

CHAPTER 1 MOVEMENT CONTROL

This chapter discusses key elements of movement control, including movement programming and highway regulation. See Appendix A for transportation movement control unit TOE data.

ELEMENTS OF MOVEMENT CONTROL

Movement control is the planning, routing, scheduling, coordinating, and in-transit visibility of personnel, units, equipment, and supplies moving over the lines of communication. Movement control requires the commitment of allocated transportation resources in keeping with command priorities. Staff planners and movement managers have primary responsibility for movement control. They, along with mode and terminal operators at each level, perform movement control functions.

Movement Control in the Communications Zone

In a theater army, the TMCA, subordinate transportation battalions (MC), and their MC detachments perform movement control functions. The TMCA serves as executive agent and primary staff element to the theater commander for planning and controlling theater transportation operations. It provides movement management services and highway regulation and coordinates personnel and material movements into, within, and out of the COMMZ or lodgment area. TMCA responsibilities include—

- Coordinating with HN and allied MCAs and transportation component commands.
- Providing technical assistance to corps MC battalion.
- Ensuring proper use of available HN and military transportation assets.

Chapter 3, FM 55-10, details TMCA missions and functions.

Movement Control in the Corps

The transportation battalion (MC) is the corps movement control organization. It provides centralized movement control and highway regulation for moving personnel and materiel into, within, and out of the corps area of operations. Responsibilities of the MC battalion include—

- Ensuring effective and efficient use of transportation resources.
- Commanding and supervising subordinate MC detachments.
- Planning, programming, coordinating, managing, and analyzing transportation and movement requirements.
- Implementing corps priorities.
- Maintaining liaison with higher-level MC organizations.

FM 55-10 discusses the role of transportation movement management within the corps.

Movement Control in the Division

The DTO and the DISCOM MCO manage the division transportation system. The DTO advises the commander on transportation matters and highway

regulation. A division support MC detachment from corps augments the DTO. The MCO programs movements and performs transportation support functions for the division. See FM 55-10 for more information.

MOVEMENT PROGRAMMING

The movement program is key to planning both known and anticipated transportation requirements for reception, onward movement, and sustainment. A complete, well-prepared movement program allocates available transportation resources to support requirements based on the commander's priorities. It establishes which requirements can be resourced given available logistic assets, units, and infrastructure. In doing so, it effectively uses these assets and identifies competing requirements and shortages. The seven steps in developing a movement program are—

- Assessing the distribution pattern.
- Determining requirements.
- Determining transportation capabilities.
- Balancing requirements against capabilities.
- Determining shortfalls and critical points and recommending solutions for handling the shortfalls.
- Coordinating the plan.
- Publishing and distributing the plan.

Assessing the Distribution Pattern

Understanding the distribution pattern is essential to developing a transportation network. Also, intelligence and engineering data about the area of operations are needed to determine network capabilities.

The distribution pattern is a complete logistic picture that constantly evolves as the theater/area develops. It shows locations of supply, maintenance, and transportation. The distribution pattern's development is guided by the commander's concept of the operation; the number, type, and location of in-place and incoming units; and the time-phased arrival of units in the theater/area. The distribution pattern outlines throughput and interzonal transportation requirements that directly affect the coordination and preparation of movement programs.

The capability of shippers and receivers to receive, handle, and load various transportation modes also affects the movement program. This capability is determined by availability of MHE, CHE, ramps, labor, and storage capacity. Information on current capability is necessary for the efficient scheduling of transportation and to prevent congestion.

Determining Requirements

Accurate requirements are key to developing an effective movement plan. Requirement forecasts must be submitted far enough in advance for the transportation and supply systems to adjust their resources to carry out the plan.

Requirements are forecast using specific planning periods. The number and speed of experienced or anticipated changes influence the length of these periods. A 14-day planning period allows a firm forecast of requirements for the current 7-day period and a tentative forecast for the succeeding 7-day period. This method provides a basis for operations during the current period and for planning during the succeeding period. When using a 14-day planning period, a new planning cycle is initiated every 7 days. An ADP system that integrates movement and supply information improves the accuracy of both forecasts and movement programming.

Class of supply, estimated weight and cube, RDD, and planned origin and destination are important in determining materiel movement requirements. The list is grouped by RDD, priority, origin, and destination and identifies special handling requirements. These include refrigerated cargo, hazardous cargo, and controlled or sensitive cargo. Personnel movement estimates are grouped by category, such as troops, civilians, patients, or prisoners of war.

