FIELD MANUAL

ARMY

MOTOR TRANSPORT

OPERATIONS

HEADQUARTERS, DEPARTMENT OF THE ARMY

MARCH 1974

FIELD MANUAL
No. 55-30

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *15 March 1974*

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*This manual supersedes FM 55-30, 20 June 1969.

CHAPTER 1

INTRODUCTION

1-1. Purpose and Scope

a. This manual is a reference for use in planning and executing military motor transport operations and movements. It prescribes motor transport operational doctrine and presents techniques and procedures to be used in planning, executing, and controlling motor transport operations. It should be used in conjunction with FM 55-31, Army Motor Transport Units, and TM 55-310, Motor Transport Operations.

(1) FM 55-31 discusses the organization, basis of assignment, capabilities, and employment of motor transport units and offers further unit operational guidance and techniques.

(2) TM 55-310 contains supplemental "how-to-do-it" information covering such subjects as selection and defense of bivouac areas, safety, loads and loading, and operational records and reports.

(3) An additional text, TM 55-311, Motor Convoy Security in Stability Operations, offers further motor transport operational guidance in that specific area.

b. This manual is applicable without modification to general, limited, and cold war.

c. Linear distances in this manual are shown in both US standard units of length and metric equivalents. Appendix B offers a metric conversion table for linear distances, a conversion table for liquid measures, and a speed conversion table.

1-2. Recommended Changes

Users of this publication are encouraged to submit recommended changes and comments to improve the publication. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons will be provided for each comment to insure understanding and complete evaluation. Comments should be prepared using DA Form 2028 (Recommended Changes to Publications), and forwarded direct to the Commandant, US Army Transportation School, ATTN: ATSTC-TO, Fort Eustis, Virginia 23604.

1-3. International Standardization Agreements

This manual is in consonance with certain international standardization agreements which are identified by type and agreement identification number at the beginning of each appropriate chapter in the manual and are contained herein as appendixes.

a. DA Pamphlet 310-35, Index of International Standardization Agreements, lists and cross-references all standardization agreements, both of a materiel and a nonmateriel nature, binding upon the United States. The several types of nonmateriel agreements applicable to military operations which may affect motor transport operations are as follows:

(1) STANAG (STANdardization AGreement): applicable to the nations of the North Atlantic Treaty Organization (NATO).

(2) CENTO STANAG (CENtral Treaty Organization STANdardization AGreement): applicable to nations of the Central Treaty Organization (CENTO).

(3) SEASTAG (SouthEast Asia STandardization AGreement): applicable to nations of the Southeast Asia Treaty Organization (SEATO).

(4) SOLOG (Standardization of Operations and LOGistics): a nonmateriel agreement among the armies of the United States, the United Kingdom, Canada, and Australia (the ABCA nations). The term SOLOG now applies only to those nonmateriel agreements which were ratified and published before 20 September 1967 (see QSTAG, (5) below).

(5) QSTAG (Quadripartite STandardization AGreement): materiel and nonmateriel agreements among the armies of the United States, the United Kingdom, Canada, and Australia (the ABCA nations). The term QSTAG was adopted on 20 September 1967 and applies to all ABCA agreements (formerly designated as SOLOG's) ratified and published subsequent to that date (see SOLOG, (4) above).

b. Except as noted in any reservations to a part or parts of an international agreement (*f* below) US military operations are governed by these various aggreements when US forces are employed within the geographical areas over which treaty organizations exercise jurisdiction; thus while operating in a European country which is a member of NATO, US forces comply with the provisions of applicable STANAG's (*a* (1) above).

c. In a number of instances the provisions of

certain agreements have been accepted as doctrine by the United States and incorporated into appropriate training and field manuals. A prime example of this is the use of the metric system to indicate distances. This accepted and published doctrine then becomes applicable to Armywide operations.

d. Although standardization agreements do not apply to military operations in the continental United States, those which may concern a unit—in this case, those with a motor transport impact—must be considered in training and operational phases to permit military personnel to become acquainted with their provisions. This is particularly true for units or groups of personnel earmarked for oversea assignment.

e. To minimize operational differences in the various types of standardization agreements of the several treaty organizations, it is practice for one treaty organization to accept and publish under its auspices an agreement that has been ratified and published by another treaty organization. For instance, all or any part of a STANAG may be adopted by the SEATO organization and be incorporated into and published as a SEASTAG. When this occurs, each organization uses the same agreement identification number wherever feasible (see DA Pam 310-35).

f. Reservations. In the ratification of international agreements a part or parts of an agreement may be nonacceptable to one or more of the participating nations. If so, a nation may accept the general terms of the agreement, reserving ratification of the particular part(s) with which it does not agree and with which it will not conform. This reservation action is noted in the allied documents to the agreement and becomes a matter of the agreement record. Any agreement applicable to this text (*g* below) to which the United States takes reservation is appropriately marked (w / reservation) and the text of the reservation is appended as an annex to the details of agreement as contained in this manual.

g. Standardization agreements which are applicable to this manual are as listed; all have been accepted by the US without reservation:

Title	NATO STANAG	CENTO STANAG	SEATO SEASTAG	SBCA QSTAG (SOLOG)
Operation Orders for Road Movement, Tables and Graphs	2041 (2d Ed)	2041	2041	51
Route Network—Definitions and Characteristics	2151 (2d Ed)	2151	2151	.....
Definitions and Regulations for Military Motor Movements by Road	2154 (3d Ed)	2154	2154	.....
Transport Request and Reply to Transport Request	2156	2156	.....	.....
Identification of Movement Control and Traffic Control Personnel and Agencies	2159 (3d Ed)	2159	2159	.....
Vehicle Weight and Dimension Card	2163 (2d Ed)	.....	2163	.....
Military Routes and Route Networks	2174 * (to be published)	.....	.....	.....
Classification of Restrictions Affecting the Movement of Certain Military Equipment and Vehicles by Land on Continental Western Europe (Annex A—Road Movements)	2805-E	.....	.....	.....

* (Will consolidate in their entirety, STANAG's 2012—Military Route Signing, 2015—Route Classification, and 2151—Road Network, Definitions and Characteristics, and so much of STANAG 2024—Military Road Traffic Lighting Regulations as pertains to lighting conditions, and will cross-reference STANAG 2154—Definitions and Regulations for Military Motor Movements by Road.)

CHAPTER 2

GENERAL OPERATIONAL CONSIDERATIONS, MOTOR TRANSPORT OPERATIONS (STANAG'S 2041, 2151, 2154, AND 2156)

2-1. Principles of Motor Transport Operations

Successful motor transport operations require proper adaptation of personnel and equipment to prevailing circumstances. Regardless of the size of the unit involved or the mission to be accomplished, certain fundamental principles must be followed in all motor transport operations. These principles include the following:

a. Maximum Utilization. Motor transport operations must be carefully planned and supervised to insure that all vehicles committed to a mission are utilized to their fullest extent, thus eliminating unnecessary vehicle idleness.

b. Economy. The principle of economy requires analysis of the assigned mission and selection of the proper number and type(s) of vehicles most suitable for the accomplishment of that mission.

c. Standardization. Standardization of methods of operation and use of personnel and equipment promotes efficiency and economy in operation, maintenance, supply, and training. It is the responsibility of each unit to conform to standardization measures (standing operating procedures (SOP)) prescribed by higher headquarters and also to initiate such unit standardization measures (SOP) as are practical.

d. Minimum Deadline Time. Minimum deadline time is achieved only through thorough training in and continuous supervision of vehicle operation and maintenance procedures at all echelons. Committment of the accepted 75 percent of assigned task vehicles will enhance the deadline rate by insuring that adequate time is available for performance of organizational maintenance and repairs as well as the normal operator and scheduled maintenance services.

e. Minimum Loading and Unloading Time. Although motor transport units are not directly responsible for loading and unloading vehicles, their advice based on experience and their full cooperation with motor transport users will help to reduce loading and unloading times and thus reduce vehicle turnaround time. Close supervision of operations and liaison with supported units will aid in the detection and correction of improper loading and unloading procedures and / or the development of improved methods of loading and unloading, thereby promoting greater efficiency in the transport operation.

2-2. Increasing Operational Capability

a. The volume of tonnage which can be transported by a given number of motor vehicles may be increased by—

(1) Maximizing the quantity of cargo loaded aboard each vehicle.

(2) Maximizing the number of hours vehicles are available for operation each day.

(3) Increasing the vehicle operating speed over the routes, thus decreasing vehicle turnaround time.

(4) Minimizing the time required to load and unload vehicles.

b. The above means of increasing capability must be used with judgment and only after a careful analysis of the types of vehicles being used and the conditions under which they are being operated. For example, loading vehicles in excess of their normal capacity may result in excessive maintenance and deadlining of vehicles; increasing vehicle operating speed may, where road conditions are poor, result in unsafe operations and vehicle accidents. Further, sufficient time must be allowed each day to permit drivers to obtain proper rest and allow vehicles to be properly serviced and maintained. It is imperative that any action taken to increase operational capability be carefully considered before it is made a matter of operational guidance or instructions.

2-3. Types of Motor Movements

a. Functionally, military motor movements are divided into two general classifications: tactical and administrative.

(1) In *tactical movements,* motor transport is used for timely delivery of units and supplies to their destinations in the best formation and condition for the accomplishment of a tactical mission; unit integrity for tactical control, combat loading for ready availability on contact, and speed of movement take precedence. The emphasis is on the timely delivery of units and / or supplies to

destination rather than on the economical use of motor transport.

(2) *Administrative movements* make maximum use of available transport. In administrative movements tactical considerations are of less importance than the economical use of vehicle cargo capacities and operating personnel.

b. Both tactical and administrative motor movements may use organic vehicle transportation, vehicles of attached or supporting units, or a combination of both. *Organic transportation* includes vehicles assigned to a unit by tables of organization and equipment (TOE), tables of allowances (TA), or modification tables of organization and equipment (MTOE). *Attached and supporting transportation* includes vehicles provided to a using unit or activity by the supporting motor transport units.

(1) *Attached vehicles* are provided by the transportation service, and during the period of attachment to a using unit are controlled by that unit. Such attachment is accomplished on order of a competent authority (commander, theater army support command (TASCOM), corps support command (COSCOM)), and extends for either a specified time period or until completion of a specific operation, at which time the attached vehicles revert to the operational control of the transportation service.

(2) *Supporting vehicles* are provided to a user by the transportation service on a mission support basis and remain under operational control of the motor transport service while performing such mission.

c. Motor movements may be further classified by the degree of control exercised over them as follows:

(1) *Casual military movements* consist of individual elements proceeding more or less at will in performing routine unit functions.

(2) *Organized military movements* consist of units or supply convoys in which elements are grouped together for control, and over which movement control measures may be exercised.

(3) *Indigenous traffic* consists of refugee and local civilian traffic and casual non-US military movements. The presence of such unorganized traffic may require control measures (military police and / or local law enforcement agencies) to maintain or restore efficient use of the road net.

2-4. Requests for, and Commitment of Motor Transport

a. In the performance of transportation services, transport missions are generated through requests for transportation support received by the transportation movements offices from shippers. These requests are coordinated with the availability of transport modes—in this case, specifically motor transport—and tasks are assigned to motor transport units (STANAG 2156, app H).

b. Shippers' requests for motor transport support must provide sufficient information on which to base a commitment. Information will include type and amount of cargo or number of persons to be transported, point of origin and destination, desired time of departure and arrival, estimated time required for loading and unloading, and any other information deemed necessary. Information on types and numbers of vehicles desired is not required and, if provided, will be accepted only as a recommendation; the final decision in this matter rests with the motor transport service or the motor transport organization providing vehicle support.

c. The operations section of the appropriate motor transport command and supervisory unit (battalion and higher) plans and supervises the accomplishment of daily vehicle commitments. This is done by matching the availability of vehicles assigned to subordinate units against assigned commitments and determining the types and numbers of vehicles to be dispatched to accomplish individual tasks. The operations section will insure the efficient movement of cargo and personnel by coordinating and supervising the execution of its plan(s) of operation.

d. Operating unit commanders will fulfill commitments as received and will comply with current directives and publications governing the dispatch and supervision of vehicles engaged in logistic support operations.

e. Insofar as possible, unit integrity should be preserved in the assignment of motor transport tasks. When the requirement arises for a number of vehicles to be committed to a specific mission, battalion should assign such task by company; within companies, specific missions should be assigned by platoon and / or squad.

2-5. Vehicle Dispatch

a. Generally, individual dispatch of vehicles is the method used in local (short) hauls; convoy dispatch is the method employed in line (long) hauls. However, the selection of the dispatch method, or combination of methods to be employed, will depend entirely on the conditions existing at the place and time truck operations are being conducted. Both convoy and the individual dispatch of vehicles have advantages and disadvantages under the varied conditions encountered in the field. Neither method should be prescribed to the total exclusion of the other.

b. The senior motor transport commander or staff transportation officer concerned may direct or provide guidance on general dispatch methods in SOP and other operating directives. These publications should not be so restrictive in nature as to deny subordinate commanders (battalion and company) the right to exercise command prerogative in planning and executing specific motor transport missions.

c. When unit vehicles are dispatched individually, the company commander exercises control over the full and proper use of vehicles and equipment through—

(1) The dispatcher, who receives vehicle commitments, prepares and maintains dispatch records, and is aware of the daily operations of the unit.

(2) Unit roving patrols or spot check teams which visit supported units and / or patrol routes over which unit vehicles operate to observe operational procedures and correct, or note for correction, instances of improper vehicle utilization or vehicle operation, or other improper or unsafe practices.

(3) Frequent inspection of trip and operational records (DA Form 2400, Equipment Utilization Record; DA Form 2401, Organizational Control Record for Equipment; and DA Form 2408-1, Equipment Daily or Monthly Log), which contain data relative to miles or hours of operation, cargo transported, gas or oil consumed, and other operational data.

2-6. Procurement and Use of Commercial and / or Commercial Design Vehicles

a. Normally, motor transport units operating in oversea areas are authorized and equipped with standard military type motor vehicles. However, mission requirements arising in the area of operations, such as the need for vehicles capable of operating with available local motor transport equipment and facilities, the trend toward containerization of military cargo shipments, and the requirement for vehicles of a specific type or capability to meet conditions created by the local motor transport environment, may demand the introduction of commercial and / or commercial design vehicles of a nonstandard or developmental type into the motor transport service of a theater of operations.

b. To meet a situation of this nature, the Army has instituted a logistic program whereby nonstandard and / or developmental equipment (including vehicles) may be made available to operating units. This program, ENSURE (Expediting Nonstandard Urgent Requirements for Equipment) as discussed in AR 11-8, establishes the procedures and responsibilities for expediting the supply of such nonstandard and developmental material to support Army elements engaged in combat or stability operations. It also provides additional guidance on such matters as the approving authority for ENSURE requests, the basis of need and justification for ENSURE equipment, the use and capabilities of ENSURE equipment, and the source for procedural information on the ENSURE program.

c. Motor transport commanders will be aware of the local procedures governing the ENSURE program and will, if the need arises, avail themselves of its support.

d. Motor transport vehicles obtained through the ENSURE program will be employed and operated in mission support operations in the same manner as TOE authorized vehicles. Maintenance services and support will be governed by locally established policies and procedures.

e. Commercial type vehicles may also be introduced into the motor transport system through local hire (rental / lease) and / or contractor-operated vehicle procedures. The procurement, use, and maintenance of such vehicles will be in consonance with contractual agreements and / or theater and local regulations and directives.

f. Current studies and plans anticipate the assignment, by TOE, of commercial type task vehicles (including container chassis capable of transporting 20- and 40-foot containers) to certain motor transport units. This action is predicated upon economy not only in developmental and procurement processes, but also in operations and maintenance.

2-7. Transport of Semitrailer as Cargo

a. In the course of motor transport operations it may become necessary, or be more advantageous, to simultaneously move two semitrailers per tractor rather than the conventional one semitrailer per tractor. This situation is more likely to arise in a driveaway operation, in a trailer transfer operation, or in the relocation of a truck unit either assigned two semitrailers per tractor or having available for movement more semitrailers than tractors, than it is likely to occur in a conventional transportation support operation.

b. Since the towing of semitrailers in tandem (using a dolly converter to support and hook up the second semitrailer) during military operations is not commonly practiced and is permitted only under unusual circumstances—and then only when authorized by the highest transportation echelon—the requirement to pull two semitrailers per tractor

normally necessitates the loading of one semitrailer onto the cargo bed of another to accomplish the operation.

c. Appendix C discusses the matter of transport of semitrailers in detail and offers several methods for loading one semitrailer onto another at point of origin of the move, and unloading these transported semitrailers at destination.

2-8. Utilization of Vehicles

a. Command Responsibility. It is the responsibility of commanders at all echelons to guarantee that vehicles of the motor transport service are so operated and maintained as to provide the fullest support capability to using units and agencies.

b. Operations. The waste of motor transport through improper dispatch, routing, loading and unloading procedures, and / or other operational discrepancies will seriously reduce the effectiveness of motor transport support. Commanders and operating personnel will, in the course of directing and supervising motor transport operations, take immediate action to correct any operational discrepancies noted.

c. Maintenance. It is the duty and responsibility of the unit maintenance personnel to keep vehicles in a safe and efficient operating condition. Thorough training and adequate supervision of maintenance personnel will insure the prompt and proper performance of services and repairs on unit vehicles. Normal maintenance programs properly administered and supervised will preserve the mobility and capability of the unit under most operating conditions; combat and / or extreme operating conditions demand additional initiative at all levels (FM 29-2).

d. Driver's Duties and Responsibilities. It is the duty and responsibility of the military driver to operate his vehicle in an acceptable manner, to report any vehicle deficiencies noted, and to perform operator maintenance services. He must be thoroughly trained in the safe and proper operation of his vehicle under all conditions, and in the proper performance of preventive maintenance services. The conscientious performance of duties by the military motor vehicle operator provides the foundation for an efficient motor transport service.

2-9. Conditions Affecting Motor Movements

Military motor movements are affected by a wide variety of conditions over which planners and operating personnel have no direct control. These conditions can be anticipated to varying degrees, and provisions can be made for operations with these factors taken into consideration. All plans and operations must be sufficiently flexible to meet unpredicted weather, terrain, or tactical conditions. General provisions for operation under such conditions follow:

a. Civilian Controls. Generally, motor movements made in the territory of a friendly nation are subject to civilian traffic regulations. Coordination with civil authorities is therefore necessary for proper clearances before motor movements are executed. Clearances will normally be obtained through ITO / MTO channels as prescribed in field SOP or local regulations.

b. Terrain and Climate. Mobility of motor vehicles may be seriously restricted by terrain and climate (FM 5-36). Often, special training is required and special equipment must be issued. Adequate training and proper planning minimize adverse effects of terrain and climate (para 7-6 thru 7-10).

c. Availability and Capacity of Road Network. Normally, the defense plans of NATO nations designate a basic military road network which includes routes selected to meet anticipated allied and national military movements and transport requirements (STANAG 2151, app F). However, in some areas a road net with highways and bridges suitable for all classes of military traffic may not have been established. Under these circumstances, a route reconnaissance must be conducted to designate such a net and to determine engineer work required. This reconnaissance must be as thorough as time and the tactical situation permit. FM 5-36 may be used as a guide for route reconnaissance.

d. Tactical Conditions.

(1) In theaters of operations, particularly in the combat zone, tactical conditions must be given the highest consideration in planning and executing motor movements. Tactical conditions include all conditions imposed by hostile forces, such as air, artillery, or chemical, biological, and nuclear attack; raids; guerrilla action and sabotage; as well as conditions imposed by the operational plans of our own forces. Plans and orders for movements under tactical conditions must include march or convoy organization, command structure, and assignment or designation of adequate security detachments and / or measures.

(2) SOP for defense of a column against ambush, normally based on the principle of strong and immediate retaliation against the ambushing force, must be developed and understood by all personnel (TM 55-311). Particular emphasis must be placed on defense of unescorted convoys. The introduction of chemical, biological, and nuclear weapons systems to the battlefield and the threat imposed by hostile aircraft demand thorough

training in defense against such forms of attack (see FM 21-48 for detailed guidance).

2-10. Effect of Counterinsurgency Operations on Motor Transport Unit Capabilities

Several factors in counterinsurgency operations in underdeveloped areas have a detrimental effect on the stated TOE capability of motor transport units to transport cargo and personnel.

a. Operations are largely confined to daylight hours, with convoys departing the point of origin after the beginning of daylight and arriving at destination before darkness. This reduces the number of trips made by vehicles in an operational day (20-hour day) and reduces the unit capabilities accordingly. However, vehicles may be spotted in secure areas at night for loading or unloading and subsequent movement during the following daylight hours. Supported activities utilizing transportation in this manner must be geared for operations to meet a specific vehicle release time so that convoys can meet movement schedules.

b. Close liaison must be maintained between motor transport organizations and shipping and receiving activities to effect timely and efficient use of motor transport resources.

c. Since motor transport units have only a limited capability to provide convoy security measures, they must rely upon escort and security elements provided by either the appropriate motor transport commander (para 3-3 *c* (2)) or support commands and tactical units to secure the road net and to provide convoy protection from hostile action. If such support is not provided, motor transport unit capabilities are degraded through both the use of operating personnel in a security role and the diversion of task vehicles from their primary mission of transport, to fire support vehicles (gun trucks).

2-11. Military Police in Convoy Escort and Security Role

Under normal conditions, military police units provide convoy escort and security forces on an area basis to transportation units. When it has been determined by the TASCOM or COSCOM commander that the rear area threat requires dedication of military police assets to the primary mission of providing convoy protection to transportation truck units engaged in line haul operations, military police units may be placed in direct support of or attached as required to the motor transport service. The composition of such support (that is, numbers and types of units or cellular teams) will depend on the commander's priorities, enemy threat, availability of resources, echelon of the motor transport service to which attached or placed in direct support, and the needs of the motor transport service.

a. Military police units placed in direct support of a motor transport unit are provided by the military police group / bridge (theater army area command (TAACOM) or COSCOM) on a mission support basis and remain under the operational control of the parent military police brigade while performing such mission.

b. Attached military police units are provided by the military police group / brigade (TAACOM or COSCOM) and during the period of attachment to the motor transport service are operationally controlled by that unit and operate in accordance with pertinent motor transport service operating directives and SOP's. Such attachment is accomplished on orders of a competent authority (commander, TASCOM, COSCOM) and extends for either a specific time period or until completion of a specific operation, at which time the attached military police resources revert to the operational control of the parent military police brigade.

2-12. Balisage

Motor transport units operating in NATO countries may become involved in blackout operations in which the balisage system of traffic lighting for military roads is used.

a. The balisage system embraces the application of small, lightweight beacon lights used by the military of the NATO nations to permit motor vehicles operating under blackout conditions to obtain "near daylight speeds." The concept of operation of this system is that it will be employed on one-way, limited access roads.

b. The beacon lights employed in the balisage system are known as "balises" and they vary in type. One type operates on a principle similar to that of the luminous dial on a watch; others are lighted by dry cell batteries or by kerosene flame. In use, balises may be mounted on stakes or placed on the ground alongside of a roadway at given intervals. They provide a row of lights to mark the road for the vehicle operator; a channel of markers through which vehicles are driven; or a warning of critical areas (curves, bridges, defiles, and other restrictive conditions) where vehicle operators must be particular observant and cautious. These lights are designed to be readily visible to a driver from his position in a vehicle cab, but not readily detectable from the air.

c. Balises come in several colors to include red, orange, yellow, green, and blue. The colors of the lights employed and their particular positioning and grouping along either or both sides of a road provide guidance and warning to vehicle operators driving along that road.

d. Since there are some contradictions between the meaning of certain colors of lights used in the balisage system and those used in the standard US traffic codes, and because of both the difficulties encountered in distinguishing between certain colors and the method of placing balises along a road, the US military does not currently intend to employ the balisage system.

CHAPTER 3

ORGANIZATION OF MILITARY MOTOR MOVEMENTS (STANAG'S 2041 AND 2154)

3-1. General

a. To exploit the increased ground mobility of military units and to make effective use of the road network, adequate control must be maintained over military motor movements; such control is provided through the organization of motor movement columns and the effective regulation of the use of the highway net.

b. An appropriate degree of standardization must be provided to permit effective centralization of control when necessary. Details of motor movement organizations and corrective actions for recurring problems are provided for in instructions from higher headquarters and unit standing operating procedures. For a further discussion of the organization and operation of military motor movements see FM 55-31 and TM 55-310.

c. The organization for movements management which provides for highway regulation and the allocation, scheduling, and controlling of motor movements over the highway net is discussed in FM 55-11.

3-2. March Organization

A march column includes all elements using the same route for a single movement under the centralized control of a single commander who is normally designated by the commander of the organization responsible for the motor movement. A large column may be composed of a number of organized subdivisions, each under the control of a subordinate commander.

a. Serial. A serial is a major subdivision of a march column; it is organized as a single unit under one commander for purposes of planning, regulation, and control.

b. March Unit. The march unit which is a subdivision of the serial is the smallest subdivision of the column. It normally corresponds to the smaller troop units such as squad, section, platoon, company, or battery. It moves and halts under the direct control of a single commander.

3-3. Column Control Personnel

a. Column Commander. The officer or noncommissioned officer in command of a column is responsible for its actions during a movement. He issues the order to initiate the march and insures that instructions contained in standing operating procedures and march orders are complied with during the preparation for and conduct of the march. He must be free to supervise the movement of the column, and selects his position in the column on the basis of providing the best possible control of the move, and meeting and coping with anticipated problems. When conditions and availability permit, the commander may use light aircraft to facilitate column control. From the air, any deviations from the prescribed formation, changes in traffic conditions, and divergence from the prescribed route can be easily noted and immediate corrective action taken. Aerial reconnaissance, concurrent with aerial column control, may also enable the commander to make timely adjustments to meet changes in the situation.

b. Control Officers and Noncommissioned Officers. Column control is maintained by command and staff personnel at all echelons within the column. Commanders of serials and march units are responsible for operating their elements of the column, each using his staff or representatives to assist as he may direct (TM 55-310).

c. Other Control Personnel. Depending on the size of the column and the requirements of the situation, control personnel may include the following:

(1) *Guides.* Guides and signs posted by signing teams direct a unit or vehicles over a specified route or to a selected locality; these personnel are normally provided by the moving unit. Placing of guides and route signing on controlled routes must be under the responsibility of the authority in charge of movements or traffic in the area concerned (STANAG 2154, app G). Signs must conform to accepted specification and design (STANAG 2154, app G).

(2) *Escort and security elements.* Escort and security elements may be provided to accompany a column or convoy to assist its movement and to protect it from interference. Convoy escort and security elements may be drawn from military police units or teams attached to or placed in direct support of the supported column by the motor

transport commander controlling both the moving unit and the convoy escort and security resource; they may be provided on a mission basis by the commander controlling both the moving unit and the convoy escort and security resource; or they may be provided on a mission basis by the commander of the area within or through which the column is moving.

(a) Escort and security elements provided by the motor transport commander concerned will normally consist of military police personnel drawn from military police teams assigned or attached to the motor transport service for escort and security purposes.

(b) Escort and security elements provided by an area commander may consist of military police (FM 19-25), civilian police, or other personnel assigned to accompany the column through congested areas or areas of possible traffic conflict; or armed guards, ground troops, armed vehicles and / or armed aircraft to protect the movement from sabotage, guerrilla activity or enemy action; or of any combination of these elements.

1 Convoy escort and security elements accompanying the movement perform their mission functions in compliance with pertinent directive and the en route requirements of the convoy commander. The composition of supporting forces is determined by the organization(s) providing the contingent. Sufficient personnel and equipment must be allocated to insure the secure and unimpeded movement of the convoy.

2 The location of the convoy escort and security element within the convoy is determined by and dependent on established policies and procedures; the enemy, weather, and terrain situation; current area intelligence; and the experience of the convoy commander and his supporting escort and security elements.

3 Transportation commanders, supported by escort and security personnel, plan, coordinate, and integrate all matters pertaining to the security of the convoy, to include noise and light discipline requirements; front, flank, and rear security during movement and halts; air cover; fire support; communications with supporting units and higher headquarters; and interrogation of local civilians along the route to develop current intelligence. The convoy commander also participates in this action.

(3) *Patrols.* Under organizational control (para 4-1 *a*), patrols supporting the convoy may be provided by the unit making the move and / or the motor transport organization of which the unit is a part. Under area control (para 4-1 *b*), patrol support is usually provided by area military police. These patrols, in conjunction with highway regulating points, facilitate movements in accordance with the traffic plan and the schedules prescribed by higher authority or by the traffic headquarters having area jurisdiction.

3-4. Control Identification of Vehicles

It is desirable to mark or otherwise designate vehicles of a column for control purposes. Such identification is subject to local conditions and is usually specified in standing operating procedures. Marking should be kept to a minimum consistent with its need in column control. Temporary markings should be easily removable.

a. Cloth Control Indicators. Command and control vehicles of each element of a column are indicated by flags approximately 12 by 18 inches (30 by 45.7 centimeters) in size. The leading vehicle displays a blue flag; the rear vehicle, a green flag; and the vehicle of the commander, a white and black flag (STANAG 2154, app G). Flags are mounted on the left size of the vehicle except where vehicles are driven on the left side of the road, in which case flags are mounted on the right side.

b. Marking of Vehicles (Movement Number).

(1) The movement number assigned to a movement serial (STANAG 2154, app G) is marked on both sides of each vehicle in the serial and, if possible, on the front of at least the leading vehicle and the last vehicle of each organized element of the column. The marking must be clearly visible from ground level and must not conceal other prescribed markings. If available, fluorescent chalk may be used to enhance readability and identification.

(2) When aircraft are used for column control, approximately every fourth vehicle in the column should have the movement number marked on the hood or cab roof for visibility from the air.

c. Special Markings on Vehicles. In addition to the markings described in *b* above, standard markings are prescribed for vehicles requiring quick and easy identification.

(1) Vehicles carrying general officers may be marked with the appropriate conventional symbol on a plate attached to the right end of the front bumper (AR 746-1). Flags indicating the rank of general officers may also be flown.

(2) Armed Forces police vehicles and military police vehicles are marked prominently in accordance with the provisions of AR 746-1.

(3) Ambulances and other vehicles provided exclusively for medical purposes are marked in conformity with AR 746-1.

(4) Vehicles of bomb disposal units have all mudguards (fenders) painted red.

(5) A plain red flag flown from any vehicle indicates danger.

(6) Any commander having area responsibility may prescribe a marking to be displayed on the front and rear of a vehicle to show that that vehicle has priority over others on the road. This marking is an equilateral triangle of red border lines on a white background; a red symbol inside the triangle indicates the commander authorizing the priority. The marking and the priority provided are valid only in the area of the commander authorizing it.

3-5. Column Communications

Adequate communication within a column is essential to effective command and control. Unit standing operating procedure and/or communication-electronics standing instructions may designate the various means of communication to be employed and their use under specific circumstances. The operation order (STANAG 2041, app E) specifies security limitations. Methods of intracolumn communication include the following:

a. Visual Signals. Visual signals (FM 21-60) are most commonly used for column control. These may be arm-and-hand, flashlight, flag, headlight, pyrotechnic, or other signals as may be arranged. They may be given directly by the commander or other control personnel to march element personnel, or may be relayed from vehicle to vehicle as in the case of standard driver's signals.

b. Audio Signals. Audio signaling is used mainly in conjunction with other means of signaling for column control. Whistles or horns are used to attract attention, to warn personnel of further transmission of commands, and to spread alarms. Voice commands and verbal messages are classed as audio signals and are used when the situation permits. Aircraft equipped with loudspeakers may be used in audio signaling.

c. Radio Communication. When communication security permits and when vehicles are adequately equipped, radio is the principal means of communication during a march. Radio provides the most rapid transmission of orders and messages between widely separated elements of a column. Its use is generally specified in orders, in the unit communication-electronics standing instructions (CESI) and in communication-electronic operation instructions (CEOI). Aircraft may be used to relay messages between FM radios on the ground in terrain that restricts direct FM radio communication.

d. Other Methods. Sign messages, written on a board and displayed by a guide in view of oncoming vehicles or posted along the route, are often used to pass instructions to personnel in a moving column. Written messages between column control personnel and/or commanders may be delivered by guides posted along the route, or by messengers using utility vehicle transport. The use of Army aircraft is practical and effective for delivering messages and for transporting control personnel to or between locations along a congested route.

CHAPTER 4

CONTROL OF MILITARY MOTOR MOVEMENTS (STANAG'S 2151 AND 2154)

4-1. Types of Control

a. Organizational Control. Organizational control is always exercised during motor movements. This control is the responsibility of the commander of the organization or unit using the road. Organizational control insures observance of rules of the road, traffic laws and regulations, speeds, gaps, routing, schedules, discipline en route and at halts, and local security measures. Organizational control is exercised through—

(1) Standing operating procedures and directives governing the organization and conduct of motor transport operations and support.

(2) Column control personnel who direct and supervise motor moves.

(3) Motor transport patrols which may not only observe and correct improper operational procedures, but may also provide assistance in the event of accidents and / or vehicle breakdowns.

b. Area Control. Area control is the responsibility of the commander having area jurisdiction. This function is normally planned, implemented, and supervised by the appropriate traffic headquarters for highway regulation, and by the area military police for traffic control. Area control is superimposed on organizational control. It is employed only to the extent necessary to assure orderly and effective movement of vehicles over the highway system. This control may be exercised through the use of traffic control posts and / or highway regulation points established along routes of march, and / or roving patrols which observe and enforce traffic rules and regulations. Road maintenance patrols and / or wrecker service may also be provided under area control policies.

4-2. Control Classification of Highway Routes (STANAG 2151)

a. Highway routes are classified according to the degree of control demanded. The following classification of highway routes is established for military operations.

(1) An *open route* is one over which minimum control is exercised. No movement credit (STANAG 2154, app G) is required for the use of an open route. Supervision is normally limited to military police traffic control at critical intersections, enforcement of standard traffic laws and regulations, and provision of necessary sign and highway markings.

(2) A *supervised route* requires limited control by a central traffic authority (highway traffic headquarters). Traffic control is provided by military police traffic control posts and patrols. A movement credit is required for use of the route by any column of 10 or more vehicles or by any vehicle of exceptional size or weight. Usually, no prior correlation of individual march schedules is necessary for use of the route by small units, although access to the route may be regulated as necessitated by the traffic situation.

(3) A *dispatch route* is a route over which full control, both as to priorities of use and regulated movement of traffic in time and space, is exercised. A movement credit is required for the movement of any vehicle or group of vehicles. Normally, in addition to organizational control, a high degree of area control is required.

(4) A *reserved route* is a route set aside for the exclusive use of a designated unit or a specified operation or type of traffic. When a route is reserved for a designated unit, the commander of that unit decides on the degree of regulation and control to be exercised. In addition to organizational control, military police traffic control may be required to deny the use of the route to unauthorized traffic.

(5) A *prohibited route* or a prohibited section of a route is one over which no traffic is allowed.

b. Other classifications of highway routes, as used in North Atlantic Treaty Organization (NATO) operations, are contained in STANAG 2151 (app F).

4-3. Methods of Column Movement

a. A fundamental for column command and control is the selection of a method of movement suitable to meet the situation and provide the degree of control necessary. In some instances, the formation of columns or convoys may be impractical owing to the need for dispersion or for avoiding interference with other traffic over a specific route. In other cases, individual dispatch may not provide the security, control, or unit in-

tegrity required to perform the assigned military mission. The commander must decide which method is best suited to meet the requirements of the current mission and situation.

b. There are three basic methods of column movement: close column, open column, and infiltration. In general, the following principles apply to each type:

(1) The head of a column or element maintains its proper position while enroute by means of a time schedule and/or by maintaining a prescribed gap (distance) from the rear of the preceding column or element.

(2) Vehicles within a column or element maintain the prescribed vehicle gap (distance) during movement.

(3) For the purposes of safety and to control the accordion action of a column or element, a minimum gap, within which vehicles will not close up while the column or element is moving on the road, may also be prescribed.

(4) The at-halt gaps between both elements and vehicles in a column are determined based upon the operational situation, traffic and road conditions, and governing directives and regulations.

(5) A maximum speed is imposed for vehicles either closing up in, or regaining their position within, a column or element.

c. The three methods of column movement are further and individually discussed as follows:

(1) *Close column.*

(a) In close column operations, each vehicle in a march unit follows the vehicle ahead at a distance sufficient only to insure against accident. This distance may be governed by a given operating gap, or by a speedometer multiplier, or the casual "follow me" method may also be used. In the latter, drivers are instructed to follow the vehicle ahead as closely as safe driving practices allow (TM 21-305).

(b) Close column formation facilitates column control and intracolumn communication, and during daylight hours fewer guides, traffic escorts, and route markers are needed. Close column is generally used in blackout operations and in operations over poorly marked routes when visual contact between vehicles is essential. It is also used in areas where hostile action is not imminent and the utilization of the full capability of roads and road nets is desirable.

(c) Close column formations do not provide dispersion for passive defense against enemy observation and attack. The strength and type of organization are readily apparent to hostile observation. Careful scheduling and rigid control of traffic are necessary to assure that vehicles do not arrive at destinations more rapidly than they can be handled. In close column operations, the use of the route by other traffic is severely limited.

(2) *Open column.* In open column operations, distances between vehicles are increased to effect dispersion. In areas vulnerable to enemy action or under difficult operating conditions, adequate dispersion may be insured by prescribing traffic density in orders. An open column formation increases the degree of passive protection against hostile observation and attack. It permits greater highway speeds with safety. The open column permits greater flexibility in highway use, both in planning movements and in making adjustments to meet changes in the tactical situation. It permits concurrent use of highways by other traffic moving at various speeds.

(3) *Infiltration.* In infiltration operations, vehicles are usually dispatched individually, in small groups, or at irregular intervals, at a rate that will keep the average traffic density down and prevent undue massing of vehicles. Average distance between vehicles in the overall plan is determined initially by the rate at which the vehicles are dispatched. Thereafter, speeds and distances are regulated by individual drivers in conformity with operating instructions. Deception for the purpose of preventing disclosure of a movement to enemy observers may be provided by intermingling various types of vehicles and by permitting passing within the column. When more than one movement is taking place over the same route at the same time, it is desirable to coordinate the rate of dispatch to achieve dispersion. Movements are supervised by regulation and control personnel stationed along the route.

(a) Infiltration provides the best possible passive defense against hostile observation and attack. Under light traffic conditions, movement of individual vehicles is not materially affected by other vehicles on the road. Individual vehicles may travel at higher speeds, and cross traffic may move with less interference since traffic density is light. The use of this method permits movement of a unit over a route on which traffic is too heavy for the entire unit to move at one time.

(b) Time length (pass time) (para 9-3 *b*) of the infiltration march is greater than that of any other type of movement. Because of extended distances between vehicles, internal control is difficult. If other units are moving simultaneously over the same route, vehicles may become bunched, thus preventing dispersion. Because of minimum control and duration of the move, tactical employment of a unit moved by infiltration may be

difficult or impossible until the movement of the entire unit is completed.

