

**\*TC 21-305-20/AFMAN 24-306(I)**

# **MANUAL FOR THE WHEELED VEHICLE OPERATOR**

**JANUARY 2016**

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# Manual for the Wheeled Vehicle Operator

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## Preface

This TC provides instructions to help the wheeled vehicle operator maintain a high degree of driving efficiency. This TC does not restrict its contents to any one particular vehicle. It is a guide to normal every day operations and to driving under difficult conditions. When more information is needed for a specific vehicle, check the technical manual (TM) or technical order (TO) written for that vehicle.

The term “Driver” is being replaced with the term “Operator” throughout this publication. The term driver implies that all the Soldiers and Airmen must do is to drive the vehicle. Today’s military operator does considerably more than just drive. The term operator reflects a requirement to master every aspect of the vehicle’s capabilities and limitations to include all current sub-components such as technologically advanced communications, navigation, intercom systems, onboard material handling cranes, self-recovery winches, integrated night-vision devices, weapons support systems, onboard electronic diagnostic systems, and load responsibility.

Leaders can use a variety of methods and environments to train and practice the safe operation of Army motor vehicles. Under paragraph 4-2.c of [AR 600-55, Training Materials](#), it states: “Instructors should use all available training materials and tools developed and or approved by TRADOC Schools having proponency for the type of vehicle or equipment on which training is being conducted. These tools include driving ranges, training devices and simulators, and the U.S. Army Transportation School (USATSCH) drivers’ training website: <http://www.transchool.eustis.army.mil>.” Before you, the leader puts a driver on the road with other vehicles you must ensure a minimum competence level has been achieved in a controlled area which minimizes dangers to all concerned.

This publication also requires the collection and or maintenance of information protected by the Privacy Act (PA) of 1974. The authorities to collect and or maintain the records prescribed in this publication are Title 37 United States Code, Section 301a and Executive Order 9397, NUMBERING SYSTEM FOR FEDERAL ACCOUNTS RELATING TO INDIVIDUAL PERSONS, November 22, 1943. System Notices F024 AF IL C, Motor Vehicle Operators' Records (December 30, 2008, 73 FR 79849) and System Notices F024 AF IL C, Motor Vehicle Operators' Records (December 30, 2008, 73 FR 79849), 62 FR 31793) apply.

This TC applies to the Active Army, the Army National Guard, the United States Army Reserve and the United States Air Force Active and Reserve components.

The proponent of this publication is Headquarters (HQ), United States Army Training and Doctrine Command (USATRADOC). Submit comments and recommendations for improving this publication on DA Form 2028 (Recommended Changes to Publications and Blank Forms) or AF Form 847 (Recommendation for Change of Publication) directly to:

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## Chapter 1

# Basic Regulation and Responsibilities

1-1. Military and civilian vehicle operators must meet specific qualifications to be certified. He/She must know his/her responsibilities and be familiar with the forms that pertain to vehicle operations.

### OFFICIAL USE REQUIREMENT

1-2. "Official use" is defined as the employment or authorization of employment of a government motor vehicle (owned, leased, or rented, if required) in the discharge or performance of an official duty, function, or service. Certain restrictions on using government vehicles are also contained in Army regulation (AR) 58-1 and Air Force Instruction (AFI) 24-301.

1-3. The law provides penalties for the willful use or authorization of any government-owned, government-leased, or government-rented motor vehicle for other than official purposes. Civilian employees who misuse government motor vehicles may have administrative discipline taken against them under their Service Civilian Personnel Disciplinary Instructions or in accordance with the Civilian Personnel Manual. Use of government motor vehicles by military personnel for other than official purposes is a violation of Article 92 of the Uniform Code of Military Justice (UCMJ).

### OPERATOR'S IDENTIFICATION CARD

1-4. A valid motor vehicle license issued in any of the 50 states, the District of Columbia, Puerto Rico, or similar licensing jurisdictions will be sufficient qualification for military and civilian personnel to operate commercially-designed, general purpose vehicles up to 1 1/2-ton cargo trucks. Personnel who operate vehicles in excess of 14,000 pounds gross vehicle weight (GVW) must possess an Air Force (AF) Form 2293 (US Air Force Motor Vehicle Operator Identification Card) (see Figure 1-1), a Department of the Army (DA) Form 5984-E (Operator's Permit Record) (see Figure 1-2), or an Optional Form (OF) 346 (US Government Motor Vehicle Operator's Identification Card) (see Figure 1-3), if units do not possess Computer Assisted Transportation Systems (CATS) or Unit Level Logistics System (ULLS) hardware and software. Airmen performing either temporary or permanent change-of-station duty in United States Air Forces in Europe (USAFE) require a valid AF Form 2293 to operate any GMV. Soldiers must possess a valid OF Form 346 (DA Form 5984-E).

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Note: All Air Force personnel must possess a valid AF Form 2293 to operate any government motor vehicle.

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### LICENSING REQUIREMENTS

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Note: While taking the road test to obtain a military license, the vehicle being used for the test must be clearly marked with a "STUDENT DRIVER" sign at all times.

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Note: Each commander has the responsibility to ensure that all operators are fully licensed and trained on the assigned vehicle according to Military and or State requirements.

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1-5. The following licensing requirements apply to military operators of government-owned or government-leased vehicles. The vehicles include both tactical and non-tactical (to include those with a gross vehicle weight rating (GVWR) of 10,000 pounds or less) (Army).

U.S. Air Force Motor Vehicle Operator Identification Card				Card Type
<b>AUTHORIZED FOR FLIGHTLINE</b>				<b>STANDARD</b>
Name of Operator		Sex	Date Issued	
PENN LARRY B.		M	05/01/09	
Height	Weight	Date of Birth	SSAN	Date Expires
73	197	05/28/73		INDEFINITE
Color of Hair		Eyes	Signature of Operator	
BLK		BRN	<b>SAMPLE</b>	
Name/Loc Issue Unit			Signature of Official	
1st AIR BASE CO. FT. NEER VA 23499				
NOT TRANSFERABLE: CARD MUST BE CARRIED WHEN OPERATING GOV AF Form 2293, Feb 1987 (Computer Generated)				
RESTRICTIONS: NONE				
QUALIFIED VEHICLES				
SE SW CA TK 1 1/2T	: MCVEAGLE 41 51 PX	:BUS 29 PAX DED		
BUS 45 PAX DED	: WASE TUG 4 5K	:BUS MOTOR 16PX 4X2		
TRK TRACTOR 5104 D	: TRK TRACTOR 10TG&D	:TRK F/L 50K AT CII		
TRK TRK 11 1 25K 11-11	: TRK TRK 11 1 5-6 1	:TRK WKR 7.5 TON		
TRK WTRK 5 TON	: TRK WTRK 10 OH	:TRK FT GAS 2-6K ST		
FKLFT 6-10K PT GED	:FKLFT GAS 10-15K	:F/L 10K AT 463L		
SFMI TRI R 70T/75FT	: SM TRI R 70T/40 FT	:N-35 TRK CGO 636 D		
TRK FUEL R 9&R 11	: TRK FUEL R 5	:TRK ACFT TON KP 4		
TRK AC/LD 25K 463L	: TRK AC/LD 40K 463L	:TRK AC/LD 10K 463L		
CRANL 9-11 2 TON	: TRK VAN 30-1 & OVLK	:VAN/CAB 240 G064X20		
LIFTGATE QUALIFIED	: ARMOR DTRK CONVOY	:TRK FIRE CRAS P-10		
CRN 4YD 7 15 TON	: TRAC ACFT 10W AU-2	:TRK BOU JAL G/D		
DISTE W 1500G 6X10	: TRK AMB MOP 4X4	:TRK CARGO M101		
TRLR CARGO M105	: TRK TRACT, 7 1/4 D	:PINTLE HOOK GUAL		
K151 JEEP 4X1	: TRK 10FT W/CONV KIT	:25F WTRK W/Z LIFT		

Figure 1-1. Sample AF Form 2293



OPERATOR'S PERMIT				DA FORM 5984-E	
<b>U.S. ARMY MOTOR VEHICLE OPERATOR'S IDENTIFICATION CARD</b>					
Name of Operator		MI	Sex	Date Issued	
DREW FREDERICK		E.	M	08-OCT-08	
Height	Weight	Date of Birth	SSN	Date Expired	
6' 1"	180 lbs	07-OCT-80	123-45-6789	08-OCT-12	
Color of Hair	Eyes	<b>SAMPLE</b> <i>Frederick E. Drew</i>			
BRN	BRN				
Name / Loc Issue Unit			SIGNATURE OF OPERATOR		
CO A, 2ND 11TH ARMOR FT KNOX KY 40121			<i>James R. Readiness, CP7</i>		
			JAMES R. READINESS COMMANDER		
NOT TRANSFERABLE: CARD REQUIRED TO OPERATE GOVT VEHICLE PRIVACY ACT OF 1974 APPLIES					
<b>QUALIFICATIONS / RESTRICTIONS</b>					
GLASSES		INSTALLATION ONLY			
COMM VEH BELOW 10,000 #		2 1/2 TON AND BELOW			
GENR 60KW AND BELOW					

Figure 1-2. Sample DA Form 5984-E

Part 1 FRONT				Part 2		
OF 346 11 FEB USOPM FPM Chapter 930		U.S. Government Motor Vehicle Operator's Identification Card		Card No ① J-7119	Restrictions R1	⑬
Name of Operator (Not Transferable) ② Jones, John L.		Sex ③ M	Signature of Operator (Not valid until signed) ④ <i>John L. Jones</i>		QUALIFIED TO OPERATE ⑬	
Date of Birth ⑤ 1 MAY 64	Social Security No ⑥ 111-41-7119	Name and Location of Issuing Unit ⑬ 6 <sup>th</sup> TRANS BN Ft. EVSTIS, VA 23604		Type Vehicle and/or Equipment HEMTT M927	Capacity 10T	Qualifying Official <i>Guy W. Smith</i>
Height ⑦ 5'4"	Weight ⑧ 160 lbs	Hair Color ⑨ BRN	Eye Color ⑩ BRN	Signature and Title of Issuing Official ⑭ <i>Paul D. Zupler</i> LTC, BN CDR		
Date Issued ⑪ 10 JUN 93	Date Expires ⑫ 31 MAY 99	Signature and Title of Issuing Official ⑭ <i>Paul D. Zupler</i> LTC, BN CDR		OTHER RESTR. ORDS (if known) ⑰ WINTER DRIVER INC		
The holder of this card is qualified to operate U.S. Government vehicles and/or equipment specified, subject to the restrictions set forth on the other half of this card. CARD must be carried at all times when operating Government vehicles.				NSN 7540-00-634-3991		50246 101
<b>BACK</b>						
<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="font-size: 2em; font-weight: bold; transform: rotate(-30deg); opacity: 0.5;">SAMPLE</div> <div style="text-align: center;"> <p style="font-size: small;">PRIVACY ACT STATEMENT</p> <p style="font-size: x-small;">Solicitation of the information is authorized by 40 U.S.C. 471 and 5 CFR Part 930 Subpart A, which requires OPM to regulate Federal employees use of Government-owned or -leased motor vehicles. Executive Order 9397 authorized agencies to use the Social Security Number (SSN) as an identifier in government personnel record systems. Your SSN and other data provided is used primarily by the National Drivers Register Service to check your driving record. Other possible uses include disclosure to former employers or law enforcement agencies to obtain additional related information. Furnishing your SSN as well as the other data is voluntary. However, failure to provide any of the data requested may result in your not being issued a U.S. Government Motor Vehicle Operator's Identification Card. When driving a motor vehicle is a prerequisite to employment, you may not be able to obtain/renew employment without such a card.</p> </div> </div>						

Figure 1-3. Sample of OF Form 346

## DRIVING OFF THE INSTALLATION

- 1-6. Within the United States (US) or US possessions, operators must have the following:
- A valid OF Form 346 (DA Form 5984-E).
  - AF Form 2293.
  - A valid civilian driver's license issued by a State (not necessarily the state in which the activity is located), the District of Columbia, or a US possession (Virgin Islands, Puerto Rico, or Guam).

## DRIVING ON THE INSTALLATION

1-7. Within the US or US possessions (unless required by DA Pamphlet 611-21 as a prerequisite for awarding a military occupational specialty [MOS]), operators must have a valid OF Form 346 (DA Form 5984-E) for operation of vehicles on the installation only. However, personnel who possess a state or host nation (HN) driver's license which is suspended or revoked will not be issued any type of OF Form 346 (DA Form 5984-E) and will have current OF Form 346 (DA Form 5984-E) suspended or revoked for the same time period.

## DRIVING OUTSIDE OF UNITED STATES POSSESSIONS

1-8. Operators must have a valid DA Form 5984-E, OF Form 346, or AF Form 2293, and meet any additional host nation (HN) and major Army commander (MACOM) requirements.

1-9. The DA Form 5984-E, OF 346, or AF Form 2293 is your official operator's card. Your card shows the types of vehicles you are qualified to operate. Any limitations may also be indicated on your operator identification (ID) card (such as "Valid Only with Glasses"). Do not operate vehicles you have not been trained on or unauthorized to operate. Be sure to sign your card when it is issued and keep it with you whenever you drive. Ensure the commander or his/her designated representative has signed the card or it will be invalid. The DA Form 5984-E, OF Form 346, or AF Form 2293 is valid only for operating government vehicles that have been properly dispatched. It is not valid for operating privately-owned vehicles or for operating a vehicle when your state operator's permit has been revoked or suspended. Keep the DA Form 5984-E, OF Form 346, or AF Form 2293 current at all times.

---

**FOR ARMY ONLY:** DA Form 5984-E is your official operator's card if your unit uses the SAMS-E system for dispatching. See the DA Pam 750-8 for complete information concerning maintenance (the vehicle operator will not have a need to use this manual, only the ULLS dispatcher).

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## QUALIFICATION RECORD

1-10. DA Form 348 (Equipment Operator's Qualification Record (Except Aircraft) (see Figure 1-4) or ULLS computer-generated DA Form 5983-E (Equipment Operator Qualification Record) (see Figure 1-5), and AF Form 2296 (U.S. Air Force Master Driver Record) (see Figure 1-6) provide the means for recording the complete history of your driving qualifications and equipment-operating experience. Required for each equipment operator, DA Form 348, DA Form 5983-E, or AF Form 2296 reflects qualifications, experience, performance, and test results. For complete information concerning maintenance of DA Form 348 (see AR 600-55 and DA Pamphlet 750-8).

## AUTHORIZATION FORM

1-11. Company commanders/squadron commanders are responsible for ensuring operator qualifications before licensing an operator. Dispatching is accomplished by determining vehicle

compatibility and availability to perform a specific mission. The dispatch form is your authorization to operate a specific vehicle. You must keep this form current. You must also have a valid authorization in your vehicle (along with a valid operator's permit) whenever you are on dispatch.

Note: The Air Force does not issue a dispatch form for operating a vehicle.

**FOR ARMY ONLY:** Department of Defense (DD) Form 1970 (Motor Equipment Utilization Record) (or for ULLS-equipped unit dispatching, DA Form 5983-E) is your dispatch authorization form for Army vehicles.

EQUIPMENT OPERATOR'S QUALIFICATION RECORD (EXCEPT AIRCRAFT)						
For use of this form, see AR 600-55; the proponent agency is DCS, G3/5/7.						
NAME (Last, first, initial) Doc, John R.				PERMIT (Initial)		
				NUMBER e-1234	DATE ISSUED 11 May 2015	
				TYPE ARMY STANDARD	LIMITATIONS (Physical or operational) Light/Heavy	
SEX Male	DATE OF BIRTH 31 May 1987	COLOR HAIR Brown	COLOR EYES Hazel	HEIGHT 5'11	WEIGHT 155	POSITION TITLE (If civilian) N/A
SECTION I - OFFICIAL QUALIFICATIONS						
TYPE OF EQUIPMENT	SIZE	SPECIAL QUALIFICATION <sup>1</sup>	DATE QUALIFIED	QUALIFIED AT	NAME OF EXAMINER	
M932A2	HI	SEE SECTION III	25 May 2015	Ft. Eustis, VA	John Smith	
M1083A1	5 Ton		16 May 2015	Ft. Eustis, VA	John Smith	
SECTION II - BACKGROUND AND EXPERIENCE						
TYPE OF EQUIPMENT	SIZE	TYPE OF DRIVING OR OPERATION <sup>2</sup>	ADDITIONAL DRIVERS LICENSES (State or agency)	NUMBER OF OTHER DRIVERS LICENSES	SATISFACTORY EXPERIENCE VERIFIED BY	
SEDAN	5-7 Pass	City/Rural	CA 05/2009	125-67-8621	John Smith	
<sup>1</sup> Special equipment, special operations or conditions			<sup>2</sup> City, rural, long haul, etc.			
SECTION III - PERFORMANCE RECORD						
(List chronologically as "credits" - awards, training, retraining, testing, retesting, roados, permit renewal, relicensing, etc; and as "debts" - accidents, arrests, violations, warnings, revocations, suspensions, etc.)						
DATE	CREDITS	DEBITS	TYPE OR NATURE	ACTION TAKEN		
1 May 2011	21/2		Accident	Accident Avoidance Tmg completed		
			Avoidance	ARMY DRIVER IMPROVEMENT Program		
			Battery II	Tmg Film Video TF 20-6367 thru 20-6377		
			Waiver	and 20-6381. Battery II Testing waived in		
				Section IV (Examination & Findings) IAW AR 600-55, Para 1-5b		
11 May 2011	40 hrs		Trained/Tested	Completed Driver Training Class given by 6th Bn Driver Training & Testing Academy on the M932A2 Trk Cgo.		
DA FORM 348, AUG 2011						
				PREVIOUS EDITIONS ARE OBSOLETE.		(Extract from personnel file to maintain at operating level.)
						Page 1 of 2 APD LC v1.00

Figure 1-4. Sample DA Form 348 (Front)

SECTION IV - EXAMINATION FINDINGS					
<b>BATTERY I -</b> (Administered as a part of reception processing, at reception stations)		<b>BATTERY II -</b> (To be administered to all applicants for Driver Permit SF 46) (To transfer raw score to standard score see DA Pamphlet 611-119)			
DA FORM 6122		RAW SCORE	12,345	STANDARD SCORE 12,345	
DA FORM 6123			12,345	12,345	
DA FORM 6124			12,345	12,345	
ENTER SCORE FROM ITEM 24 OF INDIVIDUAL'S DA FORM 20		<b>TOTAL STANDARD SCORE</b>		37,035	
		STANDARD SCORE FOR BATTERY II (Divide Total Standard Score by 3)		12,345	
STANDARD SCORE 12,345		SUCCESSFUL COMPLETION <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		EXAMINATION ADMINISTERED BY (Last name - first name - middle initial) Niceday, James, H	
<b>I PHYSICAL EVALUATION MEASURES</b>					
		? - IF QUALIFIED X - IF SUBSTANDARD		SIGNATURE OF EXAMINER	
1. VISUAL ACUITY		LEFT EYE 20/ 20	RIGHT EYE 20/ 20	John Smith	
2. FIELD OF VISION		LEFT EYE 90	RIGHT EYE 90	John Smith	
3. HEARING		LEFT EAR 15 /20	RIGHT EAR 15 /20	John Smith	
4. REACTION TIME		45 /100 SEC	45 /100 SEC	John Smith	
5. DEPTH PERCEPTION				John Smith	
6. COLOR PERCEPTION				John Smith	
				SIGNATURE OF MEDICAL AUTHORITY Kim Upass	
<b>II DRIVING PERFORMANCE TEST</b> (Check "?" if successful, "x" if failed and corrective training is needed)					
<b>A. ROAD TEST - PREREQUISITE</b>					
1. INSTRUMENTS (Location, correct reading, action for abnormal reading)		<input checked="" type="checkbox"/> OIL LEVEL STICK		<input checked="" type="checkbox"/> TEMPERATURE GAGE	
		<input checked="" type="checkbox"/> AMMETER		<input checked="" type="checkbox"/> TACHOMETER	
		<input checked="" type="checkbox"/> OIL PRESSURE GAGE		<input checked="" type="checkbox"/> VOLTOMETER	
		<input checked="" type="checkbox"/> FUEL GAGE		<input checked="" type="checkbox"/> AIR PRESSURE GAGE	
2. BEFORE OPERATION CHECK		<input checked="" type="checkbox"/> VEHICLE DAMAGE		<input checked="" type="checkbox"/> CONDITION OF TIRES	
		<input checked="" type="checkbox"/> CLEAN HEADLIGHTS		<input checked="" type="checkbox"/> OIL LEVEL	
		<input checked="" type="checkbox"/> BATTERY		<input checked="" type="checkbox"/> SEAT ADJUSTMENT	
		<input checked="" type="checkbox"/> MIRROR ADJUSTMT		<input checked="" type="checkbox"/> HORN	
		<input checked="" type="checkbox"/> HAND BRAKES		<input checked="" type="checkbox"/> FOOT BRAKES	
		<input checked="" type="checkbox"/> WATER LEVEL		<input checked="" type="checkbox"/> WIPER	
3. EMERGENCY EQUIPMENT (Location and use)		<input checked="" type="checkbox"/> FIRE EXTINGUISHER		<input checked="" type="checkbox"/> HIGHWAY WARNING KIT	
				OTHER (Describe) N/A	
4. CONTROLS - "DRY RUN"		<input checked="" type="checkbox"/> GEARS		<input checked="" type="checkbox"/> BRAKE	
		<input checked="" type="checkbox"/> CLUTCH		<input checked="" type="checkbox"/> FRONT AXLE	
5. DEPTH PERCEPTION (Two feet from target)		<input checked="" type="checkbox"/> FIRST TRY		<input checked="" type="checkbox"/> SECOND TRY	
		<input checked="" type="checkbox"/> THIRD TRY			
6. PRACTICE RUN (1/2 mile)		<input checked="" type="checkbox"/> START		<input checked="" type="checkbox"/> PULL OUT	
		<input checked="" type="checkbox"/> SHIFT		<input checked="" type="checkbox"/> 3 STOPS	
		<input checked="" type="checkbox"/> TURNS		<input checked="" type="checkbox"/> BACKING	
7. ADDITIONAL REQUIREMENTS FOR LICENSE		<input checked="" type="checkbox"/> LOCAL LAWS		<input checked="" type="checkbox"/> OPERATING PROCEDURES	
		<input checked="" type="checkbox"/> ACCIDENT REPORTING		OTHER (Describe) HAS SUCCESSFULLY DEMONSTRATED PREPARATION OF DA FORM 2404	
<b>B. ROAD TEST - SCORED PHASE</b> (DA PRT 2678)				100	
COMMENTS AND RECOMMENDATIONS OF ROAD TEST EXAMINER None				NUMBER OF TALLY MARKS ON CHECK LIST PRT 2678 (Subtract) 2	
				ROAD TEST SCORE 98	
				SIGNATURE OF ROAD TEST EXAMINER John Smith	
MY DRIVING WEAKNESSES HAVE BEEN MADE KNOWN TO ME AND I HAVE BEEN SHOWN HOW TO OVERCOME OR ADJUST THEM.		DATE 25 May 2011		SIGNATURE OF APPLICANT John Doe	

DA FORM 348, AUG 2011

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Figure 1-4. Sample DA Form 348 (Back) (continued)

DATE: 30-SEP-07 OPERATOR QUALIFICATION RECORD ANAMF-088  
 LAST NAME: DOE FIRST NAME: JOHN INITIAL: R  
 DOB: 21-SEP-55 SEX: M WT: 150 HT: FT 5 IN 10 HAIR: BRN EYES: BLU  
 SOCIAL SECURITY NUMBER: 123-45-6789 LICENSE EXPIRATION DATE: 30-SEP-09  
 MILES SINCE LAST ACTION: 000000 HOURS SINCE LAST ACTION: 000000  
 DAYS SINCE LAST ACTION: 000000 TOTAL MILES DRIVEN: 046251

**EQUIPMENT QUALIFICATIONS**

EQ CLS CO	CODE DESCRIPTION	DATE QUALIFIED
A2	COMM VEH OVER 10,000 #	20-AUG-87
B3	BUS 48 PASS AND BELOW	30-SEP-90
C2	CRANE 7 1/2 TON	21-MAY-87
E2	GENR 60 KW AND BELOW	15-JAN-00
T3	M113 FAMILY EXC M548	20-FEB-90
T4	M60 FAMILY & AVLB. M728	30-SEP-01
W4	10 TON AND BELOW	16-DEC-88

**RESTRICTIONS/ACTIONS**

RMK CD	DATE	DESCRIPTION OF REMARK	VERIFIER
31	27-JUL-00	EYEGLASSES REQUIRED	SSG J. BROWN

**SAMPLE**

Figure 1-5. Sample DA Form 5983-E

Personal Data - Privacy Act Of 1974 (5 USC 552a)

[ Master Driver Record ]

Social Sec. #: XXX-XX-XXXX  
 Driver's Record- Last: LAKE First: TOMMY NI: J JR  
 Rank/NSC Sex :M Phone:723-3122 DAFSC:2117  
 Code :0A Unit :5 LRS Off Syn:1GR000  
 Hair: BRN Eyes: BRN HT: 71 WT : 180  
 Active Record: Y Last Update: 10/07/08 Military Status: Y  
 Revoked/Suspended (R/S) : Date R/S : / /  
 Restrict :CORRECTIVE LENSE AF2293 Dt:10/07/08 Exp. Date : / /  
 Civilian Driver License #: XXX-XX-XXXX Birth Date: 11/11/74  
 Other Driver License # : Trainer : Y  
 Issuing State: SD State Expir Date: 11/11/10  
 Background Investigation: / /

[ Vehicle Qualifications ]

Database : Standard Qualifications  
 SSAN : XXX-XX-XXXX

Qual1 : 8XX: Date : 10/07/08	Qual12 : 349: Date : 10/07/08
Qual3 : 8130: Date : 10/07/08	Qual14 : 3119: Date : 10/07/08
Qual5 : 8180: Date : 10/07/08	Qual16 : 3204: Date : 10/07/08
Qual7 : 8102: Date : 10/07/08	Qual18 : 3325: Date : 10/07/08
Qual9 : 8361: Date : 10/07/08	Qual10 : 3362: Date : 10/07/08
Qual11 : 8401: Date : 10/07/08	Qual12 : 3409: Date : 10/07/08
Qual13 : 8416: Date : 10/07/08	Qual14 : 3419: Date : 10/07/08
Qual15 : 8476: Date : 10/07/08	Qual16 : 3419: Date : 10/07/08
Qual17 : C107: Date : 10/07/08	Qual18 : 3419: Date : 10/07/08
Qual19 : C116: Date : 10/07/08	Qual20 : 3419: Date : 10/07/08
Qual21 : C117: Date : 10/07/08	Qual22 : C355: Date : 10/07/08
Qual23 : C507: Date : 10/07/08	Qual24 : D560: Date : 10/07/08
Qual25 : D568: Date : 10/07/08	Qual26 : D626: Date : 10/07/08
Qual27 : D752: Date : 10/07/08	Qual28 : E801: Date : 10/07/08
Qual29 : E831: Date : 10/07/08	Qual30 : E823: Date : 10/07/08
Qual31 : E954: Date : 10/07/08	Qual32 : E957: Date : 10/07/08
Qual33 : E958: Date : 10/07/08	Qual34 : E972: Date : 10/07/08
Qual35 : X998: Date : 10/07/08	Qual36 : L290: Date : 10/07/08
Qual37 : X245: Date : 10/07/08	Qual38 : : Date : / /
Qual39 : : Date : / /	Qual40 : : Date : / /
Qual41 : : Date : / /	Qual42 : : Date : / /
Qual43 : : Date : / /	Qual44 : : Date : / /
Qual45 : : Date : / /	Qual46 : : Date : / /

AF Form 2296 (Computer Generated)

Remarks :

Figure 1-6. Sample AF Form 2296

## OPERATOR QUALIFICATIONS

1-12. To be a military or civilian operator, you must—

- Be qualified and licensed.
  - Be physically, mentally, and emotionally stable.
  - Be informed about vehicle and local traffic laws.
  - Have sound knowledge of driving techniques.
  - Have sufficient experience, evidenced by good safety habits and driving skills.
  - Have a courteous and responsible driver attitude.
- 

Note: AFI 24-301 requires civilians to have an OF 345 on file.

---

1-13. The mission of the armed services depends on you and your vehicle for mobility. Your unit's success depends, to a great extent, on how good you are at your job. Apply yourself, your knowledge, and your skills. Follow the instructions provided by your commander or supervisor and the person delegated to relay them. Maintain a neat appearance and practice courtesy.

## OPERATOR RESPONSIBILITIES

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Note: Refer to ATP 4-16, Chapter 3, Chapter 5, and Chapter 6 for detailed information on operator and assistant operator duties and responsibilities in a tactical Contemporary Operational Environment (COE).

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1-14. As a vehicle operator, you are responsible for the following:

- Safely operating your vehicle and complying with applicable federal, state, local, and HN laws and regulations.
- 

Note: There are some states that have strict laws in regards to using cell phones while driving, while in other states there are no laws. However, while operating a military vehicle, cell phones shall not be used except when using a hands-free device or hands-free operating mode.

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- Conducting before-, during-, and after-operation inspections of your vehicle.
  - Following all operator maintenance outlined in the appropriate vehicle technical manual (TM) (Army) or technical order (TO) (Air Force).
  - Caring for and cleaning your vehicle and its equipment at all times.
  - Ensuring the safety and comfort of your passengers (includes ensuring that seat and shoulder belts are fastened). The senior occupant will ensure that passengers comply.
  - Ensuring the security of the vehicle and cargo entrusted to you.
  - Exercising common sense.
  - Notifying your supervisor or noncommissioned officer (NCO) of any change in your status (for example, inability to drive due to physical condition or withdrawal of your state operator's license).
- 

Note: The life expectancy and capability of your vehicle depends on you.

---

Remember, you are subject to corrective action by your commander/squadron commander for incidents of abuse, misuse, and damage to unit-assigned vehicles (see AR 58-1 and Air Force Instruction (AFI) 24-301).

**CAUTION (FOR AIR FORCE ONLY)**

As a vehicle operator, you may be required to operate two-way radio equipment. Do not attempt to operate the two-way radio equipment in your vehicle unless you have been instructed to do so. Your supervisor will determine whether you are qualified to efficiently operate this equipment and will furnish local standard procedures, codes, and so forth which may be published in base directives or AF publication supplements.

**FUEL-EFFICIENT OPERATION**

1-15. As a qualified vehicle operator, you should operate your vehicle in the most fuel-efficient manner. To do so, you must adopt a fuel-conservation attitude. Apply the following tips to help develop this attitude:

- Plan trips to avoid unnecessary "cold starts."
- Consolidate short trips whenever possible.
- Reduce vehicle's cool-down time and select your route with consideration for terrain, weather, and type of vehicle.
- Maintain your vehicle with particular attention to proper tire inflation, brakes grabbing or pulling, oil and lubrication specifications, tune-ups, and required vehicle service schedule.
- Adhere to speed limits when driving, lower speeds not only reduce air resistance but are also safer.

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## Chapter 2

# Traffic Controls

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This chapter implements North Atlantic Treaty Organization (NATO) publication AMovP-1(A) (Road Movements and Movement Control). (NATO Unclassified) (see Appendix A)

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2-1. Except when specifically directed otherwise, military and civilian operators must comply with all civil traffic laws and ordinances. Civilian traffic police have full authority for regulating all traffic in towns and on public roads. Military police (MP) have full authority over all military vehicles wherever they are located.

## TRAFFIC CONTROLLERS

2-2. Civilian authorities and MP normally control traffic using a system of signs, signals, devices, and markings. When an authorized official (such as civilian police, traffic control personnel, flagmen, MP, and so on) is directing traffic, obey his/her signals rather than traffic lights or signs. Traffic officials usually signal traffic to stop by holding up his/her hands, palms toward traffic and by giving a long blast on their whistle. To start traffic, he/she motions with his/her hand and arm toward the direction of travel, giving two initial short blasts on his/her whistle. He/She uses three blasts or a series of short blasts on his/her whistle to warn any motorists or pedestrians of unusual or dangerous conditions, approaching emergency, and so forth. At night, visual signals may be given with a flashlight or lighted traffic baton or wand. Flagmen at railroad crossings or road construction sites use flags or color-coded sign paddles. When driving in host nations (HNs), operators need to understand the visual signals used by traffic control personnel (see Appendix B).

## SIGNALS

2-3. You must be familiar with the following three categories of signals commonly used to control traffic. You must know—

- The meaning and proper use of hand signals common to military and civilian drivers.
- The hand signals used by police to control traffic to include HN police.
- The signals used to control military vehicles in convoy (see Appendix B).

## SIGNALING DISTANCE

2-4. Always signal in advance of making a turn or stopping. If you do not signal until you have already started to turn or stop, you might as well not signal. Usually by that time, it is too late for other drivers to take whatever action may be necessary. The law usually requires you to signal at least 100 feet in advance (this is the minimum distance). The faster you are going, the farther in advance you should signal. Your signaling distance should never be less than the distance required for stopping or slowing down sufficiently to make a turn. For example, a signal for a stop when you are traveling 40 miles per hour (MPH) should never be given less than 140 feet in advance of the stop. When driving on the open highway, a good rule is to give all signals at least 300 feet in advance.

## HAND SIGNALS

2-5. Hand signals are given using the left hand and arm out the driver's window of left-hand drive vehicles (see Figure 2-1). The signal for stopping and slowing down is given by pointing the arm and hand down, palm back. The left turn signal is given by pointing the arm and hand straight out, palm forward. The right turn signal is given by pointing the arm and hand straight up from the elbow, palm forward.

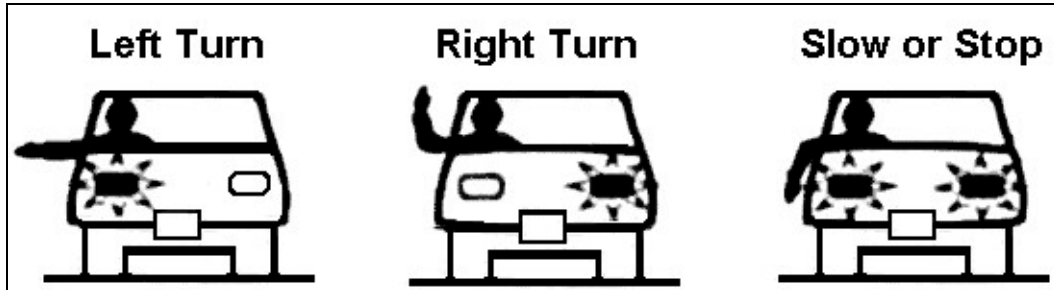


Figure 2-1. Driver Hand Signals

2-6. Make your signals clearly and pay attention to your “body” language to ensure that you do not inadvertently give misleading signals to other drivers. For example, some drivers rest their elbows on the windowsill and idly tap the top of the vehicle with their fingers. To drivers behind them, this may look like a right-turn signal. Other drivers let their hands trail out the window holding a cigarette. If you do this, the driver behind you may think you are slowing down or stopping. If the vehicle you are driving has no turn signals and the cargo bed is wider than the cab, stretch your arm out as far as possible when signaling to make sure your signal is visible to the driver behind you. When giving a hand signal for a turn, finish signaling before you actually make the turn so that you can have both hands on the wheel.

## SIGNAL LIGHTS

2-7. Almost all vehicles have at least one signal light (the brake light). The brake light lights up when the operator presses the brake pedal signaling that the operator is slowing down or coming to a complete stop. However, the brake light will not always replace the use of the hand signal for stopping or slowing down for several reasons:

- Many times operators slow down without using their brakes.
- A good operator may only start using their brakes in the last feet of travel.
- The brake light is not always visible to all motorists in the area.

## TURN SIGNALS

2-8. These flashing light signals are usually legal substitutes for hand signals, but there are times when they are difficult to see. During the day, sunlight reflections on the lenses can make it difficult to see if the signals are flashing or not. However, in the evening, a turn signal is more likely to be seen over a hand signal. Ensuring that the signal can be clearly seen is the important factor. Therefore, the method of signaling should depend on light conditions and legal requirements. A good rule is to use hand and turn signals during daylight hours (especially when the sun is low) and to use turn signals at night.

## EMERGENCY FLASHERS

2-9. Four-way emergency flashers are used to warn motorists that a vehicle has come to a stop due to an emergency in a traffic lane or on the shoulder adjacent to a traffic lane. When a vehicle halts in an authorized space, emergency flashers are not normally used. Four-way emergency flashers are not a substitute for warning devices contained in the highway warning kit.

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**FOR AIR FORCE ONLY:** Vehicles operating on the flight line (such as maintenance servicing vehicles) may use four-way flashers where authorized instead of non-revolving, pulsating hazard warning lights prescribed by Technical Order (TO) 36-1-191.

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## HORN

2-10. The vehicle's horn is the best means an operator has of alerting other drivers of their presence. If a vehicle coming from the opposite direction suddenly turns into your lane, apply the brakes and blow the horn at the same time. The sound of the horn is used as an aid in attempting to avoid a collision. Also use the horn in the following situations:

- Whenever entering traffic from a blind alley or driveway.
- When approaching and coming around curves on mountainous roads where visibility is limited.
- Immediately before backing.

2-11. Since the only lawful use of the horn is to serve as a reasonable warning device, use the horn courteously. Do not use it to greet friends or express anger at another driver's errors. Pressing the horn lightly, once or twice, will normally get the attention of another driver or pedestrian, a long blast is usually unnecessary. Abide by overseas HN traffic laws restricting use of horns in built up urban areas.

## OTHER SIGNALS

2-12. In addition to hand and signal lights, drivers constantly signal to each other merely by the position of their vehicles on the road. When a driver is seen moving towards the center of the road, it is assumed that he/she is about to turn left or pull out to pass. When seen moving to the right, it is assumed that he/she is going to turn right or stop.

2-13. Whether you realize it or not, you are guided by the position signaling of other drivers. Misleading position signals are as dangerous as misleading hand signals. The driver who pulls to the right before turning left is inviting an accident because he/she is, in effect, misinforming other drivers of his/her intentions.

## TRAFFIC SIGNALS

2-14. No traffic signal is more important than the traffic light (see Figure 2-2). Operators using common sense usually do not run through red lights. However, always be alert of the few drivers that will run through red lights. If a light turns to yellow, prepare to stop unless braking will cause the vehicle to skid. One practice that often results in an accident is when a driver, who is stopped at a red light, watches the green light on the side of the traffic, and as soon as it turns to yellow, starts to move into the intersection without waiting for the traffic coming to a complete stop at the red light.

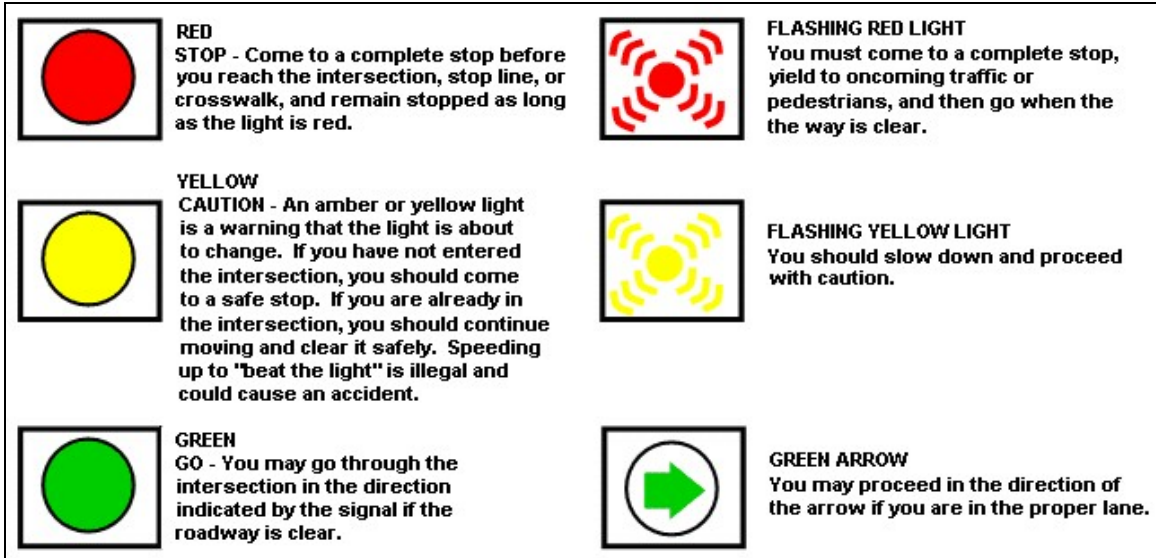


Figure 2-2. Traffic Signals

## TRAFFIC SIGNS

2-15. The United States (US) is moving toward an international system of traffic signs that emphasizes pictures and symbols rather than written messages. Symbolic signs are not entirely new and have several advantages over word messages. Symbols provide an operator with instant communication since the operator does not have to read the sign which help overcome language barriers. Familiarity with the symbolic signs will help military operators operating in overseas areas. On signs that contain messages in words, color and shape provide the operator with information at first glance before he/she is close enough to read the words (see Figure 2-3 through Figure 2-6).

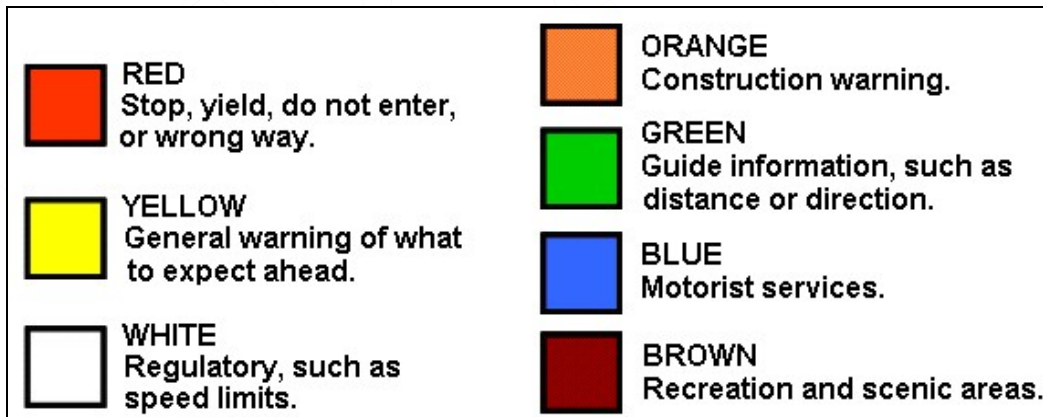


Figure 2-3. Use of Colors in Signs

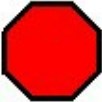






 <p><b>OCTAGON: STOP</b> The octagonal (eight-sided) shape always means stop. You must come to a complete stop at the sign, stop line, pedestrian crosswalk, or curb before entering an intersection.</p>	 <p><b>PENTAGON: SCHOOL AND SCHOOL CROSSING</b> The pentagon (five-sided) shape marks school zones and warns you about school crossings.</p>
 <p><b>TRIANGLE: YIELD</b> Slow down--or stop if necessary--and give the right of way to vehicles crossing your path.</p>	 <p><b>CROSSBUCK AND CIRCLE: RAILROAD CROSSING</b> Both of these signs mean you are approaching a railroad crossing and should slow down, look and listen for trains.</p>
 <p><b>DIAMOND: WARNING</b> These signs warn you of special conditions or hazards ahead. You may have to slow down, so be ready.</p>	
 <p><b>RECTANGLE: REGULATORY OR GUIDE</b> Vertical signs are generally used to give instructions or tell you the law. In the horizontal position, the signs may give directions or information.</p>	

Figure 2-4. Use of Shapes in Signs



The figure displays nine regulatory traffic signs arranged in two rows. The top row contains: a red octagonal STOP sign; a red inverted triangular YIELD sign; a white rectangular SPEED LIMIT 55 sign; a white rectangular DO NOT ENTER sign with a red border and a horizontal red bar; and a white rectangular NO U TURN sign with a red border and a red circle with a slash over a U-turn arrow. The bottom row contains: a white rectangular NO LEFT TURN sign with a red border and a red circle with a slash over a left-turn arrow; a yellow diamond-shaped BIKE XING sign with a black bicycle symbol; a white rectangular KEEP RIGHT sign with a black arrow curving to the right; and a white rectangular NO BICYCLES sign with a red border and a red circle with a slash over a black bicycle symbol.

Figure 2-5. Regulatory Signs

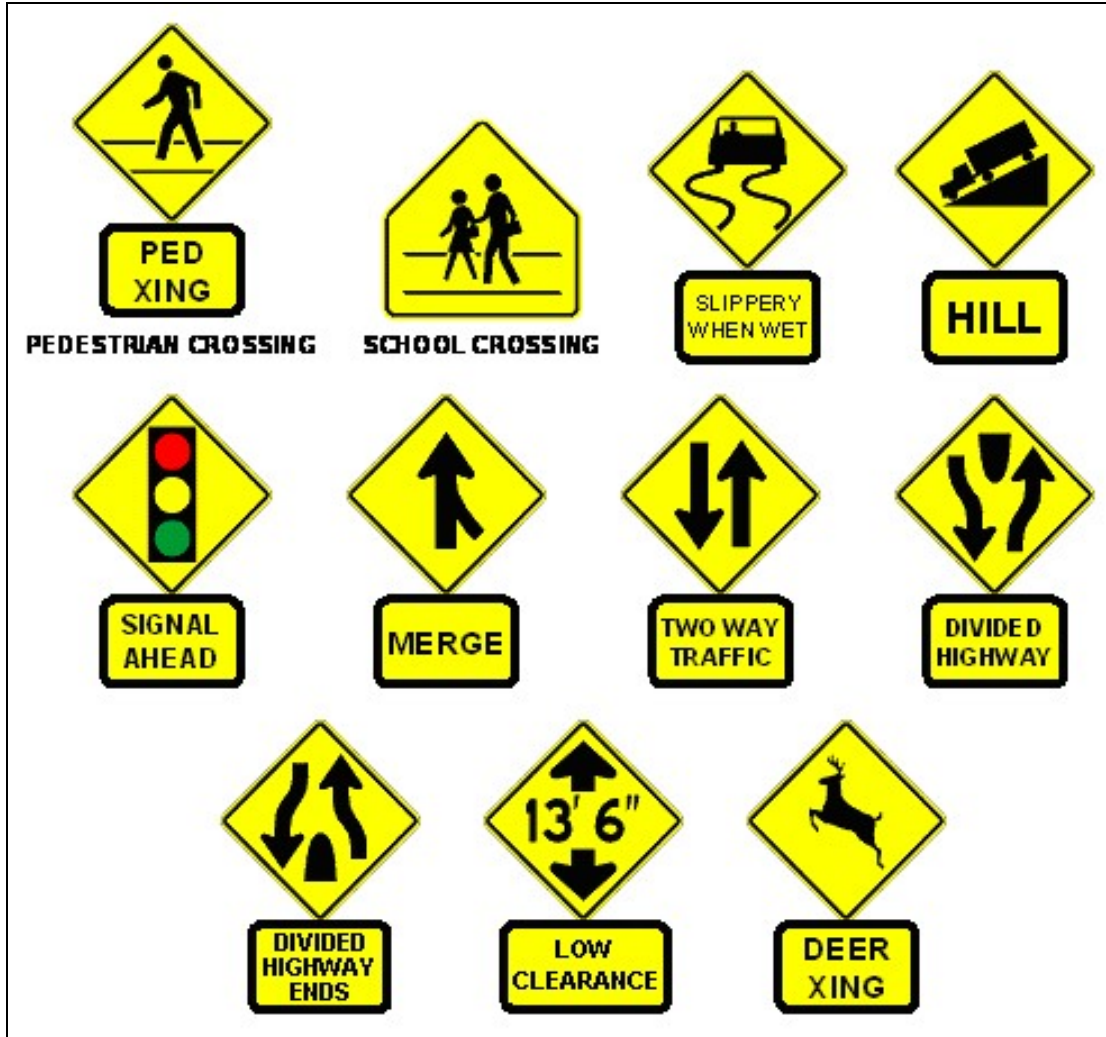


Figure 2-6. Warning Signs

## INTERNATIONAL TRAFFIC SIGNS

2-16. This system of road signs was agreed upon at the United Nations Conference on Road and Motor Transport in September 1949. It was the United Nations (UN) goal to ensure safety and to facilitate international road traffic by adopting a uniform system of road signaling. Although these signs are not military, all military personnel should be familiar with them since they are used in most overseas areas. Dimensions of signs are standardized in each country to ensure maximum uniformity (see Appendix B).

## INTERNATIONAL MILITARY ROUTE SIGNS IN NATO COUNTRIES

2-17. NATO countries have standardized road signs. These signs are shown and explained in Appendix B.

## PAVEMENT MARKINGS

2-18. Pavement markings are used to regulate the flow of traffic, as well as guide and warn operators of possible approaching hazards. Markings may be either yellow or white and used alone or in combination with each other, giving a different meaning. Yellow centerlines indicate that there is two-way traffic flowing in opposite directions. White lines separate lanes of traffic going in the same direction.

2-19. Pavement markings are widely used to control the center lane of traffic (see Figure 2-7). These markings may be used to indicate the following:

- The middle of the road.
- No passing and passing zones by using a solid line for a no passing zone and a broken line for a passing zone.
- Crosswalks, reduced speed zones, school zones, and approaches to railroad crossings.

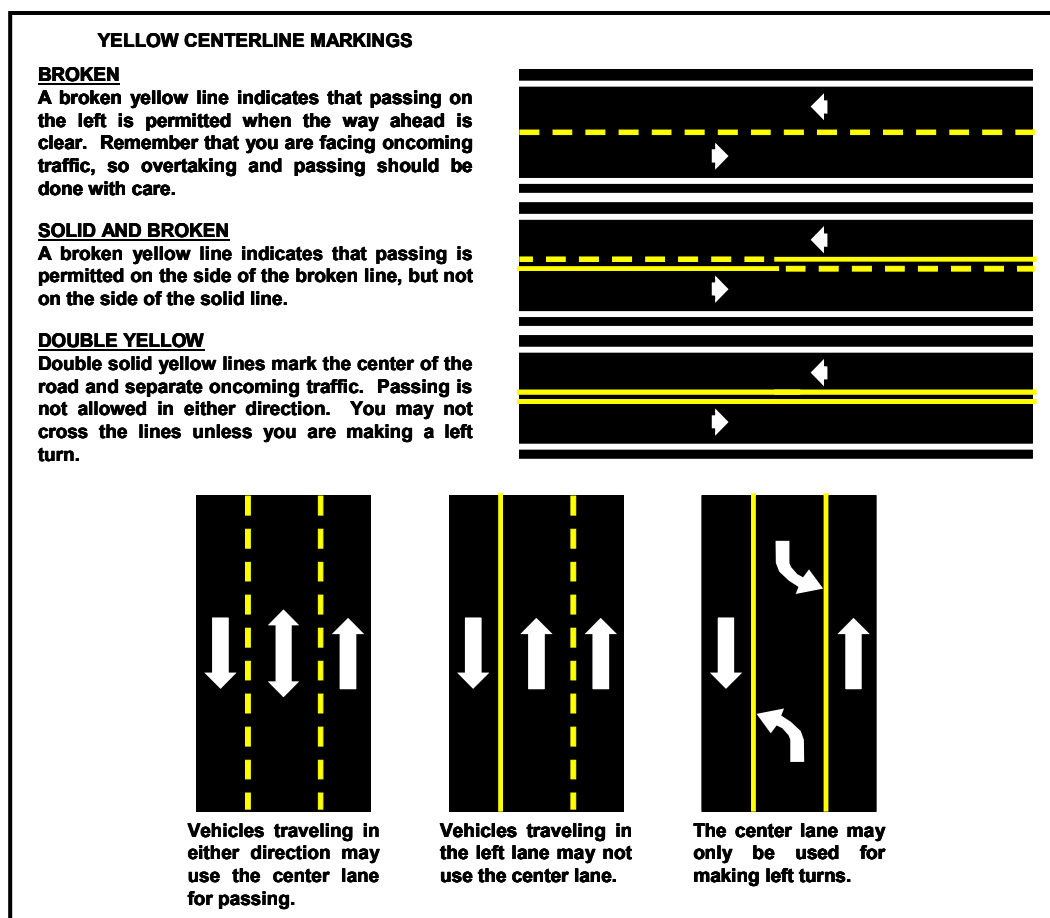


Figure 2-7. Pavement Markings

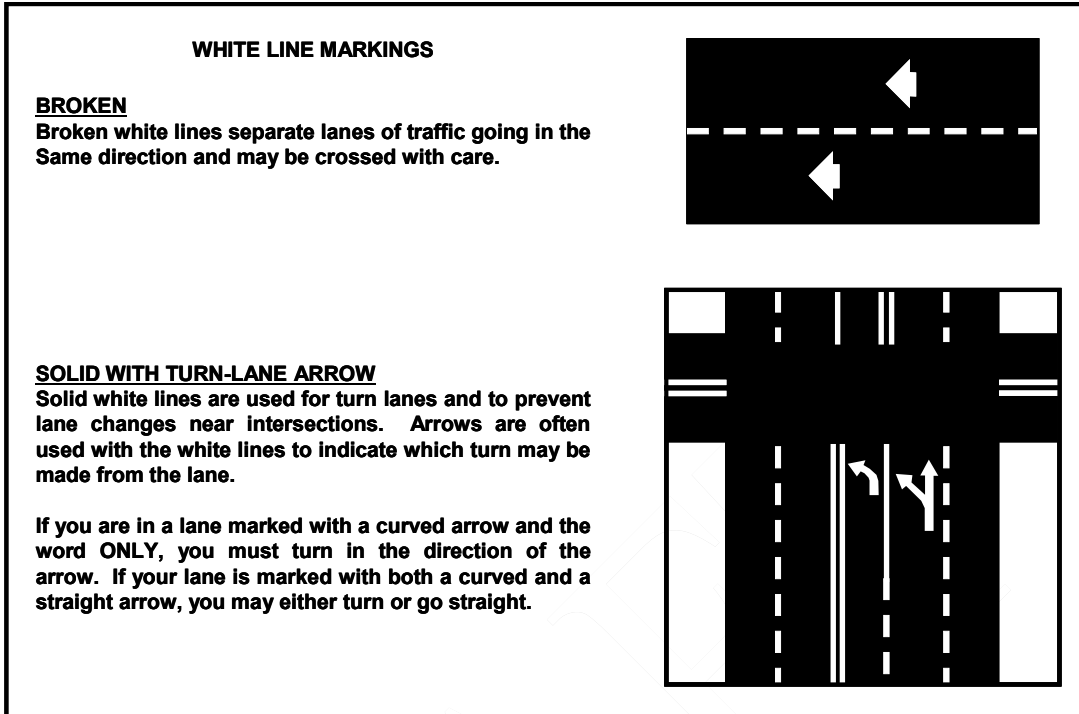


Figure 2-7. Pavement Markings (continued)



## Chapter 3

# Basic Operating Practices and Maneuvers

3-1. The objective of training a military operator is to teach him/her how to perform the job efficiently with maximum safety, comfort, and economy. Good driving habits are attained through constant practice. During daily driving, review the techniques discussed below. Test occasionally to keep information fresh. Avoid slipping into bad, perhaps dangerous habits.

### DRIVING PRACTICES

3-2. During daily driving, following these routine general practices:

- Always sit in an erect, comfortable position with shoulders parallel to the back of the driver's seat.
- Adjust the seat, if necessary, to easily manipulate the vehicle controls and have a clear view to the front.
- Adjust side and rearview mirrors for unobstructed views.
- Fasten shoulder and seat belts.
- Lock doors, if applicable.

3-3. An operator should be ready at all times for a complete, controlled turn of the wheel in a fraction of a second. Therefore, the position of the hands on the steering wheel is especially important for vehicle control, particularly in emergencies. To have more control of the wheel, follow these general practices:

- Place hands on the steering wheel at the 8 o'clock and 4 o'clock position.
- Hold the steering wheel by the rim of the wheel, not the spokes.
- Hold the steering wheel with fingers and thumbs.
- Maintain a firm, but comfortable grip.
- Remove hands from the wheel only when signaling, adjusting controls, or performing other acts essential to driving.

3-4. Before putting the vehicle into motion, carefully check the immediate front and rear of the vehicle to ensure there are no children or objects located around the vehicle that may be difficult to see. Also ensure that all mirrors are adjusted and that you have fastened your seatbelt.

3-5. Try to anticipate future situations. Continually glance far ahead and be prepared for other driver errors or unsafe maneuvers. Keep a close watch at all times on conditions behind the vehicle by regularly glancing in the rearview mirrors. Anticipation and good judgment can preclude a large percentage of emergency situations by driving defensively.

### STARTING

3-6. Instructions on starting manual and automatic shift vehicles are found in Chapter 16. However, the following points are given on specific starting conditions.

### ON HILLS

3-7. When starting the vehicle on an upgrade, engage the parking brake to keep the vehicle from rolling backward. Keep the parking brake on while shifting into low gear and begin to release the clutch pedal slowly. When the vehicle begins to pull against the brake, release the brake slowly. This

will allow the operator to start the vehicle without the danger of rolling back and losing control. Although it may not be necessary to use the parking brake in vehicles equipped with automatic transmission or special devices that prevent rolling back on hills, it is a safety precaution that an operator should take.

**ON SLIPPERY SURFACES**

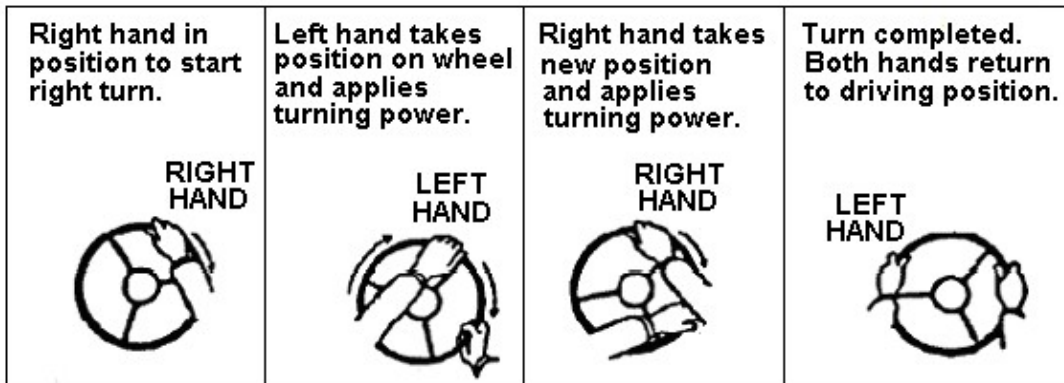
3-8. If starting a vehicle on a slippery surface (such as ice, sand, loose dirt, or so forth) use second or a higher gear instead of low gear. Feed the gas and release the clutch pedal very slowly to avoid spinning the rear wheels (manual transmission only).

**STEERING AND TURNING**

3-9. The best and safest position of the hands on the steering wheel is one hand on each side of the wheel a little below the center (the 8 o'clock and 4 o'clock position). Two hands are necessary for beginners and for experienced operators. The grip on the wheel should be firm, but not tight.

3-10. When turning a corner or making any other sharp turn, use the hand-over-hand steering method (see Figure 3-1). If turning to the right, begin by placing the right hand near the top of the wheel and pull the wheel down to the right. As the right hand nears the bottom of the circle, let the left hand take over, starting at a position on the left of the wheel, a little below the top. As the left hand nears the bottom of the circle, again place the right hand at the top of the wheel to continue the turn, if necessary. When the turn is complete, release pressure on the steering wheel and the wheels should return to their normal straightforward position straightening the vehicle.

3-11. Do not turn sharply to change lanes. Light pressure on the steering wheel will allow the vehicle to drift gradually from one lane to another. Before changing lanes, first give a turn signal in the direction you are changing lanes and also to remember to look for traffic that may be approaching from the rear or vehicles in your blind spot.



**Figure 3-1. Hand-Over-Hand Steering Method**

**BRAKING AND STOPPING**

3-12. The proper use of brakes is one of the most important elements of good driving as well as one of the best indicators of driving capability. Your brakes are used in all stopping procedures, but they are seldom used alone. Emergency stops may be the exception for the professional operator, but being prepared for them should be routine.

3-13. The heavier a vehicle, the more work the brakes must do to stop it and the more heat they absorb. The brakes, tires, springs, and shock absorbers on heavy vehicles are designed to work best when the vehicle is fully loaded. Empty trucks require greater stopping distances because they have less traction and they can bounce and lock up the wheels.

3-14. Use these general procedures for braking:

- Release the accelerator pedal.
- Downshift within the operating range of the engine (revolutions per minute [RPM]) (if manual transmission).
- Press the brake pedal.
- As the vehicle begins to reduce speed, decrease brake pedal pressure.
- Stop smoothly by releasing the brake pressure gradually as the stopping rate increases.
- As the vehicle stops, push in the clutch pedal (manual transmission) and release the brake pedal.
- After stopping, shift to neutral and reapply the brake just enough to keep the vehicle stationary. Now release the clutch pedal (manual transmission).

## GROUND GUIDE SAFETY PROCEDURES

3-15. Ground guides must be trained in standard hand and arm signals and flashlight signals before guiding a wheeled vehicle. Hand and arm signals are the basic method used for ground guiding. Operators and ground guides will coordinate signals before vehicle movement. Examples of hand and arm signals are in Appendix B and Appendix C. Voice signals between a ground guide and operator can be misunderstood. Therefore, they should not be used except in an emergency.

3-16. Before a wheeled vehicle is started for movement, a member of the crew or the operator must walk completely around the vehicle to ensure no one or nothing is in danger from the vehicle's movement. At no time will ground guides walk backwards while guiding a vehicle.

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**FOR AIR FORCE ONLY:** Ground guides may walk backwards, but must first check to ensure there are no potential hazards that may cause the ground guide to slip, trip, or fall.

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### CAUTION

The ground guides should keep ten yards between themselves and the vehicle front, rear, and corners. They should never be directly in front of or behind the vehicle. Ground guides will not position themselves between the vehicle being guided and another object where an inadvertent engine surge or momentary loss of vehicle control could cause injury or death. Vehicle operators will immediately stop their vehicles if they lose sight of ground guides or notice that the guide is dangerously positioned between the vehicle and another object. Vehicle operators in such cases will secure their vehicle, dismount, and make an on-the-spot correction before continuing operations.

3-17. Use the procedure below when there is only one ground guide or when a ground guide is not available. The ground guide or the vehicle operator will dismount and walk completely around the vehicle to do the following:

- Verify clearance.
- Determine visual clear distance with a ground reference point from the cab of the vehicle.
- Mount the vehicle, sound the horn (if tactical situation allows), and back to the rear of the pre-selected ground reference point. Stop and repeat the process, as necessary, until the desired vehicle position is obtained.

3-18. Only one ground guide gives signals to the operator. Be sure that everyone involved (the operator and ground guides) understands who will give the signal and who will receive it before any movement is done. If sight between the operator and the ground guide making the signal is lost, the operator must stop the vehicle until the signal is again visible or the confusion is cleared up.

3-19. During movement within an assembly area, wheeled vehicles require ground guides when moving forward and when backing. Ground guides are also required when vehicles enter a field site operations area.

