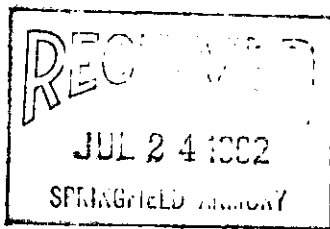


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FM 25-10

DEPARTMENT OF THE ARMY FIELD MANUAL

MOTOR TRANSPORTATION OPERATIONS



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HEADQUARTERS, DEPARTMENT OF THE ARMY

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MOTOR TRANSPORTATION, OPERATIONS

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PART ONE

GENERAL

CHAPTER 1

INTRODUCTION

1. Purpose and Scope

a. Purpose. The purpose of this manual is to provide the information necessary for troops of all branches to understand the principles of planning, operation, and control essential to successful military movements by motor vehicles.

b. Scope. This manual is limited in scope to the principles and basic techniques of planning, operation, and control. References are made to publications offering detailed treatment of techniques and procedures. This manual is designed as a common text for the use of command, staff, and operating personnel of all branches in the training for and conduct of all military motor movements. Definitions of terms relating to motor movements, explanations of march formations and traffic control measures to include the duties and responsibilities of operating personnel, and explanations of movement planning techniques and planning aids are included. Operations under varying terrain, climate, and tactical conditions are treated insofar as they affect the planning and execution of motor movements. The material presented herein is applicable without modification to both nuclear and nonnuclear warfare.

2. General

Modern war is war of movement. The speed and facility with which the commander may effect the distribution or concentration of personnel, equipment, and supplies may decide the outcome of an operation. Nuclear capabilities of modern armies with the resultant tactical dispersion accentuate this need for mobility in both offense and defense. Since motor transportation supplies a large percentage of this mobility, it is important that organization and training for efficiency in motor movements be stressed by all branches at all levels.

3. Uses of Motor Transport

a. In the combat zone where all military movements are subject to enemy action, motor transport is commonly used for the transportation of personnel, equipment, and supplies. The modern military motor vehicle has inherent characteristics of good cargo

capacity, relatively high highway speeds, adaptability, and flexibility of independent movement. Successful motor movements exploit these characteristics to the utmost through training, careful planning, and adequate control. The basic function of military motor transport is to move personnel and materiel from origin to destination to give timely and effectual tactical and logistical support to military operations. Functionally, military motor movements are divided into two general classifications, tactical and administrative. Tactical movements are characterized by the maximum exploitation of the mobility of motor transport for timely delivery of units and supplies to their destinations in the best formation and condition for the accomplishment of the assigned mission. In tactical motor movements unit integrity for tactical control, combat loading for ready availability on contact, and speed of movement are of greater importance than economy of cargo capacities. Administrative movements are characterized by the maximum use of available transport. Tactical considerations in administrative movements are of less importance than economical use of cargo capacities and operating personnel.

b. Motor movements, both tactical and administrative, may utilize organic transportation, vehicles of attached or supporting units, or a combination of both as the situation demands. *Organic transportation* includes those vehicles regularly assigned to a unit by tables of organization and equipment, by tables of allowances, or by equipment modification lists. Supporting or attached transportation may be designated to facilitate a motor movement based upon estimates of requirements, availability, and established priorities.

4. Types of Motor Movements

Motor movements may be further classified by the degree of control as—

a. *Casual Military Movements.* Those movements which consist of individual elements proceeding more or less at will in the performance of routine administrative, staff, command, supply, and evacuation functions of units.

b. *Organized Military Movements.* Movements consisting of tactical units or supply convoys in which elements are grouped together for adequate control.

c. *Unorganized Traffic.* Movement without control, including refugee and military traffic in times of panic and demoralization. The presence of unorganized traffic necessitates immediate emergency control measures to restore efficient use of the road net.

5. Conditions Affecting Motor Movements

Military motor movements are affected by a wide variety of conditions over which planning and operating personnel have no direct control. These conditions can be anticipated to a varying degree and provisions made for operation and control. All plans and operations must, however, maintain sufficient flexibility to meet unpredicted weather, terrain, or tactical conditions as they arise. Examples of varied conditions and general provisions for operation under these conditions include the following:

a. Civilian Controls. Motor movements made within the continental United States, and usually those in the territory of a friendly nation, are subject to civilian traffic laws and regulations. Coordination with civil authorities is therefore necessary for proper clearances prior to executing motor movements.

b. Terrain and Climate. Conditions of terrain and climate may seriously restrict the mobility of motor vehicles and often require special training and issues of special equipment. Adequate prior planning will minimize the adverse effects of those conditions. See chapters 8 and 9 for effects of climate and terrain.

c. Highway Conditions and Road Net. An adequate road net with highways and bridges suitable for all classes of military traffic will not be present in many areas. It is important that route reconnaissance be as thorough as time and the tactical situation will permit so that the most efficient use may be made of the existing road net and early provision made for adequate engineer support.

d. Tactical Conditions. In theaters of operations, particularly in the combat zone, tactical conditions demand the highest consideration in both the planning and the execution of motor movements. Tactical conditions include all conditions imposed by the enemy such as air, artillery, or CBR attack; raids, guerrilla action, and sabotage; and conditions imposed by the operational plans of our own forces. March or convoy organization reflecting current intelligence, command structure providing efficient command channels suitable for anticipated action, and the assignment or designation of adequate security detachments are basic provisions in plans and orders for movements under tactical conditions. The introduction of nuclear weapons systems to the modern battlefield amplifies the requirement for thorough training in the employment of cover, concealment, and dispersion at all echelons. No unit of military importance, either tactical or logistical, can afford to disregard or minimize these security responsibilities. Adequate unit SOP will facilitate meeting tactical conditions.

CHAPTER 2

PRINCIPLES OF MOTOR TRANSPORTATION OPERATIONS

Section I. COMMON FACTORS IN MOTOR MOVEMENT

6. The Military Motor Vehicle

A motor vehicle is any vehicle propelled by a self-contained power unit, except a vehicle designed primarily for use on railways or other trackage, and materials handling equipment. For the purposes of this manual, the term "motor vehicle" will include vehicles designed to be towed by a motor vehicle.

a. Military motor vehicles are divided into two general classes according to use and design.

(1) *Tactical vehicles.* Vehicles designed primarily to meet field requirements in connection with combat and tactical operations. Tactical use of a vehicle is any use in direct connection with combat or tactical operations or the training of troops for these operations.

(2) *Administrative vehicles.* Vehicles, normally of commercial type, suitable for routine purposes in connection with the transportation of supplies, personnel, or equipment at installations. Administrative use of a vehicle is any use not directly connected with combat, tactical, or service unit operations or the training of troops for these operations. Tactical vehicles may be designated and used as substitutes for administrative vehicles by the Department of the Army.

b. Vehicles are further classified as—

(1) *General purpose vehicles.* Motor vehicles designed to be used interchangeably for movement of personnel, supplies, ammunition, or equipment, or for towing artillery carriages, trailers, or semitrailers. They are used without modification to body or chassis to satisfy general automotive needs.

(2) *Special equipment vehicles.* Motor vehicles the chassis of which are identical, except for minor alterations, to those used in general purpose vehicles, but which have a special body or special equipment mounted thereon.

(3) *Special purpose vehicles.* Motor vehicles designed and intended for a specialized requirement for which no general purpose chassis can be adapted. This category includes items that are specified from time to time by

the technical services. All tractors, regardless of size or intended purpose, will be classified as special purpose vehicles. They are separate and distinct from combat vehicles.

- (4) *Combat vehicles.* Motor vehicles, with or without armor and/or armament, which are designed for specific fighting functions. Limited armor protection and/or armament mounted or installed on general purpose, special equipment, or special purpose vehicles will not change the classification of such vehicles to combat vehicles.
- (5) *Trailers.* Vehicles designed to be towed and provided with a drawbar or tongue for attachment to a coupling mounted on the towing vehicle. Trailers are classified as to type (general purpose, special equipment, special purpose, combat) in the same manner as self-propelled vehicles. For the purposes of this manual, trailers are included in the term "motor vehicle," except that towed artillery carriages are classified as motor vehicles for matters concerned with traffic regulations, speed limits, road accidents, and load size limitations only.
- (6) *Semitrailers.* Vehicles designed to be towed and to be supported in part by a prime mover through a fifth wheel or similar coupling. Semitrailers are classified and considered in the same manner as trailers.

c. Military motor vehicles are developed and designed to insure the performance of necessary tactical and administrative transportation functions under varied conditions. Military requirements generally limit the use of unmodified commercial type vehicles to administrative uses within the continental United States. Design specifications and performance characteristics of vehicles developed for military use indicate their capabilities and limitations under various conditions. Military personnel must recognize these capabilities and limitations to make the most efficient use of available transportation. The basic factors controlling vehicular performance characteristics are defined below.

- (1) *Gradeability.* The ability of a vehicle to negotiate a slope while carrying its designated payload with its transmission in the lowest forward gear.
- (2) *Traction.* The ability of the wheels or track of an automotive vehicle to adhere to the road.
- (3) *Fordability.* The ability of a vehicle to negotiate a depth of water without stalling the engine.
- (4) *Momentum.* The energy stored up by the mass of the vehicle in motion increasing proportionately with the

speed of the vehicle and the weight of the vehicle and load.

- (5) *Flotation*. The ability of a wheel or track to resist sinking into the surface supporting it, increasing with the area of ground contact per pound of weight and varying inversely with ground pressure (expressed in pounds per square inch).
- (6) *Power*. The force built up by the engine and transmitted to the wheels or track to produce motion. Power in any gasoline propelled vehicle depends upon maintaining proper engine speed. A shift to a lower gear gives more effective use of power, but with a proportional loss of speed.
- (7) *Other factors*. Other factors which limit or extend the capabilities of vehicles under various conditions include ground clearance, angle of approach, angle of departure, turning radius, gross weight and weight distribution, height, width, and length.

7. Utilization of Vehicles

A major factor in motor transportation operations is the maximum utilization of vehicles in support of tactical operations.

a. Command Responsibility. It is the responsibility of command in every echelon to guarantee that motor transportation is so maintained and administered as to give mobility and flexibility to tactical commanders when needed. Normal military maintenance programs, properly administered and supervised, will preserve the mobility of the unit under normal conditions. Combat conditions demand additional initiative at all levels.

b. Driver's Duties and Responsibilities. The military driver must be thoroughly trained in the safe operation of his assigned vehicle under all conditions and in certain limited maintenance procedures. It is his responsibility to operate the vehicle in an acceptable manner, to report deficiencies, and to perform first echelon maintenance. The driver's efficient performance of his duties in operation and preventive maintenance is the foundation of efficient motor transportation.

c. Maintenance. Based upon driver's reports of deficiencies and upon periodic inspections, it is the duty and responsibility of unit maintenance sections to keep vehicles in a safe and efficient operating condition. Thorough training and adequate supervision of maintenance personnel will lessen the time necessary for repairs at installations and on the march.

d. Administration. Administrative waste of motor transportation through improper dispatch, loading, and routing may reduce

the effective mobility of a unit as much as poor operation or poor maintenance. Being less tangible than improper operation or inefficient maintenance, the administrative deficiencies may become more serious than either before corrective action is taken.

8. Highway Characteristics and Use

Because all motor movements contemplate the use of an existing highway system to the greatest extent possible, this factor is of prime importance to both planning and operating personnel.

a. Highway Characteristics. Highway characteristics include all the physical factors of highway classification: road width and surface; hills and curves; road net; and bridge, tunnel, and overhead clearance limitations. The collection, analysis, and use of accurate data on highway characteristics is particularly important in theaters of operation due to the demands imposed by military traffic and the primitive conditions encountered in many areas. Physical restrictions on highway use are largely dependent upon the capabilities of existing bridges. Engineers, in conducting their route reconnaissance, will classify and mark rafts and bridges to indicate their capacities for military traffic in accordance with the same standards used in classifying and marking the vehicles (FM 5-36).

b. Highway Regulation. Highway regulation is the planning, routing, scheduling, and direction of all motor transport movements to meet military needs. Highway regulation becomes increasingly important as combat areas are approached and both tactical and supply traffic is increased. Enemy action may further limit the use of the existing road net, making highway regulation more necessary to the timely delivery of critical personnel, equipment, and supplies. The planning of highway regulation must provide flexibility to allow modification as the situation demands with a minimum of confusion.

c. Highway Traffic Control. Highway traffic control, a Military Police Corps function, embodies the enforcement of traffic laws and regulations; the investigation of traffic accidents; and the direction of vehicles, animals, and foot movements that will insure safe and efficient traffic circulation to meet military requirements.

Section II. PRINCIPLES OF MOTOR MOVEMENT

9. General

a. Organized military movements, as opposed to casual movements, are made by groups of elements (troops and/or vehicles) over selected routes under supervision.

b. Military movements are organized to centralize control at

the highest level at which it can be adequately exercised; to assure delivery of personnel, equipment, and supplies in accordance with established schedules and priorities; to maintain flexibility for meeting changing tactical situations; to utilize carrying capacity efficiently; to provide the maximum comfort to troops compatible with the situation; to facilitate distribution of cargo at destination; and to provide adequate security en route.

c. Organized motor movements generally include military movements either in the continental United States or theaters of operations where casual movements would prove impractical, inefficient, or unsafe due to the tactical or training situation, the size of the movement, or requirements for control.

10. Marches and Convoys

Organized overland movements of personnel, equipment, and supplies fall into the basic categories defined and explained below.

a. Marches are organized movements of troops as units under organizational command utilizing organic and/or attached transportation; they are generally further classified as to the principal means, that is, foot marches or motor marches.

b. Convoys are groups of vehicles organized for purposes of security and control.

11. March Organization

March organization is influenced by a number of factors which include the assigned mission, regulations imposed by higher authority, type of transportation available, type of load or loads, highway and traffic conditions, tactical situation, and administrative conditions. Movements of larger units are normally organized in a number of march columns which are planned, coordinated, and controlled by a traffic headquarters. Such march columns, often moving simultaneously over different routes, permit operational flexibility to meet various conditions without sacrificing the tactical integrity of the parent unit. The following terms are commonly used in describing march organization:

a. *March Unit.* A march unit is a unit that is under direct control of a single commander using voice, visual signal, or radio. The size and composition of the march unit is dependent on the situation and mission. A motor march unit is normally a company or battery which is considered to include on the average not more than 25 vehicles. Vehicles of different characteristics should not be placed in one march unit unless demanded by the tactical situation or mission.

b. *March Column.* A march column includes all elements using the same route for a single movement of troops. Thus a march

column may include one or more march units or serials moving along one route under the order and the centralized regulation of a single headquarters.

c. Serial. A serial consists of elements of a march column moving from one area, over the same route, at the same rate, to the same new area, and grouped under one commander. It may be a battalion, battle group, combat command, or larger task force, depending upon the echelon planning the move; it is organized as a single unit for the purpose of planning, regulation, and control; and given a serial designation for convenience in scheduling, preparing, and issuing march instructions.

12. Elements of a Motor Column

All motor columns, regardless of size, are composed of three functional parts.

a. The Head. The first element of the column in order of march is the head. The commander, or his representative, controls the march from this position maintaining the prescribed schedules and rates of march aided by the pace setter, following the proper route, checking in at scheduled points, receiving orders or changes in orders, and issuing instructions as required. The pace setter rides in the last vehicle of this element and sets the pace according to the speeds that can be maintained by the slowest vehicle in the column.

b. The Main Body. The main body of the column follows the head, immediately preceded by the pace setter's vehicle and consists primarily of task vehicles carrying troops, equipment, and/or supplies. The main body may be subdivided into march units which may be grouped in serials for purposes of regulation and control. March units or serials may be similarly organized with head main body, and trail sections. Each separate march unit should have its pace setter.

c. The Trail. The last element of the column in order of march is the trail. The trail officer or noncommissioned officer represents the commander in such functions as the prevention of straggling, maintaining discipline, march maintenance of vehicles, medical aid, and checking final clearance of the column at designated points; taking such action as may be required.

13. Principles of Column Movement

Three general principles should be considered in planning and executing motor movements.

a. Upon approaching hills, curves, congested areas, or other traffic obstacles, the distances between vehicles decrease as the speed of the head of the column decreases. As the head of the

column regains the open road and resumes speed these distances increase. This natural accordion action must be recognized and measures of column control should be designated to capitalize on this principle, particularly in hilly and congested areas.

b. The mobility and flexibility of a motor movement decreases progressively as the size of the column increases. The division of large columns into march units and serials minimizes this loss of mobility by increasing flexibility of movement and control.

c. The road speed of a column or element of the column is limited by the capabilities of its slowest vehicles; therefore, vehicles of similar characteristics are grouped together whenever possible so that maximum road speed may be maintained.

PART TWO
MOTOR MOVEMENTS OPERATIONS
CHAPTER 3
OPERATIONAL CONSIDERATIONS

Section I. GENERAL

14. Operational Factors

The success of a motor movement is largely dependent upon a favorable balance of operational factors. These factors include terrain, weather, the tactical situation, availability and suitability of vehicles, and driver capabilities. Planning personnel anticipate and plan for meeting as many variations in these factors as may be foreseen, yet the final responsibility rests with the operating personnel.

15. Requirements for Successful Movement

The basic requirements for successful motor movement are suitable vehicles in the amounts necessary, an adequate road net, and well trained planning and operating personnel. The thorough training of operating personnel is of particular importance since this may compensate for restrictions in either vehicles or highway facilities imposed by combat conditions. Training in operational and control techniques under a variety of conditions will provide the skills necessary to make adjustments to highway conditions, enemy actions, loss of facilities, or enforced imbalance in vehicular capabilities and requirements. Motor movements in the theater of operations are always subject to unexpected delays and sudden changes in plan. To minimize delay and confusion while adapting movement plans to the tactical situation, all routine problems of movement should be met automatically.

Section II. THE MILITARY DRIVER

16. Driver Selection and Utilization

Commanders should constantly strive to select only men with the proper qualifications to be trained as drivers. Men with low intelligence, poor physical coordination, slow reaction, or little sense of responsibility should not be trained as drivers. The

military motor vehicle is an expensive piece of mechanical equipment designed to give long, dependable service under military conditions if properly operated and maintained. Poor drivers cause excessive vehicle deadlining which impairs the mobility of the unit, places an undue burden on maintenance facilities, and greatly increases the cost of military transportation. The good driver must not only know how to drive properly and how to perform first echelon maintenance but must also perform these duties skillfully and habitually. Drivers must learn to appreciate the value of, and necessity for, good driving and good maintenance. They must *want* to drive properly and to perform their maintenance function thoroughly. Command responsibility does not end with the selection of personnel of the required standards. The unit driver training program must be well conceived, progressive, and continuing, with adequate supervision to insure the maintenance of unit mobility.

17. Driver Responsibilities

The military driver has two fields of responsibility—operation and maintenance. His operational responsibilities include the mechanical operation of his assigned vehicle, observance of traffic laws and regulations, and alert adherence to military orders and instructions at all times to insure the smooth and efficient operation of military movements. The driver also supervises the loading of his vehicle, provides adequate protection from the weather, and properly lashes the load. His basic driver training imparts the required skills in actual operation such as making smooth starts and stops, selecting the proper gear ratios for various speeds and loads, and judging speeds and distances. This skill must be coupled with a knowledge of traffic laws and regulations to insure safe highway operation under normal conditions. Since a large percentage of military movements are made in formation, the driver must also be thoroughly familiar with the mechanics of column movement and control and must be prepared to comply with orders and instructions of the commander. The driver's maintenance responsibility is preventive. By performing daily and other scheduled inspections and services properly and reporting the results on DD Form 110 (Vehicle and Equipment Operational Record), the driver makes it possible for organizational mechanics to correct defects before they necessitate major repairs. Many minor defects can be remedied by the driver on the spot.

18. En Route Procedures

The smooth, uninterrupted movement of personnel, equipment, and supplies by motor is largely dependent upon the operation of

individual vehicles. The driver must be thoroughly trained and oriented regarding the particular movement. His inspection and maintenance duties—before operation, during operation, at the halt, and after operation—insure the movement against unnecessary en route maintenance. His alert attention to instructions, to traffic laws and regulations, to column control signs and signals, and to the protection of his load or cargo is an important basic factor in motor movement. Each driver should be thoroughly oriented before the movement. He should be familiarized with the route and should know the rate of march, the formation for the movement, and distances to be maintained. He should know the procedures and timing for refueling and messing, and should be familiar with SOP's on medical care and motor repair on the march (TM 21-300 and TM 21-305).

Section III. HIGHWAY REGULATION

19. General

Highway regulation is normally a function of the transportation officer in division or higher headquarters. However, since this function has assumed major importance with the growth of mechanization in modern military organization, it is necessary for all concerned with highway movement to be familiar with the mechanics and techniques of highway regulation in order to comply intelligently with its provisions. The purpose of highway regulation is to coordinate the actual use of highways by troops, supply vehicles, refugees, and civilians to afford the maximum utilization of facilities in accordance with designated priorities. Highway regulation is essential to avoid congestion and conflict of traffic, and to keep march columns constantly under control so that their orders may be changed at any time to conform to changes in destination, routings, and priorities. For further information see FM 55-31.

20. Types of Control

a. Organizational Control. Organizational control is always exercised during highway movements. This control is the responsibility of the commander of the organization or unit using the road and, as prescribed by higher authorities, insures that rules of the road, traffic laws and regulations, speeds, spacing, routing, adherence to schedules, discipline en route and at halts, and measures for local security are observed.

b. Area Control. Area control of the highways is a function of command exercised under the general staff supervision of the

G4. Regulation is prescribed by the transportation officer. Highway regulation controls are provided by highway regulation point teams supplemented by military police who provide highway traffic control. This control is superimposed over organizational control and is the means by which highway movement is coordinated between units and organizations using the highways. It is employed only to the extent necessary to insure orderly and effective movement of vehicles over the highway system.

21. Control Classification of Highway Routes

In accordance with the degree of control demanded in the planning and operation of highway regulation, highway routes are designated by the following terms:

a. Open. An open route is one which involves a minimum of supervision. Such a route normally requires only organizational control, military police traffic control at critical intersections, and the necessary signs and markings.

b. Supervised. A supervised route requires limited control by a central traffic authority using traffic control posts, patrols, or both. No prior correlation of individual march schedules is usually necessary for the use of the route by small units although access to the route may be regulated in conformity with the traffic situation.

c. Dispatch. A dispatch route is a road over which full control, both as to priorities of use and the regulated movement of traffic in time and space, is exercised. Both highway regulation and highway traffic control are exercised. Normally, a high degree of area control is required in addition to organizational control and military police traffic control.

d. Reserved. A reserved route is one set aside for the exclusive use of a designated unit or specified type of traffic. When reserved for a designated unit the commander of the unit decides the degree of regulation and control that will be exercised. In addition to organizational control, it requires adequate military police traffic control to deny use of the route to unauthorized traffic.

22. Operating Procedures

a. Routing. Highway traffic is routed from origin to destination by the transportation service. Through traffic is routed by regulating the entire route by an intersectional service or by subordinate area commands following the established procedures of the highest command concerned.

b. Scheduling. Scheduling is the means by which priority of movement and traffic density are controlled and congestion is

avoided. It is achieved by the regulation of departures from origin or points en route, the rates of advance en route, and arrivals at destination or points en route. Normally, scheduling is done by organizational control on open and supervised routes and by area control on dispatch and reserved routes.

c. Regulating. Highway regulation points are set up along dispatch routes to transmit orders to convoy commanders and to report progress of serials. Personnel of highway regulation points work in conjunction with military police.

d. Emergency Routing and Scheduling. Local adjustments of traffic routing and scheduling frequently are necessitated by changes in the tactical situation, damage to roads, weather, or traffic congestion. Under such conditions highway regulation point teams and military police assist column commanders to take the necessary immediate action with minimum dislocation of area motor movement operations. Movements must not be delayed awaiting orders from higher headquarters; the decision must be made by the column or unit commander. For more detailed information, see FM 55-31.

