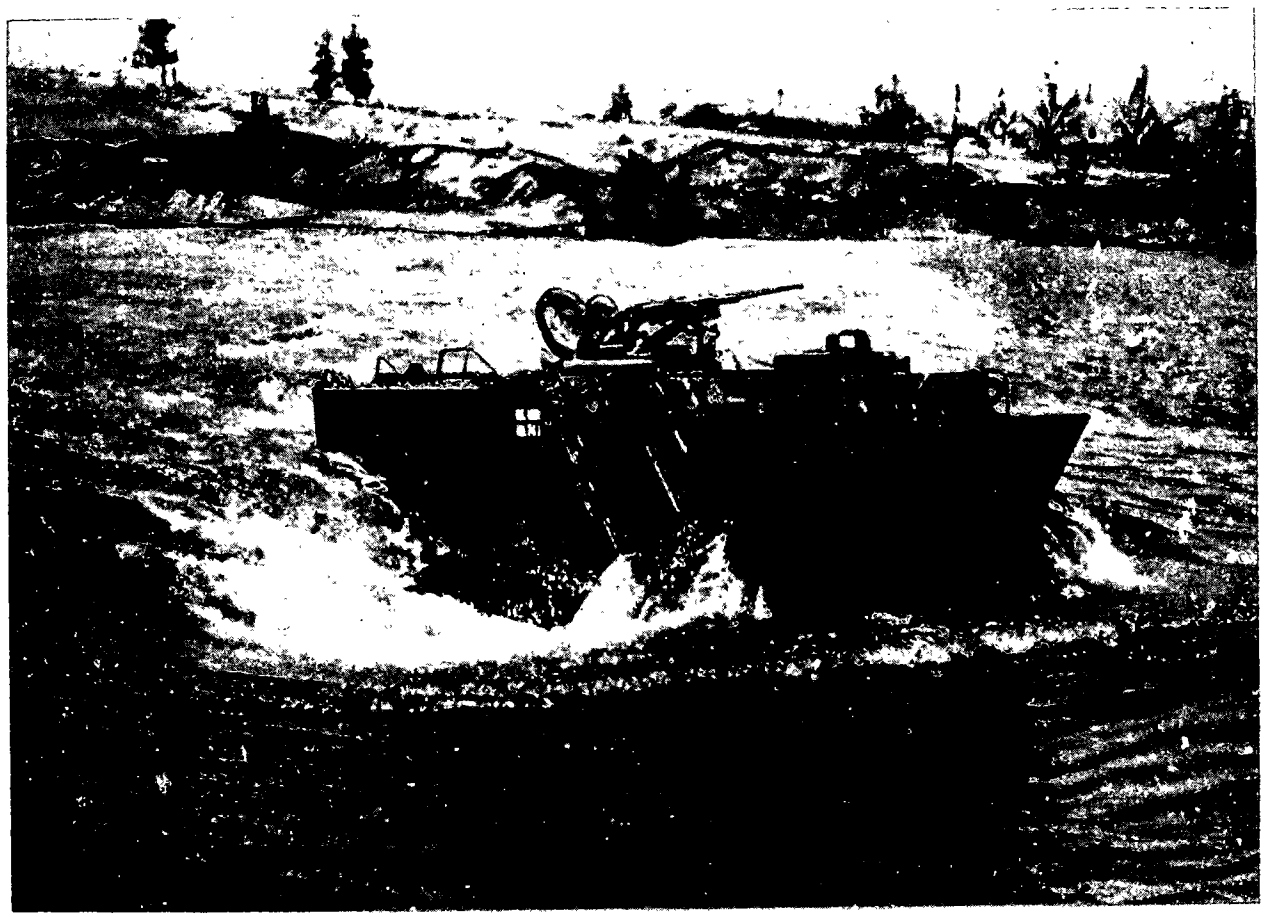


Figure 2–37. Armored personnel carrier, M113.

2–43. Ferry Types

A ferry site is a place where traffic and cargo are conveyed across a river or other water barrier by a floating vehicle which is called a ferry or ferryboat. Ferries encountered in route reconnaissance vary widely in physical appearance and capacity depending upon the width, depth, current, and the characteristics of the traffic to be moved. Propulsion of ferries may be by oars, cable and pulleys, poles, stream current (trail and flying ferries), or by steam, gasoline, and diesel engines. Construction of ferryboats varies widely ranging from expedient rafts to ocean-going vessels.

2–44. Existing Civil Ferries and Ferry Sites

a. Usually, the capacity of a civil ferryboat is expressed in tons and total number of passengers and, in addition, is often assigned a military load classification number. When more than one ferry is employed for a given site, the capacity of each is reported.

b. Ferry slips or piers are generally provided on the shore to permit easy loading of passengers, cargo and vehicles. The slips may vary from simple log piers to elaborate terminal buildings. A distinguishing characteristic of a ferry slip is often the floating pier which adjusts to the height of the ferryboat with fluctuations in the water depth.

c. Approach routes to ferry installations have an important bearing on the use of the ferry. Therefore, the condition of the approaches, including the load-carrying capacity of landing facilities, are investigated and recorded.

d. Limiting characteristics of ferry sites are considered, such as:

(1) Width of the water barrier from bank to bank.

(2) The distance and time traveled by the ferryboat from one side to the other side.

(3) Depths of the water at each ferry slip.

e. Climatic conditions have a marked effect on ferry operations. Fog and ice substantially reduce the total traffic-moving capacity and increase the hazard of the water route. Therefore, data on tide fluctuations, freezing periods, floods, excessive dry spells, and their effects on ferry operation are considered.

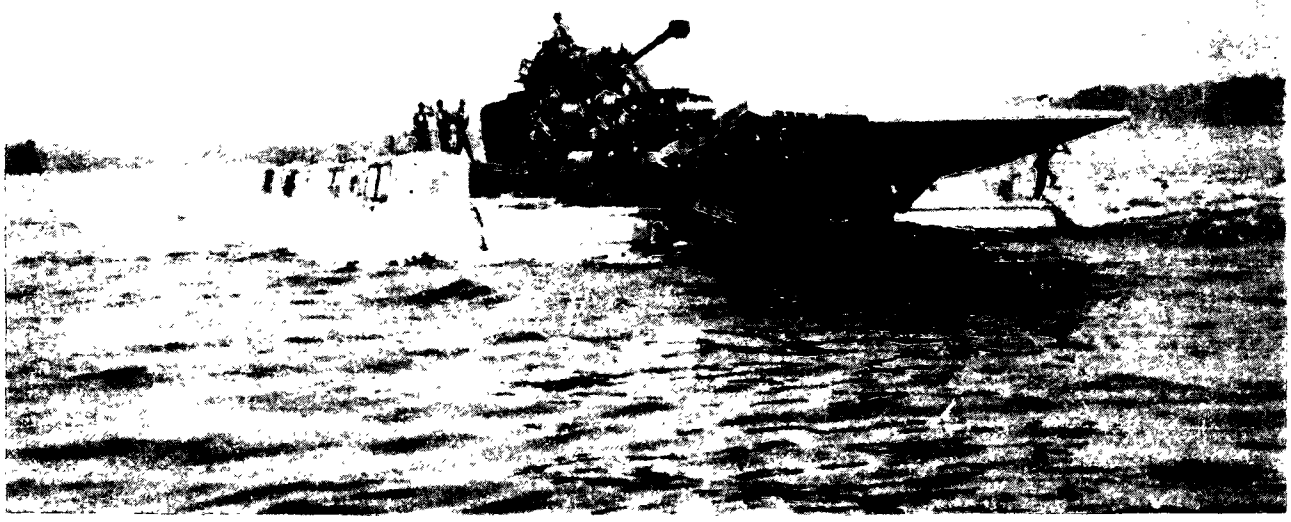


Figure 2–38. Mobile assault ferry.

2–45. Military Ferry and Rafting Sites

Reconnaissance personnel may be required to locate and report suitable sites for military rafting and/or ferrying operations. Equipment presently available for such operations are either components of military floating bridges, which are assembled into rafts at the water's edge, or units of the mobile assault bridge (MAB) which consists of individual self-propelled amphibious vehicles assembled into a ferry when in the water (fig. 2–38). For military rafting operations, the following site characteristics are desirable:

a. Current velocity between 0 and 1.6 meters per second.

b. Banks which permit loading without a great deal of preparation.

c. Approaches which permit easy access and egress.

d. Strong natural holdfasts.

e. No shoals, sandbars, or snags.

f. Sites clear of obstacles immediately downstream.

g. Sites clear of mines and boobytraps.

h. Sufficient depth to prevent grounding the raft or ferry during loading and unloading operations or when crossing.

i. Holding areas for vehicles awaiting passage.

2–46. Ferry Reconnaissance Symbol (STANAG 2253 and SOLOG 96)

Limited ferry information is recorded on maps or overlays by means of symbols as illustrated in figure 2–39.

a. The *geographic location* of the ferry is shown by an arrow from the symbol to the location of the ferry on a map or overlay. The symbol may be drawn on the map or overlay on either side of the stream.

b. A *serial number* is arbitrarily assigned each ferry for ease in subsequent reference. Numbers must not be duplicated within any one map sheet, overlay, or document. The number is recorded to the extreme left and above the symbol.

c. The *type* of ferry (V—vehicular ferry, P—pedestrian ferry) is shown after the serial number.

d. The *military load classification* of the deck is expressed by a value placed inside the symbol and to the left.

e. The *dead weight capacity,* in short tons, of the ferry is shown inside the symbol to the right of the military load classification.

f. The *turn around time* is shown by the number of minutes required and is placed below the symbol.

g. A *difficult approach* is shown by irregular lines placed on the corresponding side of the basic symbol (see para 2–38*j*). Attention must be paid to the direction of stream flow in drawing this portion of the symbol.

h. Question marks (?) are substituted for unknown or undetermined information.

2–47. Format for Electrically Transmitting Ferry Site Information (STANAG 2096, SEASTAG 2096 and SOLOG 107)

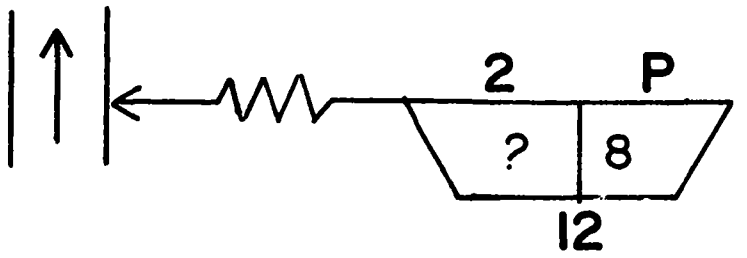
To provide standardization in reporting ferry site reconnaissance data by electrical means, the format shown in figure 2–40 has been adopted. It is primarily designed for electrical transmissions in conjunction with standard message forms (DD Form 173 and DA Form 11–170). However, the format, which is reproduced locally, may also be used to supplement written route reconnaissance reports especially when more detailed information is required. The originator completes only those parts of the format which are applicable or for which information is available. Each item of the report, however, must be accompanied by the appropriate letter designation from the format to establish the correct category of information. Messages are preceded by the term, FERRYSITEREP, or identifying codeword.

2–48. Ferry Reconnaissance Report Form

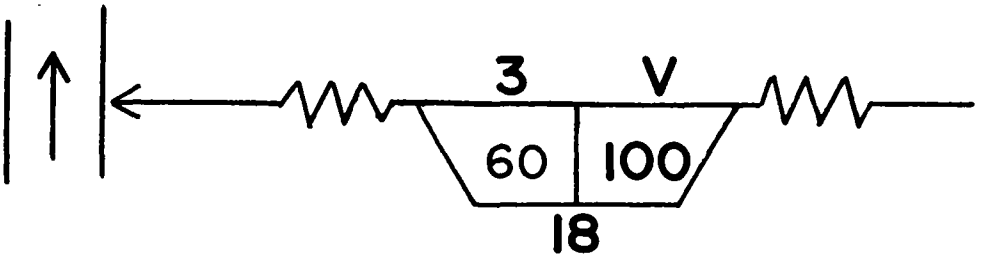
When more detailed information is required concerning a ferry or ferry site, especially when conducting deliberate reconnaissance, DA Form 1252 is used to provide a permanent record of ferry information (fig. 2–41). Short forms or worksheets for rapid field work may by designed and produced by the unit making the reconnaissance. Information to be entered on DA Form 1252 is as follows:

a. Identification (*items 1–11*). Enter all information which establishes positive identification of the ferry by route, map sheet, grid reference, ferry serial number, classification, geographic location, and the name of the stream or body of water.

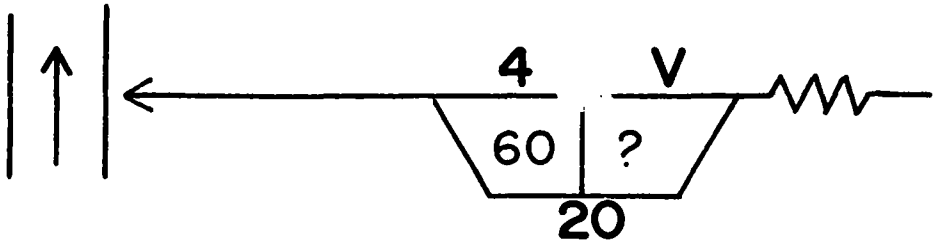
b. Limiting Features (*item 12*). Enter any limiting features which would affect ferry operations



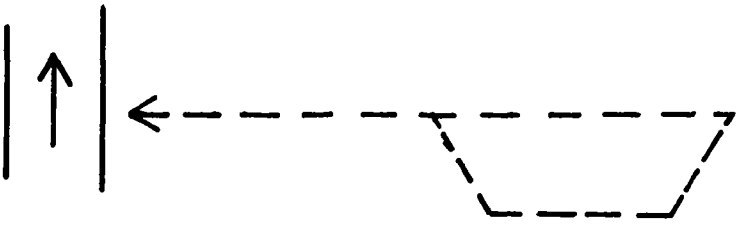
Ferry Serial Number 2, pedestrian ferry, military load class of deck unknown, 8-ton dead weight capacity, 12-minute turn around time, and a difficult left bank approach.



Ferry Serial Number 3, vehicular ferry, military load class of deck 60, 100-ton dead weight capacity, 18-minute turn around time, and difficult approaches on both banks.



Ferry Serial Number 4, vehicular ferry, military load class of deck 60, unknown dead weight capacity, 20-minute turn around time, and a difficult approach on the right bank.



Alternative prepared ferry site.

Figure 2–39. Examples of ferry symbols.

FERRYSITEREP					
Explanation	Letter designation	(1)[a]	(2)[b]	(3)[b]	(4)[b]
Map sheet(s)	ALPHA				
Date and time information was collected	BRAVO				
Location (UTM grid reference)	CHARLIE				
Military load classification of approaches	DELTA				
Possibilities for concealment and cover	ECHO				
Width of water obstacle	FOXTROT				
Depth of water at the banks to include tidal information.	GOLF				
Stream velocity	HOTEL				
Slope on bank approaches and bank conditions	INDIA				
Holding areas for road and water transport	JULIET				
Additional information such as maximum number of rafts the site can accommodate, work required in man-hours for preparation, and existing stream crossing equipment.	KILO				

Notes. [a]. First ferry site in report; report by serial number if assigned.

[b]. Additional ferry sites in report.

Figure 2–40. Ferry site report format.

such as condition of vessels, terminals, floods, low water, freezing, and tides. Also seasons and dates for any limiting climatic conditions are given.

c. Description (*items 13–15*). Record the depth of the stream or body of water at low, mean, and high water levels; the crossing time; and the length of the course.

d. Vessel features (*item 16*). Record the pertinent design features of the vessel(s) used. This information includes the number and construction type of units, the method and power of propulsion, length, beam, draft, gross and net tonnage, and capacity.

e. Terminal Features (*item 17.*). Designate the geographic direction of the banks by circling the appropriate abbreviation (NESWN). Enter the name, the dimensions of the slips, and specific docking approaches, the number of rail lines on or near the slip, and the number of sidings.

f. Remarks (*item 18*). Enter facilities for transferring freight and indicate those cases where railroad cars are loaded directly on the ferry. In addition, use this space to amplify details given in paragraphs above. Include obstructions, navigational aids, availability of and distances to alternate crossings, and other pertinent data not recorded elsewhere. Photographs should be taken of all ferries reconnoitered in support of DA Form 1252. These photographs include the ferry site, the ferry slips, the ferryboats, and the approach routes. If the ferryboats are not self-propelled, the photographs include auxiliary equipment such as cables, towers, and winches.

g. Sketches (*items 19 and 20*). Draw a sketch showing the route alinement plan and two sketches showing terminal views on both sides of the crossing.

(1) The route alinement plan indicates the geographical course of the ferry, terminals, and approaches to the slips. Particular care is taken in recording obstructions. Navigational aids such as buoys and lights are shown. The position of the approaches including surrounding terrain features is included in the sketch.

(2) Two separate sketches are made showing each terminal including the geographical position of each bank and details of the slips, ramps, and bumper piles.

2–49. Ferry Applications of Bridge Markings

Marking for ferries is accomplished in accordance with applicable instructions for marking bridges (para 2–52). Hazard, regulatory, and guide signs, as appropriate, are posted on approach routes and at ferry slips (fig. 2–42).

FERRY RECONNAISSANCE REPORT
(FM 5-36)

DATE: 14 JUN 1964

TO: (Headquarters ordering reconnaissance) COMMANDING OFFICER, ATTN: S2; 21ST ENGR BN (21ST INF DIV)

FROM: (Name, grade and unit of reconnaissance officer) John H. Doe
JOHN H. DOE 1/LT CO A 21ST ENGR BN

1. ROUTE OR LINE		2. FROM (Initial Point)	3. TO (Terminal Point)	4. DATE/TIME (Of Signature)
HIGHWAY: VA 617	RAILROAD: N/A	LORTON, VA	HOBY, MD	14 1800 JUN 64

5. MAP SERIES NR	6. SHEET NUMBER	7. GRID REFERENCE		8. FERRY NR	9. CLASS
		TYPE: UTM	COORDINATES		
V 734	5561-III	1:50,000	UT 134930	1	40

10. LOCATION FROM NEAREST TOWN			11. CROSSING (Name of stream or body of water)
DISTANCE	DIRECTION	NAME OF NEAREST TOWN	
8.0 Km	EAST	LORTON, VA	POTOMAC RIVER

12. LIMITING FEATURE (Condition of vessels, terminals, floods, low water, freezing, tides etc.) (Seasons and Dates)
CAPACITY OF LANDING - ANGELS POINT

13. WATER LEVELS (Depths)			14. CROSSING TIME	15. LENGTH
LOW	MEAN	HIGH		
3.2 m	4.7 m	7.6 m	11 MINUTES	1.0 Km

16. VESSEL FEATURES (Attach photographs)

UNITS	CONSTRUCTION TYPE	PROPULSION METHOD			LENGTH	BEAM	DRAFT	TONNAGE		CAPACITY		
		TYPE	UNITS	HP				GROSS	NET	PASS	VEHICLE	R.R. CARS
2	OPEN	DIESEL	2	210	22.5m	7.6m	1.6m	85	85	200	8 MAX	N/A

17. TERMINAL FEATURES

DIRECTION OF BANK	NAME	SLIP			DOCKING FACILITIES	APPROACHES				
		WIDTH	DEPTH	CAPACITY		HIGHWAY			RAILROAD	
						SURF	LANES	CLASS	TRACKS	SIDING
N E (S) W N	LITTLE REMO	13.2m	3.0m	1 BOAT	GOOD	ASPH	2	45	N/A	N/A
(N) E S W N	ANGELS PT	24.0m	4.0m	1 BOAT	GOOD	CONC	2	55	N/A	N/A

18. REMARKS (Amplify above details. Note obstructions, navigational and other pertinent data)

DA FORM 1 JAN 55 1252

Figure 2–41. Ferry reconnaissance report (DA Form 1252).

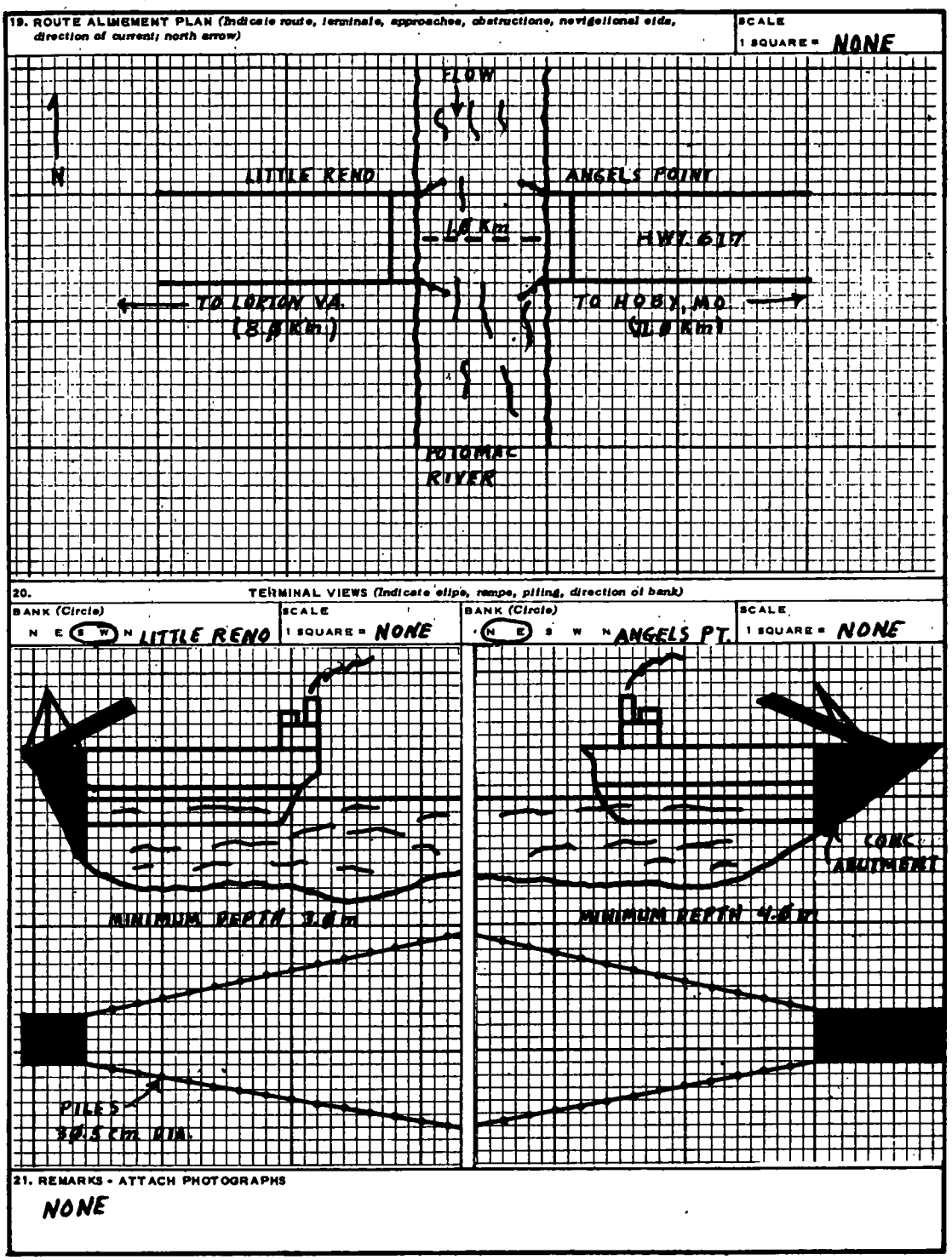


Figure 2–41—Continued.

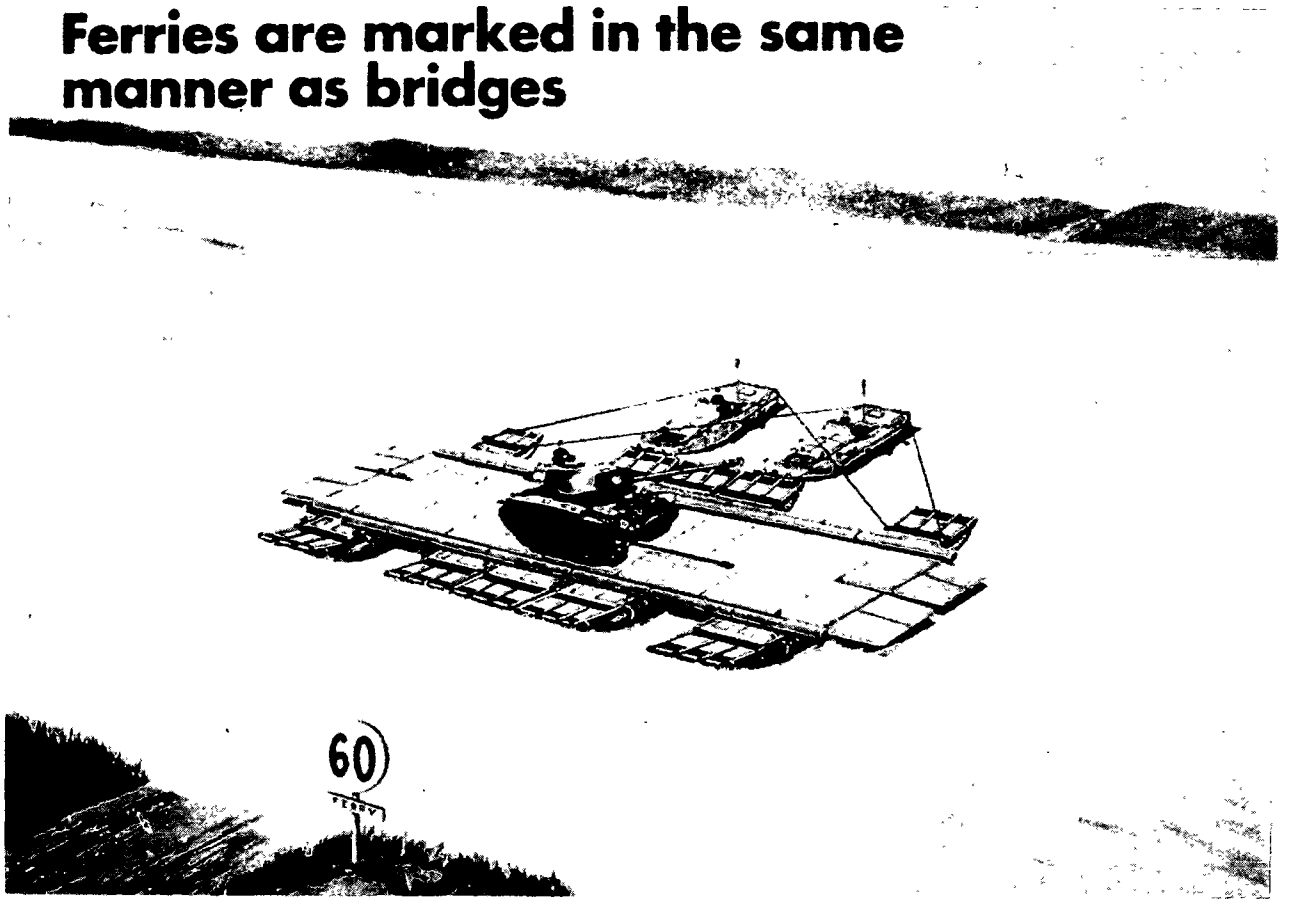


Figure 2–42. Example of ferry marking.

Section VI. THE MILITARY LOAD CLASSIFICATION SYSTEM

2–50. General

Bridge reconnaissance requires a general knowledge of the vehicle and bridge military load classification system and bridge traffic control procedures. Hence, these elements are discussed before outlining hasty bridge reconnaissance (para 2–56—2–65) and deliberate bridge reconnaissance procedures (para 3–3—3–11). The bridge and vehicle classification system is developed in conformance with standardization agreements and provides a means by which a driver can determine whether or not his vehicle can safely cross a specific bridge. The purpose of the system is to protect the bridge, vehicle, load, and driver (fig. 2–43).

2–51. Classification of Bridges (STANAG 2021, SEASTAG 2021, and SOLOG 45R)

Before a driver can determine whether or not his vehicle can cross a given bridge, he must know—(1) the military load class of the bridge and his vehicle, (2) the width of the bridge compared to the width of his vehicle, (3) the overhead clearance of the bridge compared to the height of his vehicle, and (4) the traffic control measures required during crossing.

a. Military Load Class Numbers. The capacity of a bridge is represented by a military load class number. This number, which is usually posted on the bridge, designates the safe capacity of the bridge. If not posted, the procedure used to determine it is discussed in paragraphs 3–12 through 3–15. In addition, most military vehicles display a vehicle classification sign. This class number represents the effect a vehicle has on a bridge when crossing. Its determination is disccused in paragraphs 3–16 through 3–20. The driver compares his vehicle class number with the bridge class number. If his vehicle class number is equal to or less than the bridge class number, the vehicle can execute a normal crossing (para 2–54).

b. Minimum Lane Widths. Bridges may be obstructions to traffic flow in that the traveled way

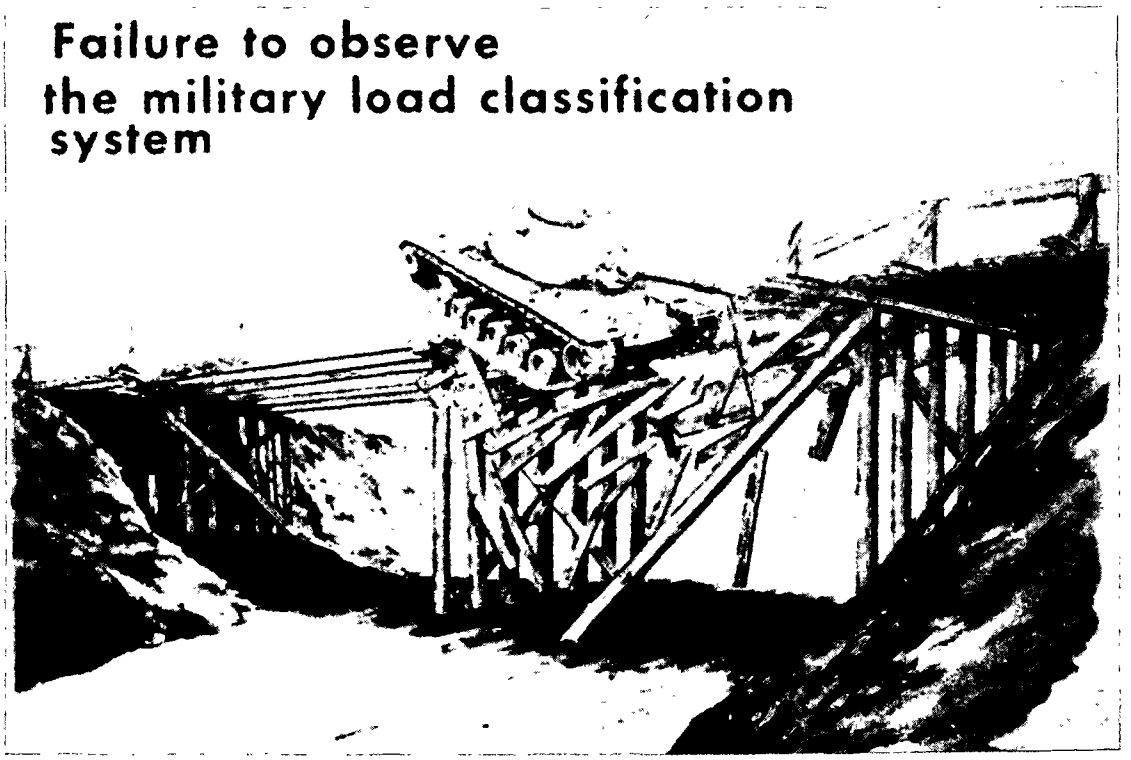


Figure 2–43. Example of a bridge failure.

of the overall route may be reduced below the minimum standards prescribed by table 2–1. If so, the bridge is reported as a width obstruction (OB) in the route classification formula. Table 2–4 lists the minimum width requirements for one and two lane bridges according to military load classification. If a bridge of a specific class meets these width requirements, no posting of the width is required; and it is understood that there are no width limitations for standard military vehicles crossing the bridge in accordance with the military load classification system. If a one-lane bridge meets all the requirements except minimum width for a certain classification, the classification is not downgraded, but the width is posted as outlined in paragraph 2–52, and appropriate travel restrictions imposed. A two-lane bridge must meet the minimum lane widths prescribed in table 2–4. If it does not, it must be downgraded to a class within the limits of its actual width. Bridge lane widths are used to determine classification, for posting, and for controlling crossing vehicles; they should not be confused with minimum traveled way widths specified for routes.

c. Minimum Overhead Clearance. Minimum overhead clearances for various bridge classifications are shown in table 2–5. If the overhead clearance of a bridge does not meet minimum requirements, the clearance restriction is posted; often a telltale or other warning device is employed prior to the bridge to indicate overhead clearance limitations (fig. 2–44). However, only overhead clearances less than 4.3 meters (14 ft) are reported as (OB) in the route classification formula (para 2–9).

Table 2–4. Minimum Lane Widths for Bridges

Bridge Classification	Minimum Width Between Curbs*	
	One Lane	Two Lane
4–12	2.75 meters (9′–0″)	5.50 meters (18′–0″)
13–30	3.35 meters (11′–0″)	5.50 meters (18′–0″)
31–60	4.00 meters (13′–2″)	7.30 meters (24′–0″)
61–100	4.50 meters (14′–9″)	8.20 meters (27′–0″)

**Note.* A minimum of 25 cm (10″) between the inner edge of the bridge structure and the inner edge of the curb is required 30 cm (12″) above the curbs for all classifications (see fig. 3–19).

Table 2–5. Minimum Overhead Clearances for Bridges

Bridge Classification	Minimum Overhead Clearance
Up to 70	4.30 meters (14 ft–0 in.)
Above 70	4.70 meters (15 ft–6 in.)

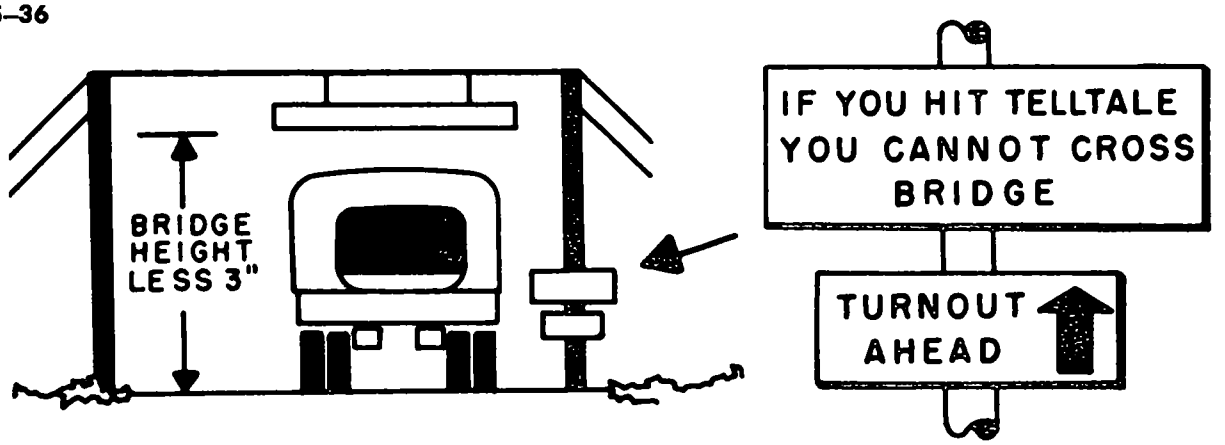


Figure 2–44. Typical telltale indicating overhead clearance of a bridge.

2–52. Bridge Classification Signs (STANAG 2010, SEASTAG 2010, and SOLOG 24)

Standardization agreements establish the following system of posting bridge classifications. In addition, special arrangements may be made by theater commanders to indicate vehicles of exceptional width or to indicate low overhead obstructions. There are two general types of standard military bridge signs. These are *circular and rectangular in shape.*

a. Circular Signs. Both civil and military bridges in an operational area which have been classified have circular signs indicating the military load classification. These signs have a yellow background with black inscriptions. The inscription is as large as the diameter of the sign allows. Circular signs are of two types: *normal* circular signs and *special* circular signs.

(1) *Normal circular signs.*

(*a*) Signs for one lane bridges are a minimum of 41 centimeters (16 inches) in diameter (fig. 2–45).

(*b*) Signs for two lane bridges are a minimum of 51 centimeters (20 inches) in diameter and are divided into right and left sections by a vertical line. The classification for double flow traffic is shown on the left half with two parallel vertical arrows beneath the number, and the classification for single flow traffic is shown on the right half of the signs with one vertical arrow beneath the number (fig. 2–46).

(2) *Special circular signs.*

(*a*) If a bridge has separate classifications for wheeled and tracked vehicles, a special circular sign which indicates both classifications is used

Figure 2–45. Typical single lane bridge sign.

Figure 2–46. Typical two lane bridge sign.

(fig. 2–47). The sign is a minimum of 51 centimeters (20 inches) in diameter and is divided into two sections by a horizontal line. On the top half, the wheeled classification is shown along with a symbol representing a wheeled vehicle. On the bottom half, the tracked classification is shown along with a symbol representing a tracked vehicle.

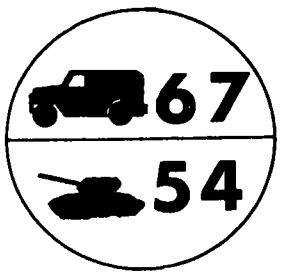
(*b*) Where similar conditions pertain to a two lane bridge, the normal and the special signs for wheeled and tracked traffic may be combined (fig. 2–47).

b. Rectangular Signs. Additional instructions and technical information are inscribed on rectangular signs. Rectangular signs are a minimum of 41 centimeters (16 inches) in height or width and have a yellow background upon which the appropriate letters, figures, or symbols are inscribed in black. The inscription is as large as the sign permits. Separate rectangular signs are used if necessary to show width limitations, height limitations (fig. 2–48), or technical information (fig. 2–49). Width and height signs are not required on bridges where existing civilian signs are already in place and are sufficiently clear. In those countries which conform to the Geneva Convention of 1949, international height and width signs (fig. 5–1) may be used in lieu of rectangular military signs.

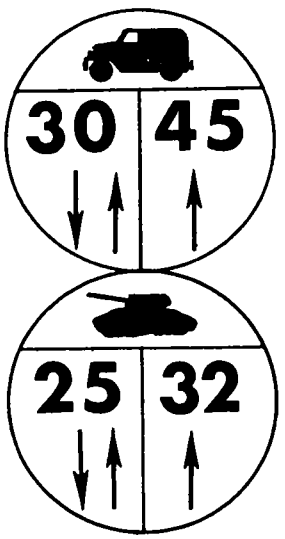
c. Multilane Bridges. Bridges of three or more lanes are special cases which require individual consideration in posting. To determine the number of lanes, minimum widths for the respective load classification (table 2–6) are used. Often, heavier loads can be carried on a restricted lane(s) than on other lanes. For example: a bridge lane may be damaged, thereby reducing capacity; or, conversely, lanes may be structurally designed to accommodate significantly heavier loads (figs. 2–50 and 2–51). Under such circumstances, standard bridge classification signs are posted for each lane, and the restricted lanes are marked by barricades, painted lines, or studs.

d. Positioning of Bridge Signs. Bridge signs are positioned so as to help maintain an uninterrupted flow of traffic across the bridge. The locations of circular and rectangular signs, special military load classification numbers, and appropriate warning signs are as follows:

(1) Circular bridge classification signs are placed at both ends of the bridge in such a position as to be clearly visible to all oncoming traffic.



SINGLE LANE



DUAL LANE

Figure 2–47. Typical dual classification signs.

(2) Rectangular signs other than those indicating height restrictions are placed immediately below the bridge classification (circular) signs.

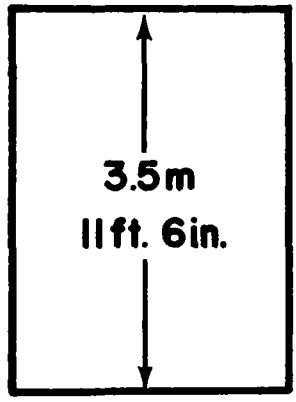
(3) Signs which indicate height restrictions are placed centrally on the overhead obstruction.

(4) Special classification numbers are never posted on standard bridge marking signs.

(5) Appropriate advance warning signs are placed on the approaches to bridges as required.

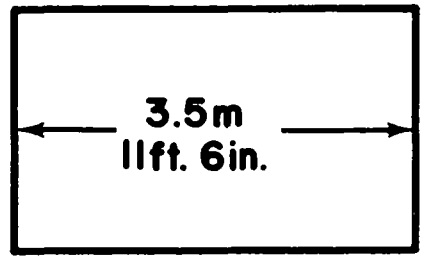
2–53. Classification Signs for Vehicles (STANAG 2010, SEASTAG 2010, and SOLOG 24)

A military vehicle is assigned a military load class number which represents the effect of the vehicle on a bridge. Standard military self-propelled vehicles with a gross weight over 3 tons and trailers with a rated payload of 1½ tons and over, *must* carry a load class number. Self-propelled vehicles of 3 tons gross weight or less and trailers with

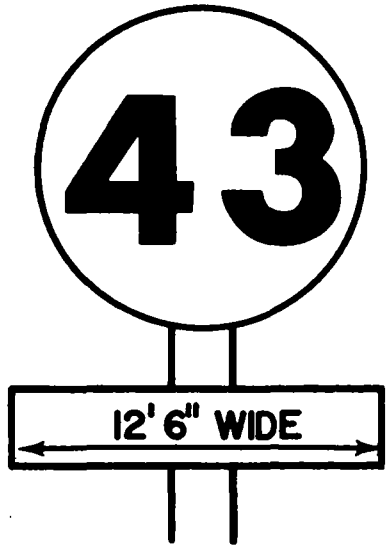


HEIGHT SIGN

YELLOW BACKGROUND.
LETTERS, FIGURES AND
SYMBOLS IN BLACK.



WIDTH SIGN



WIDTH LIMITATION POSTED ON A SINGLE FLOW BRIDGE.

Figure 2–48. Width and height signs.

rated payloads less than 1½ tons *may* carry a load class number. Military load class numbers for standard army vehicles are listed in appendix D, and a discussion of how vehicle classifications are derived is provided in paragraphs 3–16 through 3–20. Vehicles are divided into two categories for classification purposes: single and combination vehicles.

a. Single Vehicles. A single vehicle is any vehicle which has only one frame or chassis such as a tank or 2½-ton truck. Single vehicles have the class number marked on a circular sign with black

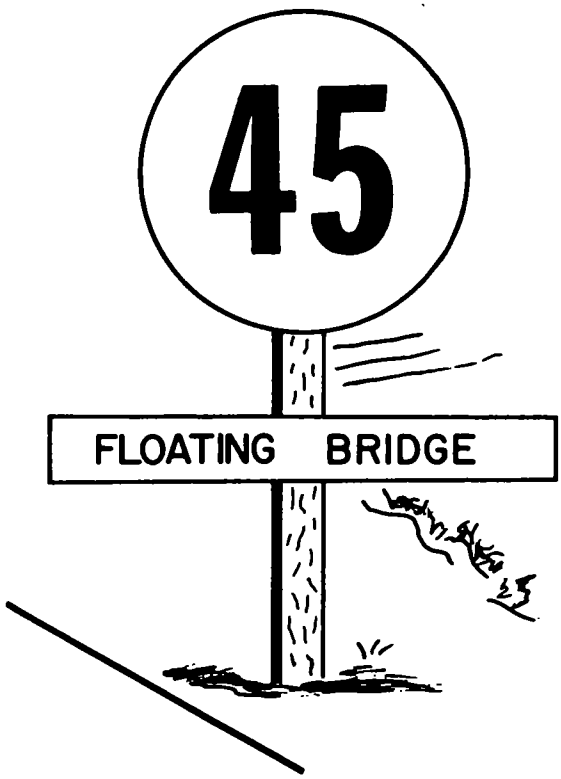


Figure 2–49. Typical sign for a floating bridge.

numerals on a yellow background. This sign is installed or painted on the front of the vehicle and below the driver's line of vision (fig. 2–52).

b. Combination Vehicles. A combination vehicle is a vehicle consisting of two or more single units which operate as one vehicle such as a prime mover pulling a semitrailer. The sign on the front of the combination vehicle (towing vehicle) has the letter "C" in red above the class number of the combination. In addition, each component vehicle of the combination carries a sign on the right side which gives the class number of the component (fig. 2–53).

c. Temporary Classification. Military vehicles may, at times, carry loads which are greater or lesser than their normal rated payloads. In this event, a temporary military load class number may be assigned to the vehicle thus increasing (or decreasing) the normal vehicle class number by an amount equal to the overload (or underload) in short tons (figs. 2–54 and 2–55).

d. Nonstandard Combination. An example of a nonstandard combination is a single vehicle towing another vehicle at a distance less than 30.5

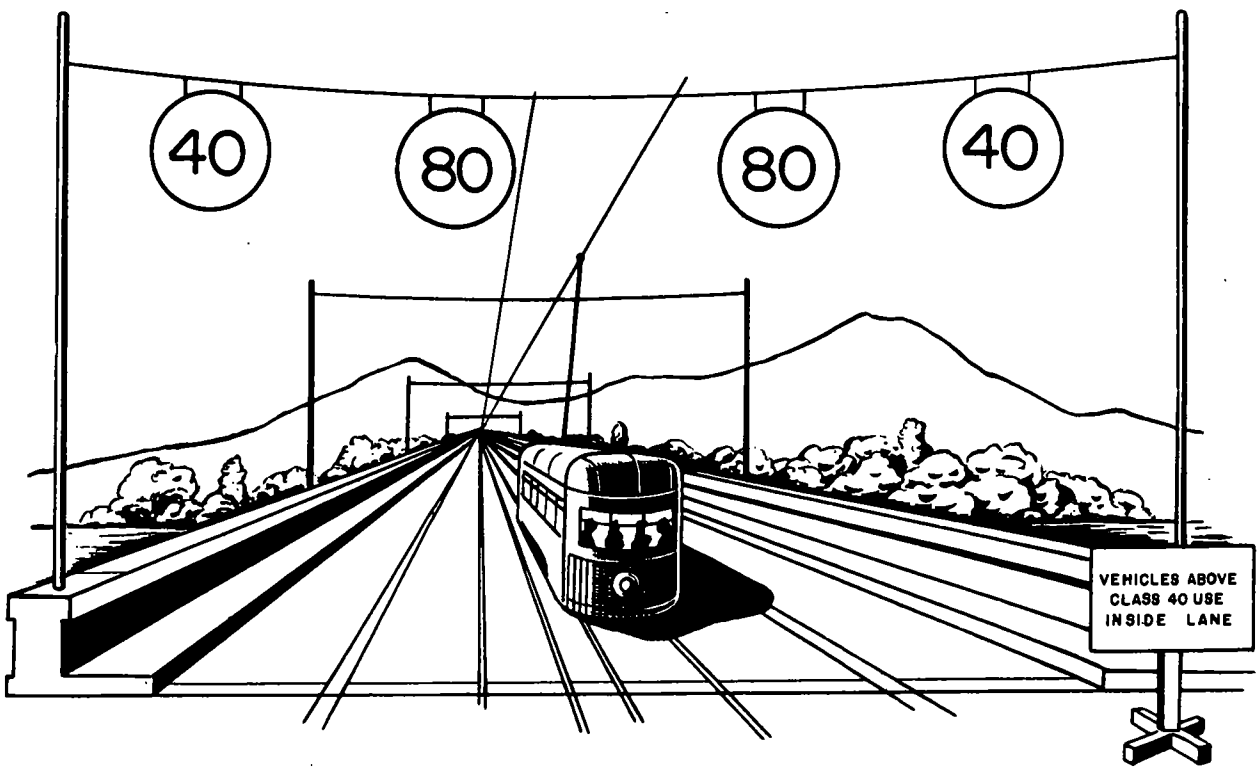


Figure 2–50. Typical multilane bridge classification and regulatory signs.

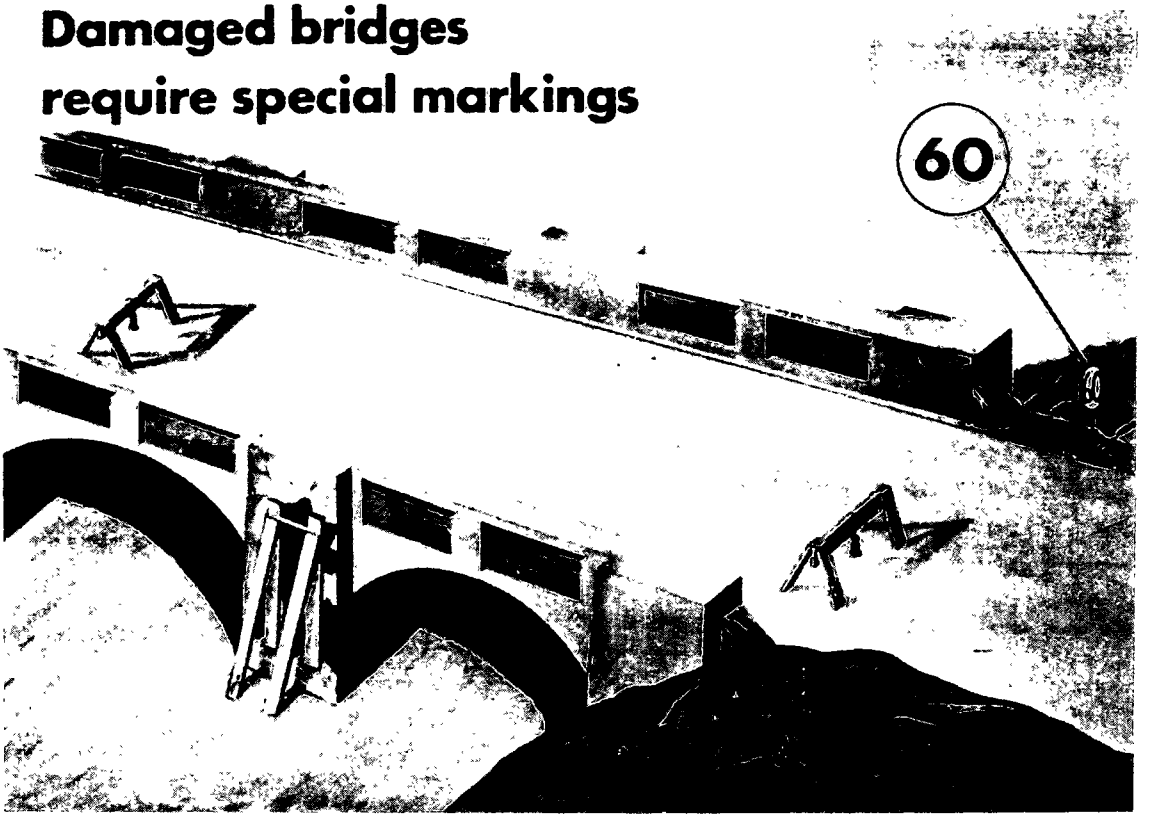


Figure 2–51. Example of posting a damaged bridge.

meters. If the sum of the vehicles' military load class numbers is less than 60, then the military load class of the nonstandard combination is nine-tenths (.9) the sum of the two class numbers. If, however, the sum of the two vehicle class numbers is 60 or over, the *total sum* represents the military load class number of the combination (fig. 2–56).

e. Special Purpose Vehicles. Such vehicles are also posted with their military load class numbers (fig. 2–57).

2–54. Types of Crossings

There are two types of crossings—normal and special.

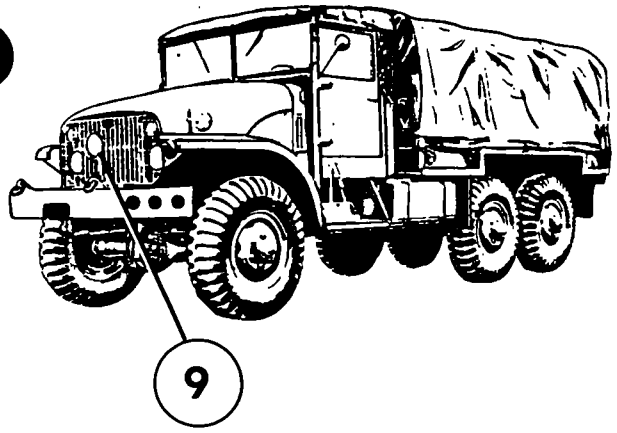
a. Normal Crossings. Normal crossings may be made whenever the vehicle military load class number is equal to or less than the bridge military load class number. Only normal convoy discipline is imposed; that is, a minimum spacing of 30.5 meters (100 feet) between vehicles and a maximum speed of 40 KPH (25 MPH). There are two types of normal crossings: single flow and double flow.

(1) *Normal single flow.* This type crossing is possible when the vehicle class number is equal to or less than the number posted on a single flow bridge or equal to or less than the single flow classification of a double flow bridge. *If a single flow crossing is made in accordance with the single flow class number on a double flow bridge, oncoming traffic must be temporarily halted while the vehicle is driven down the centerline of the bridge thereby creating a temporary obstruction to double flow traffic.*

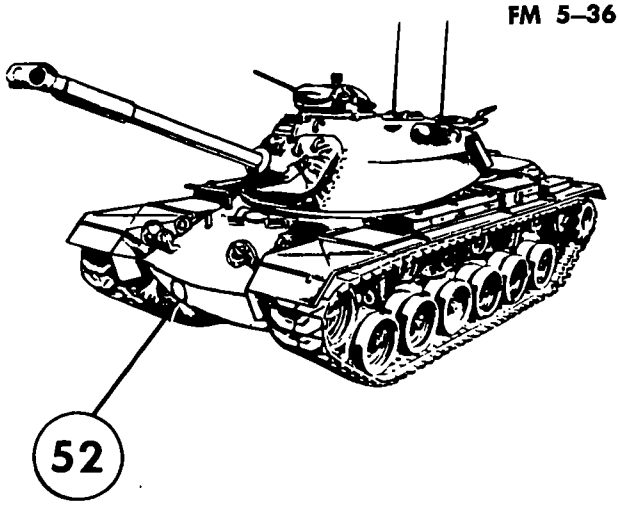
(2) *Normal double flow.* This type crossing is possible when the vehicle class number is equal to or less than the single flow class number of one of the lanes for a multilane bridge. Double flow traffic may be maintained with this type crossing.

b. Special Crossings. Under exceptional conditions, vehicles may be authorized by the local tactical commander to cross bridges when the bridge class number is less than the vehicle class number. These crossings are known as special crossings and are of two types—caution and risk.

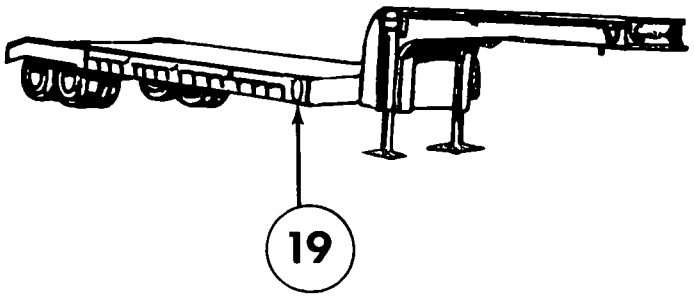
(1) *Caution crossings.* A caution classification may be obtained for nonstandard fixed

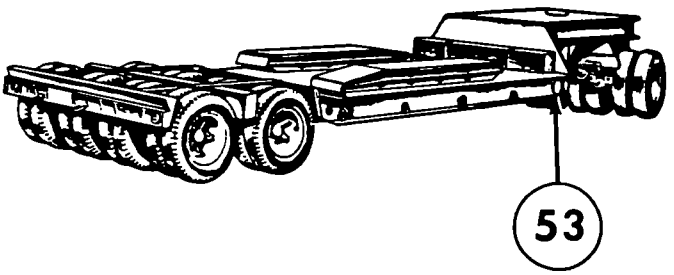


WHEELED VEHICLES



TRACKED VEHICLES





TRAILERS

Figure 2-52. Marking of single vehicles.

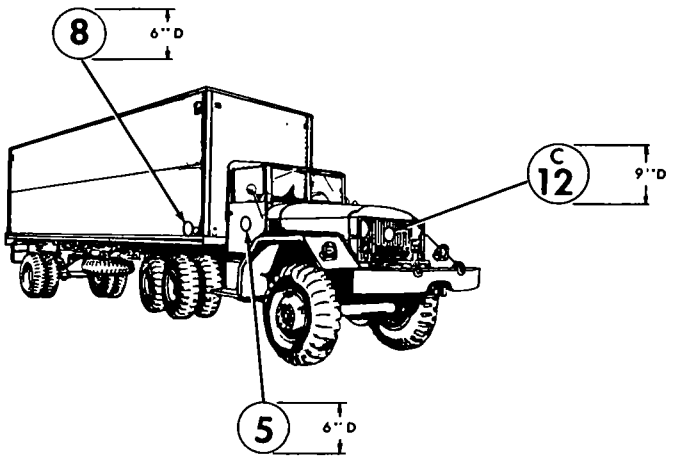


Figure 2-53. Marking of typical combination vehicle.

bridges by multiplying the class number for single flow traffic by 1.25 (5/4). For standard military prefabricated fixed and floating bridges the caution classification is obtained from appropriate technical manuals (see app A). Caution crossings require that vehicles remain on the centerline of the bridge, maintain a spacing of 50 meters between vehicles, do not exceed a speed of 12 KPH (8 MPH); and do not stop, accelerate, or shift gears while crossing.

(2) *Risk crossings. A risk crossing may be made only on standard military prefabricated fixed and floating bridges.* The classification for risk crossings is obtained from appropriate technical manuals (app A). Risk crossings may be made only in the gravest emergency. Risk crossings require that vehicles remain over the centerline; do not exceed a speed of 5 KPH (3 MPH); and do not stop, accelerate, or shift gears on the bridge. Only one vehicle is allowed to cross at a time, and an engineer officer inspects the bridge after each risk crossing for signs of failure. Damage is repaired before traffic can be resumed.

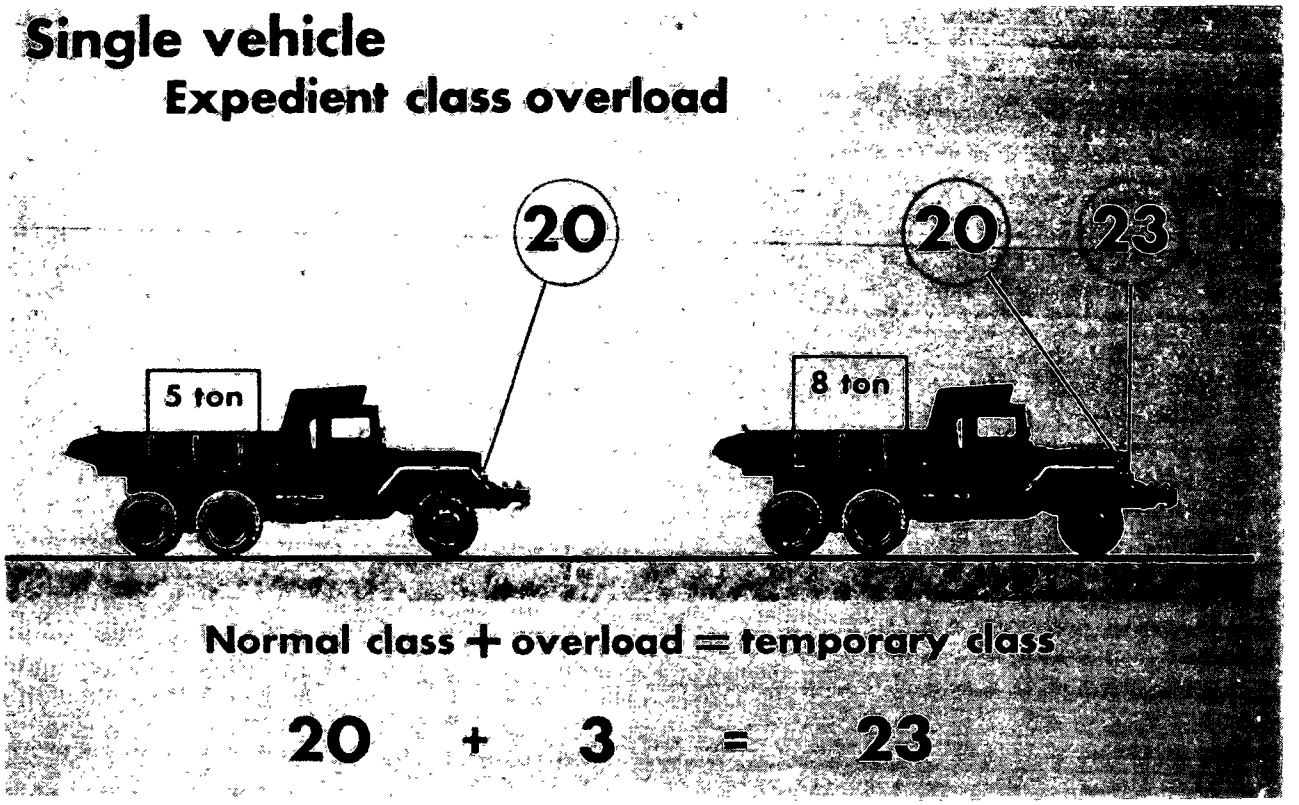


Figure 2–54. Example classification of an overload.

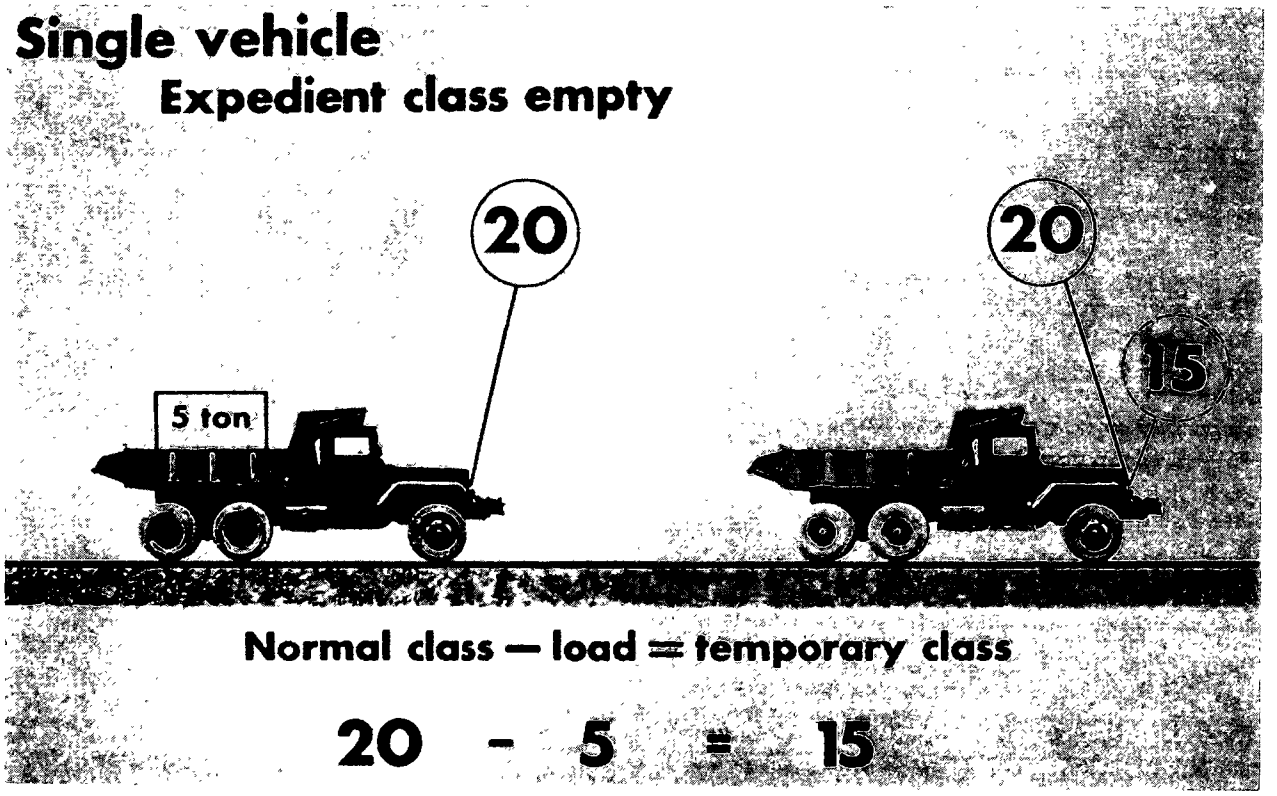
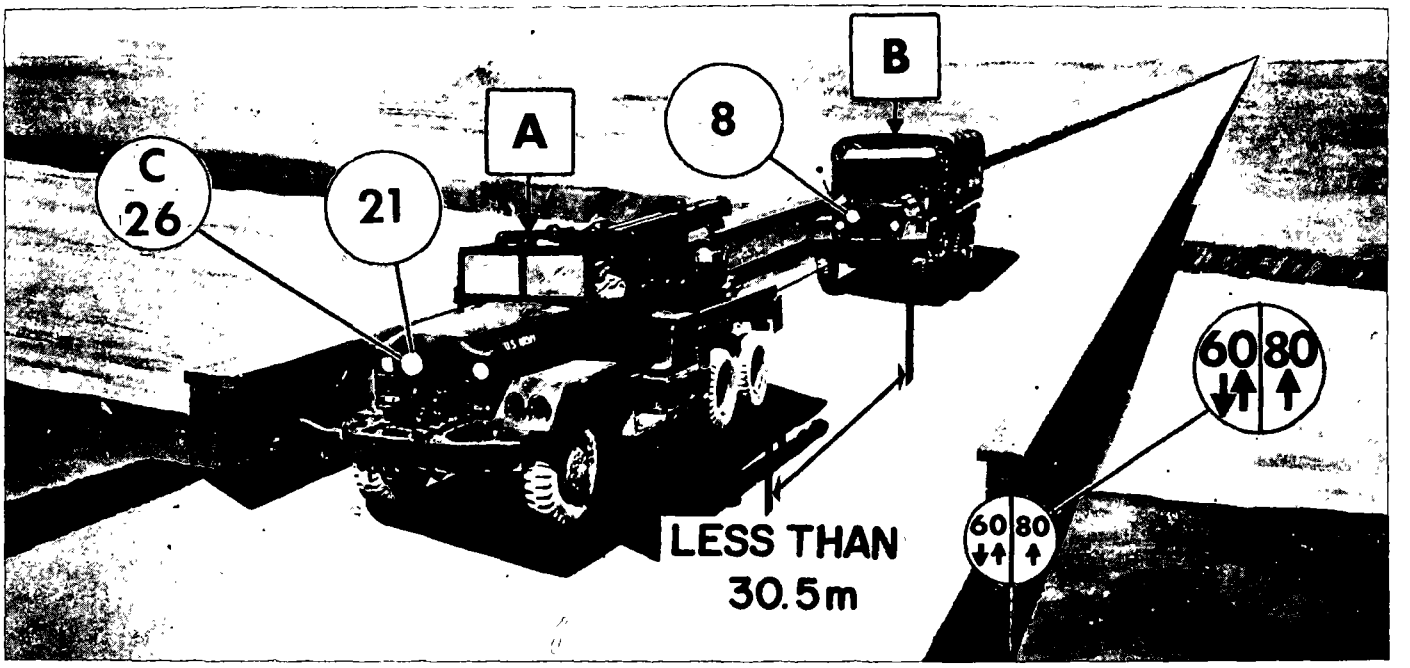


Figure 2–55. Example classification of an underload.



Distance between A and B is less than 30.5 meters
Classification A $^{(21)}$ + Classification B $^{(8)}$ = 29
Classification 29 is less than classification 60

Classification of combination = .9 (29)
= 26

Figure 2-56. Example classification of a nonstandard combination.

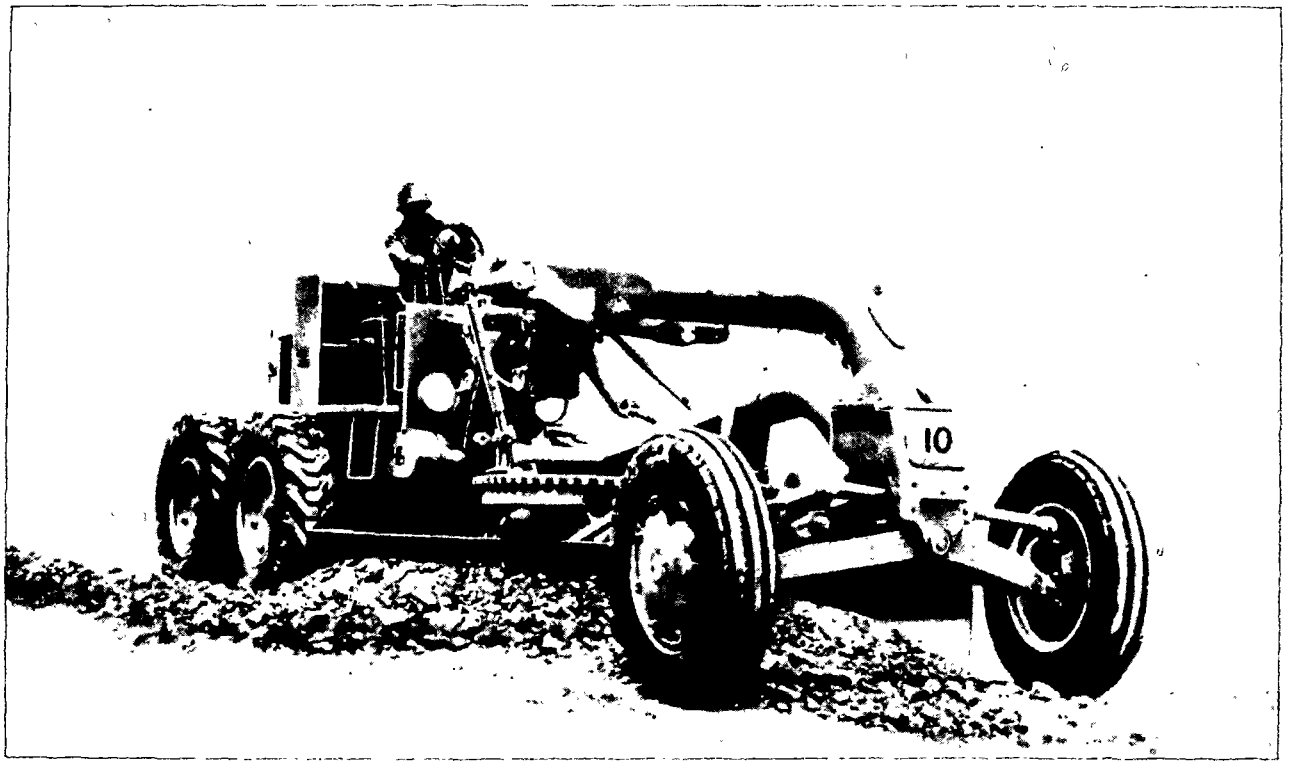


Figure 2-7. Location of classification sign on a special purpose vehicle.

2–55. Bridge Traffic Control Procedures

a. The posting of permanent standard bridge signs and other signs necessary for proper and efficient control of traffic across a bridge is the responsibility of the engineers. Supplementary signs are used when necessary to warn vehicles requiring special controls while crossing. When necessary, holding areas, turnouts for parking and unloading vehicles, and checkpoints are installed near bridges to provide the necessary control during crossings. Figure 2–58 is an example of standard bridge signs and supplementary signs that may be used at bridge and other crossing sites.

b. Traffic control measures are usually outlined in the traffic circulation plan and the traffic control plan of the commander exercising territorial jurisdiction over the area in which the bridge is located. These control measures are usually made known to drivers by means of temporary or permanent route signs posted on bridge access roads. Checkpoints may also be established to insure that users of the bridge have complied with the traffic control regulations prior to entry onto the bridge. In addition, other control measures may be required for other than normal type crossings.

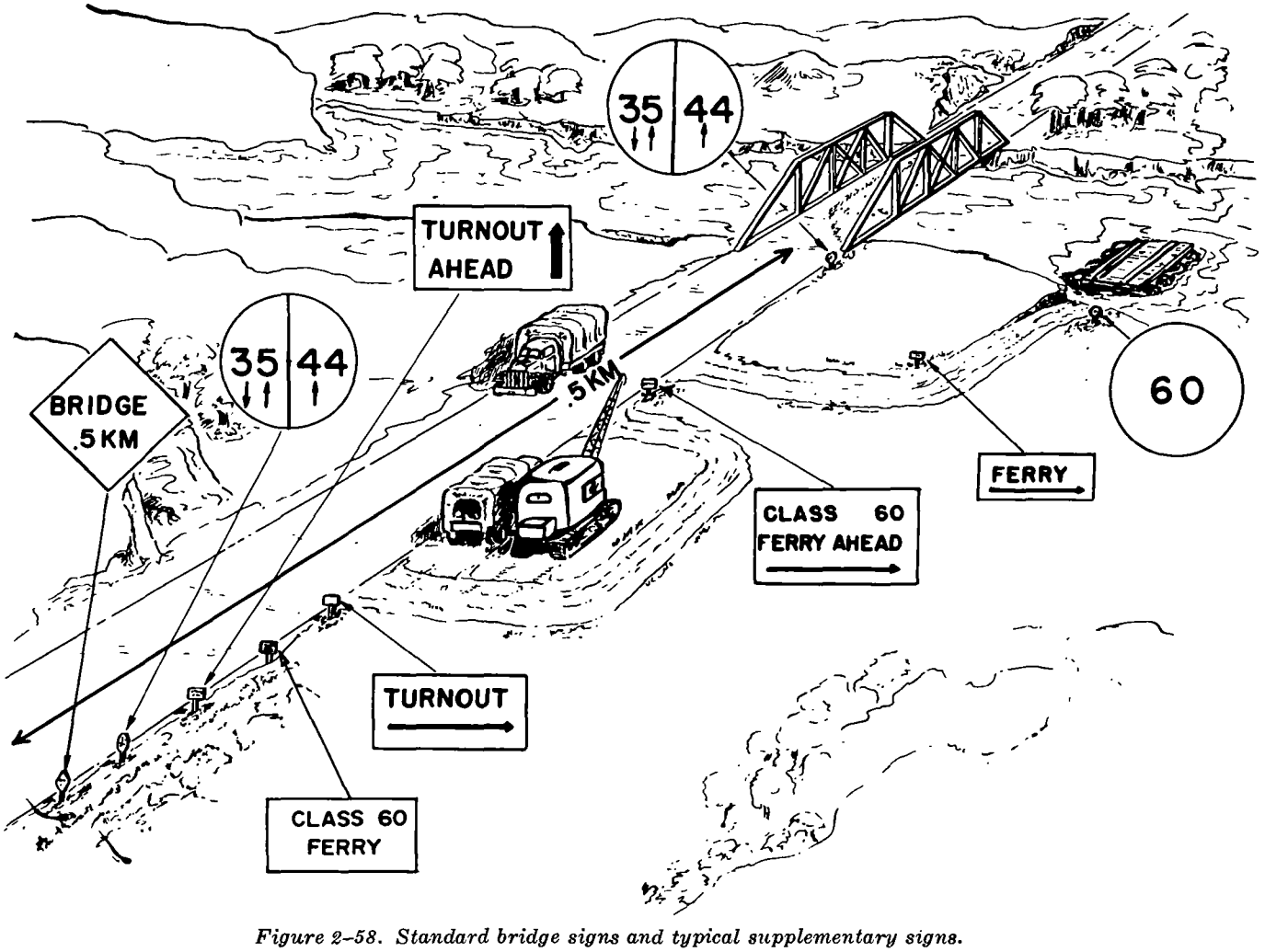


Figure 2–58. Standard bridge signs and typical supplementary signs.

Section VII. BRIDGE ENGINEERING AND RECONNAISSANCE

2–56. Bridge Reconnaissance

The purpose of bridge reconnaissance is to collect bridge data necessary to support operational planning and movement. There are two types of bridge reconnaissance depending upon the amount of time and qualified personnel available: hasty and deliberate. Hasty bridge reconnaissance is performed to acquire limited bridge information (para 2–60) necessary to determine the suitability

of a bridge for immediate tactical use. Time and other limitations preclude a more complete coverage. If calculation of a bridge's military load classification is required, deliberate reconnaissance procedures (para 3–3—3–11) are undertaken in sufficient detail to provide dimensional data for structural analysis. If a bridge fails to meet the minimum traveled way width for the type of traffic flow under consideration (table 2–1) or a minimum overhead clearance of at least 4.3 meters (14 feet), it is reported as (OB) in the route classification formula (para 2–8).

2–57. Bridge Types

A bridge is a structure that carries a roadway or railway over a depression or obstacle. A bridge which is completely supported by its two abutments (end supports) is called a single-span bridge; a bridge having one or more intermediate supports between the abutments is a multispan bridge. From a military standpoint, bridges may be divided into two main types: bridges already existing in an area of operations and those constructed for military purposes during the course of a specific operation. Existing bridges vary in size and complexity from simple wood trestle and stringer bridges to multispan arch or suspension bridges, and it is with these types of bridges that bridge reconnaissance is primarily concerned. Military bridges, on the other hand, which are usually constructed and classified by army engineers, include floating bridges, standard prefabricated bridges, and field-fabricated bridges.

2–58. Bridge Nomenclature

In general, a bridge has two principal parts: the substructure (lower part) and the superstructure (upper part). In addition, bridge approaches and bypasses are important features of a bridge complex and are included in bridge reconnaissance. Basic bridge nomenclature is shown in figure 2–59. (For further discussion, see para 3–3—3–11.)

a. Substructure. The substructure consists of the transverse supports for the superstructure. These supports are either abutments or intermediate supports. The substructure takes the load directly from the superstructure and transmits it to the ground.

b. Superstructure. The superstructure consists of the stringers, flooring, curbing, walks, handrails, trusses, and other components forming that part of the bridge above the substructure.

(1) *Stringers.* Stringers rest on and span the distance between the intermediate supports or abutments. Stringers are the main load-carrying members of the superstructure; they receive the load from the flooring and transmit it to the substructure.

(2) *Flooring.* The flooring system often consists of two parts: decking and tread. The decking is laid directly over the stringers at right angles to the centerline of the bridge. The tread is laid parallel to the centerline of the bridge and between the curbs.

(3) *Curbs.* Curbs are usually placed at both edges of the flooring and guide the suspension system of crossing vehicles. Curbs determine the maximum axle width which the bridge will accommodate. Most bridges, however, allow for vehicular overhand beyond the wheels or tracks; this allowance is termed *horizontal clearance* above the curbs (see fig. 3–19).

(4) *Handrails.* Railings along the bridge are constructed to guide drivers and to serve as a protective measure for both vehicular and foot traffic.

(5) *Trusses.* Some bridges incorporate trusses in the superstructure either above or below the traveled way to increase its load-carrying capacity. A truss is a structural element composed of a system of members joined together to form a series of triangles.

c. Approaches. An approach applies generally to the immediate portions of the route leading to a bridge. Many times, approaches are constructed to provide access to a bridge as either a fill that rises to the bridge or as a cut that slopes down to the bridge. Approaches are often mined or booby-trapped and, consequently, require thorough investigation during reconnaissance.

d. Bypasses. See paragraph 2–61*g*.

2–59. Typical Bridge Spans (STANAG 2253 and SOLOG 96)

Bridges are most effectively described by span type and construction material. The more common types of spans are shown in figure 2–60. (For further discussion, see para 3–13.)

a. Number symbols are assigned to represent types of span construction (table 2–6).

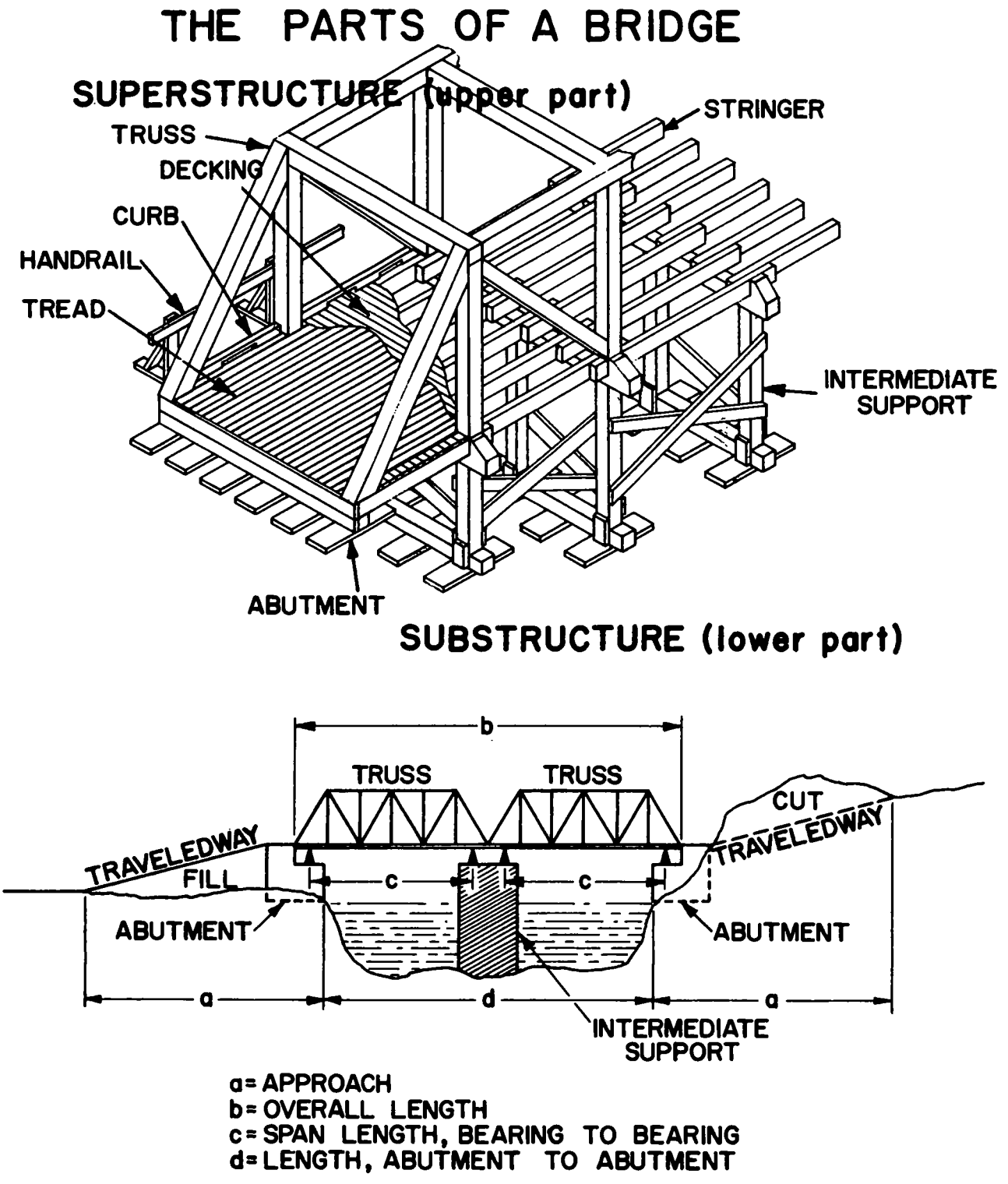


Figure 2–59. Typical bridge nomenclature.