Determining Transportation Capabilities

The characteristics and capabilities of mode and terminal operators determine transportation capabilities.

Other information that contributes to the total transportation capability includes:

- Availability of equipment to support common-user movement requirements, such as engineer, combined forces, and supply company assets.
- Total number of HN transportation assets and types allocated to support common-user movement requirements. (Include rail, inland waterways, and coastal shipping if available and feasible.)
- Number and type of third country and US-contracted assets.
- Reception, material handling, and in-transit storage capabilities.

Intratheater/theater US Air Force airlift and air-drop may be planned for if the JTB or JMC allots assets for CSS air movement operations to the theater army. The theater army commander allocates apportioned airlift based on command priorities.

When developing transport capabilities, use planning factors or experience based on the type of equipment, availability of MHE and CHE, weather, and terrain. Use planning factors from this manual when information from mode operators is unavailable.

Balancing Requirements Against Capabilities

Balancing requirements against capabilities helps to determine whether available mode assets will support movement requirements. Planners must consider all requirements including direct shipments, multiple stops, retrograde shipments, and intermodal shipments.

If there is a transportation shortfall, movement planning should focus on command priorities and the transportation priority of the shipment. The remainder should be adjusted and coordinated with the shipper, receiver, materiel managers, and logistic staffs.

Determining Critical Points

Critical points are facilities, terminals, ports, rail-heads, and cargo transfer points that, if congested, limit the efficiency and effectiveness of the entire transportation network. After identifying the

critical points, determine alternative plans or control measures that could reduce or eliminate risk of congestion.

Selecting a Transport Mode

Certain criteria should be considered when selecting a mode of transport. Follow these guidelines to achieve the best results:

- Provide service according to command and transportation priority. Evaluate other factors, such as shipment characteristics, security requirements, and political considerations.
- Minimize or eliminate cargo rehandling, avoid crosshauls, and plan for backhauls.
- Allocate all available transport equipment necessary to fulfill known requirements.
- Use the most efficient mode for the complete movement or as far forward as possible.

Coordinating the Movement Plan

To integrate planning and synchronize execution, the movement plan should be coordinated with movement planners at each command level both during and after development. So that all players understand their roles and responsibilities, the plan should also be coordinated with operations, supply, military police, engineers, and Air Force staffs.

Publishing and Distributing the Plan

Movement control organizations distribute the completed movement plan to each command level for comment and concurrence. During this phase, the plan facilitates planning. It also shows evolving distribution patterns and projected logistic activity. It does not authorize shipments to take place. The movement plan becomes a directive only when approved by the DCSLOG or G4.

HIGHWAY REGULATION PLANNING

The objectives of highway regulation planning are sustained movements in keeping with the commander's priorities and the most effective and efficient use of road networks. Planning is done

in a logical sequence and results in publication of the highway regulation plan and the traffic circulation plan.

Assembling Information

The first step in planning is to assemble critical information. Sources of information include operations plans and orders, engineering and intelligence plans or estimates, traffic density information, and terminal and facility data.

Operation plans, orders, and estimates. Operation plans, orders, and estimates contain essential information that must be read and understood. Movement planners must understand the concept of operation to effectively support the commander's intent while executing highway regulation. These plans also contain information such as geographic boundaries, task organization, priorities, and location of major supply activities. See Appendix B for sample plans and orders formats.

Engineering and intelligence plans or estimates. Engineer route reconnaissance or classification overlays provide detailed information on road network characteristics (such as, road surface, width, restrictive features, and bridge classifications). This information is needed to determine critical points and route capacity (see FM 5-170).

The route classification formula contains route characteristics. Although current information is needed, a thorough route reconnaissance may not always be feasible. Aerial photographs, local authorities, intelligence reports, and MP hasty route reconnaissance are other sources that can supplement data obtained from maps or intelligence studies.

Traffic density information. Traffic density information is the anticipated volume of traffic on route segments during specific periods. It comes from planned requirements contained in the movement program, the OPLAN or OPORD, or FRAGOs. Planners must extract specified and implied requirements for unit movements, sustainment movements, and retrograde movements. These documents may also require moving civilian refugees,

unit displacement, or shared use by allied or HN forces. Each type of movement must be prioritized, planned, and synchronized.

Terminal and facility data. Terminal and facility data include the location of supply points, trailer transfer points, terminal transfer points, staging and assembly areas, aerial ports and seaports, airfields and drop zones, and refueling points. All facilities are considered in terms of their total clearance and reception capabilities. Factors considered include location; access from MSRs; and capability to receive, load, unload, and stage.