4-4. March Discipline (FM 55-31)

a. The responsibility for good march discipline begins with the vehicle driver. Each driver is responsible for maintaining the proper vehicle gap (distance) and speed, for observing safety precautions, for performing prescribed at-halt maintenance, and for strict compliance with standing operating procedures and specific orders governing the march.

b. Serial and march unit commanders exercise general supervision over their respective units. They are responsible for maintaining the proper position of their elements within a larger column and for carrying out the orders of the column commander.

c. Commanders in a convoy or column are responsible for the conduct and operation of their units. This responsibility becomes broader and more general at each higher level of command.

4-5. Start Point

a. A start point (SP) is a well defined point on a route at which a movement of vehicles comes under the control of the commander of the movement. It is at this point that the column is formed by the successive passing, at the appointed time, of each element composing the column. In addition to the principal SP of a column, there may be secondary SP's for its various elements (STANAG 2154, app G).

b. Scheduling of the movement is based on the SP. Necessary adjustments to compensate for unforeseen delays or changes are made at this point. On dispatch routes, the SP is used as the position to check various convoys onto those routes.

4-6. Release Point

A release point (RP) is a clearly defined point on a route at which specified elements of a column or convoy of vehicles revert to the control of their respective commanders. In addition to the principal RP of a column, there may be secondary RP's for the various elements of the column (STANAG 2154, app G). Although RP's are generally considered to be located at or near the end of a route, they may be established at any point along an established convoy route where vehicles will leave the route. RP's should be located so that vehicles leaving the established convoy route have easy access to existing road nets and may clear the convoy route without delay or congestion. Where applicable, reconnaissance and organization of the area, allocation of areas to specific elements, selection and preparation of routes, and posting of guides or signing of roads must be made before arrival of the column or convoy.

CHAPTER 5

MOVEMENT OF PERSONNEL BY MOTOR TRANSPORT

5-1. General

Since it is normally desirable that troop units be kept together and that their supplies and equipment move with them, motor columns transporting personnel are often larger than supply convoys, which may more readily operate as small march units or serials. However, for control, columns of a troop movement are easily separated into march units corresponding to the smaller units making up the troop organization. For a further discussion of techniques and procedures employed in the movement of personnel, see FM 55-31 and TM 55-310.

5-2. Command

a. Personnel movements by motor vehicle include those made in vehicles organic to the unit being transported, those made by truck units of the motor transport service which are attached to or under the operational control of the unit being transported, and those made by truck units operating as part of the general hauling service provided by the motor transport service in direct support of the unit being transported.

b. It is essential that the functions and restrictions applicable to each unit involved in a troop movement— the unit being transported and the truck unit furnishing the transportation—be clearly delineated and that command responsibilities for conduct of the movement be understood and observed.

(1) When a unit is being transported in its organic vehicles, the troop commander has full command of both the personnel being transported and those operating the vehicles.

(2) The commanding officer of a unit with a truck unit under his operational control or in attached status exercises command over the commanding officer of the truck unit.

(3) In administrative type moves, when a truck unit is not attached to or placed under operational control of the unit that it is transporting but is providing the direct support required, command of the convoy and of each serial or march unit remains with the truck unit commander and his representatives at their respective levels. The commanding officer of the troops being transported (troop commander) retains full command of his troops and issues any orders necessary to conform to and implement those issued by the convoy commander concerning schedules, march discipline, and operation of the convoy. When combat troops are being transported and a tactical emergency arises, the commander of troops being transported, regardless of rank, assumes command of the convoy and issues such orders as may be necessary to meet the emergency. He controls actions of the convoy operating personnel through the convoy commander, who acts as his technical adviser in such matters.

(4) During tactical moves which are, in general, movements to contact, and since the success of the operation may depend upon the rapid and efficient tactical deployment of troops, the commander of combat troops commands the tactical movement regardless of whether it is made in organic vehicles or in vehicles belonging to a unit in attached, operational control, or direct support status. If a transportation unit is supporting the operation, the commander of this unit acts as a subordinate commander and transportation adviser to the tactical commander.

(5) The senior officer or noncommissioned officer of the troops in each truck commands the personnel transported in that truck. He is responsible for their discipline and for their compliance with existing convoy regulations and other standing operating procedures.

(6) The driver of a vehicle or the senior officer or noncommissioned officer of the operating personnel riding in that vehicle is responsible for safe operation of that vehicle and compliance with operating instructions.

(7) In individually dispatched vehicles, the senior passenger is responsible for insuring that the driver obeys laws, regulations, and instructions.

c. When casual troops are being transported, the senior officer with such troops acts as troop commander; command of the transporting vehicles (convoy) is exercised by the senior, or designated, motor transport officer. If a tactical emergency arises, the senior officer present and eligible will, *in the absence of any orders or operating directives to the contrary*, assume commany of both the convoy and the troops being transported and issue any orders necessary to meet the emergency. When the situation returns to normal, command prerogatives revert to their original status.

5-3. Methods of Movement

There are four methods by which personnel may be transported by motor transport:

a. Full Lift. When sufficient truck units are available or when the troop unit is completely motorized, the entire movement may be made in one lift.

b. Point-to-Point Shuttle. If sufficient vehicles are not available to move a unit in one lift, truck units may shuttle back and forth from point to point, taking a portion of the troops on each trip until the movement is complete. This method is not recommended in tactical movements when additional transportation is available from higher headquarters.

c. Part-Ride, Part-Walk Shuttle. In a part-ride, part-walk shuttle, a limited number of vehicles are used to speed a continuous movement of foot troops. A part of the unit entrucks at the start of the march and is carried to a selected point along the route where troops dismount and move to destination on foot. The trucks return for the balance of the unit, which meanwhile has started the march on foot; these marching troops are then entrucked and transported to destination. This method enables all elements of the unit to arrive at the destination at the same time, each having performed an equal portion of the march on foot.

d. Leapfrog Shuttle. Leapfrog shuttle is perhaps best adaptable to tactical troops making advance or retrograde movements in combat or in close support of combat operations. This method may be illustrated by the movement of two units of a single command. From one position, a unit moves, establishes, and holds another position. When this position has been established, the vehicles return for the other unit. Instead of taking these troops to the position established by the first unit, the vehicles carry them past, where they establish a third position. Then the vehicles return to the first unit and carry it past the position established by the second. This operation is repeated until the troops arrive at their final destination. This method allows the movement to continue while adequate positions are maintained.

CHAPTER 6

MOTOR TRANSPORT SERVICE SUPPORT MOVEMENTS

6-1. General

Service support movements include the movement of all elements engaged in supply, evacuation, maintenance, and administration of a combat force. Such movements may be made by organic vehicles of the service element involved, by vehicles provided by attached truck units, or by vehicles provided from truck units operating under centralized transportation movements commitment procedures. The majority of motor transport equipment involved in service support movements will be engaged in the transport of supplies. Traffic with the primary mission of evacuation, maintenance, or administration is seldom organized and may generally be considered as casual traffic operating under area control.

a. Supply movements in forward areas are generally made by motor transport units. Security and / or reconnaissance measures (personnel and equipment) required for supply moves may be provided by the motor transport unit committed to the move. However, this capability in a motor transport operating unit is limited, and its use reduces the unit's ability to accomplish its mission. When supply convoys require substantial reconnaissance and security, these functions may be performed by elements attached to the convoy organization for that specific purpose or they may be provided, on a mission basis, by the commanders of the areas through which the convoys operate. Passive security measures, including use of cover and concealment and camouflage discipline, are taken as appropriate.

b. Supply convoys should be of a size and formation that assure the most effective traffic flow over the routes involved. Since experience indicates that the best results are obtained with small groups of vehicles, march units of a supply movement should not normally exceed one truck platoon size and serials should not exceed one truck company size. Small serials require more staff planning and involve more work in recording the progress of their movement, but more detailed information is possible concerning their progress, closer supervision may be exercised, and orders may be changed more easily.

6-2. Command

The movement of cargo by motor vehicles includes operations in which truck units or vehicles of the motor transport service are attached to or placed under the operational control of a unit for the move—as when a truck company is attached to or under operational control of a division for a division move—and those made by truck units operating as a part of the general hauling service provided by the motor transport service in direct support of using agencies—as when a truck unit or vehicles are provided to a port for the purpose of port clearance. The command responsibilities for the conduct of movement in these operations are delineated as follows:

a. The commanding officer of a unit or organization to which a motor transport unit or vehicles have been attached or placed under operational control of, exercises command over that motor transport unit or vehicles through the truck unit commander or the designated motor transport commander.

b. When motor transport service units or vehicles are not attached to a using agency but provide transport in a direct support role and operate without an escort, command of the motor transport unit or of a motor transport column and its serials or march units, or of a group of vehicles, remains with the truck unit commander or the designated motor transport commander and his representatives at their respective levels as appropriate.

c. In areas where hostile activity is an imminent and recurring problem, commanders of the area providing screening forces may assume command of a convoy while it is operating within that threatened area.

6-3. Classes of Operation

Military motor transportation may be employed in various ways to execute specific service support transportation missions. These operations may be classified by either the type of haul or the service support task assigned.

a. Hauls may be described as local or short hauls and line or long hauls.

(1) *Local (short) hauls* are characterized by short running time in relation to loading and unloading time. They normally involve a number of trips per day and are evaluated on the basis of tons moved during the operational period.

(2) In planning local haul operations, the commander should make an estimate of the situation to determine the operating capability necessary to fulfill expected requirements. Consideration must be given to the tonnage to be transported, types of cargo to be handled and the distance it is to be hauled, the materials handling equipment and available labor at both loading and unloading points, the road net to be used, and weather conditions. Provisions must also be made for the reporting of trucks and drivers to designated loading points, for road control, and for overall operational supervision.

(3) *Line (long) hauls* are characterized by long running time in relation to loading and unloading time. They normally involve one trip or a portion of a trip per operating shift and are evaluated on the basis of time consumed, distance traveled, and tonnage hauled during the operational period. This latter may be expressed in ton-miles (-kilometers) forward.

(4) In preliminary planning for line hauls, plans are based on the force supported, tonnage to be moved, and truck units available. This planning is general in nature and based on certain known facts supplemented by logical assumptions. Operational plans are based on more definite (current operational) information and a specific situation.

b. Line hauls may be either intrazonal or interzonal operations.

(1) An *intrazonal* line haul is one in which the truck operations are confined within the territorial boundaries of, and under the jurisdiction of, one headquarters or command.

(2) An *interzonal* operation is one in which trucks cross territorial boundaries and operate under the area control of more than one headquarters or command. However, the transport headquarters directing the move formulates policies and maintains operational control over the entire interzonal operation. For a further discussion of interzonal line haul operations, see chapters 8 and 9.

c. Service support tasks in which motor transport is employed and which may involve either line or long hauls are as follows:

(1) Terminal (water and air) clearance (para 6-6).

(2) Installation support operations (para 6-8).

(3) Transfer operations (para 6-9).

(4) Driveaway operations (para 6-10).

(5) Bus operations (para 6-11).

(6) Combat support operations (para 6-12).

(7) Combat service support operations (para 6-13).

6-4. Methods of Operation

Three general methods are employed in the movement of cargo and/or personnel by motor transport: direct haul, shuttle, and relay operations.

a. Direct Haul. A direct haul carries out a single transport mission in one trip and involves no transfer of supplies or exchange of equipment. It is normally limited to local hauls during the initial stages of an operation before transfer or exchange points have been set up and when it may be desirable to expedite forward movements. In a line haul type operation, direct hauls of extended duration greatly tax drivers and equipment and often result in loss of control by the unit.

b. Shuttle. The simple shuttle is accomplished by repeated trips made by the same vehicles between two specified points. This method is most commonly applied in local hauls.

c. Relay. Relay hauling is the continuous movement of supplies or troops over successive segments of a route without transfer of load. It is accomplished by change of drivers, powered vehicles (tractors), or both, for each segment. This method is most commonly employed in line hauls. The relay system, employing tractor-semitrailer combinations, is the most efficient method of line haul motor transport operation in areas with a well developed road network not subject to hostile interference and when a one-way haul cannot be completed in one day. Unitization of cargo increases the effectiveness of this system and exploits the capacities and tonnage capabilities of the task equipment. In addition to rapid through movement of loads, the system provides command supervision and supporting services for segments of the route. (For detailed discussion of relay operation, see para 8-7 *a.*)

6-5. Combined Operations

Motor transport may be combined with other modes—rail, water, and air—to reduce the handling of cargo and thus reduce the time en route from origin to destination.

a. Piggyback, or Trailer on Flatcar (TOFC). Semitrailers are loaded and sealed at the point of origin, placed on railcars, and moved forward as far as possible. At this point they are unloaded from the railcars, coupled to suitable towing vehicles, and delivered to their destinations over the highway.

b. Container on Flatcar (COFC). This operation parallels TOFC type except that in COFC, containers are involved instead of semitrailers. Containers to be transported may be either mounted on chassis and then loaded onto

flatcars, or the containers only may be loaded directly onto the deck of the transporting flatcars.

c. Roll-On, Roll-Off. Loaded semitrailers are towed aboard specially constructed vessels at the port of embarkation and transported to an oversea port. There they are coupled to towing vehicles while still aboard ship and are then moved by highway to their destination.

d. Lift-On, Lift-Off. In a lift-on, lift-off operation, loaded trailers are moved to a port, uncoupled from their prime movers, and crane-loaded aboard ship. Upon arrival at an oversea area, these trailers are unloaded from the ship by crane, coupled to prime movers, and moved to destination by highway.

e. Air. With the increased use of air transport for both tactical and strategic deployment of troops and supplies and the concurrent development of aircraft of greater capacity, the movement by air of motor vehicles loaded with high-priority cargo has become possible. This allows immediate distribution of these critical supplies on landing.

6-6. Terminal (Water and Air) Clearance

Water terminals used by oversea commands may be existing commercial ports, or they may be undeveloped beaches. Rapid clearance is a major factor in successful terminal operations. As it pertains to motor transport operations, water terminal clearance is the clearing of cargo from the immediate vicinity of a port or beach area to permit continuous unloading of ships which may be otherwise hampered by a backlog of supplies within the terminal area. Moving cargo away from the terminal is most important during peak periods of operation. The operations section of the terminal battalion or terminal group operating the terminal is responsible for cargo clearance. A motor transportation officer assists in planning and coordinating the use of motor transportation in support of terminal clearance. He assists in planning and setting up the circulation net and regulating the flow of vehicles throughout the terminal area.

a. Beach Clearance. Beach clearance operations are characterized by the necessity to use poor roads and temporary facilities and by the need to move cargo from discharge points at or near the beach with minimum delay to prevent congestion on the beach proper. Effective control is essential to success in beach clearance operations. Effective control and smooth, rapid clearance are promoted by establishing an efficient truck park(s) for rapid assignment and dispatch of task vehicles, providing adequate communications, and carefully planning traffic circulation to give maximum use of access and exit routes. Engineer effort (construction command) may be required to build and / or maintain roads and to provide pierced planking or other similar expedients in soft or sandy areas.

(1) A beach truck park (also may be known as "vehicle marshaling area," "motor park," or "vehicle holding area") is a centralized vehicle receiving and dispatch point established to route, dispatch, and control vehicles engaged in mission support of the beach clearance operation. It is set up within or adjacent to the beach area and consists, at a minimum, of a dispatch facility and a vehicle parking area. Depending upon the operational situation (number of vehicles and drivers involved, anticipated duration of the operation, location of parent units of personnel and vehicles involved, location and / or availability of petroleum, oils, and lubricants (POL) and maintenance support, and / or other local factors which may influence and effect the beach clearance mission) a truck park may incorporate additional facilities such as a POL service, maintenance and mess support, documentation facilities, and other support as appropriate. A truck park operates in a manner similar to that of a truck terminal in a line haul operation; all vehicles engaged in support of the beach clearance operation move into and out of the beach site through the truck park.

(a) Empty vehicles arriving for loading—or vehicles carrying return (retrograde) loads for unloading at the beach—are checked in through the truck park dispatch facility. These vehicles may then either be dispatched directly to designated loading or unloading sites on the beach, or may be directed to a holding area within the park pending subsequent dispatch to beach sites.

(b) Loaded vehicles leaving the beach for movement to cargo destination are also checked in at the motor park dispatch facility prior to movement over the road. These vehicles may be dispatched directly to destination—either individually or in small groups—or may be directed to a holding area within the park pending formation of convoys, or consolidation of vehicles carrying like cargo loads. Further, based upon unloading capabilities at destination, vehicles may be held in the park for dispatch at intervals to regulate and control the flow of loaded vehicles into receiving activities.

(c) If tractor-semitrailer vehicles are employed in the beach clearance operation, the motor park may incorporate a shuttle vehicle system such as is employed in a truck terminal operating in conjunction with a line haul operation (para 8-8*c* (1) *(a)*). Shuttle tractors would move semitrailers between the motor park and beach sites

and spot loaded semitrailers for further movement; road tractors would move loaded semitrailers from the motor park to destination and return.

(d) Depending on the beach situation (that is, the area the beach encompasses, the availability and condition of roads into and from the beach, the area or areas suitable for the establishment of a truck park, and the number of vehicles engaged in support of the beach operation), it may be more practical to establish several truck parks in a beach clearance operation. Then, in a widely dispersed operation each park would control vehicles used to support a specific area of the overall beach. Or, depending upon the road net and the traffic flow pattern, one park could control all inbound traffic (vehicles coming into the beach area for loading or delivery of return load cargo) and another could control all outbound traffic (vehicles proceeding under load from the beach to cargo destination).

(e) The preparation and maintenance, by truck park personnel, of charts and reports to compile and record operational data and to aid in control measures is recommended.

(2) The preparation of a traffic circulation plan for the area and the posting of adequate route signs and markers are responsibilities of the appropriate transportation officer in coordination with the responsible engineer and military police agencies.

(3) The types of vehicles employed in a beach clearance operation may determine the success of the mission. Selection depends on trafficability of the beach and immediate area and on availability of suitable vehicles. In general, those vehicles with highest flotation have primary consideration. Light cargo trucks (2½ and 5-ton) with all-wheel drive are generally considered most suitable in the classic beach clearance operation where trafficability is poor, roads are primitive or nonexistent, and vehicles must traverse soft sands, dunes, and unimproved areas. However, as a beach area is improved and facilities, roads, and hardstands are provided—or if the original beach conditions are conductive to their operation—semitrailer units which offer a greater economy in vehicle and manpower requirements and greater potential in tonnage capabilities should be phased into or used in beach clearance.

b. Port Clearance. Motor transport operations in support of the clearance of a port parallel the conduct of operations in beach clearance—vehicles are loaded at port, proceed to destination where they are unloaded, and then return to the port to repeat the cycle. Control over the port clearance motor transport operation is exercised and maintained by the establishment of one or more truck parks as discussed in beach clearance (para 6-8 *a*(1)). Normally the availability of improved roads in the vicinity of the port tend to facilitate the performance of motor transport operations; within the port proper, conditions may vary.

(1) If the port to be worked is intact when taken over or put into operation, clearance will be facilitated by the availability of berthing facilities and cargo handling equipment, permanent port facilities for administration, communications and control of the operation, and established roadways and traffic patterns within the port. A greater flow of cargo tonnage into and through the port can be anticipated over that experienced in a similar type beach clearance operation. The existing operational conditions may warrant the use of tractor-semitrailer equipment rather than the smaller, less economical 2½- and 5-ton cargo trucks.

(2) If a port has incurred damage during hostilities or has undergone demolition by a withdrawing hostile force, it can be expected that both the port tonnage capability will be impaired and the movement of vehicles within the port area will be hampered and restricted commensurate with the extent of damage. Operational conditions may dictate the use of the smaller, more maneuverable 2½- and 5-ton trucks over larger vehicles with greater capacity during the initial stages of the clearance operation. However, the transport planner and operator must consider rehabilitation and / or reconstruction measures which may be taken to increase the port capacity and to improve operating conditions. When operationally feasible, tractor-semitrailer vehicles should be phased into the motor transport operation to either supplement or replace the lighter straight trucks. In this connection, a line haul operation may be established in conjunction with the port clearance to permit the throughput movement of cargo as far forward as is feasible.

c. Air Terminal Clearance.

(1) The increasing use of air lines of communication places emphasis on clearance of air terminals. Basically, air terminal clearance parallels the general pattern of port and beach clearance, with delivery of cargo into the terminal being made by air transport, and movements of cargo from the terminal being primarily a motor transport mission.

(2) Since the turnaround time of aircraft is of critical importance and because of the vulnerability of aircraft to hostile action while on the ground and while landing or taking off, particularly in forward areas, speed in unloading the aircraft and in clearing the terminal to provide for uninterrupted operations is a prime factor. This requirement not

only demands that air terminal operations be well planned, coordinated, and supervised, but also usurps the practice of maximum use of motor vehicles engaged in terminal clearance. Capacity loads may be disregarded in the effort to expeditiously unload cargo from the aircraft and to clear the terminal area, with the result that more vehicles than normal will be required to accomplish the clearance mission. This fact must be recognized and considered by planners and operators.

6-7. Truck Terminal / Trailer Transfer Point Operations

Truck terminal / trailer transfer point operations are methods employed to accomplish a motor transport task and involve establishing and operating truck terminals and / or trailer transfer points in conjunction with line haul or relay operations. This includes provisions for assembly and dispatch of motor transport equipment, maintenance and servicing of equipment to include electrical facilities for refrigerated containers, and such other facilities as may be required. (For a detailed discussion of truck terminal and trailer transfer point operations, see paras 8-8 and 8-9.)

6-8. Installation Support Operations

a. Administrative Operations. Transportation truck and car companies may be given the mission of providing transportation for headquarters and installations that do not have sufficient transportation to meet their requirements. Tasks not included in line or local hauls may be classed as administrative or utility operations. These include messenger service, ration deliveries, casual movement of personnel, support to local construction activities, and other demands for motor transportation. Normally, administrative motor pools under control of the appropriate area or command transportation officer are established for such operations and vehicles are dispatched on a mission basis. However, if transport requirements exceed the motor pool capabilities, or if no administrative motor pool is established, vehicles of the motor transport service may be called upon to meet support requirements.

b. Intradepot Operations.

(1) In a theater of operations, especially in the communications zone (COMMZ), there is a great demand for motor transportation in administration and operation of depots. Requirements are constantly changing for local movement of cargo and for rewarehousing of supplies not needed for immediate use. In addition, major construction efforts at these installations often require truck support for units engaged in construction.

(2) The depot commander is responsible for properly employing vehicles in operations within the depot. Use of roving patrols of the motor transport service to check truck operations at various depots is a primary means of assuring effective control and utilization of vehicles. Transportation movements personnel may assist depot personnel in planning vehicle utilization. In operations requiring considerable transportation, a representative of the parent transportation unit may be detailed to control and supervise the use of vehicles.

(3) Intradepot operations normally involve the frequent movement of small cargo loads to or between a number of internal destinations. Because of this, and since the operating areas and load and unload points within a depot may be limited and congested, light trucks (2½-ton, 5-ton) are generally considered to be more suitable for use in this type operation. However, each intradepot mission should be examined individually and the selection of the type vehicle to be employed in the operation should be based upon the operational characteristics of that particular mission. In many cases the use of semitrailer equipment in intradepot operations is not only feasible but also more practical and economical than the use of the smaller straight trucks.

c. Interdepot (Depot-to-Depot) or Depot-to-Unit Operations. These operations involve the movement of supplies and equipment between field depots (or other similar support activities) in the COMMZ and from COMMZ rear area depots to depots in the COMMZ forward area and / or to general support and direct support activities in the field army, corps support brigade, and / or division areas. These operations may, depending upon the requirement for movement and the location of the facilities involved, be either short or long hauls. In this connection, a substantial economy of transport and time is realized by the throughput movement of supplies directly from COMMZ rear depots to support brigade general and direct support activities and, where feasible, to division support commands. Such throughput movement is normally accomplished through the establishment of an interzonal motor transport relay operation. When the transport requirement is regular, and sufficient tonnage is involved, a motor transport unit may be placed in direct support of a depot-to-depot transport mission. Otherwise transport requirements are normally met on a daily vehicle commitment basis.

6-9. Transfer Operations

a. Transfer operations are conducted by means of transfer points which are established where

conditions require transfer of cargo from one transportation mode or conveyance to another. Motor transport units, because of their mobility and flexibility, are most often employed to transport cargo from the transfer point to destination which, in line with the concept of throughput of supplies, should be as far forward as practicable. These units may have the additional responsibility of setting up and operating the transfer points. They may be assisted by assigned or attached transportation terminal transfer companies or detachments when trained personnel are required for unloading cargo from incoming carriers, operating temporary holding areas, and loading cargo for forward movement. The transfer point commander and the senior officer or noncommissioned officer of the terminal transfer unit select and plan the use of areas and facilities to expedite the continuous forward movement of cargo. The terminal transfer unit commander acts in the capacity of a special staff officer to the transfer point commander. Operations and required facilities for motor transport service at a transfer point are similar to those of a truck terminal (paras 6-7 and 8-8).

b. Transfer points may be established at railheads, truckheads, pipeheads, airheads, or small inland waterway terminals.

6-10. Driveaway Operations

a. Driveaway operations entail over-the-road movement of vehicles, other than the assigned task vehicles of the motor transport service, by operating personnel of the motor transport service. These operations include such over-the-road movements as: driving pipeline and maintenance float stock vehicles coming into a theater from points of entry to either general or direct support activities or directly to receiving units, driving such vehicles from one location to another during relocation of general and direct support activities within the theater, or driving such vehicles to point of exit from the theater for redeployment.

b. Driveaway operations may range in scope from a one-time movement requiring driver support of truck company strength or less to an extended operation requiring support by one or more motor transport battalions; they may involve either local or line hauls. The method of carrying out a driveaway movement depends upon the distances involved and the duration and scope of the operation, and normally involves the standard practices of convoy organization and operations.

c. When required, additional driver personnel may be provided from resources (subordinate units) available within the motor transport service or the motor transport organization responsible for the operation, or they may be obtained through the use of teams established in TOE 55-540. For driveaway operations, such teams are activated without authorized task vehicle equipment; teams used will be according to the type drivers (light, medium, heavy truck) required.

d. To reduce driver requirements, semitrailers moved in a driveaway operation may be double-stacked and smaller vehicles may be loaded onto larger vehicles (¼-ton on 2½-ton trucks). Towbars will be used or semi-trailers will be operated in tandem *only when authorized* by the headquarters directing the move. For a discussion on methods of double-stacking semi-trailers, see appendix C.

6-11. Military Bus Operations

Military bus operations are comparable to commercial intercity and intracity bus operations. This service is instituted as required and authorized. Responsibility for military bus operations may be assigned to a transportation battalion or an installation transportation officer and will function under the supervision of the staff transportation officer of the area or command. TOE 55-540 provides personnel and equipment (conventional military buses) for bus operation. This service, however, may be provided by using properly trained drivers operating trucks that have been converted into buses, modified trucks, or truck tractors with properly modified semitrailers. Modification generally consists of adding passenger ladders, installing seats, raising truck tarpaulin bows, and adding bows for semitrailer tarpaulins. The advantages of local bus operations are self-evident. Very often it is more practical to use buses instead of trains, particularly when small groups of replacements are to be transported, or where the rail system itself is inadequate or subject to sabotage or enemy air attack. Ordinarily, a regularly scheduled line haul bus service is set up in a theater of operations when the situation is relatively stable. The decision to establish a line haul bus service may be the result of any one of several conditions—such as, the need to reduce the number of vehicles using a road net, or to make existing recreational facilities more readily available to the troops or to provide a rapid and direct means of transportation between major units and installations not engaged in high priority operations. When planning to establish a bus operation, the following factors must be considered: driver selection and training, scheduling and routing, passengers and cargo, and operating procedures.

a. Prospective bus drivers should be carefully

screened to determine their aptitude for bus driving. This screening should include an analysis of attitude toward bus driving, soldierly appearance, ability to learn, and overall driving experience including knowledge of traffic laws and regulations, types of vehicles previously operated, and driving and safety record.

b. Before personnel are licensed as bus drivers, they must be thoroughly trained in all phases of bus operation. This training includes—

(1) Purpose and organization of the particular bus operation in which they will be engaged.

(2) Documentation including the collecting and recording of tickets, handling of baggage and mail, and the preparing and forwarding of necessary reports.

(3) Mechanical operation of vehicle and its components, driving techniques and skills, courtesy, and knowledge and use of vehicle safety devices.

(4) Driving practice—to increase the driver's confidence and his knowledge of the capabilities of the vehicle.

(5) Practice runs with a licensed operator over the actual route, including regular stops with emphasis on adherence to schedules and preparation and maintenance of accurate records and documentation.

c. Final schedules and routes should be determined only after a thorough reconnaissance of all possible routes, and after several tests runs over the selected route have been made. When planning a schedule, allowances must be made for varied weather and road conditions and anticipated traffic. It must be kept in mind that the bus service exists for the convenience of the user; this will directly affect the selection of stops and accessibility of rest and meal halts. The route selected must provide the desired service; therefore, it will not necessarily be the shortest and fastest route. Weather or road conditions may necessitate the selection of alternate routes.

d. Information regarding either the establishment of a bus service, or changes to an existing bus service must be released to all units concerned well in advance of actual operations. This information will include routes, schedules, terminal locations, passenger and cargo procedures, priorities, and required travel authorization.

e. Personnel traveling on military buses will be limited to those authorized by current directives and priorities as established by the command responsible for the operation. Authority to use the bus service should be substantiated by appropriate tickets, travel orders, or identification.

f. Buses employed in a military bus service are not necessarily limited to the transport of passengers only, they may also be employed to provide a limited transport capability for small, high-priority cargo items of less-than-truckload (LTL) lots. When a combined passenger-express cargo bus service is established, the buses employed in that service are modified for cargo transport by removing several rear seats to provide a cargo area. A partition or screen is constructed between the cargo compartment and passenger area to not only provide for cargo security but also to protect passengers from loose or shifting cargo items. When such an express cargo service is provided, it is the responsibility of the consignor to deliver packages to a designated pickup point, and for the consignee to pick up those packages at a designated delivery point. These pickup and delivery points normally coincide with passenger load and unload points established along the bus route.

g. Passengers are responsible for their own military customs clearance, if such clearance is required, and for the security of their own accompanied baggage. Other baggage, mail, express packages, and general cargo must be documented in accordance with current directives. Cargo security and customs clearance are the responsibility of the operating unit, but documentation must be provided by the shipper. Explosives or flammable materials are not suitable cargo to be transported by bus.

h. Tickets, orders, or shipping documents must be retained by the driver and turned in to be used as a basis for analysis of operations and for planning future commitments. In the event formal travel authorization is not required, the driver must keep a summary of passenger travel.

6-12. Combat Support Operations

Motor transport units may be employed in direct support of tactical operations. Armies, corps, or divisions may use organic or attached motor transport as a pooled service to be allocated where and when needed to meet the current situation. Motor transport missions in combat support include, but are not limited to, transporting supplies and equipment to combat units, moving troops to attack or counterattack positions, and providing essential mobility for headquarters, for nonmobile equipment, and for supplies. Combat support motor transport units should be equipped with task vehicles having mobility comparable to tactical vehicles of the supported unit.

6-13. Combat Service Support Operations

Most of the missions assigned to transportation

motor transport units under current concepts are in combat service support operations that is, in the provision of logistic support—in the form of transportation—to the operating forces. One form of this support, the transportation interzonal service, is organized to serve the theater as a whole, providing necessary flexibility, diversion, concentration, and allocation of transportation to rapidly reflect changes in the strategic and tactical situation. This organization contributes to economical operation through centralized control. The transportation interzonal service retains operational control of its operating motor transport units to their most forward point of delivery. Other forms of combat service support, which the motor transport service and its units may provide on a mission basis, encompass any and all of the classes of operations and the service support tasks delineated in paragraph 6-3.

6-14. Container Operations

a. A container operation is not a motor transport operation such as a long or short haul; rather it is the movement by motor transport of containers, as vehicle cargo loads, in any of the types of transport operations which may be assigned as a motor transport mission. For a detailed discussion of transportation container operations see FM 55-70 (to be published).

b. Containers are specially designed cargo carriers (the large style container being essentially the same as the cargo body of a semitrailer that has been detached from its chassis and wheels) which permit the packaging of small and / or loose cargo items into a single unit to facilitate handling. Their introduction into the logistic system adds a new dimension to the movements requirements imposed on motor transport units—the capability to routinely transport containers of the size and weight of those currently employed in, or contemplated for use in, the military logistic system.

c. The use of containers offers a secure and safe means whereby cargo may be loaded (stuffed) into a container at a supply source (for example, continental United States (CONUS) depot, communications zone storage point, field army supply point) and then moved in that container through the transportation system to the consignee. Since the container, when readied for movement, is sealed at source and there is no requirement for opening it or rehandling the cargo shipment until its delivery at destination, cargo security is enhanced and cargo can be expected to be received intact and in serviceable condition.

d. Military-type containers vary in size and carrying capacity; however, the current types with which the motor transport operator is more likely to be concerned include—

(1) *Cargo transporter (container express (CONEX)).* This container comes in two sizes:

(a) The type I CONEX is 4 feet 3 inches (1.3 meters) long, 6 feet 3 inches (1.9 meters) wide, and 6 feet 10½ inches (2.1 meters) high. It is designed for high density cargo loads and has a 9,000-pound cargo capacity, with a maximum gross weight of 10,050 pounds.

(b) The type II CONEX is 8 feet 6 inches (2.6 meters) long, 6 feet 3 inches (1.9 meters) wide, and 6 feet 10½ inches (2.1 meters) high. It is designed for lower density cargo loads and has a 9,000-pound cargo capacity, with a maximum gross weight of 10,500 pounds.

(2) *MILVAN (military-owned demountable container).* This container is a military-owned or leased container conforming to United States and international standards, operated in a centrally controlled fleet for movement of military cargo. It is 20 feet (6.1 meters long, 8 feet (2.45 meters) wide, and 8 feet (2.45 meters) high. There are two types of MILVAN's in the current inventory. One is a dry cargo version with a tare weight of 4,700 pounds. The second version has a mechanical bracing system designed primarily for the transport of munitions and has a tare weight of 5,785 pounds. Normal cargo capacity of these vans is 35,000 pounds and 34,000 pounds, respectively. However, other limits are imposed when different combinations of single axle, tandem axle, and fifth wheel heights are considered. Refer to transportability manuals for detailed information.

e. Commercial containers may be integrated into, or be encountered in, the logistic system. These containers are generally 8 feet (2.45 meters) wide and 8-8½ feet (2.45-2.6 meters) high and come in a number of lengths—6-2 / 3 feet (2 meters), 10 feet (3 meters), 20 feet (6.1 meters), 24 feet (7.3 meters), 27 feet (8.2 meters), 35 feet (10.6 meters), and 40 feet (12.2 meters). Gross weights of these containers range from 15,000 pounds for the smallest container up to 67,000 pounds for the largest units. In addition to the conventional van, or box-type container, there are also open-top, tank, side-loading, refrigerator, and other specialized types.

f. Depending on their size (primarily length) and gross (loaded) weight, (tare weights of containers vary since constructions may be of steel, aluminum, or fiberglass reinforced plywood) containers may be transported either on conventional straight trucks, on special commercial-type chassis (which are basically semitrailer frames made to accept containers), or on conventional military semitrailers of

a type capable of accommodating the size and gross weight of the container. In the latter instance, securing the container to the semitrailer may present a problem since conventional military semitrailers are not currently equipped with locking or holding devices for securing the container in place on the semitrailer bed. Wrap-around chain or cable devices, or banding devices, may be required to meet this need.

g. The movement of containers in either short or long hauls offers no radical departure from the movement of other cargo items being transported in similar operations except for the need to consider the availability of cranes or other devices capable of lifting the containers at origin and destination.

(1) Containers transported by straight trucks are handled as any other cargo, with pickup, movement, and delivery being made in consonance with the type haul to which motor transport is committed.

(2) Containers transported by semitrailer or special container chassis are handled in the same manner as cargo being moved by conventional military semitrailers engaged in either short hauls or in a long haul involving trailer transfer operations.

h. Utilization and control of containers moving through the motor transport system is of prime importance. The pickup, delivery, and return of containers must be accomplished without delay to permit all containers in the system to be used to the maximum extent possible. This will require that a prompt and accurate reporting system be initiated and rigidly enforced so that the location of all containers in the system is known at all times. Supervisory personnel must insure that using agencies provide expeditious loading and unloading of container cargo to insure against unnecessary delay while in their hands, and that all personnel concerned adhere to theater and local policies governing the handling and use of containers in the logistic system (FM 55-10). This control and utilization policy is equally applicable to container chassis employed in a container operation.

i. Local ground rules and contractual service agreements will govern time limitations imposed on loading and unloading activities for commercial containers before demurrage cost starts. Using agencies will make every effort to abide by these limitations and control cargo load and unload procedures to meet such restrictions; motor transport operating personnel will, in the course of observing and checking motor transport operational areas, also note whether container cargo load and unload procedures are conducted in accordance with established procedures. Violations noted will be brought to the attention of both the using agency and the proper motor transport command and supervisory unit.

(1) Cargo load and unload times will apply to all military type containers and chassis to assure expeditious turnaround and efficient utilization of equipment.

(2) Where facilities and equipment permit, containers may be offloaded from chassis onto the ground for cargo load or unload to permit continuous use of container chassis in other operations.

(3) Some containers may be transported on conventional military cargo semitrailers rather than on container chassis; operating policies discussed herein are applicable to containers transported on such semitrailers as well as to those transported on container chassis.

(4) In the event that specific containers are designated by proper authority for storage purposes or for other facilities use by the consignee, they will, upon receipt at destination, be immediately removed from the transporting chassis / semitrailer and that chassis / semitrailer will be returned to transportation use.

j. In operations where it may be expected that containers will be lifted from or placed onto either chassis or other transporting vehicles, planners and operators will insure that proper and sufficient handling equipment is available to accomplish such actions.

k. A container inspection program must be established. Container inspections made at the time of pickup and delivery, and at the time of any intermediate exchanges, will aid in determining liability for container damage or cargo damage and / or loss which may be sustained while the containers are in the hands of, and are the responsibility of, the motor transport service (FM 55-31). Inspection forms should be required and may be prepared and reproduced locally. They should be as detailed as the situation warrants, and should conform to a format prescribed by the motor transport service.