Table 2–6. Span Type

Type of Span Construction	Number Symbol
Truss	1
Girder	2
Beam	3
Slab	4
Arch (closed spandrel)	5
Arch (open spandrel)	6
Suspension	7
Floating	8
Swing	9
Bascule	10
Vertical lift	11
Other (to be specified by name)	12

b. Letter symbols are assigned to present material used in span construction (table 2–7).

Table 2–7. Construction Material

Material of Span Construction	Letter Symbol
Steel or other metal	a
Concrete	k
Reinforced concrete	ak
Prestressed concrete	kk
Stone or brick	p
Wood	h
Other (to be specified by name)	o

c. Both symbols when used in combination, therefore, identify a particular bridge by span type and construction material. For example, the symbol "4ak" describes a slab span of reinforced concrete.

2–60. Limited Bridge Information (STANAG 2253 and SOLOG 96)

Limited bridge information includes those elements determined by hasty reconnaissance necessary for planning and conducting normal vehicular movement. These elements are serial number of the bridge, geographic location, military load classification, overall length, width of traveled way, overhead clearance, and available bypasses. Limited bridge information is recorded on a map or overlay by means of bridge reconnaissance symbols described in paragraph 2–61 or 2–62.

2–61. Full Bridge Symbol

The full bridge symbol (fig. 2–61) consists of a divided circle. Data which make up the full bridge symbol are recorded as follows:

a. The *geographic location* of the bridge is shown by a line extending from the symbol to the exact map location (fig. 2–2).

b. A *bridge serial number* is assigned for ease in future reference. Serial numbers are not duplicated within any one map sheet, overlay, or document. Subsequent identification, therefore, requires the map sheet and overlay number as well as the bridge serial number. The serial number is recorded in the lower portion of the symbol.

c. The *military load class* number of the bridge is shown in the top portion of the circle. This number indicates the carrying capacity of the bridge; both classifications for single and double flow traffic are included. In those instances where dual classification for wheeled and tracked vehicles exists, both classifications are symbolically shown.

d. The *overall length* of the bridge is the distance between abutments measured along the bridge centerline. This value is shown by the dimension placed to the right of the circle and is expressed in meters.

e. The *minimum traveled way width* is the clear distance between curbs. This value is shown by the dimension placed below the symbol and is expressed in meters. For one-lane bridges, widths which do not meet the minimum standard for the bridge's load class (table 2–4) are underlined.

f. The *overhead clearance* is the minimum distance between the traveled way and any obstruction above it. This value is shown by a dimension to the left of the circle and is expressed in meters. Any overhead clearance less than the minimum required by the bridge class number is underlined (table 2–5). Unlimited overhead clearance is indicated by the symbol ∞ (infinity).

g. Bypasses are local detours along a specified route which enable traffic to avoid an obstruction. Bypasses are classified as *easy*, *difficult*, or *impossible*. Each type of bypass is represented symbolically on the line extending from the bridge symbol to the map location (fig. 2–61) and defined as follows:

(1) *Bypass easy.* The obstacle can be crossed within the immediate vicinity of the bridge by a U.S. 2½-ton, 6 x 6, truck (or NATO equivalent) without work to improve the bypass.

(2) *Bypass difficult.* The obstacle can be crossed within the immediate vicinity of the bridge but some work will be necessary to prepare the bypass.

(3) *Bypass impossible.* The obstacle can only be crossed by one of the following methods:

(*a*) Repair of existing bridge.

(*b*) Construction of a new bridge.

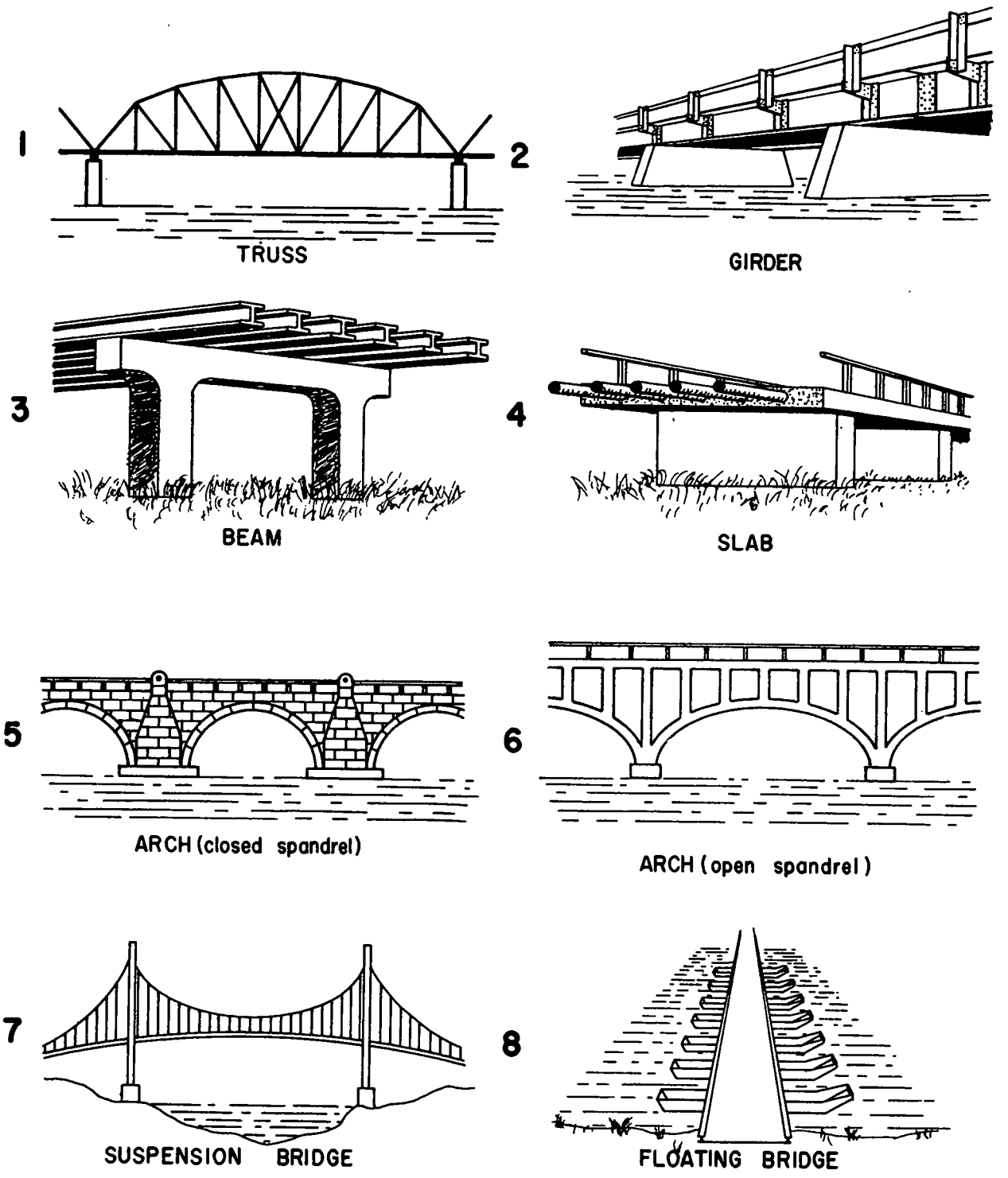
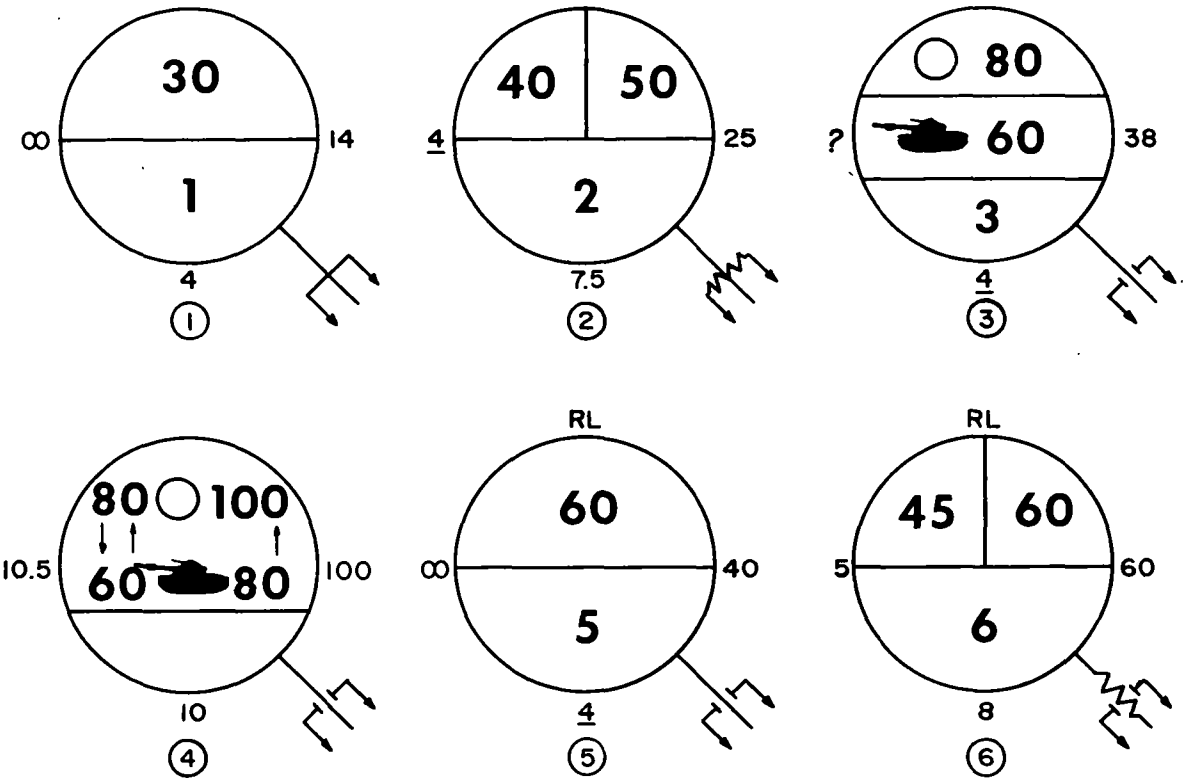


Figure 2–60. Typical bridge spans.

(*c*) Bridge detour. An alternative route which crosses the obstacle at some distance from the bridge site. It will normally follow existing roads.

(4) *Bypass limitations.* Bypasses which are limited to specific vehicle type such as to those capable of swimming or deep water fording are accordingly noted on the reconnaissance report.

h. A question mark (*?*) is used to indicate information which is unknown or undetermined and is included as part of the bridge reconnaissance symbol.



1. This symbol represents a single flow bridge, class 30, assigned the arbitrary serial number 1, with an overall length of 14m, traveled way width of 4m, unlimited overhead clearance, and easy bypass conditions.

2. This symbol represents a class 40 double flow and class 50 single flow bridge assigned the arbitrary serial number 2 with an overall length of 25 meters, traveled way width of 7.5 meters, overhead clearance 4 meters, and difficult bypass conditions. The overhead clearance of 4 meters is less than the 4.25m specified by STANAG 2021, and the dimension is, therefore, underlined.

3. This symbol represents a single flow bridge assigned the arbitrary serial number 3 which is class 80 for wheeled vehicles and class 60 for tracked vehicles with overall length of 38m, traveled way width of 4m, overhead clearance unknown, and impossible bypass conditions. The traveled way width is less than that specified by STANAG 2021, and the dimension is, therefore, underlined.

4. This symbol represents a double flow bridge assigned the arbitrary serial number 4, which is class 80 double flow and class 100 single flow for wheeled vehicles; class 60 double flow and class 80 single flow for tracked vehicles with overall length 100 meters, traveled way width of 10 meters, overhead clearance 10.5 meters, and impossible bypass conditions.

5. This symbol represents a railway bridge easy to adapt to road vehicles, single flow, class 60, 40 meters overall length, unlimited overhead clearance, 4 meters traveled way width, impossible bypass conditions, assigned the arbitrary serial number 5. The traveled way width is underlined since it is below the minimum prescribed for the load class.

6. This symbol represents a railway bridge difficult to adapt to road vehicles, class 60 single flow and class 45 double flow, 60 meters overall length, 5 meters overhead clearance, 8 meters traveled way width, impossible bypass conditions, assigned the arbitrary serial number 6.

Figure 2-61. Examples of the full bridge symbol.

i. Railway bridges which could in an emergency be used by road vehicles are indicated as follows:

(1) *Use easy.* The work necessary to adopt the bridge for use by road vehicles would take less than four hours for 35 men with appropriate equipment. The full bridge symbol, surmounted by the letters "RL", and a *straight* line indicating the bridge location.

(2) *Use difficult.* The work necessary to adopt the bridge for use by road vehicles would take *more* than four hours for 35 men with appropriate equipment, but would take less time than building

a military bridge at this point. As in (1) above, but with a *jagged* line indicating the bridge location.

2–62. Abbreviated Bridge Symbol

If the scale of the map or size of the document is too small to accommodate the full bridge symbol, an *abbreviated symbol* may be used (fig. 2–62). This necessitates an accompanying inclosure to the route reconnaissance overlay; the bridge report format (para 2–63) or DA Form 1249 is suitable for this purpose. The abbreviated symbol consists of a circle divided by a horizontal line. Data which make up the abbreviated symbol are recorded as follows:

a. The location and serial number for the abbreviated bridge symbol is indicated in the same manner as for the full bridge symbol (para 2–61*a* and *b*).

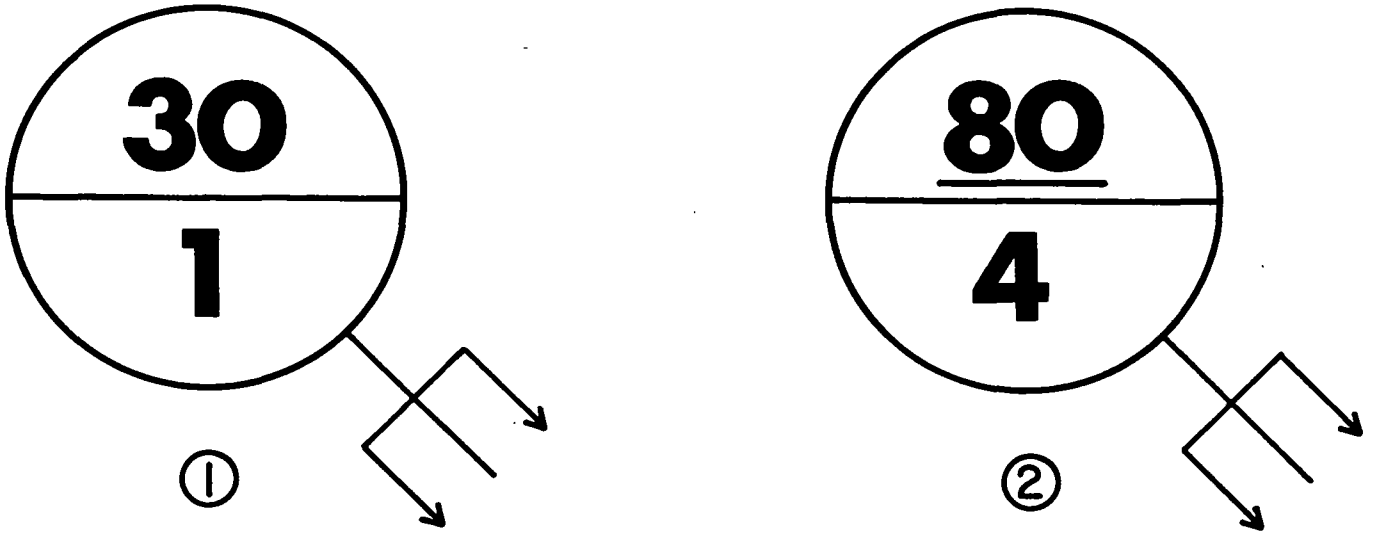
b. The military load class for *single flow traffic* only is represented in abbreviated bridge symbols, and this is shown in the upper portion of the circle. Where there are separate single flow classifications for tracked and wheeled vehicles, the lower one is shown. The load class number is underlined if either the roadway width or overhead clearance (or both) is less than the minimum required for the class of the bridge.

2–63. Format for Electrically Transmitting Bridge Information (STANAG 2096, SEASTAG 2096 and SOLOG 107)

To provide standardization in reporting bridge reconnaissance data by electrical means the format shown in figure 2–63 has been devised. Although primarily designed for electrical transmissions in conjunction with standard message forms (DD Form 173 and DA Form 11–170), the format, which is reproduced locally, may also be used to supplement route reconnaissance overlays especially when the abbreviated bridge symbol is employed. The originator reports only those parts of the format which are applicable or for which information is available. Each item of the report, however, must be accompanied by the appropriate letter designation from the format to establish the correct category or information. Messages are preceded by the term, BRIGREP, or identifying codeword.

2–64. Reconnaissance of Bridge Sites

a. Reconnaissance personnel other than engineers may often be required to assist in selecting



1. This symbol represents a single flow bridge, class 30, assigned the serial number 1 with easy bypass conditions.

2. This symbol represents a single flow, class 80 bridge, assigned the serial number 4, with easy bypass conditions. The underlined class number indicates that minimum requirements are not met by roadway width or overhead clearance or both.

Figure 2–62. Examples of the abbreviated bridge symbol.

Explanation	BRIGREP Letter designation	(1)[a]	(2)[b]	(3)[b]	(4)[b]
Map sheet(s)	ALPHA				
Date and time information was collected	BRAVO				
Location (UTM grid coordinates)	CHARLIE				
Type of bridge (use symbols explained in para. 2–58).	DELTA				
Single flow classification	ECHO				
Double flow classification	FOXTROT				
Physical condition of bridge	GOLF				
Minimum width of traveled way	HOTEL				
Overhead clearance	INDIA				
Bypasses	JULIET				
Other significant information	KILO				

Notes. [a]. First bridge in report; report by serial number if assigned.
[b]. Additional bridges in report.

Figure 2–63. Bridge report format.

sites for military bridging. General reconnaissance considerations in selecting bridge sites are as follows:

(1) *Access routes.*

(*a*) The bridge site should be located to take maximum advantage of the existing road net on both sides of the site.

(*b*) The reconnaissance should include the location of concealed areas which are accessible to the main road net to be used as holding areas for vehicles waiting their turn to cross the bridge.

(2) *Approach roads.*

(*a*) Reconnaissance should consider the construction required for bridge approaches at each site. Often, the time required to construct approaches is the controlling factor in the selection of a bridge site. Approaches should be straight and without excessive grade.

(*b*) A turnaround near the bridge site is needed for moving trucks and semitrailers during the construction phase.

(3) *Width of stream.* The width of the stream must be determined accurately enough to establish the amount of materials and equipment needed.

(4) *Banks.*

(*a*) The character and shape of the banks should be analyzed in sufficient detail to establish the type of abutments required.

(*b*) Banks should be firm and should not be so high or so steep as to require excessive grading for the approach. Straight stretches of the stream should be selected whenever possible because the banks will be subject to less scour.

(5) *Flow characteristics.* The velocity of the stream and data on the rise and fall of the water should be determined. A good bridge site is one where the current is steady, parallel to the bank, and slow to moderate (less than 1.5 meters per second).

(6) *River bottom.* The character of the river bottom should be noted so the type of support and footings can be determined.

(7) *Profile.* In order to determine the heights of bridge supports, an accurate cross section of the defile should be made.

(8) *Local materials.* The reconnaissance should locate the nearest source of materials that can be used in construction. Sources include standing timber, nearby demolished buildings or bridges, and sources of sand and gravel for bridge approaches.

b. The armored vehicle launched bridge (AVLB) is a bridge with a military load classification of 60 which is designed to be transported, launched, and retrieved by a modified turretless tank chassis (fig. 2–64). The AVLB is used to cross short gaps (18 meters or less) in a minimum of time and with a minimum exposure of bridging personnel to enemy fire. The gaps to be crossed may consist of antitank ditches, road craters, streams, demolished bridge spans, railroad cuts, and similar obstacles frequently found in the combat zone. The bridge can be launched and re-

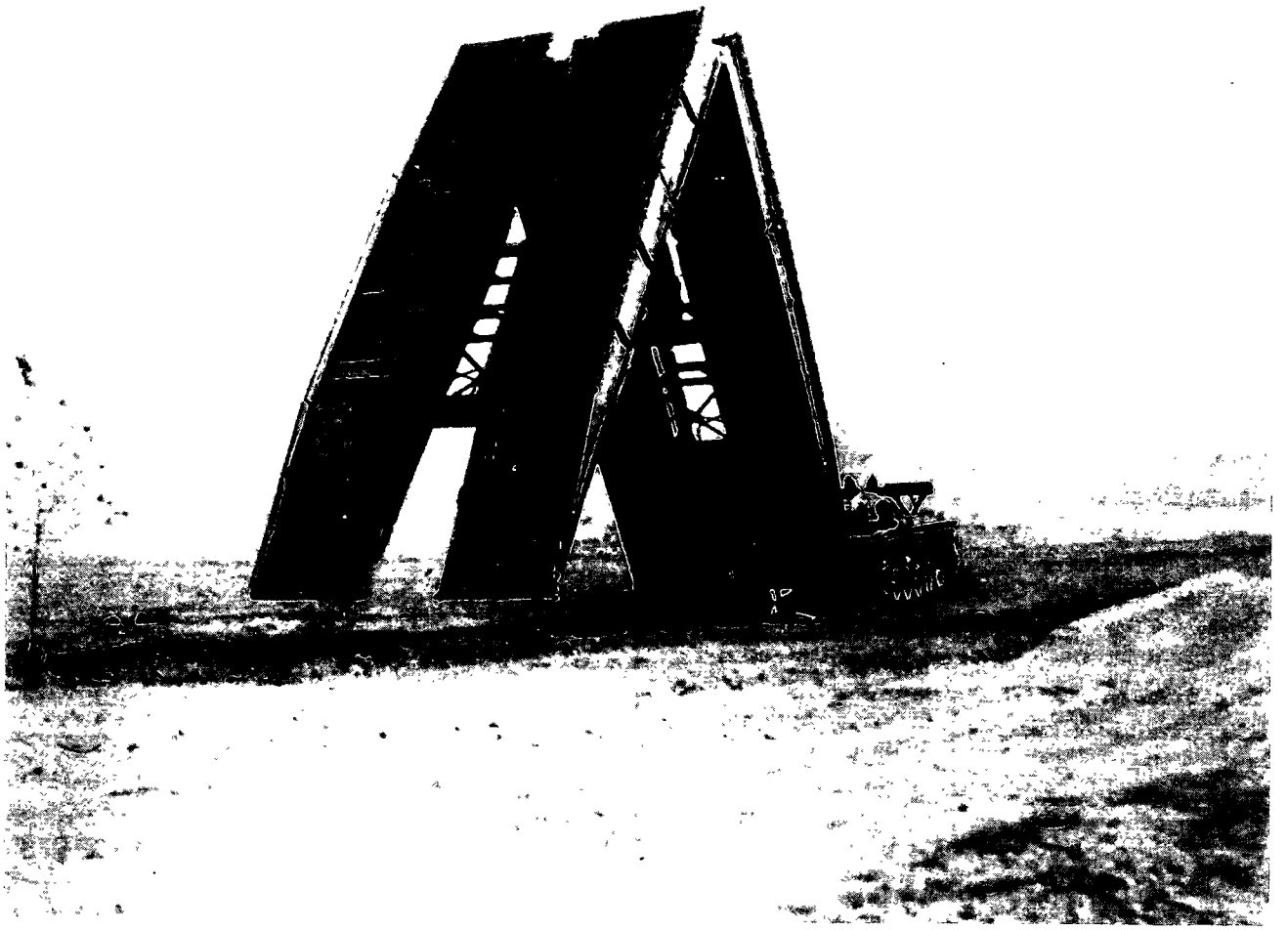


Figure 2–64. Armored vehicle launched bridge.

covered on uphill grades of 28 percent, downhill grades of 19 percent, and transverse grades of 11 percent. In all cases the *bank conditions must support the launching vehicle and provide sufficient bearing to allow the bridge to support its rated load after launching* (TM 5–216).

2–65. Drainage Considerations

Drainage is an important aspect of route reconnaissance. The entire serviceability of a route depends on the adequacy of the drainage system (TM 5–330). The washout of a single culvert may result in a traffic obstruction or close a route at a critical time. The development of a soft spot may lead to rutting, displacement, and eventual closing of a route for repairs. In addition, drainage systems are vulnerable to demolition by enemy forces. It is, therefore, incumbent on all reconnaissance personnel to inspect the drainage system, to report structures in need of repair and debris which may clog the system, and to check likely sites for prepared demolition or acts of sabotage. The more common components of drainage systems are—

a. Open Channels. Open channels or ditches provide the simplest as well as the most common method of handling surface water. Gutters or combination curbs and gutters are used to collect and control surface runoff where open ditches would be impractical. Deep or wide ditches bordering routes are definite traffic hazards. These ditches may reduce the width of the traveled way and require posting with caution signs.

b. Embankments. Dikes, berms, or intercepting embankments are used along shoulders of high fills or along the tops of cut slopes to collect runoff. Such runoff may be directed into ditches or natural drainage courses to prevent the erosion of unstable slopes.

c. Culverts (fig. 2–65). Culverts are used under roads and air landing facilities to carry water that

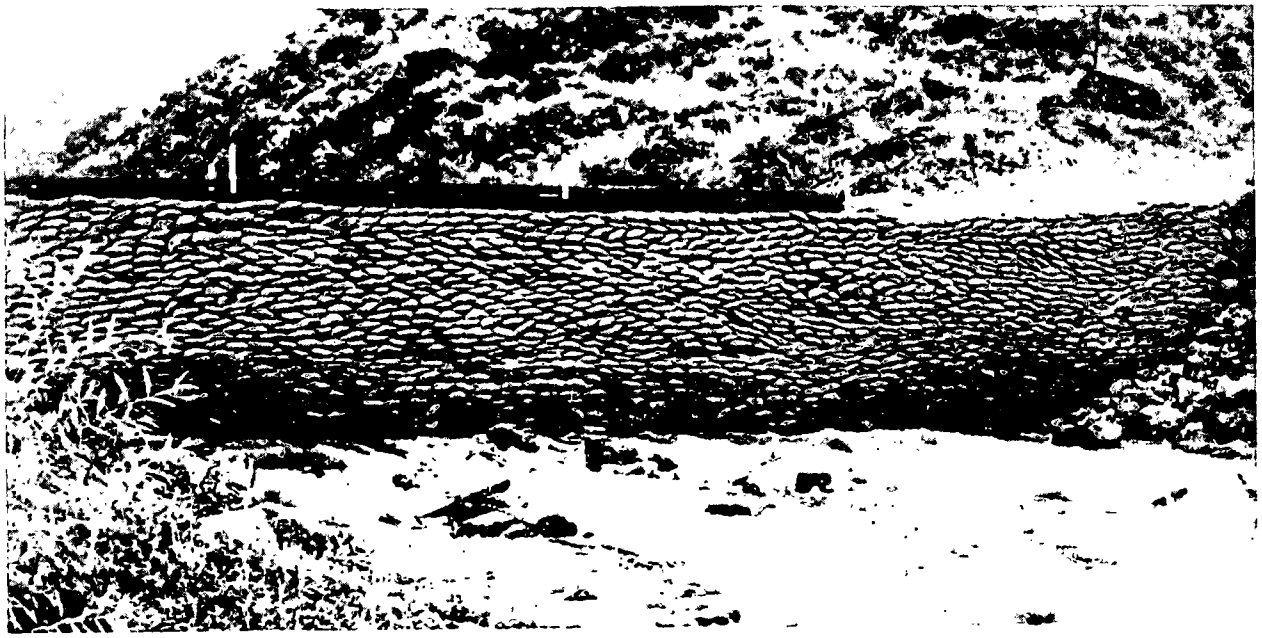


Figure 2–65. Causeway with culverts.

cannot be diverted to natural drainage channels by other means. Culverts are relatively short and conform generally to the grade and alinement of the open ditch, stream, or natural drainage course at the inlet and outlet ends. Culverts are particularly good demolition targets.

d. Dips. Dips are portions of a route, normally paved, which may be used as fords for crossing shallow arroyos or washes in semiarid regions subject to flash floods and in other locations where the construction of a bridge is impractical or too expensive.

CHAPTER 3

DELIBERATE BRIDGE AND ROAD RECONNAISSANCE

Section I. GENERAL

3–1. Deliberate Bridge and Road Reconnaissance

With the exception of bridges and roads, sufficient information for the conduct of deliberate route reconnaissance is prescribed in chapter 2. In this chapter, deliberate reconnaissance procedures for bridges and roads are discussed separately because of their technical nature and to facilitate instruction of those personnel, primarily engineers, who bear staff responsibility for the technical classification of existing routes. Section II is devoted to deliberate bridge reconnaissance, section V to deliberate road reconnaissance, and section VI to engineer reconnaissance.

3–2. Computation of Military Load Classifications

To a great extent, route classification is based on the military load classification system. Existing bridges in a theater of operations as well as enemy and civilian nonstandard vehicles requisitioned for military use may often require the computation of their respective classifications. To meet this likelihood, section III (Bridge Military Load Classification) and section IV (Vehicle Military Load Classification) are introduced following deliberate bridge reconnaissance to which the classification system is closely related.

Section II. DELIBERATE BRIDGE RECONNAISSANCE

3–3. General

The purpose of bridge reconnaissance is to collect bridge data necessary to support operational planning and movement. There are two methods of bridge reconnaissance:

a. Hasty Bridge Reconnaissance. Hasty reconnaissance is performed to acquire limited bridge information necessary to determine the suitability of a bridge for immediate tactical use. This type of reconnaissance is discussed in paragraphs 2–56 through 2–65.

b. Deliberate Bridge Reconnaissance. Deliberate reconnaissance, on the other hand, is conducted when sufficient time and qualified personnel are available to consider all aspects of a bridge required for thorough structural analysis. This analysis may be for the purpose of repairs, demolition, or military load classification.

3–4. Elements of Bridge Information (STANAG 2253 and SOLOG 96)

Bridge information is presented symbolically on overprinted maps or overlays, in bridge report format, in bridge reconnaissance report format, or in some combination of these. Not every element is necessarily investigated in every reconnaissance. The elements to be reported are dictated by the nature of the reconnaissance mission. For example, a reconnaissance performed for bridge demolition may disregard elements such as load class and overhead clearance.

a. Maps or Overlays. The following elements of bridge information are given in the form of a full bridge symbol on overprinted maps or overlays (para 2–61 and 2–62):

(1) Serial number of bridge.
(2) Location.
(3) Military load class.
(4) Overall length.
(5) Roadway width.
(6) Overhead clearance.
(7) Bypass possibilities.

b. Bridge Reconnaissance Report. Elements of bridge information required in addition to the above are given in the bridge reconnaissance report. Where the abbreviated bridge symbol has been used the reconnaissance report includes those elements omitted from the above list.

3–5. Bridge Reconnaissance Report Form

DA Form 1249 (Bridge Reconnaissance Report) supplements the route reconnaissance overlay. The instructions for making the reconnaissance guide the reconnaissance party in the amount of detail required. Short forms or bridge information tables may be designed and produced by the unit making the reconnaissance when DA forms are not available. Elements of bridge information are recorded, as required, in the columns of the Bridge Reconnaissance Report (fig. 3–1) as follows (all dimensions are in meters):

a. Column 1. The assigned serial number of the bridge is entered. This number corresponds to the serial number used in the bridge symbol of the route reconnaissance overlay.

b. Column 2. Bridge location is reported by means of UTM grid coordinates.

c. Column 3. Horizontal clearance is the clear distance between the inside edges of the bridge structure measured at a height of 30 centimeters (12 inches) above the surface of the traveled way and upwards. Any horizontal clearance less than the minimum required for the roadway width of the bridge as shown in table 2–4 is underlined. Unlimited horizontal clearance is indicated by the symbol for infinity (∞).

d. Column 4. Underbridge clearance is the minimum clear distance between the underside of the bridge and the surface of the ground or water at mean level. Mean water level can be determined from gaging station records, observation of high and low water marks, or information gained from local inhabitants.

e. Column 5. The number of identical spans (spans of the same type, material of construction, length, and condition) is listed in this column. Where only one span is described the number need not be given. Spans are listed in sequence starting from the west. In those cases where the orientation of the bridge is due north and south, or so close to north and south as to create uncertainty as to which is the most westerly span, the abbreviation for north (N) is inserted in column 5 preceding the number of spans; and the spans are listed in sequence starting from the north.

f. Column 6. The type of span construction is recorded by applicable number symbol (table 2–6).

g. Column 7. The construction material of each span is recorded by letter symbol (table 2–7).

h. Column 8. Span length is recorded. This is the center-to-center distance between bearings. Hence, the sum of the span lengths may not equal the overall length. The following special information is also recorded:

(1) Spans which are not usable because of damage or destruction are indicated by the symbol # placed after the dimension of the span length.

(2) Spans which are over water are indicated by placing the letter "W" after the dimension of the span length.

i. Additional Information. When the abbreviated bridge symbol is used, or when the reconnaissance mission requires it, columns are added to give the following elements of bridge information (fig. 3–2):

(1) Military load class.

(2) Overall length.

(3) Roadway width.

(4) Overhead clearance.

(5) Bypass possibilities. Specify "easy", "difficult", or "impossible" (para 2–61).

(6) Remarks. Include in this column any further important details of the bridge, such as damage, preparation for demolition, effort to repair, and elaboration of information given under other column headings.

j. Railway Bridges. Details of railway bridges may be included in the reconnaissance report form. The letters "RL" are added after the serial number in column 1. Details of the work required to convert the bridge to use by road vehicles are listed under "Remarks".

k. Unknown Information. Any item of information which is unknown or undetermined is represented by a question mark (?) in the appropriate column of the report.

3–6. Bridge Sketches

Sketches on the back of DA Form 1249 depict as much information as necessary (fig. 3–3). *Minimum required detail* is as follows:

a. A side elevation which shows the general features of the bridge including the number of spans, piers, and abutments and their type and material of construction. Critical dimensions such as span length, height above stream bed, water level, and panel length are also noted. A cross section of the obstacle (e.g., stream or gorge) may be also included in the sketch.

BRIDGE RECONNAISSANCE REPORT

For use of this form, see FM 5-36; the proponent agency is USCONARC.

DATE: 1 JUN 1964

SIGNATURE: John H. Doe 1st. Lt. CE

TO: (Headquarters ordering reconnaissance) COMMANDING OFFICER, ATTN: S2; 185th ENGR BN (21st INF DIV)

FROM: (Name, grade, and unit of officer or NCO making reconnaissance) John H. Doe 1/Lt CoA 21st ENGR BN

MAPS (Country, scale and sheet number or name): Virginia, Anandale, 1:25,000; Sheet 5561

DATE/TIME GROUP (OI signature): 0 0116 30R

ESSENTIAL BRIDGE INFORMATION

1 SERIAL NO.	2 LOCATION	CLEARANCE 3 HORIZONTAL	CLEARANCE 4 UNDER-BRIDGE	SPANS 5 NUMBER	SPANS 6 TYPE OF CONSTRUCTION	SPANS 7 TYPE OF CONSTRUCTION MATERIAL	SPANS 8 LENGTH AND CONDITION	ADDITIONAL BRIDGE INFORMATION (Add columns as needed) (Military load class, overall length, roadway width, vertical clearance, bridge by-pass)
1	LA 072687	00	2		3	h	4.8W	
2	LA072997	9.5	6.5		4	K	4	
					1	2	16W#	
					4	K	4W	
3	LA165650	00	23	5	3	2K	25	
4	LA156643	10.5	8.5	3	6	K	10	
				2	2	2	20W	
				3	6	K	10	

DA FORM 1 JUL 60 1249 PREVIOUS EDITION OF THIS FORM IS OBSOLETE. GPO 874-086

Figure 3-1. Example bridge reconnaissance report form used in conjunction with the full bridge symbol on a map or overlay.

BRIDGE RECONNAISSANCE REPORT
(FM 5-36)

DATE: 1 Jun 1964

SIGNATURE: John H. Doe.

TO: (Headquarters ordering reconnaissance) COMMANDING OFFICER, ATTN: S2 21ST ENGR BN (21ST INF DIV)

FROM: (Name, grade, and unit of officer or NCO making reconnaissance) John H. Doe 1st Lt. Co A 21st ENGR BN

MAPS (Country, scale and sheet number or name): Virginia, Anandale, 1:25000; Sheet 5561*

DATE/TIME GROUP (Of signature): 011900Z

ESSENTIAL BRIDGE INFORMATION

ADDITIONAL BRIDGE INFORMATION (Add columns as needed)
(Military load class, overall length, roadway width, vertical clearance, bridge by-pass)

1 SERIAL NO.	2 LOCATION	CLEARANCE 3 HORIZONTAL	CLEARANCE 4 UNDER-BRIDGE	SPANS 5 NUMBER	SPANS 6 TYPE OF CONSTRUCTION	SPANS 7 TYPE OF CONSTRUCTION MATERIAL	SPANS 8 LENGTH AND CONDITION	9 Military Load Classification	10 OVERALL LENGTH	11 Traveled width	12 Overhead Clearance	13 By-pass Possibilities	14 Remarks
1	LA072687	00	2	1	3	h	4.8 w	30	4.9	3.5	∞	Easy	NONE
2	LA118759	9.5	6.5		4	K	4	40 50	25	7.5	4	Difficult.	NONE
					1	a	16 w *						
					4	K	4 w						
3	LA165650	∞	23	5	3	ak	25	80 60	126	8.5	∞	Impossible	NONE
4	LA156643	10.5	8.5	3	6	K	10	80 100 60 80	100	10	10.5	Impossible	NONE
				2	2	a	20 w						
				3	6	K	10						

DA FORM 1 JUL 60 1249 PREVIOUS EDITION OF THIS FORM IS OBSOLETE.

GPO 927514

Figure 3-2. Example bridge reconnaissance report form used alone or in conjunction with the abbreviated bridge symbol on a map or overlay.

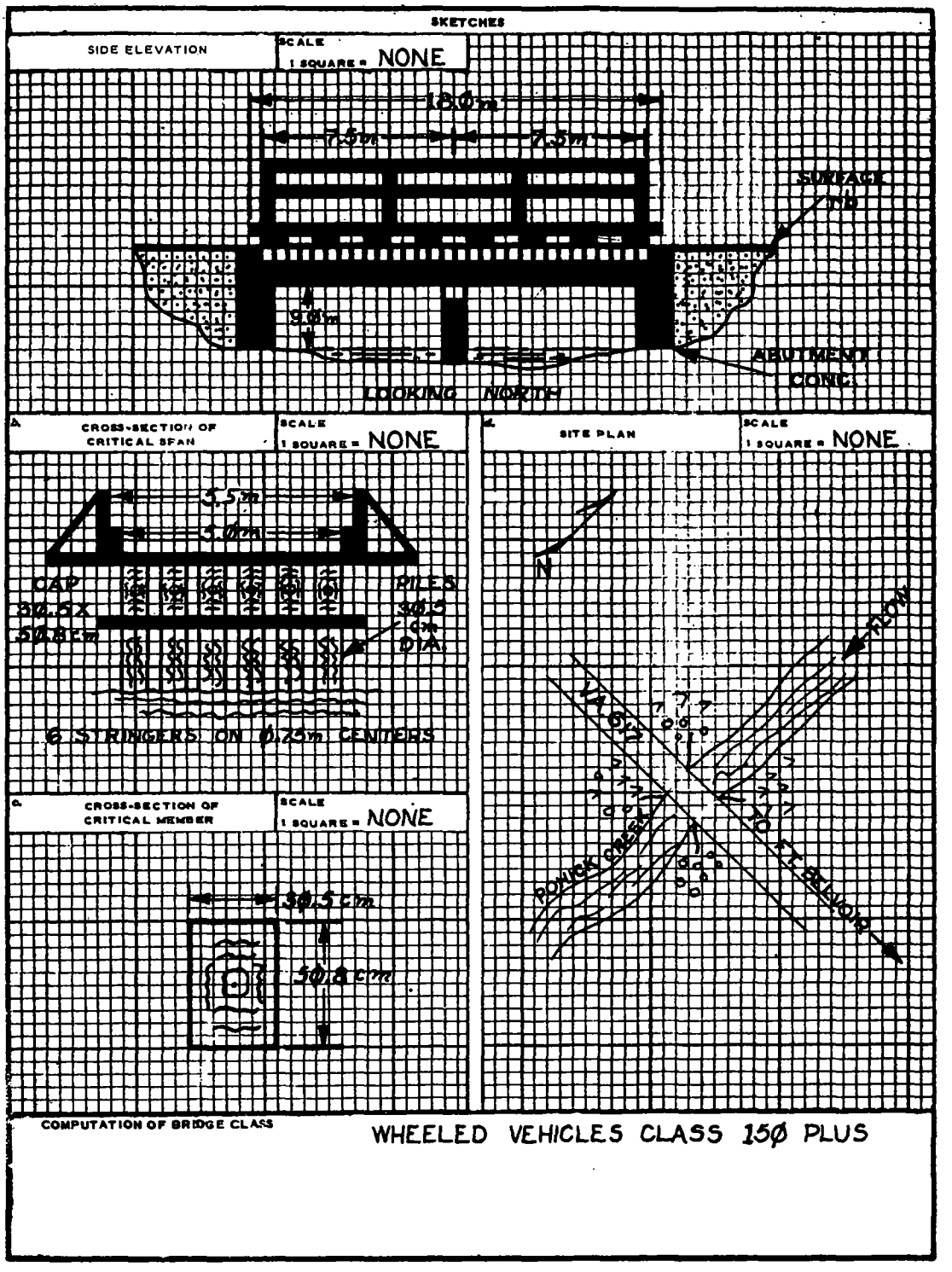


Figure 3–3. Example bridge sketch on back of reconnaissance report form.

b. The critical span (the span with the least load-carrying capacity) which is sketched in cross section shows sufficient details of construction upon which to base computation of the military load classification and to ascertain maintenance, reinforcement, and demolition requirements. Such items as width of span, type and materials of construction, and structural design are included. Tables 3–1 and 3–2 outline the required dimension measurements for each of the seven basic types of spans.

c. Cross sections of critical members which are

Table 3–1. General Dimension Data Required for Each of the Seven Basic Types of Bridges

Number on figure	Dimension data	Basic type of bridge						
		Simple stringer (fig. 3–23)	Slab (fig. 3–21)	T-beam (fig. 3–21)	Truss (fig. 3–31)	Girder (fig. 3–39)	Arch (fig. 3–42)	Suspension (fig. 3–51)
1	Overall length	x	x	x	x	x	x	x
2	Number of spans	x	x	x	x	x	x	x
2	Length of spans	x	x	x	x	x	x	x
2a	Panel length				x			x
3	Height above streambed	x	x	x	x	x	x	x
3a	Height above estimated normal water level	x	x	x	x	x	x	x
4	Traveled way width	x	x	x	x	x	x	x
5	Overhead clearance				x			x
6	Horizontal clearance	x	x	x	x	x	x	x

Notes
1. The figures referred to are outline drawings of the basic type of bridges.
2. The letter "x" indicates that the dimension is required.

sketched in sufficient detail to provide a basis for calculating the strength of individual members.

d. The site plan sketch which shows the location of the bridge; the alinement of the bridge relative to approaches; the gap or obstacle spanned; the location of unusual features such as damage or obstructions; the classification, dimensions, and gradient of approaches; the direction of flow of the stream; and sufficient topographical detail of the barrier to indicate possible fording sites.

3–7. Bridge Photographs

DA Form 1249 is accompanied by up-to-date photographs if possible. Both ground and aerial photographs are desirable. The minimum photographic coverage includes a side view, a view from the traveled way of the bridge, and a view from underneath the flooring.

3–8. Additional Bridge Information

Items of bridge information which may be collected and recorded when practicable or required are—

a. Approaches to include limiting factors, minimum traveled way width, surface material, and obstructions.

b. Nature of crossing or obstacle to include naming the geographical feature over which the bridge spans and reporting its width and depth. If the crossing is over a water obstacle, additional information includes current condition; width and depth at mean water level; tidal conditions; flood susceptibility; proximity of dams, locks, etc.; nature and slope of banks; and type of stream bottom.

c. Abutments to include foundation conditions, type and material of construction, and bearing areas (para 3–9).

d. Intermediate supports to include foundation conditions, type and material of construction, bearing areas, height above ground or mean water level, horizontal clearance between supports at ground or mean water level, special design features such as ice breakers, and critical dimensions required for demolition or strength calculations (para 3–10).

e. Bridge structure to include a detailed description of the type and material of construction to include wearing surface, deck or flooring, and supporting members (para 3–11). Also included are capacity dimensions where applicable (table 3–2), engines and machinery for swing, lift, bascule, and retractile bridges; supply, utility, or communication lines supported by the bridge; date of construction; and critical dimensions for demolition and calculation of the military load class.

f. Repair information to include a description of the nature of repair or the reinforcement needed; an estimate of time, labor, and material required; availability of construction material nearby; and results to be expected from repairs or reinforcement (TM 5–312). Extensive repair information is generally attached to the Bridge Reconnaissance Report using DA Form 1711–R (see para 3–33).

Table 3–2. Capacity Dimension Data Required for Each of the Seven Basic Types of Span

Letter designation	Capacity [a] dimension data	Basic types of bridge										
		Simple stringers (fig. 3–23)					Slab (fig. 3–21)	T-beam (fig. 3–21)	Truss (fig. 3–31)	Girder (fig. 3–39)	Arch (fig. 3–42)	Suspension (fig. 3–51)
		Timber		Steel								
		Rectang.	Log.	I-beam	Channel	Rail						
a	Thickness of wearing surface			x			x	x	x	x	x	x
b	Thickness of flooring, deck, or depth of fill at crown.			x			x	x	x	x	x	x
c	Distance, c-to-c, between T-beams, stringers, or floor beams.	x	x	x	x	x	-------	x	x	x	x	x
d	Number of T-beams or stringers	x	x	x	x	x	-------	x	x	x	-------	x
e	Depth of each T-beam or stringer	x	[b]	x	x	x	-------	x	x	x	-------	x
f	Width of each T-beam or stringer	x	-------	[c]	[c]	[c]	-------	x	x	x	-------	x
g	Thickness of web of I-beams, WF-beams, channels, or rails.	----------		x	x	x	----------	x	x	-------		x
h	Sag of cable											x
i	Number of each size of cable											x
j	Thickness of arch ring										x	
k	Rise of arch										x	
l	Diameter of each size of cable											x
m	Depth of plate girder									x		
n	Width of flange plates									x		
o	Thickness of flange plates									x		
p	Number of flange plates									x		
q	Depth of flange angle									x		
r	Width of flange angle									x		
s	Thickness of flange angle									x		
t	Depth of web plate									x		
u	Thickness of web plate									x		
v	Average thickness of flange			x								

Note. x indicates required dimensions.

[a] Capacity is computed by the use of formulas and data outlined in the bridge classification card or SOLOG 105.

[b] Diameter.

[c] Width of flange.

g. Demolition information to include a description of the demolition procedures planned and the expected effect; a description of any prior preparation; and an estimate of time, labor, and material required to execute the demolition (FM 5–25).

h. Alternate crossing sites to include data concerning the approaches; the type of crossing (e.g., ferry, ford, or floating bridge); and an estimate of the time, labor, and materials needed to construct alternate crossings.

3–9. Bridge Abutments

Bridge abutments are the ground supports at the shore end of a bridge. They may be constructed of concrete, masonry, or earth with a wooden end wall and abutment sill. Typical abutments are—

a. Straight abutment (fig. 3–4).

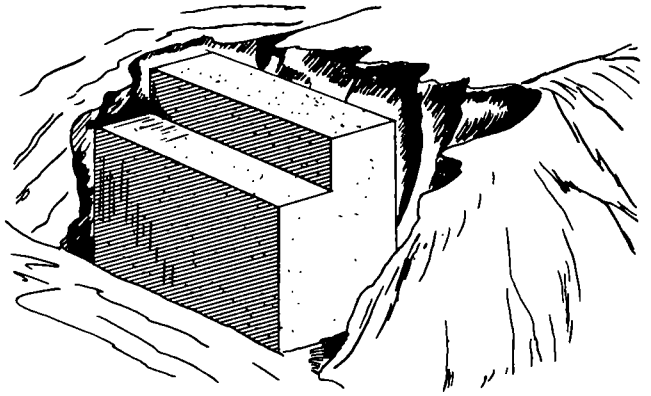


Figure 3–4. Typical straight abutment.

b. T-type abutment (fig. 3–5).

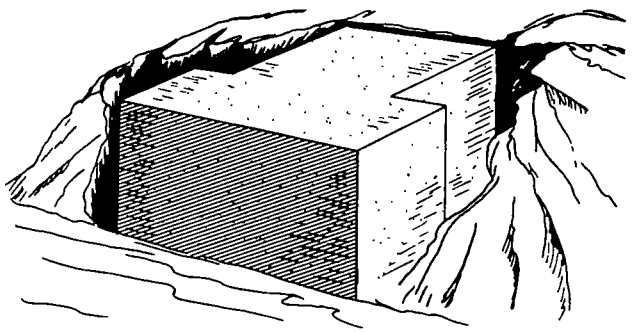


Figure 3–5. Typical T-type abutment.

c. U-type abutment (fig. 3–6).

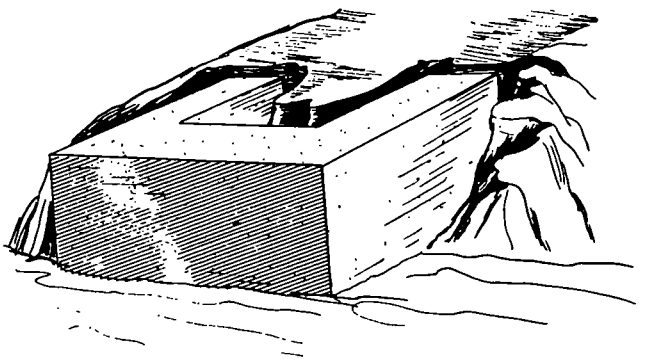


Figure 3–6. Typical U-type abutment.

d. Wing-type abutment (fig. 3–7).

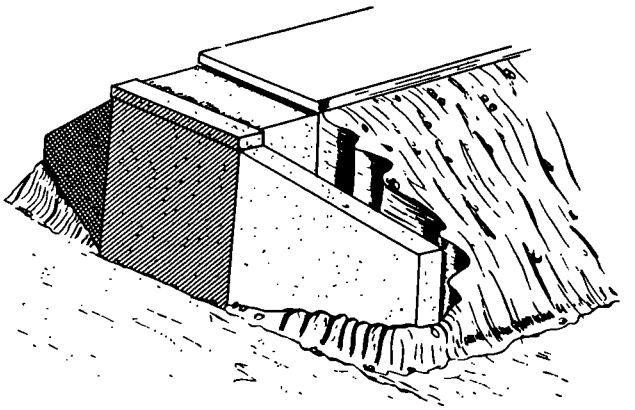


Figure 3–7. Typical wing-type abutment.

e. Earth abutment with timber abutment sill and end wall (fig. 3–8).

f. Pier abutment (fig. 3–9).

g. Box abutment (fig. 3–10).

3–10. Bridge Intermediate Supports

Intermediate supports for bridges are ground supports between abutments. They may be log pile bents (fig. 3–11), timber trestle bents (fig. 3–12), timber pile piers (fig. 3–13), crib piers (fig. 3–14), masonry piers (fig. 3–15), prefabricated steel trestle piers (fig. 3–16), open type concrete piers (fig. 3–17), or solid concrete piers (fig. 3–18).

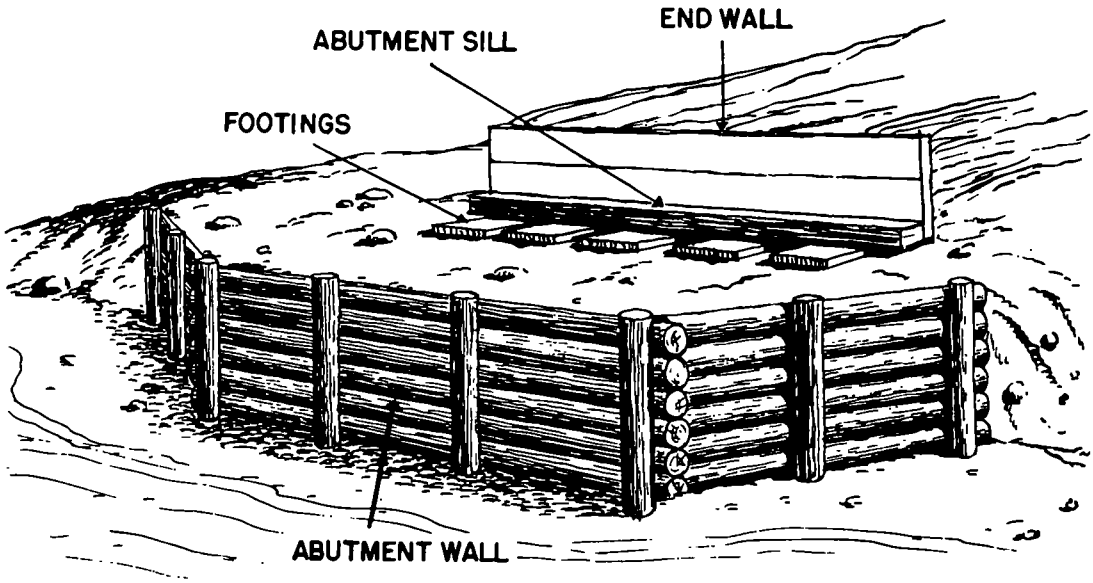


Figure 3-8. Typical earth abutment, with timber abutment sill and end wall.

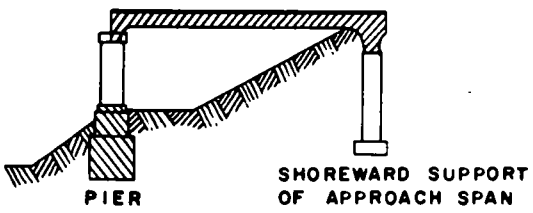


Figure 3-9. Typical pier abutment.

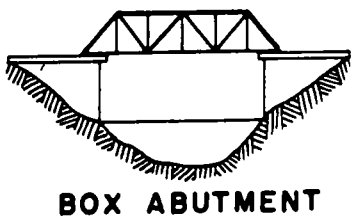


Figure 3-10. Typical box abutment.

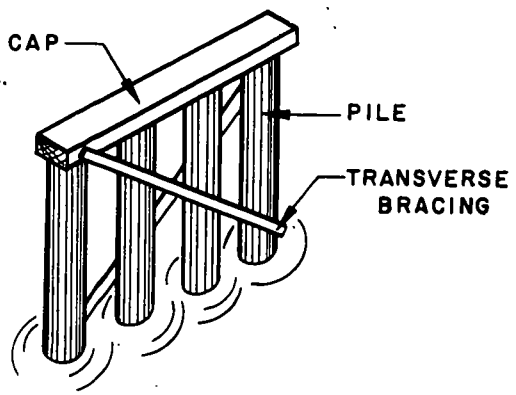


Figure 3-11. Pile bent.

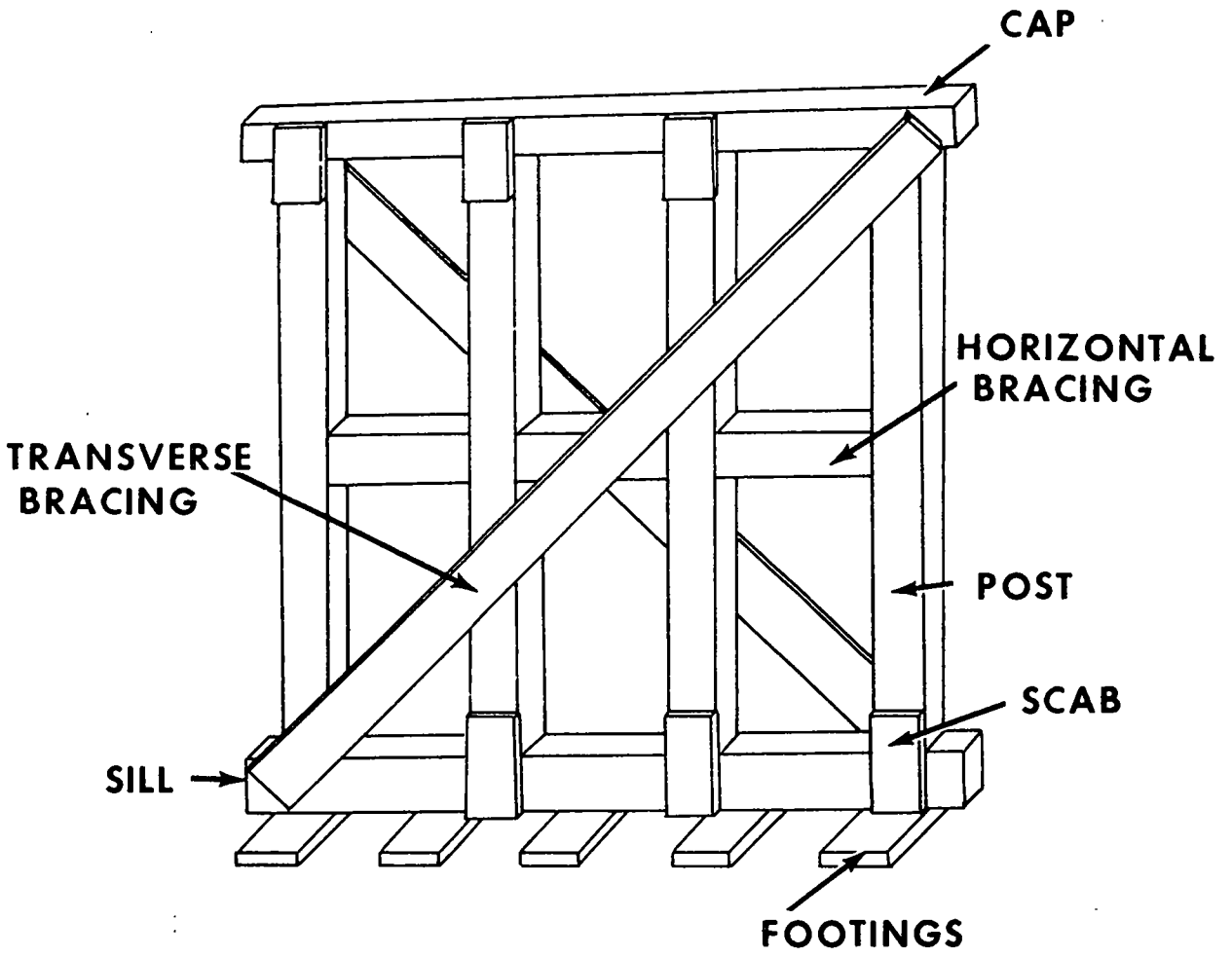


Figure 3–12. Timber trestle bent.

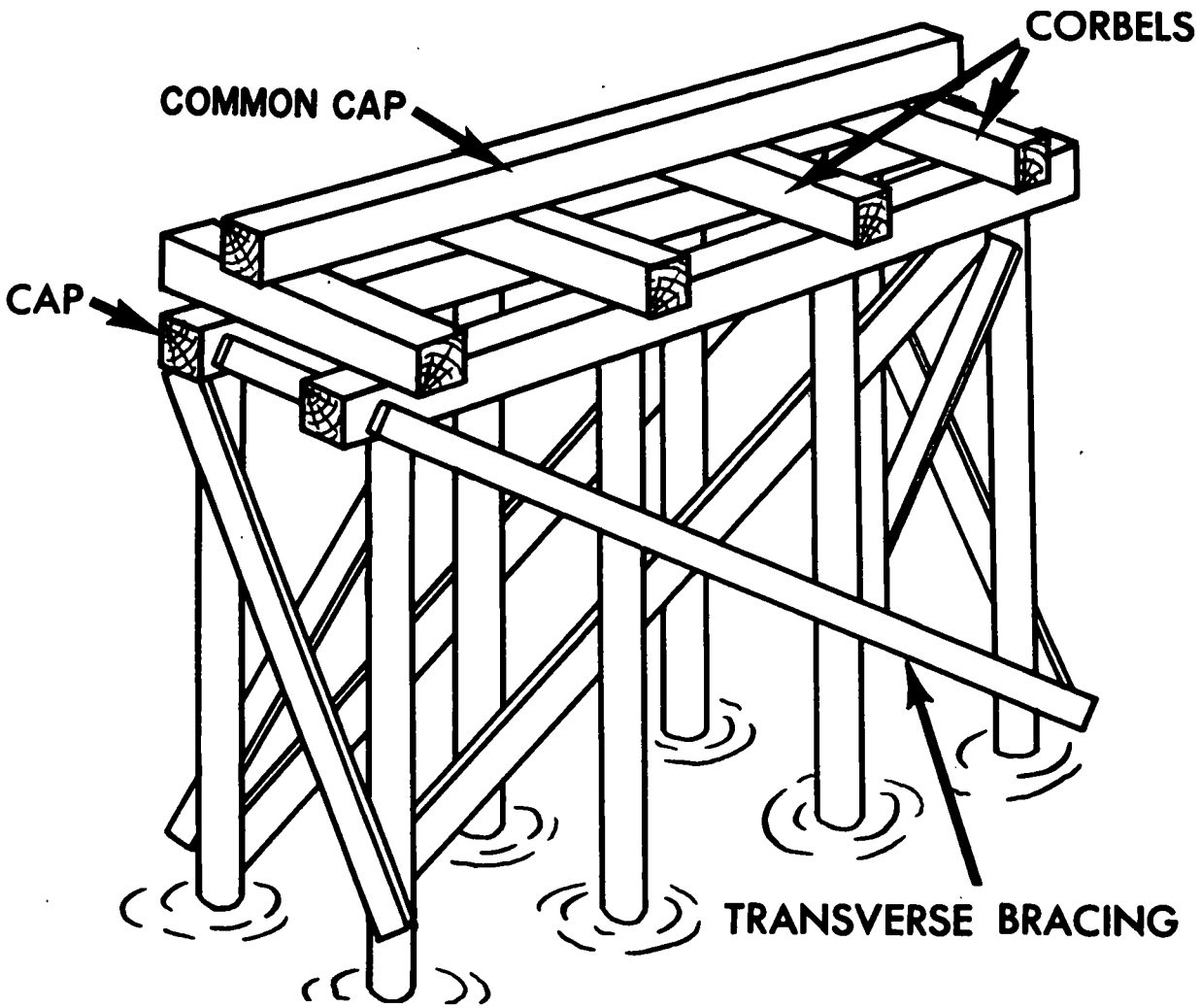


Figure 3–13. Timber pile pier.

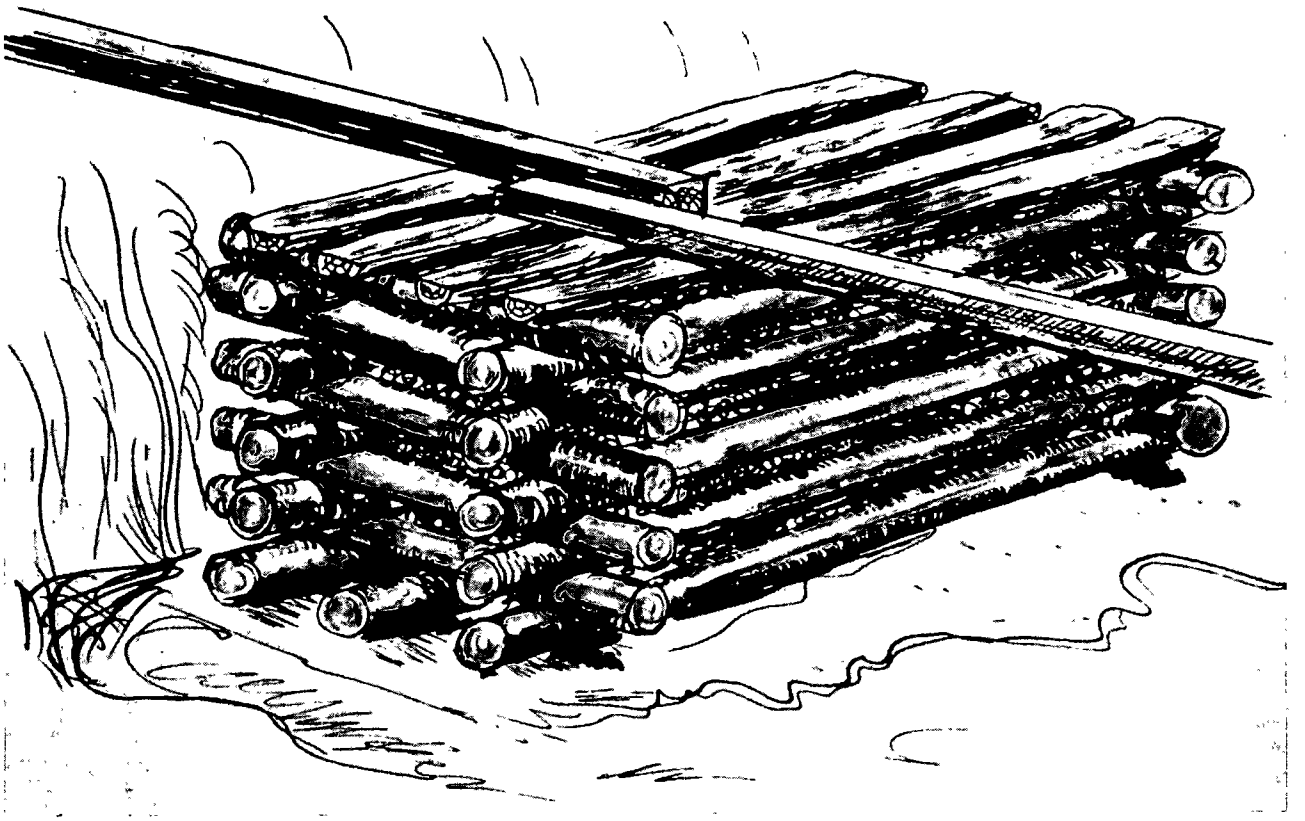


Figure 3–14. Typical crib pier.

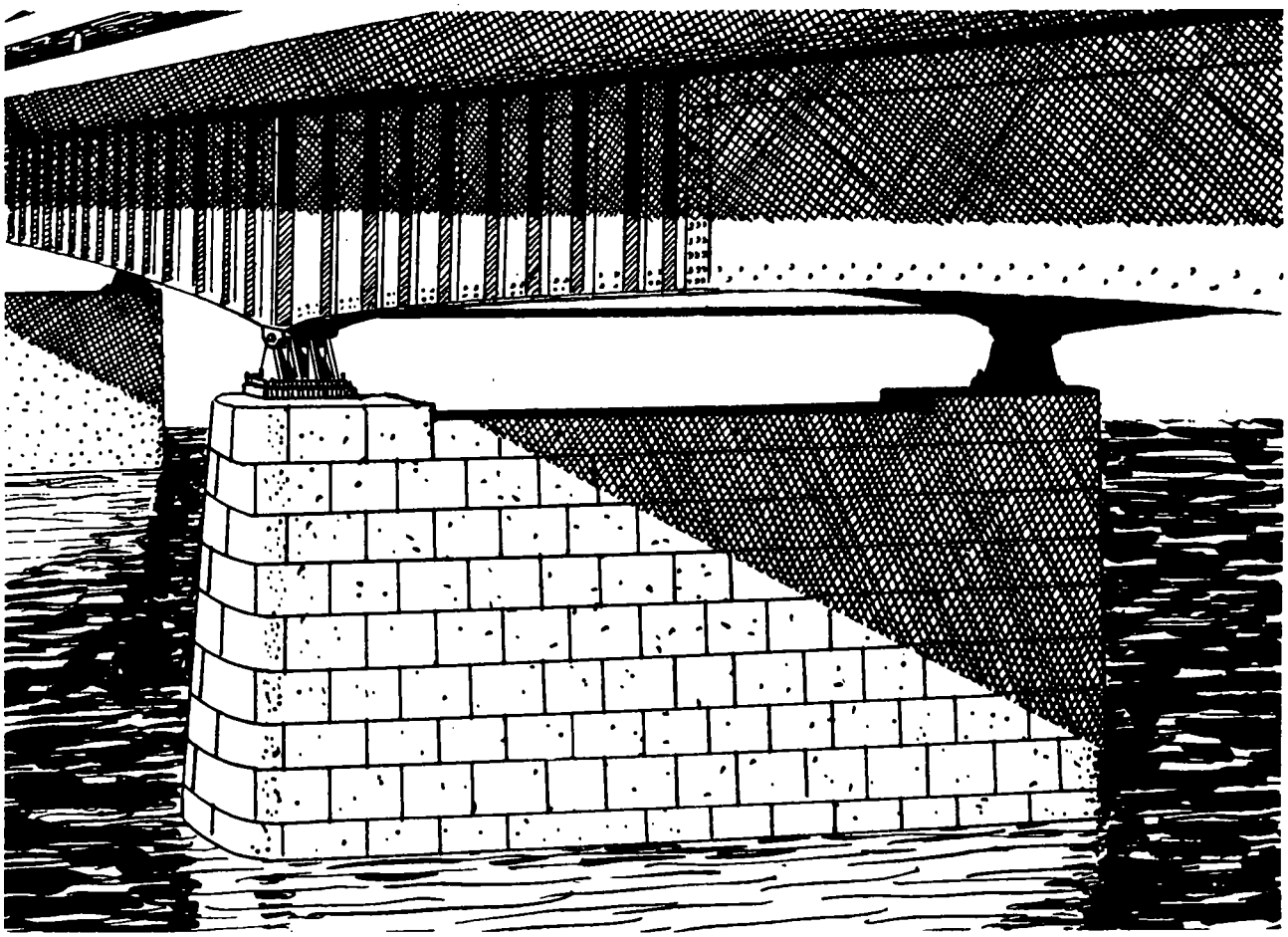


Figure 3–15. Typical masonry pier.

3–11. Bridge Spans

a. General. Bridge spans may be divided into two general types—fixed bridges and movable bridges.

(1) Fixed bridge spans (fig. 2–60) are further divided according to structural design. These designs, which are discussed in more detail in *b* through *h* below, are cantilever, slab, beam (simple or continuous), truss, girder, arch, suspension, and ponton.

(2) Movable bridges are discussed in *i* below.

(3) Principal bridge span dimensional data are illustrated in figure 3–19, and required dimensional measurements are given in table 3–1.

(4) Required dimensional data for determining the capacity of individual bridge members are illustrated in table 3–2.

b. Cantilever Bridges. A cantilever bridge is one in which two self-supporting beams or trusses project from piers toward each other with no intermediate support. These beams are either joined directly or connected by a suspended span (fig. 3–20).

c. Slab Bridges.

(1) Slab bridges are short span bridges consisting primarily of a reinforced concrete slab resting directly on the abutments or intermediate supports. A wearing surface of bituminous material, gravel, or wooden planks is usually laid over the concrete, but sometimes the upper side of the slab serves also as the wearing surface. Care should be taken not to mistake hollow girder bridges for slab bridges. The distinguishing features of hollow girded bridges are long spans and relatively deep sections. Very few slab bridges span more than 9 meters and very few hollow girder bridges span less than 15 meters.

(2) A standard dimension data guide for concrete bridges is shown in figure 3–21. A typical concrete slab bridge is illustrated in figure 3–22.

d. Beam Bridges.

(1) The majority of all bridges with short spans are simple stringer bridges. Stringers are

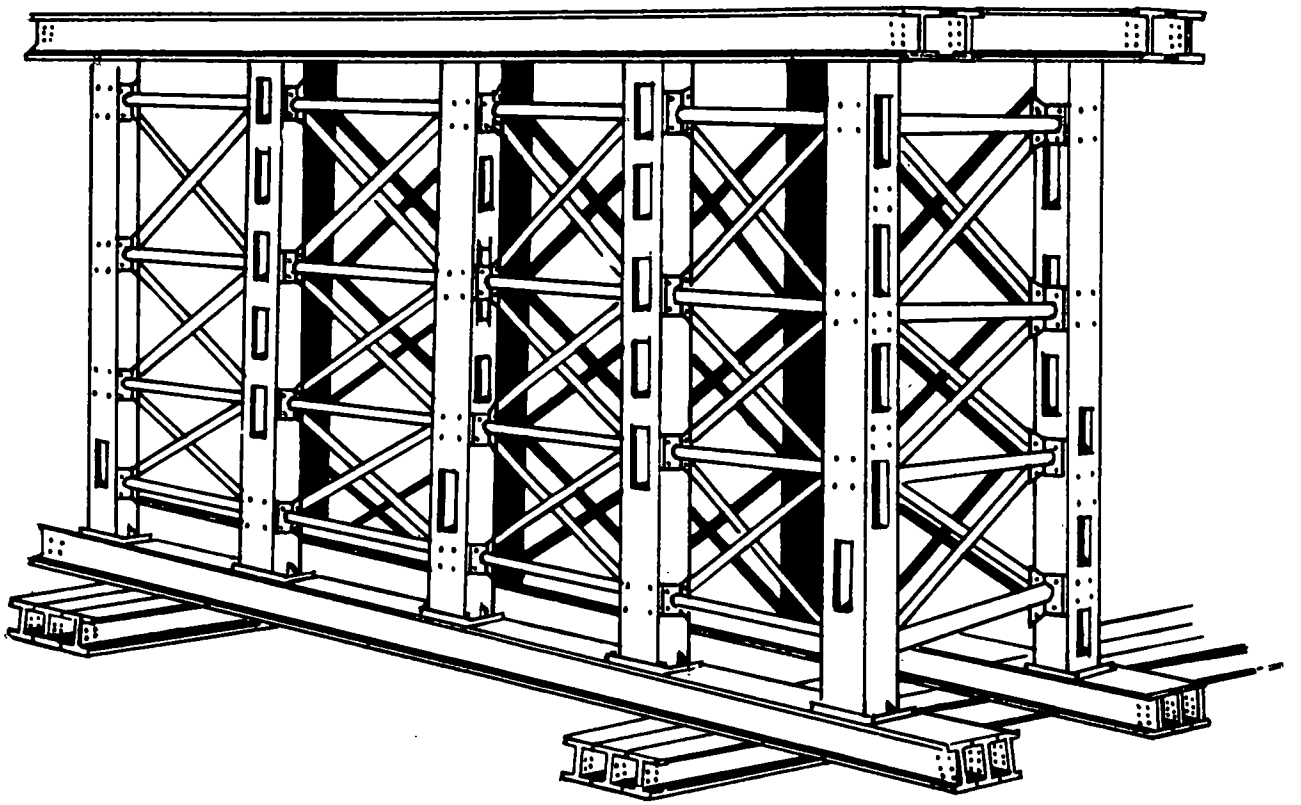


Figure 3–16. Typical prefabricated steel trestle pier.

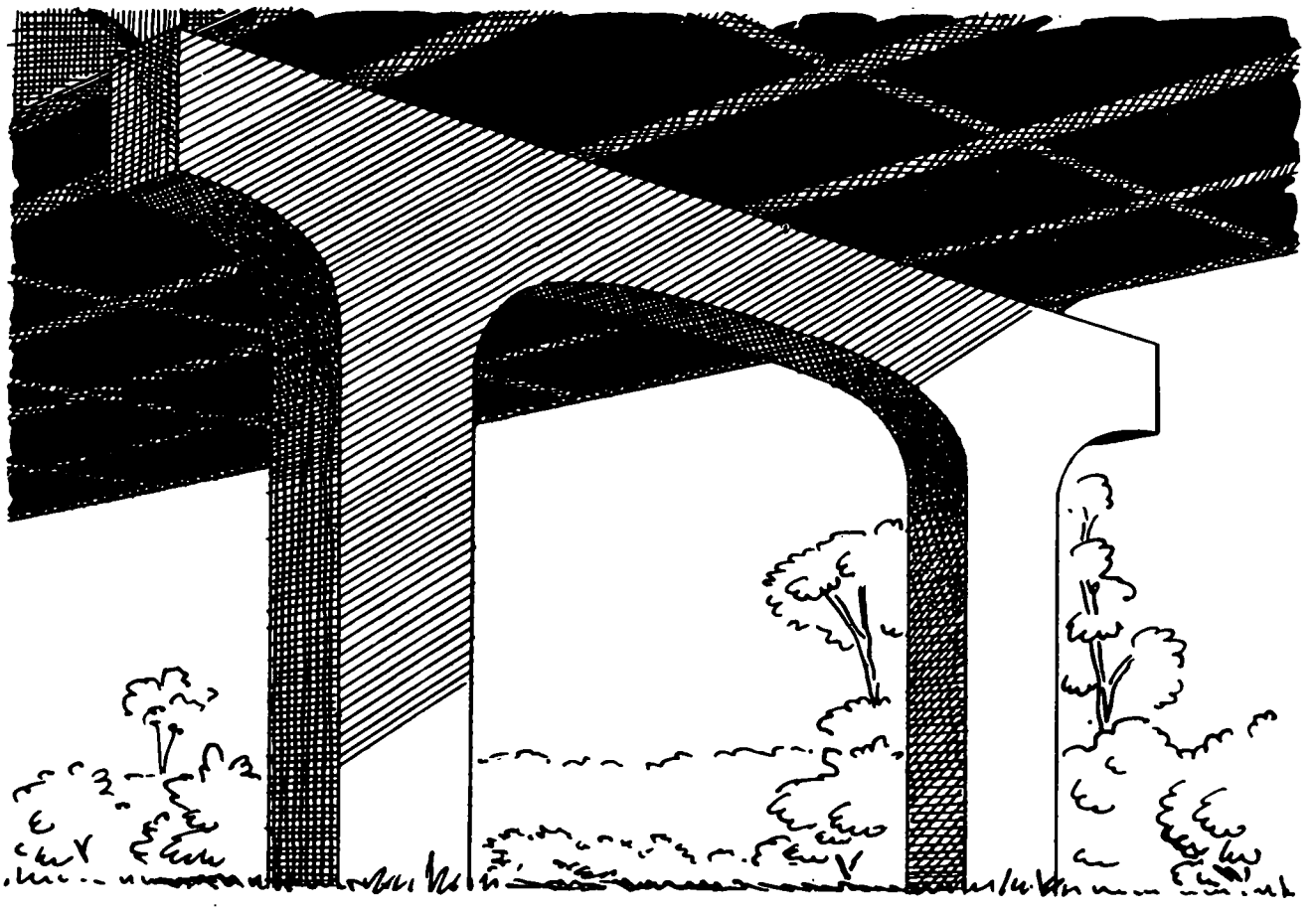


Figure 3–17. Typical open type concrete pier.