Identifying Road Networks

Once data has been assembled and studied, road networks are identified. Road networks must be able to support the volume of traffic necessary to meet planned and anticipated movement requirements. Primary and alternate MSRs must be recommended. The forward movement of maneuver forces should be anticipated and MSRs extended well beyond the current area of operation. ASRs are used when the primary MSRs are disabled; thus, ASRs should be planned for in the same way as MSRs. At this point, planners must get the approval of the G4 and G3. The G4 has staff supervision for movement planning. The G3 is responsible for terrain management and must approve the selection of MSRs before movement planners can conduct detailed highway regulation planning.

Developing the Plans

Once the G3 approves the MSRs and ASRs, the highway regulation and traffic circulation plans are developed. The highway regulation plan is a written plan that describes the MSR network and establishes control measures to promote effective regulation. The traffic circulation plan is a map overlay or graphic representation of the MSR network. Both plans are published as an appendix or annex to the OPLAN or OPORD and are used by the PM to develop the traffic control plan. The following steps are basic to developing highway regulation and traffic circulation plans.

Name each MSR according to command directives. Avoid using colors to name MSRs because MSR status, along with other logistics status, is usually reported as green, amber, red, or black. Avoid using numbers to name MSRs because they may conflict with existing route numbers.

Determine critical points. Plans do not list every critical point—only the most important ones that may affect traffic flow. Critical points include:

- Roadway structures or features that limit road width, overhead clearance, or vehicle load class. For example, washouts, overpasses, bridges, and degraded road surface conditions.
- Crossroads at grade level.
- Bridges, overpasses, underpasses, ferries, fords, constrictions, and sharp turns under a 30-meter (100-foot) radius.

Establish CPs on each MSR to segment the MSR. Segmenting the MSR facilitates highway regulation and traffic control planning and execution. CPs should be established at predetermined points along the route, such as:

- Major crossroads.
- Locations where road conditions change.
- Major supply or service areas, geographic boundaries, assembly areas, and other critical points.

Units use CPs when requesting movement clearance, identifying the unit SP, RP, and en route CPs. CPs are also used when describing the MSR in the highway regulation plan (such as, “MSR Walnut is a supervised route between CP 3 and CP 6 between 0600 hours and 1200 hours”). CPs enable quick dissemination of information during execution, such as a point where traffic will be rerouted. Sufficient CPs should be identified, but no more than operating and control units have the capability to manage. Excessive CPs will impede execution of the plan.

Establish control measures for each route. Planners should base control measures on engineer route classifications, planned and anticipated traffic volume, METT-T, and critical points. They must also consider the capabilities of movement control and traffic control units to enforce the

measures. Control measures change frequently, and movement planners must ensure that these changes are incorporated into FRAGOs or otherwise quickly disseminated.

Open route. This is the least restrictive control measure. Any unit may use the route without a movement credit. Minimum control is exercised.

Supervised route. The movement control headquarters specifies the size of convoys or characteristics of vehicles that require a movement credit to use the route. Limited control is exercised.

Dispatch route. A movement credit is required to use this route regardless of the number or type of vehicles. A dispatch route is designated when traffic volume is expected to exceed capacity or the route is critical to operations and priority of use must be strictly enforced. Full control is exercised.

Reserved route. The route is reserved for the exclusive use of a particular unit(s) or type of traffic. No other units or traffic may use the route. Reserved routes should be identified for large unit movements. Examples include the following:

- When a maneuver unit must pass another forward.
- When reserve formations are committed.
- When units are withdrawn for reconstitution.

Prohibited route. The route is closed and no unit/traffic may use the route. A route may be prohibited due to washouts, destroyed bridges, maintenance, or construction work. It may be prohibited for only short periods, such as the time necessary to do repairs.

Create a traffic circulation plan. This overlay (Figure 1-1, page 1-6) shows all MSRs, checkpoints, and HRPs. It also includes route names; direction of travel; location of boundaries; principal supply activities; any restrictive route features, critical points, and rest and refuel areas; and traffic control points (if provided by the PM before publication of the plan).

Determine reporting requirements for units using the MSR. (If reporting is necessary to effectively execute the plan, and if communications are available.)