Section IV. COLUMN COMMAND AND CONTROL

23. General

Certain internal functions of march control are the normal responsibility of the personnel of the marching unit, while other functions of control are imposed on the unit by higher authority. The commanders of march units should have detailed knowledge of both, to enforce their own directives and to insure intelligent cooperation with highway regulation and traffic control personnel. For more detailed information, see FM 55-10 and FM 55-31.

24. Methods of Movement

A fundamental measure for column command and control is the selection of a method of movement suitable to the situation and the degree of control necessary. In many instances the formation of columns or convoys may be impracticable due to the need for dispersion or interference with other traffic over a specific route. In other cases individual dispatch may not provide the degree of security, control, or unit integrity to perform the assigned military mission. The commander must make the decision suitable to the situation as to the best method for the mission and situation. The three basic methods of movement are as follows:

a. *Close Column.*

- (1) *Definition.* A close column is one in which the elements are formed as compactly as practicable to reduce road space to a minimum. Vehicles follow at the least distance which safety, traffic conditions, and the tactical situation will permit.
- (2) *Uses.* Close column is used when the road net must be utilized to its maximum capacity. It may be used in movements through cities or other congested areas for the purpose of better control, in which case arrangements should be made for escorts through such areas. Close column is often used in night movements under blackout conditions, particularly over poorly marked routes when it is essential that gaps between vehicles be short enough to enable drivers to maintain visual contact with the vehicle ahead.
- (3) *Execution.* Vehicles in each march unit will follow the vehicle ahead at a distance governed by a small speedometer multiplier (1 or 2) (par. 27a), sufficient only to insure against accident. On occasion, the casual "follow me" method of marching may be used. When this is done, drivers are instructed to follow the vehicle ahead as closely as they think is reasonable and consistent with safe driving practices. A maximum speed is prescribed for vehicles regaining lost distances. Changes in speed are accomplished smoothly and gradually to insure safety and uniformity of column movement. The head of the column maintains its position en route by the use of a time schedule or a minimum gap from the rear of the preceding unit. The at-halt gap may also be prescribed in the march order. (Unless the tactical situation prohibits congestion, vehicles within each march unit may close up to approximately 3 yards between bumpers at halts. March units and serials, however, should not close on the units ahead unless so ordered.)
- (4) *Advantages.* In close column the full traffic capacity of the road, or traffic lane, can be utilized as road space is reduced to the minimum for safe driving. Column control and intracolumn communication should be better in such compact columns, and fewer guides, escorts, and markers are needed.
- (5) *Disadvantages.* Close column formations do not provide dispersion for passive protection against enemy observa-

tion and attack. The strength and type of organization are readily apparent to hostile observation. Vehicles may arrive at terminal areas more rapidly than they can be handled without congestion. Careful scheduling and rigid control of traffic are necessary to avoid dangerous blocking at intersections. Greater driver fatigue is generally experienced in close column. Use of the highway by other traffic is severely limited.

b. *Open Column.*

- (1) *Definition.* An open column is a motor column in which the distances between vehicles are increased to afford dispersion.
- (2) *Uses.* Open column formations are employed to protect movements from effective enemy observation and action, to permit the concurrent use of highways by traffic moving at various speeds, and to reduce driver fatigue, particularly in areas where dust is a factor.
- (3) *Execution.* Open column movements are normally accomplished by designating a large speedometer multiplier (3 or more), a minimum gap between vehicles, or both. In areas particularly sensitive to enemy action or in areas of broken terrain, adequate dispersion may be further insured by prescribing traffic density in orders.
- (4) *Advantages.* Four basic advantages may be gained from the employment of open column formations. First, they offer passive protection from hostile observation and attack and minimize losses from enemy action. Second, open column formations allow greater highway speeds with safety (the use of a large speedometer multiplier gives more flexibility to the individual driver in meeting highway emergencies.) Third, open columns permit a greater flexibility in highway utilization, both in planning movements and in making adjustments for sudden changes in the tactical situation. And fourth, a definite reduction in driver fatigue, both physical and psychological, results from the use of open columns.
- (5) *Disadvantages.* In comparison with close columns, open columns are more difficult to command and control. Due to abnormal gaps, drivers have difficulty in maintaining the prescribed spacing. Open column formations also permit less traffic volume on a road than more compact formations. In comparison with infiltration, open

columns permit less secrecy and a lower degree of passive defense.

c. *Infiltration.*

- (1) *Definition.* Infiltration is the dispatch of vehicles over a route individually or in small groups or irregular intervals.
- (2) *Uses.* When sufficient time and road space are available, this formation is used to provide the maximum of secrecy, deception, and dispersion as a means of passive protection against enemy observation and attack. It is therefore well suited to daylight marches. It may also be used to execute a movement along a heavily traveled route on which it would be impracticable to impose a complete unit. Since infiltration produces a minimum of interference with other traffic and permits a higher average rate of march, it is suitable for movement in congested areas and on routes which cross heavily traveled roads.
- (3) *Execution.* Vehicles are usually dispatched individually, or in small groups, at a rate that will keep the average traffic density down and prevent the undue massing of vehicles. Every driver must be given detailed instructions regarding the route, running speeds, maximum speed, and restrictions before leaving the unit area. The route of march should be clearly marked and, if practicable, a strip map should be provided for each driver. Average distance between vehicles in the overall plan is determined initially by the rate at which vehicles are dispatched. Thereafter, speeds and distances are regulated by individual drivers in conformity with operating instructions. Deception for the purpose of preventing the disclosure of a movement to enemy observers may be provided by intermingling various types of vehicles and by permitting passing within the march. In order to provide passive defense against enemy observation and attack, vehicles should normally be dispatched so as to produce an average traffic density not to exceed 10 vehicles per mile. When more than one movement is taking place simultaneously over the same route, it is desirable to coordinate the rates of dispatch to obtain the desired dispersion. Supervision of movement is affected by stationing necessary regulation and control personnel along the route of march. To prevent massing of vehicles at or near traffic bottlenecks or the

march destination, it is important that adequate guides or markers be posted so that vehicles may proceed with minimum delay.

- (4) *Advantages.* 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 march but is limited only by the march order, road capability, vehicle mobility, and the training, experience, and physical condition of the drivers. Higher speeds by individual vehicles may be obtained by this type of movement. Since traffic density is light, cross traffic may move without excessive interference. A unit may be moved by infiltration over a route on which traffic is too heavy to move the unit at one time.
- (5) *Disadvantages.* Time length of the infiltration march is greater than with any other type of movement. Thus, in spite of a higher rate of march, the total road clearance time for a march may be longer. Because of extended distances between vehicles, internal control of the march is difficult. Drivers are usually unable to regulate their movements by the vehicle ahead, therefore careful marking of the route is necessary to prevent drivers from getting lost. If drivers operate alone, more detailed briefing is required, maintenance arrangements may be difficult, and refueling and messing are sometimes difficult to arrange. Since individual vehicles and small units operate separately, and since other units may move simultaneously over the same route there is danger that they may bunch up so that, although the average density per mile is as prescribed, there is, in effect, a close column on one section of the road but no vehicles on other sections. Due to relaxed control, the tactical employment of the unit may be difficult until the march is completed.

25. The Start Point

a. Definition. A start point is any designated place at which a column or element thereof is formed by the successive arrival of its various subdivisions.

b. Location. The start point should be so located that all march units move in the direction of the march to reach the start point and take their places in column without reduction in speed and at proper intervals. It should be inconspicuous to hostile

observation yet easily identified by those in the column to eliminate the possibility of confusion. In motor movements of larger units, several successive start points may be designated to facilitate the formation of the column.

c. Uses. The column commander assumes active control of the column at the start point. Scheduling of movements is based on the start point. At this point the commander may make the adaptations necessary to compensate for delays of certain elements or for other unforeseen circumstances. The start point is also the position often used to check various convoys onto a dispatch route. As each vehicle passes the start point its driver or front seat passenger records the odometer reading to use in referring to points along the route in terms of mileage from the start point.

26. March Discipline

a. March discipline is attained through training and through internal control within the marching unit. It is indispensable to the effectiveness of the march column. The specific objective of march discipline is to insure intelligent cooperation and effective teamwork on the part of all march personnel. Such cooperation and teamwork can be attained only by thorough training, constant supervision by every officer and noncommissioned officer, practical experience in marching, and meticulous attention to details of technique listed below.

- (1) Correct driving.
- (2) Immediate and effective response to all signals and orders.
- (3) Prompt relaying of visual signals.
- (4) Strict obedience to traffic regulations, rules of the road, and instructions of highway regulating, traffic control, and command personnel.
- (5) Effective use, as prescribed, of cover, concealment, camouflage, dispersion, radio silence, blackout precautions, and other protective measures against air, ground, or CBR attack.
- (6) Correct speeds, distances, and positions within the column.
- (7) Observance of the rules of march hygiene.
- (8) Proper care of equipment.

b. The responsibility for good march discipline begins with the driver of each vehicle and increases with each commander charged with internal control. Their duties are briefly as follows:

- (1) The driver of each vehicle is responsible for observing the proper distance and speed, for safety precautions, for

good driving, for performance of prescribed first echelon maintenance, and for strict observance of all requirements of standing operating procedure or specific orders governing the march. The driver will be given adequate orientation on routing and destination to insure safe arrival in the event of separation from the column. When time and facilities permit, he should be supplied with a strip map of his route.

- (2) The assistant driver should be constantly on the alert for column signals and warnings and for signs placed along the road, warning the driver and transmitting such information back along the column when appropriate. This is particularly important at night or under conditions of poor visibility. He should assist the driver in every way possible; guarding against his falling asleep, assisting in at-halt maintenance service, and helping with emergency repairs.
- (3) Squad leaders supervise the actions of the drivers of the vehicles composing their squads, giving particular attention to spacing of vehicles and the performance of first echelon maintenance.
- (4) Section leaders and/or platoon leaders supervise the actions of the squad leaders, giving them such instructions as may be required for the proper functioning of their sections or platoons.
- (5) The march unit leader or commander gives the orders to move or halt and exercises general supervision over the conduct of his unit. He is responsible for maintaining the proper position of his march unit within a larger column and for carrying out the orders of the column commander.
- (6) Commanders in a convoy, column, or serial are responsible for their units, the responsibility becoming broader and more general in nature at each higher level of command.

27. The Speedometer Multiplier (SM)

a. The speedometer multiplier offers a convenient method of designating and maintaining appropriate gaps between vehicles in column under varying conditions of traffic and terrain. The use of the speedometer multiplier for column control facilitates the continuous movement of the column over difficult terrain, through congested areas, and around obstacles by variation of gap and lead in direct proportion to speed. The controlled accordion action thus produced allows the maximum use of the better sections of the

route, while reducing the delay at difficult sections to a minimum. The speedometer multiplier is a constant factor selected on the basis of a minimum desired gap between vehicles at the lowest speed anticipated. It is expressed as an SM of 2, 3, or higher. The indicated speed of the vehicle in miles per hour is multiplied by the specified SM, the result is the required gap in yards between vehicles at that speed; thus, at 25 miles per hour with an SM of 3, the gap is 75 yards. Since gap and lead fluctuate in direct proportion to speed, the column will close smoothly as the speed is reduced and will open as normal road speeds are resumed; thus only those vehicles actually traversing the difficult section of highway will be traveling at minimum speeds, while the speed of the remainder of the column is affected as little as possible.

b. For movements in areas where road conditions are extremely variable, a minimum gap should be specified to prevent bunching of vehicles at slow speeds. The selection of an abnormally large SM to give the required gap and lead at slow speeds may result in a lack of column control at high speeds. Care must be exercised in specifying the minimum gap for the use of any column, or element thereof, to insure against producing time lengths at reduced speeds that will prevent clearances as scheduled in orders from higher headquarters. Minimum gap may be specified in the unit SOP.

c. The use of the speedometer multiplier in the control of motor movements is limited by the degree of security indicated by the situation. Since the use of the speedometer multiplier alone sacrifices the element of dispersion at reduced speeds in order to achieve continuous flow of traffic, other means of column regulation and control will normally be used when there is probability of enemy interference. Movements involving small units or convoys over average terrain, and administrative or supply movements in rear areas may use the SM to advantage.

28. Control Identification of Vehicles

It is often desirable to mark or otherwise designate vehicles of the column for internal, as well as external, control purposes. Such identification is subject to local conditions and is usually specified in standing operating procedures. Marking should be kept to the minimum consistent with its need in column control. Extra markings should be easily removable.

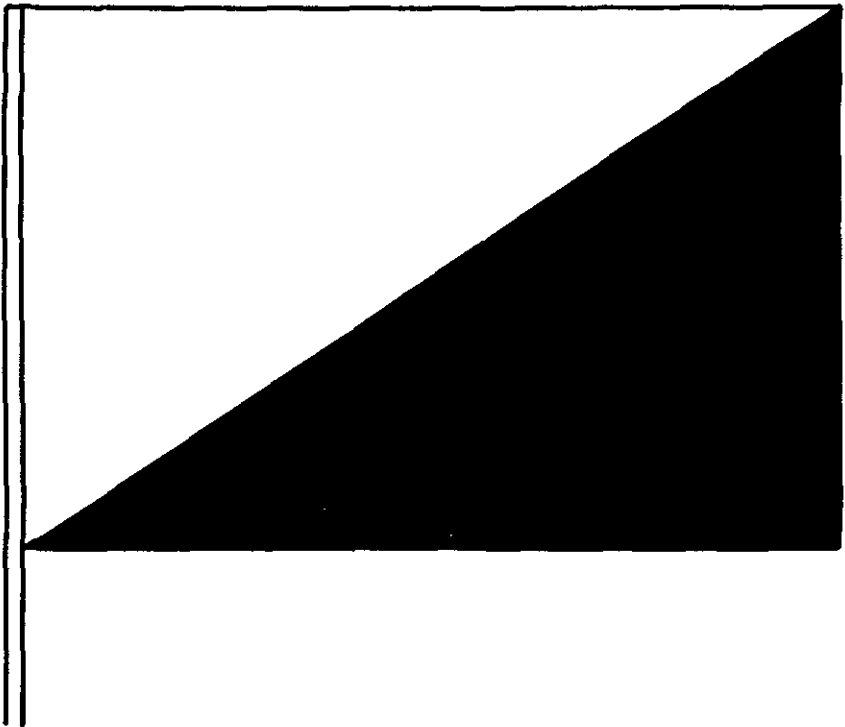
a. *Unit Flags and Symbols.* Security permitting, headquarters vehicles of companies or similar units may display guidons. Message center vehicles of battalions, battle groups, or similar units may be indicated by distinctive symbols or panels displayed on the front, rear, top, and/or sides. When necessary for security rea-

sons, guidons may be cased and symbols or panels may be covered or removed.

b. Cloth Control Indicators. Control cars of columns may be indicated by cloth or flags attached to their front or rear. The standardized markings recognized by international agreement will be employed. These markings and their uses are specified in STANAG 2027, NATO Standardization Agreement—Marking of Military Vehicles. This agreement defines a movement serial as an element or group of elements within a series which is given a numerical or alphabetical designation for convenience in planning, scheduling, or control of movement. Specifications as to flags and their use are as follows:

- (1) The leading vehicle of each movement serial will carry a blue flag.
- (2) The rear vehicle in the movement serial will carry a green flag.
- (3) The vehicle of a movement serial commander will display a white and black flag as indicated below.

(Example)



- (4) Flags should be approximately 12" x 18" (30 cms x 45.7 cms) in size.

- (5) In areas where vehicles drive on the left side of the highway the flags will be mounted on the right side of the vehicle.

c. Numbering of Vehicles. The number or letter assigned to a movement serial will be marked on the front and both sides of each vehicle in the serial. The marking will be clearly visible from the ground and will be so placed as to avoid interference with other prescribed markings. Individual vehicles within the main body of the column may be numbered serially to facilitate formation of the column and identification of individual vehicles. Such numbers may be drawn on the sides and bumpers of vehicles with soft chalk crayons or indicated by previously prepared signs.

d. Special Markings of Vehicles. In addition to the markings previously described, standard markings are prescribed for vehicles which require easy identification.

- (1) Vehicles carrying general officers will be marked with the appropriate conventional symbol on a plate attached to the right end of the front bumper and to the left end of the rear bumper (AR 746-2300-1). Flags indicating the rank or function of general officers may be flown.
- (2) Military police and traffic control vehicles will be marked prominently front and rear by means of signs with the military police or traffic control conventional symbol.
- (3) Ambulances and other vehicles provided exclusively for medical purposes will be marked in conformity with the rules of the Geneva Convention.
- (4) Vehicles of bomb disposal units will have all mudguards painted red.
- (5) A red flag flown from any vehicle indicates danger.
- (6) Priority vehicles, any vehicle which for any reason requires priority over all vehicles, may be marked by an equilateral triangle of red border lines on a white background with red symbols displayed on the front and rear of the vehicle. This marking may be prescribed by any commander having area responsibility and is valid only in the area of the commander concerned. The symbol inside the triangle will indicate the commander authorizing the use of this priority sign.

e. Air/Ground Recognition Markings. As prescribed by theater commanders, red and yellow fluorescent air ground recognition panels may be draped on vehicles in a standard unchanging pattern which will be different from the displays prescribed for other recognition services.

29. Communications Control of Column

Adequate communication within the column is essential to efficient command and control. The column is normally organized to facilitate communication by the means available. Unit standing operating procedure may designate the means and their use under specific circumstances. The march order specifies security limitations. Methods of intracolumn communication include the following:

a. Visual Signals. Visual signals are most commonly used for column control. These may be arm-and-hand, flashlight, or flag signals. They may be given directly by the commander to the entire march unit or may be relayed from vehicle to vehicle as in the case of standard drivers' signals. Visual signaling is easily understood, rapid in transmission and covers all the basic column maneuvers such as starting, stopping, changing speed, and changing direction.

b. Audio Signals. The use of sound is an elemental communication method and continues to be used, mainly in conjunction with other means of signaling, for column control. Whistles, horns, or bugles are used to attract attention, to warn personnel of further transmission of commands, and to spread alarms. Voice commands and verbal messages would be classed as audio signals and are used when the situation permits.

c. Radio Communication. When communication security permits and when vehicles are adequately equipped, radio is the principal means of communication during a march. Radio supplies the most rapid transmission of orders and messages between widely separated elements of a column. Its use is generally specified in orders, in unit SOP, and/or in signal operation instructions.

d. Other Methods. Sign messages, written on a board and posted along the route or displayed by a guide in view of oncoming vehicles, are often used to pass instructions along the moving column. When this method is used, signs are posted from the head of the column and picked up as the rear of the column passes. Messages written on message blanks may be delivered by guides along the route or by messengers. The use of messengers along a moving column is limited by traffic and by the type of vehicles available. Written messages, orders, and overlays are usually delivered by messengers at scheduled halts.

30. Column Commander

The officer or noncommissioned officer in command of a convoy is responsible for all that occurs in his unit. He issues the necessary orders to initiate the march and takes whatever action necessary to insure that instructions contained in standing operating

procedures and in march orders are adhered to during the preparation for, and conduct of, the march. He must be free to go wherever he may be required to supervise the movement of his command. A competent representative of the commander is placed at the head and another at the trail to act in his absence. The commander makes his decision as to his position in the column based upon consideration of anticipated problems and the location most suitable for their solution. When conditions and availability permit, the use of light aircraft with the necessary communications equipment will greatly facilitate column control. From the air the commander or his representative can easily note deviations from the prescribed formation, changes in traffic conditions, and errors in following the designated route and can take corrective action without delay. Air reconnaissance, concurrent with aerial column control, may also enable the commander to make timely adjustment to plans to meet changing situations.

31. Control Officers or 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 the operation of their respective commands, each utilizing his staff or representatives to assist as he may direct. The unit executive may be designated to regulate the rate of march, insuring adherence to the prescribed schedule and arrival at designated control points on time. He is also usually responsible for notification to higher headquarters as to any unavoidable delays or proposed changes in plan. Unit staff officers are usually assigned specific supervisory duties for the movement in consonance with their normal staff functions.

32. Other Control Personnel

Depending on the size of the column and the requirements of the situation, control personnel may include the following:

a. Guides. Guides direct a unit or vehicles over a predetermined route or to a selected locality. They may lead a unit or direct it from a stationary point. They may be members of the escort party or members from the organization who are familiar with the route or who have been instructed as to the direction to be followed.

b. Escorts. Escorts accompany a column or convoy to facilitate its movement and to protect it from interference. The composition of escorts varies with the situation and anticipated problems of movement. They may consist of military police, civilian police, or other personnel assigned to accompany the column through congested areas or areas of possible traffic con-

flict; of troops or armed guards to protect the movement from sabotage, guerrilla activity, or enemy action; or any required combinations of the foregoing.

c. Patrols. Patrols usually consist of military policemen in highly maneuverable vehicles. They are used in area control to provide liaison between key regulation or control posts, and provide frequent checking of critical points on the road net where traffic blocks or bottlenecks are most likely to develop. On occasion they may precede a column to stop or otherwise direct conflicting traffic, in which case they assume the characteristics of escorts. Their purpose is to facilitate movements in accordance with the traffic plan and the schedules prescribed by the highway regulation headquarters or higher authority. They keep traffic moving and, as necessary, take emergency action to restore a plan which has been temporarily disrupted. Under organizational control, these duties are performed by personnel detailed from the unit making the move. Under area control, these duties are usually performed by military police detailed by the headquarters responsible for highway traffic control in the area.

d. The Advance Officer. The advance officer is designated by the commander to precede the column by sufficient distance to reconnoiter the route of march, selecting alternate routes or detours to negotiate road blocks or traffic jams without undue delay; to instruct and post organizational traffic control personnel; to post guides or markers where necessary; to notify the proper authorities of the approach of the column; and to check at highway regulation points for instructions or changes in instructions for the movement of the column when traveling on a dispatch route. The advance officer may also command a detachment sent forward for quartering, pioneering, and other details. He maintains communication with the commander by radio or other means to advise him of developments and to receive further orders or instructions.

e. Pace Setter. The pace setter is usually an experienced officer or noncommissioned officer who rides in a lead vehicle of a column or element thereof. His primary duty is to maintain the rate of march in such a manner that the schedule is met and accordion action is properly controlled. He also gathers information and instructions concerning traffic obstructions or bottlenecks. The chief control officer may be the pace setter in addition to his other duties.

f. Trail Officer. The trail officer marches at the rear of the column or element thereof. An experienced motor transport officer should be selected for this duty. He is normally charged with

such control responsibilities as checking vehicles, march units, or serials at the point of origin or at the designated start point; posting necessary guards, warning flags, caution lights, or flares to warn traffic approaching from the rear when the column halts; picking up and, as soon as practicable, returning to the head of the column all guides and markers distributed by preceding elements; and preventing interference with the movement by traffic from the rear. He will also be alert to excessive accordion action, weaving, or other indications of a lack of discipline or of driver fatigue in the column and take appropriate action. In the event of an accident, he will see that the injured are cared for, summoning medical aid if necessary; accident reports properly completed; and preliminary investigations initiated. He is also responsible for the decision to abandon vehicles in accordance with instructions.

g. Trail Maintenance Officers. Trail maintenance officers, as available for each march unit or for the column, ride at the rear of their units with the maintenance personnel and equipment and take action within the limits prescribed by the march order to maintain vehicles in serviceable condition. They will be familiar with the ordnance support plan for the area, including location of ordnance units, operation of ordnance road patrols, and current procedures for contacting the appropriate ordnance support available for maintenance and recovery assistance (FM 9-10). At halts, they proceed along the column to inspect vehicles and supervise maintenance operations. In small columns the duties of the trail maintenance officer are usually combined with those of the trail officer.