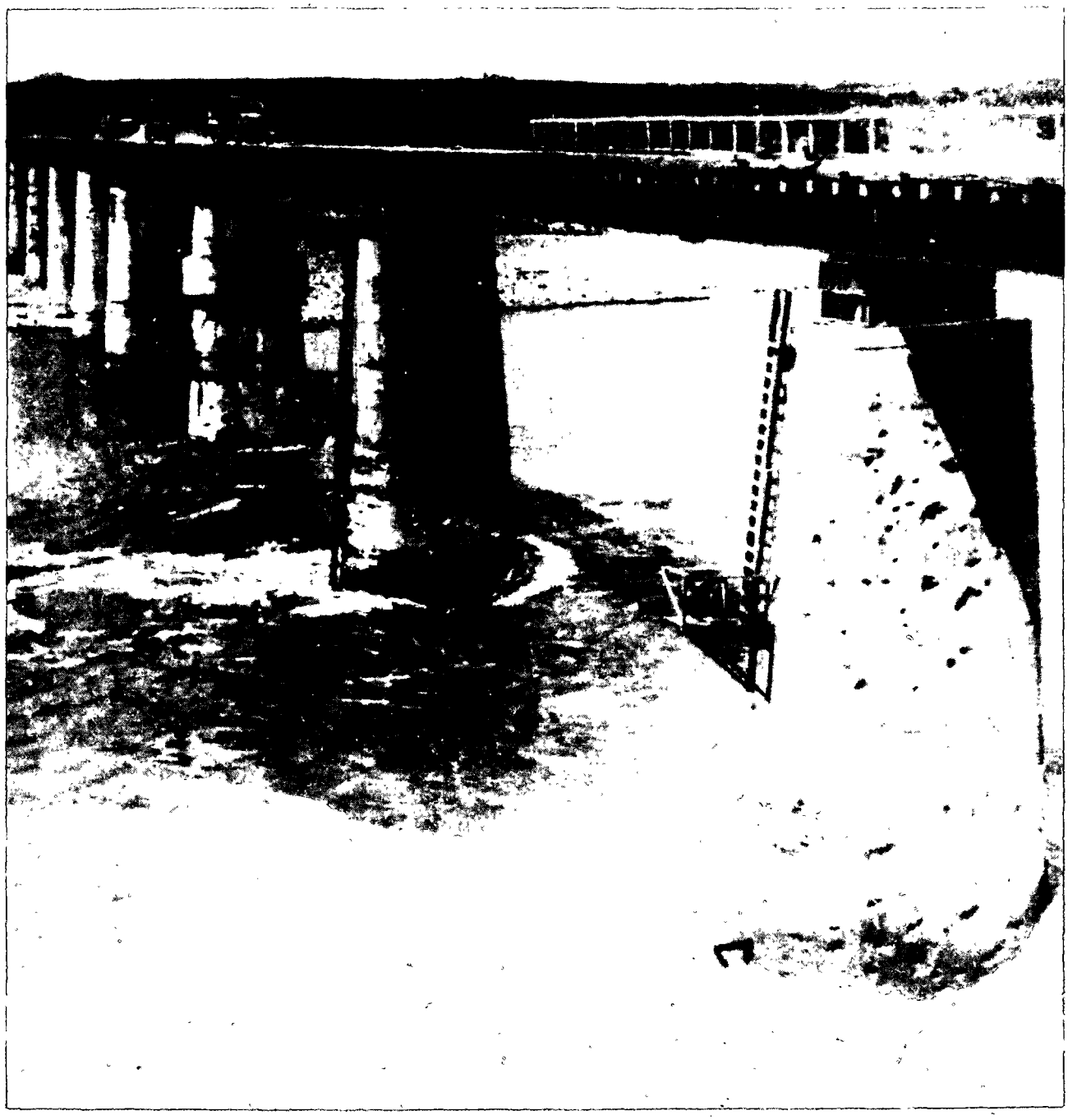
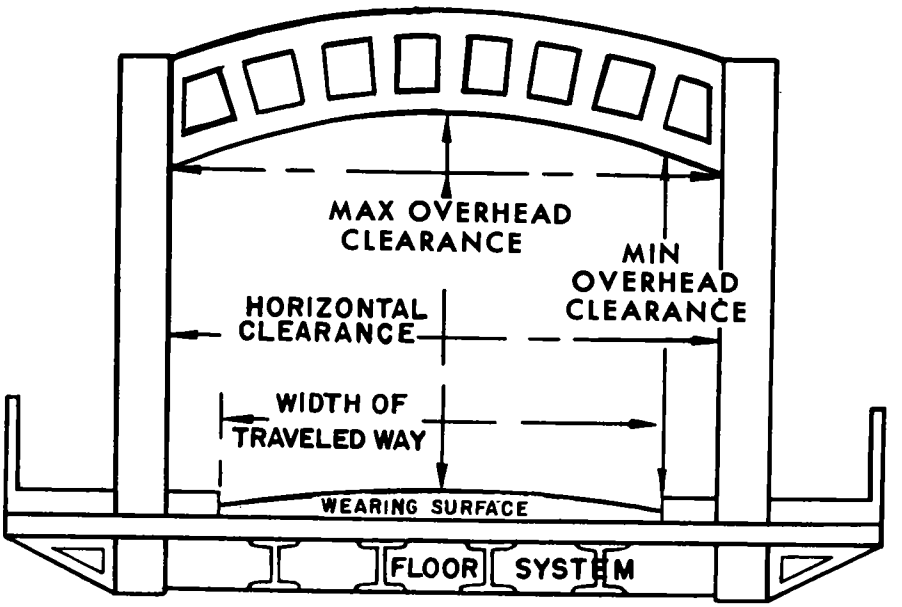
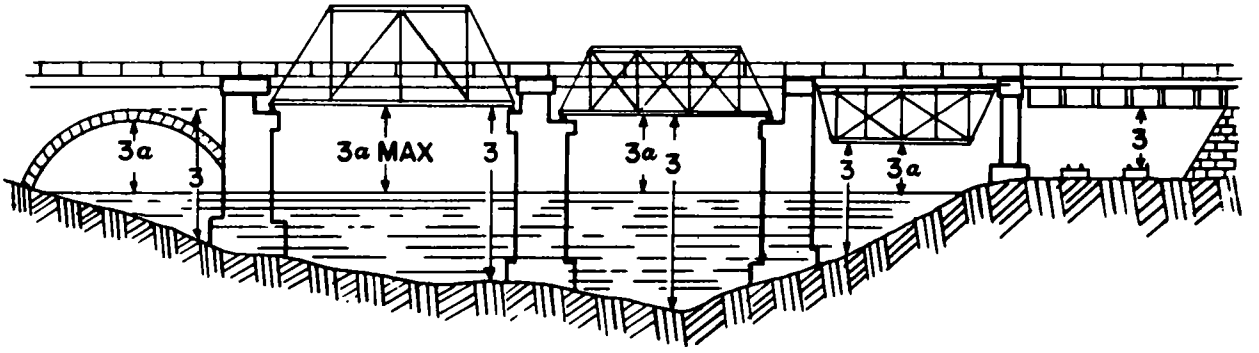


Figure 3–18. Typical solid concrete pier.



MEASURING WIDTH OF ROADWAY AND CLEARANCES



DIMENSION 3 - HEIGHT ABOVE STREAMBED (GROUND)
DIMENSION 3a - HEIGHT ABOVE NORMAL WATER LEVEL

MEASURING HEIGHT ABOVE STREAM BED AND NORMAL WATER LEVEL.

Figure 3–19. Principal bridge span dimensional data.

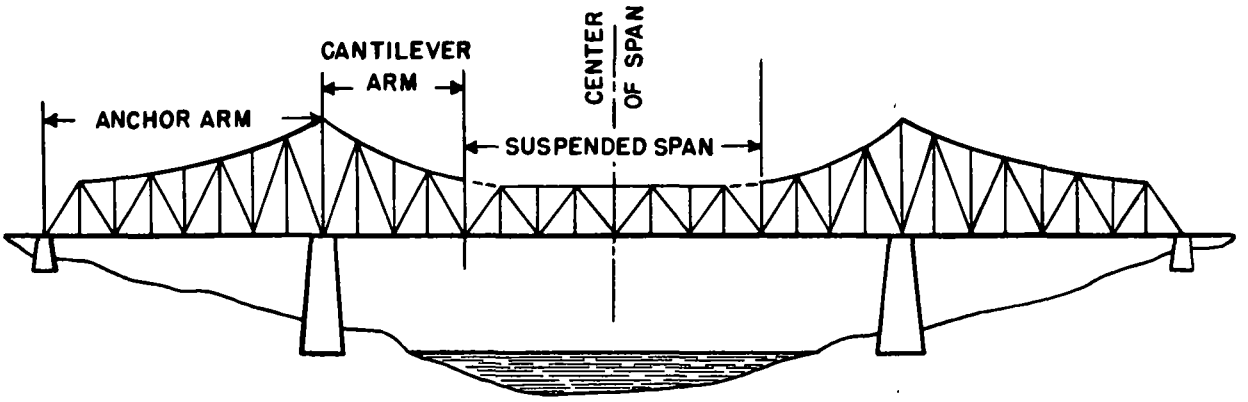


Figure 3-20. Typical cantilever bridge.

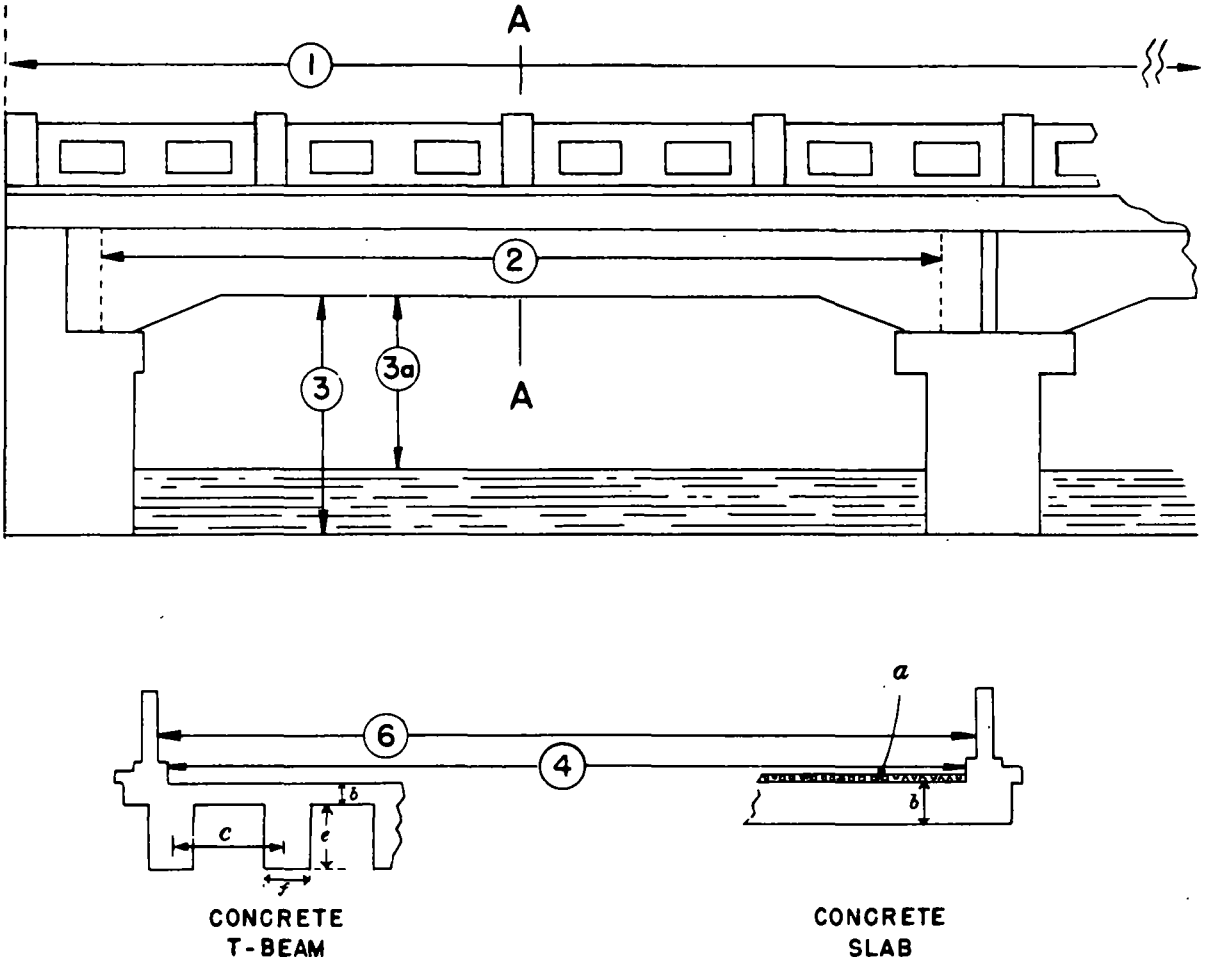


Figure 3-21. Standard dimension data guide for concrete bridges.

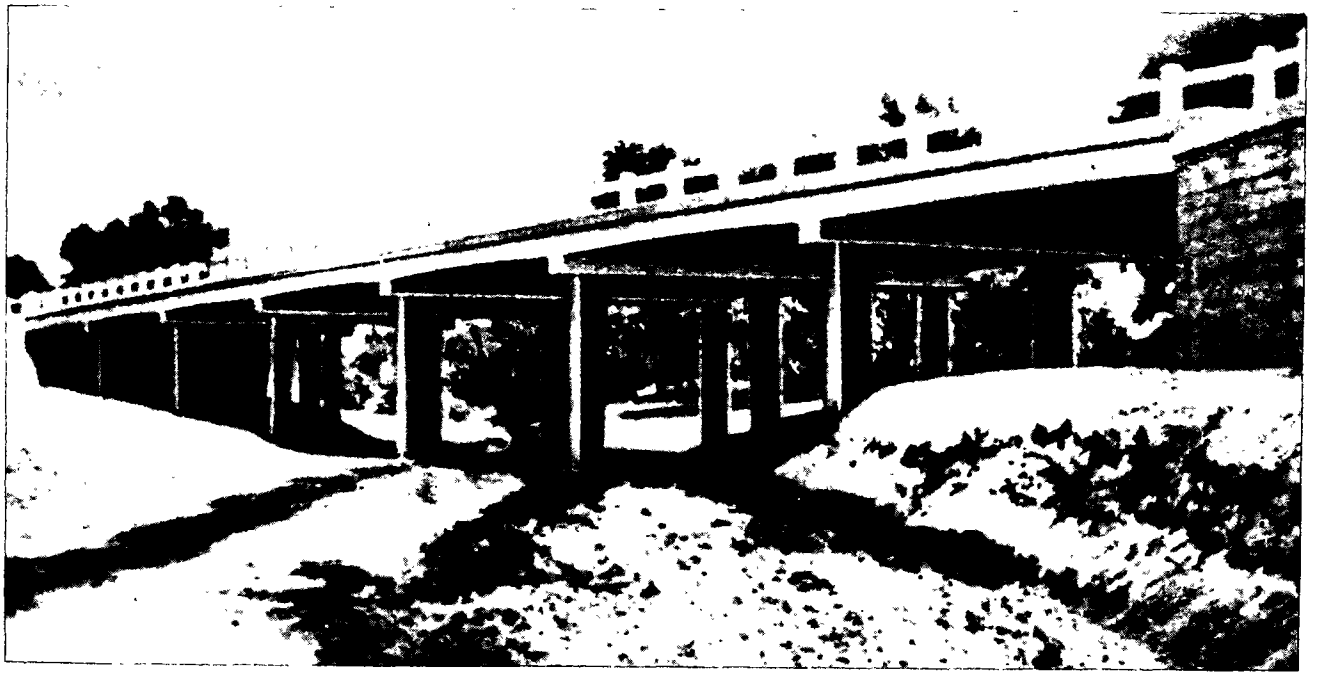


Figure 3–22. Typical concrete slab bridge.

generally constructed of steel, concrete, or wood. A standard dimension data guide for simple stringer bridges is illustrated in figure 3–23. The most common types of stringers are as follows:

(*a*) *Wooden stringers.*
1 Rectangular timber (fig. 3–24).
2 Log (fig. 3–25).

(*b*) *Steel stringers.*
1 I-beam (figs. 3–26 and 3–27).
2 Wide flange (WF) beam.
3 Channel.
4 Rail.
5 Plate girder.

(2) Beam bridges may also be constructed of reinforced concrete in the form of slabs resting on a series of rectangular beams. Beams and slabs are poured integrally. The beams may be reinforced with standard rods, steel T-beams, I-beams, or channels. The wearing surface of the traveled way may consist of bituminous material or wooden planking laid on top of the concrete slab. A standard dimension data guide for concrete bridges is illustrated in figure 3–21. Typical single span and multispan concrete bridges are illustrated in figures 3–28, 3–29, and 3–30.

e. Truss Bridges.

(1) Truss span bridges are used for spans which are too long for simple stringer or girder bridges. The truss is a compound beam in which the components are arranged to form one or more triangles in the same plane. It supports the traveled way and transmits the load to the abutments and intermediate supports. Trusses are usually constructed of steel although wood truss bridges are found in or near areas where timber is abundant.

(2) A standard dimension data guide for truss bridges is illustrated in figure 3–31.

(3) The position of the traveled way determines the truss type (fig. 3–32).

(*a*) *Deck truss.* The traveled way is located above or on the top chord.

(*b*) *Through truss.* The traveled way is situated near the bottom chord, and overhead bracing (crosswise) is frequently provided.

(*c*) *Pony (half-through) truss.* The traveled way is located close to the top chord, and no overhead bracing (crosswise) is provided.

(4) Common types of bridge trusses are illustrated in figure 3–33, but it is not generally require to include their names in bridge reconnaissance reports.

(5) Typical truss bridges are illustrated as follows:

(*a*) Typical steel deck truss bridge (fig. 3–34).

(*b*) Typical timber truss bridge (fig. 3–35).

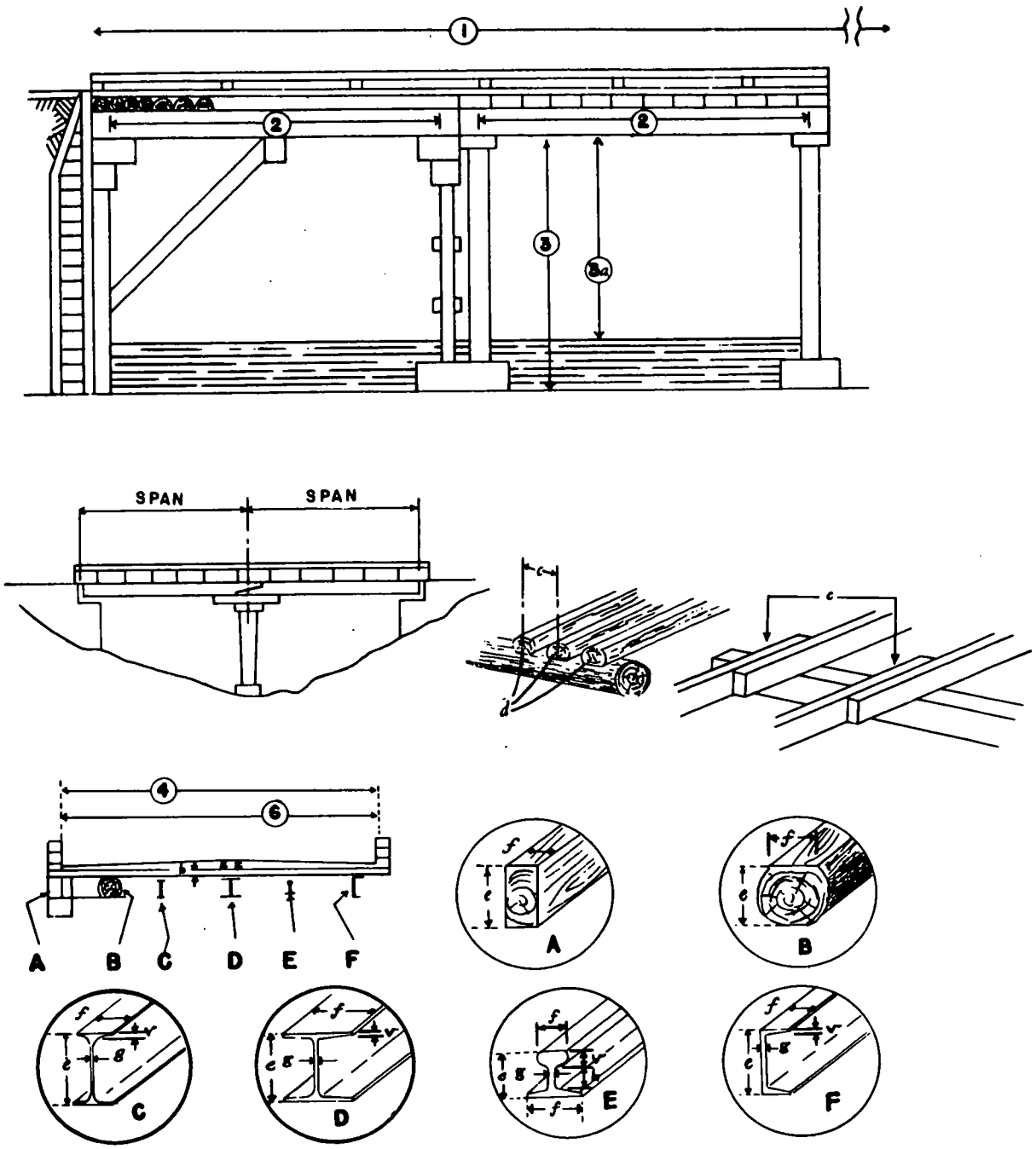


Figure 3-23. Standard dimension data guide for simple stringer bridges.

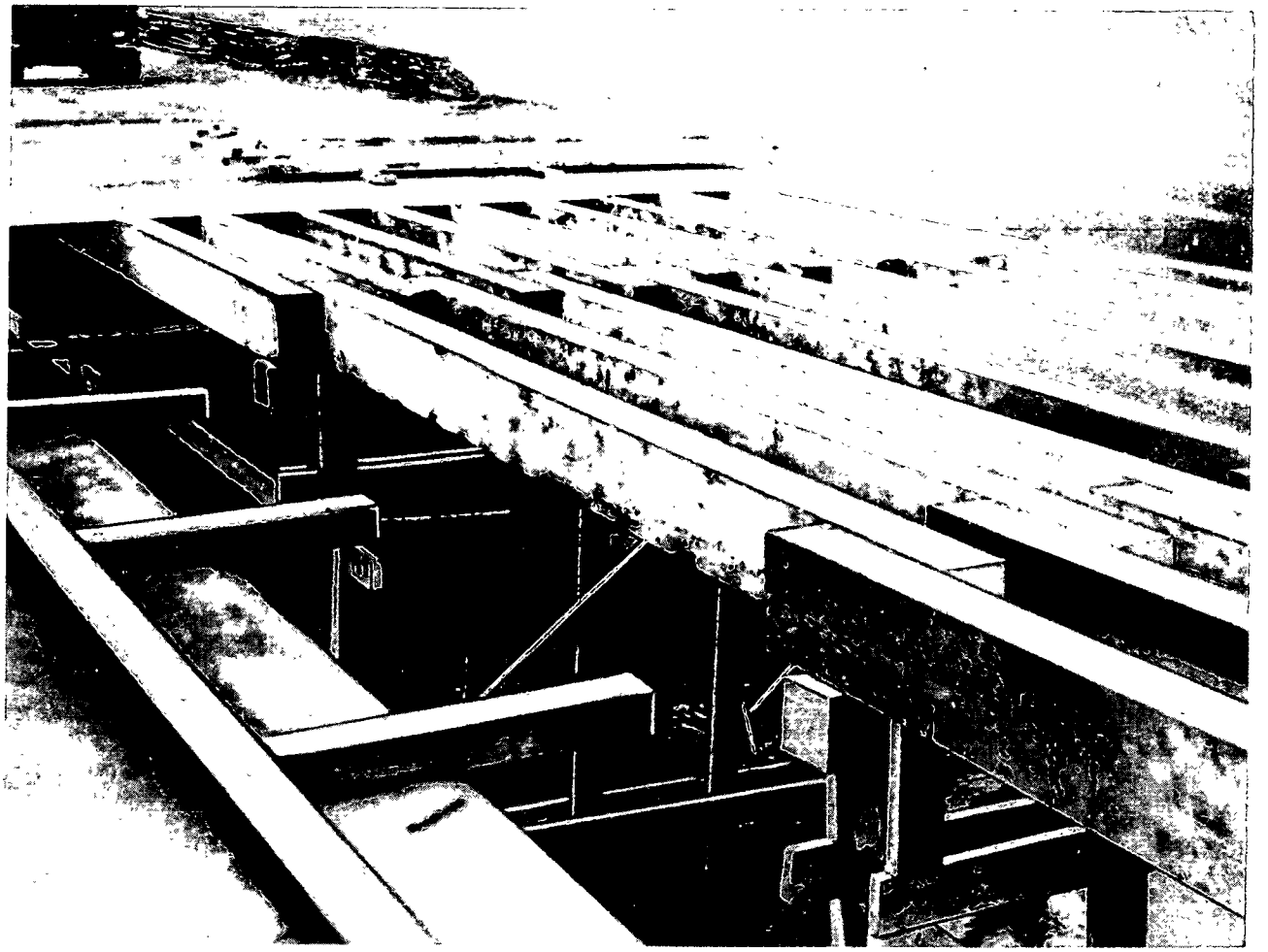


Figure 3–24. Simple stringer bridge with rectangular timber stringers.

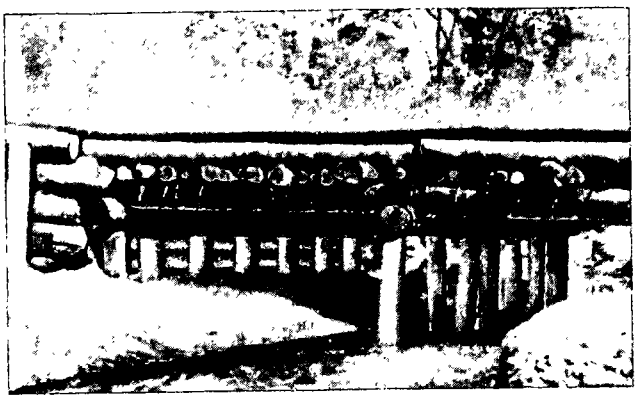


Figure 3–25. Simple stringer bridge with log stringers.

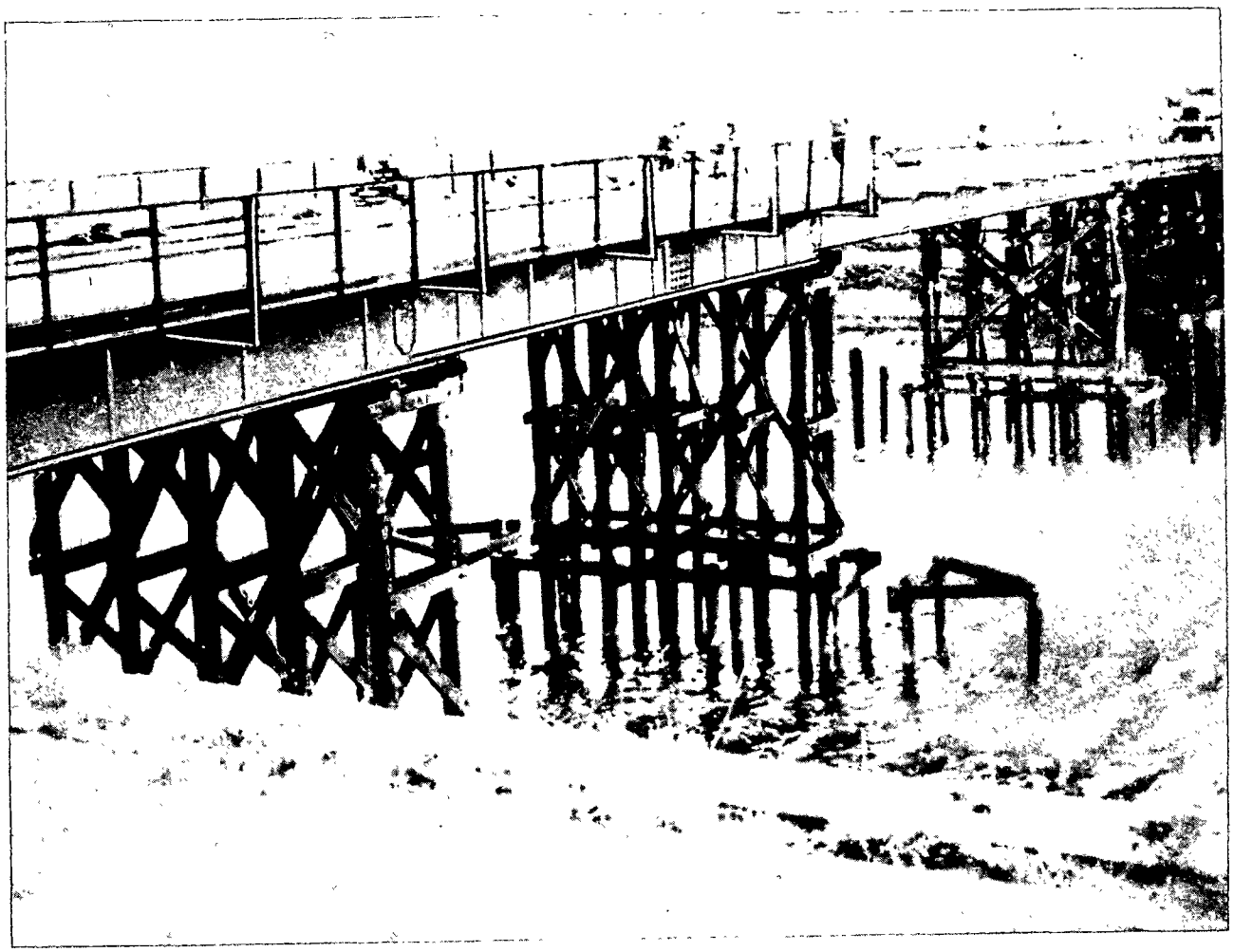


Figure 3–26. Simple stringer bridge with steel I-beam stringers and timber flooring.

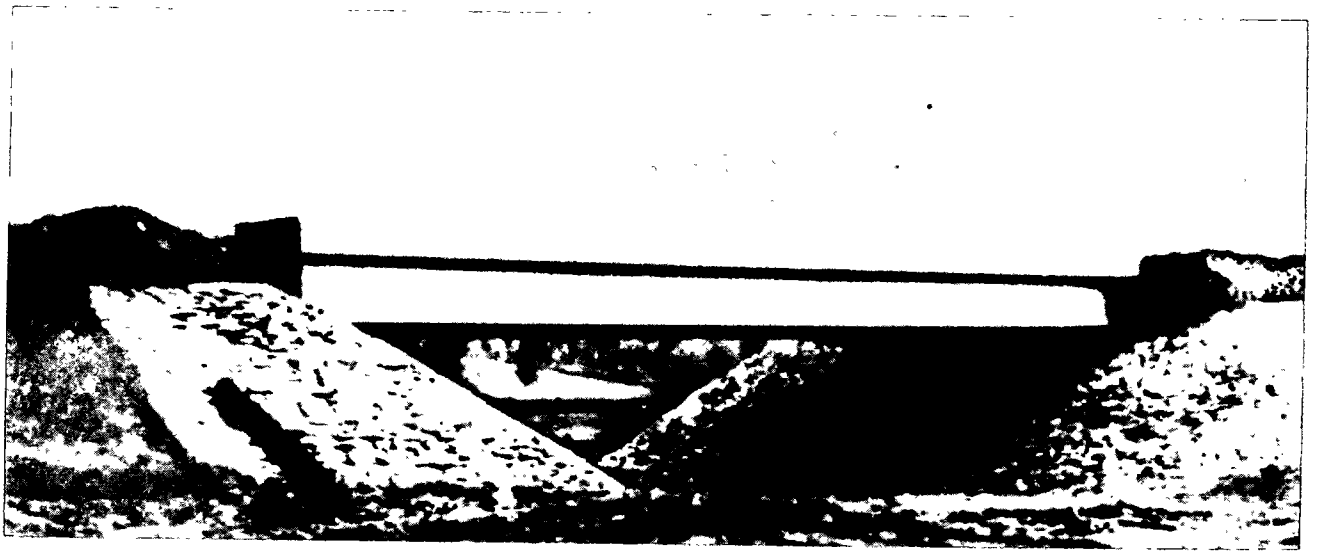


Figure 3–27. Simple stringer bridge with steel I-beam stringers and concrete slab flooring.

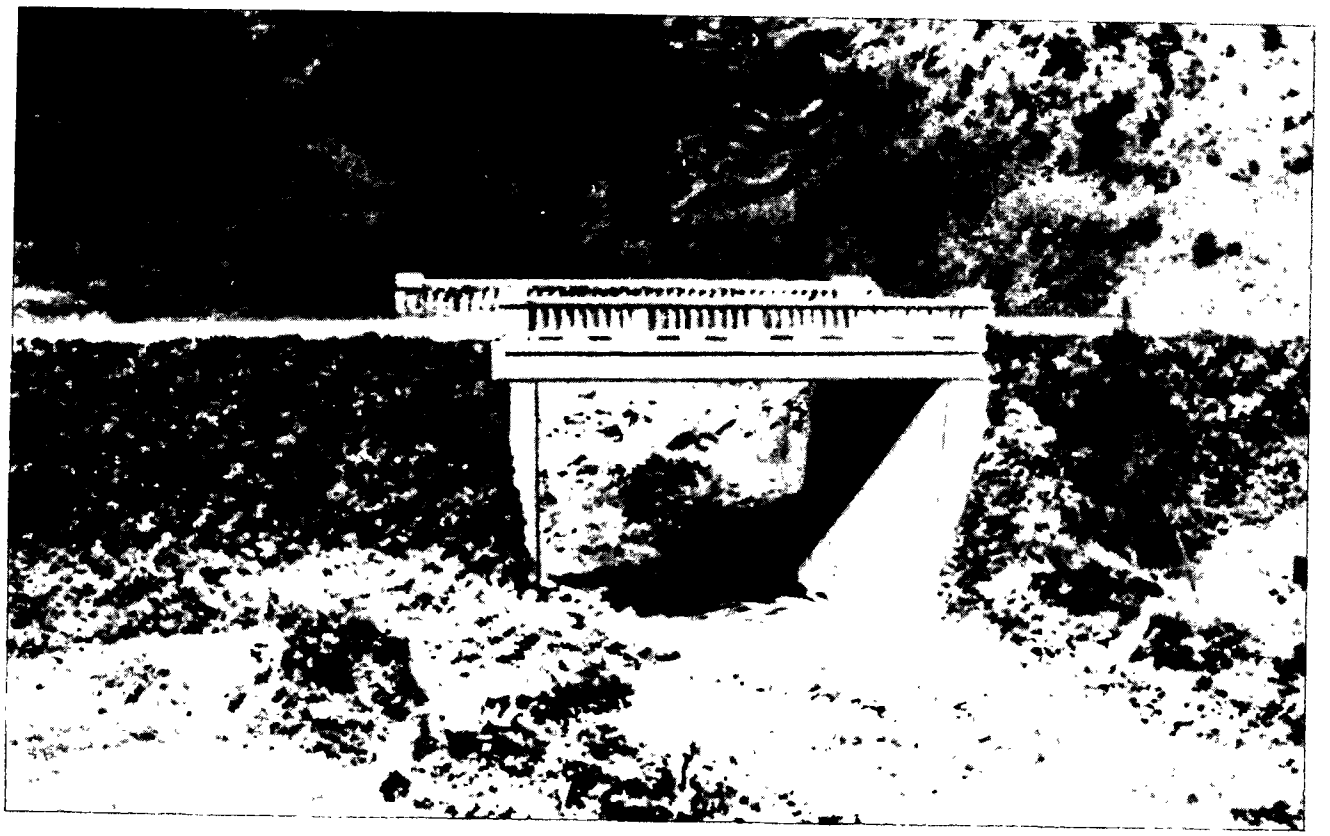


Figure 3–28. Typical single span concrete bridge.

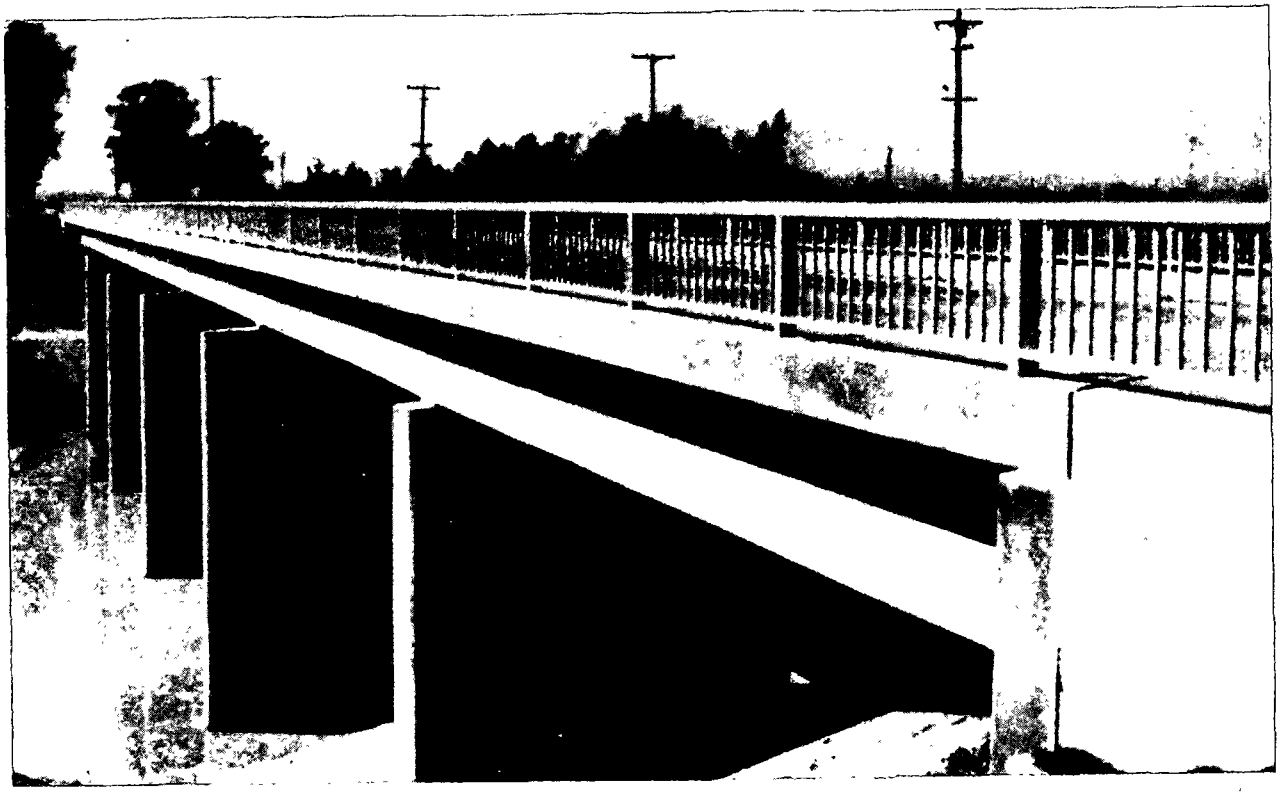


Figure 3–29. Typical concrete bridge.

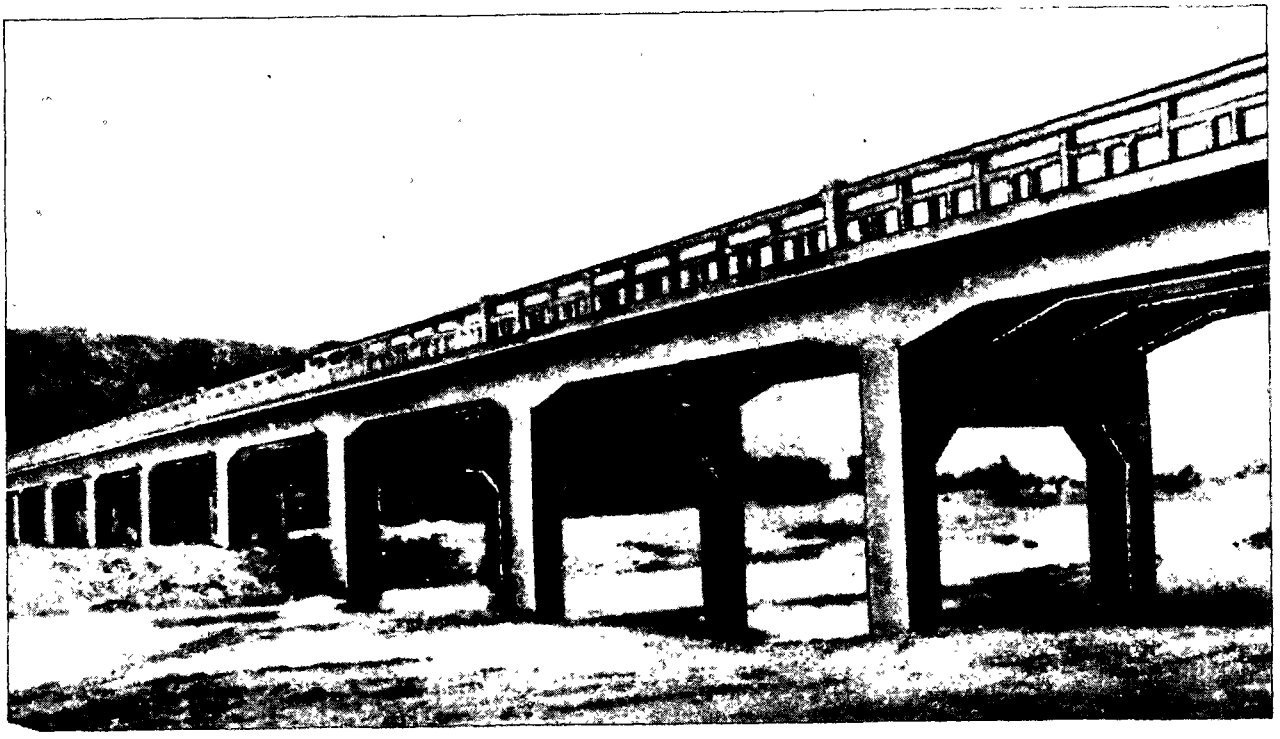


Figure 3–30. Typical multispan concrete T-beam bridge.

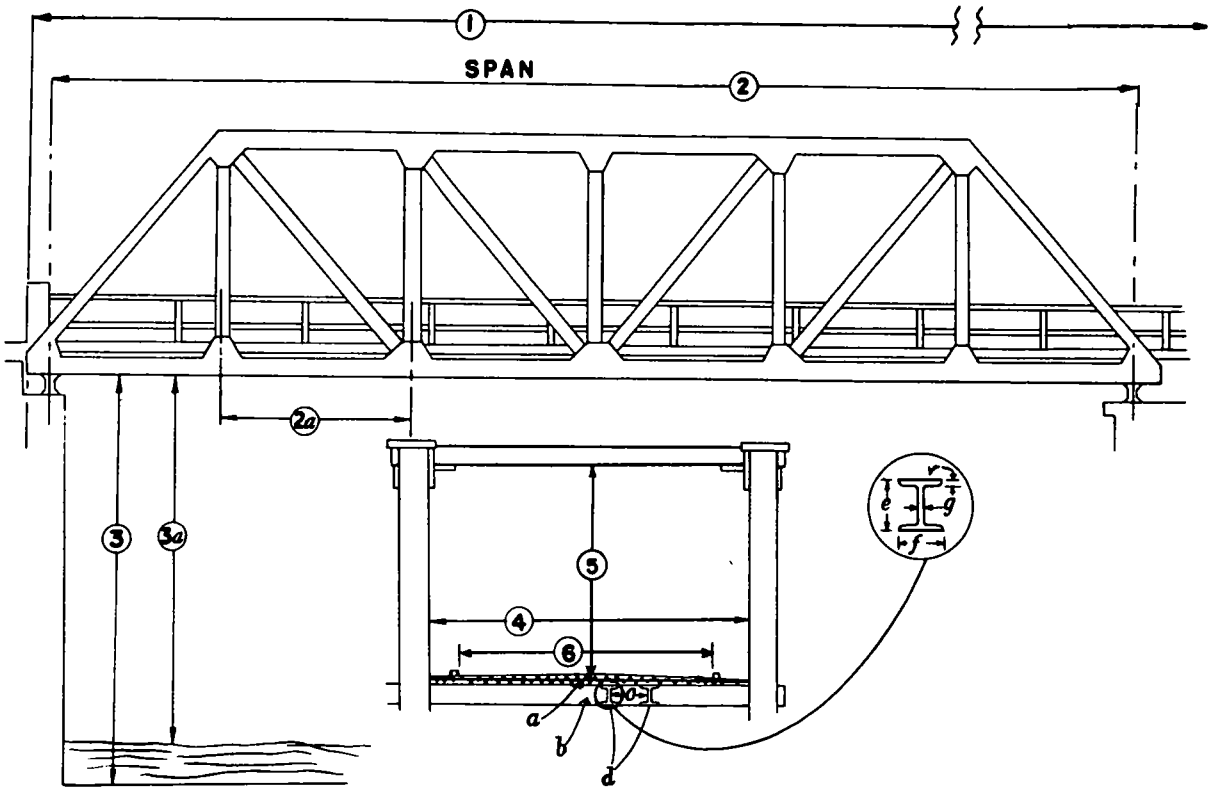
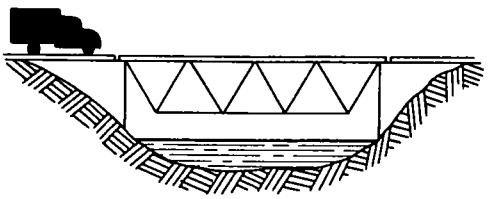
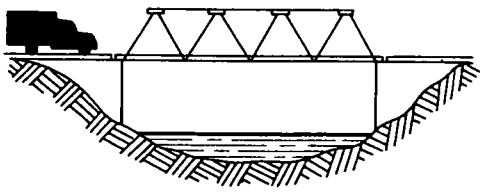


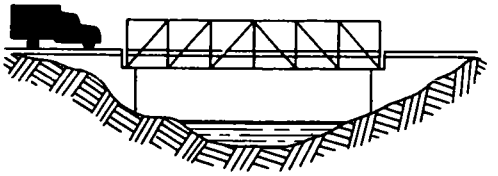
Figure 3–31. Standard dimension data guide for steel truss bridges.



DECK TYPE



THROUGH TYPE



HALF-THROUGH OR PONY TYPE

Figure 3–32. Classification of truss types of position of traveled way.

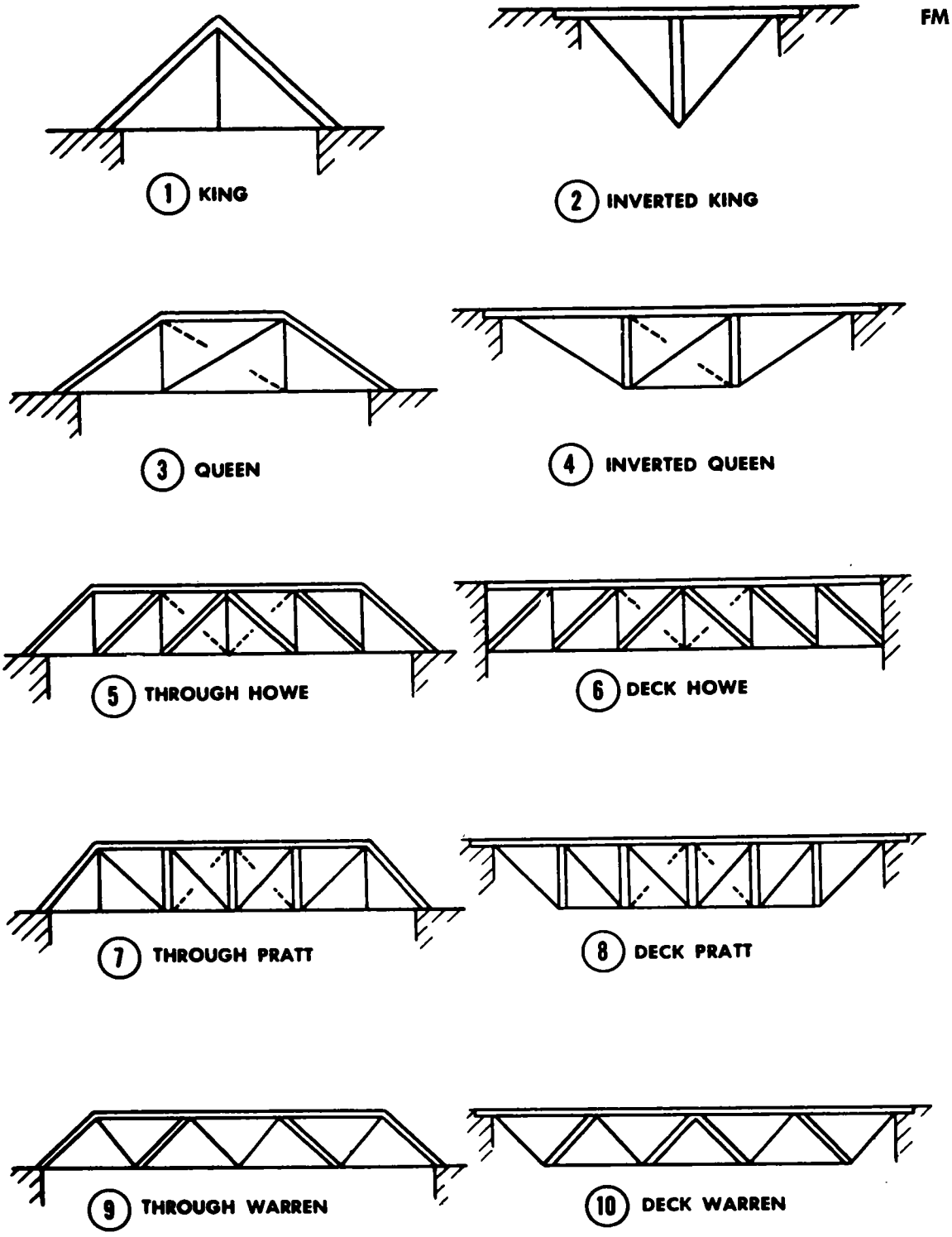


Figure 3–33. Common types of bridge trusses.

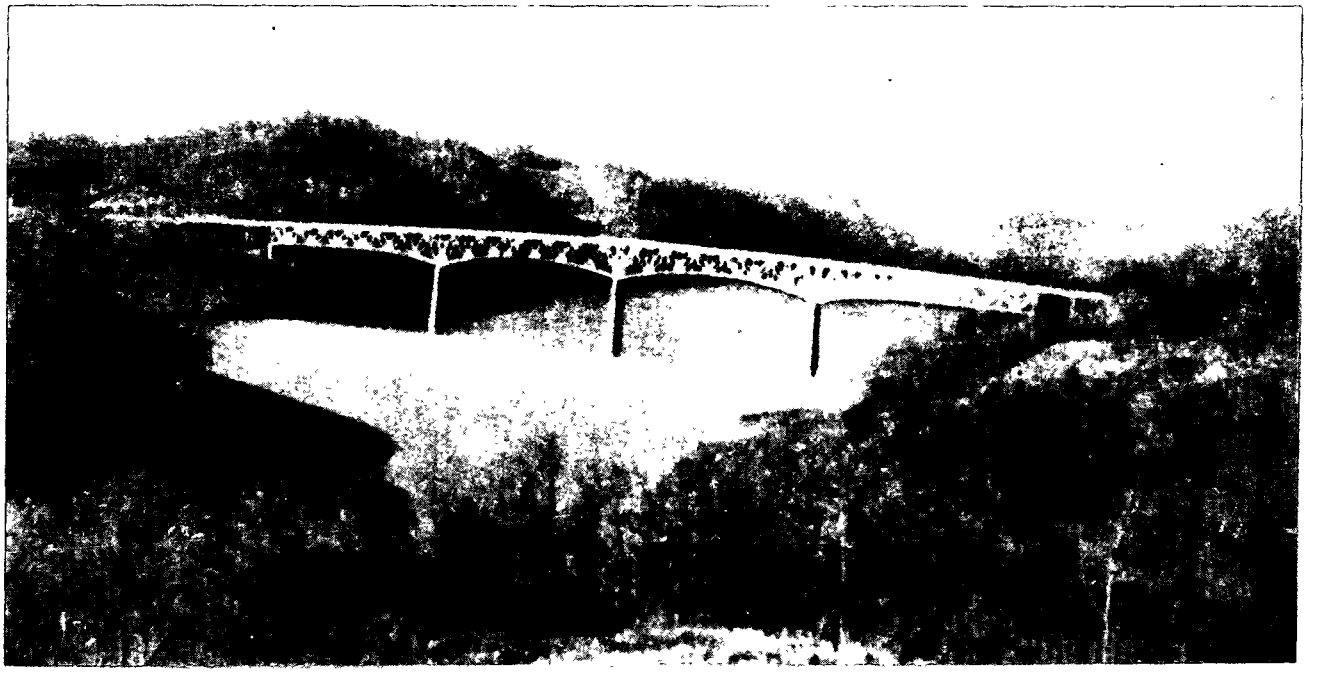


Figure 3–34. Typical steel deck truss bridge.

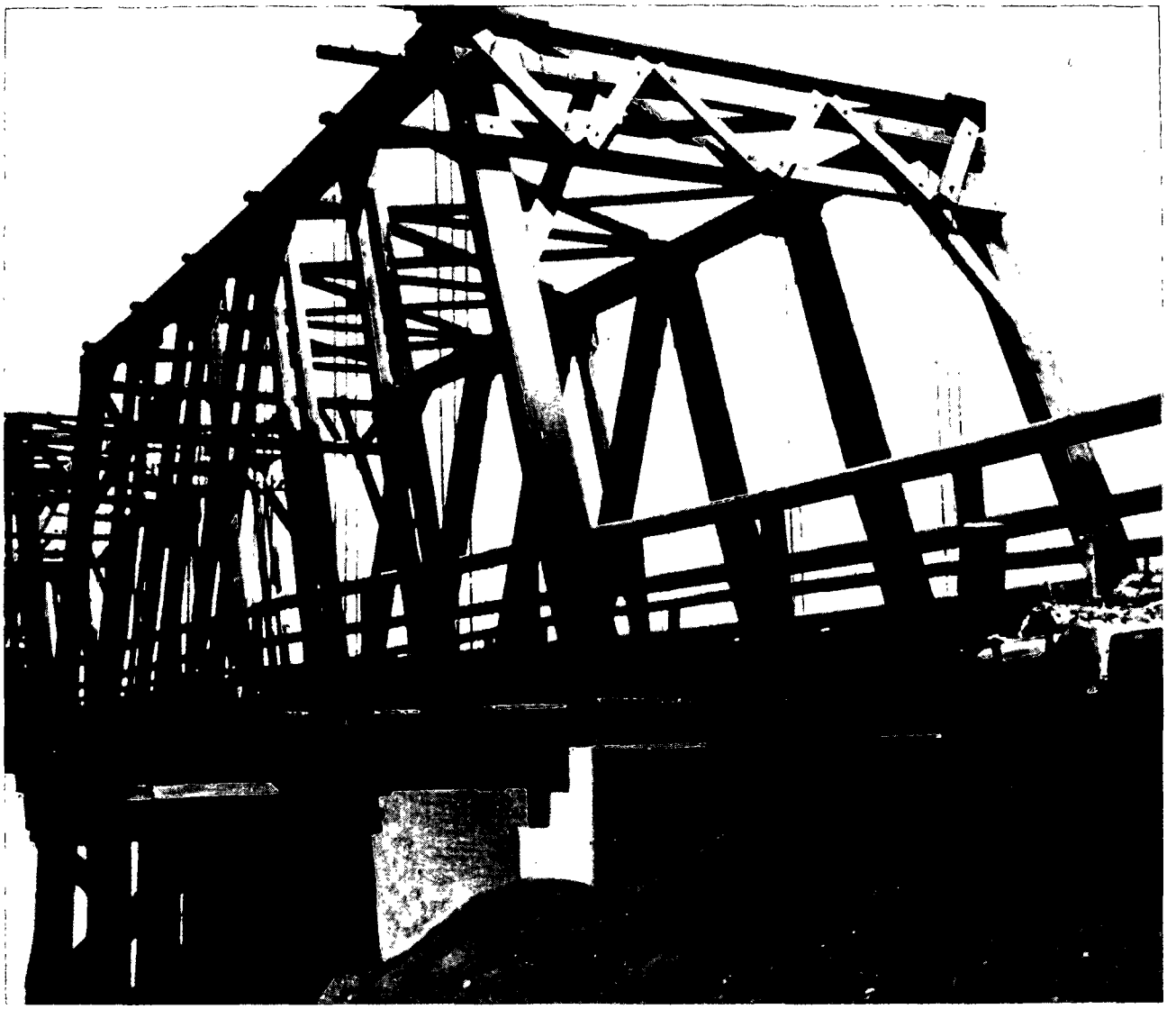


Figure 3–35. Typical timber truss bridge.

(*c*) Typical steel through truss bridge (Warren type) (fig. 3–36).

(*d*) Steel pony truss span (figs. 3–37 and 3–38).

f. Girder Bridges.

(1) Girder span bridges are composed of girders and a floor system. The girder is a compound steel beam, formed from plates, shapes (such as angles, channels, and Z-sections), lattice work, bars, and other elements which transmit the traveled way loads to the intermediate supports and abutments. The floor system is composed of stringers, floor beams, flooring, and a traveled way. Normally, girder spans are constructed of steel, but occasionally they are made of prestressed concrete.

(2) A standard dimension data guide for plate girder spans is illustrated in figure 3–39.

(3) *Identification of girder bridges is difficult. They may be mistaken for truss bridges or simple stringer bridges.* Therefore, it is important to make close inspection of girder bridges and to identify their component parts accurately when capacity calculations are involved. The common types of plate girders are single plate or box type girders. The bridges constructed of these girders are deck plate girder bridges or through plate girder bridges.

(*a*) *Deck plate girder span.* The deck plate girder span is the most common type. The traveled way is usually located above the top flange plate of the girder. A typical multispan deck plate girder bridge is illustrated in figure 3–40.

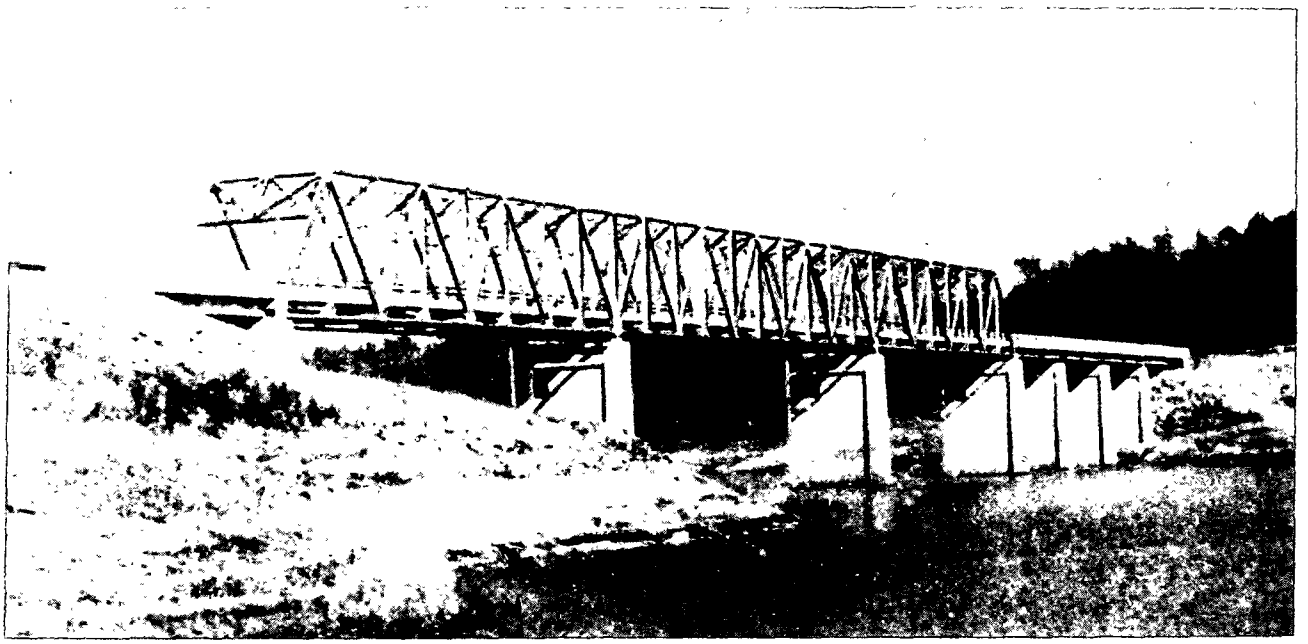


Figure 3–36. Typical steel through truss bridge (Warren type).

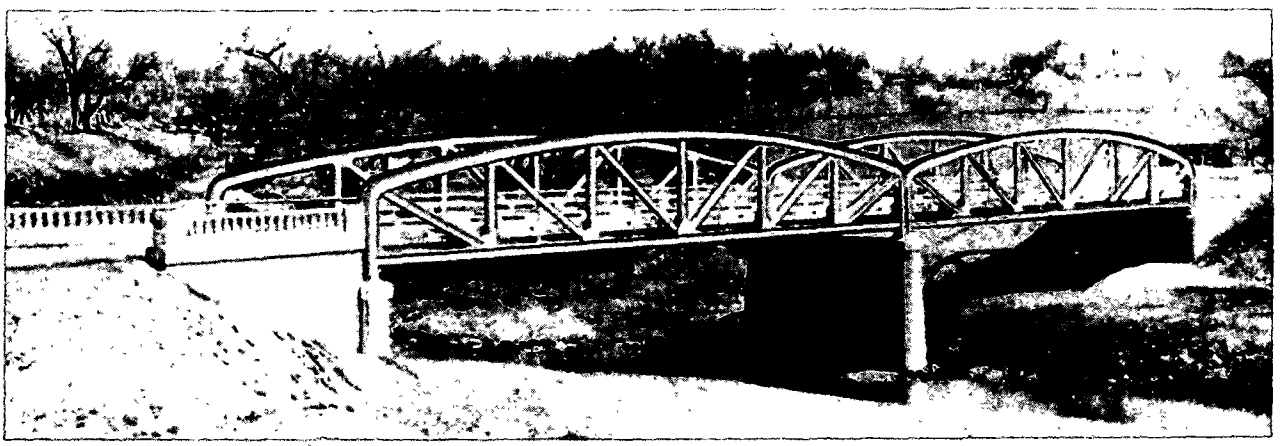


Figure 3–37. Pony truss highway bridge.

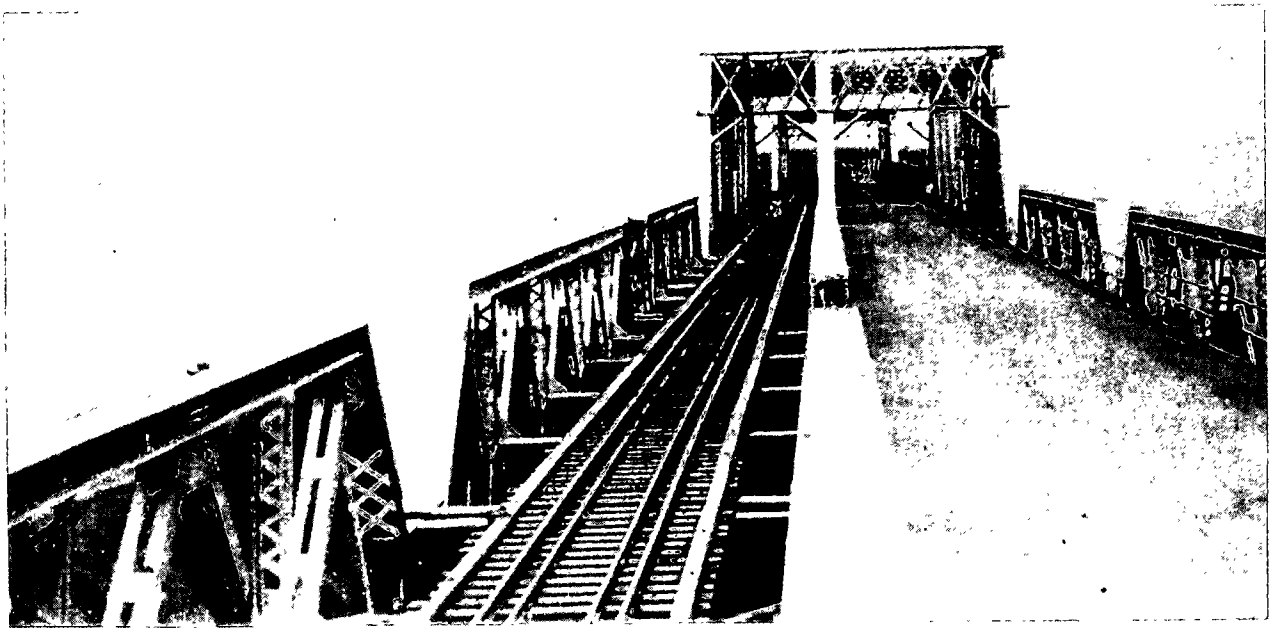


Figure 3-38. Pony truss and through truss forming combination bridge.

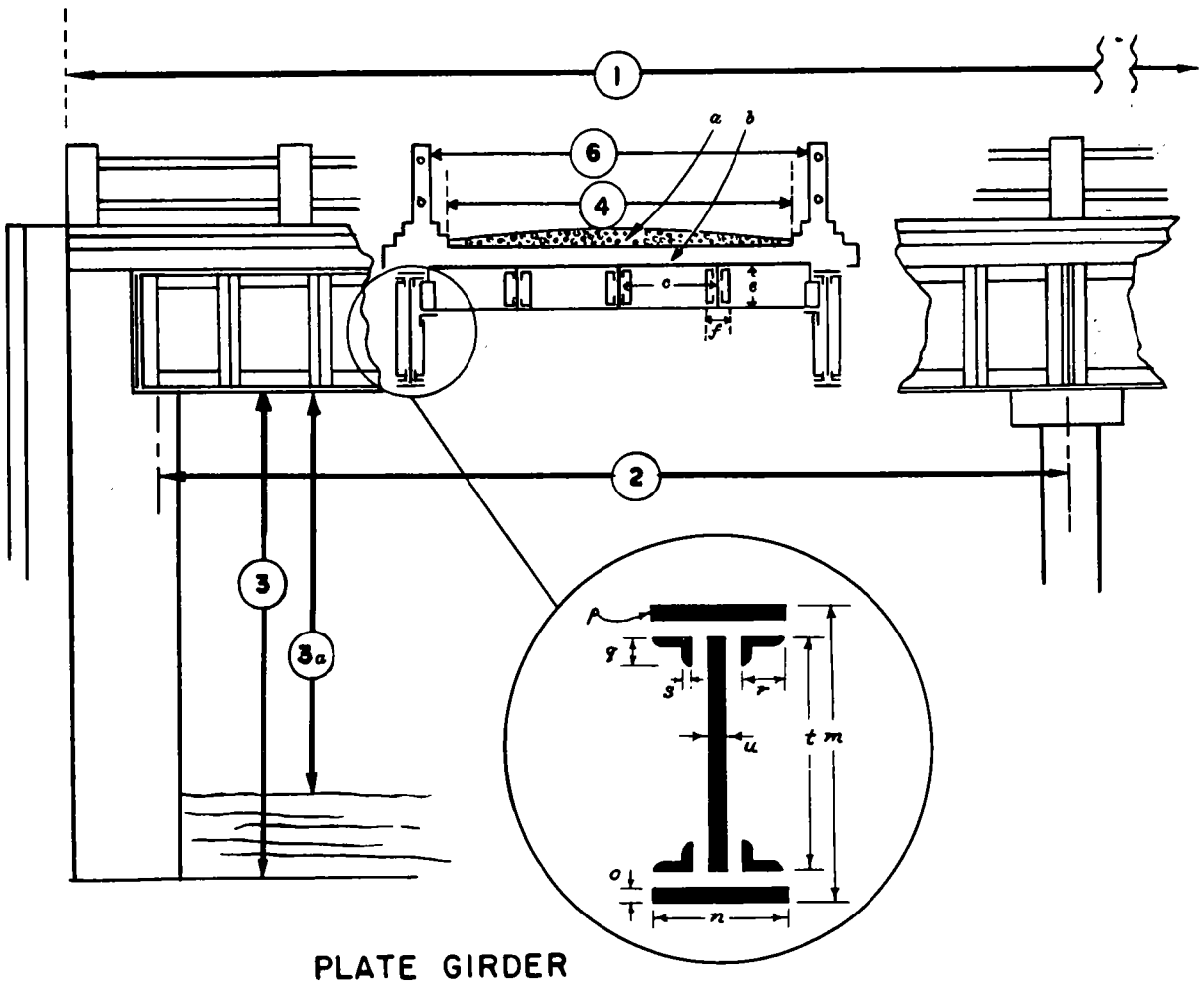


Figure 3-39. Standard dimension data guide for plate girder bridges.

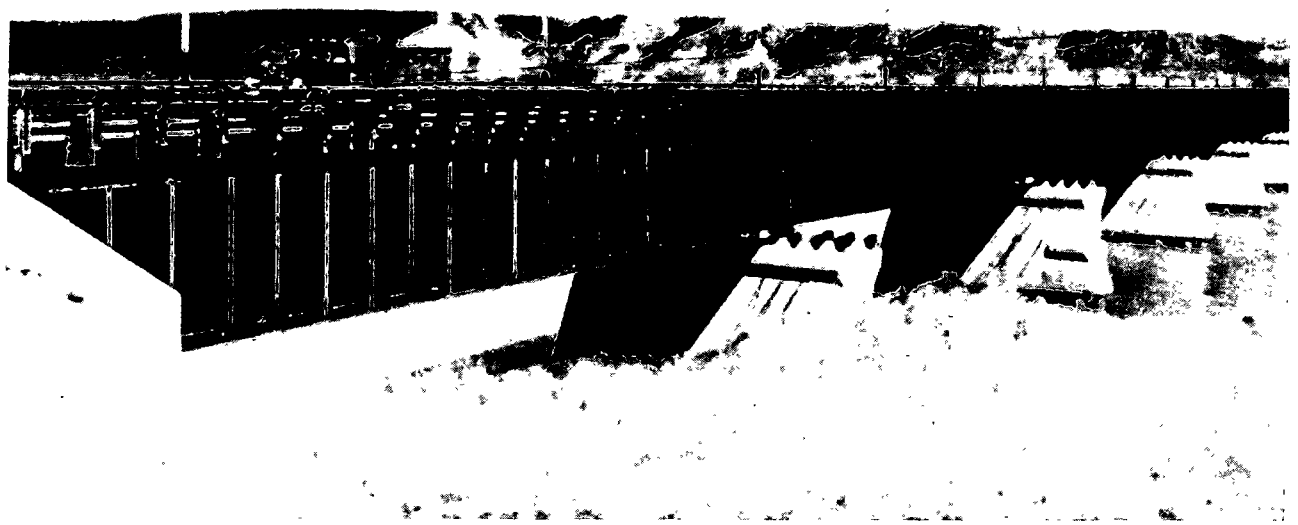


Figure 3–40. Typical multispan deck type plate girder bridge.

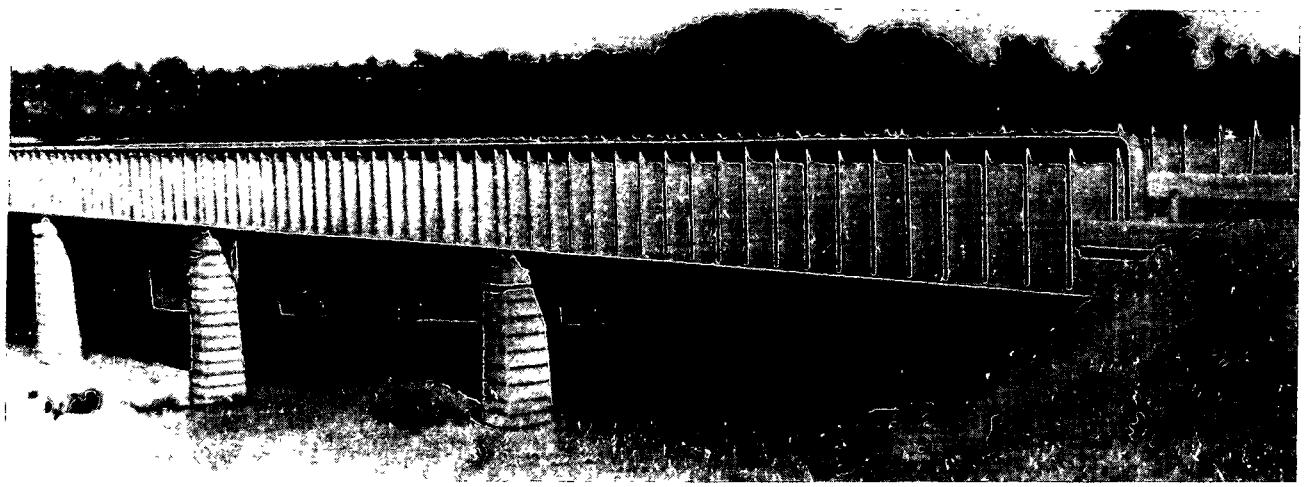


Figure 3–41. Through type girder bridge.

(*b*) *Through type plate girder span.* If the floor system is carried at or near the level of the lower chords so that the traffic passes between or through the girder, the structure is called a through type girder bridge. This type is illustrated in figure 3–41.

g. Arch Bridges.

(1) Arch span bridges are constructed in many types and variations. Basically, an arch bridge consists of an arch (including an arch ring), a crown, a fill and hinges, and a floor system. A standard dimension data guide for arch bridges is illustrated in figure 3–42. Common types of arch construction used in bridges are illustrated in figure 3–43. Nomenclature of arch bridges is given in figure 3–44.

(2) Classification of arch spans, for reconnaissance report purposes, may be given as follows:

(*a*) Masonry arch (solid earth-filled) and deck type (fig. 3–45). The Bridge Classification

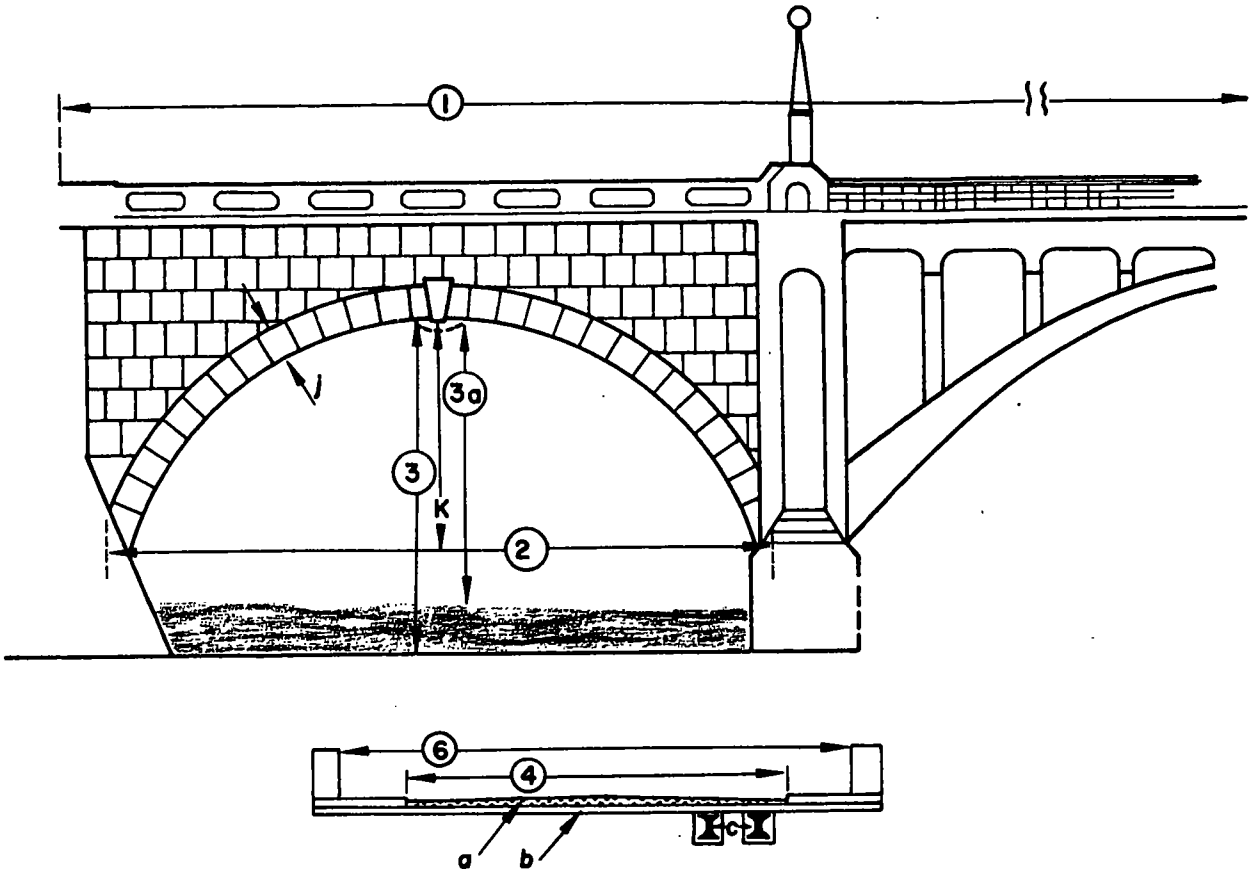


Figure 3–42. Standard dimension data guide for arch bridges.

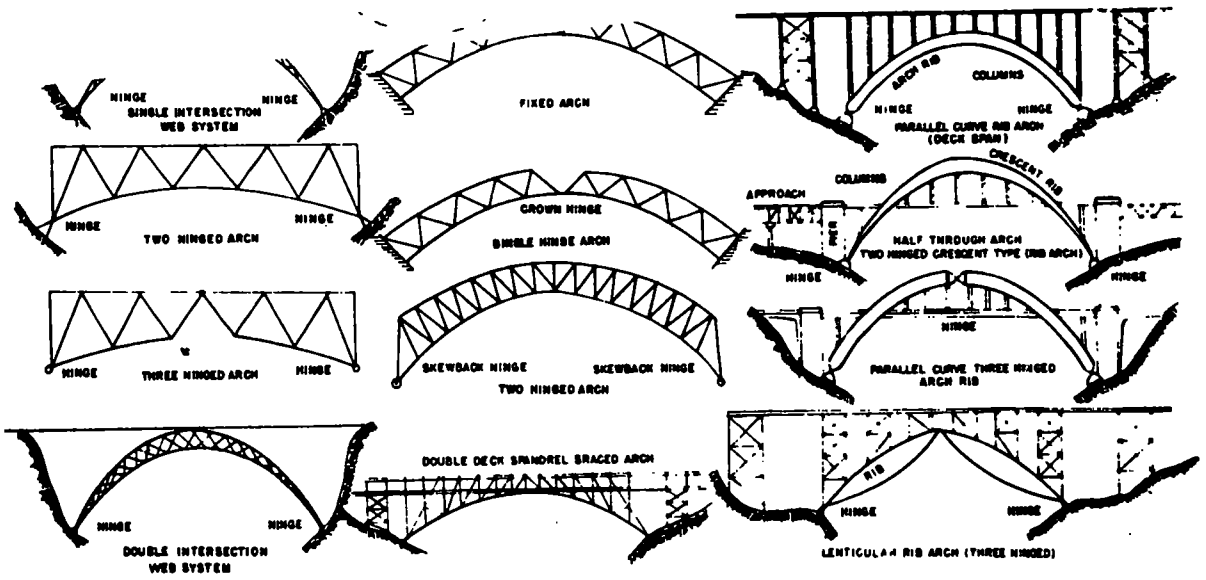
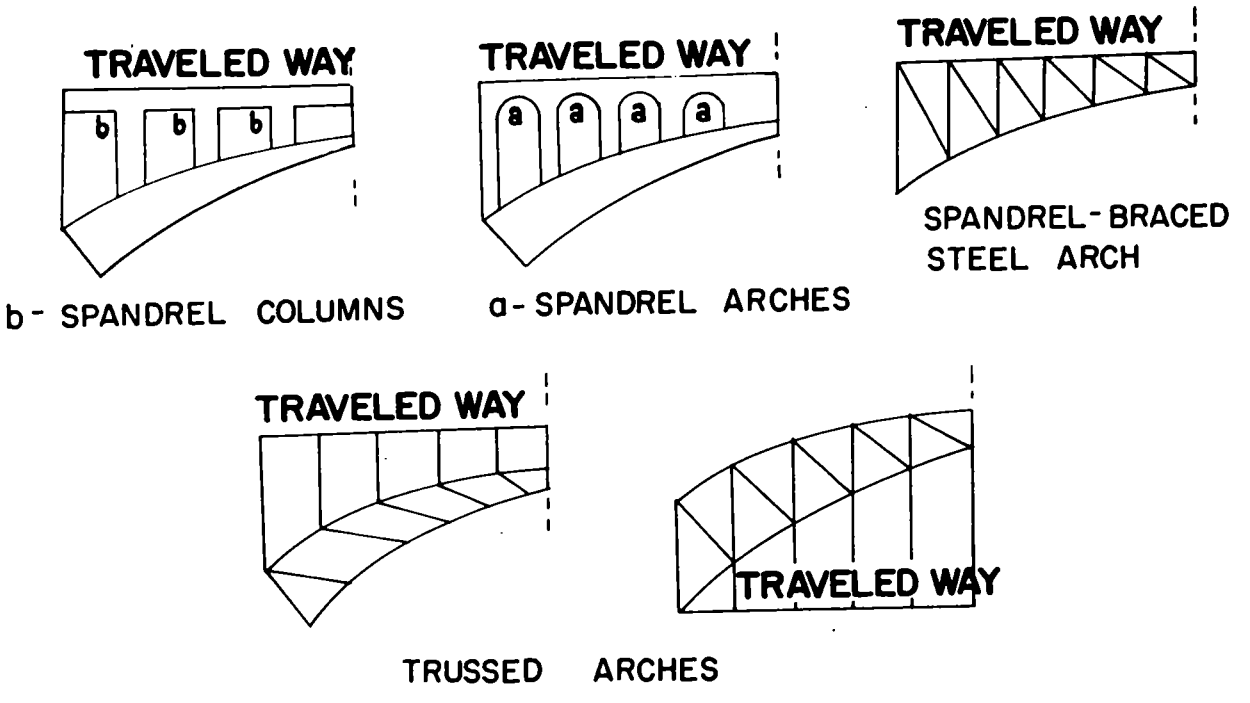


Figure 3–43. Common types of arch construction.



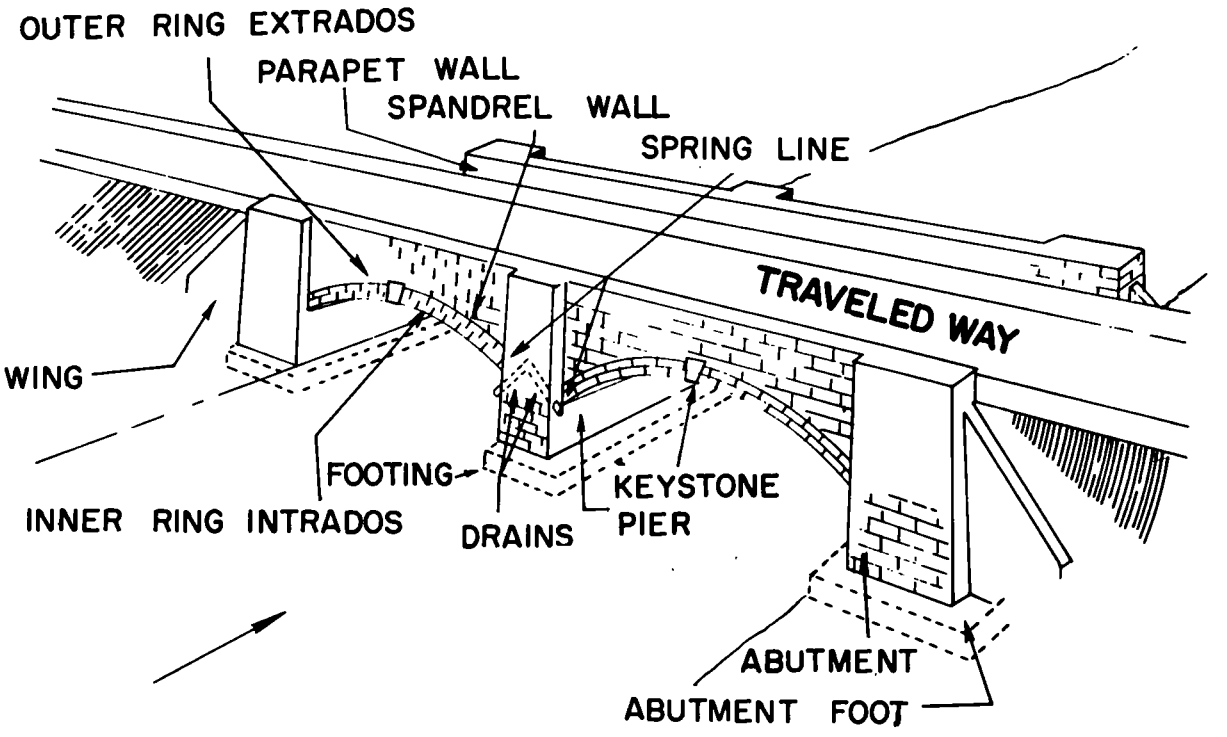


Figure 3–44. Nomenclature of arch bridges.