3-20. The best method to use at night to ground guide a vehicle into the area is to use a flashlight colored lens. Guides move forward to make sure the way is clear, turn around to face the vehicle, and give the proper signal with the flashlight. The operator moves the vehicle forward until the flashlight signal goes out. Then he/she stops the vehicle. This process is repeated as the vehicle is moved forward to its final stop.

3-21. Ground guides are required when wheeled vehicles are backed. However, the number of ground guides used is determined by visibility restrictions (cargo, darkness, and so forth). In a non-tactical situation, the horn will be sounded before any backing operation is done. Figure 3-2 shows where the ground guides will be positioned when moving vehicles forward and backwards.

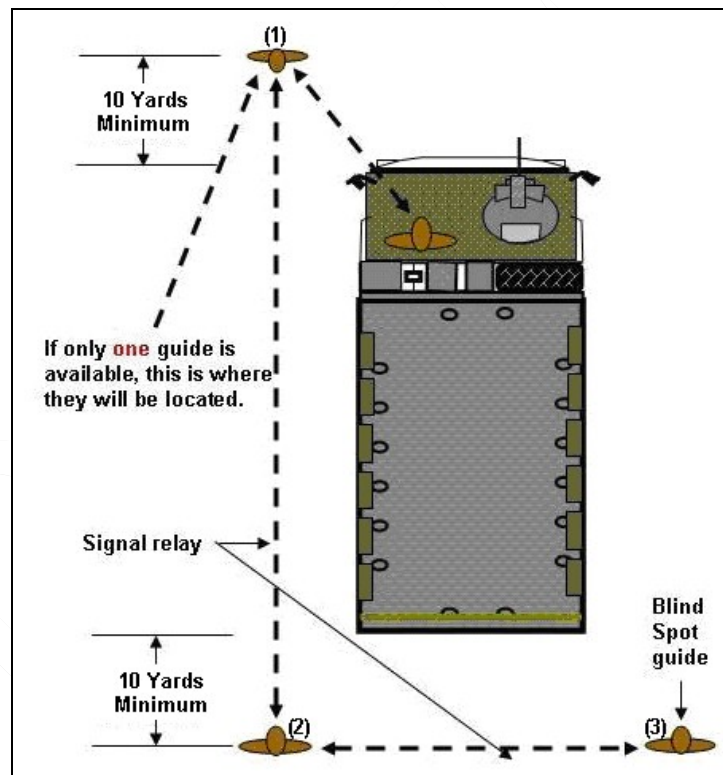


Figure 3-2. Recommended Ground Guide Positions

## BACKING

3-22. To turn while backing, turn the steering wheel in the same direction as if you were moving forward. To back to the right, turn the wheel to the right. To back to the left, turn the wheel to the left, and back slowly. In a vehicle with standard gears, speed cannot be safely controlled unless the clutch is used with the accelerator. Always come to a full stop before shifting into forward gear.

3-23. During backing when there are no ground guides available, the operator should use the vehicle mirrors and be accustomed to trusting the rearward view. Only through practice and experience will the operator be able to safely back a vehicle using mirrors as the guide. In tight quarters or low visibility, the operator may have to look out the side window to safely move the vehicle into position.

### WARNING

**NEVER open either door while the vehicle is in motion except when going over frozen ice. Backing is more dangerous than going forward. Visibility is limited and the vehicle is harder to control. Before backing even a short distance, make sure there are no people or objects behind the vehicle by physically walking around the area. NEVER back long distances, unless absolutely necessary. It is much safer to turn around and cover the distance going forward.**

## TURNING AROUND

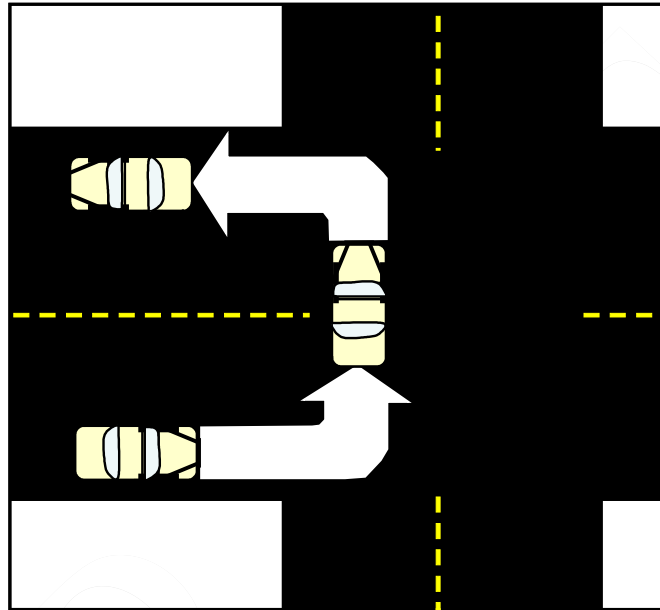
3-24. The safest and often quickest way to turn around is to drive around the block, making three right turns and a final left turn. This eliminates the problems of most left turns. However, in some cases (such as a dead-end street or other tight space) the vehicle may have to be turned completely around. Carefully follow these suggestions:

- Select a place where there is at least 500 feet of clear visibility in each direction.
- Do not attempt any turnaround near hills or curves or where visibility is limited.
- Be sure there are no signs prohibiting the turn.
- Be sure there is enough space to safely complete the turn.
- Check for vehicular and pedestrian traffic before and during the turn.

3-25. Remember that the responsibility for avoiding an accident rests with the operator. Neither of the following turns should be made on roads with heavy traffic.

- **U-turns.** U-turns are not legal everywhere, so be sure to look for prohibiting signs before making one. In cities and towns, U-turns are allowed at intersections only. To make a U-turn, follow these steps (see also Figure 3-3):
  - Move into the proper lane. On a two-lane street move as far right as possible. On four-lane and divided streets, move into the left-turn lane.
  - Check for traffic signal, stop, and then signal a left turn.
  - Check for oncoming traffic and for room to complete the turn; then make a sharp left turn.
  - Slowly finish the turn, positioning the vehicle in the far right lane. Straighten the wheels and proceed.
- **Road Turns.** If a U-turn cannot be made and no side road is available, use the road turn. There are two ways of making a road turn. The easiest is to come to a complete stop at the right curb or edge of the road, using the shoulder if available. After checking to see that the road is clear of traffic in both directions, start turning to the left. Turn the steering wheel as quickly as possible and as far to the left as it will go. Just before getting to the opposite curb or edge, reverse the steering wheel as far to the right as it will go. Now back up, keeping the steering wheel to the right. As the vehicle approaches the opposite curb or edge, turn the steering wheel back again to the left. By going forward and keeping the wheel to the left, now the vehicle should be clear of the curb or edge and

the turn can be completed. If the road is very narrow, the above steps may need to be repeated. A road turn can also be made by stopping close to the right curb or road edge and backing to the left. Just before getting to the opposite curb or edge, turn the wheel hard to the right and then go forward. When using this method, be careful to start far enough away from the right curb or edge so that the front wheels will not run into the curb or go off the road when starting to back to the left. When making these turns, it is not necessary to reverse the steering wheel just before stopping. This can be done after the vehicle has stopped. However, turning the wheels while still moving is easier and saves wear on the tires and steering mechanism.



**Figure 3-3. U-Turn**

3-26. In business districts, where traffic is usually heavy, no method of turning around may be practical or safe. In such places, the best way to reverse direction is to drive around the block.

Note: Use turn signals, four-way flashers, and if possible, a ground guide or road guard.

## PARKING

### PARALLEL PARKING

3-27. Parallel parking to the curb between vehicles is difficult for many, if not most, operators. If followed, this step-by-step method can make parallel parking easier (see Figure 3-4):

- Select a large enough space.
- Give the proper hand signal for stopping. Pull up alongside the vehicle parked in the space ahead of the vacant parking space. Your vehicle should be one to two feet away from that vehicle and the rear bumpers of both vehicles should be even.
- Start backing slowly. Turn the steering wheel as hard as possible to the right as soon as the vehicle starts moving. With the steering wheel all the way over to the right, continue backing until the vehicle is at a 45-degree angle to the curb. At this point the right front door will be opposite the rear bumper of the other vehicle.

- Straighten the front wheels. Go straight back a short distance until the right end of your front bumper is opposite the left end of the rear bumper of the other vehicle.
- Pause a moment. Now turn the steering wheel hard to the left and back slowly into the space, straightening the front wheels just as they approach the curb. If unable to get all the way into the space, usually the best thing to do is to drive all the way out, get the vehicle ahead of the space, and start again.
- Pull forward. Your vehicle should divide the parking space, leaving as much distance between your vehicle and the parked vehicles both ahead and to the rear. The front and rear wheels should be an equal distance from the curb and no more than a foot away.
- Turn off the engine. Before leaving the vehicle, set the parking brake and put the vehicle in reverse gear. If the vehicle has an automatic transmission, place the lever in the PARK position. When parking on a downgrade, if there is a curb, turn the wheels so that the front right tire is against the curb and chock the front of the rear wheels. When parking on an upgrade, turn the wheels left and away from the curb so that the back of the right front tire locks against the curb and chock the back of the rear wheels. Doing this will ensure that the vehicle does not roll. When parking uphill without a curb, use chocks behind the rear tires. When parking downhill without a curb, place chocks in front of the front tires (see Figure 3-5).
- The parking brake is the primary safety item. Only use chock blocks as a secondary safety item in conjunction with the parking brake. Using chock blocks alone is not enough or effective. The parking brake must be set at all times when the vehicle is parked.

3-28. Except on one-way streets, always park on the right side of the street. Remember to lock the ignition switch on vehicles of commercial design and remove the key. Turn off the master switch on tactical vehicles. Exceptions may be directed by local commanders.

## **DIAGONAL PARKING**

3-29. Diagonal or angle parking is easy enough for most operators. However, remember the following:

- Give the hand signal for stopping.
- Begin turning into the parking space from a position about five feet from the row of parked vehicles.
- Turn the steering wheel in the direction of the space and enter the space with the vehicle as straight as possible with the angle of the space.
- Use the parked vehicle or line marking on the left as a guide. However, be very careful to allow enough clearance between the moving vehicle and those parked on either side.

3-30. When coming out of a diagonal parking space, back very slowly until far enough to see traffic that may be coming and stop if necessary. Turn the steering wheel sharply when the left front wheel is opposite the rear bumper of the vehicle parked to the left. In turning too soon, it is possible to sideswipe the other vehicle while backing out.

## **IMPROPER PARKING**

3-31. Improper parking may inconvenience and endanger other drivers. Do not park—

- In violation of local traffic laws.
- In an intersection or in front of a driveway.
- In unauthorized parking places (such as handicap, fire lanes, and so forth).

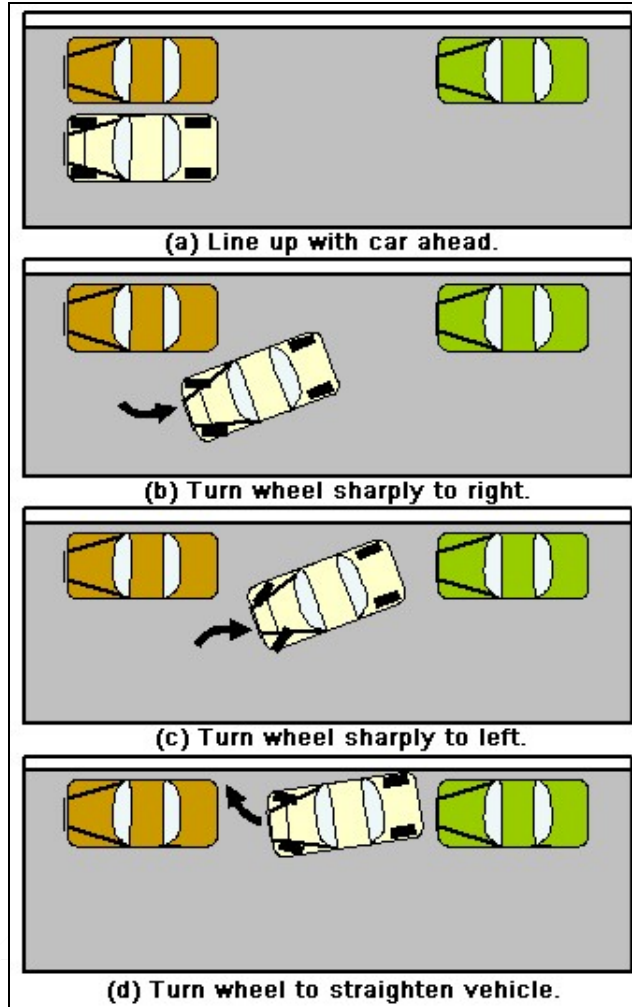


Figure 3-4. Parking Parallel to a Curb

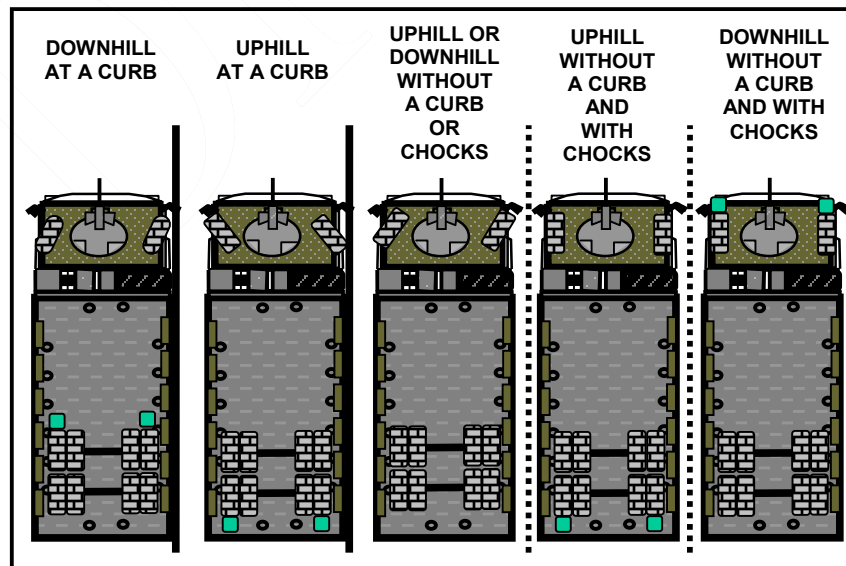


Figure 3-5. Parking on a Hill



## ELEMENTS OF SAFE DRIVING

3-32. The ability to mechanically operate a motor vehicle is not the only qualification of a safe operator. This skill must be augmented by a definite sense of personal responsibility and by knowledge of driving skills and unceasing respect for the laws of physics, physiology, and psychology as they affect the operator and their vehicle. Since safety is a command responsibility, it is the duty of commanders at all levels to ensure compliance with these non-statutory laws. Instruction for military operators should include an explanation of these elements and examples of the results of common violations.

## PHYSIOLOGICAL CONSIDERATIONS

3-33. To operate a vehicle with the maximum degree of safety, the operator must maintain top physical condition. Any deterioration in physical condition will reduce this degree of safety. Prospective operators having physical defects that will interfere with safe vehicle operation should be disqualified from the driver-training program. Instructors and supervisors should be constantly alert to evidence of any incapacitating disease (such as heart trouble, asthma, epilepsy, and so on) and of vision deficiencies not detected in physical examination and which may cause dangerously slow reaction time. Although temporary; the effects of fatigue, drugs, and alcohol seriously impair the physical condition of the operator and may be regarded as a contributing factor to accidents.

## PSYCHOLOGICAL CONSIDERATIONS

3-34. To drive properly and safely, an operator must have a proper attitude toward driving and must have emotional control. Faulty attitudes toward driving may often be detected by instructors and supervisory personnel. These attitudes may be eliminated to some degree through instruction and counseling. If the operator does not respond to corrective measures and continues to show evidence of faulty attitudes, it is advisable to drop them from the program.

3-35. Other psychological considerations include overconfidence, egotism, rationalization, and impatience. Overconfidence encourages the taking of unnecessary chances. Egotism disregards the rights of others. Rationalization prevents the operator from recognizing and correcting their own faults. Impatience leads to unsafe driving through refusal to adjust to driving conditions.

3-36. Safe driving requires a high degree of emotional control. Emotions (such as anger, fear, and grief) can affect the operator's ability to think clearly and react promptly. Emotional control may be developed in the operator through self-discipline. However, this requires their full cooperation and the will to overcome emotional instability. Avoid selecting operators who show evidence of unregulated emotion.

## EFFECT OF PHYSICAL LAWS

3-37. The laws of nature are constant and automatic. It is impossible to drive properly and safely without recognizing such natural forces as gravity, friction, centrifugal force, and kinetic energy. Instructions for the military operator should include, but not be limited to, the following:

- **Gravity.** Gravity is the force that pulls a body toward the center of the earth. It is measured in terms of weight. Without the force of gravity, the wheeled vehicle would be weightless and impossible to control by conventional means (starting, stopping, or steering). The force of gravity increases downhill speeds and stopping distances. It exerts a rearward pull on upgrades requiring increased power to the vehicle at rest, making it necessary to take precautions while parking. Level terrain is the exception rather than the rule. Therefore, the operator must always be aware of the power of gravity (see Figure 3-6).
- **Friction.** Friction is the resistance to motion caused by contact between two surfaces. It results from the interlocking of slight irregularities on surfaces in contact. When an attempt is made to slide one surface over another, the grip of the interlocked irregularities

resists the motion. The greater the contact pressure and the coarser the surfaces, the greater the friction. A heavy vehicle produces more road friction than a light one because there is greater contact pressure. More driving control is possible on a dry road than on an icy one because the dry surface is rougher. Although friction is responsible for many maintenance problems and necessitates the use of lubricants, without friction it would be impossible to get the vehicle in motion, control its direction, or stop it.

- **Kinetic Energy.** Kinetic energy is the energy of motion. It is the kind of energy that a body has because it is moving. Weight and speed determine the kinetic energy of a vehicle. The kinetic energy does not increase uniformly with speed, but with the square of the speed. In other words, if the speed is doubled, the kinetic energy becomes four times as great. A vehicle cannot be stopped until all of its kinetic energy is dissipated. The only safe way this can be done is by the controlled use of friction (proper braking) and engine compression. The speed with which the kinetic energy is dissipated has a direct relation with the force of impact when a moving vehicle strikes another object.
- **Centrifugal Force.** Centrifugal force is that force which, acting upon an object traveling in a curve, tends to force it from the curved path into a straight one. The magnitude of centrifugal force depends upon the degree of the curve and the weight and speed of the object. In driving, road curvature and vehicle weight are fixed. The only variable is speed. The following example illustrates the effect of speed. An 11,000-pound vehicle, making a turn of 500-foot radius at 20 MPH has to overcome centrifugal force of only about 583 pounds. At 30 MPH, the force is increased to 1,312 pounds. At 60 MPH, it is over 3,644 pounds (six times as great as at 20 MPH). The vehicle is prevented from skidding off the road by friction. If the wheels hit a patch of ice or water, friction may be reduced to the point where it cannot hold the vehicle against centrifugal force. If the vehicle enters the curve at too great a speed, centrifugal force will overcome friction even if the road is dry and free of ice. Whenever centrifugal force is greater than friction, the vehicle will skid. Centrifugal force also tends to tip over large vehicles on curves. This tendency is caused by loss of tire-road friction holding the tires on the road on the inside of the curve while centrifugal force pulls the upper part of the vehicle toward the outside of the curve.



**Figure 3-6. Gravity Increases Downhill Speed**

## **SPEED CONTROL**

3-38. Driving at a high rate of speed is more likely to cause an accident than any other driving infraction. A high speed driving accident is also more likely to cause a fatality. Military regulations and civilian laws govern speed. The most important and common sense rule is “NO PERSON SHALL DRIVE A VEHICLE AT A SPEED GREATER THAN IS REASONABLE AND PRUDENT UNDER THE EXISTING CONDITIONS”. However, conditions are constantly changing and it may be necessary to drive slower than the posted speed limit.

3-39. Although many improvements have been made in safety equipment on vehicles, the most important safety factor in any vehicle is the control the operator has over the vehicle. The faster the vehicle goes, the less control the operator has over the vehicle. This loss of control increases the chances of being in an accident with fatalities. Accident statistics show that speed is a factor in one-fifth of all accidents and in almost half of the fatal accidents. Speed affects all of the mechanics of your driving. It affects your ability to turn, pass, slow down, and stop.

## **STOPPING**

3-40. The following factors affect your ability to bring your vehicle to a stop:

- Type and condition of road surface (such as concrete, asphalt, dirt, or gravel).
- Foreign material on the road (such as ice, snow, rain, leaves, or mud).
- Road configuration (such as uphill or downhill, straight, curve, high crown, or dip).
- Tire condition (such as type and condition of tread and tire inflation).
- Brakes (such as type and state of repair and adjustment).

3-41. The distance required to stop a vehicle in an emergency, at any speed, depends on the following:

- Driver perception time.
- Driver reaction time.
- Vehicle stop time.

During driver perception time and driver reaction time, the vehicle slows down very little because the brakes have not yet been applied.

## **PERCEPTION DISTANCE**

3-42. Perception distance is that distance traveled between the time a dangerous situation is first seen by the driver and the time he/she actually recognizes it as being dangerous. This time varies widely in different situations. The distance traveled will vary with the speed of the vehicle and the individual mental response of the driver.

## **REACTION DISTANCE**

3-43. Reaction distance is the distance traveled by a vehicle between the times the driver determines the preventive action to be taken and actually sets the vehicle controls in motion. In stopping, it would include the time required to move the foot from the accelerator to the brake pedal. Some emergencies require complex reactions involving decisions to turn, increase speed, or stop. These require increased time for the operator to decide how to react.

## **BRAKING DISTANCE**

3-44. Ability to slow down depends on the following:

- How hard and steadily the operator presses the brake pedal.
- How efficient the brakes are compared to the weight of the vehicle and its load.
- How slippery is the road surface.

Most vehicles can be stopped on a dry road surface within the distance required by state laws. However; snow, ice, rain, and gravel reduce the vehicle's stopping ability and increases the distance necessary to bring the vehicle to a complete stop.

3-45. Vehicles equipped with air brakes take additional time to stop because it takes the air time to travel through the system to engage the brakes. This is called brake lag. The distance the vehicle travels during the brake lag is called brake lag distance.

## **AVOIDING COLLISIONS**

3-46. Many collisions can be avoided by simply slowing down. Even if it is too late to stop or slow down, an operator may often avoid collisions by swerving to one side. It is normally safer to swerve to the right than to the left. It is also better to run off the road to the right than to collide head on with an oncoming vehicle. When swerving a speeding vehicle, there is the risk of flipping the vehicle over. The faster a vehicle is going the more distance it takes to turn safely from a straight path.

## **GOOD DRIVING PRACTICES AND MANEUVERS**

3-47. Rules of the road are standardized throughout the United States (US) to promote highway safety. However, they may be modified by local laws and ordinances or by appropriate civil or military authority. Such modifications are normally indicated by traffic control personnel or by signs or markings. Operators are informed of applicable rules and variations when operating a vehicle outside the continental United States (OCONUS).

## **GENERAL RULES OF THE ROAD**

3-48. The following are the general rules of the road for all operators:

- Operate vehicles on the right of the highway, giving approaching traffic at least half of the road, unless conditions or directions indicate otherwise.
- When overtaking and passing other vehicles, pass to the left and remain on the left until safely clear of the overtaken vehicle. However, DO NOT overtake and pass another vehicle unless the left side of the road is clearly visible and free of oncoming traffic and pavement markings indicate that you are in a passing zone.
- Ensure that there is sufficient distance to pass and safely return to the right lane without coming within 100 feet of an approaching vehicle.
- Passing on the right is permitted when the front vehicle has signaled, slowed down, and is making a left turn. Be cautious because the turning vehicle may block views for the passing vehicle and the driver of an oncoming vehicle.
- Passing on the right is also permitted while driving on a street or highway designed for two or more lanes of traffic in both directions or on a one-way street with at least two lanes. Under such conditions, keep movement from one lane to another to the minimum.
- When changing lanes on multi-lane streets or highways, always use the proper turning signal and ensure that such movement can be made safely and does not interfere with the movement of traffic in other lanes.
- Passing on the right is not permitted when a vehicle must drive off the pavement or the main portion of the roadway to get around another vehicle.

- DO NOT start, stop, or turn a vehicle from its course on the highway without ensuring that making such a change is reasonably safe and by giving adequate warning to other drivers. Make a visual survey of the traffic that may be affected by this action.
- Give clear warning signals that are standard, appropriate for the operator's intentions, and timed to give reasonable warning.
- A proper signal of intent to turn right or left will be given continuously during not less than the last 100 feet traveled by the vehicle before turning. To turn right at an intersection, approach the turn at the extreme right of the right-hand lane and make the turn as close to the right as practicable. To turn left, approach the turn to the right of, and close to, the center line, leaving the intersection to the right of the centerline of the entered road. An exception is a one-way road, which will be entered to the left of the centerline. A turn to reverse the direction of a vehicle will not be made unless a vehicle approaching from either direction can be seen from a distance of 500 feet.
- Observe the rules of right-of-way with judgment and courtesy. The safe operator gives the right-of-way rather than taking it. In general, when two vehicles enter an intersection at or about the same time, the vehicle on the left yields the right-of-way to the vehicle on the right. Always yield right-of-way to the first vehicle arriving at an intersection. When entering a through highway from a secondary road, give the right-of-way to traffic on the main thoroughfare.
- Fire, police, and emergency vehicles have the right-of-way over all other vehicles. However, all emergency vehicles are required to be operated with due regard for life, property, and traffic laws. Obey directions given by traffic control personnel or signs regardless of conflict with the general rules quoted.
- Slower moving vehicles should stay in the right-hand lane.

3-49. Observed highway speeds, under normal conditions, vary somewhat from state to state. These speeds are generally posted on regulatory signs with warnings where reduction in speed is directed. Safe highway speeds are determined by analysis of traffic, highway design, and population densities. Posted speed indicates the results of such analysis under conditions of average traffic, dry pavement, and good visibility. At no time should vehicles be operated in excess of posted speed limits. Operator judgment should be consciously developed to determine speeds suitable to driving conditions. Safe driving requires constant adjustment to changing driving conditions. An operator will be trained to judge and maintain safe following distances to ensure adequate reaction time and stopping distances at any speed and under varying conditions.

## **DRIVING ON THE RIGHT**

3-50. On two-lane roads, the law requires you to drive on the right-hand side of the road. Driving on the left-hand side of the road is permitted only in certain situations (such as passing). The danger of ignoring this law is obvious. However, more than one-seventh of fatal accidents are the result of head-on and sideswipe collisions.

## **HANDLING CURVES**

3-51. Even though thousands of people are killed each year in vehicle collisions, more are killed in one-vehicle accidents. Many of these accidents occur on a curve when an operator (who is usually driving too fast) loses control of his/her vehicle, skids off the road, and careens into a telephone pole or his/her vehicle turns over and rolls down an embankment. To make a vehicle follow a curved path, force must be used to overcome its natural tendency to go straight. The natural tendency to continue in a straight path increases much more rapidly than the speed. At 60 MPH, it takes nine times as much force to keep a vehicle turning as it does at 20 MPH.

3-52. Effective steering depends on the traction between the road and the tires. Traction refers to the tendency of the rubber of the tire to stick to the road instead of slipping and sliding over it. The part of a tire in contact with the road at any one time is about the size of the sole of a shoe. Four small patches

of rubber are the only connection between the road and the vehicle. Whenever the tendency of the vehicle to travel in a straight line becomes too powerful for the traction holding the vehicle on the curve, the tires slide on the road and the vehicle starts to skid. The force represented by the natural tendency of the vehicle to follow a straight line is opposed by the force placed on the steering wheel to turn the vehicle. These opposing forces can cause the loss of control of the vehicle. Driving slowly into a curve is the only way to prevent skidding. Chapter 9 discusses what to do if the vehicle starts to skid.

3-53. When driving in a curve, do the following:

- When approaching a curve, slow down enough to keep the engine pulling and maintaining speed.
- Do not wait until in the curve to apply the brakes.
- If the brakes must be applied in a curve, be careful. Use a gentle pumping motion until it is safe to keep continuous pressure on the pedal.
- Start turning the wheels just before the point at which the road begins to turn.
- Once in a curve, stay to the right of the centerline and stay as close to the shoulder as possible. Do not cut into the lane of oncoming traffic to make the curve easier.
- Maintaining a moderate speed will make the curve easier to handle from the correct lane.
- If driving a vehicle with a standard transmission, do not engage clutch and “free wheel” into or around a curve. This may actually cause the vehicle speed to increase causing an out of control situation. Use of vehicle engine speed to control vehicle speed is important in maintaining control with this type of vehicle.

3-54. An upcoming curve cannot be judged by the previous curve. Roads with uniformly sharp or gentle curves are probably safer than roads with curves of varying degrees. However, on most roads, curves vary a good deal. Always assume that an unfamiliar curve is sharp.

## USING SELECTIVE VISION

3-55. Safe operators are completely aware of their surroundings. They know what is going on in the immediate vicinity of their vehicle and have scanned the areas far enough ahead of them that, if needed, they can react quickly to any possible dangers.

3-56. Most good operators look 12 to 15 seconds ahead. This means looking ahead the distance you will travel in 12 to 15 seconds. For example, at lower speeds the distance is about one block and at highway speeds the distance is about a quarter of a mile. By not looking ahead, an operator may cause an accident because of having to stop quickly or change lanes quickly. Good operators shift their attention back and forth, near and far.

3-57. Here are some hazards to be aware of when looking ahead:

- Turning vehicles or those entering the highway.
- Brake lights from slow moving vehicles.
- Hills, curves, or anything that might require slowing down or changing lanes.
- Paying attention to traffic signals and signs.
- Traffic signs which warn of road conditions where a change in speed is necessary.

## TURNING LEFT

3-58. Before making any turn, always signal at least 100 feet before the intersection. When making a left turn, ensure that traffic approaching from the right is visible). If there is a passenger in the front seat, lean forward to obtain a better view of traffic. Be sure there is enough space to turn left. Do the following when turning left (see also Figure 3-7):

- Signal the intent to turn and slow down.
- Start the turn only after the vehicle's rear clears the centerline.

- Be sure there is adequate distance to turn in front of traffic.
- Watch the vehicle's progress in the side mirrors.
- Steer the vehicle wide of the lane, if necessary.
- When the vehicle's wheels are into the lane, steer left to put the vehicle in the lane and straighten up.
- Always watch for oncoming traffic.
- Turn into the left lane when making a left turn.
- To turn left on multi-lane streets and highways, start from the left lane.
- If you are turning onto a highway, which has more than one lane in the direction you wish to travel, turn into the closest lane going in that direction.
- After the left turn is completed, cancel the signal.
- If you want to change to another lane, wait until you have safely completed your turn.

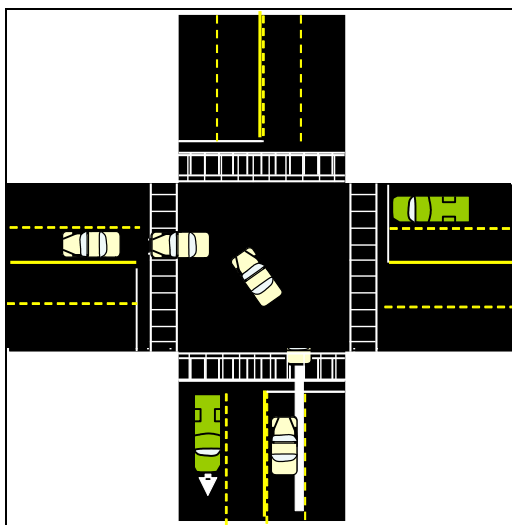


Figure 3-7. Making a Left-Hand Turn

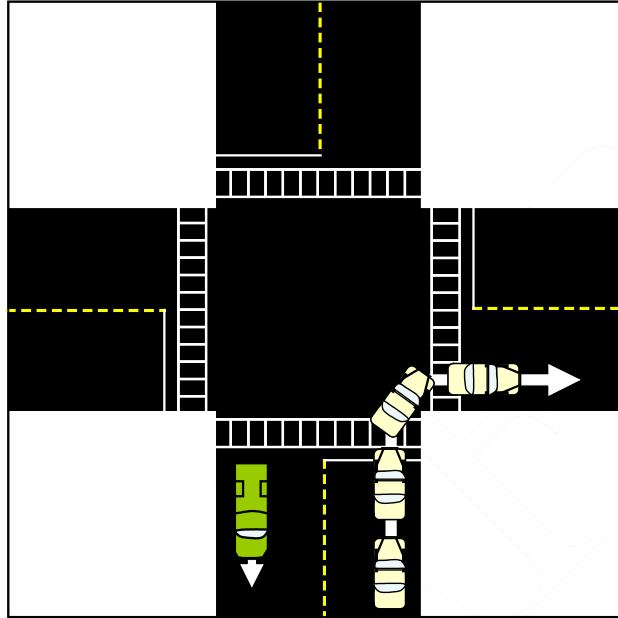
## TURNING RIGHT

3-59. Do the following when turning right (see also Figure 3-8):

- Ensure there is enough space to turn right.
- Signal the intent to turn and slow down gradually when approaching the turn.
- Be sure to let oncoming traffic clear before making the turn.
- Stay as close to the right edge of the road or street as possible.
- Never swerve to the left before turning right.
- Position the vehicle in the right-hand lane. Keep the vehicle's rear close to the curb. Do not turn wide to the left when starting the turn; a driver to the rear may assume a left turn is being made.
- Pull forward into the intersection past the right corner, ensuring the vehicle's rear clears the curb.
- Check the vehicle's progress using the right side mirrors.
- Turn into the right lane when making a right turn.
- To turn right on multi-lane streets and highways, start from the right lane.
- If it is necessary to swerve into the left lane or to enter the lane of oncoming traffic, be watchful for oncoming cars.

- After the right turn is completed, cancel the signal.
- If you want to change to another lane, wait until you have safely completed your turn.

If the vehicle is traveling at the correct rate of speed, a right or left turn should be made without swerving. If the tires squeal when turning, it is likely that the vehicle is traveling at a rate of speed that is unsafe to make the turn.



**Figure 3-8. Making a Right-Hand Turn**

## ABSTAINING FROM ALCOHOL AND OTHER DRUGS

3-60. Driving under the influence of alcohol is a factor in at least half of the fatal motor vehicle accidents in the United States. The smallest amount of alcohol is enough to impair an operator's judgment and reactionary time.

3-61. Alcohol is not the only drug that impairs driving ability. Medicines (such as barbiturates and antihistamines) may cause drowsiness. There are many over-the-counter drugs that may cause drowsiness. When uncertain about the effects of a particular medicine; before taking, check with your doctor or pharmacist. If he/she says that it may cause drowsiness, do not take it before driving. Staying alert is the key to staying alive.

3-62. Narcotics may dull the senses; induce profound sleep; or cause stupor, coma, or convulsions. Effects on the central nervous system include hilarity, carelessness, talkativeness, euphoria, distortion of sensation and perception, impairment of judgment and memory, distortion of emotional responsiveness, irritability, and confusion.

## RESTING

3-63. It is the operator's responsibility to inform his/her supervisor if they have experienced loss of sleep or feel unusually sleepy to the point that they feel their driving may be unsafe. The supervisor should then adjust the operator's duties accordingly. This does not excuse one from keeping physically capable of performing their duty. Repeated incidents will require a physical checkup and/or disciplinary action.



Note: Operators will be provided with at least 8 consecutive hours of rest during any 24-hour period. An operator will not drive more than 10 hours in a duty period (including rest and meal breaks). If more than 10 hours are needed to complete operations, commanders will assign to each vehicle an assistant operator who is qualified to operate the vehicle (see AR 385-10).

## **SAFE DISTANCES AND PASSING**

3-64. An operator who tailgates, does not allow enough time or distance to handle emergency situations. Rear end collisions often occur because an operator has not allowed for a safe stopping distance between their vehicle and the one in front of them. Safe passing requires that operators know not only how to pass, but also when and when not to pass.

## **MANAGING SPACE**

3-65. A safe operator will position his/her vehicle to ensure that there is ample space surrounding it. This space will give the operator time to think and act if something goes wrong. In order to have ample space, the operator must manage space. While this is true for all operators, it is especially important for those operators operating large vehicles. Larger vehicles occupy more space and require more space for stopping and turning.

3-66. Of all the space around your vehicle, the area ahead of the vehicle – the space you are driving into – is most important; in case you must suddenly stop. According to accident reports, trucks and buses most often run into the vehicle in front of them as a result of following too closely. Remember, a smaller vehicle can stop faster than a larger vehicle.

3-67. One good rule to keep when determining how much space should be kept in front of the vehicle is that at least one second for each 10 feet of vehicle length at speeds below 40 MPH. At greater speeds, you must add one second for safety. For example, the operator of a 40-foot vehicle traveling at a speed below 40 MPH should leave 4 seconds between himself/herself and the vehicle ahead; in a 60-foot vehicle, 6 seconds. If the 40-foot vehicle is moving faster than 40 MPH, 5 seconds would be needed; for the 60-foot vehicle, 7 seconds.

3-68. To calculate the distance/space between vehicles, wait until the vehicle ahead passes a shadow on the road, a pavement marking, or some other clear landmark. Then count off the seconds (one thousand and one, one thousand and two, and so on) until the same spot is reached. Compare the count with the rule of one second for every 10 feet of length. If driving a 40-foot truck and the count only reaches to 2 seconds, the vehicle is too close. Drop back a little and count again. Practice will enhance an operator's ability to determine the correct spacing necessary. Remember, when weather conditions have affected road conditions, more time and space is required to stop.

3-69. Specific following distances are determined for certain vehicles:

- When driving outside of cities and towns, a bus or truck should not travel closer than 200 feet behind another bus or truck.
- When a fire engine is answering an alarm, the minimum safe following distance is 500 feet.

Those violating the above distances can be prosecuted.

## NIGHT DRIVING

3-70. Headlights are a poor substitute for daylight. An operator should never drive so fast that they cannot stop within the distance able to be seen ahead with the headlights. When driving at night, take the follow precautions:

- At twilight, turn on the headlights, not just parking lights. Most states require that a driver use their headlights from sunset to sunrise in order to be more visible to others.
- Be aware that some other drivers may not have turned on their lights.
- Use low beams when driving in cities and towns, except on streets where there is no other lighting.
- Use low beams when following a vehicle.
- Use low beams when approaching traffic in oncoming lanes.
- Use high-beam headlights on highways only when it is safe and legal to do so (such as when no other vehicle is approaching).
- If the high beams of an oncoming car are not dimmed, avoid looking directly at the bright lights. Glance toward the side of the road; then quickly look ahead to determine the other vehicle's position.

## PASSING

3-71. Passing other vehicles is a part of driving. However, always pass with caution.

### SAFE PASSING

3-72. Safe passing depends primarily on knowing three things:

- When to pass.
- When not to pass.
- How to pass.

3-73. An operator cannot pass safely unless they can see far enough ahead to be sure that they can get back in line before they meet any traffic coming from the opposite direction. They must also be able to get back into line before meeting any traffic crossing or turning onto the road on which they are driving.

3-74. When passing a vehicle, the operator should give themselves sufficient distance between the right side of their vehicle and the left side of the other vehicle. The law in most localities requires a minimum clearance of two feet.

3-75. Start to pass from a safe following distance. Move over to the left and speed up quickly. Do not speed up directly behind a vehicle and then turn out suddenly, as this can interfere with the view of the road ahead. If the operator ahead slows down or stops, the operator of the passing vehicle may not have time to react causing a rear end collision. In trying to avoid such a collision, an operator may skid off the road, flip the vehicle, or cause an accident with another vehicle.

3-76. Passing is not complete until the operator of the passing vehicle has returned safely to their side of the road or in the correct lane of travel. If the operator of the vehicle being passed is forced to slow down as the passing vehicle returns to the lane of traffic, the other operator has not passed safely. Generally, it is safe to return to the right side of the road when the passed vehicle can be seen in the rearview mirror.

3-77. As a general rule, do not attempt to pass more than one vehicle at a time. Passing several vehicles increases the danger because it increases the time spent and distance covered while out of the traffic lane. If you come up behind a long line of vehicles, you can almost be sure that every driver is waiting for an opportunity to pass the slower moving vehicle. The safe and courteous thing to do is to

wait your turn. On the other hand, if you are next in line behind a slow-moving vehicle, it is discourteous to the drivers behind you not to pass when you have the opportunity.

## UNSAFE PASSING

3-78. The following are just some of the situations where passing is always dangerous and/or unlawful:

- On any curve or hill where visibility is less than 500 feet ahead.
- At intersections and railway crossings.
- Whenever there is a single or double solid line between lanes or when driver's side lane of a double line is solid.
- At crosswalks where a vehicle has stopped to allow a pedestrian to cross (see Figure 3-9).
- Whenever a stopped school bus has its red warning flashers on or the stop sign on the bus is extended.
- Whenever visibility is limited and it is impossible to see if the road is free of traffic far enough ahead to pass safely.

3-79. It is generally a good idea to pass at a speed at least 10 to 15 MPH faster than the speed of the vehicle being passed. However, remember that if the operator who is being passed is traveling just under the speed limit, passing may cause the operator of the passing vehicle to exceed the posted speed limit. If the speed limit is exceeded, it is not only unlawful but is also dangerous.

## Passing on the Right

3-80. Passing on the right may be dangerous and unlawful. The passing operator must avoid being in the other operator's blind spot and must be aware that the other operator may be intending to make move to the right, posing the real threat of an accident. However, there are three situations in which passing on the right are permissible and reasonably safe:

- If the highway has at least two lanes going in each direction.
- If all lanes of traffic move in the same direction (one-way street).
- If the vehicle that is being passed is in a left-turn lane.

## Passing on Three-Lane Highways

3-81. Passing on a three-lane highway demands extra caution. The center lane may be so marked that it is open for passing in both directions. Before passing, make sure that none of the vehicles coming from the opposite direction are moving out to pass. NEVER use the center lane to pass if the view of the road ahead is obstructed by a hill or curve.

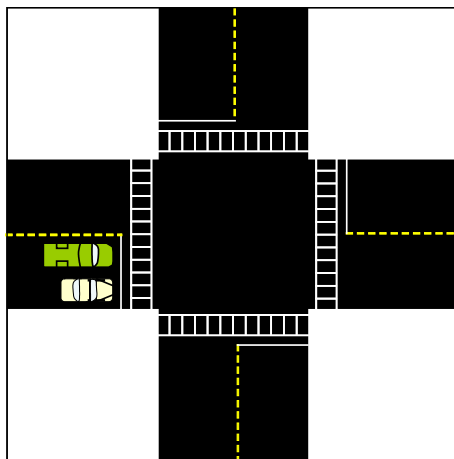


Figure 3-9. Proper Stopping Places at Crosswalks

## **SIGNALING**

3-82. When passing, do not just pull out and start around a vehicle. Look ahead and behind to be sure it is safe to pass. Alert the operators in the vehicles ahead and to the rear of the intention to pass using your turn signals since they may be getting ready to pass the vehicle ahead of them or to turn left.

## **BEING PASSED**

3-83. When being passed, the law requires that the driver of the vehicle being passed, help the driver of the passing vehicle to pass safely. When the driver of the passing vehicle signals the intention to pass, the driver being passed must give way to the right. Even if the vehicle being passed is on their side of the road, they should move over as close (as safety will permit) to the right-hand edge of the road. The driver being passed should not increase his/her speed. This action forces the passing driver to cover more distance and take more time to pass. It potentially exposes all drivers in the immediate vicinity to unnecessary danger.

3-84. When being passed, it is usually the safest to maintain a steady speed. This allows the passing driver to judge the passing distance with greater accuracy. Slowing down may be misleading causing the passing driver to overestimate their speed. If an attempt to pass becomes dangerous, slowing down and allowing the passing vehicle to get back into the proper lane in the least amount of time and distance may be safest for everyone concerned.

## **INTERSECTIONS**

3-85. The most dangerous place on a street or highway is an intersection. Many drivers and pedestrians have lost their lives at intersections. An intersection is any place where two or more roads join or cross each other. Whether a driver has the right-of-way or not, they are required to slow down when approaching all intersections. The following rules of the road are standard; however, state and local laws take precedence. The main question faced by a driver or pedestrian at an intersection is, "Who has the right-of-way?"

## **INTERSECTIONS WITHOUT TRAFFIC CONTROLS**

3-86. When approaching a primary road from a secondary road, the driver approaching the primary road must yield to traffic on that road. When entering an intersection with traffic, a driver must yield to that traffic regardless of the type of road.

3-87. The law states that when two vehicles enter an intersection from different highways at the same time, the driver on the left must yield to the driver on the right. The law does not give right-of-way to anyone; it only states who must yield it. Therefore, always be alert for those who fail to yield to avoid an accident.

## **INTERSECTIONS WITH TRAFFIC CONTROLS**

### **TRAFFIC LIGHTS**

3-88. Traffic lights greatly simplify right-of-way problems since the traffic on one road is stopped while the traffic on the other is permitted to proceed. At some intersections, a left turn may only be made when a special left-turn green light is showing. Sometimes the sign is in the form of a traffic light showing a green arrow. However, these rules may vary from state to state.

3-89. At other intersections where there are signs permitting, a right turn may be made on a red light. To turn right on a red light at one of these intersections requires the driver to be in the right-turn lane and to give a right-turn signal. The driver usually has the right-of-way over pedestrians who are crossing the street being turned onto because the light is red for them. It is unlawful to do anything that might endanger them, even if they refuse to yield the right-of-way.

## TRAFFIC SIGNS

3-90. A stop sign at an intersection signifies that a driver must come to a complete stop. A driver may not enter the intersection, whether to go straight through or to turn right or left, until the movement can be made safely. At intersections governed by yield signs, slow down to a speed reasonable for the conditions and yield the right-of-way.

3-91. When required to stop at an intersection where a line has been painted on the street indicating the place to stop, stop before the line. When the place to stop is not marked, stop close enough to the intersection so that any approaching traffic is visible. However, do not block a crosswalk. Pedestrians crossing at an intersection have the right-of-way over vehicles. Do not start again until the way is clear. Do not enter the intersection if there is traffic on the intersecting street that will reach the intersection before having cleared it.

3-92. Traffic lights and traffic signs are present at some intersections. Always obey traffic lights over traffic signs when the lights are in operation. However, as mentioned previously, a traffic officer's signal must be obeyed regardless of traffic lights or signs.

## URNS AT INTERSECTIONS

3-93. Before making any turn, signal at least 100 feet prior to the intersection. Always ensure that it is safe to turn or change lanes by visibly checking for other vehicles. When making a right turn at an intersection, stay as close as possible to the right edge of the road or street (see Figure 3-8). Never swerve to the left before turning right or swerve to the right before turning left (see Figure 3-7). Do the following when making a left turn:

- Prior to turning, move the vehicle to the lane nearest the centerline.
- Signal the intent to turn at least 100 feet prior to the turn.
- Gradually slow down when approaching the turn.
- Ensure that oncoming traffic is clear of the intersection before turning. In making the turn, enter the lane to the immediate right of the centerline of the street being entered.

3-94. Many drivers move their vehicle in the opposite direction before turning to make the turn easier. If the speed is right, the turn should be easily made without swerving. If the tires squeal when turning, it may mean that the tires are not inflated properly. However, the probable cause is that the turn is being made too fast.

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Note: Swerving in the opposite direction before making a turn is likely to mislead other drivers, possibly causing an accident.

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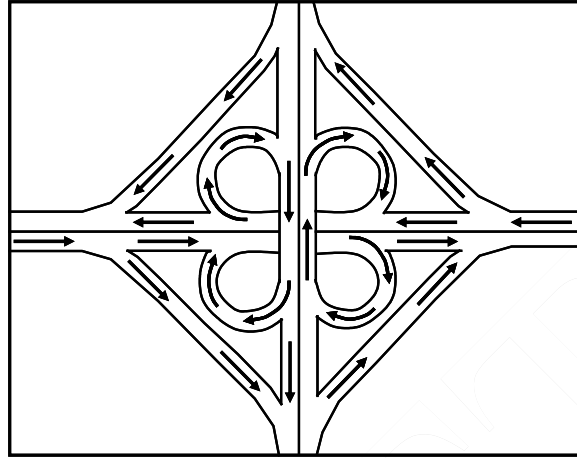
## SPECIAL INTERSECTIONS

3-95. On new highways, an increasing number of intersections are designed so that one road passes over the other instead of crossing it. To turn right or left at such intersections, it is necessary to use connecting roads to get onto the crossroads. These elevated intersections and their connecting roads are often confusing to drivers who are not used to them. Also, the method of making turns may vary from one to the other. Whenever approaching an intersection where one road passes over or under the other, slow down and pay attention to the signs that tell how to make the desired turn.

## CLOVERLEAF

3-96. Intersections, where the roads cross each other at different levels, may be designed in a number of ways. The most common type is the cloverleaf design (see Figure 3-10). To turn right, take a right turn before getting to the bridge that carries one road over the other. To turn left, take the right turn just after the bridge. This road will join the crossroad in a three-quarter circle at an ordinary

intersection. The advantages of the cloverleaf design and similar intersections are that the driver does not have to cross the path of other traffic to make a turn.



**Figure 3-10. A Cloverleaf Intersection**

## TRAFFIC CIRCLES

3-97. A rather common type of special intersection is the traffic circle. Some traffic circles have one lane, some have two lanes, and some have even more. Observe all posted lane signs before entering the traffic circle. Upon entering a traffic circle, all vehicles travel in the same direction. Simply continue around the circle in a counterclockwise direction until reaching the desired road or street. Leave the traffic circle by making a right turn. When traveling around the circle, use the inside lane if practicable. Be sure to get in the outside lane well before coming to the intended exit. Never attempt to make a right turn from the inside lane. Look and signal before turning or changing lanes. At traffic circles, the whole circle is considered an intersection. The vehicles already in the traffic circle have the right-of-way over those approaching the circle on the roads leading into it unless traffic signs indicate otherwise.

## RAILROAD CROSSINGS

3-98. Develop the following habits to move safely through a railroad crossing:

- Identify all warning signs, signals, and protective devices.
- Look both ways and listen for approaching trains before crossing.
- After a train has passed, be sure no other train is approaching from the other direction before starting across.
- Never stop on railroad tracks.
- Do not rely on mechanical equipment (flashing lights) to be sure the way is safe to cross.
- Never take familiar crossings for granted or assume that no train is coming.
- Be particularly alert for trains after dark when gates or flashing lights do not protect crossings.
- Stop the vehicle between 15 and 50 feet from a railroad crossing when transporting hazardous material (HAZMAT) or passengers (in a vehicle designed to transport 16 or more persons including the driver).
- When driving a bus, open the driver-side door to see or hear an approaching train.

**WARNING**

**NEVER attempt to bypass a closed railroad crossing to “beat the train”.**

**PRIVATE DRIVEWAYS**

3-99. When coming out of a private driveway, yield the right-of-way to all vehicles on the street or highway being entered. Stop for any pedestrians, bicyclists, and animals that may be on the sidewalk or about to cross the driveway.

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## Chapter 4

# Emergencies

4-1. There are some emergencies that are unavoidable. However, many times the operator is the cause of these emergencies because they are driving carelessly, driving too fast, not obeying traffic signals or signs, or failing to take proper care of their vehicles. The important thing is not how it happened, but how to get out of danger and how to avoid future emergencies. The techniques discussed here are not foolproof, but they will give an operator a better chance of avoiding a serious accident.

### BLOWOUTS

4-2. An operator seldom gets a warning before a blowout. There is usually a loud bang, and then a whooshing and flapping sound before the vehicle starts swerving to one side or swaying dangerously. An operator must use all their strength on the steering wheel to keep the vehicle moving straight ahead. Let off the gas but do not apply the brakes. Let the vehicle slow down gradually and then gently apply the brakes and get the vehicle under control. If in a passing lane when a blowout occurs, do not attempt to get to the highway shoulder until the lanes on the right are clear. When lanes are clear, move over as far to the right as safely possible on the shoulder and stop.

### SKIDS

4-3. Almost all skids can be avoided if driving slowly enough and if the operator stops, starts, and turns slowly enough on slippery surfaces. If the vehicle starts to skid, the operator may be able to regain control if they ease up slowly on the accelerator and do not apply the brakes. Always make sure you keep the vehicle in gear. If the skid occurs when braking, the operator should remove their foot from the brake. It may be necessary to feed gas carefully to reduce the braking effect of the engine. In either case, the reason for reducing the brake action is to keep the wheels from slowing down too quickly and making the skid worse. At the same time, turn the steering wheel in the direction of the skid (see Figure 4-1). If the rear end of the vehicle is skidding to the right, turn the steering wheel to the right. If it is skidding to the left, turn the steering wheel to the left. Do not turn the steering wheel too sharply or keep it turned too long since this may cause the vehicle to start skidding in the opposite direction. Ease the steering wheel back to the center position as the vehicle starts to recover from the skid and regain control of the vehicle. Let the engine slow the vehicle down gradually. If the brakes are applied, do not hold the pedal down. Pump the pedal gently until the vehicle comes to a complete stop. Figure 4-1 shows how to recover from a skid.

## RUNNING OFF THE PAVEMENT

4-4. At some point, a vehicle may drift off the roadway onto the shoulder or has been steered onto the shoulder to avoid a collision. Remember, there may be a drop off of several inches from the edge of the road to the shoulder. Most shoulders provide less traction than the roadway surface. They may be quite narrow and consist of loose gravel, grass, or mud. Despite these variables, pulling off onto the shoulder and returning to the roadway can be done safely. Practice the following proper procedures:

- If the two right or left wheels of the vehicle veer off the paved roadway, keep a firm grip on the steering wheel. Keep the vehicle traveling straight ahead. Straddle the edge of the pavement. Fight the tendency of the wheels to pull toward soft shoulders. Resist the urge to immediately whip the vehicle back onto the pavement.
- Ease off the accelerator pedal so the vehicle can slow down. If possible, avoid braking. If braking is necessary, pump the brakes lightly to help control steering.
- Before returning to the pavement, visually check ahead, to the sides, and to the rear. Unless some object beside the road poses a serious threat of a collision, avoid trying to return to the roadway immediately. Move the off-road tires out about one and a half to two feet away from the pavement edge. When it is safe and speed is under control, turn the wheel quickly about a quarter turn to the right or left as necessary. This lets the tire climb the pavement edge and get back on the roadway.
- As soon as the front tires are back on the roadway, counter steer quickly to maintain the proper lane.

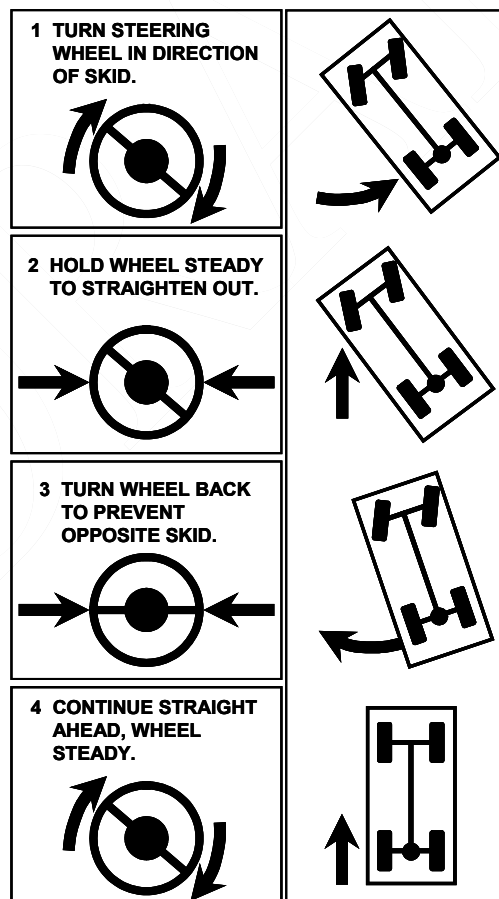


Figure 4-1. Recovering From a Skid

## **BRAKE FAILURE**

4-5. If the brakes fail and the failure is not related to engine failure, pump the brake pedal rapidly (if vehicle has hydraulic brakes) to restore braking action long enough to get off the highway. If this does not work, apply steady pressure to the parking brake that controls the rear wheels. Be careful when using the parking brake to stop and be prepared to release the brake if the rear wheels lock. Reapply the parking brake if needed. Downshifting the vehicle also serves as a braking force. Find an escape ramp or a safe exit from the highway. Communicate the emergency to other drivers by sounding the horn and flashing the lights. In more extreme cases, more severe methods may be required to slow the vehicle. An operator may have to run along an embankment; scrape against a curve; or drive into bushes, hedges, or other obstructions.

## **DOWNHILL BRAKING**

4-6. To maintain control of a vehicle (especially loaded) while descending downhill, make sure that downhill braking procedures are used as indicated in the applicable -10 TMs.

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Note: As a rule of thumb, go down the hill at least one gear lower than what is used to go up the hill. The brakes are used with the engine and transmission to keep the vehicle under control.

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## **LESS SERIOUS ACCIDENTS**

4-7. Sometimes a more serious accident can be avoided only by deliberately choosing a less serious one. Suppose an operator is driving at about 50 MPH on a two-lane road. Two vehicles are approaching from the opposite direction on the other side of the road. When they are fairly close, the second one suddenly pulls out to pass the first one. If unable to stop or slow down in time, the only thing an operator can do is to head for the right shoulder, even if it means an accident. If the operator stays on his/her side of the road, he/she will have a head-on collision with the vehicle on the wrong side of the road. If the operator swerves to the left, there is the probability of having a head-on collision with the other vehicle. The right shoulder can be dangerous, but almost any kind of accident is preferable to a head-on collision.

4-8. As another example, suppose an operator is being passed by one vehicle and there is another vehicle not far behind. As the passing vehicle draws even with the operator, a small animal runs out on the road in front of them. An unpleasant decision must be made quickly. If the operator swerves to the right, the soft surface of the shoulder may turn the vehicle over. If the operator stops suddenly, there is the likelihood that they will probably be struck by the vehicle to the rear. Although most operators do not want to hit an animal. However, to preserve a human life, it may be the safest thing to do.

## VEHICLE FIRES

### PREVENTING VEHICLE FIRES

4-9. Turn off the engine during refueling. Do not allow smoking or open flames within 50 feet of a vehicle during fueling or at an accident scene where there is danger from spilled gasoline or other flammables. If tactical refueling, ensure refueling vehicle and customer vehicle are bonded together prior to refueling.

**CAUTION**

Keep the gasoline nozzle in contact with the gas tank when fueling.

4-10. When flares are authorized, issue instructions for their handling and storage on the vehicle. Since flares are a potential fire hazard, it is imperative that operators take the prescribed precautions when handling them.

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Note: Ignited flares will not be attached to a vehicle. Further information concerning warning devices is found in Chapter 8.

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4-11. Do not allow smoking within 50 feet of the vehicle when transporting explosives or flammable cargo. Do not allow the vehicle to be exposed to open flames or explosives when it is loaded with flammables or explosives. Flares are prohibited on vehicles transporting explosives or flammable cargo.

4-12. Vehicles designed for transporting bulk flammable liquids will be permanently marked with warning signs. When a general-purpose vehicle is used to transport liquid fuels or other dangerous cargo, it is the operator's responsibility to place the prescribed warning signs on the vehicle. When dispatched to transport dangerous cargo, ask a supervisor for special instructions and warning signs for the vehicle. When operating overseas, be sure to have the required warning signs for all the countries in which you are driving. Take emergency measures (see Chapter 14) when bulk fuel transporters develop leaks.

4-13. When transporting dangerous/hazardous cargo to support a tactical mission in a threat environment, the chain of command may opt not to display placarding due to being targeted by enemy forces. In these cases, it is imperative that all mission personnel be informed as to which vehicles are loaded with dangerous/hazardous cargo. Placement within a tactical convoy should be considered in these cases to minimize collateral damage during an attack en route.

**CAUTION**

When dispensing fuel to another vehicle or a tank, a ground cable must be secured to the dispensing vehicle and the vehicle or tank being filled (Grounding and Bonding).

## FIGHTING VEHICLE FIRES

4-14. Due to the limited resources available for fighting a vehicle fire, send for help from professional fire fighters when possible. Common firefighting equipment usually consists of a hand fire extinguisher and any available natural materials (such as sand and water). Those resources, when applied at the start of a fire, have a good chance of bringing it under control. However, if the fire is out of control, attempting to extinguish it with inadequate equipment not only diminishes the possibility of successfully extinguishing the fire, but it also endangers the lives of the operator and others nearby.

4-15. When it is discovered that a vehicle is on fire, pull it off the road in an open area away from buildings, trees, brush, vehicles, or anything else that might catch fire. Do not pull into a service station. Notify the fire and police departments. Prevent the fire from spreading. With an engine fire, turn off the engine as soon as possible. Do not open the hood if avoidable.

4-16. Use the correct type of fire extinguisher. B and C rating extinguishers are designed to work on electrical and liquid fires. The A, B, and C type extinguishers are designed to work on burning wood, paper, and cloth; as well as electrical and liquid fires.

4-17. Know how to use the fire extinguisher. Stay far away as possible from the fire. Aim at the source or the base of the fire, not up in the flames. Take a position upwind from the fire. This will allow the wind to carry the extinguisher chemicals to the fire, limiting the possibility of the flames coming towards you. Do not attempt to extinguish a fire if unfamiliar with firefighting techniques and equipment.

4-18. Cargo fires in trucks and trailers are usually discovered by smell or observing smoke escaping from around doors and/or from under the tarpaulin. Unless an adequate source of firefighting equipment is available, do not open the cargo doors or remove the tarpaulin until the vehicle has been moved to a safe location where help (preferably from a fire department) can be obtained. After help has been obtained, the doors may be opened cautiously or the tarpaulin partially removed and the source of the fire determined. It may be necessary to remove part of the cargo to find the source of the fire.

4-19. Tires that are not inflated properly generate excessive heat during operation. This may result in the tires igniting, especially in dual-wheeled vehicles. Tires dragged along the road surface because of a locked wheel may begin to burn. Fires resulting from these conditions may be prevented by keeping the tires properly inflated, recognizing any difference in the performance of the vehicle that would indicate a locked wheel, and promptly taking corrective action. If a tire does start burning, it may not be possible to extinguish it with firefighting equipment. However; you may prevent further damage by employing the following measures:

- When possible, attempt to extinguish the fire by covering it with sand, mud, or water.
- When the wheel cannot be safely removed; drive the vehicle into sand, mud, or water and cover any exposed parts with mud or a similar substance.
- When the fire cannot be controlled by the above procedures, use the vehicle firefighting equipment or other suitable substance to prevent the fire from spreading.

### CAUTION

Do not attempt to transport a burned tire on the vehicle unless the fire is completely extinguished and the tire has cooled to normal temperature.

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## Chapter 5

# Accident Causes and Reports

5-1. The vehicle operator is at fault in the greatest percentage of motor vehicle accidents. Any accident is costly to the government. At a minimum, the government loses the use of a vehicle. The maximum would be the loss of human life. However, in the middle of these two extremes are the costs of repairing the vehicle, allocating additional man-hours to maintenance personnel to repair the vehicle, and the medical costs to cover injuries sustained by those personnel involved in the accident.

### PRIMARY CAUSES OF ACCIDENTS

5-2. In most accidents, the operator violates traffic regulations. The most common causes of vehicle accidents are:

- Traveling too fast for road and weather conditions.
- Following other vehicles too closely to react in time.
- Driving while fatigued or under the influence of alcohol or drugs.
- Wrongfully assuming right-of-way.
- Misjudging clearances on turns, in passing, and traffic maneuvering.
- Backing without looking and exercising caution.
- Operator distraction (occupants, equipment, and controls).