6-15. Return Loads (Retrograde Loads)

a. A return load is the movement of cargo and / or equipment from front to rear, or against the normal flow of supplies. (In the parlance of motor transport, return loads are synonomous with retrograde loads.) Return loads, when considered in the broad sense of a retrograde move, include not only movements within a theater of operations but also those from a theater of operations to CONUS.

b. The movement of return loads is not a type of motor transport operation; rather it is a means by which the efficiency of an operation, and the motor

transport service, may be increased. It is the use of vehicles, which might otherwise be returning to an operational base without a load after completing a logistic mission, to carry as a return load (retrograde load) cargo such as items for repair and/or salvage, captured enemy equipment, empty CONEXes and/or other accountable containers, or any other cargo destined for movement out of the forward areas. Return loads offer a fuller use of the motor transport capability through the increase of tonnage hauled and ton-miles accomplished in operations by providing such return loads for vehicles employed in forward moving logistic support operations. Further, they also have a definite impact on reducing the total number of vehicles required to support a military mission.

c. Although the classic return load operation visualizes vehicles picking up return loads at the destination of forward moving cargo and then moving under load back to an unloading area in the vicinity of their home station, all return load operations are not conducted in this manner. It may be that after unloading, vehicles will be required to report to a different loading site either in the vicinity of, or possible well removed from their unloading point to pick up return loads or even pick up return loads somewhere along their return route. These return loads may be destined for movement over the entire return trip, or only for delivery to other intermediate points along the return route. In any event, a return load mission, whether it be for the full return trip or for only a segment thereof, offers increased operational efficiency and should be a consideration in the planning and conduct of all operations. However, it must be assured that the circumstances surrounding a return load operation will not conflict with the accomplishment of the primary mission of the vehicles involved. If undue delays may be experienced due to either the requirement for vehicles to travel to a different location to pick up a return load, or to a delay in loading procedures, the advantages and disadvantages of the return load operation over the return of vehicles unloaded must be considered and, based on the findings and on-the-ground judgment, a decision made. For example—if in a given operation, the scheduling of vehicles and movement of tonnages were so closely regulated that any undue delays in vehicle turnaround would seriously affect that operation, it could be more practical to disregard return loads and maintain operating schedules to assure the forward movement of tonnages rather than to disrupt movement schedules by delaying vehicles in order to pick up return loads.

d. All requirements for movement of retrograde cargo should be coordinated through the servicing installation transportation officer/motor transportation officer channels to assure maximum utilization of line haul assets.

e. In line with return loads and retrograde movements, commanders concerned with movement of cargo from a *theater of operations to CONUS* must be familiar with and insure that US Department of Agriculture quarantine inspections are complied with in accordance with Joint Regulation AR 40-20, Navy General Order No. 20, Air Force Regulation 161-4, and TM's of the 750-series (116 through 204).

CHAPTER 7

MOTOR TRANSPORT OPERATIONAL ENVIRONMENT

Section I. GENERAL

7-1. Characteristics

The operational environment of mobile ground warfare is a combination of existing highway facilities, terrain, climate or weather, and enemy actions. Adverse operational environments are those in which one or more of the elements of this combination constitute a major problem in tactical maneuver or logistic support. The problem may be caused by lack of roads and bridges capable of carrying normal military loads in sustained operations, by terrain that limits vehicular movement or weather that inhibits movement, or by direct or indirect influence or enemy action. The timely and accurate evaluation of the operational environment in relation to available transport vehicles is a major factor in the success of any military operation. Operational environment must be considered not only in the planning of tactical movement and logistic support and in the selection of vehicle equipment to be used but also in the planning and conduct of individual and unit training.

7-2. Common Planning Factors

Since the possible combinations of operational environment are extremely varied, and may be either general or local in nature, detailed descriptions of specific environments and solutions for the problems they impose upon motor transport activities are beyond the scope of this text. However, general discussions in paragraphs 7-3 through 7-14 are offered as aids to personnel at all echelons in analyzing and meeting these problems.

Section II. HIGHWAY ROAD NET

7-3. General

In the determination of requirements for motor transport to support military operations in any given area, the amount, type, and condition of existing highway facilities in that area must be considered. An improved highway system with adequate surfaces and bridges will facilitate the movement of troops, equipment, and supplies as long as the system remains intact. Preliminary planning may be performed using civilian road maps of the area which offer general alinement, comparative surfacing, and some information on bridges and tunnels. This, however, must be supplemented by detailed information from other sources if operations are to be sustained. Topographic maps, air photographs, ground reconnaissance. reports of travelers or inhabitants, and construction plans of highways and bridges serve as sources for further information.

7-4. Highway Characteristics

Although the term "highway" is normally associated with an improved, hard-surfaced road, military plans must consider roads of any class as highways—or possible highways. Highway characteristics include all elements of design and construction which influence vehicular travel. These include—

a. Width of Road. This characteristic determines the size of vehicles and number of lanes of traffic that may be accommodated.

b. Type of Road. Based upon such data as road surface materiel, type of construction, alinement, grades, and other features, roads and / or routes are classified according to their ability to withstand weather effects. The type classifications which are determined by the worst section of the road or route are: type X—all-weather; type Y—all-weather (limited traffic due to weather); and type Z—fair-weather.

c. Military Load Classification. This is a load capacity rating system which considers the effect of a vehicle's weight and type upon roads and bridges. Road classification is normally based on the lowest bridge military load classification number for the particular road or route under consideration. For a detailed discussion of military load classification, see FM 5-36.

d. Obstructions. Obstructions are natural or

artificial features, either permanent or temporary, which result in a slowdown or stoppage of movement over a given section of a road. They include reductions in overhead clearance or road width caused by tunnels, bridges, or overhead wires; overhanging or encroaching buildings; watercourses where the means of crossing—bridges, fords, or ferries—have less capacity than the road; steep grades and sharp curves that materially reduce the speed of traffic; and blockages resulting from snow or flooding. The last are special conditions and are considered when resultant blockage is regular, recurrent, and serious.

7-5. Highway Evaluation

Highway evaulation at any level in an active theater is more than a review of the road network, surface treatments, and bridge capacities. The current existence of adequate highway facilities is no guarantee of a sustained favorable operational environment. Weather and both friendly and enemy activity, in combination with terrain and highway characteristics, may cause sudden changes. Highway evaluation must therefore include a consideration of all factors—climate, terrain, combat conditions, and highway characteristics—in making an overall evaluation of roads and / or road nets over which motor transport operations are to be conducted.

Section III. CLIMATE AND TERRAIN

7-6. General

The influence of climate and terrain on motor movement increases in direct proportion to the requirements for off-road or cross-country operations. Although some effects of climate on motor operations may be considered separately, consideration of this factor normally will be a part of terrain evaluation. Terrain evaluation is the study of landforms, soils, climate, and vegetation in relation to the employment of military units and equipment in a given situation. The ability to move vehicles and equipment without interruption and with minimum exposure to observation and direct fire depends largely upon the skillful use of terrain. Skillful use of the terrain, in turn, depends on prompt and realistic terrain evaluation by personnel at all levels from the driver to the commander.

7-7. Climate and Weather

Climate is the condition produced by the factors of temperature, humidity, precipitation, wind, and light in a given area over an extended period. Weather is the local, day-to-day condition of the atmosphere. Long range plans for a theater of operations are concerned with climate; local daily operations are concerned with weather.

a. Extremes of climate influence motor operations by effects on personnel and equipment.

(1) Cold climates reduce the efficiency of personnel with the requirement for bulky clothing that limits movement in the performance of maintenance and operational duties.

(2) Hot, humid climates affect personnel in the reduction of energy and efficiency through physical discomfort and in the increase of bacterial disease and problems of sanitation.

b. Extremes of temperature affect both the maintenance and the operation of motor vehicles.

(1) Low temperatures require protection of cooling systems to prevent freezing, fuel additives to prevent the formation of ice in fuel lines, and modification or protection to facilitate vehicle starting. Tire life may be reduced by continued exposure to low temperatures. Metals may become brittle and break under comparatively light shock. Battery efficiency is greatly lowered, and care must be taken to prevent their freezing and cracking.

(2) Where severe freezing occurs, extensive road maintenance may be required after each thaw, particularly in early spring.

(3) Extremely high temperatures complicate problems of engine cooling, and breakdowns from overheating are common. Heat combined with high humidity reduces the life expectancy of all equipment and adds to the problems of maintenance, repair, and replacement. Rust and corrosion of metals is accelerated. Mildew and rot rapidly attack unprotected cloth and leather products.

7-8. Terrain

Terrain is the combination of landforms, vegetation, soils, and drainage. The results of this combination are broadly classified as mountains, badlands, hills, and plains.

a. Mountains present major all-weather obstacles to military motor operations—steep grades, sharp curves, defiles, and distinct compartments.

b. Badlands are characterized by a topography of pinnacles, steep buttes, and sharply eroded ravines or canyons. Although elevations of badlands are less than those of mountains, offroad

operation of motor vehicles is extremely difficult if not impossible.

c. Hills may be considered as normal terrain in many sections of the world, particularly in the developed areas. Lower elevations, less steep grades, better alinement of roads and highways, and more moderate drainage reduce the difficulties of motor movement in hilly areas, both onroad and offroad. The variety of elevation and presence of normally trafficable soils offers a choice of offroad routes to give more flexibility in planning.

d. Plains, covering the greater part of the land surface of the world, offer few obstacles to military motor movement under average conditions.

7-9. Terrain Evaluation

Terrain evaluation relates all factors of the operational environment to the capabilities and limitations of the task equipment. In all military motor transport operations, terrain evaluation should be habitual. In active theaters, evaluations should be made for both on- and off-road operation. The source of information, the techniques, and the results of terrain evaluation vary with the echelon of interest.

a. For long range planning at higher staff levels, sources of information include meteorological records, climatology texts, topographic maps, soil maps, geologic maps, air photos, reports of travelers, interviews with former residents, and interrogation of prisoners. Techniques are based on comparative studies of a large area. The results of high-level terrain studies are broad in scope, general in nature, and are intended to give guidance for the duration of a major operation.

b. On the other hand, terrain evaluation at unit level is made to select the most suitale route or technique of operation to solve a specific local problem—to accomplish the mission most effectively under the circumstances. It is based upon information gained from observation and ground reconnaissance, aided and extended by maps, photos, and local intelligence. This information is weighed against known capabilities and limitations of the vehicle and the training or personal experience of the driver. Weather, rather than climate, is considered the most important variable. Even in a well developed area with a good road net, a driver may be required to make an offroad detour to bypass a roadblock or section of damaged highway. The habit of constant terrain evaluation enables him to make a quick decision and prompt selection of the most practical route.

7-10. Combined Effects

Adverse conditions for motor vehicle operation and military motor movement are usually caused by combinations of terrain, climate, and weather. The effects of climate on terrain include the amount and character of vegetation, the amount and frequency of precipitation, the average moisture content of soils, and the size and type of water obstacles. Weather conditions may reduce highway speeds, increase congestion, and be a major cause of accidents. Fog, rain, snow, ice, and high winds restrict movement on highways as well as cross country. In planning offroad movement and movement on unimproved roads and trails, the type and character of soils must be considered in conjunction with climate and weather. Vegetation may serve as an indicator of soil type and trafficability. It may also constitute an obstacle to movement even though it provides cover and concealment. Soils are complex combinations of disintegrated rock in the form of sand or clay and disintegrated organic material (humus). Their capacity to carry traffic depends upon structure and the effect of moisture. Generalizations as to conditions and resultant trafficability must be tempered by experience in making evaluations. The following briefly outlines major soil characteristics and the effects of climate and weather. Snow characteristics are included since the effects of snow on motor movement are considered in the same manner as soil effects.

a. Mud. Normal topsoils are a mixture of decomposed vegetation, clay, silt, or sand. Clay and silt are the basic ingredients of mud; all soils containing these substances in appreciable amounts will become soft and pliable when wet. Then the kneading action created by the movement of tracks or wheels will churn this soft, wet soil into mud. Silty soil, when dry, tends to become loose and dusty. Clayey soil, however, tends to dry hard and firm, becoming in extended hot, dry seasons almost as hard as a prepared paving surface. A sudden shower, while not generally affecting loose, dusty, silty soil, may cause the surface of dry clay to become "greasy" and affect its trafficability and traction.

b. Sand. Sand is loose granular material resulting from the disintegration of rocks. Fine sands give excellent support and traction when firmly compacted and dampened. Coarse sands dry rapidly, do not compact readily, and may usually be classed as an obstacle to motor movement.

c. Snow. Although snow may be treated in the same manner as soil in terrain evaluation, the effects of snow are more difficult to predict since no other traffic surface is as variable in structure or as sensitive to temperature change. Snow *conditions* are more important in determining trafficability than snow *depth* because comparatively minor

changes in temperature or sunlight may have major influence on vehicle movement. The trafficability of snow is judged by its strength, traction, and resistance. Strength and resistance are determined primarily by structure. A light new-fallen snow up to 20 inches in depth offers no serious obstacle to the average military vehicle, while an 8-inch fall of grainy, sand-like "sugar snow" will make wheeled vehicle operation very difficult, if not impossible. The traction afforded by snow depends to a great extent upon temperature. Under conditions of extreme cold, snow offers about the same traction as dry soil. Near or slightly above freezing temperatures, however, drastically reduce traction on hard packed snow surfaces.

Section IV. COMBAT CONDITIONS

7-11. General

The influence of combat conditions must be considered in planning and executing motor transport operations in an active theater of operations. The degree of mobility demanded by concepts of modern conventional and unconventional warfare has increased the importance of this factor in the communications zone as well as in the combat zone. The activities of a determined enemy may seriously restrict or prohibit the use of some highways. Adequate security measures, timely and accurate intelligence, and countermeasures by friendly combat forces will reduce the effects of these enemy activities. However, motor transport planning and operating personnel must consider, and exploit when necessary, the offroad capabilities of motor transport units. Further, the designation and use of alternate roads or routes to bypass critical areas along a well travelled way must be considered.

7-12. Direct Combat Interference

a. Direct interference by combat troops becomes more possible as the battlefield becomes more fluid. The dispersion required as passive defense against the threat of nuclear weapons has developed a pattern of coordinated operations of mobile, self-contained forces to replace the continuous line of mutually supporting combat units. This dispersion is also reflected in the size and location of service and support installations in rear areas. The fluid battlefield and the dispersion of supply installations increase both the requirement for motor transport support and the threat of infiltration, airborne attack, and deep penetration. Main supply routes, as well as installations, may be included as objectives for enemy combat units operating in rear areas.

b. Long range weapons, to include missiles and airborne weapons, also pose a threat to motor transport operations. These long range weapons may be used for destruction, neutralization, harassment, or interdiction.

(1) As affecting motor transport, fires of destruction would be normally limited to easily identified fixed targets such as bridges, tunnels, and buildings used as headquarters or terminal facilities.

(2) Neutralization fires may be used to reduce or deny movement in a particular area and may be employed effectively against offroad motor transport operations in rough terrain to deny the use of covered or concealed routes. High explosives, smokes, and illuminants may be used in this role as appropriate.

(3) Harassing fires would normally be used against motor transport only in highway operations. Intermittent fires on lines of communication at defiles, crossroads, or other critical points will effectively reduce the efficiency of highway motor transport with a minimum expenditure of ammunition.

(4) Interdiction fires, of less intensity than either destruction or neutralization fires, are used to deny the use of established routes intermittently or for specific periods.

c. The effects of long range artillery on motor transport are to impede movement of vehicles over supply routes, to disrupt operating schedules, to deny the use of roads, and to increase the requirement for offroad operation. The use of rockets or guided missiles is similar to that of long range artillery but, due to lower availability and increased complexity of firing techniques, rockets and missiles would probably be employed less against motor transport operations.

d. Where friendly air cover is either absent or inadequate, aerial bombardment or strafing may offer a serious threat to both highway and offroad motor transport operations. Attach aircraft are well suited for employment against targets of opportunity—and loaded supply vehicles offer lucrative targets with little means of defense.

7-13. Indirect Combat Interference

The indirect effects of combat are evidenced by

roads pock-marked by shell craters and worn by heavy military traffic; by temporary bridges and hastily constructed detours and bypasses; and by offroad routes established to bypass debris, blowdown, and uncleared mines. Requirements for emergency construction and repair may place a burden on engineer units beyond their immediate capabilities. Motor transport operations will consequently be slowed, and heavy demands will be made on vehicles and personnel to keep supplies and materiel moving.

7-14. Unconventional Warfare Activities

a. The conduct of counterinsurgency operations in underdeveloped areas poses additional problems in planning and conducting motor transport operations. Motor transport movements over long and / or unsecured lines of communication offer lucrative targets for hostile attack. Tactics employed may include destruction, interdiction, harassment, and every conceivable combination of these. Strikes will be made wherever and whenever the opportunity is presented with the dual objective of interrupting the flow of supplies to combat units and of immobilizing large numbers of combat troops.

b. Unconventional warfare tactics are ideally suited to operations in jungles, in heavily wooded areas, or in mountainous terrain where transport movement is limited to particular routes, offroad operations are greatly restricted, and cover and concealment are offered the attacking force. The variety of techniques employed will be limited only by training, equipment, and ingenuity of the attacking forces. Barriers, reinforced by mines and boobytraps, may be used along with troops in ambushes or may be used alone without protection as sources of annoyance and delay. Normally, hostiles avoid well known or stereotyped tactics to gain surprise and maximum effect from their limited resources of manpower and materiel.

c. Clandestine (hidden) activities conducted in counterinsurgency operations, when coordinated with overt (open) hostile operations, can seriously complicate transport problems. Clandestine actions may be confined to critical points in the line of communication. Sabotage of vehicles and facilities at terminals or servicing areas may vary in degree from acts of harassment to total destruction. Motor transport personnel at all echelons must therefore be constantly alert to the conditions that invite sabotage, must maintain a tight security, and must be as self-sufficient as possible in providing their own security.

CHAPTER 8

TRANSPORTATION INTERZONAL MOTOR TRANSPORT SERVICE

8-1. General

a. Transportation interzonal motor transport operations are line haul movements operated for extended distances over main supply routes. They provide for the throughput movement of supplies as far forward as possible. They originate in the communications zone (COMMZ) and extend through the COMMZ into the corps service area and, when feasible, into division areas. Transportation economy is gained when requirements for movement of equipment and supplies are made routine, regular operations are established, and operational schedules are established to move cargo at a predetermined rate. Line hauls may assume the proportions of a major logistic task in support of a corps or other large unit and be the assigned mission of a motor transport group / brigade.

b. Policies for interzonal line hauls are determined by the transportation command, theater army support command (TASCOM).

c. At times, motor transport *express operations* may be required as part of line hauls. Express operations are expedited movements of high-priority cargo in which established line haul procedures are modified in the interest of a more rapid delivery than regular line haul. Scheduling must be precise and control highly centralized. Express operations may have the specific mission of supporting a field army or other large unit or of moving a specified tonnage or type of supply within a given time. Express operations should be established only when there is a need for expeditious movement of tonnage over considerable distances and when regular line haul operations or other modes of transportation cannot meet the requirement.

8-2. Command

The commander of a motor transport unit is responsible for the line haul operation. Depending upon the size of the operation, a battalion or group headquarters may be used. In a large-scale operation requiring three or more motor transport groups, a motor transport brigade may be assigned this mission.

8-3. Organization

a. The precise organization for a line haul operation depends largely on the distance involved, the tonnage to be moved, and the type of cargo to be transported. These factors affect the number, type, and composition of units assigned. Over long distances, a motor transport brigade may be the highest headquarters and group or battalion headquarters may be assigned responsibility for operating truck terminals and specific segments of the route. Over short distances, the group or battalion headquarters may operate the entire route.

b. Truck companies and other supporting units are attached to command units of the motor transport service according to unit capabilities, the geographical area, time and distance factors of the route, and the transport mission.

8-4. Equipment

Tractor trailer equipment is ordinarily the most efficient equipment for line hauls. Medium truck companies should serve as the nucleus around which the operation is established. Heavy lift equipment organic to the heavy truck company can be used for line haul of heavy and outsize equipment.

8-5. Operational Planning

a. When planning for line haul operations, the following factors must be considered:

(1) Specific tonnages and types of cargo to be transported, locations of supported activities for cargo pickup and delivery, and availability of cargo handling equipment.

(2) Capabilities of equipment and units to perform the required tasks based upon current personnel and vehicular strengths of assigned truck units to include readiness posture of vehicles.

(3) Capacities of the routes to be used.

(4) Feasible maximum operating speeds over various segments of the route.

(5) Specific locations for units, truck terminals, and trailer transfer points.

(6) Definite requirements for any supporting services, such as petroleum, oil, and lubricants (POL) service, military police escort / security units or teams, and maintenance and communications support.

b. The operational planner must develop road movement graphs, convoy schedules, route maps, and support plans for the operation.

c. Programed movement requirements are

allocated to each transport mode through the command movements program, which is distributed to all interested agencies. This allocation is expressed as an average daily short ton movement requirement by service and class of supply. The mode planner must translate these bulk allocations into anticipated equipment requirements and adjust his capabilities to assure that the programed requirements are met. However, the program is not self-implementing. Shippers must initiage a request for movement through the transportation movements field organization in advance of the shipping date as prescribed by command standing operating procedures (SOP). If daily requirements exceed available truck capabilities, adjustments are made by the transportation movements organization according to established priorities. Information on actual or anticipated shipments is relayed to motor transport headquarters and to intermediate and destination truck terminals. This information enables these agencies to properly and efficiently plan, manage, and control an operation.

d. The programed movements procedure may be varied when shipping installations are overburdened or priority is given to specific classes of supplies or to personnel movements.

(1) If a shipper is unable to fulfill commitments, he informs his own special staff section and the local transportation movements office of anticipated difficulties. Tonnages may be allocated to other shippers, or additional loading capability may be given the overburdened shipper. Motor transport headquarters is informed of the acion and informs the origin truck terminal. Since this terminal has integrated dispatch facilities, trucks engaged in shuttle operations can be quickly shifted to new pickup points or adjustments made to meet new loading capabilities. The same system is applied at destination points when consignees encounter difficulties in handling incoming shipments.

(2) In an emergency, in-transit storage may be required at origin or destination terminals, at intermediate terminals, or at trailer transfer points. However, in-transit storage is discouraged as it reduces the capability and flexibility of motor transport equipment. Since the ratio of over-the-road vehicles to line haul semitrailer equipment is carefully proportioned, mobile storage can disrupt the operation. Continuation of storage without a proportionate decrease in tonnage allocation necessitates additional transport equipment if allocated tonnages are to be delivered.

(3) Changes in supply movement programs are relayed to subordinate command units by motor transport headquarters. All units take action to adjust operations to the changing situation.

e. Large personnel movements are expedited. If motor transport units in addition to those assigned to the unit or organization being moved are used, motor transport headquarters is responsible for integrating the move over the roadway. Priorities are established for personnel convoys and are coordinated at truck terminals and highway regulation points.

f. For additional planning procedures, see chapter 9.

8-6. Route Selection and Reconnaissance

a. Routes selected for motor transport line hauls should, where possible, be primary-type, paved highways with good connecting and access roads. If a two-way route is not available, parallel one-way routes with regular points of convergence should be selected. The points of convergence should coincide with the desired locations of truck terminals or trailer transfer points.

b. A complete and detailed analysis of the route must be made from available information or from maps and aerial photographs; whenever practicable, a ground reconnaissance should be conducted. (A valuable source of route information is the transportation section of the Technical Intelligence Company, TOE 30-34.) The analysis should include location of critical points, bottlenecks, and hazards; a full evaluation of the traffic potential; and estimates of average speeds over every segment and of approximate time distances (para 9-3 *b* (5)) between trailer transfer points. When a ground reconnaissance is made, the following information will be obtained: average travel time; desired speeds; ability of vehicles to negotiate difficult grades, defiles, bridges, or terrain; and initial repairs to roadway or structures required before operation.

c. As a result of this analysis, the route can be segmented to provide approximately equal time distances between trailer transfer points or terminals. Routings and regulations to be established for vehicular movements over various segments are determined. The location of depots and support facilities must be considered. The method of operation and the schedule of movement have a definite bearing on all these factors.

8-7. Methods of Operation

The equipment available, the road conditions, and the logistic mission or military situation governing line hauls may vary in each situation. Since line haul operations may be adapted in many ways to suit particular situations, successful operations depend in a large measure on the ingenuity and

initiative of individual commanders and on the ability of planning staffs to foresee needs and to provide the types of equipment required. The semitrailer relay method is normally used in line haul operations.

a. A simple relay operation is established with a truck terminal at origin and destination and, depending upon the distance involved, one or more trailer transfer points at intermediate sites along the route. At the origin terminal, shuttle (terminal) tractors move empty semitrailers from the terminal to surrounding depots and support agencies for loading and return loaded semitrailers to the terminal where they are documented, assembled, and prepared for forward movement. Line, or line haul, tractors of the unit responsible for operating the first segment of the journey pick up these loaded semitrailers and move them forward to the first trailer transfer point. Here the forward-moving loaded semitrailers are exchanged for empty or return loaded semitrailers, which are then returned to the origin terminal for rehandling and subsequent forward movement. Line tractors of the unit assigned the mission of operating the second segment of the trip transport the forward-moving semitrailers from the first trailer transfer point to the next trailer transfer point, where similar exchanges are made. The relay is continued until the forward-moving semitrailers arrive at the destination terminal. Shuttle tractors then move the loaded semitrailers from the terminal to ultimate destinations for unloading and return empty or return-loaded semitrailers to the terminal where they are documented, assembled, and prepared for retrograde movement. Thus there is a continuous flow of loaded semitrailers moving from depots and support agencies to forward areas and of empty or return-loaded semitrailers moving rearward for subsequent rehandling and forward movement. To provide for the best customer service and for the most efficient and economical service, return-load capability should be exploited and every effort made to obtain loads for retrograde movement semitrailers.

b. The relay system should be designed to provide the necessary command, supervision, and support services required by the operation. This may necessitate establishment of facilities for messing, vehicle service and repair, quartering, administrative support, and logistic services.

8-8. Truck Terminals

a. General.

(1) Truck terminals (fig 8-1) are normally located in or near centers of concentrated trucking activities at both extremities of a line haul where they form the connecting link between local pickup and / or delivery service to using agencies and the line haul operations. They constitute assembly points and dispatch centers for motor transport equipment employed in line haul operations. Although truck terminals may be used for in-transit storage or freight sorting, this use should be held to an absolute minimum (see also paras 9-9 and 9-11).

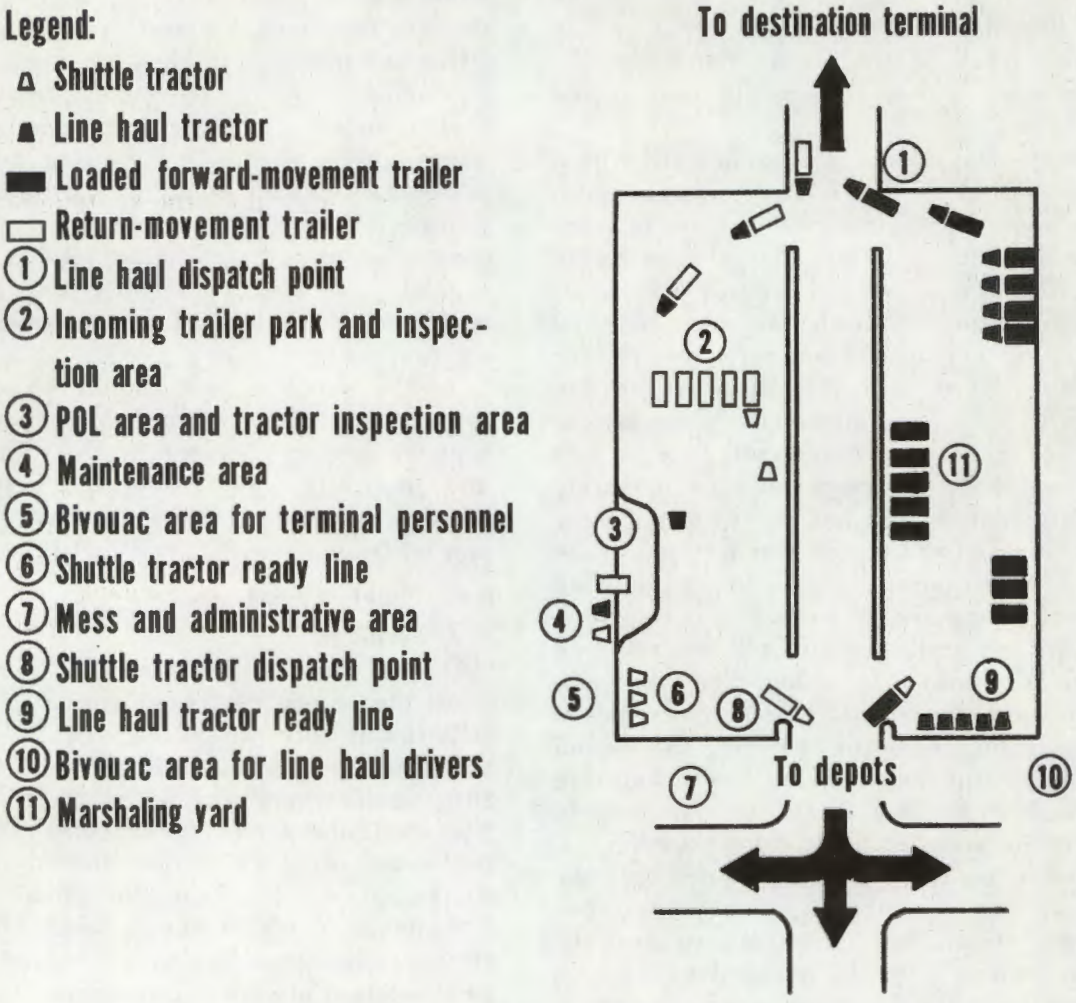


Figure 8-1. Typical truck terminal.

(2) Depending upon the organization of a line haul operation, and the location of support complexes or activities for which motor transport support is being provided, one or more truck terminals may be established at intermediate points along the route of a line haul operation to provide for delivery of cargo to service support installations located in the vicinity of the line haul route. (For instance, assume that a line haul operation were to provide the movement of cargo from a port of entry into a theater to not only a general support supply activity located in the corps rear but also to a COMMZ depot located at a distance from the port along the line haul route. In such a case, in addition to the origin (port area) and destination (corps area) terminals and trailer transfer points in between, an intermediate truck terminal would be established in the vicinity of the COMMZ depot to process vehicles and cargo destined to that depot.) When this occurs, such terminals then function in a dual capacity—as a truck terminal in the management of delivery of cargo to destination in the vicinity of the terminal, and as a trailer transfer point (para 8-9) for the processing of cargo loads moving through the facility to destination further forward on the line haul route.

b. Facilities at Truck Terminals. The truck terminal is a consolidated facility normally commanded and operated by a motor transport battalion. It includes a marshaling area and such other activities and services as are required to support the operation—normally a dispatch office, a consolidated mess for operational personnel, and consolidated maintenance and servicing facilities. Truck unit bivouacs or temporary quarters for drivers may also be located within or near terminal areas. If refrigeration vans and / or containers are employed in the system, electrical facilities and refrigerator unit maintenance services will be required.

c. Operation of Truck Terminals.

(1) For the purpose of assembling semitrailers

for further movement in a line haul operation, truck terminals employ tractor-semitrailer equipment to operate a shuttle service between the terminal and the surrounding depots and support activities which ship and / or receive cargo moved in that operation. These shuttle tractors move semitrailers from the terminal to using agencies for load or unload, and return loaded or unloaded semitrailers to the terminal for further movement through the system. The normal and most efficient shuttle tractor operation involves the continuous movement of semitrailers from a truck terminal to the adjacent supported activity(s) where these semitrailers are spotted and dropped awaiting appropriate activity action. (Any necessary further movement of semitrailers within the supported activity may be accomplished by activity organic transport and / or motor transport provided on a mission support basis.) The shuttle tractors then hook up to waiting semitrailers and return to the truck terminal where these semitrailers are spotted and dropped awaiting further movement by line haul tractors. In this repeated operation, shuttle tractor delay time is held to a minimum thus contibuting to the overall efficiency of the operation. Unusual circumstances may require deviation from this norm in that shuttle tractors moving semitrailers into a supported activity may be required to remain hooked up to that semitrailer (during loading and / or unloading) until its return to the truck terminal. Since increased shuttle tractor delay times dictate the assignment of additional vehicles and operators to meet operational needs, this latter type of operation is the lease efficient and should be avoided wherever possible.

(a) At the origin terminal shuttle tractors move incoming empty semitrailers from the terminal to shipping agencies where they are spotted and dropped for loading (incoming return loaded semitrailers are moved to proper destination for unloading and reloading with forward moving cargo). The shuttle tractors then hook up to waiting loaded semitrailers and return them to the terminal. These loaded semitrailers are then spotted in the terminal marshaling yard awaiting subsequent line haul forward movement.

(b) At the destination terminal the process is generally reversed. Shuttle tractors move incoming loaded semitrailers from the terminal to their final destination where they are spotted and dropped for unloading. The shuttle tractors then hook up to waiting empty or return-loaded semitrailers and return them to the terminal. These empty or return-loaded semitrailers are then spotted in the terminal marshaling yard awaiting subsequent line haul return movement.

(2) By using a shuttle service for local movement of semitrailers, and by preparing and marshaling semitrailers for movement in advance, delay to over-the-road tractors at either end of the line haul is minimized and the efficiency of the operation is increased.

(3) Within the truck terminals (origin, destination) operating personnel maintain records on incoming and outgoing semitrailers and on semitrailers moved to depots and other supported agencies for load and / or unload; operate the dispatch and marshaling activities of the terminal; prepare and / or check all cargo and / or vehicle documentation; inspect incoming and outgoing semitrailers for maintenance and damage, completeness of equipment (side and end boards, tarps, reflectors, etc.), and condition of the cargo load; prepare and submit periodical yard checks and operational reports on exchange activities; and perform all the other duties incidental to operation of a truck terminal.

(4) Every unit operating a truck terminal must keep a careful check on the location and use of its semitrailers which are spotted at various depots and support units awaiting loading or unloading. A close accounting of these vehicles is absolutely necessary; if required, the individual in charge of the terminal will work out suitable semitrailer receipting arrangements with the appropriate using facilities (paras 8-12 and 8-13).

8-9. Trailer Transfer Points

Trailer transfer points are located at predetermined locations along the route of a line haul operation. They form the connecting links between those segments of a route designated as the areas of responsibility for various operating units and tie the overall operation into one continuous, efficient movement procedure (see also paras 9-10 and 9-11).

a. Minimum facilities required for operations are a dispatch point and a marshaling area to facilitate semitrailer exchange. Other facilities, such as a troop mess, a maintenance and service area, and a bivouac area, are established as warranted by the operational situation.

b. Basically, a trailer transfer point offers facilities for exchanging semitrailers between line tractors operating over adjoining segments of a line haul route and for controlling and reporting on equipment engaged in the operation. Line tractors arriving from rear areas drop their loaded semitrailers at a transfer point and pick up empty or return-loaded semitrailers for retrograde movement. Line tractors coming in from forward areas drop their empty or return-loaded semitrailers

and couple onto forward-moving loaded semitrailers for further movement toward ultimate destinations. Shuttle tractors may be employed within the trailer transfer point to spot and prepare semitrailers for subsequent movement. This action reduces layover time of line tractors and expedites the overall operation.

c. Figure 8-2 illustrates a type express operation (line haul) incorporating an origin and destination terminal and one trailer transfer point located at an intermediate point along the route of travel.

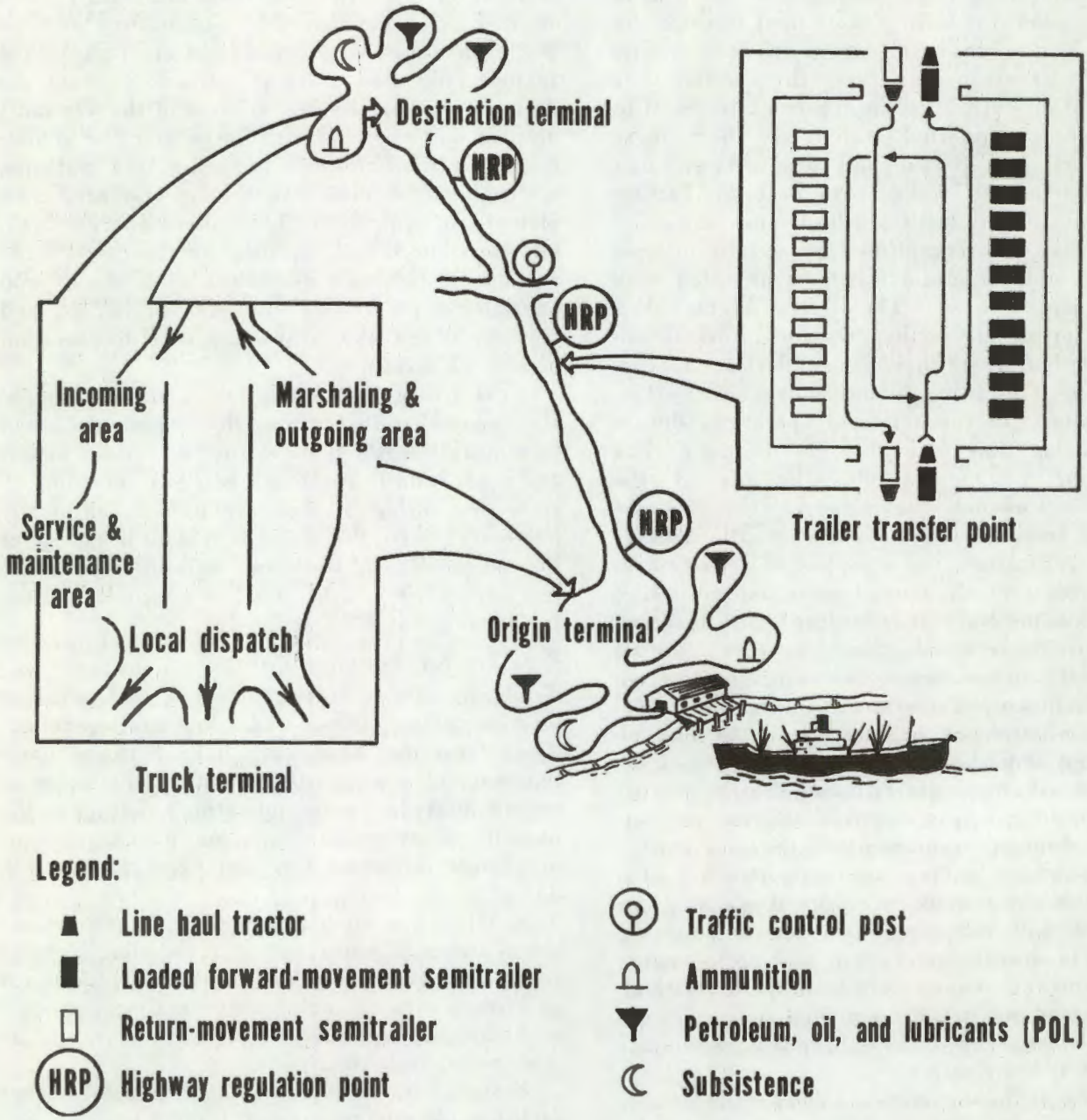


Figure 8-2. Type express operation (line haul).