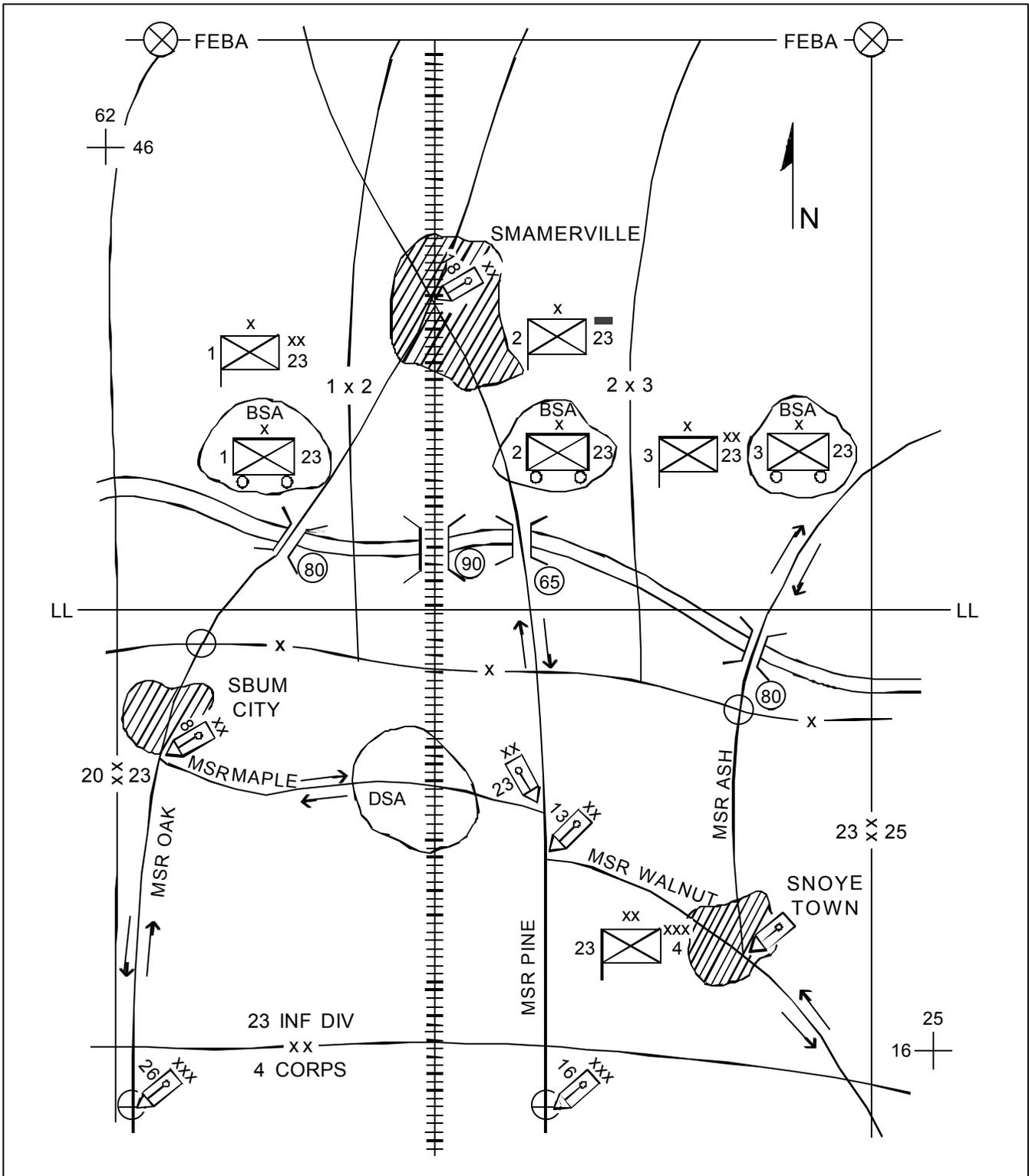


Figure 1-1. Sample traffic circulation plan

Develop the highway regulation plan and include it in the OPLAN or OPORD. The written plan describes information contained on the overlay. It also specifies the control measures that apply to each MSR or to critical segments of MSRs. If determined in advance, control measures should be coordinated to phases of the operation. These should be coordinated with the G3 – especially the requirements for reserved routes to support large unit movements.

Staff and coordinate the plan. Recommend points that require traffic control, as well as locations and priorities for engineer repair and upgrade efforts.

Once all procedures are implemented, planners must assess the availability of communications equipment to support highway regulation. Communications is always a constraint. However, careful planning will ensure that its use is weighted to routes identified as requiring the most control. Control is governed by the planned and anticipated traffic volume and the relative importance of preventing congestion on these routes.