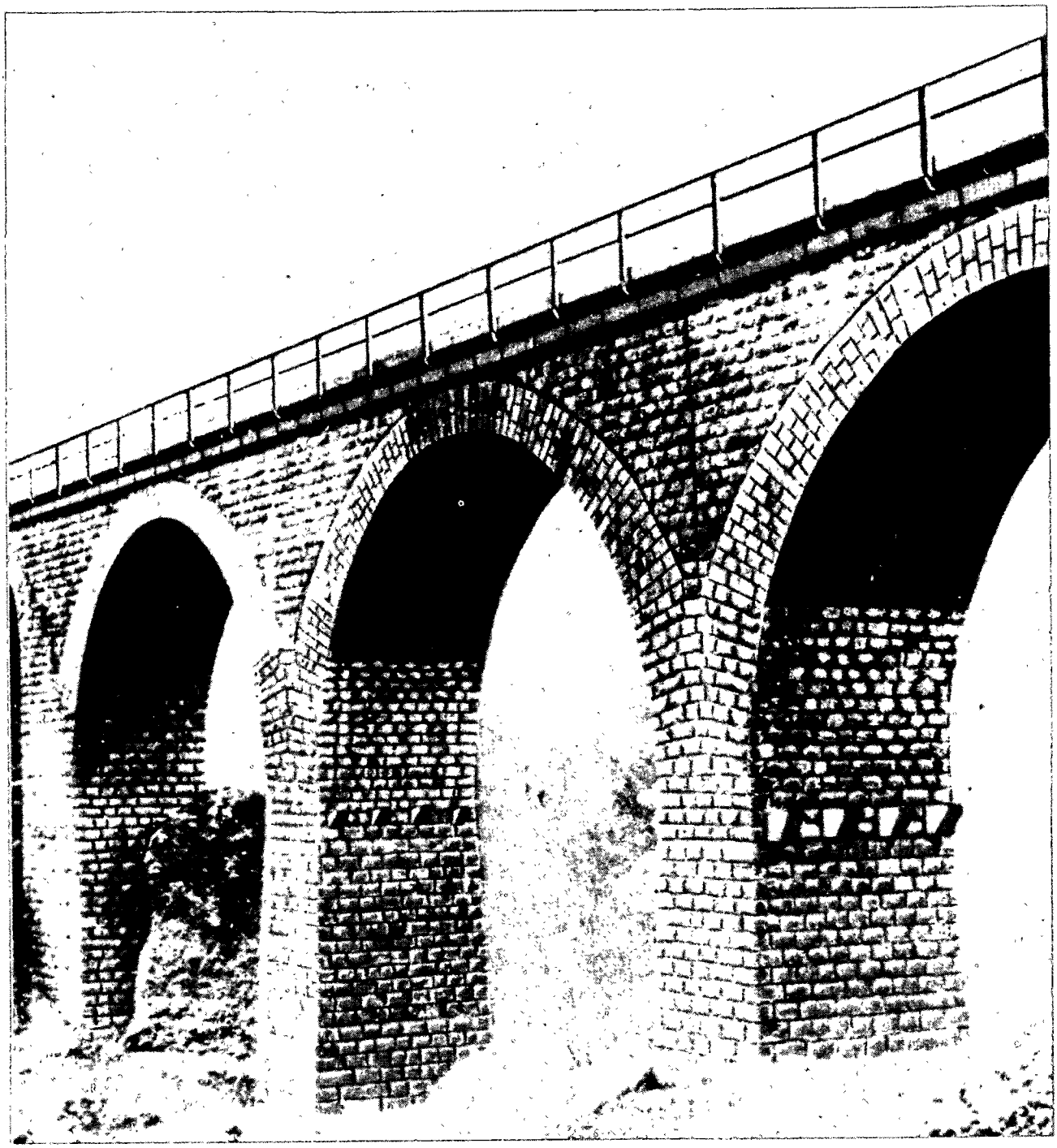


Figure 3–45. Typical solid masonry arch bridge.

Card (para 3–16) describes in detail the requirements for classifying masonry arch bridges.

(*b*) Concrete arch, either solid (earth-filled) or open spandrel type, with the traveled way usually supported above the arch ring by a series of columns, posts, or small arches (figs. 3–46 and 3–47).

(*c*) Steel arch, either deck type with the traveled way resting on the top (horizontal) member of a trussed steel arch, or through type (arch) with the traveled way suspended from the arched member (truss or beam) by a series of bars, T-beams, or webbed (latticed) vertical members (figs. 3–48, 3–49, and 3–50).

Figure 3–46. Typical solid concrete arch bridge.

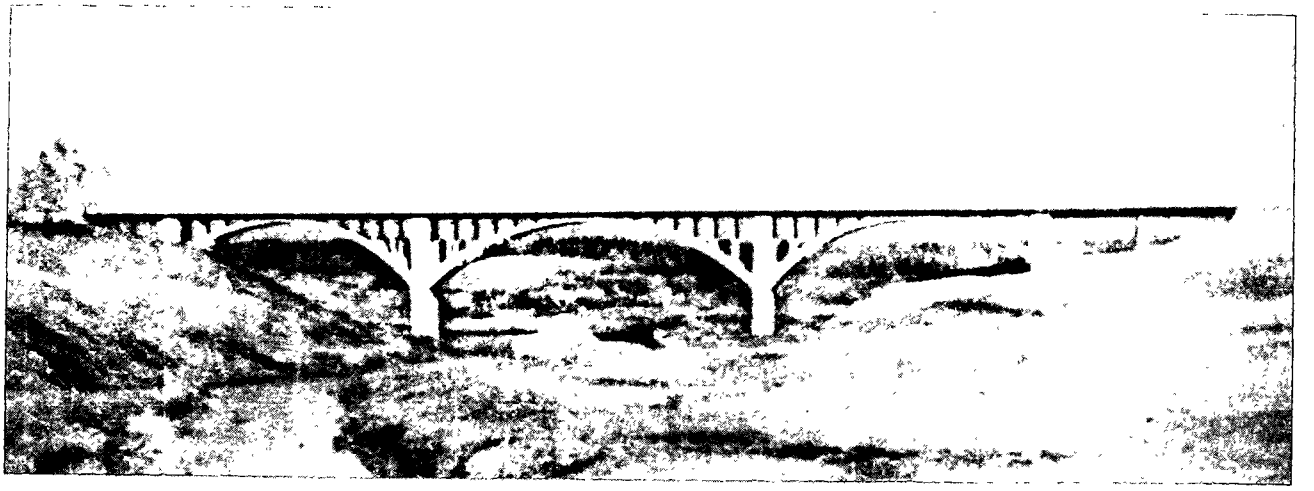


Figure 3–47. Typical open spandrel concrete arch bridge.

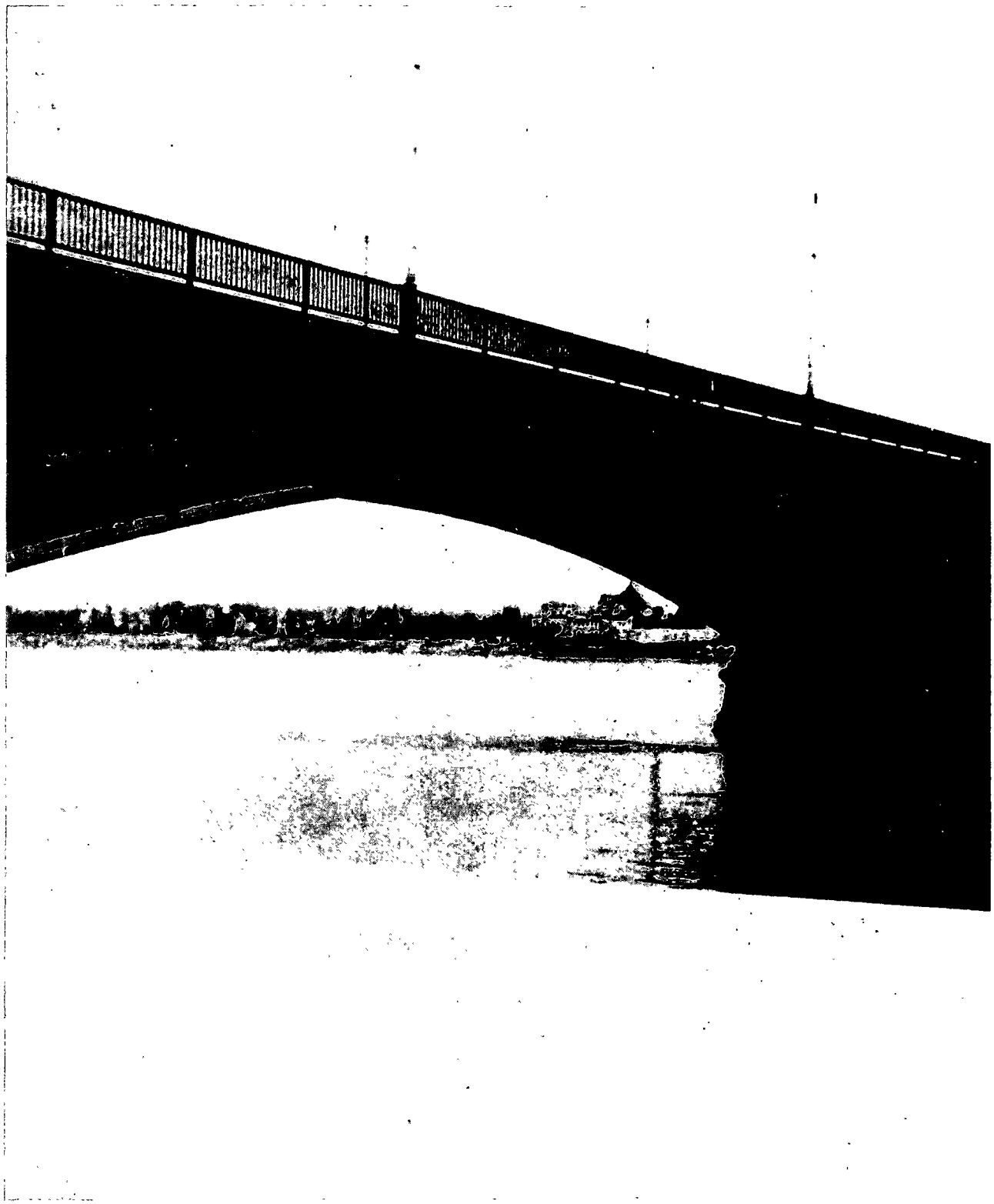


Figure 3–48. Parallel curve, steel rib, arch bridge.

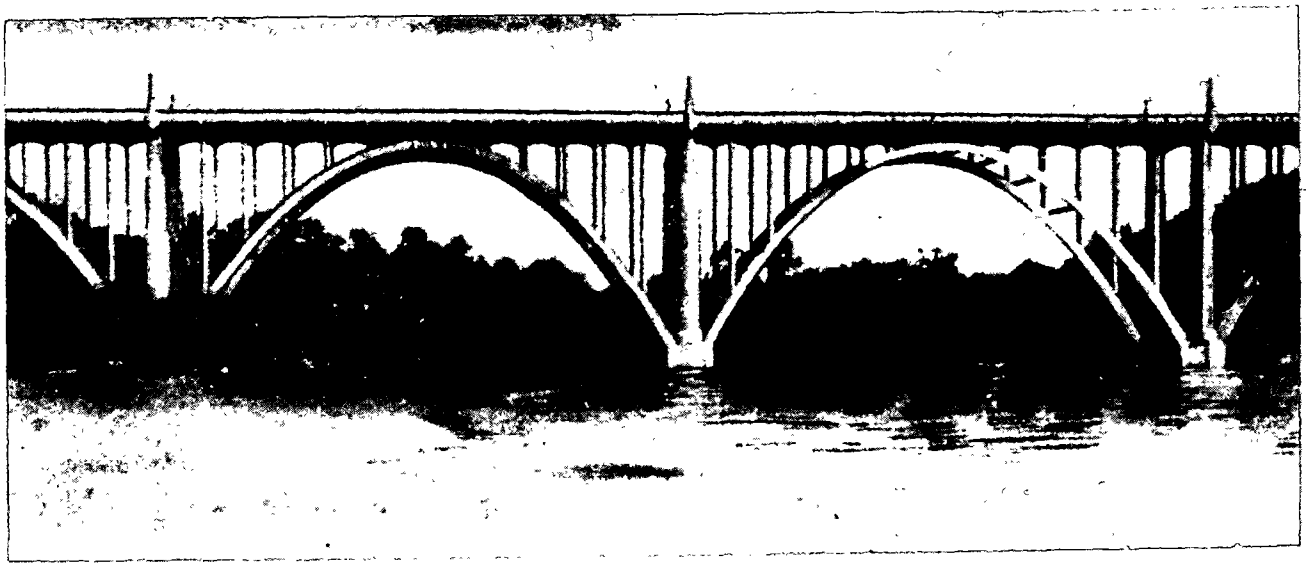


Figure 3–49. Steel trussed arch bridge, deck type.

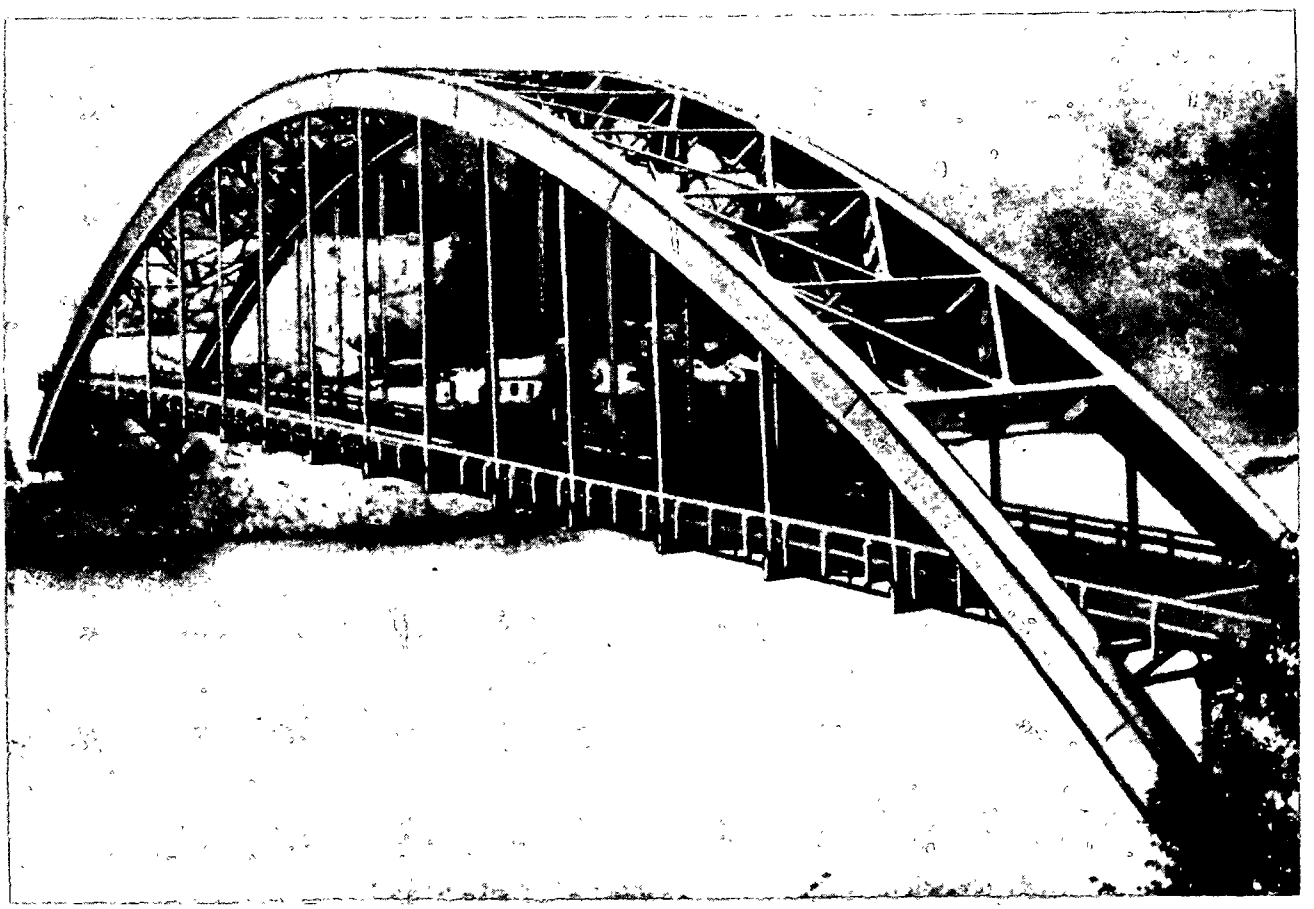
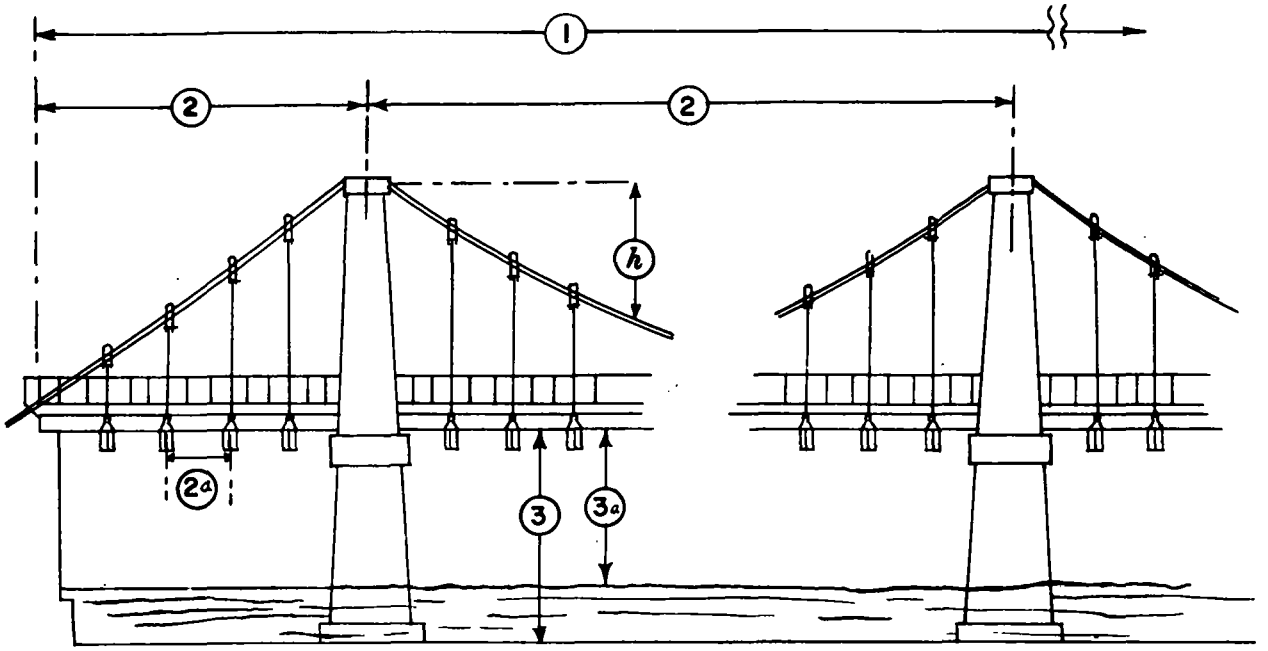


Figure 3–50. Steel arch bridge, through type.



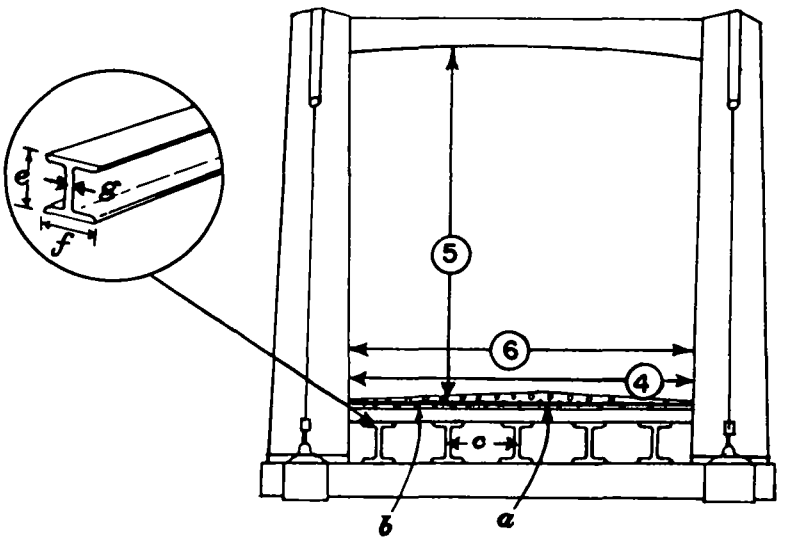


Figure 3–51. Standard dimension data guide for suspension bridges.

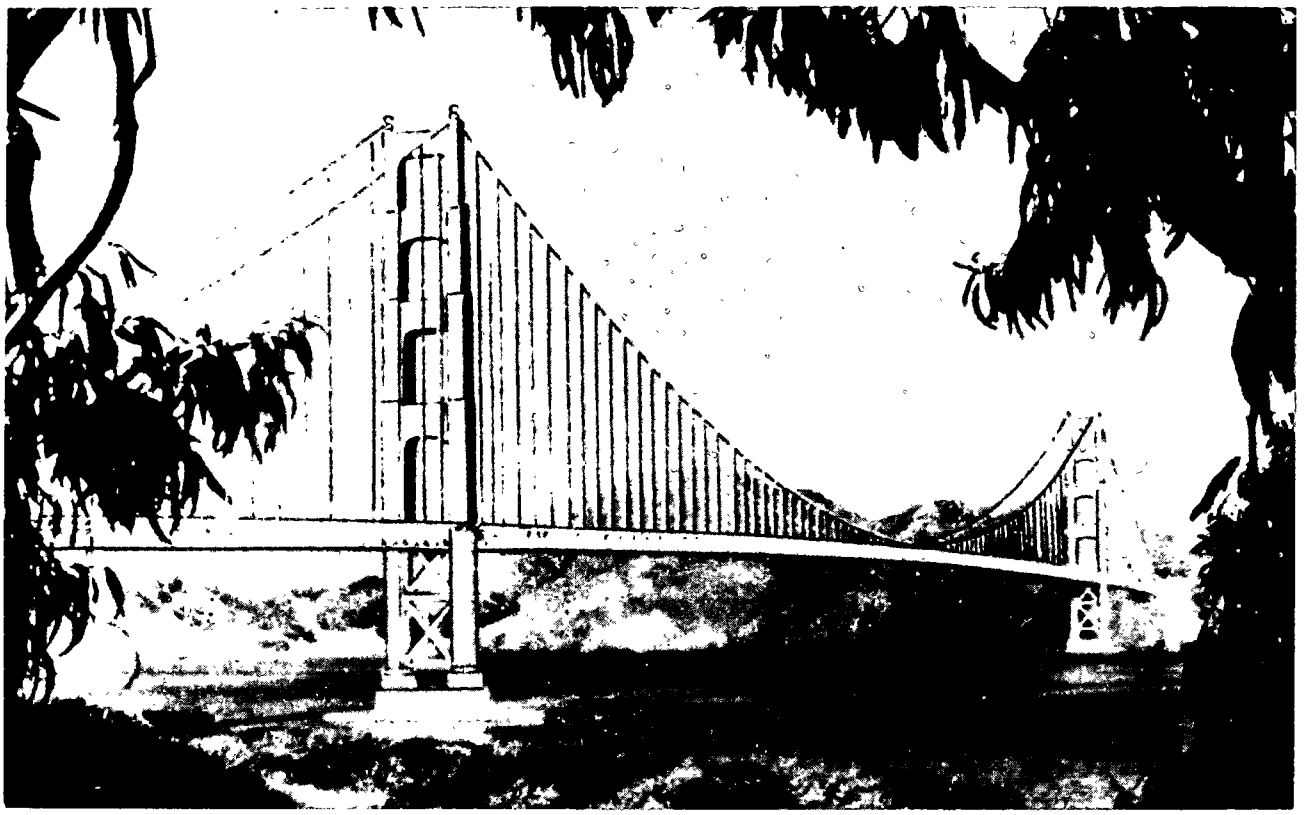


Figure 3–52. Suspension bridge with steel cable, steel reinforcing truss, steel floor beams, and external sway bracing.

h. Suspension Bridges.

(1) Suspension spans have the traveled way suspended by means of vertical cables or ropes from two or more suspension cables which pass over towers and are anchored at the ends. Suspension bridges are usually employed where the construction of intermediate supports is impracticable due to the depth of the bridge gap or where navigation must pass under the bridge.

(2) A standard dimension data guide for suspension bridges is illustrated in figure 3–51. Typical suspension bridges are shown in figures 3–52, 3–53, and 3–54.

i. Movable Bridges.

(1) Movable bridges (fig. 3–55) may be classified as follows:

(*a*) Swing bridges.

(*b*) Lift bridges.

(*c*) Bascule bridges.

(*d*) Retractile bridges.

(2) Deliberate reconnaissance of movable bridges requires special engineer training.

j. Ponton (Floating) Bridges. A ponton (floating) bridge (fig. 3–55) is a temporary bridge which is supported by low, flat-bottomed boats or other floating structures. The major components are the floats, saddle assembly, and the superstructure which carries the traveled way. Some types of ponton bridges are provided with a ramp or trestle to facilitate the approach. Ponton bridges are usually replaced as soon as possible by more permanent structures. Although they are essentially nonmovable bridges of a temporary nature, they may be released at one end to allow passage of ships.

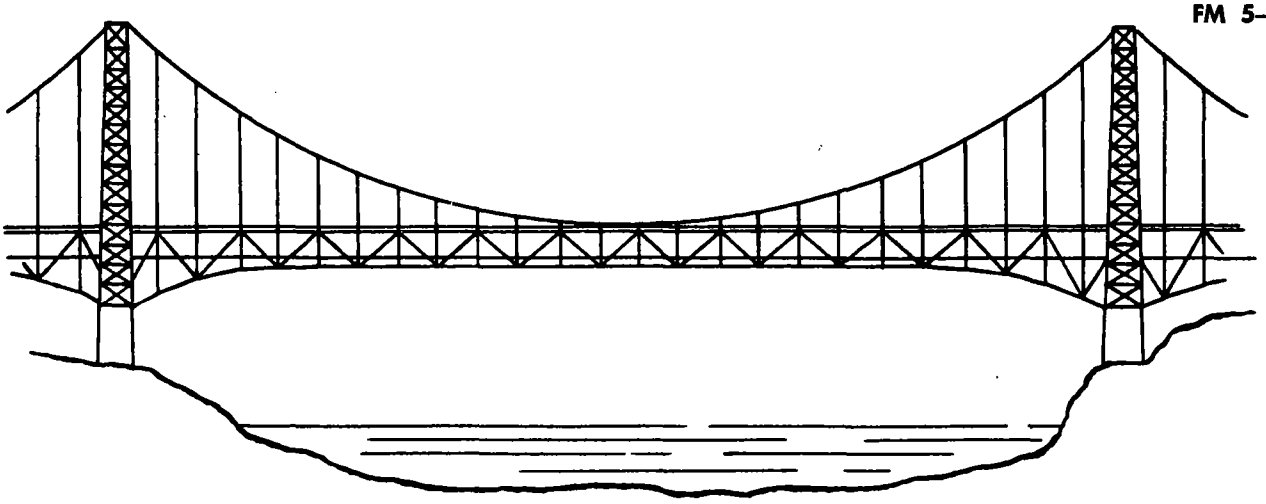


Figure 3–53. Bailey type suspension bridge.

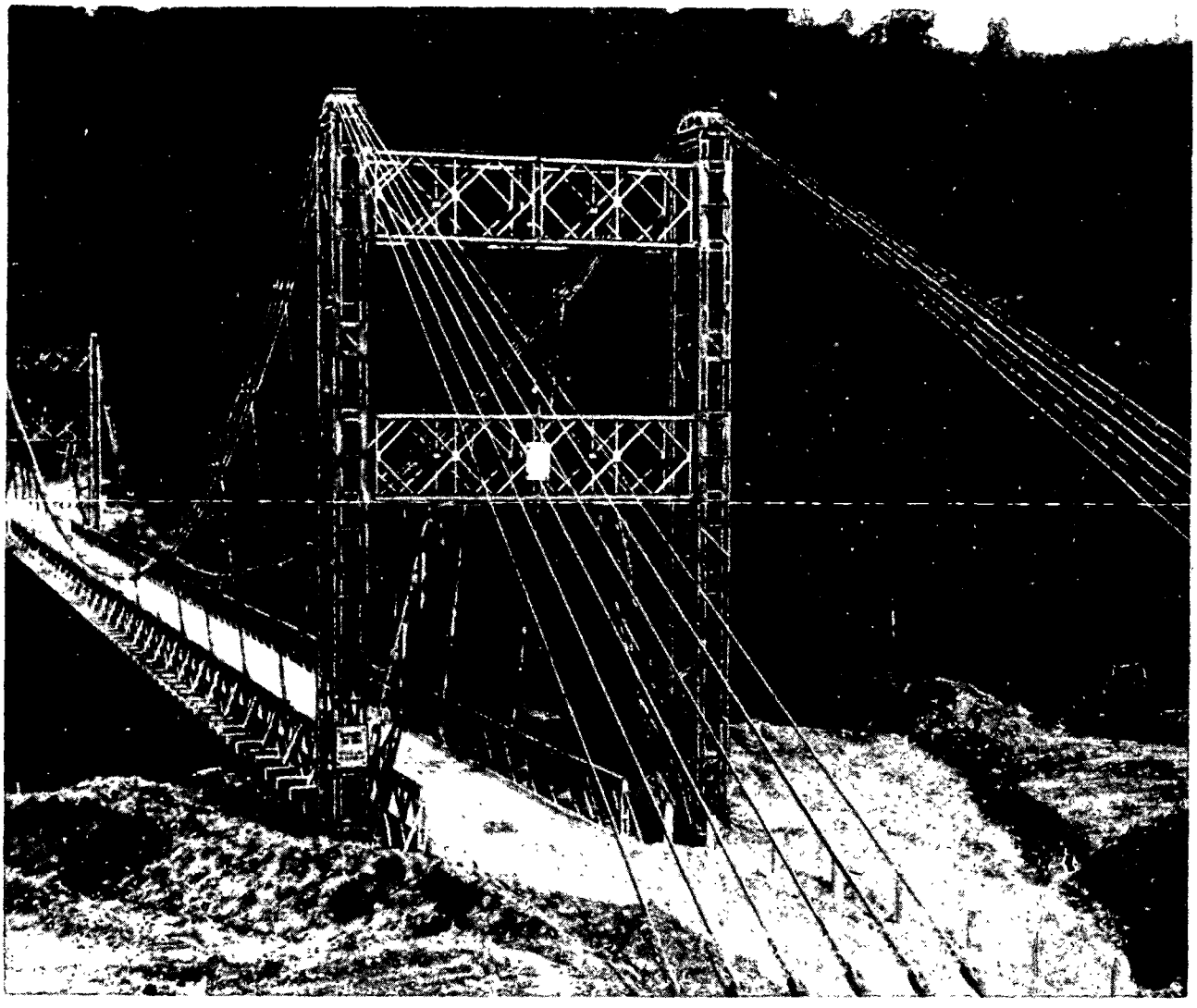
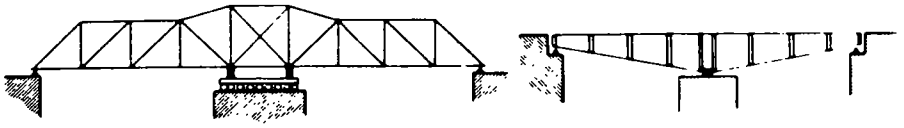
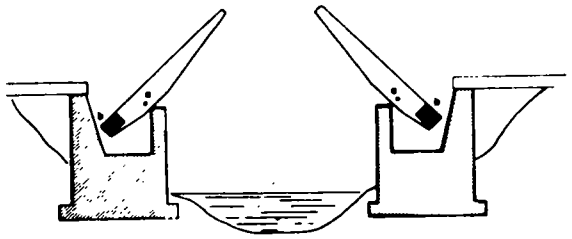


Figure 3–54. Steel suspension bridge.

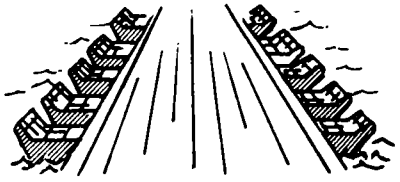


SWING BRIDGES
a. trunnion
b. counterweight

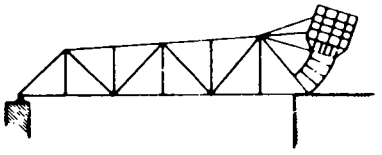
SINGLE LEAF TRUNNION TYPE
BASCULE BRIDGE



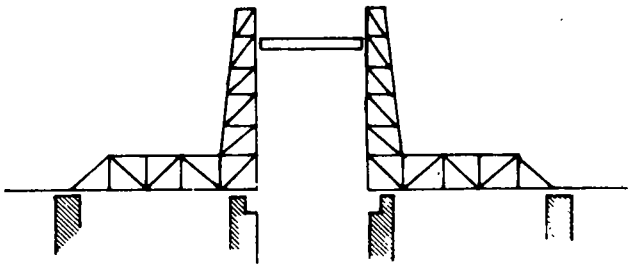
DOUBLE LEAF TRUNNION TYPE
BASCULE BRIDGE



FLOATING BRIDGE



ROLLING LIFT TYPE
BASCULE BRIDGE



VERTICAL LIFT BRIDGE

Figure 3–55. Classification of movable bridges (by type of movable structure) and ponton (floating) bridge.

Section III. BRIDGE MILITARY LOAD CLASSIFICATION (SOLOG 105)

3–12. General

a. A mobile army must make maximum use of existing bridges; but before any existing bridge can be used to capacity, it requires classification in terms of the bridge and vehicle military load classification system which has been adopted by the U.S. and allied nations. The class of each bridge is posted to prevent overloading which may cause failure and, thereby, hamper future operations. To classify bridges various methods are available; however, this manual limits discussion to only one of these methods—GTA 5–7–7, Bridge Classification Card (para 3–14).

b. In the United States, load capacities and vehicle dimension restrictions normally are regulated and posted by individual state and county governments. Where bridges in foreign areas are not posted, it is sometimes possible to ascertain bridge dimension restrictions and load capacities by consulting local civil authorities or military intelligence agencies. In many cases, however, data are not available, and the bridges on a route will require computation of their respective military load classes.

c. Bridge classification is basically the reverse of design procedure. In designing a bridge, the desired class is established, and the required quantity and size of individual bridge members are calculated. In classifying a bridge, however, the members are already present; their dimensions need only be recorded and strength characteristics considered to compute the load capacity.

3–13. Classification Factors

a. Before the class of a bridge can be determined, measurements and other data which determine the class of the bridge are noted as follows:

(1) *The number of members.* Where applicable (stringer bridges and concrete T-beam bridges, for example), the number of members in each span is noted.

(2) *Size of members.* Exact and complete dimensions pertinent to specific bridge members are taken as previously outlined in tables 3–1 and 3–2.

(3) *The span length.* Span length is measured from center to center of supports. The classification of the bridge is usually based on the weakest span; and if the weakest span is readily apparent, no other spans need be investigated. However, if the weakest span is difficult or impossible to locate by visual observation, all spans require classification. Even if several spans appear identical, actual measurements are taken to prevent error.

(4) *The width of the traveled way.* The traveled way width is the measured distance between the inside faces of the curbs.

(5) *General condition.* It is essential to note the general condition of the bridge paying particular attention to evidences of damage from natural causes (rot and rust) or combat action. Classification procedures presume that a bridge is in good condition. If the bridge is in poor condition, the class obtained from mathematical computations requires appropriate reduction in accordance with the classifier's judgment.

3–14. Bridge Classification Card

The bridge classification card (GTA 5–7–7) provides a rapid means of classifying bridges. It utilizes a partially graphic method with several approximations to simplify procedures. The card outlines procedures for determining the class of simple steel and timber stringer, masonry arch, concrete T-beam, and concrete slab bridges. Bridge classification with this card is based on the class of the superstructure only, since this is considered to be the controlling feature in classification, and a balanced design in the substructure is assumed.

3–15. Other Classification Methods

The bridge classification card is based on many assumptions in arriving at a specific military load class. This method is an expedient means for rapidly estimating the military load class of simple structure bridges under field conditions. When time and qualified personnel are available to provide a more detailed analysis, or if the bridge is of complicated design, more precise methods are employed (TM 5–312).

Section IV. VEHICLE MILITARY LOAD CLASSIFICATION (STANAG 2021, SEASTAG 2021, AND SOLOG 45R)

3–16. General

a. The basis of the vehicle military load classification system is the effect a vehicle has on a bridge while crossing. The effect is the result of a combination of factors which includes the gross weight of the vehicle; the distribution of this weight; the outside-to-outside width of tires or tracks; tire size and air pressure; the speed at which the vehicle crosses the bridge; and the resulting impact on the bridge. Heavy loads common to military equipment, such as artillery and tanks, make vehicle classification an extremely important factor in determining the suitability of a given route.

b. A list of standard vehicles, their weights, and class is given in appendix D. Temporary classification under emergency conditions may be made by comparing the axle loads, gross weight, and

dimensions of the unclassified vehicle with those of a similar classified vehicle. A temporary class thus derived may be used; however, the using unit verifies as soon as possible the temporary classification.

3–17. Data Required for Vehicle Classification

a. The data required for mathematical computation of a vehicle's classification are shown in figures D–1 through D–7. The following items, as applicable to the vehicle in question, are essential:

(1) Weight—empty, loaded for cross-country, and loaded for highway.

(2) Load on each axle—empty, loaded for cross-country, and loaded for highway.

(3) Load on lunette, pintle, or fifth wheel—empty, loaded for cross-country, and loaded for highway.

(4) Tires—number per axle, size, and inflation pressure.

(5) Distance between axles.

(6) Distance from nearest axle(s) to pintle, lunette, or fifth wheel.

(7) Outside-to-outside width of tires or tracks.

(8) Inside-to-inside width of tires or tracks.

(9) Length of track in contact with the ground.

b. Often, some of the necessary data for vehicle classification may be obtained from the vehicle weight and dimension card (STANAG 2163) which is displayed by vehicles during their transport (fig. 3–56).

3–18. Assignment of Classification Numbers

a. Military vehicles are described as wheeled or tracked. For classification purposes, military vehicles are further divided into two categories: single vehicles and combination vehicles.

(1) A single vehicle is any military vehicle which has only one frame or one chassis. Examples are trucks, tanks, trailers, and gun carriages (fig. 2–52).

(2) A standard combination vehicle is a military vehicle consisting of two or more single vehicles designed to be connected together and operate as one unit. Exmples are truck-tractors with semitrailers and trucks towing trailers or gun carriages (fig. 2–53). A nonstandard combination is, for example, a single vehicle towing another vehicle at a distance less than 30.5 meters (fig. 2–56).

b. Class numbers must be assigned to all self-propelled vehicles in military use which have a gross weight exceeding 3 tons and to all trailers which have a rated payload of 1½ tons and over (STANAG 2010). Trailers with a rated capacity of less than 1½ tons will normally be combined with their towing vehicles for classification purposes although optional class numbers may be assigned.

c. Temporary class numbers may be assigned under special conditions (see para 2–53*c* and *d*).

3–19. Mathematical Procedure for Vehicle Classification (STANAG, SEASTAG 2021 and SOLOG 45R)

The mathematical computation of a vehicle's military load classification is beyond the capability of route reconnaissance teams. If a requirement to determine a vehicle's classification exists, reconnaissance personnel supply higher headquarters with the dimensional characteristics of the vehicle in question (para 3–17), and request computation of the military load class number (see TM 5–312).

3–20. Expedient Procedure for Determination of Vehicle Load Class

It sometimes becomes necessary to classify a vehicle under field conditions. If time does not permit an accurate mathematical computation, the following procedures may be used to *estimate* a vehicle's load class.

a. All Vehicles. A comparison of the unclassified vehicle may be made with a similar classified vehicle (para 3–16*b*), or with a similar standard hypothetical vehicle (fig. 3–57).

b. Wheeled Vehicles. The hypothetical wheeled vehicles of the military load classification system represent typical military wheeled vehicles of the United States and allied nations. Therefore, any expedient rules which apply to the hypothetical vehicles also apply to a majority of actual military vehicles. The class of wheeled hypothetical vehicles is approximately equal to 85 percent of the gross weight. The initial task, then, is to determine the vehicle's gross weight. If the air pressure in the tires (in pounds per square inch) is known, it is multiplied by the total area in square inches of

VEHICLE WEIGHT AND DIMENSION CARD
. . . . . (3d language)

State unit of measure used.
. . . . . (3d language)

WEIGHT . . . . . .
. . . . (3d language)

LENGTH . . . . . .
. . . . (3d language)

BREADTH . . . . . .
. . . . . (3d language)

HEIGHT . . . . . .
. . . . (3d language)

GROUND PRESSURE OR
MAXIMUM AXLE LOAD . . . . . .
. . . . . (3d language)

Figure 3–56. Vehicle weight and dimension card.

the tires in contact with the ground. This yields the approximate weight of the vehicle in pounds which is then *converted to tons.* The expedient classification for the wheeled vehicle will be 85 percent of its weight in tons. If no gage is available for measuring tire pressure, 75 psi may be selected as an average value.

Caution: **If the criteria shown in figure 3–57 for single axle load, wheel spacing, and tire size and load are not met, this method cannot be used. In such cases, the deliberate vehicle classification procedure described in TM 5–312 is required.**

c. Tracked Vehicles. The procedure for classifying tracked vehicles in the field is similar to the

Directions for Use

1. This card is designed to display vehicle laden weight and dimensions to all concerned with loading it on any means of transport, e.g., to an aircraft, ship, etc.

1. ..... (3d language) .....

2. Accurate weight and dimensions will be printed in chalk by the unit or depot preparing a vehicle for movement. This card will then be fixed inside the windscreen on the passenger's side. On tanks or other vehicles without windscreens, this card will be fixed on a suitable surface on the opposite side of the vehicle from the driver's seat, where it can easily be seen. If possible, it should be protected from inclement weather.

2. ..... (3d language) .....

3. This is a NATO form and whoever "chalks in" the weights and dimensions should use his country's normal system of weight and measurement.

3. ..... (3d language) .....

Figure 3–56—Continued.

procedure for wheeled vehicles. Two considerations are applicable: (1) The classification of tracked vehicles may be taken as equal to the gross weight in tons. (2) The area of the track in contact with the ground may be used to determine the gross weight of the vehicle. As the pressure on the soil is approximately equal to one ton per square foot, the expedient classification number for a tracked vehicle is equal to the number of *square feet of area* in contact with the ground.

Figure 3–57. Standard class hypothetical vehicle characteristics.

(Located in back of manual)

Section V. ROAD RECONNAISSANCE AND CLASSIFICATION

3–21. General (STANAG 2253 and SOLOG 96)

A road is the open way provided for the convenient passage of vehicles. Road reconnaissance is conducted to determine the traffic capabilities of a particular road and to provide more detailed information than that required by the route classification formula. Road classification is based upon limiting characteristics, obstructions, snow blockage, flooding, civil and military road designation, turnouts, and available cover and concealment.

3–22. Road Classification Formula

a. Basic Formula. The road classification formula is developed from symbols expressed in the following order: limiting characteristics, width, construction material, length, and obstructions if present. The formula describes briefly a specific section of road and is used in conjunction with road reconnaissance reports.

(1) *Limiting characteristics.* The formula will be prefixed by the symbol, A, if there are *no limiting characteristics*, and by the symbol, B, if there is *one or more limiting characteristics.* An unknown or undetermined characteristic is represented by a question mark together with the feature to which it refers; both are inclosed in brackets. A listing of limiting characteristics, descriptive criteria, and corresponding letter symbols are outlined in table 3–3.

(2) *Width.* The minimum width of the traveled way is expressed in meters followed by a slash and the combined width of the traveled way and the shoulders; e.g., 14/16 (fig. 2–1). A description of the shoulders is not reported as part of the formula but by a separate notation which specifies the surface of the shoulders (grass, metaling, etc.), condition (unusable, emergency only, capable of improvements), width, vegetation, and critical side slopes. To report a dual road in which the two traveled ways are narrowly separated by a fixed barrier, pavement, or turf centerline; the width of each traveled way is first noted followed by the combined width including shoulder; for example, 7 + 7/18. If the two traveled ways are significantly divided, however, each is reported as two distinct roads.

(3) *Road surface materials.* Road surface material is also expressed by a letter symbol. Symbols to be used for this purpose are listed in table 3–4 and are further related to the X, Y, and Z route types of the route classification formula (para 2–6).

(4) *Length.* The length of the road expressed in kilometers may be shown, if desired, in brackets following the surface material notation.

(5) *Obstructions.* Existence of obstructions, if present, along a road is expressed by placing the symbol (OB) at the end of the formula. Details of obstructions affecting the traffic flow of a road are not shown in the formula but are reported separately by appropriate symbols on accompanying maps or overlays or by written inclosures. Obstructions to be reported are as follows (see para 2–8 for details):

(*a*) Overhead obstructions (less than 4.25 meters or 14 feet).

(*b*) Constrictions in traveled way widths.

(*c*) Gradients (slopes of 7 percent or greater).

(*d*) Curves with radius less than 30 meters (100 feet).

(6) *Special conditions.* If blockage is regular, recurrent, and serious; the effects of snow block-

Table 3–3. Criteria for Determination of Limiting Characteristics

Limiting characteristics	Criteria	Symbol
Sharp curves	Sharp curves with radius less than 30 meters (100 feet) are also reported as obstructions	c
Steep gradients	Steep gradients, 7 percent or steeper. Such gradients are also reported as obstructions	g
Poor drainage	Inadequate ditches, crown or camber, or culverts; culverts and ditches blocked or otherwise in poor condition.	d
Weak foundation	Unstable, loose, or easily displaced material	f
Rough surface	Bumpy, rutted, or potholed to an extent likely to reduce convoy speeds	s
Excessive camber or superelevation.	Falling away so sharply as to cause heavy vehicles to skid or drag toward the shoulders	j

Table 3–4. Symbols for Type of Surface Materials

Symbol	Material	Route type
k	Concrete	Type (X); generally heavy duty.
kb	Bituminous (asphaltic) concrete (bituminous plant mix)	Type (X); generally heavy duty.
p	Paving brick or stone	Type (X) or (Y); generally heavy duty.
pb	Bituminous surface on paving brick or stone	Type (X) or (Y); generally heavy duty.
rb	Bitumen penetrated macadam, waterbound macadam with superficial asphalt or tar cover.	Type (X) or (Y); generally medium duty.
r	Waterbound macadam, crushed rock or coral or stabilized gravel	Type (Y); generally light duty.
l	Gravel or lightly metalled surface	Type (Y); generally light duty.
nb	Bituminous surface treatment on natural earth, stabilized soil, sand-clay or other select material.	Type (Y) or (Z); generally light duty.
b	Used when type of bituminous construction cannot be determined	Type (Y) or (Z); generally light duty.
n	Natural earth stabilized soil, sand-clay, shell, cinders, disintegrated granite, or other select material.	Type (Z); generally light duty.
v	Various other types not mentioned above	Classify (X), (Y), or (Z) depending on the type of material used. (Indicate length when this symbol is used).

age and flooding are indicated in the road classification formula. In such cases, the symbol (T) for snow blockage or (W) for flooding follows the road classification formula (para 2–10).

(7) *Additional information.* The civil and military designation of the road, cover and concealment, possibilities of movement off the road, and similar information are indicated by appropriate symbolic notation on an accompanying map or overlay (fig. 2–2).

b. Classification Formula Examples. Usage and proper sequence of presentation are illustrated in the following examples of the road classification formula:

(1) *A 5.0/6.2k.* This formula describes a road with no limiting characteristics or obstructions, a minimum traveled way of 5.0 meters, a combined width of traveled way and shoulders of 6.2 meters, and a concrete surface.

(2) *B g s 4/5 1 (OB).* This formula describes a road with limiting characteristics of steep gradients and a rough surface; a minimum traveled way of 4 meters and a combined width of 5 meters; gravel or lightly metalled surface; and obstruction(s).

(3) *B c (f?) 3.2/4.8 p (4.3 km) (OB) (T).* This formula describes a road with limiting characteristics of sharp curves and unknown foundation; a minimum traveled way of 3.2 meters and a combined width of 4.8 meters; paving brick or stone surface; 4.3 kilometers long; with obstruction(s); and subject to snow blockage.

(4) *A 7 + 7/20 k.* This formula describes a dual road with each traveled way 7 meters wide and with an overall width of 20 meters including shoulders. It is constructed of concrete and has no limiting factors.

c. Bridge, Ford, and Ferry Information. Such information is not included in the formula for road classification. Instead, this information is expressed by means of appropriate symbols placed on the map or overlay report as explained in paragraphs 2–12 and 2–13.

d. Slides and Drainage. Where rock slides or falling rock present a traffic hazard or poor drainage characteristics may cause seasonal obstructions, the locations are pointed out by means of critical point symbols on a map or overlay and explanatory information is included in a legend or written inclosure.

3–23. Capacity of Roads

The load-bearing capacity of a road is its ability to support traffic and is expressed by a military load classification number. In determining the load-bearing capacity of roads, an elementary knowledge of road structure and design as outlined in TM 5–330 is desirable. Briefly, the component parts of a road generally consist of a pavement or surface, a base course, a subgrade, and a drainage system (fig. 3–58).

a. The surface or pavement of a road is the top portion of the road structure. It comes into direct

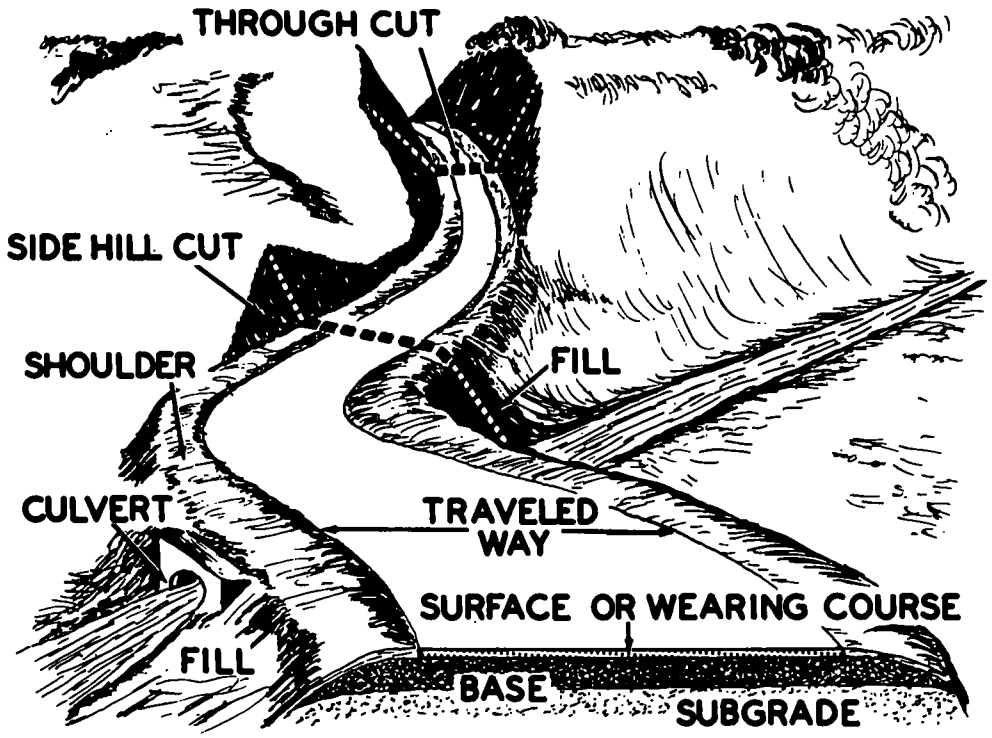


Figure 3–58. Road nomenclature.

contact with the wheeled or tracked load and is designed to resist traffic wear and to prevent surface water from infiltrating into the road substructure. Surfaces may consist of various materials as listed in table 3–4.

b. The base course of a road is the intermediate portion of a road structure which distributes the induced stresses from the wheeled or tracked load to the subgrade. Base courses are usually made from gravel or crushed rock.

c. The subgrade is the foundation of a road structure which supports the load placed upon the surface of the road. Roads usually have a subgrade composed of locally available natural materials.

d. The drainage of the road pertains to the system or systems designed to remove surface water, intercept and dispose of runoff from adjoining areas, and remove detrimental ground water from the road surface or subsurface areas. Failure to eliminate water from the road structure in any single stretch of road area may result in the deterioration or failure of the road.

3–24. Surfaces

Surfaces of roads are either flexible or rigid (table 3–4).

a. Flexible road surfaces may be composed of natural earth; earth stabilized with oil, cement, or other materials; or bituminous pavement.

b. Rigid road surfaces are usually made of portland cement concrete. Brick, block, and stone are also considered as rigid surfaces.

3–25. Subgrades and Base Courses

Soils, stabilized when necessary, form the subgrade and base course for the vast majority of roads. Soils are considered according to type, characteristics, and allowable foundation bearing pressure. Principal soil types are described in table 3–5, and characteristics of soils for construction purposes are outlined in table 3–6.

3–26. Drainage Systems

Generally, drainage systems are more effective when natural drainage patterns are used and incorporated into the drainage facilities of the road system. Culverts, ditches, French drains, check dams, and other techniques may be used as components of the road drainage system.

3–27. Load-Bearing Capacity of Roads

a. The load-bearing capacity of a road with a flexible surface is generally expressed as an allow-

Table 3–5. Principal Soil Types

Name	Description
Gravel	A mass of detached rock particles, generally waterworn, which pass a 3-inch sieve and are retained on a No. 4 sieve (0.187 inches).
Sand	Granular material composed of rock particles which pass a No. 4 sieve (0.187 inches) and are retained on a No. 200 sieve (0.0029 inches). It is difficult to distinguish sand from silt when the particles are uniformly small. Dried sand, however, differs from silt in that it has no cohesion and feels more gritty.
Silt	A fine, granular material composed of particles which pass the No. 200 sieve (0.0029 inches). It lacks plasticity and has little dry strength. To identify: prepare a pat of wet soil and shake it horizontally in the palm of the hand. With typical inorganic silt, the shaking action causes water to come to the surface of the sample, making it appear glossy and soft. Repeat tests with varying moisture contents. Squeezing the sample between the fingers causes the water to disappear from the surface and the sample quickly stiffens and finally cracks or crumbles. Allow sample to dry, and test its cohesion and feel by crumbling with the fingers. Typical silt shows little or no dry strength and feels only slightly gritty in contrast to the rough grittiness of fine sand.
Clay	Extremely fine-grained material composed of particles which pass the No. 200 sieve (0.0029 inches). To identify: work a sample with the fingers, adding water when stiffness requires. Moist sample is plastic enough to be kneaded like dough. Make further test by rolling ball of kneaded soil between palm of hand and a flat surface. Clay can be rolled to a slender thread, about ⅛ inch in diameter, without crumbling; silt crumbles, without forming a thread. Measure hardness of dry clay by finger pressure required to break a sample. It requires much greater force to break dry clay than dry silt. Clay feels smooth in contrast to the slight grittiness of silt.
Organic	Soil composed of decayed or decaying vegetation; sometimes mixed with fine-grained mineral sediments, such as peat or muskeg. Identified by coarse and fibrous appearance and odor. Odor may be intensified by heating. Plastic soils containing organic material can be rolled into soft, spongy threads.

able single wheel load. Since each hypothetical vehicle of the military load classification system has a maximum allowable wheel load, roads may be assigned a military load class using this relationship. Classification numbers and their relationship to axle and wheel loads are illustrated in table 3–7.

Road classification for tracked vehicles is normally not assigned. Other factors, such as wear and tear on road surfaces by track action, usually determine the road's capability to support tracked vehicles.

b. Computation of the approximate load-bearing capacity of a road with flexible surface for wheeled vehicles is made by measuring the thickness of the surface and of the base course, and determining the type of subgrade material. Once this information has been ascertained, the military load class of the road may be estimated by referring to tables 3–5, 3–6, 3–7, and figure 3–59. The accuracy of this method is dependent upon the experience and judgment of those conducting the reconnaissance.

(1) The California Bearing Ratio (CBR) is a measure of the shearing resistance of soil under controlled density and moisture conditions (fig. 3–59). It is expressed as a ratio of the unit load required to force a piston into the soil to the unit load required to force the same piston the same depth into standard crushed stone.

(2) An example computation of the load-bearing capacity of a road with flexible surface is as follows:

(*a*) By field inspection, it is determined that a road has an 8-inch compacted gravel *base course and a flexible 3-inch bituminous surface* for a combined thickness of 11 inches. By use of the soil identification method explained in table 3–5, it is determined that the *subgrade* consists of clayey silts with low plasticity.

(*b*) Clayey silts with low plasticity are shown in table 3–6 to be in the ML range of soil groupings and to have safe California Bearing Ratio (CBR) between 5 to 15 or an average value of 10.

(*c*) Referring to figure 3–59 for an 11-inch combined thickness of flexible surface and base course and a subgrade CBR value of 10, the permissible wheel load is approximately 13,000 pounds.

(*d*) Reference to table 3–7 shows that this load corresponds to a military load class of about 28.

(*e*) The road is, therefore, assigned a military load class of 28.

(3) Since the maximum allowable single wheel load of all vehicle classes from 50 to 120 inclusive is the same (20,000 pounds), the load class of a road capable of supporting this single

Table 3–6. Soil Characteristics Pertinent to Roads and Airfields

Major Divisions (1)	(2)	Letter (3)	Symbol: Hatching (4)	Symbol: Color (5)	Name (6)	Value as Foundation When Not Subject to Frost Action (7)	Value as Base Directly under Bituminous Pavement (8)	Potential Frost Action (9)	Compressibility and Expansion (10)	Drainage Characteristics (11)	Field CBR (12)
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW		Red	Well-graded gravels or gravel-sand mixtures, little or no fines	Excellent	Good	None to very slight	Almost none	Excellent	60-80
		GP		Red	Poorly graded gravels or gravel-sand mixtures, little or no fines	Good to excellent	Poor to fair	None to very slight	Almost none	Excellent	25-60
		GM d		Yellow	Silty gravels, gravel-sand-silt mixtures	Good to excellent	Fair to good	Slight to medium	Very slight	Fair to poor	40-80
		GM u		Yellow	Silty gravels, gravel-sand-silt mixtures	Good	Poor	Slight to medium	Slight	Poor to practically impervious	20-40
		GC		Yellow	Clayey gravels, gravel-sand-clay mixtures	Good	Poor	Slight to medium	Slight	Poor to practically impervious	20-40
	SAND AND SANDY SOILS	SW		Red	Well-graded sands or gravelly sands, little or no fines	Good	Poor	None to very slight	Almost none	Excellent	20-40
		SP		Red	Poorly graded sands or gravelly sands, little or no fines	Fair to good	Poor to not suitable	None to very slight	Almost none	Excellent	10-25
		SM d		Yellow	Silty sands, sand-silt mixtures	Good	Poor	Slight to high	Very slight	Fair to poor	20-40
		SM u		Yellow	Silty sands, sand-silt mixtures	Fair to good	Not suitable	Slight to high	Slight to medium	Poor to practically impervious	10-20
		SC		Yellow	Clayey sands, sand-clay mixtures	Fair to good	Not suitable	Slight to high	Slight to medium	Poor to practically impervious	10-20
FINE GRAINED SOILS	SILTS AND CLAYS LL < 50	ML		Green	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	Fair to poor	Not suitable	Medium to very high	Slight to medium	Fair to poor	5-15
		CL		Green	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	Fair to poor	Not suitable	Medium to high	Medium	Practically impervious	5-15
		OL		Green	Organic silts and organic silt-clays of low plasticity	Poor	Not suitable	Medium to high	Medium to high	Poor	4-8
	SILTS AND CLAYS LL > 50	MH		Blue	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	Poor	Not suitable	Medium to high	High	Fair to poor	4-8
		CH		Blue	Inorganic clays of high plasticity, fat clays	Poor to very poor	Not suitable	Medium	High	Practically impervious	3-5
		OH		Blue	Organic clays of medium to high plasticity, organic silts	Poor to very poor	Not suitable	Medium	High	Practically impervious	3-5
HIGHLY ORGANIC SOILS		Pt		Orange	Peat and other highly organic soils	Not suitable	Not suitable	Slight	Very high	Fair to poor	

Notes:

1. Column 3, Division of GM and SM groups into subdivisions of d and u are for roads and airfields only; subdivision is basis of Atterberg limits
2. Column 7, values are for subgrades and base courses except for base course directly under bituminous pavement.
3. In column 8, the term "excellent" has been reserved for base materials consisting of high quality processed crushed stone.
4. In column 9, these soils are susceptible to frost.

Table 3–7. Hypothetical Wheeled Vehicle Class with Associated Maximum Axle and Wheel Loads

Hypothetical vehicle class number	Maximum single axle load (tons)	Maximum single wheel load (pounds)
4	2.5	2,500
8	5.5	5,500
12	8.0	8,000
16	10.0	10,000
20	11.0	11,000
24	12.0	12,000
30	13.5	13,500
40	17.0	17,000
50	20.0	20,000
60	23.0	20,000
70	25.5	20,000
80	28.0	20,000
90	30.0	20,000
100	32.0	20,000
120	36.0	20,000
150	42.0	21,000

wheel load cannot be immediately determined. In such cases a determination of the single axle load which the road can carry must be known or ascertained.

c. If the military load class of the road is larger than the class of the weakest bridge on a route, the bridge class determines the capacity of the route.

3–28. Road Reconnaissance Report Form

DA Form 1248 (Road Reconnaissance Report) provides the information required for road classification (fig. 3–60). Characteristics of a given road may change considerably in relatively short distances. Therefore, any road reconnaissance report may require the use of several copies of the reporting form to cover all portions of the selected road. In this event each sheet is numbered at the lower right hand corner followed by the total number of sheets. Short forms or worksheets for rapid field work may be designed and produced by the unit making the reconnaissance when DA forms are not available.

3–29. Method of Using DA Form 1248

Any item specified by the report which is undetermined or unknown is represented by a question

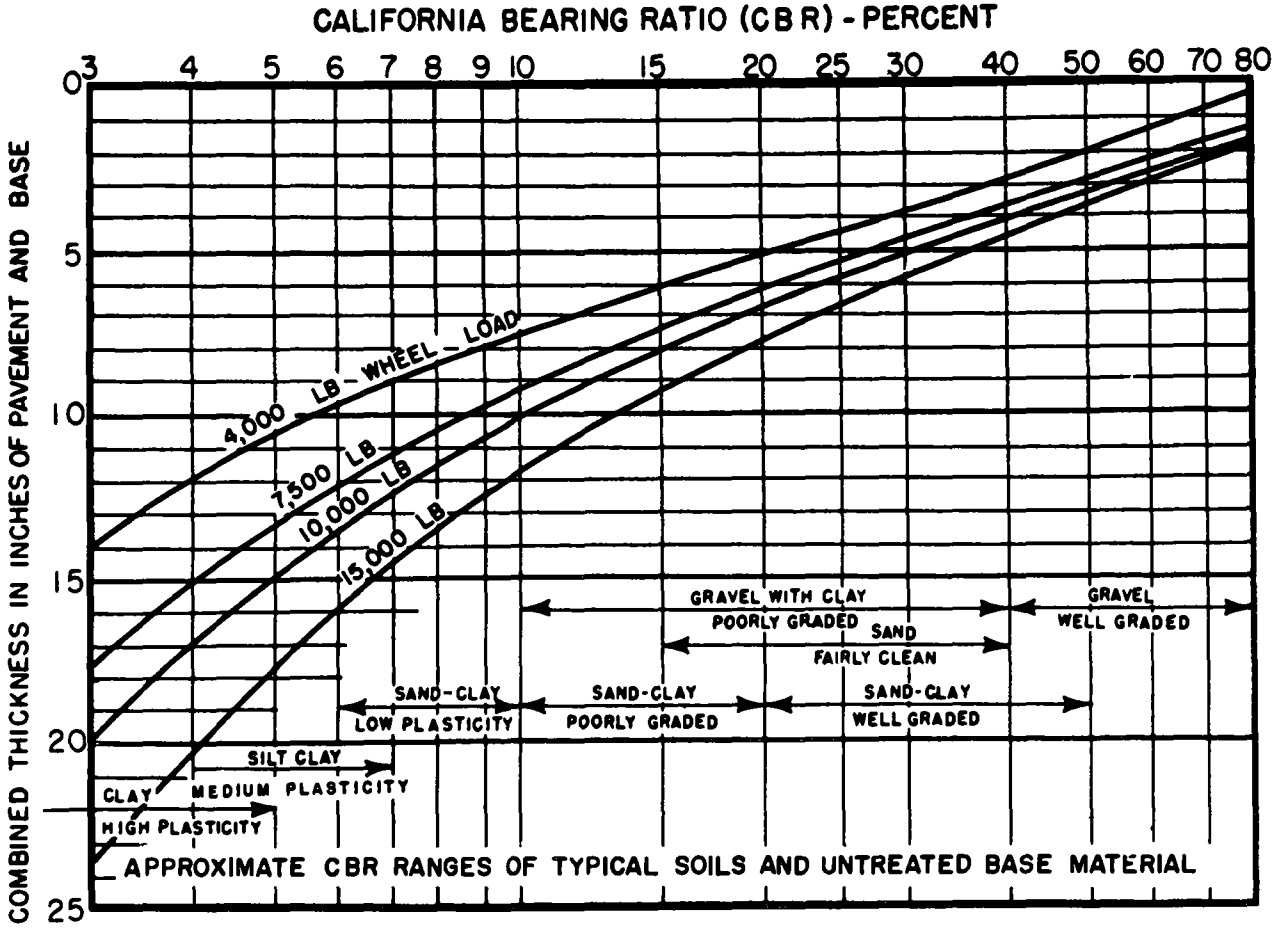


Figure 3–59. Load-bearing capacity of roads with a flexible surface.

ROAD RECONNAISSANCE REPORT

DATE: 1 JUNE 64

TO: (Headquarters ordering reconnaissance) COMMANDING OFFICER, ATTN: S2; 21ST ENGR BN (21ST INF DIV)

FROM: (Name, grade and unit of officer or NCO making reconnaissance) John H. Doe / JOHN H. DOE 1/LT CO A 21ST ENGR BN

1. MAPS	a. COUNTRY	b. SCALE	c. SHEET NUMBER OF MAPS	2. DATE/TIME GROUP (Of signature)
	QUANTICO	1:50,000	5561-III	01 1800 JUN 64

SECTION I - GENERAL ROAD INFORMATION

3. ROAD GRID REFERENCE FROM	TO	4. ROAD MARKING (Civilian or Military number of road)	5. LENGTH OF ROAD (Miles or kilometers, specify)
UT 122869	UT 097899	VIRGINIA 617	16.0 Km

6. WIDTH OF ROADWAY (Feet or meters, specify)	8. WEATHER DURING RECONNAISSANCE (Include last rainfall, if known)
6.7 - 9.3 METERS	CLEAR - TEMP. 84°
	LAST RAINFALL - APPROX. 28 MAY 64

7. RECONNAISSANCE

DATE	TIME
1 JUN 64	1000 HRS

SECTION II - DETAILED ROAD INFORMATION (When circumstances permit more detailed information will be shown in an overlay or on the mileage chart on the reverse side of this form. Standard symbols will be used.)

9. ALINEMENT (Check one ONLY)		10. DRAINAGE (Check one ONLY)	
	(1) FLAT GRADIENTS AND EASY CURVES		(1) ADEQUATE DITCHES, CROWN/CAMBER WITH ADEQUATE CULVERTS IN GOOD CONDITION
	(2) STEEP GRADIENTS (Excess of 7 in 100)		
.	(3) SHARP CURVES (Radius less than 100 ft (30m))		(2) INADEQUATE DITCHES, CROWN/CAMBER OR CULVERTS. ITS CULVERTS OR DITCHES ARE BLOCKED OR OTHERWISE IN POOR CONDITION
✓	(4) STEEP GRADIENTS AND SHARP CURVES	✓	

11. FOUNDATION (Check one ONLY)			
✓	(1) STABILIZED COMPACT MATERIAL OF GOOD QUALITY		(2) UNSTABLE, LOOSE OR EASILY DISPLACED MATERIAL

12. SURFACE DESCRIPTION (Complete items 12a and b)

a. THE SURFACE IS (Check one ONLY)			
	(1) FREE OF POTHOLES, BUMPS, OR RUTS LIKELY TO REDUCE CONVOY SPEED	✓	(2) BUMPY, RUTTED OR POTHOLED TO AN EXTENT LIKELY TO REDUCE CONVOY SPEED

b. TYPE OF SURFACE (Check one ONLY)			
	(1) CONCRETE		(6) WATERBOUND MACADAM
	(2) BITUMINOUS (Specify type where known):		(7) GRAVEL
			(8) LIGHTLY METALLED
✓	CHECK CHART		(9) NATURAL OR STABILIZED SOIL, SAND CLAY, SHELL, CINDERS, DISINTEGRATED GRANITE, OR OTHER SELECTED MATERIAL
	(3) BRICK (Pave)		
	(4) STONE (Pave)		(10) OTHER (Describe):
	(5) CRUSHED ROCK OR CORAL		

SECTION III - OBSTRUCTIONS (List in the columns below particulars of the following obstructions which affect the traffic capacity of a road. If information of any factor cannot be ascertained, insert "NOT KNOWN")

(a) Overhead obstructions, less than 14 feet or 4.25 meters, such as tunnels, bridges, overhead wires and overhanging buildings.
(b) Reductions in road widths which limit the traffic capacity, such as craters, narrow bridges, archways, and buildings.
(c) Excessive gradients (Above 7 in 100)
(d) Curves less than 100 feet (30 meters) in radius)
(e) Fords

SERIAL NUMBER a	PARTICULARS b	GRID REFERENCE c	REMARKS d
1	SHARP CURVE - RADIUS 27.5 m	UT 122869	SEE OVERLAY
2	STEEP GRADE - 8% - UPHILL EAST	UT 115875	LENGTH 300 m
3	NARROW BRIDGE - TRAVELED WAY 5.0m	UT 109879	SEE BRIDGE RPT. #1
4	UNDERPASS - V.C. 4.05 m	UT 102883	SEE OVERLAY
5	ROAD CRATER - LGT. 7.5m	UT 101884	SEE RECON RPT #1
6	FORD - LGT. 7.3m - WIDTH 8.2m	UT 100886	SEE FORD RPT #1
	BOTTOM GRAVEL - DEPTH 0.5m		

DA FORM 1 JUL 60 1248 PREVIOUS EDITION OF THIS FORM IS OBSOLETE. For use of this form, see FM 5-36; the proponent agency is the United States Army Combat Developments Command.

Figure 3-60. Road reconnaissance report (DA Form 1248).

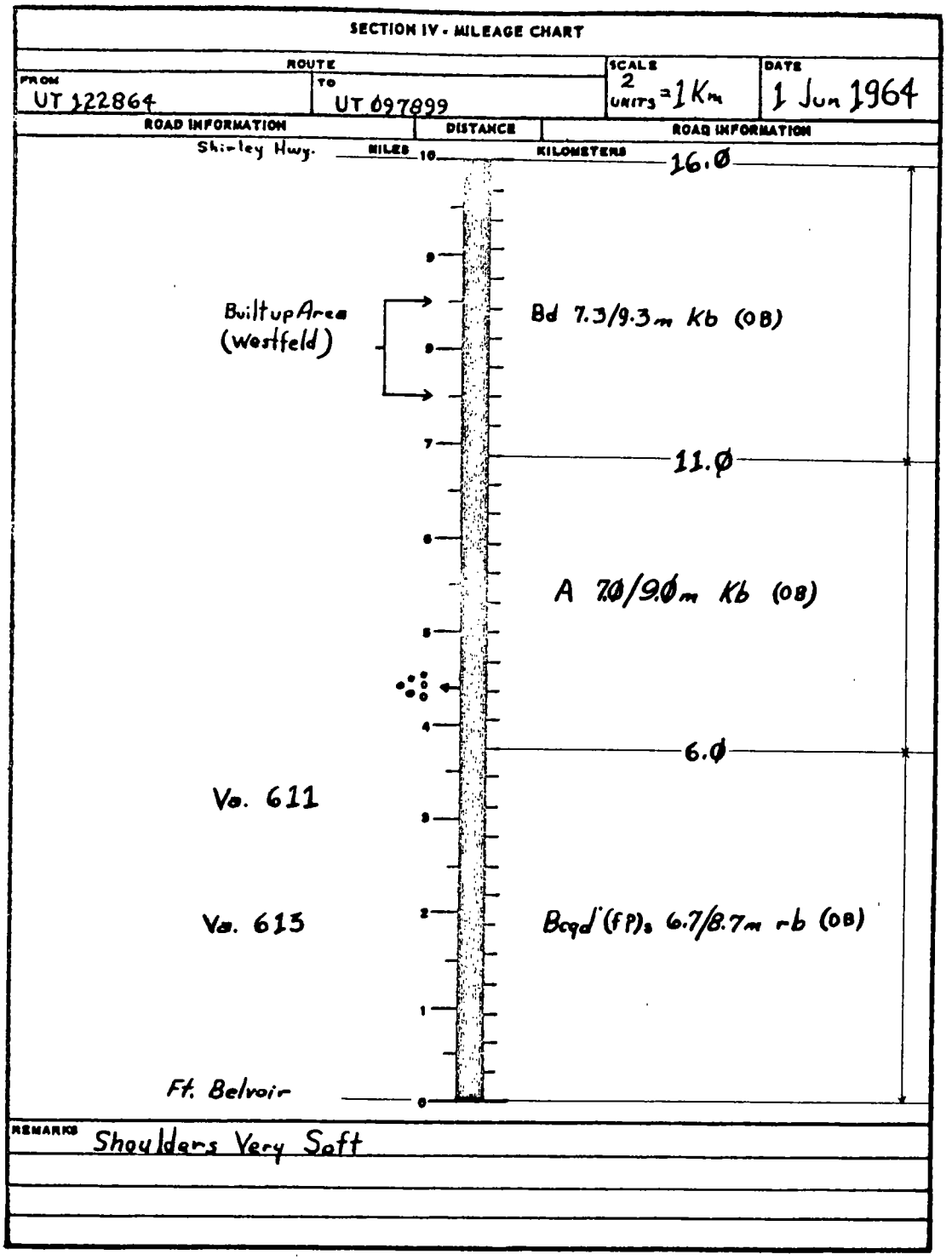


Figure 3–60—Continued.

mark (?) in the appropriate column of the form. If the width of the traveled way varies, item 6 of the form indicates the lower and upper limits of the traveled way width; and the corresponding extent of widths is shown on the mileage chart on the back of the form. Similarly, if the data for items 9, 10, 11, and 12 differ for various stretches of road, the differences are indicated by placing the appropriate road classification formula (para 3–24) on the mileage chart opposite the portion of road to which it applies. Obstructions are listed and described in section III of the form and are further shown on an accompanying map or overlay by appropriate route reconnaissance symbols

(fig. 2–3). The mileage chart on the reverse side of DA Form 1248, reading from the bottom up, is also used to show the location of salient features along the road; either measurement system may be used with the unused side available for notations.

Section VI. ENGINEER RECONNAISSANCE

3–30. General

Engineer reconnaissance, which is terrain reconnaissance conducted to support engineer activities, is designated as either general or special. *General engineer reconnaissance* provides engineer information of a broad nature within the operational area and is concerned with locating and evaluating those items, such as construction material, resources, and terrain features, which have engineer implications. General reconnaissance missions may be assigned on a zone, area, or route basis. *Special engineer reconnaissance*, on the other hand, obtains more detailed information regarding a specific engineer task or tasks; normally, such reconnaissance follows and supports general engineer reconnaissance. Special reconnaissance may be assigned as either an area or route reconnaissance mission.

3–31. Engineer Reconnaissance Techniques

When general or special engineer reconnaissance is assigned as a route reconnaissance mission, appropriate procedures and reconnaissance techniques previously outlined in this manual are followed. Moreover, engineer reconnaissance is often conducted in conjunction with deliberate route reconnaissance in order to determine route conditions (including work estimates) and to locate construction material by which the route may be improved or maintained. The technical nature of engineer reconnaissance requires the issuance of detailed reconnaissance instructions. A check list to insure that important engineer aspects are not overlooked is recommended (fig. 3–61). The results of engineer reconnaissance are usually reported on an overlay which does not differ significantly from the route reconnaissance overlay (para 2–11—2–14). Standard route reconnaissance report forms and engineer reconnaissance forms are employed to supplement the reconnaissance overlay.

3–32. Engineer Resource Symbols (STANAG 2269)

The location of important terrain features are shown on the reconnaissance overlay by conventional military, topographic, and reconnaissance symbols. In addition, symbols have been standardized to represent the more common engineer resources and construction materials (fig. 3–62). In those cases where symbols fail to provide an adequate explanation, each symbol is keyed by serial or critical point number on the overlay and is referenced and fully described in accompanying inclosures.

3–33. Formats for Electrically Transmitting Engineer Information (STANAG 2096, SEASTAG 2096, and SOLOG 107)

To provide standardization in reporting engineer reconnaissance information by electrical means, the formats shown in figures 3–61 and 3–62 have been adopted. They are primarily designed for electrical transmissions in conjunction with standard message forms (DD Form 173 and DA Form 11–170). However, the formats, which are produced locally, may also be used to supplement engineer reconnaissance reports especially when more detailed information than can be depicted by overlay symbols is required. The originator completes only those parts of the format which are applicable or for which information is available (figs. 3–63—3–69). Each item of the report, however, is accompanied by the appropriate letter designation from the format to establish the correct category of information. Messages are preceded by the type of the report or identifying codeword.

a. Installation (fig. 3–63).

b. Road making equipment (fig. 3–64).

c. Local resources such as quarries, timber stands, sawmills, and brickyards (fig. 3–65).

d. Enemy stores and equipment (fig. 3–66).

e. Water points (fig. 3–67).

f. Dams and sluices (fig. 3–68).

g. Obstacles (fig. 3–69).

RECONNAISSANCE INSTRUCTIONS NO. _____

_____
(Organization)

TO: _____ Effective _____
(Hour and Date)

MAPS _____

Complete report to _____ at _____
(Organization) (Place, Time, and Date)

Reconnoiter and report information as indicated below by items checked. Report also any other information; of technical importance incidentally secured	DETAILED INSTRUCTIONS Areas, special features or structures special reports and work estimates required.
1. ROADS: Classify using symbols.	
2. BRIDGES, FORDS AND FERRIES: classify using symbols. Possible by-pass for existing crossings.	
3. Obstacles to our movement: natural and artificial: include demolitions, mines, boobytraps.	
4. TERRAIN: general nature, ridge system, drainage system including fordability, forests, swamps, areas suitable for mechanized operations.	
5. ENGR MATERIALS: particularly road material, bridge timbers, lumber, steel, explosives.	
6. ENGR EQUIPMENT: rock crushers, sawmills, garages, machine shops, blacksmith shops, etc.	
7. ERRORS AND OMISSIONS ON MAPS USED.	
8. BARRIERS to enemy movement: natural, artificial and sites for construction of improvement. (work estimates)	
9. WATER POINTS: recommended locations.	
10. STREAMS: general description, width, depth, banks, approaches, character of bottom and means to be used at possible crossing sites. Navigability?	
11. DEFENSIVE POSITIONS.	
12. BIVOUAC AREAS: entrances, soil, drainage, sanitation, concealment.	
13. PETROLEUM STORAGE AND EQUIPMENT.	
14. UTILITIES: water, sewage, electricity, gas.	
15. PORTS: wharves, sunken obstacles, cargo handling facilities, storage facilities, transportation routes.	
16. CONSTRUCTION SITES: Drainage, water supply, power source, earthwork, access, acreage, soil.	

BY ORDER OF _____

Figure 3–61. Engineer reconnaissance checklist.

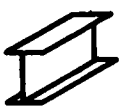
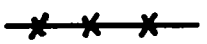
Serial Number	Description	Symbol
1.	Sawmill	
2.	Lumber Yard	
3.	Stone	
4.	Aggregate (including gravel, slag, etc.)	
5.	Sand	
6.	Cement concrete products	
7.	Stocks of bricks and other clay products	
8.	Iron and steel stock	
9.	Wire stock	
10.	Paint	
11.	Glass stock	
12.	Gypsum and lime products	

Figure 3–62. Engineer resources symbols.

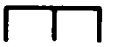
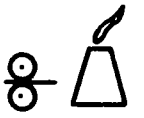
Serial Number	Description	Symbol
13.	Asphalt and bituminous stock	
14.	Stocks of roof covering	
15.	Building hardware	
16.	Industrial gasses	
17.	Cordage, nets, yarns	
18.	Civil engineering firms	
19.	Building contractors	
20.	Factories	
21.	The factory symbol may be used in connection with other symbols to indicate a factory or plant producing (as a main product) the represented material.	
22.	Steel rolling mills and foundries	
23.	Engineering workshops	

Figure 3–62—Continued.

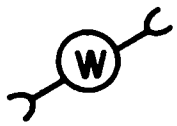
Serial Number	Description	Symbol
24.	Mobile heavy construction equipment	
25.	Forestry equipment	
26.	Quarrying equipment	
27.	Stores handling and transportation equipment	
28.	Powered hand tools	
29.	Water purification equipment (civilian)	
30.	Electrical supply equipment	
31.	Military water point	

Figure 3–62—Continued.

3–34. Engineer Reconnaissance Report (DA Form 1711–R)

DA Form 1711–R (fig. 3–70) is used to report those items of engineer reconnaissance not adequately covered by DA report forms previously discussed in route reconnaissance. The form may be locally reproduced on 8 x 10½ inch paper. The engineer reconnaissance form is used together with a reconnaissance overlay to provide a convenient and uniform means for reporting the results of engineer reconnaissance. The form is divided into four sections:

a. Heading. Completion of this section is self-explanatory.

b. Body.