### PROCEDURE IN CASE OF AN ACCIDENT

5-3. If involved in a motor vehicle accident, the operator should take certain steps to protect their own interest, as well as that of the government. The operator should also come to the aid of any others involved in the accident. Below are some steps to follow:

- If anyone seems injured, render first aid. Then, summons the nearest military or civilian doctor or ambulance, whichever can be secured in the least amount of time. When practicable, military personnel with minor injuries should be transported to a military hospital.
- If a fire breaks out and conventional means of extinguishing the fire do not work, contact the nearest fire department.
- If civil police are not present, send for them. State laws require that police be summoned to all motor vehicle accidents. In such matters, the military cooperates with civil authorities that are responsible for investigating all accidents on public highways.
- If in an area controlled by armed services police; send for them or ask someone to do so. The armed services police must complete their own investigation of the accident. Cooperate and assist them in every way.
- Whenever practical, report the accident to the commanding officer by telephone as soon as duties at the scene of the accident have been completed. If an assistant operator is present, have him/her telephone the commanding officer while you attend to other matters. In an emergency, you can usually get permission to use a nearby telephone without charge. Your unit headquarters (HQ) will accept a collect toll charge if the accident must be reported by long distance.

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**FOR AIR FORCE ONLY:** Contact the commanding officer using the chain of command.

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## **PRECAUTIONARY MEASURES**

### **PRECAUTIONS AGAINST FURTHER ACCIDENTS**

5-4. After a motor vehicle accident, the vehicle or vehicles involved are frequently in dangerous locations. Often a crowd assembles around the accident. To prevent additional accidents, damage, or injury; be sure to post guards, flags, flares, or lights (except in a blackout) to warn all other traffic to proceed with caution.

5-5. If civil or armed forces police are present, they will direct traffic. If Soldiers are present, they should be asked to act as guards. If neither police nor Soldiers are present, civilians should act as guards. Cargo, glass, or other debris spilled on the highway (as a result of the accident) should be cleared from the road surface as soon as possible.

### **PRECAUTIONS AGAINST FIRE**

5-6. Gasoline exposed to the air forms a highly flammable vapor. Avoid this danger by shutting off all engines and prohibiting smoking whenever there is spilled gasoline or whenever vehicles are badly wrecked. Permit no open flame within 50 feet of the wreck. Spread sand or dirt over spilled gasoline as soon as possible. A fire extinguisher is the first line of defense against fires. If other methods are needed to supplement the fire extinguisher, use sand or dirt. Do not use water on gasoline fires, as it will cause them to spread.

### **REMOVAL OF VEHICLE FROM ACCIDENT SCENE**

5-7. Moving the vehicle from the scene of the accident is governed by laws or regulations of the state or area where the accident occurred. Obtain all the necessary data relating to the accident before moving the vehicle. Make sure to mark the exact position of all vehicles and objects before moving them.

## **PREPARATION OF ACCIDENT FORMS**

### **DD FORM 518 (ACCIDENT-IDENTIFICATION CARD)**

5-8. The purpose of the DD Form 518 (see sample in Figure 5-1) is to give any persons involved in an accident all of the information required from the military operator. This form must be filled out at the scene of the accident or as promptly as possible and given to the person directly concerned. If the accident involves a parked vehicle and the person concerned is not present, place the DD Form 518 in the vehicle or secure it on the windshield. Notify local authorities and then stand by the scene of the accident for their arrival, if practical. A DD Form 518 can be downloaded from the Army Publishing Directorate.

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Note: Disclosure of social security number (SSN) is voluntary. No disciplinary action is taken in cases where the SSN is not provided.

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5-9. If involved in an accident, always stop and investigate the accident. The only possible exception to this rule might be in combat or in case of military necessity when operating under definite orders not to stop. Even though an accident is minor or is not your fault, you must report it so facts are clearly presented and witnesses are identified. This protects you and the government against claims and exaggerations. For the purpose of reporting an accident, use SF Form 91 (Motor Vehicle Accident Report). A SF Form 91 can be downloaded from the Army Publishing Directorate.



<b>ACCIDENT - IDENTIFICATION CARD</b>		<b>SAMPLE</b>	<b>PRIVACY ACT STATEMENT</b>	
<i>(THIS FORM IS SUBJECT TO THE PRIVACY ACT OF 1974 - SEE REVERSE)</i>			<b>AUTHORITY:</b> Sec 638a, Title 31, USC and EO 9397.	
Any correspondence regarding accident should be addressed to: <b>Commanding General CASCOM FORT Lee VA 23801-1511</b>			<b>PRINCIPAL PURPOSE:</b> To provide persons involved in an accident with a DoD owned/leased vehicle the identity of the person with the authority to act on the matter.	
MAKE REFERENCE TO			<b>ROUTINE USES:</b> Placed in each vehicle for purpose stated above. When a DoD vehicle is involved in an accident, the driver provides the other party(s) with a properly executed DD Form 518. The SSN is requested because of similarity of names, to further identify the driver of the DoD vehicle.	
DATE OF ACCIDENT <b>3 AUG 2005</b>			<b>DISCLOSURE IS VOLUNTARY:</b> No disciplinary action is taken in cases where the SSN is not provided.	
MAKE AND TYPE OF VEHICLE <b>TRUCK CARGO 5-Ton, M1083</b>				
REGISTRATION NO. <b>N POG 8CU</b>				
DRIVER (Last name - first name - middle initial) <b>Keyser, BURT</b>				
SSN <b>123-45-6789</b>	GRADE <b>PFC</b>			
ORGANIZATION <b>HHC, 244th Quartermaster BN</b>				
DD Form 518, OCT 78 (EG) PREVIOUS EDITION IS OBSOLETE. Designed using Perform Pro, WHS/DIOR, Dec 94		DD Form 518 Reverse, OCT 78		

Note: Adding SSN is strictly voluntary.

**Figure 5-1. Sample of DD Form 518**

5-10. In completing SF Form 91 (see sample in Figure 5-2), keep the following general instructions in mind:

- Secure hard-to-get facts first. The first responsibility of the operator, after ensuring that the vehicle will not cause another accident, is that the injured are cared for, and other precautions are taken. The operator should also get the names and addresses of the people involved in the accident and of all witnesses. If this is not done promptly, it may be impossible to later get the information.
- Do not leave the scene of the accident until all pertinent facts concerning the accident have been obtained. This information should include the following:
  - Condition of the road.
  - Position of the vehicles.
  - Amount of damage involved.
  - Any other information that may be relevant, but difficult to remember at a later time.
- After obtaining the information required for the report that may include information from others, the operator should complete the sections of the SF Form 91.
- Be exact. Be sure the report gives a clear picture of what actually happened. If another vehicle is involved, the operator's diagram of the accident should show exactly where the vehicles were before and after the crash and exactly what obstacles blocked either driver's view. Every name should be spelled correctly and every street address listed by number. On highways where there are no house numbers, use mileage markers, power line or telephone pole numbers, or intersecting roads to pinpoint the location of the accident.

State the visible damage (for example, crushed right rear wheel, bent or broken axle, crumpled fender, and so on). If a party claims that damage has occurred, but it is not visible to the operator, a note indicating this should be made. Follow the same procedures with injuries. If an injury is visible, write it down. If the injured party claims an injury that is not visible, make a note of the injured party's complaint. If it is not possible to obtain the exact information on an item, write "unknown." If there is a section that does not pertain to the accident, write NA or NONE. By making an entry in every blank, the reviewer will be assured that nothing was overlooked.

- Never express an opinion (either orally or in writing) to claimants or their agents concerning liability, investigation findings, or the possibility of claim approval.
- If more space is needed, use a separate sheet of paper to answer a question. Write "see attached" in the space by the question on the report and attach the extra sheet securely to the report form.
- Check each item. As an agent for the United States government, it is the operator's responsibility to ensure that all information is obtained and is accurate. If provided information does not seem legitimate, do not hesitate to further question the other driver. The operator must remember that they are representing the United States government. Therefore, the operator should tactfully address any concerns to the other driver. If the military operator has any concerns about the information provided, he/she should make a note in the report regarding these concerns.
- Check the entire report to ensure that it is complete and accurate. It is the operator's written report that will aid the investigating officer in picturing the accident. Therefore, the operator should make sure that their answers are clear and precise. If the operator is satisfied that the report is complete and accurate, the report should be signed and turned over to the commanding officer or immediate supervisor.

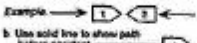


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Note: Any employee of a federal agency who fails to accurately report a motor vehicle accident involving a federal vehicle may be subject to administrative action.

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MOTOR VEHICLE ACCIDENT REPORT		Please read the Privacy Act Statement on Page 3		INSTRUCTIONS: Sections I through IX are filled out by the vehicle operator. Section X, items 72 thru 82c are filled on by the operator's supervisor. Section XI thru XIII are filled out by an accident investigator for bodily injury, fatality, and/or damage exceeding \$500.			
<b>SECTION I - FEDERAL VEHICLE DATA</b>							
1. DRIVER'S NAME (Last, first, middle) Doe, John, Michael				2. DRIVER'S LICENSE NO./STATE/LIMITATIONS T25-543-3210/VA/NONE		DATE OF ACCIDENT 08/14/2015	
4a. DEPARTMENT/FEDERAL AGENCY PERMANENT OFFICE ADDRESS 100 Happy St., Fort Hood, TX						4b. WORK TELEPHONE NUMBER (555) 458-2201	
5. TAG OR IDENTIFICATION NUMBER B-55		6. EST. REPAIR COST \$ 250.00	7. YEAR OF VEHICLE 1996	8. MAKE M1083	9. MODEL TRK.CGO5TN	10. SEAT BELTS USED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
11. DESCRIBE VEHICLE DAMAGE Left front signal light broke off, still attached, L/F fender slightly dented.							
<b>SECTION II - OTHER VEHICLE DATA (Use Section VIII if additional space is needed)</b>							
12. DRIVER'S NAME (Last, first, middle) Smith, Jane, Marie			13. SOCIAL SECURITY NO./ TAX IDENTIFICATION NO. XXX-XX-XXXX		14. DRIVER'S LICENSE NO./STATE/LIMITATIONS T25-123-1234/VA/Glasses		
15. a. DRIVER'S WORK ADDRESS 188 Main St. Blackstone, VA 23855						15b. WORK TELEPHONE NUMBER (555) 762-0089	
16a. DRIVER'S HOME ADDRESS 100 Hope Rd. Crewe, VA 23848						16b. HOME TELEPHONE NUMBER (555) 508-4143	
17. DESCRIPTION OF VEHICLE DAMAGE R/F Fender Crumpled, Front bumper dented						18. ESTIMATED REPAIR COST \$ 2,000.00	
19. YEAR OF VEHICLE 2004		20. MAKE OF VEHICLE Hyundai		21. MODEL OF VEHICLE Sante Fe		22. TAG NUMBER AND STATE XXX-XXXX/VA	
25a. DRIVER'S INSURANCE COMPANY NAME AND ADDRESS USAA 9800 Fredericksburg St. San Antonio, TX 78288						23b. POLICY NUMBER XXXX-XX-XX	
23c. TELEPHONE NUMBER (555) 531-811						25b. TELEPHONE NUMBER (555) 508-4143	
24. VEHICLE IS <input type="checkbox"/> CO-OWNED <input type="checkbox"/> RENTAL <input type="checkbox"/> LEASED <input checked="" type="checkbox"/> PRIVATELY OWNED			25a. OWNER'S NAME(S) (Last, first, middle) Smith, Jane, Marie			25b. TELEPHONE NUMBER (555) 508-4143	
26. OWNER'S ADDRESS(ES) 100 Hope Rd. Crewe, VA 23848							
<b>SECTION III - KILLED OR INJURED (Use Section VIII if additional space is needed)</b>							
27. NAME (last, first, middle) N/A						28. SEX M	29. DATE OF BIRTH N/A
30. ADDRESS N/A							
A 31. MARK "X" IN TWO APPROPRIATE BOXES <input type="checkbox"/> KILLED <input type="checkbox"/> DRIVER <input checked="" type="checkbox"/> PASSENGER <input checked="" type="checkbox"/> INJURED <input type="checkbox"/> HELPER <input type="checkbox"/> PEDESTRIAN		32. IN WHICH VEHICLE <input type="checkbox"/> FED <input checked="" type="checkbox"/> OTHER (2)		33. LOCATION IN VEHICLE N/A		34. FIRST AID GIVEN BY N/A	
35. TRANSPORTED BY N/A			36. TRANSPORTED TO N/A				
37. NAME (last, first, middle) N/A						38. SEX M	39. DATE OF BIRTH N/A
40. ADDRESS N/A							
B 41. MARK "X" IN TWO APPROPRIATE BOXES <input type="checkbox"/> KILLED <input type="checkbox"/> DRIVER <input checked="" type="checkbox"/> PASSENGER <input checked="" type="checkbox"/> INJURED <input type="checkbox"/> HELPER <input type="checkbox"/> PEDESTRIAN		42. IN WHICH VEHICLE <input type="checkbox"/> FED <input checked="" type="checkbox"/> OTHER (2)		43. LOCATION IN VEHICLE N/A		44. FIRST AID GIVEN BY N/A	
45. TRANSPORTED BY N/A			46. TRANSPORTED TO N/A				
47. Pedestrian		a. NAME OF STREET OR HIGHWAY N/A			b. DIRECTION OF PEDESTRIAN (SW corner to NW corner, etc.) FROM N/A TO N/A		
c. DESCRIBE WHAT PEDESTRIAN WAS DOING AT TIME OF ACCIDENT (crossing intersection with signal, against signal, diagonally; in roadway playing, walking, hitchhiking, etc.) N/A							
NSN 7540-00-834-4041 Previous edition not usable				STANDARD FORM 91 (2/2004) Prescribed by GSA-FMR 102-34.295			

Figure 5-2. Sample of SF Form 91 (Page 1)

SECTION IV - ACCIDENT TIME AND LOCATION (Use section VII if additional space is needed.)																													
48. DATE OF ACCIDENT 08/14/2015	49. PLACE OF ACCIDENT (Street address, city, state, ZIP Code, Nearest landmark; Distance nearest intersection; Kind of locality (Industrial, business, residential, open country, etc.); Road description) Intersection of Temple Ave and Conduit Road.																												
50. TIME OF ACCIDENT <input type="checkbox"/> AM <input checked="" type="checkbox"/> PM																													
51. INDICATE ON THIS DIAGRAM HOW THE ACCIDENT HAPPENED		52. POINT OF IMPACT (Check one for each vehicle)																											
<p>Use one of these outlines to sketch the scene. Write in street or highway names or numbers.</p> <p>a. Number Federal vehicle as 1, other vehicle as 2, additional vehicle as 3 and show direction of travel with arrow.</p> <p>Example: </p> <p>b. Use solid line to show path before accident and broken line after the accident.</p> <p>c. Show pedestrian by </p> <p>d. Show railroad by </p> <p>e. Place arrow in the circle to indicate NORTH.</p>		<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>FED</th> <th>2</th> <th>AREA</th> </tr> </thead> <tbody> <tr><td></td><td></td><td>a. Front</td></tr> <tr><td></td><td><input checked="" type="checkbox"/></td><td>b. R. Front</td></tr> <tr><td><input checked="" type="checkbox"/></td><td></td><td>c. L. Front</td></tr> <tr><td></td><td></td><td>d. Rear</td></tr> <tr><td></td><td></td><td>e. R. Rear</td></tr> <tr><td></td><td></td><td>f. L. Rear</td></tr> <tr><td></td><td></td><td>g. R. Side</td></tr> <tr><td></td><td></td><td>h. L. Side</td></tr> </tbody> </table>	FED	2	AREA			a. Front		<input checked="" type="checkbox"/>	b. R. Front	<input checked="" type="checkbox"/>		c. L. Front			d. Rear			e. R. Rear			f. L. Rear			g. R. Side			h. L. Side
FED	2	AREA																											
		a. Front																											
	<input checked="" type="checkbox"/>	b. R. Front																											
<input checked="" type="checkbox"/>		c. L. Front																											
		d. Rear																											
		e. R. Rear																											
		f. L. Rear																											
		g. R. Side																											
		h. L. Side																											
<p>53. DESCRIBE WHAT HAPPENED (Refer to vehicles as "Fed", "2", "3", etc. Please include information on posted speed limit, approximate speed of vehicles, road conditions, weather conditions, driver visibility, condition of accident vehicles, traffic controls (warning light, stop sign, etc.), condition of light (daylight, dusk, night, dawn, artificial light, etc.), and driver actions (making a U-turn, passing, stopped in traffic, etc.)</p> <p>I was driving Fed vehicle #1 on Temple Ave, (one way street) with no light and no stop sign and collided with vehicle #2 when I was crossing Conduit Rd. Vehicle #2 had run through the stop sign and hit my left front fender. Weather was clear with good visibility. Speed limit was 35 on Temple Ave and 25 on Conduit Road.</p>																													
SECTION V - WITNESS/PASSENGER (Witness must fill out SF 94, Statement of Witness) (Continue in Section VIII.)																													
54. NAME (Last, first, middle) Isawall, Robert Dale		55. WORK TELEPHONE NUMBER (555) 862-4130																											
57. WORK ADDRESS 20 Gate Dr. Dublin, CA. 944543		56. HOME TELEPHONE NUMBER (555) 865-4468																											
59. NAME (Last, first, middle) N/A		60. WORK TELEPHONE NUMBER N/A																											
62. WORK ADDRESS N/A		61. HOME TELEPHONE NUMBER N/A																											
63. HOME ADDRESS N/A																													
SECTION VI - PROPERTY DAMAGE (Use Section VIII if additional space is needed.)																													
64a. NAME OF OWNER (Last, first, middle) N/A		64b. WORK TELEPHONE NUMBER N/A																											
64d. WORK ADDRESS N/A		64c. HOME TELEPHONE NUMBER N/A																											
64e. HOME ADDRESS N/A																													
65a. NAME OF INSURANCE COMPANY N/A		65b. TELEPHONE NUMBER N/A																											
65c. POLICY NUMBER N/A																													
66. ITEM DAMAGED N/A	67. LOCATION OF DAMAGED ITEM N/A	68. ESTIMATED COST \$0.00																											
SECTION VII - POLICE INFORMATION																													
69a. NAME OF POLICE OFFICER Public, John		69b. TELEPHONE NUMBER (555) 265-8812																											
69c. BADGE NUMBER 549																													
70. PRECINCT OR HEADQUARTERS Colonial Heights Police		71a. PERSON CHARGED WITH ACCIDENT Jane Smith																											
		71b. VIOLATION(S) Failure to stop.																											

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Figure 5-2. Sample of SF Form 91 (Page 2)

SECTION VIII - EXTRA DETAILS					
SPACE FOR DETAILED ANSWERS. INDICATE SECTION AND ITEM NUMBER FOR EACH ANSWER. IF MORE SPACE IS NEEDED, CONTINUE ITEMS ON PLAIN BOND PAPER.					
Mrs. Smith was complaining about neck problems. She looked OK at the scene of the accident.					
PRIVACY ACT STATEMENT					
The information on this form is subject to the Privacy Act of 1974 (5 U.S.C. section 552a). Authority to collect the information is Title 40 U.S.C. Section 491 and the title 31 U.S.C. Section 7701. The formation is required by federal Government agencies to administer motor vehicle programs, including maintaining records on accidents involving privately owned and Federal fleet vehicles, and collecting accident claims resulting from accidents. Federal employees, and employees under contract, will use the information only in the performance of their official duties. Routine uses of the collected information may include disclosures to: appropriate Federal, State, or local agencies or contractors when relevant to civil, criminal, or regulatory investigations or prosecutions; the Office of personnel Management and the General Accounting Office for program evaluation purposes; a Member of Congress or staff in response to a request for assistance by the individual of record; another Federal agency, including the Department of Treasury and Justice, or a court under judicial proceedings; agency Inspectors General in conducting audits; private insurance, and the collection agencies (including agencies under contract to Treasury to collect debt), and to other agency finance offices for federal management and debt collection. Furnishing the requested information is mandatory, including the Social security Number or Taxpayer's Identification Number (TIN) for use as a unique identifier to ensure accurate identification for individuals or firms in the system.					
SECTION IX - FEDERAL DRIVER CERTIFICATION					
I certify that the information on this form (Sections I thru VII) is correct to the best of my knowledge and belief.					
72a. NAME AND TITLE OF DRIVER			72b. DRIVER'S SIGNATURE AND DATE		
John Doe			DIGITAL SIGNATURE 123456789 08/14/2015		
SECTION X - DETAILS OF TRIP DURING WHICH ACCIDENT OCCURRED					
73. ORIGIN			74. DESTINATION		
483d Trans Bn, Motor Pool			Downtown Colonial Heights		
75. EXACT PURPOSE OF TRIP					
Logistics Support For Army Day Display					
76. TRIP BEGAN		DATE	TIME (include AM or PM)	77. ACCIDENT OCCURRED	
		08/14/2015	12:30 PM	DATE	
				TIME (include AM or PM)	
				08/14/2015	
				1:15 PM	
78. AUTHORITY FOR THE TRIP WAS GIVEN TO THE OPERATOR			79. WAS THERE ANY DEVIATION FROM DIRECT ROUTE?		
<input type="checkbox"/> ORALLY <input checked="" type="checkbox"/> IN WRITING (Explain)			<input checked="" type="checkbox"/> NO <input type="checkbox"/> YES (Explain)		
Dispatched			N/A		
80. WAS THE TRIP MADE WITHIN ESTABLISHED WORKING HOURS?			81. DID THE OPERATOR, WHILE ENROUTE, ENGAGE IN ANY ACTIVITY OTHER THAN THAT FOR WHICH THE TRIP WAS AUTHORIZED?		
<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO (Explain)			<input checked="" type="checkbox"/> NO <input type="checkbox"/> YES (Explain)		
N/A			N/A		
a. DID THIS ACCIDENT OCCUR WITHIN THE EMPLOYEE'S SCOPE OF DUTY					
82. COMPLETED BY DRIVER'S SUPERVISOR		<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		b. COMMENTS	
				None	
83a. NAME AND TITLE OF SUPERVISOR			83b. SUPERVISOR'S SIGNATURE AND DATE		83c. TELEPHONE NUMBER
Iboss, David - SFC			DIGITAL SIGNATURE 123456789 08/14/2015		(555) 757-1549

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Figure 5-2. Sample of SF Form 91 (Page 3)

SECTION XI - ACCIDENT INVESTIGATION DATA					
84. DID THE INVESTIGATION DISCLOSE CONFLICTING INFORMATION. <input checked="" type="checkbox"/> NO <input type="checkbox"/> YES (If checked, explain below.)					
N/A					
85. PERSONS INTERVIEWED					
NAME	DATE	NAME	DATE		
a. John Doe	08/14/2015	c. Robert Thompson	08/14/2015		
b. Jane Smith	08/14/2015	d.			
86. ADDITIONAL COMMENTS (Indicate section and item number of each comment).					
None					
SECTION XII - ATTACHMENTS					
87. LIST ALL ATTACHMENTS TO THIS REPORT					
None					
SECTION XIII - COMMENTS/APPROVALS					
88. REVIEWING OFFICIAL'S COMMENTS					
None					
89. ACCIDENT INVESTIGATOR			90. ACCIDENT REVIEWING OFFICIAL		
a. SIGNATURE	b. DATE		a. SIGNATURE	b. DATE	
DIGITAL SIGNATURE 123456789	08/14/2015		DIGITAL SIGNATURE 123456789	08/14/2015	
c. NAME (First, middle, last)			c. NAME (First, middle, last)		
Timothy D. Sleuth			Greg A. Honcho		
d. TITLE			d. TITLE		
Special Agent			Executive Officer		
e. OFFICE			e. OFFICE		
555 MP Co. Fort Hood TX			483 Trans BN, Fort Hood, TX		
f. OFFICE TELEPHONE NUMBER			f. OFFICE TELEPHONE NUMBER		
AREA CODE	NUMBER	EXTENSION	AREA CODE	NUMBER	EXTENSION
555	555-4568	N/A	555	555-5568	N/A

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Figure 5-2. Sample of SF Form 91 (Page 4)

## Chapter 6

# Hazards and Safety Measures

6-1. Every military operator will face many hazardous driving situations. Hazards may be the result of weather, time of day, or season of the year. They may be caused by conditions of the road, the vehicle being driven, or vehicles driven by others. Pedestrians, bicyclists, motorcyclists, and animals pose special problems for drivers. Many times they are difficult to see and a driver must be alert at all times in order to avoid a collision with them.

### PEDESTRIANS

6-2. In the United States, about 40,000 people are killed in traffic accidents each year. When pedestrians are involved in collisions, speeds of no greater than 15 or 20 MPH often prove fatal.

6-3. It is true that pedestrians often violate laws passed for their protection. However, it is the responsibility of the operator of a vehicle to be aware of his/her surroundings. By being alert, an operator can avoid fatal accidents with pedestrians. An operator should inform pedestrians of their intentions by using the proper signals.

6-4. The operator must also anticipate the pedestrian's intentions. If a person is in the street, slow down the vehicle and be ready to stop. A pedestrian's actions are not always predictable, so be prepared at all times. Never pass a stopped vehicle that is permitting a pedestrian to cross traffic.

6-5. Watch people on the sidewalks and at the side of the road. They may not stay there. The operator should allow enough space between his/her vehicle and the row of parked vehicles in case a pedestrian steps from between them. When near pedestrians, drive slowly. When approaching a pedestrian from the rear, carefully pass them allowing plenty of room between them and the vehicle.

6-6. In school zones, slow down to the posted speed limit and watch for children. Obey the directions given by members of the school safety patrol or by the school crossing guards. When stopped by the stop signal of a school bus, do not move until the bus is placed in motion and the highway is clear of students.

6-7. Observe the following rules at intersections:

- Pedestrians have the right-of-way where there are no traffic lights.
- A blind pedestrian is entitled, by law, to special consideration at intersections with no traffic lights. When a blind pedestrian enters an intersection, all approaching vehicles must stop and must remain stopped until the blind pedestrian has completed crossing.
- Pedestrians must obey the same traffic light signals, at intersections, as operators. When crossing on a green light, they have the right-of-way. If a light changes to yellow or red while crossing, operators must allow them to complete crossing safely.
- Special crossing lights, at some intersections, instruct pedestrians when it is safe to walk. Where these lights are in operation, pedestrians must obey them rather than the traffic lights. Pedestrians crossing on a special pedestrian signal have the right-of-way just as they do when crossing on a green light.
- When a pedestrian crosses against the light, slow down and stop, if necessary. The safe operator yields the right-of-way to a pedestrian whether the pedestrian is entitled to it or not.

## **BICYCLISTS**

6-8. The number of bicycles being used on streets and highways for exercise purposes and transportation is increasing daily. Bicyclists are expected to obey the same traffic rules and regulations as vehicle operators. However, many children may not obey or even know the rules.

6-9. A major problem for operators, especially at night, is their inability to see bicyclists. Be cautious because a bicyclist could be in the blind spot of your vehicle. Keep on the lookout and slow down when approaching bicyclists. Give them plenty of room when passing and be prepared to stop suddenly.

## **MOTORCYCLISTS**

6-10. It is often difficult to see motorcyclists, especially when they are coming up from behind, coming from the side streets, and around curves. Always look out for them when you are approaching an intersection.

6-11. When passing motorcyclists, give them plenty of room. If they look over their shoulder while you are following them it could mean that they may soon attempt to turn right. Give them time and space to do so.

6-12. Motorcyclists may suddenly need to avoid uneven road surfaces and obstacles such as drain covers or oily, wet, or icy patches on the road. Give them plenty of room.

6-13. Never drive a motorcycle, motor scooter, or motorbike without wearing a safety helmet and shatterproof eye protectors. Keep the lights on, day or night, so that other drivers can see the vehicle more easily. Never carry more than the number of riders for which the vehicle was designed.

## **ANIMALS**

6-14. Livestock laws vary from state to state and in some instances are not properly enforced. Therefore, a vehicle operator should always be alert to the possibility of a collision with an animal. A collision with even a small animal can cause serious vehicle damage and endanger human life. As a vehicle operator, be thoroughly familiar with and obey all local laws. Exercise good judgment and drive defensively at all times to avoid endangering not only animals, but also human life and property.

## **NIGHT DRIVING**

6-15. Darkness increases driving dangers. Although traffic is not as heavy at night, the fatality rate for nighttime drivers is double that for daytime drivers. On the basis of mileage driven, night driving is more dangerous than day driving. Fatigue and sharply reduced vision of the operator are primarily responsible for this greater danger. The danger of driving at night is also increased because drivers who have been drinking are more likely to be on the road.

## **REDUCED VISION**

6-16. An operator can often see several thousand feet ahead in the daytime if the road is straight and there are no obstructions. However, at night (even with good headlights) an operator can usually see no more than a few hundred feet ahead. The headlights may be powerful, but the amount of the beam reflected by an object or a pedestrian may be very small and it decreases very rapidly as the distance increases.

6-17. Hills and curves reduce vision during the daytime, but not nearly as much as they do at night. An operator going downhill in the daytime can ordinarily see the level road at the bottom and/or the upgrade of the next hill. However, at night, the headlight beams slant downward with the vehicle, illuminating only the road directly ahead. Curves have a similar effect. As an operator rounds a curve



at night, the headlights do not follow the path of the curve. Instead, they shine across the road, leaving most of the curve in darkness.

6-18. Vision to the sides and the rear is also greatly restricted at night. It is especially important at night that rearview mirrors are properly adjusted. If not, an operator may have little warning of vehicles coming from behind.

6-19. Glare from the headlights of other vehicles often results in several seconds of near blindness. This is especially true if the headlights of the other vehicle are out of adjustment or if the other driver fails to dim his/her high beam lights. However, even the glare from properly adjusted and dimmed headlights may affect some drivers. The light from buildings or signs along the road may also be blinding. It takes most operators at least two or three seconds to recover from the effects of glare. At 50 MPH, three seconds means 219 feet.

6-20. A dirty windshield multiplies the effect of glare. In the headlight beams of an approaching vehicle, the specks of dirt on the windshield seem to glow and turn the windshield into a wall of light that is almost impossible to see through. An operator cannot drive safely, especially at night, without a clean windshield.

6-21. When parking at night, never leave the headlights on. They are just as likely to blind approaching drivers when the vehicle is standing still as they are when it is moving. They may also confuse approaching drivers about the exact position of the road. This danger is increased if the vehicle is parked on the wrong side of the road. Whenever parking on or along a highway at night, turn on the parking lights or four-way emergency flasher.

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Note: Emergency vehicles may leave headlights on when they are required to illuminate an area in an emergency.

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6-22. Vision is especially difficult at dusk. There is no longer enough natural light to see clearly without using headlights, but there is too much natural light for the eyes to adjust properly for night driving. The twilight hazard is especially serious in the fall as the days grow shorter and it begins to get dark as people are driving home from work. Many of them do not notice the darkness increasing from day to day and fail to take it into account in their driving.

## **FATIGUE**

6-23. Many operators on the road after dark are likely to be tired after a day's work. Others have been driving all day and are trying to add a few more miles before they stop for the night. Seeing things through a drowsy haze, a tired operator may need several seconds to recognize dangers and decide what to do. The decisions made may be wrong and their reactions slow.

6-24. When an operator is tired, it takes longer to recover from the effects of glare. Many times, their eyes will play tricks on them. More than one operator has been seriously injured or killed trying to avoid a collision with a pedestrian or animal that existed only in their imagination. Tired operators greatly increase the hazards of night driving.

## **SAFE NIGHT DRIVING**

6-25. The basic rule for safe night driving is NEVER OUTFRAN THE HEADLIGHTS. Stopping distance should always be less than sight distance. The law requires that headlights should allow the driver to clearly see any person on the highway for at least 200 feet ahead of their vehicle. Since the effectiveness of headlights diminishes greatly as the distance increases, headlights must be in good working order to meet legal requirements. At 55 MPH, the stopping distance for a vehicle with brakes meeting the legal stopping distance requirements is 307 feet, or 107 feet more than the distance a driver can see.

6-26. Speeds of 50 MPH and 55 MPH (safe and legal under good conditions in the daytime) are very often unsafe at night. They may be unsafe because by the time the headlights reveal a dangerous condition, it may be too late to stop. These speeds may also be illegal under the basic provisions of the speed law that makes it unlawful to drive at a speed greater than is reasonable and prudent under existing conditions.

6-27. As a general rule, keep the speed of the vehicle under 50 MPH at night. On curves or hills, the speed should be even lower. The speed should be slow enough so that an operator is always able to stop within the range of the headlights.

6-28. Some operators, preparing for long trips, prefer to drive at night because traffic is lighter and they can make better time. Traffic is lighter, but on a mileage basis, the chances of getting killed or killing someone are two to three times greater. When planning trips, plan to drive during daylight hours.

6-29. Most state laws require that headlights must be on from sunset to sunrise. Turn on the lights in the daytime whenever rain, fog, or snow impairs visibility or if there is not enough light to clearly see an object 200 feet ahead. Keep the headlights on low beam when driving in areas where adequate lighting is provided by street lamps. Where there is no street illumination, use the high beams except when meeting or following another vehicle.

6-30. Lower the high beams when approaching an oncoming vehicle. When meeting another vehicle on the road at night, the operator should divert their eyes from directly looking into the oncoming vehicle's headlights. Do not flick the lights at an oncoming vehicle if the other driver fails to lower their high beam. Avoid looking directly at the bright lights. Glance to the right side of the road, then quickly look ahead to determine the other vehicle's position. Once past the oncoming vehicle, switch the high beams on again. It is dangerous to meet another vehicle with high beams, but it can also be dangerous to drive along with low beams when there is no reason for it.

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Note: Never drive with only the parking lights on. If conditions are such that there is reduced visibility, the headlights should be on.

---

## **WEATHER**

6-31. Bad weather means poor driving conditions. Rain, snow, and sleet reduce visibility and make driving dangerous. In fog and sometimes in heavy rain or snow, visibility may be limited to only a few feet ahead of the vehicle. Braking distances on slippery pavements may be from two to ten times greater than on dry pavement. The danger of swerving sharply to one side or the other when applying the brakes is much greater on slippery pavements, especially if the brakes are out of adjustment and the pressure is not equalized.

## **RAIN**

6-32. Most operators slow down or pull off the road in a heavy downpour. However, many do not realize that roads are likely to be especially slick just after rain or drizzle begins. The first few drops loosen grease and dirt accumulated on the road surface which quickly covers the road with an extremely dangerous, slippery film. To the safe operator, the first few drops of rain are danger signals telling him/her to slow down and be extra cautious. On wet pavements, allow at least two times the normal following distance. For example, when following on wet pavement, use a four-second rule instead of a two-second rule.

6-33. In wet weather, extra caution is necessary on mountain roads. Rocks, loosened by water seepage, may fall onto the road. Water beneath the pavement may freeze during a cold snap and cause the pavement to buckle. Operators may suddenly find broken pavement or rocks in their path as they round a curve. Unless they are driving slowly, they may not be able to avoid them. Wet roads may

also cause hydroplaning, a condition in which directional control is partially or totally lost as the tires on the vehicle lose traction with the road.

## **SNOW AND ICE**

6-34. Snow and ice reduce traction even more than a wet pavement does. A careful operator can negotiate a thin layer of soft snow that allows tires to sink through to the road. When driving on snow or ice, make sure the vehicle is equipped with chains, snow tires, or studded tires. However, an operator must use extreme caution to maintain traction to avoid skidding when attempting to stop or turn. When roads are dangerous because of weather, drive with extra care and at reduced speed according to conditions.

6-35. Even when a road appears to be generally clear of ice, use caution. There can always be small patches of black ice on the road that can cause even the most experienced operator to have an accident. Melting snow running down from the upper side of a banked curve may freeze on the pavement as the sun sets. Since bridges cool much more rapidly than other road surfaces, moisture often condenses on them and freezes quickly into thin sheets of ice when the temperature drops. A good winter driving rule is to slow down before coming to bridges and shaded places. Be especially careful in late afternoon and after dark.

## **FOG**

6-36. Fog is dangerous at any time, but particularly so at night. It is possible that fog can be so thick that an operator can barely see the front of the vehicle. The only thing to do in dense fog is to get off the road as quickly as possible.

6-37. Sometimes, on otherwise fairly clear nights, thick fog collects in small pockets at the bottom of hills. When running into one of these pockets, slow down as quickly as possible and switch to the low-beam headlights. Once through the fog, continue to drive slowly. One pocket of fog is usually a warning that there will probably be more fog at the bottom of the next hill. Continue to drive slowly until completely out of the fog area.

## **SEASONAL HAZARDS**

6-38. Fallen leaves often make roads dangerous because tires are more likely to skid on them when an operator applies the brakes, especially if the leaves are wet. If leaves are seen on the road, proceed with caution.

6-39. In winter and spring, dirt roads are likely to be muddy. The wheels of vehicles turning from dirt roads onto paved roads track mud and dirt onto the pavement. At such places, there is an increased danger of skidding. Mud, loose dirt, and sand on the road are all indicators that the operator should slow down.

6-40. Spring and summer foliage may greatly reduce sight distances, especially on curves and at intersections. An operator, though familiar with a road, may not realize how quickly sight distances have been reduced when spring foliage appears. Unless an operator adjusts their speed to the changed conditions, they may have or cause an accident.

## **SECONDARY ROADS**

6-41. Secondary roads, built for local transportation and not as main highways, may be hazardous. The fact that a secondary road is paved does not necessarily mean that it was designed for heavy traffic or regular highway speeds. So-called “farm-to-market” roads are much more serviceable than the dirt roads they have replaced. However, they were still built for local transportation. On these roads, hills are likely to be steeper and curves sharper than on primary roads. Sight distances are often very short.

6-42. Secondary roads are recognizable by their rectangular route signs. An operator who is unfamiliar with one of these roads must be on guard for sudden bends and sharp dips. They cannot be driven

safely at speeds that would be normal on primary highways. Probably the highest reasonable speed on most of them is 40 MPH to 45 MPH. These roads are not just unsafe; but they require operators to adjust their driving and awareness.

6-43. Gravel roads are particularly dangerous because of their loose surface and flat (unbanked) curves. Stopping distances at all speeds are greater and skids and spinouts are more likely to occur. On gravel roads, keep the vehicle under tight control and drive at a much lower speed than would be safer on a paved road.

## **EATING, SMOKING, AND DRINKING**

6-44. Never eat while operating a vehicle. Using tobacco and alcohol impairs your senses (especially sight). Do not smoke or drink alcoholic beverages while driving. Do not drink any alcoholic beverages eight hours before driving. However, operators are ultimately responsible for exercising good judgment by imposing additional time restraints as needed.

## **OVERLOADING AND CROWDING**

6-45. No vehicle is safe when it is overloaded or crowded to the point that the operator's normal vision of the road is obstructed or they have difficulty operating the vehicle. As a general rule, an operator cannot safely drive if they allow more than three persons, including themselves, in the front seat of a vehicle with the gearshift lever on the steering column or more than two persons with the gearshift on the floor of the vehicle. In some compact vehicles, the maximum safe limit may be only two, regardless of the position of the gearshift. Overcrowding in the back seat (more than three persons) is dangerous because it is likely to interfere with the line of sight from the rearview mirror. When a vehicle is equipped with seat belts, the number of passengers should not exceed the number of seat belts provided.

6-46. Do not use a car as a truck. A heavy load decreases performance and increases stopping distances. A heavy load may also damage the springs, shock absorbers, tires, and transmission. A heavy load or one that is not evenly distributed may upset the trim and balance of a vehicle, making curves and stops more dangerous. Loads on trucks and trailers should be securely fastened to prevent any part of them from falling off. See Chapter 26 for loading and tiedown instructions.

## **SCHOOL BUSES**

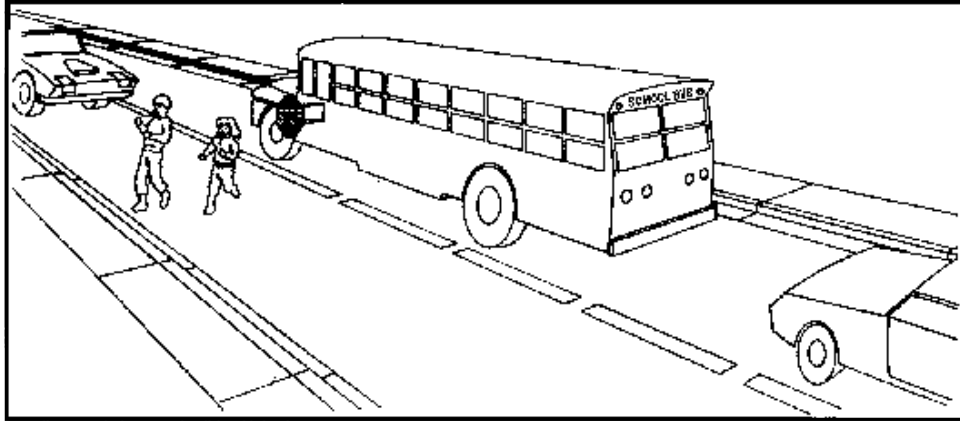
6-47. Except on highways with a median strip, all traffic in both directions must come to a complete stop whenever a school bus stops to pick up or discharge passengers (see Figure 11-1). In some localities, this rule applies to certain other vehicles (such as city or church buses). Traffic must remain stopped until the bus driver turns off the special "stop lights" on the front and rear and/or withdraws the special stop sign located on the left side of the bus.

## **EMERGENCY VEHICLES**

6-48. Police cars, ambulances, and fire engines are entitled to the right-of-way whenever they give an audible warning of their approach. This warning is usually a siren. Additional warnings may be given by using a bell or flashing red or blue lights. The law requires that drivers pull to the right-hand curb or edge of the road and come to a complete stop. They must remain stopped until the emergency vehicle has passed or until they are directed to proceed by a police officer.

6-49. Though laws and regulations require that a driver pull to the right side of the road, they do not require them to do it carelessly or without regard to consequences. Be sure to look before turning the steering wheel. Turning suddenly to the right without looking, may cause a collision with the emergency vehicle, another driver, a pedestrian, or a bicyclist.

6-50. Never follow within 500 feet of a fire truck or other emergency vehicle. Never drive into or park in a block where an emergency vehicle has stopped in answer to an alarm. Doing so exposes the driver to unnecessary dangers and may hinder the work of the emergency workers. Never drive over a fire hose unless directed to do so by a fireman or police officer.



**Figure 6-1. Stopping for a School Bus**

## **BREAKDOWNS**

6-51. If the vehicle breaks down, remove it from (if possible) the main traveled portion of the road. If the vehicle has a flat tire, it is possible to damage the tire beyond repair if the operator continues to drive on it. However, if necessary, an operator should take this risk to get the vehicle off the road to avoid greater danger. When the vehicle is disabled at night, always leave the parking lights on as a warning to other drivers. Whether day or night, always turn on the four-way flasher warning lights.

6-52. Place warning devices contained in the highway warning kit as prescribed in the kit instructional manual. If the instructions are not with the kit, follow the procedures in Chapter 13.

6-53. If it is impossible to get the vehicle off the road and it is obstructed from view by a curve or hill, walk back along the shoulder of the road to a position where it is possible to signal approaching drivers to stop in time. Do not attempt to make repairs on the vehicle while it is in an exposed position on the road.

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**FOR ARMY ONLY:** If possible, make limited repairs or notify the unit maintenance personnel according to the operating procedure of the unit.

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**FOR AIR FORCE ONLY:** For disabled vehicles on base, notify vehicle maintenance through the unit vehicle control officer during normal duty hours. After normal duty hours, notify the on-duty vehicle operation dispatcher. For off-base vehicle disabilities, contact the vehicle operations officer/superintendent to obtain vehicle repair instructions (AFI 24-301 and AFI 24-302).

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## SAFETY

6-54. Safety is a command responsibility. The operator must receive adequate instruction on safe practices when operating vehicles. Safety, properly taught and constantly emphasized, will prevent much needless manpower and equipment loss during critical military operations. AR 385-10 (The Army Safety Program) defines these safety responsibilities. The following are a few of the safety precautions that should be followed:

- Do not move vehicles without first checking both sides, front, rear, and underneath to ensure that the vehicle can be maneuvered without endangering personnel or equipment. Always post ground guides when maneuvering a vehicle in a motor pool or bivouac area, especially at night and under blackout (BO) conditions in any off-road area when it is too dark to see the surroundings.
- Do not run engines in closed areas without adequate ventilation.
- Do not use cutting wheels or torches without wearing protective goggles.
- Do not use defective or improper tools.
- Do not wear any jewelry (especially rings or watches) when working around the vehicle.
- Ensure the vehicle has proper support when changing wheels.
- Do not climb over bumpers and running boards without first removing ice or frost.
- Do not maneuver vehicles with vision obscured by frost or dirt on windshield and mirrors.
- Do not drive too fast for roads or traffic conditions.
- Do not perform backing operations without a ground guide.
- Do not smoke during refueling operations.
- Do not fail to wear seat belt, helmet, and hearing and eye protection.

## VEHICLE ROLLOVERS

6-55. The US Army's various commands and centers, as well as their sister service counterparts, have undertaken studies and identified steps to lower the number of HMMWV rollovers and to reduce the effect on combat readiness if rollover accidents do occur. Most up armored HMMWV rollovers are preventable and actions can be taken to prevent or reduce the severity when they occur.

6-56. For this reason the HEAT Simulator was developed (Figure 6-2). The initial goal of the HEAT Simulator is to instill the training necessary to first avoid a rollover. However, when a rollover does occur, then training is required to learn how to survive the rollover and then successfully egress from an inverted vehicle by emphasizing teamwork and developing muscle memory through crew/battle drills.

6-57. For more in-depth information about the HEAT simulator refer to TC 55-HEAT. The TC provides a standardized training program for the HEAT. It outlines personnel responsibilities and provides implementation instructions, goals, and methods to ensure the overall success of the HEAT device and related programs.

6-58. See Appendix C for information on Vehicle Rollover Prevention.



**Figure 6-2. HMMWV Egress Assistance Trainer (HEAT)**

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## Chapter 7

# Mounted Land Navigation

### BLUE FORCE TRACKING (BFT)

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Note: Blue Force Tracker is a United States military automated system that helps provide commanders with information about friendly and enemy forces.

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7-1. FBCB2/BFT consists of the AN/UYK-128(V) ruggedized computer and peripheral equipment. Peripheral equipment consists of a Precision Lightweight GPS Receiver (PLGR) or Defense Advanced GPS Receiver (DAGR) (see Figure 7-1, Figure 7-2, and Figure 7-3).



**Figure 7-1. Blue Force Tracker Display Unit**



Figure 7-2. Precision Lightweight GPS Receiver (PLGR)



Figure 7-3. Blue Force Tracker Display Unit with the Defense Advanced GPS Receiver (DAGR)

7-2. FBCB2-EPLRS peripheral/interface equipment may consist of an Internet Controller (INC), Single Channel Ground and Airborne Radio System (SINCGARS), Enhanced Position Location Reporting System (EPLRS), Spitfire, Long Range Advanced Scout Surveillance System (LRAS3), Automatic Chemical Agent Detector and Alarm (ACADA), and/or Radiation Detection, Indication and Computation (RADIAC). FBCB2-EPLRS transmits via the Lower Tactical Internet and is interoperable with other Army Battle Command Systems.

7-3. FBCB2-Blue Force Tracking peripheral/interface equipment consists of a MT-2011E L-Band Transceiver. The system continually transmits their actual locations over the FBCB2 network. It then monitors the location and progress of friendly forces and sends those specific coordinates to a central location called the Army Tactical Operations Center. There the data is consolidated into a common picture and sent back out to units. The system also allows users to input or update operational graphics (such as obstacles and engineer reconnaissance on the road). Once uploaded it can be mailed back to higher headquarters or mailed to other subscribers of that user's list.

7-4. An additional capability comes from route planning tools. By inputting grid coordinates the BFT becomes both the map and compass for motorized units. With proximity warnings enabled, the vehicle crew is made aware as they approach critical or turn points.

## **PRECISION LIGHTWEIGHT GLOBAL POSITIONING SYSTEM (GPS) RECEIVER (PLGR)**

7-5. The PLGR is a legacy military GPS receiver still in wide use today. It is being replaced by the DAGR. PLGRs are used by infantry as handheld sets, by Artillery to plot precise positions for gun systems, in tracked and wheeled vehicles. PLGR is a key element in Task Force XXI, providing real-time, precise position data for all combat elements to the battlefield information systems.

## **DEFENSE ADVANCED GLOBAL POSITIONING SYSTEM (GPS) RECEIVER (DAGR)**

7-6. The DAGR is a self-contained, hand-held, 12-channel, dual frequency continuously tracking GPS receiver. It uses state-of-the-art GPS receiver technology including "All in View" satellite tracking and the Selective Availability Anti-Spoof Module (SAASM) to access the Precise Positioning Service (PPS) signal for highly accurate Position, Navigation, and Timing (PNT) information 24 hours a day under all weather conditions. Although designed as a hand-held receiver for ground-mobile and airborne troops, standardized interfaces enable DAGR to provide PNT information to a wide variety of vehicles and host systems including integrated configurations for position location, target location, rendezvous and en-route and terminal navigation.

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Note: Refer to the appropriate equipment Technical Manual for more detailed information on a specific piece of equipment, or TB 11-7010-326-10-3 or TC 3-25.26 for more general information.

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## **GRIDS AND STRIP MAPS**

7-7. An easy way to become familiar with the area in which you are operating is by studying a map. From the map you can determine the major roads and where they go. Also, you can find obvious landmarks such as mountains, valleys, coastlines, rivers, cities, railroads, crossroads, and bridges. The two basic types of maps are the grid map and the strip map. TC 3-25.26 covers map reading and land navigation.

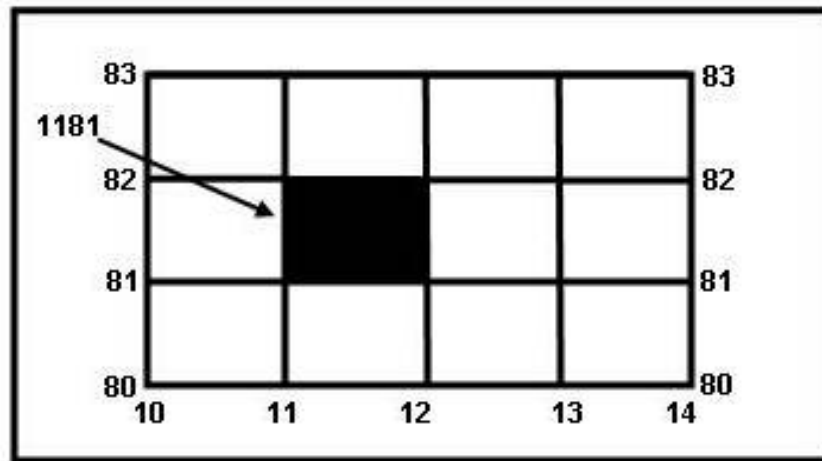
## USING THE MILITARY GRID REFERENCE SYSTEM

7-8. To keep from getting lost, you have to know how to find out where you are. There are no street addresses in a combat area, but a military map can spot your location accurately. The map has lines running up and down (north and south) and across (east and west). These lines form small squares 1,000 meters on each side called grid squares.

7-9. The lines that form grid squares are numbered along the outside edge of the map picture. No two grid squares will have the same number. The precision of a point location is shown by the number of digits in the coordinates the more digits, the more precise the location; for example:

- 1181 is a 1,000 meter grid square.
- 115813 is to the nearest 100 meters.
- 11508133 is to the nearest 10 meters.

7-10. For instance, suppose your address is grid square 1181. How do you know this? Start from the left and read right until you come to 11, the first half of your address. Then read up to 81, the other half. Your address is somewhere in grid square 1181 (see Figure 7-4).



**Figure 7-4. Grid Square**

7-11. Grid square 1181 gives your general neighborhood, but there is a lot of ground inside that grid square. To make your address more accurate, just add another number to the first half and another number to the other half, so your address has six numbers instead of four.

7-12. To get those extra numbers pretend that each grid square has 10 lines inside it running north and south and another 10 running east and west. This makes 100 smaller squares. You can estimate where these imaginary lines are.

7-13. If you are halfway between line 11 and line 12, the next number is 5 and the first half of your address is 115. If you are also three-tenths of the way between line 81 and line 82, then the second half of your address is 813. (If you are exactly on line 81, the second half would be 810.) Figure 7-5 shows that if you were where the dot is in the grid square 1181, then your address would be 115813.

7-14. The most accurate way to determine the coordinates of a point on a map is to use a coordinate scale (see Figure 7-6). You do not have to use imaginary lines because you can find the exact coordinates on the coordinate scale and protractor or the plotting scale. Located on both of these devices are two coordinate scales: 1:25,000 and 1:50,000 meters. When you use either of these devices, be sure to use the correct scale.

7-15. Use the coordinate scales to determine the coordinates of a point (Point A) already plotted on a map (see Figure 7-7). First, locate the grid square in which the point is located. The number of the vertical grid line on the left (west) side of the grid square will be the first and second digits of the coordinates (11). The number of the horizontal grid line on the bottom (south) side of the grid square will be the fourth and fifth digits of the coordinates (81).

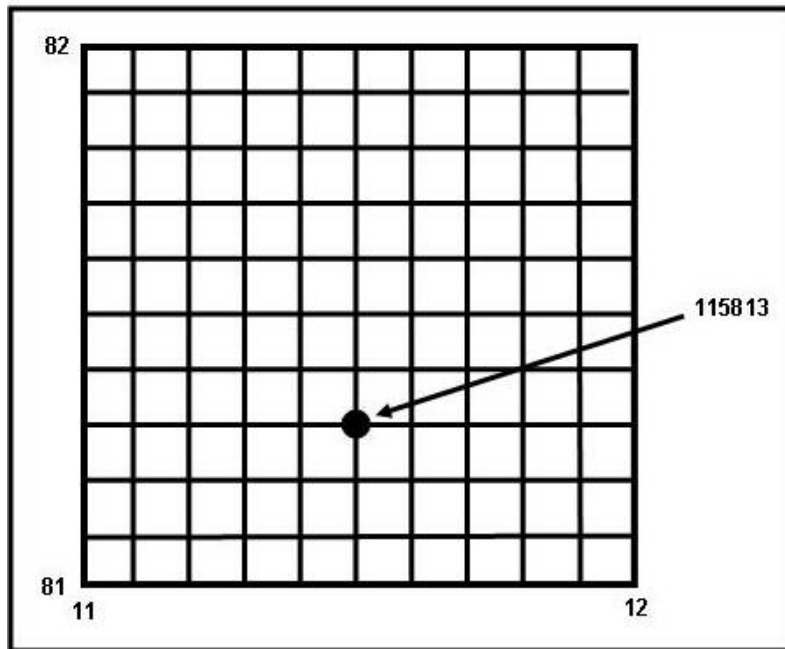


Figure 7-5. Point on Grid Square

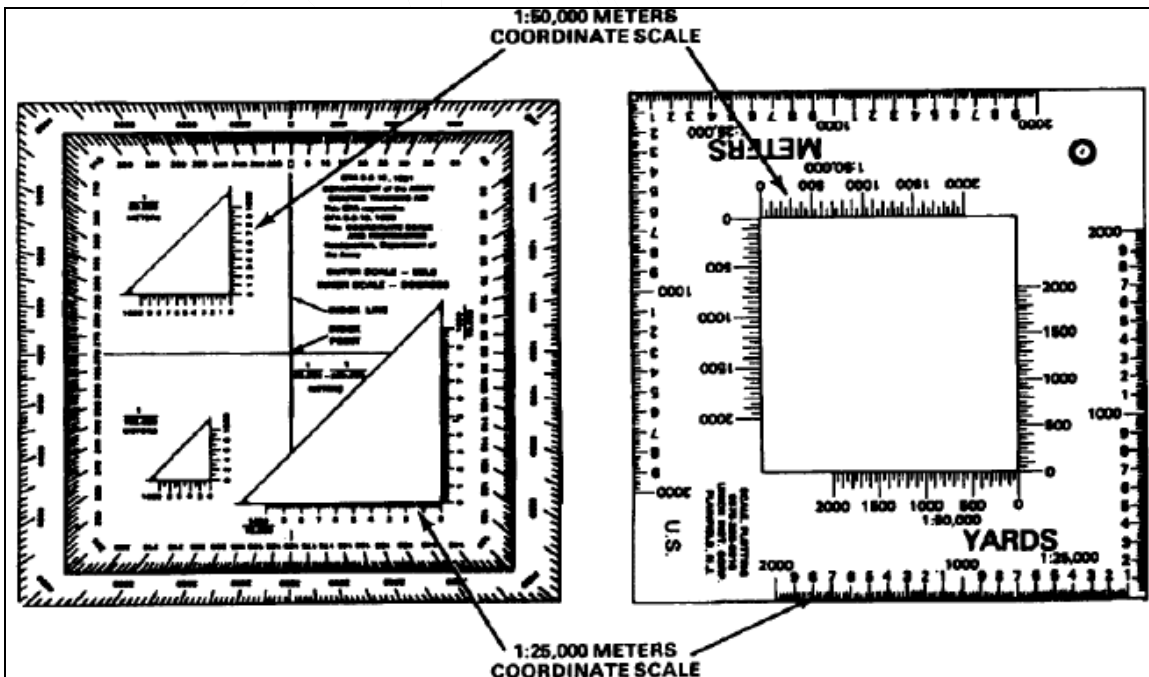
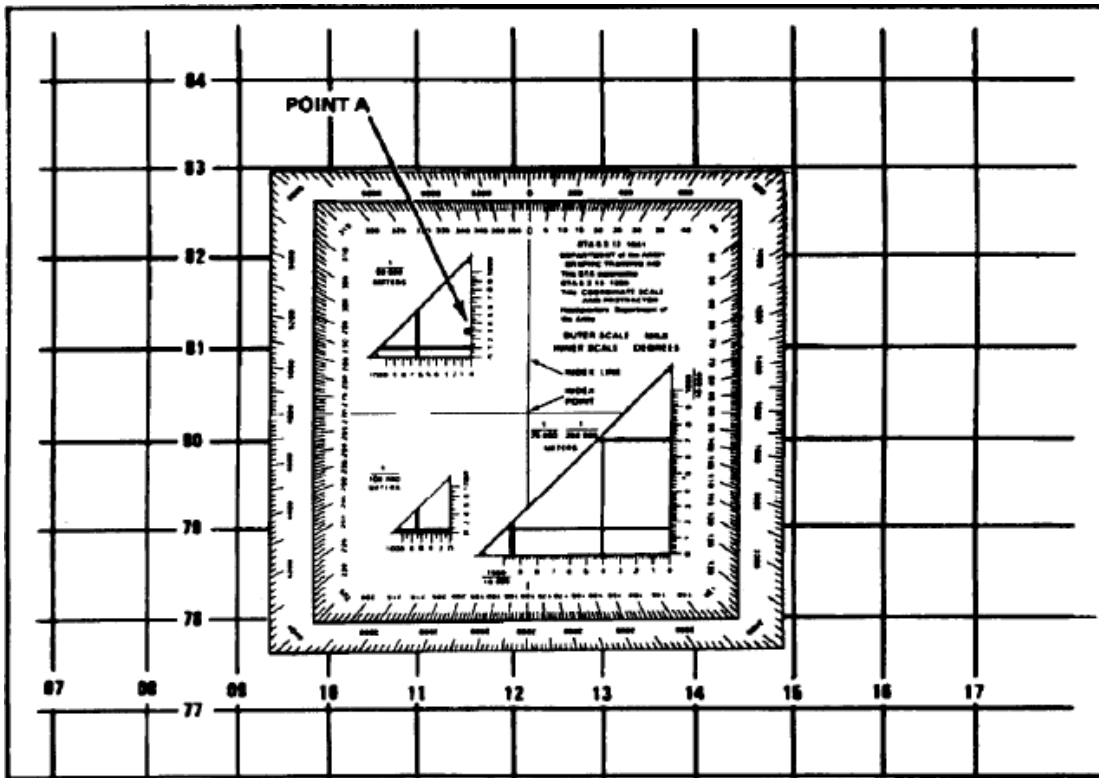


Figure 7-6. GTA 05-02-012: Coordinate Scale and Protractor



**Figure 7-7. Determining Coordinates of a Point Using Coordinate Scale**

7-16. To determine the third and sixth digits of the coordinates, place the coordinate scale on the bottom grid square containing point A. Be sure the zeros of the coordinate scale are in the lower left-hand (south-west) corner of the grid square. Slide the coordinate scale to the right, keeping the bottom of the scale on the bottom grid line until point A is under the vertical (right-hand) scale.

7-17. To determine a six-digit coordinate, the 100-meter mark on the bottom scale, which is nearest the north-south grid line, is the third digit, 5. The 100-meter mark on the right-hand scale, which is nearest point A, is the sixth digit, 3. Putting these together, you have 115813.

7-18. To determine an eight-digit coordinate, which locates a point on the ground to within 10 meters, keep in mind that there are 100 meters between each 100-meter mark (number) on the scale. A short tick mark indicates 50 meters between each 100-meter mark. As shown in Figure 7-5, the grid line crosses the bottom scale on the 500-meter mark, this makes the third and fourth digits 50. If the grid line crossed the scale between the 500- and 600-meter mark, you must interpolate how many meters it is beyond 500 meters. To determine the seventh and eighth digits, read the right-hand scale where the point is on the scale. As shown, the point is between the 300- mark and the 50-meter tick mark. You must estimate how many 10s the point is beyond the 300 mark. In this case it is 3, which makes the seventh and eighth digits, 33. Putting these together, you have 11508133.

7-19. To determine the correct two-letter 100,000-meter square identifier, look at the grid reference box in the margin of the map. Place the 100,000 – meter square identifier in front of the coordinate GL 11508133 (see Figure 7-8, Figure 7-9, Figure 7-10, and Figure 7-11).