8-10. Highway Regulation and Other En Route Services

a. Line haul operations require a closely supervised system of highway regulation and traffic control. Routes should be planned so that there will be as little interference as possible from other traffic. They should normally be reserved for express hauls or other priority movements cleared through the command having jurisdiction over the entire route. Routes must be well marked to assist drivers in following them easily. Drivers should be familiarized with the route over which they will

operate. Strip maps—or tactical maps depicting the specific route to be followed— may be furnished each driver.

b. Highway regulations points should be provided at convenient locations along the routes. Reports from highway regulation points enable the motor transport staff to maintain constant control of movements, to effect priorities, to make adjustments in routing, and to coordinate travel over the route in adapting operations to the ever-changing tactical situation. Highway regulation points may be established at communications zone sectional boundaries, truck terminals, trailer transfer points, and any other point as required. See FM 55-10 for detailed information concerning highway regulation.

c. Military police traffic control personnel should be provided at busy intersections and other congested areas to assist traffic. In areas where local police are retained as a functional organization, they may supplement military police, particularly in control of civilian vehicle and pedestrian traffic.

d. Mobile maintenance teams and wrecker service should be provided at strategic points for repair and recovery of disabled vehicles. Normally such support is provided by the direct support maintenance unit in the area as described in FM 29-23 and FM 29-30-1.

8-11. Assignment of Semitrailer Equipment

The use of motor transportation permits employment of company-size units in a wide variety of tasks under many different circumstances. Since one or more units must often operate independently, it is essential that each truck unit be assigned semitrailers to meet specific requirements.

a. The medium truck company may be assigned stake and platform, refrigerator, fuel transporting, or other specifically authorized types of semitrailers such as container / cargo, to perform its assigned mission. This variety of semitrailers enables the company to provide for the movement of unitized general cargo, bulk petroleum products, refrigerated cargo, and / or containerized cargo without a change in basic organization or operating procedure.

b. The ratio of semitrailers to truck tractors in a line haul relay operation depends on the ration of traveltime to loading and unloading time. The number of semitrailers assigned is based on maximum operating time for the tractors engaged in the line haul.

8-12. Accountability for Semitrailer Equipment

a. The commanding officer of the motor transport unit responsible for a relay operation may solve his semitrailer assignment problem in one of several ways. If relay operations are to be of short duration, he may leave the semitrailers assigned to companies and impose stringent measures for maintaining responsibility over semitrailers away from parent units. However, it may be preferable to transfer informal accountability for semitrailers to either his unit or subordinate command units and to maintain property books and control records at those levels.

b. AR 710-2 authorizes the motor transport brigade, group, or battalion to assume informal accountability for semitrailer equipment of assigned companies when a relay operation is established. This provision may be implemented by direction of the theater commander or on order of the commanding officer of the motor transport brigade, group, or battalion. At the discretion of the appropriate supply agency, equipment modification lists and other records may be used to simplify accountability and to fix direct responsibility.

c. When the provisions of AR 710-2 are put into effect, the truck company commander is relieved of informal accountability for semitrailer equipment assigned to his unit. He is, however, charged with direct responsibility for the semitrailers with which he is operating and must assure that adequate care is given all semitrailers in his custody.

d. The appropriate motor transport headquarters must establish informal accountability for semitrailers used in the relay operation and must provide for maintaining property records in its supply section. The headquarters must also establish, through its operations section, reporting and control procedures which can pinpoint the location of semitrailers wherever they are within the system and which can identify and establish the responsibilities of a unit or person having custody of the equipment at a particular time.

e. Upon entry into the operational phase of a relay system, the appropriate headquarters establishes a trailer accounting office within the supply section. Individual truck units are relieved of informal accountability for trailers and semitrailers, and the information is recorded in a consolidated trailer property book maintained by the headquarters. Upon completion of the operation, return of a unit to routine operations, or transfer of a unit to another command, the consolidated property book is adjusted to reflect the current status of on-hand semitrailer equipment and hand receipts are made reassigning equipment to the companies.

8-13. Control of Semitrailer Equipment

In the centralized relay operation, accountability and control of semitrailer equipment are vested at the same level of command. The commander of the headquarters unit operating the relay operation assumes command responsibility for semitrailer equipment employed in the operation. The supply section of the headquarters unit assumes property responsibility for the equipment, and the operations section of the headquarters until assumes responsibility for operational control. Control is effected through reports from units and the maintenance of records. Maximum use of high-speed communications, confirmed by written reports, is imperative to maintaining control.

a. At the operating level, direct responsibility for the semitrailer equipment employed in the relay operation is vested in the unit of convoy commander having possession of or using such equipment. Reports forwarded to the headquarters operations section from trailer transfer points and / or truck terminals are used to establish direct responsibility for equipment on the unit / convoy commander having control of or utilizing that equipment at a given time. These reports also provide the operations section with a daily check on the location of all semitrailer equipment in the system and on the status and condition of such equipment. For a detailed discussion of records and reports, see TM 55-310.

b. Information received from operating units on their daily reports should be posted on a control board maintained in the operations office. This control board, in addition to indicating the status of semitrailer equipment throughout the system, is an invaluable aid to the commander in controlling the operation, determining responsibility for semitrailers requiring maintenance and / or repair, locating lost or delayed semitrailers, and rerouting cargo loads en route. The simplest form of control board is one on which semitrailers are listed by registration numbers, and terminals and trailer transfer points are listed in sequence according to route of travel. Locations of semitrailers may be indicated by tabs, and loads and destinations by various colors or notations on the tabs. Semitrailers loading or unloading at support installations may be charged to the appropriate terminals, or separate columns may be provided on the board to indicate specific loading or unloading locations.

8-14. Maintenance and Repair Services

a. General. Maintenance and repair services for vehicles used in relay operations are the same as for all military vehicles. However, modifications in usual procedure may be required. Vehicles engaged in relay operations may operate 20 hours a day over extended periods, thereby increasing maintenance requirements. To provide maintenance services at truck terminals, battalion (or appropriate motor transport headquarters) may draw the required mechanic personnel, tools, and equipment from assigned companies, or procure as augmentation, organizational maintenance terms from TOE 29-600. Under certain circumstances, available nondriver personnel may be used as mechanic's helpers.

b. Consolidated Maintenance. A consolidated maintenance facility which pools and permits maximum use of available unit maintenance skills and resources may be established by battalion to either supplement or support unit level maintenance operations. Depending upon the situation, a consolidated maintenance facility may be established in several ways:

(1) Grouping all company maintenance personnel into one centralized area or pool under battalion supervision.

(2) Drawing only the mechanics required to perform certain consolidated maintenance tasks under battalion supervision.

(3) Detailing company mechanics to the battalion maintenance service and rotating them on a day-to-day shift basis.

(4) Using organizational maintenance teams provided in TOE 29-600.

c. Maintenance Records. When semitrailers are employed in relay operations, they are away from the parent unit much of the time and individual units cannot retain maintenance records and individual vehicle files for semitrailers used throughout the system. These files may be maintained at the central accounting office, and all other necessary maintenance papers may accompany the semitrailer; in such an operation, a watertight compartment may be built in the semitrailer to hold these papers. If no papers accompany the semitrailer, a maintenance schedule board may be stenciled on the tarp box for recording scheduled maintenance services.

8-15. Relationship With Consignor and Consignee

The productivity of motor transport equipment is, to a great extent, a function of its turnaround time. Of the major factors affecting turnaround time—distance, rate of march, and delays—the delays incurred at loading and unloading sites offer the greatest potential for improvement through management.

a. To the extent that the motor transport unit commander is required to maintain or improve

turnaround time to accomplish a mission or to achieve a desired or established level of unit performance, he depends on users of motor transport—the shippers and receivers—over whom he has no direct control, for the expeditious handling and release of motor transport equipment. This problem is often further complicated in that consignees are in the forward areas under tactical commanders.

b. To reduce or eliminate undue delays in loading, unloading, and / or releasing motor transport equipment, the normal contacts at the operating level (between truck unit personnel and shipping and receiving agency personnel) must be backed up by close liaison between commanders and staffs of the motor transport organization and the using agencies.

c. Publication of command directives and standing operating procedures, which establish coordination policies and provide criteria by which to control delay of motor transport equipment by using agencies, may be required.

CHAPTER 9

MOTOR MOVEMENT PLANNING (STANAG'S 2041 AND 2154)

Section I. GENERAL PLANNING

9-1. General

This section provides guidance for planning motor transport operations by Army units. The techniques and procedures discussed are applicable to both tactical and administrative moves and may be adapted to meet the needs of any situation. See also chapter 4 for control of military motor movements.

9-2. Preliminary March Data

a. The march planner, having certain basic data, may, by simple arithmetic, determine additional information about a movement. Normally he knows the number and types of vehicles in the column, the origin and destination of the convoy, and the time of arrival at destination. From a map he can determine the number of miles or kilometers that the convoy must travel and, from the movement schedule, the number of hours that the move should require. By dividing miles or kilometers by hours, he can determine the rate of march that vehicles must maintain to meet the schedule. With his knowledge of road conditions and of the skill of the drivers, he can establish safe driving distances, determine positions of vehicles in the column, and organize the march column.

b. Road movements for small units may be planned with a minimum of preliminary data. The commander must first know the assigned task or mission, the destination, the time of completion, and the equipment required. In addition to this basic information, he determines the departure time, the road distance, the time distance, and the required rate of march. On the basis of this information, an adequate road movement plan can be produced that may be easily implemented by an operation order.

c. The larger and more complex the movement, the more complete and detailed the planning must be. If the movement is scheduled over a dispatch route, exact data are needed as to road space allocated, time space allowed, and other factors of lead, gap, and length in time and space. The rate of movement necessary to meet the schedules must be determined. In consideration of the mission, the planner determines the tactical or administrative purpose of the move, special measures or arrangements necessary to make the move, and the load to be transported. In regard to the march formation, the planner considers the number and types of vehicles or units required; the method of dispatch or grouping for movement and relative positions in the column; and the time required for the move based on maximum allowable speeds of the vehicles, their average running times, and the effect of the rate of march on march organization. In selecting a route to be traveled, the march planner considers loading points for elements of the convoy, start point(s) for the movement, critical points along the route, scheduling of halts, probable traffic and road conditions, and release point(s).

d. To facilitate planning for road movement and permit timely dissemination of pertinent information to the troops concerned, planners normally use such planning aids as march formulas, road movement graphs, and road movement tables. Checklists (convoy commander's checklist; convoy briefing checklist, etc.) for use by convoy personnel are also helpful to assure the provision and dissemination of information necessary to insure an efficient operation. In addition to the planning aids discussed in this chapter, a type time-distance table for selected vehicle speeds is shown in appendix D.

9-3. Distance, Time, and Rate Factors

The relationship between distance and time is the basis for all march planning (fig 9-1). Distance factors and their corresponding time factors pertaining generally to columns or elements within columns are as follows:

Distance		*Time*
Length	—	Time length
Gap	—	Time gap
Lead	—	Time lead
Road space	—	Time space
Road distance	—	Time distance
Road clearance distance	—	Road clearance time

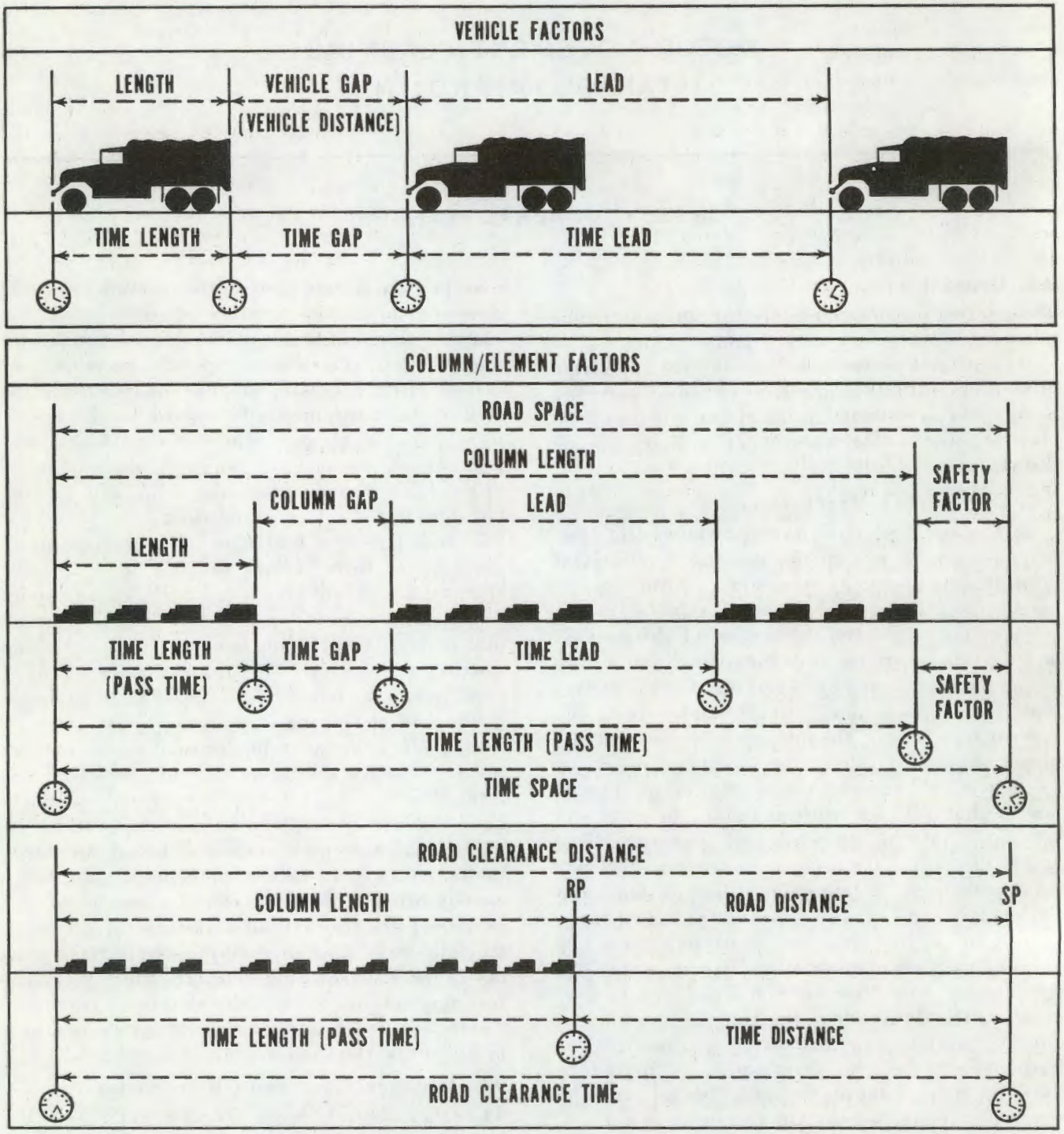


Figure 9-1. Distance and time factors, vehicle and column / element.

a. Distance Factors. The distance factors of a march may be expressed in miles, yards, and feet or in kilometers and meters. The metric system is used in military and foreign maps. However, in the United States, nonmilitary maps show distances in Miles. Distance factors are defined below:

(1) The *length* of any column or element of a column is the length of roadway it occupies, measured from front to rear. Length is also applicable to a single vehicle.

(2) *Gap* is the space between successive vehicles or elements in a column or between successive columns as measured from the rear of one element to the front of the following element.

(a) Vehicle gap (vehicle distance) (STANAG 2154) is the space between consecutive vehicles in a column.

(b) Column gap is the space between the elements of a column, or between columns.

(3) *Lead* is the linear spacing between the heads of elements in a column or between heads of successive vehicles, serials, march units, or columns.

(4) *Road space* is the total length of roadway occupied by a column or an element thereof. It includes any additional space required as a safety factor or to maintain flexibility. When no safety factor is applied, road space is synonymous with column length.

(5) *Road distance* is the distance from one given point to another on a road or route, expressed in miles or kilometers

(6) *Road clearance distance* is the total distance that the head of the column must travel for the entire column to clear either a section or all of the given road or route. Road clearance distance equals column length plus road distance.

b. Time Factors. Time factors are used to clock the relative positions and the arrival and / or passage of elements of a march and are expressed in seconds, minutes, or hours. Each of the following time factors is related to a corresponding distance factor as indicated in *a* above:

(1) *Time length (pass time)* (STANAG 2154, app G), is the time required for a column or element thereof to pass a given point. (Time length may also be applied to a single vehicle.)

(2) *Time gap* is the time between the tail of one element or vehicle and the head of the next as they move past any given point.

(3) *Time lead* is the time between the head of one element or vehicle and the head of the next as they move past any given point. (For individual vehicles, there is little difference between time gap and time lead.)

(4) *Time space* is the time consumed while a column or element thereof proceeds past any point en route. It includes time gaps between subordinate elements and any additional time added as a safety factor to maintain flexibility. When no safety factor is applied, time space is synonomous with time length.

(5) *Time distance* is the time required to move from one point to another at a given rate of speed.

(6) *Road clearance time* is the time a column or element thereof requires to travel over and clear either a section, or all, of a given road or route. Road clearance time equals time length of the column plus time distance.

c. Rate of Movement. Rate of movement is the ratio of distance to time. Although no exact distinction is made between terms expressing rate of movement, the following interpretations are offered as aids to planners and operators:

(1) *Speed* is the actual rate at which a vehicle is moving at a given time as registered on the speedometer. It is usually expressed in miles or kilometers per hour (mph or kmph).

(2) *Pace* is the regulated speed of a column or element as set by the pace setter. It undergoes constant adjustment consistent with terrain, weather, and road and traffic conditions encountered along the route of march.

(3) *Rate of march* is the average distance traveled in any given time, including periodic halts and other short delays. It is expressed in miles or kilometers in the hour (mih or kmih).

9-4. March Formulas

March formulas are the basic arithmetic of march planning. By means of these simple formulas, the planner may solve for the unknown factor necessary for completing his movement plan. When two of the basic march factors of distance (D), time (T), and rate (R) are known, the third may be found by simple arithmetic equation:

$D = R \times T$ (distance equals rate multiplied by time)

$T = \frac{D}{R}$ (time equals distance divided by rate)

$R = \frac{D}{T}$ (rate equals distance divided by time)

Any of the distance factors may be substituted in the equation if the corresponding time factors are also substituted. For example—

a. Determining Distance Factors.

(1) Gap (yards or meters) equals rate (yards or meters per minute) multiplied by time gap (minutes).

(2) Lead (yards or meters) equals rate (yards or meters per minute) multiplied by the time lead (minutes).

(3) Road distance (miles or kilometers) equals rate (miles or kilometers in the hour) multiplied by time distance.

b. Determining Time Factors.

(1) Time length, or pass time (minutes), equals the length (yards or kilometers) divided by rate (yards or meters per minute).

(2) Time lead (minutes) equals lead (yards or meters) divided by rate (yards or meters per minute).

(3) Time space (hours) equals road space

(miles or kilometers) divided by rate (miles or kilometers in the hour).

(4) Time distance (hours) equals road distance (miles or kilometers) divided by rate (miles or kilometers in the hour).

c. Determining Rate Factors. Rate (miles or kilometers per hour) equals road distance (miles or kilometers) divided by time distance (hours).

d. Converting Factors into Others of the Same Class.

(1) Length plus gap equals lead.

(2) Time length (pass time) plus time gap equals time lead.

(3) Distance in miles multiplied by 1,760 equals distance in yards.

(4) Distance in kilometers multiplied by 1,000 equals distance in meters.

(5) Distance in kilometers multiplied by .621 equals distance in miles (approximately).

(6) Distance in miles multiplied by 1.609 equals distance in kilometers (approximately).

(7) Time in hours multiplied by 60 equals time in minutes.

9-5. Road Movement Graphs

Road movement graphs are time-space diagrams for visually presenting the pattern of scheduled road movements so that conflicts and discrepancies can be discovered and corrected in the planning stage rather than when congestion occurs on the route. In addition to their use by planning staffs, road movement graphs are used, when applicable, in supervising or regulating complicated movements. They are also used in preparing and checking road movement tables, and they provide a convenient means of recording actual moves of units over a period of time. The unit of measure used (miles or kilometers) depends on the requirements of the authorities concerned. (An example of a road movement graph is contained in Annex C to STANAG 2041, app E. Detailed instructions on preparing a road movement graph are contained in FM 55-10 and TM 55-310).

9-6. Road Movement Tables

Road movement tables are a convenient means of transmitting to subordinates the schedules and other essential details pertaining to a road move. This is particularly true in cases where inclusion of such details in the body of an operation order would tend to complicate the order or to make it unduly long. Road movement tables consist of two parts: the first consists of data paragraphs reflecting general information or information common to two or more elements of a move; the second, which is arranged in tabular form, provides a list of elements and the specific information applicable to each of these elements. The security classification given road movement tables is in accordance with their contents and is not necessarily the same as that given the operation order. (An example of a road movement table is contained in Annex B to STANAG 2041, app E.)

9-7. Unit Standing Operating Procedures

Standing operating procedures (SOP) are prepared by units, usually down to and including company size, to simplify the preparation and transmission of orders; to simplify and perfect the training of troops; to promote understanding and teamwork between commander, staff troops, and installations; to facilitate operations; and to minimize confusion and errors.

a. Requirements. The requirements for, and the scope of, unit SOP vary with the size of the unit, its organization, and its normal missions. Certain prerequisites, however, are common to all units. These include conformity with the SOP of the next higher unit, sufficient flexibility to allow addition or deletion without demanding major revision, sufficient detail to avoid ambiguity, and avoidance of repetition of material contained in field manuals available to the unit.

b. Items Covered in Motor Movement SOP. The following items may be included in a unit movement SOP:

(1) Standard organization of columns for movement, including grouping of vehicles and designation of commanders as applicable.

(2) Composition and duties of the advance party, reconnaissance echelon, or other detached parties.

(3) Priorities of movement of columns or elements.

(4) Responsibility for manning start point and release point.

(5) Discipline en route, use of lights, procedures at halts, and accident procedures.

(6) Traffic densities and operating speeds.

(7) Posting of guides and markers and traffic control measures.

(8) Normal vehicle loads, including personnel.

(9) Passive defense measures and action to be taken in the event of enemy attack.

(10) Supply, maintenance, and evacuation procedures.

(11) Communications, required reports, and liaison methods.

(12) Location of medical and other support facilities along route of march. (See FM 55-31 for a further discussion of SOP.)

Section II. OPERATIONAL PLANNING FOR LINE HAUL MOVEMENTS

9-8. General

The information contained in this section provides for planning and establishing a line haul move involving the operation of truck terminals and trailer transfer points. It discusses establishment of such facilities and computations necessary to determine the number of transportation units required to operate the line haul. Section I is used in conjunction with this section to provide necessary general guidance. See also chapter 8 for interzonal motor transport service planning considerations.

9-9. Selection of Truck Terminal Sites

If the tasks for a particular operation include line haul and the semitrailer relay method is to be used, truck terminal locations must be planned at points of cargo ingress and egress on the route selected. Truck terminals are normally located slightly forward of points where cargo is to be picked up and slightly to the rear of points where cargo is to be delivered.

9-10. Selection of Trailer Transfer Point Sites

Trailer transfer points are established along the line haul system as required to divide the line haul into legs (segments) for operational efficiency. These points provide facilities for exchanging semitrailers and accomplishing administrative actions (reports, vehicle and cargo inspections, documentation, and dispatch procedures) related to such exchange activities. If required, they may also provide for mess, maintenance, and other support or miscellaneous administration. Trailer transfer points are not used for pickup and delivery of cargo.

a. The length of a line haul leg is selected on the basis of time distance. For advance planning, the most desirable time distance is 4.5 hours. In operational planning, the desirable time distance of a leg is determined by deducting relay time and any other delays from the number of hours per operating shift and halving the remaining time to determine one-way running time between trailer transfer points. This permits each driver to complete one round trip per shift, it precludes the requirement for billeting drivers away from their assigned unit, and it simplifies both provision of rested drivers for each trip and maintenance of vehicles. The actual time distance of legs between trailer transfer points may vary slightly from desirable time distance because of the necessity for placing such installations at physically suitable sites.

b. The actual road distance of a haul, when divided into legs based upon the desirable time distance for each leg, will seldom result in all legs being of equal length. To minimize the relocation of facilities in the event of extension of the haul, the shortest leg should be located at the forward end of a haul.

9-11. Physical Characteristics of Truck Terminal and/or Trailer Transfer Point Sites

a. In the selection of sites for truck terminals and/or trailer transfer points, many factors must be considered. The size, complexity, and duration of the operation; number and type of vehicles to be employed in the operation; facilities required at the terminals and transfer points; any anticipated backlog of semitrailers at these sites; and other various operational factors all impact on selecting the location for terminals and/or transfer points. In addition, certain physical factors of the facilities require consideration. The area(s) selected should—

(1) Be of sufficient size to provide ample space for parking and marshaling of incoming and outgoing semitrailers and prime movers.

(2) Offer, or provide for the establishment of, an acceptable internal road net and traffic pattern.

(3) Be centrally located with respect to activities to which transportation support will be provided, and be conveniently located with respect to the road net over which operations will be conducted.

(4) Be level and well drained, and provide a suitable hardstand capable of withstanding heavy vehicular traffic.

(5) Provide sufficient space for troop billeting and messing facilities, maintenance and POL (petroleum, oil, and lubricants) service, and other internal support activities if such are needed.

b. Security of both the operating area and of the vehicles and cargo handled within the area is another matter of prime concern. Depending upon security requirements, measures may be established using personnel and equipment available within the motor transport organization having jurisdiction over the operation, or additional security support may be provided by other agencies and/or headquarters (for instance, adjacent units, military police organizations, area support commands/groups).

c. Although the classic line haul operation visualizes truck terminals and trailer transfer points

as being facilities established on or immediately adjacent to the line haul route and separate from any motor transport organization or unit facility, this is not always the case. The requirements for hardstand, support facilities, and security, and the availability of real estate may dictate that such truck terminals and / or trailer transfer points be established off the line haul route and / or collocated in motor transport unit areas (for instance, truck terminals or trailer transfer points collocated in a truck battalion motor park area; trailer transfer points collocated in a truck company motor park area). This has been and is the practice in operating theaters and the establishment of these facilities within a battalion or company area in no way changes or affects their primary purpose. It does offer a point for consideration when planning for and establishing a line haul operation since it dictates that, in such a case, units and / or line haul facilities be located as close to and have as ready an access to the line haul route as is possible.

9-12. Location of Motor Transport Units

a. Generally, when selecting sites for the location of motor transport units (both command and supervisory and operating units) to be engaged in an operation, the same factors apply as when selecting sites for truck terminal and / or trailer transfer points. The overall plan of the operation must be considered, the areas selected should be capable of supporting sustained traffic and occupation by vehicles, and the areas should be on or near a suitable road net. Command and supervisory units should be centrally located so as to be capable of not only directing and controlling subordinate units but also establishing and maintaining liaison with supported and supporting agencies. Operating units should be located in the vicinity of the activity to which they will provide transport support. In addition, other factors which should be considered include—

(1) The location and capabilities of supporting services (for example, maintenance, POL, construction, and communications support).

(2) The availability of existing facilities such as office space, billets, maintenance and shop areas, and parking and / or hardstand areas.

(3) The requirement and / or capability of transportation units engaged in the operation to provide mutual support (mess, billets, maintenance, POL) to each other.

(4) The requirement to establish roving patrols (supervisory and / or maintenance), transient messes, and other facilities on the operating route(s).

b. Defensibility of unit areas must also be considered. Local defense and security may be attained by locating on favorable terrain in the vicinity of build-up areas where security may be provided. Concealment and cover may be important considerations. Defense plans must be coordinated with those of other friendly units in the vicinity, and with area or support commands involved.

c. The capability of the enemy will govern the degree of dispersion required. However, the ability of motor transport units to disperse will be limited by the nature of the terrain, the availability of personnel, and the degree of operating efficiency maintainable while dispersed. A balance must be obtained between the dispersion necessary for passive defense and that which will allow the unit to accomplish its mission efficiently.

9-13. General Planning Factors

a. Motor transport planning, particularly in its earliest stages, must often be based on broad planning factors and assumptions. However, because of the varied services performed, the type of loads carried, and the varied terrain features over which motor transport operations are conducted, planning factors should be used with caution and applied only in the absence of specific data on the local situation.

b. In the absence of specific data, the following factors are used in motor transport planning to compute truck and truck company requirements:

(1) Average number of assigned task vehicles not in maintenance and therefore available for daily operations:

Operational short range—83 percent (maximum sustained effort; used only for all-out effort, and then only for periods of less than 30 days).

Long range planning—75 percent.
percent.

(2) Anticipated payload per vehicle:

Offroad—rated cargo capacity of vehicle (except 5,000-gallon tank semitrailers which are rated at 3,000-gallon capacity for offroad operations).

Highway—rated cargo capacity plus 50 percent for trailers or semitrailers and 100 percent for tactical wheeled vehicles (except 5,000-gallon tank semitrailers which have a maximum load capacity of 5,000 gallons).

(3) Daily round trips that a vehicle averages (these vary with running time and delay times):

Line haul—one per operating shift.
Local haul—four per day (two per operating shift).

(4) One-way distance cargo is to be hauled, from which round trip mileage may be computed:

Line haul—90 miles (144 km) one way per operating shift.
Local haul—15 miles (24 km) one way per trip.

(5) Average number of miles covered in an hour, including short halts during the period of movement:

Poor roads—10 miles (16 km) in an hour.
Good roads—20 miles (32 km) in the hour.

Note. In assessing road conditions, not only the road surface must be considered but also terrain, weather, and hostile activity which may affect rate of march.

(6) Turnaround time—time consumed in round-trip movement, including delays.

(7) Delay item—time consumed in loading and unloading and / or relay time in line haul relay operations. (Time for halts and delays en route, such as mess halts, ferrying operations, etc., which can be anticipated but are not included in the rate of march, must be included in delay time.)

Straight trucks—2.5 hours loading and unloading time per round trip (direct haul).
Semitrailers—2.5 hours loading and unloading time per round trip (direct haul).
Truck tractors in semitrailer relay operations—1 hour per relay (round trip per line haul leg).

(8) Number of hours per day in which vehicles with drivers are normally employed:

One operating shift—10 hours.
Round-the-clock (two operating shifts)—20 hours.

(9) Unit lift and daily lift—unit lift is the amount of cargo a truck company can move at one time; daily lift is that which it can move in a day, making a number of trips.

(10) Ton-miles / kilometers and passenger-miles / kilometers—the product of the number of tons or passengers times the number of miles / kilometers such cargo or personnel are moved.

9-14. Unit and Vehicle Capability Estimates

a. For planning purposes and in the absence of other specific operational data, motor transport unit capability estimates, based on tables of organization and equipment (TOE) capabilities, are shown in tables 9-1 through 9-4.

Table 9-1. Unit Tonnage Capability Estimates—Local Hauls

(Vehicle availability x average tons per vehicle x trips per day = short ton capability per day.)	
Light truck company (2½-ton truck)	45 x 4 x 4 = 720
Light truck company (5-ton truck)	45 x 6 x 4 = 1,080
Medium truck company (cargo) (12-ton stake and platform)	45 x 12 x 4 = 2,160
Medium truck company (petroleum) (5,000-gallon tanker)	45 x 5,000 gal x 4 = 900,000 gal
Medium truck company (reefer) (7½-ton reefer van)	45 x 6 x 4 = 1,080
Heavy truck company (50-ton semitrailer)	18 x 40 x 4 = 2,880
Light-medium truck company:	
2½-ton truck	45 x 4 x 4 = 720
12-ton stake and platform	8 x 12 x 4 = 384
Total	1,104

Note. Capabilities stated are based on TOE effective as of date of publication of this text. Since TOE are presently undergoing major revision to incorporate capability to transport containers, to increase span of control by adding a fourth truck platoon to operating units, and to change types of task vehicles assigned, planners and operators should consult current TOE to verify unit capability, organization, and number and type of task vehicles assigned.

Table 9-2. Unit Passenger Capability Estimates—Local Hauls

(Vehicle availability x passengers per vehicle x trips per day = passenger capability per day.)	
Light truck company (2½-ton truck)	45 x 20 x 4 = 3,600
Light truck company (5-ton truck)	45 x 20 x 4 = 3,600
Medium truck company (cargo) (12-ton stake and platform semitrailer[a])	45 x 50 x 4 = 9,000
Light-medium truck company:	
2½-ton truck	45 x 20 x 6[b] = 5,400
12-ton stake and platform [a]	8 x 50 x 6[b] = 2,400
Total	7,800

[a] Recommended for emergency use only; no troop seats provided.

[b] Number of trips based on employment of unit in tactical situation (short turnaround times); for general troop movements, planner should recompute based on four trips per day.

Note. Capabilities stated are based on TOE effective as of date of publication of this text. Planners and operators should consult current TOE to verify unit capability, organization, and number and type of task vehicles assigned.

Table 9-3. Unit Tonnage Capability Estimates—Line Hauls

(Vehicle availability x average tons per vehicle x trips per day = short ton capability per day.)	
Light truck company (2½-ton truck)	45 x 4 x 2 = 360
Light truck company (5-ton truck)	45 x 6 x 2 = 540
Medium truck company (cargo) (12-ton stake and platform)	45 x 12 x 2 = 1,080
Medium truck company (petroleum) (5,000-gallon tanker)	45 x 5,000 gal x 2 = 450,000 gal
Medium truck company (reefer) (7½-ton reefer van)	45 x 6 x 2 = 540
Heavy truck company (50-ton semitrailer)	18 x 40 x 2 = 1,440
Light-medium truck company:	
2½-ton truck	45 x 4 x 2 = 360
12-ton stake and platform	8 x 12 x 2 = 192
Total	552

Note. Capabilities stated are based on TOE effective as of date of publication of this text. Planners and operators should consult current TOE to verify unit capability, organization, and number and type of task vehicles assigned.

Table 9-4. Unit Passenger Capability Estimates—Line Hauls

(Vehicle availability x passengers per vehicle x trips per day = passenger capability per day.)	
Light truck company (2½-ton truck)	45 x 16 x 2 = 1,440
Light truck company (5-ton truck)	45 x 18 x 2 = 1,620
Medium truck company (cargo) (12-ton stake and platform semitrailer[a])	45 x 50 x 2 = 4,500
Light-medium truck company:	
2½-ton truck	45 x 20[b] x 2 = 1,800
12-ton stake and platform[a]	8 x 50 x 2 = 800
Total	2,600

[a] Recommended for emergency use only; no troop seats provided.

[b] Number of personnel per vehicle based on employment of unit in tactical situation; for general troop movements, planner should recompute based on 16 troops per vehicle.

Note. Capabilities stated are based on TOE effective as of date of publication of this text. Planners and operators should consult current TOE to verify unit capability, organization, and number and type of task vehicles assigned.

b. Vehicle Capabilities. Vehicle capatilities as indicated in table 9-5 may be used in conjunction with other planning factors. Additional vehicle and unit capability data are contained in FM 55-15.

c. Specific Loads. A transport mission may require the movement of a number of specific loads consisting of one or more items which may or may not be packaged (aircraft engines, missile components) and which, due to their peculiarities in either size, shape, cube, or weight, involve a variation of the normal planning process to determine vehicle requirements for the operation. In such a case, vehicle requirements may be determined through test loading or by using operational data available from previous similar operations. If test loading is not feasible or operational data is unavailable, vehicle requirements may be determined using the following method:

(1) First, determine the number of items that

may be transported by one vehicle. This may be computed by using either cargo weight (*(a)* below) or cargo cube (*(b)* below), or if the circumstances warrant, by using both methods to arrive at an optimum figure.

(a) $\frac{\text{Vehicle payload capacity}}{\text{Weight of item}} =$ Number of items, by weight, that may be loaded onto one vehicle

(b) $\frac{\text{Vehicle cargo compartment cube}}{\text{Cube of item}} =$ Number of items, by cube, that may be loaded onto one vehicle

Table 9-5. Vehicle Payload Capacities for General Planning

Nomenclature	Offroad (tons)	Highway average (tons)	Highway maximum (tons)	Towing capacity (tons)		Passengers[a]	Cargo space (approximate)
				Highway	Cross country		
Automobile, sedan, light						4[b]	
Bus, convertible, 37-passenger						37 or 18 litters	
Carrier, personnel, full-tracked, armored, M59	1½	1½	1½			10	
Carrier, personnel, full-tracked, armored, M113						11	
Semitrailer, cargo van, 6-ton, 2-wheel, M119	6	9	9			24[c]	1,020 cu ft
Semitrailer, shop, van, 6-ton, 2-wheel, M146	6	8	8				1,675 cu ft
Semitrailer, stake, 6-ton, 2-wheel, M118	6	9	9			24[c]	1,130 cu ft
Semitrailer, reefer, 7½-ton, 2-wheel	6[d]	6	7½				790 cu ft
Semitrailer, van, 10-ton, 4-wheel	8	10				50[c]	1,355 cu ft
Semitrailer, cargo, 12-ton, 4-wheel, M127A1	12	12	18			50[c]	830 sq ft
Semitrailer, low-bed, 12-ton, 25-foot	12	16	18				200 sq ft
Semitrailer, supply van, 12-ton, 4-wheel, M129	12[d]	18	18			50[c]	1,342 cu ft
Semitrailer, low-bed, 15-ton, 4-wheel, M172	25	16	25				320 sq ft
Semitrailer, truck transporter, 50-ton, 8-wheel, M15A2	50[d]	40	50				
Semitrailer, low-bed, 60-ton, 8-wheel, M162	60	60	60				204 sq ft
Semitrailer, tank, gas, 5,000-gallon (gal), 4-wheel, M131A2	3,000 gal[d]	5,000 gal	5,000 gal				
Trailer, amphibious, cargo, ¼-ton, 2-wheel	¼	3/8	3/8				60 cu ft
Trailer, cargo, 3/4-ton, 2-wheel	3/4	1 1/8	1 1/8				175 cu ft
Trailer, cargo, 1½-ton, 2-wheel	1½	2¼	2¼				283 cu ft
Trailer, ammunition, 2-ton, 2-wheel	2	2	3				
Truck, utility, ¼-ton, 4 x 4	0.4	0.4	0.6	1	3/4	2	66 cu ft
Truck, cargo, 3/4-ton, 4 x 4	3/4	1	1½	2		8	160 cu ft
Truck, cargo, 2½-ton, 6 x 6	2½	4	5	5	3	20[e]	456 cu ft
Truck, shop, van, 2½-ton, 6 x 6, M220	2½	3½	3½	4	3		
Truck, shop, van, 2½-ton, 6 x 6, M292	2½	2½	2½	4	3		
Truck, tank, gas, 2½-ton, 6 x 6, M217	750 gal	1,200 gal	1,200 gal				
Truck, tank, water, 2½-ton, 6 x 6, M222	1,000 gal	1,000 gal	1,000 gal				
Truck, cargo, 5-ton, 6 x 6 (single tires)	5	6	7½	15	7½	20[f]	550 cu ft
Truck, cargo, 5-ton, 6 x 6 (dual tires)	5	6	10	15	7½	20[f]	550 cu ft
Truck, cargo, 10-ton, 6 x 6, M125	10	10	15	25	15		600 cu ft

[a]Based on 18 inches per man. Does not include driver or assistant.
[b]Less individual field equipment.
[c]Recommended for emergency use only. No troop seats provided.
[d]Not generally used for this type of operation.
[e]For short hauls; reduced to 16 for long hauls.
[f]For short hauls; reduced to 18 for long hauls.