33. Completing the Movement

The successful accomplishment of the movement mission is achieved only upon the arrival of personnel, equipment, and supplies at the destination in condition for and suitably distributed to support the next operation. Arrival of the head of the column at the release point marks the beginning of the final phase of the movement. A release point is a location at which specified elements of a column or convoy revert to the control of their respective commanders. It is the final point at which the column is checked before leaving the route of march and breaking up to enter assigned bivouacs, assembly areas, or dumps. In the case of large movements, successive secondary release points may be designated for successively smaller elements. To insure the smooth, continued movement of elements past the release point and to guard against traffic congestion and confusion, adequate

reconnaissance and organization of the area must be made prior to the arrival of the column. The posting of guides, selection and preparation of routes, and allocation of areas to specific elements may be done by advance details and will enable the column to clear the route without halting or obstructing the flow of traffic. In tactical situations the rapid distribution of vehicles and loads, early camouflage action, and elimination of noise and confusion through adequate organization and discipline may easily be the critical factor of the entire operation.

Section V. ADMINISTRATION AND MAINTENANCE EN ROUTE

34. General

Administration and maintenance en route are functions of motor movement that must be well planned and efficiently executed to insure the success of the operation. Although these functions are normally associated with periods when the column is halted, some administrative and maintenance duties must be performed at times other than scheduled halts, without delaying the progress of the column. Adequate troop training and the development of unit SOP's will facilitate administration and maintenance en route.

35. Halts

Halts are made for purposes of rest, personal comfort and relief, messing, refueling, maintenance and inspection of equipment, and allowing other traffic to pass.

a. Time, Duration, and Frequency. The time and duration of halts as well as their purpose are usually prescribed in orders from higher headquarters. A halt of 15 minutes is normally made at the end of the first hour, with a 10-minute halt every 2 hours thereafter. One-half hour to one hour is generally allowed for mess and refueling halts. When it is necessary to allow others to pass and the situation permits, mess and refueling halts should be scheduled to coincide, thus utilizing necessary delay to advantage. To maintain proper gaps between serials it is necessary that all elements halt at the same time. In cases of radio silence or where intracolumn communication is inadequate, the time of each halt may be scheduled in orders.

b. Location.

- (1) The locations for scheduled halts should be selected in advance, specifically ordered, and plotted on road movement graphs (par. 101). These selections may be pre-

scribed by higher authority, made tentatively by map reference, or made by the reconnaissance party. On dispatch routes, highway regulation points may include refueling stations, messing facilities, temporary quarters, and maintenance facilities. When such facilities have been provided, highway regulation orders or other orders from higher headquarters usually prescribe the places at which halts will be made.

- (2) If the halt is of brief duration and will not interfere with normal traffic flow, the column may stop on the shoulder of the road. It is desirable that halting places, especially off-road areas, provide turnaround facilities or circuitous exits so that the column may be quickly reversed or be able to re-enter the route when necessary.
- (3) If crossroads, railroad crossings, or similar danger points lie within the halt area of a column, subordinate commanders will require vehicles to stop a reasonably safe distance from such points; no part of a column should stop on bridges. Halts on steep grades and sharp curves should be avoided.
- (4) Comfort of personnel and servicing facilities for vehicles are important considerations in selecting sites for long halts. If a column starts from a populous area, its first halt should be delayed, when practicable, until a rural area is reached to facilitate relief of personnel. For the same reason halts should not ordinarily be made in villages or towns unless there is a special need.

c. Precautions at Halts.

- (1) Columns should be halted at points providing a clear view; normally more than 200 yards should be maintained to the front and to the rear of the column. If road conditions prevent adequate sight distances, steps must be taken to forewarn approaching traffic.
- (2) Guards, warning flags, caution lights, or flares (security conditions permitting) should be posted in front and rear of the column and at any other points where there is a hazard to passing traffic. If the column blocks part of the road at the halt so that it is necessary to operate one-way traffic, authorized traffic movements may be alternated by using flags transmitted from one end of the single lane to the other by the last vehicle of each passing group or by guards controlling traffic by signal.
- (3) When the column halts on the traveled way forcing traffic moving in the same direction to cross the center

line, vehicles may be parked with enough distance between to allow passing vehicles to enter the column upon the approach of vehicles from the opposite direction.

- (4) Unless otherwise prescribed, when traffic approaches from the rear of the halted column and cannot clear the column before its resumption of movement, officers may require such traffic to remain behind until it is safe to pass.
- (5) All personnel other than traffic guides must remain off the road to the right of their assigned vehicles, keeping the traveled portion of the road clear at all times.

d. Duties at Halts.

- (1) Officers and noncommissioned officers will check the welfare of personnel, the security of loads, and the performance of first echelon maintenance.
- (2) Control personnel will make necessary inspections and give instructions to insure prompt resumption of the movement with a minimum of confusion at the end of the halt.
- (3) Mess, medical, and maintenance personnel will perform such special duties as the purpose and duration of the halt permit.

36. Messing En Route

Messes en route may be provided by organizations in the column or from facilities set up at highway regulation points or other centers on heavily traveled routes.

a. Organizational Messes. Unit kitchen trucks may travel in the column with their respective organizations, or be dispatched ahead of the movement, to provide mess facilities en route. Insofar as conditions permit, mess personnel riding in the kitchen trucks initiate preparation of meals while the column is in motion in order to shorten serving time at the halt. Careful supervision of field sanitation is particularly necessary when mobile kitchens are used since sources of food and water contamination are multiplied and troops tend to become careless in areas that they expect to occupy briefly. The success of organizational messing en route is dependent upon the training, skill, and ingenuity of mess personnel. This type of mess has the advantage of being able to feed troops at regular intervals independent of routing.

b. Mess Stations. On dispatch or other regularly used routes, messes may be set up by personnel stationed along the route. These messes are particularly suited to convoys on a regular, established line haul and to personnel movements traveling with-

out tactical organization. Mess stations must be notified sufficiently in advance to enable them to have the required quantity of food at the scheduled hour.

37. Maintenance

Maintenance en route is performed by the driver of the vehicle and trail maintenance personnel. The driver performs normal first echelon inspection and maintenance duties at each scheduled halt. He also makes such roadside repairs as fall within the limits of his training and capabilities. These repairs may include changing tires, tightening loose parts, and minor repairs to fuel, electrical, and cooling systems. The driver should not attempt repair unless he is reasonably certain of his diagnosis of the trouble and of his ability to correct it. Unnecessary tampering with mechanisms is prohibited. At the first opportunity after an emergency repair has been effected, the driver should report the facts to his squad or section chief so that proper action may be taken. In cases where repairs or adjustments are beyond the capabilities of the driver, the trail maintenance officer makes the decision on the procedure to be followed, contacting appropriate ordnance support units if necessary. Diagnosis is made by trail maintenance personnel. If the necessary repairs are of a minor nature, a mechanic with tools and necessary parts is dropped off to make the repairs and rejoin the column later. If doubt exists as to repair within a reasonable time, the cargo or tow may be temporarily transferred to another vehicle to proceed with the column until the repaired vehicle rejoins. In any case the driver remains with his vehicle unless directed by competent authority to abandon it. Vehicles undergoing repairs and abandoned vehicles are placed off the road so that they will not interfere with the traffic on the route. When necessary repairs have been effected, the vehicle resumes the march at the maximum permissible speed, rejoining the rear of the column. At the next authorized halt the driver takes his normal place in column.

38. Accident Procedures

The following procedures are those normally required regardless of the location or circumstances of the accident. They may be followed in the case of damage or casualties resulting from enemy action as well as those caused by carelessness. However, deviations may be necessary for certain situations.

a. Column Continues March. The main part of the column does not stop to render assistance. Every effort is made to clear the route and continue the march. However, a serious accident may

block a part of the convoy or make it advisable for a small convoy to be halted. Such halts should be made at a sufficient distance from the scene of the accident to prevent further congestion and mishap.

b. Trail Gives Assistance. Vehicles to the rear pull around the accident. If the accident blocks the route, the occupants of vehicles in the rear assist in clearing the route and proceed with the march as soon as a passage is cleared. If immediate assistance is required for injured personnel, this aid is rendered by the next following vehicle. The next officer or noncommissioned officer to the rear will take control of the situation, rendering emergency aid and directing traffic until the trail officer, medical officer, or other competent assistance arrives. The necessary measures for the care of the injured, salvage or disposition of vehicles and cargos, and complete clearance of the route are normally carried out under the direction of the trail officer, aided by medical, maintenance, and salvage personnel available for the purpose.

c. Precautions Against Further Accident

- (1) After a motor vehicle accident the vehicle or vehicles involved are frequently in dangerous locations and a crowd may collect in the road. This situation may cause another accident, perhaps more serious than the first, when another vehicle crashes into the wreck or hits persons in the crowd. Immediate action must be taken to warn traffic to proceed with caution. Guards, flares, lights, or flags may be posted in keeping with the situation. Civil or military police, if present, will control traffic; otherwise, personnel should be detailed from the column for this purpose.
- (2) Traffic control personnel restore normal traffic movements as soon as possible. It is desirable that damaged vehicles be left undisturbed when this does not interfere with important traffic to assist the investigating officer in determining how the accident happened. Witnesses should remain at the scene of the accident to provide information for the investigating officer if the military situation permits. All others are kept away and traffic is kept moving.

d. Aid to the Injured. Basic first aid, in which all military personnel are trained, may be rendered by those first arriving on the scene of the accident. However it is important not to move the injured unnecessarily and to summon competent medical personnel immediately. In cases where there is danger from

fire or explosion, the injured must be moved to safety immediately, regardless of the absence of medical personnel.

e. Precautions Against Fire. In all motor vehicle accidents there is a great danger of fire due to gasoline leakage. To minimize this danger, engines should be cut off immediately and smoking and open flames should be prohibited near the wreck.

f. Summon the Proper Authorities.

- (1) Normally all accidents which result in injury to an individual or animal, or to damage to property are reported to the column commander or designated staff officer without delay, and to the military police of the nearest military installation.
- (2) Most civil governments require that police be summoned in cases of motor vehicle accidents. The Army cooperates with civil authorities in the United States and friendly countries in such matters. If civil police are not on hand, they should be notified.

39. Medical Service

Medical service should be provided for every motor movement. The type and amount of medical service needed to support the movement will depend on the situation and on the type and size of the march or convoy. This service may be organic to the unit, or units, in the movement, attached by higher headquarters, or provided by the area command in the form of medical aid stations located along the route. Elements organic to a unit should accompany the parent organization; normally, ambulances and medical personnel travel at the rear of the march unit or serial. In large columns, medical elements are so dispersed through the column as to minimize delay in cases of emergency. In small columns, medical service may be limited to medical aid men and/or motor vehicle first aid kits, often requiring special requisition to supply even minimum needs. The status of first aid equipment should be determined by inspection well in advance of the movement. While TOE units traveling in tactical groupings will usually have adequate organizational medical personnel and equipment, it is the responsibility of column commanders of other movements, to insure necessary medical personnel and equipment to protect their commands.

Section VI. MOTOR POOLS

40. General

The localized pooling of available motor transportation will, under most conditions, provide the most efficient, economical,

and safe administrative motor transport service to the installation or activity served. Regulations therefore provide for the establishment and operation of transportation motor pools with the mission of furnishing all administrative transportation of persons and things for the installations or activities which they support, and of effecting efficient management, administration, operation, utilization, and maintenance of general transport administrative vehicles. The degree of success in accomplishing this mission is measured by the movement of the *maximum* amounts of cargo and personnel with the *minimum* of vehicles. In general, this type of centralized control for the administration, operation, and maintenance of motor transport may be used to advantage in theaters of operations under a variety of circumstances.

41. Organization

a. A motor pool consists of a group of vehicles under central control, available for the common use of several agencies or individuals. These vehicles may be pooled administratively with the vehicles garaged or parked with their own or different organizations, or pooled physically with all vehicles assembled in one place and available for use as needed. It is generally advantageous for the commander to physically pool all general transport administrative vehicles insofar as practicable to provide coordination between maintenance, supply, and transportation activities; to insure efficient and economical utilization of vehicles; and to produce effective vehicle control and eliminate misuse and abuse.

b. Organic vehicles of units or organizations, when available for general transport administrative use, will be administratively pooled with the transportation motor pool for dispatch control during the period of availability; but will not be considered administrative vehicles.

c. Subpools may be established where factors of distance or parking facilities render the operation of one pool uneconomical or impracticable. Subpools will remain under the complete control and supervision of the motor transport officer and will be an integral part of the post transportation motor pool.

d. The transportation motor pool shop is an essential part of the transportation motor pool. Any part, or all, of the maintenance necessary to keep vehicles in serviceable condition will be performed in the transportation motor pool shop. This facility may be supplemented by other military shops on a reimbursable basis, or by commercial facilities, as may be in the best interests

of the Government. Established categories and echelons of maintenance are not applicable to either transportation motor pools or general transport administrative vehicles.

42. Command Structure

The commanding officer under whose jurisdiction the transportation motor pool is established is responsible for its operation. To provide uniformity in administrative and operational procedures, the outline of specific functions shown below provides a logical organizational structure for transportation motor pools (fig. 1).

a. *Installation Transportation Officer.* The installation transportation officer is responsible for the management control of general transport administrative vehicles and for the exercise of technical supervision over the administration and operation of the transportation motor pool. He advises the commander and the appropriate staff officers on all matters pertaining to the administration and operation of the transportation motor pool and the supply of motor transport services.

b. *Motor Transport Officer.* The motor transport officer, who is a Transportation Corps officer or a civilian transportation specialist with appropriate training and experience, exercises direct supervision over the allocation, supply, administration, operation, utilization, maintenance, inspection, storage, and disposal of general transport administrative vehicles assigned to the installation.

c. *Administrative Section.* The administrative section performs all the necessary clerical functions pertaining to the administration of the motor pool. These functions may include maintenance of all files and records, preparation of reports and correspondence, and the procurement, issue, and accounting for all toll tickets and courtesy cards as required.

d. *Operations Section.* This section determines and takes appropriate action to maintain suitable operational levels of vehicles by quantity and type, exercises operational control over all assigned vehicles, receives requests for transportation and dispatches the required quantities and types of vehicles, maintains close supervision of vehicles on dispatch to eliminate misuse or abuse, maintains complete operational records, and develops and operates driver selection, testing, and training facilities.

e. *Maintenance Section.* The maintenance section operates the transportation motor pool shop. Its functions include all organizational maintenance on motor vehicles in the pool, emergency repairs, scheduling of preventive maintenance service, mainte-

nance of vehicle service records and preparation of reports, care and requisition of tools, equipment, and supplies, and the training of maintenance personnel.

f. Supply Section. The supply section supervises all supply activities of the transportation motor pool and maintains all necessary supply records. Its functions include the requisition, storage, and issue of all authorized fuel and lubricants, repair parts, and tools and equipment for the motor pool; and the maintenance of appropriate records of supplies and equipment issued.

g. Inspection Section. The inspection section supervises and/or performs inspections and road tests prescribed by regulations or assigned by the motor transportation officer, and maintains records and prepares reports pertinent to its assigned functions.

43. Authorized Use of Motor Vehicles

a. Motor vehicles will not be used for other than official business. No officer or employee of the Department of the Army within the continental limits of the United States is authorized to use a motor vehicle for other than the performance of official duties. Authorized use shall not be construed to include transportation between domiciles and places of employment for other than cases specifically excepted by AR 58-5.

b. General transport administrative vehicles will not be employed within the continental limits of the United States when

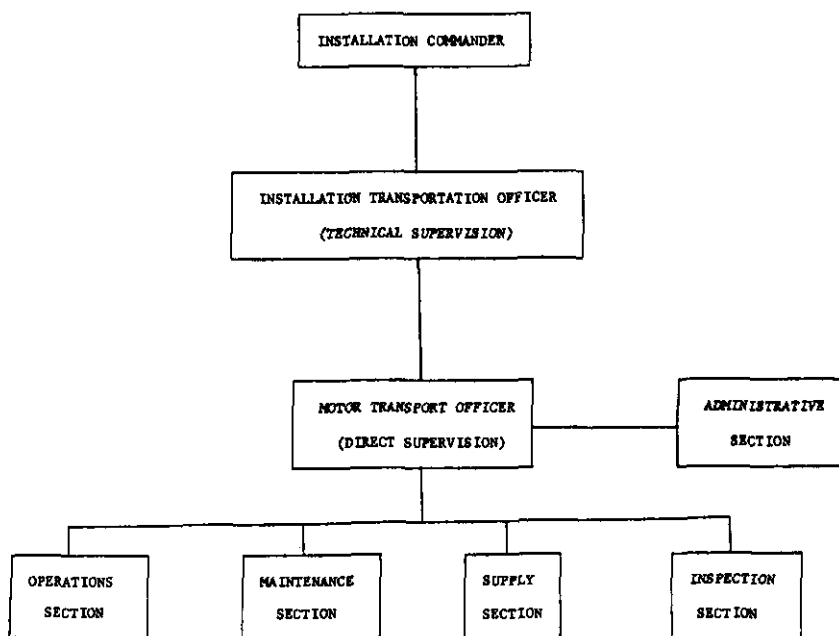


Figure 1. Command structure, transportation motor pool.

commercial transportation facilities are or can be rendered adequate. The only exceptions will be in cases of military necessity, such as emergencies, maneuvers, training activities or operations requiring a high degree of security, or as otherwise authorized under Department of the Army regulations governing bus operations. Local hauling of cargo or the local transportation of personnel on official business within a metropolitan area or in the immediate vicinity of an installation is also excepted.

c. General transport administrative vehicles may be used locally by special direction of the commanding officer for purposes specified in AR 58-5.

44. Requests for Motor Transportation

a. All agencies of the Department of Defense will be permitted to use the facilities of Army motor pools under such regulations as may be prescribed.

b. Requests for motor transport service will include the number of passengers or the tonnage and description of the cargo to be transported; the origin and destination; and the date and time the service is required. Determination as to the quantity and types of vehicles required to provide the requested service is the responsibility of the motor transport officer.

c. Using agencies should indicate the extent to which requested service can be deferred or rescheduled to avoid conflict with periods of peak workloads. Where requests for service exceed capabilities, it will be necessary for the installation commander to establish priorities.

d. One person and one alternate within each using agency should be designated to approve requests to the transportation motor pool for motor transport service. All written requests for such service should bear the designated individual's (or alternate's) signature. Except in emergencies or as otherwise directed by the commanding officer, dispatchers will accept telephone requests for administrative vehicles only from designated individuals and/or alternates.

45. Dispatching Vehicles

a. All dispatching should be planned and controlled at one central dispatch office. For convenience or reasons of economy, vehicles in auxiliary parking areas or subpools may be dispatched by personnel assigned thereto. Properly accomplished records will be forwarded to the parent installation or motor pool daily, or as prescribed by the designated motor transport officer. Priorities are normally assigned on the basis of the emergency nature

of the request, its importance, or in accordance with the time of the request.

b. As requests for transportation come in they are consolidated so that the greatest degree of utilization is attained. For example, if two individuals request transportation to the railroad station in a nearby town, it will frequently be practicable for one vehicle to take both at the same time and also meet any incoming personnel at the station.

c. General passenger transportation service will be provided to the maximum extent by the use of regularly scheduled buses. An efficient bus system which serves densely populated areas of the installation will materially reduce requirements for light passenger carrying vehicles, thereby resulting in substantial economy. The use of buses for other than regularly scheduled service will be governed by procedures prescribed in applicable regulations.

d. A taxi type vehicle service should be established to meet requirements for short trips within or in close proximity to the installation where bus service cannot be economically or advantageously used. This type of service is provided by passenger and cargo carrying vehicles operated on an "on call" basis. Trips will be consolidated to the maximum extent practicable. Vehicles will be released immediately upon completion of the mission for which service was requested. When one or more stops are required to complete the mission, limited waiting periods may be prescribed by the motor transport officer. Where net savings to the Government will result, the use of radio-controlled dispatch of taxi vehicles should be employed.

e. Return load programs should be instituted in all commands, and transportation officers should have authority to use any available vehicles to transport return loads. When a vehicle is sent to a point at which its load (passengers or cargo) will be discharged and no return load has been arranged in advance, the driver should be instructed to telephone the central dispatch office when his mission is complete. It is then possible to send the vehicle on another job without having it return to the motor pool.

f. No vehicle should be dispatched to one person or agency as daily procedure without approved written request justifying such daily dispatch. Approval of daily dispatch should be for a limited period only and subject to revocation. The motor transportation officer is responsible for carefully investigating the need for daily dispatch of vehicles to any person or agency, and

for permitting the daily dispatch of no vehicle beyond the requirements of sound utilization.

g. DD Form 110 (Vehicle and Equipment Operational Record) should be made out each time a vehicle is dispatched from a pool or subpool. The motor transport officer or his representative should approve all off-post dispatches, and DD Form 110 for vehicles so dispatched will be clearly stamped "OFF POST OPERATION AUTHORIZED BY_____". These vehicle and equipment operational records should be completely filled in as prescribed. They must be made out by the dispatcher at the pool or subpool from which the vehicles are physically dispatched regardless of the type of organization of the pool. If dispatched from a subpool, necessary data is transmitted by the subpool to the central dispatching office by available means of communication. The motor transport officer will provide for the daily review of all DD Forms 110 to determine that vehicles are efficiently and economically operated.

h. Motor vehicle status and dispatch boards may be established and maintained in the dispatch office of transportation motor pools. These boards should show the following data:

- (1) Vehicles grouped by types.
- (2) USA registration numbers.
- (3) Location of vehicles; i. e., on dispatch or in the pool available for dispatch.
- (4) Notation showing the location of vehicles out of service for maintenance; i.e., transportation motor pool shop; Ordnance or other Government shops; or commercial facilities.

46. Maintenance

a. Basic Policy. Furnishing essential administrative motor transport service at installations and activities with a minimum number of vehicles is dependent upon the maintaining of the maximum number of such vehicles in serviceable condition at all times. An efficient and economical program for the maintenance of general transport administrative vehicles will include—

- (1) Establishment of an adequate preventive maintenance program based on the performance of only that maintenance essential to keep vehicles in a safe and serviceable operating condition during the normal life expectancy.
- (2) The performance of maintenance and repair to the extent economically justifiable and practicable less major repair and rebuild of vehicles or assemblies within the limits outlined in regulations.

b. Responsibility. All commanders are responsible for compliance with applicable procedures and instructions for the maintenance of general transport administrative vehicles and the operation of transportation motor pool shops. The motor transport officer, charged with direct supervision of all motor transportation pool operations, is responsible to the installation transportation officer.

c. Maintenance Operations. Detailed operational procedures for maintenance in transportation motor pools are contained in TM 38-660-2 and AR 58-5.