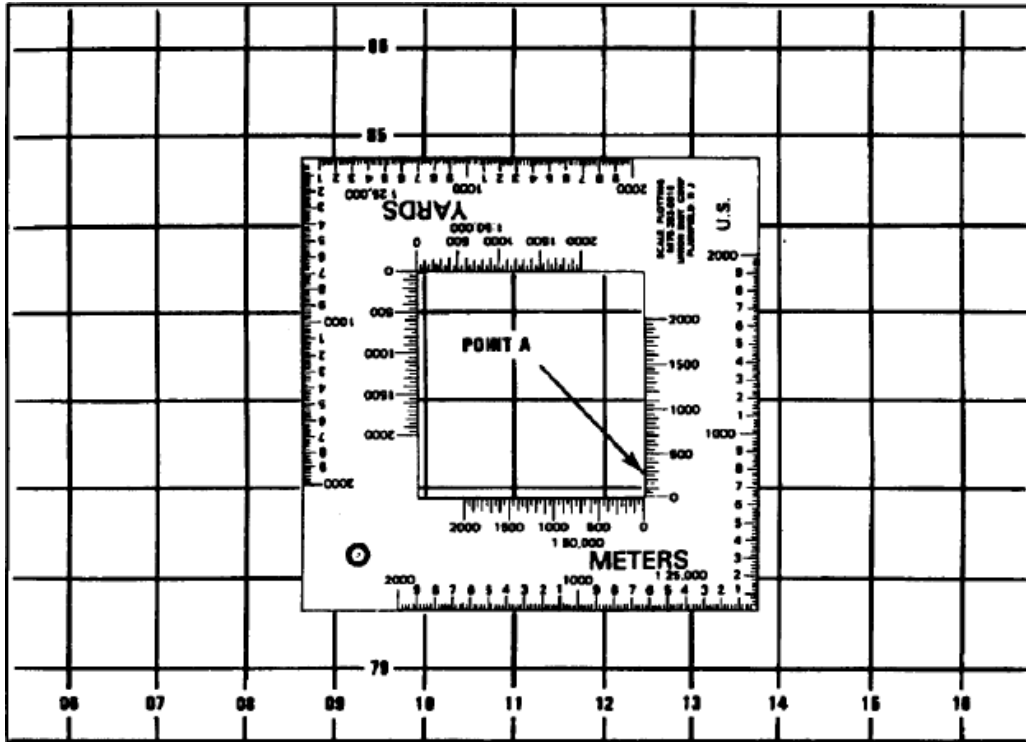


Figure 7-8. Locating a Point on a Grid Square

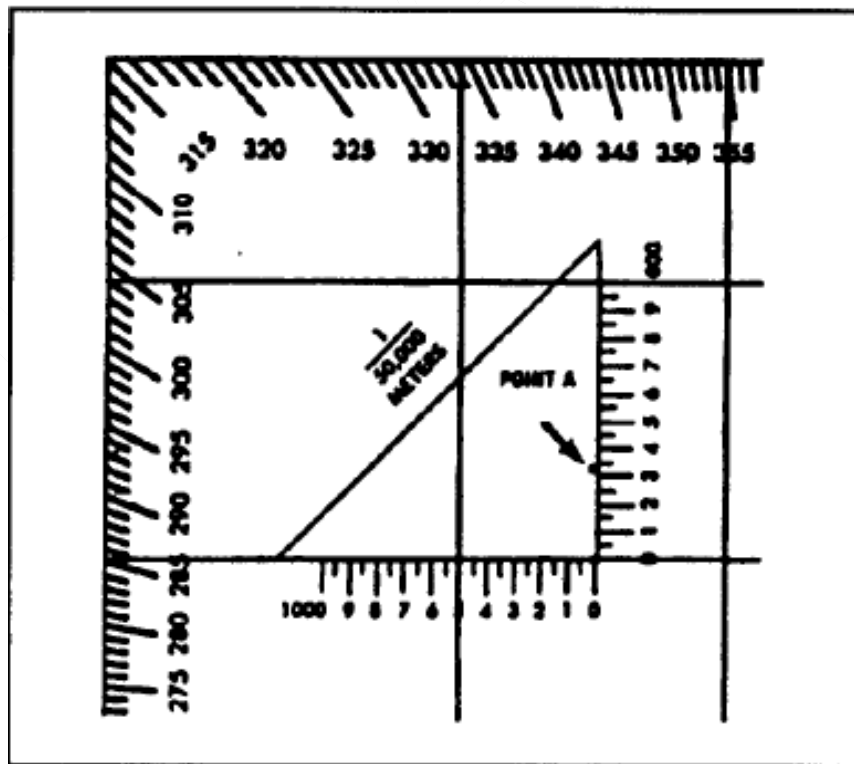


Figure 7-9. Coordinate Scale

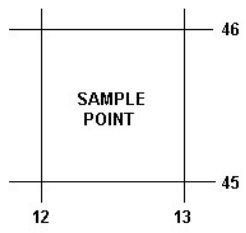

<p><b>SAMPLE 1,000 METER GRID SQUARE</b></p> 	<p><b>100 METER REFERENCE</b></p> <ol style="list-style-type: none"> <li>1. READ LARGE NUMBERS LABELING THE VERTICAL GRID LINE LEFT OF POINT AND ESTIMATE TENTHS (100 METERS) FROM GRID LINE TO POINT.</li> <li>2. READ LARGE NUMBERS LABELING THE HORIZONTAL GRID LINE BELOW POINT AND ESTIMATE TENTHS (100 METERS) FROM GRID LINE TO POINT.</li> </ol> <p>EXAMPLE: 123456</p>
<p><b>100,000 M. SQUARE IDENTIFICATION</b></p> 	<p>WHEN REPORTING ACROSS A 100,000 METER LINE, PREFIX THE 100,000 METER SQUARE IDENTIFICATION, IN WHICH THE POINT LIES.</p> <p>EXAMPLE: FL 123456</p>
<p><b>GRID ZONE DESIGNATION</b></p> <p>16S</p>	<p>WHEN REPORTING OUTSIDE THE GRID ZONE DESIGNATION AREA, PREFIX THE GRID ZONE DESIGNATION.</p> <p>EXAMPLE: 16SFL123456</p>

Figure 7-10. Grid Reference Box

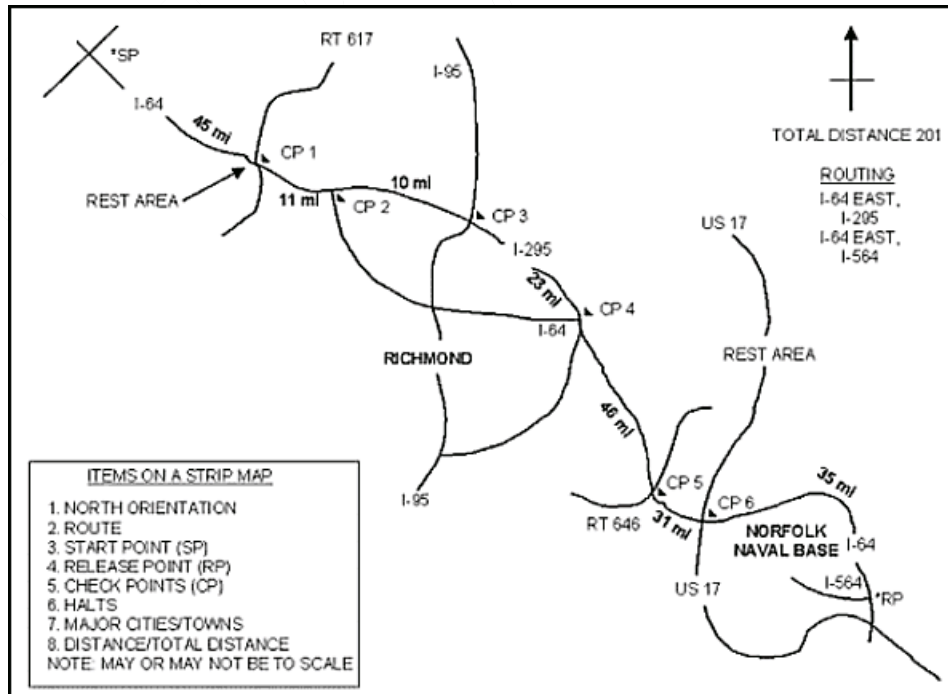


Figure 7-11. Strip Map



## ESTIMATING THE DISTANCE

7-20. Maps are drawn to scale so by measuring the distance on the map you can estimate the distance on the ground. This scale may be indicated by a note such as "3 inches equals 1 mile." This means that 3 inches on the map equals 1 mile on the ground. You can then use a 3-inch strip of paper as a ruler to measure the number of miles on the map. Sometimes instead of a note, a ruler is printed on the map for you. Another way to show the scale is by a representative fraction; for instance, 1/63,360 or 1:63,360. This means that one unit of distance on the map equals 63,360 units on the ground. For instance, 1 inch on the map equals 63,360 inches on the ground which equals 5,280 feet or 1 mile.

7-21. United States units for measuring distance are in terms of miles, yards, and feet. In most overseas areas, the metric system is used. You need to know metric measurements and how they compare to ours because your speedometer and odometer will measure in miles. A kilometer equals a little over six-tenths of a mile. The following conversion method shows how to convert (approximately) to the metric system:

- Kilometers (km) to miles (mi): multiply km by .62.
- Example: 37 km x .62 = 22.94 or 23 mi.
- Miles to kilometers: multiply mi by 1.6.
- Example: 23 mi x 1.6 = 36.8 or 37 km.

## ESTIMATING THE TIME

7-22. Having estimated the distance, the next step is to figure-the time you will need. In estimating time, remember that your maximum allowable speed must not exceed that shown on the caution plate in the cab or that specified by your commander. Your average speed will be less than your maximum speed, as average speed includes halts and traffic slowdowns. For detailed information, refer to ATP 4-16.

## RECOGNIZING MILITARY SIGNS

7-23. In addition to the signs and devices normally encountered in civilian and military driving, you must know signs peculiar to the military service. These include signs or symbols and installation markers (see Figure 7-12). Military signs and symbols can be found in ADRP 1-02.

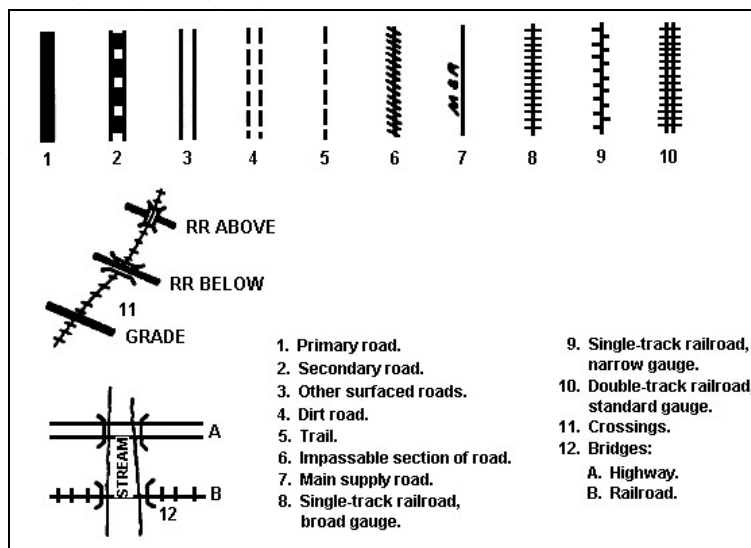


Figure 7-12. Strip Map Symbols

## USING A STRIP MAP

7-24. The strip map shown in Figure 7-11 is a sketch of a route of march. It may or may not be drawn to scale, but it should show the identifying landmarks. A strip map may include varying degrees of information, such as —

- Start point and Release point.
  - The start point (SP) is where all elements of a column come under the control of the convoy commander. The SP must be a place along the route easily recognized on both maps and ground.
  - The release point (RP) is a well-defined point on a route at which the elements composing a column return under the authority of their respective commanders, each one of these elements continuing its movement towards its own appropriate destination.
- Routes and route numbers .
- Major towns.
- Major roads and crossroads.
- Mileage between points.
- Bivouac, rest, halt, and petroleum, oils, and lubricants (POL) areas.
- Directional arrows.
- Legend.

7-25. When you are assigned a driving mission, you are told which route to follow. However, you must study the map and check the road system for alternate routes so that you can make detours when necessary.

7-26. If you turn on the wrong road, your sense of direction should help you find your way. The task is much easier if you have oriented yourself properly in the beginning and have picked out landmarks along the way. Check your road map to find the road you are on and either select a new route or return to the one you were following originally.

## MOUNTED LAND NAVIGATION

7-27. A vehicle commander should be able to navigate from one point on the ground to another with or without a compass. If separated from his/her unit and given an azimuth and distance from their position, he/she should be able to reach the unit and continue the mission. To move effectively while mounted, he/she must know the principles of mounted navigation.

## PRINCIPLES

7-28. The principles of land navigation, while mounted, are basically the same as while dismounted. The major difference is the speed of travel. Walking between two points may take one hour, but riding the same distance may only take 15 minutes. To be effective at mounted land navigation, the travel speed must be considered.

## NAVIGATOR'S DUTIES

7-29. The duties of a navigator are so important and exacting that he/she should not be given any other duties. The leader should never try to be the navigator, since his/her normal responsibilities are heavy, and one or the other job would suffer. The following are the duties of a navigator:

- **Assembling Equipment.** The navigator must gather all the equipment that will help him/her perform his/her job (maps, pencils, and so forth). He/She must do this before the mission starts.
- **Servicing Equipment.** The navigator must make sure that all the equipment he/she may use or require is working.

- **Recording Data for Precise Locations.** During movement, the navigator must make sure that the correct direction and distance are recorded and followed. Grid coordinates of locations must be recorded and plotted.
- **Supplying Data to Subordinate Leaders.** During movement, any change in direction or distance must be given to the subordinate leaders in sufficient time to allow them to react.
- **Maintaining Liaison with the Commander.** The commander normally selects the route that he/she desires to use. The navigator is responsible for following that route. However, there may be times when the route must be changed during a tactical operation. Therefore, the navigator must maintain constant communication with the commander. The navigator must inform the commander when checkpoints are reached, when a change in direction of movement is required, and how much distance is traveled.

## MOVEMENT

7-30. When preparing to move, the effects of terrain on navigating mounted vehicles must be determined. The operator will cover great distances very quickly and must develop the ability to estimate the distance that has been traveled. Remember that 0.1 mile is roughly 160 meters, and 1 mile is about 1,600 meters or 1.6 kilometers. Having a mobility advantage helps while navigating. If an operator gets disoriented, mobility makes it much easier so that the operator can move to a point where he/she can reorient himself/herself.

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Note: To convert kilometers per hour (KMPH) to miles per hour (MPH), multiply by .62. (9 KMPH x .62 = 5.58 MPH). To convert MPH to KMPH, divide MPH by .62 (10 MPH 0.62 = 16.12 KMPH).

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## CONSIDER VEHICLE CAPABILITIES

7-31. When determining a route to be used when mounted, consider the capabilities of the vehicles to be used. Most military vehicles are limited in the degree of slope they can climb and the type of terrain they can negotiate. Swamps, thickly wooded areas, or deep streams may present no problems to dismounted Soldiers, but the same terrain may completely stop mounted Soldiers. The navigator must consider this when selecting a route.

7-32. Most vehicles will knock down a tree. The bigger the vehicle, the bigger the tree it can knock down. Most vehicles cannot knock down several trees at once. It is best to find paths between trees that are wide enough for the vehicle. Military vehicles are designed to climb 60 percent slopes on a dry, firm surface (see Figure 7-13).

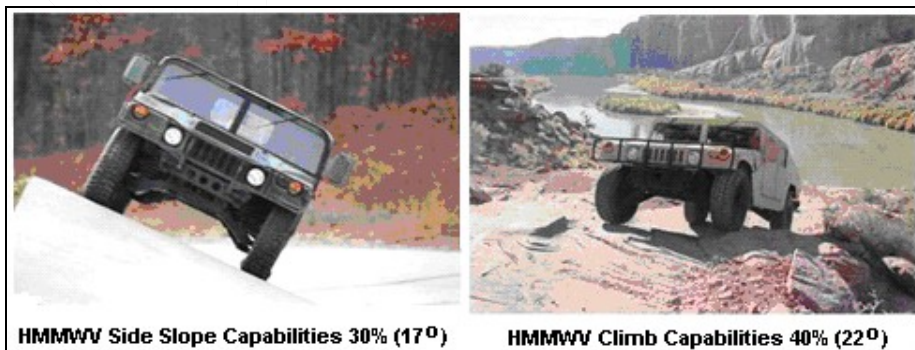


Figure 7-13. HMMWV Slope and Climb Capabilities

- 7-33. Refer to a military grid map with contour lines and make the following determination—
- The slope can easily be determined; just look at the route that has been selected. If there is a contour line in any 100 meters of map distance on that route, it is a 10 percent slope. If there are two contour lines, it is 20 percent, and so forth. If there are four contour lines in any 100 meters, look for another route.
  - Side slope is even more important than the slope he/she can climb. Normally, a 30 percent slope is the maximum in good weather. If a side slope is traversed, do it slowly and without turns.
  - For tactical reasons, he/she will often want to move in draws or valleys because they give cover. However, side slopes force him/her to move slowly.
  - Refer to vehicle TM for guidance on maximum slope allowances.

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Note: The above figures are true for a 10-meter or a 20-foot contour interval. If the map has a different contour interval, just adjust the arithmetic. For instance, with one contour line in 100 meters, a 20-meter interval would give a 20 percent slope.

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## KNOW THE EFFECTS OF WEATHER ON VEHICLE MOVEMENT

7-34. Weather can halt mounted movement. Snow and ice are obvious dangers, but more significant is the effect of rain and snow on the soils load-bearing ability. Cross-country vehicles may be restricted to road movement in heavy rain. If it has rained recently, adjust the route to avoid flooded or muddy areas. A mired vehicle only hinders combat capability.

## PREPARE BEFORE MOVEMENT

7-35. Locate the start point and finish point on the map. Determine the map's grid azimuth from start point to finish point and convert it to a magnetic azimuth. Determine the distance between the start point and finish point or any intermediate points on the map and make a thorough map reconnaissance of that area. Ensure vehicle is prepared for inclement weather operations prior to movement.

## TERRAIN ASSOCIATION NAVIGATION

7-36. This is currently the most widely used method of navigation. The navigator plans his/her route so that he/she moves from terrain feature to terrain feature. The navigator selects routes or streets between key points or intersections. These routes must be capable of sustaining the travel of the vehicle or vehicles, should be relatively direct, and should be easy to follow. In a typical move, the navigator does the following:

- Determines his/her location.
- Determines the location of his/her objective.
- Notes the positions of both on his/her map.
- Selects a route between the two.

After examining the terrain, he/she adjusts the route by the following actions:

- **Consider Tactical Aspects.** Avoid skylining, select key terrain for overwatch positions, and select concealed routes.
- **Consider Ease of Movement.** Use the easiest possible route and bypass difficult terrain. Remember that a difficult route is harder to follow, is noisier, causes more wear and tear (and possible recovery problems), and takes more time. Tactical surprise is achieved by doing the unexpected. Try to select an axis or corridor instead of a specific route. Make sure there is enough maneuver room for the vehicles (see Figure 7-14).
- **Use Terrain Features as Checkpoints.** These checkpoints must be easily recognizable in the light and weather conditions and at the speed at which he/she will move. He/She

should be able to find a terrain feature from his/her location that can be recognized from almost anywhere and used as a guide. An example is checkpoint 2, the church, and checkpoint 3, the orchard (see Figure 7-14).

- The best checkpoints are linear features that cross the route. Use streams, rivers, hard-top roads, ridges, valleys, and railroads.
  - The next best checkpoints are elevation changes (such as hills, depressions, spurs, and draws). Look for two contour lines of change. He/She will not be able to spot less than two lines of change while mounted.
  - In wooded terrain, try to locate checkpoints at no more than 1,000-meter intervals. In open terrain, he/she may go to about 5,000 meters.
- **Follow Terrain Features.** Movement and navigation along a valley floor or near (not necessarily on) the crest of a ridgeline is easiest.
- **Determine Directions.** Break the route down into smaller segments and determine the rough directions that will be followed. He/She does not need to use the compass; just use the main points of direction (north, northeast, east, and so forth). Before moving, note the location of the sun and locate north. Locate changes of direction, if any, at the checkpoints picked.
- **Determine Distance.** Get the total distance to be traveled and the approximate distance between checkpoints. Plan to use the vehicle odometer to keep track of distance traveled. Use the pace-count method and keep a record of the distance traveled. When using a pace count, convert from map distance to ground distance by adding the conversion factors of 20 percent for cross-country movement.
- **Make Notes.** Mental notes are usually adequate. Try to imagine what the route is like and remember it.
- **Plan to Avoid Errors.** Restudy the route selected. Try to determine where errors are most apt to occur and how to avoid any trouble.
- **Use a Navigational Log.** Prepare a navigational log when the routes have been selected and when the distance to be traveled has been divided into legs. The log is an informal record of the distance and azimuth of each leg, with notes to aid the navigator in following the correct route. The notes list easily identifiable terrain features at or near the point where the direction of movement changes (see Figure 7-15).

## DEAD RECKONING NAVIGATION

7-37. Dead reckoning is moving a set distance along a set line. Generally, it involves moving so many meters along a set line, usually an azimuth in degrees. There is no accurate method of determining a direction in a moving vehicle. A magnetic vehicle-heading reference unit may be available in a few years; for now, use a compass.

- **With Steering Marks.** This procedure is the same for vehicle travel as on foot.
  - The navigator dismounts from the vehicle and moves away from the vehicle (at least 18 meters).
  - He/She sets the azimuth on the compass and picks a steering mark (rock, tree, and hilltop) in the direction on that azimuth (see Figure 7-16).
  - He/She remounts and has the operator identify the steering mark and proceed to it in as straight a line as possible.
  - On arrival at the steering mark or on any changes in direction, he/she repeats the first three steps above for the next leg of travel.

- **Without Steering Marks.** This procedure is used only on flat, featureless terrain.
  - The navigator dismounts from the vehicle, which is oriented in the direction of travel, and moves at least 18 meters to the front of the vehicle.
  - He/She faces the vehicle and reads the azimuth to the vehicle. By adding or subtracting 180 degrees, he/she determines the forward azimuth (direction of travel).
  - On order from the navigator, the operator drives on a straight line to the navigator.
  - The navigator remounts the vehicle, holds the compass as it will be held while the vehicle is moving, and reads the azimuth in the direction of travel.
  - The compass will swing off the azimuth determined and pick up a constant deviation. For instance, say the azimuth was 75 degrees while he/she was away from the vehicle. When he/she remounted and the operator drove straight forward, the compass showed 67 degrees. He/She will have a deviation of -8 degrees. All he/she needs to do is maintain that 67 degrees compass heading to travel on a 75 degrees magnetic heading.
  - At night, the same technique can be used. From the map, determine the azimuth he/she is to travel. Convert the grid azimuth to a magnetic azimuth. Line the vehicle up on that azimuth, and then move well in front of it. Be sure it is aligned correctly. Then mount, have the operator move slowly forward, and note the deviation.
  - The distance factor in dead reckoning is easy. Just determine the map distance to travel and add 20 percent to convert to ground distance. Use the vehicle odometer to be sure the proper distance is traveled.

## COMBINATION NAVIGATION

7-38. Some mounted situations may call for both methods to be combined. Just remember the characteristics of each.

- Terrain association is fast, is error-tolerant, and is best under most circumstances. It can be used day or night if he/she is proficient in it.
- Dead reckoning is very accurate if he/she does everything correctly. He/She must be very precise. It is also slow, but it works on very flat terrain.
- He/She frequently will combine both. He/She may use dead reckoning to travel across a large, flat area to a ridge, and then use terrain association for the rest of the move.
- He/She must be able to use both methods. He/She should remember that errors are probable, in order of frequency, will be—
  - Failure to determine distance(s) to be traveled.
  - Failure to travel the proper distance.
  - Failure to properly plot or locate the objective.
  - Failure to select easily recognized checkpoints or landmarks.
  - Failure to consider the ease of movement factor.

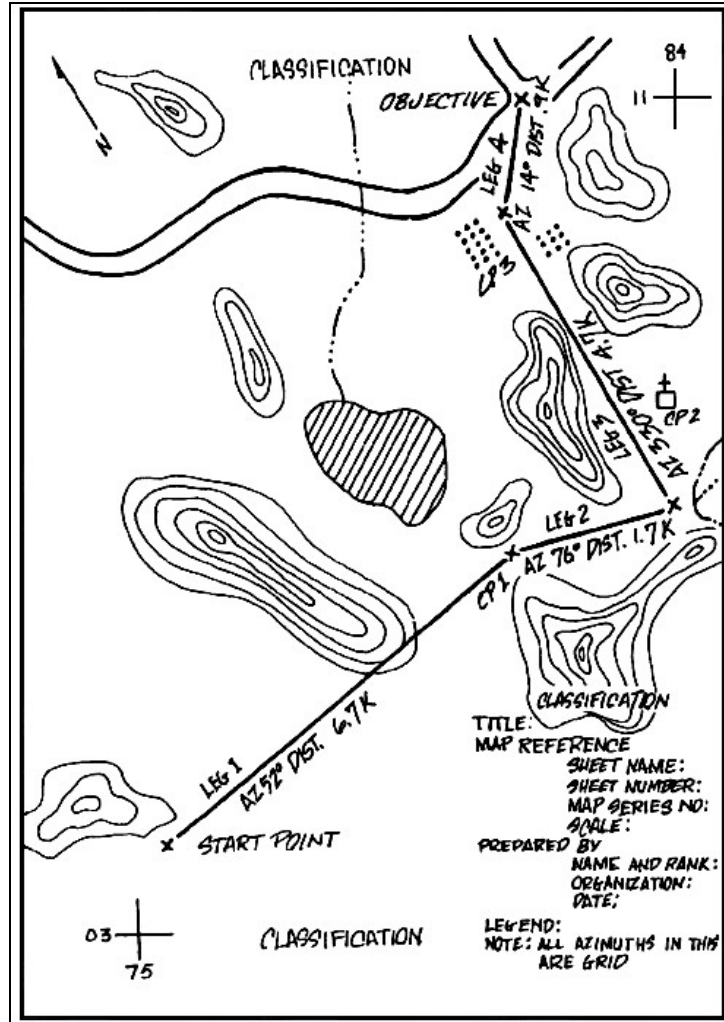


Figure 7-14. Primary Route

ODOMETER READING AT START	ODOMETER READING AT FINISH	DISTANCE IN MILES	AZIMUTH	DEVIATION CORRECTION	NOTES
12815	12830	15	1600 mils (90 degrees)	400 mils (23 degrees)	
<b>SAMPLE</b>					

Figure 7-15. Sample of a Navigational Log Format

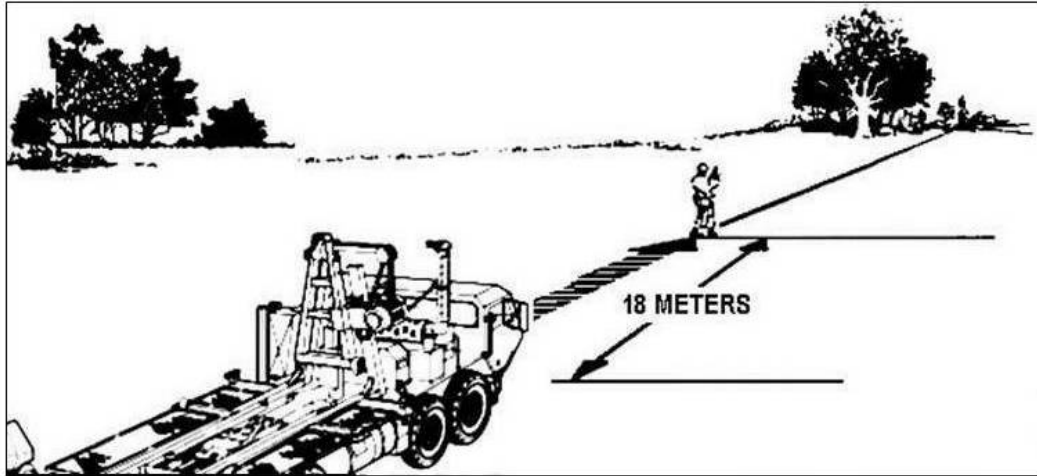


Figure 7-16. Determining an Azimuth, Dismounted



## Chapter 8

# Operation of Government Vehicles Off Post/Base

8-1. Off post/base dispatches may be limited to those approved by the motor transport officer or their designated representative. Off post/base operation of a government vehicle involves operator responsibility additional to on post/base operation. Previous chapters contain guidance on general techniques and methods of highway driving. This chapter gives instructions that should be followed while driving on an off post/base dispatch. If the instructions are not clear or if more detailed instructions are required, discuss the matter with your supervisor or dispatcher before starting on an off post/base dispatch.

### DISPATCHER'S RESPONSIBILITY

8-2. The unit vehicle control officer/dispatcher will provide the operator with required items for an off post/base dispatch. All necessary vehicle forms will be included in the folder based on unit SOP.

### SUPERVISOR'S RESPONSIBILITY

8-3. The recommended route should display the locations of repair facilities and communication services to include a list of telephone numbers. It is the vehicle operator's platoon sergeant or company truckmaster's responsibility to ensure all necessary route instructions and information accompanies the operator prior to departure.

### OFF POST/BASE DRIVING ITEMS AND EQUIPMENT

#### PROOF OF AUTHORIZATION

8-4. To prove you are authorized to take a government vehicle off post/base, you must have in your possession a valid state driver's license, your OF Form 346, DA Form 5984-E or AF Form 2293, and your vehicle dispatch document (For Army Only) Department of Defense [DD] Form 1970 or DA Form 5987-E (Motor Equipment Dispatch)). Check local procedures for other authorizations required for off post/base dispatches.

#### CREDIT CARD

8-5. The US Government National Credit Card is controlled since it could possibly be misused if lost and then found by dishonest persons. The operator will be expected to sign for this item and to limit its use to an absolute minimum and only for authorized purchases. Proper servicing of vehicles before departure from the post/base will reduce the need for credit card purchases.

- 8-6. When required, the following items and services may be procured with the credit card:
- Gasoline (regular unleaded, premium unleaded, special unleaded).
  - Gasoline (aviation grade, unleaded for boats, diesel marine fuel oil, and aviation turbine fuel).
  - Gasohol.
  - Diesel fuels.

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Note: Operators of government vehicles will use self-service pumps when available at commercial service stations to purchase the fuels noted above.

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- Lubricating service and lubricants (including differential and transmission lubricant).
- Oil filter elements and servicing.
- Ethylene glycol antifreeze.
- Brake fluid.
- Air filters (replacement of throwaway type only, cleaning of permanent type).
- Battery charging.
- Tire and tube repairs.
- Mounting and dismounting snow tires or chains.
- Emergency replacement of spark plugs, fan and generator belts, windshield wiper arms and blades, lamps, and so forth.
- Other emergency repairs, known in the automobile trade as “road repairs.”

8-7. Emergency roadside repair involves replacing or repairing automotive accessories at the point of breakdown. Repair is limited to the guidelines of the region responsible for that transportation motor pool (TMP) and/or the local installation policies. Repairs of this type include tires, tubes, batteries, and automotive accessories. When government facilities are nearby, use them (if possible) instead of commercial facilities. The dispatcher will normally advise an operator if a government facility is readily available or if a commercial source must be used. The operator may be held liable for the bill if this procedure is not followed.

8-8. The person who signs for a government credit card is solely responsible for the control and purchases made with the card. Credit card purchases must be substantiated with a copy of the service station receipt. In addition to the information normally shown on delivery receipts, ensure that the speedometer reading and the registration (or license) number of the vehicle and the operator’s name, grade, and organization are put on the receipt. The receipt must also show the credit card number; date of purchase; name and address of the station; the grade, quantity, and price per gallon of fuel; and the total amount charged. Upon returning to the post/base, the operator will return the credit card issued and a copy of any credit card receipts to the dispatcher.

## **TOLL TICKETS**

8-9. When routes off post/base include locations where passage would require a toll, prepaid toll tickets may be furnished (if available) at the time of dispatch. If not, follow local policy for being reimbursed for tolls and parking fees. Always ask the toll keeper for a receipt. Upon returning, submit any toll receipts and/or unused toll tickets to the dispatcher.

## **ACCIDENT FORMS**

8-10. The operator should use SF Form 91 if the operator has an accident while off post. See Chapter 10 for instructions on how to fill out this form. DD Form 518 is completed and furnished as identification according to instructions in Chapter 4.

## **SPARE TIRE AND TOOL KIT**

8-11. The operator must ensure that the vehicle is equipped with the proper tools in case of an emergency breakdown. The vehicle should have a suitable jack, lug wrench, and screwdriver; as well as any additional tools based on conditions (such as bad weather, difficult terrain, warfare, and so forth). The unit vehicle control officer will provide a spare tire, tool kit, and basic issue items (BII) for each vehicle.

## **ROUTE MAPS AND OPERATOR INFORMATION**

8-12. The map provided might be cut from an ordinary road map and securely attached to a card in order to reduce bulk and provide a map that is ready to read. Additional maps of cities along the route will be included if necessary. The map or card should be marked to show the north direction and the

scale, if necessary. To assist the operator in reading the map, a strip map with map symbols may be furnished.

**FOR ARMY ONLY:** Operators of Army vehicles must be authorized at the time of dispatch to pay parking fees in order to obtain reimbursement.

## HIGHWAY WARNING KIT

8-13. This kit has reflectors that can be used in all cases where warning is necessary (see Figure 8-1). All Army or Air Force motor vehicles, capable of carrying ten or more persons or with a rated capacity of more than four tons, will be equipped with approved highway warning kits. Vehicles of lesser capacity that regularly operate over public highways will also be equipped with warning kits. These kits stay with vehicles regularly used on public highways. Additional kits are stored in post/base motor pools. The kits are issued for specific trips when required. Convoys will be equipped with one kit for each ten vehicles, with a minimum of two kits per convoy. Of the total kits, at least one will be carried in the trail vehicle. Instructions for use will accompany each kit when issued.

**FOR AIR FORCE ONLY:** The unit vehicle control officer/NCO will furnish the highway warning kit in accordance with AFI 24-301.

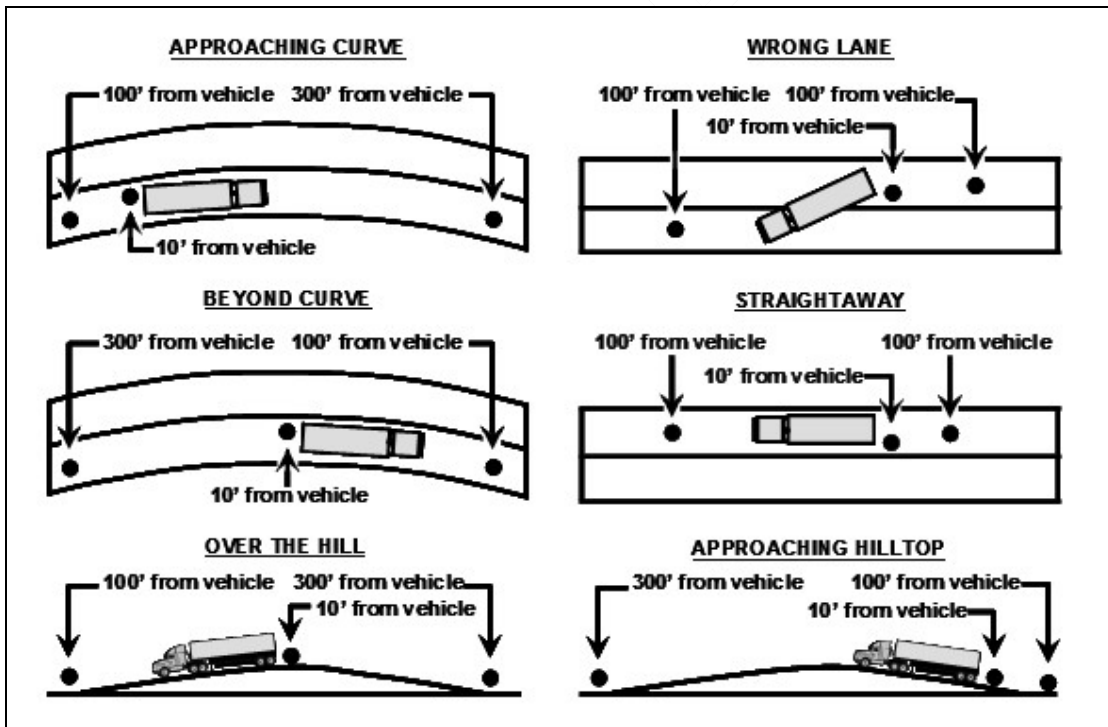


Figure 8-1. Use of Highway Warning Kits

8-14. Whenever a vehicle is inoperative or unable to move on a traveled portion of any highway, the following instructions will be complied with immediately (except in blackouts or within business or residential districts where traffic conditions do not permit or warrant the placing of warning devices):

- Make every reasonable effort to move the vehicle from the traveled portion of the roadway onto the shoulder if possible.
- When lights are required (sunset to sunrise), place a reflector in the obstructed lane, or on the shoulder of the road if the vehicle is on or over the shoulder, between the vehicle and the approaching traffic using that lane. Do this before trying to repair the vehicle. Place the reflectors as follows:
  - One reflector in the center of the lane of traffic occupied by the vehicle, not less than 40 paces (about 100 feet) from the vehicle in the direction of traffic approaching in that lane. If the vehicle is on or over the shoulder and does not occupy a traffic lane, place the warning device alongside the edge of the roadway to avoid obstructing the traffic lane.
  - One reflector on the traffic side of the vehicle four paces (about ten feet) to its rear, in the direction of traffic approaching in that lane.
  - One reflector not less than 40 paces from the vehicle in the opposite direction.
  - If the motor vehicle is stopped within 300 feet of a curve, crest of a hill, or other obstruction to view, place one reflector not less than 40 paces or more than 120 paces from the vehicle to afford ample warning to other highway users.
- When lights are not required (sunrise to sunset), place red flags or reflectors with flags mounted on them as prescribed for night. Since most warning kits contain only two flags, the reflector placed 20 feet behind the vehicle will not have a flag mounted on it.

8-15. A basic vehicle highway warning kit containing three sets of reflectors and two red flags which are acceptable in most states. Some states also require items, such as flares in the kit. However, vehicles transporting compressed gases, explosives, or flammable liquids will use three red electric flashing lanterns instead of flares. Check the kit and/or additional items periodically to ensure compliance with local legal requirements.

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**FOR AIR FORCE ONLY:** Obtain highway warning kit and/or road kit through VCO/VCNCO.

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## **OFF POST/BASE REPAIR SERVICE**

8-16. The supervisor or dispatcher can furnish local procedures and policies for the off post/base area to be served by the installation's vehicle maintenance crew. When the vehicle needs service at an off post/base location and it is too far away to obtain practical vehicle maintenance furnished from the post/base, proceed according to the instructions below.

- If the nearest suggested repair station will accept a collect telephone call, use this method to obtain service. If the station will not accept a collect telephone call, call the post/base motor transport officer so they can assist in contacting a repair station or help in some other way. When acceptable service from other than suggested repair stations is more convenient and timesaving, be sure the credit card or government invoice will be honored before requesting service be performed. The government invoice used is SF Form 44 (U.S. Government Purchase Order Invoice Voucher (to include SF 44A, 44B, 44C, and 44D)).
- Contact the nearest military installation for major repairs not listed in the paragraph above when it is determined that such assistance would be advantageous to the government. For instance, when the mission requires repair or service without delay or when the vehicle

must be towed for safety reasons, it would be advantageous to request service from a suggested repair station or some other acceptable service station. If in doubt on what to do, the operator should contact the motor transport officer or officer of the day at their home post/base or activity.

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**FOR AIR FORCE ONLY:** Use AF Form 15 (United States Air Force Invoice) to get emergency repairs, materials, supplies, and labor services. Use it to acquire services not authorized to be procured on a credit card. The form was originally intended for use with aircraft. Some modification of the form is required for use with vehicles. Emergency roadside repairs include the repair or replacement of minor assemblies (such as starters, generators, distributors, fuel pumps, water pumps, and similar component assemblies). AF Form 15A (Invoice Envelope) is used with the AF Form 15. A credit card can also be used for service normally acquired with an AF Form 15 when the vendor refuses to accept an AF Form 15. A statement concerning the refusal of the AF Form 15 must accompany the delivery receipt. When purchases are made using a government invoice, turn in a copy of the invoice to the dispatcher when you return to the post/base.

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## Chapter 9

# Procedures for Transporting Personnel

9-1. The operator of a government vehicle transporting military or civilian personnel has a special obligation to their passengers. These responsibilities are in addition to the previously described responsibilities for operating a vehicle.

### GENERAL PROCEDURES

9-2. Many passengers transported will be from other posts/bases or they may be visiting dignitaries from nearby cities. The visitor's first impression is the one they will remember most. The way an operator performs their duties when transporting personnel directly reflects upon their motor transportation operation. Regardless the grade or status of a passenger (officer, noncommissioned officer [NCO], enlisted, or civilian), an operator should always—

- Report promptly to the person requesting transportation.
- Show courtesy to all passengers regardless of grade.
- Open and close the vehicle door for passengers of senior grades.
- See that all passengers have secured seat and shoulder belts (if installed).
- Park the vehicle so passengers are able to load and unload on the curbside.

### SPECIAL SITUATIONS

#### OFF POST/BASE

9-3. There may be the requirement for an operator to transport personnel to off post/base destinations (such as airports, train stations, and bus stations). When picking up personnel off post/base, park the vehicle as near the exit or entrance as possible. Then report to the information section and have the passengers publicly paged over loud speakers. If the vehicle is parked a block or more from the station, the operator should ask their passengers to meet them at the front entrance; and then they can go for the vehicle. When transporting personnel to stations, the operator must only deliver them to the station entrance.

#### VERY IMPORTANT PERSONS (VIPS)

9-4. As a military operator, the opportunity may arise to transport VIPS (such as high-ranking officers or civilians, dignitaries, and so on) who visit the post/base. Generally, a VIP will be assigned one driver for their entire visit. The length of the visit varies, but is usually one to three days. A group of VIPS will normally consist of three to eight persons. The group generally has one person who acts as a liaison between the operator and the guests. This designated person is who the operator will report to and from whom they will also receive their orders. This person will have the itinerary for the VIPS and will be able to tell the operator when and where they need to be available with their vehicle. Between runs, be sure that the vehicle is ready for further service. Keep the vehicle wiped off, windows clean, and floor swept. The operator and their vehicle must be neat and clean at all times. If the operator and vehicle are needed past normal duty hours, a change of uniform is in order.

9-5. Salute when reporting to an officer to inform them their transportation is available. When the officer arrives at the vehicle, the operator must stand at attention, open the door, and salute. Additional officers must be saluted upon arriving at the vehicle.

9-6. Stand at parade rest by the vehicle door the officer will enter. When the driver sees the officer approaching, they stand at attention, salute, and open the door.

9-7. When transporting general officers, display the appropriate star plates and flags. When a general officer is not present, plates and flags will be cased.

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**FOR ARMY ONLY:** When retreat is sounded, halt the vehicle. If driving a bus or truck, only the senior occupant dismounts and renders the appropriate courtesy. If driving any other vehicle, all occupants are to dismount and render the appropriate courtesy.

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**CAUTION**

When dismounting on the traffic side, watch for traffic coming and going.

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**FOR AIR FORCE ONLY:** When retreat is sounded, stop the vehicle and remain seated.

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Note: The above applies when the American flag is passing.

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## BUSES, TRUCKS, AND PANEL VANS

### Buses

- 9-8. Perform the following when transporting personnel on buses:
- Secure all equipment to prevent possible injury to passengers.
  - Permit only authorized passengers to ride in the vehicle.
  - Permit passengers to board or leave the vehicle only when the vehicle has come to a complete stop.
  - Do not permit passengers to extend legs or arms outside the vehicle when it is in motion.
  - Never permit a passenger to obstruct a clear view of the road. An operator must have maximum visibility to drive safely.
  - See that baggage, if carried, is safely stowed and secured and not in the way of the passengers. Obey the regulations prohibiting the overload of vehicles.
  - Place the vehicle next to the curb or to the extreme right of the roadway when loading or unloading passengers.
  - Do not allow smoking on or in military vehicles.
  - Stop the vehicle between 15 and 50 feet before railroad crossings. Listen and look in both directions for trains. Before crossing after a train has passed, be sure another train is not coming in the other direction on other tracks. If the vehicle has manual transmission, do not change gears while crossing the tracks.
  - Slow down and carefully check for other vehicles at these locations:
    - Streetcar crossings.
    - Railroad tracks used only for industrial switching within a business district.
    - Where a policeman or flagman is directing traffic.
    - Where a traffic signal shows green.



- Avoid sudden stops and starts or any jerky movement.
- Comply with federal, state, municipal, and area laws and regulations pertaining to the operation of buses and mass personnel carrying vehicles when the vehicle is used over public streets or highways.
- Stop at drawbridges that do not have a signal light or traffic control attendant. Stop at least 50 feet before the draw of the bridge.
- Be sure the draw is completely closed before crossing.
- Slow down and be sure it is safe to cross when there is a traffic light showing green or there is an attendant or traffic officer that controls traffic whenever the bridge opens.

### Trucks and Panel Vans

9-9. Allow passengers to be carried only in trucks equipped with sideboards and end enclosures (to include safety straps) at least 36 inches above the standing surface of the vehicle body. Require all passengers to be seated when the vehicle is in motion. Safety straps must be connected when transporting personnel. Be sure the passengers have enough room to stay seated within the vehicle. The operator must lower the tailgate when loading or unloading personnel and secure it before moving the vehicle.

9-10. When transporting personnel, the operator is responsible for delivering them to their destinations safely and on time. The operator should—

- Be courteous and responsive to the instructions of official passengers, unit commanders, and cargo security personnel traveling with them.
- Talk as little as possible while en route.
- Observe the rules of military courtesy when loading or discharging officer personnel.
- Not exceed the passenger limit of the vehicle except in an emergency or as directed by your supervisor. Generally, when all passengers are seated and the weight limit of the vehicle is not exceeded, the passengers may be carried safely.
- Walk to the rear of the vehicle before starting to ensure the tailgate and safety strap are in place and all passengers are seated.
- Walk to the rear of the vehicle after stopping, release the safety strap, and lower the tailgate before allowing passengers to dismount.

9-11. Do not move the vehicle if any personnel are in unsafe positions (such as standing; attempting to ride between the cab and body; hanging on sideboards, running boards, or fenders; or sitting on the tailgate or sides of the truck). Adjust the vehicle tarpaulin according to the weather or as directed by your supervisor. Always ensure there is proper ventilation to prevent the accumulation of exhaust gases in the cargo compartment.

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**FOR AIR FORCE ONLY:** The operator may transport personnel in the cargo bed of a 1/4- or 3/4-ton general-purpose pickup truck if they follow these safety procedures:

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- |  |
|--|
| <ul style="list-style-type: none"><li>● Be sure vehicle is equipped with a working tailgate.</li><li>● Be sure passengers are seated on the cargo deck with no portion of their bodies overhanging the vehicle sides or rear.</li><li>● Do not operate the vehicle off base.</li><li>● Be cautious when entering and exiting pickup trucks.</li><li>● Tailgates do not have to be lowered for personnel to enter and exit the cargo deck of the vehicle.</li></ul> |
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### EMERGENCY VEHICLES

9-12. Personnel may be designated as an operator of an ambulance or other emergency vehicle. However, the person designated must still conform to normal traffic regulations unless otherwise directed by their supervisor. Emergency runs will be restricted to actual emergencies.

9-13. The speed of emergency vehicles will be reasonable and proper with due regard for actual and potential hazards. Ambulances and police vehicles will exceed the posted speed limits only in emergencies and as directed by the provost marshal or security police directives.

9-14. Certain emergency vehicles are equipped with warning devices (usually a siren and/or a red or blue flashing light). These warning devices should be used to get other vehicles to yield the right-of-way. Under no circumstances assume that these signals give full clearance to operate the vehicle without suitable regard for life, property, and traffic laws.

9-15. Unless ordered otherwise, by the medical officer in charge, do not use the sirens on ambulances. Except when responding to an emergency call, observe all traffic laws carefully during the transfer of patients. When responding to an emergency, emergency vehicles may proceed through a stop sign or light (if not in violation of local law), only after slowing down or stopping to assure safe operation. Police vehicles responding to emergency calls use sirens and flashing lights according to local directives or as directed by the provost marshal or chief of the Air Force security police.

9-16. The foregoing provisions do not relieve emergency vehicle operators from the responsibility to drive with regard for the safety of all persons and property. Nor do any of these provisions protect the operator from the consequence of any reckless disregard for the safety and well being of others.

9-17. As an emergency vehicle operator, personnel will receive additional operator training and must be licensed in accordance with AR 600-55 to operate emergency vehicles. An operator should gain as much knowledge as possible in the operation of emergency vehicles and be fully familiar with local operating procedures for such vehicles. The safe operation of emergency vehicles and the transportation of personnel on such vehicles demand more driving skill and knowledge than ordinary vehicle operation requires. Remember at all times that emergency vehicle accidents are possible and are, in fact, quite frequent and serious.

## Chapter 10

# Maintenance Responsibilities

10-1. The responsibilities of a military vehicle operator include keeping the vehicle in a safe operating condition. The operator must also maintain the vehicle's mechanical efficiency.

### ARMORED VEHICLE MAINTENANCE

10-2. Armored vehicles require increased-interval maintenance due to the intense wear on the suspension, steering, and braking systems. These components of the vehicle may prematurely fail unless more frequently checked by the operator. Ensure mission requirements provide time and opportunity to the inspect vehicles at an increased rate.

### PREVENTIVE MAINTENANCE CHECKS AND SERVICES

10-3. Preventive maintenance checks and services (PMCS) are commonly known as operator maintenance. It is that part of the overall maintenance program that the using organization must perform on its assigned equipment. PMCS is the systematic care of a vehicle. This includes the daily cleaning, servicing, and inspecting for maintenance discrepancies. Its purpose is to maintain serviceability at reduced cost. Detecting and correcting defects in their early stages before they develop into major defects results in lower maintenance costs and less vehicle out-of-commission time. Unless regulations direct otherwise, the vehicle operator performs organizational maintenance.

10-4. The operator must properly and safely operate their vehicle, as they are the most important single factor in preventive maintenance. Daily maintenance of the vehicle includes:

- Inspecting, servicing, adjusting, documenting, and cleaning the vehicle according to procedures in the vehicle TM (Army) or TO and AFI 24-302 (Air Force).
- Recording any deficiencies and shortcomings (include those that are corrected by replacing parts and those that are not corrected). Deficiencies are malfunctions that may result in an unsafe condition to personnel or serious damage to the vehicle (for example, loose battery connections or a missing or broken rearview mirror or wiper blade on the operator's side). Shortcomings are defects or malfunctions that must be corrected to make the vehicle completely serviceable (for example, a missing battery cap or broken speedometer).

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**FOR ARMY ONLY:** Use DA Form 2404 (Equipment Inspection and Maintenance Worksheet) or DA Form 5988-E (Equipment Inspection Maintenance Worksheet).

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**FOR AIR FORCE ONLY:** Use AF Form 1800 (Operator's Inspection Guide and Trouble Report) in accordance with AFI 24-302.

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- Lubricating the vehicle according to procedures outlined in the vehicle lubrication order (Army) sometimes included within the vehicle TM or TO.
- Helping your unit maintenance personnel perform scheduled periodic services on your vehicle.

10-5. An operator must be thoroughly familiar with the TM and lubrication order (LO) and TO for their vehicle. Refer to them frequently when maintaining equipment.

## **BEFORE-, DURING-, AND AFTER-OPERATION INSPECTIONS**

10-6. The operator must perform before-, during-, and after-operation inspections. The operator must also provide routine service and repairs on their assigned vehicle.

### **BEFORE-OPERATION**

10-7. Before-operation inspection is a visual inspection to make sure the vehicle is safe and in good operating condition before it is driven. Many defects, especially leaks, are more apparent after the vehicle has been parked overnight.

10-8. Proper before-operation inspection, servicing, and proper starting procedures will increase the useful life of the vehicle. Refer to the vehicle TM and Chapter 16 of this manual for before-operation and starting procedures.

### **DURING-OPERATION**

10-9. During-operation inspection consists of the operator being alert to indications of vehicle malfunction while driving. Some of these include the following:

- Unusual vibrations, noise, and odors.
- Abnormal instrument readings.
- Erratic brake and steering operations.

10-10. Good operators habitually inspect their vehicles at each halt. A walk-around inspection to check the tires, suspension, and load (an abbreviated after-operation check) is appropriate. During this inspection, the operator may discover and correct equipment faults that might cause a breakdown. Maintenance personnel are normally available in the rear element of convoys to help make repairs beyond the operator's capabilities or to provide, if required, vehicle recovery. It is important that the operator notifies their supervisor as soon as possible of any problem and keeps them informed of its status. Unusual noises, vibrations, and changes in engine performance detected en route, but not identified, should be reported to the supervisor.

### **AFTER-OPERATION**

10-11. After-operation inspection consists of all daily vehicle services and correction, if possible, of any deficiencies found. This inspection prepares the vehicle for operation on a moment's notice. After-operation maintenance procedures are prescribed in the vehicle TM.

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Note: As a vehicle operator, the operator is ultimately liable for the proper operation and care of their vehicle. Therefore, the importance of performing before-, during-, and after-operation checks cannot be over stressed. An operator could be held liable for damages to their vehicle if they fail to properly inspect for and annotate discrepancies.

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## ARMY AND AIR FORCE EQUIPMENT AND MAINTENANCE FORMS AND RECORDS

### ARMY FORMS AND RECORDS

10-12. When dispatched, the operator will be given an equipment record folder containing all forms and records pertaining to their vehicle. The equipment and maintenance records found in this folder are—

- DD Form 1970 (or for Unit Level Logistics System [ULLS] users, DA Form 5983-E). This is a dispatch form and is further explained in DA Pamphlet 750-8. When using this form, the automatic data processing (ADP) card mentioned below will not be maintained.
- DA Form 2404 (or for ULLS users, DA Form 5988-E). When using DD Form 1970, it may be required to maintain two DA Forms 2404. A daily form is used to record deficiencies noted during vehicle inspection. The form must be with the vehicle whenever it is being operated. The second DA Form 2404 is for deferred maintenance. It is carried only when items on the vehicle are on deferred maintenance status. These forms are further explained in DA Pamphlet 750-8.
- ADP card. This is a dispatch form issued by a transportation motor pool (TMP) using an ADP system. When using this system, the DD Form 1970 or the daily DA Form 2404 will not be used.

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Note: The operator may still be required to maintain the deferred maintenance form (DA Form 2404).

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- SF Form 91. This form must be completed if an operator is involved in a motor vehicle accident. This form is further explained in Chapter 10.
- DD Form 518. This form must be completed if an operator is involved in a motor vehicle accident. This form is further explained in Chapter 10.

### AIR FORCE FORMS AND RECORDS

10-13. Use the information below to perform inspections and maintenance required by AF Form 1800.

- Damage. Inspect the general condition of the vehicle. Check for tampering or damage that may have occurred since the vehicle was last operated. Inspect doors, windows, windshields, seats, and upholstery. Examine paint condition and legibility of markings.
- Leaks. Inspect the engine compartment and look under the vehicle for evidence of leaks.
- Tire, Jack, and Lug Wrench. Be sure lugs are tight and tires have correct air pressure. There should be at least 1/8-inch (military) and 1/16-inch (commercial) tread remaining. The spare tire must also have the appropriate tread remaining in accordance with TM 9-2610-200-14.

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Note: When a vehicle is supported on a jack stand, chock at least one wheel. When both front wheels are in a raised position, chock the rear wheels.

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- Fuel, Oil, and Coolant. Check fuel, engine oil, and coolant. Add amounts necessary to bring them to the correct levels. Do not overfill. Add only premixed coolant solution.
- Battery. Inspect fluid levels, terminal, clamps, hold down, and so forth for security and corrosion. Add water, clean surfaces, and tighten any loose connections.

**WARNING**

**Personnel should remove watches, rings, ID tags, and all other jewelry before checking or inspecting the batteries.**

- Horn. Inspect the horn for security of mounting and operation.
- Lights and Reflectors. Inspect all lights and reflectors for condition and proper operation.
- Instruments. During operation, monitor all instrument readings for indications of malfunctions. Do not continue to operate the vehicle if instrument readings are not within acceptable limits or if warning lights are lit or buzzers are sounding.
- Windshield Wipers. Inspect for condition of blades and proper operation of blades and wiper assembly.
- Windshield. Clean windshield and other glass surfaces on a daily basis. Inspect for cracks or discoloration that would obstruct visibility. Fill windshield washer reservoir.
- Cargo and Mounted Equipment. Inspect for security, proper operation, and damage of mounted equipment. Mounted equipment will receive the same type of service and inspection as the vehicle.
- Vehicle Components. Clean inside and outside of vehicle as needed.
- Steering. During operation, check steering for abnormal steering.
- Safety Devices. Inspect condition and operation of all safety devices (such as seat belts, horn, lights, warning buzzer, warning decals, and fire extinguisher).
- Drive Belts and Pulley. Inspect belts for deterioration, wear, and proper tension.
- Brakes. Inspect brake pedal for free travel. Brake pedal should have some free travel, but it should not exceed one-half of the total pedal travel distance. Inspect parking brake for operation and effectiveness. For special-purpose vehicles, inspect (daily when used) and adjust levels of hydraulic fluid in the master cylinder reservoir as necessary.
- Lube and Oil Change. Maintain lube and oil at the prescribed levels. This includes any special (daily, weekly, and so on) lubrication requirements specified for the vehicle or mounted equipment. Make sure that lubrication and oil changes are done at established intervals (miles or month).
- Other. The “other” space on the operator’s inspection guide and trouble report is provided for inspections. It is also used for the recording of defects found during vehicle inspections that are not otherwise covered by the form.

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Note: Ensure that all records created as a result of processes prescribed in this publication are maintained in accordance with AFMAN 33-363 (Management of Records) and disposed of in accordance with Air Force Records Disposition Schedule (RDS) located at <https://www.my.af.mil/faf/FAF/fafHome.jsp>

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## **DEFECTS**

10-14. If no defects are found during the before-operation checks and all cleaning and servicing requirements have been met, the driver is ready to start operating the vehicle. If vehicle defects are found, enter the details in the appropriate space on the operator's inspection guide and trouble report. When correction of these defects exceeds the operator's responsibility, take the AF form and the vehicle to the vehicle diagnostic and quality assurance section for corrective action. In some cases, required maintenance of the vehicle may be delayed by maintenance control due to the type of defect or to maintenance work backlog. When maintenance is deferred, maintenance control personnel will enter the status code and initial the driver's form to show that defects have been reported and maintenance delayed. This form must be retained in the vehicle as a record of defects that have been reported to maintenance control. Any new maintenance defects not previously reported and identified as delayed maintenance, must be reported to maintenance control. Maintenance control will update the inspection guide when delayed maintenance items have been completed. Refer to AFI 24-302 for more specific information on reporting a vehicle for maintenance.

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## Chapter 11

# Compression Ignition Engines (Diesel)

11-1. Conventional gasoline-fueled and spark ignition engines differ in their principles of operation. Before-, starting-, and during-operation procedures also differ for conventional and diesel engines.

### OPERATING PRINCIPLES FOR DIESEL FUEL ENGINES

11-2. Diesel fuel engines in most tactical wheeled vehicles use JP-8. On the M939-series vehicles (5-ton), the filter is located under the left-front fender. On the M915 (commercial 14-ton truck-tractor), the filter is located on the left side of the engine. Both require daily maintenance.

### BEFORE-, STARTING-, AND DURING-OPERATION PROCEDURES

11-3. Drivers converting from vehicles powered by conventional spark ignition gasoline engines to vehicles powered by compression ignition engines should become thoroughly familiar with the before-, starting-, and during-operation procedures required by compression ignition engines (Diesel). Consult the vehicle TM before trying to start or operate the vehicle.

#### BEFORE-OPERATION PROCEDURES

11-4. Hydrostatic lock occurs when fuel, water, or other liquid is on top of one or more of the pistons. When the piston rams this fluid against the cylinder head, it can ruin or seriously damage the engine. The procedure to check for hydrostatic lock is simple.

- With the gearshift in neutral, hand brake applied, fuel off, and accessory switch on; push the clutch pedal to the floor (M35A1 or A2, 2 ½-ton only).
- Next, engage the starter switch with a hard, firm action for two or three seconds.
- Look for these signs of hydrostatic lock:
  - Hard thud in the engine as it turns over.
  - Engine turning over and quitting with a thump.
  - Engine not turning over at all.
- If there is any evidence of hydrostatic lock, release the starter button at once and report the problem to the supervisor.

#### STARTING-OPERATION PROCEDURES

11-5. After determining the engine is free of hydrostatic lock, start the engine. Follow these procedures:

- Make sure that the transmission is in neutral and the parking brake is applied.
- Turn the accessory switch to the ON position.
- Press or turn the starter switch with a hard, firm action. Not firmly closing the starter switch may damage the starting motor and switch. Release the starter switch as soon as the engine fires. Never engage the starter switch for longer than ten seconds at one time. If the engine does not start within ten seconds, wait at least two minutes and try again. If the multi-fuel engine does not start in three tries, report the condition to the supervisor. Do not start multi-fuel engines by towing or pushing, except in an emergency.

- After the engine has started, let it idle for three to five minutes or until the engine heat reaches 140° Fahrenheit (F). Engine idling speed should not exceed the RPM prescribed in the vehicle TM. Too slow an idle creates vibrations that will loosen some parts and may break others. The warm-up benefits the entire engine, but it is especially important for the turbo-supercharger. Exhaust gas turns the turbo-supercharger at approximately 30,000 RPM at idle speed and up to 60,000 RPM at operating speed. Idling at a low speed allows time for the oil to circulate.
- Observe the oil pressure gauge closely during the first 20 seconds of idling. If pressure does not reach 15 pounds per square inch (psi) at 800 to 1,000 RPM, stop the engine immediately and report the condition to the supervisor.
- Allow engine coolant temperature to reach 140° F before putting the vehicle in motion. Drive at moderate speed until the temperature reaches 170° F to 200° F.
- Heavy black smoke, engine missing, and power loss may indicate a dirty air cleaner. When the red flag in the air cleaner is up over halfway, cleaning is required. Follow instructions in the vehicle TM or TO when cleaning the air cleaner.
- If the vehicle is equipped with air or air hydraulic brakes, do not move it until the air pressure reaches the required level. When the buzzer stops, there is enough pressure to operate the brakes. Changes in air pressure are registered on the pressure gauge. The vehicle manual specifies the amount of air pressure that should be maintained.

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**FOR AIR FORCE ONLY:** Operating instructions and operating maintenance requirements are contained in the TO for each vehicle.

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## DURING-OPERATION PROCEDURES

11-6. Do not idle the engine of a parked vehicle except when necessary to keep the engine warm in extremely cold weather.

### WARNING

**Keep windows, curtains, and tarps open to prevent dangerous accumulation of carbon monoxide inside vehicle while the engine is idling.**

11-7. Never let the vehicle idle for long periods of time. In addition to wasting fuel, excess idling allows carbon formation and oil dilution to take place in the engine. Never run the engine to recharge a rundown battery unless specifically instructed to do so by an immediate supervisor. Never leave a vehicle unattended with the engine running.

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**FOR AIR FORCE ONLY:** Cold weather bases may allow unattended vehicles to remain idling during extreme cold weather, as approved by competent authority. Unit commanders will establish procedures that have been coordinated and approved by installation health and safety officials. Operators will be familiar with these procedures prior to leaving a vehicle unattended.

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11-8. Do not exceed allowable speeds indicated on the vehicle instruction plate (if applicable) or operate at an engine speed low enough to cause the engine to labor. Vehicle instruction plates are usually located on the instrument panel.

## Chapter 12

# Manual, Semiautomatic, and Automatic Transmissions

12-1. The vehicle operator must be prepared to drive vehicles with either manual, semiautomatic, or automatic transmissions. Each transmission type requires specific methods to ensure smooth operation.

## MANUAL SHIFT OPERATION

12-2. The following paragraphs cover the manual transmission.