(2) Secondly, using the appropriate single vehicle load (use the lesser of *(a)* and *(b)* if vehicle capacity is figured both ways—see note below) compute the number of vehicles required as follows:

$$\frac{\text{Number of items to be transported*}}{\text{Number of items that may be loaded onto one vehicle}} = \text{Vehicles required}$$

* This figure may be for a one time lift or on a day-to-day basis, depending upon the mission.

Note. When the vehicle load capacity is computed both ways, use the lesser of the results of *(a)* and *(b)* since:

1. If *(a)* is the lesser, it indicates that the weight of the computed load will exceed the vehicle payload capacity before all available cargo space in the vehicle is filled.
2. If *(b)* is the lesser, it indicates that the computed cargo load will "cube out" (exceed the cubic feet of cargo space available in the vehicle) before it exceeds the vehicle payload capacity.

The vehicle payload (offroad or on highway as applicable) and the cubic capacity of the vehicle cargo compartment may be obtained from the vehicle data plate and / or the technical manual pertinent to that vehicle. See also table 9-5 for vehicle payload capacity. The weight and / or cubic volume of the specific item or load to be transported may be obtained from the shipper, the service representative, or the technical manual applicable to the particular item to be transported.

9-15. Highway Tonnage Capacities

a. In selecting routes over which cargo is to be transported, consideration must be given to capabilities of roads and bridges to sustain the operation. The gross weight of the heaviest loaded vehicle should not exceed the rated tonnage capacity of the weakest bridge unless the bridge will be strengthened before operations begin. It is difficult to determine exact tonnage capacities of highway for sustained operations because of varying conditions. The volume of tactical, administrative, and indigenous traffic to be accommodated on supply routes further restricts the capabilities of motor transport.

b. Highway capacities contained in table 9-6 may, in the absence of more current data, be used as a guide for estimating supply support tonnage capacities of highways under varied conditions assuming that operations are sustained, that road maintenance is adequate, that bridges are capable of sustaining anticipated vehicle load weights, and that each road bears two-way traffic. Columns 5 through 9 define the various conditions of roadway, terrain, and weather and provide a guide for estimating daily forward tonnage capacities based on percentile deviations from standard conditions. Although percentage capacity factors may be considered in any sequence, a typical application involving all limiting factors is as follows: first apply the narrow roadway degradation factor to determine the adjusted highway capacity; to that adjusted capacity, apply the limiting terrain factor; finally, to the latter adjusted capacity, apply the weather factor. The following guidelines must be considered:

(1) When more than one terrain factor (columns 6, 7, 8) is present, only the *one most restrictive* factor is used to compute capacity reduction.

Table 9-6. Highway Capacity

Highway type	Daily tonnage forward (short tons)			Capacities applicable under various conditions (percentages) [1]				
	Optimum dispatch route only	Supply traffic		Narrow roadway	Rolling terrain	Hilly with curves	Mountainous	Seasonal bad weather
		Communications zone	Combat zone					
Concrete	60,000	36,000	8,400	75	90	70	40	80
Bituminous	45,000	27,000	7,300	75	90	70	40	70
Bituminous treated	30,000	18,000	5,800	75	80	60	35	60
Gravel	10,150	6,090	3,400	75	80	50	30	40
Earth	4,900	2,940	1,600	75	75	40	20	10

[1] Factors are minimum under extreme conditions.

(2) The weather factor is considered when such conditions are expected to exist for a sustained period. However, this "sustained period" must be considered in relationship to the road surface. For instance, a several-day rainfall may have no effect on operations over a concrete-surfaced road; however, this same rainfall could seriously disrupt operations over a gravel or earth road.

c. Planned tonnage movement should not exceed the capacity of any portion of the road net to be used or of any bridge on the road net unless construction or heavy maintenance support is provided to increase the capacity of that section of highway or of the bridge to meet the demands. Otherwise, alternate routes must be selected to distribute the load. If no alternate routes are available and the indicated tonnage is not reduced, the highway or bridge can be expected to deteriorate rapidly and / or fail and operations cannot be sustained. (It should be kept in mind that maintenance vehicles and personnel on a road may also interfere with the flow of traffic and thereby limit capacity.) For more detailed information on highway capacity estimation, see FM 55-15.

9-16. Traffic Density—Traffic Flow

a. Table 9-7 provides the motor transport planner and / or operator with a ready reference for determining either, or both, the traffic density and the traffic flow for planned or actual motor movements operating over the road at various speeds and gaps.

(1) *Traffic density* is the average number of vehicles that occupy one mile or one kilometer of road space. It is expressed as vehicles per mile (VPM) or vehicles per kilometer (VPK as appropriate. This factor, which is based upon an average vehicle length and a given vehicle gap, remains constant for given vehicle gap regardless of variations in operating speed.

(2) *Traffic flow* is the total number of vehicles which will pass a given point along a road or route of march in a given period of time (normally an hour). Traffic flow is expressed as vehicles per hour (VPH). This factor is based upon a given operating speed as well as an average vehicle length and a given vehicle gap. At a given vehicle gap, traffic flow increases as speed increases and decreases as speed is reduced.

b. The information available in table 9-7 may be used in either the regulation and control of motor movements over roads and—or road nets, or the planning and operation of convoys.

c. To use this chart to determine either traffic density or traffic flow, two operating factors must be known; these factors are *vehicle gap* and operating *speed* for the operation under consideration. These factors are applied by—

(1) Reading across the bottom scale to the column indicating the appropriate vehicle gap.

(2) Reading up that vehicle gap column to the block opposite the appropriate speed. This block at the intersection of these known data provides the desired answer concerning traffic density and traffic flow.

EXAMPLE 1: Assume that a convoy is to move over a road at a vehicle gap of 40 yards and at a speed of 25 miles per hour (mph). By reading across the bottom scale (Vehicle gap) to the 40-yard column, and then reading up that column to where it intersects the horizontal scale (speed) at 25 mph, you come to a box that reads as $\frac{35}{875}$. The figure in the upper diagonal indicates traffic density (number of vehicles per mile of roadway) for this operation; the figure in the lower diagonal indicates traffic flow (the number of vehicles that will pass a given point in 1 hour) for this operation.

d. The same procedure as outlined in *c* above is followed when vehicle gap and speed are expressed in the metric system (meters and kilometers). However, the traffic density figures on the chart indicate *vehicles per mile* and this must be converted to *vehicles per kilometer;* this is done by multiplying the given traffic density figure by .62. No adjustment is required for the traffic flow since this is based on a constant time factor of 1 hour, and on a given point along a route or road.

EXAMPLE 2: Assume that a convoy is to move over a road at a vehicle gap of 32 meters and at a speed of 32 kilometers per hour (kmph). By reading across the bottom scale (vehicle gap) to the 32-meter column, and then reading up that column to where it intersects the horizontal scale (speed) at 32 kmph, you come to a box that reads as $\frac{39}{780}$. The figure in the upper diagonal indicates traffic density (number of vehicles per *mile* of roadway) for this move. To determine the number of vehicles per *kilometer* of roadway the traffic density figure is multiplied by .62—if the answer contains a fraction of less than .50, that fraction is dropped; if the answer contains a fraction of .50 or greater, the answer is raised to the next higher full number. For this example, 39 x .62 = 24.18 or 24 vehicles per kilometer. Since the figure in the lower diagonal represents traffic flow and is based on a time factor, no adjustment is required for this figure.

e. This chart has other applications—for instance, it may be used by the motor transport planner and / or operator to determine appropriate vehicle gaps and operating speeds compatible to

restrictions imposed on an operation with which he is concerned. Thus, if instructions from higher headquarters or if operating conditions dictate that only a given number of vehicles per hour arrive at a designated point such as a critical road junction, a river crossing point, or a loading or unloading point (example 3), or that traffic density on a certain route be limited to a specific number of vehicles per mile (example 4), these restrictive figures may be correlated with those contained in the table and suitable operating gaps and speeds may be determined.

EXAMPLE 3: Assume that the planner or operator is informed by higher headquarters that forward moving traffic passing a given critical point (road junction, bridge, one-way defile, or other bottleneck) on a route is restricted to no more than 400 vehicles per hour and he is to maintain that flow as nearly as possible. By scanning the traffic flow figures of the chart he can determine that there are several speed and gap combinations which will meet this restriction (for example, 10 mph at 35-yard vehicle gap—390 VPH; 15 mph at 60-yard vehicle gap—375 VPH; 20 mph at 80-yard vehicle gap—400 VPH; 25 mph at 100-yard vehicle gap—400 VPH). Based on this guidance, and considering other operational factors involved, he can determine a suitable speed and gap for his operation.

EXAMPLE 4: Assume that the planner or operator is informed by higher headquarters that traffic density over a given route is restricted to no more than 30 vehicles per mile and no less than 25 vehicles per mile and he is to maintain this density as nearly as possible. By scanning the traffic density figures of the chart he can determine the vehicle gaps which will meet this restriction (at a vehicle gap of 50 yards, traffic density is 29 vehicles per mile; at a vehicle gap of 55 yards, traffic density is 27 vehicles per mile; and at a vehicle gap of 60 yards, traffic density is 25 vehicles per mile). This information provides guidance to him in determining the vehicle gap for the operation with which he is involved.

f. Although this chart is set up in speed increments of 5 miles / 8 kilometers per hour, traffic flows for intermediate speeds may be determined if desired. This is accomplished by dividing the difference in traffic flow between two consecutive speeds by either 5, for miles per hour (example 5), or 8, for kilometers per hour (example 6). The result is the number of vehicles to be added to the lesser of the traffic flow figures used, for each additional mile / kilometer per hour desired above that lesser figure. (Carry any fractions through third step, then raise *any fraction* in result of third step to next higher number—see example 6.)

EXAMPLE 5: Miles per hour. Assume that a planner or operator wishes to determine the traffic flow for a motor move to be operated at a speed of 23 mph and at a vehicle gap of 50 yards between vehicles. He must—

First, determine the difference in traffic flow between 20 mph and 25 mph at a vehicle gap of 50 yards:

725 (VPH at 25 mph)
—580 (VPH at 20 mph)
145

Then, divide this result by 5 (the numerical difference between 20 and 25 mph) to determine the traffic flow for 1-mile-per-hour steps between these speeds.

$$\frac{145}{5} = 29$$

Then, multiply this result by 3 (numerical difference between 20 and 23 mph).

29
x 3
87

Finally, add this resulting figure to the traffic flow indicated for 20 mph to determine the traffic flow at 23 mph.

580
+87
667 (VPH at 23 mph)

EXAMPLE 6: Kilometers per hour. Assume that a planner or operator wishes to determine the traffic flow for a motor move to be operated at a speed of 45 kmph and at a vehicle gap of 64 meters between vehicles. He must—

First, determine the difference in traffic flow between 40 kmph and 48 kmph at a vehicle gap of 64 meters.

660 (VPH at 48 kmph)
550 (VPH at 40 kmph)
110

Then, divide this result by 8 (the numerical difference between 40 and 48 kmph) to determine the traffic flow for 1-kilometer-per-hour steps between these speeds.

$$\frac{110}{8} = 13.7$$

Then, multiply this result by 5 (the numerical difference between 40 and 45 kmph).

13.7
x5

68.5 or 69

Finally, add this resulting figure to the traffic flow indicated for 40 kmph to determine the traffic flow at 45 kmph.

550
+69
---
619 (VPH at 45 kmph)

Table 9-7. Vehicle Traffic Density/Traffic Flow at Given Operating Speeds and Vehicle Gaps

Miles per hour	Kilometers per hour (approximately)	Yards	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
		Meters (approximately)	9	14	18	23	27	32	37	41	46	50	55	59	64	69	73	78	82	87	91
50	80										29 / 1450	27 / 1350	25 / 1250	23 / 1150	22 / 1100	21 / 1050	20 / 1000	19 / 950	18 / 900	17 / 850	16 / 800
45	72								35 / 1575	32 / 1440	29 / 1305	27 / 1215	25 / 1125	23 / 1035	22 / 990	21 / 945	20 / 900	19 / 855	18 / 810	17 / 765	16 / 720
40	64								35 / 1400	32 / 1280	29 / 1160	27 / 1080	25 / 1000	23 / 920	22 / 880	21 / 840	20 / 800	19 / 760	18 / 720	17 / 680	16 / 640
35	56						44 / 1540	39 / 1365	35 / 1225	32 / 1120	29 / 1015	27 / 945	25 / 875	23 / 805	22 / 770	21 / 735	20 / 700	19 / 665	18 / 630	17 / 595	16 / 560
30	48			70 / 2100	58 / 1740	50 / 1500	44 / 1320	39 / 1170	35 / 1050	32 / 960	29 / 870	27 / 810	25 / 750	23 / 690	22 / 660	21 / 630	20 / 600	19 / 570	18 / 540	17 / 510	16 / 480
25	40		88 / 2200	70 / 1750	58 / 1450	50 / 1250	44 / 1100	39 / 975	35 / 875	32 / 800	29 / 725	27 / 675	25 / 625	23 / 575	22 / 550	21 / 525	20 / 500	19 / 475	18 / 450	17 / 425	16 / 400
20	32		88 / 1760	70 / 1400	58 / 1160	50 / 1000	44 / 880	39 / 780	35 / 700	32 / 640	29 / 580	27 / 540	25 / 500	23 / 460	22 / 440	21 / 420	20 / 400	19 / 380	18 / 360	17 / 340	16 / 320
15	24		88 / 1320	70 / 1050	58 / 870	50 / 750	44 / 660	39 / 585	35 / 525	32 / 480	29 / 435	27 / 405	25 / 375	23 / 345	22 / 330	21 / 315	20 / 300	19 / 285	18 / 270	17 / 255	16 / 240
10	16		88 / 880	70 / 700	58 / 580	50 / 500	44 / 440	39 / 390	35 / 350	32 / 320	29 / 290	27 / 270	25 / 250	23 / 230	22 / 220	21 / 210	20 / 200	19 / 190	18 / 180	17 / 170	16 / 160
5	8		88 / 440	70 / 350	58 / 290	50 / 250	44 / 220	39 / 195	35 / 175	32 / 160	29 / 145	27 / 135	25 / 125	23 / 115	22 / 110	21 / 105	20 / 100	19 / 95	18 / 90	17 / 85	16 / 80

Notes:

1. Figures in upper diagonals of boxes denote traffic density; figures in lower diagonals of boxes denote traffic flow.
2. Traffic density figures represent vehicles per mile (VPM); to convert to vehicles per kilometer (VPK) multiply by .62.

9-17. Formulas for Determining Unit and Vehicle Requirements

The following formulas are applied in computing unit or vehicle requirements on the basis of planning data discussed in paragraphs 9-13 through 9-15, actual operational data, or a combination of both. The number of units or vehicles required for workloads expressed in gallons, persons, or other units of measure can be determined by substituting that unit of measure for tons in the formulas.

a. One-Time Lifts. To determine the number of truck companies or vehicles required to move a given number of tons in one lift, substitute appropriate figures in the following formula:

$$\text{Companies required} = \frac{\text{Tons to be lifted}}{\text{Tons per vehicle x Vehicles available per company}}$$

$$\text{Vehicles required} = \frac{\text{Tons to be lifted}}{\text{Tons per vehicle}}$$

b. Turnaround Time. To determine turnaround time, use the following formula. (Caution must be exercised to make sure that the delay factor is accurate. Turnaround time should be rounded off to the nearest tenth for use in further computations.)

$$\text{Turnaround time} = \frac{2 \text{ x Distance}}{\text{Rate of march (mih)}} + \text{Delays}$$

c. Distance Between Truck Terminals or Trailer Transfer Points. When locating truck terminals or trailer transfer points, the following formula is used to determine the appropriate distance between these installations in order to obtain a specific turnaround time:

$$\text{Distance} = \frac{\text{(Hours per operating shift—Delays) x Rate (mih}}{2}$$

d. Sustained Operations. The following formula is used to determine the number of truck companies required to move a given daily tonnage in sustained operations. (This formula is applicable to both local and line haul operations. The number of vehicles required can be determined by omitting vehicles available per company from the formula.)

$$\text{Companies required} = \frac{\text{Daily tonnage x Turnaround time}}{\text{Tons per vehicle x Vehicles available per company x Operational day}}$$

9-18. Line Haul Operational Planning Exercise

The following procedure demonstrates the method of planning and setting up a motor transport line haul move involving trailer transfer operations. For the purpose of planning this exercise, the location of support facilities involved, the routes to be used, and the distances between points and over which the operation will be conducted are shown in figure 9-2.

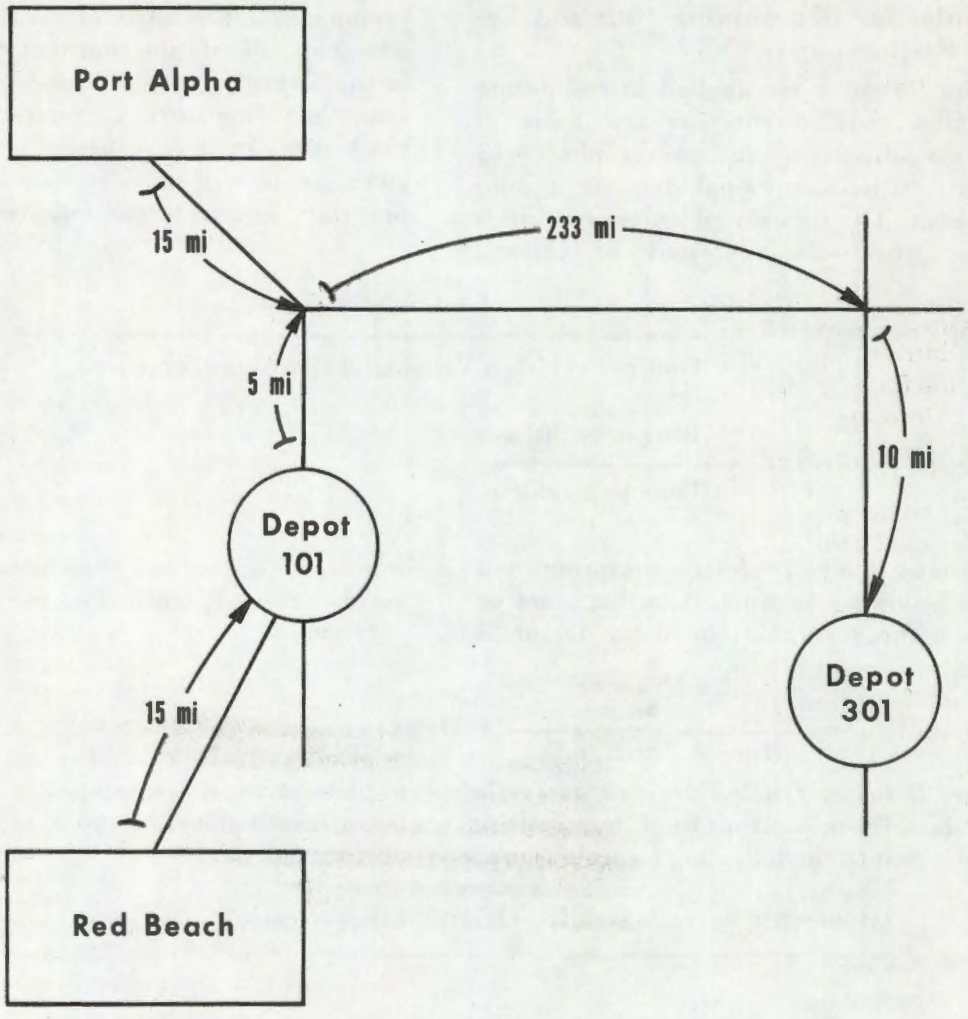


Figure 9-2. Route and facilities diagram.

a. Tonnages to be Moved by Motor Transport.

(1) Information provided by the staff movements officer establishes tonnages to be moved over the road as follows:

3,600 short tons daily from Port Alpha to Depot 301

2,400 short tons daily from Red Beach to Depot 101

1,500 short tons daily from Depot 101 to Depot 301

(2) A graphic portrayal of the daily tonnages to be moved between activities, and the routes over which these tonnages will move in this operation is illustrated in figure 9-3. The daily movement of the 3,600 STON's from Port Alpha forward, and of the 1,500 STON's from Depot 101 forward have been combined at the point on the route where these forward movements coincide. This provides both a realistic picture of the flow of tonnages over the road, and a working aid for planning the operation.

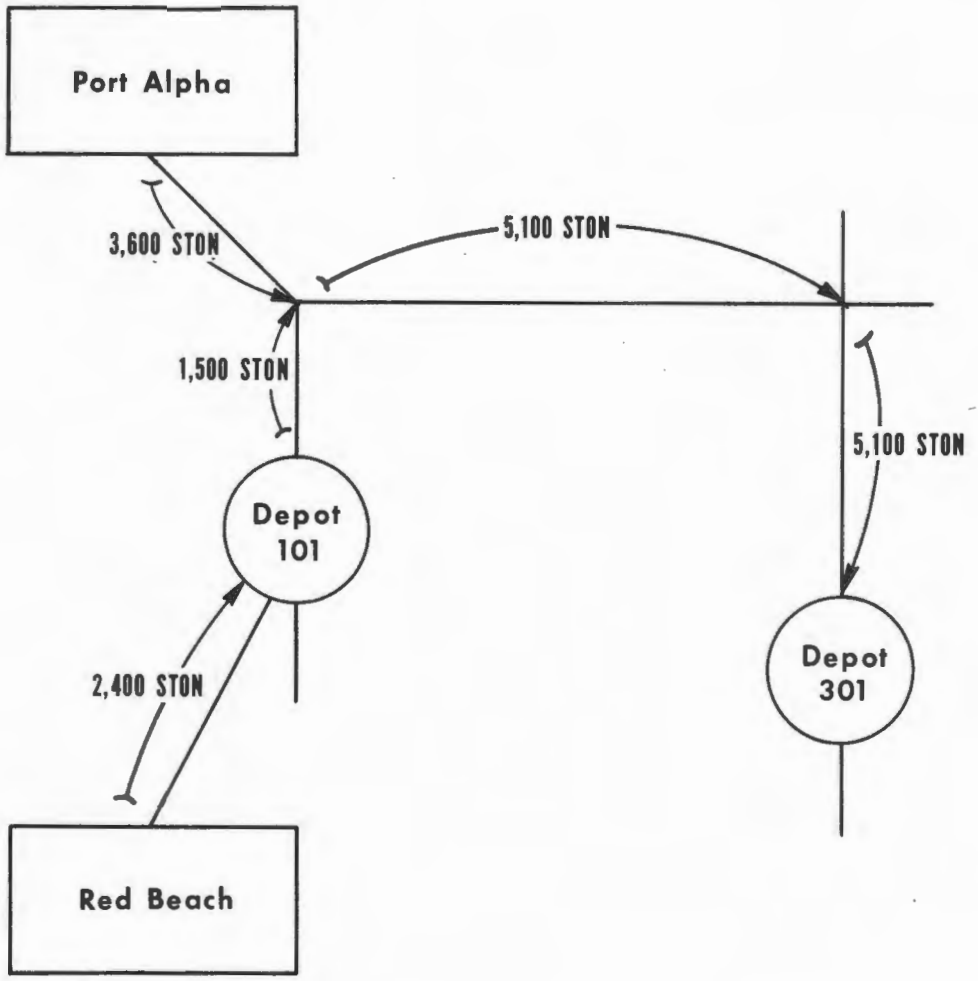


Figure 9-3. Tonnage information diagram.

b. Operational Planning Factors. The following operational factors will govern the planning for this operation:

(1) Round-the-clock operations; two 10-hour operating shifts.

(2) Vehicles available per unit—42.

(3) Load per 2½-ton truck—3.5 tons.

(4) Load per 12-ton cargo semitrailer—10 tons.

Note. Cargo to be transported is of a type that will permit vehicles to be loaded to indicated capacities without exceeding cubic capacities of vehicle cargo compartments.

(5) Rate of march: 20 mih—main supply route between origin and destination terminals
15 mih—Port Alpha to origin terminal
Depot 101 to origin terminal
Destination terminal to Depot 301
10 mih—Red Beach to Depot 101

(6) Delay times:

2.5 hours per round trip for loading and unloading straight trucks (1.25 hours for loading and 1.25 hours for unloading).

1 hour per relay (round trip per leg) for truck tractors engaged in line haul operations and / or shuttle operations between terminals and supported agencies.

c. Location of Truck Terminals (fig. 9-4). Since the operation involves a line haul, and the distances and operating factors dictate the establishment of short haul and / or shuttle tractor operations in conjunction with a trailer relay operation, it is necessary to determine the approximate locations of the origin and destination truck terminals for the line haul task in order to separate the line haul from

local operations and to identify specific workloads and tasks.

(1) The origin truck terminal should be centrally located near the road intersection between Port Alpha and Depot 101, provided a suitable site is available.

(2) The destination truck terminal should be located near the intersection of the road leading to Depot 301 to be near the cargo's destination and to be on the main route to allow for expansion forward without relocation.

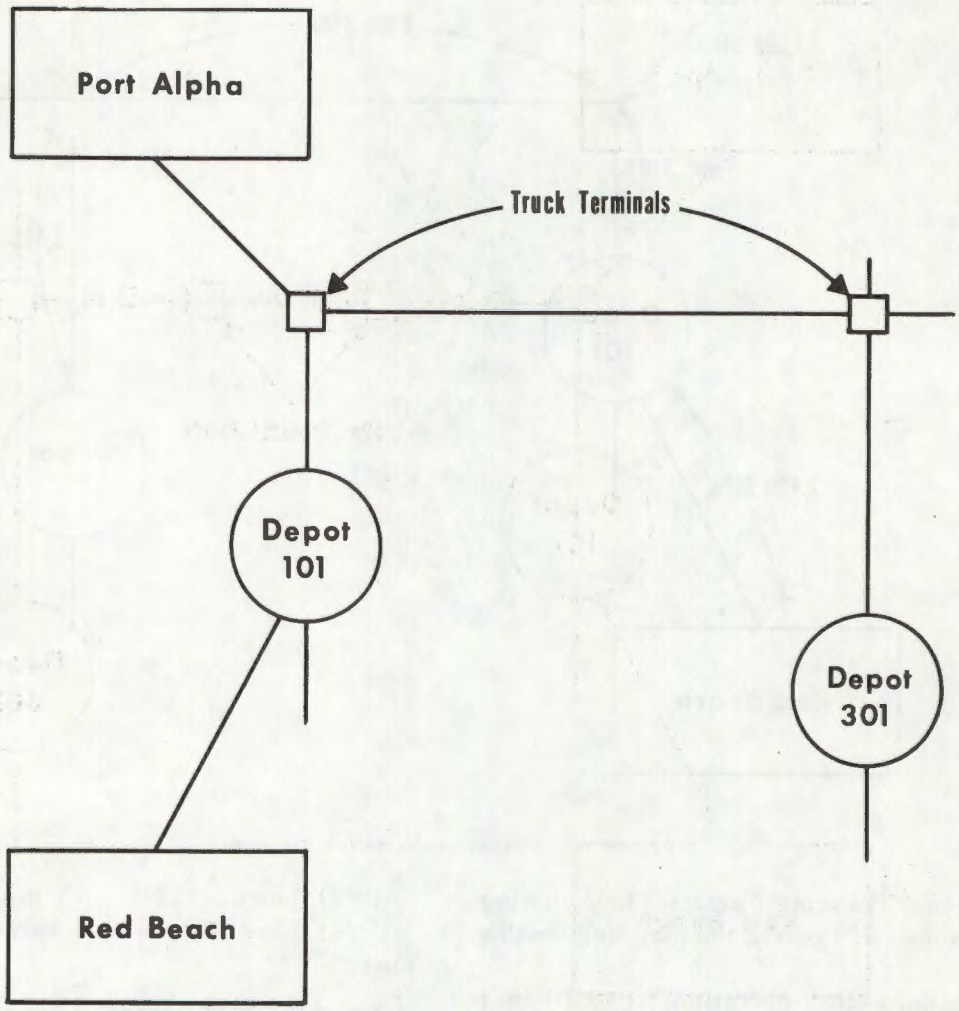


Figure 9-4. Location of truck terminals.

d. Location of Trailer Transfer Points. Before determining and computing the type and number of truck units required for each task for the line haul, the location of trailer transfer points to divide the line haul into legs must be determined so that total delays and total turnaround time for the entire line haul can be computed. The distance to allow between trailer transfer points to obtain a turnaround time of 10 hours (one shift in the operational day) is obtained as follows (the 1-hour delay in the formula is the 1-hour relay time per line haul leg):

$$\text{Distance} = \frac{(10 \text{ hours per operating shift} - 1 \text{ hour delay}) \times 20 \text{ mih}}{2}$$

$$= \frac{(10 - 1) \times 20}{2}$$

$$= 90 \text{ miles between trailer transfer points}$$

Trailer transfer points are then located as shown in figure 9-5. In addition to the consideration of distance to allow for the most desirable turnaround time, the planner must consider suitable sites for locating these facilities (paras 9-10 and 9-11). Note that the short leg (53 miles) has been placed forward. This is to avoid relocating any but the most forward trailer transfer point in the event of expansion of the operation.

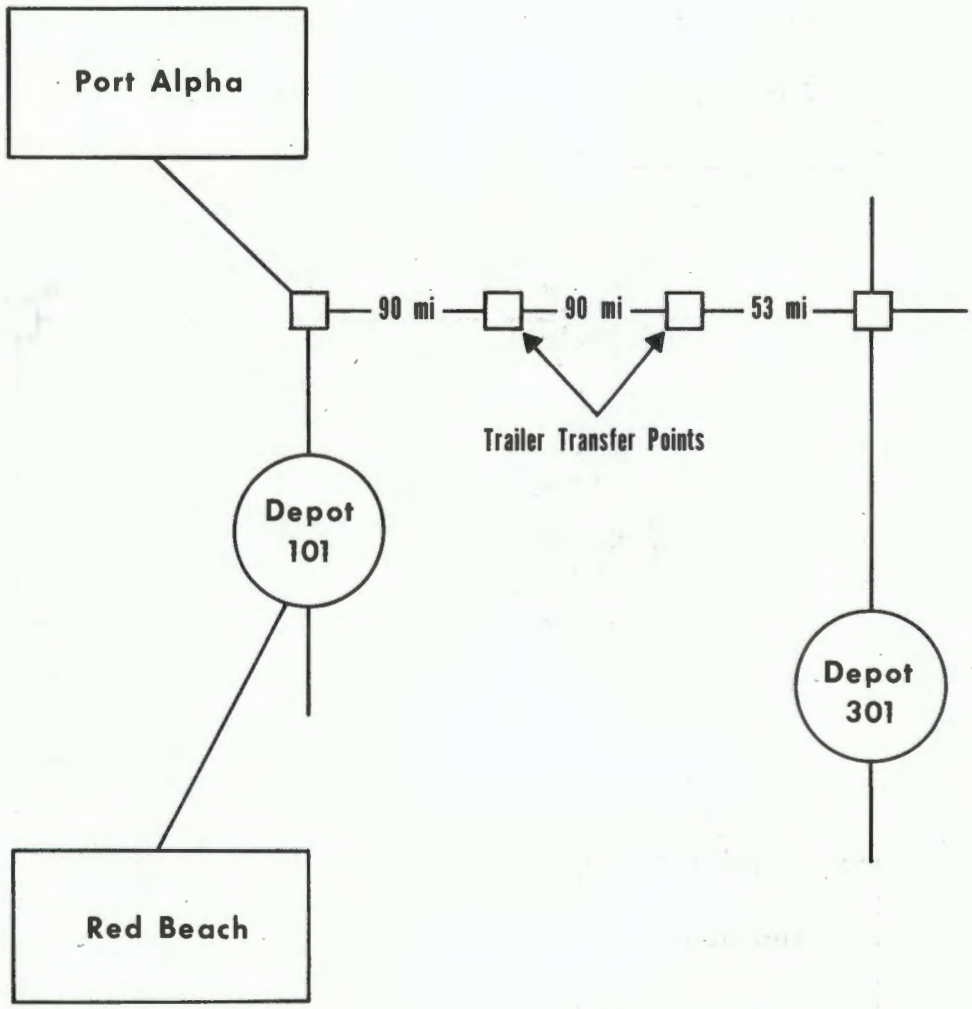


Figure 9-5. Location of trailer transfer points.

e. Types of Units Required. Based on the preceding information, specific tasks, workloads, and the types of units required to perform the various transport missions of this operation can now be determined. A study of the overall operation including the types of hauls involved, the operating areas, and the daily tonnage requirements indicates that the following types of units would be most suitable for the missions as indicated:

(1) Line haul from origin truck terminal to destination terminal: 5,100 short tons, medium truck companies (cargo).

(2) Port clearance from Port Alpha to origin truck terminal: 3,600 short tons, medium truck companies (cargo).

(3) Beach clearance from Red Beach to Depot 101: 2,400 short tons, light truck companies (2½-ton).

(4) Delivery of cargo from Depot 101 to origin truck terminal: 1,500 short tons, medium truck companies (cargo).

(5) Delivery of cargo from destination truck terminal to Depot 301: 5,100 short tons, medium truck companies (cargo).

f. Computing for Medium Truck Companies Required for the Line Haul Task.

Daily tonnage = 5,100 STON

$$\text{Turnaround time} = \frac{2 \times 233 \text{ miles}}{20 \text{ mih}} + \begin{matrix}\text{3 hours delay (1 hour for each relay,} \\ \text{3 relays for the line haul)}\end{matrix}$$

$$= 26.3 \text{ hours}$$

Tons per vehicle (12-ton semitrailer) = 10 STON
Vehicles available per company = 42
Operational day = 20 hours

Thus:

$$\text{Companies required} = \frac{5{,}100 \text{ STON} \times 26.3 \text{ hours}}{10 \text{ STON} \times 42 \text{ vehicles} \times 20 \text{ hours}}$$

$$= 15.96 \text{ or } 16.0 \text{ medium truck companies required}$$

g. Computing for Medium Truck Companies Required for Local Hauls.

(1) Movement of 5,100 short tons from destination truck terminal to direct support activity (Depot 301):

Daily tonnage = 5,100 STON

$$\text{Turnaround time} = \frac{2 \times 10 \text{ miles}}{15 \text{ mih}} + 1 \text{ hour delay (1 hour relay time)}$$

$$= 2.33 \text{ hours}$$

Ton per vehicle (12-ton semitrailer) = 10 STON
Vehicles available per company = 42
Operational day = 20 hours

Thus:

$$\text{Companies required} = \frac{5{,}100 \text{ STON} \times 2.33 \text{ hours}}{10 \text{ STON} \times 42 \text{ vehicles} \times 20 \text{ hours}}$$

$$= 1.41 \text{ or } 1.5 \text{ medium truck companies required}$$

(2) Movement of 3,600 short tons from Port Alpha to the origin truck terminal:

Daily tonnage = 3,600 STON

$$\text{Turnaround time} = \frac{2 \times 15 \text{ miles}}{15 \text{ mih}} + 1 \text{ hour delay (1 hour relay time)}$$

$$= 3 \text{ hours}$$

Tons per vehicle (12-ton semitrailer) = 10 STON
Vehicles available per company = 42
Operational day = 20 hours

Thus:

$$\text{Companies required} = \frac{3{,}600 \text{ STON} \times 3 \text{ hours}}{10 \text{ STON} \times 42 \text{ vehicles} \times 20 \text{ hours}}$$

$$= 1.28 \text{ or } 1.3 \text{ medium truck companies required}$$

(3) Movement of 1,500 short tons from Depot 101 to the origin truck terminal:

Daily tonnage = 1,500 STON

$$\text{Turnaround time} = \frac{2 \times 5 \text{ miles}}{15 \text{ mih}} + 1 \text{ hour delay (1 hour relay time)}$$

$$= 1.66 \text{ hours}$$

Tons per vehicle (12-ton semitrailer) = 10 STON
Vehicles available per company = 42
Operational day = 20 hours

Thus:

$$\text{Companies required} = \frac{1{,}500 \text{ STON} \times 1.66 \text{ hours}}{10 \text{ STON} \times 42 \text{ vehicles} \times 20 \text{ hours}}$$

= .29 or .3 medium truck company required

h. Total Medium Truck Companies Required.

(1) The total medium truck companies required for local and line haul tasks are as follows:

16.0 line haul
1.5 destination truck terminal to Depot 301
1.3 Port Alpha to origin truck terminal
.3 Depot 101 to origin truck terminal
19.1 or 20 truck companies

Note. One team, GE, medium truck squad (TOE 55-540) may be used as augmentation to meet the transport capability required by the .1 percent required over 19 companies. This would eliminate the need to assign a full 20 medium truck companies to the operation.

(2) Thus 20 medium truck companies, or 19 augmented by one medium truck squad, are required to accomplish all tasks for which medium truck companies have been selected. In this operation, the workload is shared among all medium truck companies, since all are connected with the semitrailer relay operation. Therefore, the fractional part of the unit requirement for each task is retained and included in the total; the total is then rounded off to the next higher number of units. However, where the workload cannot be shared among units doing varied tasks, the unit requirement for each task must be rounded off to the next higher whole number.

i. Computing for Light Truck Companies Required for Beach Clearance. Computation of the number of light truck companies required for moving 2,400 short tons daily from Red Beach to Depot 101 is as follows:

Daily tonnage = 2,400 STON

$$\text{Turnaround time} = \frac{2 \times 15 \text{ miles}}{10 \text{ mih}} + 2.5 \text{ hours delay}$$

(2.5 hours per round trip for loading and unloading straight trucks)

$$= 5.5 \text{ hours}$$

Tons per vehicle (2½-ton truck) = 3.5 STON
Vehicles available per company = 42
Operational day = 20 hours

Thus:

$$\text{Companies required} = \frac{2{,}400 \text{ STON} \times 5.5 \text{ hours}}{3.5 \text{ STON} \times 42 \text{ vehicles} \times 20 \text{ hours}}$$

$$= 4.48 \text{ or } 5 \text{ light truck companies (fraction raised to next higher number)}$$

Note. Three teams, GD, light truck squad (TOE 55-540) may be used as augmentation to meet the transport capability required by the .48 percent required over four companies. This would eliminate the need to assign a full five companies to the operation.

j. Control Units Required. Based on the preceding computations, either 19 medium truck companies with augmentation, or 20 full medium truck companies and either four light truck companies with augmentation, or five full light truck companies are required for the operation. In addition, four teams (team GF, TOE 55-540) are required to man the two trailer transfer points and the transfer operations in the truck terminals. For command and control of these units, four motor transport battalions and one motor transport group are required. (See FM 101-10-2, for basis of allocation.) The group commander has overall responsibility for the operation and assign a specific geographic area for location and operation to each battalion. The responsibility for operating each truck terminal is assigned to a specific battalion.