CHAPTER 4

MOTOR MOVEMENTS IN THE THEATER OF OPERATIONS

Section I. GENERAL

47. Considerations

All training in military motor movements has as its ultimate objective the successful movement of troops, equipment, and supplies to support tactical operations in combat. It is therefore of primary importance that all military personnel know and recognize the problems associated with movements in the theater of operations and the accepted procedures and techniques used in their solution. As mobility requirements increase, the problems of successful movement constantly grow in number and complexity. The problems of traffic regulation and control naturally increase in proportion to the traffic load on existing road nets. The physical limitations of highway facilities, possible damage to roads and bridges, and the disorganization of civil government are factors which add to the basic problem of rapid movement of troops and supplies to support tactical operations. With the introduction of mass destruction weapons, the speed with which troops, equipment, and supplies can be concentrated or dispersed at the will of the commander may be the deciding factor in the outcome of the operation. No movement of significant proportions may be considered safe from hostile interference. Enemy capabilities to include sabotage and guerrilla attack as well as air, artillery, and missile damage must be considered in both the planning and execution of all movements.

48. Characteristics of Military Traffic

Military traffic consists largely of movements of groups of vehicles having a common mission. Civilian traffic is usually the movement of vehicles having limitless variations of origin and destination. There is a considerable amount of casual military and civilian traffic in areas of military operations which is essential and cannot be disregarded. The flow of military traffic is subject to large, erratic, and often unpredictable changes and may be interrupted by traffic jams and bottlenecks of long or short duration. Such changes and interruptions may occur with little or no advance warning.

Section II. ADMINISTRATIVE MOTOR MOVEMENTS— PERSONNEL

49. General

a. Since it is normally desirable that troop units be kept together, motor columns transporting personnel are often larger than supply convoys, which may more readily operate as small march units or serials. However, while columns of an administrative troop movement are often much longer than those of supply convoys, they are nevertheless separated into march units corresponding as closely as practicable to the smaller units making up the troop organization.

b. Two units—the unit being transported and the truck unit furnishing the transportation—are frequently involved. It is therefore essential that the functions of and restrictions on each be clearly delineated and that command responsibilities be understood and observed.

c. When personnel are being transported, some of them may be detailed to guide, guard, reconnaissance, or security duties. This presents a command problem in the delineation of responsibilities for the conduct of the movement.

d. It is of utmost importance that officers of all troops have knowledge of the general principles of highway transport movement. Movement by highway must operate under a thoroughly coordinated system. The effectiveness of troops depends not only on their own movement but also on the movement of supplies.

50. Command

a. Personnel movements require close coordination between those in command of the transportation and those in command of the troops being transported.

b. Personnel movements by motor vehicle include—

- (1) Those using vehicles which are organic to the unit being transported.
- (2) Those made by means of truck units attached or assigned to the unit being transported.
- (3) Those made by means of Transportation Corps truck units, operating as part of the general hauling service provided by the highway transport service and not assigned or attached to the unit being transported.

c. When a unit is being transported by its organic vehicles, the troop commander has full command of both the personnel being transported and those operating the vehicles.

d. The commanding officer of a unit to which a truck unit has been assigned or attached by proper authority exercises command over the truck unit through its commanding officer.

e. When a truck unit is not assigned or attached to the unit which it is transporting but is merely providing the transportation service required, command of the convoy and of each serial or march unit thereof remains with the truck unit commander and his representatives at their respective levels. In this case the commanding officer of the troops being transported (troop commander) retains full command of his troops and issues such orders as may be necessary to conform to and implement those issued by the convoy commander as to schedules, march discipline, and operation of the convoy. The troop commander should no more interfere with the operation of the convoy than he would with the operation of a troop ship or railroad train if his troops were so transported. However, should a tactical emergency so require, the commander of troops being transported, regardless of rank, will assume command of the convoy and issue such orders as may be necessary to meet the emergency. In so doing, the troop commander should realize that the convoy commander may be proceeding under orders which are a part of a closely integrated schedule and that unnecessary changes in any part of the schedule may seriously impair the operation of the larger plan. The troop commander must accept full responsibility for any action which unnecessarily interferes with the overall highway schedules.

51. Command During Movement

a. 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 the existing convoy regulations.

b. The driver of the vehicle, or the senior officer or noncommissioned officer of the operating personnel, is responsible for compliance with the schedule and operating instructions. He is responsible for safe operation of the vehicle and is required to insure that personnel being transported observe safety, sanitary, and other regulations. Regardless of rank, he will insure that the senior officer or noncommissioned officer of troops is familiar with applicable safety instructions.

c. While the senior officer of troops should not interfere with the operation of the vehicle and should conform to all proper instructions of the operating personnel, it is his duty to report to the appropriate superior any derelictions on the part of operating personnel.

d. At the lower levels of command, these principles apply whether the movement is by organic vehicles, by attached TC truck units, or by independently operated TC units. In each case, certain personnel are charged with responsibility for the movement. They operate under definite plans and officers and noncommissioned officers of troops being transported should conform to the orders issued under those plans.

e. In individually dispatched vehicles, the senior passenger is responsible for seeing that the driver obeys laws, regulations, and instructions—usually published on a card carried in the vehicle.

52. Methods of Movement

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

b. *Point-to-Point Shuttle.* 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. Unless the situation is well in hand or can be met by the first troops transported, this method is not usually used in tactical movements when additional transportation is available from higher headquarters.

c. *Leapfrog Shuttle.* Leapfrog shuttle is perhaps best adaptable to tactical troops while making advance or retrograde movements in combat or in close support of combat operations. It is a variation of the point-to-point shuttle and may be varied to meet the situation. It may be demonstrated 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 second unit. Instead of taking them to the position established by the first, they carry them past, where they establish a third position. Then the vehicles return from 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 uninterrupted while adequate positions are maintained.

d. *Part-Ride, Part-Walk Shuttle.* This method uses a limited number of vehicles in speeding the continuous forward movement of foot troops. A part of the unit entrucks at the start of the march and is carried to a predetermined point along the route where troops dismount and proceed on foot. The trucks return for the balance of the unit, which, meanwhile, has initiated the march on foot. By this method, all elements of the unit may

arrive at the destination at the same time, each having performed an equal portion of the march on foot.

53. Considerations in Loading

The primary objectives of administrative movements are comfort and convenience of personnel, rapid transit, and the most efficient utilization of available transportation. Complete attainment of these objectives must be compromised by consideration of the situation. Complete security in the theater of operations can seldom be assumed. In most cases, troops will carry arms and ammunition to provide some degree of protection against attack and security duties will be assigned to personnel although vehicles may be loaded to their maximum capacity consistent with personal comfort, and without regard to tactical organization. When troops are being transported to build up reserves in a rear area or as casual movements of replacements, and where the possibility of interference by the enemy is remote, supplies and equipment can often be transported in separate vehicles or in a separate convoy preceding or following the personnel convoy. Small trailers are useful for transporting individual equipment in personnel convoys composed of light trucks.

54. Entrucking Procedures

a. The entrucking point is selected which will require a minimum of marching by foot troops and a minimum of movement of supplies and equipment, affords adequate area for the method selected for entrucking, presents no undue obstacles to the movement of vehicles, and offers ready access to the selected route of march.

b. When time and space allow, the troop commander may ascertain the exact makeup of the motor column which will transport his unit, the exact capacity of each vehicle, and the exact gaps between vehicles as they halt for entrucking. The troop commander then forms his command in parties corresponding to the location and capacity of each vehicle. At the prescribed hour, the troop commander forms his unit in line or line of columns along the line of march of the vehicles, with intervals corresponding to the gaps between vehicles at the halt. On command, all troops mount their assigned vehicles simultaneously. This is by far the quickest method of entrucking, but requires careful planning and adequate space for trucks and troops.

c. When time and space are not adequate for the method of entrucking described above, the trucks may be parked and the troops marched alongside in single file or column of twos or

threes, and counted off into vehicle parties. Each party is then led to its proper vehicle. Although this method may be somewhat slower, it is the easiest and most practical method under many conditions.

d. A combination of the two methods may be used for general troop loadings by assigning each section, platoon, or company to a selected number of trucks. Then, upon command, all units are marched simultaneously alongside their assigned trucks. Each platoon or section leader counts off his men into parties as they mount the assigned vehicles.

e. The driver of each vehicle is responsible for unfastening the safety strap and lowering the tailgate before personnel are permitted to mount the vehicle. After personnel have entrucked, the driver will close and secure the tailgate and fasten the safety strap.

55. Loading of Individual Equipment

a. Packs, other than combat packs, are normally not worn in military vehicles. Usually it is desirable to have troops board the vehicles with their packs on and then take them off, stacking them on the floor between or under the seats.

b. Duffel bags may be loaded on vehicles with the men to whom they belong. This procedure reduces the number of men who may occupy the vehicle with comfort, but lessens the probability of loss of equipment.

c. All items of individual equipment not needed on the march may be loaded in separate trucks or trailers. This relieves the troops of responsibility, is less fatiguing, and insures that they will not be burdened with unnecessary equipment in case of contact with the enemy. When this is done, these items are loaded by troops detailed for the purpose in advance of entrucking.

d. Individual arms should remain with the individual soldier. However, troop commanders must instruct their troops in the proper manner of boarding with arms in order to eliminate the possibility of accidents. Each man in turn passes his weapon to the man behind him, securing it again after he boards the vehicle. The last man passes his weapon to one already aboard, securing it after boarding.

56. Detrucking Procedures

a. Normal detrucking should provide for the reassembly of units, prompt unloading of troops and equipment, clearing of unloading areas, staging, and reuniting of troops and their equipment. Except in emergency, the order to detruck should not

be given by the commander until drivers have lowered tailgates to decrease the possibility of injuries.

- (1) When sufficient area is available, the column may be halted in close formation and all troops detrucked simultaneously. This method is quick but may require troops in the rear to march the length of the column in assembling or in reaching their immediate destination.
- (2) A second method is to have successive trucks, truck squads, truck sections, or platoons pull up to a designated detrucking point at which the troops detruck and assemble.
- (3) When troops are going into billet or bivouac, a satisfactory method is to designate a dispersal point from which guides conduct sections of the truck column to the vicinity of the billet or bivouac where the troops detruck with their equipment.

b. Emergency detrucking should be included in the training of troops since the speed with which troops can leave their vehicles and be prepared for action may be a deciding factor in event of enemy attack. Emergency detrucking, which requires jumping over the sides of the vehicles or dismounting in any other way that may prove to be equally quick, may cause sprained or broken ankles or other injury. Men trained in the proper techniques of emergency detrucking can dismount with weapons in hand ready for use in a fraction of a minute with little danger of injury.

c. In both normal and emergency detrucking, troops should not be permitted to dismount until vehicles have come to a full stop—and then only upon the command or signal of the commander or his authorized representative (FM 55-31).

Section III. ADMINISTRATIVE MOTOR MOVEMENTS— SUPPLY

57. Distinctive Characteristics

a. Since most supply convoys operate in the communications zone or in rear areas of the combat zone, they normally require no advance, rear, or flank guards. Supply movements are made in general by truck companies with personnel sufficient only for the actual conduct of the convoy. There are no personnel available to provide security or extensive reconnaissance. When supply convoys require reconnaissance and security, these functions are performed by other troops provided for the purpose. Passive

security measures, including use of cover and concealment and camouflage discipline, will be fully utilized as appropriate to the situation.

b. Supply convoys should be of such size and formation as to assure the most effective flow of traffic over the supply routes. Experience indicates that, in the operation of supply convoys, the best results are obtained through small groups of vehicles. March units of a supply movement normally should not exceed one truck platoon. Serials should not exceed one truck company.

c. Although small serials require more staff planning and involve more work in recording the progress of the movement, their use is recommended over large serials since more detailed information is possible as to progress, closer supervision may be exercised, and changes in orders dictated by the situation may be more easily effected.

58. Composition of Supply Serials

In order to maintain maximum flexibility in the highway transport system, it is advisable to limit each serial to supplies of a generally similar nature. If it then becomes necessary to divert a certain type of supplies, the diversion order may be issued to a particular serial. It is not practicable to make rigid specifications as to how the supplies should determine the division between serials. In general, vehicles transporting gasoline, ammunition, rations, or other different types of supply should constitute different serials so that diversions can be made according to the class of supply being transported. However, when other factors warrant the loss in flexibility, a serial may be formed of several types of supplies needed by a certain unit or installation. Under favorable conditions and with good highway regulation, serials transporting various types of supplies may be intercepted at a highway regulation point, reorganized, rerouted, and rescheduled to meet the requirements of a specific unit or installation; although the extra work, delay, and increased possibility of error indicate the advisability of avoiding such situations.

59. Command

a. Under normal conditions, convoys of motor vehicles hauling supplies are commanded by the senior officer or noncommissioned officer of the unit whose trucks make up the convoy. Supply movements made in vehicles of assigned or attached truck units are under the command of the senior officer of the truck unit, who, in turn, is under the command of the commander of the organization to which the truck unit is assigned or attached.

b. In cases where the tactical situation requires an armed escort to protect the supply convoy, the senior line officer will usually be placed in command of the convoy, the highway transport officer acting as his technical adviser and subordinate commander of operating personnel. The tactical commander will, insofar as possible, conform to established routes and schedules.

60. Types of Supply Operations

a. Military highway transportation may be employed in a variety of ways to accomplish specific transportation missions. Types of operations in which trucks are used are determined by the task to be accomplished, such as clearing a congested area, connecting other modes of transportation, adjusting the distribution of supplies within a depot, or supporting troops in combat. Hauls may be described by dividing them into local or short hauls, and line or long hauls.

b. Local or short hauls are characterized by low 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.

c. Line or long hauls are characterized by high running time in relation to loading and unloading time. They normally involve one trip or a portion of a trip per day and are evaluated on the basis of time consumed, distance traveled, and tonnage hauled during the operational period.

61. Classes of Operation

The types of logistical support in which motor transport is employed over varying distances may include the following:

a. *Port and Beach Clearance.* A water terminal is a transfer point at which personnel and cargo are transferred from water transportation to land or air transportation, or to water transportation from land or air transportation. Water terminals utilized by oversea commands may be of the major commercial port type or, in the event that the terminal's capacity has been reduced, small ports and beaches. The important factor in this operation is the movement of cargo away from loading point. Port clearance, as it pertains to highway operations, is the clearing of cargo from the immediate vicinity of the port to permit continuous unloading of ships that would otherwise be hampered by backlogs of supplies within the port area. Beach clearance is the clearing of cargo from the immediate vicinity of the beach promptly, regardless of poor roads and temporary facilities.

b. *Installation Support Operations.* Installation support is established to provide highway transportation for commands,

installations, depots, and dumps that cannot be provided by their organic vehicles. Highway transport operations at or between installations, depots, terminals, and supply dumps may be either local or line hauls. Primarily, these hauls are concerned with the adjustment of supply levels or the distribution of supplies within the supply system (FM 55-31).

c. Transfer Operations. Transfer points are transportation facilities established when required to effect the transfer of cargo or personnel from one unit of transport or mode of transportation to another. Highway transportation, because of its mobility and flexibility, is the primary method of connecting or bridging the gap between other modes of transportation.

d. Field Support Operations. Hauls by highway units may be made in direct support of tactical operations. Armies, corps, or divisions may utilize organic or attached motor transport as a pooled service to be allocated where and when needed to meet the current situation. They may involve moving troops to attack or counterattack, or moving logistical support forward. A high degree of speed and mobility will be required of highway transport units to enable them to exercise sufficient defensive measures and to negotiate the terrain in the same manner as combat unit vehicles.

e. Express Operations. Highway express operations are expedited movements over highways in which vehicles and convoys are scheduled according to priority of loads. A high degree of control is exercised over these movements to assure adherence to schedules, diversions and adjustments to the changing situation, and expeditious delivery of cargo. Express hauls may be either line or local hauls, but in the majority of cases they are line hauls.

62. Methods of Operation

There are three general methods employed to accomplish the transportation mission of hauling supplies by highway. These may be classified as direct, shuttle, and relay.

a. Direct Hauling. This is the simple method of a single hauling job accomplished in one trip, involving 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. As a line haul method, it greatly taxes drivers and equipment and often results in loss of control by the unit.

b. Shuttle. The simple shuttle is accomplished by means of repeated trips made by the same vehicles between two specified points. The continued movement forward is accomplished by a

repetition of this operation by vehicles operating successive legs of the overall distance.

c. Relay. This 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 and/or powered vehicles for each segment. In tractor-semitrailer operations, relay implies the through movement of semitrailers by shuttle tractors operating over segments of the route.

63. Loads and Loading

Correct loading of cargo is essential to securing reasonable vehicle life and the full utilization of vehicles. Full utilization of vehicle carrying capacity is essential to efficient and successful supply movements.

a. In loading for supply movement the following must be taken into consideration:

- (1) *Underloading.* If vehicles are loaded with less than their capacities for the existing conditions, more vehicles will be required for the task, requiring, in turn, more drivers for the operation, increased highway space, and more work for highway regulation and traffic control personnel. This decreases the efficiency of all highway movement in the area.
- (2) *Overloading.* If vehicles are loaded with more than their capacities for the existing conditions, the mobility of the convoy may be seriously reduced, disrupting highway movement schedules and jeopardizing supported tactical operations. In addition, overloading may result in damage to vehicles causing excessive vehicle deadlining which may reduce the effective capacity of the unit for a long period.
- (3) *Improper load distribution.* If vehicles are loaded with uneven or top-heavy distribution of weight, an undue strain is placed upon some parts of the vehicle, causing excessive and uneven wear or breakage; loads may shift or fall off, resulting in loss or damage to cargo; or unbalance may cause great difficulty in operation which can result in serious accidents.

b. Military cargo vehicles of the tactical type have been developed to give satisfactory performance when operating under off-road conditions and are powered to negotiate unusually steep grades. Thus, given a smooth hard-surfaced highway, a tactical-type vehicle can be expected to carry more than its off-road rated capacity.

c. On good roads tactical general purpose cargo trucks and cargo trailers are permitted to carry loads over their rated capacity but not in excess of the highway load limit indicated on the vehicle data plate and/or in the TM applicable to the vehicle. However, only in case of emergency and upon proper authority will vehicles operating cross-country, or on anything less than smooth hard-surfaced highways, be loaded above their rated capacities.

d. Carrying more than the rated load has, by common usage, come to be called overloading; it is not in fact an overload, but a calculated safe load under favorable conditions. However, those responsible for automotive equipment must realize that much of the safety factor built into a vehicle disappears under overloading; therefore, drivers must be instructed to exercise caution when their vehicles are loaded to maximum highway capacity.

e. In recognition of the fact that the availability of vehicles is normally less than the need, and that use of the maximum calculated safe load will be general where good highway conditions exist, the driver must realize that—

- (1) Shocks to the frame and running gear of the vehicle increase as the load increases. The hole in the road that would cause no damage to springs or shock absorbers with a load of 2½ tons may cause broken springs or ruined shock absorbers with a load of 5 tons. The best highway surface will develop some chuck holes under heavy traffic. The driver must be alert and either avoid rough spots or reduce his speed.
- (2) Heavier loads require more gear shifting. The driver must be careful in picking up the load with the clutch. Proper gear ratios must be selected in both climbing and descending hills.
- (3) Highway movement often requires running at high, sustained speeds. The “lube” in the gear boxes must be checked more often and vents must be kept open.
- (4) It is *not* necessary to carry higher tire pressure since the tires normally carry the maximum desirable pressure. However, it is more important to keep tires up to regulation pressure since the heavier loads will flex low tires and cause them to wear or rupture.
- (5) A heavily loaded vehicle requires more time and distance to stop from a given speed than a vehicle carrying its normal load. The driver must be constantly mindful of this in maintaining intervehicular distance and especially when operating on surfaces affording low traction (FM 55-6, FM 55-31, and TM 21-305).

Section IV. TACTICAL MOTOR MOVEMENTS

64. Characteristics

Tactical motor movements are characterized by flexibility of employment, ability to deliver large numbers of troops over long distances in short periods of time, increased logistical requirements, and vulnerability to enemy action. Tactical movements are conducted in anticipation of contact with the enemy. Troops must be prepared for combat whether the movement is to contact, is away from the enemy, or is any other movement in accordance with operational plans. The degree of combat readiness varies with the probability of contact with the enemy. Basic characteristics of tactical motor movements include formations affording the commander ease of control and the maximum of flexibility for deployment upon contact, and adequate provision for reconnaissance and security.

65. Formation for Tactical Movements

In a tactical march, the formation is governed by the mission, the terrain, and the tactical situation. Units are arranged in the expected order of use, or in the order that they are to enter a new assembly area or attack position. Provision is made for immediate, conclusive action when enemy resistance is slight, and for rapid development in cases of deliberate resistance.

a. *Contact Remote.* When contact with enemy forces is remote, march dispositions which expedite movement are adopted. Columns having different rates of movement are assigned separate routes or are echeloned in time. Route column organization depends upon the mode of transport, the road and traffic conditions, and the effectiveness of enemy long-range weapons and aircraft. Route columns employing motor transport are made up of three internal elements: the head, the main body, and the trail.

b. *Contact Imminent.* As the approach to contact progresses and contact with the enemy becomes more probable, the formation of the command will be changed from that of route column to tactical column. In tactical column, with elements of the command grouped in the manner best suited for their tactical employment and with ground security elements active, the rate of advance is somewhat slowed. The speed of advance at this stage is dependent upon the inherent, tactical mobility of the troops involved, upon the size of the unit, and upon the rapidity of development of the tactical situation.

66. Reconnaissance and Security

Reconnaissance and security are vital to any tactical movement of troops. In any tactical situation, timely and accurate informa-

tion of the enemy and the terrain is of primary interest to the commander in making his decisions as to movement and formation of his command. Security elements assure the continued advance of the command, protect it from surprise ground attack, deny observation by the enemy, and give timely warning in the case of air attack. Security elements and measures may include—

a. Covering Force. A force normally operating well forward of the main force with the mission of early development of the situation, crushing enemy resistance when possible, and deceiving, delaying, and disorganizing enemy forces until the main force can prepare for action. The covering force precedes the advance guard of the column and provides its own security.

b. Advance Guard. The advance guard has the mission to prevent delay of the main body and to protect it against surprise attack. Its size, composition, and disposition vary with the mission, terrain, and tactical situation.

c. Flank Guards. Flank guards cover routes of approach that might be used by hostile forces to attack the flanks of the column, driving off harassing forces, and giving timely warning of the approach of larger enemy forces.

d. Rear Guard. The rear guard follows and protects the main body on the march, defeating or delaying hostile forces attacking from the rear, protecting the trains, and collecting stragglers.

e. Air Guards. Air sentries are placed on all vehicles to warn of the approach of enemy aircraft. In addition to the security afforded by air guards, defense against air attack is achieved by the continuous manning of antiaircraft guns, dispersion, and the maintenance of proper distances.

f. Communication Security. Communication security, normally prescribed in standing signal instructions (SSI), insures adequate protection against enemy communication intelligence activities such as radio interception, position finding, traffic analysis, and cryptanalysis.

g. Organic Army Aviation. Organic Army aviation will be used to the fullest extent on close and distant reconnaissance, selection of alternate routes, movement of security forces, and highway regulation and control.

67. Command

Since tactical movements are, in general, movements to contact, and since the success of the operation may be dependent upon the rapid and efficient tactical deployment of troops, the commander of combat troops will command the movement regardless of whether it is made in organic vehicles or in temporarily attached or assigned vehicles. If a transportation unit is supporting the

operation, the commander thereof will act as a subordinate commander and technical transportation adviser to the tactical commander.