(1) The *key* provides reference to the item of the report and its corresponding location on the reconnaissance overlay. The serial or critical point number of the object is entered in this column.

Installation Report					
Explanation	Letter designation	(1)[a]	(2)[b]	(3)[b]	(4)[b]
Map sheet(s)	ALPHA				
Date and time information was collected	BRAVO				
Location (grid references)	CHARLIE				
Nature	DELTA				
Capacity, including capacity as shelter or storage	ECHO				
Condition	FOXTROT				
Additional information	GOLF				

Notes. [a]. First installation in report; report by serial number if assigned.
[b]. Additional installations in report.

Figure 3–63. Installation report format.

Road-Making Equipment Report					
Explanation	Letter designation	(1)[a]	(2)[b]	(3)[b]	(4)[b]
Map sheet(s)	ALPHA				
Date and time information was collected	BRAVO				
Location (grid references)	CHARLIE				
Type	DELTA				
Number	ECHO				
Condition	FOXTROT				
Additional information	GOLF				

Notes. [a]. First road-making equipment in report; report by serial number if assigned.
[b]. Additional road-making equipment in report.

Figure 3–64. Road-making equipment report format.

Local Resources Report					
Explanation	Letter designation	(1)[a]	(2)[b]	(3)[b]	(4)[b]
Map sheet(s)	ALPHA				
Date and time information was collected	BRAVO				
Location (grid references)	CHARLIE				
Type	DELTA				
Quantity of stock	ECHO				
Capacity and output per day	FOXTROT				
Additional information	GOLF				

Notes. [a]. First local resource in report; report by serial number if assigned.
[b]. Additional local resources in report.

Figure 3–65. Local resources report format.

Enemy Stores and Equipment Report					
Explanation	Letter designation	(1)[a]	(2)[b]	(3)[b]	(4)[b]
Map sheet(s)	ALPHA				
Date and time information was collected	BRAVO				
Location (grid references)	CHARLIE				
Type	DELTA				
Quantity	ECHO				
Condition	FOXTROT				
Additional information	GOLF				

Notes. [a]. First enemy stores and equipment in report; report by serial number if assigned.
[b]. Additional enemy stores and equipment in report.

Figure 3–66. Enemy stores and equipment report format.

Water Point(s) Report					
Explanation	Letter designation	(1)[a]	(2)[b]	(3)[b]	(4)[b]
Map sheet(s)	ALPHA				
Date and time information was collected	BRAVO				
Location (grid references)	CHARLIE				
Type (well, spring, watercourse, lake or pond)	DELTA				
Rate of delivery of water	ECHO				
Total quantity of water available in sources and description of water in source, i.e. brackish, clear, etc.	FOXTROT				
Existing pump and storage facilities	GOLF				
Accessibility	HOTEL				
Additional information	INDIA				

Notes. [a]. First water point in report; report by serial number if assigned.
[b]. Additional water points in report.

Figure 3–67. Water point report format.

Dam and Sluice Report					
Explanation	Letter designation	(1)[a]	(2)[b]	(3)[b]	(4)[b]
Map sheet(s)	ALPHA				
Date and time information was collected	BRAVO				
Location (grid references)	CHARLIE				
Type	DELTA				
Dimensions	ECHO				
Condition	FOXTROT				
Additional information	GOLF				

Notes. [a]. First dam or sluice in report; report by serial number if assigned.
[b]. Additional dams or sluices in report.

Figure 3–68. Dam and sluice report format.

Obstacle Report					
Explanation	Letter designation	(1)[a]	(2)[b]	(3)[b]	(4)[b]
Map sheet(s)	ALPHA				
Date and time information was collected	BRAVO				
Location (grid references)	CHARLIE				
Type	DELTA				
Enemy weapons having action on the obstacle, if any.	ECHO				
Additional information	FOXTROT				

Notes. [a]. First obstacle in report; report by serial number if assigned.
[b]. Additional obstacles in report.

Figure 3–69. Obstacle report format.

(2) The *object* to be explained is shown in this column either by conventional symbol or brief written description.

(3) If a *work estimate* (*d* below) is included as part of the report, enter YES; if not, NO.

(4) In the *additional remarks* column, report the location of the object by grid coordinates followed by explanatory remarks, calculations, and an appropriate sketch.

c. Authentication (Signature Block). Completion of this section is self-explanatory.

d. Work Estimate. The other side (reverse side) of DA Form 1711–R is used to indicate the amount and type of engineer effort required for construction or repair (fig. 3–71). Each work estimate is keyed by serial or critical point number to the appropriate object on the reverse side of the form. Only those columns which are appropriate need be completed. Additional sketches may be drawn, if needed, to better explain the type of work required.

ENGINEER RECONNAISSANCE REPORT | PAGE 1 OF 4 PAGES

TO: CO: 21ST ENGR BN | FROM: CO A 21ST ENGR BN.

FILE NO. | PARTY LEADER (NAME, GRADE, ORGANIZATION): THOMAS P TAYLOR 2d LT | PLACE - HOUR - DATE: UT586788

REPORT NO. 1 | CO A 21ST ENGR BN. | 112000 MAR 65

MAPS QUANTICO, VIRGINIA 1:50,000 SHEET 5561 III

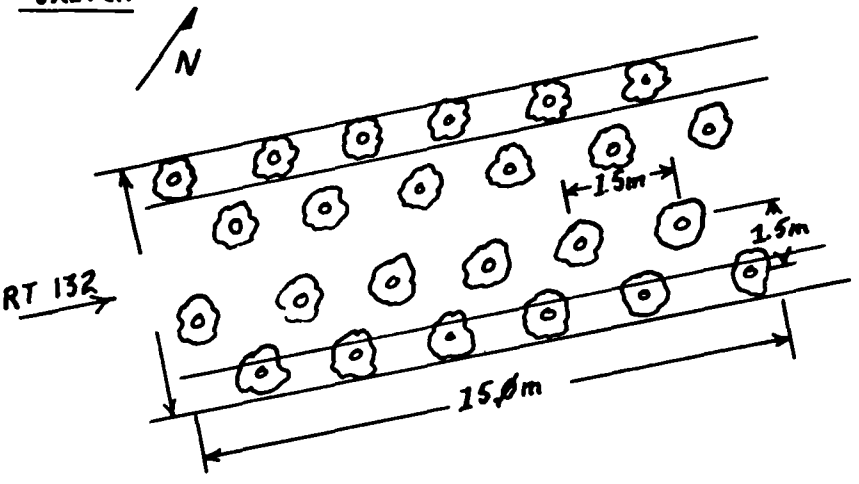
DELIVER TO (Organization, Place, Hour and Date)
S2: 21ST ENGR BN. UT556461 121200 MAR 65

KEY	OBJECT	TIME OBSERVED	WORK ESTIMATE?
1	⊗	0900	YES

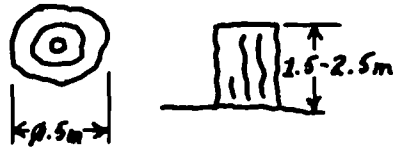
ADDITIONAL REMARKS AND SKETCH

UT 058689 - LOG POST OBSTACLE BLOCKING RT 132

SKETCH



(24) LOG's @ 0.5m. DIAMETER, C-C 1.5m.
ON ALL SIDES, 1.5m. TO 2.5m. ABOVE GROUND



ENGINEER WORK ESTIMATES ON OTHER SIDE

TYPED NAME, GRADE AND ORGANIZATION
THOMAS P TAYLOR 2d LT.
CO A 21ST ENGR BN.

SIGNATURES
Thomas P Taylor

DA Form 1711-R, 1 Jun 61 — Edition of 1 May 56 is obsolete.

Figure 3-70. Engineer reconnaissance report (DA Form 1711-R).

ENGINEER RECONNAISSANCE REPORT | PAGE 2 OF 4 PAGES

TO: CO: 21ST ENGR BN | FROM: CO: CO A 21ST ENGR BN

FILE NO. | PARTY LEADER (NAME, GRADE, ORGANIZATION) | PLACE - HOUR - DATE

REPORT NO. 1 | THOMAS P TAYLOR 2d LT COA 21ST ENGR BN | UT 586708 11 2000 MAR 65

MAPS QUANTICO, VIRGINIA 1:50,000 SHEET 5561 III

DELIVER TO (Organization, Place, Hour and Date)
S2: 21ST ENGR BN UT 556461 12 0100 MAR 65

KEY	OBJECT	TIME OBSERVED	WORK ESTIMATE?	ADDITIONAL REMARKS AND SKETCH
1		—	—	CONT. OBSTACLE NOT DEFENDED: BYPASS: DIFFICULT (DRY) DUE TO SWAMPY TERRAIN
2		0920	NO	UT 509686 - GRAVEL PIT IN OPERATION QUANTITY: APROX. 6,000 YD^3 STOCKPILED RANGING FROM 1 IN. TO 3 IN. IN DIAMETER TYPE: CRUSHED GRANITE COMMUNICATIONS: GOOD ACCESS ROADS WITH AMPLE SPACE FOR TURN AROUND AND LOADING.
3		0940	NO	UT 50974 - ABANDONED ENEMY EQPT. QUANTITY & TYPE: (2) "ZIPLO" MODEL 200 CRAWLER CRANES. (OPERATIONAL) CHECKED FOR BOOBY TRAPS - NONE

ENGINEER WORK ESTIMATES ON OTHER SIDE

TYPED NAME, GRADE AND ORGANIZATION
THOMAS P TAYLOR 2d LT
COA 21ST ENGR BN

SIGNATURES
Thomas P. Taylor

DA Form 1711-R, 1 Jun 61 Edition of 1 May 56 is obsolete.

Figure 3-70—Continued.

ENGINEER RECONNAISSANCE REPORT | PAGE 3 OF 4 PAGES

TO: CO: 21ST ENGR BN | FROM: CO: COA 21ST ENGR BN

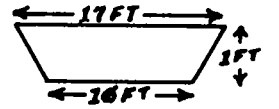
FILE NO. | PARTY LEADER (NAME, GRADE, ORGANIZATION): THOMAS P. TAYLOR 2dLT | PLACE - HOUR - DATE: UT 586708

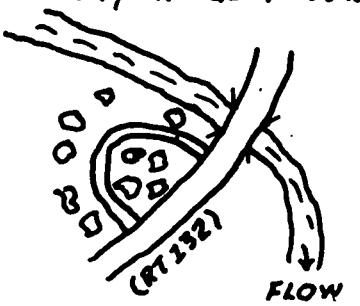
REPORT NO. 1 | COA 21ST ENGR BN | 11 2000 MAR 65

MAPS QUANTICO, VIRGINIA 1:50,000 SHEET 5561 III

DELIVER TO (Organization, Place, Hour and Date)
S2: 21ST ENGR BN UT556461 12 0100 MAR 65

KEY	OBJECT	TIME OBSERVED	WORK ESTIMATE?	ADDITIONAL REMARKS AND SKETCH
4	BIV AREA	1035	NO	UT512692 – POSSIBLE BIVOUAC AREA SIZE: 700m X 900m COMMUNICATIONS: GOOD ACCESS ROAD W/GOOD DRAINAGE & HARD SURFACE SITE CONDITIONS: GOOD DRAINAGE WITH FIRM SOIL, GOOD CK, GOOD OBSERVATION & F/F
5		1150	NO	UT558680 – POSSIBLE WATER POINT QUANTITY: Q=AV6.4 A=13.5 FT^2 V=35FPM Q=(13.5)(35)(6.4)=3,012 GPM QUALITY: CLOUDY, NO ODOR, NO OBSERVED SOURCE OF POLUTION, SPL WAS TAKEN FOR TESTS COMMUNICATIONS: GOOD ACCESS RDS FROM MSR, GOOD TURN AROUNDS & PARKING ON SITE SITE CONDITIONS: GOOD, SLOPE OF BANKS 5%, BIVOUAC AREA ON SITE FOR W.P. TEAM, BRIDGE POSSIBLE ARTILLERY TARGET





ENGINEER WORK ESTIMATES ON OTHER SIDE

TYPED NAME, GRADE AND ORGANIZATION	SIGNATURES
THOMAS P. TAYLOR COA 21ST ENGR BN	Thomas P. Taylor

DA Form 1711-R, 1 Jun 61 — Edition of 1 May 56 is obsolete.

Figure 3–70—Continued.

ENGINEER RECONNAISSANCE REPORT | PAGE 4 OF 4 PAGES

TO: CO: 21ST ENGR BN | FROM: CO: COA 21ST ENGR BN

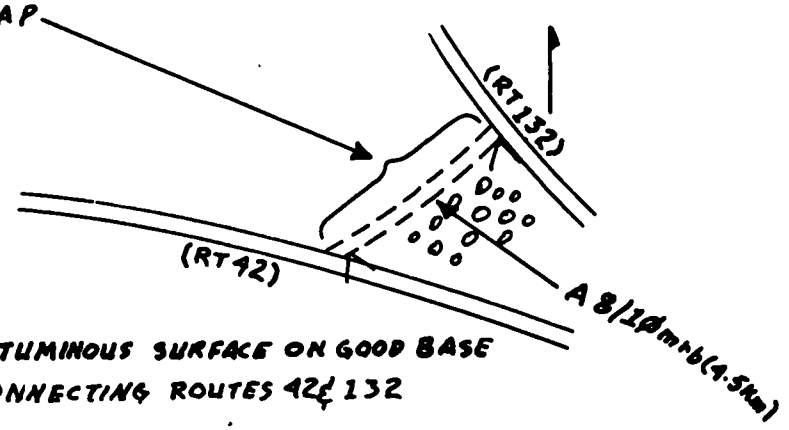
FILE NO. | PARTY LEADER (NAME, GRADE, ORGANIZATION) THOMAS P. TAYLOR 2d LT COA 21ST ENGR BN | PLACE - HOUR - DATE UT586708 112000 MAR 65

REPORT NO. 1

MAPS QUANTICO, VIRGINIA 1:50,000 SHEETS 5562 III

DELIVER TO (Organization, Place, Hour and Date)
S2: 21ST ENGR BN UT566461 121100 MAR 65

KEY	OBJECT	TIME OBSERVED	WORK ESTIMATE?	ADDITIONAL REMARKS AND SKETCH
6	MAP FEATURE	1200	NO	UT557963 TO UT558003 ROAD NOT SHOWN ON MAP
7	W	1230	NO	UT761432 EXISTING WATER PURIFICATION PLANT SUPPLYING WATER TO THE CITY OF YUCH OUTPUT 60,000 GAL PER DAY



ENGINEER WORK ESTIMATES ON OTHER SIDE

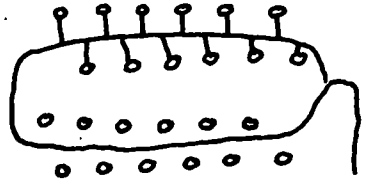
TYPED NAME, GRADE AND ORGANIZATION
THOMAS P. TAYLOR 2d LT
COA 21ST ENGR BN

SIGNATURES
Thomas P. Taylor

DA Form 1711-R, 1 Jun 61 Edition of 1 May 56 is obsolete.

Figure 3-70—Continued.

ENGINEER WORK ESTIMATE

LOCATION KEY	DESCRIPTION OF WORK	UNIT REQ'D	HOURS	EQUIPMENT TYPE	EQUIPMENT NO.	EQUIPMENT HOURS	MATERIALS TYPE	MATERIALS UNIT	MATERIALS QUANTITY
⚠	REMOVE LOG POST FROM ROUTE 132 BY DEMO	1 SQD	2	DEMO SET #1	1	2	TNT	#	240
$P = \frac{0^2}{40} = \frac{(19.2)^2}{40} = 9.3\#$				D-7 CAT	1	2	D-CORD	FT	140
∴ 10#/POST							NON ELECT CAPS	EA	25
240# TOTAL							TIME FUSE	FT	4
							M-2 FUSE LIGHTER	EA	1

RECONNAISSANCE REPORT ON OTHER SIDE

Figure 3-71. Work estimate (reverse side of DA Form 1711-R).

CHAPTER 4

SPECIAL TERRAIN RECONNAISSANCE

Section I. GENERAL

4–1. Introduction

Chapters 2 and 3 outline route reconnaissance procedures for existing vehicular routes in an operational area. Military activities, however, are not confined to road networks; and in many situations, other types of routes such as waterways, trails, and footpaths, are called upon to supplement existing routes, or, at times, completely support military operations. Under such circumstances, it becomes necessary to initiate area or zone reconnaissance to exploit the capabilities of modern cross-country vehicles and aircraft as well as route reconnaissance to ascertain the potential of supplementary routes.

4–2. Scope of Reconnaissance

Special terrain reconnaissance is greatly influenced by the operational environment; consequently, standardized formats and DA forms have not been prepared, in most cases, to report terrain data. Moreover, special terrain reconnaissance is not easily divided into hasty and deliberate reconnaissance procedures. For the most part, requirements for terrain information is determined by the headquarters initiating the reconnaissance; consequently, reconnaissance instructions must be more detailed than in routine route reconnaissance operations. Overlay reports utilizing conventional military and reconnaissance symbols are the preferred method of rendering special terrain reconnaissance reports. Nevertheless, particular attention must be given to other reporting techniques before reconnaissance elements are dispatched.

Section II. CROSS-COUNTRY MOVEMENT

4–3. General (STANAG 2259 and SOLOG 100)

Cross-country movement refers to the feasibility for tactical movement by military tracked and wheeled vehicles away from all-weather routes. The increased capability of military vehicles to negotiate rough terrain provides the command with additional means to maintain mobility. Although prepared routes are still essential for large-scale operations, especially combat support and combat service support activities, natural and manmade obstacles along a specified route may often be avoided or bypassed by executing cross-country detours. Reconnaissance personnel, therefore, are required to recognize and analyze the cross-country characteristics of an area. Factors of terrain that affect cross-country movement are slope, soil composition, vegetation, manmade features, and drainage. Weather is also an important consideration; but unlike the other factors, weather affects cross-country movement indirectly by influencing soil composition and drainage. Rarely, does one factor by itself determine cross-country movement; more commonly, it is a combination. Therefore, although each factor is discussed separately below, reconnaissance personnel must realize that cross-country movement usually is dependent on a variety of these factors.

4–4. Slope

a. Ground reconnaissance permits on-the-spot determination of slope percentages. An instrument such as a clinometer for slope measurement is recommended since slopes tend to appear, particularly to the untrained eye, much steeper than they actually are. Because of the time involved, slopes can be accurately measured only on critical approaches; therefore, great reliance must be placed upon other sources such as maps and aerial photographs for obtaining general slope data over large areas.

b. Aerial photographs and aerial battlefield surveillance are admirably suited for quick investiga-

tion of slopes and are, perhaps, the best source of information other than ground reconnaissance in ascertaining this factor. Aerial photographs provide permanent imagery records of large relief features such as hills and mountains as well as small relief features such as small gullies and rock ledges. Ditches, for example, which are not generally depicted on topographic maps but which appreciably affect cross-country movement, usually appear plainly on aerial photographs.

c. In evaluating terrain for cross-country movement, a 45 percent slope is commonly accepted as the reasonable upper limit for tanks and a 30 percent slope for wheeled vehicles. If other factors are extremely favorable, these slopes may be increased somewhat; but if unfavorable, reduction must be made in accordance with the prevailing conditions. For vertical slopes, such as rock ledges or curbs, heights between .6 to 1.2 meters (2 to 4 feet) are the practical upper limits for tracked vehicles and .15 to .3 meters (6 to 12 inches) for most wheeled vehicles.

4–5. Soil Composition

a. Soil trafficability is defined as the capacity of soil to support traffic by military vehicles and is not the same as cross-country movement. Soils, when dry, will support vehicles almost without exception, but when wet, their capacity to sustain cross-country movement is variable and difficult to evaluate. Engineers may be called upon to perform empirical tests in order to determine soil trafficability; however, inspection and several passes with trial vehicles are usually adequate for most purposes.

b. The part of the soil most important to cross-country mobility is the top layer, particularly from .15 to .30 meters (6 to 12 inches) in depth although soil to a depth of .60 meters (2 feet) may occasionally be of consequence. To a large extent, weather determines the amount of moisture in the soil. If the moisture content is known, it is possible on the basis of weather forecasts to predict what the content may be at a later date; however, there is a point where soil becomes saturated and the amount of moisture will not be appreciably exceeded. When the weather is warm enough to support plant growth, soil moisture becomes rapidly depleted. Slippery and sticky soils may also be troublesome, but they seldom cause immobilization of traffic, particularly tracked vehicles. Nearly all immobilizations from soil are the result of loss of traction cause by vehicles sinking so deeply that they become high-centered. Soil trafficability characteristics are generally applicable for wet periods only.

c. Soils may be classified as to type such as sand, silt, clay, etc., (tables 3–5 and 3–6) or as to *trafficability class* (TC) as defined below and further clarified in table 4–1.

(1) TC I—Soil permits at least 50 vehicle passes in trace or one or more maneuvers by individual vehicles (starts, stops, sharp turns, or crossings of another trace) in the same location.

(2) TC II—Soil permits approximately 10 to 50 passes in trace; maneuvers by individual vehicles are risky; cautious driving necessary; movement by vehicles following in trace should be avoided.

(3) TC III—Soil permits 1 to approximately 10 passes in trace; maneuvers by individual vehicles extremely risky; very cautious driving necessary; movement by vehicles following in trace must be avoided.

(4) TC IV—Soil permits no vehicular passes, and engineer work is required for movement.

4–6. Vegetation

The term vegetation includes not only natural growth but also crops and orchards. Nearly all forests, dependent upon the size of the tree diameters, have a slowing effect on wheeled vehicular movement. Trees with trunk diameters less than two inches are only a slight hindrance for tracked vehicles; whereas, the practical upper limit of tree diameters to be toppled by medium tanks is from 15–20 centimeters (6 to 8 inches). Trees somewhat less than 15 centimeters (6 inches) in diameter, however, may cause an obstacle when growing very close together. The average distance to permit vehicular passage between trees which cannot be felled is from 4.5 to 6 meters for both wheeled and tracked vehicles. This distance is greater than the width of standard military vehicles, but allowance is made for individual vehicle maneuver.

4–7. Manmade Features

Manmade features are those works of man such as railroad embankments, built-up areas, stone walls,

Table 4–1. Trafficability Characteristics of Wet Soils (STANAG 2259 and SOLOG 100)

Trafficability class	Soil type	Slipperiness effects	Stickiness effects	Comments
I	Coarse-grained cohesionless sands and gravels.	Slight to none.	None	Will support continous traffic of military vehicles. Wheeled vehicles with standard tires may be immobilized in dry sands.
I, II	Inorganic clays of high plasticity, fat clays.	Severe to slight.	Severe to slight.	Usually will support more than 50 passes of military vehicles. Going will be difficult at times.
II, III	Clayey gravels, gravel-sand-clay mixtures. Clayey sands, sand-clay mixtures. Gravelly clays, sandy clays, inorganic clays of low to medium plasticity, lean clays, silty clays.	Severe to slight.	Moderate to slight.	Often will not support 50 passes of military vehicles, but usually will support limited traffic. Going will be difficult in most cases.
III, IV	Silty gravels, gravel-sand-silt mixtures. Silty sands, sand-silt mixtures. Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity. Inorganic silts, micaceous or diatomaceous fine sandy or silty soils; elastic silts. Organic clays of medium to high plasticity, organic silts.	Moderate to slight.	Slight	Usually will not support 50 passes of military vehicles. Often will not permit even a single pass. Going will be extremely difficult in mosts cases.

hedgerows, dikes, cuts, fills, etc., which are deterrents or obstacles to movement.

4–8. Drainage

The water features of an area comprise its drainage. They include streams and canals; drainage and irrigation ditches; lakes, marshes, bogs, and swamps; artificial bodies of standing water such as reservoirs and ponds as well as such subsurface outlets as springs and wells. The character of these drainage features is determined by precipitation, temperature, relief, surface runoff, ground-water flow, and various types of manmade drainage construction. If bridges, fords, or special purpose vehicles are unavailable, engineer assistance is usually required to negotiate obstacles of this type. During cross-country movement, low areas are avoided in which water runoff is likely to maintain soil saturation. These areas can often be recognized by the deeper green and greater density and height of foliage and grasses.

4–9. Cross-Country Movement in Snow

Snow may be considered as similar in its effect upon cross-country movement as certain type soils. Snow in itself is seldom a critical obstacle for tracked vehicles although it frequently may be a hindrance especially on slopes. Snow, because of its slippery nature, reduces the steepness of slopes which can be negotiated. On level or gently sloping terrain, the mobility of tracked vehicles is generally retained in snow up to 1 meter (3 feet) in depth. In those locations where snow accumulates to depths greater than 1 meter such as in forested or mountainous areas, cross-country movement is generally prohibited by other more decisive terrain factors. Snow is considerably more of an obstruction and hazard for wheeled vehicles. Even though traction can be enhanced by tire chains or reduced tire pressure, icy conditions which make movement of wheeled vehicles difficult may be created by snow which barely covers the ground. If the depth of snow exceeds .3 meter (12 inches), standard wheeled vehicles are likely to become immobilized unless the snow is well packed. When the ground is snow covered, it is difficult to predict the trafficability because of the changing condition of the snow during the day. Wet snow in the morning may freeze by the afternoon; or a wind-packed snow slab may support a tracked vehicle during one part of the day and may not during another time of the day. When the air temperatures are above 15°F, snow may form a serious obstacle to cross-country movement because at these temperatures the snow may become wet. A depth of 1 meter or more of this wet snow will normally immobilize a tank.

4–10. Crossings on Ice

a. Conditions Governing Crossings on Ice. Crossing a water barrier on ice depends upon the weather and ice conditions. Sudden rises in temperature above the freezing point weaken the ice; artillery fire or demolitions may break up the ice. However, under favorable conditions, crossings on ice are practicable and can be successfully executed by large bodies of troops and heavy equipment.

b. 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 freezing, thawing, and refreezing; temperature; snow cover; and water currents under the ice. Warm weather reduces the carrying capacity of an ice layer even though thickness remains the same since the ice rapidly becomes porous. Tables 4–2 and 4–3 are based on the characteristics of good quality waterborne ice. These data may be used as a planning factor until actual load tests are made to determine the capacity of the ice.

c. Points for consideration during reconnaissance for ice-crossing sites are—

(1) The ice formation along the shore generally is thinner and more likely to develop cracks in comparison to ice conditions in the center of a frozen stream or lake.

(2) When a current of water flows under a large section of ice, the ice in contact with the current is subject to greater temperature fluctuations than ice in adjacent or surrounding areas; hence, the ice may be of reduced strength.

(3) Shallow water ice is usually thinner than deep water ice.

(4) Good quality ice is characterized by clearness and freedom from air bubbles and cracks.

(5) Muskeg lakes contain a great deal of vegetation which retards freezing and results in ice of poor quality.

(6) The carrying capacity of reinforcing ice layers formed by alternate freezing and thawing

Table 4–2. Ice Load-Carrying Capacity for Sleds

Ice Thickness (cm/in.)	Gross Sled Weight (Tons)
15/6	1
17.5/7	2
23/9	5
33/13	10
40/16	15
46/18	20

Table 4–3. Ice Load-Carrying Capacity for Personnel and Equipment

Load type	Gross weight (tons)	Minimum (risk) ice thickness (cm/in.)	Normal ice thickness (cm/in.)	Minimum distance between loads (m/yd)
Soldier on skis or snowshoes	0.1	4/1.6	5/2	5/5.5
Soldier on foot	0.1	5/2	7/2.8	5/5.5
Infantry (column of 2)		7.6/3	10/4	7.3/8
Infantry (column of 4)		10/4	13/5	10/11
Whld veh loads up to:	3.5	23/9	25/10	15/16.4
Whld veh loads up to:	6	30/12	35/14	20/22
Whld veh loads up to:	10	40/16	45/18	25.6/28
Whld veh loads up to:	15	61/24	70/28	30/33
Trckd veh loads up to:	3.5	20/8	25/10	15/16.4
Trckd veh loads up to:	10	30/12	35/14	20/22
Trckd veh loads up to:	12.5	40/16	45/18	25.6/28
Trckd veh loads up to:	25	61/24	70/28	40/44
Trckd veh loads up to:	45	71/28	80/32	50/55
Trckd veh loads up to:	60	81/32	90/36	60/66
Helicopter OH–6A	1.4	15/6	18/7	N/A
Helicopter OH–58A	1.5	15/6	18/7	N/A
Helicopter UH–1D	4.8	23/9	25/10	N/A
Helicopter CH–47A	16.5	65/26	72/28	N/A
Helicopter CH–54A	21.0	72/28	80/32	N/A
Aircraft O–1	1.2	15/6	18/7	N/A
Aircraft OV–1A, OV–1C	7.4	30/12	35/14	N/A
Aircraft OV–1B	7.9	32/13	38/15	N/A
Aircraft C7–A	14.3	61/24	70/28	N/A

and ice formed from slush is considered as only half as strong as that of prime, natural ice.

(7) During freezing weather the thickness of ice is increased by removing the snow cover.

(8) Ice which is left unsupported because of a drop in water level is of reduced strength.

(9) During extremely cold weather the cracks caused by the contraction in the ice may be significantly enlarged by heavy traffic resulting in a reduction of ice strength.

4–11. Cross-Country Movement Studies (STANAG 2259 and SOLOG 100)

Cross-country movement data are often overprinted on standard military topographic maps. Reconnaissance personnel may find such studies useful in planning and conducting reconnaissance missions. The desirable map scale of such studies is 1:100,000; however, map scales may vary from 1:25,000 to 1:250,000. Cross-country movement data are organized into terrain types, which are areas with reasonably similar combinations of slope, soil composition (including moisture content), and vegetation. Each terrain type is, subsequently, divided into smaller terrain groups which are evaluated for cross-country movement. The following three groups are standard:

a. Terrain Group A includes terrain with soil rated as Trafficability Class I regardless of seasonal variations. Terrain Group A is overprinted without color (white) except for areas of steep slopes which are depicted by thin diagonal magenta lines.

b. Terrain Group B includes terrain with soil rated as Trafficability Class I more than 50 percent of the time but is seasonally rated as Trafficability Class II, III, or even IV. Terrain Group B is overprinted in two tones of yellow, the darker representing soil more susceptible to seasonal miring. As in Terrain Group A, areas of steep slopes are indicated by thin diagonal magenta lines.

c. Terrain Group C includes terrain with soil rated only as Trafficability Class II, III, or IV except for prepared routes through the area. Group C will usually include poorly drained terrain such as bogs, swamps, and marshes or terrain which is too rough and steep for vehicular movement. Magenta in three tones indicates this terrain group; the lighter tone represents terrain which offers better prospects for some seasonal movement; the intermediate tone for terrain which offers poorer prospects for movement; and the darkest tone for terrain which is too steep for movement.

d. Other Terrain Features. In addition to soil trafficability, other terrain features which influence cross-country movement are represented by conventional map symbols and colors.

(1) *Steep slopes in terrain other than Group C.* Dark magenta is used to represent escarpments, cuts, embankments, gravel pits, and other slope obstacles in areas otherwise not too steep for movement.

(2) *Vegetation.* Green represents vegetation primarily forests that hinder movement. Distinctive patterns of green may be employed to represent different types of vegetation.

(3) *Drainage.* Blue is used to depict water obstacles.

(4) *Urban areas.* Built-up areas are represented by overprints of black criss-cross lines.

Section III. RECONNAISSANCE OF LANDING AREAS

4–12. General

Although landing area construction remains an engineer responsibility, the increased number of aircraft in the army area requires that all reconnaissance personnel be generally familiar with terrain characteristics pertinent to airfield, heliport, and helipad construction. This section, therefore, is designed to acquaint personnel with specifications of the more common types of *army aircraft* and their corresponding landing requirements. Aviation technicians and construction engineers will still be required to reconnoiter the more permanent types of landing facilities, especially those for USAF aircraft; however, procedures are herewith provided for preliminary reconnaissance. For greater detail, see FM 1–100 and TM 5–330.

4–13. Role of Army Aviation

The mission of army aviation is to augment the capability of the Army to conduct prompt and sustained combat incident to operations on land. Aerial operations within the capabilities of army aircraft normally do not duplicate those of USAF. Army aircraft are designed to perform the following functions:

a. Command and control.

b. Battlefield surveillance and aerial observation.

c. Aeromedical evacuation.

d. Air mobility for troops, equipment, and supplies.

e. Aerial fire support.

4–14. Characteristics of Army Aircraft

Army aircraft are sturdy, relatively easy to maintain, and capable of operating from short, unimproved fields. To assist in reconnaissance planning, pertinent characteristics of U.S. Army aircraft are listed in tables 4–4 and 4–5.

4–15. Classification of Landing Areas

Airfields and heliports in the theater of operations are classified by the military area in which they are located and by the category of aircraft intended to use them.

a. Military Areas. For landing area classification the theater of operations is divided into areas as follows:

(1) *Battle area.* That sector of the battlefront normally under control of a brigade.

(2) *Forward area.* That sector of the theater of operations immediately behind the battle area and normally under control of a division or brigade.

(3) *Support area.* That sector of the theater of operations behind the forward area and normally in the corps rear area or the area under control of the fighter air support command.

(4) *Rear area.* That sector of the theater of operations behind the support area and normally in the army service area or the communications zone.

Table 4–4. Characteristics of Fixed Wing Army Aircraft

Aircraft	Overall dimensions (ft)			Weight (1000 lbs)		Takeoff (ft)*	
	Length	Width	Height	Basic	Maximum takeoff	Ground run	To clear 50 ft.
O–1E	25.8	36.0	7.5	1.61	2.4	390	675
OV–1A	41.0	42.0	13.0	9.91	14.72	1005	1450
OV–1B	41.7	48.0	13.0	10.98	15.79	1410	2185
OV–1C	41.0	42.0	13.0	10.01	14.82	1440	2230
U–1A	42.0	58.0	12.4	4.90	8.0	950	1630
U–6A	30.5	48.0	10.4	3.10	5.1	760	1080
U–8D	31.5	45.3	11.6	4.99	7.3	1455	2400
U–8F	33.3	45.9	14.2	5.49	7.7	1065	1660
U–10	30.3	39.0	8.8	2.01	3.8	290	500
U–21A	35.8	45.9	14.2	5.38	9.5	1500	2000

*At sea level, 59° F., no wind, hard surface.

Table 4–5. Characteristics of Army Helicopters

Helicopter	Overall dimensions (ft)			Weight (1000 lbs)		Takeoff (ft)*	
	Length	Width	Height	Basic	Takeoff	Ground run	To clear 50 ft.
OH–6A	30.30	26.30	8.20	1.16	2.70	0	0
OH–13H	41.40	35.16	9.50	1.78	2.75	0	0
OH–13S	43.25	37.00	12.00	1.91	2.85	0	0
OH–23G	43.25	35.16	10.16	1.91	2.80	0	0
UH–1B	52.83	44.00	16.41	5.08	9.50	0	0
UH–1D	57.01	48.00	17.16	4.92	9.50	0	0
CH–34	65.83	56.00	15.83	7.76	13.30	0	0
CH–37B	88.00	72.00	22.00	21.50	31.00	161	316
CH–47A	98.01	59.16	18.50	18.04	33.00	0	0
CH–54A	88.41	72.00	25.33	19.82	42.00	0	0
AH–1G	52.97	44.00	11.00	----------		0	0

*At aea level, 59° F., no wind, hard aurface.

b. Controlling Aircraft Classification.

(1) *Fixed wing aircraft.* Six categories which embrace all fixed wing aircraft in the current military inventory have been established. A controlling aircraft, or a combination of controlling aircraft, has been designated for each category to establish the limiting geometric and surface strength requirements of the airfield. The categories and associated controlling aircraft are:

(*a*) Liaison (O–1)
(*b*) Surveillance (OV–1)
(*c*) Light lift (C–7A)
(*d*) Medium lift (C–130)
(*e*) Heavy lift (C–124, C–135, and C–141)
(*f*) Tactical (F–4C and F–105)

(2) *Rotary wing aircraft.* Four helicopters have been designated as controlling aircraft to establish the limiting geometric and surface strength requirements of helipads and heliports. These are:

(*a*) Observation (light) (OH–6A)
(*b*) Utility (UH–1D)
(*c*) Cargo (medium transport) (CH–47)
(*d*) Cargo (heavy lift) (CH–54)

Table 4–6. Partial Minimum Airfield Geometric Requirements

Airfield Type	Runway Length Ft	Runway Width Ft	Runway Shoulder Width Ft	Total Aircraft* Traffic Area 1,000 Sq Ft
Battle Area:				
Light Lift	1,000	50	10	120
Medium Lift	2,000	60	10	223
Forward Area:				
Liaison	750	50	N/A	37.5
Surveillance	2,500	60	10	337
Light Lift	1,200	60	10	220
Medium Lift	2,500	60	10	358
Support Area:				
Liaison	1,000	50	N/A	50
Surveillance	3,000	60	10	490
Light Lift	1,500	60	10	953
Medium Lift	3,500	60	10	753.5
Heavy Lift	6,000	100	10	1,421
Tactical	5,000	60	4	1,071
Rear Area:				
Army	3,000	72	10	882
Medium Lift	6,000	72	10	2,362
Heavy Lift	10,000	156	10	3,926
Tactical	8,000	108	20	1,989

*This area includes parking, runway, taxiway, and warm-up apron.

Table 4–7. Partial Minimum Helipad and Heliport Geometric Requirements

Helipad or Heliport Type	Landing Pad			Taxi [1] Hover-lane	Runway [2]		
	Length Ft	Width Ft	Shoulder Width Ft	Width Ft	Length Ft	Width Ft	Shoulder Width Ft
Forward Area:							
OH–6A	12	12	N/A	75	N/A	N/A	N/A
UH–1D	20	20	N/A	140	N/A	N/A	N/A
CH–47	50	25	N/A	180	N/A	N/A	N/A
CH–54	50	50	N/A	200	N/A	N/A	N/A
Support Area:							
OH–6A	12	12	10	100	N/A	N/A	N/A
UH–1D	20	20	10	200	N/A	N/A	N/A
CH–47	50	25	10	240	450	25	10
CH–54	50	50	10	250	450	50	10
Rear Area:							
OH–6A	25	25	25	100	N/A	N/A	N/A
UH–1D	40	40	25	200	N/A	N/A	N/A
CH–47	100	50	25	240	450	40	25
CH–54	100	100	25	250	450	60	25

[1] Taxi-hoverlane is used for takeoff and landing where provided. Length is variable.
[2] Where runway is not shown, takeoff and landing is on taxi-hoverlane.

c. Airfield and Heliport Types. Airport and heliport types are derived by combining the category and the appropriate military area. For example, airfield types include battle area light lift, forward area liaison, and rear area heavy lift airfields; heliport types include forward area UH–1D, and rear area CH–54 heliports. When an airfield is to serve as a multi-mission facility for support of all classes of Army or Air Force aircraft, the first term in its type designation becomes "Army" or "Air Force", the second term is the military area; for example, Army rear area airfield. Helicopter landing areas in the battle area are considered landing zones of opportunity and no criteria have been developed for them. Tables 4–6 and 4–7 list partial minimum geometric requirements for airfields and heliports, respectively.

4–16. Runway Orientation and Dimensions

a. Wind Consideration. Normally, runways are oriented in accordance with the prevailing winds in the area. Particular attention should be paid to gusty winds of high velocity in determining runway locations.

b. Length of Runway.

(1) The determination of runway length required for any aircraft is empirical in nature and must include not only the surface actually required for landing rolls or takeoff runs, but a rea-

sonable allowance for variations in pilot technique, psychological factors, wind, snow, and other surface conditions, and unforeseen mechanical failure. Runway length is accordingly determined by applying a factor of safety to the takeoff ground established for the geographic and climatic conditions at the installation.

(2) The ground run required for any type of aircraft is greatly affected by air density which, in turn, is governed by conditions of temperature and pressure at the site. Increases in either temperature or altitude reduce the density of air with a resultant material increase in required ground run. The required length of runway for any specific type of aircraft will accordingly vary with geographic location. It must be computed in each case on the basis of the average maximum temperature and the altitude of the site. The average maximum temperature is the average of the highest daily values occurring during the hottest month of the year.

(3) The takeoff ground run (TGR), at mean sea level and 59°F, for all aircraft considered is shown in tables 4–4 and 4–5. For all other conditions, these values should be corrected for temperature (above 59°F), altitude above 1,000 feet, effective gradient, and safety factor. Table 4–8 provides an excellent guide to the accurate determination of runway length requirements. In the computation of the runway length a 10 percent increase in length must be provided for each 1,000-foot increase in altitude above an altitude of 1,000 feet. The runway length is further increased 4 percent for each 10° increase in temperature above 59°F if the TGR is less than 5,000 feet and 7 percent per 10° if TGR is 5,000 feet or greater. The temperature to be considered is the average of the mean daily temperatures for the warmest period during which operations will be conducted from the airfield. A safety factor of 25 percent is normally applied to the runway lengths of battle, forward, and support area airfields unless sufficient evidence is provided to justify use of a higher factor. A safety factor of 50 percent normally is used in the computation of runway lengths for rear area airfields. If the effective gradient of the runway exceeds 2 percent, the runway length will be increased 8 percent for each 1 percent over a 2 percent gradient. The term "effective gradient" as used herein is the percent expression of the maximum difference in elevation along the runway divided by the length of the runway. The final runway length will be the TGR corrected (if required) for conditions of altitude, temperature, safety factor, and effective gradient, and *raised to the next larger 100 feet.* In no case will negative corrections be applied to the TGR (that is, the runway will not be shortened for operating temperatures below 59°F, etc.), and in no case will the final length of the runway be less than the minimum shown in tables 4–6 and 4–7 for each kind of airfield considered.

Table 4–8. Steps in Runway Length Determination

(1) Takeoff ground run	Takeoff ground run (TGR) for individual aircraft is shown in tables 4–4 and 4–5.
(2) Altitude correction	Increase the takeoff ground run (TGR) by + 10 percent for each 1,000 ft increase in altitude above 1,000 ft.
(3) Temperature* correction.	Increase the corrected runway length, obtained from the previous computation, by +7 percent for each 10° increase in temperature above 50°F, if takeoff ground run is 5,000 feet or greater. Increase by 4 percent per 10° above 59° if takeoff ground run is less than 5,000 ft.
(4) Safety factor	Multiply the corrected runway length from the previous computation by 1.5 for rear area airfields and 1.25 for support, forward, and battle area airfields.
(5) Effective gradient correction.	Increase the corrected runway length, obtained from the previous computation, by +8 percent for each 1 percent of effective gradient over 2 percent. The effective gradient can be determined from the profile of the airfield.
(6) Round up	The final runway length will be the takeoff ground run corrected (if required) for conditions of altitude, temperature, safety factor, and effective gradient, and raised to the next larger 100 feet.
(7) Compare with minimum req'd.	Compare calculated length obtained from the previous computation with the minimum length required as shown in tables 4–6 and 4–7. Use the greater value.

* The temperature to be considered is the mean temperature for the warmest period during which operations will be conducted from the airfield.

c. Runway Width. Runway width is primarily based on safe operation under reduced visibility conditions and the lateral stability of the aircraft in the final approach and landing. Values are given in tables 4–6 and 4–7 for minimum widths of runway for each class of airfield and heliport.

4–17. Reconnaissance for Specific Locations

Sites for battle and forward area airfields and heliports may be selected after only a brief reconnaissance. However, most airfield and heliport sites require detailed reconnaissance. This is best accomplished with a combined map, air, and ground reconnaissance.

a. Map Reconnaissance. A study of appropriate maps is first made to determine the location of favorable areas, the proximity to the supported unit, type of terrain, and availability of access routes. Map reconnaissance by itself is used only when additional methods are not practical; however, it may be the only method when displacing over a long distance or into previously denied areas.

b. Aerial Reconnaissance. Aerial reconnaissance usually follows map reconnaissance. Aerial reconnaissance alone is generally incomplete without followup ground reconnaissance but may suffice if time does not allow or if landing surfaces can be readily determined from the air. Availability and condition of air and ground access routes are an essential part of the reconnaissance.

c. Ground Reconnaissance. A ground reconnaissance is made to determine the nature and condition of the surface and to select exact locations for installations (bivouac, refueling, maintenance, etc.). Ground reconnaissance alone is not entirely satisfactory, but aerial reconnaissance may occasionally be impractical, especially during hours of darkness.

d. Combined Map, Air, and Ground Reconnaissance. Combined map, air, and ground reconnaissance will be used whenever possible. This type of reconnaissance is most effective when:

(1) Sufficient time is available and the weather and tactical situation permit.

(2) A ground reconnaissance is made in conjunction with the air reconnaissance.

4–18. Air Landing Selection Criteria

The following criteria are important in selecting a landing area. These factors are indicative of the specific information which is sought during reconnaissance for landing areas.

a. Accessibility, Communications, and Logistics. One aim of landing area selection is to place a minimum burden on supply channels by insuring that adequate supply routes by land, water, and air are available. The more routes available to the site, the simpler the supply problem.

b. Obstructions. A location which is free from obstructions around the entire landing area is preferable, but an approach zone with no obstructions at each end of the flightway satisfies minimum requirements. Removal of obstructions such as towers, smokestacks, and trees may often be necessary. Besides physical obstructions, pilot reactions are considered. There is a strong, psychological opposition to landing over obstacles even though well marked and below the glide path. Moreover, a landing area on a plateau with steep sides falling away immediately beyond the overruns may have good approaches; however, under such circumstances, pilots are inclined to land well down the runway. A canal, ditch, bank, or pole line at the end of a runway has a similar effect. The result of these human reactions is equivalent to a shortened runway, and compensation in the layout of the landing area should be made.

c. Meteorological Conditions. Wind, rainfall, fog, snow, and frost are considered in landing area selection because, singly or in combination, they can delay or damage construction or restrict the operational use of the location. Meteorological data is frequently difficult to obtain. Extensive records of meteorological observations at the exact site are seldom available. To be of value, such records must include observations taken over a length of time at the actual landing area. Because of differences in altitude and topography, meteorological conditions noted in the general location in which the landing area is situated may be misleading as to the conditions which prevail at the landing area itself. This is particularly true of down drafts, cross currents, haze, fog, and precipitation. If practicable, proposed landing areas near prominent features of relief are flight tested to disclose the existence and effect of hazardous air eddies and currents. Ground haze and its effect upon visibility are also checked. Interrogation of local inhabitants may help to confirm meteorological data and, in some cases, may be the only source of such information. However, the primary source is the intelligence sections of division, corps, and army.

d. Drainage Conditions. Drainage conditions include the height of the ground-water table and its seasonal variations, the flood characteristics of streams bordering the location, and tidal variations at coastal locations. Unless care is taken, reconnaissance during the dry season may be misleading. Vegetation sometimes discloses evidence

of seasonal seepage or rise in the ground-water table. For example, reeds, sedges, cottonwoods, and willows thrive where seepage occurs, even though the seepage is seasonal. Tree trunks along the stream banks, scarred by the abrasive action of ice floes during breakup, indicate the elevation of high water.

e. Relief. A location with favorable relief is one located on high ground with sufficient slope for natural drainage and a reasonable smooth surface requiring little earthmoving. Runway surfaces must be smooth enough to permit takeoffs and landings without damage to aircraft. Uphill takeoffs and downhill landings require longer runways.

f. Soil Characteristics and Quality of Subgrade. The character of the soil at the location determines whether stabilization or surfacing will be required. Excessive dust can significantly affect air landing operations and aircraft performance. Soil characteristics also determine whether surfaces or pavements can be placed directly on a prepared subgrade without a base course.

g. Vegetation. The primary consideration in connection with ground vegetation is the amount of clearing and grubbing involved. The difficulties of clearing, grubbing, and stripping varies in every climatic zone in accordance with the types of vegetation encountered. Considerations most pertinent to clearing are the density of various vegetation and the nature of the root systems.

h. Availability of Local Materials. Reconnaissance should include investigation of sources near the location which yield suitable construction ma-

AIRSITEREP or AIRSTRIPREP[a]					
Explanation	Letter designation	(1)[b]	(2)[c]	(3)[c]	(4)[c]
Map sheet(s)	ALPHA				
Date and time information was collected	BRAVO				
Location (UTM grid references)	CHARLIE				
Dimensions of facility	DELTA				
Type and condition of facility	ECHO				
Additional information	FOXTROT				

Notes. [a]. The above format is adapted from STANAG 2096 and SOLOG 107.
[b]. First air site in report; report by serial number if assigned.
[c]. Additional air sites in report.

Figure 4–1. Format for electrically transmitting reconnoitered air landing area information.

AIRFIELDREP[a]					
Explanation	Letter designation	(1)[b]	(2)[c]	(3)[c]	(4)[c]
Map sheet(s)	ALPHA				
Date and time information was collected	BRAVO				
Location (UTM grid references)	CHARLIE				
Number and dimensions of runways	DELTA				
Orientation of runways	ECHO				
Type and surface of runways	FOXTROT				
Condition of runways	GOLF				
Hangers and bulk fuel storage facilities including condition.	HOTEL				
Parking areas for aircraft	INDIA				
Additional information	JULIET				

Notes. [a]. The above format is adapted from STANAG 2096 and SOLOG 107.
[b]. First airfield in report; report by serial number if assigned.
[c]. Additional airfields in report.

Figure 4–2. Format for electrically transmitting reconnoitered airfield information.

terial. The location and evaluation of construction materials are discussed in TM 5–330.

i. Water Sources. Large quantities of water generally are required during construction and subsequent use of landing area; reconnaissance should disclose likely sources. See FM 101–10–1 and TM 5–700 for further information.

AIR RECONNAISSANCE REPORT

DATE 29 SEPT 68 NO. 4

1. To CO, 327 ENGR BN
2. From CO. C
3. Map Sheet JOHANNASVILLE QUADRANGLE
4. 10 MILES NORTH OF JOHANNASVILLE (Nearest main road center)
5. (a) Coordinates of EAST end of runway NA3 765, 1 900
   (b) Length (feet) 5000 FT. BUT MIGHT BE EXTENDED 2000 FT. (SEE ITEM 12)
6. Classification of Site (overall):

   Excellent ____ Good ✓ Fair ____ Poor ____ Reject* ____

7. Natural Surface Drainage:

   Excellent ____ Good ✓ Fair ____ Poor ____

8. Flying Approaches:

   Excellent ____ Average ✓ Poor ____

9. Clearing:

   Light ✓ Moderate ____ Excessive ____

10. Aircraft Dispersal:

    Unlimited ✓ Adequate ____ Inadequate ____

11. Access Roads:

    Good ____ Adequate ✓ Inadequate ____

12 Remarks: EXTENSION MENTIONED IN 5(B) ABOVE MUST BE CHECKED AS THERE MAY BE A SWAMP AREA IN THAT SUGGESTED EXTENSION. CANNOT BE CERTAIN FROM AIR OBSERVATION

Lt. Bolinder (Signature)

1400 (Time)

*If "Reject" classification is indicated, reason(s) for same will be given under remarks.

Figure 4–3. Air reconnaissance report.

j. Camouflage. Desirable site characteristics include the absence of identifying landmarks and sufficient natural concealment for service installations and supplies. To aid in camouflage, standing trees and brush outside of the landing areas are not removed unless necessary.

k. Ground Defense. In order to maintain a tenable position for air operations, the practicability of ground defense against both ground and air attack is a factor of consideration for each location. Terrain favorable for defense provides observation, fields of fire, concealment, obstacles, and routes of communication. Natural obstructions which prevent air landing in areas adjacent to the facility assist in the defense against hostile airmobile operations.

l. Miscellaneous Factors. There are many factors such as flash floods or sand storms in landing area selection which cannot be anticipated. Such factors are not discussed because they do not have broad application. For a particular location, however, they may be extremely important; and their consideration requires the application of sound judgment coupled with practical experience.

4–19. Reconnaissance Reports for Landing Areas

a. Basic Considerations. Full details on the method, place, and time of submitting reconnaissance reports are included in the instructions given to the reconnaissance party. Reconnaissance reports may be submitted in writing, by electrical means, or both. Prepared forms are desirable since they insure full coverage of information and facilitate comparative evaluation of two or more possible landing areas. Forms should be locally produced and modified to meet the desires of the headquarters concerned and the peculiarities of the operational area.

b. Symbols. Reconnaissance symbols and conventional topographic symbols are useful in graphically reporting landing areas.

c. Reports by Electrical Means. It is often imperative that an initial reconnaissance report reach the supported headquarters with the least possible delay. Formats established for this purpose and standardized by STANAG 2096, SEASTAG 2096, and SOLOG 107 are illustrated in figures 4–1 and 4–2.

d. Written Reports. The following formats are applicable for written reconnaissance reports:

(1) *Airfield reconnaissance report* (fig. 4–3).

(2) *Ground reconnaissance of undeveloped landing area* (see TM 5–330).

(3) *Ground reconnaissance of captured enemy landing area* (TM 5–330).

(4) *Annexes.* Suitable sketches are attached to written reconnaissance reports when applicable (TM 5–330).

Section IV. RECONNAISSANCE AND MARKING OF INLAND WATERWAYS

4–20. General

The use of inland waterways for military purposes is usually considered only in underdeveloped areas in which alternate routes are either lacking or insufficient. In jungle areas and delta regions, for example, inland waterways may not only offer the best but the only practicable means of extensive ground movement for long distances. The actual capacity of a waterway, the availability of waterborne craft, and the adequacy of terminal facilities are primary elements in the decision to employ inland water routes. Waterways are categorized by type—open and restricted. Lakes, rivers, canals, and other inland waterways whose *fairway* (a navigable part of a river, bay, or harbor) can be negotiated without restriction are termed "open" while those inland waterways whose fairways are interrupted by dams, locks, or by a required portage are termed "restricted".

4–21. Means of Inland Waterway Reconnaissance

The methods employed in reconnoitering inland waterways are dependent upon the time available, the extent and characteristics of the waterway, the amount of detail required, and the type of reconnaissance craft utilized. A preliminary map or aerial photo study supplemented in instances where aerial observation is not obscured by overgrowth is usually a prerequisite before conducting waterborne reconnaissance. Ground reconnaissance of a waterway may be accomplished either by paralleling the shore on foot or by vehicle, or preferably, by directly following the watercourse employing some mode of water transportation. In either event, means to check critical underwater features of the fairway such as depth, width, and likely underwater obstacles is mandatory. In most cases, army personnel will be required to exercise

Table 4–9. Standard Landing Craft, Boats, and Amphibian Vehicles of the Transportation Corps

a. Landing Craft.

Type	Length	Beam	Light displacement (LT)	Draft loaded		Speed loaded (knots)	Operating range nautical miles (loaded)	Fund consumption (gal. per hour)	Crew *	Capacity		Cargo space dimension
				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″ × 14′ plus 26′ × 26′ plus 13′2½″ × 12′6″.
Landing craft, utility (LCU) (1466 class).	115′	34′	180	3′	4′	6.5	700	34	12	160.0	300 (min)	52′ × 29′6″ plus 22′5″ × 14′4″.
Landing craft, mechanized, Mark VI (LCM (6)).	56′	14′	28	3′	4′2″	8.0	128	28	4	32.0	120	37′6″ × 9′6″.
Landing craft, mechanized, Mark VIII (LCM (3)).	73′3″	21′	40	3′	5′6″	10.2	234	41	6	53.5	200	42′ × 14′6″.
Landing craft, vehicle, personnel (LCVP).	35′	10′5″	8	2′2″	3′	10.5	135	15	4	3.5	36	17′3″ × 7′5″.

* For around-the-clock operations.

b. Boats.

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		Remarks
											Cargo	Passenger	
Utility, diesel, plastic, 26′, design 6009.	J*	26′6″	8′1″	3.04′	4′	30	4	10	200	2	1 LT	12 to 15	Can be transported in cradle on freight vessels.
Picket, diesel, wood, 36′6″, design 243–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	----------		Replaces design 243–B.
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 vessel, steel, 65′, design 2001.	T	65′6″	17′8″	66	7′	1,150	19	10.5	635	4	24 LT 1,300 cu ft	24	Normally deckloaded on large cargo ship. Under good conditions, can proceed overseas under own power.

*Obselescent nonstandard.

Table 4–9. Standard Landing Craft, Boats, and Amphibian Vehicles of the Transportation Corps—Continued

c. Amphibian Vehicles.

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″ × 6′10″.
Lighter, amphibian, 5-ton (LARC-V).	35′	10′	7.2	4′1″	4′3″	3.7 knots, water 25 mph, land	60, water 160, land	20	2	Normal 4.5 Maximum 5.0	Emergency 20 20	16′ × 8′8″.
Lighter, amphibian, 60-ton (LARC-LX)	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 80.3	Normal 125 Emergency 200.	38′3″ × 14′
Landing vehicle, tracked, Mark V (LVPT).	29′8″	11′3¼″	31.2	5′3″	5′3″	6.7 knots, water 27.8 mph, land	45, water 137, land	47	3	Water 6.0 Land 9.0	34	15′2″ × 7′9″ × 5′3″.

Table 4–10. Standard Engineer Boats

Type craft	Crew	Maximum loads	Max steam velocity	Length	Beam	Weight	Remarks
1. Plastic assault boat:							
a. Paddle propelled	3 men	12 riflemen with individual equipment (in addition to crew).	1.5m/sec	16′	5′4″	291 lb	
b. Employed as storm boat	1 man	5 riflemen (in addition to crew)	3.3m/sec				Equipped with 25 HP outboard motor.
c. Outboard motor propelled	2 men	10 riflemen (in addition to crew)	2.4m/sec				Equipped with 25 HP outboard motor.
2. Pneumatic assault boat:							
a. Paddle propelled	3 men	12 riflemen with individual equipment (in addition to crew).	2.4m/sec	17′	5′8″	250 lb	
b. Outboard motor propelled	1 man	14 riflemen (in addition to crew)	3.3m/sec				Equipped with 25 HP outboard motor.
3. Pneumatic reconnaissance boat: Paddle propelled	3 men	Maximum cargo 600 lb including crew	1.5m/secc	9′	4′	31 lb	
4. Bridge erection boat	2 men	9 riflemen with individual equipment (in addition to crew).		19′	8′	3800 lb	Propelled by 90 HP inboard engine; maximum speed up to 27 KPH; 30″ draft.
5. Bridge erection boat	2 men	9 riflemen with individual equipment (in addition to crew).		27′	3′2″	6800 lb	Propelled by two 90 HP inboard engines; maximum speed up to 27 KPH; 40″ draft; boat may be divided into two sections to facilitate transporting overland.

ingenuity in obtaining suitable reconnaissance craft, at times employing whatever means is locally available. On the other hand, certain engineer and transportation units have organic landing craft and boats which can be adapted for reconnaissance purposes (tables 4–9 and 4–10). In situations where reconnaissance craft may come under hostile fire, consideration should be given to providing each craft with suitable armament and improvised armor plating or sandbag protection. Swimming vehicles, such as the armored personnel carrier, are not generally appropriate for waterway reconnaissance because of their slow water speed, relatively deep craft, and limited maneuverability.

4–22. Preparation for Inland Waterway Reconnaissance

Suitable communications are required by waterborne reconnaissance parties; in most cases, this will be radio. Also, improvised methods for taking depth readings, determining current velocities, and measuring and marking fairways are required (para 2–30—2–49). If underwater reconnaissance is anticipated, provisions as outlined in paragraph 2–37 are made. Reconnaissance instructions must be specific, and all personnel thoroughly acquainted with the reconnaissance mission. If the reconnaissance is to be of long duration, methods of refueling and resupply, often by aircraft, are established. Coordination with and assistance from local civilians can be extremely helpful and should be sought when appropriate. In delta regions, swamps, and other areas where water channels abound, navigational aids will be required to maintain direction.

4–23. Consideration in the Conduct of Water Route Reconnaissance

As waterways vary greatly and reconnaissance requirements are not consistent, only general guidance can be offered as to what limiting features determine the movement capability of a specific inland waterway (FM 55–15). Limiting features will largely be dependent upon the operational environment and the contemplated military operation. Major considerations in waterway reconnaissance are as follows:

a. Restricting widths and depths of fairways.

b. Vertical and horizontal clearance of bridges.

c. Location of dams or other bars to navigation.

d. Location of locks to include dimensions, timing, and method of operation.

e. Frequency, duration, and effect of seasonal floods and droughts to include types and dimensions of levees.

f. Normal freezeup and opening dates.

g. Navigation hazards such as rapids, falls, underwater and antiamphibious mines.

h. Speed and fluctuations of current.

i. Tidal influences.

j. Significant changes in channel direction.

k. Availability of civilian and/or military craft.

l. Number and types of terminal facilities including wharves, cranes, handling equipment, maintenance shops, and port clearance.

m. Aids to navigation such as buoys and lights.

n. Fords and sites suitable for swimming vehicles.

o. Potability, contamination, and sediment movement.

p. Nature of waterway bed.

q. Local organization and administration of waterways to include the indigenous labor force.

4–24. Waterway Reconnaissance Reports

As waterways vary considerably, no standardized forms have been established to report the results of reconnaissance; however, short forms or worksheets based on field requirements are recommended to insure that important aspects of waterway reconnaissance are not overlooked. Generally, reconnaissance information of inland waterways is reported in overlay form utilizing standard route reconnaissance symbols and conventional topographic symbols (fig. 4–4). If reconnaissance information cannot be adequately portrayed in overlay form, written reports describing specific terrain features accompany the overlay report.

4–25. Marking of Inland Waterways

a. The buoyage system employed in United States waters (fig. 4–5) can be readily adapted to marking inland waterways within an operational area. Buoys can be expeditiously fabricated under field conditions in accordance with the needs of the command. Reconnaissance personnel should be familiar with the buoyage system, for frequently the marking of an inland waterway is accomplished in conjunction with its reconnaissance. In

developed areas, however, major inland waterways have been marked by the indigenous population. In such circumstances, it is generally easier to adapt the local navigational system to meet military needs rather than convert to the U.S. system.

b. Buoys are wooden or metal floats of various shapes, sizes, and colors anchored to the bottom of harbors, bays, rivers, and channels. The primary function of a buoy is to warn of some danger, obstruction, or change in the contours of the bottom, and to delineate the fairways. The different types of buoys are identified by size, shape, coloring, numbering, and the signaling devices with which they are equipped. They are usually marked on charts so that a course can be plotted to avoid the potential hazards indicated.

c. The buoyage system used in the United States employs a simple arrangement of colors, shapes, numbers, and lights. *Buoy characteristics are determined by the location of the buoy with respect to the navigable channels as entered from a seaward direction.* As all channels do not directly connect with the sea, arbitrary assumptions are applied. In such circumstances, operators are required to consult navigational charts to determine the *assumed* seaward direction of the fairway. The principal types of buoys are described below:

(1) A *spar buoy* is usually a large log, trimmed and appropriately painted; it may also be constructed of steel plates joined to form a slim cylinder. The shape of a spar buoy has no significance. Coloring reveals the particular meaning of the buoy.

(2) A *can buoy* is usually constructed of metal and its shape is similar to that of an ordinary tin can. Normally, it is used to designate the port side (entering from seaward), but may be used to mark the middle of a channel, a junction, or an obstruction. Color indicates its particular purpose. *A can buoy is never used to mark the starboard side of a channel.*

(3) A *nun buoy* is also constructed of metal and has a conical top. It is normally used to mark the starboard side of the channel (entering from seaward), but may also be used for mid-channel, junction, or obstruction marking; the color denotes its particular purpose. *A nun buoy is never used on the port side of a channel.*

(4) A lighted buoy is a float upon which is mounted a short skeleton tower with a lantern at the top. Its shape has no significance; however, its purpose is indicated by color.

(5) *Bell buoys, gong buoys,* and *whistle buoys* are floats with sound equipment installed. No significance is attached to their shapes.

d. 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) A *black buoy* marks the port side of a channel or the location of obstructions which must be passed by keeping the buoy on the port side of the vessel. It displays white or green lights at night.

(2) A *red buoy* marks the starboard side of a channel or the location of obstructions which must be passed by keeping the buoy on the starboard side. It displays white or red lights at night.

(3) A *red and black horizontally banded buoy* marks a junction in the channel or an obstruction 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 top-most band is red, the preferred channel will be followed by keeping the buoy on the starboard side. This buoy may have white, red, or green lights.

(4) A *black and white vertically striped buoy* marks the fairway or mid-channel and may be passed on either side. It displays 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.

e. Buoys indicating the starboard side are marked with even numbers; those indicating the port side are marked with odd numbers. Mid-channel, junction, and special-purpose buoys are not numbered, but may be lettered for identification.

f. 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. Mid-channel buoys use white only while obstruction and junction buoys use the appropriate color to indicate 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 four seconds between series. Mid-channel 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.

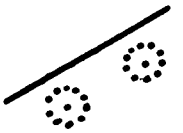
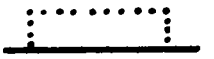
Serial Number	Description	Symbol
	OPERATING FACILITIES	
1.	Slipway, Shipyard	
2.	Tow path	
3.	Bumping posts	
4.	Icebreaker	
5.	Mooring poles	
6.	Shipturning point	
7.	Alongside berth	
8.	Tanker berth	
9.	Lighter berth	
10.	Water level indicator	

Figure 4–4. Conventional symbols for use in military geographic documentation on navigable inland waterways and sea and river ports (STANAG 2254, STANAG 2255, SOLOG 97, and SOLOG 98).

Serial Number	Description	Symbol
	OPERATING FACILITIES (Cont'd)	
11.	Water gauge	
12.	Recording tide gauge	
13.	Highwater mark gauge	
14.	Kilometer stone	
15.	Warning station	
16.	Drinking water supply	
17.	Fueling station	
18.	Coaling station	
19.	Crane	
20.	Traveling crane	

Figure 4–4—Continued.

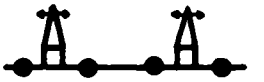
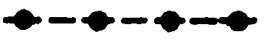
Serial Number	Description	Symbol
	OPERATING FACILITIES (Cont'd)	
21.	Loading berth	
22.	Elevator for oil	
23.	Electricity supply point	
	AUXILIARY SERVICES	
24.	Transformer	
25.	Radar station	
26.	Phone booth	
27.	High tension line	
28.	Telephone overhead line	
29.	High tension cable	

Figure 4–4—Continued.

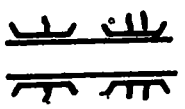
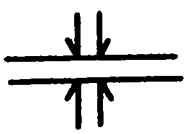
Serial Number	Description	Symbol
	AUXILIARY SERVICES (Cont'd)	
30.	Telephone cable	
31.	Waterworks	
32.	Pumping station	
	WATERWAY CONSTRUCTION AND CHARACTERISTICS	
33.	Aqueduct	
34.	Culvert	
35.	Syphon	
36.	Sewer	
37.	Navigable canal	
38.	Raised canal	

Figure 4–4—Continued.

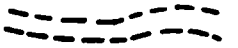
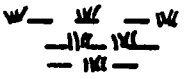
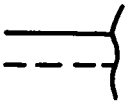
Serial Number	Description	Symbol
	WATERWAY CONSTRUCTION AND CHARACTERISTICS (Cont'd)	
39.	Canal cut	
40.	Fairway	
41.	Dry river bed	
42.	Cataract, rapids	
43.	Waterfall	
44.	Reeds	
45.	Single stones or rocks	
46.	Rock or reef	
47.	Breakwater	
48.	Groins	

Figure 4–4—Continued.

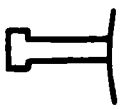
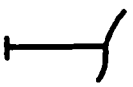
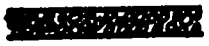
Serial Number	Description	Symbol
	WATERWAY CONSTRUCTION AND CHARACTERISTICS (Cont'd)	
49.	Stone mole or pier	
50.	Wooden mole or pier	
	LANDING STAGES	
51.	- for vehicles	
52.	- for passengers	
	BANK CONSTRUCTION	
53.	Iron	
54.	Brick work or concrete up to 5 m width	
55.	Brick work or concrete over 5 m width	
56.	Wattle work (fascine filling) or grit layer	
57.	Paving	

Figure 4–4—Continued.

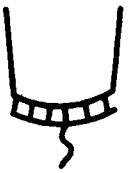
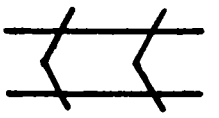
Serial Number	Description	Symbol
	DAMS	
	Dam across a valley	
58.	- of earth or rock filling	
59.	- of masonry or concrete	
60.	Weir	
61.	Sliding-, Safety-, Guard- or Tide-lock	
62.	Emergency gate	
63.	Harbor lock	
64.	Lock	
65.	Ship-lift	
	NAVIGATION SYMBOLS	
66.	Lightship	

Figure 4–4—Continued.

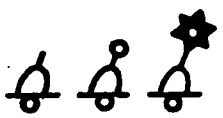
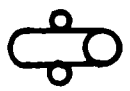
Serial Number	Description	Symbol
	NAVIGATION SYMBOLS (Cont'd)	
67.	Light house	
68.	Light beacon	
69.	Light beacon (coordinated)	
70.	Storm signal mast	
71.	Signal post	
72.	Beacon	
73.	Floating beacon	
74.	Deviation beacon	
75.	Buoys	
76.	Mooring buoy	

Figure 4–4—Continued.

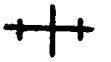
Serial Number	Description	Symbol
	NAVIGATION SYMBOLS (Cont'd)	
77.	Broom (brush)	
78.	Wind indicator, and combined wind indicator and water gauge	
79.	Presignal for swingbridge	
80.	Mooring prohibited	
81.	Free anchorage area	
82.	Wreck, trunk visible	
83.	Wreck, dangerous to surface navigation	
84.	Wreck, not considered dangerous to surface navigation	
	MISCELLANEOUS	
85.	Section mark	

Figure 4-4—Continued.

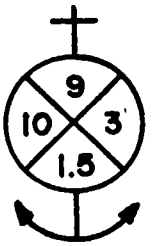
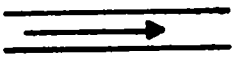
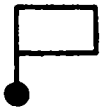
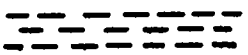
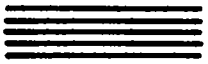
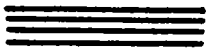
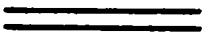
Serial Number	Description	Symbol
	MISCELLANEOUS (Cont'd)	
86.	Extremely variable water level	 (Vertical clearance)
87.	Limit of navigability for vessels with indicated dimensions expressed in meters	(Length)  (Width) (Draft)
88.	Direction of flow	
89.	River port	
90.	River port connected to a railway	
91.	Canal - green	
92.	River - blue	
93.	Improvement	
94.	Planned	

Figure 4–4—Continued.

Serial Number	Description	Symbol
	MISCELLANEOUS (Cont'd)	
95.	*Canal class O	
96.	*Canal class I	
97.	*Canal class II	
98.	*Canal class III	
99.	*Canal class IV	
100.	*Canal class V	

*Canal Class	SHIP DIMENSIONS			
	Tonnage	Length	Width	Maximum Draft
O	300T	-	-	-
I	300T	38.50 m	5.00 m	3.55 m
II	600T	50.00 m	6.60 m	4.20 m
III	1,000T	67.00 m	8.20 m	3.95 m
IV	1,350T	80.00 m	9.50 m	4.40 m
V	2,000T	95.00 m	11.50 m	6.70 m

Figure 4-4—Continued.

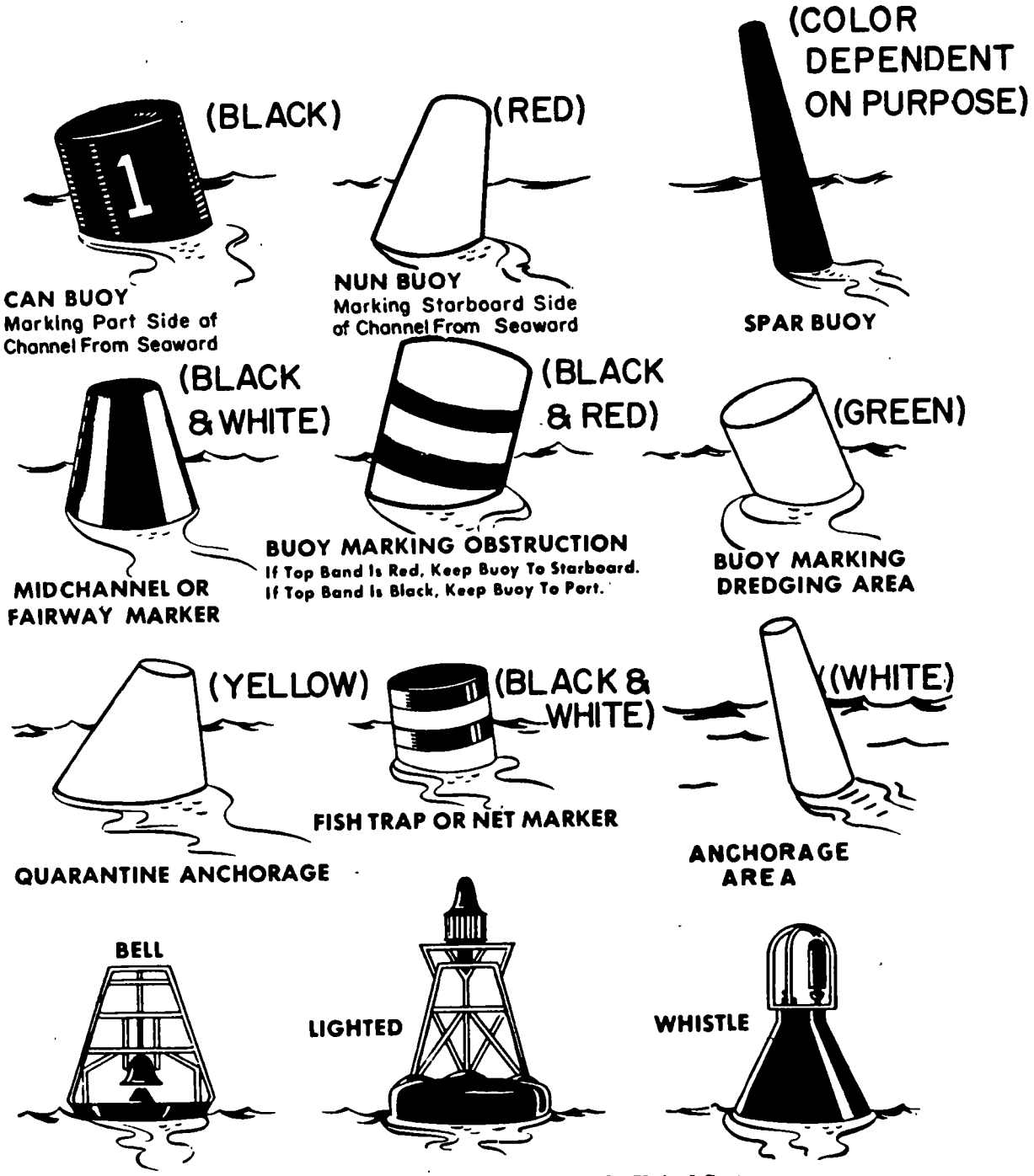


Figure 4–5. Buoyage system of the United States.

Section V. RECONNAISSANCE OF FOOTPATHS AND TRAILS

4–26. General

A *route of communication* generally is a network of roads over which supplies are carried and combat movements are made; however, in counterinsurgency operations, footpaths and trails rather than roads often may be the only reliable land means of reaching otherwise inaccessible points. Therefore, particularly in underdeveloped areas of the world where insurgencies generally occur, forces must be prepared to carry supplies and to conduct combat movements in areas where only footpaths and trails exist.

4–27. Factors Affecting Reconnaissance

Various factors affect reconnaissance of footpaths and trails in an area of operations. Among these factors are the following:

a. Degree of influence of the enemy in the area.

b. Terrain and climatic features within the area of operations.

c. Degree of training and ability of reconnaissance personnel.

d. Ability to support reconnaissance personnel through use of signal communications and aircraft.

4–28. Trail Marks

Trail marks normally are used to assist in land navigation by identifying a location, showing a direction, or indicating a distance. Trail marks, however, may have other uses, such as indicating degree of enemy activity or degree of danger within an area. Trail marking, like route marking, is essentially a form of communication used to convey previously gathered or established information to personnel who are passing through or find themselves at a particular geographic point. Trail marks may be simple or complex, depending upon the degree of permanency desired, the amount of information to be conveyed, and the requirement for secrecy to prevent unauthorized persons from identifying the trail marks and/or correctly interpreting them.

4–29. Methods of Trail Marking

In an operational environment there will likely be standard or accepted trail marks already in use by indigenous personnel of the area. Such trail marks will probably utilize natural land marks and available resources of the area. In general, conventional methods of trail marking include the following:

a. Tree blazing with distance and/or direction being shown by the placement of the blaze mark.

b. Marking the underbrush by breaking branches and/or twigs. Direction and method of breaking may indicate direction and/or distance.

c. Use of sticks, stones, or other indigenous material placed in a particular pattern may convey distance and/or direction.

d. Marked sticks placed in the ground may be used to convey information. The length(s) of the stick(s) and/or cuts on the sticks may indicate various types of information.

e. Items abnormal to the environment, such as strings, rags, paper, etc., may be used to mark a trail.

f. Use of paint to mark trees and other landmarks may be used to convey almost any quantity or type of information.

CHAPTER 5

MARKING OF ROUTES

5–1. Purpose and Responsibility (STANAG 2027, CENTO STANAG 2027, SEASTAG 2027, and SOLOG 62)

The procedures for the posting of military routes with signs have been standardized for the United States and allied nations; furthermore, the system may be integrated into existing civil systems in accordance with military requirements. Signs affecting routes include those specifically posted for the movement of troops and supplies and those designed to inform and to regulate traffic. Preparation and posting of *permanent signs* for route marking and traffic control is an engineer responsibility. Signs are posted as directed in the traffic circulation plan and traffic control plan. Operational responsibility for route signing, however, remains a command function.

5–2. Dimensions

In general, the size of route signs is not prescribed; however, they must be sufficiently large to be easily read under poor lighting conditions. Exceptions to this rule are bridge classification signs (para 2–52) for which dimensions are specific. As a guide, signs for civil international road use are normally not less than 16 inches square (fig. 5–1).

5–3. Types and Application of Signs

Standard route signs are grouped into three general types: hazard signs, regulatory signs, and guide signs. Application of the three general types is listed in table 5–1.

Table 5–1. General Road Signs Applications

Type	Application
Hazard	Advance warning of stop signs and traffic signals.
	Bumps.
	Changes in road width.
	Crossroad.
	Curves.
	Danger or hazard.
	Dangerous corner.
	Dips.
	Junction T.
	Junction Y.
	Level railroad crossing, advance warning.
	Men working.
	Railroad crossing.
	Road construction repairs.
	Road narrows.
	Slippery road.
	Steep grades.
	Steep hill.
	Turns.
Regulatory	No entry.
	One way.
	Parking restrictions.
	Specific regulations for vehicles.
	Speed limit.
	Stop.
	Bridge classification.
Guide	Detour.
	Detour begins.
	Detour ends.
	Directions.
	Distances.
	Information to help driver.
	Locations.
	Route number.

a. Military hazard signs are used to indicate traffic hazards. Employment of these signs in a communications zone normally requires coordination with civil authorities. Hazard signs are square and are installed with one diagonal in a vertical position. A military hazard sign not included in the Geneva Convention or in the system of the host country has a yellow background with the legend or symbol inscribed in black (fig. 5–2). The wording on these signs is in the language or languages determined by the authority erecting the sign. If a *military hazard sign* employs a traffic sign approved by the Geneva Convention or other civil traffic sign designated by the host country, the civil symbol is superimposed on a yellow background (fig. 5–3).

b. Military regulatory signs regulate and control traffic and define the light line. Regulatory signs are rectangular and are posted with the sides vertical (fig. 5–4). Regulatory signs have a black background on which the legend or symbol is superimposed in white; exceptions to this rule

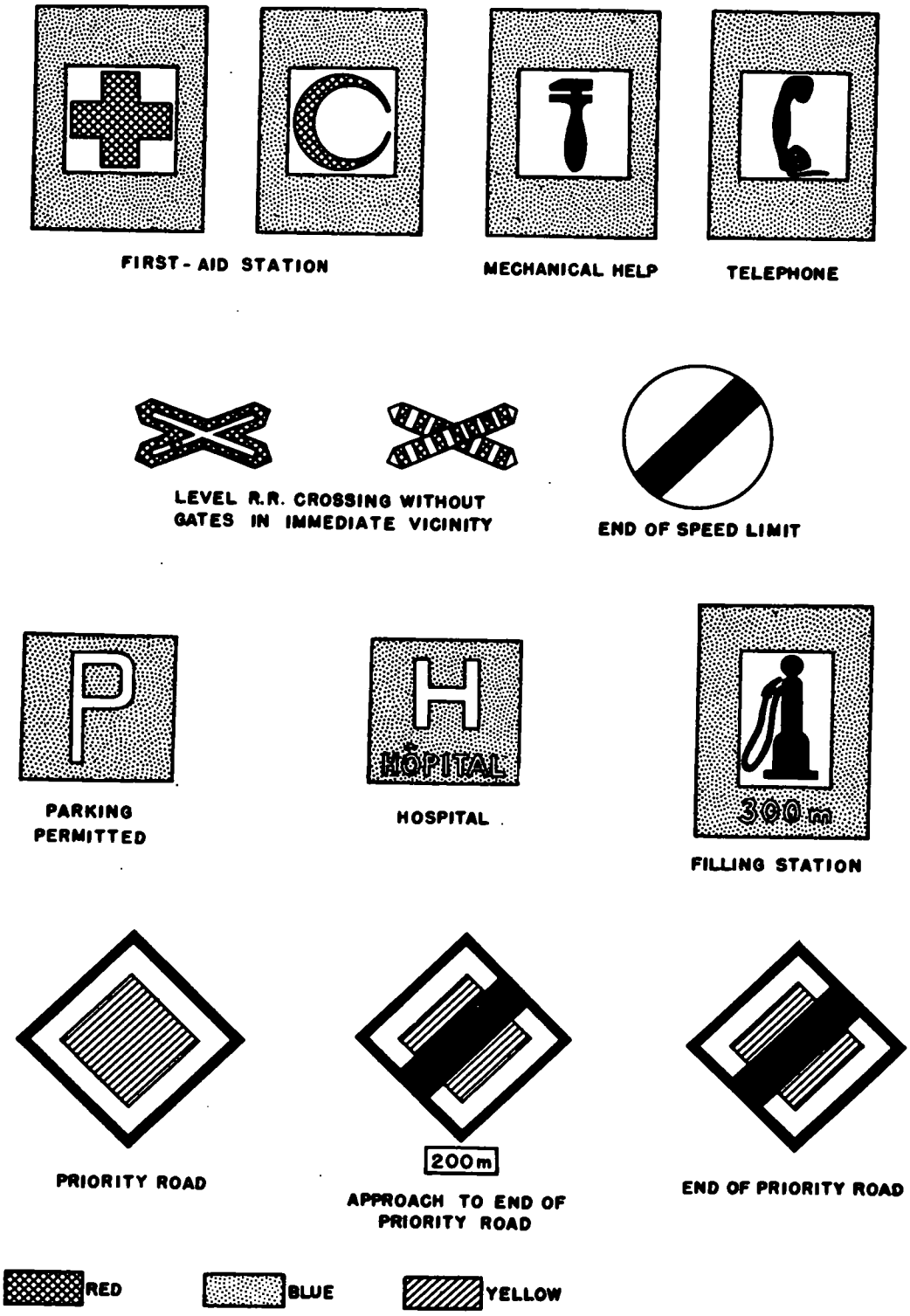


Figure 5–1. Examples of international road signs.

are: bridge classification signs, stop signs, no entry signs, and signs applicable to civil as well as military traffic (para 5–4).