9-19. Collection of Operational Data

In planning for an operation, reliance must be placed on available facts, broad planning factors, and assumptions. Planning and operational procedures may be refined by applying data collected once an operation is underway (experience factor) to either adjust that operation or to substitute this known experience factor for assumptions or variables when planning subsequent transport operations. To provide this known operational data, a uniform system for collecting, reporting, and compiling data should be established for motor transport operating units. Data to be collected can be divided into two categories: unit operating data and highway and terrain data.

a. Unit operating data to be collected include, but are not limited to, the following information:

(1) Average load per vehicle by type and the tonnage moved by units in specific periods; average vehicle mileage for specific operating periods.

(2) Time required to move between specific points; delay times to include loading, unloading, relay, transfer, and servicing; and time required for administrative and logistical support.

(3) Average rate of march attainable (by type of vehicle) on specific routes and sections of routes.

(4) Maintenance data to include: vehicle downtime, vehicle availability, component life, fuel and lubricant consumption, and maintenance and / or repair problems peculiar to the area.

(5) Percentage of utilization for units and vehicles.

(6) The incidence and causative factors of accidents and losses sustained from accidents.

(7) Location of supported and supporting agencies and units.

b. Highway and terrain data to be collected include the following information:

(1) General road and / or route characteristics. (Much of this information may be provided by engineer road reconnaissance reports. However, motor transport operating units can collect and develop other supplemental data that directly affect operations such as distances between points, feasible loads per vehicle, types of vehicles suitable, and width of the roadway as it permits or prohibits two-way traffic.)

(2) Effect of weather and enemy action on the road net.

(3) Information regarding the impact of civilian traffic and other military traffic on the road net.

(4) General characteristics of terrain including trafficability, gradients, natural obstacles, and the effect of weather on trafficability.

APPENDIX A

REFERENCES

A-1. Army Regulations (AR's)

11-8	Principles, Objectives, and Policies of the Army Logistic System.
11-14	Logistic Readiness.
40-20	Evacuation of Patients.
55-1	CONNEX Container Control, Utilization, and Reporting.
55-165	Agreement Between Army and Air Force for Joint Operation of CONEX Containers in a Pooled Fleet.
55-355	Military Traffic Management Regulation.
310-25	Dictionary of United States Army Terms.
310-50	Authorized Abbreviations and Brevity Codes.
380-5	Department of the Army Information Security Program.
385-10	Army Safety Program.
385-40	Accident Reporting and Records.
385-55	Prevention of Motor Vehicle Accidents.
600-20	Army Command Policy and Procedure.
710-2	Materiel Management for Using Units, Support Units, and Installations.
746-1	Color, Marking, and Preparation of Equipment for Shipment.
750-series	Maintenance of Supplies and Equipment.

A-2. Field Manuals (FM's)

5-34	Engineer Field Data.
5-36	Route Reconnaissance and Classification.
8-35	Transportation of the Sick and Wounded.
19-4	Military Police Support, Theater of Operations.
19-25	Military Police Traffic Control.
19-30	Physical Security
20-22	Vehicle Recovery Operations.
21-5	Military Training Management.
21-6	Techniques of Military Instruction.
21-26	Map Reading.
21-30	Military Symbols.
21-48	Planning and Conducting Chemical, Biological, and Radiological (CBR) and Nuclear Defense Training Exercises.
21-60	Visual Signals.
24-16	Signal Orders, Records, and Reports.
27-10	The Law of Land Warfare.
29-2	Organizational Maintenance Management.
29-23	Direct Support Maintenance Battalions (Nondivisional).
29-30-1	Division Maintenance Battalion.
30-5	Combat Intelligence.
30-10	Military Geographic Intelligence (Terrain).
31-16	Counterguerrilla Operations.
31-25	Desert Operations.
31-35	Jungle Operations.
31-70	Basic Cold Weather Manual.
31-71	Northern Operations.
31-72	Mountain Operations.
31-81 (Test)	Base Defense.

31-85	Rear Area Protection (RAP) Operations.
55-1	Army Transportation Services in a Theater of Operations.
55-8	Transportation Intelligence.
55-10	Army Transportation Movements Management.
55-11	Air Movement Control Units.
55-15	Transportation Reference Data.
55-31	Army Motor Transport Units.
55-60	Army Terminal Operations.
55-70	Transportation Container Operations (to be published).
100-5	Operations of Army Forces in the Field.
100-10	Combat Service Support.
101-5	Staff Officers' Field Manual—Staff Organization and Procedure.
101-10-1	Staff Officers' Field Manual: Organizational, Technical, and Logistical Data (Unclassified data).
101-10-2	Staff Officers' Field Manual: Organizational, Technical, and Logistical Data—Extracts of Nondivisional Tables of Organization and Equipment.
(S) 101-10-3	Staff Officers' Field Manual: Organizational, Technical, and Logistical Data—Classified Data (U).

A-3. Technical Manuals (TM's)

5-series	Engineers.
9-500	Data Sheets for Ordnance Type Materiel.
38-750	The Army Maintenance Management Systems (TAMMS).
55-310	Motor Transport Operations.
55-311	Motor Convoy Security in Stability Operations.
750-series	Maintenance of Supplies and Equipment.

A-4. Tables of Organization and Equipment (TOE)

29-500	Composite Service Organization.
29-600	Organizational Maintenance Teams.
30-34	Military Intelligence Company, Technical Intelligence.
55-2	Headquarters and Headquarters Company, Transportation Command.
55-11	Headquarters and Headquarters Company, Transportation Motor Transport Brigade.
55-12	Headquarters and Headquarters Detachment, Transportation Motor Transport Group.
55-16	Headquarters and Headquarters Detachment, Transportation Motor Transport Battalion.
55-17	Transportation Light Truck Company.
55-18	Transportation Medium Truck Company.
55-19	Transportation Car Company (Support Command or Airborne Corps).
55-28	Transportation Heavy Truck Company.
55-62	Headquarters and Headquarters Company, Transportation Brigade, Field Army Support Command or Corps Support Command.
55-67	Transportation Light-Medium Truck Company.
55-84	Transportation Motor Transport Company, Supply and Transport Battalion Infantry Division (Mechanized).
55-87	Transportation Motor Transport Company, Supply and Transport Battalion, Armored Division.
55-88	Transportation Motor Transport Company, Supply and Transport Battalion, Infantry Division.
55-540	Transportation Motor Transport Teams.

A-5. Department of the Army Pamphlets (DA Pam)

108-1	Index of Motion Pictures and Related Audio-Visual Aids.
310-series	Military Publication Indexes.
690-80	Use and Administration of Local Civilians in Foreign Areas During Hostilities.
700-2	Commander's Supply and Maintenance Handbook.
750-series	Preventive Maintenance Guide for Commanders.

A-6. Technical Bulletin (TB)

55-46-1	Standard Characteristics (Dimensions, Weight, and Cube) for Transportability of Military Vehicles and Other Outsize / Overweight Equipment (in TOE Line Item Number Sequence).

A-7. DOD Regulation

4500.32-R	Military Standard Transportation and Movement Procedures (MILSTAMP).

A-8. DA Forms

285	Accident Report.
348	Equipment Operator's Qualification Record (Except Aircraft).
2028	Recommended Changes to Publications.
2400	Equipment Utilization Record.
2401	Organizational Control Record for Equipment.
2404	Equipment Inspection and Maintenance Worksheet.
2408-1	Equipment Daily or Monthly Log.
2408-5	Equipment Modification Record.
2409	Equipment Maintenance Log (Consolidated).

A-9. DD Forms

314	Preventive Maintenance Schedule and Record.
518	Accident—Identification Card.

A-10. Standard Forms (SF)

46	US Government Motor Vehicle Operator's Identification Card.
91	Operator's Report on Motor Vehicle Accidents.

APPENDIX B

METRIC CONVERSION TABLES

Linear Measure (Kilometers to Miles / Miles to Kilometers)

Kilometers to miles (km x .621 = mi) (km ÷ 1.609 = mi)			Miles to kilometers (mi x 1.609 = km) (mi ÷ .621 = km)		
1	=	.62	1	=	1.60
2	=	1.24	2	=	3.21
3	=	1.86	3	=	4.82
4	=	2.48	4	=	6.43
5	=	3.10	5	=	8.04
6	=	3.72	6	=	9.65
7	=	4.34	7	=	11.26
8	=	4.96	8	=	12.87
9	=	5.58	9	=	14.48
10	=	6.21	10	=	16.09
20	=	12.42	20	=	32.18
30	=	18.63	30	=	48.27
40	=	24.84	40	=	64.36
50	=	31.05	50	=	80.45

Linear Measure (General)

Unit	Miles	Kilometers	Yards	Meters	Feet	Inches	Centimeters
1 mile	.....	1.609	1,760	1609.3	5,280	63,360	160,933
1 kilometer	0.6214	....	1,093.6	1000	3,281	39,370	100,000
1 yard	.....	....	.....	0.9144	3	36	91.44
1 meter	.....	....	1.0936	.....	3.281	39.37	100
1 foot	.....	....	0.333	0.3048	....	12	30.48
1 inch	.....	....	.....	.....	0.0833	.....	2.540
1 centimeter	.....	....	.....	.....	0.0328	0.3937	.....

Liquid Measure

Gallons (US)	x	3.785	=	liters
Gallons (US)	x	.8327	=	gallons (imperial)
Gallons (US)	x	3.332	=	quarts (imperial)
Quarts (US)	x	.946	=	liters
Quarts (US)	x	.2082	=	gallons (imperial)
Quarts (US)	x	.8327	=	quarts (imperial)
Liters	x	.2642	=	gallons (US)
Liters	x	1.057	=	quarts (US)
Liters	x	.2201	=	gallons (imperial)
Liters	x	.8804	=	quarts (imperial)
Gallons (imperial)	x	1.201	=	gallons (US)
Gallons (imperial)	x	4.802	=	quarts (US)
Gallons (imperial)	x	4.545	=	liters
Quarts (imperial)	x	.3001	=	gallons (US)
Quarts (imperial)	x	1.201	=	quarts (US)
Quarts (imperial)	x	1.136	=	liters

Speed Conversion

Unit	Knots	Statute miles per hour	Kilometers per hour	Feet per minute	Feet per second	Meters per minute	Meters per second
1 knot*	.....	1.1516	1.8532	101.34	1.6890	30.89	0.5148
1 mile per hour	0.8684	.....	1.6093	88.00	1.4667	26.82	0.4470
1 kilometer per hour	0.5396	0.6214	.....	54.68	0.9113	16.67	0.2778

* One knot—nautical mile per hour.

APPENDIX C

METHODS OF LOADING AND UNLOADING CARGO SEMITRAILERS IN THE MOVEMENT OF TWO SEMITRAILERS BY ONE TRUCK TRACTOR

Section I. DISCUSSION

C-1. General

a. When the requirement arises to load one semitrailer onto another for transport, problems may arise if no loading facilities or equipment (ramps, loading docks, gantry cranes, or other loading or lifting devices) are available. This appendix offers several methods by which units in the field may conduct an operation of this type using various expedient loading or unloading measures.

b. In an operation in which semitrailers are loaded onto other semitrailers and either shipped as cargo or moved from one point to another as a matter of convenience, close coordination with the receiving activity must be accomplished to assure that that activity will have the equipment and / or facilities available to perform unloading procedures. In this connection, it may be necessary to combine varied operational procedures by using one loading method at origin and a different unloading method at destination. For instance, semitrailers loaded by using a portable ramp at origin may, at destination, be required to be unloaded using a modified terrain feature or a permanent loading dock. Further, if lifting devices of sufficient capacity are available at destination, such as when semitrailers are being moved into a port area, semitrailers ramp-loaded at origin may be unloaded by being lifted off at destination. This fact must be considered in planning and conducting an assigned transport mission.

c. When loading and unloading procedures involve the use of tractors to position semitrailers on, or remove them from, transporting semitrailers, care must be taken to insure that the tractor operators employed are the fully qualified and experienced drivers.

d. In the first method described in this appendix and illustrated in figure C-1 (flip method, para C-3), the transported and transporting semitrailers ride bed-to-bed; the securing of the transported semitrailer for movement is simply a matter of properly securing it in place on the cargo bed of the transporting semitrailer using chains, wire rope, or banding devices for tiedown. In the other methods described herein and illustrated in figures C-2 through C-5, the transported semitrailer rests in an upright position (on its wheels and landing gear) on the bed of the transporting semitrailer; it must not only be tied down but also must be securely blocked and braced for movement.

e. To prevent accidents, personal injuries and / or damage to equipment, and delays, care must be taken to make certain that the transporting tractor-semitrailer unit rests on as level and compacted a surface as is possible during loading and unloading. When the transporting semitrailer is not hooked up to a tractor during operations, special care must be taken to insure that—

(1) The surface on which the landing gear rests is firm. If necessary, the ground surface will be strengthened and reinforced using fill, gravel, lumber or timbers, pierced steel planking, or any other suitable materials available, to reduce the possibility of landing gear legs sinking into the ground during loading and unloading.

(2) The wheels of the transporting semitrailer are blocked and the brakes are set to prevent movement of the semitrailer during the operation.

Section II. LOADING AND UNLOADING METHODS

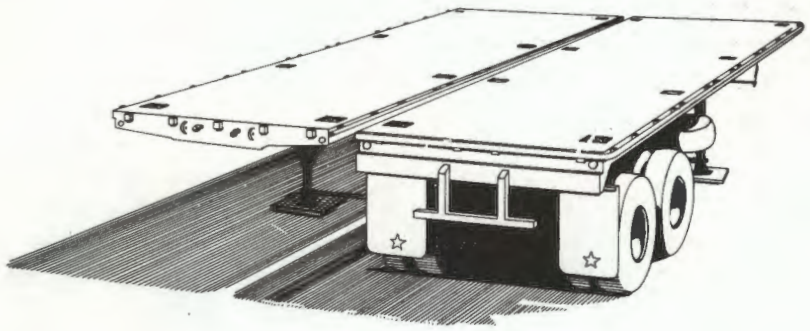
C-2. General

The several methods of loading and unloading semitrailers to be transported as presented in this appendix are not intended to be either all-inclusive or restrictive. Depending upon the personnel and equipment or facilities available—and on the ingenuity of personnel engaged in the operation—units in the field may devise and use other suitable

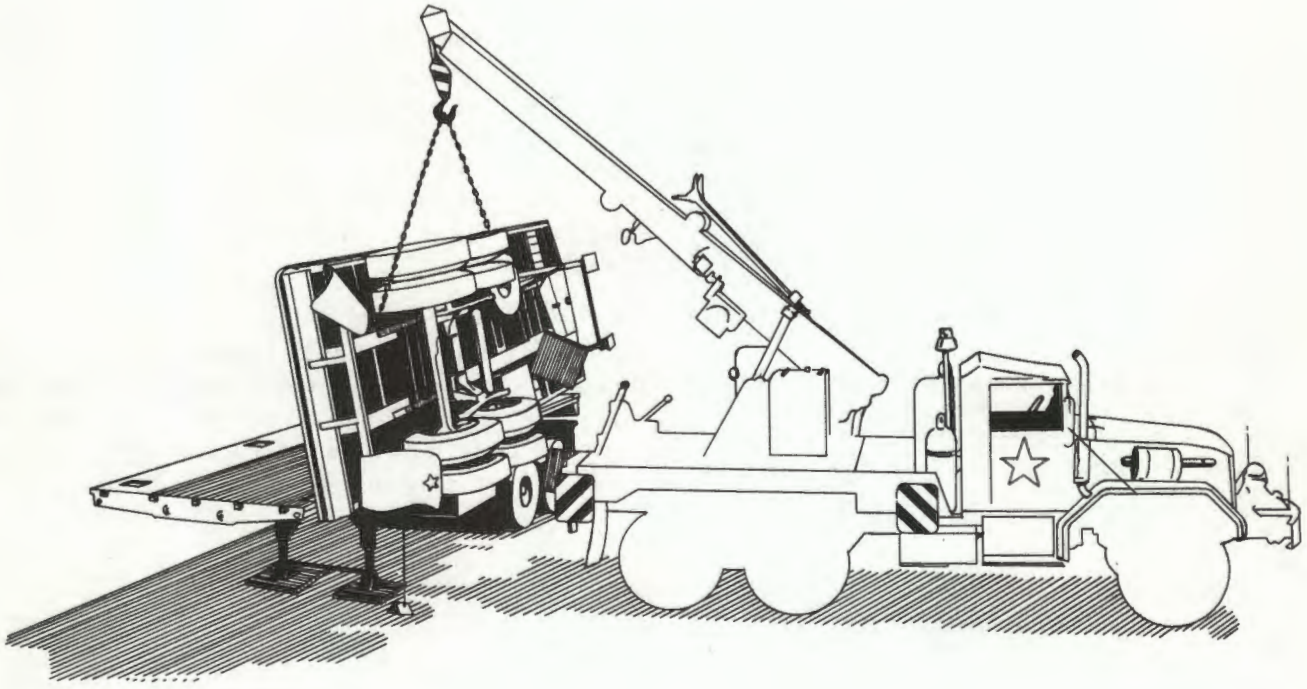
methods or may use variations and expedients (for example, substitution of plank treadways for portable ramps) for the methods discussed herein.

C-3. Flip Method

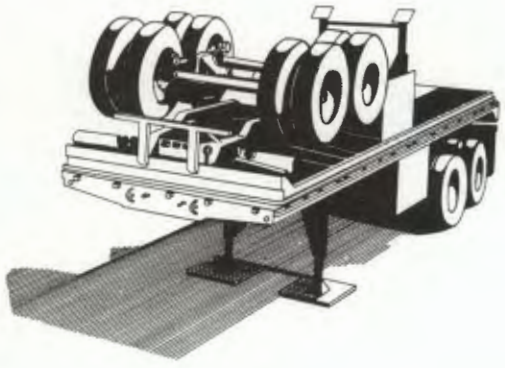
a. This method loads the transported semitrailer onto the transporting semitrailer in a bed-to-bed position. It requires no fabrication of facilities and can be performed using a unit wrecker (or other available lifting device).



(a)



(b)



(c)

Figure C-1. Flip method for loading semitrailers.

b. The loading procedure is as follows:

(1) Spot two stake and platform semitrailers, with side and end boards removed, side by side as shown in figure C-1a (park axle-to-axle or axle-to-landing-gear as desired).

(2) Fasten siderails together at two or more places using chain, wire rope, or other available material, passed through the side rails.

(3) Use wrecker (or other lifting device) to lift the off-side of the transported semitrailer and flip it over onto the cargo bed of the transporting semitrailer (fig C-1 *b* and 1 *c*).

Note. Retract the landing gear either after the initial lift of the transported semitrailer, or after it is positioned on the cargo bed of the transporting semitrailer.

(4) Secure transported semitrailer to bed of the transporting semitrailer using chains and / or wire rope; load and tie down side and end boards.

c. To unload the transported semitrailer at destination the procedure is a general reversal of the loading steps. All tiedowns are removed and the side and end boards are unloaded; siderail tiedowns are attached and a wrecker or lifting device is used to lift and flip the transported semitrailer back onto the ground; the siderail ties are then removed.

Note. Extend the landing gear after the rear wheels of the transported semitrailer rest on the ground; use the wrecker to hold the load until the gear is extended.

d. Field reports indicate that the following problems may be encountered when using this transport method:

(1) Siderails and marker lights on both semitrailers may be damaged during the flipping process (both loading and unloading).

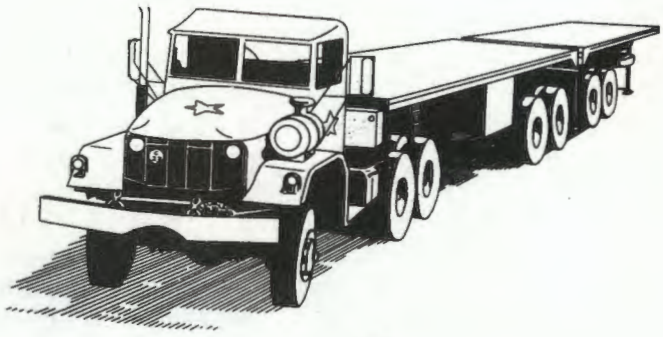
(2) Brake fluid may be lost from the transported semitrailer by leakage through the master cylinder vent and hydraulic fluid may be lost from the landing gear due to the semitrailer resting in an upside down position during transport.

Operating personnel are cautioned to use care during loading and unloading to minimize damage. After delivery, both semitrailers will be inspected and serviced and / or repaired prior to being put back into road service.

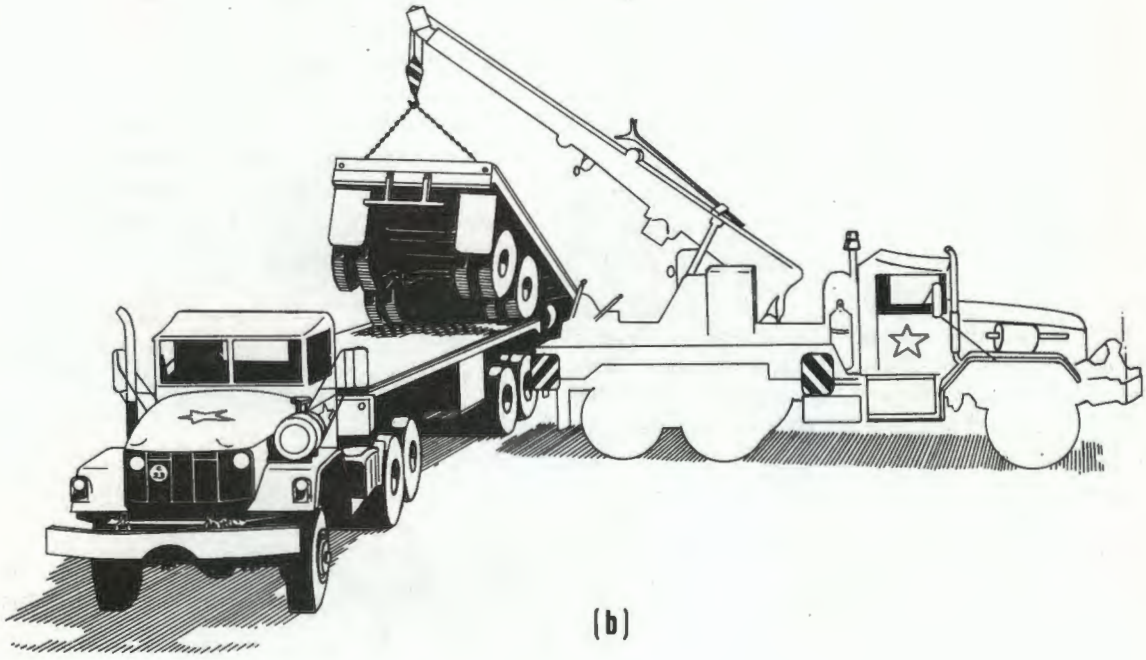
e. A variation of this flip method is one in which the transported semitrailer is first flipped over to rest on its bed, upside down on the ground. Two wreckers—one set off to the side at each end—then lift and hold this semitrailer while the transporting semitrailer is maneuvered and backed under it. The transported semitrailer is then lowered into proper load position in the bed of the transporting semitrailer.

C-4. Lifting Method

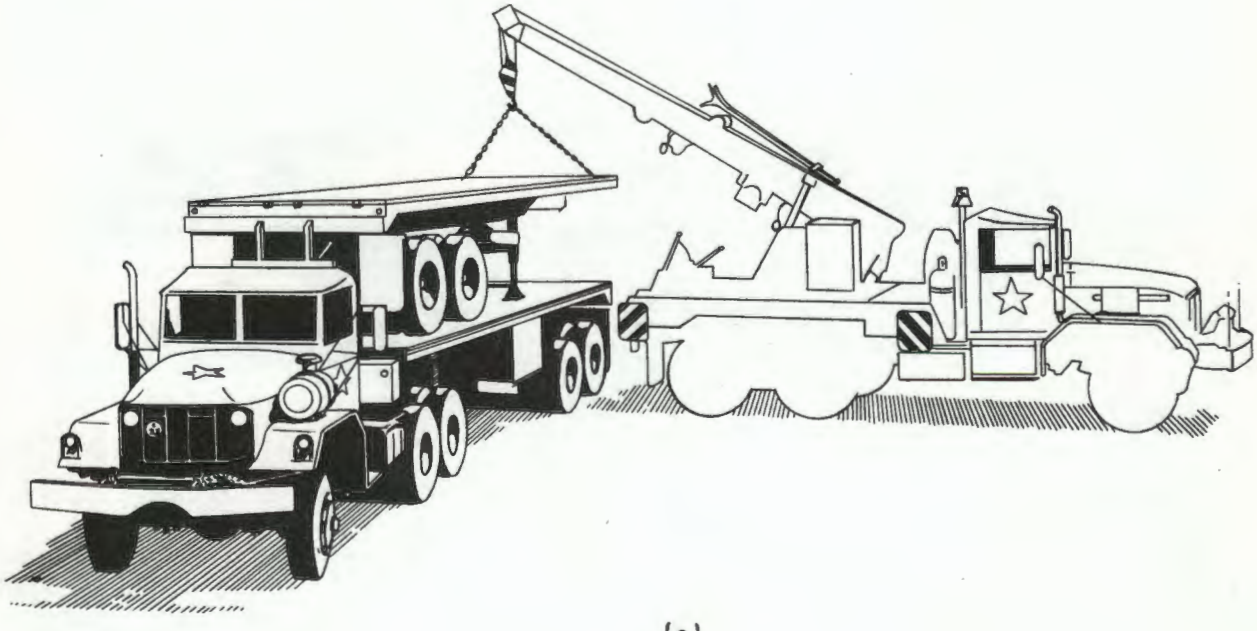
a. This method loads the transported semitrailer onto the transporting semitrailer in an upright position. It requires no fabrication of facilities and can be performed using one tractor and the unit wrecker (or other suitable, available lifting device).



(a)



(b)



(c)

Figure C-2. Lifting method for loading semitrailers.

b. The loading procedure is as follows:

(1) Back transporting semitrailer up to rear of transported semitrailer (fig C-2 *a*).

(2) Use wrecker to lift transported semitrailer by the rear lifting shackle (fig C-2 *b*).

(3) Back transporting semitrailer approximately half way under lifted semitrailer; lower lifted semitrailer onto cargo bed of transporting semitrailer.

(4) Shift wrecker to front end of transported semitrailer and, using front lifting shackle, lift front end.

(5) Hold and maneuver transported semitrailer with wrecker boom while transporting semitrailer is backed into proper position under the load; lower transported semitrailer onto cargo bed of transporting semitrailer (fig C-2 *c*).

(6) Block, brace, and tie down transported semitrailer; load and secure side and end boards.

Note. If two wreckers or lifting devices are available they may be positioned—one set off to the side at each end of the transported semitrailer—and used to lift and hold that semitrailer while the transporting semitrailer is maneuvered and backed under it. The transporting semitrailer is then lowered into proper load position on the bed of the transporting semitrailer.

c. To unload the semitrailer at destination using this same method (where loading ramp or other unloading facility is not available) the loading steps are generally reversed as follows:

(1) Remove semitrailer tiedowns and blocking and bracing; unload side and end boards.

(2) Using wrecker, lift transported semitrailer by front lifting shackles; hold while transporting semitrailer is moved forward approximately three-quarters of its length.

(3) Lower front end of transported semitrailer onto the ground.

(4) Shift wrecker to rear of transported semitrailer and using rear lift shackle, lift free of transporting semitrailer; move transporting semitrailer out.

(5) Lower rear of transported semitrailer to the ground; release from wrecker lift.

(6) Install (or load) side and end boards; move semitrailer out.

C-5. Portable Ramp Method

a. This method requires the fabrication, from available lumber and / or metal, of a portable ramp (mounted on skids, rollers, or wheels) for use in the loading process.

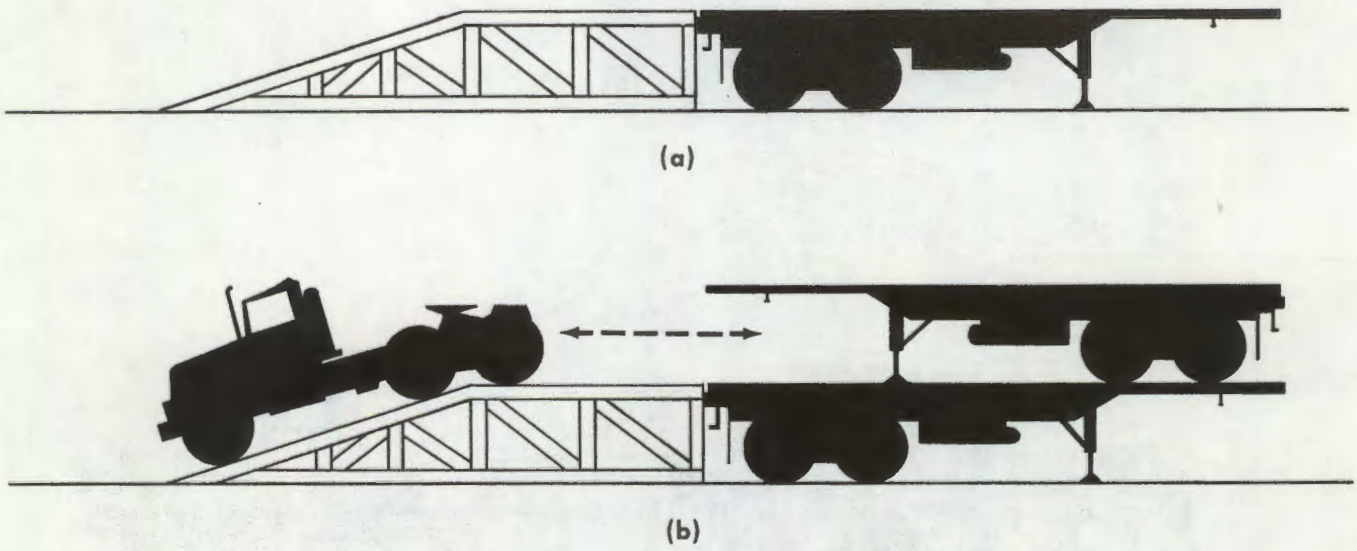


Figure C-3. Portable ramp used for loading semitrailers.

b. The loading procedure is as follows:

(1) Position ramp at rear of transporting semitrailer (fig C-3 *a*).

Caution. **It ramp is on wheels or rollers it must be blocked to prevent movement. If the transporting semitrailer is not hooked to a tractor during loading the wheels must be blocked and the brakes set.**

(2) Use tractor to back transported semitrailer up ramp and onto transporting semitrailer; extend landing gear, uncouple and remove tractor (fig C-3 *b*.).

(3) Block, brace, and tie down transported semitrailer; load and secure side and end boards.

c. To unload the semitrailer at destination using this same method, the loading steps are generally reversed as follows:

(1) Place portable ramp in position at rear of transporting semitrailer.

Caution. **Instructions contained in caution to paragraph C-5 *b* (1) apply as appropriate during unloading.**

(2) Remove semitrailer tiedowns and blocking and bracing (unload side and end boards as required).

(3) Back towing tractor into position and up ramp; hook up and tow transported semitrailer from transporting semitrailer.

(4) Install (or load) side and end boards; move semitrailer out.

C-6. Fixed Ramp Method

a. This method is performed in an almost identical manner as when loading with a portable ramp. In this case, however, the ramp used is an inmovable field expedient type, and the transporting semitrailer must be backed into position at the ramp for loading.

b. The fixed ramp is prepared using heavy timbers or railroad ties (fig C-4 *a*) or impacted earth (fig C-4 *b*). The timbers or ties should be spiked, bolted, or otherwise secured together; the earthen ramp should be firmly tamped and then surfaced with planks, pierced steel planking, or other available materials to provide a firm, solid surface over which to load. The earthen ramp should also be shored at the loading end to prevent breakdown during use.

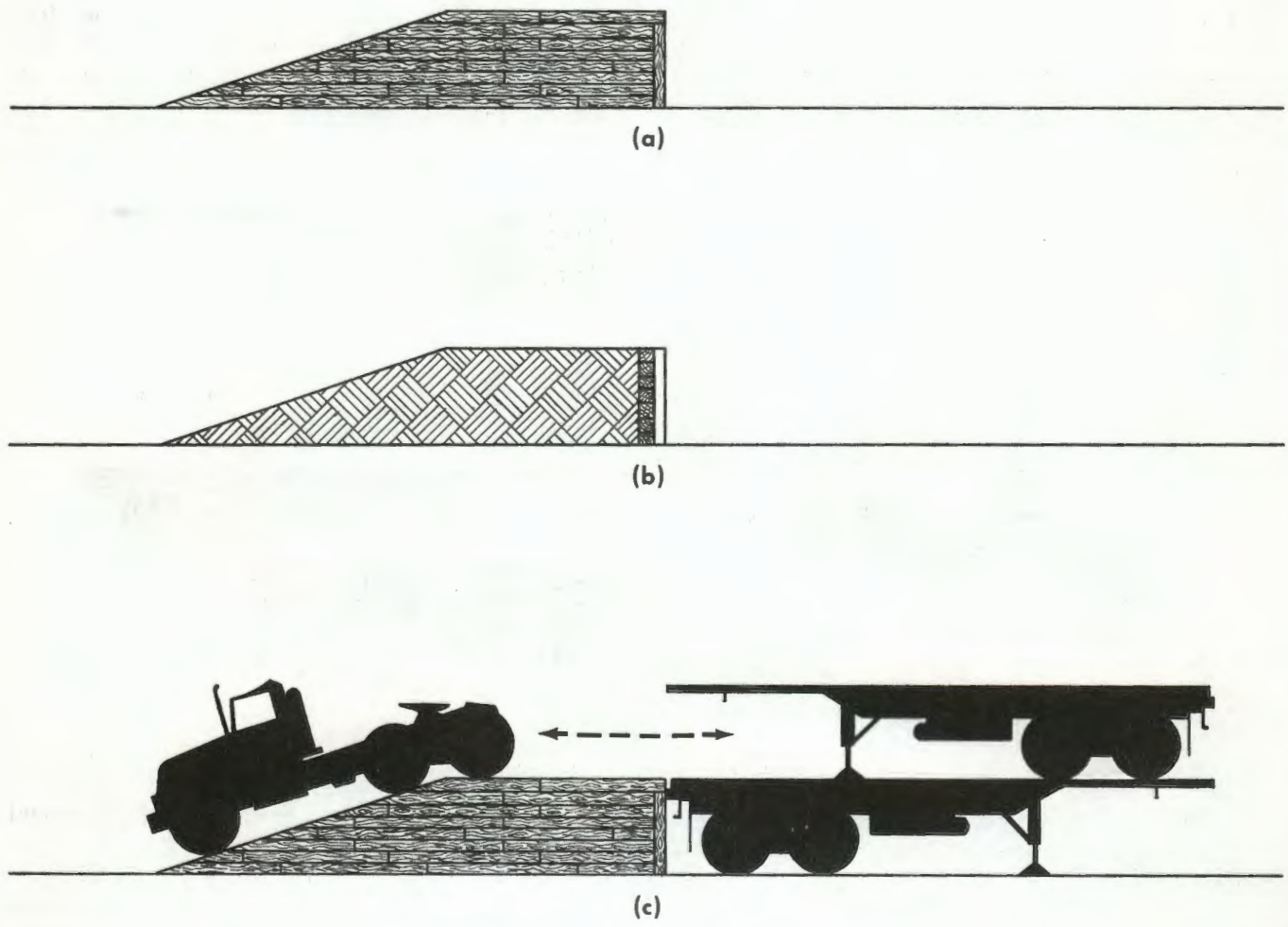


Figure C-4. Nonportable ramp used for loading semitrailers.

c. The loading procedure is as follows:

(1) Back transporting semitrailer into position at ramp as shown in figure C-4 *c*.

Caution. **If the transporting semitrailer is not hooked to a tractor during loading, the wheels must be blocked and the brakes set.**

(2) Back semitrailer to be transported up ramp and into position on bed of transporting semitrailer; extend landing gear, uncouple and remove tractor (fig C-4 *c*).

(3) Block, brace, and tie down transported semitrailer; load and secure side and end boards.

d. To unload the semitrailer at destination using a tow-off method, either a portable or fixed ramp or other similar facility may be used.

(1) If a portable ramp is used, the procedures as outlined in paragraph C-5 *c* apply.

(2) If a fixed ramp or facility is used, the provisions of paragraph C-5 *c* apply except that in C-5 *c* (1), the transporting *semitrailer is backed into position* at the fixed ramp or facility.

C-7. Use of Terrain Features

a. Natural or manmade terrain features (arroyos, dry river beds, natural land depressions, cuts and fills, ditches, trenches, etc.) may be used or adapted for use as loading ramps. Depending upon the contours of the feature used, either little or no pioneer work, or extensive work may be required to prepare it for operations.

(1) In some cases, a cut or fill, irrigation ditch, roadside drainage ditch, or other type ditch or trench may require little or no pioneer work to prepare it as a loading ramp. Figure C-5 *a* illustrates how such a feature may be used to load one semitrailer onto another.