68. Loading

Loading for a tactical motor movement will normally be done in the manner best suited to the speedy employment of troops according to their normal methods of combat. Utilization of transport space will be subordinated to tactical considerations. Techniques and procedures of entrucking and detrucking used in administrative movements of personnel may be modified to fit the tactical situation. Adequate security must be provided since troops are particularly vulnerable in entrucking and detrucking areas. This security must include the maximum use of cover and concealment, dispersion in conformity with tactical considerations, and the highest standards of troop discipline to meet the requirements for defense against atomic weapons.

CHAPTER 5

MOTOR MOVEMENTS IN THE CONTINENTAL UNITED STATES

Section I. GENERAL

69. Types of Motor Movement

Motor movements in CONUS may be generally classified in three categories: the casual movement of military vehicles performing maintenance, housekeeping, and administrative duties incidental to the operation of continental installations; the movement of convoys engaged in supply activities or the transfer of personnel; and training movements of a tactical or administrative nature under conditions simulating, insofar as possible, those that might be encountered in a theater of operations.

70. Considerations

Basically, all military motor movements in CONUS are made with consideration for and in coordination with normal civilian traffic over routes under civilian control. In effecting this coordination with civilian authorities, those responsible for military movements must consider the mission of the specific operation and should make every effort to influence final decisions on coordinated traffic control to most effectively accomplish that mission. This is particularly important when conducting tactical training movements since the effectiveness of the training is directly proportionate to the simulation of combat conditions. However, regardless of the purpose of military movements in CONUS, it is the responsibility of all concerned to insure meticulous compliance with all applicable state and local laws, ordinances, and regulations to promote the safe and efficient movement of both civilian and military traffic.

Section II. COORDINATION WITH CIVILIAN AUTHORITIES

71. Clearances

a. To assure compliance with state and local laws, safeguard highway facilities, and to avoid delays and accidents, movements within the continental United States, its territories, and possessions will be coordinated with state or local highway traffic authorities concerned and other appropriate civilian agencies. For example, the movement of 10 or more vehicles organized to operate

as a column, or the dispatching of 10 or more vehicles per hour to the same destination over the same route, or the movement of military vehicles of sizes or weights unusual for ordinary highway travel should be cleared with civil authorities. All necessary permits, clearances, escorts, and guides prescribed by civil authorities will be secured as far in advance as practicable and in no case, except in an emergency, less than 24 hours in advance of the movement (AR 55-162).

b. In the case of an intrastate movement by highway, civilian assistance in planning the movement is obtained by the local installation or unit transportation officer, who makes the necessary arrangements with the highway traffic authorities of the state concerned and other appropriate civilian agencies.

c. In the case of interstate movements within one continental Army area, the matter should be referred to the area transportation officer, who coordinates the movement with the authorities of the various states concerned.

d. When the movement passes out of the continental Army area in which it originates, the transportation officer of that area coordinates the movement with the transportation officers of all areas through which it passes, and the transportation officer of each such area coordinates the movement with the proper civilian authorities within his area.

e. Civilian authorities will be furnished with any information (except classified data) which they request. The data which may be given to civilian authorities concerned is governed by regulations and directives existing at the time of the movement. For example, during peacetime the identity of troops being moved is normally not concealed, but in case of war or imminent war, this information is usually secret.

f. The following example illustrates information which civilian authorities may desire:

- (1) Origin and destination of movement.
- (2) Desire to enter state at _____ (hour) on _____ (highway number or name) at _____ (point).
- (3) Desire to leave state at _____ (hour) on _____ (highway number or name) at _____ (point).
- (4) Designation of column.
- (5) Officer in command.
- (6) Number of vehicles.
- (7) Personnel strength.
- (8) Necessary halts.
- (9) Column does (does not) have explosives. If so, their nature.

- (10) March characteristics of column (speed, type of column, distances between vehicles). If military terms are used such as "open column," "close column," "infiltration," or "SM," an explanation should be given.
- (11) List of overweight or oversize vehicles with characteristics of each.
- (12) Other data pertinent to the move such as blackout or other unusual operations.

g. Civilian authorities may, in return, be of material assistance to military authorities by furnishing advice as to—

- (1) Most practicable route(s) to be used, identifying route markings.
- (2) Alternate route(s), identifying route markings.
- (3) Points where it may be advisable to divide columns and use two or more routes to alleviate congestion or road wear.
- (4) Time when it is best to pass through areas of traffic congestion or traffic defiles.
- (5) Vehicle spacing and speeds most desirable for coordination with other traffic.
- (6) Location and nature of any unusual road conditions.
- (7) Highway repair work which may be encountered.
- (8) Information on weight limitations of bridges and clearances in height and width along the route.
- (9) Location of facilities of service and supplies.
- (10) State and city police escorts to assist the column.
- (11) Availability of police communications system for emergency messages, including possibility of tuning column radios into police net.
- (12) Location of hospitals available in case of emergency.
- (13) Procurement of dependable road maps.

h. Whenever unforeseen circumstances dictate a change in plans for the movement, the civilian agency concerned will be notified promptly of the change.

i. Information in *a* through *h* above does not preclude the establishment of standing operating procedure with the proper state or local authorities for the coordination of local, routine, or regional movements in the vicinity of or between installations.

j. So far as the civilian practice permits, contact with civilian authorities should be informal and, when practicable, should be established by personal conference between civil authorities and the appropriate commander or his representative. When time will not permit personal conference, liaison should be established by telephone, telegraph, or radio, in which event sufficient information will be furnished to permit intelligent planning.

72. Traffic Escorts

a. Normally, military police will provide traffic escorts as needed; however, civil authorities may provide the escorts necessary in assisting a movement through congested areas.

b. A city, county, or state police force may furnish a traffic escort for the length of the movement within their respective jurisdictions, but arrangements should be made for another traffic escort, when needed, to meet the column at the point where it leaves one area and enters another.

c. Civilian police escorts may be provided to aid the military police. When military police are not available, civil police may furnish the entire escort.

- (1) In the absence of both civilian and military police, such traffic escorts as may be needed are furnished from the column.
- (2) It should be kept in mind that military police or escorts furnished by the column do not have the same authority over civilians as civilian police (except in case of martial law). In practice, military police will usually be obeyed, but soldiers other than military police, used as traffic escorts should be carefully selected and well instructed to reduce the probability of antagonizing civilians encountered in the course of their duty.

73. Tolls and Ferries

Normally, there is an arrangement between the Army and authorities controlling a toll route or ferry under which tickets are provided or slips signed to cover the passage of Army vehicles. Commanding officers of columns should ascertain in advance whether there are any toll bridges, tunnels, or ferries on their routes, and should be sure that they are prepared to comply with the prescribed procedure.

74. Reconnaissance

Main roads within the continental United States are generally good, lacking in prohibitive grades, and of high capability. They are well signed and marked; good, up-to-date road maps are readily available; and civil authorities can furnish information concerning roads under repair, unusual conditions, bridge capacities, detours, and other restrictions. However, reconnaissance in some form should be conducted prior to any motor movement.

75. Safety Precautions

Civilian safety precautions for movements in the United States are fully applicable to military movements. So far as is consistent

with military necessity, it is the policy of the Army to conform to all interstate commerce and local safety regulations.

76. Quartering Parties

In cases involving the movement of personnel within the continental United States, it is necessary to make arrangements in advance for bivouac areas, quarters or billets, loading and parking facilities, supplies and rations, water, fuel, and medical assistance so that all are provided prior to the arrival of the column. This often involves selection of suitable areas and rental of facilities under varying conditions and will require careful selection of personnel to adequately perform these duties.

77. Followup Parties

The functions of a nontactical followup party are especially applicable to movements in the continental United States, where it is important that property used for bivouacs or quarters should be left in the same, or better, condition than before occupancy by troops. The followup detachment is designated to inspect bivouac areas and other halt sites after they have been vacated by the column and to correct and report any deficiencies observed. The followup party completes necessary paperwork in connection with leased camp sites or with claims arising from damage to private or public property. On the road this party may also pick up guides, guards, and markers which have been placed by the advance party, make final investigation of accidents when military police are not available, and dispose of disabled vehicles separated from the column. The public relations aspect of the followup party's duties is of great importance to the unit concerned and to the Army in general.

Section III. MOTOR MARCHES AND CONVOYS

78. Motor Movements for Training

Training movements are normally made in formations suitable to the simulated tactical conditions of the exercise. To accomplish the training mission with due consideration to normal civilian traffic on the assigned routes, a high degree of coordination must be maintained between the commander and his staff and the appropriate civilian authorities. In the interest of good public relations, ample notice should be given through newspapers and other media to the general public along the selected routes as to the purpose, the routes, and the schedules of the proposed exercise. So far as practicable, the movement should be scheduled for

periods of light civilian traffic and congested areas should be avoided. Adequate route reconnaissance is obligatory; traffic escorts should be provided where necessary; and discipline must be rigidly enforced on the march, at halts, and in bivouac.

79. Movement of Convoys

Except in the event of war or the threat of war, the movement of convoys engaged in supply activities or the transfer of personnel within the continental limits of the United States will normally be limited to the preparation for maneuvers or relief operations in cases of local or regional calamities. In the former case, where troops and supplies must be concentrated for short periods in a maneuver area, it is often of economic advantage to effect this by military motor movement. When this is done, coordination with civilian authorities is initiated early in the planning phase and maintained throughout the operation. Formations for such convoys are dictated by the factors of civilian traffic, military traffic control, and expediency. Prior to the movement of supply or personnel convoys, all commercial means of transportation must be investigated and evaluated in terms of economy to the Government and the efficient accomplishment of the assigned mission. In cases of relief to stricken areas, supply and personnel convoys will usually be given a high priority over routes offering the most expeditious access to the area. Civilian authorities will reroute or delay civilian traffic that is not also engaged specifically in relief activities, and the commanders of military convoys will thus be operating under conditions normally found only in a theater of operations.

PART THREE
PLANNING MOTOR MOVEMENTS
CHAPTER 6
PRINCIPLES OF MOVEMENT PLANNING

Section I. COMMAND AND STAFF DUTIES AND RESPONSIBILITIES

80. General

a. Every motor march and convoy should be organized along a previously prepared plan. In some cases, such a plan may merely tell where to go, what vehicles to take, the route to take, and when to start. Such simple plans may require only a moment's thought and an oral order. In other cases, extensive study and detailed written orders from different echelons of command are necessary to assure an efficient movement. In every case the planning should be limited to that required for the efficient accomplishment of the mission. Both overplanning and oversimplification should be avoided.

b. When highway movements are regulated, the coordination and most of the planning are performed by the appropriate staff. In such cases, planning by convoy and march unit commanders is normally restricted to that necessary to assure that the unit complies with orders issued and that it marches in an orderly, systematic manner under the instructions received.

c. If a unit is given an order to move and a plan has not been furnished by higher command, details to implement the move must be worked out by the unit command. When there is any possibility of producing serious conflicts with other traffic, organization commanders making a march on their own initiative should give advance notice of time of movement and routes to be used in order to obtain proper authority.

81. Unit Commander

Regardless of the size of the unit, the commander alone bears the full responsibility for the planning and execution of motor movements of his unit in the same manner as he does for any operation. His staff assists as he directs by securing necessary information, by preparing estimates and recommendations, by preparing detailed plans and orders based on his decisions, and by issuing orders and supervising their execution. The commander

will utilize his staff to the degree demanded by the situation, the complexity of the operation, and the time available for staff action. The timely issuance of warning orders serves to alert troops and prepare them for a move before receipt of the detailed operation order for the move. The operation order for a road move will cover all essential details, usually in the form of a five-paragraph operation order, and may include as annexes a road movement table and an administrative annex (Example—operation order for a road move). Commanders of subordinate units should receive the operation order in sufficient time to prepare plans and issue orders as necessary for the efficient participation by their units in the movement.

EXAMPLE OPERATION ORDER FOR A ROAD MOVE

(intended as a guide only)

“(SECURITY CLASSIFICATION)

Copy No. 4.

21st Inf Div

YREVA, BLOKSKY,

011030 October 1956

OPS 27

Operation Order 14:

Map: BLOKSKY, 1/250,000 NOTKLOTS-DRAKCIR

Task Organization/Grouping: Annex A,

Task Organization/Grouping (NOT attached to this example).

Time Zone A.

1. SITUATION

- a. Enemy Forces: BLOKSKY 42nd Infantry Division (reinforced) is delaying advance V Corps.
- b. Friendly Forces: V Corps attacks early 2nd January.
- c. Attachments and Detachments: None.

2. MISSION

21st Infantry Division moves from YREVA at 012030A January into NAEJ.

3. EXECUTION

- a. 121 Brigade moves RED route to DRAKCIR and WHITE route to vicinity of NAEJ.
- b. 221 Brigade moves BLUE route to NOTKLOTS and GREEN route to vicinity of NAEJ.
- c. 321 Brigade follows 121 Brigade.
- d. Division Artillery follows 221 Brigade.
- e. Division Troops follow 321 Brigade.
- f. Miscellaneous.
- g. Coordinating instructions.
 - (1) Annex B Movement Table (NOT attached to this example).
 - (2) First halt 012200A January.
 - (3) No weapons will be fired at aircraft unless attacked.

4. ADMINISTRATION AND LOGISTICS

Administrative/Logistic Order 19 follows.

5. COMMAND AND SIGNAL

- a. Continue radio silence.

b. Division Headquarters. Head of Division Troops during
move.

Acknowledge

Major-General
AVERS

Annexes A—Task Organization. (NOT attached to this example.)
B—Movement Table.

Distribution:—

Authentication:—

(SECURITY CLASSIFICATION)

82. Staff Duties In Movement Planning

a. The duties of unit staff sections will vary substantially with the type and size of the movement. In general, the duties are outlined below.

- (1) G1 will plan and coordinate the movement of the headquarters, and will submit requirements to G4 for the transportation of replacements, prisoners of war, and repatriates.
- (2) G2 will supervise procurement and issue of necessary maps and photographs; will keep the commander and staff informed on the enemy situation and capabilities, weather, and terrain; will direct counterintelligence activities associated with movement; and will initiate and direct the collection of additional information as required.
- (3) G3 will plan, coordinate, and supervise the tactical and training aspects of all troop movements, selecting and designating destinations, priorities, and times, organization for movement and march formations, and routes where the selection has tactical implications; will provide security for the movement; and will authenticate and issue movement orders. G3 will coordinate activities in road movement with G4.
- (4) G4 will plan, coordinate, and supervise the logistical aspects of all troop movements. His staff duties include the administrative transportation of units, personnel, and supplies; provision of transportation and logistical support to tactical movements; the control of movements to include the selection of routes (in coordination with G3 where the selection has tactical implications), highway regulation, and traffic control; the preparation of orders, annexes, or instructions pertaining to regulation or control measures; the selection and designation of service units; the establishment of priorities for service units; and the selection and designation of destinations and times for the movement of service units.
- (5) G5 will determine requirements for the transportation and movement of civilian supply and will coordinate with G4. G5 will also determine the capabilities and availability of civilian transportation and so inform G4.

b. Special staff functions in the planning of motor movements include the following:

- (1) *Transportation officer.* The transportation officer makes plans and recommendations pertaining to requirements for, availability of and employment of transportation and transportation troops within the command. He plans

and supervises the preparation of detailed plans for movement of troops and supplies. He directs the preparation of plans and orders pertaining to the regulation of transportation means, to include the enforcement of established priorities as to the utilization of transportation. He coordinates all organic, attached, and supporting transportation agencies of the command, to include civilian transportation when appropriate. He directs the preparation and maintenance, as appropriate, of records, studies, graphs, and plans pertaining to the employment of transportation of the command to include such items as availability tables, assignment tables, road distance and time length tables, road movement tables, road movement graphs, loading plans and the highway regulation plan. In the performance of the above duties, the transportation officer is responsible to the commander, under the general staff supervision of G4.

- (2) *Provost marshal.* The provost marshal exercises staff supervision for traffic control. He will normally maintain close liaison with the transportation officer, G3, and G4 and, based upon the movement plans of the unit, will direct traffic control reconnaissance and prepare the road traffic control plan. The provost marshal recommends traffic control policies and issues instructions to military police units for enforcement of approved traffic control policies. He is also responsible for timely instruction to his subordinate units and operating personnel, and for liaison with other agencies concerned with traffic regulation and control.
- (3) *Engineer.* The engineer plans and supervises the engineer operations pertaining to the procurement, reproduction, and distribution of maps and map substitutes under general staff supervision of G2; engineer reconnaissance, field surveys, mapping projects, and the preparation of terrain studies; recommendations for traffic regulations on roads and bridges as indicated by their physical condition; preparation and posting of signs for route marking and traffic control on permanent routes; issue of signs and/or sign materials to military police units for preparation and posting of temporary signs on routes; and the construction, maintenance, and repair of roads and trails. In the performance of these duties, the engineer coordinates with and maintains liaison with appropriate staff sections. He will normally assist the

commander in recommending camouflage and deception measures and in training troops in their use.

- (4) *Aviation officer.* The aviation officer submits recommendations to the commander pertaining to the utilization of organic Army aviation. He coordinates with the G2 and G3 during the development of plans concerning reconnaissance, movement of security forces, and control.

Section II. STEPS IN MOVEMENT PLANNING

83. General

Highway traffic planning is a continuing process during the course of an operation. Concurrent movements are separated in space by assignment to nonconflicting zones of movement, routes, or traffic lanes. Movements can be separated in time by scheduling to avoid conflict. The plan must be adaptable to ready modification, expansion, or alteration.

- a. Only with the cooperation of all elements using the highways may the traffic authority properly perform its functions of regulation and control (pars. 89-92).

- b. Knowing the number, nature, and capabilities of the highways and the quantity and nature of that which is to be moved, the highway transport officer must plan the number and type of vehicles and truck units needed. These plans must reflect consideration of the factors of trafficability, highway adequacy, and economy. The vehicles selected should be suited to the road, weather, and terrain conditions imposed by the situation; should conserve road space by the use of maximum loading where possible; and should provide maximum utilization of personnel and fuel. Plans must be made for the necessary highway transport personnel, not only for the actual hauling but also for command and staff supervision, including highway regulation functions and coordination with appropriate ordnance support units.

- c. The location of terminals, depots, and dumps must be planned to conform to the general traffic circulation plan. In addition, it must be practicable for vehicles to reach the dumps or depots, even in bad weather, and there must be sufficient hardstanding for operation within the installation.

84. Determination of Requirements

Estimates of requirements for motor movements are made on a continuing basis at all command and staff levels. At each echelon of command, prospective users of transportation, or their staff representatives, periodically submit an estimate of requirements

for transportation for a future period including insofar as possible amounts and/or tonnage of personnel, equipment, and supplies to be moved, and the origin and destination of movement. The transportation officer of the command assembles these estimates, makes adjustments or corrections in accordance with changing situations, and adds any known requirements imposed by higher authority.

85. Movement Capabilities

Current knowledge of transportation capacities is essential to movement planning. This knowledge of capacities is maintained by the compilation of information on the physical characteristics of the various types of transportation available to the command, highway transport units assigned or attached, and truck-lift capabilities of organic and available transportation. Also included in this analysis is information on the capability of units and installations to receive and ship.

86. Establishment of Priorities

Requirements normally exceed capabilities, thus imposing a need for the establishment of priorities in order that the commander's plan may be appropriately implemented. Establishment of priorities is a command function and a staff responsibility of the G4 in coordination with the G3. Actual implementation of the established priorities is a responsibility of the transportation officer (par. 81).

87. Initiation of Highway Regulation Plan

The regulation of highway transportation over routes is a responsibility of the staff transportation officer. The planning for highway regulation starts well in advance of actual operations and is a continuing process fully coordinated between all echelons of command to insure complete integration in the overall plan.

a. Traffic Reconnaissance. An accurate, current, and comprehensive knowledge of the highway network, transportation facilities, and conditions is essential as a basis for the traffic circulation plan. Information gained from traffic reconnaissance agencies should include the physical characteristics of the road net; a survey of possible locations for dumps, terminals, and other facilities; and such traffic information as existing or anticipated traffic density and traffic volume, location of areas of probable traffic congestion, and needs for traffic control.

b. Estimate of the Situation. An estimate of the situation is prepared by the staff transportation officer concurrently with and based, in part, upon the information gained from the reconnaissance. This estimate will reflect transportation intelligence; cur-

rent tactical plans; quantity, type of traffic, origin, destination, and date; policies, priorities, and restrictions imposed by higher headquarters; location of installations; and the road net and traffic flow. In the preparation of this estimate, planning and intelligence activities at all echelons of command will be considered. Early coordination of these activities insures the inclusion of essential information.

c. The Highway Regulation Plan. The highway regulation plan is based upon the estimate of the situation and the decision of the commander concerned. Details of the plan will depend upon the level of the command and the regulation and control necessary to meet the responsibility of the command. The highway regulation plan will contain the following information:

- (1) Traffic circulation plan, including road net and direction of movement, classification of routes, bridge capacities, tunnels, and other restrictions on the route.
- (2) Priorities of movement for vehicles and convoys.
- (3) Location of depots, ports, and terminals.
- (4) Communication system.
- (5) Speed, safety, use of lights, security, and other pertinent regulations.
- (6) Location of highway regulation points, MP traffic control points, and ordnance road patrols.
- (7) Reporting procedures.
- (8) Makeup of march serials and convoys.
- (9) Methods of scheduling and reporting the progress of convoys and other movements.
- (10) Regulations concerning convoy clearances; arrangements with civil authorities (when applicable) for military vehicular movements.
- (11) Procedures for highway movements such as those through area commands and into the combat zone (Army service area).
- (12) Location of support facilities such as POL, mess, medical, and ordnance.

88. Routing and Scheduling

Planning for highway movements is normally culminated in routing and scheduling. Routing and scheduling are done on the basis of all planning and information outlined above. Routing is the planning of movements over designated routes. It may be accomplished through balance (vehicle performance characteristics balanced against road characteristics and limitations), separation (separating in space of concurrent movements to non-conflicting routes), and distribution (spreading of the demand for

road space and traffic over as many of the available roadways as possible). Scheduling is the time apportionment of roadways used for road movements. The proper coordination of time and space factors through routing and scheduling should insure the maximum use of the highway net with a minimum of congestion. Provision must be made for emergency routing and scheduling to make adjustments necessitated by changes in the tactical situation, and both column commanders and military police should be informed in advance of the prescribed procedures.

CHAPTER 7

TECHNIQUES OF MOVEMENT PLANNING

Section I. HIGHWAY REGULATION AND HIGHWAY TRAFFIC CONTROL

89. General

The planning requirements for highway regulation and traffic control will vary with the size of the command concerned, the highway net, the logistical situation, and the mission, composition, and disposition of tactical units. Since the plans of higher headquarters have a constant bearing upon operation of smaller elements, a knowledge of the basic planning factors and techniques employed by the higher staffs is helpful to those having planning responsibilities in all echelons. Military highway regulation and traffic control include the coordination and control of all movements over highways, streets, roadways, and within traffic terminals, for the purpose of meeting military needs with a minimum of congestion or conflict and with maximum flexibility.