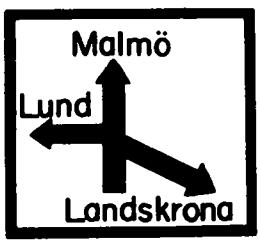
c. Military guide signs indicate direction or location.

5–4. Exception to Standard Military Regulatory Signs

a. Stop Signs. Military stop signs are octagonal (8-sided) and consist of a yellow background with the word, STOP, superimposed in black (fig. 5–5).

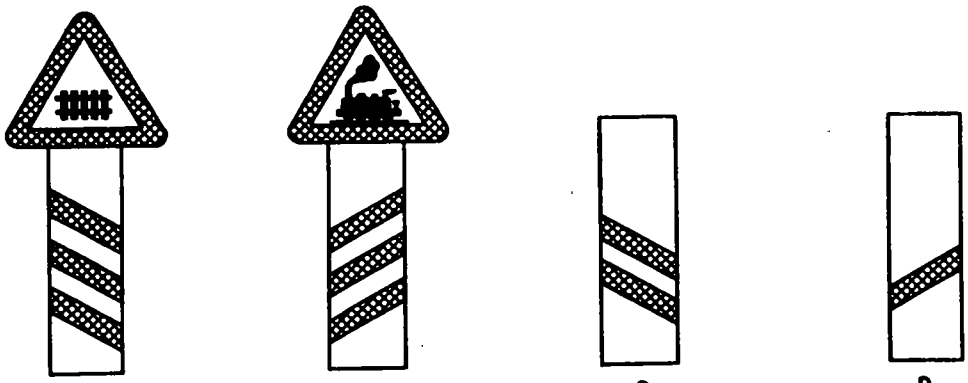
DISTANCE SIGNS

LOCALITY SIGNS



DIRECTION SIGNS

MILESTONE



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 5–1—Continued.

b. No Entry Signs. No entry signs employ the standard Geneva Convention symbol superimposed on a black background (fig. 5–5).

c. Bridge Markings. See paragraph 2–52.

d. Indication of the Light Line. See paragraph 5–13.

e. Application to Civilians. If military forces erect signs which require compliance by civilian traffic, the civil traffic sign system of the local area is used.

5–5. Guide Signs for Military Axial and Lateral Routes

a. Military route guide signs are rectangular and are posted with the long axis vertical (figs.

Figure 5–1—Continued.

5–6 and 5–7). These signs consist of the military route number and the appropriate directional disk. Route guide signs have a black background with white inscriptions.

b. Route guide signs often show the direction of traffic flow. For *axial routes*, differentiation between traffic flow moving toward the FEBA and traffic flow moving away from the FEBA is made by means of a directional disk with barred arrow representing traffic movement toward the rear (fig. 5–6). On route signs of *lateral routes*, the standard direction abbreviations—N, E, S, W, NE, SE, NW, and SW—are used to indicate the general direction of traffic flow (fig. 5–7).

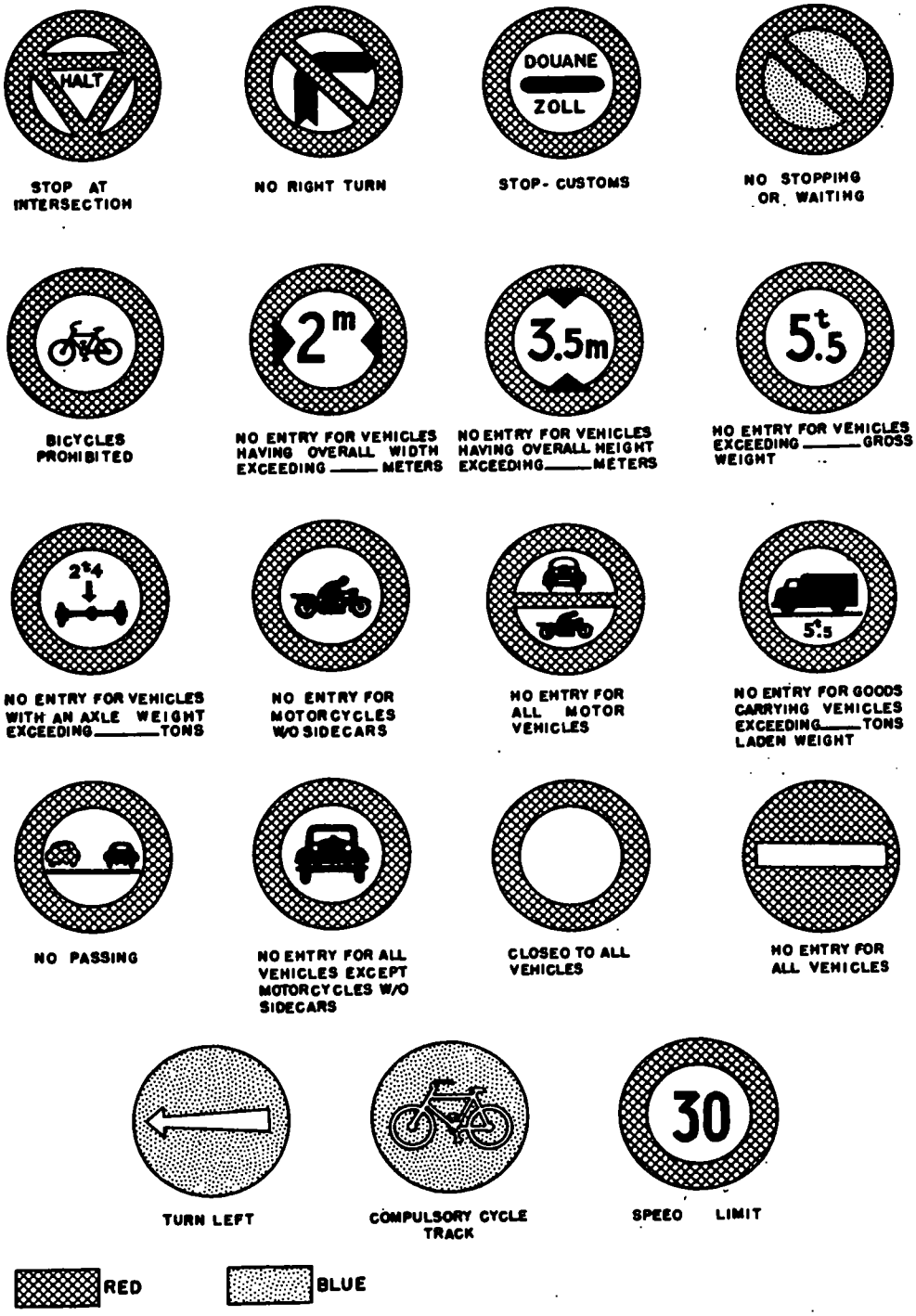


Figure 5–1—Continued.

c. If standard signs are not available, military route guide signs may be fabricated from a directional disk placed over a rectangular panel upon which the route number is inscribed (figs. 5–6 and 5–7).

5–6. Other Guide Signs

In addition to guide signs for military routes, guide signs may be employed for informational purposes. These signs depict such information as location, distance, direction, civilian route numbers, and road destinations and are rectangular with black backgrounds and white inscriptions. This type of sign is posted with the sides vertical and with the long axis in a position which best accommodates the inscription on the sign (fig. 5–8).

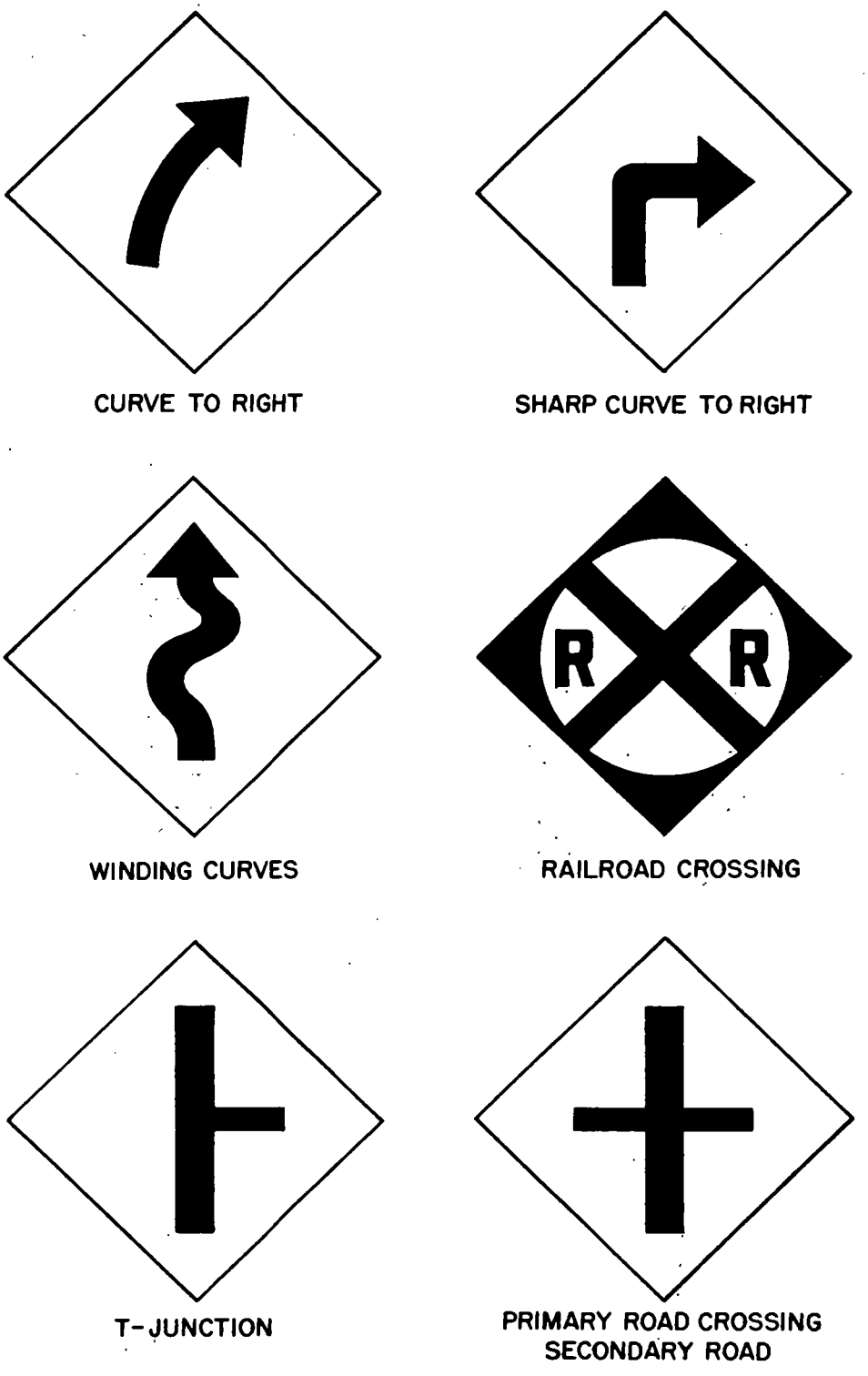


Figure 5–2. Examples of hazard signs not included in the Geneva Convention (yellow background and black symbols or letters).

5–7. Signs for Marking Headquarters and Logistical Installations (STANAG 2035 and SOLOG 64)

Location signs for headquarters and logistical installations are rectangular and posted with the sides vertical. To mark a headquarters or logistical installation, the appropriate military symbol (FM 21–30) is used. The inscription is black superimposed on a yellow background. The basic symbol may be supplemented by national distin-

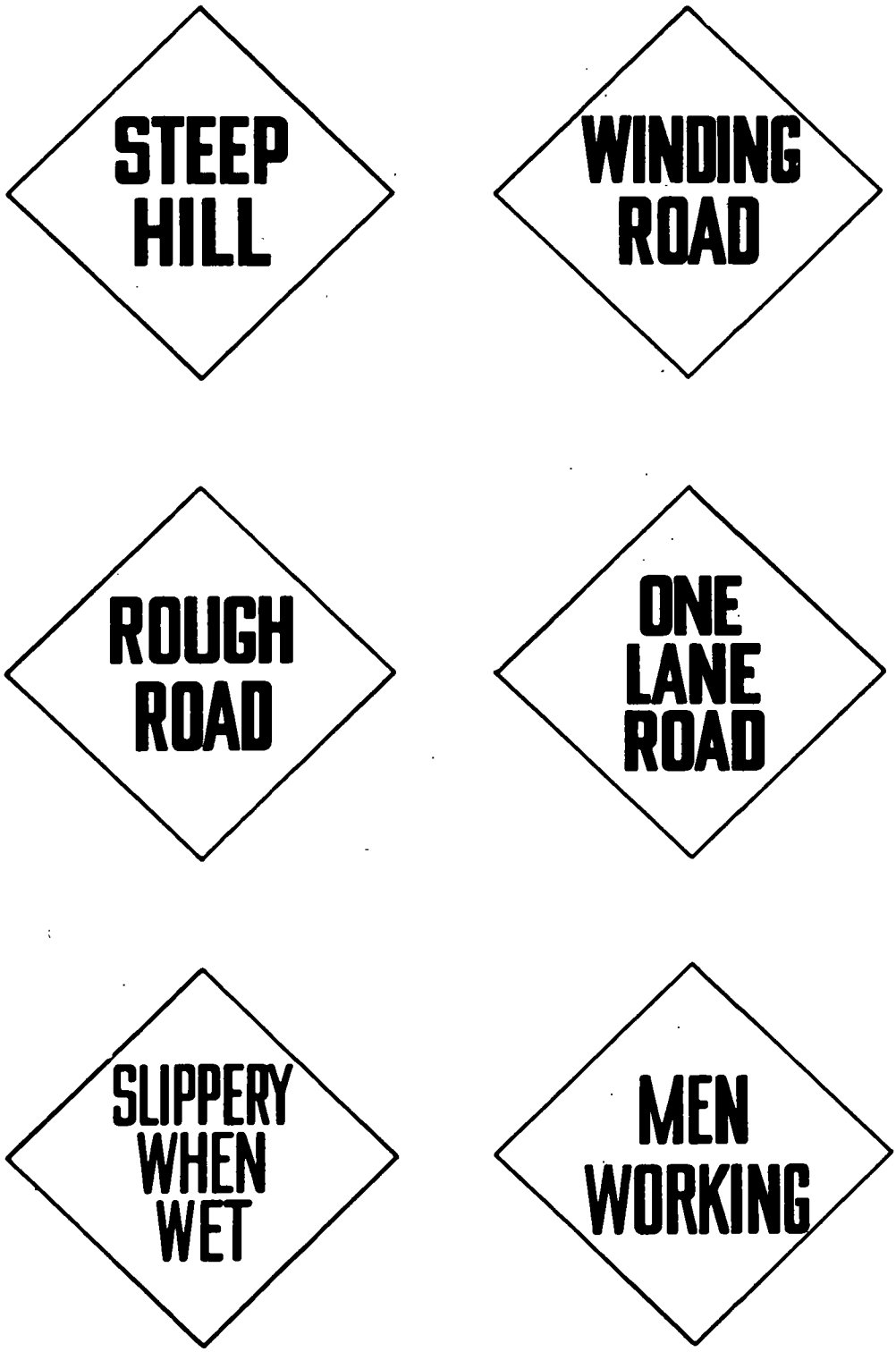


Figure 5–2—Continued.

guishing symbols or abbreviations (AR 310–50). For *division headquarters and above, nationality is always indicated.* Colors other than yellow and black are prohibited except for national distinguishing symbols. When security interests require, headquarters and installation markings may be temporarily covered or removed. Lighting requirements are specified by the local commander.

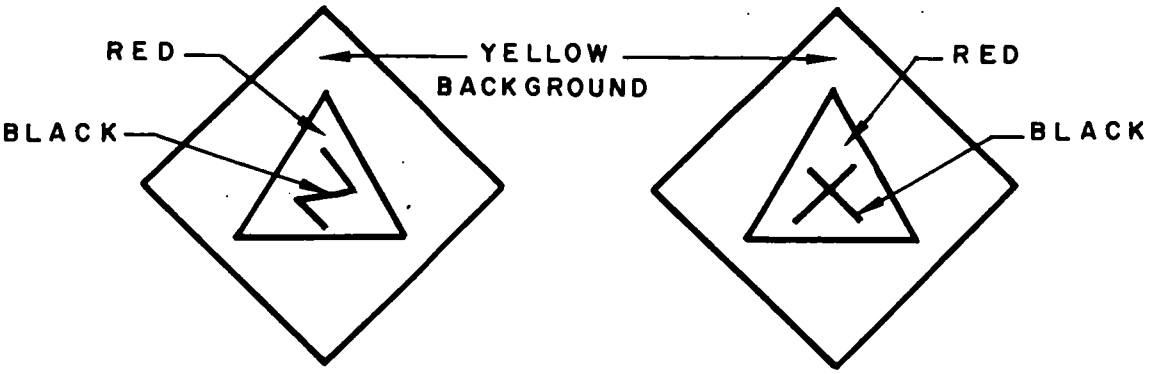


Figure 5–3. Examples of hazard signs included in the Geneva Convention.

5–8. Guide Signs for Casualty Evacuation Routes

a. On a rectangular sign with white background, the following inscriptions *in red* indicate a casualty evacuation route (fig. 5–9).

(1) Directional arrow.

(2) Red cross (red crescent for Turkish Armed Forces).

(3) Unit or subunit designation if required.

(4) Additional information such as unit or national marking if required.

b. An alternate sign may be fabricated from a white disk, four segments of which are cut out to give a cruciform shape. The inscriptions as above are shown in red.

5–9. Directional Disks

a. The directional disk consists of a fixed black arrow, with or without bar, on a white background. Eight equally spaced holes around the edges of the circumference allow the disk to be nailed with the arrow pointing in the desired direction. Disks are no larger than 16 inches in diameter (fig. 5–10).

b. Directional disks are used in conjunction with standard guide signs to indicate military axial and lateral routes (para 5–5). Moreover, directional disks may be used together with unit signs to indicate direction to locations of major units (group and above). Battalions and smaller units are prohibited from utilizing directional disks; however, any arrow sign which provides a different shape and color from the standard directional disk may be employed to indicate unit location.

5–10. Unit Direction Arrow (STANAG 2154 and SEASTAG 2154)

Temporary unit direction arrows may be used to mark routes of march. The unit direction arrow consists of a black inscription superimposed on a white background (fig. 5–11). In addition to the direction arrow, the unit identification symbol (a distinctive mark or number) is included as part of the inscription. Unit route signs are placed a short time in advance of the moving column and are picked up by a trail vehicle.

5–11. Military Detour Signs

Military detour signs consist of a white arrow superimposed on a blue square (fig. 5–12). The sign is placed with one diagonal in a vertical position. The number of the diverted route is shown either by placing it on the square over the arrow or by adding the number under the square by means of a small panel. Detour signs as illustrated in figure 5–8 may also be used.

5–12. Road Markers in Northern Areas

Conditions of heavy snow require special attention in posting road signs. Permanent routes are delineated by durable markers spaced evenly on both sides of the traveled way. In open country, poles of appropriate height with direction markers, snow markers, brushwood, rock cairns, or flags may be employed. Markers should be erected at least one meter off the traveled way to avoid traffic damage. If complete road delineation cannot be accomplished, arrow signs may be erected at prominent points to indicate road direction. Road markers and signs used for long periods in northern areas are checked frequently to insure their positions have not been altered. In areas with prolonged conditions of snow, yellow (international orange) may be substituted for white on all standard military route signs.

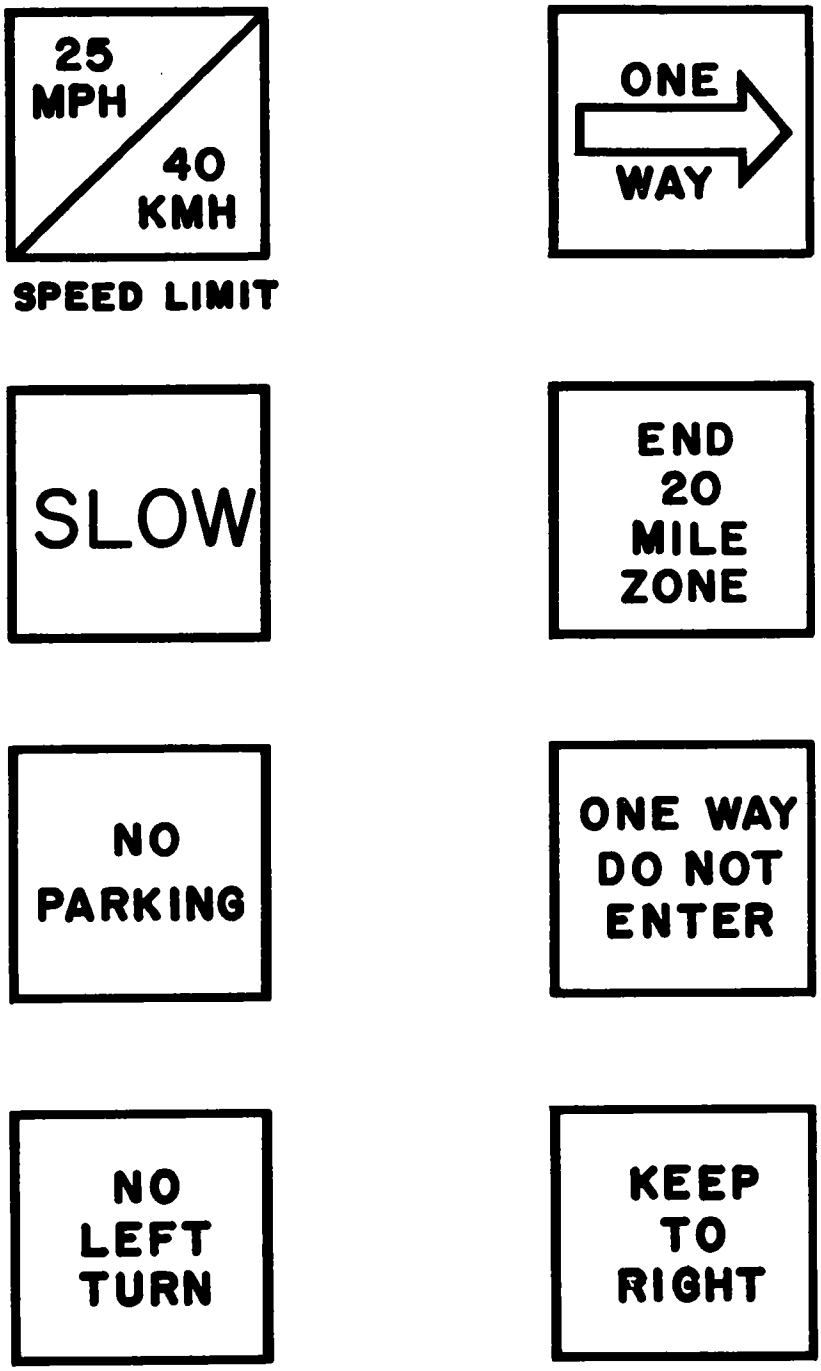


Figure 5–4. Examples of regulatory signs.

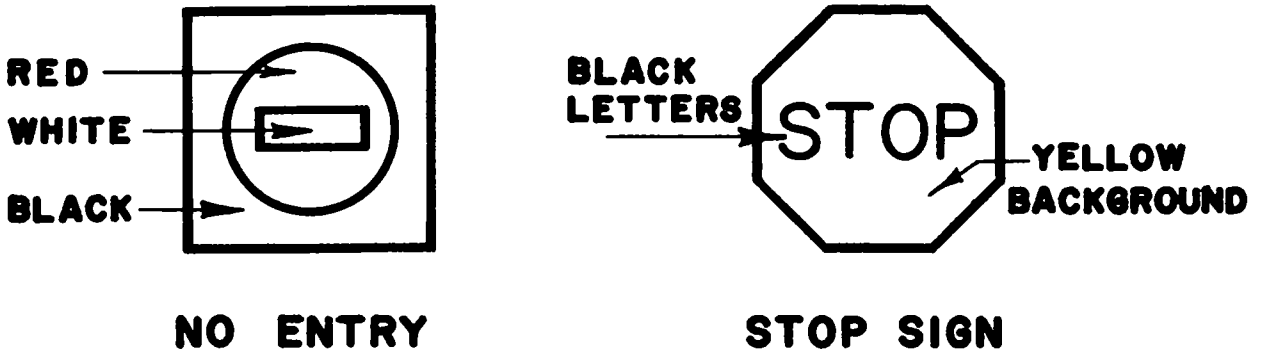


Figure 5–5. Exceptions to standard coloring of regulatory signs.

5–13. Indication of the Light Line (STANAG 2024, SEASTAG 2024, and SOLOG 55)

The light line is a designated line forward of which vehicles are required to use blackout lights at night. The light line is indicated by a rectangular sign which is preceded by two warning panels which are placed in accordance with the situation and the nature of the terrain (fig. 5–13). The first warning panel is preferably located between 500 and 200 meters before the light line.

5–14. Lighting of Military Route Signs (STANAG 2012, SEASTAG 2012, and SOLOG 119)

The appropriate military authority in the area specifies those signs which are to be illuminated with primary consideration being given to hazard and directional signs. Requirements for illuminating signs vary in accordance with the following conditions.

a. Normal Lighting Conditions. Under normal lighting conditions, it is the responsibility of each armed force to insure that standard signs are visible at night and other periods of reduced visibility.

b. Reduced Lighting Conditions. Under reduced lighting conditions, the positioning of the signs and the methods adopted to make them visible (illumination or reflection) must enable personnel to see them from vehicles fitted with reduced lighting or filtering devices.

c. Blackout Conditions. In a blackout zone, sign illumination is as follows:

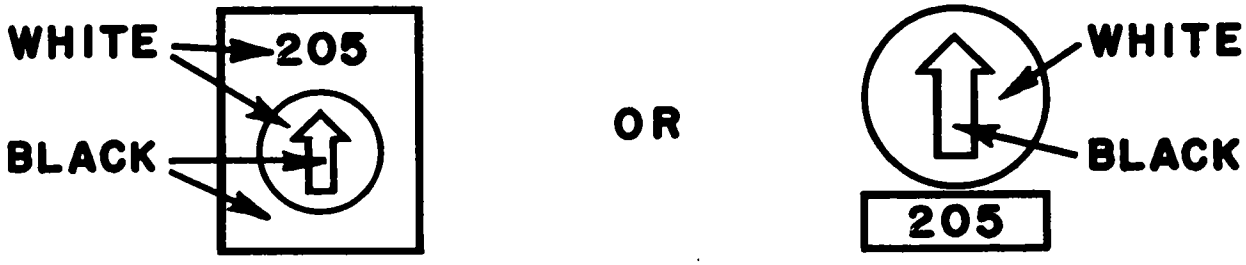
(1) Signs are provided with upper shields which prevent light from being directly observed from the air. Additionally, the light illuminating the sign is of such low intensity that it is not possible to locate the sign from the air at altitudes greater than 150 meters by its reflection off the road surface.

(2) Illumination devices are positioned so as to be recognizable by oncoming vehicles at a road distance of 100 meters and readable at a distance of 80 meters.

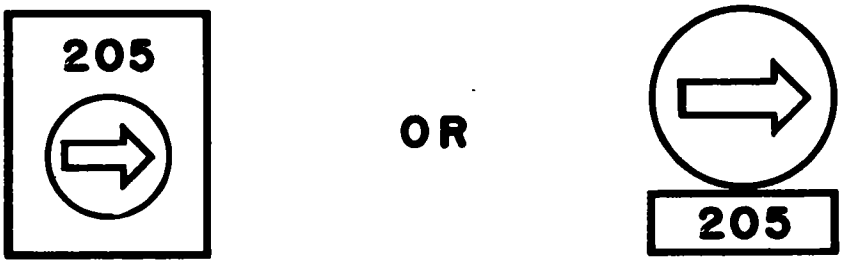
5–15. Specifications for Route Sign Lighting

a. The system of lighting must remain operational for a minimum of 15 hours without refueling or change of batteries. If the source of light is of an expendable type (such as battery, liquid fuel, etc.), quiet and simple replacement must be possible under combat conditions.

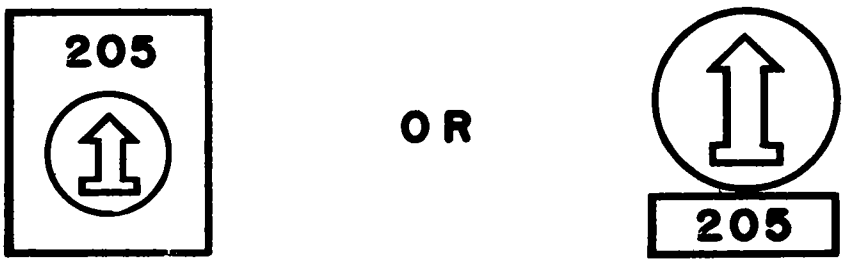
b. When the method of illumination is an independent light source, the equipment must be of light weight, easily stored and transported in small vehicles. Likewise, the system of lighting must be shock, fire, and weather resistant and simple to install and operate.



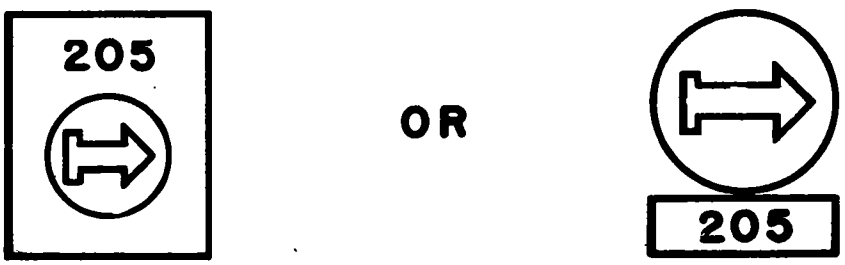
FORWARD TRAFFIC STRAIGHT ON



FORWARD TRAFFIC TURN RIGHT

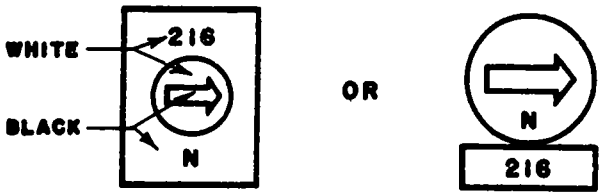


REARWARD TRAFFIC STRAIGHT ON



REARWARD TRAFFIC TURN RIGHT

Figure 5–6. Military route guide signs for axial routes.



NORTH GOING TRAFFIC TURN RIGHT

Figure 5–7. Military route guide signs for lateral routes.

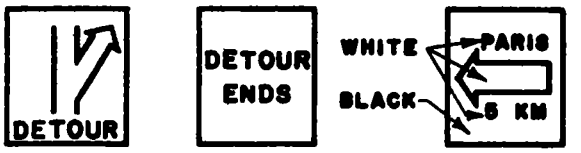
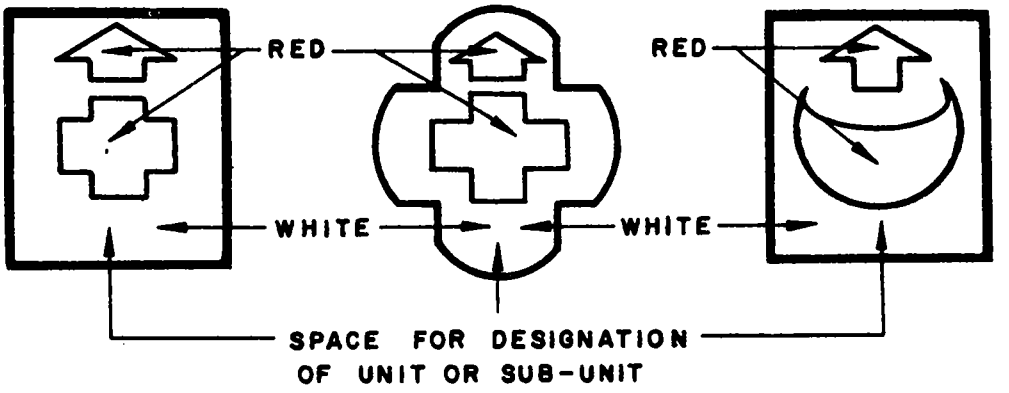


Figure 5–8. Examples of other guide signs.



FOR ALL NATIONS EXCEPT TURKEY

(TRAFFIC STRAIGHT ON)

ALTERNATIVE SIGN MAY BE USED INSTEAD OF

FOR TURKISH MEDICAL UNITS

(TRAFFIC STRAIGHT ON)

Figure 5–9. Examples of guide signs for casualty evacuation routes.

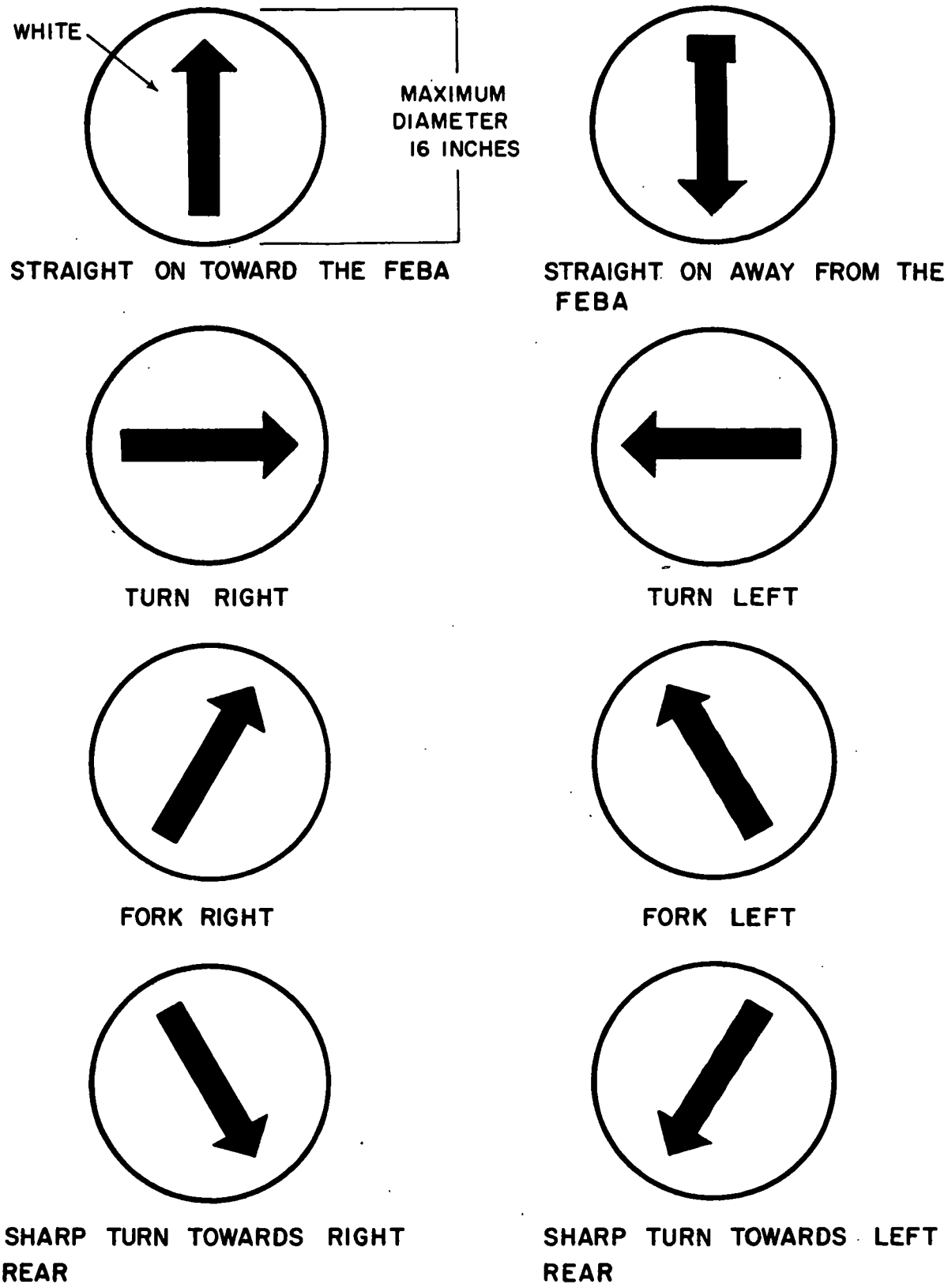


Figure 5–10. Examples of directional disks.

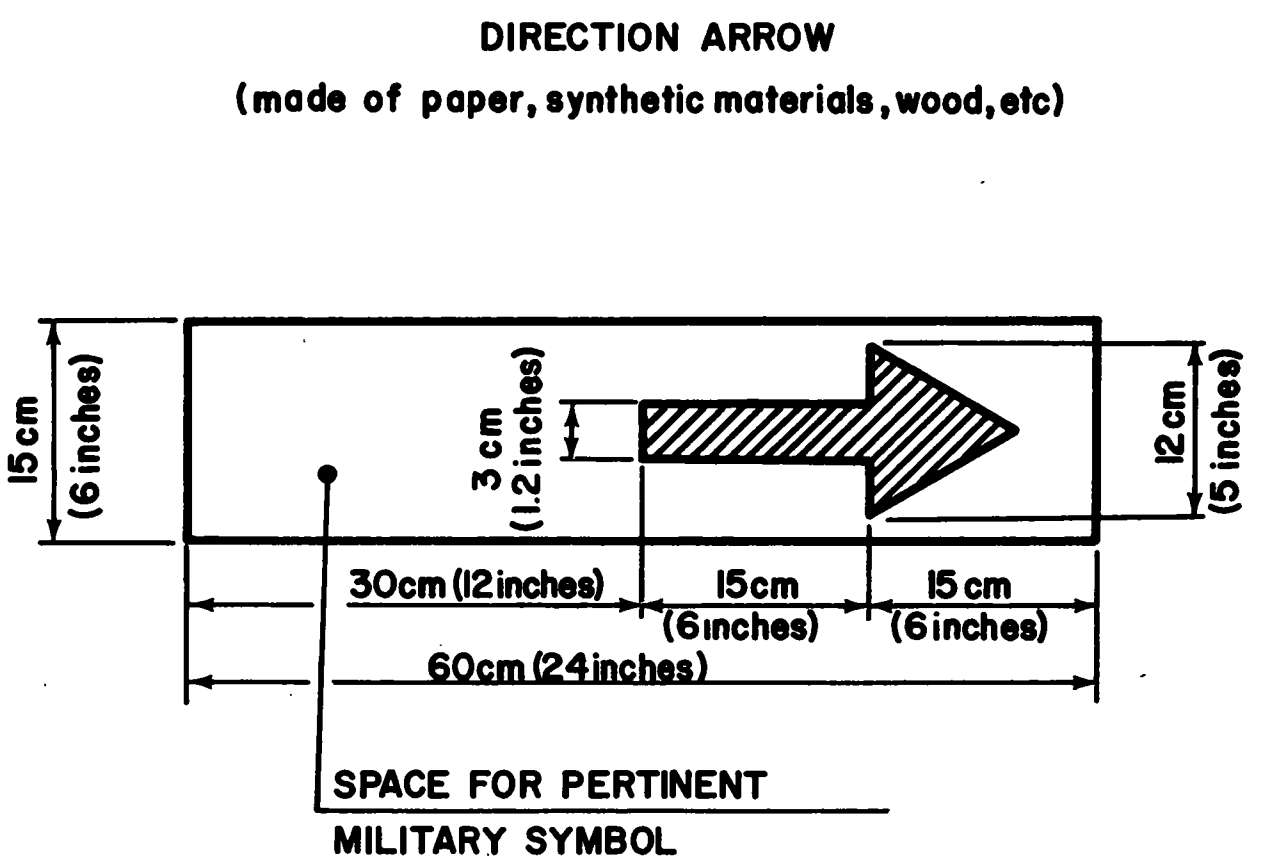
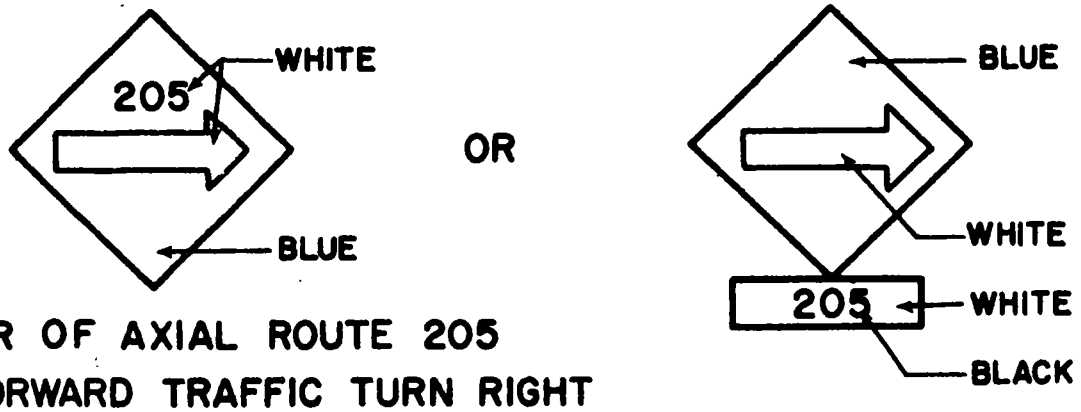
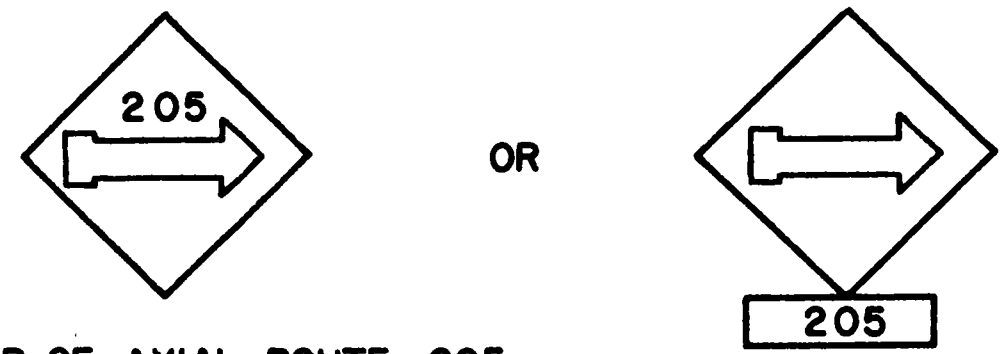


Figure 5–11. Unit direction arrow.



DETOUR OF AXIAL ROUTE 205
FORWARD TRAFFIC TURN RIGHT



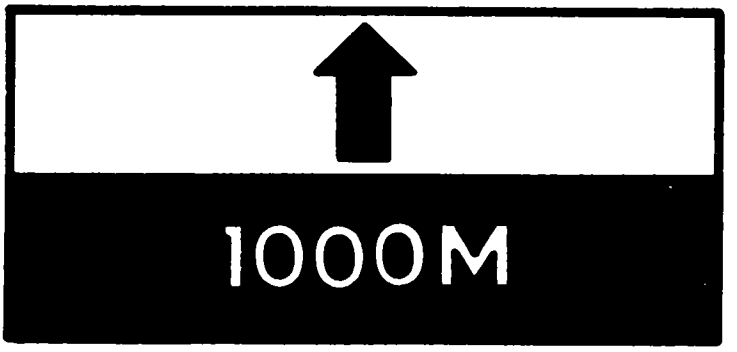
DETOUR OF AXIAL ROUTE 205
REARWARD TRAFFIC TURN RIGHT

Figure 5–12. Examples of detour signs.

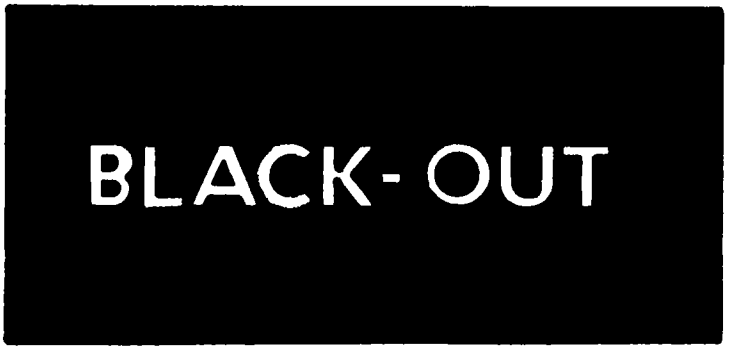
SIZE OF SIGN: 70cm X 60cm

COLORS: WHITE LETTERING ON BLACK BACKGROUND.

A. WARNING SIGN



B. ENFORCEMENT SIGN



APPENDIX A

REFERENCES

A–1. Army Regulations (AR)

117–5	Military Mapping and Geodesy
310–25	Dictionary of United States Army Terms.
310–50	Authorized Abbreviations and Brevity Codes.
746–5	Color and Marking of Army Materiel.

A–2. Field Manuals (FM)

1–80	Aerial Observer Techniques and Procedures.
1–100	Army Aviation Utilization.
5–1	Engineer Troop Organizations and Operations.
5–25	Explosives and Demolitions.
5–30	Engineer Intelligence.
5–34	Engineer Field Data.
5–35	Engineers' Reference and Logistical Data.
19–25	Military Police Traffic Control.
21–26	Map Reading.
21–30	Military Symbols.
21–31	Topographic Symbols.
21–60	Visual Signals.
30–5	Combat Intelligence.
30–10	Terrain Intelligence.
30–20	Aerial Surveillance-Reconnaissance, Field Army.
55–8	Transportation Intelligence.
55–15	Transportation Reference Data.
55–30	Army Motor Transport Operations.
101–10–1	Staff Officers' Field Manual; Organizational, Technical and Logistical Data, Unclassified Data.

A–3. Technical Manuals (TM)

5–210	Military Floating Bridge Equipment.
5–216	Armored Vehicle Launched Bridge.
5–232	Elements of Surveying.
5–312	Military Fixed Bridges.
5–330	Planning and Design of Roads, Airbases, and Heliports in the Theater of Operations.
5–530	Materials Testing.
5–700	Field Water Supply.

A–4. Other DA Publications

DA Pam 310–1	Index of Administrative Publications.
DA Pam 310–2	Index of Blank Forms.
DA Pam 310–3	Index of Doctrinal, Training, and Organizational Publications.
DA Pam 310–4	Index of Technical Manuals, Technical Bulletins, Supply Manuals, Supply Bulletins, and Lubrication Orders.
GTA 5–7–7	Bridge Classification Card.
GTA 19–5	Route Signs—Classification, Application, and Design.

A–5. International Standardization Agreements

NATO STANAG	CENTO STANAG	SEATO SEASTAG	ABCA SOLOG	
2010		2010	24	Bridge Classification Markings.
2012		2012	119	Military Route Signing.
2015	2015		53	Route Classification.
2019	2019	2019	28	Military Symbols.
2021		2021	45R	Computation of Bridge, Raft, and Vehicle Classifications.
2024		2025	55	Military Road Traffic Lighting Regulations.
2027	2027	2027	62	Marking of Military Vehicles.
2029	2029	2029	34R	Method of Describing Ground Locations, Areas, and Boundaries.
2035	2035		64	Marking of Headquarters and Dumps.
2096		2096	107	Reporting Engineer Information in the Field.
2151	2151			Route Network—Definition and Characteristics.
2154	2154	2154		Definitions and Regulations for Military Motor Movements by Road.
2163		2163	114	Vehicle Weight and Dimension Card.
2253			96	MGD—Roads and Road Structures.
2254			97	MGD—Navigable Inland Waterways.
2255			98	MGD—Sea and River Ports.
2259			100	MGD—Terrain.
2269			103	MGD—Engineer Resources.
			105	Military Load Classification of Civil Bridges by Reconnaissance and Correlation.

APPENDIX B

CONVERSION TABLES, TRIGONOMETRIC RELATIONS, AND NUMERICAL FUNCTIONS

B–1. Conversion Tables

a. Meters to Feet; Feet to Meters.

(1 Meter = 3.2808 Feet; 1 Foot = 0.3048 Meter)

Meters	Feet or Meters	Feet
0.3048	1	3.2808
0.6096	2	6.5616
0.9144	3	9.8424
1.2192	4	13.1232
1.5240	5	16.4040
1.8288	6	19.6848
2.1336	7	22.9656
2.4384	8	26.2464
2.7432	9	29.5272
3.0480	10	32.8080
3.3528	11	36.0888
3.6576	12	39.3696
3.9624	13	42.6504
4.2672	14	45.9312
4.5720	15	49.2120
4.8768	16	52.4928
5.1816	17	55.7736
5.4864	18	59.0544
5.7912	19	62.3352
6.0960	20	65.6160
6.4008	21	68.8968
6.7056	22	72.1776
7.0104	23	75.4584
7.3152	24	78.7392
7.6200	25	82.0200
7.9248	26	85.3018
8.2296	27	88.5816
8.5344	28	91.8624
8.8392	29	95.1432
9.1440	30	98.4240
9.4488	31	101.7048
9.7536	32	104.9856
10.0584	33	108.2664
10.3632	34	111.5472
10.6680	35	114.8280
10.9728	36	118.1088
11.2776	37	121.3896
11.5824	38	124.6704
11.8872	39	127.9512
12.1920	40	131.2320
12.4968	41	134.5128
12.8016	42	137.7936
13.1064	43	141.0744
13.4112	44	144.3552
13.7160	45	147.6360
14.0208	46	150.9168

(1 Meter = 3.2808 Feet; 1 Foot = 0.3048 Meter)

Meters	Feet or Meters	Feet
14.3256	47	154.1976
14.6304	48	157.4784
14.9352	49	160.7592
15.2400	50	164.0400
15.5448	51	167.3208
15.8496	52	170.6016
16.1544	53	173.8824
16.4592	54	177.1632
16.7640	55	180.4440
17.0688	56	183.7248
17.3736	57	187.0056
17.6784	58	190.2864
17.9832	59	193.5672
18.2880	60	196.8480
18.5928	61	200.1288
18.8976	62	203.4096
19.2024	63	206.6904
19.5072	64	209.9712
19.8120	65	213.2520
20.1168	66	216.5328
20.4216	67	219.8136
20.7264	68	223.0944
21.0312	69	226.3752
21.3360	70	229.6560
21.6408	71	232.9868
21.9456	72	236.2176
22.2504	73	239.4984
22.5552	74	242.7792
22.8600	75	246.0600
23.1648	76	249.3408
23.4696	77	252.6216
23.7744	78	255.9024
24.0792	79	259.1832
24.3840	80	262.4640
24.6888	81	265.7448
24.9936	82	269.0256
25.2984	83	272.3064
25.6032	84	275.5872
25.9080	85	278.8680
26.2128	86	282.1488
26.5176	87	285.4296
26.8224	88	288.7104
27.1272	89	291.9912
27.4320	90	295.2720
27.7268	91	298.5528
28.0416	92	301.8336

(1 Meter = 3.2808 Feet; 1 Foot = 0.3048 Meter)		
Meters	Feet or Meters	Feet
28.3464	93	305.1144
28.6512	94	308.3952
28.9560	95	311.6760
29.2608	96	314.9568

(1 Meter = 3.2808 Feet; 1 Foot = 0.3048 Meter)		
Meters	Feet or Meters	Feet
29.5656	97	318.2376
29.8704	98	321.5184
30.1752	99	324.7992
30.4800	100	328.0800

b. Millimeters and Equivalent Decimals of Inches.

ADVANCING BY 1 MM							
MM	Inches	MM	Inches	MM	Inches	MM	Inches
1	.03937	26	1.02362	51	2.00787	76	2.99212
2	.07874	27	1.06299	52	2.04724	77	3.03149
3	.11811	28	1.10236	53	2.08661	78	3.07086
4	.15748	29	1.14173	54	2.12598	79	3.11023
5	.19685	30	1.18110	55	2.16535	80	3.14960
6	.23622	31	1.22047	56	2.20472	81	3.18897
7	.27559	32	1.25984	57	2.24409	82	3.22834
8	.31496	33	1.29921	58	2.28346	83	3.26771
9	.35433	34	1.33858	59	2.32283	84	3.30708
10	.39370	35	1.37795	60	2.36220	85	3.34645
11	.43307	36	1.41732	61	2.40157	86	3.38582
12	.47244	37	1.45669	62	2.44094	87	3.42519
13	.51181	38	1.49606	63	2.48031	88	3.46456
14	.55118	39	1.53543	64	2.51968	89	3.50393
15	.59055	40	1.57480	65	2.55905	90	3.54330
16	.62992	41	1.61417	66	2.59842	91	3.58267
17	.66929	42	1.65354	67	2.63779	92	3.62204
18	.70866	43	1.69291	68	2.67716	93	3.66141
19	.74803	44	1.73228	69	2.71653	94	3.70078
20	.78740	45	1.77165	70	2.75590	95	3.74015
21	.82677	46	1.81102	71	2.79527	96	3.77952
22	.86614	47	1.85039	72	2.83464	97	3.81889
23	.90551	48	1.88976	73	2.87401	98	3.85826
24	.94488	49	1.92913	74	2.91338	99	3.89673
25	.98425	50	1.96850	75	2.95275	100	3.93700

c. Time Distance Conversion.

Miles per hour	Knots	Feet per second	Kilometers per hour	Meters per second
1	0.8684	1.4667	1.6094	0.447
2	1.74	2.93	3.22	0.894
3	2.60	4.40	4.83	1.34
4	3.47	5.87	6.44	1.79
5	4.34	7.33	8.05	2.24
6	5.20	8.80	9.66	2.68
7	6.07	10.27	11.27	3.13
8	6.95	11.73	12.88	3.58
9	7.81	13.20	14.48	4.02
10	8.68	14.67	16.09	4.47
11	9.55	16.13	17.70	4.92
12	10.42	17.60	19.31	5.36
13	11.29	19.07	20.92	5.81
14	12.15	20.53	22.53	6.26
15	13.02	22.00	24.14	6.71
16	13.89	23.47	25.75	7.15
17	14.76	24.93	27.36	7.60
18	15.63	26.40	28.97	8.05
19	16.50	27.87	30.58	8.49
20	17.37	29.33	32.19	8.94

Miles per hour	Knots	Feet per second	Kilometers per hour	Meters per second
21	18.24	30.80	33.80	9.39
22	19.10	32.27	35.41	9.83
23	19.97	33.73	37.02	10.28
24	20.84	35.20	38.63	10.73
25	21.71	36.67	40.24	11.18
26	22.57	38.13	41.84	11.62
27	23.44	39.60	43.45	12.07
28	24.32	41.07	45.06	12.51
29	25.18	42.53	46.67	12.96
30	26.05	44.00	48.28	13.41
31	26.92	45.47	49.89	13.86
32	27.79	46.93	51.50	14.30
33	28.66	48.40	53.11	14.75
34	29.52	49.87	54.72	15.20
35	30.39	51.33	56.33	15.65
36	31.26	52.80	57.94	16.09
37	32.13	54.27	59.55	16.54
38	33.00	55.73	61.16	16.99
39	33.87	57.20	62.77	17.43
40	34.73	58.67	64.38	17.88

Miles per hour	Knots	Feet per second	Kilometers per hour	Meters per second
41	35.60	60.13	65.98	18.33
42	36.47	61.60	67.59	18.77
43	37.34	63.07	69.20	19.22
44	38.21	64.53	70.81	19.67
45	39.08	66.00	72.42	20.12
46	39.95	67.47	74.03	20.56
47	40.81	68.93	75.64	21.00
48	41.68	70.40	77.25	21.45
49	42.55	71.87	78.86	21.90
50	43.42	73.33	80.47	22.35
51	44.28	74.80	82.08	22.80
52	45.16	76.27	83.69	23.24
53	46.02	77.73	85.30	23.70
54	46.89	79.20	86.91	24.14
55	47.76	80.67	88.52	24.59
56	48.63	82.13	90.13	25.03
57	49.50	83.60	91.74	25.48
58	50.37	85.07	93.35	25.93
59	51.23	86.53	94.95	26.37
60	52.10	88.00	96.56	26.82
61	52.97	89.47	98.17	27.27
62	53.84	90.94	99.78	27.71
63	54.70	92.40	101.39	28.16
64	55.58	93.87	103.00	28.61
65	56.45	95.34	104.61	29.06
66	57.31	96.80	106.22	29.50
67	58.18	98.27	107.83	29.95
68	59.05	99.74	109.44	30.40
69	59.92	101.20	111.05	30.84
70	60.78	102.67	112.66	31.29
71	61.65	104.14	114.27	31.74
72	62.52	105.60	115.88	32.18
73	63.39	107.07	117.49	32.63
74	64.26	108.54	119.10	33.08
75	65.13	110.00	120.71	33.53
100	86.84	146.67	160.94	44.70

B–2. Conversion Factors

a. Linear Measure.

Meters*	Inches	Feet	Yards	Miles		Kilometers	Fathoms
				Statute	Nautical**		
1.0	39.37	3.28083	1.09361	0.0006214	0.0005396	0.001	0.546
.0254	1.0	.0833	.0278	.00001578	.00001371	.0000254	.0139
.3048	12.0	1.0	.3333	.0001894	.0001645	.0003048	.167
.9144	36.0	3.0	1.0	.0005682	.0004934	.0009144	.500
5.0292	198.0	16.5	5.5	.003125	.002714	.005029	2.76
20.1168	792.0	66.0	22.0	.0125	.01085	.02012	11.0
1,609.35	63,360.0	5,280.0	1,760.0	1.0	.8684	1.6094	879.0
1,853.25	72,962.5	6,080.2	2,026.73	1.15155	1.0	1.85325	1,010.0
1,000.0	39,370.0	3,280.83	1,093.61	.6214	.5396	1.0	546.0
219.5	8,640.0	720.0	240.0	.1364	.1184	.2195	120.0
1.829	72.0	6.0	2.0	.00114	.00098	.00183	1.0

*1 meter = 10 decimeters = 100 centimeters = 1,000 millimeters.
**A nautical mile is the length on the earth's surface of an arc subtended by one minute of angle at the center of the earth.

b. Surface Measure.

Square meters	Square inches	Square feet	Square yards	Square rods	Square miles (statute)	Square kilometers
1.0	1,550.0	10.764	1.196	0.03954	0.000000386	0.000001
.00065	1.0	.0069	.00077	.00000026	.00000000025	.00000000065
.0929	144.0	1.0	.1111	.00367	.0000000359	.0000000929
.8361	1,296.0	9.0	1.0	.0331	.000000323	.000000836
25.293	39,204.0	272.25	30.25	1.0	.00000977	.0000253
4,046.8	6,272,640.0	43,560.0	4,840.0	160.0	.00156	.00405
10,000.0	15,499,969.0	107,639.0	11,960.0	395.37	.00386	.01
2,589,999.0	Sq ft × 144	27,878,400.0	3,097,600.0	102,400.0	1.0	2.59
1,000,000.0	Sq ft × 144	10,763,867.0	1,195,985.0	39,537.0	.3861	1.0

c. Cubic Measure.

Cubic centimeters	Cubic inches	Cubic feet	Cubic yards	U.S. gallons		Measurement tons
				Liquid	Dry	
1.0	0.061	0.0000353	0.0000013	0.000264	0.000227	0.00000088
1,000.0	61.023	.0353	.00131	.2642	.227	.000882
16.39	1.0	.0005787	.0000214	.00433	.00372	.0000144
28,317.0	1,728.0	1.0	.03704	7.481	6.4285	.025
764,559.0	46,656.0	27.0	1.0	201.974	173.57	.677
946.4	57.75	.03342	.00124	.25	.2148	.000837
1,101.2	67.201	.03889	.00144	.2909	.25	.000975
3,785.4	231.0	.13368	.00495	1.0	.8594	.00335
4,404.9	268.803	.15556	.00576	1.1636	1.0	.00388
35,239.3	2,150.42	1.2445	.0461	9.3092	8.0	.0312
1,130,000.0	69,120.0	40.0	1.48	298.0	256.0	1.0

d. Angular Conversions.

Circle	Degrees	Minutes	Seconds	Mils
1.0	360.0	21,600.0	1,296,000	6,400.0
.16	57.3	3,430.0	206,000	1,018.6
.00279	1.0	60.0	3,600	17.778
.0000463	.0167	1.0	60	.297
.00000078	.00028	.0167	1	.00495
.000157	.05625	3.375	202	1.0
.25	90.0	5,400.0	324,000	1,600.0
.50	180.0	10,800.0	648,000	3,200.0

e. Weight.

Kilograms (kg)	Pounds		Tons		
	Troy	Avoirdupois (svdp)	Short (2,000 lb)	Long (2,240 lb)	Metric (1,000 kg)
1.0	2.67923	2.20462	0.001102	0.0009842	0.001
.0000648	.0001736	.0001429	.00000007	.00000006	.00000006
.0311	.08333	.06857	.00003429	.00003061	.0000311
.02385	.07595	.0625	.00003125	.0000279	.00002835
.37324	1.0	.82286	.0004114	.0003674	.0003732
.45359	1.21528	1.0	.0005	.0004464	.004536
907.185	2,430.56	2,000.0	1.0	.89286	.90719
1,016.05	2,722.22	2,240.0	1.12	1.0	1.01605
1,000.0	2,679.23	2,204.62	1.10232	.98421	1.0

f. Speed.

Meters per second	Meters per minute	Feet per second	Feet per minute	Miles per hour	Knots	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

g. Temperature.

°F.	°C.	°F.	°C.	°F.	°C.	°F.	°C.	°F.	°C.	°F.	°C.
−66	−54.4	−33	−36.1	0	−17.8	33	0.6	66	18.9	99	37.2
−65	−53.9	−32	−35.6	1	−17.2	34	1.1	67	19.4	100	37.8
−64	−53.3	−31	−35.0	2	−16.7	35	1.7	68	20.0	101	38.3
−63	−52.7	−30	−34.4	3	−16.1	36	2.2	69	20.6	102	38.9
−62	−52.2	−29	−33.9	4	−15.6	37	2.8	70	21.1	103	39.4
−61	−51.6	−28	−33.3	5	−15.0	38	3.3	71	21.7	104	40.0
−60	−51.1	−27	−32.8	6	−14.4	39	3.9	72	22.2	105	40.6
−59	−50.6	−26	−32.2	7	−13.9	40	4.4	73	22.8	106	41.1
−58	−50.0	−25	−31.7	8	−13.3	41	5.0	74	23.3	107	41.6
−57	−49.4	−24	−31.1	9	−12.8	42	5.6	75	23.9	108	42.2
−56	−48.9	−23	−30.6	10	−12.2	43	6.1	76	24.4	109	42.7
−55	−48.3	−22	−30.0	11	−11.7	44	6.7	77	25.0	110	43.3
−54	−47.8	−21	−29.4	12	−11.1	45	7.2	78	25.6	111	43.9
−53	−47.2	−20	−28.9	13	−10.6	46	7.8	79	26.1	112	44.4
−52	−46.6	−19	−28.3	14	−10.0	47	8.3	80	26.7	113	45.0
−51	−46.1	−18	−27.8	15	− 9.4	48	8.9	81	27.2	114	45.6
−50	−45.6	−17	−27.2	16	− 8.9	49	9.4	82	27.8	115	46.1
−49	−45.0	−16	−26.7	17	− 8.3	50	10.0	83	28.3	116	46.6
−48	−44.4	−15	−26.1	18	− 7.8	51	10.6	84	28.9	117	47.2
−47	−43.9	−14	−25.6	19	− 7.2	52	11.1	85	29.4	118	47.8
−46	−43.3	−13	−25.0	20	− 6.7	53	11.7	86	30.0	119	48.3
−45	−42.8	−12	−24.4	21	− 6.1	54	12.2	87	30.6	120	48.9
−44	−42.2	−11	−23.9	22	− 5.6	55	12.8	88	31.1	121	49.4
−43	−41.6	−10	−23.3	23	− 5.0	56	13.3	89	31.7	122	50.0
−42	−41.1	− 9	−22.8	24	− 4.4	57	13.9	90	32.2	123	50.6
−41	−40.6	− 8	−22.2	25	− 3.9	58	14.4	91	32.8	124	51.1
−40	−40.0	− 7	−21.7	26	− 3.3	59	15.0	92	33.3	125	51.7
−39	−39.4	− 6	−21.1	27	− 2.8	60	15.6	93	33.9	126	52.2
−38	−38.9	− 5	−20.6	28	− 2.2	61	16.1	94	34.4	127	52.7
−37	−38.3	− 4	−20.0	29	− 1.7	62	16.7	95	35.0	128	53.3
−36	−37.8	− 3	−19.5	30	− 1.1	63	17.2	96	35.6	129	53.9
−35	−37.2	− 2	−18.9	31	− 0.6	64	17.8	97	36.1	130	54.4
−34	−36.7	− 1	−18.3	32	0	65	18.3	98	36.7		

h. Simplified Conversion Factors for Quick Computation. The following are 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.

$°C. = \frac{5}{9}(°F. - 32)$

$°F. = \frac{9}{5}(°C. + 32)$

B–3. Map-Distance Conversion

a. Table.

Map distance	Ground distance	Representative fraction (RF) 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
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	32,803
	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.

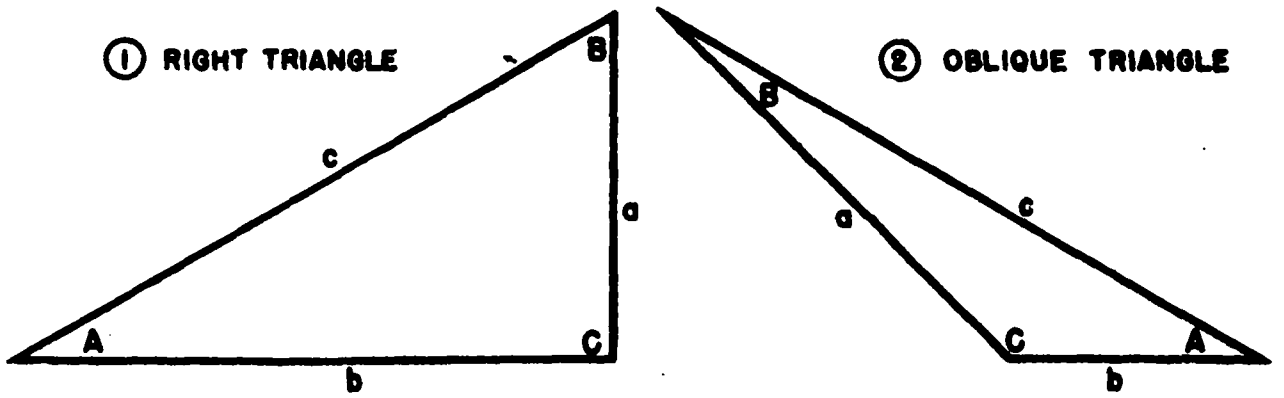
(1) A map distance of 1 inch is equivalent to a ground distance of 4,167 feet on a map with RF of 1/50,000.

(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.

B–4. Trigonometric Functions

a. Trigonometric Relations.



$$\text{Sin } A = \frac{a}{c} \qquad \text{Cos } A = \frac{b}{c}$$

$$\text{Tan } A = \frac{a}{b} \qquad \text{Cot } A = \frac{b}{a}$$

$$\text{Sec } A = \frac{c}{b} \qquad \text{Csc } A = \frac{c}{a}$$

$$\text{Area} = \frac{ab}{2} = \frac{a}{2}\sqrt{c^2 - a^2} = \frac{a^2 \text{ Cot } A}{2} = \frac{b^2 \text{ Tan } A}{2} = \frac{c^2 \text{ Sin } 2A}{4}$$

$$a^2 = b^2 + c^2 - 2bc \text{ Cos } A$$

$$b^2 = a^2 + c^2 - 2ac \text{ Cos } B$$

$$c^2 = a^2 + b^2 - 2ab \text{ Cos } C$$

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$

Where

$$s = \frac{a+b+c}{2}$$

Figure B–1.

b. 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	2.094	1.058	.946	71
20	.342	2.924	.364	2.747	1.064	.940	70
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
	Cos	Sec	Cotan	Tan	Cosec	Sin	

B–5. Functions of Numbers

No.	Square	Cube	Sq. root	Logarithm
1	1	1	1.0000	0.00000
2	4	8	1.4142	.30103
3	9	27	1.7321	.47712
4	16	64	2.0000	.60206
5	25	125	2.2361	.69897
6	36	216	2.4495	.77815
7	49	343	2.6458	.84510
8	64	512	2.8284	.90309
9	81	729	3.0000	.95424
10	100	1000	3.1623	1.00000
11	121	1331	3.3166	1.04139
12	144	1728	3.4641	1.07918
13	169	2197	3.6056	1.11394
14	196	2744	3.7417	1.14613
15	225	3375	3.8730	1.17609
16	256	4096	4.0000	1.20412
17	289	4913	4.1231	1.23045
18	324	5832	4.2426	1.25527
19	361	6859	4.3589	1.27875
20	400	8000	4.4721	1.30103
21	441	9261	4.5826	1.32222
22	484	10648	4.6904	1.34242
23	529	12167	4.7958	1.36173
24	576	13824	4.8990	1.38021
25	625	15625	5.0000	1.39794
26	676	17576	5.0990	1.41497
27	729	19683	5.1962	1.43136
28	784	21952	5.2915	1.44716
29	842	24389	5.3852	1.46240
30	900	27000	5.4772	1.47712
31	961	29791	5.5678	1.49136
32	1024	32768	5.6569	1.50515
33	1089	35937	5.7446	1.51851
34	1156	39304	5.8310	1.53148
35	1225	42875	5.9161	1.54407
36	1296	46656	6.0000	1.55630
37	1369	50653	6.0828	1.56820
38	1444	54872	6.1644	1.57978
39	1521	59319	6.2450	1.59106
40	1600	64000	6.3246	1.60206
41	1681	68921	6.4031	1.61278
42	1764	74088	6.4807	1.62325
43	1849	79507	6.5574	1.63347
44	1936	85184	6.6332	1.64345
45	2025	91125	6.7082	1.65321
46	2116	97336	6.7823	1.66276
47	2209	103823	6.8557	1.67210
48	2304	110592	6.9282	1.68124
49	2401	117649	7.0000	1.69020
50	2500	125000	7.0711	1.69897
51	2601	132651	7.1414	1.70757
52	2704	140608	7.2111	1.71600
53	2809	148877	7.2801	1.72428
54	2916	157464	7.3485	1.73239
55	3025	166375	7.4162	1.74036
56	3136	175616	7.4833	1.74819
57	3249	185193	7.5498	1.75587
58	3364	195112	7.6158	1.76343
59	3481	205379	7.6811	1.77085
60	3600	216000	7.7460	1.77815
61	3721	226981	7.8102	1.78533
62	3844	238328	7.8740	1.79239
63	3969	250047	7.9373	1.79934
64	4096	262144	8.0000	1.80618
65	4225	274625	8.0623	1.81291
66	4356	287496	8.1240	1.81954
67	4489	300763	8.1854	1.82607
68	4624	314432	8.2462	1.83251
69	4761	328509	8.3066	1.83885
70	4900	343000	8.3666	1.84510
71	5041	357911	8.4261	1.85126
72	5184	373248	8.4853	1.85733
73	5329	389017	8.5440	1.86332
74	5476	405224	8.6023	1.86923
75	5625	421875	8.6603	1.87506
76	5776	438976	8.7178	1.88081
77	5929	456533	8.7750	1.88649
78	6084	474552	8.8318	1.89209
79	6241	493039	8.8882	1.89763
80	6400	512000	8.9443	1.90309
81	6561	531441	9.0000	1.90849
82	6724	551368	9.0554	1.91381
83	6889	571787	9.1104	1.91908
84	7056	592704	9.1652	1.92428
85	7225	614125	9.2195	1.92942
86	7396	636056	9.2736	1.93450
87	7569	658503	9.3274	1.93952
88	7744	681472	9.3808	1.94448
89	7921	704969	9.4340	1.94939
90	8100	729000	9.4868	1.95424
91	8281	753571	9.5394	1.95904
92	8464	778688	9.5917	1.96379
93	8649	804357	9.6437	1.96848
94	8836	830584	9.6954	1.97313
95	9025	857375	9.7468	1.97772
96	9216	884736	9.7980	1.98227
97	9409	912673	9.8489	1.98677
98	9604	941192	9.8995	1.99123
99	9801	970299	9.9499	1.99564
100	10000	1000000	10.0000	2.00000

APPENDIX C

ORGANIZATION OF A TYPICAL MOUNTED ROUTE RECONNAISSANCE PATROL

C–1. General

To insure that reconnaissance patrols are adequately manned and equipped, the operational environment and the specific reconnaissance mission must be considered. Commanders and intelligence officers analyze the reconnaissance mission in the light of their unit's capabilities, both in personnel and equipment. If the mission is beyond organic capabilities, assistance should be expeditiously requested. Most units are required, at times, to conduct route reconnaissance during forward or retrograde movement. On the other hand, many organizations do not have organic reconnaissance elements, and the formation of temporary reconnaissance teams or patrols are necessary. General guidelines for organizing temporary patrols applicable to most situations are:

a. Personnel adequately trained in required reconnaissance techniques.

b. Means of transportation commensurate with the reconnaissance mission.

c. Proper equipment to conduct anticipated measurements and calculations.

d. Means of communication between patrol elements and the dispatching headquarters.

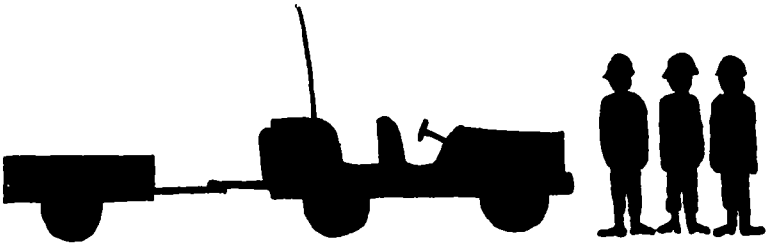
e. Special considerations such as fluency in the local language, security limitations on movement, identification and coordination in conducting passage through friendly lines.

C–2. Organization

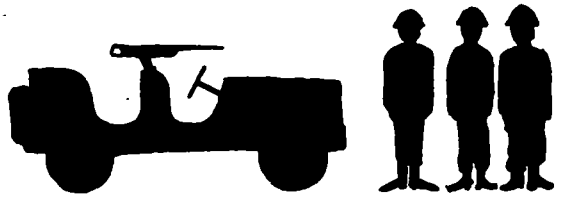
A suggested organization for a route reconnaissance patrol is shown in figure C–1. This organization may be varied to meet the needs of the command and the operational environment.

C–3. Equipment

A checklist in addition to individual weapons and equipment to accompany a typical route reconnaissance patrol is shown in table C–1.



PATROL LEADER
RADIO OPERATOR/RECORDER
DRIVER



ASSISTANT PATROL LEADER
MACHINE GUNNER/OBSERVER
DRIVER

Figure C–1. Suggested organization of a route reconnaissance patrol.

Table C–1. Suggested Items to Accompany Route Reconnaissance Patrol

Item	Quantity
Truck, utility, ¼ ton, 4x4	2
*Carrier, personnel, armored	2
Trailer, amphibious, cargo, ¼ ton	1
Machine gun, 7.62 mm	1
Pedestal, 7.62 mm machine gun mount	1
Launcher, grenade, 40 mm	1
Binocular 7x50	2
Goggles, sun, plastic	6
Radiacmeter, IM–93/UD	1
Radiacmeter, IM–174/PD	2
Detector kit, chemical agent, VGH, AN–M15A1A	1
Paper, chemical agent detector, VGH, ABC M8	1 bk
Wrist watch	2
Radio set AN/VRC–47, mounted in truck, ¼ ton	1
Radio set AN/PRC–25	1
Flashlight	4
Lensatic compass	2
Clinometer	1
Panel marking sets	2
Pioneer tools	1 set/vehicle
Towing chain	2
Material for marking fording and swimming sites	As required
Improvised means of measuring water depths	1
Measuring tape	2
Three-man pneumatic reconnaissance boat	1
Vehicular first aid kit	2
FM 5–34	1
Reconnaissance report forms and formats	As required
Adequate map and aerial photo coverage	As required
Tracing tape (tape, textile)	As required
Camera (polaroid)	1

*Desirable when operating in support of mechanized forces or in northern areas.

APPENDIX D

MILITARY LOAD CLASSIFICATION FOR STANDARD VEHICLES

D–1. General

The vehicle load classification list presented in this appendix includes all vehicles for which the load class is currently available. Future changes will include data on new vehicles as their classification becomes available. Certain items of equipment no longer standard have been retained in the list when it was judged that their numbers in use by other nations warranted retention. Requests for classification of vehicles should be addressed direct to the Commanding Officer, U.S. Army Combat Developments Command Engineer Agency, Fort Belvoir, Va., 22060. The applicable following format, filled out as completely as possible and modified where required, must accompany each request. At a minimum, the information listed in paragraph 3–17*a* must be furnished. If available, the Federal Stock Number (FSN) should be included. *Requests for classification which do not include the necessary information may not be met.*

a. Tracked vehicle (fig. D–1).

b. Wheeled vehicle (fig. D–2).

c. Trailer (fig. D–3).

d. Semitrailer (fig. D–4).

e. Combination track and wheel vehicle (fig. D–5).

f. Combination wheeled vehicle (fig. D–6).

g. Combination wheeled (truck-tractor) vehicle (fig. D–7).

D–2. Military Load Classification List

The symbols found in the heading of the listing are defined below:

E—Weight or class of vehicle w/o payload.

C—Weight or class of vehicle with rated maximum cross country payload.

H—Weight or class of vehicle with rated maximum highway payload.

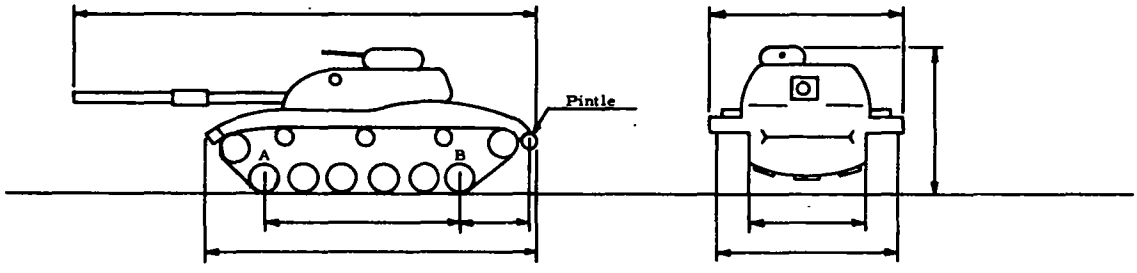
The load class number to be posted on vehicles is the number listed under the "C" subcolumn of the class column. This number is taken from the normal design load of the vehicle. Where no number appears in the "C" column, take the number appearing in the "H" column. If both these columns are blank take the number from the "E" column. The listing is organized into tables as follows:

Table D–1. Tracked vehicles.
Table D–2. Half-tracked vehicles.
Table D–3. Wheeled vehicles.
Table D–4. Towed vehicles.
a. Artillery.
b. Trailers.
c. Semitrailers.
Table D–5. Construction equipment.
Table D–6. Missile and fire distribution systems.
a. Pershing.
b. Sergeant.
c. Little John.
d. Honest John.
e. Hawk.
f. Nike-Ajax.
g. Nike-Hercules.
Table D–7. Combination vehicles.

VEHICLE CLASSIFICATION DATA
TRACKED VEHICLE
DATA REQUIRED FOR IDENTIFICATION AND LOAD CLASSIFICATION OF SUBJECT VEHICLE

Nomenclature:
Model Number:
Manufacturer:
Federal Stock Number (FSN):

Traveling Load Category	Total Weight	Pay Load	Maximum Towed Load	Maximum Pintle Load
Empty (E)		X		
Laden Cross Country or off Highway (C)				
Laden on Highway (H)				



Traveling Load Category	LOAD		
	A - B	psi A - B	Pintle Maximum
Empty (E)			
Laden Cross Country or off Highway (C)			
Laden on Highway (H)			

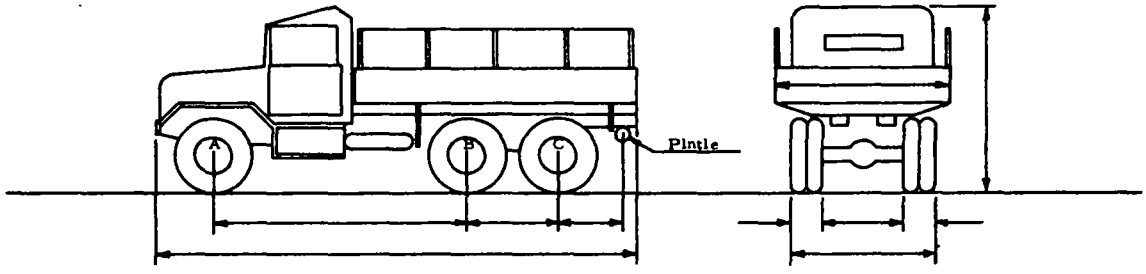
All loads in short tons.
All loads to include weight of crew and appurtenances.
Longitudinal dimensions in feet.
Vertical and transverse dimensions in inches.

Figure D–1. Tracked vehicle.