### CLUTCH OPERATION

12-3. A clutch provides the means to apply engine power to the wheels smoothly and gradually. The vehicle operator must learn the following:

- Where the clutch starts to engage.
- How far the pedal moves to become fully engaged.
- How much free play the pedal has.
- How fast they should engage the clutch.

12-4. The vehicle operator's foot should not be on the clutch pedal except when actually starting, stopping, or shifting gears. Even a slight constant pressure on the clutch pedal causes excessive wear. For this reason, when stopped on a hill, never slip the clutch to keep from rolling backward; instead use the brakes. While waiting in a long line at traffic lights or when halted for other reasons, press the clutch pedal and move the transmission shift lever into neutral. Release the clutch after shifting into neutral.

12-5. When slowing a government vehicle to stop or to turn, be sure to reduce speed to 15 MPH or less before pressing the clutch pedal. Coasting a vehicle at a high speed with the clutch pedal pressed is dangerous. Vehicle control becomes more difficult and the clutch may be damaged. Damage resulting from this practice is considered vehicle abuse.

12-6. Skill in manual shifting is a requirement of good driving. Poor manual shifting results in poor vehicle performance and can damage the vehicle. The vehicle operator should be so familiar with the gearshift lever positions that they can shift to any gear without looking at the shift lever. The gearshift pattern is usually diagramed on the vehicle caution plate. Never move the gearshift lever from one position to another while the engine is running and until the clutch pedal has been fully pressed with the left foot. To shift gears smoothly and quietly, keep the pedal fully pressed until the shift has been completed. When shifting gears in a 1 ½-ton or larger truck, the vehicle operator may be required to use the double-clutching instructions.

### Clutch Shifting Procedure

12-7. After becoming acquainted with the vehicle's instruments and controls, the vehicle operator is ready to begin driving operations. Start and warm the engine with the transmission in neutral. Perform the following steps to start moving the vehicle in low or first gear:

- Press the clutch pedal and shift into low gear.
- Check the inside and outside rearview mirrors.
- Check blind spots.
- Let the clutch pedal up slowly, pausing at friction point or when the clutch feels like it is taking hold. Hesitate; then check mirrors again for traffic.

- Release the parking brake.
- Slowly release the clutch pedal and at the same time slightly press the accelerator.
- When driving operation is underway, the left foot should be completely removed from the clutch pedal.

### **Double-Clutch Shifting Procedure (M809 Series)**

12-8. Good driving practice in trucks (1 ½-ton or larger) often requires the vehicle operator to double-clutch to properly engage the gears and to prevent loss of momentum. Do the following to shift to a lower gear by double-clutching:

- Release pressure from the accelerator and begin pressing the clutch pedal.
- When the clutch pedal is fully pressed, move the gearshift lever to the neutral position.
- Release the clutch pedal and at the same time press the accelerator to speed up the engine.
- Let up on the accelerator and press the clutch pedal.
- While the clutch pedal is pressed, move the gearshift lever to the next lower gear speed.
- Release the clutch pedal and at the same time press the accelerator to maintain engine speed as the load is again connected to the engine.

12-9. The procedure is the same for shifting to a higher gear speed, except that the engine is not accelerated while the gear is in neutral.

#### **CAUTION**

When shifting gears in rough terrain and on hills, never let the vehicle slow down to a point where the engine begins to labor or jerk before shifting into a lower gear ratio. Always anticipate the need for extra power and shift gears accordingly. When descending a hill, with or without a heavy cargo, always drive with the vehicle in gear and the clutch pedal out.

### **SPARK IGNITION ENGINE BRAKING OPERATION**

12-10. If the hill is steep enough to require using brakes to reduce speed, shift into the next lower gear at the crest of the hill and use the engine compression as a brake. Take extreme care to prevent excessive engine speed while descending a hill. Judge the necessary gear and shift, if necessary, at the crest of the hill before speed has increased from downhill movement. Ordinarily, the gear required to ascend a hill is proper to use to descend it. Gearing down after engine speed has increased may extensively damage the engine. Except when used to compensate for brake failure, damage resulting from this practice is considered vehicle abuse. With proper gear selection, intermittent application of brakes will reduce the speed of the vehicle to safe limits.

#### **CAUTION**

The preceding paragraph applies to spark ignition engines only. Compression ignition (multi-fuel/diesel) engines should not be used to reduce speed. This practice will damage compression ignition engines.

12-11. The vehicle operator, when preparing to stop the vehicle, should remove his/her foot from the accelerator and use the engine compression as a brake to help stop the vehicle. Do not press the clutch pedal until the motor is operating at low speed and is no longer serving as a brake. Then press the clutch pedal before the engine begins to labor from slow speed. Apply the foot brake to help this braking action. When preparing to turn or stop, avoid downshifting above 20 MPH. Braking on icy roads requires a special technique that is discussed in Chapter 21.

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Note: The above rules apply to most vehicles. To meet the military's transportation needs for moving heavy equipment and traveling over rough terrain, new vehicles are constantly being developed. These vehicles may have more complicated transmissions (such as multi-gear ranges and dual-speed axles or other special features). To understand how a new vehicle may operate, read the vehicle operator's TM before attempting to operate it.

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## **SEMIAUTOMATIC TRANSMISSION OPERATION (M915 TRUCK-TRACTOR)**

12-12. The following paragraphs cover the semiautomatic transmission.

### **SELECTOR LEVER POSITIONS**

12-13. This transmission has 16 forward speeds and 2 reverse. Advancement through the forward gears is done by selecting the gear ratio needed in increments of two gears at a time. A built-in inhibitor will prevent the transmission from advancing more than two forward gears at a time. In gears 11 through 16 the gears are advanced one at a time. Move the selector lever forward or rearward to select the desired gear ratio position. The transmission will remain in the previously selected position until the selector lever is moved into the notch adjacent to the newly selected gear ratio.

12-14. The inhibitor override is provided to allow selection of the proper gear ratio for startup. This is done by pulling upward on the selector lever and may be used only when the truck is at a standstill. Do not use the inhibitor override when the truck is in motion.

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Note: The transmission clutch disengages at engine speeds of 1,100 RPM or less causing loss of braking efficiency of the engine as a brake. This condition can damage the transmission clutch if held in low range for 12 seconds. Down shifting within this time is mandatory.

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### **SELECTION OF STARTING GEAR RATIO**

12-15. When the vehicle is empty up to 75,000 pounds gross combined vehicle weight (GCVW), use the 6<sup>th</sup> gear. For loads of 75,000 to 105,000 pounds GCVW, use 4<sup>th</sup> gear. For loads of 105,000 to 130,000 pounds GCVW, use 3<sup>rd</sup> gear.

## AUTOMATIC TRANSMISSION OPERATION

12-16. While some military vehicles are equipped with manual transmissions, an increasing number are equipped with automatic transmissions. Though operation of automatic shift vehicles is quite simple, the good vehicle operator must learn to operate them smoothly and properly. The following paragraphs cover the automatic transmission.

### SELECTOR LEVER POSITIONS

12-17. In vehicles equipped with automatic transmissions, initial gear selection is controlled with a selector lever. When in drive (D or DR), shifting from drive to low (L) and returning to drive is controlled automatically by engine speed. Since there are a number of different automatic transmissions, the vehicle operator must become acquainted with the vehicle and learn the selector lever positions. The selector lever positions are as follows:

- P (park position) is used to lock the transmission so the vehicle (light vehicles such as sedans and pickups) will not roll while parked. In some heavier vehicles, the park position does not lock the transmission. In vehicles with a park position, start the engine from the park position.
- N (neutral position) is used to start engines of vehicles without a park position. In the neutral position, the engine is disengaged from the drive shaft of the vehicle.
- D or DR (drive position) is used to move the vehicle forward. With the shift lever at D or DR, the vehicle moves forward as the accelerator is pressed. After starting the engine in the neutral or park position, change the selector to D or DR to move forward. To avoid premature forward movement, apply the brake while in the drive position until ready to move the vehicle. The transmission automatically shifts to higher gears as the speed increases.
- L (low or power position) is used to negotiate steep grades and rough terrain or when the braking power of the engine is required. The transmission will not shift automatically to higher gear ratios when the lever is in the low position. When the low range is no longer needed, release the accelerator temporarily and move the shift lever to the drive position for normal gear progression. In the drive position, the low range is engaged automatically when the engine speed is reduced. If the accelerator is suddenly fully pressed when the vehicle is in the drive position, the low range becomes engaged. This procedure may be used to provide a sudden burst of speed for passing. When a predetermined engine speed has been attained, the transmission automatically returns to driving range.
- R (reverse position) is used to move the vehicle in reverse. Some shift levers require raising the lever slightly before moving to the reverse position. Others require the vehicle operator to press a button on the end of the lever before moving to R. Park vehicles without a park position in the reverse position by bring the vehicle to a full halt, placing it in R; and then setting the parking brake.

12-18. A good operator, before driving a vehicle, will become thoroughly familiar with the vehicle instruments and controls. They will always check the selector positions before moving the lever. Serious accidents can occur if these rules are not followed.

12-19. A good operator will shift from D or DR according to driving needs. Never shift from D or DR to L at a high rate of speed because this will seriously damage the transmission and could result in a severe accident by causing a skid on wet or slippery pavement.

## DUAL-RANGE DRIVING POSITIONS

12-20. Tactical vehicles may be equipped with automatic transmissions. Due to the diverse conditions under which they may be required to operate, tactical vehicle automatic transmissions are designed for greater flexibility than commercial types. Flexibility is attained with low and high transmission ranges. Consult the vehicle TM frequently for instructions on how to operate that vehicle.

12-21. Vehicles equipped with dual-range driving positions offer the operator a selection of two ranges in driving pattern D or DR. Use them according to driving needs as prescribed below. On some vehicles, these positions are F1 and F2.

12-22. D (F1) position is used for all ordinary driving. It does the following:

- Provides four forward speeds.
- Shifts automatically to fourth gear.
- Increases economy by reducing engine speed.

12-23. DR (F2) position is used for congested areas, rough terrain, and mountain driving. It does the following:

- Provides three forward speeds automatically.
- Will not shift into fourth gear unless the engine is accelerated to very high RPM.
- Uses the engine as a brake on long, steep downgrades.

## OPERATING PROCEDURE

12-24. To put the vehicle in motion, do the following:

- Apply the foot brake.
- Select the proper transmission lever position (forward or reverse).
- Place the transfer shift lever in the appropriate range.
- Check traffic conditions front and rear, using mirrors if necessary.
- Release the parking brake.
- Check again for traffic blind spots to the left or right rear. Signal if pulling away from a curb.
- Release the foot brake.
- Press the accelerator pedal gradually for a smooth start.

### CAUTION

Government vehicle operators are not permitted to tow or push automatic shift vehicles for the purpose of starting them.

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**FOR AIR FORCE ONLY:** During normal duty hours, contact the maintenance control section of vehicle maintenance to start the vehicle with a booster battery, jumper cables, or other equipment. After duty hours, contact vehicle operations for wrecker service. See the supervisor, for detailed instructions.

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## JUMP STARTING VEHICLES

12-25. Thousands of people are injured each year from auto battery explosions. Nearly two-thirds of these injuries involve the eyes. Most Soldiers, at one time or another, will use jumper cables to start a vehicle. Many are not aware of the danger involved. It is the commander or supervisor's responsibility to ensure the safety of their Soldiers, both on and off duty. They should stress that one of the procedures below be used when jump starting a vehicle.

### USING JUMPER CABLES TO START ENGINE

#### WARNING

**Operators must know the voltage of the vehicles involved prior to attempting any jump start. Attempting to jump start vehicles of different voltages may cause an explosion or electrical fire.**

- Position the jump-starting vehicle with batteries opposite the batteries of the disabled vehicle.
- Stop the engine of the jump-starting vehicle.
- Open battery compartment doors of both vehicles. Pull both battery boxes onto running boards.
- Clamp one jumper cable to the positive terminal (usually RED) of the jump-starting vehicle and the positive terminal (usually RED) of the disabled vehicle.
- Clamp the other jumper cable to the negative terminal (usually BLACK) of the jump-starting vehicle and to the body (away from the batteries) of the disabled vehicle.
- Start the engine of the jump-starting vehicle.
- Start the engine of the disabled vehicle. If the engine does not start after four tries, notify the supervisor.

#### WARNING

**Failure to connect the batteries correctly may cause the batteries to explode, injuring or killing personnel. Be sure jumper cable clamps do not contact other jumper cable clamps or terminals or ground against the metal vehicle frame. Failure to do so may also cause batteries to explode, injuring or killing personnel.**

- Remove jumper cables.

### USING SLAVE CABLES TO START ENGINE

12-26. Use the following procedure to start an engine using North Atlantic Treaty Organization (NATO) style slave cables (these slave cables are identical in design at both ends). It does not matter which end is connected to specific vehicle.

- Position the slaving (recharging) vehicle to the closest side of the vehicle needing slave start.
- Stop the slaving vehicle engine.



- Pull the cover from the slave receptacle of the disabled vehicle. The receptacle is usually located on the right side of the vehicle on the side of the cab or the top of the right front fender within easy reach.

**CAUTION**

When slaving, always connect the slave cable to the disabled vehicle first. Damage to the batteries or cable may result from improperly connecting hot batteries before connecting the cable to the receptacle of the disabled vehicle.

- Connect the slave cable to the disabled vehicle first. Connect the slave cable to the slaving vehicle last.

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Note: Turn off all unnecessary electrical switches in both vehicles.

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- Start the slaving vehicle engine. Pull out the hand throttle control until idle speed is between 700 to 800 RPM.
- Start the slaved vehicle engine.
- After the engine starts, disconnect the slave cable from both vehicles.
- Put the covers back over the receptacles.
- Clean and stow the slaving cable.
- Operate the slaved vehicle. If the voltmeter is not in the green area, notify organizational maintenance.

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## Chapter 13

# Trucks, Tractors, Semitrailers, and Special-Purpose Vehicles

13-1. The operation instructions and traffic regulations found elsewhere in this manual generally apply to trucks, tractors, semitrailers, and other special-purpose vehicles. However, there are additional special instructions for operating and loading these vehicles.

### STARTING/STOPPING THE TRACTOR-SEMITRAILER COMBINATION

13-2. Proper techniques for starting and stopping are needed to ensure personnel safety. They also prolong the condition of the vehicle.

### STARTING THE ENGINE AND PUTTING THE VEHICLE IN MOTION (MANUAL SHIFT)

13-3. Start the engine following instructions contained in the operator's manual for the vehicle concerned. Then do the following:

- Check all instrument gauges.

#### CAUTION

Always build up air pressure to FULL TANK CAPACITY before moving the vehicle.

- Be sure all seat belts or restraining devices are secured.
- With the engine warmed up and the air pressure gauge at the correct pressure, depress the clutch pedal and move the gearshift lever to the lowest forward gear.

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Note: When using a tractor equipped with a two-speed axle, be sure the selector button is down or in the low-range position. When using a tractor equipped with an auxiliary transmission, be sure the gearshift for auxiliary transmission is in the low-range position. These procedures are used when the vehicle is heavily loaded or additional power is needed. The gearshift lever for an auxiliary transmission is to the right of the main gearshift lever.

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- With the gearshift lever in the lowest forward gear, locate the semitrailer hand brake lever on the steering post just behind the steering wheel. The vehicle operator needs to pull the lever towards them. This applies brakes to the trailer only.
- Release the tractor emergency brake. Push the semitrailer brake lever away from the vehicle operator. As it is pushed away, release the clutch GENTLY and accelerate slightly. This allows the vehicle operator to start off without rolling backward, even on an upgrade. This step is very important.
- Accelerate further and release the clutch pedal completely. Remove foot from the pedal. Do not ride the clutch, doing so causes unnecessary wear on the clutch plate.

## STARTING THE VEHICLE AND PLACING THE VEHICLE IN MOTION (SEMIAUTOMATIC SHIFT)

13-4. Start the engine following instructions contained in the operator's manual for the vehicle concerned. Then do the following:

- Check all instrument gauges.

### CAUTION

Always build up air pressure to FULL TANK CAPACITY before moving the vehicle.

- Be sure all seat belts or restraining devices are secured.
- With the engine warmed up and the air pressure at the correct amount, select the appropriate starting gear for the load on the semitrailer. See specific vehicle TM for range speeds.

### Operation of Gears When Starting Out (Shifting Up)

13-5. After building up enough speed to overcome any lugging of the engine in first gear, shift to the next higher gear as follows:

- Depress the clutch pedal and release the accelerator at the same time.
- When the engine idles down, bring the gearshift lever to the neutral position.
- Release the clutch pedal.
- Depress the clutch pedal and put the gearshift lever in the next higher gear.
- Release the clutch pedal GENTLY and accelerate at the same time (double-clutching). To shift smoothly, it is essential to double-clutch on all transmissions except synchromesh transmissions.

### CAUTION

If gears fail to mesh because of faulty timing, DO NOT USE FORCE TO MOVE THE LEVER. Instead, return the gearshift lever to the neutral position, release the clutch, reaccelerate the engine, depress the clutch pedal, and try again. Repeat these steps until the lever goes smoothly into the next higher gear. If the gears fail to mesh after two or three tries, stop the vehicle safely and start over. Continue up through the gears until reaching the allowed road speed. Remember to always accelerate enough to overcome any lugging of the engine before shifting to the next higher gear.

### Operation of Gears When Starting Out (Upshifting) (Semiautomatic Transmission)

- The transmission will upshift twice automatically. Upshift to the next higher range if the engine is not lugging and it is capable of handling the next higher gear ratio.
- Continue upshifting, two gears at a time (one if needed for heavy loads) until you reach the 11<sup>th</sup> gear.
- Upshift from 11<sup>th</sup> gear through the 16<sup>th</sup> gear one gear at a time until desired speed is obtained.

**CAUTION**

DO NOT use the inhibitor override while vehicle is in motion.

**Operation of Gears When Going Upgrade (Shifting Down)**

13-6. When necessary, shift from a higher to a lower gear as follows:

- Depress the clutch pedal and release the accelerator. At the same time, move the gearshift lever to the neutral position.
- Release the clutch pedal.
- With the clutch released and the gearshift in neutral, accelerate enough to mesh the next gear without clashing.
- Immediately after accelerating depress the clutch pedal and move the gearshift to the next lower gear.
- Release the clutch GENTLY. At the same time, take up the clutching shock by accelerating enough to shift smoothly.

13-7. DO NOT FORCE THE GEAR. Remember, it is necessary to accelerate to a slightly higher RPM than required for the lower gear to shift smoothly. Properly using the clutch compensates for any difference in speed between the engine and transmission. UNLESS THE CLUTCH IS RELEASED GENTLY, IT CANNOT DO WHAT IT IS INTENDED TO DO. Force is never necessary to properly shift.

**Operation of Gears While Going Upgrade (Downshifting) (Semiautomatic Transmission)**

13-8. As you start uphill, depress the accelerator pedal all the way down and keep it there as the truck moves up the grade. If there is enough power to maintain a satisfactory RPM, remain in that gear for the entire grade.

13-9. If the hill causes a steady decline in engine RPM, downshift when engine RPM is at or below 1,650 RPM. Continue to downshift in this manner until engine RPM can be maintained.

**Operation of Inter-Axle Differential**

13-10. The inter-axle differential may be locked or unlocked at any speed. However, be sure all axles are turning at the same rate before engaging the differential. Be sure to lock the axle only at low speeds and when easing up on the throttle.

13-11. Vehicles equipped with inter-axle differentials normally operate on a paved surface in an unlocked position to prolong tire life. At the first sign of a slippery or icy highway, lock the inter-axle differential. The locked position is used for normal operation on a dirt road to assure maximum traction and to prevent overworking of the differential. Always use the locked position for the following conditions:

- When ice or snow is on the highway (with or without tire chains).
- When loose sand, mud, or other slippery off-highway road conditions exist.
- When operating on a dynamometer is required or when the vehicle is blocked up.
- When loss of traction is anticipated.

## STOPPING THE VEHICLE

13-12. Smoothly stop the vehicle by following these steps:

- Wait until the vehicle has slowed down (almost to idling speed) before depressing the clutch pedal.
- Apply the brakes firmly. As the vehicle slows down, release the brakes gradually. When the vehicle is about to stop, there will not be much force on the brakes.
- The instant the vehicle stops, release the brakes completely. This prevents a jerk or rebound. Reapply the brakes to hold the vehicle in place.

13-13. Do not intermittently apply (fan) brakes in normal slowing or stopping; this wastes air pressure and does not aid in making a good stop. In normal operation use the foot (service) brakes alone since they control the tractor and trailer simultaneously. Except when necessary, avoid sudden stops to prevent possible damage to cargo and vehicle.

13-14. Skidding or locked wheels, normally due to hard braking in emergency or hazardous conditions, causes jackknifing. Locked or skidding wheels will tend to take the lead or come around. Tractor jackknifing occurs when the rear tractor wheels lock and skid to the left or right. To gain control, steer in the direction of the skid.

13-15. Semitrailer jackknifing occurs when the semitrailer wheels lock and skid to the left or right. Control must be regained immediately if it is to be regained at all. To regain control, quickly release the brakes to get the wheels turning. **DO NOT USE THE SEMITRAILER HAND BRAKE.**

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Note: Use the semitrailer hand brake **ALONE, ONLY** to prevent roll while stopped on an incline and when coupling the tractor and semitrailer.

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### WARNING

**DO NOT use the semitrailer hand brake in driving because this can cause the trailer to skid or jackknife. NEVER use the semitrailer hand brake for parking because all the air may leak out, unlocking the brakes (in trailers that do not have spring valves).**

## USING THE ENGINE RETARDER (JACOBS BRAKE)

13-16. Many military vehicles are equipped with an engine retarder system that lets the engine act as a brake. Use the engine retarder for descending grades in city traffic or in any situation where slowing is required. Do not use it on slippery road surfaces (such as rain, snow, sleet, or ice). Using the engine brake on slippery surfaces can cause the vehicle to skid. The engine retarder is most effective between RPM's specified in the vehicle's TM.

13-17. Do not use the engine retarder in any gear except those outlined in the vehicle's TM when descending steep grades. Never let the engine speed drop below the RPM specified in the vehicle's TM with the engine retarder applied or it will seriously damage the transmission. Do not engage the engine retarder when shifting or when the transmission is in neutral.

- 13-18. Use the following procedures when the vehicle tires have good traction:
- Select a gear that allows the engine with the engine retarder applied to control the truck speed with the engine at or below the recommended RPM and service brakes not applied. As the vehicle operator approaches a downgrade, they should progressively select a gear that, when combined with the engine retarder, allows them to maintain an engine speed at the recommended RPM.
  - As the engine speed exceeds the recommended vehicle RPM, apply the service brakes once to slow the engine speed to the recommended RPM. Release the engine retarder. Downshift one gear (for example, if in 10<sup>th</sup> gear, downshift to 9<sup>th</sup> gear) and reapply the engine retarder. Repeat this procedure until the engine speed can be maintained at the RPM listed in the vehicle operator's TM.
  - If the engine speeds above the RPM specified in the vehicle's TM, apply the service brakes once to slow the vehicle speed and regain control.

**WARNING**

**Failure to follow the downhill driving procedures may cause a vehicle operator to lose control of the vehicle which could result in severe injury or death.**

**CAUTION**

Excessive use of the service brake to control downhill speed will cause the loss of braking power due to heat buildup.

- 13-19. If the transmission speeds above the RPM specified in the vehicle's TM and the transmission totally disengages, do the following:

- Release the engine retarder.
- Upshift the transmission to the next higher gear (for example, if in 10<sup>th</sup> gear, upshift to 11<sup>th</sup> gear).
- Apply the service brakes once to slow the vehicle speed and help regain control of the vehicle.

- 13-20. If the transmission totally disengages from the engine due to a shift being made with the engine retarder applied and the engine speed returns to low idle free-wheeling, accelerate the engine to reengage the transmission.

- 13-21. Do the following if a total loss of braking occurs due to heat buildup:

- Apply the engine retarder (place switch in high mode).
- Upshift as the engine speed approaches the RPM specified in the vehicle's TM. Before each upshift, release the engine retarder.
- In the gear specified in the vehicle's TM, continue to apply the engine retarder and maintain directional control of the vehicle.

- 13-22. The vehicle operator must understand the importance of the proper downhill braking procedures and the use of the engine retarder (especially on slippery surfaces) as outlined above. Vehicle operators must know that if these procedures are not followed, death or serious injury can result. The vehicle operator must also know that braking ability and braking techniques are different when loaded. The vehicle operator must think and plan ahead. The vehicle operator must increase their following distance and reduce their speed consistent with road and traffic conditions.

## PLACING THE CHOCK BLOCKS

13-23. When on level ground, place one chock block in front of the rear duals. Place the other chock block behind the rear duals on the opposite side (see Figure 13-1). For single-axle trailers, place one chock block in front of the left wheel and the other chock block behind the opposite rear wheels.

13-24. When uncoupling, place chock blocks firmly behind wheels on both sides of the semitrailer when parking uphill. Place the blocks in front of the wheels on a downgrade. On level ground wheels should be blocked on one side in front and one side in rear.

## COUPLING/UNCOUPLING THE TRACTOR AND SEMITRAILER

13-25. The tractor and semitrailer are separate units joined together by the tractor's fifth wheel and the semitrailer kingpin. The fifth wheel on the tractor and the kingpin on the semitrailer form a coupling held together by the fifth wheel coupling jaws. When not joined to the tractor, the semitrailer is held upright by two legs that support the front end.

### COUPLING

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Note: Due to the different types of vehicles and fifth wheels, these procedures may differ slightly from vehicle to vehicle. Refer to your vehicle's TM for specific guidance.

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13-26. Do the following to couple the tractor and semitrailer:

- Check all coupling devices on the tractor and semitrailer for condition and working order.
- Set the coupling jaws by swinging the locking plunger safety latch right or left to free the locking plunger lever. Move the locking plunger lever toward the front of the truck until it stays in the forward position. Coupler jaws are now unlocked.
- Position the tractor so that the fifth wheel coupler jaws line up with the semitrailer kingpin.
- Check the fifth wheel wedge adjustment (if appropriate) for the type of terrain. Position wedges fully below the walking beam for highway operations and back and away from the walking beam for cross-country operations. Do the following to position the wedges:
  - Remove the two cap screws from each wedge.
  - Remove the wedges and reverse the position.
  - Using the same holes, reinstall and tighten the cap screws.
- Be sure chock blocks are properly placed at semitrailer wheels. If chock blocks are not in place, properly position them (see Figure 13-1).
- Be sure all moving parts and the top of the fifth wheel (semitrailer coupler) are properly lubricated.
- After checks are completed, start the tractor and line it up with the semitrailer in a straight line. Sound the horn before backing (if tactical situation permits). When backing use ground guides (if available).
- Back the tractor up slowly and maneuver it so the kingpin (#13) of the semitrailer is in line with the coupling jaws (#35) of the tractor's fifth wheel (#3) (see Figure 13-2).
- Stop the tractor in front of the semitrailer. Place the transmission shift lever in neutral. Apply the tractor's parking brake.
- Adjust the height of the semitrailer to the height of the tractor's fifth wheel. Use the crank handle on the semitrailer to raise or lower the landing legs so the semitrailers approach ramps are slightly lower than the tractor's fifth wheel.
- Pull the fifth wheel plunger handle forward and then out to open the coupler jaws.
- Remove dummy couplings from the air connections on the semitrailer.



- Connect air line hoses from the tractor to the semitrailer by—
  - Attaching the emergency hose on the tractor (color coded red) to the emergency coupling on the semitrailer.
  - Attaching the service hose (color coded yellow or blue) to the service coupling on the semitrailer.

**CAUTION**

Be sure the service air hose from the tractor is connected to the service coupling, the emergency air hose, to the emergency coupling on the semitrailer.

**WARNING**

**Air brake hose shut-off valves must be open at all times during the normal operation of the tractor and the semitrailer. The semitrailer brakes must be functional. Failure to do this may cause injury or death.**

- The tractor may come with either the lever shut-off valves or the handle shut-off valves. To position the valves—
  - Open the lever shut-off valves; place the levers in the down position. Place the lever in the up position to close the shut-off valves.
  - Open the handle shut-off valves; place the handles in the vertical (up) position. Place the handles in the horizontal (down) position to close the shut-off valves.
- Press in the trailer air supply valve; hold it in place for 15 seconds. Release the valve. The valve should stay in the engaged position indicating the semitrailer air brake system has proper air pressure. If the valve does not stay in the engaged position, disconnect the air couplings and notify the supervisor.
- Pull down the trailer air brake hand control lever (#6) to engage the semitrailer brakes (see Figure 13-3).
- Release the parking brake lever. Place the transmission selector lever in reverse. Resume backing up, sounding the horn and using ground guides.
- Stop the vehicle when the coupling jaws close around the semitrailer kingpin.
- Place the transmission selector lever in neutral and apply the parking brake lever.
- Visually check to make sure the jaws have completely closed.
- With the trailer air brake control handle engaged, release the parking brake lever, place the transmission selector lever in first, and slightly depress the accelerator pedal. The tractor will not move forward if the fifth wheel is properly connected to the semitrailer.

**CAUTION**

Stop the vehicle immediately if the tractor moves forward and repeat the previous six steps.

- Place the transmission selector lever in neutral and apply the parking brake lever.
- Connect the electrical cable (#39) to the electric receptacle on the tractor (#40) and semitrailer (#41) (see Figure 13-4).
- Check the semitrailer lights by—
  - Turning the light switch to service drive.
  - Operating the turn signal switch and directing the ground guides to check for the proper operation of the semitrailer signal lights.
  - Depressing the brake pedal and directing the ground guides to check for the proper operation of the semitrailer stoplights.
- Turn the crank to raise the landing gear on the semitrailer. Be sure the crank handle is stowed securely.
- Stow the landing gear float pads in the racks; remove and stow the chock blocks.
- Check the operation of the semitrailer brakes using the trailer brake hand control in the cab (#6) (see Figure 13-3).

## UNCOUPLING

### WARNING

Use ground guides when backing up to park the semitrailer. Failure to do so could damage the vehicle or cause injury or death to personnel.

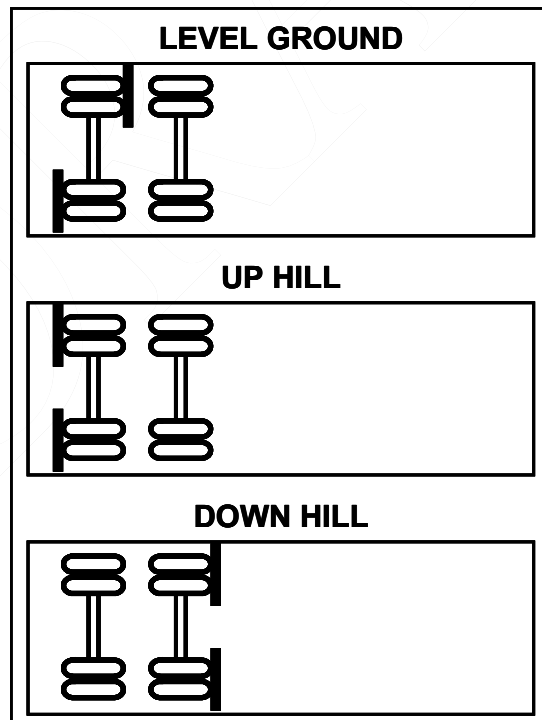
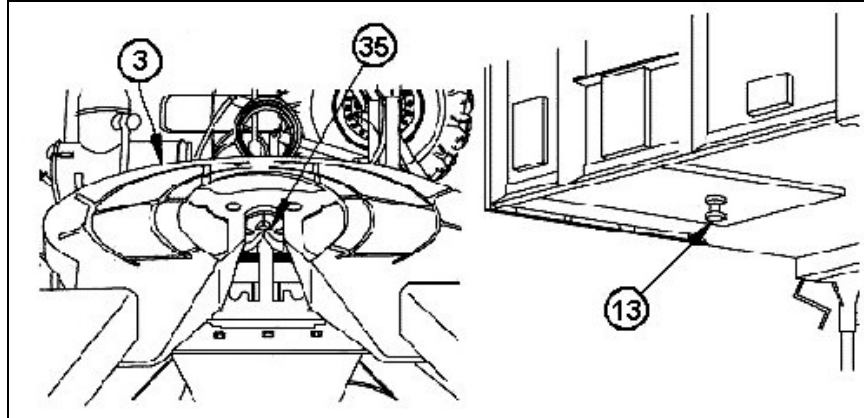
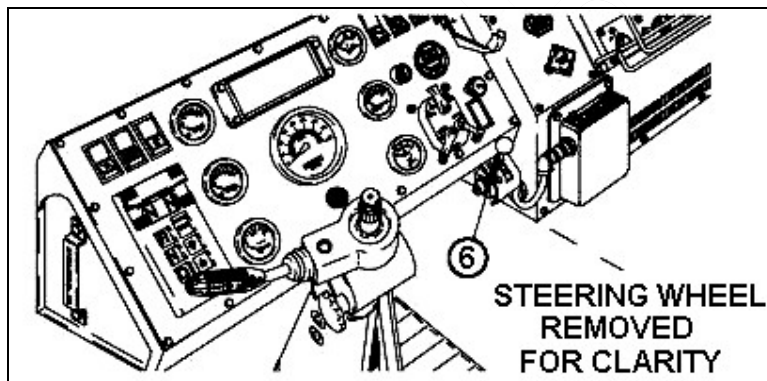


Figure 13-1. Chock Block Placement



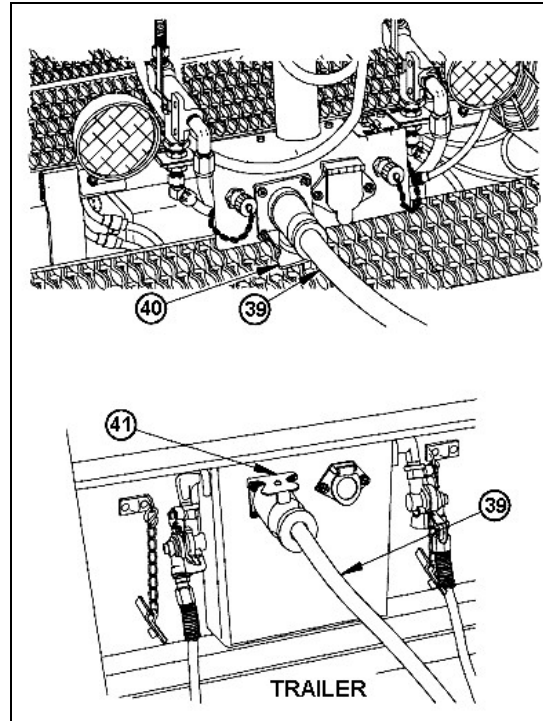
Note: #3 = Fifth Wheel, #13 = Trailer Kingpin, and #35 = Coupling Jaws

Figure 13-2. Coupling



Note: #6 = Air Brake

Figure 13-3. Air Brake Hand Control Lever



Note: #39 = Intervehicular Cable, #40 = Cable Receptacle on Truck, and #41 = Cable Receptacle on trailer.

**Figure 13-4. Coupling Receptacles and Intervehicular Cables**

13-27. To uncouple the tractor and semitrailer:

- Place the semitrailer in the proper location. Place the transmission selector lever in neutral. Engage the air brake hand control lever. Apply the parking brake.
- Place wheel chocks in front of and behind the semitrailer wheels.
- Place the landing gear float pads on the ground under the semitrailer landing gear.
- Turn the crank handle until the landing gear firmly contacts the float pads.
- Disconnect and remove the electrical cable from the semitrailer and secure the cable on the tractor.
- Turn the air brake hose shut-off valve levers to the closed position.

Note: The trailer air supply valve inside the vehicle cab will automatically pop back and disengage when the air couplings are disconnected.

- Disconnect the air couplings from the semitrailer and secure the air hose on the tractor.
- Install dummy couplings on the semitrailer air couplings.
- Release the semitrailer kingpin by pulling the plunger handle forward, and then out to open the fifth wheel coupling jaws.
- Place the transmission selector lever in drive and release the parking brake.
- Enter the cab and move the tractor forward slightly until the trailer kingpin is free from the lock guard and the landing gear is supporting the trailer weight.

- Stop for a moment. Do not pull all the way from under the trailer to ensure the landing gear will support the trailer. If it collapses, the rear frame area of the truck can catch the front of the trailer before equipment is damaged.
- Have a crewmember observe the semitrailer kingpin to be sure it clears properly during separation of the vehicles. Be sure the kingpin will clear the rear three cross-members when the tractor is pulled out from under the trailer.
- Pull slowly forward to allow the semitrailer gooseneck and kingpin to totally clear the rear frame area of the tractor.

## **MANEUVERING THE TRACTOR-SEMITRAILER**

13-28. The tractor (towing vehicle) is usually equipped with air brakes. The semitrailer may be controlled by hand-controlled trailer brakes or by automatically controlled semitrailer brakes. When driving a towing vehicle and semitrailer, keep in mind the overall length of the unit when passing other vehicles and when turning. Remember, the unit is hinged in the middle and therefore turns and backs differently than a truck and the distribution of weight will affect stopping the vehicle.

13-29. When driving a tractor/semitrailer, off-tracking must be allowed for. Therefore, when entering a right-hand curve, position the front of the vehicle as close to the centerline as possible (without letting the semitrailer tire cross the centerline) to keep the semitrailer tires from running off the pavement. When driving into a left-hand curve, move as close as possible to the shoulder of the road (without running off the road) to keep the semitrailer tires from crossing the centerline. Do not brake while in a curve. Brake before entering the curve.

## **BACKING**

13-30. Sound horn before backing (if tactical situation permits). Back a semitrailer by reversing the direction that is used to back a truck. Always use ground guides to help backing operations.

### **Backing to the Left**

13-31. Turn the steering wheel to the right until the trailer is headed in the desired direction. Then turn the tractor wheels to the left to put the tractor on the same line of travel as the semitrailer. This method is known as backing sight side (see Figure 13-5). Use this method whenever possible.

### **Backing to the Right**

13-32. Reverse the procedure described above. This is known as backing blind side (see Figure 13-6). Use it only when there is not enough space to manipulate the vehicle for backing sight side.

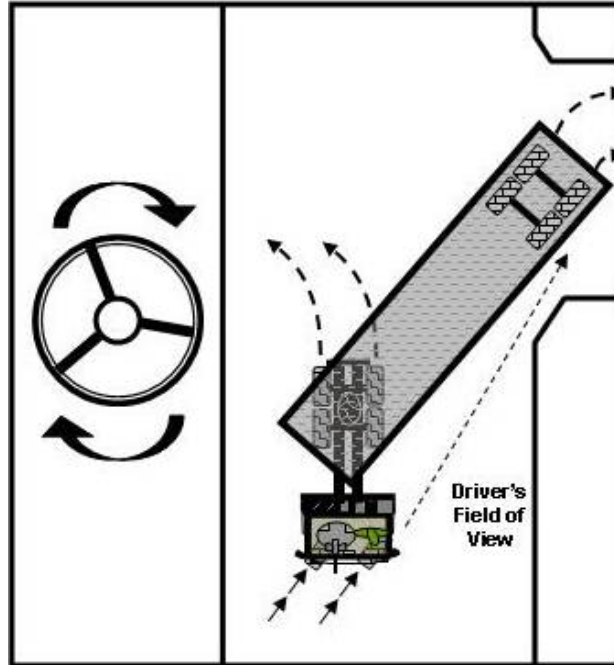


Figure 13-5. Backing the Semitrailer (Sight Side)

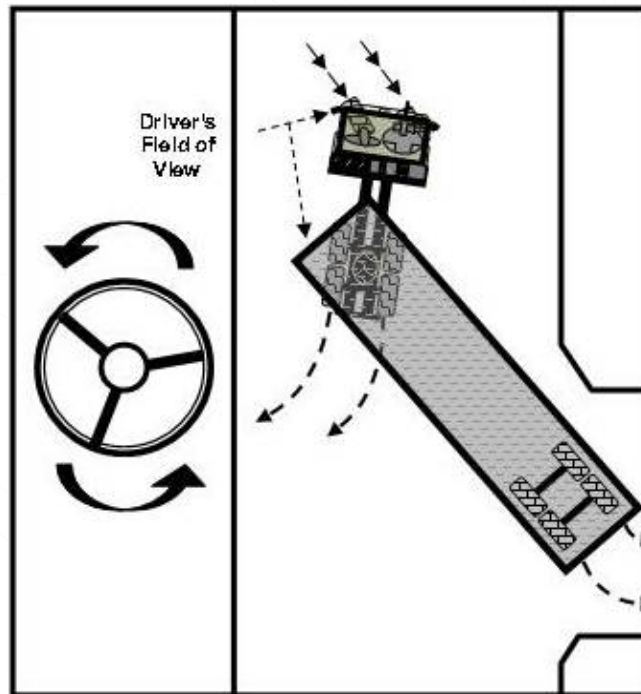


Figure 13-6. Backing and Semitrailer (Blind Side)

**PARKING**

13-33. Do not use the trailer hand brake control as a parking brake. Using the semitrailer hand control to park can cause all the air to leak out.

## CONNECTING AND DISCONNECTING PINTLE-CONNECTED TRAILER

13-34. The following shows how to connect the trailer to the vehicle and also to disconnect the trailer from the vehicle. Refer to the appropriate trailer TM for complete trailer operation procedures.

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Note: Ensure the trailer/tow equipment is within the tow vehicle's rated capacity.

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### CONNECTING

13-35. To connect the trailer to the vehicle:

- Remove the cotter pin, raise the latch, and open the pintle hook lock.
- Sound horn before backing (if tactical situation permits).
- Using ground guides, align and back up the vehicle until the trailer lunette can be lowered onto the pintle hook.
- Close the pintle hook lock, close the latch, and replace the cotter pin.
- Pass the left safety chain under the trailer lunette and secure it to the right lifting shackle of the towing vehicle. Pass the right safety chain under the lunette and secure it to the left lifting shackle of the towing vehicle.
- Raise the landing (support) legs and secure properly.

#### WARNING

**Ensure the chains are long enough to be cross hooked. If the chains are too short, damage to equipment is possible while towing and turning the vehicle.**

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Note: Crossing the chains under the trailer lunette in an X figure decreases the distance the trailer pintle will travel if dropped and may prevent trailer lunette from hitting the ground and digging in causing an accident during movement.

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- Connect the inter-vehicular service brake hose, emergency brake hose, and electrical cable.

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Note: The location of the service air couplings, emergency air couplings, and trailer electrical outlet may vary from model to model.

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- Turn on both the service and emergency brakes air cutoff cocks.
- Release trailer hand brakes. Check the operation of the trailer brakes and lights.

#### WARNING

**Failure to turn on the air cutoff cocks will cause loss of brakes on the trailer. This may cause injury or death to personnel.**

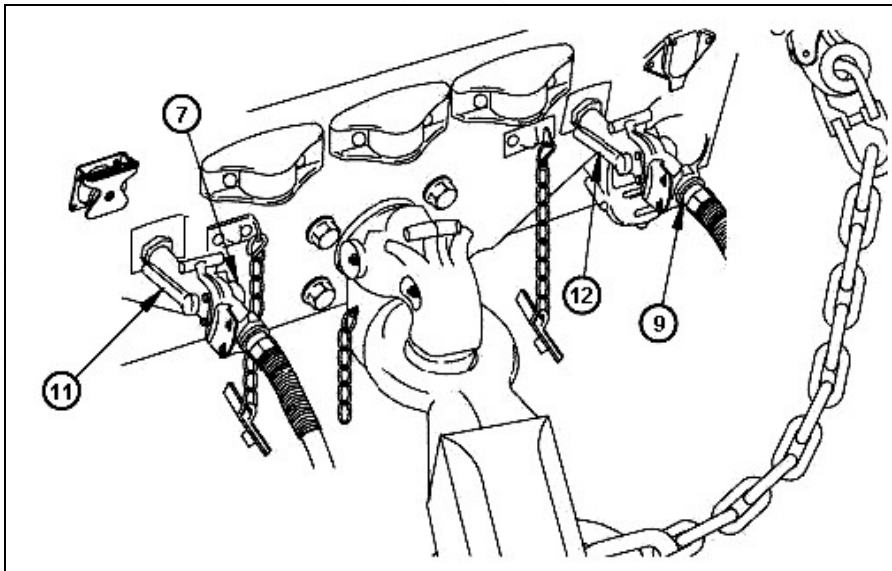
## DISCONNECTING

- 13-36. To disconnect the trailer from the vehicle (see Figure 13-7):
- Sound horn before backing (if tactical situation permits).
  - Using ground guide, back trailer into position for parking.
  - Apply the vehicle and trailer parking brakes.
  - Lower landing (support) legs.
  - Emplace chock blocks on trailer.
  - Turn off both the service and emergency brakes air cutoff cocks completely.

### WARNING

**Failure to turn off the air cutoff cocks completely may cause loss of vehicle brakes. This may cause injury or death to personnel.**

- Disconnect the inter-vehicular service brake and emergency brake hoses, the electrical cable, and safety chains.
- Remove the cotter pin. Raise the latch. Open the pintle hook lock.
- Disconnect the lunette from the pintle hook.
- Close the pintle hook lock and the latch. Replace the cotter pin.



Note: #7 = trailer SERVICE gladhand hose, #11 = SERVICE gladhand, #9 = trailer EMERGENCY gladhand hose, #12 = EMERGENCY gladhand.

**Figure 13-7. Vehicle and Trailer Attachment Point**



## OPERATING SPECIAL-PURPOSE VEHICLES

13-37. The driving principles learned for regular vehicles also apply to special-purpose vehicles. However, each special-purpose vehicle may require additional training for operation. Some (such as ambulances) require training not directly related to driving. The applicable vehicle TM or manufacturer's manual furnishes information on special-purpose vehicles and their operation. These are examples of special-purpose vehicles:

- ASV.
- STRYKER.
- M898 Yard Dog.
- JLTV.
- Forklifts.
- MHE.

13-38. A vehicle operator **MUST NOT** operate special equipment until their OF Form 346 (DA Form 5988-E) or AF Form 2293 has been validated. The form must indicate that they are qualified to operate that particular vehicle or equipment.

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## Chapter 14

# Dangerous/Hazardous Cargo and Materials

**This chapter implements Standardization Agreement  
(STANAG) 2002.**

## TRANSPORTING DANGEROUS/HAZARDOUS CARGO

14-1. Transporting dangerous/hazardous cargo is perhaps the most demanding job a military vehicle operator will ever perform. Much of the cargo that trucks move is dangerous, delicate, or awkward. It may be explosive, radioactive, sensitive to shock, or simply oversized or overweight. Before dispatching a vehicle to the loading site, the truck master or operations officer ensures the vehicle operator is properly trained in the correct procedures to haul, load, block, and brace the special or hazardous cargo.

14-2. Various forms are necessary for transporting special cargo. The vehicle operator must keep these forms safely on board the vehicle when transporting special cargo. Although the vehicle operator does not fill out any of the following forms, they must be familiar with their purpose and where they need to be signed:

- DD Form 836 (Dangerous Goods Shipping Paper/Declaration and Emergency Response Information for Hazardous Materials Transported by Government Vehicles) (see Figure 14-1).
- DD Form 2890 (DOD Multimodal Dangerous Goods Declaration) (not shown). This form is now authorized in lieu of DD Form 836 for same purpose.
- DD Form 626 (Motor Vehicle Inspection (Transporting Hazardous Materials)) (see Figure 14-2).

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Note: DD Form 626 is an extremely important form used whenever transporting dangerous or hazardous cargo. Before signing, read it carefully.

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## GENERAL SAFETY MEASURES

14-3. Observe these safety measures when dealing with HAZMAT:

- Establish a safety program (AR 385-10) for loading, unloading, and handling HAZMAT. Be sure each person involved in the operation is familiar with its contents.
- Provide qualified supervisors to direct and control the loading, unloading, and handling of HAZMAT. Supervisors must thoroughly understand the hazards involved and will indoctrinate subordinates on special precautions and emergency situations that may arise.
- Designate specific segregated areas for container re-stowing activities, if available, and for in-transit storage purposes.
- Mark HAZMAT operating and storage areas with appropriate warning signs (see Appendix D, extract of STANAG 2002).
- When appropriate, initiate security measures to prevent theft, sabotage, and so forth.

- When handling explosives or flammable materials—
  - Prohibit smoking except in an established smoking area and provide facilities for safe disposal of smoking materials.
  - Prohibit matches, lighters, or other sparking or open-flame producing items in the hazardous area.
  - Prohibit footwear strengthened with nails or other spark-producing metal, unless the footwear is covered with rubber, leather, or other non-sparking material.
  - Establish firefighting and other emergency plans and provide for firefighting and other emergency equipment.
  - Avoid jars or shocks, particularly with sensitive explosives used in detonators. Subject nuclear weapons to minimum handling and minimum exposure to shock.
- Ensure that protective clothing and/or equipment are used during handling of toxic oxidizers, fuels, or chemical agents. This may include masks, goggles, gloves, or other garments. Suitable neutralizing agents should be available for personnel handling toxic gases, etiologic agents, and white phosphorus.
- Keep personnel clear of loads being lifted by terminal or marshaling yard equipment.
- Keep roadways and marshaling yard aisles in good repair to minimize the danger of toppling container-bearing transporters.

## **RULES FOR TRANSPORTING DANGEROUS/HAZARDOUS CARGO**

14-4. In addition to the rules that apply to general cargo, the following general rules apply to most dangerous/hazardous cargo (see also DA Pamphlet 385-64 for detailed standards of moving this type of cargo):

- Inspect vehicles that carry dangerous/hazardous cargo according to DD Form 626. The inspector checks to see that the vehicle can be operated safely and is free of grease accumulations that can cause a fire.
- Once the vehicle passes inspection, attach the proper warning placards (if tactical situation permits) to the vehicle's front, rear, and sides to identify its cargo (see Figure 14-3). Use bilingual placards of HN when OCONUS.
- When loading and unloading, the vehicle operator must—
  - Set the vehicle's parking brakes.
  - Chock at least one wheel if the vehicle is on a grade.
  - Chock the semitrailer when separated from the tractor.
  - Turn off the vehicle's motor unless it is providing power to the vehicle accessories used to load or unload.
  - Keep smokers 50 feet or more away from the vehicle.
- When driving with dangerous/hazardous cargo, keep a safe distance from the other traffic. Avoid sudden stops and turns. Do not smoke inside the vehicle. Do not enter tunnels or park overnight in populated areas.

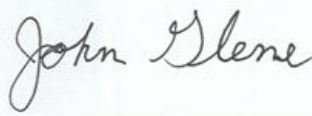

HAZMAT // HAZMAT // HAZMAT // HAZMAT // HAZMAT // HAZMAT									
DANGEROUS GOODS SHIPPING PAPER/DECLARATION AND EMERGENCY RESPONSE INFORMATION FOR HAZARDOUS MATERIALS TRANSPORTED BY GOVERNMENT VEHICLES									
1.a. NOMENCLATURE: TRK, CGO, 2 1/2 TON b. MODEL NO.: M1078 c. BUMPER NO.: HQ324					d. CONTAINER SEAL NO.: AWGMLRDFGK00690XX e. SERIAL NO.: 884336 f. TCN NUMBER: HT51AB				
2. SHIPPER NAME/ADDRESS/TELEPHONE NO./DATE OF PREPARATION HHC, 1/8 2FA, Ft. Hood, TX. (459) 784-9110, 16/06/2008								3. PAGE <u>1</u> OF <u>1</u> PAGES	
4. CARGO (To be completed by the unit or shipper Transportation Office (TO))									
UN/ID NUMBER	PROPER SHIPPING NAME <small>(Include RQ, Technical Names, Additional Information per 49 CFR172.203, as required.)</small>	HAZARD CLASS/DIVISION	SUBSIDIARY HAZARD	PACKING GROUP (PG)	PACKAGES		TOTAL NET QUANTITY	TOTAL AMMO (NEW)	
a.	b.	c.	d.	e.	f.	g.	h.	i.	
0328	CARTRIDGE FOR WEAPON W/INERT PROJECTILE	(08) 1.2C		II	8	BOXES	1 Box @ 2 Rnds	363.64	KGS
SAMPLE									
5. CONSIGNEE NAME 8th Maint Bn, Hanau, German									
6. REMARKS EMERGENCY RESPONSE GUIDE 46, GUIDE 50									
7.a. COPY OF EMERGENCY RESPONSE GUIDE NUMBER(S)									
b. EMERGENCY NOTIFICATION. In all cases of accident, breakdown or fire, promptly call emergency assistance telephone number(s) in Item 7c below and then shipper and/or consignee in Item 2 above, in that order.									
c. 24-HOUR EMERGENCY ASSISTANCE TELEPHONE NUMBERS:									
DOD NON-EXPLOSIVE HAZMAT: 1-800-851-8061  AT SEA: COLLECT: 1-804-279-3131	DOD HAZ CLASS 1 (EXPLOSIVES) ONLY: (703) 697-0218 or 0219 (COLLECT) OR DSN 227-0218 (WATCH OFFICER)	CHEMICAL/BIOLOGICAL WARFARE MATERIAL DUTY HOURS: DSN 584-3044, 584-7211, 584-6455, Comm. (410) 436-3044, (410) 436-7211, (410) 436-6455 AFTER DUTY HOURS: DSN 584-2148, Comm. (410) 436-2148 (Ask for TEU S3)	SECURE HOLDING: Non-AA&E: 1-800-524-0331 AA&E: 1-800-826-0794 OIL AND CHEMICAL SPILLS: NATIONAL RESPONSE CENTER (NRC) AND TERRORIST HOTLINE: 1-800-424-8802 AT SEA: 202-267-2675 (COLLECT)	DOD RADIOACTIVE MATERIALS: ARMY: (703) 697-0218 (COLLECT) USAF: (202) 767-4011 (COLLECT) USN/MC: Use 24-hour emergency response phone number provided by USN/MC activity initiating shipment. DLA: 1-800-851-8061 (AT SEA: (804) 279-3131)					
8. SHIPPER'S CERTIFICATION This is to certify that the above named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the regulations of the Department of Transportation.									
a. TYPE OR PRINT NAME OF SHIPPER CERTIFIER SHERYL HINDS					c. SIGNATURE(S) OF VEHICLE OPERATOR(S) 				
b. SIGNATURE OF SHIPPER CERTIFIER AND DATE 									
DD FORM 836, DEC 2007 <span style="float:right;">PREVIOUS EDITION IS OBSOLETE. <small>Adobe Professional 7.0</small></span>									
HAZMAT // HAZMAT // HAZMAT // HAZMAT // HAZMAT // HAZMAT									

Figure 14-1. Sample of DD Form 836

HAZMAT INST // HAZMAT INST // HAZMAT INST // HAZMAT INST	
INSTRUCTIONS FOR COMPLETING DD FORM 836, DANGEROUS GOODS SHIPPING PAPER/DECLARATION AND EMERGENCY RESPONSE INFORMATION FOR HAZARDOUS MATERIALS TRANSPORTED BY GOVERNMENT VEHICLES	
<p><b>GENERAL</b></p> <p>DD Form 836 will be completed by a qualified* individual from a transportation office, unit or other organization offering Hazardous Material (HAZMAT) for transportation in areas accessible to the general public.</p> <p>*An individual is considered qualified to complete and sign (certify) DD Form 836, only after having satisfactorily completed either a DOD authorized HAZMAT Course from one of the DOD-approved schools listed in the Defense Transportation Regulation (DTR) or military technical specialist training in accordance with the DTR, Chapter 204, Paragraph D. This person will be appointed in writing by the activity or unit commander, to include scope of authority and expiration date of training.</p> <p><b>Item 1.</b> Fill in the nomenclature, model number, TCN, and bumper number/serial number of the vehicle/container. For containers carrying sensitive or classified items, the container security seal is required.</p> <p><b>Item 2.</b> Enter the shipper's address and telephone number of the HAZMAT origination and date of preparation. Telephone number is for NOTIFICATION PURPOSES ONLY. Emergency assistance will be obtained from the 24-HOUR EMERGENCY ASSISTANCE TELEPHONE NUMBER(S) in Item 7c, on the first page of this form.</p> <p><b>Item 3.</b> Self-explanatory.</p> <p><b>Item 4a.</b> Enter the identification numbers, e.g., NA, UN. The letters "UN" or "NA" must be noted. "NA" may not be used for Organic Peroxides.</p> <p><b>Item 4b.</b> Enter the proper shipping name of the HAZMAT and if applicable include the technical name. (Enter additional information as required by 49 CFR, 172.203 - Example: RQ, Inhalation Hazard.) NOTE: In the case of multiple HAZMAT items on the same form with different emergency response telephone numbers, each phone number will be annotated below or adjacent to the HAZMAT item to which they apply.</p> <p><b>Item 4c.</b> Enter the Hazard class/division and, if applicable, the Compatibility Group.</p> <p><b>Item 4d.</b> Enter the subsidiary hazard of the material if applicable.</p> <p><b>Item 4e.</b> Enter the packing group (e.g. I, II, or III) of the HAZMAT.</p> <p><b>Item 4f.</b> Enter the total number of packages/items.</p> <p><b>Item 4g.</b> Enter the type of packaging (e.g., container, box, drum, pallet), the HAZMAT is packed in.</p> <p><b>Item 4h.</b> Enter the total net quantity for non-explosive material in metric measure. US measure may be added in parentheses underneath the metric measure. For ammunition, enter the total number of rounds/articles. Exception: Net total quantity is not required for bulk packages, empty packages, and cylinders of Class 2.</p>	<p><b>Item 4i.</b> Enter total Net Explosive Weight (NEW) in kilograms for ammunition/ explosive (Class 1 items). NEW information is found in the Joint Hazard Classification System (JHCS) in the entry for the NEW (Transportation Quantity). Example: 27.231 kg.</p> <p><b>Item 5.</b> Enter the six digit Department of Defense Activity Address Codes (DODAAC) and/or the clear geographical location of the ultimate consignee of the HAZMAT shipment. If this is a unit move, the unit name will be the same as that for Item 2.) Additional information if needed can be annotated in Item 6.</p> <p><b>Item 6.</b> Additional handling instructions/information.</p> <p><b>Item 7a.</b> Enter Emergency Response Guide Number.</p> <p><b>Item 7b.</b> Self-explanatory. Call 24-hour Emergency Response number(s) circled in Item 7c first and then shipper.</p> <p><b>Item 7c.</b> Circle emergency response telephone number. NOTE: For Radioactive Material Shipments only: Circle numbers and cross out those numbers that do not apply, e.g., Army shipments - cross out Army's radioactive response number.</p> <p><b>Item 8.</b> Certifying person must type or print name legibly in 8a, and must sign in writing (longhand) and add the date signed in 8b.</p> <p><b>Item 8c.</b> Self explanatory.</p> <p><b>NOTES:</b></p> <ol style="list-style-type: none"> <li>1. Units returning from firing range must have a certified or qualified person to ensure that all HAZMAT is properly repackaged and secured (i.e. braced, blocked, and tied down) prior to being transported back to base. See exception below.</li> <li>2. Completion of a new DD Form 836 is not required. Original DD Form 836 may be used provided that:             <ol style="list-style-type: none"> <li>a. Change Item 2 (Date Prepared).</li> <li>b. Change Item 4 (Cargo):                 <ol style="list-style-type: none"> <li>(i) HAZMAT used will be deleted from form by crossing out or lining through.</li> <li>(ii) HAZMAT that remains, but is in different quantities, will have the correct amounts entered in the section(s).</li> </ol> </li> </ol> </li> </ol> <p><b>EXCEPTION:</b></p> <ol style="list-style-type: none"> <li>c. Change Item 8b.:             <ol style="list-style-type: none"> <li>(i) A qualified individual (if available) must sign in writing (longhand). If a qualified individual is not available, then the Officer-In-Charge (OIC) or Non-Commissioned Officer-In-Charge (NCOIC) must sign in writing (longhand) to verify that the above procedures have been performed for the return trip to base.</li> <li>(ii) Cross out original signature if different certifier will be used.</li> </ol> </li> </ol>
DD FORM 836 (BACK), DEC 2007	
HAZMAT INST // HAZMAT INST // HAZMAT INST // HAZMAT INST	

Figure 14-1. Sample of DD Form 836 (continued)

MOTOR VEHICLE INSPECTION (TRANSPORTING HAZARDOUS MATERIALS)										
<i>(Read Instructions before completing this form.)</i>										
This form applies to all vehicles which must be marked or placarded in accordance with Title 49 CFR.					1. BILL OF LADING/TRANSPORTATION CONTROL NUMBER FE01308					
SECTION I - DOCUMENTATION			ORIGIN a.			DESTINATION b.				
2. CARRIER/GOVERNMENT ORGANIZATION			Miller Motor Express			N/A				
3. DATE/TIME OF INSPECTION			1 Mar 2012			N/A				
4. LOCATION OF INSPECTION			Ft. Eustis, VA			N/A				
5. OPERATOR(S) NAME(S)			John Doe			N/A				
6. OPERATOR(S) LICENSE NUMBER(S)			T62-767-7643			N/A				
7. MEDICAL EXAMINER'S CERTIFICATE*			15 Jan 2013			N/A				
8. <i>(X if satisfactory at origin)</i>					9. CVSA DECAL DISPLAYED ON COMMERCIAL EQUIPMENT*					
a. HAZMAT ENDORSEMENT		<input checked="" type="checkbox"/>		d. ERG OR EQUIVALENT COMMERCIAL:		<input checked="" type="checkbox"/> YES		NO		
b. VALID LEASE*		<input checked="" type="checkbox"/>		e. DRIVER'S VEHICLE INSPECTION REPORT*		<input checked="" type="checkbox"/>		a. TRUCK/TRACTOR		
c. ROUTE PLAN		<input checked="" type="checkbox"/>		f. COPY OF 49 CFR PART 397		<input checked="" type="checkbox"/>		b. TRAILER		
SECTION II - MECHANICAL INSPECTION										
<i>All items shall be checked on empty equipment prior to loading. Items with an asterisk shall be checked on all incoming loaded equipment.</i>										
10. TYPE OF VEHICLE(S) Tractor and Closed Semi-Trailer					11. VEHICLE NUMBER(S) T-462-187 / 27A-883					
12. PART INSPECTED <i>(X as applicable)</i>		ORIGIN (1)		DESTINATION (2)		ORIGIN (1)		DESTINATION (2)		COMMENTS (3)
		SAT		UNSAT		SAT		UNSAT		
a. SPARE ELECTRICAL FUSES		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		k. EXHAUST SYSTEM		<input checked="" type="checkbox"/>		None
b. HORN OPERATIVE		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		l. BRAKE SYSTEM*		<input checked="" type="checkbox"/>		
c. STEERING SYSTEM		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		m. SUSPENSION		<input checked="" type="checkbox"/>		
d. WINDSHIELD/WIPERS		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		n. COUPLING DEVICES		<input checked="" type="checkbox"/>		
e. MIRRORS		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		o. CARGO SPACE		<input checked="" type="checkbox"/>		
f. WARNING EQUIPMENT		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		p. LANDING GEAR*		<input checked="" type="checkbox"/>		
g. FIRE EXTINGUISHER*		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		q. TIRES, WHEELS, RIMS		<input checked="" type="checkbox"/>		
h. ELECTRICAL WIRING		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		r. TAILGATE/DOORS*		<input checked="" type="checkbox"/>		
i. LIGHTS AND REFLECTORS		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		s. TARPULIN*		<input checked="" type="checkbox"/>		
j. FUEL SYSTEM*		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		t. OTHER <i>(Specify)</i>		<input checked="" type="checkbox"/>		
13. INSPECTION RESULTS <i>(X one)</i>					ACCEPTED <input checked="" type="checkbox"/>					REJECTED <input type="checkbox"/>
<i>(If rejected give reason under "Remarks". Equipment will be approved if deficiencies are corrected prior to loading.)</i>										
14. SATELLITE MOTOR SURVEILLANCE SYSTEM: <i>(X one)</i>					ACCEPTED <input checked="" type="checkbox"/>					REJECTED <input type="checkbox"/>
15. REMARKS N/A										
16. INSPECTOR SIGNATURE <i>(Origin)</i> John Smith					17. INSPECTOR SIGNATURE <i>(Destination)</i> John Smith					
SECTION III - POST LOADING INSPECTION										
<i>This section applies to Commercial and Government/Military vehicles. All items will be checked prior to release of loaded equipment and shall be checked on all incoming loaded equipment.</i>										
		ORIGIN (1)		DESTINATION (2)						COMMENTS (3)
		SAT		UNSAT		SAT		UNSAT		
18. LOADED IAW APPLICABLE SEGREGATION/COMPATIBILITY TABLE OF 49 CFR		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		None				
19. LOAD PROPERLY SECURED TO PREVENT MOVEMENT		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>						
20. SEALS APPLIED TO CLOSED VEHICLE; TARPULIN APPLIED ON OPEN EQUIPMENT		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>						
21. PROPER PLACARDS APPLIED		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>						
22. SHIPPING PAPERS/DD FORM 2890 FOR GOVERNMENT VEHICLE SHIPMENTS		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>						
23. COPY OF DD FORM 626 FOR DRIVER		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>						
24. SHIPPED UNDER DOT SPECIAL PERMIT 868		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>						
25. INSPECTOR SIGNATURE <i>(Origin)</i> John Smith					26. DRIVER(S) SIGNATURE <i>(Origin)</i> John Doe					
27. INSPECTOR SIGNATURE <i>(Destination)</i> John Smith					28. DRIVER(S) SIGNATURE <i>(Destination)</i> John Doe					
DD FORM 626, OCT 2011										
PREVIOUS EDITION IS OBSOLETE.										
Page 1 of 3 Pages Adobe Professional 8.0										