90. Consideration of Planning Factors

The planning for highway regulation and traffic control involves basic staff functions such as examination of the assigned mission; collection, collation, and evaluation of information; estimate of the situation; and preparation of recommendations.

a. Highway regulation planning is a function of the transportation officer and specifically involves—

- (1) The assigned mission, which may be an extension of the tactical mission of the command, specifying critical points and critical time factors.
- (2) Traffic reconnaissance, which will include collection of information on the physical capabilities and limitations of routes and facilities; traffic densities and flow; signal communications; traffic control measures; and an analysis of such information with recommendations as necessary.
- (3) An estimate of the situation which will reflect current transportation intelligence; operational plans of the command; quantity, type of traffic, origin, destination, and date of movement; policies, priorities, and restrictions imposed by higher headquarters; location of installations; and the road net and traffic flow.

- (4) Preparation of the highway regulation plan, based upon the decision of the commander and upon the above-mentioned preliminary data.

b. Highway traffic control planning is a function of the provost marshal who coordinates with staff personnel responsible for highway regulation. Performance of this function involves—

- (1) Traffic control reconnaissance to secure information pertinent to the planning of traffic control.
- (2) Analysis and coordination of information collected.
- (3) Preparation of an estimate of the situation reflecting current traffic intelligence, enemy situation, operational plans of the command, and orders and restrictions imposed by higher headquarters.
- (4) Preparation of a traffic control plan to enforce the provisions of the highway regulation plan. Continuous liaison with appropriate staff sections must be maintained to insure close coordination in planning.

91. Traffic Reconnaissance

Traffic reconnaissance will be as thorough as the situation and the time available will permit. Ground reconnaissance will normally be preceded by a study of available maps and aerial photographs of the area, a review of intelligence reports and transportation intelligence studies, and conferences with personnel familiar with the area. Ground reconnaissance parties may be composed of military police, engineer, or transportation personnel, or a combination thereof. This may be supplemented with aerial reconnaissance when the situation permits. Reconnaissance parties are assigned specific missions for the collection of information. They will not normally be assigned the collection of data available from other sources, unless it is necessary to secure confirmation and/or current status reports on this information.

92. Traffic Control Planning

Traffic control planning for most highway movement is confined to the selection of control methods suitable to conditions, the designation of personnel to perform the function, and selection of critical areas requiring maximum control measures. During the course of traffic control planning, the selection of methods of control to satisfy requirements is based upon the principle of minimum restriction to provide the maximum flexibility with minimum personnel requirements. Traffic control methods include the following:

a. *Point Control.* Point control is exercised by military police through the establishment of traffic control posts (TCP's) at

points on a road net where streams of traffic conflict or where direction is necessary to insure the maximum use of road space. Personnel operating TCP's control traffic, enforce laws and regulations, and give information and on-the-spot directions to drivers.

b. Patrols. Patrols are mounted military police circulating in certain areas or moving along designated routes for the purpose of controlling traffic and enforcing traffic laws and regulations.

c. Escorts. Escorts are mounted military policemen assigned to accompany a specific movement to expedite and/or facilitate its progress.

d. Signs and Devices. Regulatory, guide, and warning signs and devices are installed on roads to insure that users know the traffic regulations that apply, are given timely warning of road hazards, and are directed to their destinations (FM 19-25).

Section II. OPERATIONAL PLANNING

93. Preliminary March Data

a. The march planner, having certain basic data, may determine by simple arithmetic additional information which he may desire in regard to a movement.

b. The planner will normally know the number and types of vehicles in the column, the origin and destination of the convoy, and the time of arrival at the destination. He can determine from his map the number of miles the convoy must travel, and from his schedule the number of hours it should require. By dividing miles by hours he can determine the rate of march vehicles must maintain to meet the schedule. If he knows something of the road conditions and the skill of his drivers he can make a reasonable estimate of safe driving distances, positions vehicles should maintain in the column, and how the march units will be formed.

c. 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 will determine the departure time, the road distance, the time distance, and the required rate of march. Consideration of these factors will produce an adequate road movement plan which may easily be implemented by an operation order.

d. The larger and more complex the movement the more complete and detailed must be the planning. If the movement is scheduled over a dispatch route, exact data as to road space allocated, time space allowed, and other factors of lead, gap, and length, in both time and space, may be required to be known.

The rate of movement necessary to meet the point schedule, within the limitations of the other factors, and as limiting them, must be determined. In consideration of the mission, the planner will determine the tactical or administrative purpose of the move, special measures or arrangements necessary to assure its accomplishment, and the load to be transported either in troops or cargo or both. In regard to the march formation, the planner will consider 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 considering the maximum allowable speeds of the vehicles, their average running times, and the effect of the rate of march on march organization. In the selection of the route to be traveled, the march planner will consider loading points for elements of the convoy, the start point for the movement, critical points along the route, scheduling of halts, probable traffic and road conditions, and release points.

e. Normally, the march planner will have or will be supplied with the information mentioned above. March formulas are the means by which he applies the known data to secure other information. However, march formulas are only one aid to the march planner in evaluating his mission and in gathering information which the commander may desire in regard to the movement. They should be used in conjunction with other planning aids such as road movement graphs and road movement tables.

94. Time and Distance Factors in Movement

The relationship between distance and time is the basis for all march planning (fig. 2). The corresponding factors as used in movement planning are as follows:

a. Those pertaining generally to columns or to elements within columns.

<i>Length</i>	<i>Time length</i>
<i>Gap (distance)</i>	<i>Time gap (time interval)</i>
<i>Lead</i>	<i>Time lead (headway)</i>

b. Those pertaining generally to the column on the route.

<i>Road space</i>	<i>Time space</i>
<i>Road distance</i>	<i>Time distance</i>
<i>Road clearance distance</i>	<i>Road clearance time</i>

95. Distance Factors

The distance factors of a march are usually expressed in miles, yards, or feet. These factors are defined below.

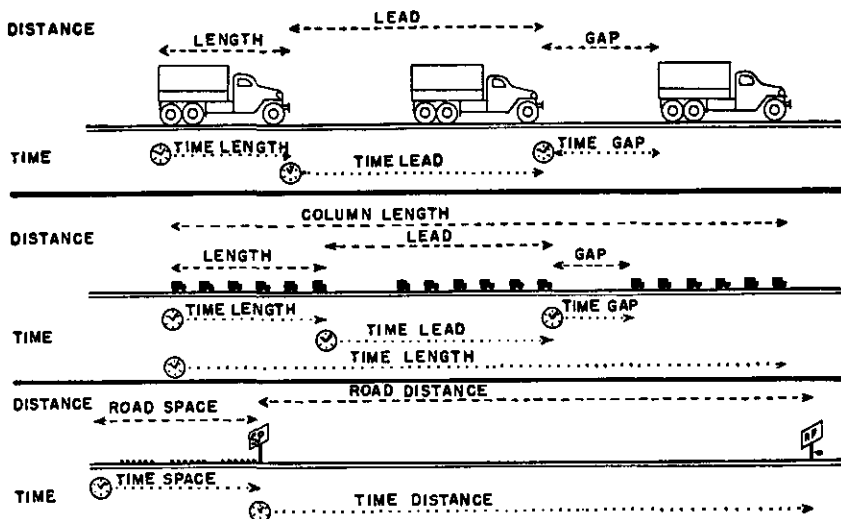


Figure 2. Space and time factors illustrated.

a. The length of any column or element of a column is the length of roadway which it occupies, measured from front to rear inclusive.

b. Road space is the total length of roadway occupied by a column or element thereof plus any space in addition to the length which may be required as a safety factor or to maintain flexibility. For example, a column of three serials, each one mile in length, with one-half mile gaps between serials, and a one mile gap to the next column would have a *length* of 4 miles, and a *road space* of 5 miles.

c. Gap is a term used to designate distance 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.

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

e. Road distance is the distance from point to point by road, usually expressed in miles.

f. Road clearance distance is the total distance that the head of the column must travel for the entire column to clear a given section of road.

96. Time Factors

Time factors are used to clock the relative positions and 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 factor of distance:

a. Time length is the time required for a column, or element thereof, to pass a given point.

b. Time gap is the period of time, measured from rear to front, between successive vehicles or elements as they move past any given point.

c. Time lead (headway) is the period of time between individual vehicles or elements of a march measured from head to head as they pass a given point.

d. Time distance is the time required to move from one point to another at a given rate of speed.

e. Time space is the time consumed by a column, or element thereof, while proceeding past any point en route. It includes the time gaps between subordinate elements and additional time required for safety and for maintenance of flexibility.

f. Road clearance time is the total time a column or element thereof requires to travel over and clear a section of road. Road clearance time equals time distance plus the time length of the column.

97. Rate of Movement

Rate of movement is measured by a ratio of distance and time and is expressed as miles per hour. Although no exact distinction is made between terms expressing rate of movement, the following distinctions are helpful to march planners:

a. Speed is the actual rate at which a vehicle is moving at a given time, usually expressed in miles per hour (mph) as registered on the speedometer.

b. Pace is the regulated speed of a column or element as set by a lead vehicle (the pace setter). It undergoes constant adjustment due to terrain and road conditions as different sections of road are passed over.

c. Rate of march is the average number of miles traveled in any given period of time, including short periodic halts and other short delays. This rate is expressed as miles in the hour (mih).

Section III. PLANNING AIDS

98. General

To facilitate the planning for road movement and the timely dissemination of pertinent information to the troops concerned, staff sections or personnel planning the movement will normally use such planning aids as march formulas, road movement

graphs, and road movement tables. Checklists compiled by the staff sections concerned are also helpful to insure the inclusion of all information necessary to efficient operation.

99. March Formulas

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

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

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

$$D = R \times T \text{ (distance equals rate multiplied by time).}$$

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

a. Determining Rate Factors.

- (1) *Rate* (yards per minute) equals *length* (yards) divided by *time length* (minutes).
- (2) *Rate* (miles per hour) equals *road distance* (miles) divided by *time distance* (hours).

b. Determining Time Factors.

- (1) *Time length* (minutes) equals *length* (yards) divided by *rate* (yards per minute).
- (2) *Time lead* (minutes) equals *lead* (yards) divided by *rate* (yards per minute).
- (3) *Time space* (hours) equals *road space* (miles) divided by *rate* (miles per hour).
- (4) *Time distance* (hours) equals *road distance* (miles) divided by *rate* (miles in the hour).

c. Determining Distance Factors.

- (1) *Gap* (yards) equals *rate* (yards per minute) multiplied by *time gap* (minutes).
- (2) *Lead* (yards) equals *rate* (yards per minute) multiplied by *time lead* (minutes).
- (3) *Distance* (miles) equals *rate* (miles in the hour) multiplied by *time distance* (hours).

d. Converting Factors Into Others of the Same Class.

- (1) *Length plus gap equals lead.*

- (2) *Time length* plus *time gap* equals *time lead*.
- (3) *Distance* (miles) multiplied by 1760 equals *distance* (yards).
- (4) *Time* (hours) multiplied by 60 equals *time* (minutes).
- (5) *Rate* (miles in the hour) multiplied by 30 equals *approximate rate* (yards per minute).

100. Road Movement Graphs

A road movement graph is a time-space diagram providing an easily used device for the visual presentation of movement so that conflicts and discrepancies may be prevented in the planning stage before congestion occurs on the route. Road movement graphs are used by staffs in planning and, when applicable, in supervising and/or regulating complicated movements. They also provide a convenient means of recording actual moves of units over a period. The unit of measure used, whether kilometers or miles, will depend on the requirements of the authorities concerned. However, the resulting orders and instructions should reflect only one unit of measure.

101. Preparation of the Road Movement Graph

a. The road movement graph is based upon an analysis of the route from maps of the area and current highway information to ascertain critical points along the route such as cities, towns, road junctions, and bottlenecks, and to determine the road distances between major points. The road movement graph is prepared on cross-section paper with a vertical scale showing distance in miles, or kilometers, and a horizontal scale showing time. The lower left hand corner of the sheet will thus represent the start point of the movement at the earliest time movement is contemplated (zero miles at "x" hours) (fig. 3).

b. Columns, serials, or march units, as required, are represented on the graph by horizontal lines drawn to scale, equal to the time length of the elements. The head of the column is plotted at the start point on the vertical scale and at the time of starting on the horizontal scale. This time of clearance of the trail is then plotted, and the two points are connected by a line to indicate the element (fig. 4).

c. Progress of the column, or element, is indicated by plotting time and distance on the graph using the planned rate of march. Critical points along the route are indicated at their respective distances from the start point. When halts are planned, they will be shown on the graph (fig. 5).

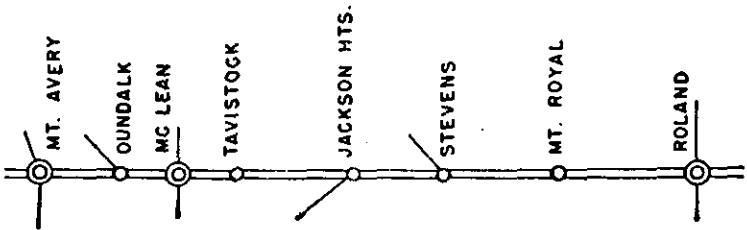
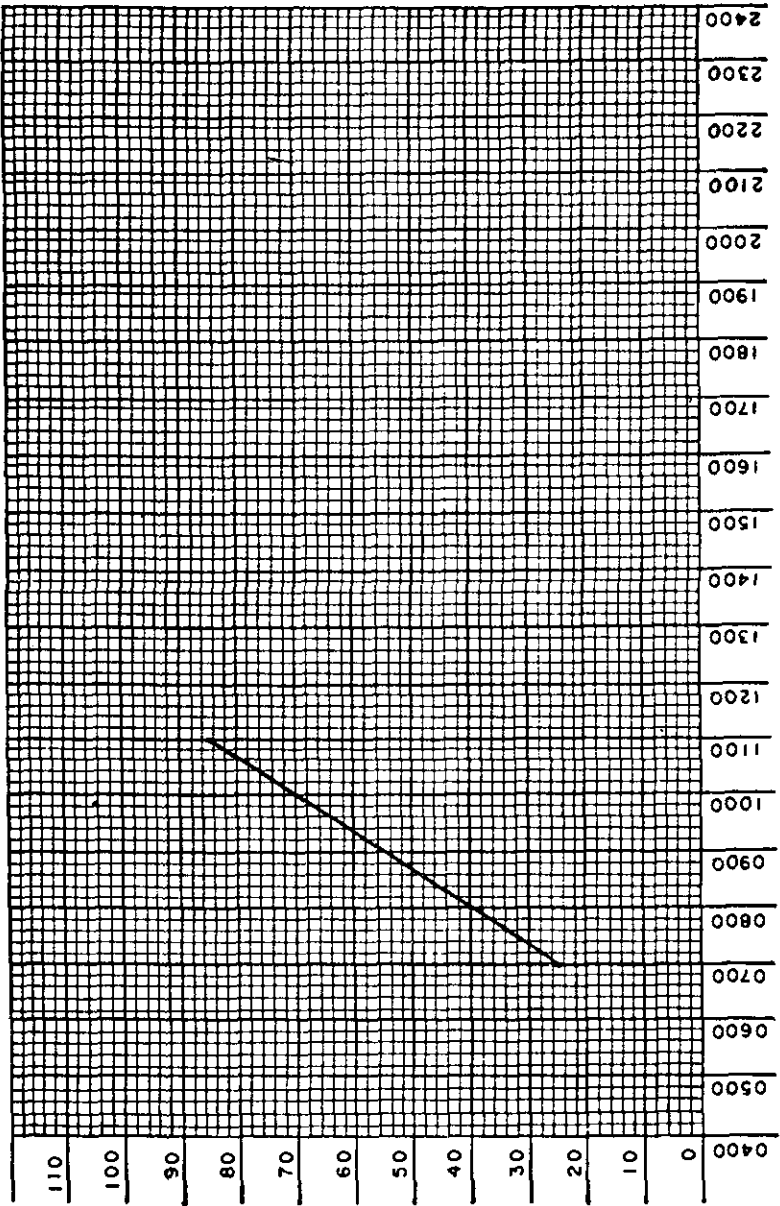


Figure 3. Schedule of the head of the column.

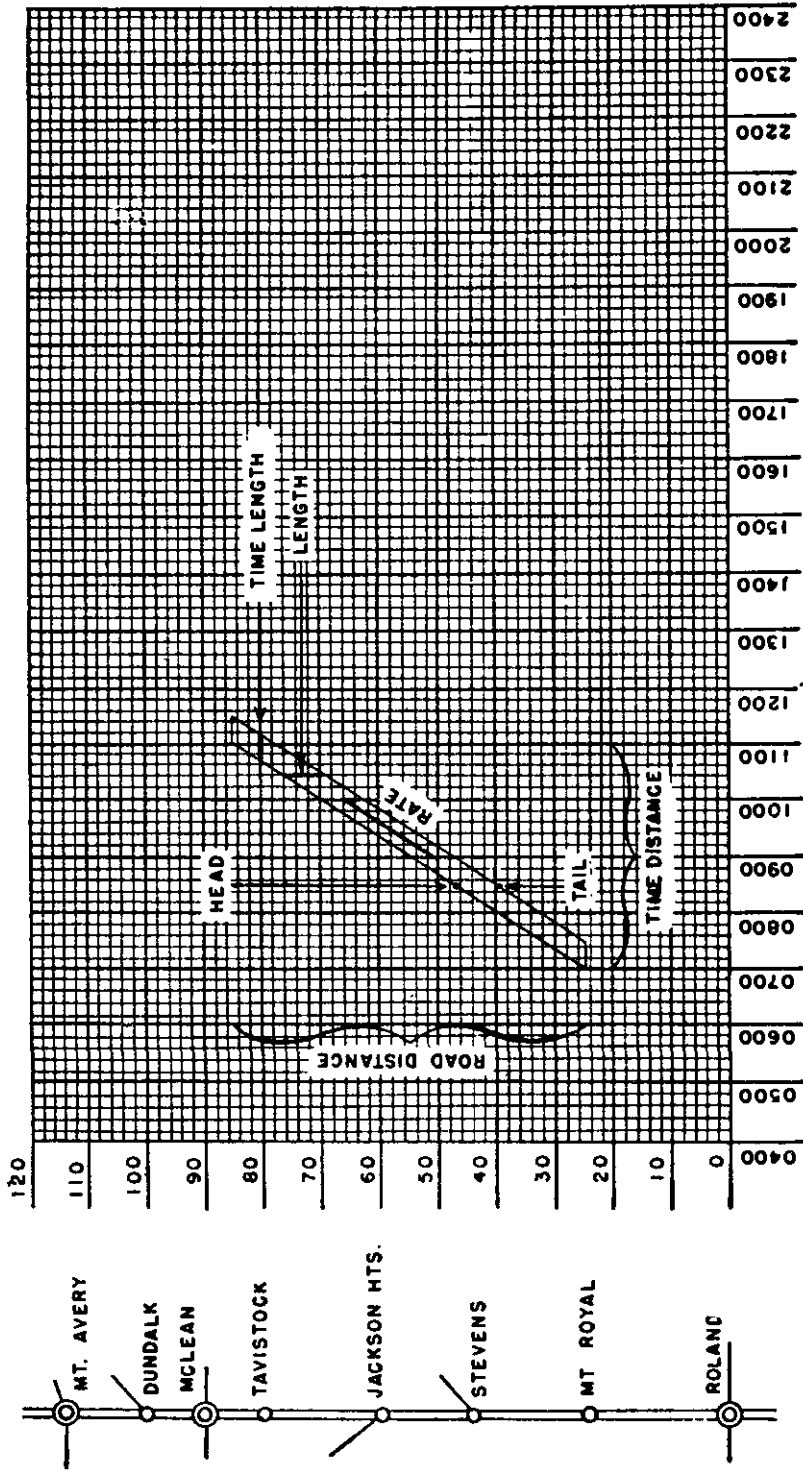


Figure 4. Analysis of major factors of the graph.

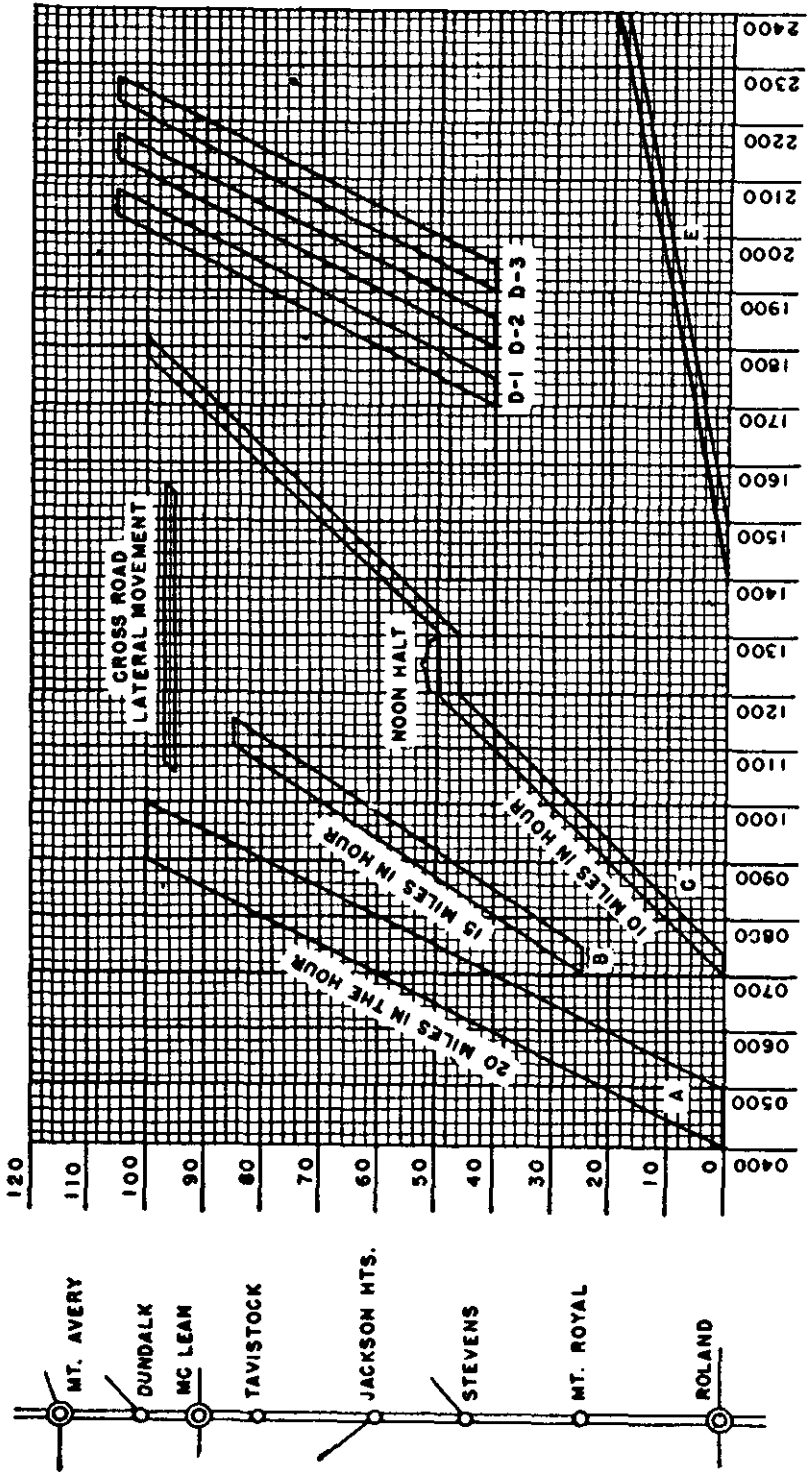


Figure 5. Scheduling a number of columns over a route.