VEHICLE CLASSIFICATION DATA
WHEELED VEHICLE
DATA REQUIRED FOR IDENTIFICATION AND LOAD CLASSIFICATION OF SUBJECT VEHICLE

Nomenclature:
Model Number:
Manufacturer:
Federal Stock Number (FSN):

Traveling Load Category	Total Weight	Pay Load	Maximum Towed Trailer Load	Maximum Pintle Load
Empty (E)				
Laden Cross Country or off Highway (C)				
Laden on Highway (H)				



Traveling Load Category	Loads On				Front Tires			Rear Tires		
	A	B	C	Pintle	Number Per Axle	Size	psi	Number Per Axle	Size	psi
Empty (E)										
Laden Cross Country or off Highway (C)										
Laden on Highway (H)										

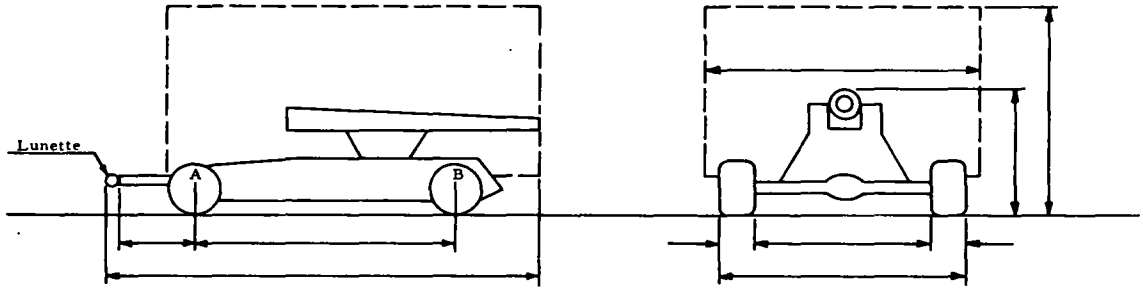
All loads in short tons.
All loads to include weight of crew and appurtenances.
Longitudinal dimensions in feet.
Vertical and transverse dimensions in inches.

Figure D–2. Wheeled vehicle.

VEHICLE CLASSIFICATION DATA
TRAILER
DATA REQUIRED FOR IDENTIFICATION AND LOAD CLASSIFICATION OF SUBJECT VEHICLE

Nomenclature:
Model Number:
Manufacturer:
Federal Stock Number (FSN):

Traveling Load Category	Total Weight	Pay Load	Minimum Towing Vehicle
Empty (E)			
Laden Cross Country or off Highway (C)			
Laden on Highway (H)			



Traveling Load Category	Load On			Front Tires			Rear Tires		
	A	B	Lunette	Number Per Axle	Size	psi	Number Per Axle	Size	psi
Empty (E)									
Laden Cross Country or off Highway (C)									
Laden on Highway (H)									

All loads in short tons.
All loads to include weight of crew and appurtenances.
Longitudinal dimensions in feet.
Vertical and transverse dimensions in inches.

Figure D–3. Trailer.

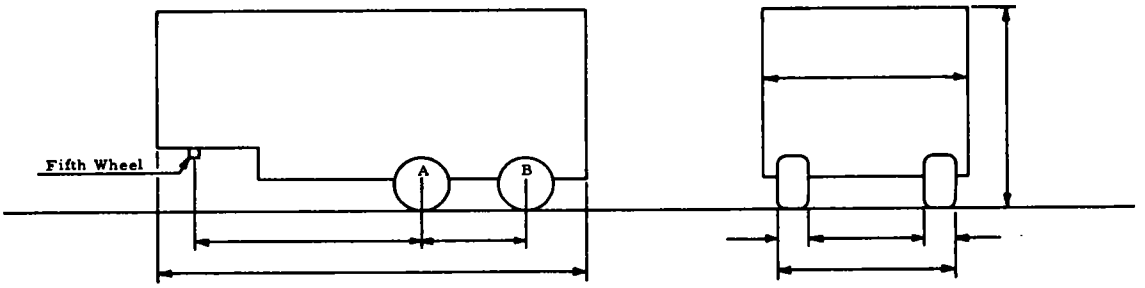
VEHICLE CLASSIFICATION DATA

SEMITRAILER

DATA REQUIRED FOR IDENTIFICATION AND LOAD CLASSIFICATION OF SUBJECT VEHICLE

Nomenclature:
Model Number:
Manufacturer:
Federal Stock Number (FSN):

Traveling Load Category	Total Weight	Pay Load	Fifth Wheel	Minimum Towing Vehicle
Empty (E)				
Laden Cross Country or off Highway (C)				
Laden on Highway (H)				



Traveling Load Category	Loads On			Dolly Tires			Rear Tires		
	A	B	Fifth Wheel	Number Per Axle	Size	psi	Number Per Axle	Size	psi
Empty (E)									
Laden Cross Country or off Highway (C)									
Laden on Highway (H)									

All loads in short tons.
All loads to include weight of crew and appurtenances.
Longitudinal dimensions in feet.
Vertical and transverse dimensions in inches.

Figure D–4. Semitrailer.

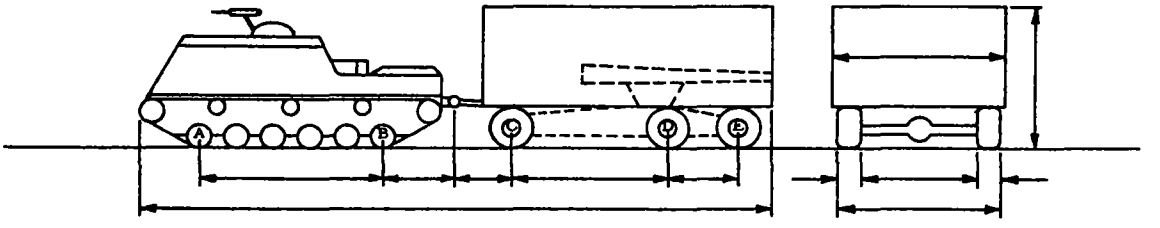
VEHICLE CLASSIFICATION DATA

COMBINATION TRACK AND WHEEL VEHICLE

DATA REQUIRED FOR IDENTIFICATION AND LOAD CLASSIFICATION OF SUBJECT VEHICLES

Nomenclature:
Model Number:
Manufacturer:
Federal Stock Number (FSN):

Traveling Load Category	Total Weight of Combination	Pay Load of Combination	Pintle Load
Empty (E)		X	
Laden Cross Country or off Highway (C)			
Laden on Highway (H)			



Traveling Load Category	Loads On						Tires C			Tires D and E		
	A-B	psi A-B	C	D	E	Pintle	Number Per Axle	Size	psi	Number Per Axle	Size	psi
Empty (E)												
Laden Cross Country or off Highway (C)												
Laden on Highway (H)												

All loads in short tons.
All loads to include weight of crew and appurtenances.
Longitudinal dimensions in feet.
Vertical and transverse dimensions in inches.

Figure D–5. Combination tracked and wheeled vehicle.

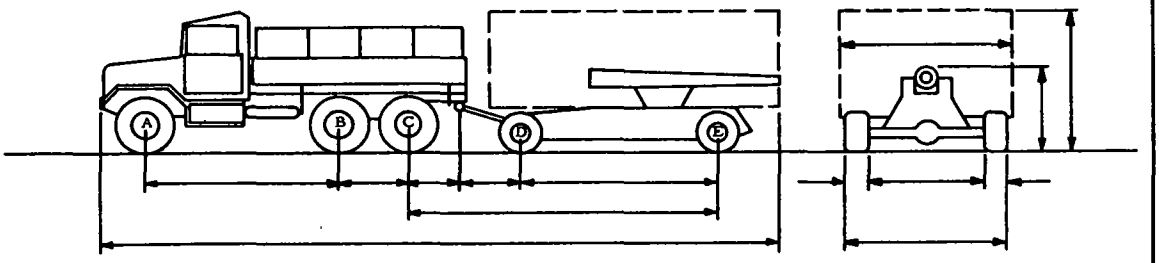
VEHICLE CLASSIFICATION DATA

COMBINATION WHEELED VEHICLE

DATA REQUIRED FOR IDENTIFICATION AND LOAD CLASSIFICATION OF SUBJECT VEHICLE

Nomenclature:
Model Number:
Manufacturer:
Federal Stock Number (FSN):

Traveling Load Category	Total Weight of Combination	Pay Load of Combination	Lunette
Empty (E)			
Laden Cross Country or off Highway (C)			
Laden on Highway (H)			



Traveling Load Category	Loads On						Tires								
							A			B and C			D/E		
	A	B	C	D	E	Lunette	Number Per Axle	Size	psi	Number Per Axle	Size	psi	Number Per Axle	Size	psi
Empty (E)															
Laden Cross Country or off Highway (C)															
Laden on Highway (H)															

All loads in short tons.
All loads to include weight of crew and appurtenances.
Longitudinal dimensions in feet.
Vertical and transverse dimensions in inches.

Figure D–6. Combination wheeled vehicle.

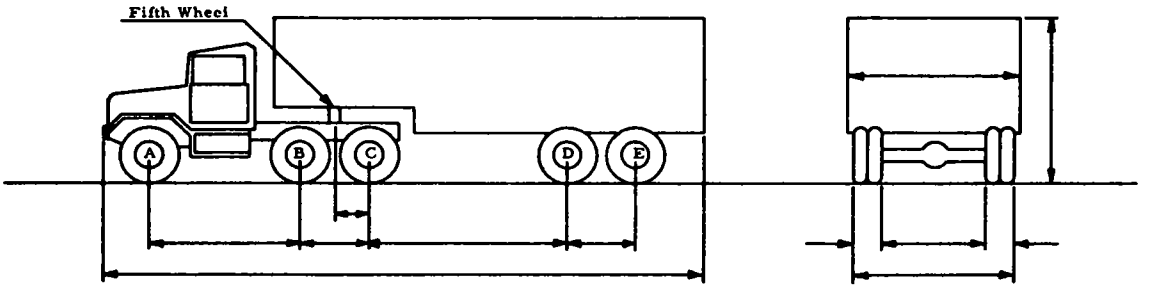
VEHICLE CLASSIFICATION DATA

COMBINATION WHEELED (TRUCK-TRACTOR) VEHICLE

DATA REQUIRED FOR IDENTIFICATION AND LOAD CLASSIFICATION OF SUBJECT VEHICLE

Nomenclature:
Model Number:
Manufacturer:
Federal Stock Number (FSN):

Traveling Load Category	Total Weight of Combination	Pay Load of Combination	Fifth Wheel
Empty (E)			
Laden Cross Country or off Highway (C)			
Laden on Highway (H)			



Traveling Load Category	Loads On						Front Tire A			Tires B and C			Tires D and E		
	A	B	C	D	E	Fifth Wheel	Number Per Axle	Size	psi	Number Per Axle	Size	psi	Number Per Axle	Size	psi
Empty (E)															
Laden Cross Country or off Highway (C)															
Laden on Highway (H)															

All loads in short tons.
All loads to include weight of crew and appurtenances.
Longitudinal dimensions in feet.
Vertical and transverse dimensions in inches.

Figure D–7. Combination wheeled vehicle (truck-tractor and semitrailer).

Table D-1. Tracked Vehicles

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Armored reconnaissance airborne assault vehicle, M551:	—	16.8	—	—	16	—
W/armor applique mine prot kit	—	18.8	—	—	18	—
Assault vehicle, full tracked, amphibious, XM 733	4.38	5.25	—	4	5	—
Bulldozer, earthmoving, tank mounted:						
M6, on tank, combat, M47	49.5	51.6	—	50	53	—
M8, on tank, combat, M48	52.89	57.39	—	52	60	—
M9, on tank, combat, M60 and M60 A1	52.94	54.74	—	50	52	—
Bulldozer, earthmoving, tractor mtd, on tractor, high speed M8A2	24.25	33.5	—	23	32	—
Carrier, cargo, amphibious, tracked:						
M76	4.16	6.02	—	4	6	—
M116	3.94	5.44	—	4	5	—
*Carrier, cargo, tracked, 1 1/2T, XM759	7.15	8.65	—	6	8	—
Carrier, cargo, tracked, 6T M548	8	14	—	7	13	—
Carrier, command post, light, tracked:						
M577	11.08	11.95	—	10	11	—
M577A1	10.97	12.13	—	10	12	—
Carrier, command & reconnaissance, armored, M114 A1	—	6.9	—	—	7	—
Carrier, flame thrower, self-propelled, M132 and M132A1	11.71	11.95	—	11	11	—
Carrier, mortar, 81 mm, tracked, XM 755	—	6.25	—	—	6	—
Carrier, mortar, 107 mm, self-propelled M106	8.69	12.35	—	11	15	—
Carrier, personnel, full tracked, armored:						
M59	19.35	20.9	—	18	19	—
M75	18.34	20.75	—	17	20	—
M113 and M113A1	10.12	11.69	—	9	11	—
Gun, antiaircraft artillery, self-propelled:						
*20 mm, M163 (Vulcan)	11.97	12.63	—	11	12	—
Twin 40 mm, M19A1	16.88	19.25	—	16	18	—
Twin 40 mm, M42 & M42A1	22.15	24.9	—	20	23	—
Gun, antitank, self-propelled, 90 mm, M56	6.25	7.87	—	6	8	—
Gun, field artillery, self-propelled:						
155 mm, M53	44.5	48	—	42	46	—
175 mm, M107	—	30.75	—	—	29	—
Howitzer, heavy, self-propelled, 8 inch:						
M55	44	47.5	—	41	46	—
M110	—	29.25	—	—	27	—
*M110A1	27.90	31.05	—	26	29	—
*M110A2	28.12	31.27	—	26	29	—
Howitzer, light, self-propelled, 105 mm:						
M37	19.32	23	—	18	22	—
M52 and M52A1	24.9	26.5	—	23	25	—
M108	20.05	23.45	—	18	22	—
Howitzer, medium, self-propelled, 155 mm:						
M44 and M44A1	29	32	—	27	30	—
M109	22.1	25.5	—	24	24	—
*M109A1	23.3	26.5	—	21	24	—
Landing vehicle, tracked:						
Command	32.1	36.23	—	28	36	—
Engineer	41.37	48.75	—	37	46	—
Personnel	32.1	43.89	—	28	40	—
Recovery	37.51	41.1	—	33	37	—
*Launcher, M48A2 tank chassis, transporting, w/ bridge, armored vehicle launched scissoring type, 60 ft, C1 60	48.65	63.39	—	46	66	—
*Launcher, M60A1 tank chassis, transporting, w/ bridge, armored vehicle launched, scissoring type, 60 ft, C1 60	46.10	60.84	—	45	59	—
Mortar, infantry, self-propelled, 107 mm (4.2 in.), M84	20.57	23.55	—	19	22	—

Table D-1. Tracked Vehicles—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Recovery vehicle, full tracked:						
Light, M578	23.5	27	—	25	25	—
*Light armored (M113), XM806	11.85	12.14	—	11	12	—
*Light armored (M1134A1): XM806E1	11.90	12.60	—	11	12	—
Medium, M88	54	56	—	53	55	—
Heavy, M51	56.25	60	—	54	58	—
Rifle, multiple, 106 mm, self-propelled, M50	8.06	8.84	—	8	9	—
Tank, combat, full tracked:						
76 mm gun, M41, M41A1, M41A2 and M41A3	22.35	25.9	—	21	24	—
90 mm gun:						
M48	41.7	45	—	38	42	—
M48A1	48.5	53	—	46	52	—
M48A2 & M48A2C	49	52.5	—	47	51	—
M48A3	49.75	52.5	—	48	51	—
*105 mm gun, M48A5	50	54.0	—	48	54	—
105 mm gun, M60	47.5	52.5	—	45	50	—
*105 mm gun, M60A1	53.7	56.2	—	52	54	—
*105 mm gun, M60A1 (ARISE)	51.7	54.8	54.8	49	53	53
*105 mm gun, M60A3	54.8	57.3	57.3	53	55	55
120 mm gun, M103A1	57.8	62	—	55	60	—
*152 mm gun/launcher, M60A2	54.7	57.2	—	52	55	—
Tank, combat, full tracked, counterinsurgency, amphibious, light weight, XM 729	4.53	5.25	—	5	6	—
Tank, combat, full tracked, flame-thrower, M67A1 and M67A2	50.48	52.89	—	51	51	—
Tractor, full tracked, high speed, 13T:						
M5 and M5A1	11.89	14.29	—	12	14	—
M5A2	10.54	13.07	—	10	12	—
M5A3	12.6	15.17	—	12	14	—
M5A4	12.25	14.9	—	11	14	—
Tractor, full tracked, high speed, 32T, M8A1 and M8A2	22.25	31.5	—	21	30	—
Vehicle, combat engineer, full tracked, M728	54.5	57.5	—	54	57	—

Table D-2. Half-Tracked Vehicles

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Car, half track, M2A1	—	9.8	—	—	9	—
Carriage, motor, multiple gun, M16	—	10.82	—	—	10	—
Carrier, 81 mm mortar, half track, M21	—	10	—	—	9	—
Carrier, personnel, half track, M3 and M3A1	—	10.25	—	—	9	—

Table D-3. Wheeled Vehicles

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Assault trackway outfit, class 30 on truck 5T, 6 x 6, M139	—	—	20.82	—	—	18
Bridge, floating, mobile assault, amphibious (French)	—	26.5	—	—	25	—
Bus, 29-passenger, 4 x 2	5.25	—	7.75	5	—	8

Table D-3. Wheeled Vehicles—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Bus, 37-passenger, 4 x 2	7.6	–	11.95	7	–	12
Car, armored, wheeled, V-100 (Commando)	6.8	8.13	–	7	8	–
*Chassis, truck, 1¼ T, 4 x 4, M887	2.06	4.00	4.00	2	4	4
Chassis, truck, 2½ T, 6 x 6:						
M44 and M44C	5.33	–	–	5	–	–
M45 and M45C	5.47	–	–	5	–	–
M46 and M46C	5.64	–	–	5	–	–
M57	5.41	–	–	5	–	–
M58	5.43	–	–	5	–	–
M133	5.58	–	–	5	–	–
M207 and M207C	5.8	–	–	5	–	–
M209	5.6	–	–	5	–	–
Chassis, Truck, 5 T, 6 x 6:						
M39, M40, and M40C	8.75	–	–	8	–	–
M61	9.02	–	–	8	–	–
M63 and M63C	9.62	–	–	8	–	–
M139, M139C, and M139D	9.8	–	–	8	–	–
Decontaminating apparatus, power driven, trk mtd, M45 chassis:						
M39	8.38	10.08	–	7	9	–
M3A3	7.14	8.84	–	6	7	–
Lighter, amphibious, resupply, cargo:						
5 T, 4 x 4, (LARC-V)	10	15	–	10	15	–
15T, 4 x 4 (LARC-XV)	22.6	37.6	–	27	50	–
Service unit, flamethrower, trk mtd, M4	8.25	9.38	–	7	8	–
*Shelter, elec testing, trk med, AN/TSM115	10.47	–	–	9	–	–
Shop equipment, contact-maintenance trk mtd, 4 x 4 (FSN 4940-291-9518)	4.45	–	–	4	–	–
Shop equipment, organizational repair, light, trk mtd	16.39	–	–	15	–	–
*Shop, repair, radar antenna drive, trk mtd, M45A2	8.30	–	–	7	–	–
Topographic mapping set, trk mtd, 2½ T, 6 x 6:						
Cartographic section	–	11.3	–	–	10	–
Copy and supply section	–	11.8	–	–	10	–
Map revision section	–	10.9	–	–	9	–
Multiplex section	–	12.1	–	–	11	–
Photomapping section	–	10.9	–	–	9	–
Rectifier section	–	12.1	–	–	11	–
Topographic reproduction set, trk mtd, 2½ T, 6 x 6:						
Camera section	–	9.75	–	–	9	–
Laboratory section	–	9.3	–	–	8	–
Map layout section	–	9.1	–	–	8	–
Photographic-printing-processing section	–	10.5	–	–	9	–
Photomechanical process section	–	12.1	–	–	11	–
Plate grainer section	–	10.2	–	–	9	–
Plate process section	–	9.5	–	–	8	–
Press section	–	11.6	–	–	10	–
Transporter for mobile floating assault bridge-ferry:						
w/superstructure, end bay	25.8	–	–	24	–	–
w/superstructure, interior bay	23.5	–	–	21	–	–
*Transporter, ribbon bridge, M812						
M812 chassis	13.70	–	–	11	–	–
w/interior bay	–	19.73	–	–	17	–
w/ramp bay	–	19.58	–	–	17	–
w/boat and cradle	–	18.07	–	–	16	–
w/pallet, cargo, 5 ton	–	19.44	–	–	17	–
Truck, ambulance, 4 x 4:						
¾ T, M43 and M43B1	4.39	4.97	–	3	4	–
1¼ T, M725	3.15	4.35	–	3	4	–
*1¼ T, M886	3.06	4.00	4.00	3	4	4
*1¼ T, M893	2.84	3.75	3.75	3	3	3

Table D-3. Wheeled Vehicles—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Type IV, 7,000 lbs GWV, XM679	2.52	3.50	—	2	3	—
*Truck, ambulance: front line, 4 x 4, ¼ T, M718	1.39	1.84	—	1	2	—
Truck, amphibious, 2½ T, 6 x 6, M147	9.6	12.1	13.6	9	11	13
Truck, bolster, 2½ T, 6 x 6:						
On M44 chassis	6.14	—	—	5	—	—
On M45 chassis	6.5	—	—	5	—	—
M751A2	7.16	9.66	12.16	6	8	11
Truck, bolster, 5 T, 6 x 6:						
On M40 chassis	9.49	—	—	8	—	—
M748A2	10.48	15.48	20.48	9	14	19
XM815	10.92	15.92	20.92	9	15	20
Truck, cargo, ¾ T, 4 x 4, M37 and M37B1	2.84	3.59	3.84	3	4	4
Truck, cargo, pickup, 4 x 4, 7,000 lbs GWV:						
Type I, XM 677	2.48	3.5	—	2	3	—
Type II, XM 676	2.33	3.5	—	2	3	—
Truck, cargo, 1¼ T:						
4 x 4, M715	2.78	4.23	4.48	2	4	4
*4 x 4, M880	2.32	4.00	4.00	2	4	4
*4 x 4, M890	2.11	3.75	3.75	2	4	4
6 x 6, M561	3.27	4.72	—	3	4	—
Truck, cargo, 2½ T, 6 x 6:						
M34	6.1	8.6	11.1	5	8	10
M35 and M35A1	6.44	8.94	11.44	5	8	10
M35A2	7.15	9.65	12.15	6	8	11
M36 and M36C	6.75	9.25	11.75	6	8	10
M36A2	7.51	10.01	12.51	6	8	11
M135	6.37	9.04	11.54	6	9	11
M211	6.79	9.47	11.97	6	8	11
Truck, cargo, 5 T, 6 x 6:						
M41	9.55	13.3	17.05	9	15	18
M54	9.62	14.79	19.79	8	14	19
M54A2	10.46	15.46	20.46	9	14	20
M55 and M55A2	12.03	17.21	22.03	10	16	21
M55A1	12.26	17.26	22.26	10	16	21
XM 813	10.9	15.9	20.9	9	15	20
XM 814	12.55	17.55	22.55	10	16	21
Truck, cargo, 5T, 8 x 8, M658	7.8	12.8	—	7	11	—
Truck, cargo, 8T, 4 x 4, M520	11.95	19.95	—	10	16	—
Truck, cargo, 10T, 6 x 6, M125 and M125A1	15.8	25.8	30.8	14	25	33
Truck, cargo, 16T, 4 x 4, XM437E1	19.34	35.54	—	22	45	—
Truck, carryall, 4 x 4, Type III, 7,000 lbs GWV, XM 678	2.3	3.5	—	2	3	—
Truck, dump, ¾ T, 4 x 4, XM 708 and XM 708E1	3.39	4.64	—	3	5	—
Truck, dump, 2½ T, 6 x 6:						
M59	6.92	8.97	11.42	6	8	10
M215	7.44	9.49	11.94	7	9	11
M342	7.97	10.64	13.14	7	9	12
M342A2	8.28	10.78	13.28	7	9	12
Truck, dump, 5 T, 6 x 6:						
M51	11.33	16.51	21.51	10	16	21
M51A1	11.22	16.4	21.4	9	16	21
M51A2	11.69	16.69	21.69	10	16	22
XM 817	12.13	17.13	22.13	10	16	22
Truck, dump, 15 T, 4 x 2:						
Euclid mdl 5FD	14.3	—	29.3	15	—	72
Mack mdl LR	16.25	—	31.25	15	—	72
*Truck, dump, 20 T, Paystar F5070, 6 x 4	15.50	35.50	—	14	40	—
Truck, earthboring machine and polesetter, 2½ T, 6 x 6, XM 764	10.07	10.32	11.07	9	9	10
Truck, firefighting, 6 x 6, 500 gpm:						
Hesse mdl HC-26, pumper, foam & water, on M44 Chassis	8.7	10.3	—	8	9	—
Class 530B, on M45A2 chassis	10.57	—	—	9	—	—

Table D-3. Wheeled Vehicles—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
*Truck, lift, fork: 6,000 lb, MHE-200 & MHE-202	11.50	14.50	–	12	16	–
*10,000 lb, MHE-199	17.00	22.00	–	17	37	–
Truck, lift, fork, DED, pneu. tired, all purpose:						
6,000 lb capacity	11	–	14	12	–	18
10,000 lb capacity	15.3	–	20.3	15	–	29
Truck, lift, fork, rough terrain:						
3,000 lb capacity, Clark Model ART-30	1.6	3.1	–	2	3	–
4,000 lb capacity, Clark Ranger mdl 40	4.35	6.35	–	5	9	–
6,000 lb capacity, Baker mdl RJF-060	8.51	11.51	–	9	16	–
10,000 lb capacity, Clark mdl MR100	13.8	18.8	–	15	23	–
Truck, maintenance, earth borer, pole setter, 2½ T, 6 x 6, V18A/MTQ	8.59	9.56	11.56	8	9	11
Truck, maintenance, general purpose repair shop, 2½ T, 6 x 6	–	9.56	–	–	9	–
Truck, maintenance, pipeline const, 2½ T, 6 x 6, M756A2	8.71	11.21	13.71	7	10	13
Truck, maintenance, telephone const:						
¾ T, 4 x 4, M201 & M201B1	3.48	4.23	4.4	3	4	4
2½ T, 6 x 6, V-17A/MTQ	8.28	9.42	11.42	8	9	11
*2½ T, 6 x 6, W/W, M763	10.06	10.31	12.06	9	9	11
Truck, Panel, 1 T, 4 x 2, commercial type, 7,000 lb GWV	2.3	3.5	–	2	3	–
Truck, stake & platform, 1½ T, 4 x 2	2.84	4.34	6.23	3	4	7
Truck, stake, bridge transporting, 5 T, 6 x 6:						
M139	13.2	21.0	–	10	18	–
XM821	14.28	19.28	24.28	11	17	22
*Truck, tactical, 5 T, 6 x 6,						
*M815 W/W:	11.35	16.35	21.35	10	16	20
*M816 W/W	19.12	22.62	25.12	18	24	32
*M818 W/W	11.25	18.75	23.75	10	18	23
*M818 WO/W	10.35	17.87	22.85	9	17	22
*M819 W/W	17.75	23.75	25.75	16	22	24
*M821 W/W	14.64	19.64	24.64	12	17	22
Truck, tank, fuel servicing, 2½ T, 6 x 6 1,200 gal:						
M49 and M49C	6.75	9.25	10.25	6	8	10
M49 A2C	7.76	10.26	11.26	7	9	11
M217 and M217C	7.17	9.67	10.67	6	9	10
Truck, tank, fuel servicing, 4 x 4:						
2,500 gal M559	13.8	22.74	–	10	19	–
5,000 gal XM 438E2	19.24	34.24	–	22	46	–
Truck, tank, water, 2½ T, 6 x 6, 1,000 gal:						
M50, M50A1, and M50A2	7.52	10.02	11.72	7	9	11
*M50A3	7.53	9.21	11.70	6	8	10
M222	7.05	9.55	11.25	6	8	10
Truck, telephone maintenance & construction, 2½ T, 6 x 6, XM763	9.36	10.11	12.36	8	9	11
Truck, tractor, 2½ T, 6 x 6:						
M48	5.92	–	–	5	–	–
M221	6.05	–	–	5	–	–
M275	5.8	–	–	5	–	–
M275A2	6.26	–	–	5	–	–
Truck, tractor, 5 T, 6 x 6:						
M52, M52A1, and M52A2	9.62	–	–	8	–	–
XM818	10.06	–	–	8	–	–
*Truck, tractor, 5 T, 8 x 8, XM757, W/W	8.34	–	–	7	–	–
Truck, tractor, 5 T, 4 x 2:						
Federal mdl 45M2	4.9	–	–	4	–	–
International Harv. Mdl L-201	5.11	–	–	5	–	–
International Harv. Mdl R-202	5.12	–	–	5	–	–
Truck, tractor, 10 T, 6 x 6, M123 and M123C	16.12	–	–	14	–	–
Truck, tractor, 10 T, 8 x 8, XM191	17.18	–	–	15	–	–
Truck, tractor, 12 T, 6 x 6, M26A1	24.45	–	–	28	–	–

Table D-3. Wheeled Vehicles—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Truck, tractor, 15 T, 8 x 8:						
XM194	23.82	—	—	20	—	—
XM194E1	24.08	—	—	20	—	—
XM194E2 & XM194E3	24.22	—	—	21	—	—
XM194E4	26.3	—	—	23	—	—
Truck, tractor, 25 T, 6 x 6, M523E2	20.49	—	—	18	—	—
Truck, tractor, wrecker, 5 T, 6 x 6:						
M246	16.42	—	—	15	—	—
M246A1	16.65	—	—	15	—	—
XM819	16.31	—	—	14	—	—
*Truck, utility, ¼ T, 4 x 4, M151A1C	1.29	2.30	—	1	3	—
Truck, van, expansible, 2½ T, 6 x 6, M292A2	10.23	12.73	—	9	11	—
Truck, van, expansible, 5 T, 6 x 6:						
M291	12.75	15.25	20.25	11	14	19
M291A2	13.18	15.68	20.68	11	14	19
XM820	13.67	16.17	21.17	11	15	19
XM 820E2	13.79	16.49	21.49	12	15	20
Truck, van, expansible, 5 T, 8 x 8, M791	12.45	13.98	17.78	10	11	16
Truck, van, shop, 2½ T, 6 x 6:						
M109, M109C, & M109D	7.62	10.29	—	7	9	—
M109A3	7.97	10.47	11.74	7	9	10
M220, M220C, & M220D	7.54	10.22	11.29	7	9	10
Truck, wrecker, ¾ T, 4 x 4, XM711	3.88	5.63	—	4	8	—
Truck, wrecker, 2½ T, 6 x 6:						
M108	7.06	9.06	10.25	6	9	11
XM519	7.41	8.91	—	6	8	—
Truck, wrecker, light, 2½ T, 6 x 6, M60	11.98	12.73	13.9	11	12	13
Truck, wrecker, medium, 5 T, 6 x 6:						
M62	17.01	20.51	23.01	16	21	23
M543, M543A1, & M543A2	17.6	—	—	17	—	—
XM816	17.77	—	—	17	—	—
*Truck, wrecker, 10 T, 4 x 4, M553	19.29	23.27	—	15	20	—
Truck, wrecker, 20 T, 4 x 4, XM554	28.3	33.33	—	39	43	—

Table D-4. Towed Vehicles

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
a. Artillery						
Gun, anti-aircraft, towed, 77 mm, M51	10.64	—	—	8	—	—
Gun, anti-aircraft artillery, towed, 90 mm, M2, on mount, 90 mm, M2	16.5	—	—	16	—	—
Gun, antiaircraft artillery, towed, 120 mm, M1, on Mount, 120 mm, M1 or M1A1	30.75	—	—	38	—	—
Gun, field artillery, towed, 155 mm, M59	13.85	—	—	14	—	—
Howitzer, light, towed, 105 mm:						
M101 and M101A1	2.49	—	—	4	—	—
M102	1.55	—	—	2	—	—
Howitzer, medium, towed, 155 mm, M114 & M114A1	6.44	—	—	9	—	—
Howitzer, medium, towed 155 mm, aux. propelled, M123A1	6.77	—	—	9	—	—
*Howitzer, towed, 155 mm, M198	7.35	—	—	9	—	—
Howitzer, heavy towed, 8 in., M115	14.8	—	—	15	—	—
b. Trailers						
*Chassis, trailer, gen. 2½ ton, M200A1	1.20	3.50	—	2	5	—

Table D-4. Towed Vehicles—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
*Dolly set, lift, transportable shelter, 5¼ T, XM832	1.85	7.10	—	2	6	—
Trailer, ammunition, 1½ T, 2 whl, M332	1.4	2.9	—	2	4	—
Trailer, ammunition, 2 T, 2 whl, M10	1.4	3.4	—	2	5	—
Trailer, ammunition, 4 T, 2 whl, M21	2.65	6.65	—	4	9	—
Trailer, ammunition, 8 T, 4 whl, M23	5	13	—	5	11	—
Trailer, basic utility, pole type, 2½ T, 2 whl	1.2	3.7	—	2	5	—
Trailer, bolster, 2½ T, 2 whl	1.1	3.6	—	2	5	—
Trailer, bolster, pole handling, 3½ T, 2 whl, M271 & M271A1	1.21	4.71	—	2	7	—
Trailer, bolster, general purpose 4 T, 4 whl, M796	2.41	6.41	—	2	7	—
Trailer, bolster, 4 whl, special tandem, 7-14 T	3.6	17.6	—	4	21	—
Trailer, bomb, 2 T, 4 whl, M143 and M143A1	3.2	5.2	—	3	5	—
Trailer, cable reel, 3½ T, 2 whl, M310	1.26	4.76	—	1	7	—
*Trailer, cargo ¾ T, M101A1	0.67	1.42	1.80	1	2	2
Trailer, cargo, 1½ T, 2 whl:						
M104, M104A1 & M104A2	1.36	2.86	4.11	2	4	6
M105, M105A1 & M105A2	1.32	2.82	3.57	2	4	6
Trailer, clamshell bucket, 3 T, 2 whl, GRAMMA mdl M16	1.22	4.12	—	2	5	—
Trailer, firefighting, pumper, water:						
100 gpm, 2 whl	2.6	—	—	4	—	—
500 gpm, 2 whl, Hale mdl CFS	1.75	—	—	3	—	—
1,500 gpm, 4 whl, Sabre mdl TT2000	4.85	—	—	6	—	—
Trailer, flat bed, 4 T, 4 whl M794	2.08	6.08	—	2	7	—
*Trailer, flatbed, cargo:						
*5 T, 4 whl, XM835	2.85	7.85	12.85	2	7	12
*4 T, 4 whl, M794	4.78	—	—	5	—	—
*4 T, 4 whl, XM843	3.04	8.04	—	3	9	—
Trailer, flat bed, dough mixing & makeup outfit, 4 T, 4 whl, M795	2.56	6.56	—	3	8	—
Trailer, flat bed, tilt loading, 6 T, 4 whl, XM714	0.9	5.4	6.9	1	6	8
Trailer flat bed, 7 T, 4 whl:						
7 T La Crosse w/single whls	5.8	12.8	19.8	7	15	24
7 T La Crosse w/dual wheels	5.6	12.6	—	6	15	—
Trailer, flat bed, 10 T 4 whl:						
M345 (FSN 2330-200-1737)	5.63	15.63	18.63	6	18	20
w/4 dual midship wheels (FSN 2330-377-0389)	5.6	15.6	—	6	18	—
Trailer, low bed, 8 T, 4 dual whls:						
Fontaine mdl T8-105	4.83	12.83	—	4	12	—
Fruehauf mdl CF-8	5.3	13.3	—	5	13	—
Fruehauf mdl CPT-8 Special	4.76	12.76	—	4	12	—
Hobbs mdl F-1386	4.89	12.89	—	4	13	—
Jahn mdl LKS-408	3.8	11.8	—	4	12	—
LaCrosse mdl DF-4-C-8F	4.8	12.8	—	4	14	—
Winter-Weiss mdl S-458	4.27	12.27	—	4	13	—
Trailer, low bed, 60 T, 4 dual front whls, 8 dual rear whls:						
Dorsey mdl MT-60	12.1	—	72.1	8	—	96
Fontaine mdl C16-60-SP	16.05	—	76.05	11	—	130
Rogers mdl D-60-DS-5	17	—	77	13	—	110
Rogers mdl DW-60-LS-6	14.06	—	74.06	10	—	123
Rogers mdl D-60-DS-7	16.34	—	76.34	12	—	117
Steel Products mdl "Great Dane"	15.59	—	75.59	10	—	130
Trailer, tank, water, 1½ T, 2 whl, 400 gal:						
M106, M106A1, M106A2, M107, M107A1, and M107A2	1.14	2.81	—	2	4	—
M149	1.25	2.92	—	2	4	—
Trailer, transporter, 45 T, 12 whl, M9, Fruehauf mdl CPT45 SP	10.08	—	55.08	8	—	82
Trailer, van, shop, folding side, 1½ T, 2 whl, M448	1.48	2.98	3.73	2	4	6
Transporter, liquid rolling wheel (RLT), 1,000 gal, M6:						
Single	1.07	4.21	—	1	6	—
Two in tandem	2.14	8.42	—	2	7	—
Three in tandem	3.21	12.63	—	2	10	—
Four in tandem	4.28	16.84	—	3	12	—

Table D-4. Towed Vehicles—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
c. Semitrailers						
Semitrailer, low bed, 15 T, 4 whl, M172	7.75	–	22.75	6	–	19
Semitrailer, low bed, 25 T, 4 whl, M172A1	7.43	32.43	37.43	6	28	36
*Semitrailer, low bed, 40 T, transporter, M870	8.25	–	48.25	5	–	27
*Semitrailer, low bed, heavy equipment transporter, 52½ T, M747	15.84	–	68.34	11	–	79
Semitrailer, low bed, wrecker, 12 T, 4 whl:						
M269 and M269A1 (25 ft)	7.1	19.1	27.1	6	17	23
M270 and M270A1 (40 ft)	8.75	20.75	28.75	8	17	24
Semitrailer, maintenance, weapon, 6 T, 2 whl:						
Connecting unit, M459	–	7.2	–	–	6	–
Electrical unit, M458	–	7.2	–	–	6	–
Mechanical unit, M457	–	6.92	–	–	6	–
Semitrailer, stake, 6 T, 2 whl, M118 and M118A1	3.57	9.57	11.67	4	8	11
Semitrailer, stake, 12 T, 4 whl:						
M127, M127A1, and M127A1C	7.2	19.2	25.2	8	23	30
M127A2C	7.02	19.02	25.02	7	22	29
Semitrailer, stake & platform 5 T, 2 whl, Olsen mdl 516	3.32	8.32	10.82	3	8	10
Semitrailer, tank, alcohol, 2 whl, 3,000 gal, M388	4.15	12.15	–	5	13	–
Semitrailer, tank, bituminous liquid, 6 T, 1,500 gal, w/dolly	5.1	–	11.1	4	–	10
Semitrailer, tank, 6 T, 1,500 gal dual whls:						
Columbian Steel Tank mdl M1944	3.3	–	9.55	3	–	8
Littleford mdl JAN-T-505	4	–	10	4	–	9
Semitrailer, tank, fuel servicing, 2 whl, 2,000 gal, Heil Co. Type F-2B	4	–	10	4	–	9
Semitrailer, tank gasoline, 6 T, 2 whl, 2000 gal, M30, Progress mdl ST62M	3.38	–	9.48	3	–	9
Semitrailer, tank, gasoline, 12 T, 4 whl, 5,000 gal, M131, M131A1, and M131A2	7.42	17.23	22.69	7	16	21
Semitrailer, tank, storage, liquid, argon-nitrogen-oxygen, 9 T, 1,800 gal, Cambridge mdl 217-30	8.41	–	17.41	7	–	16
Semitrailer, tank transporter:						
40 T, 8 whl, M15	21.19	61.19	–	15	53	–
45 T, 8 whl, M15A1	21.19	66.19	–	15	59	–
50 T, 8 whl, M15A2	21.3	71.3	–	16	78	–
60 T, 12 whl, XM160	23.07	83.08	–	18	100	–
Semitrailer, tank, water, 2 whl, 2,000 gal, M586	3.21	–	11.51	4	–	14
Semitrailer, van 6 T, 2 whl, M146F	3.66	9.66	11.77	4	9	10
Semitrailer, van, cargo, 6 T, 2 whl, M119 and M119A1	3.59	9.59	11.69	4	8	11
Semitrailer, van, cargo, 12 T, 4 whl:						
M128A1 and M128A1C	7.74	19.74	25.74	7	18	23
M128A2C	7.7	19.7	25.7	8	23	30
Semitrailer, van electronic, 3 T, 2 whl:						
M348A1 and M348A2	4.32	7.32	9.32	5	10	11
M373A1	4.75	7.75	7.75	5	10	10
Semitrailer, van, electronic, 6 T, 2 whl:						
M348A2C, D, F, and G	4.38	9.38	10.38	5	10	11
M373A2C	4.85	9.85	10.85	5	10	11
Semitrailer van: expansible, 6 T, 4 whl, M313	8.05	13.20	15.19	7	11	14
Semitrailer, van, refrigerator, 7½ T, 2 whl, M349 and M349A1	4.3	–	11.8	5	–	13
Semitrailer, van: repair parts storage, 6 T, 4 whl, XM750	7.58	13.58	15.08	6	11	13
Semitrailer, van, shop, 6 T, 2 whl, M146 and M146C	3.66	9.66	11.76	4	9	10
Semitrailer, van, shop, 6 T, 4 whl, M447 and M447C	7.59	10.09	11.56	6	8	9
Semitrailer, van supply, 12 T, 4 whl, M129A2C	7.8	19.8	25.8	8	23	30

Table D-5. Construction Equipment

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Bin, aggregate loading, trlr mtd, 30 T:						
Iowa mdl 30 T	5.93	–	–	5	–	–
Pioneer mdl 220	8.58	–	–	7	–	–
Universal mdl PB-20	5.86	–	–	5	–	–
*Compactor, high-speed, Koering K300	15.5	–	–	20	–	–
Compressor, air, reciprocating, trlr mtd, 4 whl, 315 cfm, 100 psi:						
Davey mdl 315 WDS	3.48	–	–	4	–	–
Ingersoll Rand mdl IK-315	4.08	–	–	4	–	–
LeRoi mdl 315D2-C	4.36	–	–	4	–	–
Compressor, air, reciprocating, truck mtd, 6 x 6, 60 cfm, 5,000 psi:						
Clark mdl HO-6-5C	9.25	–	–	6	–	–
Joy mdl 60-HGC2-MS-1 and 60-HGC3-MS-1	9.21	–	–	6	–	–
Compressor, air, reciprocating, truck mtd, 6 x 6, 210 cfm, 100 psi:						
Davey mdl 210 WDS	7.9	–	–	7	–	–
Joy mdl 210G1	7.65	–	–	7	–	–
Compressor, air, rotary, trlr mtd, on trlr, 3½ T, 2 whl, M353, 250 cfm, 100 psi, Joy mdl RPV 250 DC MS-1	4.83	–	–	7	–	–
Compressor, air rotary, trlr mtd, 4 whl, 600 cfm, 100 psi Ingersoll-Rand mdl DR-600 and DR-600W	5.6	–	–	6	–	–
Compressor, air, rotary, truck mtd, 6 x 6, 210 cfm, 100 psi:						
Harris mdl J-210-FED	7.53	–	–	7	–	–
LeRoi mdl RPA-210GD3-MS-1	7.35	–	–	6	–	–
*Compressor, air, rotary, 750 cfm, 100 psi, wheel mtd, Sullair Corp.	5.36	–	–	5	–	–
Conversion-storage-charging unit, CO_2, semitrlr mtd, 16,000 lb capacity, Cardox mdl FE34365	11.7	–	–	10	–	–
Conversion unit, CO_2, semitrlr mtd, 260 lb/hr:						
Electric Heat mdl SCO2	16	–	–	20	–	–
Girdler mdl 32-4150	15	–	–	13	–	–
Girdler mdl 131-4910	19.3	–	–	17	–	–
Conveyor belt, whl mtd, electric, 300 tph, 50 ft, Barber Greene mdl PG70	4.82	–	–	4	–	–
Cooling tower, liquid, semitrlr mtd, 240 gpm, Badger mdl CT-1	8.5	–	–	7	–	–
Crane-shovel, crawler mtd, 12½ T, ¾ cu yd, w/boom, crane, 30 ft	23.11	–	–	22	–	–
Crane-shovel, basic unit, crawler mtd, 10 T, ¾ cu yd:						
American Hoist mdl 375 BC	18.7	–	–	19	–	–
Baldwin-Lima-Hamilton mdl 34CA and 34CH	19.1	–	–	22	–	–
Bucyrus Erie mdl 22B	21.16	–	–	19	–	–
Byers mdl 83	19.8	–	–	19	–	–
Thew Shovel mdl TL25K	16	–	–	15	–	–
Unit mdl 1020 YD	17.5	–	–	16	–	–
Crane-shovel, basic unit, crawler mtd, 35 T, 2 cu yd:						
Harnischfeger mdl 855B	52	–	–	72	–	–
Thew Shovel mdl L-820 and L-820-J	50.6	–	–	55	–	–
Crane-shovel, basic unit, crawler mtd, 40 T, 2 cu yd:						
Baldwin-Lima-Hamilton mdl 802	66.3	–	–	153	–	–
Bucyrus-Erie mdl 51-B	66.3	–	–	134	–	–
Harnischfeger mdl 855BG	48.2	–	–	56	–	–
Harnischfeger mdl 855BG2 and 855BG3	48.2	–	–	58	–	–
Manitowoc mdl 3000 B	58.5	–	–	101	–	–
Crane-shovel, basic unit, truck mtd, 3 T, 3/8 cu yd, 6 x 6:						
Quickway mdl N-383AB	9.2	–	–	8	–	–
Schield Bantam mdl ABM-53	9.3	–	–	8	–	–
Crane-shovel, basic unit, truck mtd, 10 T, ½ cu yd, 6 x 6:						
Bay City mdl 150M	18.9	–	–	16	–	–
Thew Shovel mdl MC-254	19.5	–	–	20	–	–
Thew Shovel mdl E-6610	18.1	–	–	18	–	–
Wayne Crane mdl 40	19.2	–	–	19	–	–
Crane-shovel, basic unit, trk mtd, 20 T, ¾ cu yd, 6 x 6:						
Baldwin-Lima-Hamilton mdl 34 T	28.7	–	–	27	–	–
Gar-Wood mdl M-20-A	28.1	–	–	34	–	–
Gar Wood mdl M-20-B	28.3	–	–	34	–	–

Table D-5. Construction Equipment—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
*Harnischfeger M320T, M320T2	30.06	–	–	29	–	–
Koehring mdl 304	27.8	–	–	32	–	–
Link Belt mdl HC-70	26.9	–	–	25	–	–
Quickway mdl M200	23.5	–	–	22	–	–
Quickway mdl M202	25.39	–	–	25	–	–
Thew Shovel mdl MC-1416	26.6	–	–	28	–	–
Unit mdl 1220-CE	26.3	–	–	31	–	–
*AH&D mdl 2360	25.05	–	–	23	–	–
Crane-shovel, whl mtd, 7 T, ½ cu yd, 4 x 4:						
Gar Wood mdl GW7	8.12	–	–	8	–	–
Koehring mdl 155-1A	8	–	–	8	–	–
Crane, tractor towed, 20 T, 20 ft lift, LeTourneau mdl M-20	4.6	–	–	6	–	–
*Crane, trk mtd, 25 T, MT 250	32.66	–	–	31	–	–
*Crane, whl mtd, 3 T, Anthony mdl M63, M65	10.5	–	–	10	–	–
Crane, whl mtd, 5 T, 3/8 cu yd, 4 x 4, rough terrain, air transportable	14.68	–	–	15	–	–
Crane, whl mtd, 20 T, ¾ cu yd, rough terrain	28.5	–	–	30	–	–
*Crane, whl mtd, 20 T, ¾ cu yd, model 2385	31.25	–	–	33	–	–
*Crane, whl mtd, 20 T, w/blade, w/30 foot boom	–	33.57	–	–	40	–
Crusher, jaw, whl mtd, 15 tph, Iowa mdl AB-1424-SP15T	7.25	–	–	8	–	–
Crusher, jaw, whl mtd, 200 tph Pioneer mdl 153 PRD	42.02	–	–	51	–	–
*Crusher, jaw & screening plant, GED, semitrailer mtd, 35 tph, Iowa mdl 2A	16.45	–	–	15	–	–
Crusher, jaw, diesel and electric driven, whl mtd, 75 tph, Eagle mdl 5157	36.6	–	–	37	–	–
*Crusher, jaw: DED, whl mtd, 75 tph, Eagle mdl 7300	36.1	–	–	40	–	–
Crusher, roll, diesel and electric driven, whl mtd, 75 tph, Eagle mdl 5230B	30.7	–	–	27	–	–
Crushing & screening plant, semi-trlr mtd, 35 tph, 2 unit Iowa mdl 2A:						
Unit #1, jaw crusher	16.25	–	–	13	–	–
Unit #2, roll crusher	17.69	–	–	19	–	–
Crushing & screening unit, whl mtd, 40 tph:						
Pioneer mdl 42VDE	22.02	–	–	19	–	–
Pioneer mdl 42 VA	28.2	–	–	25	–	–
Crushing & screening unit, crawler mtd, 100 tph, Pioneer mdl 54VA	38.56	–	–	58	–	–
*Crushing, screening & washing unit; DSL driven, whld, 50 tph, Iowa mdl DJ50	31.94	–	–	28	–	–
Crushing, screening, and washing unit, whl mtd, 40 tph, Pioneer mdl, 300 WDE	26.58	–	–	22	–	–
Crushing, screening, and washing unit, whl mtd, 40 tph, dual unit:						
Iowa mdl DJ-50	31.94	–	–	26	–	–
Pioneer mdl 33R Triplex	31.8	–	–	39	–	–
Universal mdl 1830 CWL	32.68	–	–	45	–	–
*Crushing, screening & washing unit, DED, 50 tph, Pioneer mdl 33-R Triple X	31.8	–	–	28	–	–
*Universal mdl 1830 CWL	32.68	–	–	30	–	–
Dehydrator, sand, trlr mtd:						
Iowa mdl 5022E	8.75	–	–	7	–	–
Pioneer mdl P-300W	9.35	–	–	9	–	–
Pioneer mdl 1833	3.42	–	–	6	–	–
Universal mdl 20 PW	3.73	–	–	6	–	–
Dehydrator, sand, compression, whl mtd, 90 tph, Pioneer mdl 2220-SDE	7.58	–	–	7	–	–
Distributor, bituminous material tankless type, trailer mtd 375 gpm:						
Littleford mdl US-3C-TOD	2.19	–	–	3	–	–
Littleford mdl US-3C	2.13	–	–	3	–	–
*Distributor, bituminous, 1500 gallon, Etnyre D60	12.1	–	–	11	–	–
Distributor, bituminous material, tank type, trk mtd, 6 x 6, 800 gal	11.7	–	15.7	10	–	15
Distributor, water, tank, type, trk mtd, 8 x 6, 1,000 gal	10.35	–	14.52	9	–	14
Ditching machine, DED, whl mtd, ladder type	18	–	–	19	–	–

Table D-5. Construction Equipment—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Ditching machine, GED, crawler mtd:						
Barber Greene mdl 44C	10.7	–	–	18	–	–
Parsons mdl 221	10.1	–	–	14	–	–
Drier, aggregate, trlr mtd, 10-25 tph, Barber Greene mdl 830	6.81	–	–	9	–	–
Drier, aggregate, trlr mtd, 80-120 tph:						
Barber Greene mdl 833	21.7	–	–	19	–	–
Barber Greene mdl 837	18.1	–	–	17	–	–
Dust collecting machine, semi-trlr mtd, Barber Greene mdl 857	10.3	–	–	11	–	–
Generator and charging plant, acetylene, semitrlr mtd, 750 cu ft/hr, Rexarc mdl TMCP-750	14.18	–	–	12	–	–
*Generating & charging plant, acetylene, semitrlr mtd, Rexarc, Inc, mdl TMCP 751	15.50	–	–	12	–	–
Generating and charging plant, CO_2 semitrlr mtd, 300 lb/hr:						
Girdler mdl 32-4176	24	–	–	23	–	–
Girdler mdl 32-4027	24.5	–	–	26	–	–
*Generating & charging plant, CO_2, semitrlr mtd, Lewis Domarkus mdl CMST-300	24.50	–	–	21	–	–
*Generating & charging plant, CO_2, semitrlr mtd, gas equipment engrg mdl J66124	23.25	–	–	19	–	–
Generator & charging plant, hydrogen-CO_2, semitrlr mtd, 156 lb CO_2/hr, Electric Heating Equipment mdl H_2-CO_2	24.47	–	–	23	–	–
Generator & charging plant, oxygen-nitrogen, semitrlr mtd, 200 cu ft N_2/hr, Air Products mdl A2	15	–	–	17	–	–
*Generating and charging plant, oxygen-nitrogen, semitrlr mtd, process plant mdl TM-1	18.25	–	–	17	–	–
Generator & charging plant, oxygen-nitrogen, semitrlr mtd, 5 T oxygen and 200 lb nitrogen per day, Air Products mdl LON-5, 2 unit:						
Air source semitrlr	28.6	–	–	45	–	–
Air separation semitrlr	24.6	–	–	21	–	–
Grader, road, motorized, air transportable, 6 x 4:						
Caterpillar mdl 212	7.46	–	–	6	–	–
LeTourneau Westinghouse mdl 220	8	–	–	7	–	–
Grader, road, motorized, heavy, 6 x 4:						
Caterpillar mdl 12	12.5	–	–	10	–	–
Galion mdl 118	12.7	–	–	10	–	–
Huber Warco mdl 4D	12.4	–	–	10	–	–
Huber Warco mdl 4D, winterized	12.59	–	–	11	–	–
LeTourneau Westinghouse mdl 440HA	13.5	–	–	11	–	–
Riddle Warco mdl 4D-1000	12.41	–	–	10	–	–
Grader, road, motorized, heavy 4 x 4, all whl steer, Austin-Western mdl 99H	10.7	–	–	9	–	–
Gradation control unit, aggregate, trlr mtd, Barber Greene mdl 866	15.29	–	–	12	–	–
Heater, bitumen, trlr mtd, 3-car heating:						
Cleaver Brooks mdl Ds	2.7	–	–	4	–	–
William Bros mdl SG45T	3.23	–	–	5	–	–
William Bros mdl SG52A	3.1	–	–	5	–	–
*Loader/backhoe tractor Model JD410	7.0	8.8	8.8	9	10	10
Loader, belt type, crawler mtd 10-20 cu yd/min, Barber Greene mdl 538B	7.84	–	–	11	–	–
Loader, bucket type, crawler mtd 3 cu yd/min:						
Barber Greene mdl 82-A	9.24	–	–	13	–	–
Barber Greene mdl 82-AG	10.15	–	–	15	–	–
Haiss mdl 77-PC	11.5	–	–	12	–	–
Loader, scoop type, 4 whl, 1½ cu yd, Clark mdl 85 AM	7.35	–	10.35	9	–	14
*Loader, scoop type, 1½ cu yd, H60M	8.60	–	–	10	–	–
Loader, scoop type, 4 whl, 2½ cu yd:						
Clark mdl 175 AM	15	–	19	16	–	22
Hough mdl 90 M	14.2	–	18.2	15	–	30
*Loader, scoop type, 2½ cu yd, 645M	12.8	16.8	–	12	24	–
*Loader, scoop, 2½ cu yd, MW24	12.60	16.60	–	12	24	–

Table D-5. Construction Equipment—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
*Loader, scoop type, 4 x 4, 4½ to 5 cu yd, mdl Michigan, 175B equipped w/4½ cy rock bucket	26.96	33.71	33.71	27	76	76
*Loader, scoop type, 4 x 4, 4½ to 5 cy, mdl Michigan, 175B, equipped w/5 cy gen'l purpose bucket	26.96	34.46	34.46	27	82	82
Legging arch for tractor, medium, w/10 ft boom	5.58	–	–	10	–	–
Mixer, bituminous material, trlr mtd, Barber Greene mdl 848	15.7	–	–	16	–	–
Mixer, concrete, trlr mtd, 16 cu ft:						
Chain Belt mdl 16-S	2.95	–	–	3	–	–
Construction Machinery mdl 16S	3	–	–	3	–	–
Construction Machinery mdl 16 SM	3.2	–	–	3	–	–
Gilson mdl 16S-SCE	3.65	–	–	4	–	–
Mixer, rotary tiller, selfpropelled, Seaman mdl TP-84M	5.75	–	–	5	–	–
Paver, concrete, crawler mtd, dual drum, 34 cu ft:						
Rex mdl 34E	26.12	–	–	79	–	–
Worthington mdl 34E	25.1	–	–	38	–	–
Paving machine, bituminous material, crawler mtd, 12 ft:						
Barber Greene mdl 879-A	12.13	–	–	21	–	–
Barber Greene mdl 879-B	11.25	–	–	14	–	–
Power Unit, gasoline, 120-140 bhp, whl, mtd, Minneapolis-Moline mdl 1210-12A	7.19	–	–	8	–	–
Pump, centrifugal, trlr mtd, 6 in., 1,000 gpm:						
Carver mdl KN6H	2.82	–	–	3	–	–
Jaeger mdl GPHO	3.08	–	–	3	–	–
Roller, motorized, GED, tandem, 2 rolls, 5-8 T:						
Buffalo Springfield mdl KT-16B	6	–	–	7	–	–
Galion mdl T-5G	5.9	–	–	6	–	–
Roller, motorized, DED, tandem 2 rolls, 16T, Galion mdl T-8G	8.84	–	–	11	–	–
Roller, motorized, GED, tandem 3 rolls, 9-14T:						
Buffalo, Springfield mdl KX-16C2	6.3	–	–	7	–	–
Galion mdl 3T9G	10.77	–	–	12	–	–
Roller, motorized, GED, 3 whl, heavy:						
Galion mdl Chief	10.02	–	–	11	–	–
Galion mdl Chief CG	10.6	–	–	13	–	–
Roller, motorized, GED, 3 whl 10 T, Galion mdl Chief Rolomatic	10.8	–	–	13	–	–
Roller, motorized, pneu tired-airmobile 8 whl Brothers mdl SP-54B	11.02	–	–	12	–	–
*Roller, pneu tired, self-propelled, Hyster C530	4.0	–	–	4	–	–
*Roller, steel wheel, 10-15 ton, Hyster C35OB	10.0	–	–	10	–	–
Roller, towed, pneu tired, 4 tire, 7½-35 T:						
Browning mdl HP4-35	6.8	–	–	10	–	–
Tampo mdl 35T4	6.15	–	–	9	–	–
Williams Bros mdl 435AB	6.45	–	–	10	–	–
Roller, towed, pneu tired, 4 tire, 7½-50 T:						
Grace mdl WLTR	7.25	–	–	10	–	–
Shovel Supply mdl RT-100CE	6.95	–	–	10	–	–
*Roller, vibratory, self-propelled, Tampo RS 28	9.75	–	–	10	–	–
Rooter, road, towed, cable operated, 24" depth, LeTourneau Westinghouse mdl H3	3.8	–	–	6	–	–
Rooter, road, towed, cable operated, 30" depth:						
*LeTourneau Westinghouse mdl K30	6.2	–	–	10	–	–
Southwest mdl RH-3	6.7	–	–	10	–	–
Scraper, air mobile, sectionalized, towed, 8 cu yd	8.1	19.1	–	7	18	–
Scraper, earthmoving, towed, 7½ cu yd	4.9	14.9	–	4	15	–
Scraper, earthmoving, towed, 13½ cu yd, Southwest mdl S-152	12	28	–	9	37	–
Scraper, earthmoving, towed, 12 cu yd:						
LeTourneau Westinghouse mdl LP	9.75	21.75	–	8	22	–
LeTourneau Westinghouse mdl LPO	9.75	21.75	–	8	26	–
Woolridge mdl 05-122A	12.1	27.1	–	9	37	–
Scraper, earthmoving, towed, 18 cu yd, Curtis Wright mdl CWT-18M, w/dolly	19.45	–	51.95	17	–	99
Scrubber & washer, aggregate, DED, whl mtd, 88 tph, Pioneer mdl 3620LWD66	15.7	–	–	17	–	–

Table D-5. Construction Equipment—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Snow removal unit, selfpropelled, rotary, trk, mtd, 7½ T:						
Klauer mdl TU3	11.38	–	–	10	–	–
Klauer mdl TU330	15.8	–	–	16	–	–
*Snow removal unit, whl mtd, S-349-V	16.65	–	–	17	–	–
*Tractor, full-track w/ripper, ROPs and blade	–	41.55	–	–	62	–
*Tractor, full-track w/winch, ROPs and blade, mdl D8K	–	37.70	–	–	51	–
*Tractor, full-tracked, w/winch, ROPs, and air droppable,						
Case mdl 1150, NSN 2410-01-024-4065	11.5	–	–	14	–	–
Tractor, full-tracked, low speed, light dbp:						
Allis Chalmers mdl HD6M	8	–	–	8	–	–
Caterpillar mdl 933	7.99	–	–	9	–	–
Caterpillar mdl D4:						
FSN 2410-190-0020	7.6	–	–	9	–	–
FSN 2410-190-0217	8	–	–	10	–	–
Caterpillar mdl D5A	12	–	–	15	–	–
Caterpillar mdl D6:						
FSN 2410-542-4206	7.98	–	–	8	–	–
Tractor, full-tracked, low speed, medium dbp,						
Caterpillar mdl D7:						
FSN 2410-191-0532	12.75	–	–	13	–	–
FSN 2410-191-0536	17.5	–	–	19	–	–
FSN 2410-191-0537	16.4	–	–	18	–	–
FSN 2410-233-5746	17.8	–	–	20	–	–
FSN 2410-233-5749	16.3	–	–	18	–	–
FSN 2410-277-1280	17.85	–	–	20	–	–
FSN 2410-294-6614	16.7	–	–	24	–	–
Tractor, full-tracked, low speed, heavy dbp,						
Caterpillar mdl D7E, FSN 2410-782-1130	24.28	–	–	28	–	–
Tractor, full-tracked, low speed, heavy dbp, Caterpillar mdl D8:						
FSN 2410-223-1214	23.4	–	–	30	–	–
FSN 2410-223-1216	18.1	–	–	20	–	–
FSN 2410-233-5750	23.3	–	–	27	–	–
FSN 2410-233-5752	25.3	–	–	33	–	–
FSN 2410-267-6888	21.8	–	–	22	–	–
FSN 2410-268-8229	20.9	–	–	27	–	–
FSN 2410-453-6816	17.39	–	–	27	–	–
FSN 2410-542-4881	22.05	–	–	35	–	–
FSN 2410-542-4882	22.05	–	–	30	–	–
Tractor, full-tracked, low speed, heavy dbp,						
International Harvester mdl TD-24-241:						
FSN 2410-542-2337	27.66	–	–	32	–	–
FSN 2410-542-2338	27.09	–	–	31	–	–
Tractor, full-tracked, low speed, medium dbp,						
International Harvester:						
Mdl TD20-200	20.2	–	–	24	–	–
Mdl TD18-182	19.93	–	–	25	–	–
*Tractor, full tracked, low speed, med, W/W Allis-Chalmers						
mdl HD16M	–	24.30	–	–	30	–
*Tractor, full tracked, low speed: w/ripper, med.						
Allis-Chalmers mdl HD16M	–	25.05	–	–	32	–
*Tractor, full track, low speed, DED:						
Caterpillar, mdl D7F:						
*FSN 2410-177-7283	–	26.00	–	–	31	–
*FSN 2410-185-9794	–	27.11	–	–	34	–
*FSN 2410-185-9792	–	24.35	–	–	24	–
*FSN 2410-177-7284	–	23.25	–	–	23	–
Tractor, wheeled, industrial GED, 5200-7775 dbp,						
Case mdl LA1	6.25	–	–	8	–	–
Tractor, wheeled, industrial light dbp, MRS mdl 100	8	–	–	8	–	–
Tractor, wheeled, industrial DED, 14025-20000 dbp:						
LeTourneau Westinghouse mdl, Super C Tourna Tractor	16.24	–	–	19	–	–
MRS mdl 150:						
FSN 2420-190-0053	14.4	–	–	18	–	–
FSN 2420-517-0675	17.65	–	–	21	–	–

Table D-5. Construction Equipment—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Tractor, wheeled, industrial DED, 20025-27000 dbp:						
LeTourneau Westinghouse mdl Super C Tourna Dozer	17.3	–	–	19	–	–
MRS mdl 190	15.37	–	–	17	–	–
Tractor, wheeled, industrial, DED, 27025-38000 dbp,						
Caterpillar mdl DW 20M	24.8	–	–	34	–	–
Tractor, wheeled, industrial, medium dbp:						
Caterpillar mdl 830M	26.14	–	–	43	–	–
Caterpillar mdl 830MB	26.45	–	–	43	–	–
Clark mdl 290M	27.1	–	–	44	–	–
*Tractor, wheeled, loader backhoe, JD410	7	–	8.8	9	–	10
Trailer, dump, 11 cu yd, MRS mdl 110AWG	7.23	–	24.23	6	–	22
Trailer-tractor, dump, 13 cu yd Euclid mdl 89W						
trlr with Euclid mdl 71FDT Tractor	17.9	–	37.9	13	–	31
Water purification equipment set, trlr mtd, 600 gph	2.91	–	–	5	–	–
Water purification equipment set, trk mtd:						
1,500 gph	9.51	–	–	8	–	–
3,000 gph	10.71	–	–	9	–	–

Table D-6. Missile and Fire Distribution Systems [1]

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
a. Pershing						
Carrier, guided missile equipment, full tracked, XM474E2	5.95	–	–	5	–	–
Communications pack, mtd on carrier, XM474E2	–	8.9	–	–	8	–
Erector-launcher, mtd on carrier, XM474E2	–	9.73	–	–	9	–
Facilities distribution, mtd on trailer, 1½ T, 2 whl, M105A2	–	2.54	–	–	4	–
Generator, 45 KW, mtd on trlr, 2 whl, 3½ T, XM353	–	3.78	–	–	6	–
Power Station and programmer, mtd on carrier, XM474E2	–	10.91	–	–	10	–
Warhead pallet and warhead handling gear, mtd on						
carrier XM474E2	–	8.19	–	–	8	–
**b. Pershing 1a*						
Battery control central, AN/MSW-8(XO-1), M79	–	14.30	–	–	13	–
Erector launcher, GM semi-trailer mounted, M790 w/missile	–	17.80	17.80	–	14	14
Erector launcher, M790, semitrlr mtd	–	17.80	–	–	14	–
Generator set; 15KW mounted on chassis, trailer: 2½ T, M200A1	2.53	2.53	2.53	4	4	4
Generator set: 45KW mounted on chassis trailer:						
2½ T, M200A1	3.27	3.27	3.27	5	5	5
Power station, GM system: mounted chassis, trailer, 2½ T,						
trailing arm, M3325	2.56	5.26	5.26	4	8	8
Programmer test station, trk mtd on M656	–	12.50	–	–	11	–
System component test station, semitrlr mtd	–	16.60	–	–	13	–
Truck cargo: 2½ T, M35A2, towing generator set, 45 KW	9.97	12.67	12.67	8	10	10
Truck cargo: 2½ T, M35A2, towing power station, GM system	9.26	14.66	14.66	7	11	11
Truck tractor, 5 T, 8 x 8, XM757, W/W with Pershing PLA						
improved erector launcher	17.26	22.56	–	13	18	–
Truck, van, expansible 5T, M791, towing generator set, 15 KW	8.78	16.30	16.30	7	13	13
c. Sergeant						
Launching station, guided missile, semi-trlr mtd, 4 whl, XM504	–	8.5	–	–	7	–
Combined with truck, tractor, 5 T, 6 x 6, M52	–	18.22	–	–	14	–
Semitrailer, motor-guidance transport	–	7.75	–	–	7	–
Combined with truck, tractor, 2½ T, 6 x 6, M275	–	13.55	–	–	10	–
Test station, guided missile system components,						
field maintenance, mtd on semitrlr XM539	–	7.75	–	–	6	–
Combined with truck, tractor, 2½ T, 6 x 6, M275	–	13.55	–	–	10	–

1. On those items of new equipment for which vehicle classes are not given in this table, the official vehicle classes were not available at time of publication.

Table D-6. Missile and Fire Distribution Systems—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Test station, guided missile system components, organizational maintenance, mtd on semitrlr, XM539	—	7.75	—	—	6	—
Combined with truck, tractor, 2½ T, 6 x 6, M275	—	13.55	—	—	10	—
Transport trlr, 4 whl, 6 T, XM527:						
With 2 forebodies	—	5.11	—	—	4	—
With missile motor, fin & guidance	—	7.74	—	—	6	—
d. Little John						
Handling unit, 318 mm rocket, trk mtd, 6 x 6, M572	7.5	9.3	—	6	8	—
e. Honest John						
Handling unit, 762 mm rocket, trlr mtd, M405 & M405A1	4.31	7.31	—	5	7	—
Heating and tiedown unit, 762 mm rocket, trk mtd, M78 and M78A1	12.43	15.39	—	10	14	—
Combination of above two	16.74	22.70	—	13	18	—
Launcher, 762 mm rocket, truck mtd:						
M289	20.8	23.8	—	19	22	—
M386	17.1	20.1	—	15	18	—
Trailer, rocket transporter, 762 mm rocket, 4 whl, M329A2	3	5.97	—	3	7	—
f. Hawk						
*Chassis, trailer, 2 T, 2 whl, M390C, w/3 missiles, MIM23A and 1 pallet M1E1	—	4.25	—	—	6	—
Generator, 45KW, mtd on trlr, M200A1	—	4.25	—	—	5	—
*Launcher, GM, carrier mtd, self-prop, M754E1	12.25	14.20	—	12	14	—
*Launcher, zero length, M78E2, trlr mtd	2.14	—	—	3	—	—
*Loader, transporter, guided missile, M501E3	2.77	4.75	—	3	5	—
Radar set, trlr mtd:						
CW acquisition, AN/MPQ-34	—	2.17	—	—	3	—
CW illuminator, AN/MPQ-33	—	2.63	—	—	3	—
High power illuminator, AN/MPQ-39	—	4.65	—	—	6	—
Pulse acquisition, AN/MPQ-35	—	3.97	—	—	6	—
Shop equipment, guided missile, organizational maintenance, AN/MSM-43 on M389 trlr	—	2.75	—	—	4	—
g. Improved Hawk						
Improved range-only radar, AN/MPQ-51, mounted on M514 trailer towed by truck, 2½ T, M35 loaded w/5 data cables	—	9.58	—			
Improved high power illuminator radar, AN/MPQ-46, mounted on M390 trailer towed by truck, 2½ T, loaded w/3 data cables	—	10.96	—			
Improved continuous wave acquisition radar, AN/MPQ-48, mounted on M514 trailer, towed by truck, 2½ T, M35, loaded with improved ground equipment test set AN/TSM-112 and four cables	—	9.44	—			
Improved pulse acquisition radar, AN/MPQ-50, mounted on M390 trailer, towed by truck 2½ T, M36 loaded with PAR antenna and five data cables	—	11.42	—			
Information and coordination center AN/MSQ-95 mounted on M390 trailer, towed by truck, 2½ T, M36, loaded with improved battery control center, AN/TSW-8	—	9.65	—			
Improved platoon command post, AN/MSW-11, mounted on M390 trailer, towed by truck, 2½ T, M36 loaded with cables	—	12	—			
Improved launcher M-192, mounted on special trailer, 2w, towed by truck, 2½ T, M36 loaded with pallet M1E1 with 3 improved missiles and one data cable	—	11.86	—			
Pallet M1E1 w/3 improved missiles, mounted on M390 trailer, towed by truck, 2½ T, M36 loaded with loader-transporter M501E3	—	14.19	—			
Generator, mounted on M200A1 trailer, towed by truck M35, loaded with four power cables	—	10.22	—			
Generator, mounted on M200A1 trailer, towed by truck, 2½ T, M36, loaded w/3 improved missile containers	—	15.67	—			
Improved launcher M192, mounted on special trailer, 2w, towed by truck, 2½ T, M35, loaded with one data cable and two improved launcher control boxes	—	8.55	—			

Table D-6. Missile and Fire Distribution Systems—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Improved launcher M192, mounted on special trailer, 2w, towed by truck, 2½ T, M36, loaded with loader-transporter M501E3 and one data cable	–	12.02	–			
Pallet M1E1 w/3 improved missiles mounted on M390 trailer, towed by truck, 2½ T, M36, loaded w/loader-transporter M501E3 and one power cable	–	14.41	–			
Pallet M1E1 w/3 improved missiles mounted on M390 trailer, towed by truck, 2½ T, M36, loaded with pallet M1E1 w/3 improved missiles	–	14.13	–			
Pallet M1E1 w/3 improved missiles mounted on M390 trailer, towed by truck, 2½ T, M36, loaded with missile assembly stand	–	11.70	–			
h. Nike-Ajax						
Antenna-receiver-transmitter group, trlr mtd, on trlr M260 or M260A1:						
Missile tracking	–	5.49	–	–	5	–
Target tracking	–	5.49	–	–	5	–
Director station, guided missile, trlr mtd, on trlr M259, M259A1, M259A1C, or M259C	–	6.32	–	–	6	–
Electronics shop, trlr mtd, M304 and M304A1	–	6.59	–	–	6	–
Electronics shop, van, trlr mtd:						
Trailer #1, M382	–	6	–	–	6	–
Trailer #2, M383	–	6.25	–	–	6	–
Electronics shop, maintenance and spares, trlr mtd, on trlr M359	–	6	–	–	6	–
Launching control group, trlr mtd on trlr, M262 or M262A1	–	6	–	–	6	–
Tracking station, guided missile, trlr mtd, on trlr, M258 or M258A1	–	6.18	–	–	5	–
Trailer, flat bed, guided missile:						
M261	3.85	6.17	–	4	6	–
M261A1	3.13	6.77	–	3	7	–
i. Nike-Hercules and Improved Hercules						
Antenna receiver transmitter group, trlr mtd on trlr M406, M406A1, M406E1, or M406E2:						
Missile tracking	–	6.36	–	–	6	–
Target tracking	–	6.36	–	–	6	–
Director station, guided missile, trlr mtd on trlr M424, M424A1, or M424E1	–	6.87	–	–	7	–
Electronic shop, trlr mtd, M304 and M304A1	–	6.59	–	–	6	–
Launching control group, guided missile, trlr mtd:						
On trailer M262A1C	–	6	–	–	6	–
On trailer M262A2	–	6.23	–	–	6	–
*Radar signal simulator van, trlr mtd on trlr M446	–	8.5	–	–	9	–
*Semitrailer, lowbed: 15 T, 4 whl, M674 loaded with:						
Equipment & antenna AS1774/MPQ43	–	–	22.32	–	–	18
Power plant, elec. AN/MJ	–	–	28.68	–	–	24
Radar power control set, GM AN/MJQ-7	–	–	22.61	–	–	20
Receiver set, radar, AN/MPR-1	–	–	19.61	–	–	17
*Transmitting set, radar, AN/MPT-2	–	–	23.49	–	–	20
Shop equipment van, trlr mtd, on trlr M564, M564A1, or M564A2	–	8.77	–	–	9	–
Shop van, trlr mtd on trlr M582 or M583	–	6.1	–	–	6	–
Tracking station, guided missile, trlr mtd:						
On trailer M428E1	–	6.64	–	–	7	–
On trailer M428 or M428A1	–	6.43	–	–	6	–
*Traller, low bed, guided missile, 7 T, 4 whl, M529	7.25	14	–	6	12	–
j. Chaparral						
*Chaparral, M48	–	13.2	–	–	13	–
*Recovery vehicle, full-tracked, M758	–	23.3	–	–	23	–
*Guided missile shop equipment, AN/TSM96, mounted on truck, 2½ T, M36C	–	9.25	–			

Tabla D-6. Missile and Fire Distribution Systams—Continued

Vehicle Dascription	Waight (Short tons)			Class		
	E	Loadad		E	Loadad	
		C	H		C	H
**k. Forward Arae Alerting Radar*						
Forward area alerting radar AN/USM 49, mountad on truck 1¼ T, 6 x 6, M561, towing trallar, cargo, ¾ T, M101A2, containing ganarator and accessorias	–	7	–			
**l. Fire Distribution System AN/MSG-4*						
Oparations cantral AN/MSQ-28B, mounted on 2½ T truck	–	9.3	–			
Oparations central AN/MSQ-56, mountad on 2½ T truck	–	9.3	–			
Oparations cantral AN/TSQ-38, mountad on 2½ T truck	–	9.3	–			
Operations central AN/MSQ-18, mounted on 2½ T truck	–	9.3	–			
**m. Commend end Control Systam AN/TSQ 51*						
Equipmant trallar	–	9.4	–			
Operations traller	–	9.4	–			
Remote radar integration station	–	9	–			
**n. ADA Command end Control System (missile minder).*						
ADA command and control system AN/TSQ-73, ahelter mounted on truck, 5 T, M55	–	17	–			
Ganerator, 115/208 VAC, mountad on trailer, 2w, towed by truck, 5 T, M55, loaded with cables and accessories	–	17.21	–			

Table D-7. Combination Vahiclas

Vehicla Description	Waight (Short tons)			Class		
	E	Loaded		E	Loadad	
		C	H		C	H
*Heavy aquipmant transportar, M746/M747	38.83	–	98.35	28	–	85
Tractor, full tracked, high spaad, 13 T, M5 or M5A1, towing: Howitzar, madium, 155 mm, M114 or M114A1	–	20.73	–	–	18	–
Tractor, whaalad, industrial, Catarpillar mdl 830M, towing: Scrapar, aarthmoving, 18 cu yd Curtiss Wright mdl 18M, wo/dolly	42.38	–	74.88	45	–	99
Tractor, wheeled, industrial, Catarpillar mdl 830MB, towing:						
*Scrapar, aarthmoving, 23 cu yd, Hancock mdl 223M	47.50	–	74.48	48	–	121
*Scraper, aarthmoving, 18 cu yd, WABCO mdl C-4	–	–	71.88	–	–	91
*Scrapar, earthmoving, 18 cu yd, Euclid mdl 58SH-G	43.77	–	68.88	48	–	82
Tractor, whealad, Industrial Clark mdl 290M, towing:						
*Scraper, earthmoving, 23 cu yd, Hancock mdl 223M	48.57	–	75.55	50	–	121
*Scraper, earthmoving, 18 cu yd, WABCO mdl CT-4	43.16	–	73.16	49	–	91
*Scraper, earthmoving, 18 cu yd, Euclid mdl 58SH-G	–	–	70.35	–	–	84
Truck, cargo ¾ T, 4 x 4, M37, towing:						
Trlr, cargo, ¼ T, 2 whl, M100	3.24	4.24	–	3	4	–
Trlr, cargo, ¾ T, 2 whl, M101	3.63	5.13	5.76	3	5	5
Truck, cargo, 1¼ T, 4 x 4, M715, towing:						
Trailer, cargo, ¾ T, 2 whl, M101 or M101A1	3.45	5.65	6.28	3	5	6
*Truck, cargo: 1¼ T, 4 x 2, M890 w/trailar, cargo, ¾ T, M101A1	2.78	5.16	5.53	2	4	5
*Truck, cargo: 1¼ T, 4 x 4, M880 w/trailar, cargo: ¾ T, M101A1	2.99	5.42	5.80	3	5	5
*Truck, cargo, 1½ T, 4 x 4, M717, towing:						
Gun, anti-aircraft artillery, 20 mm, M167, trlr mtd	4.27	5.72	–	4	5	–
*Truck, cargo, 1½ T, 6 x 6, M561, towing:						
Gun, anti-aircraft artillary 20 mm, M167, trlr mtd	4.76	6.21	–	4	5	–
Truck, cargo, 2½ T, 6 x 6, M35, towing:						
Gun, anti-aircraft artillary, 20 mm, XM167, trlr mtd	7.93	10.43	12.93	7	8	10
Howitzer, light, 105 mm, M101 or M101A1	8.93	11.43	13.93	7	9	11
*Howitzer, light, 105 mm, M102	7.99	10.49	12.99	6	9	10
Kattla, Haating, Bitumen trlr mtd, 165 gal	7.28	10.44	12.94	6	9	10
Trlr, basic utility, pole type, 2½ T, 2 whl	7.64	12.64	15.14	6	10	12
Trailer, cargo, 1½ T, 2 whl, M104	7.8	11.8	15.55	7	10	12
Trailer, cargo, 1½ T, 2 whl, M105A1	7.76	11.76	15.01	6	9	12
Trailer, tank, water, 400 gal., 2 whl, M106A1	7.58	11.75	14.25	6	9	12

Table D-7. Combination Vehicles—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
*Truck, cargo: 2½ T, 6 x 6, M35A2; towing generator set (15KW) on chassis, trailer: 2½ T, M200A1	4.68	12.18	14.68	8	10	11
Truck, cargo, 2½ T, 6 x 6, M36 towing:						
Conveyor, belt, whl mtd. Barber Greene mdl PG-70	11.46	13.96	16.46	8	10	12
Truck, cargo, 2½ T, 6 x 6, M211, towing:						
Semitrailer, van, cargo, 6 T, M119, w/dolly, M197	11.82	20.50	25.10	10	17	20
Trailer, basic utility, pole type, 2½ T, 2 whl	7.99	13.17	15.67	7	10	12
Trailer, cargo, 1½ T, 2 whl, M104	8.15	12.33	16.08	7	10	13
Trailer, cargo, 1½ T, 2 whl, M105A1	8.11	12.29	15.54	7	10	12
Trailer, tank, water, 400 gal., 2 whl, M106A1	7.93	12.28	14.78	7	10	11
Truck, cargo, 5 T, 6 x 6, M41, towing:						
Mixer, bituminous material, trlr mtd, Barber Greene mdl 848	25.25	–	32.75	22	–	30
Trailer, ammunition, 4 T, 2 whl, M21	12.2	19.95	23.7	11	21	24
Trailer, cargo, 1½ T, 2 whl, M104	10.91	16.16	21.16	10	15	18
Trailer, cargo, 1½ T, 2 whl, M105A1	10.87	16.12	20.62	10	15	17
Truck, cargo, 5 T, 6 x 6, M54, towing:						
Howitzer, heavy, 8 in., M115	24.77	29.77	34.77	20	26	30
Mixer, bituminous material trlr mtd, Barber Greene mdl 848	25.67	–	35.67	21	–	32
Semitrailer, tank, gasoline, 5,000 gal., 4 whl, M131A, w/dolly, M198A1	19.11	33.92	44.38	16	27	37
Trailer, cargo, 1½ T, 2 whl, M104	11.33	17.83	24.08	9	15	20
Truck, cargo, 5 T, 6 x 6, M55 towing:						
Howitzer, heavy, 8 in., M115	26.83	31.83	36.83	21	25	30
*Truck, cargo, 5 T, 6 x 6, M55A2 towing: trailer, M200A1	–	19.0	–	–	15	–
Truck, cargo, 10 T, 6 x 6, M125, towing:						
Howitzer, heavy, 8 in., M115	30.60	39.35	48.10	24	32	38
Mixer, bituminous material, trlr mtd, Barber Green mdl 848	31.5	–	49	25	–	44
Truck, dump, 5 T, M51, towing:						
Bin, aggregate loading, trlr mtd, Universal mdl PB-20	17.19	–	27.37	12	–	23
Conveyor, belt, GED, 52 ft long, Barber Greene mdl PH-70	17	–	–	11	–	–
Elevator, hot, aggregate, tlrl mtd, Barber Greene mdl 882-251	15.5	–	–	11	–	–
Elevator, hot, aggregate, trlr mtd, Barber Green mdl 882-241	15.7	–	–	12	–	–
Mixer, bituminous material, trlr mtd, Barber Greene mdl 848	27.03	–	37.21	22	–	33
Trailer, basic utility, 2½ T, 2 whl	12.53	20.21	25.21	10	17	21
Trailer, low bed, 8 T, Fruehauf mdl CPT-8 Special	16.09	19.27	34.27	12	17	28
Truck, tractor, 2½ T, 6 x 6, M221, towing:						
Semitrailer, van, cargo, 6 T, 2 whl, M119	9.82	15.52	17.92	8	13	14
Semitrailer, van, shop, 6 T, 2 whl, M146	9.63	15.63	–	8	13	–
Truck, tractor, 2½ T, 6 x 6, M275, towing:						
Semitrailer, stake and platform, 5 T, 2 whl, Olson mdl 516	9.12	14.13	16.62	8	12	15
Truck, tractor, 5 T, 6 x 6, M52, towing:						
Conversion unit, CO_2, strlr mtd, 260 lbs/hr, Girdler mdl 32-4150	24.04	–	–	20	–	–
Cooling tower, strlr mtd, 4 section, 240 gpm	17.25	–	–	13	–	–
Dust collecting machine, strlr mtd, Barber Greene mdl 857	19.7	–	–	16	–	–
Generator and charging plant, CO_2, strlr mtd, 300 lbs/hr	31.53	–	–	25	–	–
Semitrailer, low bed, 15 T, 4 whl, M172	16.78	–	31.78	12	–	25
Semitrailer, low bed, 25 T, 4 whl, M172A1	16.78	–	41.78	12	–	35
Semitrailer, low bed, wrecker, 12 T, 4 whl, M270	18.25	30.25	38.25	13	23	30
Semitrlr, stake, 12 T, 4 whl, M127A1	15.68	27.78	33.78	12	23	29
Semitrailer, tank, alcohol, 3,000 gal., 2 whl, M338	13.21	21.19	–	10	18	–
Semitrailer, tank, gasoline, 12 T, 4 whl, 5,000 gal:						
M131	16.93	26.74	32.2	13	22	28
M131C	16.58	27.77	33.86	13	24	30
Semitrailer, van, cargo, 12 T, 4 whl, M127	16.25	28.28	34.25	12	25	31
Truck, tractor, 10 T, 6 x 6, M123 or M123C, towing:						
Semitrailer, low bed, 25 T, 4 whl, M172A1	23.55	48.55	53.55	17	37	42
Semitrailer, low bed, wrecker, 12 T, 4 whl, M269 or M269A1	23.22	35.22	43.22	16	26	33
Semitrailer, tank, gasoline, 12 T, 4 whl, 5,000 gal., M131, M131A1, or M131A2	23.54	33.35	38.81	17	26	31

Table D-7. Combination Vehicles—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Semitrailer, tank transporter, 8 whl:						
40 T, M15	37.31	—	77.31	24	—	60
45 T, M15A1	37.3	—	82.3	24	—	65
50 T, M15A2	37.42	—	87.42	24	—	72
*Truck tractor, M123A1C, towing semi-trailer, M870	22.36	64.10	64.10	17	52	52
Truck, tractor, 12 T, 6 x 6, M26 or M26A1, towing:						
Semitrailer, low bed, 60 T, Rogers mdl D-60-DS-5	41.45	—	101.45	30	—	108
Semitrailer, tank, gasoline, 12 T, 4 whl, 5,000 gal., M131, M131A1, or M131A2	31.87	41.68	47.14	25	33	37
Semitraller, tank transporter, 8 whl:						
40 T, M15	45.64	—	85.64	32	—	68
45 T, M15A1	45.63	—	90.63	32	—	73
Truck, tractor, wrecker, 5 T, 6 x 6, M246, towing:						
Mixer, bituminous material, 110-220 TPH, trlr mtd, Barber Greene mdl 848	32.12	—	—	26	—	—
Semitrailer, low bed, wrecker, 12 T, 4 whl, M270 or M270A1	23.52	—	35.52	19	—	28
Semitrailer, tank, gasoline, 12T, 4 whl, 5,000 gal., M131, M131A1, or M131A2	23.84	33.65	39.11	19	28	33

APPENDIX E

(STANAG 2096)

REPORTING ENGINEER INFORMATION IN THE FIELD

E-1. INTRODUCTION.