FUNDAMENTALS AND METHODS OF SCHEDULING

Scheduling is the process of coordinating times for road movements. It involves receiving movement bids (requests), deconflicting the requests, and issuing credits (clearances). Scheduling is necessary to—

- Apply command priorities.
- Apply the fundamentals of routing to minimize delays, conflicts, and congestion.
- Conduct detailed planning for large unit or high-priority movements.
- Reserve time for route maintenance.
- Reroute or hold movements based on changes in priority or the tactical situation.

Scheduling Guidelines

It is important to follow certain guidelines when scheduling movements. For example, movements on routes requiring a movement credit must be scheduled. Also, movements that cross movement

control boundaries must be scheduled, coordinated, and inbound-cleared. These functions are accomplished by the movement control organization responsible for the area where the movement originates to the movement control organization where the movement terminates. Other important guidelines are as follows:

- Large unit movements should be scheduled.
- Movements in one direction on routes that require a movement credit are treated as a single movement regardless of the distance or time involved. Each movement retains the same movement credit to destination.
- Schedules and changes to schedules due to immediate movement requirements are given to the MRTs to execute highway regulation and to the PM to provide traffic control.

Types of Schedules

The method of scheduling road movements is based on the control measures specified for the route. The four types of schedules (ranging from the least to the most restrictive) are infiltration, route, location, and column.

Infiltration. An infiltration schedule is a rate of dispatch assigned to units for specific routes and time blocks. The desired result is an average traffic flow that is within the capacity of the route. By assigning rates of dispatch to different units that need to use the same route, average traffic flow can be held within desired limits. An infiltration schedule may be used for open or supervised routes.

Route. The route schedule is a flexible scheduling method. It apportions blocks of time on MSRs to units, types of movements, phases of the operation, or for route maintenance. A route schedule may be used for supervised, dispatched, or reserved routes.

Location. A location schedule is more restrictive than an infiltration or route schedule. It assigns arrive and clear times to different units that need to use the same entry point onto MSRs. The location is normally a checkpoint. For example, at a particular checkpoint, Unit A may be scheduled to arrive

at 1000 hours and to clear at 1015, Unit B to arrive at 1020 and to clear at 1030, and so on. A location schedule may be used for supervised or dispatch routes.

Column. The column schedule is the most restrictive scheduling method. It specifies arrive and clear times at CPs along an entire route. It is based either on the requester's movement bid or movement table or on movement tables issued by the movement control organization. A column schedule can be the most effective method of highway regulation. It provides in-transit times to reach CPs and helps the pacesetter to maintain the prescribed rate of march. It may be used for supervised, dispatch, or reserved routes. It should be used when congestion is anticipated.

As a rule of thumb – the longer the time and distance involved, the more restrictive the method of scheduling should be.

MEASURING MOVEMENTS

Movements are measured by calculating how long it takes to move a given distance. The three methods of measurement are speed, pace, and rate of march. They are defined as follows:

- Speed is the actual rate at which a vehicle is moving at a given time as shown on the speedometer. It is expressed as KPH or MPH.

- Pace is the regulated speed of a convoy or an element as set by a lead vehicle, the pacesetter. It is constantly adjusted to suit road, terrain, and weather conditions. Pace is also expressed as KPH or MPH.

- Rate of march is the average number of kilometers traveled in a specific time period. It includes short periodic halts and short delays, but does not include long halts, such as those for eating meals or for overnight stops. It is expressed in KMIH or MIH. Rate of march is used in movement calculations.

TIME-DISTANCE FACTORS

Time and distance factors (Figure 1-2, page 1-9) are used to perform a wide range of calculations

for planning highway movements. They can be used to develop movement tables and to conduct expedient planning and calculating to deconflict movement requests.

Distance Factors

Distance factors are expressed in kilometers or meters. The following terms are used to describe distance factors:

- Length of any column or element of a column – length of roadway which the column occupies. It is measured from the front bumper of the lead vehicle to the rear bumper of the trail vehicle and includes all gaps inside the column.

- Road space – length of a column, plus any space (safety factor), added to the length to prevent conflict with preceding or succeeding traffic.

- Gap – space between vehicles, march units, serials, and columns. Gap is measured from the trail vehicle of one element to the lead vehicle of the following element. The gap between vehicles is normally expressed in meters. The gap between march elements is normally expressed in kilometers.