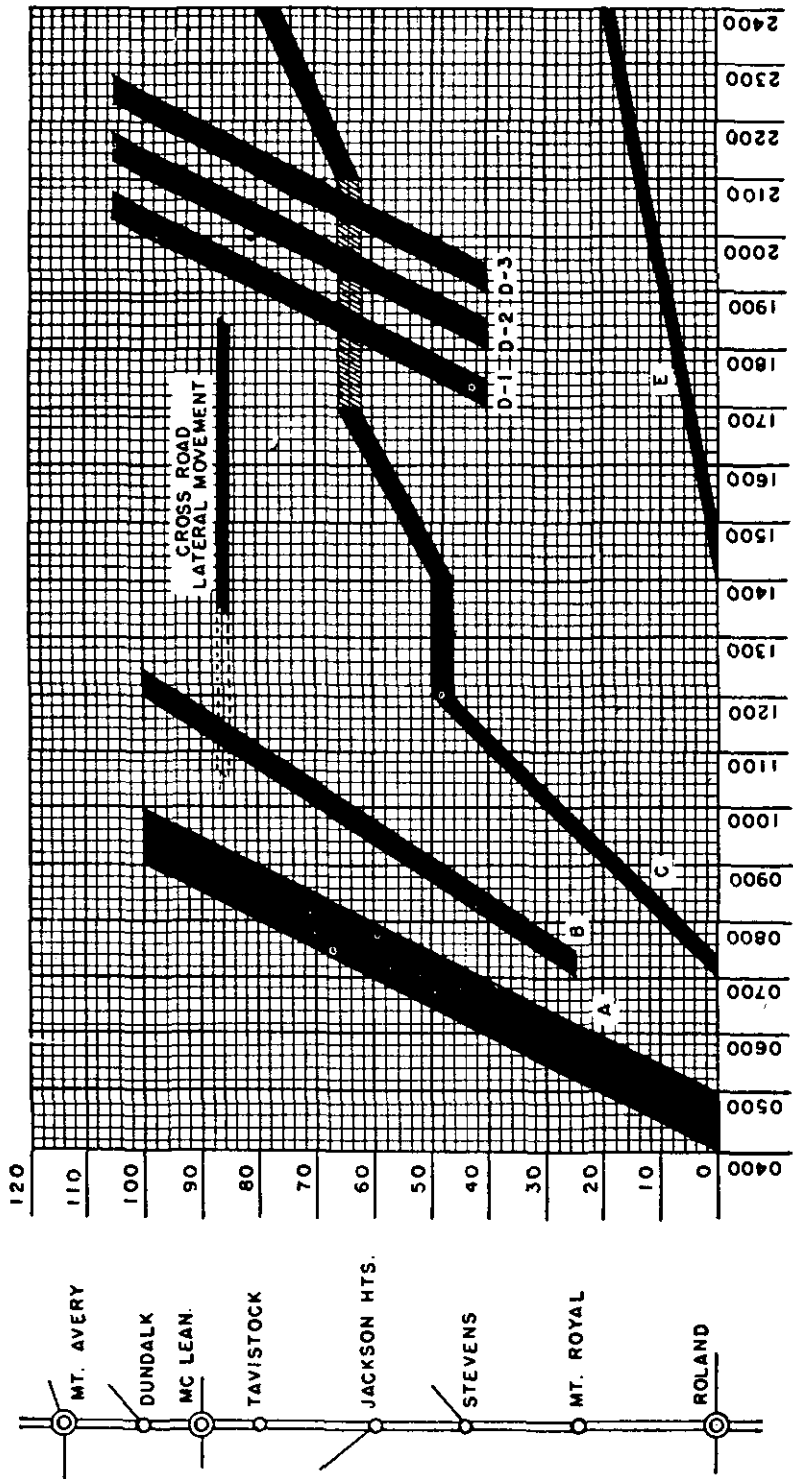


Figure 6. Schedule adjustment.

d. With slight modification of the procedure outlined above, the movement may be plotted from a specified time of arrival at the release point, or from any point en route where times of arrival or clearance are specified. In this way, departure times may be determined to insure movement in conformity with plans of higher headquarters.

102. Use of the Road Movement Graph

The road movement graph (fig. 7) is particularly helpful in coordinating movements at critical points. When more than one movement must be scheduled and maximum use must be made of the existing road net, movements involving possible conflicts may be plotted on the same road movement graph. Conflicts will then be obvious and adjustments in schedule may be made to eliminate them (fig. 6).

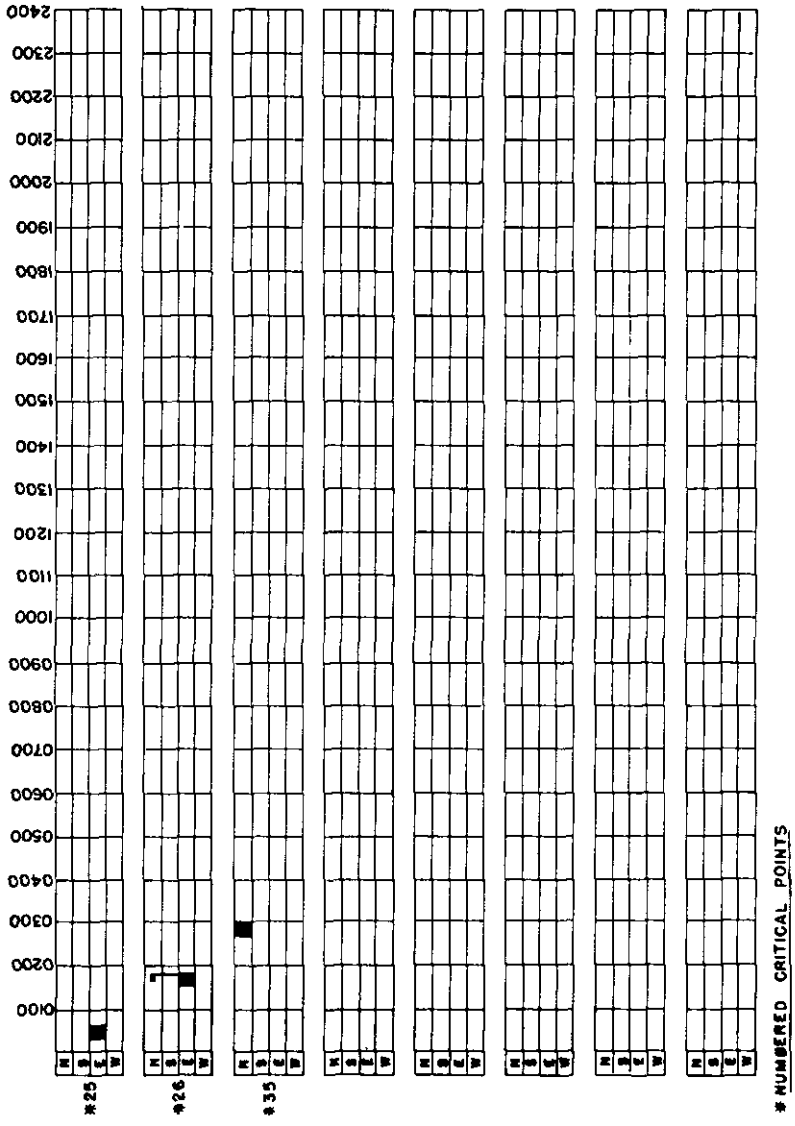
103. Road Movement Tables

Road movement tables are a convenient means of transmitting to subordinates their schedules and other essential detail pertaining to a road move. This is particularly true in cases where the inclusion of such detail in the body of the operation order would tend to complicate it or make it unduly long. Road movement tables will consist of two parts, the first being 'data' paragraphs reflecting general information or information common to two or more serials. The second part is a list of serials together with all other necessary information, arranged in tabular form. The security classification given road movement tables will be in accordance with the contents, not necessarily the same as that given the operation order. A wider distribution will normally be given to road movement tables than that given the operation order so that copies can be issued to personnel involved in regulation and control, as well as those having command responsibilities. (*Example: Specimen road movement table.*)

104. Critical Time and Point Graph

The critical time and point graph may be utilized by the headquarters responsible for the movement of numerous columns over a limited road net. This aid will speed the consolidation of road movement graphs of subordinate units to facilitate the resolution of conflicts at selected critical points.

a. The critical time and point graph consists of a separate graphic chart for each selected critical point. These are divided vertically into four sections to represent the directions of column movement and horizontally in time spacings to represent a 24-hour



NUMBERED CRITICAL POINTS

Figure 8. Critical time and point graph.

period. Any number of selected critical points may be so represented on the graph.

b. To use the critical time and point graph, the period of occupation of each numbered critical point is determined from the road movement graphs of units using the road net during the period shown. As this information is plotted, conflicts will be immediately apparent. Separate convoys or columns may be identified by symbols in lieu of shading as shown in the example.

c. To demonstrate the use of the graph, three numbered critical points have been selected from a study of the road net and identified on the graph (fig. 8). A convoy traveling east will occupy critical point 25 from 0015 to 0030. It will occupy critical point 26 during 0130-0145 where it changes direction to move north. Between 0245 and 0300 it will occupy critical point 35. With this information plotted on the graph, possible conflicts will become apparent as information of other movements is plotted and provisions for adjustment may be made with a minimum of delay.

Section IV. DEVELOPMENT OF UNIT SOP's

105. General

Standing operating procedures (SOP's) are prepared by units, usually down to and including those of 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, both tactical and administrative; and to minimize confusion and errors.

SPECIMEN ROAD MOVEMENT TABLE

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

(SECURITY CLASSIFICATION)

- Maps _____ Annex _____ to _____ (Formation/Unit)
 Operation Order _____ dated _____
- Connect with paragraph 3a. of Details of Agreement.
 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.
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
 7. Main Routes from Release Points

Serial	Date	Unit/Formation	No. of Vehicles	Load Class of Heaviest Vehicles	From	To	Route	Route to Start Point	Critical Points		Route from Release Point
									Ref	Due Clear	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(l) (m)	(n)
See NOTE 5											

(SECURITY CLASSIFICATION)

SPECIMEN ROAD MOVEMENT TABLE—Continued

- NOTES:
1. Only the minimum number of columns should be used. Any information which is common to two or more serials should be included under the 'data' 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 locations.
 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 'Movement Serial' defined as an 'element or group of elements within a series which is given a numerical or alphabetical designation for convenience in planning, scheduling or control of movement'.

106. Requirements

The requirements for, and extent of, unit SOP's will vary with the size of the unit concerned, its organization, and its normal missions. Certain prerequisites, however, are common to all units, such as, 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 the avoidance of repetition of material contained in field manuals available to the unit.

107. Responsibilities and Procedures

The initial draft of the unit SOP is normally drawn up during the initial training phase of the unit by the G3 (or S3) in cooperation with other members of the unit staff. This initial draft is modified as the training of the unit progresses and its requirements become known. Normally the initial draft will state the requirements specified by that of the next higher unit with a more detailed operational procedure for the unit concerned.

108. Items Covered in Movement SOP's

The following items may be included in the unit movement SOP:

- a. Standard organization of columns for movement, including

the grouping of vehicles and specification of group commanders as applicable.

b. Composition and duties of the advance party and/or reconnaissance echelon.

c. Priorities of movement of columns or elements.

d. Responsibility for manning start point and release point.

e. Discipline en route, use of lights, and procedures at halts.

f. Traffic densities and speeds.

g. Posting of guides and markers, and traffic control measures.

h. Normal vehicle loads, including personnel.

i. Action in the event of enemy attack, and passive defense methods.

j. Supply, maintenance, and evacuation procedures.

k. Communications, required reports, and liaison methods.

109. Form of Publication

The unit SOP may be prepared in the form most convenient for the purpose of the unit concerned. Smaller units will normally prepare an SOP covering all functions of the unit in either pamphlet or looseleaf form. Larger units may prepare separate pamphlets for diverse functions, issuing only those applicable to specific subordinate units.

PART FOUR
MOVEMENTS UNDER ADVERSE CONDITIONS
CHAPTER 8
EFFECTS OF TERRAIN

Section I. GENERAL

110. Terrain Characteristics

Among the most common barriers encountered by motor movements are those imposed by terrain. However, these obstacles can usually be foreseen and prepared for through routine map study and reconnaissance since terrain conditions that may cause serious delays are notable land features such as hills, swamps, unfordable streams, ditches, or canals. Steep grades, sharp curves, and narrow roadways characterize hilly terrain, with operational difficulty increasing in proportion to the size of the hills. In the majority of instances, the difficulty experienced will be limited to reduced speeds and restrictions of load capability. Water obstacles, on the other hand, may necessitate the use of special equipment or alternate routes.

111. General Planning and Operational Factors

Although standard military vehicles are designed and manufactured with characteristics to minimize the effect of terrain conditions, it is necessary for all planning and operating personnel to recognize and make necessary allowances for the degree of limitation and the tactical or logistical effects such conditions impose. The greatest single factor in maintaining column mobility through difficult terrain is the training of the individual driver. Under combat conditions, the available road net will often present problems similar to those encountered in cross-country movement in the normal training situation. It is therefore important that drivers receive training over a variety of terrain so that they may negotiate such obstacles with confidence, a sure technique, and minimum delay.

Section II. HILLY OR MOUNTAINOUS CONDITIONS

112. General

Plans for motor movements in hilly or mountainous regions must be based on a knowledge of current conditions. The need

for specific information regarding grades, road characteristics, and bridge capacities increases in proportion to the ruggedness of the terrain. Careful study of available maps and information from reconnaissance and intelligence agencies will indicate the type and maximum number of vehicles that can profitably be employed in any particular operation. In many instances, engineer assistance will be required for reinforcement of bridges and culverts, and for essential maintenance of serviceable road surfaces during any continued movement. Due to grades or road conditions, normal loads may have to be drastically reduced in order to keep traffic moving at a reasonable rate, and many of the heavier vehicles with little off-road capability may be found useless under severe conditions. Proper analysis of the transport situation and the selection of appropriate vehicles, coupled with operation by adequately trained drivers, are essential to successful motor movement under such conditions.

113. Control Measures

Measures for column control, highway regulation, and traffic control must be well planned and rigidly maintained to prevent traffic congestion and delay. These may include:

- a. Well defined and fixed responsibilities for regulation and control.
- b. Adequate communications for the control of traffic on long stretches of one-way road.
- c. Priorities of movement, more detailed than normal.
- d. Designated turnaround and passing areas as well as special traffic instructions to insure safe operation.
- e. Definite procedures for the repair, evacuation, and disposal of disabled vehicles.

114. Maintenance

Maintenance, particularly first echelon, is of major importance in motor movements over mountainous terrain. Prior to and during operation under these conditions, the safety devices of all vehicles must be thoroughly checked and on-the-spot adjustments should be made to insure proper operation. Mechanical failures which might be considered of minor importance in other situations may be the cause of serious accidents on steep grades and sharp curves. Proper inspection of the brake linkage and proper adjustment of brakes is extremely important. The emergency brake must be capable of holding the vehicle on any slope without the aid of gears or foot brakes. Since the braking power of the engine is normally used to assist in the descent

of steep slopes, it is important that the transmission is properly aligned and in good condition so that the danger of slipping out of gear is eliminated. Any tendency of the vehicle to slip out of gear should be immediately reported by the driver and necessary repairs made before it is operated on steep grades.

115. Operational Precautions and Techniques

Although steep grades are continuously encountered in mountainous terrain, the proper selection of vehicles for the operation will enable continued movement without resort to winching except in isolated instances where necessary items of equipment are too heavy for the selected vehicles or where abnormal conditions prevail in limited areas. Drivers must exercise extreme care at all times because of the many sharp, blind curves and dangerous grades. All curves must be taken at a speed which will enable the driver to stop the vehicle in half the visible road space. Either up- or downhill grades should be taken in a gear ratio that will enable the vehicle to take the entire hill without shifting. When coming into a steep grade, the driver may build up momentum on the approach in the case of a short grade where this added momentum will carry him over without excessive speed at the start, or he may drop into a lower gear to allow for a long, steady pull with maximum traction. Caution must be exercised to see that the speed of the vehicle does not exceed two-thirds of the speed (listed on the chart in the cab of the vehicle) for that particular gear ratio. Hills should be descended with a combination of braking and engine—neither should be used alone to bring a vehicle downhill. In daylight operations under tactical conditions, all vehicles will normally be in open column and care must be taken to guard against bunching on the approaches to grades and curves since the slow movement of columns in mountainous areas makes them extremely vulnerable to enemy attack. Because the danger of blackout driving in mountains will often exceed the danger of enemy action, driving without lights on narrow winding mountainous roads should be held to a minimum. When blackout driving is necessary because of enemy observation it should be limited to those stretches of road visible to the enemy. At these points signs and guides should be posted to give special instructions to each driver as he approaches. Trucks should be in close column. Only when the driver can definitely see the road or the taillight of the vehicle in front is it safe to drive without the assistant driver preceding on foot.

Section III. SWAMPY GROUND AND WATER OBSTACLES

116. General

Evidence of ground water (i. e., the presence of springs, pools, or characteristic plant growth) along a route invariably presents a problem in the movement of wheeled vehicles. Although swampy ground and water obstacles are generally associated with valleys or lowlands, sidehill bogs and ridgeline swamps may appear locally where geological faults allow ground water to emerge. For planning and operational purposes, these barriers may be considered to be all-seasonal although seasonal conditions will affect them as the water table is raised by rainfall or melting snow and ice, or lowered in times of drought. Timely estimation of the size and characteristics of obstacles through map study, reconnaissance, and intelligence will determine the amount and type of additional equipment necessary to effect the passage of the column, the probable delays and adjustments in schedule to avoid congestion, and the advisability of using an alternate route to bypass the obstacle.

117. Mud and Swamps

Swamps, bogs, and mud caused by the proximity of the water table to the surface should be avoided by all traffic if possible. Although the surface crust may appear comparatively dry and well-covered with vegetation, any breakthrough may result in the vehicle becoming hopelessly mired. The depth of soft mud below the surface is extremely difficult to determine and may vary in the same swamp from 1 to 2 feet to pits that cannot be sounded. When it becomes necessary to cross such barriers, provision should be made to bridge the surface by suitable reinforcement with mats of brush or special materials protected by an adequate surface. By increasing flotation in this way and by avoiding concentrated loads, traffic may cross otherwise impassable areas without loss. Drivers should be cautioned against parking vehicles, or even stopping, on swampy ground. In the event that support of a tactical operation requires the movement of personnel, equipment, and supplies over large areas of marsh or swampland, suitable reinforcement by engineer troops and equipment and selection of vehicles with maximum flotation must be made.

118. Ditches and Streams

Drainage ditches and canals, gullies and ravines, and streams and rivers present obstacles to motor movement in proportion to

their size and susceptibility to enemy action. Map study, reconnaissance, and intelligence reports may supply all information necessary to planning personnel. Where reasonable doubt exists regarding the feasibility of crossing or requirements for additional personnel and equipment, engineer reconnaissance should be requested. The smaller ditches, gullies, and streams will not cause serious delays although approach and passage at reduced speeds require traffic control to avoid congestion. Canals, ravines, and rivers are important obstacles to motor movement and require definite means for crossing. Existing bridges and fords offer remunerative targets to enemy artillery and bombing, as well as to sabotage and guerrilla activities. No movement should therefore be made without provision for changes in plan demanded by current intelligence. Techniques of crossing, capabilities of vehicles, and requirements for the construction of temporary bridges or crossing expedients are covered in appropriate field and technical manuals. In general, the existence of canals, ravines, and rivers across the route selected require additional preparation on the part of planning personnel to avoid congestion in critical areas, to provide for repair or construction at crossing sites, and to furnish adequate instructions to operating personnel to insure proper discipline.

CHAPTER 9

EFFECTS OF CLIMATE

Section I. GENERAL

119. Climatic Conditions

The effect of climate on motor movement is a factor that must be carefully considered in every phase of movement planning. Specific information for a given area as to absolute extremes, means, and frequencies of departures from these means; of temperature; wind direction and velocity; precipitation; and other weather elements is generally available in standard references. Analysis of this information will indicate the suitability of certain types of vehicles for motor movement during any specific season, the type and probability of hazardous conditions, the necessity for special training, and the need for supplementary troops and/or equipment.

120. Common Planning Factors

The factors of climate—temperature, humidity, precipitation, wind, and light—are important in the planning and conduct of military motor movements since they have a direct effect upon terrain, troops, vehicles, and equipment. The systematic consideration of these factors, with their seasonal variations, in conjunction with information on terrain, condition and state of training of troops, and availability of suitable vehicles and equipment is necessary to the planning of a successful movement under adverse conditions. In general, military motor movements are most concerned with the typical combinations of these factors causing desert conditions, jungle conditions, and conditions of snow and ice.

Section II. DESERT OPERATIONS

121. General

Desert environments occupy one-fifth of the total land area of the earth with the predominant core area covering a large portion of North Africa and the Middle East. The two great Asiatic deserts, the Gobi and Taklamakan, form large boundary zones along Russian Siberia. The location of desert areas in the world and conditions of climate and terrain existing therein justify careful examination of the limitations imposed upon military movement

and the possibility of improving capabilities through training of personnel and modification of equipment. Although broad generalities must be avoided in the description of desert environments since wide variations occur with transitional desert forms in the same general areas, there are some characteristics common to most. For example, most deserts have a basic condition of low rainfall creating a scarcity or total lack of water; extensive barren areas of gravel or sand; a high sunshine percentage, exceeding 70 percent; extreme daily temperature ranges, with low relative humidity during the day; strong seasonal winds, with periodic sand and dust storms; and a relative lack of vegetation except for scattered, scrubby bushes with small leaves and thorns. Desert landforms are variable. Not only do they include sand dunes but also rocky hills and steep escarpments, broad level valleys covered with gravel or stones, areas of clay that may become impassable in rainy periods, or wadies that can suddenly become raging torrents. Desert conditions will produce the common effects of reduced efficiency of personnel, increased problems of maintenance of equipment, reduced mobility, and tactical insecurity due to lack of cover and concealment.