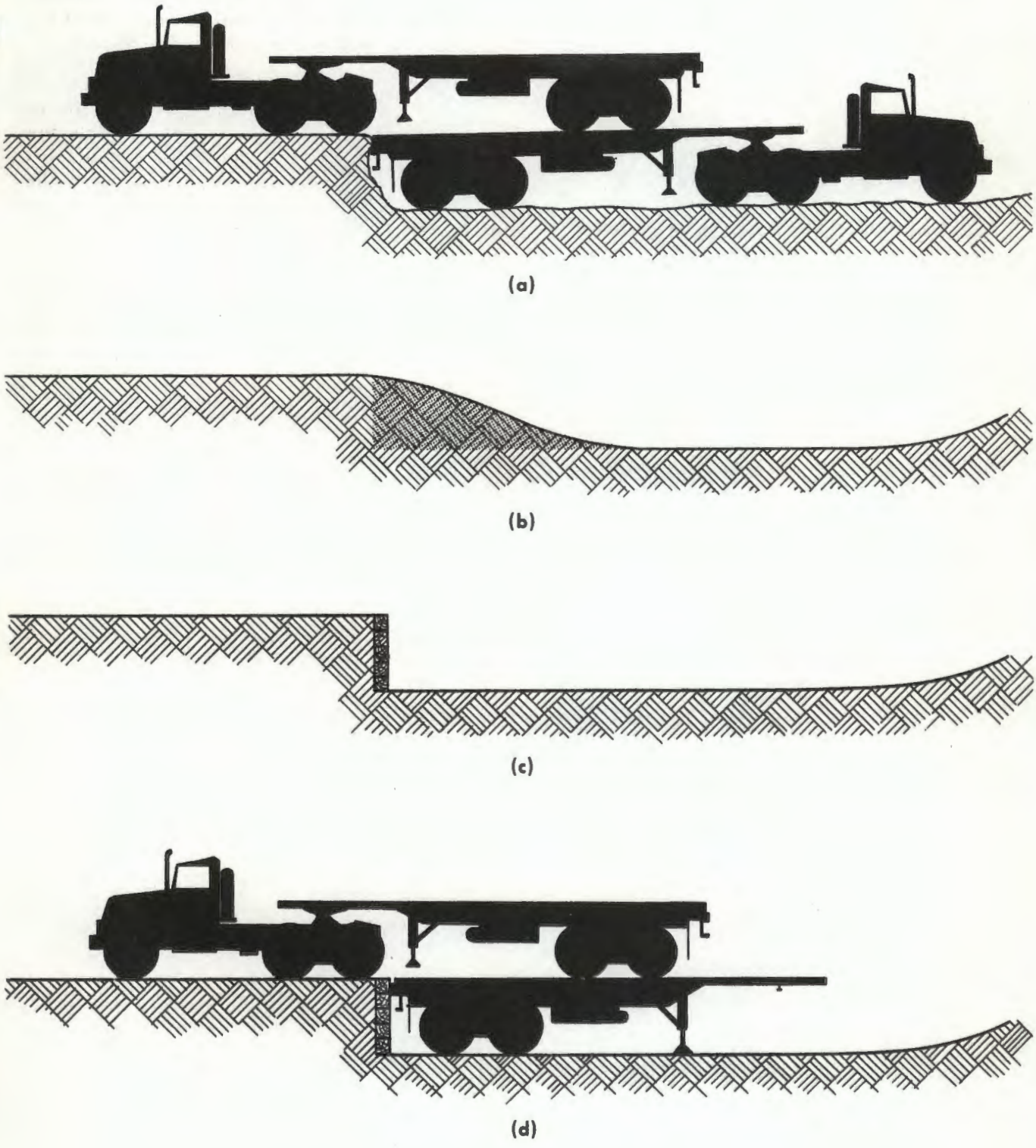


Figure C-5. Use of terrain features for loading semitrailers.

(3) In other cases, an arroyo, dry river bed, or natural depression may require fairly extensive work to prepare it as a loading ramp. Figure C-5 *b* illustrates a cross section of such a feature—the heavily shaded area illustrates where earth removal is required to prepare a suitable ramp. Figure C-5 *c* illustrates the feature after it is prepared; note that the face of the cut has been shored to prevent breakdown during use.

b. The loading procedure (fig C-5 *d*) generally follows the procedures for ramp loading as stated in paragraphs C5 *b* and C-6 above.

c. The method of unloading the transported semitrailer at destination will depend upon the facilities available at that point and can be accomplished in any of the procedures as outlined in paragraphs C-4 *c*, C-5 *c*, and C-6 *d*, above, or it may be unloaded using a terrain feature to provide the unloading facility.

APPENDIX D

TYPE TIME-DISTANCE TABLE

The following table may serve as a guide in planning motor transport movements. A tabular listing is given of the time required for vehicle(s) to move a specified distance at specific speeds and rates of march. Planners can modify the table to suit their specified needs.

Time-Distance Table for Selected Vehicle Speeds

Distance		Traveltime [1]					
		Rate		Rate		Rate	
		10 mph (7.5 mih) 16 kmph (12 kih)		20 mph (15 mih) 32 kmph (24 kih)		30 mph (25 mih) 48 kmph (40 kih)	
Km	*Mi*	*Hr*	*Min*	*Hr*	*Min*	*Hr*	*Min*
1		0	5	0	2.5	0	1.5
	1	0	8	0	4	0	2.4
2		0	10	0	5	0	3
3		0	15	0	7.5	0	4.5
	2	0	16	0	8	0	4.8
4		0	20	0	10	0	6
	3	0	24	0	12	0	7.2
5		0	25	0	12.5	0	7.5
6		0	30	0	15	0	9
	4	0	32	0	16	0	9.6
7		0	35	0	17.5	0	10.5
8		0	40	0	20	0	12
	5	0	40	0	20	0	12
9		0	45	0	22.5	0	13.5
	6	0	48	0	24	0	14.4
10		0	50	0	25	0	15
	7	0	56	0	28	0	16.8
	8	1	4	0	32	0	19.2
	9	1	12	0	36	0	21.6
	10	1	20	0	40	0	24
20		1	40	0	50	0	30
30		2	30	1	15	0	45
	20	2	40	1	20	0	48
40		3	20	1	40	1	0
	30	4	0	2	0	1	12
50		4	10	2	5	1	15
	40	5	20	2	40	1	36
	50	6	40	3	20	2	0

[1] The mph / kmph figures indicate vehicle speed (miles or kilometers per hour), and the mih / kih figures indicate the rate of march (miles or kilometers in the hour) for that speed.

APPENDIX E

STANAG 2041 (EDITION NO. 3)
OPERATION ORDERS FOR ROAD MOVEMENT, TABLES AND GRAPHS

Agreed English / French Texts

STANAG 2041 (Edition No. 3)
NAVY / ARMY / AIR

NATO STANDARDIZATION AGREEMENT
(STANAG)
OPERATION ORDERS FOR ROAD MOVEMENT, TABLES AND GRAPHS

Annexes: A. Example of an Operation Order for Road Movement
B. Specimen Road Movement Table
C. Example of a Road Movement Graph

Related Documents: STANAG 2014— Operation Orders, Annexes to Operational Orders, Administrative and Logistics Orders
STANAG 2029— Method of Describing Ground Locations, Areas and Boundaries.
STANAG 2151— Route Network—Definitions and Characteristics.
STANAG 2154— Definitions and Regulations for Military Movement by Road.

OBJECT

1. The aim of this Agreement is to standardize operation orders, tables and graphs for road movement.

AGREEMENT

2. Participating nations agree to use the standard layouts for operation orders for road movement, road movement tables and graphs, as given in Annexes A to C. The instructions given in subsequent paragraphs are in amplification of these layouts.

DEFINITIONS

3. These definitions are taken from the NATO Glossary of Military Terms in English and French (AAP-6) and are repeated for convenience:

a. Warning Order. A preliminary notice of an order or action which is to follow. It is designed to give subordinates time to make necessary plans and preparations.

b. Operation Order. A directive, usually formal, issued by a commander to subordinate commanders for the purpose of effecting the coordinated execution of an operation.

c. Standing Operating Procedures. Set of instructions covering those features of operations which lend themselves to a definite or standardized procedure without loss of effectiveness. The procedure is applicable unless prescribed otherwise in a particular case.

d. Standing Order. Promulgated order which will remain in force until amended or cancelled.

ORDERS

4. Warning orders and operation orders are the primary means of effecting a road movement. Much detail can be eliminated from these orders by the use of standing operating procedures and standing orders for road movement.

a. Warning Orders. These orders are issued when required and should include sufficient data to alert troops for movement and to allow subordinate commanders to make preliminary plans. The amount of detail included will depend on the military and traffic situation, the state of training of the troops and the extent to which standing orders / standing operating procedures have been developed.

b. Operation Orders for Road Movement. Whenever possible, detailed orders should be issued in the form of operation orders for road movement, in conformity with STANAG 2014 and Annex A. Annexes to the orders may include road movement tables and / or road movement graphs (See Annexes B and C). Overlays may be used to reduce the amount of written detail.

c. Standing Operating Procedures and Standing Orders. This instructions should contain information on techniques, drills and procedures which are likely to be constant under any conditions. Properly developed, they will help to avoid unnecessary repetition of detail in orders. Some headings that may be used in preparing standing operating procedures and standing orders are:

(1) Composition and duties of advance party.
(2) Vehicle loads, including personnel.
(3) Grouping of vehicles and group commanders.
(4) Organization of columns.
(5) Sign-posting and traffic control.
(6) Responsibility for manning start point and release point.
(7) Discipline; halts; lighting.
(8) Action in the event of enemy attack.
(9) Drill for establishing headquarters on arrival.
(10) Responsibility for issue of operation orders for movements for headquarters.
(1) Safety measures.

ROAD MOVEMENT TABLES (See Annex B)

5. a. Road movement tables will consist of two parts; one giving "data" paragraphs reflecting general information common to two or more columns (or elements of column), the other listing the columns (or elements of column), together with all other necessary information arranged in tabular form.

b. These afford a convenient means of transmitting to subordinates their schedules and other essential detail pertaining to road movement. This is particularly so in cases when the inclusion of such detail in the body of the operation order would tend to complicate it or make it unduly long.

c. They will frequently require a wider distribution than a normal operation order so that copies can be issued to movement control personnel, traffic posts, etc.

d. Their security classification will be based on content and need not necessarily be the same as that of the operation order for road movement.

ROAD MOVEMENT GRAPHS (See Annex C)

6. General

a. Road movement graphs are used by staffs in planning, supervising and regulating complicated movements and for providing a convenient means of recording actual moved of units over a period.

b. The unit of measure to be used, i.e. kilometres or miles, will depend on the requirements of the authorities concerned. However, the resulting orders and instructions should not contain a mixture of units except where both are shown throughout, e.g. 5 miles / 8 kilometres.

7. Pass Time. Pass time is calculated by the following formula:

$$\text{Pass time (in mins)} = \frac{N \times 60}{D \times S} + \frac{N}{25}$$

Where N = Number of vehicles
D = Density
S = Average speed

In the case when a column consists of 600 vehicles or more the formula should read:

$$\frac{N \times 60}{D \times S} + \frac{2N}{25}$$

8. Gaps Between Columns. Between columns having different movement numbers, no standard gaps are prescribed; these gaps are allotted by the staff ordering the movement.

IMPLEMENTATION OF THE AGREEMENT

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

ANNEX A TO STANAG 2041 (Edition No. 3)

EXAMPLE OF AN OPERATION ORDER FOR ROAD MOVEMENT

(See STANAG 2014)

(Subheadings of paragraphs 3, 4 and 5 are intended as a guide only)

SECURITY CLASSIFICATION)

(Change from Oral Orders, if any)

Copy No. ..... of ..... copies
Issuing Headquarters
Place of Issue (may be in code)
Date-Time Group of Signature
Message Reference No.

MOVEMENT ORDER No.

References: A. Maps, tables and relevant documents (See STANAG 2029)
B.

Time Zone used throughout the Order:

Task Organization

1. SITUATION
   a. Enemy Forces.
   b. Friendly Forces.
   c. Attachments and Detachments.
   d. Commander's Evaluation (optional).
2. MISSION
3. EXECUTION
   a. Concept of movement.
   b. Tasks to subordinate units.
   c.
   d.
   e. Detailed timings.

(SECURITY CLASSIFICATION)

3. f. Coordinating Instructions
   (1) Order of March
   (2) Routes
   (3) Density
   (4) Speed
   (5) Method of Movement
   (6) Defence on Move
   (7) Start, Release or Other Critical Points
   (8) Convoy Control
   (9) Harbour Areas
   (10) Instruction for Halts
   (11) Lighting
   (12) Air Support
4. SERVICE SUPPORT
   a. Traffic Control
   b. Recovery
   c. Medical
   d. Petrol, Oil and Lubricants
   e. Water

(SECURITY CLASSIFICATION)

5. COMMAND AND SIGNAL

a. Commander / s

b. Communications

c. Position of key Vehicles

Acknowledgment Instructions:

Authentication:

Annexes:

Distribution:

Last name of commander

Rank

(SECURITY CLASSIFICATION)

ANNEX B TO STANAG 2041 (Edition No. 3)

SPECIMEN ROAD MOVEMENT TABLE

(A guide only, will need adjustment to suit individual cases)

(SECURITY CLASSIFICATION)

Annex B - "Movement Table" to Operation Order for Movement No.
Map:

Copy No.
Issuing HQ
Place of Issue
Date-Time Group of Signature
Message Reference No.

General Data:

1. Average Speed
2. Traffic Density
3. Halts
4. Routes (i.e. between Start Points and Release Points)
5. Critical Points (See NOTE 4)
   (a) Start Points
   (b) Release Points
   (c) Other Critical Points
6. Main Routes to Start Points (See NOTE 7)
7. Main Routes from Release Points (See NOTE 7)

) Connect with paragraph 4.a. of this STANAG. These routes and points are here described by grid references, codewords, etc., and, if necessary, numbered or lettered for ease of reference in the columns below.

Serial or Movement Number	Date	Unit/Formation	Number of Vehicles	Load Class of Heaviest Vehicles	From	To	Route	Route to Start Point (See Note 7)	Critical Points			Route from Release Point (See Note 7)	Remarks
									Ref.	Due (hrs.)	Clear (hrs.)		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(l)	(m)	(n)	(o)
(See NOTE 5)													

Acknowledge

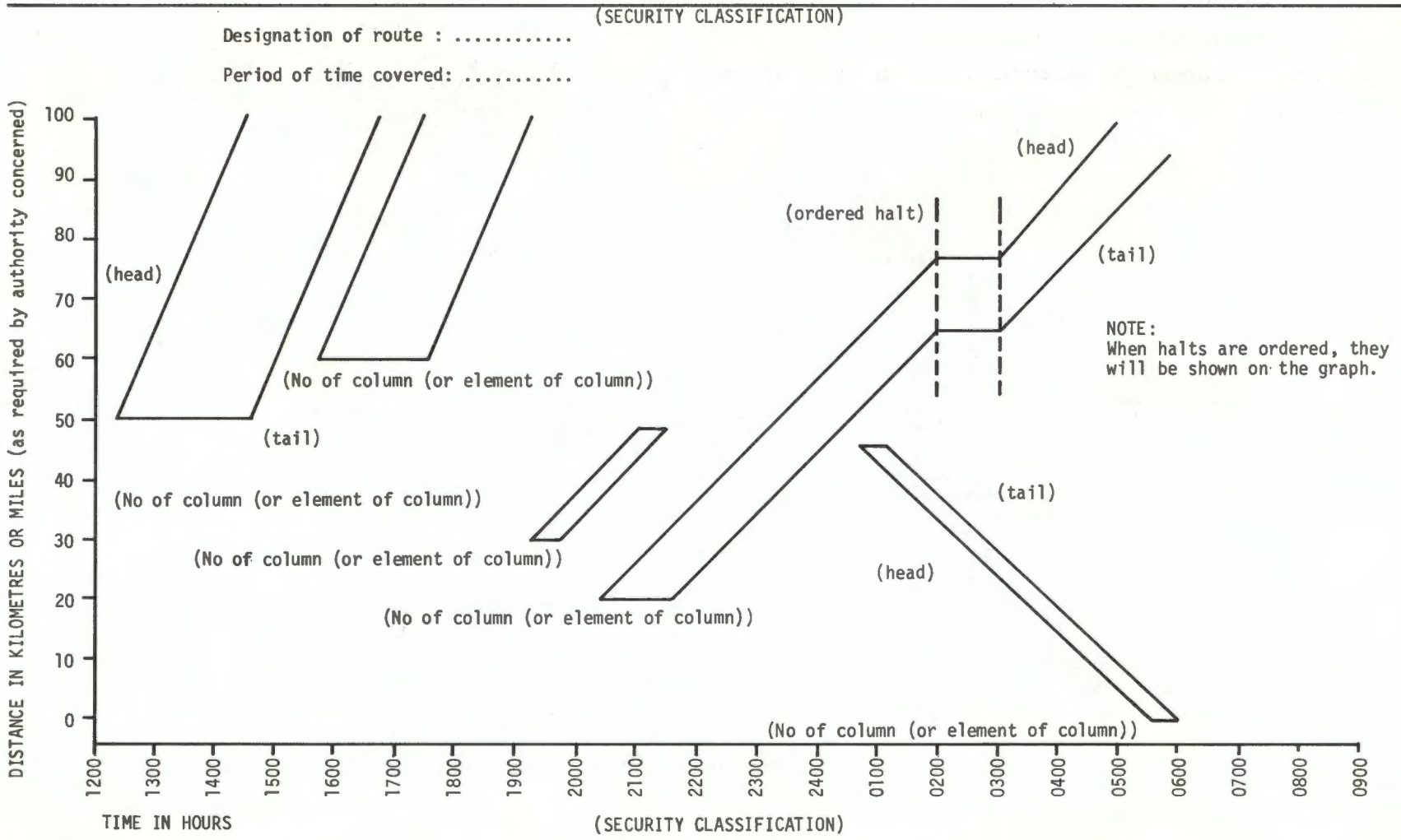
Distribution:

Authentication:

(SECURITY CLASSIFICATION)

NOTES:- 1. Only the minimum number of headings above should be used. Any information which is common to two or more movement numbers should be included under the 'date' paragraphs.
2. As the table may be issued to personnel concerned with control of traffic, the security aspect must be remembered. It may not be desirable to include dates or location.
3. If the table is issued by itself, and not as an annex to a more detailed order, the table must be signed or authenticated in the normal way.
4. 'Critical Point' is defined as 'a selected point along a route used for reference in giving instructions. It includes start points, release points and other points along a route where interference with movement may occur or where timings are critical'.
5. This will be the number which is used to identify a column (or element of column) during the whole of the movement (see STANAG 2154, paragraphs 8 and 9).
6. In the case of an annex having the same distribution as an operation order it will not be necessary to include the headings and ending as shown on this page.
7. Definitions of these terms will be found in STANAG 2154 (paragraphs 19 and 20).

EXAMPLE OF A ROAD MOVEMENT GRAPH



APPENDIX F

STANAG 2151 (EDITION NO. 2)
ROUTE NETWORK—DEFINITIONS AND CHARACTERISTICS

STANAG 2151
(Edition No. 2)

Agreed English / French Texts

DETAILS OF AGREEMENT (DofA)
ROUTE NETWORK—DEFINITIONS AND CHARACTERISTICS

AGREEMENT

1. The NATO Armed Forces agree to adopt the following definitions in connection with the use of the road network and to evaluate the potential of this network in accordance with the characteristics indicated below.

DEFINITIONS

2. a. The Basic Military Route Network. This network includes all routes designated in peacetime by the host nations to meet the anticipated military movements and transport requirements, both allied and national.

NOTE: See definition of "route" in STANAG 2015.

b. The basic network should already, in peacetime, have sufficient capacity and be equipped with the necessary facilities.

NOTE (for information): There is a basic CENTRAL EUROPE military network formed from national networks.

3. a. A Military Road Manoeuvre Network. This network is the road system required by a commander for the conduct of a specific operation and for the required logistical support for that operation.

b. It is built up from the corresponding basic military road network the routes of which form the framework of the military manoeuvre nets, taking into consideration such additions or alternatives as may be required by circumstances and the needs of the Command. This network is defined and controlled (allotment of movement credits) by the military authorities, national or allied, according to the break-down of responsibilities in the theatre of operations (Communication Zone, Rear and Forward Combat Zone).

GENERAL BUILD-UP OF MILITARY ROUTE NETWORKS

4. a. Axial Routes ("pénétrantes" or "axiales"). This term denotes the routes running through the rear area and into the forward area. They are identified by odd numbers and shown on overlays by unbroken lines.

b. Lateral Routes ("latérales" or "rocades"). This term denotes the routes, the general direction of which is roughly parallel to the frontline, which feed into or cross axial routes. They are identified by even numbers and shown on overlays by broken lines.

STATUS OF ROUTES IN A MILITARY NETWORK

5. a. A Controlled Route ("itinéraire réglementé") denotes a route the use of which is subject to traffic or movement restrictions. ("Movement Credit" mentioned below is defined in STANAG 2154). Controlled routes can be divided into:

(1) A Supervised Route ("itinéraire surveillé") is a roadway over which control is exercised by a traffic control authority by means of traffic control posts, traffic patrols or both. A "Movement Credit" is required for its use by a column of 20 or more vehicles or by any vehicle of exceptional size or weight.

(2) A Despatch Route (UK: "regulated route"; FR: "itinéraire garde") is a roadway over which full control, both as to priorities of use and the regulation of

movement of traffic in time and space is exercised. A "Movement Credit" is required for its use by any independent vehicle or group of vehicles regardless of number or type.

(3) A Reserved Route ("itinéraire réservé ou spécialisé") is a route the use of which is:

(a) Allocated exclusively to a particular authority or formation ("itinéraire reservé") e. g. route reserved for the 10 Division, or

(b) Intended to meet a particular requirement ("itinéraire specialise") e. g. route reserved for evacuation.

b. An Open Route ("itinéraire libre") is a route for the use of which no "Movement Credit" is required.

c. A Blocked Route ("itinéraire bloqué") is a route on which the flow of traffic has become temporarily impassible owing to a material obstruction.

SPECIAL RESTRICTIONS AND / OR INDICATIONS

6. a. A One Way Route ("itinéraire ou route a sens unique") is a road on which vehicles may move in one direction only at a particular time.

b. Prohibited Route ("itinéraire interdit") or Prohibited Section of Route is a route or section of route over which all traffic is prohibited.

c. A Signed Route ("itinéraire fléche") is a route along which a unit has placed, on its own initiative, for its exclusive use, and under the conditions prescribed by the Command or the manoeuvre regulations, directional signs which include the identification symbol of the unit concerned.

d. Route Where Guides Are Provided ("itinéraire jalonn"). This term denotes a route on which a unit has placed, under its own initiative and for its exclusive use and under the conditions prescribed by the Command or the manoeuvre regulations, guides responsible for showing the vehicles of the unit the direction they are to follow. These guides direct the personnel and vehicles of their own formation, but do not give any indication to personnel and vehicles of other units who must respect the common signing and regulations.

TRAFFIC FLOW AND ROAD CAPACITY

7. a. Traffic Flow ("débit d'un itinéraire"). The traffic flow at a given point is defined by the number of vehicles passing that point at a given time. Traffic flow is expressed as vehicles per hour (VPH).

b. Road Capacity.

(1) (Expressed in Vehicles)—The maximum traffic flow (VPH) in one direction over a particular road or route. It cannot be greater than the maximum traffic flow at the most restricted point on the road or route. (When the road is to be used in both directions this should be noted and the two capacities might be reduced accordingly).

(2) (Expressed in Tons). The maximum number of tons which can be moved in one direction over a particular road or route in one hour. It is the product of Road Capacity (Vehicles) and the average payload of the vehicles using the road or route. It is expressed in tons per hour. (When the road is to be used in both directions this should be noted and the two capacities might be reduced accordingly).

c. Complementary Remarks. Estimate of traffic flows and / or tonnage capacity should take into account the existing conditions. They may include:

(1) Road characteristics (terrain, type of roadway, number of lanes available, road maintenance, rated tonnage capacity of the weakest bridge).

(2) Military traffic regulations (density, speed limits, direction of traffic).

(3) Types of vehicles employed.

(4) Movement conditions (by day, by night, lighting and / or weather conditions).

CHARACTERISTICS

8. The characteristics of a route are in particular:

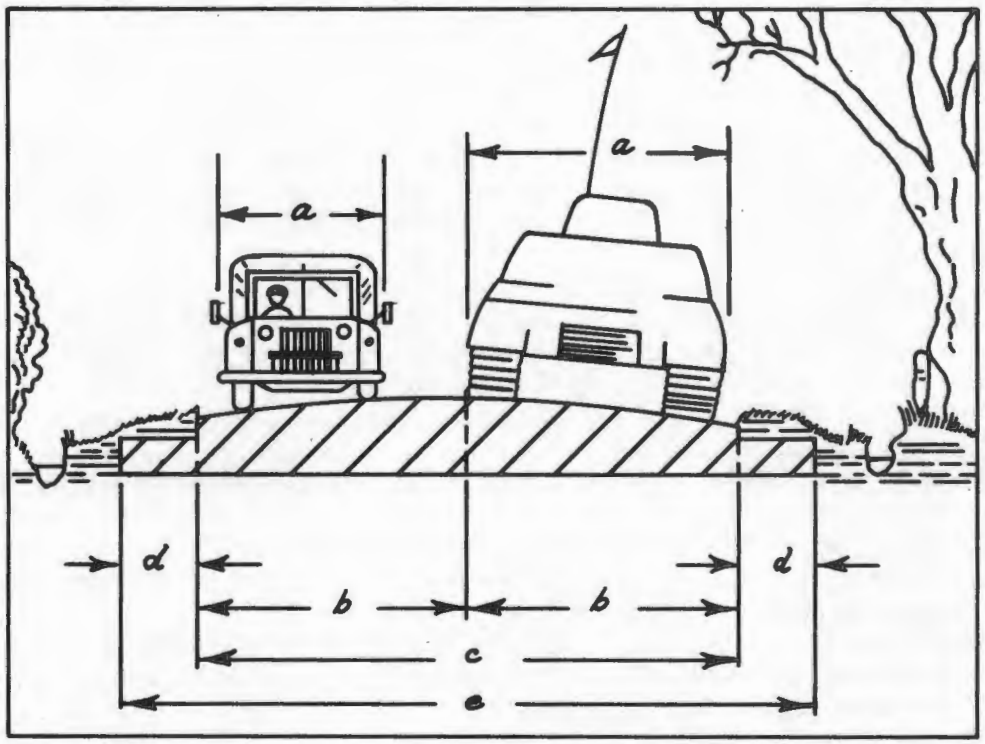
a. The width of the travelled way (UK: "carriage way").

b. The clearance of obstacles (e. g. tunnels, bridges, etc.).

c. The class of loads which can be accepted in accordance with STANAG 2021.

WIDTHS

9. a. The various widths of a road are illustrated in the drawing below:



LEGEND

a. Width of vehicle
b. " " lane
c. " " travelled way (UK: "carriage way")
d. " " hard shoulder
e. " " grading

b. The number of lanes is determined by the width of the traveled way; i.e. the subdivision of the traveled way to allow the movement of a single line of vehicles. Taking into account the width of a normal vehicle and the space required on either side of that vehicle, the width of the lane required for the movement of one column is normally estimated at 11½ feet (3.50m) and 13 feet (4m), for a tracked combat vehicle. A single lane road can only be used in one direction at any one time.

c. A route or road can be classified as single or double flow according to the number of lanes.

(1) A route or road is single flow ("simple courant") when it allows a column of vehicles to proceed and, in addition, isolated vehicles to overtake or to pass in the opposite direction, at predetermined points. It is desirable that the width of a single flow road be equal to at least 1½ lanes.

(2) A route or road is double flow ("double courant") when it allows two columns of vehicles to proceed simultaneously. It is essential that the width of a double flow road be equal at least to 2 lanes.

d. In the light of the above definition, the traffic possibilities can be shown in the following table:

Flow possibilities	Road widths for normal vehicles only	Road widths for tracked combat vehicles
Isolated vehicles of appropriate width only and in one direction only.	At least 11½ ft., (3.50m)	At least 13 ft., (4m)
Generally one way only; no overtaking or passing in opposite direction.	Between 11½ ft., and 18 ft. (3.50m and 5.50m)	Between 13 ft., and 19½ ft., (4m and 6m)
Single flow	Between 18 ft., and 23 ft. (5.50m and 7m)	Between 19½ ft., and 26 ft. (6m and 8m)
Double flow	Over 23 ft. (7m)	Over 26 ft. (8m)

e. The width of a route, for any given section, is that of the narrowest part of its traveled way for that given section (UK: "carriage way"). It is expressed in metres or feet.

OVERHEAD CLEARANCE

10. Overhead clearance ("hauteur limite") is the least distance between the surface of the traveled way and any obstruction vertically above it. It is an obstruction to the use of a route for all vehicles which exceed in height the overhead clearance of the route.

CLASS

11. a. Route. The class of a route is fixed in relation to the heaviest gross weight vehicle the route will accept. In such a case the choice of the route may be limited (see STANAG 2021).

b. Network. The class of a network is fixed in relation to the minimum route classification in that network.

12. To facilitate movement, those routes included in a low class network but over which heavier equipment can be moved are regrouped in broad categories:

Average traffic routes	:	Class 50
Heavy traffic routes	:	Class 80
Very heavy traffic routes	:	Class 120

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

POTENTIAL

14. For planning purposes it would be useful that the potential of a route should be expressed on diagrams, tables and maps (by road sections) by:

a. Road capacity (in vehicles per hour—one way traffic or two way traffic—see para 7c(1)).

b. Number of lanes (normal vehicles, see para 9b.).

c. Load class (tracked vehicles, one way—see para 11a.).

(Example: 900 / 2 / 80 / 780 means a route with a one way traffic capacity of 900VPH, 2 lanes,Class 80, or a two way traffic capacity of 780 VPH)

IMPLEMENTATION OF THE AGREEMENT

15. This STANAG will be considered to have been implemented when the necessary orders / instructions to use the information contained in this Agreement have been issued to the forces concerned.

APPENDIX G

STANAG 2154 (EDITION NO. 3) DEFINITIONS AND REGULATIONS FOR MILITARY MOTOR MOVEMENTS BY ROAD

Agreed English / French Texts

STANAG 2154
(Edition No. 3)

DETAILS OF AGREEMENT (DOfA)

DEFINITIONS AND REGULATIONS FOR MILITARY MOTOR MOVEMENTS BY ROAD

Annex A (DofA). Direction Arrow.

AGREEMENT

1. It is agreed that the NATO Armed Forces are to use the definitions and regulations applying to military motor movements by road, defined in the following paragraphs.

ORGANIZATION OF COLUMNS

2. A column is a group of vehicles moving under a single commander, over the same route, in the same direction.

3. A large column may be composed of a number of organized elements (subunits, march units, sections of vehicles, etc.).

4. Each column and each organized element of the column must include:

a. A commander whose place may vary.

b. In the first vehicle: a subordinate commander known as the 'pace setter' (in French: guide).

c. In the last vehicle: a subordinate commander known as the 'trail officer' (in French: serre-file).

5. The pace setter of the first element of a column leads it and regulates its speed. The trail officer of the last element deals with such problems as occur at the tail of the column.

6. In addition, each vehicle is to have a 'vehicle commander' (who may be the driver).

IDENTIFICATION OF COLUMNS

7. Each column is to be identified by flags and in some cases by a movement number.

8. Each column which has received a movement credit is to be identified by a number known as "the movement number" which is allocated by "the authority authorizing / arranging the movement" (the national authority on the Continent of Europe of the country where the movement or transport starts from, responsible for the planning and coordination after obtaining the agreement by the authorities concerned, e. g. territory, district or country to be crossed). (see paragraph 12 below). This number identifies the column during the whole of the movement.

9. The movement number is to be placed on both sides and, if possible, on the front of at least the leading vehicle and the last vehicle of each organized element of the column. It is to be composed of:

a. Two figures indicating the day of the month on which the movement is due to commence.

b. Three or more letters indicating the authority organizing the movement, the first two letters being the national symbols indicated in STANAG 1059.

c. Two figures indicating the serial number of the movement.

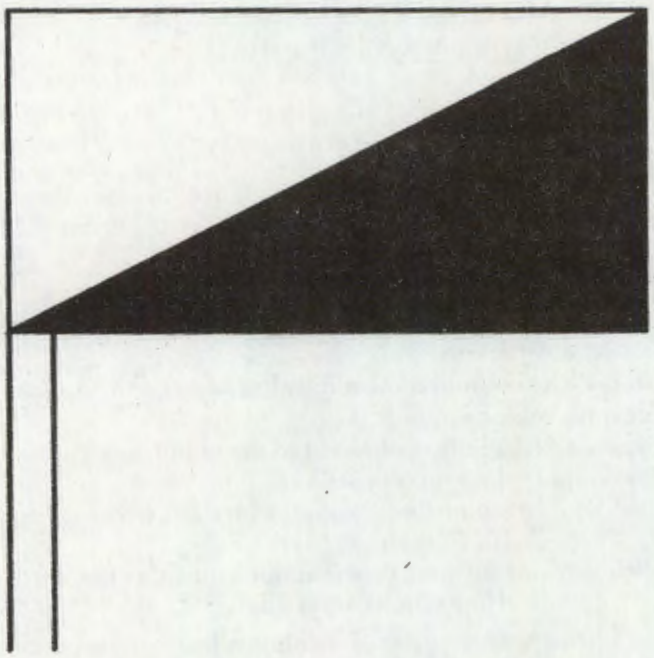
d. One letter to identify the element of the column (This is optional). (Example: identification 03-BEA-08-C will indicate that "C" element of column No. 8 will be moved by the BE authority (A) on the 3rd day of the current month).

10. Additionally, each column is to be identified by flags or, for night movement, by lights, security permitting, as described below:

a. The leading vehicle of the column is to display a blue flag (and a blue light at night.)

b. The last vehicle of the column is to display a green flag (and a green light at night.)

c. The vehicle of the column commander is to display a white and black flag as indicated below, subject to the commander's discretion in certain circumstances.



d. A vehicle that cannot maintain its position in a column may indicate this condition by displaying a yellow flag.

e. Flags should be approximately 12" (30 cm) x 18" (45 cm) in size.

f. Flags are to be mounted on the left side of vehicles except where vehicles drive on the left, in which case the flags are to be mounted on the right side of the vehicles.

11. Headlights. In peacetime, all vehicles driving in a column are to use their dipped headlights, even in daylight.

MOVEMENT CREDIT

12. a. A movement credit (in French "credit de mouvement") is the allocation granted, by the authority referred to in paragraph 8 above, to one or more vehicles in order to move over a controlled route in a fixed time according to movement instructions (see STANAG 2151, paragraph 5 of the Details of Agreement).

b. The movement credit includes the indication of times at which the first and the last vehicle of the column are scheduled to pass.

(1) The entry point, that is to say the point where the column enters the controlled route.

(2) The exit point, that is to say the point where the column leaves the controlled route.

(3) At critical points, and, if necessary at traffic control posts.

TIME AND DISTANCE FACTORS IN MOTOR COLUMNS

13. Vehicle Distance (Vehicle Gap). 'Vehicle distance' (in French: distance) is the space between two consecutive vehicles of an organized element of a column.

14. Column Gap. 'Column gap' (in French: créneau) is the space between two consecutive elements proceeding in the same direction on the same route. It can be calculated in units of length or in units of time measured from the rear of one element to the front of the following element. (See AAP-6).

15. Traffic Density. 'Traffic density' (in French: densité du trafic) is the average number of vehicles that occupy one mile or one kilometre of road space, expressed in vehicles per mile (VPM) or per kilometre (VPK). (See AAP-6).

16. Length of a Column. 'Length of a column' (in French: longueur d' encombrement) is the length of roadway occupied by a column in movement including the gaps inside the column from the front of the leading vehicle to the rear of the last vehicle.

17. Pass Time. 'Pass time' (in french: durée d' écoulement) is the time that elapses between the moment when the leading vehicle of a column passes a given point and the moment when the last vehicle passes the same point. (See AAP-6).

18. Road Clearance Time. 'Road clearance time' (in French: durée d' encombrement) is the total time a column requires to travel over and clear a section of road. (See AAP-6).

FORMATION AND DISPERSAL OF COLUMNS

19. Start Point. 'Start point' (in French: point initial) is a well defined point on a route at which a movement of vehicles begins to be under the control of the commander of this movement. It is at this point that the column is formed by the successive passing, at an appointed time, of each of the elements composing the column. In addition to the principal start point of a column there may be secondary start points for its different elements. (See AAP-6).

20. Release Point. 'Release point' (in French: point de dislocation) is a well defined point on a route at which the elements composing a column return under the authority of their respective commanders, each one of these elements continuing its movement towards its own appropriate destination. (See AAP-6). (In addition to the principal release point of a column, there may be several secondary release points for the various elements.)

SPEED AND FLOW OF COLUMNS

21. Average Speed. 'Average speed' (in French: vitesse de croisière) is the average distance travelled per hour calculated over the whole journey excluding specifically ordered halts. (See AAP-6). (It is expressed in miles or kilometres per hour.)

22. Speed. 'Speed' (in French: vitesse instantanée) indicates the actual rate of speed of a vehicle at a given moment, as shown on the speedometer (in kilometres / hour or miles / hour).

23. Pace. 'Pace' (in French: vitesse de marche) is the regulated speed of a column or element as set by the pace setter in order to maintain the average speed prescribed. (See AAP-6).

24. Rate of March. 'Rate of march' (in French: vitesse de progression) is the average number of miles or kilometres to be traveled in a given period of time including all ordered halts. It is expressed in miles or kilometres in the hour. (See AAP-6). (The rate of march is a general planning factor used by staffs.)

ROUTE SIGNING AND ROAD GUIDES

25. STANAG 2151 gives the definition of a 'signed route' and of a 'route where guides are provided'.

26. Signing and guide teams are normally provided by the moving unit (see paragraph 29 below). Members of these teams must not, under any circumstances, wear the armbands and cuffs specified in STANAGs 2025 and 2159. They may wear coloured armbands.

27. Direction arrows used should preferably be black on white background and bear the identification symbol of the unit in question (distinctive sign or identification

number). They may be of a similar type to those shown in Annex A (DofA). Before crossroads leading to several directions, a warning arrow can be used (type similar to that shown in Annex C to the Details of Agreement of STANAG 2012).

MILITARY ROUTE SIGNING

28. Unit route signs and unit guides are to be put out a short time in advance of the column and picked up as soon as possible after the tail of the column has passed.

29. Route signing and the placing of guides on controlled routes must be under the responsibility of the authority in charge of movements or traffic in the area concerned.

30. Outside these itineraries, the tasks above are to be the responsibility of the column commander.

SPECIAL REGULATIONS FOR THE EXECUTION OF MOVEMENTS

31. All personnel exercising a command in the column and all drivers must strictly obey the instructions of traffic control and regulating personnel.

32. When approaching a traffic control or a regulating post indicated by prescribed signs (STANAGs 2025 and 2012) the column commander or his representative must advance ahead of his column and report to the regulating post commander to:

a. Give the required information concerning his organized elements and their movements.

b. Receive information and possible instructions.

33. Through this post, he can also arrange for the transmission of his own instructions, or information, to the various elements of his column as they pass the post, where however they must not stop unless ordered to do so.

HALTS

34. Short Halts.

a. Short halts made by columns or elements of columns on the controlled routes normally are to last 10 minutes and take place in principle, every 2 hours, 10 minutes before the full hour, even or odd (this detail to be specified in orders). All columns following the same route are to stop at the same time.

b. However, the characteristics of the road may make it necessary for the halt to take place in one particular part of the route rather than simultaneously at a fixed time. In such cases, the necessary instructions are given in the orders relating to the movement.

35. Long halts. No standard rules for the observance of long halts are laid down. They must always be specifically plotted on movement graphs in order to avoid possible conflict.

36. Particular attention is to be paid to the following aspects of traffic discipline:

a. When making a long halt, isolated vehicles or vehicles forming part of a column, should move off the roads as much as possible.

b. If this practice cannot be observed, the commander of a column which is halted on an itinerary must take all necessary measures to facilitate circulation for other road users and avoid accidents or traffic jams. The measures to be taken will vary according to the condition and width of the road.:

(1) Warning, at a sufficient distance from the front and rear of the column (guards, warning flags, lights or flares, security permitting).,

(2) If required, organize (direct) a system of one-way traffic alternately along the columns etc.

c. When a halted column resumes movement it has the right of way while moving back on to the road, unless otherwise prescribed.