- Lead – linear spacing between the heads of elements in a convoy or between heads of successive vehicles, march units, serials, or columns.

- Road distance – distance from point to point on a route, normally expressed in kilometers.

- Road clearance distance – distance that the head of a column must travel for the entire column to clear the RP or any point along the route. Road clearance distance equals the column's length or road space plus road distance.

Time Factors

Time is expressed in hours or minutes. The following terms are used to describe time factors:

- Pass time (or time length) – time required for a column or its elements to pass a given point on a route.

- Time space – time required for a column or its elements to pass any given point on a route plus any additional time (safety factor) added to the pass time.

- Time gap – time measured between vehicles, march units, serials, or columns as they pass a given point. It is measured from the trail vehicle of one element to the lead vehicle of the following element.
- Time lead – time measured between individual vehicles or elements of a column, measured from head to head, as they pass a given point.
- Time distance – time required to move from one point to another at a given rate of march. It is

the time required for the head of a column or any single vehicle of a column to move from one point to another at a given rate of march.

- Road clearance time – total time required for a column or one of its elements to travel the road distance and clear a point along the route or the RP. Road clearance time equals the column’s pass time or time space plus time distance.

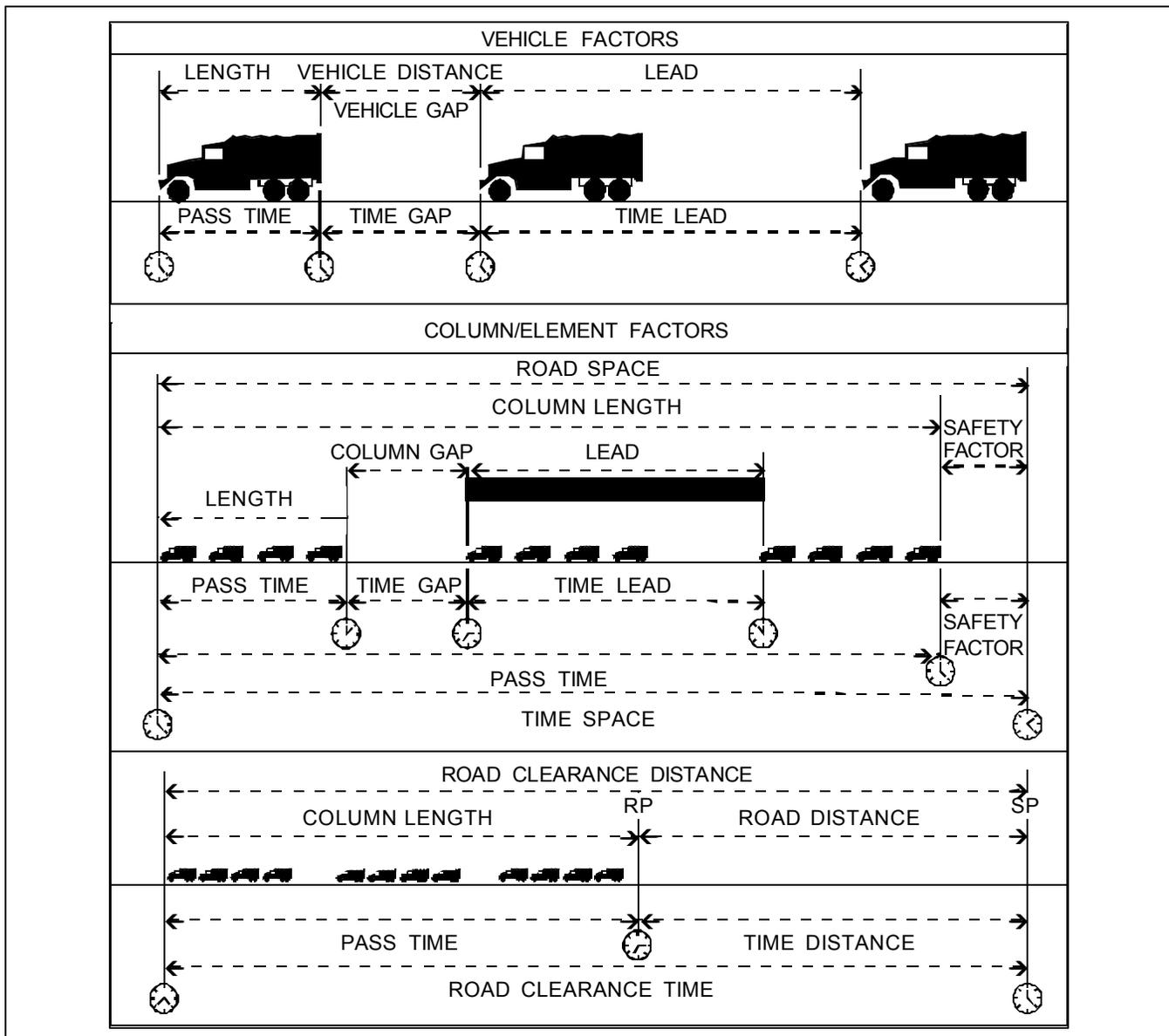


Figure 1-2. Time and distance factors

**DISTANCE, RATE,
AND TIME CALCULATIONS**

Distance, rate, and time factors are used to make scheduling calculations for columns of any size. When two of the three factors are known, the third can be found by using one of the equations shown in Figure 1-3. These factors are determined using the following formulas:

- Distance equals rate multiplied by time. If the rate of march is 40 KMIH and time is 4 hours, the distance is 160 kilometers.

$$40 \times 4 = 160$$

- Rate equals distance divided by time. If a convoy travels for 5 hours to complete a 190 kilometer trip, its rate of march is 38 KMIH.

$$190 \div 5 = 38$$

- Time equals distance divided by rate. If the distance is 210 kilometers and the rate of march is 42 KMIH, the time is 5 hours.

$$210 \div 42 = 5$$

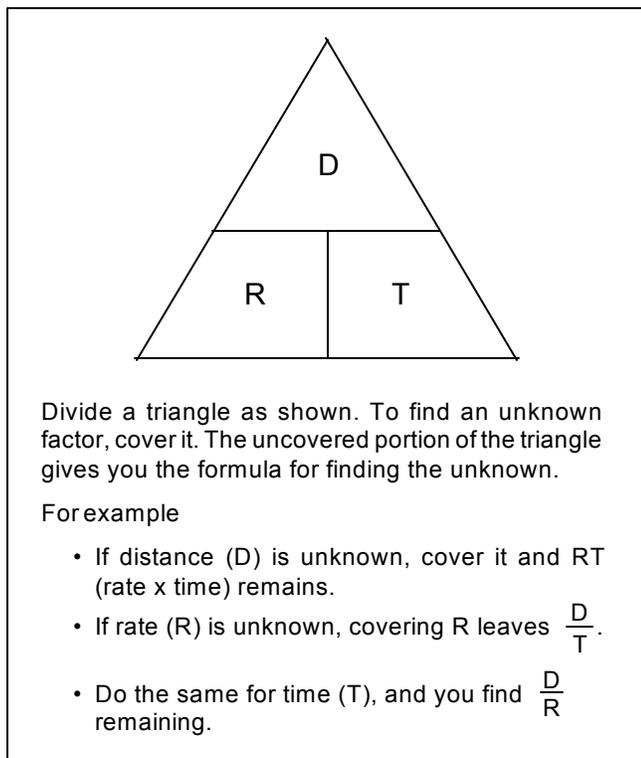


Figure 1-3. Finding an unknown factor of distance, rate, or time

**ARRIVE AND CLEAR
TIME CALCULATIONS**

Arrive and clear times are not the same as time factors. The time factors measure a quantity of time or distance. Arrive and clear times represent actual time as displayed on a clock. The arrive time is the time the first vehicle in the column will arrive at an SP, CP, or RP. It is derived from the time distance. The clear time is the time the last vehicle in the column will clear that SP, CP, or RP.

Calculating Arrive Times

The arrive time at the SP is the same as the SP time. Calculate arrive times as follows:

- To calculate the arrive time at the first CP, take the distance from the SP to the first CP, divide by the planned rate of march, and multiply by 60 (minutes). Add this amount of time to the arrive time at the SP to determine the arrive time at the first CP.

Example: Distance from SP to first CP: 10 km
March rate: 50 KMIH

Solution: $10 \div 50 = .20$ hrs $\times 60 = 12$ min

If the arrive time at the SP was 0800, then the arrive time at the first CP would be 0812.

- To calculate the arrive time at the second CP, take the distance from the first CP to the second CP, divide by the rate of march, and multiply by 60. Add this amount of time to the arrive time at the first CP to determine the arrive time at the second CP.