122. Operational Precautions and Techniques

Successful motor movement under desert conditions requires additional training and conditioning of personnel, specific adaptation of vehicles, and modification of maintenance procedures. Since combinations of terrain and climate vary greatly among the world's deserts, general operational precautions and techniques will naturally undergo some modification to be applicable to any specific area. The following may be used as a guide:

a. Desert Driving. Due to the general absence of established roads in desert areas, desert driving calls for experience, individual skill, and physical endurance on the part of the vehicle operator. The driver training should include as much off-road operation under a wide variety of conditions similar to those of the specific operational area as is possible. This training should include orientation on landforms, soil, and climatic conditions through the use of photographs, films, and discussions. In most desert areas, sand will be a common obstacle. Driving in sand requires judgment in the selection of proper gear ratios, determination of suitable speeds, and choice of the best ground. The driver must recognize the limitations of his equipment, particularly the tendency of wheeled vehicles to dig in when forward momentum is lost, and must be able to employ proper expedients immediately. Provision should be made for additional equipment on the vehicle, or within the column, to facilitate the rapid release of stuck vehicles. Unit

SOP's should be modified for desert operations to include procedures necessary to keep the column moving without unnecessary congestion around a stuck vehicle. Driving in other desert landforms requires the application of a wide variety of driving principles demanding sound judgment and experience on the part of both vehicle operators and command personnel. Since no simple formula or means of testing to determine soil trafficability has been evolved to date, each new situation must be evaluated in the light of local experience and necessary decisions made on the basis of calculated risk.

b. Desert Maintenance. Vehicular maintenance presents a major problem in all desert operations. Under the best conditions, the movement of vehicles over desert terrain will create a great volume of dust. This dust alone will necessitate constant first echelon maintenance to prevent abnormal wear and inoperable vehicles. Drivers must be particularly careful to check and clean air filters daily, to check the oil filters, and to inspect constant-velocity universal joints. Instruments should be sealed with tape to keep out dust. Care must be taken when servicing vehicles to insure that no sand is allowed to get into gas tanks and crankcases. However, with the best maintenance possible under desert conditions, wear will be greater than that under normal conditions and provision must be made for repair parts in greater quantities, carried in lower echelons. Excessive heat is another cause of increased maintenance. Overheating of vehicles, through long periods of operation in low gear and the rapid evaporation of coolants, requires the provision of additional rest periods to allow vehicles to be stopped and faced into the wind to cool before damage is done to motors. Fan belts should be inspected frequently and immediately replaced when wear is excessive. Radiators should also be frequently inspected to insure free circulation of air and coolant. Batteries should be carefully inspected daily to maintain the proper level of the electrolyte. The combination of heat, sand, and rough ground found in desert areas shortens the life of tires. To get maximum mileage the driver should increase or decrease tire pressures to meet varying conditions only within specific limitations. Proper tire pressures will insure against rim slippage and broken fabric. Drivers of dual wheeled vehicles should also frequently inspect for stones wedged in the space between the tires and remove them before damage is done to the sidewalls.

c. March Techniques. Motor movement operational techniques must be somewhat modified for desert conditions. Since the desert usually has no well defined roads or trails, normal methods of assigning routes, direction by signs and guides, and movement con-

trol are not applicable. Movement from place to place is usually made by maintaining direction through the use of navigational methods and equipment. In conducting desert movements, care must be taken to maintain sufficient dispersion to prevent presentation of remunerative targets to the enemy. Deserts generally offer little natural concealment from aerial observation, though unevenness in terrain may give sufficient cover and concealment from direct ground observation. Camouflage nets and shadows in broken ground must be exploited to give some measure of security.

123. Planning Considerations for Movement, Supply, and Evacuation

Movement planning for desert operations involves long-range consideration of the influence of climate and terrain on the performance of the transport function. Planning personnel at all levels must be familiar with the capabilities and limitations of movement means, to include both personnel and equipment, in order to meet desert requirements effectively. Suitable modifications in organization, training, and equipment should be initiated as early as the situation will permit. The selection of vehicles most suitable for local conditions of climate and terrain will insure maximum mobility and will minimize the logistical complications imposed by excessive supply and evacuation requirements by the transportation itself. Selection and/or training of operational personnel to exploit available transportation effectively under desert conditions is a major consideration in planning since the physical and psychological influence of climate and terrain reduces efficiency of personnel while the demands of operation and maintenance are at their peak. Selection should include only those best qualified physically and mentally to endure hardship. Training should stress leadership, physical conditioning, operation of vehicles under desert conditions, and the principles of land navigation. Motor movement in desert areas is further complicated by the need for modification of normal routing, scheduling, and control procedures due mainly to tactical and terrain conditions. The need for increased dispersion to achieve some degree of tactical security increases the time length of convoys. Furthermore, the experience of time and space schedules developed in other terrain has little meaning, although in some areas lateral dispersion may be effective in reducing time length. Routing must be general rather than specific since point-to-point distances may be materially increased by local conditions of nontrafficability. Column control will normally be exercised from within the column by radio or visual signals. Supply and evacuation movements in the desert nor-

mally involve greater distances due to the dispersion of installations, and greater volume due to the increase in casualties, both personnel and vehicular.

Section III. JUNGLE OPERATIONS

124. General

Any combination of climatic factors favorable to the growth of vegetation will cause jungle conditions to some degree. These conditions, as they affect military motor movement, may vary from the heavily forested areas of the north temperate zone to the impenetrable equatorial rain forests. Heavy annual rainfall, high relative humidity, and adequate soil fertility are characteristic of all such areas. In temperate zones, where the growing season is limited, the forests are characterized by the dominance of large trees with the lack of tangled undergrowth becoming more noticeable as the growing season is shortened. While these northern forests definitely restrict cross-country motor operations and are usually limited as to road net, they afford many advantages to military operations due to the concealment offered by overhead cover. Equatorial rain forests, on the other hand, present a definite obstacle to all military operations. All mobility, even for foot troops, is limited by a tangle of dense undergrowth which often must be cleared to allow any passage. Roads, if present at all, must be constantly maintained and are usually limited to unimproved trails. Military motor movements in all heavily forested areas are particularly susceptible to enemy ambush and delaying actions.

125. Operational Considerations

Motor movement operations in areas of heavy vegetation depend upon the successful analysis and meeting of conditions imposed by climate and terrain. Consideration of climatic conditions must include the type of vegetation in the area and its effects on movement, the effect of climate on maintenance and human efficiency, and the tactical effect of these conditions.

a. The type of vegetation in the locality will affect the movement of vehicles in direct proportion to its density. Although roads and trails may be adequate for the movements considered, some off-road movement may be necessitated by enemy denial actions; therefore, the movement organization should include personnel and equipment necessary to insure continued movement by providing emergency bypasses, making highway repairs, or reducing road blocks. Continued use of routes through these areas may require engineer road maintenance patrols to keep them open

for wheeled traffic. Tracked vehicles, except in equatorial rain forests, have sufficient off-road mobility to bypass damaged sections of road without assistance. However, these vehicles are limited in speed and cargo capacity as compared with wheeled vehicles, and are also less economical to operate.

b. The task of motor maintenance is increased in these operations due to the additional strains of operation on unimproved roads, the long periods of operation in lower gears, and the rust and corrosion caused by high humidity. While human efficiency is not lowered in temperate zones, it drops sharply in tropical areas of high humidity and efficient maintenance becomes doubly difficult.

c. The techniques of march management must be modified for operations in jungle or heavily forested areas. To facilitate control, to improve security measures, and as an aid to rapid movement, march units should normally move as compactly as possible. Close column formations permit easier following of trail breaks; however, in tactical situations such formations increase the danger of ambush. Open columns, or infiltration, lessen the danger of a general ambush but increase the possibility of an element being separated and ambushed. The type of formation selected should be based on a careful evaluation of existing conditions. Prescribed distances should be maintained at the cost of reduced speed. Close liaison between elements of the march should be maintained at all times. Complete dependence upon radio communication should be avoided since normal operating ranges are seriously reduced by dense vegetation and adverse operating conditions. Alternate means of communication should be provided in movement orders or appropriate SOP's. Reconnaissance must be provided both in advance of and during the movement to insure adequate information on the selected route, provision of alternate routes, and timely warning of possible enemy interference. Reconnaissance units operating in these areas must be particularly well trained and alert since the presence of enemy forces will not be obvious in a majority of cases. March discipline must be maintained at all times and adequate security must be provided at halts. Aerial observation of ground movements is seriously restricted by overhead cover and, by careful use of this overhead screen, large groups of vehicles may move or bivouac without danger of detection or attack from the air.

126. Planning Considerations for Movement, Supply, and Evacuation

The planning of movements in jungle or heavily forested areas calls for the early consideration of climate and terrain factors.

The necessity for additional troops and equipment must be anticipated to give timely support to movements. The fact must be constantly kept in mind that, while distances involved may seem comparatively short, road speeds will normally be greatly reduced and allowances must be made for route construction and maintenance. Supply and evacuation in jungle operations should be closely coordinated to give the maximum utilization to available transportation and to reduce traffic to a minimum. Tropical conditions will require additional protection for supplies against the effects of rain, high humidity, and heat from tropical sunshine.

Section IV. MOVEMENTS IN SNOW, ICE, AND CONDITIONS OF EXTREME COLD

127. General

Operations in snow, ice, and conditions of extreme cold may be divided into two general categories: arctic and subarctic operations, and winter operations in the north temperate zone. Conditions in the arctic and subarctic mainly involve the effects of low mean annual temperatures. Although minimum temperatures recorded in this area are not necessarily lower than minimums recorded in some areas of the north temperate zone, the fact that subzero temperatures are constant during the winter months and continue for a longer period makes this area unique. The advent of long-range aircraft has given the arctic regions strategic importance and has consequently stimulated research and experimentation in the field of arctic operations. Special equipment and techniques have been evolved and tested to meet arctic conditions. Current doctrine on all phases of operations under these conditions is covered in detail in FM's 31-70, 31-71, and 31-72. The second category, winter operations in the north temperate zone, directly affects the movement of most land armies. The north temperate zone includes a large portion of the civilized world and consequently those lands most affected by armed conflict. A knowledge of expected winter conditions and their influence on military operations is essential to the success of winter campaigns. In the north temperate zone, conditions of snow, ice, and extreme cold may restrict some movements while favoring others. Motor movement on highways is definitely restricted by heavy snowfalls or ice conditions, and in many cases special equipment is necessary to make any movement possible. In all cases, highway speeds will be reduced. Cross-country movement, on the other hand, may be facilitated by the presence of deep frost in otherwise nontrafficable soils.

128. Operational Precautions and Techniques

Winter operations in the north temperate zone involve movement of personnel, equipment, and supplies by motor transport under conditions where snowfalls of over 2 feet are common, where sleet storms can glaze highways with clear ice in a matter of hours, and where temperatures to -40° F. may be encountered. All of these conditions demand operational modification, both organizational and individual. Motor columns operating under these conditions must travel at reduced speeds and must be prepared to encounter sudden changes in highway trafficability. Distances between vehicles should be greater than normal and drivers should be instructed to maintain prescribed gaps, since stopping distances are greatly increased. Accidents due to road conditions will be common until drivers gain experience, although the provision of emergency vehicles within the column will minimize delays. Personnel and equipment for snow removal or sanding will seldom be available except on regularly traveled routes. Therefore, all drivers must be instructed to use extreme caution at all times, to put on chains when in doubt, and to test the traction of their vehicles occasionally while on the march. Temperature affects traction more than any other weather element. Traction for wheeled vehicles on snow and ice without the use of chains, is improved by subzero temperatures although the presence of a light dusting of snow over glazed ice is extremely treacherous. In cases where moisture is present on the tires, chains are indicated. Until better classification methods are evolved to indicate snow trafficability, the judgment and experience of the drivers must suffice. Techniques of smooth, gradual acceleration and deceleration must be mastered by the individual—sudden starts and stops will result in complete loss of traction. Further discussion of winter driving techniques can be found in TM 21-305.

129. Maintenance

a. Motor maintenance at all levels becomes increasingly important and more difficult during the winter in cold climates. Automotive equipment must be maintained in top mechanical condition to run efficiently in subzero weather, and the conditions under which this maintenance must be performed are normally unfavorable. Seasonable preparation for cold weather is the most effective means of preventive maintenance. All vehicles should be thoroughly inspected and winterized before freezing temperatures are to be expected. Winterization includes the following:

- (1) *Lubrication.* Lubricate vehicles thoroughly, using oil and grease appropriate for expected temperatures as indicated in lubrication orders.

- (2) *Ignition.* Clean spark plugs and adjust gaps. Test coil, generator, starter, voltage regulator, and distributor.
- (3) *Battery.* Test cells, clean terminals, and tighten cables and clamps. Battery efficiency drops in conditions of extreme cold at the same time that the heaviest loads are put on it.
- (4) *Cooling system.* Carefully inspect for leaks, tightening connections and replacing worn hose. Check water pump, thermostat, and fan belt for proper operation. Drain and thoroughly flush system, and refill with the indicated solution of antifreeze.
- (5) *Fuel system.* Check for fuel leaks and replace parts if necessary. Adjust carburetor for cold weather operation. Check intakes and manifold gaskets. When extreme cold is expected, drain fuel tank sump to remove any water that may have accumulated and refill, adding 1 pint of grade III denatured alcohol to every 10 gallons of gas to prevent freezing of fuel lines.
- (6) *Brakes.* Check adjustment, fluid, lining, and connections.
- (7) *Exhaust.* Check exhaust system for leaks. Carbon monoxide from a leaky exhaust system is *deadly* in a closed, heated cab.
- (8) *Vision.* Check lights, windshield wipers, and defrosters.
- (9) *Chains.* Make sure that chains are present, of proper size, and in good repair.

b. Driver duties and responsibilities in preventive maintenance are increased during cold weather operation. Each driver must be impressed with the fact that his comfort, safety, and perhaps his life, depend on the proper performance of these duties. In addition to the normal before, during, and after-operation preventive maintenance, the driver must be careful to warm up his engine gradually before putting a load on it. He must take all precautions that the winterization of his vehicle is adequate—and that it stays that way. And he must know and apply the measures necessary to give him adequate vision in all kinds of winter weather. He must also be able to recognize the early symptoms of ignition failure or battery failure and take appropriate corrective action.

c. Command supervision of maintenance activities in all echelons is particularly important when heated facilities are inadequate or not available, since only those items considered most important will receive attention from men whose discomfort is their major concern.

130. Planning Factors

The successful planning and conduct of winter motor movements in the north temperate zone is based upon thorough familiarity with local weather conditions over a period of years, if such data is available, combined with a knowledge of the terrain. Movement plans under these conditions will anticipate maximum severity of weather for the season and be flexible to allow for sudden changes in weather conditions. These changes may often adversely affect motor transport. A rise in temperature accompanied by a warm rain such as one often experiences in the middle of an otherwise cold winter will turn trafficable snow into mud and slush. Temperatures, while above freezing, will cause great discomfort to personnel and will also necessitate a greater burden of maintenance. Midwinter thaws are followed just as suddenly by subzero temperatures, causing the freezing of deep ruts and dangerous ice conditions. Advance planning and preparation must include complete winterization of vehicles to meet the most severe conditions, instruction of operating personnel in winter hygiene and first aid, issue of suitable cold weather clothing and equipment, and requisition of engineer personnel and equipment as indicated to expedite movement. Route and area reconnaissance should produce data on trafficability under varying conditions upon which route selection may be based. Provision for alternate routes should be made to exploit changes in trafficability due to weather. In spite of reduced speeds, column formations will normally be open due to the gaps required to allow for increased stopping distances. During periods of low visibility, columns will close up to maintain control. Frequent halts should be scheduled to allow drivers to rest and to allow other personnel to move about to improve their circulation. Conditions of deep snows make every road, in effect, a defile. Provision of adequate column security when subject to enemy action must reflect this condition.

APPENDIX I

REFERENCES

1. Field Manuals

FM 5-20	Camouflage, Basic Principles.
FM 5-20B	Camouflage of Vehicles.
FM 5-34	Engineer Field Data.
FM 5-35	Engineers' Reference and Logistical Data.
FM 5-36	Route Reconnaissance and Classification.
FM 8-35	Transportation of the Sick and Wounded.
FM 9-10	Ordnance Maintenance and General Supply in the Field.
FM 19-25	Military Police Traffic Control.
FM 19-90	The Provost Marshal.
FM 21-5	Military Training.
FM 21-6	Techniques of Military Instruction.
FM 21-26	Map Reading.
FM 21-30	Military Symbols.
FM 21-40	Defense Against CBR Attack.
FM 27-5	United States Army and Navy Manual of Civil Affairs/ Military Government.
FM 27-10	The Law of Land Warfare.
FM 30-5	Combat Intelligence.
FM 30-7	Combat Intelligence Battle Group, Combat Command and Smaller Units.
FM 31-25	Desert Operations.
FM 31-70	Basic Arctic Manual.
FM 55-6	Transportation Services in Theaters of Operation.
FM 55-10	Movement Control in Theaters of Operation.
FM 55-31	Highway Transportation Service in Theaters of Operation.
FM 70-10	Mountain Operations.
FM 72-20	Jungle Warfare Operations.
FM 100-5	Field Service Regulations; Operations.
FM 100-10	Field Service Regulations; Administration.
FM 101-5	Staff Officer's Field Manual: Staff Organization and Procedure.
FM (0) 101-10	Staff Officer's Field Manual: Organization, Technical, and Logistical Data.

2. Technical Manuals

TM 9-2800-1	Military Vehicles (Ordnance Corps Responsibility).
TM 21-300	Driver Selection and Training.
TM 21-301	Driver Selection, Training, and Supervision Full-Track Vehicles.
TM 21-305	Manual for the Wheeled Vehicle Driver.
TM 38-660-1	Operator's Maintenance Instructions and Procedures for Administrative Motor Vehicles.
TM 38-660-2	Organizational Maintenance Instructions and Pro- cedures for Administrative Motor Vehicles.

3. Army Regulations

AR 55-162	Permits for Oversize, Overweight, or Other Special Military Movements on Public Highways.
AR 55-355	Military Traffic Management Regulation.
AR 58-5	Administrative Motor Vehicle Management.
AR 320-5	Dictionary of United States Army Terms.
AR 320-50	Authorized Abbreviations.
AR 345-278	Records Administration; Maintenance and Disposition of Transportation Services Files.
AR 380-5	Safeguarding Defense Information.
AR 385-40	Accident Reporting and Records.
AR 385-55	Prevention of Motor Vehicle Accidents.
AR 385-56	Compliance With Civil Traffic Laws.
AR 600-55	Motor Vehicle Driver; Selection, Testing, and Licensing.
AR 700-10	Registration of Motor Vehicles.
AR 700-2300-1	Motor Vehicles.
AR 746-2300-1	Color and Marking of Vehicles and Equipment.
AR 750-1	Concept of Maintenance.

4. Special Regulations

SR 700-51-143	Logistical Responsibilities for Standard Commodity Classification, Major Group 43, Motor Vehicles.
SR 700-51-165	Logistical Responsibilities for Standard Commodity Classification, Major Group 65, Trade and Service Industry Equipment.

5. Department of the Army Pamphlets

DA Pam 108-1	Index of Army Motion Pictures, Film Strips, Slides, and Phono-Recordings.
DA Pam 310-series	Military Publications Indexes (as applicable).

APPENDIX II

PLANNING DATA

1. Table of Precalculated Road Spaces and Time Lengths

Number of vehicles in the column	Road space (miles)		Time length (minutes)	
	Close column 75 veh/mi at 10 MPH	Open column 20 veh/mi at 15 MPH	Close column 75 veh/mi at 10 MPH	Open column 20 veh/mi at 15 MPH
1	0.013	0.05	0.08	0.20
2	0.026	0.10	0.16	0.40
3	0.039	0.15	0.24	0.60
4	0.052	0.20	0.32	0.80
5	0.065	0.25	0.40	1.00
6	0.078	0.30	0.48	1.20
7	0.091	0.35	0.56	1.40
8	0.104	0.40	0.64	1.60
9	0.117	0.45	0.72	1.80
10	0.130	0.50	0.80	2.00
20	0.260	1.00	1.60	4.00
30	0.900	2.25	5.40	9.00
40	1.200	3.00	7.20	12.00
50	1.500	3.75	9.00	15.00
60	1.800	4.50	10.80	18.00
70	2.100	5.25	12.60	21.00
80	2.400	6.00	14.40	24.00
90	2.700	6.75	16.20	27.00
100	3.000	7.50	18.00	30.00
200	6.000	15.00	36.00	60.00
300	9.000	22.50	54.00	90.00
400	12.000	30.00	72.00	120.00
500	15.000	37.50	90.00	150.00

2. Simplified Formulas for Movement Calculations—Infantry Division

(Derivation of formulas is shown in FM 101-10.)

Column	R (MPH)	D (veh/mi)	No. of serials	No. of vehs in serial	Road space (miles)	Time length (min)
Close column	10	75	One***	25 or less	$V/75$	$0.08V^*$
				25 plus	$0.03V$	$0.18V$
			Two or more	25 or less	$V/75 + 2.5I$	$0.08V + 15I^{**}$
				25 plus	$0.03V + 2.5I$	$0.18V + 15I$
Open column	15	20	One***	25 or less	$V/20$	$0.2V$
				25 plus	$0.075V$	$0.3V$
			Two or more	25 or less	$V/20 + 3.75I$	$0.2V + 15I$
				25 plus	$0.075V + 3.75I$	$0.3V + 15I$
Infiltration	15	3	Not applicable	Any number	$V/3$	$4V/3$

*Number of vehicles.

**Number of intervals between serials of battle group size.

***Applicable to armored division.

3. Table of Time Distances

Answers to the time-distance equation, $TD = D/R$, precomputed for routine rates of march, will simplify time distance calculations and help the planner to avoid making errors in calculations.

4. Vehicle Availability Table

The vehicle availability table is used in planning the movement of an infantry division by means of its own organic transportation. It helps the transportation officer make a plan for drawing 2½-ton or 5-ton trucks from subordinate units of the division in accordance with their ability to furnish them. Across the top of the table are listed all subordinate units of the division except the cavalry squadron. This unit is omitted because its vehicles are not normally available. In column 1, the 2½-ton and 5-ton trucks of the division are divided into priorities of availability according to their normal uses. When the transportation officer levies on units

for trucks, he will deplete each priority, starting with the highest, until he obtains the required number of vehicles. All of the 2½-ton and 5-ton trucks of the division do not appear on the table. The prime movers, maintenance vehicles, command and fire control vehicles, and essential signal communication vehicles are omitted because it is not intended that these vehicles ever be used for general cargo hauling or for transporting troops of other units. For any given move, the number of vehicles actually available will vary because of deadlined trucks, combat losses, and restrictions applicable to the move under consideration. Using the vehicle availability table and the troop strengths of the units requiring additional transportation, the number and source of vehicles required for the march can be quickly and accurately determined. A sample vehicle availability table is shown below.

5. Vehicle Assignment Table

The assignment table simply shows from what units the vehicles will be drawn and to what units they will be assigned for the move. This table is based on the vehicle availability table. An example of the vehicle assignment table is shown in table II.

Table I. Vehicle Availability.

PRIORITY	NORMAL USE	1ST BG, 61ST INF	2D BG, 62D INF	TOTAL DIV
1	SUP AND GEN CARGO	0*	0	97
			**	
2	ORG EQUIP	0	0	20
3	KI TRK	6	5	71
4	ENG TOOL AND B	3	3	59
5	AMMO TRK	10	10	104
6	SIG COMM	0	0	46
	TOTAL	18	18	397

* MAXIMUM AVAILABILITY

** CURRENT AVAILABILITY

Table II. Vehicle Assignment.

	1	2	3	4	5	6	7
	Unit from which transport is furnished	Number of 2½-ton or 5-ton trucks provided and unit to which furnished					
		1st echelon ^a			2d echelon		
		TF 1	TF 3	TF 4	TF 2	TF 5	Elm Div Trp and Div Tn
2	TF 1.....				22		
3	TF 3.....				22		
4	TF 4.....					22	
5	TF 2.....		5				
6	TF 5.....	5					
7	HQ Btry, Div Arty.....				1	3	
8	1st FA Bn (Rkt/How).....					20	
9	20th Engr Bn.....		5				
10	20th Sig Bn.....	2					
11	20th QM Bn.....	5					
12	20th Ord Bn.....		5				
13	20th Trans Bn.....	30	30	°			80°
14	Admin Co.....	3					
15	Total.....	45	45	0	45	45	80

a The division troops that move with the first echelon are completely mobile. The administrative equipment of these troops that cannot be transported on organic transportation will be moved by transportation battalion trucks with elm Div Trp in the second echelon.

b The 2½-ton trucks in the transportation battalion will be used to assist the movement of all units in Div Trp and Div Tn that are not 100 percent mobile.

c The 2 armored carrier companies will be attached to 1 BG task force for movement of personnel and equipment for which no organic transportation has been provided. Based on 75 percent vehicle availability, 2 armored carrier companies normally have 80 armored carriers operational at any given time.

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