Figure 14-2. Sample of DD Form 626

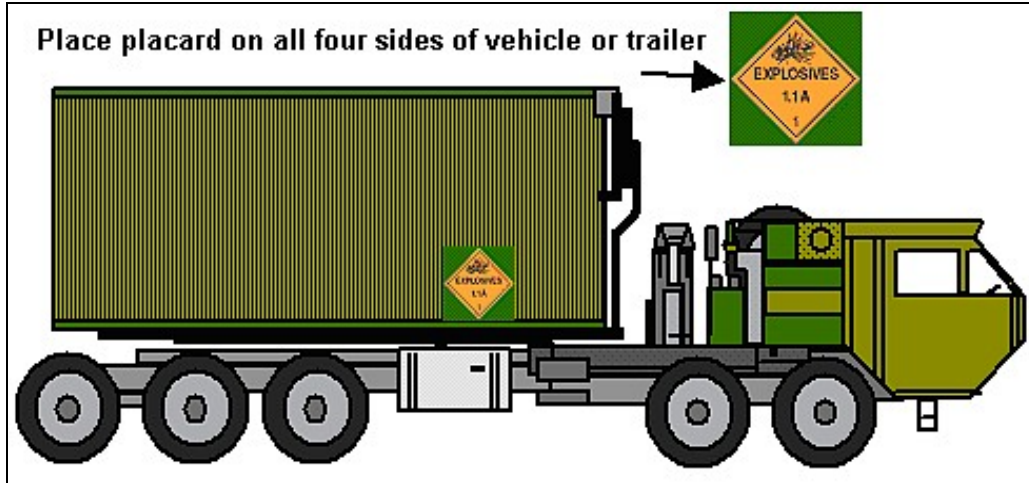
INSTRUCTIONS	
<p><b>SECTION I - DOCUMENTATION</b></p> <p><b>General Instructions.</b></p> <p>All items (2 through 9) will be checked at origin prior to loading. Items with an asterisk (*) apply to commercial operators or equipment only. Only items 2 through 7 are required to be checked at destination.</p> <p>Items 1 through 5. Self explanatory.</p> <p>Item 6. Enter operator's Commercial Driver's License (CDL) number or Military OF-346 License Number. CDL and OF-346 must have the HAZMAT and other appropriate endorsements IAW 49 CFR 383.</p> <p>Item 7. *Enter the expiration date listed on the Medical Examiner's Certificate.</p> <p>Item 8.a. Hazardous Materials Certification. In accordance with applicable service regulations, ensure operator has been certified to transport hazardous materials. Check the expiration date on driver's HAZMAT Certification.</p> <p>b. *Valid Lease. Shipper will ensure a copy of the appropriate contract or lease is carried in all leased vehicles and is available for inspection. (49 CFR 376.12 and 376.11(c)(2)).</p> <p>c. Route Plan. Prior to loading any Hazard Class/Division 1.1, 1.2, or 1.3 (Explosives) for shipment, ensure that the operator possesses a written route plan in accordance with 49 CFR Part 397. Route Plan requirements for Hazard Class 7 (Radioactive) materials are found in 49 CFR 397.101.</p> <p>d. Emergency Response Guidebook (ERG) or Equivalent. Commercial operators must be in possession of an ERG or equivalent document. Shipper will provide applicable ERG page(s) to military operators.</p> <p>e. *Driver's Vehicle Inspection Report. Review the operator's Vehicle Inspection Report. Ensure that there are no defects listed on the report that would affect the safe operation of the vehicle.</p> <p>f. Copy of 49 CFR Part 397. Operators are required by regulation to have in their possession a copy of 49 CFR Part 397 (Transportation of Hazardous Materials Driving and Parking Rules). If military operators do not possess this document, shipper will provide a copy to operator.</p> <p>Item 9. *Commercial Vehicle Safety Alliance (CVSA) Decal. Check to see if equipment has a current CVSA decal and mark applicable box. Vehicles without CVSA, check documentation of the last vehicle periodic inspection and perform DD Form 626 inspection.</p>	<p><b>SECTION II (Continued)</b></p> <p>Item 12.a. Spare Electrical Fuses. Check to ensure that at least one spare fuse for each type of installed fuse is carried on the vehicle as a spare or vehicle is equipped with an overload protection device (circuit breaker). (49 CFR 393.95)</p> <p>b. Horn Operative. Ensure that horn is securely mounted and of sufficient volume to serve purpose. (49 CFR 393.81)</p> <p>c. Steering System. The steering wheel shall be secure and must not have any spokes cracked through or missing. The steering column must be securely fastened. Universal joints shall not be worn, faulty or repaired by welding. The steering gear box shall not have loose or missing mounting bolts or cracks in the gear box mounting brackets. The pitman arm on the steering gear output shaft shall not be loose. Steering wheel shall turn freely through the limit of travel in both directions. All components of a power steering system must be in operating condition. No parts shall be loose or broken. Belts shall not be frayed, cracked or slipping. The power steering system shall not be leaking. (49 CFR 396 Appendix G)</p> <p>d. Windshield/Wipers. Inspect to ensure that windshield is free from breaks, cracks or defects that would make operation of the vehicle unsafe; that the view of the driver is not obscured and that the windshield wipers are operational and wiper blades are in serviceable condition. Defroster must be operative when conditions require. (49 CFR 393.60, 393.78 and 393.79)</p> <p>e. Mirrors. Every vehicle must be equipped with two rear vision mirrors located so as to reflect to the driver a view of the highway to the rear along both sides of the vehicle. Mirrors shall not be cracked or dirty. (49 CFR 393.80)</p> <p>f. Warning Equipment. Equipment must include three bidirectional emergency reflective triangles that conform to the requirements of FMVSS No. 125. FLAME PRODUCING DEVICES ARE PROHIBITED. (49 CFR 393.95)</p> <p>g. Fire Extinguisher. Military vehicles must be equipped with one serviceable fire extinguisher with an Underwriters Laboratories rating of 10 BC or more. (Commercial motor vehicles must be equipped with one serviceable 10 BC Fire Extinguisher). Fire extinguisher must be located so that it is readily accessible for use and securely mounted on the vehicle. The fire extinguisher must be designed, constructed and maintained to permit visual determination of whether it is fully charged. (49 CFR 393.95)</p> <p>h. Electrical Wiring. Electrical wiring must be clean and properly secured. Insulation must not be frayed, cracked or otherwise in poor condition. There shall be no uninsulated wires, improper splices or connections. Wires and electrical fixtures inside the cargo area must be protected from the lading. (49 CFR 393.28)</p>
<p>DD FORM 626, OCT 2011</p>	<p>Page 2 of 3 Pages</p>

Figure 14-2. Sample of DD Form 626 (continued)



INSTRUCTIONS	
<p><b>SECTION II (Continued)</b></p> <p>i. Lights/Reflectors. (Head, tail, turn signal, brake, clearance, marker and identification lights, Emergency Flashers). Inspect to see that all lighting devices and reflectors required are operable, of proper color and properly mounted. Ensure that lights and reflectors are not obscured by dirt or grease or have broken lenses. High/Low beam switch must be operative. Emergency Flashers must be operative on both the front and rear of vehicle. (49 CFR 393.24, 25, and 26)</p> <p>j. Fuel System. Inspect fuel tank and lines to ensure that they are in serviceable condition, free from leaks, or evidence of leakage and securely mounted. Ensure that fuel tank filler cap is not missing. Examine cap for defective gasket or plugged vent. Inspect filler necks to see that they are in completely serviceable condition and not leaking at joints. (49 CFR 393.83)</p> <p>k. Exhaust System. Exhaust system shall discharge to the atmosphere at a location to the rear of the cab or if the exhaust projects above the cab, at a location near the rear of the cab. Exhaust system shall not be leaking at a point forward of or directly below the driver compartment. No part of the exhaust system shall be located where it will burn, char or damage electrical wiring, fuel system or any other part of the vehicle. No part of the exhaust system shall be temporarily repaired with wrap or patches. (49 CFR 393.83)</p> <p>l. Brake System (to include hand brakes, parking brakes and Low Air Warning devices). Check to ensure that brakes are operational and properly adjusted. Check for audible air leaks around air brake components and air lines. Check for fluid leaks, cracked or damaged lines in hydraulic brake systems. Ensure that parking brake is operational and properly adjusted. Low Air Warning devices must be operative. (49 CFR 393.40, 41, 42, 43, 44, 45, 47, 48, 49, 50, 51, 52, 53, and 55)</p> <p>m. Suspension. Inspect for indications of misaligned, shifted or cracked springs, loosened shackles, missing bolts, spring hangers unsecured at frame and cracked or loose U-bolts. Inspect for any unsecured axle positioning parts, and sign of axle misalignment, broken torsion bar springs (if so equipped). (49 CFR 393.207)</p> <p>n. Coupling Devices (Inspect without uncoupling). Fifth Wheels: Inspect for unsecured mounting to frame or any missing or damaged parts. Inspect for any visible space between upper and lower fifth wheel plates. Ensure that the locking jaws are around the shank and not the head of the kingpin. Ensure that the release lever is seated properly and safety latch is engaged. Pintle Hook, Drawbar, Towbar Eye and Tongue and Safety Devices: Inspect for unsecured mounting, cracks, missing or ineffective fasteners (welded repairs to pintle hook is prohibited). Ensure safety devices (chains, hooks, cables) are in serviceable condition and properly attached. (49 CFR 393.70 and 71)</p> <p>o. Cargo Space. Inspect to ensure that cargo space is clean and free from exposed bolts, nuts, screws, nails or inwardly projecting parts that could damage the lading. Check floor to ensure it is tight and free from holes. Floor shall not be permeated with oil or other substances. (49 CFR 393.84)</p> <p>p. Landing Gear. Inspect to ensure that landing gear and assembly are in serviceable condition, correctly assembled, adequately lubricated and properly mounted.</p>	<p><b>SECTION II (Continued)</b></p> <p>q. Tires, Wheels and Rims. Inspect to ensure that tires are properly inflated. Flat or leaking tires are unacceptable. Inspect tires for cuts, bruises, breaks and blisters. Tires with cuts that extend into the cord body are unacceptable. Thread depth shall not be less than: 4/32 inches for tires on a steering axle of a power unit, and 2/32 inches for all other tires. Mixing bias and radial on the steering axle is prohibited. Inspect wheels and rims for cracks, unseated locking rings, broken, loose, damaged or missing lug nuts or elongated stud holes. (49 CFR 393.75)</p> <p>r. Tailgate/Doors. Inspect to see that all hinges are tight in body. Check for broken latches and safety chains. Doors must close securely. (49 CFR 177.835(h))</p> <p>s. Tarpaulin. If shipment is made on open equipment, ensure that lading is properly covered with fire and water resistant tarpaulin. (49 CFR 177.835(h))</p> <p>t. Other Unsatisfactory Condition. Note any other condition which would prohibit the vehicle from being loaded with hazardous materials.</p> <p>Item 14. For AA&amp;E and other shipments requiring satellite surveillance, ensure that the Satellite Motor Surveillance System is operable. The DTTS Message Display Unit, when operative, will display the signal "DTTS ON". The munitions carrier driver, when practical, will position the DTTS message display unit in a manner that allows the shipping inspector or other designated shipping personnel to observe the "DTTS ON" message without climbing aboard the cab of the motor vehicle.</p> <p><b>SECTION III - POST LOADING INSPECTION</b></p> <p><b>General Instructions.</b></p> <p>All placarded quantities items will be checked prior to the release of loaded equipment. Shipment will not be released until deficiencies are corrected. All items will be checked on incoming loaded equipment. Deficiencies will be reported in accordance with applicable service regulations.</p> <p>Item 18. Check to ensure shipment is loaded in accordance with 49 CFR Part 177.848 and the applicable Segregation or Compatibility Table of 49 CFR 177.848.</p> <p>Item 19. Check to ensure the load is secured from movement in accordance with applicable service outload drawings.</p> <p>Item 20. Check to ensure seal(s) have been applied to closed equipment; fire and water resistant tarpaulin applied on open equipment.</p> <p>Item 21. Check to ensure each transport vehicle has been properly placarded in accordance with 49 CFR 172.504.</p> <p>Item 22. Check to ensure operator has been provided shipping papers that comply with 49 CFR 172.201 and 202. For shipments transported by Government vehicle, shipping paper will be DD Form 2890.</p> <p>Item 23. Ensure operator(s) sign DD Form 626, are given a copy and understand the hazards associated with the shipment.</p> <p>Item 24. Applies to Commercial Shipments Only. If shipment is made under DOT Special Permit 868, ensure that shipping papers are properly annotated and copy of Special Permit 868 is with shipping papers.</p> <p>Item 26. Ensure driver/operator signs DD Form 626 at origin.</p> <p>Item 28. Ensure driver/operator signs DD Form 626 at destination.</p>
DD FORM 626, OCT 2011	Page 3 of 3 Pages

Figure 14-2. Sample of DD Form 626 (continued)



**Figure 14-3. Placarding a Vehicle**

14-5. Unless there is no practicable alternative, a motor vehicle, which contains HAZMAT, must be operated over routes, which do not go through or near the following:

- Heavily populated areas.
- Places where crowds are assembled.
- Tunnels.
- Narrow streets.
- Alleys.

14-6. Except as provided below, the vehicle operator or another individual qualified to operate the vehicle must stay with a motor vehicle at all times which contains Class A or Class B explosives. The vehicle operator must attend to a motor vehicle which contains HAZMAT other than Class A or Class B explosives and which is located on a public street or highway. However, the vehicle need not be attended while its vehicle operator is performing duties that are incident and necessary to their duties as the operator of the vehicle.

## LOAD CUSTODY

14-7. For purposes of this section:

- A motor vehicle is attended when the person in charge of it is awake in the vehicle (not in the sleeper berth) or is within 100 feet of it and has an unobstructed field of view of it.
- A qualified representative of the unit is a person who meets all of the following criteria:
  - The unit has designated them to attend the vehicle.
  - They are aware of the nature of the HAZMAT contained in the vehicle.
  - They have been instructed on the procedures to follow in emergencies.
  - They are authorized and have the ability to move the vehicle.
  - They are HAZMAT certified.
- A safe haven is an area specifically approved (in writing) by local, state, or federal governmental authorities for the parking of unattended vehicles containing Class A or Class B explosives.

14-8. These rules do not relieve a vehicle operator from any legal obligation relating to placing warning devices when a motor vehicle is stopped on a public street or highway. A motor vehicle that contains Class A or Class B explosives must not be parked under any of these circumstances:

- On or within five feet of the traveled portion of a public street or highway.
- On private property (including premises of a fueling or eating facility) without the knowledge and consent of the person who is in charge of the property and who is aware of the nature of the HAZMAT the vehicle contains.
- Within 300 feet of a bridge, tunnel, dwelling, building, or place where people work, congregate, or assemble except for brief periods when the necessities of operation require the vehicle to be parked and make it impracticable to park the vehicle in any other place.

## MISSILES

14-9. Missiles are very different from most items the Army transports because they can be at the same time overweight, sensitive, and flammable. These complex characteristics call for special loading procedures. The Army publishes detailed loading and bracing drawings for each missile system.

## AMMUNITION AND EXPLOSIVES

14-10. Army motor vehicles often transport ammunition and explosives. Although safety is always important, it is especially so when the cargo itself is dangerous.

14-11. A vehicle carrying explosives must be equipped with two fully charged dry chemical fire extinguishers. One of them must be mounted on the outside of the cab on the vehicle operator's side; the other mounted inside the cab.

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Note: All fire extinguishers must be inspected monthly to make sure they have not been damaged and the hose nozzles are not clogged. The inspection date and the initials or name of the inspector must be recorded on a tag. The tag must be attached to the extinguisher. Another tag, indicating the date of the last weight-test, must also be attached to the extinguisher. Obtain instructions on these procedures from the local or military fire station.

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**FOR AIR FORCE ONLY:** The inspection is recorded on the appropriate AF Form 1800.

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14-12. Block and brace the load well to prevent its shifting during travel. Drawings of approved methods of blocking and bracing are available from the US Army Ammunition Procurement and Supply Agency. Be sure that detonating caps (for such explosives as dynamite) are not carried in the same vehicle as the explosives. While loading or unloading, handle explosives with care.

### CAUTION

The truck's tailboard or tailgate must be closed and secured to be sure all ammunition or explosives stay inside the cargo compartment.

## CHEMICAL AGENTS

14-13. Federal agencies govern and regulate the transport of hazardous chemicals and related items within the US. A brief summary of the regulations and safety standards to be used to load and unload this kind of cargo follows.

- **The Vehicle.** The cargo compartment of the vehicle must be a closed body or one covered with a fire resistant tarpaulin. The vehicle must be equipped with red lanterns, red reflectors, red cloths, and two fire extinguishers for use in emergencies.
- **Loading and Unloading Safely.** In addition to those precautions already explained, securely load containers with valves or fittings to prevent damage to the valves or fittings during transit. Once unloaded, vehicles should be swept clean. The sides and floors should be tested for contamination and decontaminated, if necessary.
- **Vehicle Operator Instructions.** Each vehicle operator of a motor vehicle transporting dangerous chemicals must be given full and complete information about the shipment to help them safely deliver the cargo to its destination. When the vehicle is loaded, the vehicle operator is informed of necessary safety precautions both verbally and in writing, using DD Form 836.

## LIQUID FUELS

14-14. When carrying gasoline or other liquid fuels, two fully charged fire extinguishers must accompany the vehicle. Inspect gasoline cans for leaks. Do not let defective cans be loaded. Keep all gasoline cans, full or empty, tightly closed. When hauling gasoline in a cargo truck, remove tarpaulins, unless otherwise instructed. If tarpaulins must be used, carefully air and dry them before they are folded and stored.

## TRANSPORTING HAZMAT BY HIGHWAY

14-15. Because the transportation of ammunition, explosives, flammables, chemical agents, and radioactive materials is dangerous, it is essential that personnel involved know and observe applicable safety regulations. A vehicle transporting Class A or Class B ammunition, explosives, or other HAZMAT is inspected at the following:

- The origin of shipment. At this time, deficiencies are corrected before the transporter enters a sensitive area.
- At trailer transfer points (when prime movers are exchanged).
- At destination, before delivery is accepted.

14-16. In CONUS, the shipper uses DD Form 626 (see Figure 14-2) as a guide and record of the inspection. In an overseas theater, DD Form 626 (modified appropriately) may be used or may serve as a model for a locally produced inspection form.

14-17. In CONUS, military shippers use DD Form 836 (see Figure 14-1) to instruct vehicle operators of military and commercial vehicles transporting dangerous material. Sections of the form outline actions to be taken in case of fire, accident, and breakdown. The form also provides for entry of specific information by the shipper or transportation officer. This form (appropriately modified) may also be used in an overseas theater or may serve as a model for a locally produced instruction form. The vehicle operator must have shipping papers available at all times (see Code of Federal Regulation [CFR] 49 177.817).

14-18. In CONUS, military vehicles transporting ammunition, flammable materials, or toxic chemicals must comply with Department of Transportation (DOT) regulations governing highway movement of these materials. In an overseas theater, such movement must comply with theater policies and HN requirements.

- 14-19. Follow these general safety guidelines for motor transport of ammunition and explosives:
- To prevent accidental movement of the transporter while it is being loaded or unloaded, stop the engine, place the vehicle in gear, and set the parking brake and block the wheels. If automatic, place transmission in neutral.
  - Handle the explosives with care. Do not jar or shock them.
  - Prohibit smoking within 50 feet of a transporter loaded with explosives or flammable liquids. The vehicle operator will not smoke during transport.
  - Prohibit open flames (such as matches, cigarette lighters, and torches) within 100 feet of a transporter loaded with explosives or flammable liquids.
  - Each truck hauling explosives or flammables must have two dry chemical fire extinguishers (one inside the truck cab and one outside on the vehicle operator's side). Vehicle operators must know how to check the serviceability of the extinguishers and how to use them.
  - Vehicles will be driven at a safe distance from other traffic. Caution vehicle operators against sudden stops or turns.
  - Clearly label or placard vehicles to warn other traffic.

14-20. During highway movement of chemical agents, hazardous chemicals, and chemical ammunition, the vehicle operator should have a protective mask, protective clothing, and the appropriate first aid items (such as burn ointment).

14-21. The vehicle operator must know the hazardous side effects that may be caused by their cargo (such as symptoms produced by toxic chemical agents) and what actions to take in case of fire, spillage, or any other emergency.

## **DETECTING FUEL LEAKAGE OCCURRING ON A PUBLIC HIGHWAY**

- 14-22. Do the following immediately, upon detecting a fuel leak in the cargo tank:
- Turn off the vehicle's electrical system. Extinguish any cigarettes or open flames in the vicinity. Remove the vehicle's fire extinguisher from its bracket and keep it close at hand. If an assistant vehicle operator or other person is available, tell him/her to man the fire extinguisher.
  - Notify police of the hazardous situation by the most expeditious means.
  - Inspect the leak. Determine if a field expedient (for example, a wooden plug or rubber matting) can be used to control the leak.
  - Place highway warning devices at prescribed locations. Do not use flares.
  - Keep spectators away from areas where flammable liquids are spilled or toxic fumes have accumulated.
  - Guard against smoking by spectators or passing motorists. If personnel are available, post guards to warn passing vehicle operators of the fire hazard.
  - Notify nearby residents when spillage may place them in danger.

14-23. When civilian police and/or firefighting personnel arrive, tell them the nature of the cargo. Follow instructions issued by fire or police department personnel until the hazard is neutralized. Military personnel will inform civilian investigators and cooperate with civilian authorities in clearing the damaged equipment from the highway.

## DETECTING FUEL LEAKAGE OCCURRING OFF THE ROAD

14-24. When travelling off road, check for leaks at all stops. The movement from the bumps could jar something loose and cause a leak.

## EMERGENCY PROCEDURES

- 14-25. Do the following immediately upon detecting a leak in the cargo tank:
- Turn off the vehicle's electrical system.
  - If the tanker is a semitrailer, lower the landing legs, disconnect the semitrailer from the tractor, and drive the tractor a safe distance from the semitrailer.
  - Remove the vehicle fire extinguisher from its bracket and keep it close at hand. If an assistant vehicle operator or other person is available, tell him/her to man the fire extinguisher.
  - Inspect the leak. Determine if a field expedient (for example, a wooden plug or rubber matting) can be used to control the leak.
  - If space is available in another compartment of the tanker, transfer the fuel from the leaking compartment to the secure one. However, this procedure is not recommended when fumes have accumulated around the tanker pump.

## FUEL JETTISONING

14-26. When fuel cannot be transferred from the leaking compartment, contact the nearest HAZMAT protection facility (local fire station) for permission to locate a proper location to jettison fuel.

### CAUTION

Army, Department of Defense, and Federal regulations prohibit discharge of fuel on the ground.

## USING SAFETY PROCEDURES

14-27. If using petroleum tank vehicles, know and observe the safety precautions in this chapter and those in the chapters dealing with specific vehicles and operations. These procedures apply to all the vehicles in this manual. Whenever operating a tank vehicle, follow these safety procedures:

- Position the tank vehicle in the transfer area so that it is headed toward the nearest exit and away from buildings or other obstructions. Do not let other vehicles block exit routes.
- When possible, conduct petroleum operations on level ground. Always stop the engine and set the brakes. If on a grade, chock the wheels.
- Keep at least 25 feet between the tank vehicles during receipt and issue operations. To avoid congestion during transfers to other vehicles, maintain a distance of 100 feet between the tank vehicles engaged in transfer operations. Also, be sure there is a clear escape route when the tank vehicles are parked overnight in the designated parking area.
- During all loading, unloading, and fuel-servicing operations, keep the tractor coupled to the tank semitrailer. However, if the semitrailer is used for temporary storage, it may be uncoupled from the tractor.
- Keep the manhole cover open during all loading, unloading, and fuel-servicing operations. Do this so the tank shell does not collapse if a vent fails. When opening the manhole cover, stand on the windward side of the vehicle.

- When transferring a product, the vehicle operator of the receiving vehicle operates the dispensing nozzle of the discharge hose. By doing this, the vehicle operator can top off their own vehicle at the proper level.
- When the transfer operation is completed, carry the nozzle and the discharge hose back to the fuel tank vehicle. Do not drag it on the ground.
- Keep the canvas top and rear curtain of the tractor in place whenever the vehicle is carrying, loading, or unloading fuel. The top and curtain keep the tractor from being splashed with fuel from the vehicle catwalks.
- Check the pressure vacuum relief valves frequently in cold weather to be sure they are operating properly.

## **FIRE PREVENTION**

14-28. Aside from enemy attack, fire is the greatest danger during fuel tank vehicle operations. Do the following to prevent fires:

- Post “NO SMOKING” signs around the area of operation. Observe no smoking rules. Do not let anyone carry matches or lighters when working around a fuel tank vehicle.
- Keep a dry chemical fire extinguisher manned and ready for use during all petroleum tank vehicle operations. At permanent fueling installations, build a covered storage point in which a carbon dioxide, foam, or dry chemical fire extinguisher and sand may be kept. Keep this storage point close to the loading and unloading area. Inspect all fire extinguishers at this storage point monthly to be sure they have not been damaged and the hose nozzles are not clogged. Record the inspection date and the initials or name of the inspector on a tag and attach the tag to the extinguisher.
- Bond and ground all vehicles and equipment before starting any petroleum tank vehicle operation.
- Stop all petroleum operations if there is an enemy attack, electrical storm, or a fire in the area.
- Keep all possible sources of vapor ignition away during fuel tank vehicle operations.
- Be sure the drop tube or discharge hose is close to the bottom of the tank during top loading. This cuts down on vapors and static electricity. When top loading jet fuel, start pumping at a reduced flow rate until the lower end of the drop tube or discharge hose is covered with the product.
- Use explosion-proof extension lights, flashlights, and electric lanterns. Be sure all electrical equipment used is explosion-proof and in good operating condition.
- Do not drag hoses across the rear decks of combat vehicles or near their exhaust systems. Armor plates and exhaust pipes get hot during operation and could damage hoses and cause a fire.
- Do not drive past or near a fire until it is safe to do so.
- Stop the flow of fuel and close the manhole cover if a fire is in a tank compartment.
- Personnel who get fuel on their skin should wash immediately with soap and water.
- Wet fuel-soaked clothes with water and remove them immediately. If there is no water available, personnel should temporarily ground themselves by holding a piece of grounded equipment with both hands. They then may remove their hands from grounded equipment and take off their clothes. This grounding action removes the danger of a static spark igniting clothes.

## BONDING AND GROUNDING

14-29. Bonding is the process of electrically connecting two units to equalize any static potential that might exist between them. Bonding also forms a path for any static potential that might develop while the operation is in progress. Grounding is the process of electrically connecting single or bonded units to ground rods so that any static potential that might exist at the beginning of the operation or that might develop during the operation is discharged into the earth.

14-30. Always bond and ground both vehicles and equipment before starting petroleum operations. To do this, first ground the tank vehicle and the other unit involved to the ground rod. If only one ground rod is used to do this, it is not necessary to bond. If two rods are used, bond the tank vehicle to the other unit by running a cable between them. Then touch the hose, drop tube, or discharge nozzle to fill the cap before removing it. During the operation, keep the nozzle in contact with the fill opening at all times. When the operation is completed, close the fill cover before disconnecting the bonding and grounding cables.

## SPILL CONTROL

14-31. Fuel spills or overflows at tank vehicle receipt and issue points can pollute the soil, create a fire hazard, and cause a loss of fuel. Do the following to prevent spills or overflows:

- Gauge both the receiving tank and the tank vehicle before and after a transfer. When traveling cross-country, use a gauge stick to measure the amount of product in the tank compartment.
- Attend all discharge nozzles or loading arms constantly while refueling. Also, do not use nozzles with notched handles. If a nozzle with a notched handle is found, modify it so the handle cannot be held open in the locked position.
- Do not exceed safe refueling rates. Also, top off all containers at a reduced flow rate and fill containers only to prescribed levels. At the completion of every operation, drain all hose sections into an appropriate container.
- Keep nozzles, hoses, or drop tubes inside containers to avoid spray.
- Try to keep the product from entering streams or sewers except as directed by police or fire department personnel.
- Fill drums and cans on the ground or on a ground rack.
- Use the pressure control when filling a 500-gallon collapsible drum. If there is not a pressure control or meter available, leave a 1 ½-inch depression in the top of the drum to allow for product expansion. Whenever the drums are airlifted, pressure control **MUST** be used.
- Park loaded bulk petroleum transporting vehicles under shade whenever possible. Heat from the sun will cause the bulk fuel to expand. If natural cover is not available, use a camouflage screen system to shade the tanker.



## Chapter 15

# Chemical, Biological, Radiological, and Nuclear (CBRN) Operations

**This chapter implements STANAG 2002.**

15-1. Actual operations prove that what is done in training will also be done during warfare. Part of this training will come through field exercises and maneuvers simulating warlike conditions. A vehicle operator must know what to do during passive defense and blackout (BO) driving and when driving under CBRN conditions. The unit standing operating procedures (SOPs) contains warning systems; actions to take when under aircraft, guerrilla, and CBRN attack; and conduct in a motor march or convoy. Learn what is expected – know automatically, what actions need to be taken and when.

## OPERATIONS UNDER CBRN CONDITIONS

15-2. After a suitable period following CBRN contamination of an area, a vehicle operator may operate their vehicle through the area safely using the protective measures they have been taught. Time limits vary depending on the use of protective clothing, temperature, nature of the contaminant, type of soil and terrain, and task to be performed. If the mission requires that a vehicle operator operate their vehicle in a radio logically contaminated area, the commanding officer must decide the maximum dose to which they will be exposed.

## PRACTICES FOR OPERATING VEHICLE IN CONTAMINATED AREA

15-3. The following practices are helpful in carrying out the mission:

- Before entering CBRN-chemically contaminated areas, don protective clothing and the protective mask, as required.
- Use hard-surface roads, if available.
- Avoid unnecessary splashing if roads are muddy.
- Clean the wheels of the vehicle after crossing the area.
- Move through the area as rapidly as safety rules will allow.

## VEHICLE OPERATION WHILE WEARING PROTECTIVE MASKS

15-4. Under combat conditions, situations change. Personnel may be moving forward with assault troops, in a fighting position, or standing by in a replacement area some distance from the combat area. In any of these situations, they are subject to enemy gas attack. However, they should always remember the mission comes first and must continue. Therefore, they may be operating their vehicle while wearing their protective mask. Although wearing a protective mask may be inconvenient and slightly uncomfortable, the ease with which one can wear it for an extended period improves with practice and self-discipline. Learn to drive while wearing the mask. Above all, keep it on until instructed to remove it. The undisciplined Soldier, feeling terribly sick, uncomfortable, and ill at ease, will remove their mask and die. A well-trained disciplined Soldier will keep their mask on and live. If you remain calm and do not panic, there is a much better chance of completing the mission.

## MARKER DESCRIPTIONS

15-5. Use the triangular signs described in this chapter and Appendix D (STANAG 2002), unless the area is to be abandoned to threat forces, to mark CBRN contaminated areas, chemical minefields, booby traps, and unexploded munitions. The colors of the signs indicate the nature of the contamination or danger. These include the primary color and the secondary color (see Table 15-1). The primary color is used for the background of the front surface and for the entire back surface. The secondary color is used for additional markings and inscriptions on the front surface.

15-6. Areas containing more than one type of contamination or other hazard are marked with the relevant signs placed close to each other. However, the sign GAS MINES is assumed to include the presence of high-explosive mines and booby traps, as well as chemical mines. Simulated contaminated areas are marked exactly as if they were real.

15-7. The signs are the shape of a right isosceles triangle (90 degrees by 45 degrees by 45 degrees). They are made of plastic, wood, metal, or other rigid material with holes or “ears” that are used to hang them above the ground. They are placed on wire boundary fences, poles, trees, or rocks. STANAG 2002 prescribes the coloring and markings of the signs. The signs may be mass-produced by major commands for distribution to subordinate units or may be made locally. The base of the triangle is about 28 centimeters (11 inches); the opposite sides, about 20 centimeters (eight inches) each (see Figure 15-1).

### CHEMICAL CONTAMINATION MARKER

15-8. This triangle is yellow on both sides. The word GAS, in red five-centimeter (two-inch) block letters, is placed on the front side of the marker facing away from the contamination. Use fluorescent paint, if available. Place the name of the agent (if known) and the date and time of detection on the front of the marker with paint, marking pencil, or grease pencil at the time of emplacement.

### BIOLOGICAL CONTAMINATION MARKER

15-9. This triangle is blue on both sides. The letters BIO, in red five-centimeter (two-inch) block letters, are placed on the front side of the marker facing away from the contamination. Use fluorescent paint, if available. Place the name of the agent (if known) and the date and time of detection on the front of the marker at the time of emplacement.

### RADIOLOGICAL CONTAMINATION MARKER

15-10. This triangle is white on both sides. The word ATOM, in black five-centimeter (two-inch) block letters, is placed on the front side of the marker facing away from the contamination. Place the dose rate, date and time of reading, and the date and time of burst (if known) on the front of the marker at the time of emplacement.

Table 15-1. Primary and Secondary Colors

DANGER	PRIMARY COLORS	SECONDARY COLORS	
		MARKINGS	INSCRIPTIONS
RADIOLOGICAL CONTAMINATION	WHITE	NONE	BLACK
BIOLOGICAL CONTAMINATION	BLUE	NONE	RED
CHEMICAL CONTAMINATION	YELLOW	NONE	RED
CHEMICAL MINEFIELDS	RED	YELLOW STRIPE	YELLOW
BOOBY-TRAPPED AREAS	RED	WHITE STRIP	NONE
UNEXPLODED MUNITIONS	RED	WHITE STRIPE	NONE

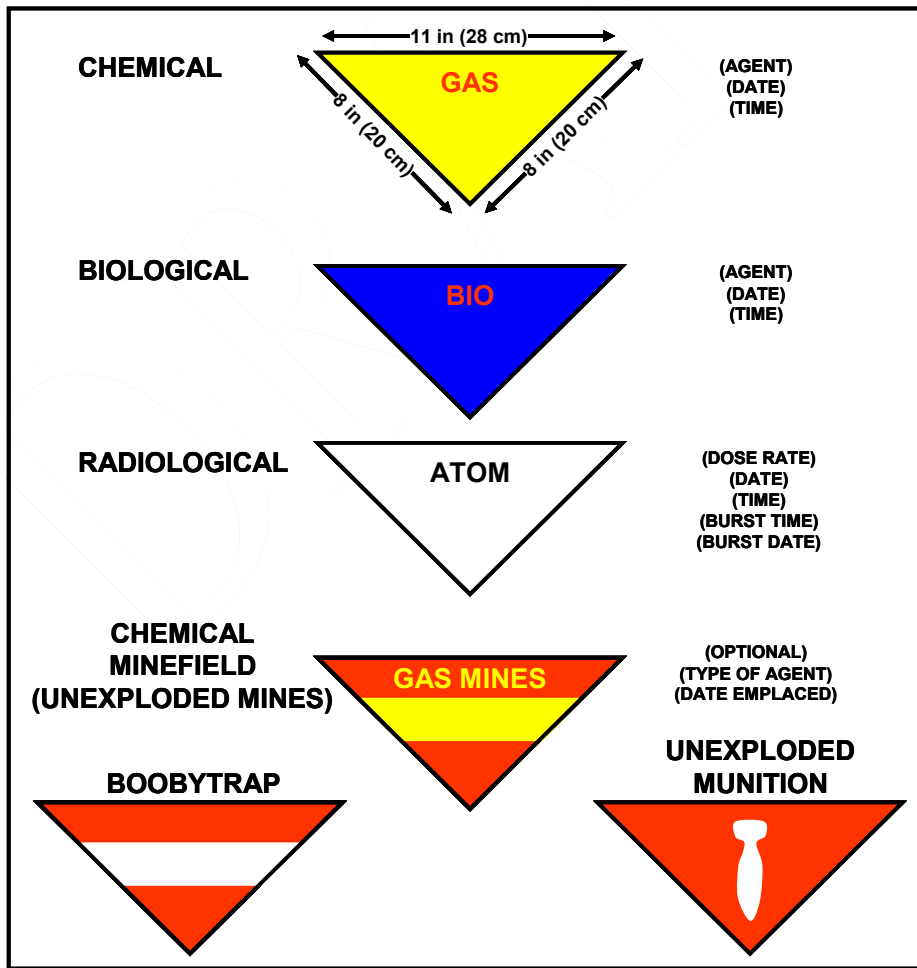


Figure 15-1. Markers of Contaminated or Dangerous Land Areas

## **CHEMICAL MINEFIELD MARKER**

15-11. This triangle is red on both sides. The words GAS MINES, in yellow 2.5-centimeter (one-inch) block letters with a horizontal yellow 2.5-centimeter (one-inch) stripe underneath the lettering, are placed on the front side of the marker facing away from the contamination. Use fluorescent paint, if available. The name of the chemical agent in the mines may be inscribed and the date of emplacement on the front of the marker if the commander desires.

## **BOOBY TRAP MARKER**

15-12. This triangle is red on both sides. A white four-centimeter (1.6-inch) horizontal stripe is painted on the front side of the marker facing away from the booby-trapped area.

## **UNEXPLODED MUNITIONS MARKER**

15-13. This triangle is red on both sides. A white bomb at least ten centimeters (four inches) tall is painted on the front side of the marker facing away from the dangerous area.

## **SPECIAL RADIOLOGICAL MARKING PROCEDURES**

15-14. The marking of radio logically contaminated areas merely indicates a hazard. Newly arrived Soldiers must determine the extent of the contamination by using instrument readings, surveys, and information from other units.

15-15. At the commander's discretion, a radio logically contaminated area need not be marked when it is a military advantage to not do so. In this case, take positive measures to warn other friendly forces of the contaminated area.

15-16. Place signs on all probable routes leading into contaminated areas at the points where the dose rate reaches one rad per hour (rad/hr) measured one meter above the ground. Levels of radiation less than one rad/hr normally are not marked even though long stays in areas of old contamination might produce significant doses. Units planning prolonged stays in any area during a nuclear war must check the area with radiac instruments even if it is marked.

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Note: The unit responsible for the area corrects or moves signs periodically to account for radioactive decay.

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15-17. Unless an area is being abandoned to threat forces, commanders leaving an area or otherwise giving up responsibility for an area should leave perimeter signs in place. The commander taking over the responsibility for the area will continue the periodic correction or movement of the signs and remove them when they are no longer necessary.

15-18. Mark dumps for radio logically contaminated material at intervals around the perimeter with signs that are visible from one another. Ensure signs are periodically corrected or removed when no longer necessary.

## **PERSONAL DECONTAMINATION**

15-19. Once a Soldier is aware of chemical or biological contamination on his/her bare skin, he/she initiates immediate decontamination techniques, without command, by using his/her personal Skin Decontamination Kit (SDK) (M291 Kit). He/She decontaminates his/her hood, mask, gloves, and weapon using the Individual Equipment Decontamination Kit (IEDK) (M295 Kit) or an additional SDK. To remove radiological contamination from equipment and personnel, brush it off and/or use soap and water.

## **OPERATOR'S WIPE DOWN**

15-20. The personal wipe down techniques are most effective when done within 15 minutes of being contaminated. The chemical agent monitor (CAM) and/or M8/M9 paper is used to detect and monitor equipment. Wipe down your mask, hood, gloves, and other essential gear. Do not attempt to remove chemical contamination from your protective overgarment unless there are obvious clumps of the agent. In this case, scrape off the material. Brush off radiological or frozen chemical-agent contamination.

## **CHEMICAL**

15-21. Decontaminate personal equipment using the IEDKs. Wearing your Kevlar helmet protective cover will prevent or reduce the absorption of any liquid chemical agent. Washing with soap and water and bleach solutions is partially effective.

## **BIOLOGICAL**

15-22. Wash with soap and water. If water is not available, use SDKs in the same manner as described for chemical-agent decontamination.

## **RADIOLOGICAL**

15-23. Locate radiological contamination with monitoring equipment and remove by brushing and shaking it off. Wash exposed areas of your skin and pay particular attention to your hair and fingernails. Avoid breathing the dust particles you shake off by wearing your protective mask or a piece of cloth over your nose and mouth. If wet, conduct a mission oriented protective posture (MOPP)-gear exchange as soon as possible because brushing or shaking will not remove the contamination. Wipe off your equipment with warm, soapy water using rags or damp paper towels.

## **EQUIPMENT DECONTAMINATION**

15-24. As soon after contamination occurs, and as the situation permits, decontaminate unit equipment as follows. After self-decontamination has been performed, vehicle operators should perform an operator's spray down.

## **OPERATOR'S SPRAY DOWN**

15-25. Operator's spray down is performed during the Intermediate level of decontamination. The best time to perform a spray down is around 15 minutes from the first signs of decontamination. The spray down can be performed by the operator or by the whole crew. A thorough spray down will help prevent contaminated agents from penetrating the vehicle.

## **VEHICLES**

15-26. Using either the M11 or the M13 decontamination apparatus loaded with DS2, spray those areas of the vehicle or equipment that will most likely be points of contact during mission (such as steering wheel, seats, door handles, troop seating, and so forth). The M11 or the M13 decontamination apparatus is not intended to decontaminate the entire vehicle. One filling of DS2 is sufficient for emergency decontamination of the operator controls (M11). The IEDK may be used on equipment that DS2 may cause damage to by corrosive action.

15-27. If sufficient DS2 is not available, use STB or soapy water or any other expedient. Decontaminate contaminated wood surfaces and tires with slurry.

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Note: If the operator realizes the vehicle is contaminated, all occupants mask and don protective equipment and continue their mission until the situation permits decontamination.

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15-28. Decontaminate the vehicle with DS2, soapy water, solvents, or slurry. Lightly contaminated vehicles may be decontaminated by airing.

### **CREW-SERVED WEAPONS**

15-29. Decontaminate these weapons using the methods described above (operator's spray down). If considered necessary, decontaminate the bore by using cleaning solvent or hot soapy water. Decontaminate ammunition with cool, soapy water.

### **AMMUNITION**

15-30. Use cool, soapy water to decontaminate ammunition. Apply the soapy water with the PDDA or with brushes, mops, rags, or brooms. Dispose of ammunition corroded from contact with chemical agents, particularly if the brass cannot be cleaned. Do not use dry super tropical bleach (STB) on ammunition contaminated with mustard type blister agents because when mixed they may ignite and start a fire.

### **OPTICAL INSTRUMENTS**

15-31. Optical systems are extremely vulnerable to decontamination materials that might scratch or adversely affect the lenses. Wipe optical systems with soft, nonabrasive materials (such as a lens-cleaning tissue, cotton wadding, or soft cloth dipped in hot, soapy water). Wipe the optical system with decontaminates. DO NOT IMMERSSE!

### **COMMUNICATIONS AND RADAR EQUIPMENT**

15-32. Most field electronic equipment is watertight for environmental protection. This also provides good protection against CBRN contamination. Contamination will probably not penetrate gasket-equipped protective covers and sealed components of electronic equipment. If exposed on outside, wipe down outside portions of equipment case with a designated decontaminate. For chemical contamination, wipe metal cases with DS2 and allow 30 minutes contact time (for high density [HD]). If DS2 is not available, wipe case with hot, soapy water. DO NOT IMMERSSE!

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Note: Any metal surface decontaminated with DS2 must then be cleaned to remove the DS2, which is corrosive.

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### **SUPPORT LEVEL EQUIPMENT DECONTAMINATION STATIONS**

15-33. Equipment decontamination stations are located as far forward as possible. A specialized decontamination team or unit normally runs them. A typical layout for such a station is shown in Figure 15-2. The station is also described in FM 3-11.5. Collapsible tanks may be used to store water. Use standard decontaminating materials and equipment, if available. Brooms, mops, and pails may be used if the standard equipment is not available. Dispose of contaminated wash water in such a way that it is not a hazard. A sump pit is one means of disposing of the wash water.

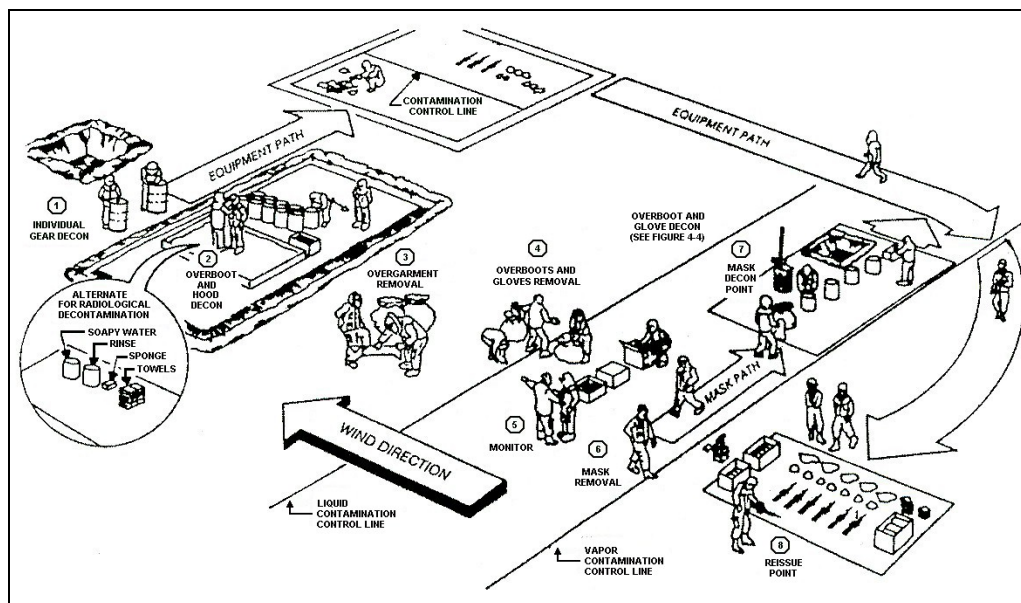


Figure 15-2. Detailed Troop Decontamination (DTD) Layout

## DETAILED SOLDIER DECONTAMINATION

15-34. The contaminated unit or its higher HQ is responsible for the setting up, operating, manning, and closing the DTD areas at the thorough-decontamination site. The chemical unit leader determines the general location of the DTD within the decontamination site and provides technical advice on setting up, operating, and closing the DTD area. The supervisor of the DTD must establish a work/rest cycle.

15-35. This site consists of eight stations for decontaminating Soldiers in the field. They are as follows:

- Station 1 – Individual Gear Decontamination. Remove decontamination from individual equipment (such as LCE, mask, carrier, helmet, and weapon).
- Station 2 – Overboot and Hood Decontamination. To neutralize gross contamination on overboots and lower trouser legs. The protective mask and hood is also decontaminated.
- Station 3 – Overgarment Removal. Removal of contaminated overgarments.
- Station 4 – Overboots and Gloves Removal. Overboots and gloves are removed and decontaminated.
- Station 5 – Monitor. Identification of decontamination on personnel, provides spot decontamination capability, and provides medical aid, as required.
- Station 6 – Mask Removal. The mask is removed without contaminating the individual.
- Station 7 – Mask Decontamination Point. All decontaminates are removed from the mask.
- Station 8 – Reissue Point. Reissue of all individual gear with components.

15-36. The field expedient DTD may be established in many configurations depending on the available equipment and location. If water is not available, a mobile DTD can be established using the M12A1 power-driven decontamination apparatus (PDDA). The field expedient personnel decontamination stations are normally located as far forward as possible and near a medical aid station, if possible. A clothing exchange facility and a first aid and monitoring facility are operated in conjunction with the field expedient DTD. The field expedient DTD should also be located in an area that provides concealment from air and ground observation and where contaminated water can be disposed of safely.

15-37. In an emergency when a PDDA is not available, there may be the need to establish a field expedient DTD to decontaminate personnel units that cannot be withdrawn from combat. The DTD provides fresh clothing, equipment, and a means to dispose of contaminated clothing, equipment, and water.

15-38. An uncontaminated area near a source of water (such as a stream, well, or water storage facility) is selected, if possible. If the area is contaminated, first decontaminate it by turning or removing a top layer of soil or sand or by using available decontaminating agents. Preferably, the area selected should have overhead cover. If not, provide this cover to protect against chemical attack. The area should be located to take advantage of any available cover and concealment and camouflaged to hinder enemy detection.

15-39. The following materials and equipment can be used to establish a field expedient DTD:

- Containers (such as government issue (GI) cans, boxes, or plastic bags) in which to put contaminated clothing.
- Water pump and hose (if PDDA is not available).
- Water heater, improvised (if an M1 or M2 water heater is not available).
- An overhead pipe with showerheads (ordinary pipe or rubber hose with holes can be used).
- Lumber and nails for benches and walks.
- Pails of soapy water and clear water with brushes to decontaminate boots and masks.
- Tarpaulin or any other material to use as overhead cover.
- Medical tent or substitute.
- Clothing exchange tent or substitute.

Assistants are required at the various stations within the DTD to supervise and help personnel going through the line.

15-40. FM 3-11.5 details a recommended undressing procedure. However, the undressing procedure should be modified according to the facilities and conditions at the specific DTD.

15-41. The unit SOP should include a personnel decontamination station annex that gives guidance on the following:

- Organization of the decontamination line.
- Personnel required at stations on the line and their duties.
- Supplies required.
- Description of boot cleaning buckets and instructions for use, frequency of contents renewal, disposal of contaminated waste, and replenishing buckets.
- Undressing procedure, including a practical unmasking procedure for personnel going through the line.
- Procedures for decontaminating individual equipment and reissue before departure from the DTD.
- Coordination for disposing of contaminated clothing.

15-42. If units with both male and female personnel need to be decontaminated, the DTD may be set up to provide separate facilities. To do this, establish two lines of decontamination points (shower heads) separated by a canvas tarpaulin. Female assistants, if available, would assist the females; and male assistants, the males. However, if such arrangements are not available, the primary concern must be the preservation of life and the immediate removal of the contaminant from all personnel without regard to gender. In either case, once personnel have departed the shower area (are no longer in a life-death situation), separate dressing areas should be provided.



## DECONTAMINATION MATERIALS AND THEIR USE

15-43. The following is a list of Decontaminates. Follow the guidance listed for application of the decontaminate.

### STB DECONTAMINATING AGENT (BLEACH)

15-44. STB can be applied undiluted but should be used either as a dry mix (with earth) or a wet mix (with water). Do not leave it on contaminated surfaces for longer than 24 hours because it corrodes metals. STB neutralizes liquid chemical agents by chemical action. Dry bleach in direct contact with liquid blister agents reacts violently and can cause flame and heavy vapor. STB is chemically active, causing vigorous corrosion of metals. Wet mix is effective against biological agents.

### DS2 DECONTAMINATING AGENT

15-45. Ready-to-use solution is available in 1 1/3-quart cans and five-gallon drums. DS2 can be applied easily with the M11 decontaminating apparatus, a broom, or a swab. One application of DS2 should be made to the contaminated surface and flushed with water after 30 minutes. The solution is effective at temperatures from -26° C to 52° C (-15° F to 125° F). DS2 neutralizes all known chemical agents and most biological agents. It reacts with G-agents, V-agents, and blister agents to reduce their hazards within 30 minutes after application.

#### CAUTION

If DS2 is used during decontamination, care should be taken not to come in contact with STB, as this combination is combustible.

### WASHING SODA (SODIUM CARBONATE)

15-46. Make a solution by stirring two pounds of washing soda into 2 ½ gallons of water. Then apply it to the contaminated surface. Washing soda neutralizes most chemical agents and is especially effective against G-agents. It is used as a washing agent for blister agents. Decontamination is faster with concentrated solutions.

### CAUSTIC SODA (LYE)

15-47. Make a five percent solution by stirring one pound of lye into 2 ½ gallons of water. Then apply it to the contaminated surface. Caustic soda neutralizes chemical agents and biological agents. It is especially effective against G-agents. Decontamination is faster with concentrated solutions.

### FUELS AND SOLVENTS

15-48. Fuel is applied to contaminated areas and ignited. Solvents (like gasoline, kerosene, or carbon tetrachloride) are applied with swabs, taking care not to spread the contamination. Ignited fuels destroy agents. Solvents merely remove them, but sufficient solvent can dilute most dangerous contamination.

### WATER OR STEAM

15-49. Water or steam is applied under high pressure. The action of hot water is speeded by using soap or other detergent. Hot water may also be applied with swabs. Water or steam removes dirt or grease containing chemical agents or radioactive material. Hot, soapy water removes G-agents and physically removes other chemical and radiological contamination.

**CAUTION**

Use temperature and air velocities that are safe for the particular equipment involved. The discharged air/water will be contaminated.

**HOT AIR**

15-50. Hot air is used in special situations (such as decontamination of delicate instruments contaminated with liquid agents or decontamination of aircraft cabins) using the engine heaters. Hot air evaporates liquid chemical contaminants.

**WARNING**

**Drain water and condensed steam into a properly marked sump pit. If it must be drained into a stream, notify friendly units downstream.**

## Chapter 16

# Off-Road and Winter Driving

### WARNING

**Vehicle operators of large vehicles should be aware, that due to vehicle weight, the shoulder of the road might give way.**

16-1. Off-road and winter driving conditions present special challenges for the vehicle operator. This chapter gives guidance on driving off-road and during winter conditions.

## OFF-ROAD DRIVING

### CAUTION

The operator should first check the vehicle's TM for the equipment being operated and follow instructions for driving under other than normal conditions. Driving techniques are different for rear-wheel drive, front-wheel drive, and all-wheel drive vehicles.

## CENTRAL TIRE INFLATION SYSTEM (CTIS)-EQUIPPED VEHICLES

16-2. If vehicle is CTIS-equipped, select one of the following modes (depending on vehicle) appropriate for the type of terrain/obstacle.

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Note: Observe vehicle-operating restrictions (TM -10 series).

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- **X-C** (Cross-country) mode.
- **SAND** (Soft terrain) mode.
- **EMER** (Emergency) mode.

### WARNING

**If vehicle is up armored, the maximum side slope will be reduced from what the TM states. See TM reference for details.**

## **DITCHES**

16-3. If equipped, select appropriate CTIS mode (see paragraph 16-2). Crossing shallow ditches requires shifting into low gear or range and proceeding slowly. Enter the ditch obliquely so that one wheel leaves the ditch as the other wheel on the same side enters. When crossing deep ditches, use the lowest forward gear and four-wheel drive if the vehicle is so equipped. When reaching the bottom, accelerate the motor enough to keep rolling as the vehicle goes up the other side. If the ditch is deep and has very steep sides, it may be necessary to cut away the tops of the banks before trying to cross.

## **GULLIES AND RAVINES**

16-4. If equipped, select appropriate CTIS mode (see paragraph 16-2). Gullies and ravines are natural formations caused by running water. Look over these formations carefully to find a place to cross and to ensure that the vehicle can get across. Examine both banks. If water is flowing in the ravine, check its depth. Put the vehicle in low gear and slowly approach the ravine at a right angle to the edge. Using the service brake, ease the front wheels into the gully; taking care to have them strike the bottom at the same time. Bring the engine up to normal operating speed as the wheels hit the bottom. Accelerate enough to climb as the front wheels touch the opposite bank.

## **WOODS**

16-5. Woods help to conceal the vehicle operator and their vehicle from air observation. However, woods present certain problems. Fairly open woods with trees at least as far apart as the width of the vehicle will allow passage if the vehicle operator can maneuver the vehicle around the trees. Use an established trail if possible. Do not plan to return on the same route because these same saplings may stop or damage the vehicle when braced against it. If the trees are too dense and prevent passage, drive as closely as possible to the edge of the woods using shadows for concealment. Although wooded areas can be obstacles to vehicles, they are not to the foot Soldier. Wooded areas are likely spots for guerrillas, partisans, or enemy troops. Be alert to the possibility of an ambush.

### **Stumps**

16-6. A high tree stump, if straddled by the vehicle, can seriously damage the vehicle axles, tires, and other low parts. Check ground clearances and drive with caution.

### **Low Limbs**

16-7. When driving through wooded areas, whether on country roads or cross-country, low hanging limbs may rip the tarp, break the tarp bows or radio antennas. It is usually best to remove the canvas top and the bows for field operation. Survey the route to determine if the vehicle can proceed without damage from low-hanging limbs or if it is practicable to remove obstructing limbs.

### **Timber**

16-8. If necessary, driving over fallen trees is possible if angle crossings cannot be achieved. By piling dirt and other materials/debris over the fallen tree, the obstacle will become more level with the path being traveled enabling the vehicle operator to pass.

## **ROCKY TERRAIN**

16-9. If equipped, select appropriate CTIS mode (see paragraph 16-2). Do not try to straddle large boulders; they will damage axles and other low parts of the vehicle. Move very slowly when driving in rocky terrain. If available, a vehicle operator should carry an extra spare tire because the possibility of getting a flat is greatly increased. Remove stones between dual tires as often as possible to prevent breaking the sidewalls of the tires.

## MUD AND SWAMPS

16-10. If equipped, select appropriate CTIS mode (see paragraph 16-2). Every military vehicle has enough power in its lowest gear to pull out of mud if it gets traction. Try to pull out slowly in low gear or low range if the vehicle is equipped with an automatic transmission. Placing boards, brush, or similar material under the vehicle's wheels can increase traction. Remember the following:

- Select the gear that will get the vehicle through. Roll onto the soft area at a medium speed for the selected gear. Carefully maintain a steady throttle until reaching solid ground.
- If stopped by mud rolling up in front of the wheels, the vehicle operator may have to back up and try again, this time with increased momentum. Under most conditions, this technique requires prompt action. Otherwise, the mud will fill the tracks behind the wheels and slow or stop the backing. There must be solid footing within reach of the vehicle in order to do this.
- If a vehicle with an automatic transmission gets stuck, pull out slowly in low gear or low range. If the vehicle cannot get out, and if brush or boards do not provide the traction needed, have another vehicle pull out the stuck vehicle. When other vehicles are not available and the vehicle is equipped with a winch, attach the winch cable to a tree or solid object and pull the vehicle out with winch power. Do not rock the vehicle; it will only dig in.

## STREAMS

16-11. If equipped, select appropriate CTIS mode (see paragraph 16-2). The vehicle's technical manual/technical order (TM/TO) contains specific instructions on fording streams. In addition to those instructions, follow these precautions before fording:

- Check the stream bottom to determine how firm it is.
- If some sinking is expected, determine if this sinking added to the water depth will exceed the vehicle's fording limit. If the fording limit will be exceeded, find another crossing point.

16-12. After reaching dry land, test the brakes while moving at a reduced speed. If the brakes do not operate properly, continue at a slow speed while maintaining a light steady pressure on the brake pedal to cause a slight drag on them. The heat should dry the brakes.

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Note: See the appropriate vehicle TM -10 series for correct procedure.

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## SAND

### CAUTION

When driving in sand, never drive while holding the inside of the steering wheel. The sand can grab the tires causing the steering wheel to jerk suddenly and cause injury to you.

16-13. The main objective when driving in sand is to maintain movement with the least amount of strain on the vehicle, its engine, and its power train. To do this—

- Estimate if a sandy area is drivable.
- Adjust the tire pressure to meet changing conditions.
- Use various aids to improve bearing surfaces.
- Exercise sound driving techniques.

The vehicle operator's ability to do these things well comes only through experience.

### **Tire Pressure**

16-14. If equipped, select appropriate CTIS mode (see paragraph 16-2). If not equipped with CTIS mode, reduce tire pressure when driving in soft sand and over dunes. This increases the amount of tire surface in contact with the sand to provide better flotation (support). However, never reduce tire pressure so much that the tire slips on the rim. Refer to the vehicle TM/TO for proper tire pressure. When operating with reduced tire pressure, drive at low speed. Inflate tires to normal pressure (for cross-country or hard surface, as appropriate) as soon as the situation permits.

### **Accessories**

16-15. To help overcome the many difficult conditions associated with extended driving in sand, the vehicle operator should be provided with the following:

- A tire gauge.
- The means to inflate tires if the vehicle is not so equipped.
- Spare valve cores.
- Readily available material for use under wheels in extremely soft areas.
- Shovels and tow chains or cables.

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Note: Lubricate and service the vehicle at more frequent intervals as specified by the unit commander.

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### **Driving on Sand**

16-16. Do the following to start on sand:

- Ensure tires have proper tire pressure. If equipped, select appropriate CTIS mode (see paragraph 16-2).
- Follow normal engine-starting procedures.
- Select a gear or range that will start to move the vehicle forward with a minimum of, or no, clutch slippage and wheel spinning.
- Accelerate gradually.

16-17. Do the following to drive on sand:

- Maintain a steady and even rate of movement.
- Avoid unnecessary shifting of gears. If the vehicle is equipped with an automatic transmission, keep it in low range.
- Anticipate difficult spots and try to bypass them.
- Head for a small stretch of soft sand with increased speed, when necessary, to take advantage of momentum.
- Stop before entering an extensive stretch of soft sand. Reduce the tire pressure, if necessary. Start off in a gear or range that will drive the vehicle through with little need for further shifting and a minimum of clutch slippage and wheel spinning. As soon as the need for low tire pressure ceases, stop and re-inflate to appropriate pressure.