Example: Distance from first to second CP: 15 km
March rate: 50 KMIH

Solution: $15 \div 50 = .30$ hrs $\times 60 = 18$ min

If the arrive time at the first CP was 0812, then the arrive time at the second CP would be 0830. Continue this method to calculate the arrive time at succeeding CPs through the RP.

Calculating Clear Times

To calculate the clear times at each CP, planner must determine the pass time. Calculating pass time requires four calculations: density, time gaps, road

space, and pass time. These four calculations are determined using the following formulas:

- Density = $\frac{1,000 \text{ (m)}}{\text{vehicle gap} + \text{avg length of vehicle}}$

NOTE: Vehicle gap is expressed in meters, representing the gap between vehicles. Average length of vehicle is expressed in meters, representing the average length of the most common vehicle in the column.

Example: If the vehicle gap is 100 meters and the average vehicle length is 18 meters, then—

$$\text{Density} = \frac{1,000}{100 + 18} = \frac{1,000}{118} = 8.5 \text{ vehicles per km}$$

- Time gaps = [(number of march units - 1) x march unit time gap] + [(number of serials - 1) x (serial time gap - march unit time gap)].

Example: If a column has two serials with two march units each and the gap between march units is 5 minutes and the gap between serials is 10 minutes, then—

$$\text{Time gaps} = [(4 - 1) \times 5] + [(2 - 1) \times 5] = [3 \times 5] + [1 \times 5] = 15 + 5 = 20 \text{ minutes}$$

$$\text{Road space} = \frac{\text{number of vehicles}}{\text{density}} + \frac{\text{time gaps} \times \text{rate}}{60 \text{ (minutes)}}$$

Example: number of vehicles = 87

Density = 8.5 per km
 Rate = 50 KMIH
 Time gaps = 20

$$\text{Road space} = \frac{87}{8.5} + \frac{20 \times 50}{60} = 10.2 + 16.7 = 26.9 \text{ km}$$

- Pass Time = $\frac{\text{road space} \times 60}{\text{rate}}$

Example: Continuation from above.

$$\text{Pass time} = \frac{26.9 \times 60}{50} = \frac{1,614}{50} = 32.2 \text{ or } 33 \text{ min}$$

NOTE: Always round pass time up regardless of the decimal value.

In this example, the clear time at the SP is 33 minutes after the first vehicle crosses the SP. If the arrival time at the SP is 0800, the clear time at the SP will be 0833. If the arrival time at the first CP is 0812, the clear time at the first CP will be 0845. Use this same method to calculate the arrive and clear times at succeeding CPs to the RP. This movement can be depicted as follows:

CP	Arrive Time	Clear Time
1	0800	0833
2	0812	0845
3	0830	0903

The pass time will stay the same throughout the route as long as the march rate and density do not change. If the march rate or density changes, then recalculate the pass time to determine the new clear time.

REST HALTS

The march rate compensates for short halts, but does not include scheduled rest halts. Plan scheduled rest halts during the movement planning process. Rest halts are scheduled either at a CP or between CPs.

When planning rest halts, allow time to get vehicles off the road and staged, time to rest, and time to get vehicles back on the road. If you need 10 minutes for a rest halt, then schedule 15 minutes for the halt to ensure time to get vehicles on and off the road.

If a rest halt is scheduled at a CP, the arrive time at the CP does not change. What changes is the clear time at that CP and the arrive and clear times at succeeding CPs. Adjust the clear time by the scheduled halt time. If a rest halt is scheduled between CPs, adjust both the arrive and clear times at the next CP by the scheduled halt time. Continuing with

the previous example, if you plan a 15-minute rest halt between CP 2 and CP 3, you must adjust the times as follows:

CP	Arrive Time	Clear Time
1	0800	0833
2	0812	0845
3	0845	0918

Note the 15-minute delay in arriving and clearing CP 3. If you planned the rest halt at CP 2, your adjustments would be as follows:

CP	Arrive Time	Clear Time
1	0800	0833
2	0812	0900
3	0845	0918

Note the 15-minute delay in clearing CP 2, arriving at CP 3, and clearing CP 3.

The pass time will stay the same throughout the route as long as the march rate and density do not change. If the march rate or density changes, you must recalculate the pass time to determine the new clear time. Follow these guidelines to simplify calculations:

- Prepare and use conversion tables for changing US common distances to metric distances, number of vehicles to time length, and distance to time.
- Standardize variables to reduce calculation time. When possible, use standard march rates and density.
- Use automated programs such as MOVEPLAN or DAMMS-R to calculate arrive and clear times.