The purpose of this appendix is to implement the provisions of STANAG 2096 (Edition No. 3), Reporting Engineer Information in the Field.

OBJECT

1. The aim of this Agreement is to standardize, for the use by the NATO Armed Forces, the format for reporting engineer information collected in the field.

AGREEMENT

2. Participating nations agree that the NATO Armed Forces are to use the format as a simple and concise method for reporting engineer information collected in the field.

GENERAL

3. This format is intended for use by units of all arms or services. Much of the detail will only be reported by qualified engineer personnel. Non-specialist personnel of other arms and services should include only that detail which they are qualified to report.

4. While this Agreement does not provide for the mandatory use of this format below battalion/regimental or equivalent level, it can be used at all echelons.

CLASSIFICATION

5. Completed reports are to be classified in accordance with current security regulations.

METHOD OF RENDERING AND TRANSMISSION

6. The format is designed primarily for transmission by radio using the standard message form. Radio reports should commence with a code such as 'ENGREP'. It may be used for a written report, however, and either a message report or a written report may be supported by drawings, maps, traces, overlays, etc. If not transmitted by radio, the fastest possible alternative means should be used.

7. The originator should complete only those parts of the format which are applicable to his report, but he should use the letters and numbers exactly as shown in order properly to identify his information. Nil returns for incomplete parts are not required. It is emphasized, however, that incomplete reports are often of great value, e.g. that mines have been found at a certain point although no details are known.

IMPLEMENTATION OF THE AGREEMENT

8. This STANAG will be considered to have been implemented when the necessary orders/instructions to adopt the format described in this Agreement have been issued to the forces concerned.

E-2. FORMAT TO BE USED FOR REPORTING ENGINEER INFORMATION IN THE FIELD

Information as to originator, addressee, security classification, precedence, date, time, etc., as provided on standard message form is to be provided in written reports as well as messages. Radio messages should commence with a code word such as 'ENGREP'. Each written report or message commences with the identification of the map sheet(s) referred to the reconnaissance and time of collection of information. Each location reported is to be followed by the respective UTM map coordinates.

A. **FRIENDLY MINEFIELD(S)**

(Note:

This report does not take the place of the detailed minefield record which is mandatory in accordance with STANAG 2036.) N

1. **First Friendly Minefield in Report.**
   a. Map sheet(s).
   b. Date and time of collection of information.
   c. NATO classification of minefield — as detailed in STANAG 2036.
   d. Type of minefield: anti-tank, anti-personnel or mixed.
   e. Grid references (GR) of minefield extremities.
   f. Number of strips laid.
   g. Depth of the minefield.
   h. i., j., etc., Grid references of lanes (entry) and width of lanes in metres.
2. **Second Friendly Minefield.**
   a. through h., etc., same as above.

3., 4, etc., **Additional Friendly Minefields.** Reported as above.

B. **ENEMY MINEFIELD(S) AND/OR UNIDENTIFIED MINEFIELD(S) NOT LAID BY REPORTING UNIT**

(Note:

This report is additional to the requirement to mark the minefield(s) as detailed in STANAG 2002.)

1. **First Enemy Minefield in Report.**
   a. Map sheet(s).
   b. Date and time of collection of information.
   c. Type of minefield; anti-tank, anti-personnel or mixed.
   d. Grid references of minefield extremities.
   e. Depth of minefield.
   f. Enemy weapons or surveillance bearing on the minefield, if any.
   g. Estimated time required to clear minefield.
   h. Estimated material and equipment required to clear minefield.
   i. Routes for bypassing the minefield, if any.
   j. k., l., etc. Grid references of lanes (entry, exit) and width of lanes in metres.
   z. Any other information which could be provided, such as types of mines used, new mine or booby-trap types.
2. **Second Enemy Minefield in Report.**
   a. through z., same as above.

3., 4., etc. **Additional Enemy Minefields.** Reported as above.

C. **ROAD(S) CLOSED**

(Note:

Paragraphs C and D apply only to major axial or lateral routes. Classification of roads to be given in respect of weakest part of section of road under report, i.e. the class of the route may be restricted by low class of bridge.)

1. **First Road in Report.**
   a. Map sheet(s).
   b. Date and time of collection of information.
   c. From grid reference _____) or show on trace.
   d. To grid reference _____) or overlay.
   e. Reason for closing of road.

(Note:

The reason for closing of road should be the nature of the obstacle, i.e. bridge blown at grid reference, mines at grid reference, road made unusable through constant heavy traffic, etc.)

f. Estimated duration.
g. Detour from _____ to _____ including, if possible, class of road as detailed in STANAG 2015, or at least the following information: width of road, smooth or rough surface, gradual or sharp curves, gentle or steep grades.
h. Cross-country by-pass permitted to _____ (wheeled or tracked vehicles and class).
i. Any other information which could be provided, such as class of road as detailed in STANAG 2015 after re-opening and characteristics of the road as detailed in STANAG 2151, to include information on shoulders.

2., 3., etc. **Additional Roads.** Reported as above.

D. **ROAD(S) OPENED**

(Note:

Paragraphs C and D apply only to major axial or lateral routes. Classification of roads to be given in respect of weakest part of section of road under report, i.e. the class of the route may be restricted by low class of bridge.)

1. **First Road in Report.**
a. Map sheet(s).
b. Date and time the road is opened.
c. From grid reference _____) or show on trace.
d. To grid reference _____) or overlay.
e. Class of road as detailed in STANAG 2015 and characteristics of the road as detailed in STANAG 2151, to include information on shoulders.
f. Minimum widths.

2., 3., etc. **Additional Roads.** Reported as above.

E. **ENEMY DEMOLITION(S)**

1. **First Enemy Demolition in Report.**
a. Map sheet(s).
b. Date and time of collection of information.
c. Location (grid reference or trace).
d. Type of target destroyed.
e. Size of the gap.
f. Possible by-pass routes, times and facilities (personnel and materials) required for build-up of by-pass (if possible).
g. Any other information which could be provided, such as local availability of construction or repair materials, material requirements, work required in man-hours.
h. Enemy weapons or surveillance bearing on the demolition, if any.

2., 3., etc. **Additional Enemy Demolitions.** Reported as above.

F. **FRIENDLY DEMOLITION(S)** (see STANAG 2017)

1. **First Friendly Prepared Demolition in Report.**
a. Map sheet(s).
b. Presumed date, and time of demolition.
c. Location (grid references or trace).
(Note:

Location and types of target destroyed are to be referred to by Bridge Demolition Schedule Code Number wherever possible.)

d. Type of target to be destroyed.
(Note:

Location and type of target destroyed are to be referred to by Bridge Demolition Schedule Code Number wherever possible.)

e. Estimated size of the gap.
f. Possibilities of by-passing.
g. Time in man-hours, personnel and facilities required to complete the preparation of the demolition.

2.- 19. **Additional Friendly Prepared Demolitions.** Reported as above.

20. **First Executed Demolition in Report.**
    a. Map sheets(s).
    b. Date, and time of execution.
    c. Location (grid references or trace).
    (Note:
    Location and type of target destroyed are to be referred to by Bridge Demolition Schedule Code Number wherever possible.)
    d. Type of target destroyed.
    (Note:
    Location and type of target destroyed are to be referred to by Bridge Demolition Schedule Code Number wherever possible.)
    e. Size of the gap.
    f. Possibilities of by-passing.
    g. Any other information which could be given, such as estimated time in man-hours required for build-up of by-pass and facilities required for repair work.

21. etc. **Additional Executed Demolitions.** Reported as above.

G. **BRIDGE(S)**
(Note:
Information is recorded in this part only when the bridge is first reconnoitered or when it has been altered by enemy or own action. Alterations may be either strengthening or weakening of the bridge(s).)

1. **First Bridge in Report.**
    a. Map sheet(s).
    b. Date and time of collection of information.
    c. Location, (grid references or trace).
    d. Type of bridge (number of spans, length, etc.).
    e. Class _____ one way traffic as detailed in STANAG 2021.
    f. Class _____ two way traffic as detailed in STANAG 2021.
    g. Condition.
    h. Clearance width for the passage of vehicles.
    i. Clearance height for the passage of vehicles.
    j. Possible by-pass route as detailed in STANAG 2015.
    k. Any other information which could be given.

2., 3., etc. **Additional Bridges.** Reported as above.

H. **FERRY SITE(S)**

1. **First Site in Report.**
    a. Map sheet(s).
    b. Date and time of collection of information.
    c. Location (grid references or trace).
    d. Minimum class of approach as detailed in STANAG 2015.
    e. Possibilities for concealment or cover.
    f. Width of the river.
    g. Depth of water at the banks, including tidal information.
    h. Stream velocity.
    i. Maximum slope on bank approaches and bank conditions.
    j. Parking areas for road and water transport.
    k. Any other information which could be given, such as maximum number of rafts for which site is usable, work required in man-hours for preparation of approach routes, and present water gauge reading if available.

2., 3., etc. **Additional Sites.** Reported as above.

I. FORD(S)

1. **First Ford in Report.**
   a. Map sheet(s).
   b. Date and time of collection of information.
   c. Location (grid references or trace).
   d. Minimum width.
   e. Maximum depth.
   f. Stream velocity.
   g. Type of bottom.
   h. Maximum slope on bank approaches and bank conditions.
   i. Class of approach routes as detailed in STANAG 2015.
   j. Rise and fall of water level.
   k. Any other information which could be given, such as class of traffic for which ford is usable, and, if possible, seasonal limiting factors.

2., 3., etc. **Additional Fords.** Reported as above.

J. TUNNEL(S)

1. **First Tunnel in Report.**
   a. Map sheet(s).
   b. Date and time of collection of information.
   c. Location (grid references or trace).
   d. Length.
   e. Width.
   f. Height.
   g. Gradient.
   h. Type of tunnel.
   i. Condition.
   j. Possible by-pass routes including classification as detailed in STANAG 2015.
   k. Any other information which could be given, if possible, cross-section.

2., 3., etc. **Additional Tunnels.** Reported as above.

K. INSTALLATION(S)

1. **First Installation in Report.**
   a. Map sheet(s).
   b. Date and time of collection of information.
   c. Location (grid references or trace).
   d. Nature.
   e. Capacity, including capacity as shelter or storage.
   f. Condition.
   g. Any other information which could be given.

2., 3., etc. **Additional Installations.** Reported as above.

L. ROAD-MAKING EQUIPMENT (To cover static and mobile mechanical equipment)

1. **First Road Making Equipment in Report.**
   a. Map sheet(s).
   b. Date and time of collection of information.
   c. Location (grid references or trace).
   d. Type.
   e. Number.
   f. Condition.
   g. Any other information which could be given.

2., 3., etc. **Additional Road-Making Equipment.** Reported as above.

M. **LOCAL RESOURCES.** (To include quarries, sawmills, brickworks, etc.) (See STANAG 2269)

1. **First Item in Report.**
   a. Map sheet(s).
   b. Date and time of collection of information.
   c. Location (grid references or trace).
   d. Type.
   e. Quantity of stock.
   f. Capacity and output per day.
   g. Any other information which could be given.

2., 3., etc. **Additional Items.** Reported as above.

N. **ENEMY STORES AND EQUIPMENT.** This part is only suitable for the initial reporting of significant items of equipment. Subsequent action should be taken in accordance with agreed procedures for handling of captured enemy equipment (STANAG 2084)

1. **First Item in Report.**
   a. Map sheet(s).
   b. Date and time of collection of information.
   c. Location (grid references or trace).
   d. Type.
   e. Quantity.
   f. Condition.
   g. Any other information which could be given.

2., 3., etc. **Additional Items.** Reported as above.

O. **WATER SUPPLY POINTS.** (See STANAG 2256)

1. **First Water Supply Point in Report.**
   a. Map sheet(s).
   b. Date and time of collection of information.
   c. Location (grid references or trace).
   d. Type (well, spring, watercourse, lake or pond).
   e. Rate of delivery of water.
   f. Total quantity of water available in sources and description of water in source, i.e., brackish, clear, etc.
   g. Existing pump, storage, filtration and distribution facilities.
   h. Accessibility (to include road network).
   i. Natural cover (vegetation) and concealment possibilities.
   j. Any other information which could be given.

2., 3., etc. **Additional Water Supply Points.** Reported as above.

P. **AIRSTRIP(S)**

1. **First Airstrip in Report.**
   a. Map sheet(s).
   b. Date and time of collection of information.
   c. Location (grid references or trace).
   d. Dimensions.
   e. Type and condition of the airstrip.
   f. Access by road.
   g. Feasibility of runway extension.
   h. Any other information which could be given, such as work required in man-hours to make the airstrip serviceable for sustained or limited operations.

2., 3., etc. **Additional Airstrips.** Reported as above.

Q. AIRFIELDS

1. **First Airfield in Report.**
   a. Map sheet(s).
   b. Date and time of collection of information.
   c. Location (grid references or trace).
   d. Number of runways (length and width).
   e. Orientation of the runways.
   f. Type and surface of runways.
   g. Condition of the runways.
   h. Hangars and bulk fuel storage facilities, including condition.
   i. Parking area for the aircraft.
   j. Maintenance facilities.
   k. Access by road.
   l. Any other information which could be given, such as type or aircraft admissible.

2., 3., etc. **Additional Airfields.** Reported as above.

R. DAMS AND/OR SLUICES (See STANAG 2256)

1. **First Dam and/or Sluice in Report.**
   a. Map sheets(s).
   b. Date and time of collection of information.
   c. Location (grid references or trace).
   d. Type of dam and/or sluice.
   e. Dimensions of dam and/or sluice.
   f. Condition.
   g. Any other information which could be given, such as possibility of inundation, work required in man-hours to bring about the inundation.

2., 3., etc. **Additional Dams and/or Sluices.** Reported as above.

S. OBSTACLES

1. **First Obstacle in Report.**
   a. Map sheet(s).
   b. Date and time of collection of information.
   c. Location (grid references or trace).
   d. Type.
   e. Enemy weapons having action on the obstacle, if any.
   f. Any other information which could be given, such as work required in man-hours to take the obstacle away.

2., 3., etc. **Additional Obstacles.** Reported as above.

T. TERRAIN

1. **First Area in Report.**
   a. Map sheet and grid references.
   b. Shape of the ground, i.e., flat, rolling, hilly, mountainous, etc.
   c. Cross country movement.
   d. Vegetation.
   e. Concealment.
   f. Land use.
   g. Suitability of the soil for digging.

2., 3., etc. **Additional Areas.** Reported as above.

U. BRIDGE SITES

1. **First Bridge Site in Report.**
   a. Map sheet.
   b. Date and time of collection of information.
   c. Location (grid reference or trace).
   d. Width of gap at bankseats.
   e. Width at water level.
   f. Rise and fall of water level and change in wet gap width.
   g. Velocity of current.
   h. Nature of bottom.
   i. Height of near bank above water level.
   j. Height of far bank above water level.
   k. Safe bearing pressure of soil.
   l. Description of work required on approaches, near and far banks.
   m. Possible local areas for concealing bridging equipment.

2., 3., etc. **Additional Bridge Sites.** Reported as above.

V. AIR LANDING SITES

1. **First Air Landing Site in Report.**
   a. Map sheet.
   b. Date and time of collection of information.
   c. Location (grid reference or trace).
   d. Runway:
      (1) Bearing.
      (2) Length and width.
      (3) Gradients exceeding standards laid down.
      (4) Rough appraisal of earth work.
      (5) Feasibility of runway extension.
   e. Drainage.
   f. Major obstacles to flying:
      (1) Within the approach zone.
      (2) Outside the approach zone but within five miles.
   g. Type of soil.
   h. Whether suitable area for dispersals can be found.
   i. Local resources.
   j. Approach roads.

2., 3., etc. **Additional Bridge Sites.** Reported as above.

W. AMPHIBIOUS CROSSING SITES

1. **Water Obstacles.**
   a. Map sheet(s).
   b. At grid reference _____ at _____ date/time.
   c. Width of water obstacle in metres.
   d. Maximum current in metres per second.
   e. Depth in metres.
   f. Entry bank:
      (1) Access zone) As detailed in STANAG 2256, Annex F.
) The soil type should be noted.
      (2) Contact zone)
   g. Exit bank
      (1) Contact zone) As detailed in STANAG 2256, Annex F.
) The soil type should be noted.
      (2) Access zone)

h. Obstacles in water; e.g. boulders, shoals or sand bars, covered by less than 2.0 m water.
i. General information, e.g. approaches, mines, variations due to tides, rainfall and temperature.

2. **Crossing Site**
   a. Map sheet(s).
   b. At grid reference _____ at _____ date/time.
   c. Types of amphibious vehicles considered (wheeled, tracked, etc.).
   d. Classification and frontage in meters of complete site; e.g., White 400 m.

      White. A site where vehicles can be expected to make a passage with such ease that a few if any, will require assistance.

      Grey. A site where the majority of vehicles will require assistance to make a passage.

      Black. An impracticable site owing to the excessive amount of assistance required.

   e. General information to include other limitation; e.g. mines, debris, ice floes, ice thickness, enemy observation, enemy fire, and amplification of site classification when required.

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By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, United States Army,
Chief of Staff.

Official:

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Major General, United States Army,
The Adjutant General.

Distribution:

To be distributed in accordance with DA Form 12–11 requirements for Route Reconnaissance and Classification.

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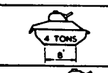
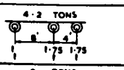
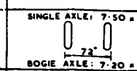
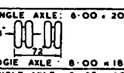
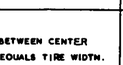
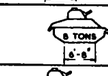
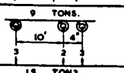
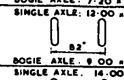
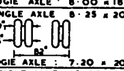
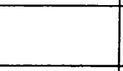
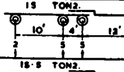
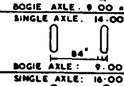
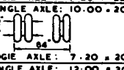
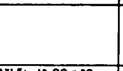
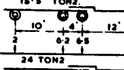
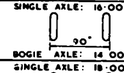
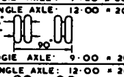
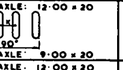
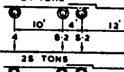
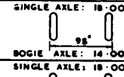
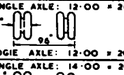
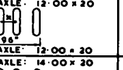
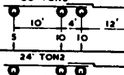
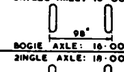
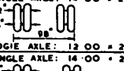
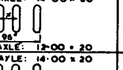
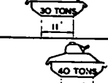
HYPOTHETICAL VEHICLES FOR CLASSIFICATION OF ACTUAL VEHICLES AND BRIDGES.

1	2	3	4	5	6	7	8	9
		WHEELED VEHICLES.						
CLASS	TRACKED VEHICLES.	AXLE LOADS AND SPACING.	MAXIMUM SINGLE AXLE LOAD IN SHORT TONS.	MINIMUM WHEEL SPACING AND TIRE SIZES OF CRITICAL AXLES.			MAXIMUM TIRE LOAD AND MINIMUM TIRE SIZE.	CLASS
4						NOTE :- 2PACING BETWEEN CENTER TIRES 'X' EQUALS TIRE WIDTH.		4
8								8
12								12
16								16
20								20
24								24
30								30
40								40
50								50
60								60
70								70
80								80
90								90
100								100
120								120
150								150

SHORT TONS.

N. B.
(1) SINGLE AXLE TIRE SIZES SHOWN IN COLUMNS 5, 6 & 7 REFER TO THE MAXIMUM SINGLE AXLE LOAD2 GIVEN IN COLUMN 4.
(2) BOGIE AXLE TIRE SIZES SHOWN IN COLUMNS 5, 6 & 7 REFER TO THE MAXIMUM BOGIE LOADS SHOWN ON THE DIAGRAM IN COLUMN 3
(3) THE MAXIMUM TIRE PRESSURE FOR ALL TIRES SHOWN IN COLUMN 5 SHALL BE TAKEN AS 75 LBS/SQ. INCH.
(4) THE FIRST DIMENSION OF TIRE SIZE REFERS TO THE OVERALL WIDTH OF TIRE AND THE SECOND DIMENSION IS THE RIM DIAMETER OF THE TIRE.

Figure 3–57. Standard class hypothetical vehicle characteristics.

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PAGES

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FIELD MANUAL
No. 5-36

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *20 January 1970*

ROUTE RECONNAISSANCE AND CLASSIFICATION

* This manual supersedes FM 5-36, 14 May 1965, including all changes.

Table D–1. Tracked Vehicles

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Armored reconnaissance airborne assault vehicle, M551:		16.8			16	
W/armor applique mine prot kit		18.8			18	
Assault vehicle, full tracked, amphibious, XM 733	4.38	5.25		4	5	
Bulldozer, earthmoving, tank mounted:						
M6, on tank, combat, M47	49.5	51.6		50	53	
M8, on tank, combat, M48	52.89	57.39		52	60	
M9, on tank, combat, M60 and M60 A1	52.94	54.74		50	52	
Bulldozer, earthmoving, tractor mtd, on tractor, high speed M8A2	24.25	33.5		23	32	
Carrier, cargo, amphibious, tracked:						
M76	4.16	6.02		4	6	
M116	3.94	5.44		4	5	
Carrier, cargo, tracked, 6T M548	8	14		7	13	
Carrier, command post, light, tracked:						
M577	11.08	11.95		10	11	
M577A1	10.97	12.13		10	12	
Carrier, command & reconnaissance, armored, M114 A1		6.9			7	
Carrier, flame thrower, self-propelled, M132 and M132A1	11.71	11.95		11	11	
Carrier, mortar, 81 mm, tracked, XM 755		6.25			6	
Carrier, mortar, 107 mm, self-propelled M106	8.69	12.35		11	15	
Carrier, personnel, full tracked, armored:						
M59	19.35	20.9		18	19	
M75	18.34	20.75		17	20	
M113 and M113A1	10.12	11.69		9	11	
Gun, antiaircraft artillery, self-propelled:						
20 mm, XM 163 (Vulcan)	11.97	12.63		11	12	
Twin 40 mm, M19A1	16.88	19.25		16	18	
Twin 40 mm, M42 & M42A1	22.15	24.9		20	23	
Gun, antitank, self-propelled, 90 mm, M56	6.25	7.87		6	8	
Gun, field artillery, self-propelled:						
155 mm, M53	44.5	48		42	46	
175 mm, M107		30.75			29	
Howitzer, heavy, self-propelled, 8 Inch:						
M55	44	47.5		41	46	
M110		29.25			27	
Howitzer, light, self-propelled, 105 mm:						
M37	19.32	23		18	22	
M52 and M52A1	24.9	26.5		23	25	
M108	20.05	23.45		18	22	
Howitzer, medium, self-propelled, 155 mm:						
M44 and M44A1	29	32		27	30	
M109	22.1	25.5		24	24	
Landing vehicle, tracked:						
Command	32.1	36.23		28	36	
Engineer	41.37	48.75		37	46	
Personnel	32.1	43.89		28	40	
Recovery	37.51	41.1		33	37	
Launcher, M48A2 tank chassis, transporting, w/bridge, armored vehicle launched scissoring type, 60 ft, C1 60	48	64		45	66	
Launcher, M60 tank chassis, transporting, w/bridge, armored vehicle launched, scissoring type, 60 ft, C1 60	41.5	56.4		38	54	
Launcher, M60A1 tank chassis, transporting, w/bridge, armored vehicle launched, scissoring type, 60 ft, C1 60	43.15	57.95		40	57	
Launcher, M113 APC chassis, transporting the M113 light assault bridge		11.76			11	
Launcher, M113A1 APC chassis, transporting the M113, light assault bridge		12.04			11	
Mortar, infantry, self-propelled, 107 mm (4.2 in.), M84	20.57	23.55		19	22	
Recovery vehicle, full tracked:						
Light, M578	23.5	27		25	25	
Medium, M88	54	56		53	55	
Heavy, M51	56.25	60		54	58	

Table D-1. Tracked Vehicles—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Rifle, multiple, 106 mm, self-propelled, M50	8.06	8.84	-------	8	9	------
Tank, combat, full tracked:						
76 mm gun, M41, M41A1, M41A2 and M41A3	22.35	25.9	-------	21	24	------
90 mm gun:						
M48	41.7	45	-------	38	42	------
M48A1	48.5	53	-------	46	52	------
M48A2 & M48A2C	49	52.5	-------	47	51	------
M48A3	49.75	52.5	-------	48	51	------
105 mm gun, M60 and M60A1	47.5	52.5	-------	45	50	------
120 mm gun, M103A1	57.8	62	-------	55	60	------
Tank, combat, full tracked, counterinsurgency, amphibious, light weight, XM 729	4.53	5.25	-------	5	6	------
Tank, combat, full tracked, flame-thrower, M67A1 and M67A2	50.48	52.89	-------	51	51	------
Tractor, full tracked, high speed, 13T:						
M5 and M5A1	11.89	14.29	-------	12	14	------
M5A2	10.54	13.07	-------	10	12	------
M5A3	12.6	15.17	-------	12	14	------
M5A4	12.25	14.9	-------	11	14	------
Tractor, full tracked, high speed, 32T, M8A1 and M8A2	22.25	31.5	-------	21	30	------
Vehicle, combat engineer, full tracked, M728	54.5	57.5	-------	54	57	------

Table D-2. Half-Tracked Vehicles

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Car, half track, M2A1		9.8	----------		9	------
Carriage, motor, multiple gun, M16		10.82	----------		10	------
Carrier, 81 mm mortar, half track, M21		10	----------		9	------
Carrier, personnel, half track, M3 and M3A1		10.25	----------		9	------

Table D-3. Wheeled Vehicles

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Assault trackway outfit, class 30 on truck 5T, 6 x 6, M139			20.82			18
Bridge, floating, mobile assault, amphibious (French)		26.5	----------		25	------
Bus, 29-passenger, 4 x 2	5.25	-------	7.75	5	------	8
Bus, 37-passenger, 4 x 2	7.6	-------	11.95	7	------	12
Car, armored, wheeled, V-100 (Commando)	6.8	8.13	-------	7	8	------
Chassis, truck, 2½ T, 6 x 6:						
M44 and M44C	5.33	----------		5	----------	
M45 and M45C	5.47	----------		5	----------	
M46 and M46C	5.64	----------		5	----------	
M57	5.41	----------		5	----------	
M58	5.43	----------		5	----------	
M133	5.58	----------		5	----------	
M207 and M207C	5.8	----------		5	----------	
M209	5.6	----------		5	----------	

Table D-3. Wheeled Vehicles—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Chassis, Truck, 5 T, 6 x 6:						
M39, M40, and M40C	8.75			8		
M61	9.02			8		
M63 and M63C	9.62			8		
M139, M139C, and M139D	9.8			8		
Decontaminating apparatus, power driven, trk mtd, M45 chassis:						
M39	8.38	10.08		7	9	
M3A3	7.14	8.84		6	7	
Lighter, amphibious, resupply, cargo:						
5 T, 4 x 4 (LARC-V)	10	15		10	15	
15 T, 4 x 4 (LARC-XV)	22.6	37.6		27	50	
Service unit, flamethrower, trk mtd, M4	8.25	9.38		7	8	
Shop equipment, contact-maintenance trk mtd, 4 x 4 (FSN 4940-294-9518)	4.45			4		
Shop equipment, organizational repair, light, trk mtd	16.39			15		
Topographic mapping set, trk mtd, 2½ T, 6 x 6:						
Cartographic section		11.3			10	
Copy and supply section		11.8			10	
Map revision section		10.9			9	
Multiplex section		12.1			11	
Photomapping section		10.9			9	
Rectifier section		12.1			11	
Topographic reproduction set, trk mtd, 2' T, 6 x 6:						
Camera section		9.75			9	
Laboratory section		9.3			8	
Map layout section		9.1			8	
Photographic-printing-processing section		10.5			9	
Photomechanical process section		12.1			11	
Plate grainer section		10.2			9	
Plate process section		9.5			8	
Press section		11.6			10	
Transporter for mobile floating assault bridge-ferry:						
w/superstructure, end bay	25.8			24		
w/superstructure, interior bay	23.5			21		
Truck, ambulance, 4 x 4:						
¾ T, M43 and M43B1	4.39	4.97		3	4	
1¼ T, M725	3.15	4.35		3	4	
Type IV, 7,000 lbs GWV, XM679	2.52	3.50		2	3	
Truck, amphibious, 2½ T, 6 x 6, M147	9.6	12.1	13.6	9	11	13
Truck, bolster, 2½ T, 6 x 6:						
On M44 chassis	6.14			5		
On M45 chassis	6.5			5		
M751A2	7.16	9.66	12.16	6	8	11
Truck, bolster, 5 T, 6 x 6:						
On M40 chassis	9.49			8		
M748A2	10.48	15.48	20.48	9	14	19
XM 815	10.92	15.92	20.92	9	15	20
Truck, cargo, ¾ T, 4 x 4, M37 and M37B1	2.84	3.59	3.84	3	4	4
Truck, cargo, pickup, 4 x 4, 7,000 lbs GWV:						
Type I, XM 677	2.48	3.5		2	3	
Type II, XM 676	2.33	3.5		2	3	
Truck, cargo, 1¼ T:						
4 x 4, M715	2.78	4.23	4.48	2	4	4
6 x 6, M561	3.27	4.72		3	4	
Truck, cargo, 2½ T, 6 x 6:						
M34	6.1	8.6	11.1	5	8	10
M35 and M35A1	6.44	8.94	11.44	5	8	10
M35A2	7.15	9.65	12.15	6	8	11
M36 and M36C	6.75	9.25	11.75	6	8	10

Table D–8. Wheeled Vehicles—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Truck, cargo, 2½T, 6 x 6—Continued						
M36A2	7.51	10.01	12.51	6	8	11
M135	6.37	9.04	11.54	6	9	11
M211	6.79	9.47	11.97	6	8	11
Truck, cargo, 5 T, 6 x 6:						
M41	9.55	13.3	17.05	9	15	18
M54	9.62	14.79	19.79	8	14	19
M54A2	10.46	15.46	20.46	9	14	20
M55 and M55A2	12.03	17.21	22.03	10	16	21
M55A1	12.26	17.26	22.26	10	16	21
XM 813	10.9	15.9	20.9	9	15	20
XM 814	12.55	17.55	22.55	10	16	21
Truck, cargo, 5T, 8 x 8, M656	7.8	12.8	-------	7	11	------
Truck, cargo, 8 T, 4 x 4, M520	11.95	19.95	-------	10	16	------
Truck, cargo, 10 T, 6 x 6, M125 and M125A1	15.8	25.8	30.8	14	25	33
Truck, cargo, 16 T, 4 x 4, XM437E1	19.34	35.54	-------	22	45	------
Truck, carryall, 4 x 4, Type III, 7,000 lbs GWV, XM678	2.3	3.5	-------	2	3	------
Truck, dump ¾ T, 4 x 4, XM708 and XM 708E1	3.39	4.64	-------	3	5	------
Truck, dump, 2½ T, 6 x 6:						
M59	6.92	8.97	11.42	6	8	10
M215	7.44	9.49	11.94	7	9	11
M342	7.97	10.64	13.14	7	9	12
M342A2	8.28	10.78	13.28	7	9	12
Truck, dump, 5 T, 6 x 6:						
M51	11.33	16.51	21.51	10	16	21
M51A1	11.22	16.4	21.4	9	16	21
M51A2	11.69	16.69	21.69	10	16	22
XM 817	12.13	17.13	22.13	10	16	22
Truck, dump, 15 T, 4 x 2:						
Euclid mdl 5FD	14.3	-------	29.3	15	------	72
Mack mdl LR	16.25	-------	31.25	15	------	72
Truck, earthboring machine and polesetter, 2½ T, 6 x 6, XM764	10.07	10.32	11.07	9	9	10
Truck, firefighting, 6 x 6, 500 gpm:						
Hesse mdl HC–26, pumper, foam & water, on M44 Chassis	8.7	10.3	-------	8	9	------
Class 530B, on M45A2 chassis	10.57	-------	-------	9	------	------
Truck, lift, fork, DED, pneu. tired, all purpose:						
6,000 lb capacity	11	-------	14	12	------	18
10,000 lb capacity	15.3	-------	20.3	15	------	29
Truck, lift, fork, rough terrain:						
3,000 lb capacity, Clark Model ART–30	1.6	3.1	-------	2	3	------
4,000 lb capacity, Clark Ranger mdl 40	4.35	6.35	-------	5	9	------
6,000 lb capacity, Baker mdl RJF–060	8.51	11.51	-------	9	16	------
10,000 lb capacity, Clark mdl MR100	13.8	18.8	-------	15	23	------
Truck, maintenance, earth borer, pole setter, 2½ T, 6 x 6, V18A/MTQ	8.59	9.56	11.56	8	9	11
Truck, maintenance, general purpose repair shop, 2½ T, 6 x 6	-------	9.56	-------	------	9	------
Truck, maintenance, pipeline const, 2½ T, 6 x 6, M756A2	8.71	11.21	13.71	7	10	13
Truck, maintenance, telephone const:						
¾ T, 4 x 4, M201 & M201B1	3.48	4.23	4.4	3	4	4
2½ T, 6 x 6, V–17A/MTQ	8.28	9.42	11.42	8	9	11
Truck, Panel, 1 T, 4 x 2, commercial type, 7,000 lb GWV	2.3	3.5	-------	2	3	------
Truck, stake & platform, 1½ T, 4 x 2	2.84	4.34	6.23	3	4	7
Truck, stake, bridge transporting, 5 T, 6 x 6:						
M139	13.2	21.0	-------	10	18	------
XM821	14.28	19.28	24.28	11	17	22
Truck, tank, fuel servicing, 2½ T, 6 x 6, 1,200 gal:						
M49 and M49C	6.75	9.25	10.25	6	8	10
M49 A2C	7.76	10.26	11.26	7	9	11
M217 and M217C	7.17	9.67	10.67	6	9	10

Table D–3. Wheeled Vehicles—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Truck, tank, fuel servicing, 4 x 4:						
2,500 gal M559	13.8	22.74	-------	10	19	------
5,000 gal XM 438E2	19.24	34.24	-------	22	46	------
Truck, tank, water, 2½ T, 6 x 6, 1,000 gal:						
M50, M50A1, and M50A2	7.52	10.02	11.72	7	9	11
M222	7.05	9.55	11.25	6	8	10
Truck, telephone maintenance & construction, 2½ T, 6 x 6, XM763	9.36	10.11	12.36	8	9	11
Truck, tractor, 2½ T, 6 x 6:						
M48	5.92	----------		5	----------	
M221	6.05	----------		5	----------	
M275	5.8	----------		5	----------	
M275A2	6.26	----------		5	----------	
Truck, tractor, 5 T, 6 x 6:						
M52, M52A1, and M52A2	9.62	----------		8	----------	
XM818	10.06	----------		8	----------	
Truck, tractor, 5 T, 8 x 8, XM757	7.54	----------		6	----------	
Truck, tractor, 5 T, 4 x 2:						
Federal mdl 45M2	4.9	----------		4	----------	
International Harv. Mdl L–201	5.11	----------		5	----------	
International Harv. Mdl R–202	5.12	----------		5	----------	
Truck, tractor, 10 T, 6 x 6, M123 and M123C	16.12	----------		14	----------	
Truck, tractor, 10 T, 8 x 8, XM191	17.18	----------		15	----------	
Truck, tractor, 12T, 6 x 6, M26A1	24.45	----------		28	----------	
Truck, tractor, 15 T, 8 x 8:						
XM194	23.82	----------		20	----------	
XM194E1	24.08	----------		20	----------	
XM194E2 & XM194E3	24.22	----------		21	----------	
XM194E4	26.3	----------		23	----------	
Truck, tractor, 25 T, 6 x 6, M523E2	20.49	----------		18	----------	
Truck, tractor, wrecker, 5 T, 6 x 6:						
M246	16.42	----------		15	----------	
M246A1	16.65	----------		15	----------	
XM819	16.31	----------		14	----------	
Truck, van, expansible, 2½ T, 6 x 6, M292A2	10.23	12.73	-------	9	11	------
Truck, van, expansible, 5 T, 6 x 6:						
M291	12.75	15.25	20.25	11	14	19
M291A2	13.18	15.68	20.68	11	14	19
XM820	13.67	16.17	21.17	11	15	19
XM 820E2	13.79	16.49	21.49	12	15	20
Truck, van, expansible, 5 T, 8 x 8, M791	12.45	13.98	17.78	10	11	16
Truck, van, shop, 2½ T, 6 x 6:						
M109, M109C, & M109D	7.62	10.29	-------	7	9	------
M109A3	7.97	10.47	11.74	7	9	10
M220, M220C, & M220D	7.54	10.22	11.29	7	9	10
Truck, wrecker, ¾ T, 4 x 4, XM711	3.88	5.63	-------	4	8	------
Truck, wrecker, 2½ T, 6 x 6:						
M108	7.06	9.06	10.25	6	9	11
XM519	7.41	8.91	-------	6	8	------
Truck, wrecker, light, 2½ T, 6 x 6, M60	11.98	12.73	13.9	11	12	13
Truck, wrecker, medium, 5 T, 6 x 6:						
M62	17.01	20.51	23.01	16	21	23
M543, M543A1, & M543A2	17.6	----------		17	----------	
XM816	17.77	----------		17	----------	
Truck, wrecker, 10 T, 4 x 4, M553	19.29	----------		15	----------	
Truck, wrecker, 20 T, 4 x 4, XM554	28.8	33.33	-------	39	43	------

Table D–4. Towed Vehicles

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
a. Artillery						
Gun, anti-aircraft artillery, towed, 75 mm, M51	10.64			8		
Gun, anti-aircraft artillery, towed, 90 mm, M2, on mount, 90 mm, M2	16.5			16		
Gun, anti-aircraft artillery, towed, 120 mm, M1, on Mount, 120 mm, M1 or M1A1	30.75			38		
Gun, field artillery, towed, 155 mm, M59	13.85			14		
Howitzer, light, towed, 105 mm:						
M101 and M101A1	2.49			4		
M102	1.55			2		
Howitzer, medium, towed, 155 mm, M114 & M114A1	6.44			9		
Howitzer, medium, towed, 155 mm, aux. propelled, M123A1	6.77			9		
Howitzer, heavy towed, 8 in., M115	14.8			15		
b. Trailers						
Trailer, ammunition, 1½ T, 2 whl, M332	1.4	2.9		2	4	
Trailer, ammunition, 2 T, 2 whl, M10	1.4	3.4		2	5	
Trailer, ammunition, 4 T, 2 whl, M21	2.65	6.65		4	9	
Trailer, ammunition, 8 T, 4 whl, M23	5	13		5	11	
Trailer, basic utility, pole type, 2½ T, 2 whl	1.2	3.7		2	5	
Trailer, bolster, 2½ T, 2 whl	1.1	3.6		2	5	
Trailer, bolster, pole handling, 3½ T, 2 whl, M271 & M271A1	1.21	4.71		2	7	
Trailer, bolster, general purpose 4 T, 4 whl, M796	2.41	6.41		2	7	
Trailer, bolster, 4 whl, special tandem, 7–14 T	3.6	17.6		4	21	
Trailer, bomb, 2 T, 4 whl, M143 and M143A1	3.2	5.2		3	5	
Trailer, cable reel, 3½ T, 2 whl, M310	1.26	4.76		1	7	
Trailer, cargo, 1½ T, 2 whl:						
M104, M104A1 & M104A2	1.36	2.86	4.11	2	4	6
M105, M105A1, & M105A2	1.32	2.82	3.57	2	4	6
Trailer, clamshell bucket, 3 T, 2 whl, GRAMMA mdl M16	1.22	4.12		2	5	
Trailer, firefighting, pumper, water:						
100 gpm, 2 whl	2.6			4		
500 gpm, 2 whl, Hale mdl CFS	1.75			3		
1,500 gpm, 4 whl, Sabre mdl TT2000	4.85			6		
Trailer, flat bed, 4 T, 4 whl M794	2.08	6.08		2	7	
Trailer, flat bed, dough mixing & makeup outfit, 4 T, 4 whl, M795	2.56	6.56		3	8	
Trailer, flat bed, tilt loading, 6 T, 4 whl, XM714	0.9	5.4	6.9	1	6	8
Trailer, flat bed, 7 T, 4 whl:						
7 T LaCrosse w/single whls	5.8	12.8	19.8	7	15	24
7 T LaCrosse w/dual wheels	5.6	12.6		6	15	
Trailer, flat bed, 10 T 4 whl:						
M345 (FSN 2330–200–1737)	5.63	15.63	18.63	6	18	20
w/4 dual midship wheels (FSN 2330–377–0389)	5.6	15.6		6	18	
Trailer, low bed, 8 T, 4 dual whls:						
Fontaine mdl T8–105	4.83	12.83		4	12	
Fruehauf mdl CF–8	5.3	13.3		5	13	
Fruehauf mdl CPT–8 Special	4.76	12.76		4	12	
Hobbs mdl F–1386	4.89	12.89		4	13	
Jahn mdl LKS–408	3.8	11.8		4	12	
LaCrosse mdl DF–4–C–8F	4.8	12.8		4	14	
Winter-Weiss mdl S–458	4.27	12.27		4	13	
Trailer, low bed, 60 T, 4 dual front whls, 8 dual rear whls:						
Dorsey mdl MT–60	12.1		72.1	8		96
Fontaine mdl C16–60–SP	16.05		76.05	11		130
Rogers mdl D–60–DS–5	17		77	13		110
Rogers mdl DW–60–LS–6	14.06		74.06	10		123
Rogers mdl D–60–DS–7	16.34		76.34	12		117
Steel Products mdl "Great Dane"	15.59		75.59	10		130
Trailer, tank, water, 1½ T, 2 whl, 400 gal:						
M106, M106A1, M106A2, M107, M107A1, and M107A2	1.14	2.81		2	4	
M149	1.25	2.92		2	4	

Table D–4. Towed Vehicles—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Trailer, transporter, 45 T, 12 whl, M9, Fruehauf mdl CPT45 SP	10.08	-------	55.08	8	------	82
Trailer, van, shop, folding side, 1½ T, 2 whl, M448	1.48	2.98	3.73	2	4	6
Transporter, liquid rolling wheel (RLT), 1,000 gal, M6:						
Single	1.07	4.21	-------	1	6	------
Two in tandem	2.14	8.42	-------	2	7	------
Three in tandem	3.21	12.63	-------	2	10	------
Four in tandem	4.28	16.84	-------	3	12	------
c. Semitrailers						
Semitrailer, low bed, 15 T, 4 whl, M172	7.75	-------	22.75	6	------	19
Semitrailer, low bed, 25 T, 4 whl, M172A1	7.43	32.43	37.43	6	28	36
Semitrailer, low bed, wrecker, 12 T, 4 whl:						
M269 and M269A1 (25 ft)	7.1	19.1	27.1	6	17	23
M270 and M270A1 (40 ft)	8.75	20.75	28.75	8	17	24
Semitrailer, maintenance, weapon, 6 T, 2 whl:						
Connecting unit, M459	-------	7.2	----------		6	------
Electrical unit, M458	-------	7.2	----------		6	------
Mechanical unit, M457	-------	6.92	----------		6	------
Semitrailer, stake, 6 T, 2 whl, M118 and M118A1	3.57	9.57	11.67	4	8	11
Semitrailer, stake, 12 T, 4 whl:						
M127, M127A1, and M127A1C	7.2	19.2	25.2	8	23	30
M127A2C	7.02	19.02	25.02	7	22	29
Semitrailer, stake & platform 5 T, 2 whl, Olsen mdl 516	3.32	8.32	10.82	3	8	10
Semitrailer, tank, alcohol, 2 whl, 3,000 gal, M388	4.15	12.15	-------	5	13	------
Semitrailer, tank, bituminous liquid, 6 T, 1,500 gal, w/dolly	5.1	-------	11.1	4	------	10
Semitrailer, tank, 6 T, 1,500 gal dual whls:						
Columbian Steel Tank mdl M1944	3.3	-------	9.55	3	------	8
Littleford mdl JAN–T–505	4	-------	10	4	------	9
Semitrailer, tank, fuel servicing, 2 whl, 2,000 gal, Heil Co. Type F–2B	4	-------	10	4	------	9
Semitrailer, tank, gasoline, 6 T, 2 whl, 2,000 gal, M30, Progress mdl ST62M	3.38	-------	9.48	3	------	9
Semitrailer, tank, gasoline, 12 T, 4 whl, 5,000 gal, M131, M131A1, and M131A2	7.42	17.23	22.69	7	16	21
Semitrailer, tank, storage, liquid, argon-nitrogen-oxygen, 9 T, 1,800 gal, Cambridge mdl 217–30	8.41	-------	17.41	7	------	16
Semitrailer, tank transporter:						
40 T, 8 whl, M15	21.19	61.19	-------	15	53	------
45 T, 8 whl, M15A1	21.19	66.19	-------	15	59	------
50 T, 8 whl, M15A2	21.3	71.3	-------	16	78	------
60 T, 12 whl, XM160	23.07	83.08	-------	18	100	------
Semitrailer, tank, water 2 whl 2,000 gal, M586	3.21	-------	11.51	4	------	14
Semitrailer, van, 6T, 2 whl, M146F	3.66	9.66	11.77	4	9	10
Semitrailer, van, cargo, 6 T, 2 whl, M119 and M119A1	3.59	9.59	11.69	4	8	11
Semitrailer, van, cargo, 12 T, 4 whl:						
M128A1 and M128A1C	7.74	19.74	25.74	7	18	23
M128A2C	7.7	19.7	25.7	8	23	30
Semitrailer, van electronic, 3 T, 2 whl:						
M348A1 and M348A2	4.32	7.32	9.32	5	10	11
M373A1	4.75	7.75	7.75	5	10	10
Semitrailer, van, electronic, 6 T, 2 whl:						
M348A2C, D, F, and G	4.38	9.38	10.38	5	10	11
M373A2C	4.85	9.85	10.85	5	10	11
Semitrailer, van, refrigerator, 7½ T, 2 whl, M349 and M349A1	4.3	-------	11.8	5	------	13
Semitrailer, van, shop, 6 T, 2 whl, M146 and M146C	3.66	9.66	11.76	4	9	10
Semitrailer, van, shop, 6 T, 4 whl, M447 and M447C	7.59	10.09	11.56	6	8	9
Semitrailer, van, supply 12 T, 4 whl, M129A2C	7.8	19.8	25.8	8	23	30

Table D–5. Construction Equipment

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Bin, aggregate loading, trlr mtd, 30 T:						
Iowa mdl 30 T	5.93			5		
Pioneer mdl 220	8.58			7		
Universal mdl PB–20	5.86			5		
Compressor, air, reciprocating, trlr mtd, 4 whl, 315 cfm, 100 psi:						
Davey Mdl 315 WDS	3.48			4		
Ingersoll Rand mdl IK–315	4.08			4		
LeRoi mdl 315D2–C	4.36			4		
Compressor, air, reciprocating, truck mtd, 6 x 6, 80 cfm, 5,000 psi:						
Clark mdl HO–6–5C	9.25			8		
Joy mdl 80–HGC2–MS–1 and 80–HGC3–MS–1	9.21			8		
Compressor, air, reciprocating, truck mtd, 6 x 6, 210 cfm, 100 psi:						
Davey mdl 210 WDS	7.9			7		
Joy mdl 210G1	7.65			7		
Compressor, air, rotary, trlr mtd, on trlr, 3½ T, 2 whl, M353, 250 cfm, 100 psi, Joy mdl RPV 250 DC MS–1	4.83			7		
Compressor, air, rotary, trlr, mtd, 4 whl, 600 cfm, 100 psi, Ingersoll Rand mdl DR–600 and DR–600W	5.6			6		
Compressor, air, rotary, truck mtd, 6 x 6, 210 cfm, 100 psi:						
Harris mdl J–210–FED	7.53			7		
LeRoi Mdl RPA–210GD3–MS–1	7.35			6		
Conversion-storage-charging unit, CO_2, semitrlr mtd, 16,000 lb capacity, Cardox mdl FE34365	11.7			10		
Conversion unit, CO_2 semitrlr, mtd, 260 lb/hr:						
Electric Heat mdl SCO2	16			20		
Girdler mdl 32–4150	15			13		
Girdler mdl 131–4910	19.3			17		
Conveyor belt, whl mtd, electric, 300 tph, 50 ft, Barber Greene Mdl PG70	4.71			6		
Cooling tower, liquid, semitrlr mtd, 240 gpm, Badger mdl CT–1	8.5			7		
Crane-shovel, crawler mtd, 12½ T, ¾ cu yd, w/boom, crane, 30 ft	23.11			22		
Crane-shovel, basic unit, crawler mtd, 10 T, ¾ cu yd:						
American Hoist mdl 375 BC	18.7			19		
Baldwin-Lima-Hamilton mdl 34CA and 34CH	19.1			22		
Bucyrus Erie mdl 22B	21.16			19		
Byers mdl 83	19.8			19		
Thew Shovel mdl TL25K	16			15		
Unit mdl 1020 YD	17.5			16		
Crane-shovel, basic unit, crawler mtd, 35 T, 2 cu yd:						
Harnischfeger mdl 855B	52			72		
Thew Shovel mdl L–820 and L–820–J	50.6			55		
Crane-shovel, basic unit, crawler mtd, 40 T, 2 cu yd:						
Baldwin-Lima-Hamilton mdl 802	66.3			153		
Bucyrus-Erie Mdl 51–B	66.3			134		
Harnischfeger mdl 855BG	48.2			56		
Harnischfeger mdl 855BG2 and 855BG3	48.2			58		
Manitowoc mdl 3000 B	58.5			101		
Crane-shovel, basic unit, truck mtd, 3 T, ⅜ cu yd, 6 x 6:						
Quickway mdl N–383AB	9.2			8		
Schield Bantam mdl ABM–53	9.3			8		
Crane-shovel, basic unit, truck mtd, 10 T, ½ cu yd, 6 x 6:						
Bay City mdl 150M	18.9			18		
Thew Shovel mdl MC–254	19.5			20		
Thew Shovel mdl E–6610	18.1			18		
Wayne Crane mdl 40	19.2			19		
Crane-shovel, basic unit, trk mtd, 20 T, ¾ cu yd, 6 x 6:						
Baldwin-Lima-Hamilton mdl 34 T	28.7			27		
Gar Wood mdl M–20–A	28.1			34		
Gar Wood mdl M–20–B	28.3			34		
Koehring mdl 304	27.8			32		
Link Belt mdl HC–70	26.9			25		

Table D-5. Construction Equipment—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Quickway mdl M200	23.5			22		
Quickway mdl M202	25.39			25		
Thew Shovel mdl MC-1416	26.6			28		
Unit mdl 1220-CE	26.3			31		
Crane-shovel, whl mtd, 7 T ½ cu yd, 4 x 4:						
Gar Wood mdl GW7	8.12			8		
Koehring mdl 155-1A	8			8		
Crane, tractor towed, 20 T 20 ft lift, LeTourneau mdl M-20	4.6			6		
Crane, whl mtd, 3 T, Anthony Mdl M63	10.5			10		
Crane, whl mtd, 5 T, ⅜ cu yd 4 x 4, rough terrain, air transportable	14.68			15		
Crane, whl mtd, 20 T, ¾ cu yd, rough terrain	28.5			30		
Crusher, jaw, whl mtd, 15 tph, Iowa mdl AB-1424-SP15T	7.25			8		
Crusher, jaw, whl mtd, 200 tph Pioneer mdl 153 PRD	42.02			51		
Crusher, jaw, diesel and electric driven, whl mtd, 75 tph, Eagle mdl 5157	36.6			37		
Crusher, roll, diesel and electric driven, whl mtd, 75 tph, Eagle mdl 5230B	30.7			27		
Crushing & screening plant, semi-trlr mtd, 35 tph, 2 unit Iowa mdl 2A:						
Unit #1, jaw crusher	16.25			13		
Unit #2, roll crusher	17.69			19		
Crushing & screening unit, whl mtd, 40 tph:						
Pioneer mdl 42VDE	22.02			19		
Pioneer mdl 42 VA	28.2			25		
Crushing & screening unit, crawler mtd, 100 tph, Pioneer mdl 54VA	38.56			58		
Crushing, screening, and washing unit, whl mtd, 40 tph, Pioneer mdl, 300 WDE	26.58			22		
Crushing, screening, and washing unit, whl mtd, 40 tph, dual unit:						
Iowa mdl DJ-50	31.94			26		
Pioneer mdl 33R Triplex	31.8			39		
Universal mdl 1830 CWL	32.68			45		
Dehydrator, sand, trlr mtd:						
Iowa mdl 5022E	8.75			7		
Pioneer mdl P-300W	9.35			9		
Pioneer mdl 1833	3.42			6		
Universal mdl 20 PW	3.73			6		
Dehydrator, sand, compression, whl mtd, 90 tph, Pioneer mdl 2220-SDE	7.56			7		
Distributor, bituminous material tankless type, trailer mtd 375 gpm:						
Littleford mdl US-3C-TOD	2.19			3		
Littleford mdl US-3C	2.13			3		
Distributor, bituminous material, tank type, trk mtd, 6 x 6, 800 gal	11.7		15.7	10		15
Distributor, water, tank type, trk mtd, 6 x 6, 1,000 gal	10.35		14.52	9		14
Ditching maching, DED, whl mtd, ladder type	18			19		
Ditching machine, GED, crawler mtd:						
Barber Greene mdl 44C	10.7			18		
Parsons mdl 221	10.1			14		
Drier, aggregate, trlr mtd, 10-25 tph, Barber Greene mdl 830	6.81			9		
Drier, aggregate, trlr mtd, 80-120 tph:						
Barber Greene mdl 833	21.7			19		
Barber Green mdl 837	18.1			17		
Dust collecting machine, semi-trlr, mtd, Barber Greene mdl 857	10.3			11		
Generator and charging plant, acetylene, semitrlr mtd, 750 cu ft/hr, Rexarc mdl TMCP-750	14.18			12		
Generating and charging plant, CO_2, semitrlr mtd, 300 lb/hr:						
Girdler mdl 32-4176	24			23		
Girdler mdl 32-4027	24.5			26		
Generator & charging plant, hydrogen-CO_2, semitrlr mtd, 156 lb CO_2/hr, Electric Heating Equipment mdl H_2-CO_2	24.47			23		
Generator & charging plant, oxygen-nitrogen, semitrlr mtd, 200 cu ft N_2/hr, Air Products mdl A2	15			17		
Generator & charging plant, oxygen-nitrogen, semitrlr mtd 5 T oxygen and 200 lb nitrogen per day, Air Products mdl LON-5, 2 unit:						
Air source semitrlr	28.6			45		
Air separation semitrlr	24.6			21		

Table D–5. Construction Equipment—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Grader, road, motorized, air transportable, 6 x 4:						
Caterpillar mdl 212	7.46			6		
LeTourneau Westinghouse mdl 220	8			7		
Grader, road, motorized, heavy, 6 x 4:						
Caterpillar mdl 12	12.5			10		
Galion mdl 118	12.7			10		
Huber Warco mdl 4D	12.4			10		
Huber Warco mdl 4D, winterized	12.59			11		
LeTourneau Westinghouse mdl 440HA	13.5			11		
Riddle Warco mdl 4D–1000	12.41			10		
Grader, road, motorized, heavy 4 x 4, all whl steer, Austin-Western mdl 99H	10.7			9		
Graduation control unit, aggregate, trlr mtd, Barber Greene mdl 866	15.29			12		
Heater, bitumen, trlr mtd, 3-car heating:						
Cleaver Brooks mdl Ds	2.7			4		
William Bros mdl SG45T	3.23			5		
William Bros mdl SG52A	3.1			5		
Loader, belt type, crawler mtd 10–20 cu yd/min, Barber Greene Mdl 538B	7.84			11		
Loader, bucket type, crawler mtd 3 cu yd/min:						
Barber Greene mdl 82–A	9.24			13		
Barber Greene mdl 82–AG	10.15			15		
Haiss mdl 77–PC	11.5			12		
Loader, scoop type, 4 whl, 1½ cu yd, Clark mdl 85 AM	7.35		10.35	9		14
Loader, scoop type, 4 whl, 2½ cu yd:						
Clark mdl 175 AM	15		19	16		22
Hough mdl 90 M	14.2		18.2	15		30
Logging arch for tractor, medium, w/10 ft boom	5.58			10		
Mixer, bituminous material, trlr mtd, Barber Greene mdl 848	15.7			16		
Mixer, concrete, trlr mtd, 16 cu ft:						
Chain Belt mdl 16–S	2.95			3		
Construction Machinery mdl 16S	3			3		
Construction Machinery Mdl 16 SM	3.2			3		
Gilson mdl 16S–SCE	3.65			4		
Mixer, rotary tiller, selfpropelled, Seaman mdl TP–84M	5.75			5		
Paver, concrete, crawler mtd, dual drum, 34 cu ft:						
Rex mdl 34E	26.12			79		
Worthington mdl 34E	25.1			38		
Paving machine, bituminous material, crawler mtd, 12 ft:						
Barber Greene mdl 879–A	12.13			21		
Barber Greene mdl 879–B	11.25			14		
Power Unit, gasoline, 120–140 bhp, whl mtd, Minneapolis-Moline mdl 1210–12A	7.19			8		
Pump, centrifugal, trlr mtd, 6 in., 1,000 gpm:						
Carver mdl KN6H	2.82			3		
Jaeger mdl GPHO	3.08			3		
Roller, motorized, GED, tandem, 2 rolls, 5–8 T:						
Buffalo Springfield mdl KT–16B	6			7		
Galion mdl T–5G	5.9			6		
Roller, motorized, DED, tandem 2 rolls, 16 T, Galion Mdl T–8G	8.84			11		
Roller, motorized, GED, tandem 3 rolls, 9–14 T:						
Buffalo, Springfield Mdl KX–16C2	6.3			7		
Galion mdl 3T9G	10.77			12		
Roller, motorized, GED, 3 whl, heavy:						
Galion mdl Chief	10.02			11		
Galion mdl Chief CG	10.6			13		
Roller, motorized, GED, 3 whl 10 T, Galion mdl Chief Rolomatic	10.8			13		
Roller, motorized, pneu tired-airmobile 9 whl Brothers mdl SP–54B	11.02			12		

Table D-5. Construction Equipment—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Roller, towed, pneu tired, 4 tire, 7½-35 T:						
Browning mdl HP4-35	6.8			10		
Tampo mdl 35T4	6.15			9		
Wiliams Bros mdl 435AB	6.45			10		
Roller, towed, pneu tired, 4 tire, 7½-50 T:						
Grace mdl WLTR	7.25			10		
Shovel Supply mdl RT-100CE	6.95			10		
Rooter, road, towed, cable operated, 24″ depth, LeTourneau Westinghouse mdl H3	3.8			6		
Rooter, road, towed, cable operated, 30″ depth:						
LeTourneau Westinghouse mdl K30	6.2			10		
Southwest mdl RH-3	6.7			10		
Scraper, air mobile, sectionalized, towed, 8 cu yd	8.1	19.1		7	18	
Scraper, earthmoving, towed, 7½ cu yd	4.9	14.9		4	15	
Scraper, earthmoving, towed, 13½ cu yd, Southwest mdl S-152	12	28		9	37	
Scraper, earthmoving, towed, 12 cu yd:						
LeTourneau Westinghouse mdl LP	9.75	21.75		8	22	
LeTourneau Westinghouse Mdl LPO	9.75	21.75		8	26	
Woolridge mdl 05-122A	12.1	27.1		9	37	
Scraper, earthmoving, towed, 18 cu yd, Curtis Wright mdl CWT-18M, w/dolly	19.45		51.95	17		99
Scrubber & washer, aggregate, DED, whl mtd, 88tph, Pioneer mdl 3620LWD66	15.7			17		
Snow removal unit, selfpropelled, rotary, trk, mtd, 7½ T:						
Klauer mdl TU3	11.38			10		
Klauer mdl TU330	15.8			16		
Tractor, full tracked, low speed, light dbp:						
Allis Chalmers mdl HD6M	8			8		
Caterpillar mdl 933	7.99			9		
Caterpillar mdl D4:						
FSN 2410-190-0020	7.6			9		
FSN 2410-190-0217	8			10		
Caterpillar mdl D5A	12			15		
Caterpillar mdl D6:						
FSN 2410-542-4206	7.98			8		
Tractor, full tracked, low speed, medium dbp, Caterpillar mdl D7:						
FSN 2410-191-0532	12.75			13		
FSN 2410-191-0536	17.5			19		
FSN 2410-191-0537	16.4			18		
FSN 2410-233-5746	17.8			20		
FSN 2410-233-5749	16.3			18		
FSN 2410-277-1280	17.85			20		
FSN 2410-294-6614	16.7			24		
Tractor, full tracked, low speed, heavy dbp, Caterpillar mdl D7E, FSN 2410-782-1130	24.28			28		
Tractor, full tracked, low speed, heavy dbp, Caterpillar, mdl D8:						
FSN 2410-223-1214	23.4			30		
FSN 2410-223-1216	18.1			20		
FSN 2410-233-5750	23.3			27		
FSN 2410-233-5752	25.3			33		
FSN 2410-267-6888	21.8			22		
FSN 2410-268-8229	20.9			27		
FSN 2410-453-6816	17.39			27		
FSN 2410-542-4881	22.05			35		
FSN 2410-542-4882	22.05			30		
Tractor, full tracked, low speed, heavy dbp, International Harvester mdl TD-24-241:						
FSN 2410-542-2337	27.66			32		
FSN 2410-542-2338	27.09			31		

Table D–5. Construction Equipment—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Tractor, full tracked, low speed, medium dbp, International Harvester:						
Mdl TD20–200	20.2			24		
Mdl TD18–182	19.93			25		
Tractor, wheeled, industrial GED, 5200–7775 dbp, Case mdl LA1	6.25			8		
Tractor, wheeled, industrial light dbp, MRS mdl 100	8			8		
Tractor, wheeled, industrial DED, 14025–20000 dbp:						
LeTourneau Westinghouse Mdl, Super C Tourna Tractor	16.24			19		
MRS mdl 150:						
FSN 2420–190–0053	14.4			18		
FSN 2420–517–0675	17.65			21		
Tractor, wheeled, industrial DED, 20025–27000 dbp:						
LeTourneau Westinghouse mdl Super C Tourna Dozer	17.3			19		
MRS Mdl 190	15.37			17		
Tractor, wheeled, industrial, DED, 27025–38000 dbp, Caterpillar Mdl DW 20M	24.8			34		
Tractor, wheeled, industrial, medium dbp:						
Caterpillar mdl 830M	26.14			43		
Caterpillar mdl 830MB	26.45			43		
Clark mdl 290M	27.1			44		
Trailer, dump, 11 cu yd, MRS mdl 110AWG	7.23		24.23	6		22
Trailer-tractor, dump, 13 cu yd Euclid mdl 89W trlr with Euclid mdl 71FDT Tractor	17.9		37.9	13		31
Water purification equipment set, trlr mtd, 600 gph	2.91			5		
Water purification equipment set, trk mtd:						
1,500 gph	9.51			8		
3,000 gph	10.71			9		

Table D–6. Missile and Fire Distribution Systems

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
a. Pershing.						
Carrier, guided missile equipment, full tracked, XM474E2	5.95			5		
Communictations pack, mtd on carrier, XM474E2		8.9			8	
Erector-launcher, mtd on carrier, XM474E2		9.73			9	
Facilities distribution, mtd on trailer, 1½ T, 2 whl, M105A2		2.54			4	
Generator, 45KW, mtd on trlr, 2 whl, 3½ T, XM353		3.78			6	
Power Station and programmer, mtd on carrier, XM474E2		10.91			10	
Warhead pallet and warhead handling gear, mtd on carrier XM474E2		8.19			8	
b. Sergeant.						
Launching station, guided missile, semi-trlr mtd, 4 whl, XM504		8.5			7	
Combined with truck, tractor, 5 T, 6 x 6, M52		18.22			14	
Semitrailer, motor-guidance transport		7.75			7	
Combined with truck, tractor, 2½ T, 6 x 6, M275		13.55			10	
Test station, guided missile system components, field maintenance, mtd on semitrlr XM539		7.75			6	
Combined with truck, tractor, 2½ T, 6 x 6, M275		13.55			10	
Test Station, guided missile system components, organizational maintenance, mtd on semitrlr, XM539		7.75			6	
Combined with truck, tractor, 2½ T, 6 x 6, M275		13.55			10	
Transport trlr, 4 whl, 6 T, XM527:						
With 2 forebodies		5.11			4	
With missile motor, fin & guidance		7.74			6	
c. Little John.						
Handling unit, 318 mm rocket, trk mtd, 6 x 6, M572	7.5	9.3		6	8	

Table D–6. Missile and Fire Distribution Systems—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
d. Honest John.						
Handling unit, 762 mm rocket, trlr mtd, M405 & M405A1	4.31	7.31	-------	5	7	------
Heating and tiedown unit, 762 mm rocket, trk mtd, M78 and M78A1	12.43	15.39	-------	10	14	------
Combination of above two	16.74	22.70	-------	13	18	------
Launcher, 762 mm rocket, truck mtd:						
M289	20.8	23.8	-------	19	22	------
M386	17.1	20.1	-------	15	18	------
Trailer, rocket transporter, 762 mm rocket, 4 whl, M329A2	3	5.97	-------	3	7	------
e. Hawk.						
Chassis, trailer, 2 T, 2 whl, M390C, w/3 missiles, XMIM23A and 1 pallet XM1E1		4.25	----------		6	------
Generator, 45KW, mtd on trlr, M200A1		4.25	----------		5	------
Launcher, zero length, XM78E2, trlr mtd	2.14	----------		3	----------	
Loader, transporter, guided missile, XM501E3	2.77	4.75	-------	3	5	------
Radar Set, trlr mtd:						
CW acquisition, AN/MPQ–34		2.17	----------		3	------
CW illuminator, AN/MPQ–33		2.63	----------		3	------
High power illuminator, AN/MPQ–39		4.65	----------		6	------
Pulse acquisition, AN/MPQ–35		3.97	----------		6	------
Shop equipment, guided missile, organizational maintenance, AN/MSM–43 on XM389 trlr		2.75	----------		4	------
f. Nike-Ajax.						
Antenna-receiver-transmitter group, trlr mtd, on trlr M260 or M260A1:						
Missile tracking		5.49	----------		5	------
Target tracking		5.49	----------		5	------
Director station, guided missile, trlr mtd, on trlr M259, M259A1, M259A1C, or M259C		6.32	----------		6	------
Electronics shop, trlr mtd, M304 and M304A1		6.59	----------		6	------
Electronics shop, van, trlr mtd:						
Trailer #1, M382		6	----------		6	------
Trailer #2, M383		6.25	----------		6	------
Electronics shop, maintenance and spares, trlr mtd, on trlr M359		6	----------		6	------
Launching control group, trlr mtd on trlr, M262 or M262A1		6	----------		6	------
Tracking station, guided missile, trlr mtd, on trlr M258 or M258A1		6.18	----------		5	------
Trailer, flat bed, guided missile:						
M261	3.85	6.17	-------	4	6	------
M261A1	3.13	6.77	-------	3	7	------
g. Nike-Hercules and Improved Hercules.						
Antenna receiver transmitter group, trlr mtd on trlr M406, M406A1, M406E1, or M406E2:						
Missile tracking		6.36	----------		6	------
Target tracking		6.36	----------		6	------
Director station, guided missile, trlr mtd on trlr M424, M424A1, or M424E1		6.87	----------		7	------
Electronic shop, trlr mtd, M304 and M304A1		6.59	----------		6	------
Launching control group, guided missile, trlr mtd:						
On trailer M262A1C		6	----------		6	------
On trailer M262A2		6.23	----------		6	------
Radar signal simulator van, trlr mtd on trlr XM446		8.5	----------		9	------
Shop equipment van, trlr mtd, on trlr M564, M564A1, or M564A2		8.77	----------		9	------
Shop van, trlr mtd on trlr M582 or M583		6.1	----------		6	------
Tracking station, guided missile, trlr mtd:						
On trailer M428E1		6.64	----------		7	------
On trailer M428 or M428A1		6.43	----------		6	------
Trailer, low bed, guided missile, 7 T, 4 whl, XM529	7.25	14	-------	6	12	------
h. Chaparral.						
Chaparral, XM48		13.2	----------		13	------
Recovery vehicle, full-tracked, XM758		23.3	----------		23	------

Table D–7. Combination Vehicles

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Tractor, full tracked, high speed, 13 T, M5 or M5A1, towing:						
Howitzer, medium, 155 mm, M114 or M114A1		20.73			18	
Tractor, wheeled, industrial, Caterpillar mdl 830M, towing:						
Scraper, earthmoving, 18 cu yd Curtiss Wright mdl 18M, wo/dolly	42.38		74.88	45		99
Tractor, wheeled, industrial, Caterpillar mdl 830MB, towing:						
Scraper, earthmoving, 18 cu yd LeTourneau Westinghouse mdl CT4	41.88			51		
Tractor, wheeled, industrial Clark mdl 290M, towing:						
Scraper, earthmoving, 18 cu yd, Euclid mdl 58SH–G	44.41			50		
Truck, cargo, ¾ T, 4 x 4, M37, towing:						
Trlr, cargo, ¼ T, 2 whl, M100	3.24	4.24		3	4	
Trlr, cargo, ¾ T, 2 whl, M101	3.63	5.13	5.76	3	5	5
Truck, cargo, 1¼ T, 4 x 4, M715, towing:						
Trailer, cargo, ¾ T, 2 whl, M101 or M101A1	3.45	5.65	6.28	3	5	6
Truck, cargo, 1½ T, 4 x 4, XM717, towing:						
Gun, antiaircraft artillery, 20 mm, XM167, trlr mtd	4.27	5.72		4	5	
Truck, cargo, 1½ T, 6 x 6, XM561, towing:						
Gun, antiaircraft artillery 20 mm, XM167, trlr mtd	4.76	6.21		4	5	
Truck, cargo, 2½ T, 6 x 6, M35, towing:						
Gun, antiaircraft artillery, 20 mm, XM167, trlr mtd	7.93	10.43	12.93	7	8	10
Howitzer, light, 105 mm, M101 or M101A1	8.93	11.43	13.93	7	9	11
Kettle, Heating, Bitumen trlr mtd, 165 gal	7.28	10.44	12.94	6	9	10
Trlr, basic utility, pole type, 2½ T, 2 whl	7.64	12.64	15.14	6	10	12
Trailer, cargo, 1½ T, 2 whl, M104	7.8	11.8	15.55	7	10	12
Trailer, Cargo, 1½ T, 2 whl, M105A1	7.76	11.76	15.01	6	9	12
Trailer, tank, water, 400 gal., 2 whl, M106A1	7.58	11.75	14.25	6	9	12
Truck, cargo, 2½ T, 6 x 6, M36 towing:						
Conveyor, belt, whl mtd. Barber Greene mdl PG–70	11.46	13.96	16.46	8	10	12
Truck, cargo, 2½ T, 6 x 6, M211, towing:						
Semitrailer, van, cargo, 6 T, M119, w/dolly, M197	11.82	20.50	25.10	10	17	20
Trailer, basic utility, pole type, 2½ T, 2 whl	7.99	13.17	15.67	7	10	12
Trailer, cargo, 1½ T, 2 whl, M104	8.15	12.33	16.08	7	10	13
Trailer, cargo, 1½ T, 2 whl, M105A1	8.11	12.29	15.54	7	10	12
Trailer, tank, water, 400 gal., 2 whl, M106A1	7.93	12.28	14.78	7	10	11
Truck, Cargo, 5 T, 6 x 6, M41, towing:						
Mixer, bituminous material, trlr mtd, Barber Greene mdl 848	25.25		32.75	22		30
Trailer, ammunition, 4 T, 2 whl, M21	12.2	19.95	23.7	11	21	24
Trailer, cargo, 1½ T, 2 whl, M104	10.91	16.16	21.16	10	15	18
Trailer, cargo, 1½ T, 2 whl, M105A1	10.87	16.12	20.62	10	15	17
Truck, cargo, 5 T, 6 x 6, M54, towing:						
Howitzer, Heavy, 8 in., M115	24.77	29.77	34.77	20	26	30
Mixer, bituminous material trlr mtd, Barber Greene mdl 848	25.67		35.67	21		32
Semitrailer, tank, gasoline, 5,000 gal., 4 whl, M131A, w/dolly, M198A1	19.11	33.92	44.38	16	27	37
Trailer, cargo, 1½ T, 2 whl, M104	11.33	17.83	24.08	9	15	20
Truck, cargo, 5 T, 6 x 6, M55 towing:						
Howitzer, heavy, 8 in., M115	26.83	31.83	36.83	21	25	30
Truck, cargo, 10 T, 6 x 6, M125, towing:						
Howitzer, heavy, 8 in., M115	30.60	39.35	48.10	24	32	38
Mixer, bituminous material, trlr mtd, Barber Greene mdl 848	31.5		49	25		44
Truck, dump, 5 T, M51, towing:						
Bin, aggregate loading, trlr mtd, Universal mdl PB–20	17.19		27.37	12		23
Conveyor, belt, GED, 52 ft long, Barber Greene mdl PH–70	17			11		
Elevator, hot, aggregate, trlr mtd, Barber Greene mdl 882–251	15.5			11		
Elevator, hot, aggregate, trlr mtd, Barber Greene mdl 882–241	15.7			12		
Mixer, bituminous material, trlr mtd, Barber Greene mdl 848	27.03		37.21	22		33
Trailer, basic utility, 2½ T, 2 whl	12.53	20.21	25.21	10	17	21
Trailer, low bed, 8 T, Fruehauf mdl CPT–8 Special	16.09	19.27	34.27	12	17	28
Truck, tractor, 2½ T, 6 x 6, M221, towing:						
Semitrailer, van, cargo, 6 T, 2 whl, M119	9.82	15.52	17.92	8	13	14
Semitrailer, van, shop, 6 T, 2 whl, M146	9.63	15.63		8	13	

Table D–7. Combination Vehicles—Continued

Vehicle Description	Weight (Short tons)			Class		
	E	Loaded		E	Loaded	
		C	H		C	H
Truck, tractor, 2½ T, 6 x 6, M275, towing:						
Semitrailer, stake and platform, 5 T, 2 whl, Olson mdl 516	9.12	14.13	16.62	8	12	15
Truck, tractor, 5 T, 6 x 6, M52, towing:						
Conversion unit, CO_2, strlr mtd, 260 lbs/hr, Girdler mdl 32–4150	24.04	----------		20	----------	
Cooling tower, strlr mtd, 4 section, 240 gpm	17.25	----------		13	----------	
Dust collecting machine, strlr mtd, Barber Greene mdl 857	19.7	----------		16	----------	
Generator and charging plant, CO_2, strlr mtd, 300 lbs/hr	31.53	----------		25	----------	
Semitrailer, low bed, 15 T, 4 whl, M172	16.78	-------	31.78	12	------	25
Semitrailer, low bed, 25 T, 4 whl, M172A1	16.78	-------	41.78	12	------	35
Semitrailer, low bed, wrecker, 12 T, 4 whl, M270	18.25	30.25	38.25	13	23	30
Semitrailer, stake, 12 T, 4 whl, M127A1	15.68	27.78	33.78	12	23	29
Semitrailer, tank, alcohol, 3,000 gal., 2 whl, M338	13.21	21.19	-------	10	18	------
Semitrailer, tank, gasoline, 12 T, 4 whl, 5,000 gal.:						
M131	16.93	26.74	32.2	13	22	28
M131C	16.58	27.77	33.86	13	24	30
Semitrailer, van, cargo, 12 T, 4 whl, M127	16.25	28.25	34.25	12	25	31
Truck, tractor, 10 T, 6 x 6, M123 or M123C, towing:						
Semitrailer, low bed, 25 T, 4 whl, M172A1	23.55	48.55	53.55	17	37	42
Semitrailer, low bed, wrecker, 12 T, 4 whl, M269 or M269A1	23.22	35.22	43.22	16	26	33
Semitrailer, tank, gasoline, 12 T, 4 whl, 5,000 gal., M131, M131A1, or M131A2	23.54	33.35	38.81	17	26	31
Semitrailer, tank transporter, 8 whl:						
40 T, M15	37.31	-------	77.31	24	------	60
45 T, M15A1	37.3	-------	82.3	24	------	65
50 T, M15A2	37.42	-------	87.42	24	------	72
Truck, tractor, 12 T, 6 x 6, M26 or M26A1, towing:						
Semitrailer, Low Bed, 60 T, Rogers mdl D–60–DS–5	41.45	-------	101.45	30	------	108
Semitrailer, tank, gasoline, 12 T, 4 whl, 5,000 gal., M131, M131A1, or M131A2	31.87	41.68	47.14	25	33	37
Semitrailer, tank transporter, 8 whl:						
40 T, M15	45.64	-------	85.64	32	------	68
45 T, M15A1	45.63	-------	90.63	32	------	73
Truck, tractor, wrecker, 5 T, 6 x 6, M246, towing:						
Mixer, bituminous material, 110–220 TPH, trlr mtd, Barber Greene mdl 848	32.12	----------		26	----------	
Semitrailer, low bed, wrecker, 12 T, 4 whl, M270 or M270A1	23.52	-------	35.52	19	------	28
Semitrailer, tank, gasoline, 12 T, 4 whl, 5,000 gal., M131, M131A1, or M131A2	23.84	33.65	39.11	19	28	33