- Approach a dune (hill of sand piled up by the wind) from the windward (most gradual) slope at a 90-degree angle. Select the proper gear or range to avoid shifting while on the slope. Maintain as much momentum as possible while going up the slope. Be prepared to change direction upon reaching the crest. Ride the crest if necessary to seek a safe route. If the lee (steepest) slope must be used, select a point where the angle of approach will allow the front bumper to clear.
- Follow in the tracks of preceding vehicles or break a new path depending on conditions.
- Make wide turns. Sharp turns can stall or even overturn the vehicle.

16-18. Do the following to stop in sand:

- Let the vehicle roll to a halt if practicable. Otherwise, brake gradually. This prevents tires from digging in.
- Try to stop on a downhill slope. This gives a vehicle operator an advantage when starting.

### Freeing Vehicle

16-19. At the first sign the vehicle is bogging down, try shifting to a lower gear. Do the following if it still bogs down:

- Stop power to the driving wheels. If a vehicle operator continues to use the motor to force the vehicle out of the sand, it will only sink deeper and become more difficult to get out.
- Check tires for sand operation inflation. High temperature may have built up the pressure.
- Lower the tire pressure, if necessary, for emergency movement over a short distance.

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Note: Check the vehicle TM/TO for the allowable minimum tire pressure.

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- As soon as the need for low tire pressure ceases, stop and re-inflate the tires to the appropriate pressure.

16-20. If lowered tire pressure is not enough to free the vehicle, use any or all of the following procedures:

- Shovel a clear path ahead of the wheels.
- Lay boards, brush, canvas, wire netting, rope ladders, or some similar material under and in front of the tires for better flotation and traction.
- Use the winch or a tow if it appears that continued operation of the vehicle under its own power would only cause it to sink deeper into the sand.
- If a vehicle is bellied down and must be pulled out, unload the vehicle to the extent needed.
- As soon as the need for low pressure ceases, stop and re-inflate tire to appropriate pressure.

### Vehicle Care

16-21. In addition to responsibilities contained in the vehicle TM/TO, a vehicle operator must do the following:

- Keep valve caps on all tires.
- Check engine temperature and oil pressure frequently.
- Check for a loose or broken fan belt if overheating occurs. Correct as necessary.
- Clean the oil spout before adding oil. Remove any accumulation of sand or dirt around the filler hole.

- Clean the spouts of gasoline containers before using them for refueling. Under extremely dirty conditions, filter gasoline when filling tank.
- Inspect nuts, bolts, springs, mountings, and accessories frequently for evidence of looseness or damage.
- Park with the rear of the vehicle toward the wind when halted overnight or for any extended period. If this is not possible, cover the windshield and radiator with a tarpaulin to prevent sand from accumulating in the engine compartment and damage to the windshield.

## WINTER DRIVING

16-22. Particularly during cold weather, exercise extreme care starting and operating a vehicle. Keep the vehicle in the best mechanical condition possible; otherwise, it will not operate properly. Carbon monoxide poisoning is an added hazard. This poisoning, from inhaling the exhaust fumes of the vehicle, usually results in death. To avoid the possibility of inhaling these fumes, never sleep in the cab of the vehicle with the engine or heater running. Whenever the heater is used while driving, leave a window open slightly. Inspect the vehicle exhaust manifold, muffler, and tail pipe for serviceability and tightness daily. Never leave the engine running while working on the vehicle in a closed building. Remember these points when driving on ice or snow:

- Vehicles equipped with mud and snow tires will slide more easily on icy road surfaces than those with commercial tread. Mud and snow treads are more effective on roads covered with loosely packed snow.
- All-wheel drive vehicles, without chains, generally perform better than two-wheel drive vehicles with chains on rear wheels.
- Chains give a good bite in snow or mud, but tend to slip and slide on ice and packed snow.
- Sand, cinders, or dirt scattered on icy road surfaces gives more traction than chains.
- Fresh snow may conceal an icy road surface.
- Although snow or ice may be melting on roads, it may remain solidly packed or frozen on bridges.
- Better traction is gained when the load is distributed evenly on all wheels.
- Three to eleven times more distance is required to stop a vehicle on roads covered with ice or snow.
- Isolated patches of ice may be on an otherwise clear road, especially in shaded areas.

16-23. As a last resort when the engine will not start, tow the vehicle with another or call the unit maintenance crew according to unit policies. Do not push the vehicle. Do not race a cold engine once started.

16-24. Start driving in second or third gear rather than first or low. Engage the clutch gradually (or in D2, high, with automatic transmission), and accelerate no more than necessary to keep from stalling. Avoid quick acceleration on slick roads. This can result in the vehicle skidding.

16-25. Driving methods and practices discussed in Chapter 8 apply here, modified as follows:

- Drive at reduced speeds. This allows the vehicle operator to bring the vehicle to a stop more quickly.
- Give turn signals sooner than usual. This gives other vehicle operators more time to react.
- Pump the brakes to give others an early warning of the intention to stop.
- Maintain at least double the normal distance from the vehicle ahead.



16-26. Good all-around visibility is the first requirement for safe driving. Keep windshields, windows, mirrors, headlights, spotlights, and body clearance lights clean and free of snow and ice. If defrosters are not available, keep windshields clean by using the windshield wiper, wedging the rear of the hood open so motor heat is vented toward the windshield (for rear-opening hoods) or thoroughly ventilating inside the vehicle. Cover windshields of vehicles parked in open lots with cardboard or canvas to prevent overnight frosting.

16-27. Descend moderate grades in the gear normally used to climb the same grade. On steep or very slippery grades, use at least one gear lower and go slower.

16-28. When visibility is poor, a vehicle operator should use low-beam headlights to warn other vehicle operators of their position. Stop, park off the roadway, and wait for conditions to improve if visibility is zero. If continuing is an absolute must, have an assistant vehicle operator or passenger walk in front of the vehicle as a guide.

16-29. Avoid vehicle tracks, rocks, and other objects that might throw the vehicle sideways causing a skid. Also avoid sharp turns that will make a vehicle skid.

16-30. Keep the cab door open when crossing frozen streams. This ensures that the vehicle operator can exit the vehicle if the ice thins and they are in danger of falling through the ice.

16-31. After driving through slush or water, test the brakes while moving at a reduced speed. If the brakes do not operate normally, continue at a slow speed while maintaining moderate pressure on the brake pedal to create a slight drag. The heat generated by friction between the brake shoe and brake drum will dry the brakes.

16-32. On roads that slope toward side ditches, straddle the center or crown to avoid sliding to the side. Watch carefully for approaching traffic.

16-33. If unsure about a difficult stretch of road, bring the vehicle to a stop and inspect the road carefully before going across. Select a gear that will allow the vehicle to pass safely. If following a vehicle, wait until it crosses. This allows the vehicle operator the ability to render assistance to the lead vehicle if it gets stuck. It also ensures that the lead vehicle will be able to render assistance to the second vehicle if it gets stuck.

16-34. To drive through heavy slush, downshift before entering and keep moving. If wheels begin to spin, disengage the clutch at once, back up, and try again. If necessary, try rocking the vehicle by shifting rapidly between forward and reverse gears.

16-35. Do the following at traffic stops:

- Gradually ease up on the gas. Leave vehicle in gear.
- Apply brakes intermittently and lightly. Use engine compression as much as possible to assist braking.
- Disengage the clutch at the last possible moment to prevent stalling.
- Avoid sudden braking on slick roads so the vehicle will not skid.

16-36. Do the following when parking:

- Place brush, boards, or other suitable material beneath wheels when parking for an extended period on wet, slushy, or muddy surfaces. This keeps the tires from sinking, freezing to the ground, or being “pocketed” in ice.
- Do not set the parking brake. During cold weather conditions, applying the parking brake may cause the linings to freeze to the brake drums. Instead, block the wheels and place the transmission in the appropriate gear for parking as directed by the vehicle TM/TO.

## TIRE CHAINS

16-37. Chains are designed to creep or move on the tires. Tighten them by hand, never with tools. Creeping or moving of chains reduces the possibility of the links gouging into the tires. When using chains continuously, check their fit and condition at each halt. Install repair links as soon as one of the cross chains is broken.

16-38. Do the following when installing tire chains under normal conditions:

- Check the condition of the chains. Eliminate twists.
- On some vehicles, tire chains must be installed on all driving wheels. Check the vehicle operator's TM.
- Drape chains over tires with OPEN ENDS OF CROSS CHAIN HOOKS AWAY FROM THE TIRE and with fasteners on the trailing ends of the side chains.
- Tuck the first cross chain under the front of the tire. Move the vehicle forward until the fasteners are hub high.
- Straighten and center the chains.
- Lift the ends of the side chains to determine which links will be hooked into the fasteners.
- If installing on duals, first fasten chains between wheels, then inner chains, and finally the outer chain. If installing on singles, fasten the inner chain before the outer chain.

16-39. Do the following when the vehicle is mired:

- Determine whether to install the chains with a forward or backward wheel motion.
- Check the condition of the chains. Eliminate twists.
- Drape chains over tires with OPEN ENDS OF CROSS CHAIN HOOKS AWAY FROM THE TIRE and with fasteners on the trailing ends of the side chains.
- Locate the first cross chain near mud or snow line.
- If the chains are dual, fold the inner half of the chain over top of the outer half. This makes a doubled chain on the outer wheel. For this reason, the methods listed below then apply to either dual or single wheels.
- Secure one end of each side chain to the wheel by a strong wire, cord, or chain passed through the opening in the wheel and fasten to the inner and outer side chains adjacent to the first cross chain.
- Pull the chain back to take up slack and align with tire. To keep the loose chain from one wheel from being caught up by the other, pile it close behind the wheel to which it is secured.
- Revolve wheels slowly to draw chains around tires. Stop when fasteners are at the top of the tires.
- Pull side chains up tight to select links to be hooked into fasteners. Hook the inner side chain first.
- When the vehicle has been moved to solid ground, loosen and remove the temporary wires, cords, or chains. Adjust the chains to their proper position.

## VEHICLE CARE IN COLD WEATHER

16-40. In addition to the responsibilities contained in the vehicle TM/TO, follow these procedures for vehicle care in cold weather:

- Keep all fuel tanks and containers as nearly full as possible to keep moisture from condensing inside the fuel tanks and containers. Moisture not only contaminates the gasoline, but also may freeze in the fuel lines. Filter the gasoline through a chamois to remove water.
- Drain the air tanks in the vehicle each time it is stopped (long enough for the tanks to become cold). This procedure reduces the chance of moisture collecting in the tanks, entering the brake lines, freezing, and making the brakes inoperative.
- On brief halts during extremely cold weather, let the engine run at a fast idle so that the ammeter shows a charge. Fast idle results in better burning of fuel and a more even engine temperature. Under normal operating conditions, stop the engine during brief halts. This will prevent plug fouling and overheating.
- On long halts, park the vehicle with the rear end toward the wind to keep snow out of the engine.
- When it is very cold, cover the radiator and hood with a tarpaulin or other suitable material.
- In severe cold, start the engine frequently between operating periods to keep it warm.

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## Chapter 17

# Vehicle Recovery

17-1. This chapter describes a few of the more common field vehicle recovery procedures – operations that can be performed with limited resources. In any of these operations, remember to use brainpower to make up for a lack of available horsepower. Time should be taken to figure out the rigging and include a reasonable factor for safety. Sloppy planning results in wasted time and may further damage the vehicle and equipment as well as causing injury or death to personnel. Recovery failures are often the direct result of haste.

### RECOVERY SAFETY

17-2. Recovery can be inherently dangerous unless safety is continually observed and practiced. Each of the recovery functions (winching, lifting, and towing) must only be performed with safety as the primary concern. Always follow safety warnings in this manual and in the operator's manual for both the recovery vehicle and the recovered vehicle or equipment. Following are some key factors and actions that can help or prevent unnecessary damage to equipment and more importantly, injury to personnel.

17-3. Know recovery equipment capabilities and limitations! Winches have tremendous power and if not properly secured to the disabled vehicle, can rip off tow lugs, bumpers, and other attachments that often become missiles injuring personnel and/or damaging equipment. Always follow the safe rigging guidelines in this manual. Keep all but the minimum required personnel away from the recovery area. Each recovery crew member must know where other crew members are located at all times.

- Ground chock blocks have their limitations. If overloaded, the recovery vehicle can slide out of control.
- Winch cables can break and backlash into equipment and personnel.
- Exercise extreme caution when towing.
- Some wheeled vehicles may not have any braking effect. The recovery vehicle must provide braking for the towed vehicle as well as itself.

### COMMON TOOLS FOR RECOVERY

- Tow Strap.
- Tow Cable.
- Tow Chains.
- Hydraulic Jack.
- Highway Warning Kit.

17-4. Other recovery lifting actions also require extreme caution to prevent injury to personnel and/or slide. If the crane has a remote control, use to keep away from the action. The remote control can also assist in allowing observation of equipment movement and location of other crew members. Never exceed the limitations of the crane or its outriggers.

### GROUND GUIDES FOR RECOVERY

17-5. For safe control of a recovery operation, there should be two ground guides to prevent confusion. One ground guide in the front, and one in the rear, both ground guides will stand off to the side of the vehicle. Never stand directly in front of or behind the vehicle. Only one guide will be giving signals.

The ground guides should stand apart from other personnel at the recover site and be in a position where operators can easily observe the signals. The operators must know the meaning of the signals to be used and act only on those signals.

**REMEMBER, SAFETY FIRST IN RECOVERY OPERATIONS!**

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**FOR ARMY ONLY:** Army Training Publication (ATP) 4-35 for further information.

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**FOR AIR FORCE ONLY:** Refer to Technical Order (TO) 36A-1-98 for further information.

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## **TOWING VEHICLES WITH BARS**

### **TOWING STATEMENT**

17-6. To the extent possible, a wrecker will be used to tow Army wheeled vehicles. Use of a wrecker or an approved tow bar will negate the need for an operator in the towed vehicle. When a wrecker or tow bar is not used an operator must be placed in the towed vehicle to assist with steering if required. Due to increased risk of injury to the operator in the towed vehicle, it is extremely important to limit the use of anything but a wrecker or tow bar to those cases where moving the vehicle for short distances is an absolute military necessity. In such cases, speed must be kept to a minimum to ensure safe operation. Unusual or unique towing operations must have an associated risk assessment with residual risk approved at the proper level of command.

### **GENERAL RULES FOR TOWING**

17-7. Before towing any vehicle, refer to the vehicle technical manual (TM)/technical order (TO) 36A-1-98. The following are general rules for towing:

- Move towed loads at slow speed. Avoid quick stops.
- Mark towing vehicles with warning lights or flags.
- Use a wrecker whenever possible. It is designed for towing.
- Use a tow bar in preference to chains, ropes or cables. Tow bars keep the towed vehicle from running into the towing vehicle.
- Connect cables, chains, or ropes, if used, to the pintle of the towing vehicle and to the lifting shackles of the towed vehicle.
- In cities or heavy traffic, tie the front lifting shackles of the towed vehicle tightly to the rear lifting shackles of the towing vehicle and connect the air brakes.
- Proceed slowly at five to ten miles per hour (MPH) because the towed vehicle will skid on turns at higher speeds.
- When using a tow bar, connect a chain between the two vehicles for safety in case the bar breaks or becomes disconnected.
- Be sure a vehicle operator is in every motor vehicle being towed to control it, unless a wrecker is towing the vehicle.

**CAUTION**

Always use rigger's gloves when handling chains, cables, and wire rope.

**ANCHORING VEHICLES**

17-8. Trees, stumps, or rocks are natural anchors. Always attach lines near the ground when using a tree or a stump as an anchor. A vehicle operator should lash the first tree or stump to a second one to provide added support for the line. When using a rock as an anchor, be sure it is large and firmly embedded in the ground.

17-9. Construct anchors when natural ones are not available. The "deadman" is one of the best types of constructed anchors and can be used for heavy loads (see Figure 17-1). It consists of a log timber, steel beam, or other similar object buried in the ground with a deadline connected to it at the center. To construct a "deadman," follow these steps:

- Select a place where the direction of pull is as nearly horizontal as possible, such as a sharp bank or crest. This provides more holding power with less digging.
- When digging, slant the bank at least 15 degrees from the vertical and undercut toward the disabled vehicle.
- Drive stakes in front of the "deadman" at each end to hold it in place.
- Tie the deadline to the center of the "deadman" so the main or standing part of the line leads from the bottom of the "deadman." Dig a narrow trench for the deadline; bear to the center of the "deadman." If the deadline has a tendency to cut into the ground, place a log or plank under the line at the outlet from the inclined trench.
- Tie the deadline to the center of the "deadman" so the main part of the line leads to the bottom. This will keep the "deadman" from rotating out of the hold.

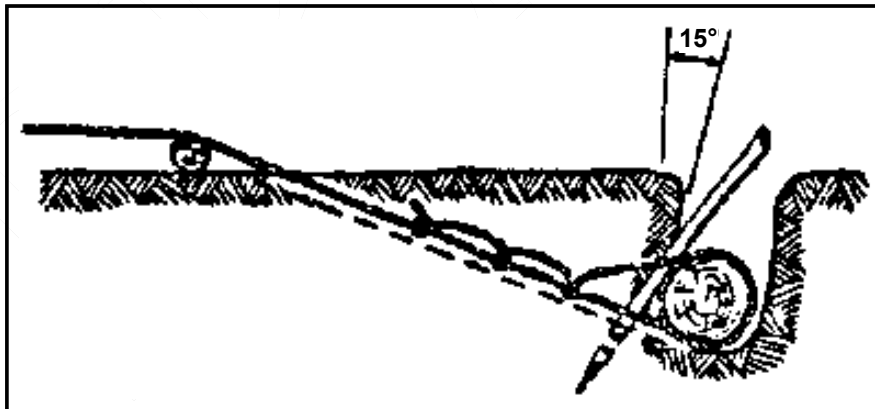


Figure 17-1. Log Deadman (Anchor)

**WINCH RECOVERY**

17-10. Many military trucks are equipped with winches. Know how to get the most from a winch without danger to personnel or abuse to the equipment.

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**FOR ARMY ONLY:** The vehicle TM completely describes the winch on the vehicle and details of its operation, care, and maintenance.

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17-11. To ensure safety, the protection of the equipment, and the success of the recovery operation, use the following as a guide:

- Check the capacity of the winch. The capacity shown on the manufacturer's plate is the maximum with one layer of cable on the drum. Each successive layer increases the diameter of the drum and reduces the winch capacity to as little as 50 percent of the rated capacity when the last layer is being wound on the drum.
- Check the cable for rust, kinks, or frays.
- Estimate the total resistance. Consider grade or slope, weight of the vehicle, and type of terrain. Then add a reasonable factor for safety.
- Check the equipment. Be sure to rig safely to overcome the resistance with the equipment available.
- Select or provide a suitable anchor.
- Rig and check rigging. Do not put power on the winch until every element in the rigging has been checked.
- Clear personnel from the danger area. All persons observing the operation should stand outside the angle formed by the cable under stress at a distance at least equal to the distance between the two most distant points in the rigging. Clear personnel away before tightening the cable.

### **SINGLE-VEHICLE WINCH OPERATION**

17-12. If a vehicle operator has been individually dispatched and drives into an area where the traction is not enough to pass, use the winch and suitable rigging to pull the vehicle back to solid footing.

#### **Vehicle With Front Winch**

17-13. Select or construct a strong anchor. Attach a snatch block to the anchor with the tow chain. Run the winch cable through the block and back to the truck (see Figure 17-2). Take up the slack gradually and pull the truck forward with its winch. Power may be applied to the wheels at the same time.

#### **Vehicle With Side-mounted Winch**

17-14. Vehicles with side-mounted winches can only self recover. They may not be used to pull other vehicles.

#### **Vehicle Without Winch (Dual Wheels)**

17-15. Dual wheels and ropes may be used to winch out vehicles not equipped with winches (see Figure 17-3). Fasten one end of each rope to a rear wheel hub and the other to an anchor. Place the rope between the duals and through one of the holes in the wheel disk. Tie the rope around the hub where it will be clear of the valve stem. Move the vehicle in reverse gear to wind the rope.



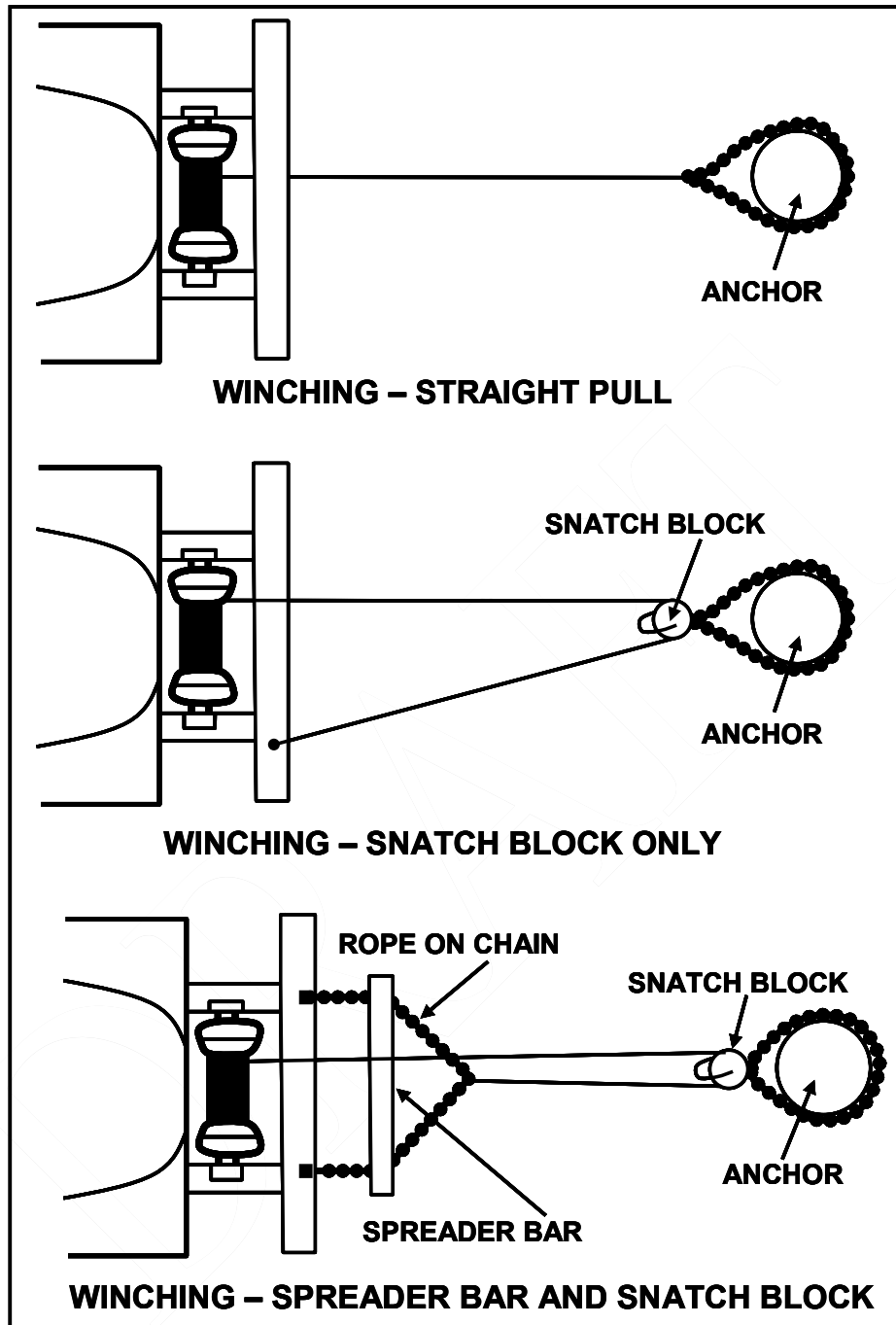


Figure 17-2. Vehicle Winching

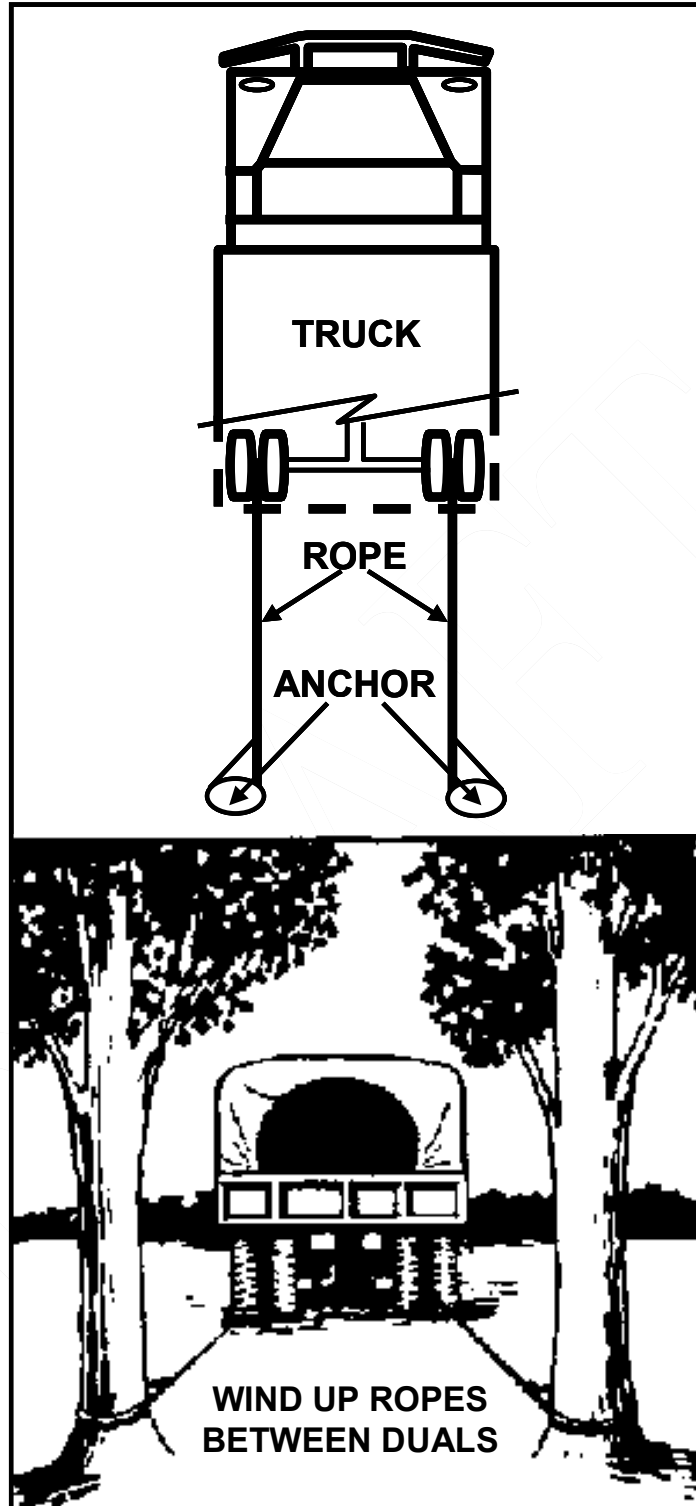


Figure 17-3. Dual Wheels and Rope Used as a Winch

## TWO-VEHICLE WINCH OPERATION

17-16. Mechanical advantage is gained by using a mechanism to transmit force. A small force, when moved through a long distance by one or more mechanisms (pulleys), will move a large weight (vehicle) for a short distance. Use one of the following procedures when rigging for greater mechanical advantage.

### Two-Part Line

17-17. This simple hookup gives a 2:1 mechanical advantage (see Figure 17-4). Attach a snatch block to the load. Next, run the winch cable through the block and secure the cable to the winch vehicle. Place a log in front of the towing vehicle to help hold its ground.

### Three-Part Line

17-18. To get a mechanical advantage of 3:1, use two snatch blocks – one at the load and one on the winch vehicle (see Figure 17-5). Thread the winch cable first through the block on the load, back through the block on the winch, and then again to the load where it is secured.

### Four-Part Line

17-19. To get a 4:1 mechanical advantage, use two snatch blocks – a double-sheave block for the load and a single-sheave block for the winch vehicle (see Figure 17-6). Thread the winch cable through one sheave of the double block attached to the load back through the single sheave on the winch vehicle, and again to the load through the second sheave of the double block. Finally secure it to the winch vehicle.

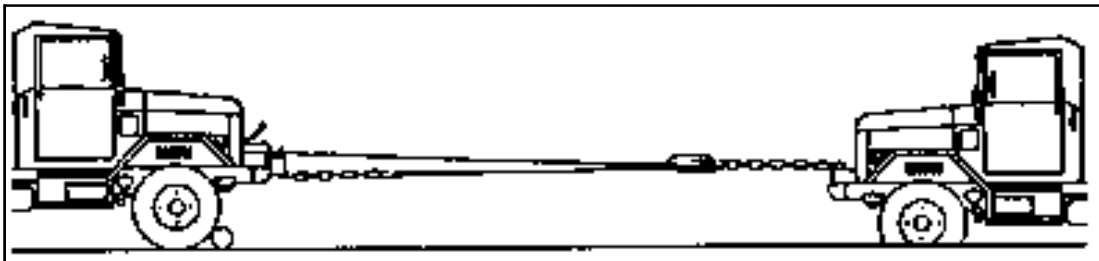


Figure 17-4. Two-Part Line

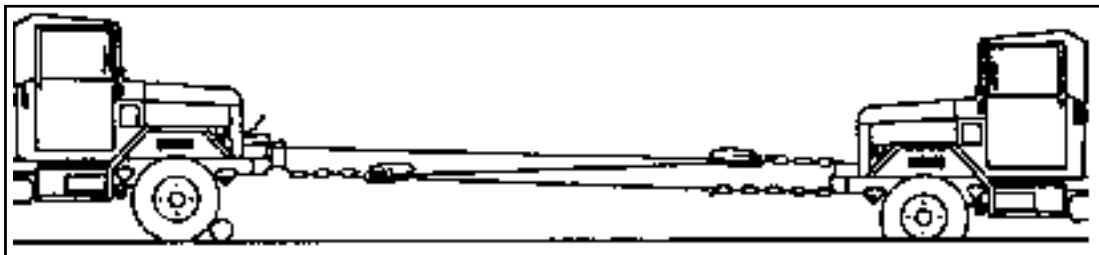


Figure 17-5. Three-Part Line

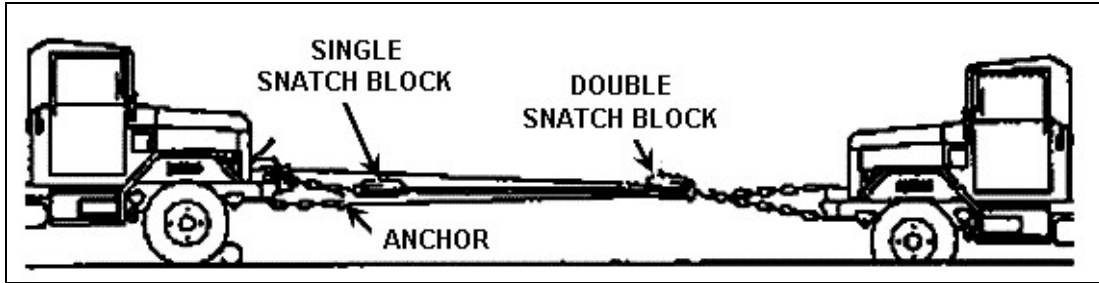


Figure 17-6. Four-Part Line

## WINCH SAFETY

### Cable

17-20. Recovery operations take time. Do not hurry. A broken winch line reacts like a whip. When hooking to a vehicle, use both shackles whenever possible so effort is applied equally and damage to the vehicle is minimized.

17-21. Never bend the wire cable at a sharp angle. Straighten out all kinks and twists as the slack is taken out. Ensure tractors or vehicles with metal tracks do not run over the cable. Such abuse flattens the cable, exposes the Manila hemp core, and allows water to enter, causing internal rust and weakening the cable.

### WARNING

**Stand clear of a winch cable before it is tightened. A cable being tightened may break and whip back with enough force to maim or kill.**

17-22. After using the winch, have one person or preferably two pull back on the cable while it is wound slowly and evenly on the drum in accordance with the appropriate vehicle operator TM -10 series. Keep the cable lubricated according to the vehicle lubrication order.

### Shear Pin

17-23. When the winch is overloaded, the shear pin breaks to protect the cable. Never use makeshift shearing of unknown strength to replace a broken pin. Too strong a pin may snap the cable and damage the winch. Use only authorized replacement pins. Do not depend on the shear pin for protection. Even with the proper pin installed, a kinked, damaged, or weakened cable may snap. Vehicles with electric winches have circuit breakers to protect the winch from overloading. Check the appropriate vehicle operator TM -10 series for correct winch.

## MANPOWER RECOVERY

17-24. Recovery operations with limited manpower and material at hand can be successful if there is enough time. If the vehicle has dropped into a hole or ditch, manpower may get it out. First, find an eight-foot length of timber or similar material with a diameter that available personnel can handle. Place a suitable fulcrum near the point of lift – a log or rock that will not move when pressure is applied. Rig the lever under the bumper for the first lift.

17-25. Block when the vehicle has gained all it can. Re-rig the vehicle for a second lift with the point of the lever under the axle if possible. Lift and block. Repeat these steps until the vehicle can be backed off without too much trouble.

17-26. If a vehicle operator is alone and must move a light vehicle a short distance without power, use a lever. A vehicle operator will need a fairly long pole or crowbar, a rope, cable, or chain, and a suitable anchorage for the point of the bar. The distance from the lever to the point of attachment of the towrope must be quite short to give enough advantage. The vehicle will not move very far with each try, but it will be able to move slowly.

## A-FRAME RECOVERY

17-27. Narrow ditches, slit trenches, and shell holes can quickly stop a truck. They are common obstacles to off-road movement and maybe hard to see. If the front wheels should drop into one, the A-frame is a very useful recovery tool (see Figure 17-7). It is not very difficult to put together, nor too complicated to use. All that is needed are two eight-foot poles with a large enough diameter to support the front end of the truck. Lash them together near the top with a figure eight or girth knot; use the tow chain or a length of rope (see Figure 17-8). Dig two 10-to 12-inch holes five or six feet apart to hold the legs in position when power is applied. Rest the upper end of the A-frame on the hood of the truck with the legs in the anchor holes. Select a suitable anchor in front of the truck. Tie a line from the A-frame joint to the anchor, bringing the frame up to a position where the frame joint is directly over or slightly to the rear of the bumper. Move the winch line through a snatch block fastened to the A-frame joint and secure it to the front bumper.

17-28. Winch up the front end of the truck until the wheels clear the ditch. Then, slowly back the vehicle off to solid ground. When safely away from the edge of the ditch, lower the wheels and unhitch the rig. If the vehicle has no winch, another vehicle may be used for power, though more rigging will be required.

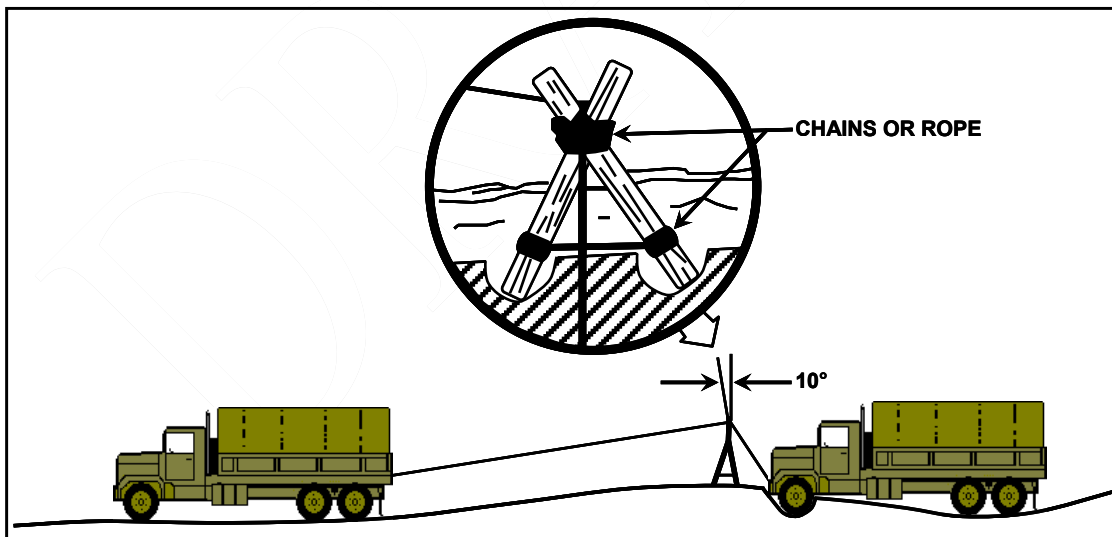


Figure 17-7. An A-Frame Supplying Lifting Force

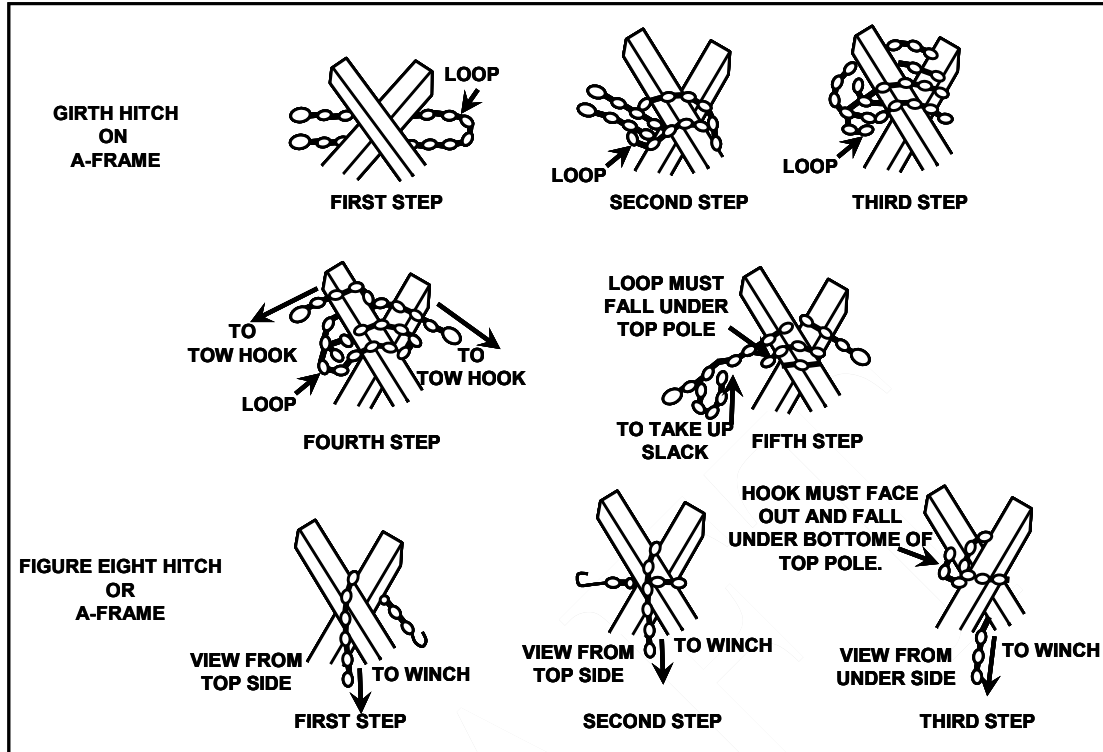


Figure 17-8. Lashing an A-Frame With a Girth Hitch and a Figure Eight Hitch

## FIELD EXPEDIENTS

17-29. Field expedients are one-time emergency operations or procedures that may be used to get out of tight spots during tactical operations. Use expedients only under unusual or emergency conditions. The equipment is usually prepared, as needed, from materials at hand, most of which are designed or intended to serve another purpose. For instance, tire chains used as tow chains are a field expedient. The list of field expedients that have been successfully used is long. It is beyond the scope of this text to describe all of them. However, the few described below give ideas of the possibilities.

## SUBSTITUTES FOR A JACK

17-30. If an outside dual is flat, a practical substitute for a jack is to run the inside dual up on a small rock or log. This lifts the outside tire off the ground so the tire can be changed.

## METHOD FOR RAISING A WHEEL

17-31. If one of the driving wheels falls in a deep hole, a vehicle operator can get the vehicle out with a log and a chain (see Figure 17-9). Chain the log to the wheel and move forward slowly to prevent spinning (see Figure 17-10). If the wheel spins, the log will damage the fender or other parts of the vehicle. After clearing the hole, force the log under the wheel to keep it from falling back into the hole.

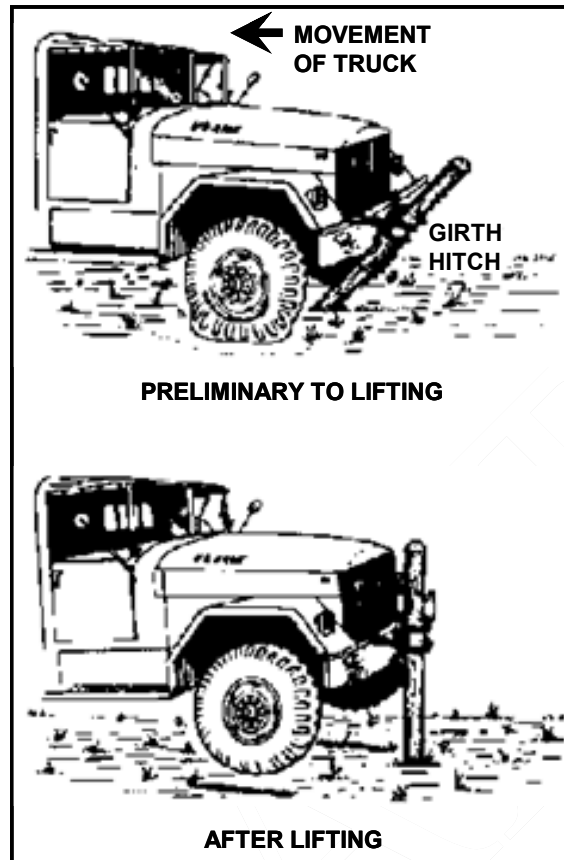


Figure 17-9. Substitute for a Jack (Bumper)

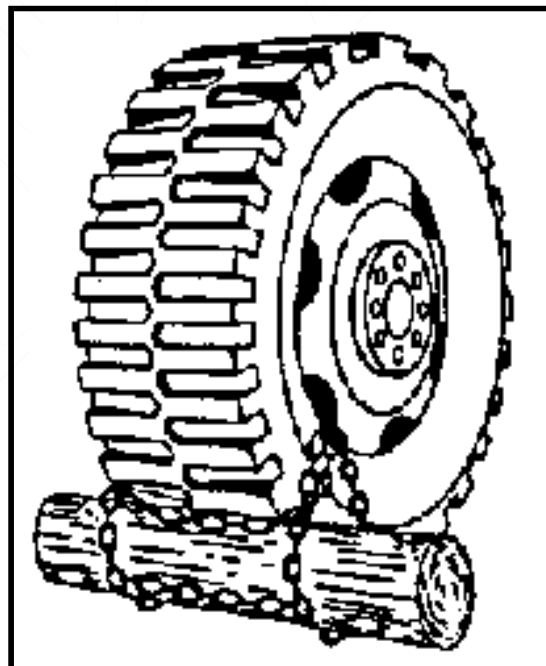


Figure 17-10. Raising a Wheel

## DEFECTIVE TANDEM AXLE

17-32. A tandem axle with a burned-out bearing or damage wheel can disable a vehicle or cause further damage if operation continues. Move the wheel of the disabled axle onto a rock, log, or similar object, to raise the wheel as high as possible. While wheel is raised, tie the axle as tightly as possible to the frame by using heavy wire or a tow chain (see Figure 17-11). Do not let the chain or wire cause damage to the brake lines. If the wheel bearing is burned out, or for some other reason the wheel does not turn, remove the axle shaft from the axle housing. Stuff the hole with rags to keep out foreign matter. This expedient method allows the other wheels to drive. Use the same technique on both ends of the axle if both wheels are defective

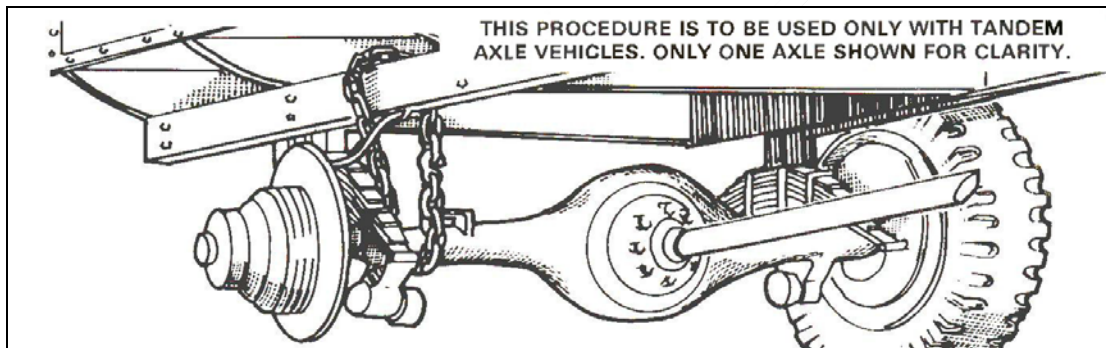


Figure 17-11. Defective Tandem Axle

## SUBSTITUTES FOR TIRE CHAIN

17-33. Rope or tow chains can be wrapped around the wheels as tire chain substitutes. Fasten them securely, but leave slack around the tires to prevent damage. Remember, these are only temporary substitutes. Remove them as soon as possible.

## VEHICLE FAILURES DURING TACTICAL OPERATIONS

### Leaking Line Fitting

17-34. Leaks at fuel line fittings can develop from the vibrations caused by cross-country operation and may result in an extremely dangerous condition if not discovered and corrected promptly. To correct this deficiency, unscrew the coupling nut, wind a piece of string clockwise behind the flare, slide the coupling nut over this temporary gasket, and tighten with a wrench (see Figure 17-12).

17-35. If the vehicle has a broken fan belt and no available replacement, use a fiber rope from the vehicle tarpaulin or a piece of field telephone wire. Loop the rope around the pulley three or four times and tie with a square knot. Find and replace faulty fan belts during the vehicle's daily maintenance service and inspection.



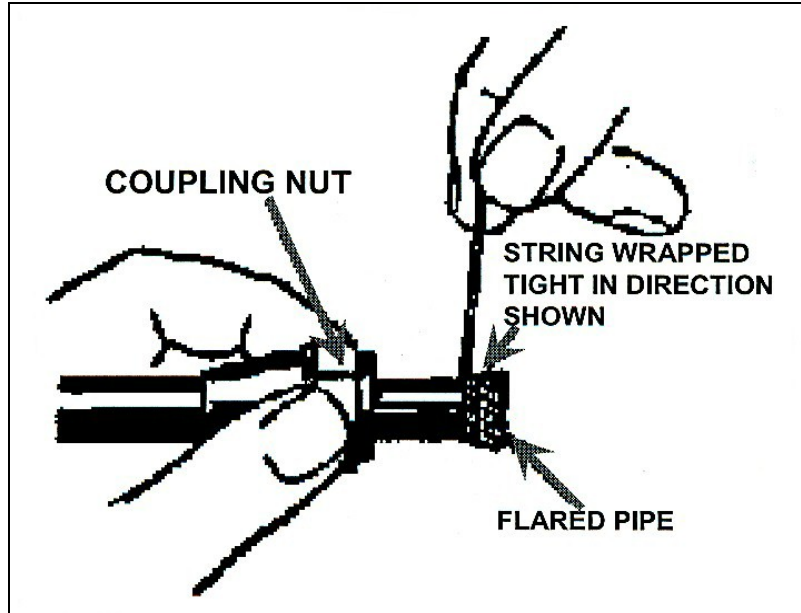


Figure 17-12. Leaking Fuel Line Repair

### Broken Fan Blades

17-36. A broken fan blade will cause the engine to vibrate and make it dangerous to operate. On fans with an equal number of blades equally spaced, remove the remainder of the broken blade, and then remove the blade opposite the broken blade. The vehicle can now be operated, but be careful that it does not overheat. On fans with unequally spaced blades, the entire fan can be operated under a light load for short periods of time.

### Damaged Front Axle Brake System

17-37. When damage has occurred to the front axle brake system, close the line at the junction block to the axle. This assists the operator in maintaining steering control while braking and allows pressure buildup in the rear brakes.

### Punctured Tube-type Radiator Core

17-38. Radiators are often punctured when vehicles are operating in wooded or combat areas. When this happens, cut the cooling fins and push them away from the leaking tubes. Cut the leaking tube in half and fold the ends of the tube back about three-fourths of an inch (see Figure 17-13). Close the tube ends by pressing them flat with pliers. Cooling system efficiency is reduced when several tubes are cut, causing the engine to overheat. When field expedient repairs on the radiators are made, loosen the radiator cap. This keeps the radiator pressure from building up and breaking the repair.

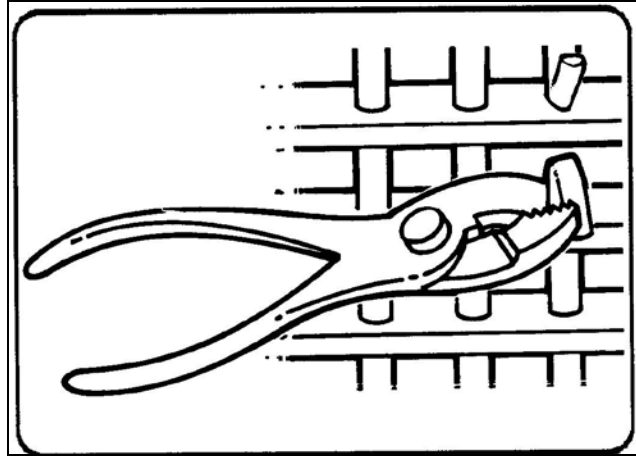


Figure 17-13. Radiator Repair

## Chapter 18

# Vehicle Operations Using Night Vision Devices and Operations Under Blackout Conditions

18-1. Night operations in combat, combat support, and combat service support units have played an important role in many US Army battles. In fact, the ability to conduct effective tactical transportation operations during hours of darkness and limited visibility is a long-standing Army objective. Today's technology provides the wheeled vehicle operator with the ability to meet these objectives using the driver's vision enhancer (DVE) and night vision goggles (NVGs). A vehicle operator's ability to safely and effectively drive using night vision devices (NVDs) depends on their understanding the device's limitations and capabilities, the amount of ambient (available) light, driving ability, proficiency with NVDs, familiarity with the terrain, and availability of NVDs.

## NIGHT VISION GOGGLES (NVGS)

18-2. Night vision goggles are image-intensification devices that improve visibility during periods of low light levels. They amplify available ambient light (such as moonlight and starlight). However, NVGs do not magnify an image. An object viewed through the NVGs looks the same size as if it were seen in the day without the NVGs. Objects that are hard to see during the day are also hard to see at night through the NVGs. NVG performance is directly related to the amount of ambient light. During periods of high ambient light, resolution is improved and objects can be identified at greater distances. However, visual acuity (the accuracy with which an object is seen) with NVGs will never be as good as it is with the naked eye during daylight conditions.

18-3. Rain, haze, fog, snow, or smoke and viewing into shadows and other darkened areas greatly reduce the effectiveness of NVGs. Vision using NVGs equals the vision of an unaided vehicle operator with less than perfect vision. The best case for a vehicle operator with 20/20 vision wearing the NVGs is 20/40 with the AN/PVS-7 and 20/50 with the AN/PVS-5.

18-4. The NVGs affect depth perception and distance estimation. For the first 20 feet in front of the user, the NVG decreases depth perception. From 20 to 500 feet, depth discrimination roughly equals that of the unaided eye. NVGs reduce depth perception beyond 500 feet and distance viewing. This is due mainly to reduced visual acuity and lack of peripheral vision. Peripheral vision lets a person see things on the side of the field of vision while concentrating on looking straight ahead at an object. Color discrimination is absent when NVGs are used.

## SINGLE COLOR VISION

18-5. The picture seen with NVGs is green. It is also less distinct than normal daylight vision. As a result, it is hard to distinguish between certain objects or features. For example, shadows are hard to distinguish from puddles of water, walls, or ditches and vice versa when viewed through the NVGs at night.

## COLOR ADAPTATION

18-6. A person, because of the green color in NVGs, may see one of two things when removing the NVGs after several minutes. If looking at the lighter of two backgrounds, one may see the complement or opposite of the green color to which they had become adapted. If looking at the darker of the two backgrounds, one might see an after-image of the green light to which they had become adapted. Do not be concerned with this after-image, it is a normal physical reaction.

## SECOND VERSUS THIRD GENERATION NVGS

18-7. NVGs have been produced over a period of 25 years. There are two distinct generations (models) of devices with militarily significant performance differences. AN/PVS-5 devices are second generation.

18-8. AN/PVS-7 devices have been produced in both second and third generation versions. External examination will not determine if a PVS-7 is second or third generation. Commanders should ask supporting maintenance units to identify second and third generation PVS-7 devices during routine maintenance checks. PVS-7 devices can be upgraded from second to third generation by changing the tubes. However, the cost of changing the tube is high and is not necessary unless the tube is not functioning properly.

18-9. Third generation devices have increased performance and longer tube life. Normally, a second generation device operating under quarter moon conditions and a third generation device operating under starlight conditions provide the operator with equal quality images. Under bright light (full moon) conditions, the performance of the two devices will seem exactly alike.

18-10. Second generation devices have a tube life projected at 2,500 hours. They tend to fail slowly, so maintenance personnel must periodically check the devices to ensure they are performing at a satisfactory level. An operator may not notice the gradual loss of performance normal for these second generation devices.

18-11. Third generation devices have a tube life designed to last 7,500 hours. When they eventually fail, they tend to fail quickly. Check them periodically in accordance with the applicable TM and local policies.

18-12. Second generation devices are sensitive to all visible light as well as light in the near infrared (IR) spectrum. All flashlights, even those with blue-green filters, will be seen by second generation devices and may make it harder to see other objects in the field of view.

18-13. Third generation devices are sensitive to yellow and red visible light as well as light in the near IR. They have reduced sensitivity to blue or green light. Flashlights with blue-green filters minimally affect the performance of third generation devices.

## OPERATIONAL CHARACTERISTICS AND CARE CONSIDERATIONS

18-14. Take special care in dusty, sandy, and humid conditions. Never store NVGs wet or in a wet carrying case. Moisture may form on the eyepieces when they are first placed on the head. This is caused by heat and moisture given off by the body. It is more noticeable in cold temperatures when there is a significant temperature difference between the NVGs and the body. De-misting shields are provided to prevent collection of moisture on the lenses. Do not use anti-misting chemicals or chemically treated cloths on the de-misting shield or lenses.

18-15. Install the lens covers when not wearing the NVGs. Do not hang the NVGs from the neck by the safety strap without covering the objective lenses (the objective lenses may be scratched).

18-16. When installing or removing a battery, be sure the selector switch is in the OFF position. If the switch is on, intermittent electrical contact is made when unscrewing or screwing the battery cap. This causes a flicker or power surge to the tubes, which may cause burn spots on the tubes. Always remove the battery before storing the NVGs to avoid turning the switch on accidentally when placing the NVGs in the case. If the NVGs are stored for a long period of time with the battery installed, corrosion can develop.

**CAUTION**

For lithium batteries, this increases the possibility of battery venting, which can cause serious injury to personnel and damage to equipment.

18-17. Avoid rough treatment of the NVGs. Mistreatment may cause the tubes or the electrical system to fail. If the NVGs do not operate when the switch is turned on and the battery is fully charged, check the wiring for breaks or the battery terminals for the presence of oxidation.

18-18. Never operate the NVGs during daylight hours. Doing so commonly causes tube failure. A vehicle operator may use the IR light on the NVGs to illuminate the instrument panel or to read maps when they do not want to turn on the interior light. However, continuous use of the IR light shortens the battery life.

**CAUTION**

Use of the IR light makes the NVG an active system. As such, it can be detected by the enemy and will severely limit vision outside the vehicle.

18-19. Resolution checks are required on NVGs every 180 days using either the TS-3895U/V test set or the alternate test method (direct support level). Perform this test as instructed in the applicable system's TM:

- AN/PVS-5 (A, B, C models), TM 11-5855-238-10.
- AN/PVS-7A, TM 11-5855-262-10-1.
- AN/PVS-7B, TM 11-5855-262-10-2.

**PROPER FOCUSING PROCEDURES**

18-20. An improper focusing adjustment significantly reduces visual acuity and increases eye fatigue. Always ensure NVG's are properly focused.

**Eye Relief**

18-21. Eye relief is the distance between the NVG eyepiece lens and the eye. It is recommended that the eye relief for the NVG be one inch. This distance may not be achievable because of helmet/helmet liner configurations and facial features (such as deep-set eyes or protruding forehead). If eye relief is too little, an unnecessary strain is placed upon the eyes, which accelerates fatigue. However, if the eye relief is too large, a significant loss of field of view can occur.

**Interpupillary Distance (IPD)**

18-22. IPD is the distance between the NVG eyepiece lens and the pupils of the eyes. It is also called eye span. The center of the intensifier tubes should align with the pupil of the eyes. The distance from the center of the tubes should equal the user's IPD. If the tubes are not aligned, the eyes tend to drift towards the center of the tubes. This leads to focusing problems and eye fatigue. It has also been attributed as the cause of short-term reduction of near depth perception.

18-23. IPD is adjusted with the interpupillary lever clamp on the AN/PVS-5 series. On the AN/PVS-7 series, it is adjusted by moving the eyepieces apart or closer together. The common method of aligning the tubes is the subjective overlapping of the images until a single, clear, circular field of view is reached. However, this procedure makes most people bring the tubes too close

together. A more objective and accurate method involves using a millimeter ruler to measure from the outside edge of one objective lens (or eyepiece lens) to the inside edge of the other. This will require all NVG users to be measured for their distant IPD at their clinic. Record and memorize this value given in millimeters.

**Eyepiece Lens Adjustment**

18-24. The eyepiece focus rings (also referred to as the diopter adjustment rings) focus the image at the eyepiece lens. They allow those who wear corrective lenses to accommodate for certain problems (such as farsightedness). However, they will not correct a stigmatism. It is recommended that corrective lenses be worn with the NVG. Eyeglasses can only be worn with the AN/PVS-7 series. AN/PVS-5 users may wear contact lenses.

**Objective Lens Adjustment**

18-25. The objective focus knob is adjusted as a function of distance (called focal range) from the object. The focal range of the NVGs is between ten inches and infinity. The vast majority of driving with NVGs requires the optical infinity setting. A vehicle operator must focus the NVGs outdoors at night or indoors with a small light source (such as a 7 ½-watt light bulb). Focusing on a small light source or lettering on a nearby sign is not sufficient for proper adjustment. A visual acuity chart can be hung on a tree at slightly lower than eyesight because it is closer to the optical infinity distance.

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Note: Twenty feet is the desired distance between the user and the chart.

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18-26. Focus one knob at a time. DO NOT close the other eye. Instead, block the eye with the hand or with a 3 x 5 card. First, rotate the objective focus ring to get the clearest focus on the eye chart. Next, position the eyepiece focus ring at its full counterclockwise setting. For reading use, first turn to full clockwise setting. Rotate the eye focus ring clockwise (counterclockwise for reading). Stop when the image is clear. Do not continue clockwise because the image will remain clear at the expense of eye fatigue. If it feels that the turn has gone too far clockwise, start the ring back counterclockwise until the image blurs; then start again clockwise until the clearest image is reached.

18-27. The appropriate line on the visual acuity chart should now be readable at the distances given below.

	<u>10 Feet</u>	<u>20 Feet</u>
<b>AN/PVS-5 Series</b>	<b>20/25</b>	<b>20/50</b>
<b>AN/PVS-7 Series</b>	<b>20/20</b>	<b>20/40</b>

Failure of the visual performance checks is determined when the following lines on the eye chart are not readable at the distances given below.

	<u>10 Feet</u>	<u>20 Feet</u>
<b>AN/PVS-5 Series</b>	<b>20/30</b>	<b>20/70</b>
<b>AN/PVS-7 Series</b>	<b>20/25</b>	<b>20/50</b>

## DEFECTIVE TUBES

18-28. Tube operation must be checked before each mission. If any of the following tube conditions exist (see Figure 18-1), take the appropriate action before using the NVGs.

- **Shading.** Both tubes should show a perfect circle. If shading is present, a fully circular image will not be seen. Shading always begins on the edge and moves inward. Replace the tubes if this condition exists.
- **Edge Glow.** This is a bright area in the outer portion of the viewing area. To check for this defect, cup hand over the lens to block out all light. Replace the tubes if this condition exists.
- **Bright Spots (White Dots).** A pinhole in the phosphorous screen causes this condition. Spots may flicker or appear constant. Check by cupping the hand over the lens to block out all light. If bright spots or white dots are visible, turn in the NVG to direct support (DS) maintenance where it can be properly checked with a TS-3895U/V test set.
- **Dark Spots.** Black marks that may look like spots or streaks are acceptable as long as they do not interfere with the mission. No action is required when such dark spots occur.
- **Fixed Pattern Noise (Honeycomb).** A faint honeycomb pattern occurs most often in high light levels. This condition is acceptable as long as the pattern does not interfere with the mission.
- **Flashing, Flickering, or Intermittent Operation.** The NVG may appear to flicker on and off or the output may flash. This can occur in one or both tubes. If more than one flicker is seen, consult the troubleshooting chart in the operator's manual.

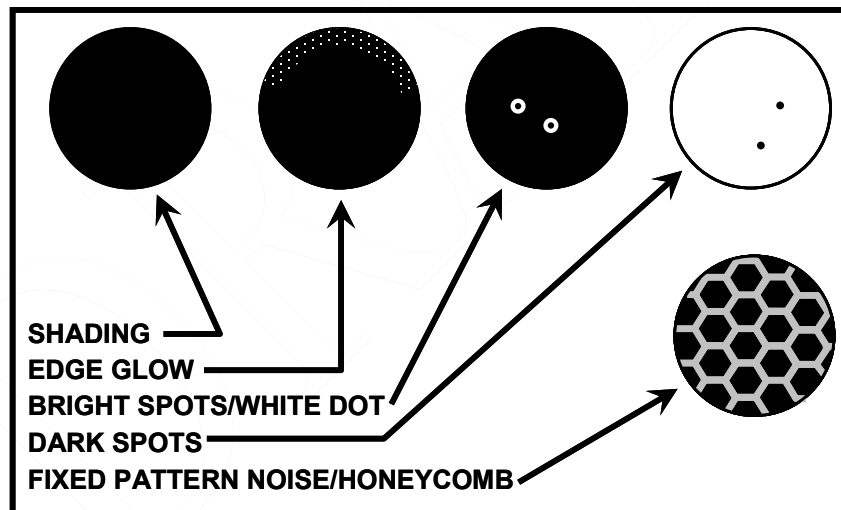


Figure 18-1. Tube Defects

## DRIVING WITH NIGHT VISION GOGGLES

18-29. Driving during the day takes a lot of concentration. Driving at night with Night Vision Goggles compounds the amount of concentration needed to safely operate a vehicle.

## EFFECTS OF LIGHT

18-30. Any detectable light source in the vehicle's cab may affect the vehicle operator's ability to see with NVGs. The adverse effect of panel lights on the NVGs is greatest during low ambient light conditions.