OVERTAKING OF COLUMNS

37. By Isolated Vehicles.

a. An isolated vehicle is only authorized to overtake a moving column when:

(1) Its maximum authorized speed is appreciably higher than the speed at which the column is moving, thus enabling it to overtake each vehicle rapidly.

(2) There is sufficient distance between the vehicles of the column to allow the

overtaking vehicle to regain its position in the proper lane after overtaking each vehicle.

(3) The trail officer of the column gives a clear signal that overtaking is possible.

b. In all other cases, an isolated vehicle is to overtake the column only when the latter is halted.

38. By Other Columns.

a. On a controlled route a column may only overtake another column on the orders of the movements authorities and as arranged by the traffic regulating personnel.

b. On an open route no column may overtake another moving column, except in special cases, e.g. on a one-way road wide enough. In these cases, the commander of the column desiring to pass is to contact the commander of the column to be passed prior to effecting passage.

c. Outside these special cases, the overtaking of a column by another column is only authorized if the former is halted and providing the moving column has the time to overtake the whole of the halted column before the latter is ready to move on. In this case, the commander of the column desiring to pass is to contact the commander of the column to be passed prior to effecting passage. The commander of the halted column after giving his agreement must facilitate the overtaking.

MOVING BY NIGHT (Reference: STANAG 2024)

39. By night, road movements are carried out according to traffic regulations as follows:

a. With normal lighting)
OR)
b. Reduced lighting)
OR)
c. Blackout lighting) From a certain line or on certain routes specified by orders.
OR)
d. Without lights)
OR)
e. Possibly with 'balisage' (1))

40. When columns are moving under blackout conditions, traffic normally will be one-way.

IMPLEMENTATION OF THE AGREEMENT

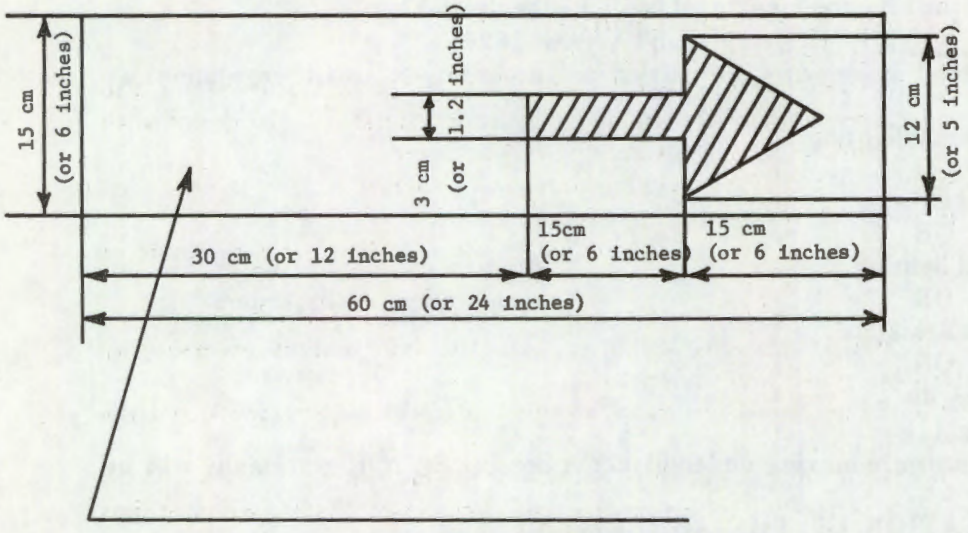
41. This STANAG will be considered to have been implemented when the necessary orders / instructions to use the definitions and regulations contained in this Agreement have been issued to the forces concerned.

NOTE: (1) 'Balisage' is a method by which a route is outlined by a system of dim beacon lights enabling vehicles to be driven at near daytime speed, under blackout conditions.

ANNEX A (DofA) TO STANAG 2154
(Edition No 3)

DIRECTION ARROW

(made of paper, synthetic matter or wood.....)



SPACE FOR PRINTING THE SYMBOLS

A(DofA/MdeA)-1

APPENDIX H

STANAG 2156

TRANSPORT REQUEST AND REPLY TO TRANSPORT REQUEST

Agreed English / French Texts — STANAG 2156

DETAILS OF AGREEMENT
TRANSPORT REQUEST AND REPLY TO TRANSPORT REQUEST

Enclosures: I. Annex 'B' — TRANSPORT REQUEST and Appendices 1 and 2.
II. Annex 'B' — REPLY TO TRANSPORT REQUEST and Appendices 1 and 2.

INTRODUCTION

1. When a unit or formation has to effect a movement for which :—
   a. it does not possess appropriate means of transport.
   b. it has inadequate means of transport,
   c. it cannot use its own means of transport,

such a unit or formation must prepare a TRANSPORT REQUEST and submit it to the headquarters concerned (Movements and Transport Staff) in accordance with national instructions and international agreements in force.

2. The TRANSPORT REQUEST will be prepared either:—
   a. by the unit or formation requiring transport,
   b. or, in urgent cases, by the military commander ordering the movement or transport.

3. The headquarters concerned (Movements and Transport Staff) which receives the TRANSPORT REQUEST should find in it ALL the information necessary to enable it to determine quite independently:—
   a. the most suitable means of transport, in relation to the requirements and the actual transport available;
   b. the action necessary to organize the transport or the movement.

4. The headquarters concerned (Movements and Transport Staff), when it has considered the Transport Request, will send the unit or formation a reply in the form of a REPLY TO TRANSPORT REQUEST. The Reply to a Transport Request :—
   a. is used for the purpose of giving the requesting unit or formation a reply as soon as possible so that it may make the preparations for the movement or transport in question;
   b. may be circulated as an integral part of (or as an annex or supplement to) the Movement Order issued by the authorities responsible:
   c. does not preclude the submitting of a "Movement Credit" request on the routes where it is required (in accordance with STANAG 2151).

AGREEMENT

5. In order to standardize the information to be incorporated in the TRANSPORT REQUEST and REPLY TO TRANSPORT REQUEST, the NATO Armed Forces agree to comply with instructions in paragraphs 7 and 8 below when preparing such forms. It is further agreed:—
   a. that these documents must be capable of transmission, in code form, by message or telephone;
   b. that it is not necessary to standardize the layout and format of the forms used for TRANSPORT REQUEST and REPLY TO TRANSPORT REQUEST.

6. If the TRANSPORT REQUEST is for a troop or supply movement by Air and is approved by the proper authority, the Movements Staff concerned will transcribe the

requirement onto a form NATO Request for Air Transport (NARAT) in accordance with STANAG 3093.

THE TRANSPORT REQUEST

7. The TRANSPORT REQUEST will give the information called for in the example shown at ANNEX 'A'.

a. The FIRST Part must be completed in full.

b. The SECOND, THIRD, FOURTH and FIFTH Parts will be filled in as necessary. Unused spaces will not be taken up subsequently. It is therefore UNnecessary to give nil returns.

c. Examples :—

(1) for the movement of an Infantry Battalion see Appendix 1 to ANNEX 'A';

(2) for the transport of a general cargo see Appendix 2 to ANNEX 'A'.

THE REPLY TO TRANSPORT REQUEST

8. The REPLY TO TRANSPORT REQUEST will provide the information listed in the example at ANNEX 'B'.

a. The FIRST Part must be completed in full.

b. The other parts will be filled in as necessary. Unused spaces will not be taken up subsequently. It is therefore UNnecessary to give nil returns.

c. Examples are given at Appendices 1 and 2 to ANNEX 'B'.

ANNEX 'A' to STANAG 2156

TRANSPORT REQUEST

CODE (a)	CODE (b)	MEANING (c)	REMARKS (d)
		FIRST PART	
ONE		Very brief description of operation	
TWO		Priority category	If known
THREE		Headquarters concerned (Movements and Transport Staff), unit or service submitting Transport Request	Add: a. rank, name and appointment of officer signing transport request b. address and Tl. No.
FOUR		Security Classification, Reference No. and "Date-time" group given to Transport Request by requesting authority mentioned in FIRST PART THREE	
FIVE		Departure point of transport	Exact position and coordinates
SIX		"Date-time" group of possible start of embarkation or loading operation.	Indicate Time Zone
SEVEN		Destination of transport	Exact position and coordinates
EIGHT		"Date-time" group by which it is desirable that the transport should reach its destination	Indicate Time Zone
NINE		Means of transport desired	Use the following code :— RED : for road transport BLACK : for rail transport BLUE : for inland waterways GREEN : for sea transport YELLOW: for air transport
TEN		Has the agency requesting transport a m[illegible]al field loading ramp?	Answer YES or NO
ELEVEN		Any further information considered to be of use.	
		SECOND PART	
ONE	ALPHA	Male personnel to be transported :— A / B / C	A = number of officers B = number of Sergeants (or equivalent ranks) and above C = number of Corporals (or euivalent ranks) and below
	BRAVO	Female personnel to be transported :— A / B / C	A, B and C as for SECOND PART ONE ALPHA
TWO		Personal baggage, dress, personal weapons, etc.	Brief description
THREE		Officer commanding personnel during movement	Give: rank, name
FOUR	ALPHA	Animals : A / B	A = kind B = number

CODE (a)	CODE (b)	MEANING (c)	REMARKS (d)
	BRAVO	etc.	
		THIRD PART	
ONE		TANKS AND TRACKED VEHICLES	
		Re first category of vehicles	A = official description B = number to be moved C = weight in tons D = military class a = overall length b = overall width c = overall height (cm for centimetres in for inches) Where a detail is not known the word 'BLANK' will be inserted; in this way, it will always be possible to identify the data given
	ALPHA	A / B / C / D	
	BRAVO	E = a x b x c centimetres or inches	
		Re second category of vehicles	
	CHARLIE	A / B / C / D	As above
	DELTA	E	As above
		Re third category of vehicles	
	ECHO	A / B / C / D	
	FOXTROT	E	As above
		etc.	
TWO		ARTILLERY	
		Re first category	
	ALPHA	A / B / C	A = official description B = number to be moved C = weight in tons a = overall length b = overall width c = overall height Insert the word 'BLANK' where any detail is not known
	BRAVO	D = a x b x c centimetres or inches (cm or in)	
		Re second category	
	CHARLIE	A / B / C	As above
	DELTA	D	As above
		Re third category	
	ECHO	A / B / C	
	FOXTROT	D	As above

CODE (a)	CODE (b)	MEANING (c)	REMARKS (d)
THREE		WHEELED MOTOR VEHICLES	
		Re first category of vehicles	
	ALPHA	A / B / C / D	As for tanks (THIRD PART ONE above)
	BRAVO	E	
		Re second category of vehicles	
	CHARLIE	A / B / C / D	As above
	DELTA	E	
		etc.	
	ZULU	Number of motor-cycles	
FOUR		TRAILERS	
		Re first category of trailers	
	ALPHA	A / B / C / D	As for tanks (THIRD PART ONE above)
	BRAVO	E	
		Re second category of trailers	
	CHARLIE	A / B / C / D	As above
	DELTA	E	
		etc.	
	YANKEE	Type of tractor necessary for trailers with no tractor vehicle	Allow the authority to which the request is submitted to settle this problem, if a road movement is prescribed.
FIVE		TROOPS, MISCELLANEOUS EQUIPMENT, SUPPLIES, ETC. (WHICH CANNOT BE LOADED IN THE UNIT'S OWN TRANSPORT)	
	ALPHA	Personnel : A / B / C	A = number of officers B = number of Sergeants (or equivalent ranks) and above C = number of Corporals (or equivalent ranks) and below
	BRAVO	A / B for first category of cargo	A = brief description of cargo B = weight (in tons)
	CHARLIE	A / B for second category of cargo etc.	As above

FOURTH PART

ONE		GENERAL CARGO—FIRST TYPE	
	ALPHA	Brief description	
	BRAVO	Weight	In tons
	CHARLIE	Average dimensions of items :— a x b x c centimetres or inches	1) State cm for centimetres, in for inches. 2) a = length b = width c = height

CODE (a)	CODE (b)	MEANING (c)	REMARKS (d)
	DELTA	Loading Capability of sender: A	A = tons per hour
	ECHO	Unloading capability of receiving unit: A	A = tons per hour
	FOX-TROT	Special precautions desired	
	GOLF	Brief description of heavy or awkward lifts.	
TWO		GENERAL CARGO—SECOND TYPE	
	ALPHA BRAVO CHAR-LIE DELTA ECHO FOX-TROT GOLF	As for FOURTH PART ONE	

FIFTH PART

	ALPHA	Requests for procuring of special means of transport	
	BRAVO	Items or convoys requiring an escort which the unit itself is unable to provide	
	CHAR-LIE	Any further information considered to be of use	

NOTE:

The FIRST Part of this format must be completed in full. The SECOND, THIRD, FOURTH and FIFTH Parts to be filled in as necessary.

APPENDIX 1 to ANNEX 'A'
to STANAG 2156

MESSAGE — SECRET

FROM : COMMANDER 12 INF BN

FOR : ACTION : COMMANDER MCG / INTER — URGENT OPS
INFO : COMMANDER F INTER — ROUTINE

SUBJECT : TRANSPORT REQUEST

FIRST
- ONE : MOV OF 12 INF BN OVER DISTANCE OF 25ØKM
- THREE : COMMANDER 12 INF BN MAJOR JEAN S3 KLEMSKERKE EDEN CINEMA TEL. OSTEND 46521
- FOUR : SECRET 982 OF 12Ø73Ø Z
- FIVE : KLEMSKERKE ES Ø177
- SIX : 1222ØØZ
- SEVEN : VERVIERS GS Ø4Ø8
- EIGHT : 14Ø6ØØZ
- NINE : BLACK
- TEN : NO

SECOND
- ONE : A 4Ø + B 116 + C 638
- TWO : KITBAG / BATTLE DRESS
- THREE : CAPT. LOUIS

THIRD
- ONE
  - ALPHA : CARRIER 81 MM MORTAR MT / 8 / 8 / 8
  - BRAVO : 638 x 223 x 227 CM
  - CHARLIE : CARRIER HT M9 / 1Ø / 8 / 9 /
  - DELTA : 618 x 221 x 228 CM
- THREE
  - ALPHA : JEEP / 5Ø / 2 / 2 /
  - BRAVO : 69 x 55 x 7Ø IN
  - CHARLIE : AMBULANCE / 2 / 5 / 5
  - DELTA : 59Ø x 213 x 264 CM
  - ECHO : VAN BAN / 1Ø / 3 / 4
  - FOXTROT : BLANK
  - GOLF : LORRY 3T / 6Ø / 8 / 1Ø /
  - HOTEL : 567 x 23Ø x 31Ø CM
  - INDIA : TRUCK MED WRECKER / 3 / 18 / 15
  - JULIET : 31Ø x 9.7 x 1Ø3 IN
  - ZULU : 22
- FOUR
  - ALPHA : TRAILER 25ØKG 2-WHEEL / 17 / 1 / 1 /
  - BRAVO : 1Ø9 x 56 - 4Ø IN
  - CHARLIE : TRAILER 1 T 2-WHEEL / 3Ø / 1 / 1 /
  - DELTA : 38Ø x 22Ø x 217 CM
- FIVE
  - BRAVO : RESERVE GOOD SUPPLIES / 15 T
  - CHARLIE : INF AMMO / 5 T

APPENDIX 2 to ANNEX 'A'
to STANAG 2156

MESSAGE — SECRET

FROM : CMP
OSTEND — NIEUWPOORT

FOR : ACTION : COMMANDER MCG / INTER — URGENT OPS
INFO : COMMANDER 1ØAMMO DEPOT — ROUTINE

SUBJECT : TRANSPORT REQUEST

FIRST
ONE : TRANSPORT OF AMMUNITION
THREE : CMP OSTEND LT COL BAUDRIER S3 HOTEL COSMOPOLITE OSTEND TEL. 65232
FOUR : SECRET 2155 OF 12Ø83ØZ
FIVE : PORT NIEUWPOORT—BASSIN DES PECHEURS DS 8276
SIX : 131ØØØZ
SEVEN : 1Ø AMMO DEPOT HOUTHULST DS 9746
NINE : RED
TEN : YES

FOURTH
ALPHA : INF AND ARTY AMMO
BRAVO : 4ØØ T
CHARLIE : 8Ø x 4Ø x 3Ø CM
DELTA : 5Ø T / HR
ECHO : 6Ø T / HR

ANNEX 'B' to STANAG 2156

REPLY TO TRANSPORT REQUEST

CODE (a)	CODE (b)	MEANING (c)	REMARKS (d)
		FIRST PART	
ONE		Security Classification, Reference No. and "Date-time" group of transport request to which this reply relates	
TWO		Security Classification, Reference No. and "Date-time" group allocated to this reply by sender	
THREE		Means of transport allocated	Use the following code: RED : road BLACK : rail BLUE : inland waterway GREEN : sea YELLOW : air
FOUR		Complete statement of means of transport allocated.	
FIVE		Rank, name and appointment of officer by whom this reply is signed.	
SIX		Any additional information considered useful.	
		SECOND PART	
ONE		Exact location of transport allocated	Identification and coordinates
TWO		"Date-time" group when embarkation or loading operations can begin	Indicate Time Zone, If necessary, break down into ALPHA, BRAVO, CHARLIE etc., if transport availability is spaced out over a period of time
THREE		Expected approximate "Date-time" group of departure of loaded movement or transport	Particularly important in the case of rail movements. Indicate Time Zone.
FOUR		Route	Only for road or inland waterway movement or transport.
FIVE		Plate of disembarkation or unloading	Identification and coordinates
SIX		Any information considered useful	
		THIRD PART	
ONE		Any information regarding waiting or transit area; points of first destination, etc.	If necessary, break down into ALPHA, BRAVO, etc.
TWO		Special instructions: standards of marching, lighting, blackout line etc.	As above.
THREE		Comments regarding control and regulating of movements	As above.

NOTE: The FIRST Part of this format must be completed in full. The other Parts will be filled in as necessary.

APPENDIX 1 to ANNEX 'B'
to STANAG 2156

REPLY TO TRANSPORT REQUEST

MESSAGE SECRET

FROM : COMMANDER MCG / INTER
FOR : ACTION : COMMANDER 12 INF BN
INFO : COMMANDER F INTER
SUBJECT : REPLY TO TRANSPORT REQUEST
FIRST
ONE : YOUR SECRET 982 OF 120Ø73Ø Z
TWO : SECRET 551 OF 12 1100 Z
THREE : RED EXCEPT FOR YOUR THIRD PART ONE AND THIRD PART FIVE WHICH WILL USE BLACK
FOUR : 12 15METRE FLAT WAGONS AND 5 12T CLOSED WAGONS
FIVE : MAJOR JACQUES S3
SECOND
ONE : OSTEND MARITIME STATION DS 9775
TWO : 130Ø2ØØZ
THREE : 13Ø6ØØZ
FIVE : VERVIERS EAST STATION GSØ4Ø9
THIRD
TWO : RAMPS AVAILABLE AT OSTEND AND VERVIERS
THREE ALPHA : FOR YOUR RED MOVEMENT, YOU SHOULD APPLY FOR MOVEMENT CREDIT THROUGH NORMAL CHANNELS
BRAVO : BLACK MOVEMENT CAN BE CONTACTED VIA RTO GAND ST PIERRE AND LOUVAIN

APPENDIX 2 to ANNEX 'B'
to STANAG 2156

REPLY TO TRANSPORT REQUEST

MESSAGE — SECRET

FROM : COMMANDER MCG / INTER
FOR : ACTION : CMP OSTEND-NIEUWPOORT
INFO : COMMANDER iØMMO DEPOT — URGENT OPS URGENT

SUBJECT : REPLY TO TRANSPORT REQUEST

FIRST
- ONE : YOUR SECRET 2155 OF 12Ø83 ØZ
- TWO : SECRET 558 OF 12 1345 Z
- THREE : RED
- FOUR : 20 5T CIVILIAN LORRIES FOR 4 UNINTERRUPTED TRIPS
- FIVE : MAJOR JACQUES S3
- SIX : THESE CIVILIAN VEHICLES WILL BE PROVIDED BY OTR FURNES TEL. 216.29—GARAGE MODERNE—55, RUE DE LA GARE

SECOND
- ONE : NIEUPWOORT—MARCHE AUX GRAINS—DS 8276
- TWO : 13Ø9Ø0 Z
- THREE : 13 13ØØZ / 13 18Ø Ø Z / 13 23ØØ Z / 14Ø4ØØZ
- FOUR : PERVYSE / DIKSMUIDE / KLERKEN / HOUTHULST
- FIVE : 1Ø AMMO DEPOT HOUTHULST DS 9746

THIRD
- ONE ALPHA : SEND REPRESENTATIVE TO MARCHE AUX GRAINS NIEUWPOORT TO DIRECT VEHICLES TO LOADING QUAY
- BRAVO : WHEN MISSION COMPLETED, PLACE TRANSPORT AT DISPOSAL OF OTR FURNES
- THREE : ROUTE UNSPECIFIED

APPENDIX I

STANAG 2159 (EDITION NO. 3) IDENTIFICATION OF MOVEMENT CONTROL AND TRAFFIC CONTROL PERSONNEL AND AGENCIES

STANAG 2159
(Edition No. 3)

Agreed English / French Texts

DETAILS OF AGREEMENT (DofA)

IDENTIFICATION OF MOVEMENT CONTROL AND TRAFFIC CONTROL, PERSONNEL AND AGENCIES

AGREEMENT

1. The NATO Armed Forces agree to use the methods set out below for identifying:
   a. Movement Control and Traffic Control Personnel.
   b. Movement Control and Traffic Control Agencies.

DEFINITIONS

2. a. Movement Control. The planning, routing, scheduling and control of personnel and supply movements over lines of communication; also an organization responsible for these functions. This definition is taken from the NATO Glossary of Military Terms in English and French (AAP-6) and is repeated for convenience.

b. Traffic Control. For the purpose of this Agreement, this term is defined as: the physical direction of traffic to meet military requirements.

STATEMENT OF DETAILS

3. Identification of Movement Control and Traffic Control Personnel

a. Movement Control Personnel. Armbands will be used to identify all movement control personnel who come into personal contact with forces (individual members and / or units of the Armed Forces) being moved by water, rail, motor or air transport modes.

(1) The armband will be red, approximately 16½ inches (42 cm) long and 3½ inches (9cm) wide, with an 8-spoked yellow wheel, 3 inches (7½ cm) in diameter, centered on the band.

(2) The armband will be worn by movement control personnel while on duty, in accordance with the uniform regulations of the country concerned, and in a manner so that the wheel is clearly seen. Staff officers may wear normal staff armbands if that is the usual practice of the countries concerned.

b. Traffic Control Personnel. Personnel posted along routes and engaged in traffic control will wear white cuffs. A general description (including recommended dimensions) of these cuffs is contained in STANAG 2025, paragraphs 23 and 24.

4. Identification of Movement Control and Traffic Control Agencies

a. Standard guide signs shall be used to identify and provide road directions to movement control and traffic control agencies.

(1) For those agencies which are part of a superior headquarters, guide signs and identification shall be in accordance with STANAG 2035.

(2) For those agencies which are not an integral part of a superior headquarters, guide signs and identification shall be in accordance with paragraphs b. and c. below and the example shown in Annex I, pages 1-6, STANAG 2019.

b. The guide signs referred to in paragraph 4.a.(2) above will conform to the provisions of paragraphs 5 and 13 of STANAG 2012.

c. The guide signs will display the following:

(1) The symbols laid down in STANAG 2019 or, if no appropriate symbol can be found in STANAG 2019, an eight-spoked wheel.

(2) The national distinguishing letters in accordance with STANAG 1059.

(3) The direction and / or distance to the agency concerned, if necessary.

IMPLEMENTATION OF THE AGREEMENT

5. This STANAG will be considered to have been implemented when the necessary orders / instructions to adopt the methods of identification described in the Agreement have been issued to the forces concerned.

APPENDIX J

STANAG 2163
VEHICLE WEIGHT AND DIMENSION CARD

Agreed English / French Texts

STANAG 2163 (Edition No. 3)
(1st Draft)
ARMY / NAVY / AIR

NATO STANDARDIZATION AGREEMENT (STANAG)

VEHICLE WEIGHT AND DIMENSION CARD

Annex: A. Format of the Vehicle Weight and Dimension Card.

Related Documents: STANAG 2175— Classification and Designation of Flat Wagons Suitable for Transporting Military Vehciles and Equipment. (Draft)

STANAG 3466— Responsibility of Air Transport Units and User Units in the Loading and Unloading of Transport Aircraft in Tactical Air Transport Operations.

OBJECT

1. The aim of this Agreement is to adopt for the use by the NATO Armed Forces a standard card to facilitate the loading planning and loading operations of whatever means of transport is to be used.

AGREEMENT

2. Participating nations agree to adopt for the transportation of their vehicles the card, the characteristics of which are described hereunder.

GENERAL

3. The layout of the front and reverse sides of the Vehicle Weight and Dimension Card is given in Annex A.

4. The card is to be printed black on a white background.

5. The card is to be written in both official NATO languages (English and French) and in the language of the country of origin if other than English or French.

6. The minimum size of the card is the following:
   24 cm (9½in) x 18 cm 7¼in).

DIRECTIONS FOR USE

7. The directions for use are shown on the reverse of each card.

8. When printed forms are not immediately available, a substitute card will be used.

IMPLEMENTATION OF THE AGREEMENT

9. This STANAG will be considered as implemented when the necessary orders / instructions to adopt the card described in this Agreement have been issued to the forces concerned.

NATO UNCLASSIFIED

ANNEX A TO STANAG 2163
ANNEXE A AU STANAG 2163

FORMAT FOR VEHICLE WEIGHT AND DIMENSION CARD
EXEMPLAIRE DE LA FICHE DE DIMENSIONS ET DE POIDS D'UN VEHICULE

VEHICLE WEIGHT AND DIMENSION CARD
FICHE DE DIMENSIONS ET DE POIDS DU VEHICULE
.....(3rd language/3ème langue)

1
WEIGHT kilogrammes/
POIDS lbs
..... (3rd language/3ème langue)

2
LENGTH mètres/
LONGUEUR inches
..... (3rd language/3ème langue)

3
WIDTH metres/
LARGEUR inches
..... (3rd language/3ème langue)

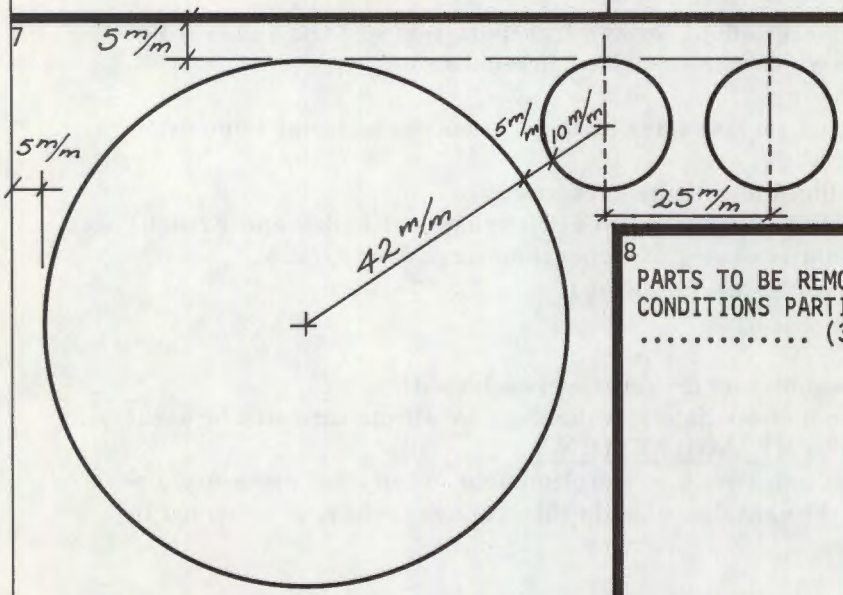
4
HEIGHT mètres/
HAUTEUR inches
..... (3rd language/3ème langue)

5
GROUND PRESSURE/AXLE WEIGHT (FRONT & REAR)
PRESSION UNITAIRE/POIDS PAR ESSIEU (AVANT & ARRIERE)
..... (3rd language/3ème langue)
(kg/cm²/PSI) /

6
MEASUREMENT TONS
TONNAGE VOLUMETRIQUE
..... (3rd language/3ème langue)

(APPLICABLE TO TRANSPORT BY SHIP)
(APPLICABLE AUX TRANSPORTS MARITIMES)
..... (3rd language/3ème langue)

7



(APPLICABLE TO RAIL TRANSPORT ONLY)
(APPLICABLE AUX TRANSPORTS FERROVIAIRES)
(..... (3rd language/3ème langue)

SKETCH BOOK NUMBER
NUMERO DE FEUILLET
..... (3rd language/
3ème langue)

8
PARTS TO BE REMOVED FOR TRANSPORT
CONDITIONS PARTICULIERES DE CHARGEMENT
..... (3rd language/3ème langue)

A-1
OTAN NON CLASSIFIE

Directions for Use

1. This card is designed to display to transport personnel the actual characteristics (laden or empty) of vehicles or equipment for the loading on any means of transport.
2. Accurate inscriptions will be indicated in capitals by the consigning unit or depot preparing the vehicles or equipment for transport. The card will be fixed on suitable surface on the opposite side of the vehicle from the driver's seat, where it can easily be seen. If outside the card should be protected from weather elements.
3. This card is a NATO form and whoever is responsible for the inscriptions should use his country's normal system of weight and measurements, indicating the measurement system used.
4. For rail transport see instructions contained in STANAG 2175.

APPENDIX K

STANAG 2805-E
CLASSIFICATION OF RESTRICTIONS AFFECTING THE MOVEMENT OF CERTAIN MILITARY EQUIPMENT AND VEHICLES BY LAND ON CONTINENTAL WESTERN EUROPE

Agreed English / French Texts — STANAG 2805-E

DETAILS OF AGREEMENT (DofA)

REQUIREMENTS COMMON TO MANY DIFFERENT TYPES OF EQUIPMENT USED BY NATO ARMED FORCES OPERATING IN A GROUND ROLE:
E. CLASSIFICATION OF RESTRICTIONS AFFECTING THE MOVEMENT OF CERTAIN MILITARY EQUIPMENT AND VEHICLES BY LAND ON CONTINENTAL WESTERN EUROPE

Annexes: A (DofA)— Road Movements.
B (DofA)— Rail Movements.

AGREEMENT

1. the NATO Armed Forces agree to take into consideration the clearance dimensions set forth in Annexes A and B (DofA) of this STANAG for movement of certain military equipment and vehicles which are likely to be moved by road and / or rail in Continental Western Europe.

GENERAL

2. Land movement of certain military equipment and vehicles entails different types of restriction according to the method of movement used:

a. By Road. By road, the limitations of class and gauge imposed by the different nations call for the application of special procedures and, where necessary, specialised methods, to effect movement of certain equipments and vehicles whether loaded or not.

b. By Rail. By rail, specific technical limitations of class and gauge makes it necessary to take special technical measures to render the transport of certain equipments and vehicles possible.

3. Annex A (DofA) outlines, with regard to each nation, the class and gauge limits beyond which a road movement becomes a special movement as regards that particular action.

4. Annex B (DofA) outlines:

a. The The maximum rail gauge to be adopted by the Continental Western European nations, with a view to reducing the amount of checking of safety margin details and allowing the movement of normal traffic.

b. The maximum characteristics that should be observed in the construction of equipment so that it can be transported over the rail networks of those countries.

IMPLEMENTATION OF THE AGREEMENT

5. This STANAG will be considered to have been implemented when the necessary orders / instructions to adopt the method mentioned in the Agreement have been issued to the forces concerned.

ANNEX A (DofA) TO STANAG 2805-E

ROAD MOVEMENTS

Appendix: 1 to Annex A (DofA)

INTRODUCTION

1. The expression "Road Movement of Special Vehicles" means movement of vehicles with or without load which because of their class and / or dimensions require special routing arrangement.

LIMITATIONS AFFECTING THE ROAD MOVEMENT OF MOTOR VEHICLES

2. The conditions for the road movement of military equipment and vehicles are governed by the capabilities of existing road networks as defined in STANAG 2151. Further, the special regulations in force in the different countries place certain limitations on ordinary road movements of:

a. Individual wheeled or tracked vehicles, whether loaded or not.

b. Articulated vehicles consisting of a prime mover and semi-trailer.

c. Articulated trains of vehicles consisting of a tractor and one or more trailers.

d. Passenger transport vehicles (motor coaches).

3. These limitations, details of which are given at Appendix 1 to this Annex for each country concerned with this Agreement, related to some or all of the following characteristics of the equipment referred to in paragraph 2 above:

a. Width measured on any cross-section, including all projections.

b. Length (of vehicle or train of vehicles), including all projections and, where applicable, length of each part of the train: tractor + trailer(s).

c. Total height of the vehicle, including load, if any.

d. Turning radius.

e. Class of vehicle (or train of vehicles), calculated according to the method laid down in STANAG 2021.

RULES GOVERNING ROAD MOVEMENT OF SPECIAL VEHICLES

4. Any road movement of military equipment and vehicles of which one or more of the characteristics listed in paragraph 3 above exceeds the corresponding limitation(s) imposed by the regulations in force in one of the countries it will have to cross (See Appendix 1 to this Annex) constitutes a "movement of a special vehicle" in the country concerned. It is then subject to the rules given below.

5. Any movement of special vehicles except those exempted by bilateral agreement supplmenting the NATO Status of the Forces Agreement, should be requested on a Road Movement Bid as laid down in STANAG 2155. The request is forwarded through the normal movements channels by the originating military authority to the territorial military authority of the country in which the movement becomes a movement of a special vehicle.

6. The territorial military authority concerned will implement the Road Movement Credit for special vehicles in accordance with the procedure in force in the country concerned and will notify the authority originating the movement of its decision. Such notification may include in addition to the normal headings of a standard Movement Credit (c. f. STANAG 2155) the following instructions or information:

a. Special safety and / or traffic regulations imposed by day and, where applicable, by night (c. f. STANAG 2024) and the facilities to be provided to this end. This facility may be provided by the host nation.

b. Military or civilian authority or authorities of the Host Nation which the head of the "road movement of a special vehicle" may contact in case of need.

NOTE: To simplify the execution of road movements of special vehicles, Nations are recommended to prepare a documentation (in map or any other form) showing the route and any special characteristics of the itineraries suitable for such movements.

APPENDIX 1 TO ANNEX A(DofA) TO STANAG 2805-E

CLASSIFICATION OF LIMITATIONS AFFECTING THE ROAD MOVEMENT OF MOTOR VEHICLES

REGULATIONS IN FORCE IN NATO COUNTRIES

Country	Width including all projections	LENGTH OF VEHICLES				Motor Coach	Total Height (including load)	Turning Radius	Class (STANAG 2021)
		Single Vehicles	Articulated Vehicle (prime vehicle and semi-vehicle)	Articulated train of vehicles (tractor & trailer(s))					
				Total length of train	Length of one UNIT				
1	2	3	4	5	6	7	8	9	10
BELGIUM	2m50	12m	15m	18m	11m (1)	12m	4m	-	≤50
CANADA	2m438(8')	10m058(33')	15m240(50')	15m240(50')	-	10m058(33')	3m81(12'6")	-	-
DENMARK	2m50	10m or 12m(2)	14m	18m	10m	12m	3m60	-	≤35
FRANCE	2m50	11m	15m	18m	11m (1)	12m	-	-	≤50
Fed Rep of GERMANY	2m50	12m	15m	18m	-	12m	4m	-	≤50 (9)
GREECE	2m50	10m or 11m (3)	14m	18m	-	12m	3m8	-	-
ITALY	2m50	11m (3)	14m	18m (10)	11m (5)	11m	4m	10m (11)	≤50 (7)(8)
LUXEMBOURG	2m50	Note (6)	15m	20m	11m (3)	12m	4m	-	≤40
NETHERLANDS	2m50	11m	15m	18m	-	12m	4m	-	≤50 (4)
NORWAY	2m25	12m	15m	18m	-	12m	3m	-	≤50
PORTUGAL	2m45	10m	12m	14m	10m	10m30	4m	-	≤50
TURKEY	2m50	10m	14m	16m	-	11m	3m80	-	-
UNITED KINGDOM	2m50 (8'2½")	11m (36'1½")	15m (49.21')	18m(59'0 5/8")	9m144 (30')	11m(36'1½")	No LIMIT (12)	-	≤50
UNITED STATES	2m438(8')	10m668(35')	15m240(50')	18m288 (60')	10m668(35') (1)	12m192(40')	3m81(12'6")	-	≤50

NOTES:
(1) Exclusive of coupling device on trailer.
(2) Lorry with 2 axles: 10m; other vehicle: 12m
(3) Motor vehicle with 3 or more axles: 11m. Motor vehicles with only 2 axles: 10m (ITALY - motor coaches excluded).
(4) Maximum tyre-load: 5000 kg.
(5) This figure concerns the tractor only: the length of the trailer cannot exceed 6m for 1 axle trailer, 7m50 for 2 axle trailer, 8m for 3 or more axle trailer.
(6) Vehicle with one axle: 7m. Vehicle with 2 axles: 10m. Vehicle with 3 axles or more: 12m.
(7) Maximum load:
(a) Motor vehicles and trailers - with ground pressure 8 kg/cm^2: 14,000 kg (2 axles); 18,000 kg (3 axles*); 22,000 kg (4 or more axles*).
*with a distance of 1m between two axles.
(b) Busses: 15,000 kg (2 axles); 19,000 kg (3 axles).
(c) Tractors and semi-trailers: 14,500 kg. Under the condition indicated in (a) above: 18,000 kg (3 axles); 28,000 kg (4 axles); 32,000 kg (5 or more axles).
(d) In any case, maximum load on each single axle 10,000 kg; on 2 axles (at a distance of 2m) 14,500 kg.
(8) Highways only can be considered very heavy traffic routes (Class 120) but they cannot be used in peacetime by tracked vehicles.
(9) Maximum load per single axle: 8 tonnes. Load on driving axle of vehicle: 10 tonnes. Load per double axle: 14.5, and providing there is a minimum wheelbase of 1.3m, 16.0 tonnes.
(10) The total length should be less, if conditions of column n.9 cannot be satisfied.
(11) Each vehicle (single, articulated or train) should be included in a 4m. 50 wide circular crown of turning way. The internal radius of this circular crown cannot be longer than 10 m.
(12) No limit is imposed on height in the UK but on some secondary roads bridges may give only 3m 962(13') headroom, on main roads 4m 572(15') is general.

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By Order of the Secretary of the Army:

CREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

Official:
VERNE L. BOWERS
Major General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-11B requirements for Army Motor Transport Operations (Qty rqr block no. 392).

☆ U.S. GOVERNMENT PRINTING OFFICE: 1974—713-210/5059