## Vehicle Light System

18-31. NVG compatibility is best achieved by eliminating all interior and exterior light sources. Tape up lights that cannot be controlled to reduce the amount of light they emit. Instruments and gauges can normally be read with NVGs without instrument lighting.

### **WARNING**

**Vehicle operators without NVGs may not see another vehicle operator. Ensure the route selected is in an area where other traffic (commercial and tactical) is precluded. If the route does not preclude this, establish some form of traffic control.**

## Dark Adaptation

18-32. No dark adaptation period is necessary for effective viewing through NVGs. In fact, viewing through NVGs for a short period of time lessens the normal dark adaptation period. After using NVGs, it takes about two minutes to reach the 30-minute dark adaptation level.

## Lasers

18-33. Lasers are used on the battlefield (in training and in combat). Lasers affect NVGs as much as other light sources do. Most lasers will not cause permanent damage to NVGs. In fact, the NVGs protect the vehicle operator's eyes from the damaging effects of lasers, even if the laser is bright enough to damage the NVGs. If the NVGs are damaged, it is possible to continue using the NVGs with a bright or dark spot at the point where the tube was damaged. To reduce the effects of the laser on the NVGs and eyesight, look away.

## Object Identification

18-34. Viewing an area lit by artificial lights (such as flares) will limit the ability to see objects outside the lighted area. The ability to see objects within the lighted area depends on the brightness of the light and the object's distance. Try to keep the light source outside the field of view of the NVGs.

18-35. Using NVGs enable personnel to detect light sources that are not visible to the unaided eye. Light from vehicles, flashlights, IR light sticks, and burning cigarettes is easily detected at great distances. The capability of NVGs to detect these light sources improves as the ambient light level decreases.

18-36. When using NVGs, some objects will be more difficult to distinguish (low contrast against the background) than during the day when color clues are available. Pay close attention to unfamiliar objects.

## WEATHER CONSIDERATIONS

18-37. Rain, haze, fog, snow, or smoke greatly reduces NVG effectiveness. As visibility decreases, there will be a gradual reduction in light and visual sharpness. When visibility is reduced, try to determine the severity of the condition. If driving can be conducted safely with the NVGs, continue the mission. If not, adjust the driving speed, remove the NVGs, and turn on the headlights or switch to blackout (BO) drive lights. Use NVGs only when the situation permits and it is safe to do so. Table 18-1 lists countermeasures to use when faced with specific vehicle lighting conditions that degrade NVG performance (such as using NVGs in conjunction with BO drive lights).



18-38. Visual clues to the presence of visibility restrictions include the following:

- A halo around artificial lights when using NVGs. The halo effect tends to increase when atmospheric obscurations are present. Note the size of this halo effect around lights in the staging area. If the halo becomes noticeably larger, a restriction could be developing.
- An increase in “image noise” when atmospheric interference is present or when ambient light level is low. This is similar in appearance to the “snow” seen on television with poor reception.

**Table 18-1. NVG Lighting Countermeasures**

<b>SPECIFIC CONDITIONS</b>	<b>IMPACT ON NVGs</b>	<b>COUNTERMEASURES</b>
Driving with external and internal lights off. (Vehicles without NVGs may not see you.)	None.	N/A
Blue-green instrument panel lights on. (Vulnerable to threat detection with NVGs.)	Minimal on third generation tubes; will degrade performance of second generation tubes.	Turn to lowest light level or turn off. Tape over nonofficial lights. (May allow warning lights to go unnoticed.)
Instrument panel lights on. (Vulnerable to threat detection with NVGs.)	Will degrade all NVG performance.	Turn to lowest level or turn off. Tape over nonofficial lights. (May allow warning lights to go unnoticed.)
Headlights on. (Vulnerable to threat detection.)	Non recommended. Will shorten life of NVGs and blind oncoming vehicle operators with NVGs.	Use BO lights.
Chemlights on front of lead vehicle and rear of trail vehicle. (Vulnerable to threat detection.)	Will degrade lead vehicle’s distance vision to some degree under low light conditions.	Tape over part of chemlight. Use BO lights.
BO marker lights on. (Vulnerable to threat detection with NVGs.)	As low light levels (heavy overhead canopy or starlight), will degrade NVG performance.	Tape over all but one or four markers on rear of vehicle. Tape over brake marker.
BO markers with BO drive. (Threat detection easy with NVGs.)	Will enhance near vision, but degrade distance vision. May blind oncoming vehicle operators with NVGs.	Turn off BO drive or ensure BO hood is adjusted so light only shines down.
Normal parking/brake lights. (Vulnerable to threat detection.)	Will seriously degrade all NVG performance and may blind oncoming vehicle operators with NVGs.	Use BO lights.

**GROUND SPEED LIMITATIONS**

18-39. Most vehicle operators tend to overdrive their capability to see. To avoid obstacles, a vehicle operator must understand the relationship between the NVG visual range capability and speed.

18-40. Different light levels affect the distance at which an object can be identified. This, in turn, limits the ground speed at which the vehicle operator can safely drive. The range limitation graph (see Figure 18-2) shows how to determine the maximum range that an object can be identified. It also gives the commander a good rough estimate of the NVGs working range. The graph addresses a hazard three meters in length and 15 centimeters in diameter (the size of a small pole or a bare tree limb) with 30 percent contrast.

18-41. To find the minimum range at which an object can be detected in a given ambient light condition, follow the chart along the top at a point representing the ambient light condition. Move down until the range curve is intercepted. Read the minimum range (meters) an object can be identified at the left.

18-42. After computing the range at which an object can be detected, use the ground speed limitation graph (see Figure 18-3) to determine a safe speed for driving with NVGs. This graph gives the commander a good rough estimate of ground speed limitations for non-convoy movements. Follow the graph along the left side at the predetermined detection range. Move right until the ten-second vehicle operator response line is intercepted. This line measures the time it takes for the vehicle operator to react to an object at a given distance and a given speed. From the intersection, move down and read the safe ground speed for driving with the AN/PVS-5 or AN/PVS-7.

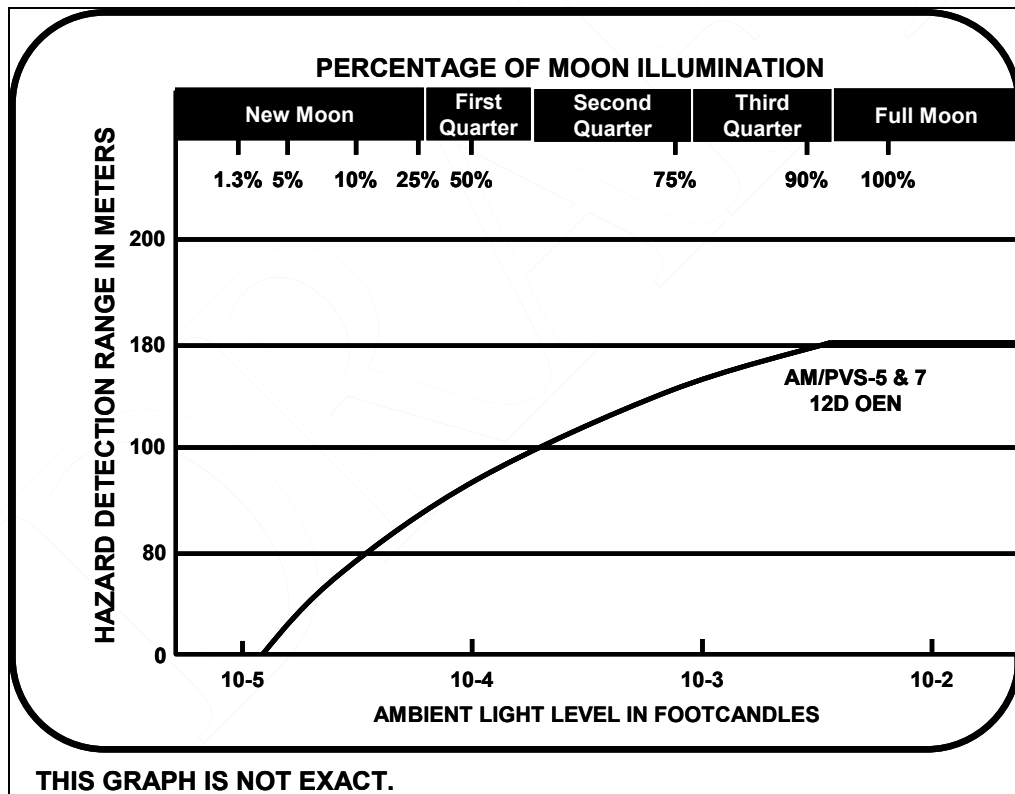


Figure 18-2. Minimum Hazard Recognition Range

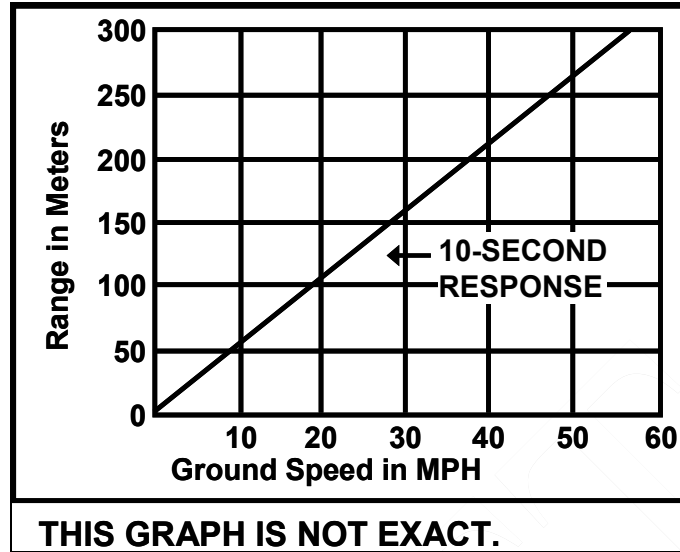


Figure 18-3. Ground Speed Limitations

18-43. AR 600-55, Chapter 8, requires commanders to establish speed limitations for all modes of driving while wearing the NVGs. In deciding what those limitations are, they must consider the following factors as a minimum:

- The type of NVG being used for driving, the age of the tubes, and the generation of tubes (second or third) of the NVGs. For example, an AN/PVS-7 equipped with third generation tubes will outperform an AN/PVS-5 with second generation tubes in terms of improved resolution.
- The type of vehicle used for training.
- Weather conditions.
- Mode of driving (such as convoy, off-road, and cross-country).
- Terrain.
- Amount of light.
- Type of mission.

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Note: As a general rule, driving with NVGs should never exceed 25 MPH under any circumstance. Speed under convoy conditions should not exceed the limitations established for normal convoy movement without NVGs.

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## VEHICLE PREPARATION

18-44. The design of some Army vehicles will affect the ability to see outside the windshield. To reduce the loss of night vision because of vehicle shortcomings, properly prepare the vehicle for night driving with NVGs.

18-45. Dirty windshields can reduce the ability to see outside the vehicle. Keep them clean. Remove dirt, grease, bugs, and scratches before each mission.

18-46. Vehicle instruments are easier to read under high levels of instrument lighting. However, the level of light needed for the best reading interferes with the NVGs ability to see dim objects outside the vehicle. Interior lights also interfere with NVG performance. They reflect off the windshield, reduce outside visibility, and are subject to enemy detection. To minimize these effects, turn off all interior lights and turn off or tape all exterior lights.

## VEHICLE OPERATOR PREPARATION

18-47. Proper preparation of the vehicle and ground facilities for driving with NVDs will contribute greatly to the success of a night mission. However, the mission may fail unless the Soldier is physically and mentally prepared. Do the following to ensure readiness:

- Keep physically fit.
- Eat a well-balanced diet.
- Get enough rest.
- Avoid the use of tobacco and alcohol.
- Avoid all bright lights (including sunlight) during the day. Wear sunglasses when outside.
- Participate in frequent night driving.

## DRIVING WITH NIGHT VISION GOGGLES AND EMERGENCY PROCEDURES

18-48. The ability to drive with NVGs is developed through training. The more a vehicle operator drives with NVGs, the more they learn about them. As a result, they gain confidence in their ability and in the capability of the device. On the other hand, overconfidence is a main fault associated with NVG use. After wearing the device for only a short time, one may feel they have complete visual acuity and depth perception when in fact they do not.

18-49. Driving techniques and visual clues used during unaided night driving (without NVGs) also apply to aid night driving (with NVGs). The advantage of NVG use is improved ground reference and object identification. However, the field of view is greatly reduced. Use a continual scanning pattern to make up for this. To view an area while using NVGs, turn head slowly until the NVGs point in the desired direction. Rapid head movement can induce vertigo, which may lead to dizziness and nausea.

### WARNING

**NEVER use NVGs on public highways. The effect of oncoming headlights on the device may cause some very dangerous situations (such as the vehicle operator not being able to see other objects in the field of view). If the light is sufficiently bright, the devices all have a bright source protection feature that shuts down the NVG to protect it. If the bright source protection is activated, the NVG will be off for at least two seconds.**

18-50. To minimize the effect of headlights from an oncoming vehicle on NVGs, slow down. Look away so that the light source is just outside the NVGs field of view. Pull off to the far right-hand side of the road, and stop the vehicle. DO NOT continue driving with NVGs unless authorized by a responsible officer or individual (such as the range control officer).

18-51. If the vehicle malfunctions while driving with NVGs, or if the NVGs fail or begin to fail, slow down. Pull off to the far right-hand side of the road, and stop the vehicle. Immediately warn approaching NVG-equipped vehicle operators with hand and arm signals and NVG-compatible light sources (such as an IR light stick or tactical flashlight) (see Table 18-2). DO NOT turn on the four-way emergency flasher lights; they may blind approaching vehicle operators with NVGs. If the vehicle breaks down on a road hidden from approaching vehicle operators by a curve or hill, walk back along the shoulder of the road to a position where they can be signaled to slow down. DO NOT try to repair the vehicle while it is in an exposed position on the road.

18-52. If the NVGs low battery indicator turns on, replace the batteries. DO NOT wait until the NVGs shut down due to a weak or dead battery while driving. Slow down, pull off to the far right-hand side of the road, and stop the vehicle. DO NOT switch NVGs or refocusing may be required.

18-53. Operating a vehicle while wearing the NVGs (AN/PVS-7 series only) over the chemical, biological, radiological, and nuclear (CBRN) protective mask further reduces the field of view to about 20 degrees and is not recommended. Driving with one lens focused inside and one focused outside the vehicle can cause spatial disorientation (dizziness, nausea) and is not recommended.

18-54. The assistant vehicle operator plays an important role in driving with NVGs. The vehicle operator must focus the NVGs for distance vision even though this makes instrument reading difficult. An assistant vehicle operator wearing NVGs can compensate for this by alternating between distance and close-up viewing and telling the vehicle operator the status of warning lights, speedometer, fuel gauge, and other instrument readings. Depending on the vehicle configuration, the assistant vehicle operator may need to sit directly behind the vehicle operator to gain a better view of the instrument panel. The assistant vehicle operator must also use a slow scanning pattern and tell the vehicle operator of any obstacles inside or outside his/her field of view.

18-55. When parking vehicles in areas where NVG tactical lighting is used, trained ground guides equipped with NVGs should direct vehicle operators to parking spots. Neither vehicle operators nor guides should remove their NVGs until the vehicle is in the desired parking spot. Modify flashlights used by ground guides for NVG compatibility. Alternative light sources for use during tactical operations are available in the Army supply system. Table 18-2 lists NVG-compatible items and their stock numbers.

**Table 18-2. NVG-Compatible Light Sources**

ITEM	NSN
30-min high-intensity light stick (yellow), 6"	6260-01-074-4230
12-hour low-intensity light stick (green), 6"	6260-01-074-4229
3-hour IR light stick, 1 ½"	6260-01-247-0364
3-hour IR light stick, 6"	6260-01-195-9752
3-hour IR light stick, 15"	6260-01-247-0366
3-hour IR flexible band, 7 ½"	6260-01-247-0365
IR transmitter (battery-operated)	6240-01-275-8080
IR paper	6230-01-074-4230
Filter, flashlight (green)	6230-00-504-8341
Filter, flashlight (blue)	6230-01-189-1480

## CONVOY DRIVING

18-56. Convoy driving with the NVG presents some unique problems, some influenced by the type of terrain and the road surface. The major concern is keeping a safe distance between the vehicles in the convoy. The use of IR light sticks affixed to the rear center of each vehicle aids to keeping safe distances between vehicles.

18-57. Convoy movement over winding or hilly terrain can cause the loss of visual contact with the lead vehicle. Therefore, a high degree of speed discipline is required to maintain safe distances. Dirt or extremely dusty surfaces also cause problems keeping visual contact with the lead vehicle. When driving on these surfaces, the convoy's speed must be reduced. Convoys composed of

different types of vehicles should proceed at the speed of the slowest vehicle. As a general rule, the speed limit should not exceed that established for BO driving without the use of NVGs.

18-58. For safety reasons, permit convoy driving with NVGs only if every vehicle operator and assistant vehicle operator are NVG equipped. If insufficient quantities of NVGs prohibit this, a mix of NVG and BO driving may be used. Group the NVG-equipped vehicles together at the rear of the convoy. Do not disperse and intermix them with other vehicles not equipped with NVGs. If grouped in this manner, be sure the last non-NVG-equipped vehicle has its rear BO drive lights off.

## **MOTORCYCLE AND ALL-TERRAIN VEHICLE (ATV) OPERATION**

18-59. Motorcycles and ATVs may be operated with NVGs. Since a motorcycle or ATV operator does not have an assistant vehicle operator, the limitations of NVGs may require slowing down proportionately more than a wheeled vehicle operator when using the NVGs. A motorcycle or ATV operator usually requires much more training with NVGs than a wheeled vehicle operator to achieve equal levels of proficiency and safety. The additional weight that the NVGs place on the vehicle operator's head and the position of this weight may require the motorcycle or ATV operator to redevelop their sense of balance during training.

18-60. In conditions where normal lights are not permitted, the motorcycle or ATV should be operated with headlights off, or at most, with BO marker lights on. Turn instrument lights off. Users of AN/PVS-5 NVGs should focus both tubes for distance vision, even though this makes instrument reading difficult.

18-61. The limited field of view of NVGs will have a greater impact on motorcycle and ATV users than on other vehicles. Vehicle operators must practice and train to turn their heads from side to side to make up for the loss of peripheral vision.

## **NIGHT VISION GOGGLE TRAINING MISSION PLANNING AND BRIEFINGS**

18-62. Night driving operations are more easily conducted when ambient light sources provide the greatest amount of hemispherical illumination. Try to schedule qualification training on a night when the moon offers not less than 25 percent illumination (quarter moon) and is positioned at least 30 degrees above the horizon.

18-63. Every NVG training mission should be planned and briefed with all possible situations considered (to include deteriorating weather, disorientation, loss of depth perception, and equipment failure). All primary and assistant vehicle operators must know their responsibilities under each situation. Communication between vehicle operator and vehicle commander is critical. The vehicle operator must be able to advise the vehicle commander of any reduction in vision.

18-64. At a minimum these subjects should be discussed during a training mission briefing when NVGs are to be used:

- Weather (including winds, sunset, moonrise, moonset, percent moon available, ambient light level, and effect of cloud coverage on ambient light levels). Weather forecasts should cover from one hour before training begins through one hour after training ends. If actual weather conditions deteriorate, modify night training as necessary.
- Light-level planning calendar. The commander, helped by supporting weather personnel, can develop a light-level calendar to predict when optimum levels of ambient light will exist. Furthermore, a computer program termed NIGHTVIS provides NVG users with accurate forecasts of favorable/unfavorable times of use. This user-friendly software program is available by writing to: Commander, US Army Atmospheric Sciences Laboratory, ATTN: ALCAS-AE-A, White Sands Missile Range, NM 88002-5501.
- Visibility restrictions (such as smoke, haze, or fog).

- Hazard map review for obstructions located in the training area.
- Mission to be performed.
- Vehicle and site preparation/lighting.
- Vehicle operator and assistant vehicle operator duties and responsibilities.
- Parking and recovery plans.
- Emergency procedures (such as what to do if a tube fails while driving).
- Medical evacuation/fire support.
- Personal equipment.
- Safety.

18-65. Draw all charts, drawings, and diagrams to scale as accurately as possible. Conduct a reconnaissance of the selected route during the day and night. The area should have a variety of road and terrain conditions available (for example, heavy/little overhead canopy, hilly roads, off-road terrain, unimproved roads, and good and poor contrast). It should also be an area where other traffic is precluded.

18-66. Conduct the formal briefing far enough in advance of the scheduled departure to allow time to resolve any problems or questions raised during the briefing. Schedule a final briefing just before departure time to do the following:

- Update weather conditions.
- Confirm time schedule.
- Discuss any mission changes.
- Ensure NVGs are properly focused.
- Ensure there are sufficient quantities of spare batteries available.
- Review safety precautions and emergency procedures.
- Give the commander time to reemphasize important aspects of the mission.

Commanders/team leaders should hold individual briefings after the formal briefing. Each vehicle operator should be required to discuss the entire mission.

## **SUPPORT REQUIREMENTS**

18-67. Support requirements for conducting safe NVG vehicle operator training include the following:

- Before driving a route at night, check it during the day for obstructions. Post a hazard map in the briefing room. Update it when a new obstruction is detected.
- Set up the tactical site/staging area lighting system for night training. Tactical lights, for aided and unaided vision, are required when operating at a tactical site.
- A command and control vehicle equipped with NVGs must be on the route during qualification and refresher training. Establish communication between the command and control vehicle and the tactical operations center (TOC). Medical evacuation (MEDEVAC) and fire support personnel must be on site or on standby.
- Get an eye chart from the organization's servicing medical company. Make it available for vehicle operators to properly focus the NVG before the start of actual driving.
- If the route selected does not preclude other traffic (such as commercial traffic) military police support may be needed for traffic control purposes.

## **TRAINING PROGRAMS**

18-68. Before training begins, all support personnel not involved with NVG training should be briefed on what will be going on and what they should and should not do (for example, random use of flashlights or other lights and walking around and between vehicles).

## COMMAND CONSIDERATIONS

18-69. Commanders must fully understand the limitations and requirements of night driving operations. The success of any night operation depends on the amount and quality of preparation and training conducted before the mission. Night operations require extensive training and maximum support and attention from commanders.

18-70. Commanders must establish and support night training programs. Mission goals must be realistic and developed around the proficiency and experience of the unit in night operations.

18-71. Using vehicle operators in day and night roles reduces their ability to operate effectively at night. Since night driving is more tiring than day driving, commanders must ensure that personnel get every opportunity to rest. When vehicle operators are scheduled for night driving, commanders should consider limiting workloads to night driving only.

18-72. Maintenance requirements for day and night driving are greater than those required for day operations alone. To allow enough time for maintenance, commanders should decrease day operations when night missions are scheduled. Maintenance personnel may have to be divided into two shifts to support day and night operations.

18-73. Commanders should be alert to signs of fatigue, overconfidence, or carelessness that personnel display when engaging in night driving. A carefully planned and executed night driving safety awareness program is essential for accident-free operations. Commanders must ensure that leaders at the lowest level emphasize and enforce the spirit and the standards of this program.

18-74. Commanders must ensure that proper facilities are available for night training. Failure to provide the proper training environment reduces an individual's ability to perform night driving and creates an unsafe situation.

18-75. Until the entire unit is fully trained in all aspects of night missions, commanders may consider dedicating a platoon or company solely to tactical night operations. Once established and proficient, this element can then help train the remainder of the organization.

18-76. Since the introduction of NVGs, many units have established aggressive NVG training programs. Their experience has shown that night tactical missions are much more effective under ALL ambient light levels when conducted with the use of NVGs.

## PSYCHOLOGICAL AND PHYSIOLOGICAL TRAINING CONSIDERATIONS

18-77. Training with NVGs is challenging. Some vehicle operators may initially experience sore neck muscles, headaches, and fatigue. Some may develop anxiety due to reduced depth perception. Most of the mental and physical effects of NVGs can be reduced if the following considerations are included in NVG training programs.

18-78. The first NVG driving lesson should be conducted over a short range (for example, three to five kilometers and when a high ambient light level exists). This procedure introduces the vehicle operator to NVGs during ideal conditions; the short route helps prevent fatigue. As training progresses, conduct longer training periods in lower ambient light levels. Using these procedures increases the student's endurance and confidence.

18-79. Students experience greater fatigue during night driving. Duty hours for vehicle operators, instructors, data collectors, and support personnel undergoing night training should not exceed eight continuous hours a day. Instructors conducting NVG training should be restricted to four hours of instruction within a 24-hour period. A typical duty day would be 1600 to 0200 hours. To comply with this requirement, duty should be limited to driving and academic training only. Additional duty, requiring a Soldier's presence during the day, should be avoided when possible.

18-80. Commanders should consider using reversed cycle training for personnel selected to receive NVG training. This procedure means training at night and resting during the day. This enables the Soldier's body to physically and mentally adjust to night operations and provides continuity to a



unit night training effort. Individual Soldiers require at least five days to begin to physically adapt to a night training cycle. Physical adaptation is essentially complete after two to three weeks, but training efficiency is again reduced during the period of adjustment back to day cycle.

## **TRAINING PREREQUISITES**

18-81. Driving proficiency with NVGs can be maintained only through a training program that requires frequent NVG driving. Vehicle operators who do not maintain NVG proficiency must receive refresher training.

18-82. In accordance with AR 600-55, Chapter 8, students must be licensed motor vehicle operators, receive NVG academic subjects before receiving hands-on training in a vehicle, and pass a written exam. Academic training makes students aware of the limitations of NVG driving and ensures a safer operating environment.

18-83. AR 600-55, Appendix E, contains a list of mandatory academic subjects and driving (hands-on) tasks for vehicle operator qualification or refresher training. It also contains instructor qualification requirement.

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Note: An NVG-equipped instructor must be in the cab of the vehicle at all times during qualification/refresher training.

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## **EXPORTABLE TRAINING PACKAGE**

18-84. Training Circular (TC) 21-305-2 is an exportable training package for units authorized either the AN/PVS-5- or AN/PVS-7-series NVG. It is available through normal publication channels. This TC includes the following:

- Lesson plans.
- Advance sheets.
- Paper copies of viewgraph transparencies.
- A sample training calendar.
- Eye charts.
- Written examination and quizzes with answer sheets.
- A performance evaluation checklist (road test).

Lesson plans contain the conditions and standards for those mandatory academic and hands-on tasks outlined in AR 600-55, Appendix E.

18-85. Training videotapes support this training and must be ordered separately through the local training and audiovisual center (TASC). The videotapes provide instruction on operational functions, care, preventive maintenance, and proper wear of the AN/PVS-5 series and AN/PVS-7B NVG.

## **STANDING OPERATING PROCEDURES**

18-86. Standing operating procedures (SOPs) should cover all aspects of a unit's training program. Each operator should become thoroughly familiar with the contents of the SOP. The information that follows is minimal and is provided for guidance only. Each SOP must be developed to meet the particular training needs of the unit. The following information should be addressed:

- Hemispherical illumination limitations for NVG training.
- Rest requirements for personnel undergoing NVG training.
- Vehicle lighting configurations for night and NVG driving.
- Command and control vehicle for tactical operations.
- Additional light sources authorized for NVG driving.

- Care and security of the NVG.
- Weather requirements for night and NVG training.
- Vehicle speed limitations.
- Emergency procedures while driving with NVGs (such as NVG failure and vehicle breakdowns).
- Vehicle operator and assistant vehicle operator responsibilities.
- Qualification/refresher training requirements.
- NVG instructor qualification requirements.
- NVG licensing procedures.
- NVG-related accident reporting procedures.

## **DRIVERS VISION ENHANCER (DVE)**

18-87. The AN/VAS-5A(v) 11 – 15 DVE are a compact, lightweight, uncooled, passive, thermal imaging system for use on a variety of combat and tactical wheeled vehicles during darkness or during periods of degraded visibility.

18-88. The ability to drive with the DVE is developed through training. This system takes the temperature differences in view and transfers the image to the screen. This system does not use accumulations of ambient light as with the NVGs. The more the vehicle operator drives with the DVE system, the more they will learn. Overconfidence may cause a vehicle accident.

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Note: The new TC 21-305-2, dated Feb 2014 is a supporting reference.

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## **OPERATIONS UNDER BLACKOUT CONDITIONS WITHOUT NIGHT VISION AIDES**

18-89. When operating under BO conditions, be sure the BO marker lights are functioning properly. Lower the windshield to improve visibility. Drive at reduced speeds. If in a column, watch the rear BO marker lights of the vehicle ahead to be sure of following at the correct distance. Remember, the white BO stoplight of the vehicle ahead is on the right and left side.

## **BLACKOUT MARKER LIGHTS**

18-90. To show the location of vehicles during BO conditions, military vehicles are equipped with four BO marker lights. Two of these lights are on the rear corners of the vehicles and the other two are on the front (see Figure 18-4 and Figure 18-5). They do not illuminate the road but depending on the weather can indicate the position of a vehicle as much as 250 yards ahead. These lights cannot be seen from an airplane flying higher than 400 feet.

18-91. When operating a vehicle in a convoy under BO conditions, if practicable, post a person equipped with a screened flashlight or large white piece of material in the rear of the vehicle to warn the following vehicle operator if they approach too closely. An alert rear guard can usually detect a vehicle at a reasonable distance, even one with no lamps. In BO operation, vehicles will maintain a speed of five to ten MPH (8 to 16 kilometers per hour).

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Note: When a vehicle is disabled on the side of the road, the vehicle operator is posted at the rear of the disabled vehicle with a screened flashlight or large white piece of material to warn approaching vehicles of the danger.

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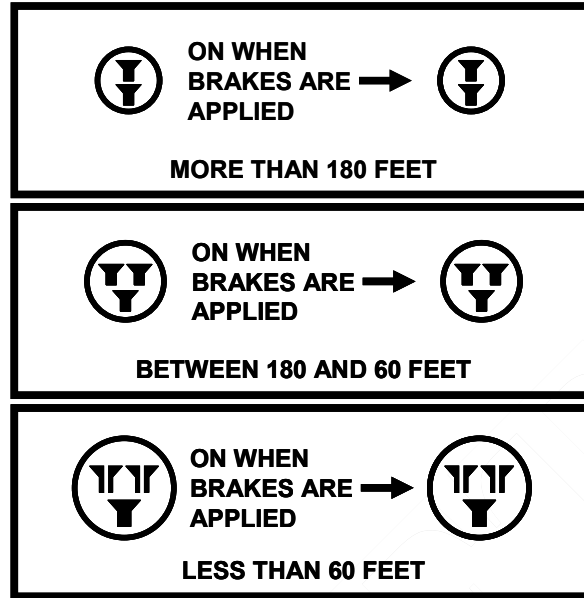


Figure 18-4. Rear BO Marker Lights

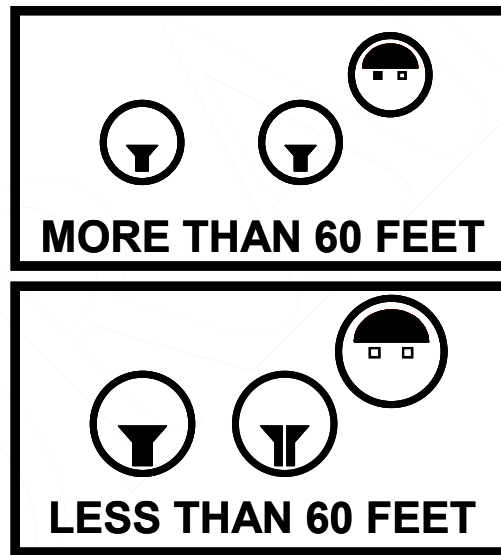


Figure 18-5. Front BO Marker Lights and BO Driving Lights

### Taillights

18-92. Each rear lamp has two pairs of “cat’s eyes” that show red when on. Each pair appears as one red light when 60 to 180 feet (20 to 60 yards) away and as two pairs of cat’s eyes in each light at less than 60 feet.

18-93. Remember, one point of light tells a vehicle operator that they are too far behind the vehicle ahead. Two lights assure that they are following at a proper distance. Four lights warn that they are getting too close.

18-94. The BO stoplight is normally a separate unit mounted on the right and left taillights. It flashes a white light when brakes are applied.

## **Front Lights**

18-95. Each front light has one pair of cat's eyes that show white when on. Each pair appears as one light when more than 60 feet away. When 60 feet away, a vehicle operator can see one pair of cat's eyes in each light. This warns that the vehicle is near.

## **BLACKOUT DRIVING LIGHT**

18-96. The BO driving light is mounted to the left of the left headlight. It furnishes a diffused light beam for limited illumination when driving under BO conditions.

## **NIGHT VISION PRINCIPLES**

18-97. Vision is the most important sense used while driving. It makes the vehicle operator aware of the position of the vehicle in relation to the road. The vehicle operator needs good depth perception to determine height and distance, good visual acuity to identify terrain features and obstacles that lie along the road and good night vision techniques to be efficient in night operations. When driving during daylight hours, eyes can rapidly identify and interpret visual clues. During hours of darkness, however, illumination is reduced, and vision is limited. Wheeled vehicle operators with 20/20 daylight vision may not have adequate night vision.

18-98. To increase the capability to operate at night, the vehicle operator must understand night vision principles and the use of night vision techniques for viewing at night. This chapter includes information about the anatomy of the eye, types of vision, visual problems that affect night vision, differences between day and night vision, target detection, dark adaptation, night vision scanning techniques, distance estimation and depth perception visual illusions, measures used to protect night vision, self-imposed stresses, the effect of nerve agents on night vision, sources of ambient light and meteorological considerations.

## **EVALUATION OF NIGHT VISION**

18-99. The ability to drive at night is based on the ability to see at night and how well the vehicle operator has been trained in night vision techniques. Although the limits of night vision vary from person to person, most vehicle operators never learn to use night vision to its fullest capacity. A vehicle operator with average night vision who uses night vision techniques is more effective than a vehicle operator with superior night vision who does not use these techniques.

## **ANATOMY AND PHYSIOLOGY OF THE EYE**

18-100. The eye is similar to a camera. The cornea, lens, and iris combination gathers and controls the amount of light that enters the retina (see Figure 18-6).

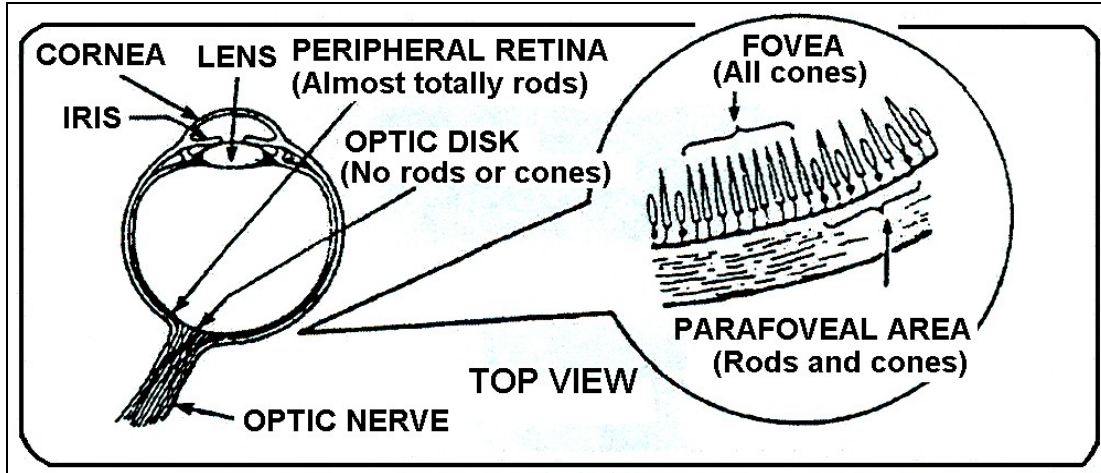


Figure 18-6. Anatomy of the Eye

18-101. The parts of the eye are described as follows:

- The **CORNEA** is a transparent tissue covering the front of the eye like a watch crystal covers a watch. (Contact lenses are fitted over the cornea.)
- The **IRIS** is a thin circular curtain which is the colored part of the eye. A person's eye color depends on the amount of pigment in the iris. Light blue has the least amount and dark brown the most.
- The **PUPIL** is a hole in the center of the iris. It is black because the inside of the eye is dark. The size varies with the amount of light entering the eye. It gets smaller with increased light.
- The **LENS** is a transparent, semi-soft material about half the size of a dime. It can change shape to focus on objects at different distances from the eye.
- The **RETINA** is the lining at the back of the eye where the image is formed. It consists of rod cells, which see black and white, and cone cells, which see colors. The picture seen by the retina is sent to the brain along the optic nerve.

18-102. Light enters the eye through the pupil. The iris controls the amount of light entering the eye. The light passes through the lens which focuses it onto the retina at the back of the eye. The picture seen by the retina is upside down the brain turns it right side up. The brain gets a slightly different picture from each eye and usually combines them to make one picture.

## TYPES OF VISION

18-103. There are three types of vision. Each type requires different sensory preceptors to identify an image.

### PHOTOPIC VISION

18-104. Photopic vision is experienced during daylight hours or when a high level of artificial light exists. Under these conditions, sight is achieved primarily by the cones, especially those concentrated in the fovea. Due to the high light condition, rod cells are bleached out and become less effective. Sharp image interpretation (fine resolution of detail) and color vision are characteristic of photopic vision. Under these conditions, objects are detected with peripheral vision but are viewed primarily with central (foveal) vision.

## **MESOPIC VISION**

18-105. Mesopic vision is experienced at dawn and dusk and during periods of mid-level light. Vision is achieved by a combination of the rods and cones. Visual acuity steadily decreases; the available light decreases. A reduction in color vision occurs as the light level decreases; the cones become less effective. Due to gradual loss of cone sensitivity, greater emphasis is placed on off-center vision and scanning to detect objects.

## **SCOTOPIC VISION**

18-106. Scotopic vision is experienced in low-level light conditions. Cone cells become ineffective causing poor resolution of detail. Visual acuity decreases to 20/200 or less. Color perception is totally lost. A central blind spot occurs due to the loss of cone sensitivity. Objects must be viewed using off-center viewing and scanning. The natural reflex of looking directly at an object must be reoriented by night vision training. The use scotopic vision demands searching movements of the eyes to locate an object and small eye movements to keep the object in sight. Characteristically, in this type of vision a dim image may fade away if the eyes are held stationary for more than a few seconds.

## **VISUAL PROBLEMS AFFECTING NIGHT VISION**

18-107. Two visual deficiencies that may become more apparent at night are presbyopia and night myopia. Another visual problem that affects night vision is astigmatism.

### **PRESBYOPIA**

18-108. This deficiency, which commonly occurs in individuals over 40 years of age, is due to hardening of the lens. It involves a loss of the eye's ability to focus diverging light rays from near objects. As a result, light transmission from the lens to the retina decreases light scattering or glare increases. As presbyopia increases, instruments, maps, and checklists become more difficult to read, especially in red light. Certain types of bifocal lenses that compensate for this condition can correct this deficiency.

### **NIGHT MYOPIA**

18-109. At night, the spectrum of available light changes; blue wavelengths of light are dominant. Therefore, a person who is slightly nearsighted (myopic) will find it hard to see at night; blurred vision could occur. Special lenses can be prescribed to correct myopia.

### **ASTIGMATISM**

18-110. Astigmatism is an irregularity of the eye that produces an out-of-focus condition. For example, if you focus on power poles (vertical), the wires (horizontal) will be out of focus in most cases. The typical prescription for glasses is written showing three numbers for each eye. The first number is the spherical portion of your prescription, which can be compensated for by night vision goggles (NVGs). The second number is the astigmatism in degrees, and the third number is the axis of the astigmatism in degrees.

## **DIFFERENCES BETWEEN DAY AND NIGHT VISION**

### **COLOR**

18-111. One way night vision differs from day vision is in color vision. As light levels decrease, the eyes shift from photopic vision (cones) to scotopic vision (rods). With this shift, the eyes become less sensitive to the red end of the spectrum and more sensitive to the blue part of the spectrum. Color perception is not possible with the rods. Colors of non-lighted objects cannot be determined

at night under very low light conditions. Light and dark colors can be distinguished at night only in terms of the brightness of reflected light. If, however, the brightness of a color is above the threshold for cone vision, the color can be seen.

## DETAIL

18-112. Perception of fine detail is impossible at night. Low light conditions greatly reduce visual acuity. At 0.1 foot-candle (level of full moonlight), acuity is one-seventh as good as it is in average daylight. Therefore, objects must be rather large or nearby to be seen at night. Identification at night must depend on the perception of generalized contours and outlines and not on small distinguishing features.

## RETINAL SENSITIVITY

18-113. Another important distinction between night vision and day vision is the difference in the sensitivity of various parts of the retina under these two conditions.

18-114. The central part of the eye is not sensitive to starlight levels. During darkness or with low-level light, central vision becomes less effective, and a relative blind spot (5 to 10 degrees wide) develops. This is due to the concentration of cones in the area immediately surrounding the fovea of the retina.

18-115. Since the central fields of vision for each eye are laid over each other for binocular (two-eyed) vision, a night blind spot occurs during periods of low-level illumination. If an object is viewed directly, it may not be detected because of this blind spot (see Figure 18-7).

18-116. Because of the central blind spot, as distance increases, larger and larger objects will not be seen. To see things clearly at night, use off-center vision and scanning techniques.

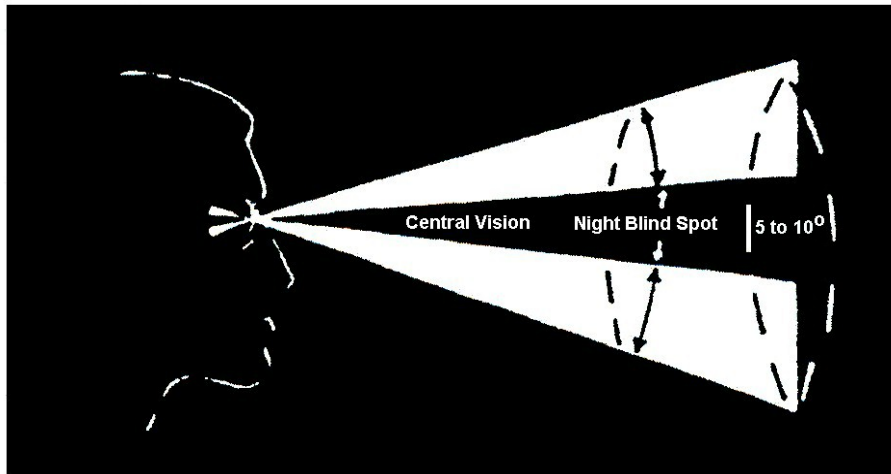


Figure 18-7. Night Blind Spot

## TARGET DETECTION

18-117. With 20/20 vision detection of a target depends on several factors including—

- Target size and distance (relative target size).
- Overall brightness (luminance).
- Brightness and color contrast between target and background.
- Location of eye focus.
- Angle between central visual axis and target.

## **DARK ADAPTATION**

18-118. Dark adaptation is the process by which a person's eyes increase their sensitivity to low-light levels. People dark-adapt to varying degrees and at different rates. During the first 30 minutes, the sensitivity of the eye increases roughly ten thousand fold, with little further increase after that time.

18-119. Going suddenly from bright light into darkness occurs often; for example, when entering a movie theater during the day or leaving a brightly lit room at night. In both cases, the sensations are the same. At first he/she can see very little, if anything. After several minutes he/she can see dim forms and very large outlines. As time passes he/she can see more details of the surroundings.

18-120. The lower the complete dark level of light, the more rapidly he/she can adapt. For example, less time is needed to completely dark-adapt after being exposed to a darkened theater than after being exposed to the brightness of day.

18-121. Maximum dark adaptation is reached in 30 to 45 minutes under minimal lighting conditions. If the dark-adapted eye is exposed to a bright light, the sensitivity of that eye is temporarily impaired. The amount of impairment depends on the intensity and duration of the exposure. Exposure to a flare or lightning may seriously impair night vision. Recovery to dark adaptation could take from 5 to 45 minutes in continued darkness.

18-122. Night vision goggles affect dark adaptation. If the vehicle operator dark-adapts before donning the goggles and removes them in a darkened environment, expect to regain full dark adaptation in 2 to 10 minutes.

## **NIGHT VISION SCANNING TECHNIQUES**

18-123. Dark adaptation is only the first step to maximizing the ability to see at night. Applying night vision techniques will help overcome many of the physical limitations.

18-124. Scanning techniques are important to identify an object at night. To scan effectively, scan from right to left or left to right using a slow, regular scanning movement (see Figure 18-8).

18-125. Viewing an object using central vision during daylight poses no limitation. If the same technique is used at night, the object may not be seen. This is due to the night blind spot that exists during periods of low light. To make up for this limitation use off-center vision. This technique requires viewing an object by looking 10 degrees above, below, or to either side of, rather than directly at an object. This lets the peripheral vision maintain contact with an object.

18-126. Even when off-center viewing is practiced, the image of an object viewed longer than 2 to 3 seconds tends to bleach out and become a solid tone. As a result, the object is no longer visible. This produces a potentially unsafe operating condition. To overcome this limitation, be aware of the phenomenon. Avoid looking at an object longer than 2 or 3 seconds.

18-127. Visual acuity is greatly reduced at night. Therefore, objects must be identified by their shape or outline. Familiarity with the architectural design of the structures common to the area will determine the success using this technique. For example, the outline of a building with a high roof and a steeple can be easily recognized in the United States as a church. Churches in other parts of the world may have entirely different distinguishing features. Man-made features depicted on the map can help with recognizing outlines during night driving.



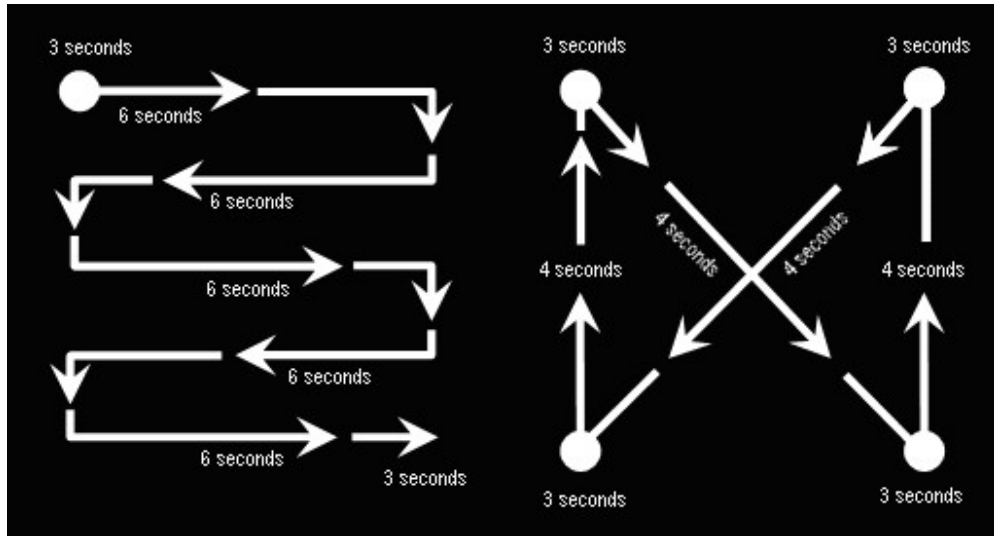


Figure 18-8. A Typical Scanning Pattern

## DISTANCE ESTIMATION AND DEPTH PERCEPTION

18-128. Distance estimation and depth perception clues are easily recognized using central vision during periods of good lighting. But as light levels decrease, the tendency to have visual illusions and the ability to correctly judge distances decreases. Knowledge of distance estimation and depth perception clues will help to better judge distance at night.

18-129. Distance and depth perception clues may be monocular (one-eyed) or binocular (two-eyed). The binocular clues depend on the slightly different view each eye has of the object. Consequently, binocular perception is useful only when the object is close enough to make the viewing angle of the two eyes obviously different. Because they are rarely improved by study and training, binocular clues are not discussed here. Monocular clues used to help distance estimation and depth perception are discussed below.

## GEOMETRIC PERSPECTIVE

18-130. An object has an apparent different shape depending on the distance and angle from which it is seen (see Figure 18-9). Geometric perspective clues include linear perspective, apparent foreshortening, vertical position in the field, and motion parallax.

- **Linear Perspective.** Parallel lines such as railroad tracks or runway lights (see Figure 18-9, view A) tend to converge as distance from the observer increases.
- **Apparent Foreshortening.** The true shape of an object or terrain feature seems oval when seen from a distance. As the distance to the object or terrain feature decreases, the apparent perspective changes to its true shape or form. Figure 18-9, view B illustrates how the shape of a body of water changes when viewed at different distances at the same altitude.
- **Vertical Position in the Field.** Objects or terrain features at a distance from the observer seem higher on the horizon than objects or terrain features that are closer to the observer. The highest vehicle in Figure 18-9, view C looks the closest to the top and is judged to be the greatest distance from the observer.
- **Motion Parallax.** This clue to depth perception is often considered the most important. Motion parallax is the apparent relative motion of still objects as seen by an observer moving across the landscape. Near objects seem to move backward, past, or opposite the path of motion. Far objects seem either to move in the direction of motion or remain fixed. The rate of apparent movement depends on the distance the observer is from the

object. For example, while driving along a road, a picket fence whizzes by while a tree further away from the road passes more slowly. Mountains in the distance seem to be fixed or to move with the vehicle.

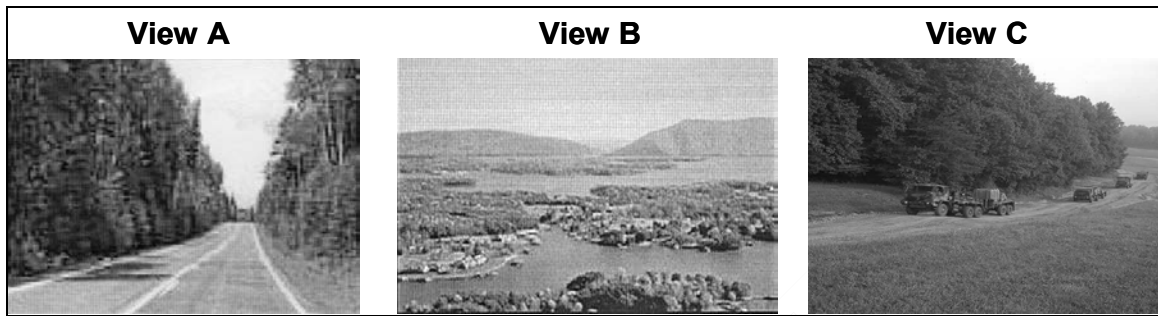


Figure 18-9. Geometric Perspective

## RETINAL IMAGE SIZE

18-131. The brain perceives the size of an image focused on the retina to be a certain size. To determine distance using the retinal image, consider three factors: known size of objects, increasing/decreasing size of objects, and land associations.

- **Known Size of Objects.** The nearer an object is to the observer, the larger its retinal image. The brain learns from experience to associate the distance of familiar objects by the size of their retinal image. A structure will fix a specific angle on the retina based on the distance from the observer. If the angle is small, the observer judges the structure to be at a great distance. If the angle is large, the building is judged as being close. To use this clue, the observer must know the actual size of the object and have seen it before. If the observer has not seen it before, they need to determine an object's distance primarily by motion parallax.
- **Increasing/Decreasing Size of Objects.** If the retinal image size of an object increases, it is getting closer. If the image size decreases the object is moving farther away. If the image size is constant, the object is at a fixed distance.
- **Land Associations.** Comparing an object, such as a motor pool, with an object of known size, such as a 5-ton truck will help determine the object's relative size and apparent distance from the observer. Objects ordinarily associated together are judged to be about the same distance.

## VISUAL ILLUSIONS

18-132. As visual information decreases, the probability of spatial disorientation increases. Reduced visual references also create illusions that can cause spatial disorientation.

## AUTOKINESIS

18-133. When a person stares at a still light in the dark, the light seems to move. This occurrence can be rapidly demonstrated by staring at a lighted cigarette in a dark room. Apparent movement will start after 8 to 10 seconds. Although the cause is not known, it seems to be related to the loss of surrounding references that normally serve to stabilize the visual perceptions. This illusion can be eliminated or reduced by visual scanning, increasing the number of lights, or varying the brightness of the light. The most important of the three solutions is visual scanning.

## **RELATIVE MOTION**

18-134. A person sitting in a car at a railroad crossing waiting for a train to pass often experiences the illusion of relative motion. Even though the car is not moving, the person feels that it is moving. The only way to correct this illusion is to understand that such illusions do occur and to not react to them on the vehicle's controls. Using proper scanning techniques can help prevent this illusion.

## **REVERSIBLE PERSPECTIVE ILLUSION**

18-135. A vehicle may seem to be moving away when it is in fact approaching. This illusion is often experienced when a vehicle is moving parallel to the course. To determine its direction, watch its lights. If the brightness of the lights increases, the vehicle is approaching. If the lights dim, the vehicle is retreating.

## **STRUCTURAL ILLUSIONS**

18-136. Heat waves, rain, snow, sleet, or other factors that block vision cause structural illusions. For example, a straight line may appear to be curved when seen through a desert heat wave.

## **SIZE-DISTANCE ILLUSION**

18-137. This illusion results from staring at a point of light that approaches and then retreats from the observer. Instead of seeing the light advancing or receding, the lights may seem to expand and contract at a fixed distance. Without additional distance clues, accurate range estimation is extremely difficult. Using proper scanning techniques can help prevent this illusion.

## **NIGHT VISION PROTECTION**

18-138. Night vision should be protected whenever possible. There are various precautions that can be taken.

## **SUNGLASSES**

18-139. Repeated exposure to bright sunlight has an increasingly negative effect on dark adaptation. This effect is intensified by reflective surfaces, such as sand and snow. Exposure to bright sunlight for 2 to 5 hours definitely decreases the scotopic visual sensitivity for as long as 5 hours. Additionally, the rate of dark adaptation and degree of night vision will decrease. These effects combine with each other and may persist for several days.

18-140. If night driving is expected, use military neutral density (N-15) sunglasses or equivalent falter lenses when exposed to bright sunlight. This precaution will maximize the rate of dark adaptation at night and improve night vision sensitivity.

## **NIGHT TACTICAL OPERATIONS PRECAUTIONS**

18-141. During a night tactical mission, expect to experience battlefield conditions, such as artillery flashes, flares, and searchlights, as well as oncoming vehicle headlights and lightning. These conditions will cause total or partial loss of night vision. When confronted with these conditions, use the following techniques:

- If a flash or high-intensity light is expected from a certain direction, turn the vehicle away from the light source. When such a condition occurs unexpectedly and cannot be avoided, save the dark adaptation by closing one eye. Once the light source is no longer a factor, the eye that was closed will provide enough night vision to continue driving. This is possible because dark adaptation occurs independently in each eye. Viewing with one dark-adapted eye, however, will cause depth perception problems.
- Select routes to avoid built-up areas with heavy concentrations of light. If these conditions are encountered, alter the route to avoid brightly lighted areas. A decrease in dark adaptation from a single light source, such as a farmhouse or an automobile can be reduced by turning the head and eyes away from the light.
- When flares are used to light the viewing, maneuver the vehicle away from the flare to the edge of the lighted area. Thus the exposure to the light source is minimized.
- Use short bursts of fire when firing automatic weapons. Close one eye or look away from the firing to minimize loss of dark adaptation.

## **SELF-IMPOSED STRESSES**

18-142. Many self-imposed stresses limit night vision. Be aware of these restrictions to ensure they are avoided before driving at night.

## **SMOKING**

18-143. Smoking significantly increases the amount of carbon monoxide carried by the hemoglobin of red blood cells. This reduces the blood's ability to combine with oxygen. The smoker effectively loses 20 percent of his/her night vision at sea level.

## **ALCOHOL**

18-144. Alcohol is a sedative that impairs coordination and judgment. As a result, night vision techniques will not be properly applied.

## **FATIGUE**

18-145. A person will not be mentally alert if tired when performing night driving. The response to night situations that require immediate reaction will slow down. Depending on the degree of fatigue, performance may become a safety hazard.

## **NUTRITION**

18-146. Missing or postponing meals can negatively affect night driving performance. The resulting hunger pains cause unpleasant feelings, distraction, breakdown inhabit pattern, shortened attention span, and other physical changes.

18-147. Failure to eat foods that provide sufficient vitamin A can reduce night vision. Food high in vitamin A include eggs, butter, cheese, carrots, squash, peas, and all types of green vegetables. A balanced diet normally provides an adequate amount of vitamin A. Excess amounts of vitamin A will not increase the night vision ability and may be harmful.

## **PHYSICAL CONDITIONING AND SLEEP AND REST REQUIREMENTS**

18-148. Because of the physical stresses of night driving, a person will tire more easily. To overcome this, exercise daily. Good physical fitness will help night driving with less fatigue and will improve night scanning efficiency. However, too much exercise in one day may leave a person too tired for night driving.

18-149. Night driving is more tiring and stressful than day driving. Therefore, get adequate rest and sleep before driving.

## **NERVE AGENTS AND NIGHT VISION**

18-150. Exposure of the eyes to very small amounts of nerve agents negatively affects night vision. Chemical alarms are not sensitive enough to detect the low levels of nerve agent gas that can cause miosis (contracting of the pupils). Miosis may occur gradually through exposure to low levels of nerve agent gas over a long period of time. However, exposure to a high level can cause miosis in the few seconds it takes to put on a protective mask.

18-151. The onset of miosis is tricky in that it is not always immediately painful. Miotic subjects may not realize their condition even when carrying out tasks requiring vision in low ambient light. After an attack by nerve agents, especially the more lasting types, commanders should assume there will be some loss in night vision among personnel otherwise fit for duty. No drug can cure the effects of miosis without causing other visual problems that may be just as severe.

## **SOURCES OF AMBIENT LIGHT**

18-152. Sources of ambient light include the moon, background illumination, artificial light, and solar light.

### **THE MOON**

18-153. The moon provides the greatest source of ambient light at night. It rises in the east and sets in the west. The time at which it rises and sets changes continually. The moon angle changes approximately 1.5 degrees per hour (1 degree every 4 minutes). Light from the moon is brightest when the moon is at its highest point.

### **BACKGROUND ILLUMINATION**

18-154. Natural light sources provide background illumination at night. Besides the light provided by the sun and moon, the following natural light sources add to night brightness:

- Airglow (also called night-sky luminance).
- Aurora (also called Northern Lights in the Northern Hemisphere and Southern Aurora in the Southern Hemisphere).
- Starlight.
- Zodiacal light (also called counter glow).

### **ARTIFICIAL LIGHT**

18-155. Lights from cities, automobiles, fires, and flares normally are sources of small amounts of artificial light. The lights of a large metropolitan area will, however, increase the light level around the city. The light from these sources is most pronounced in overcast conditions.

### **SOLAR LIGHT**

18-156. Ambient solar light is usable for certain periods following sunset and before sunrise. After sunset, solar light steadily decreases until the level of light is not usable to the unaided eye. This occurs when the sun is 12 degrees below the horizon. Before sunrise, solar light becomes usable when the rising sun is 12 degrees below the horizon.

## METEOROLOGICAL CONSIDERATIONS

18-157. Atmospheric conditions can affect hemispherical illumination. Because weather conditions vary, light levels cannot always be accurately predicted. An awareness of these factors will help to evaluate the available ambient light. Some meteorological conditions that restrict hemispherical illumination are discussed below.

18-158. Due to reduced vision at night, a person may fail to detect a gradual increase in cloud coverage. At night be alert for the following indications that clouds are present:

- A gradual reduction in light level.
- Obscuration of the moon and stars.
- Shadows resulting in varying levels of ambient light.

18-159. Humidity reduces transmission of light through the atmosphere. When humidity is high, ambient light is greatly reduced. High dew point temperatures indicate high humidity. An increase in the humidity content of the air will decrease the brightness of ground lights.

18-160. Restrictions, such as fog, dust, haze, or smoke, reduce hemispherical illumination. These conditions are greater at lower altitudes and intensify as temperatures decrease and the dew point spread approaches zero.

18-161. At least one weather occurrence INCREASES illumination. Lightning flashes have an effect similar to that of a bright flare. The brightness of the illumination depends on the closeness of the thunderstorm.

## Chapter 19

# Motor Marches and Convoys

19-1. The wheeled vehicle operator must know specific procedures for maintaining convoy speed, halting, and handling breakdowns. The vehicle operator must also know convoy and aircraft loading signals as well as NATO convoy flags. See Appendix B and ATP 4-16, Chapter 5 respectively for further details.

### PROPER SPEED AND GAP

19-2. The road, weather, and amount of space needed between vehicles to allow for stopping without rear-end collisions and for letting faster-moving vehicles pull into the column after passing, determine the proper speed and gap. Of all the space around the vehicle, the area ahead of the vehicle (the space the vehicle operator is driving into) is most important. A vehicle operator needs space ahead in case he/she must suddenly stop. According to accident reports, trucks and buses most often run into the vehicle in front of them. The most frequent cause is following too closely. If the vehicle ahead is smaller, it can probably stop faster. If following too closely, this may cause an accident as you will not have time to react.

19-3. One good rule to determine how much space to keep in front of the vehicle is to allow at least one second for each ten feet of vehicle length at speeds below 40 MPH. At greater speeds, add one second for safety. For example, if driving a 40-foot vehicle, the vehicle operator should leave four seconds between their vehicle and the vehicle ahead, in a 60-foot vehicle, six seconds. Over 40 MPH, a vehicle operator needs five seconds for a 40-foot vehicle; seven seconds for a 60-foot vehicle.

19-4. To know how much space a vehicle operator has, he/she should wait until the vehicle ahead passes a shadow on the road, a pavement marking, or some other clear landmark. Then count the seconds, one thousand one, one thousand two, and so on, until he/she reaches the same spot. The vehicle operator can compare their count with the rule of one second for every ten feet of length. If driving a 40-foot truck and only count two seconds, the vehicle operator is too close. He/She should drop back a little and recount until the right number of seconds of following distance is reached. When the road is slippery, more space is required to stop.

19-5. Maintain the proper place in the convoy. If a vehicle operator has no other orders, a good general rule is to keep a distance in yards that is twice the rate of speed at which driving. For example, if traveling at 25 MPH, leave 50 yards between the vehicle and the one just ahead at 30 MPH, 60 yards. Remember, this distance is in yards, not feet. The number that is used to multiply, in this case two, is called the speedometer multiplier (SM). The convoy commander may set an SM greater than two.

19-6. In applying the SM, the vehicle operator must be able to judge distances. They can do this more easily by practicing estimating distances. Take a known distance (such as the length of a truck or the distance between telephone poles) and observe carefully how that distance looks. Try this in different light conditions (such as day, night, and dusk). A vehicle operator will soon be able to estimate distances accurately.

## VEHICLE FAILURES

- 19-7. If the vehicle fails while driving in a convoy, remember these basic rules:
- Signal a stop and pull off the road.
  - Signal vehicles behind to proceed.
  - Correct the trouble if possible and fall back in the column at one of the breaks (halts). If the vehicle operator or a mechanic left with the vehicle operator cannot repair the trouble, wait for the trail officer and tell them of the difficulties. They will make the necessary arrangements.

### CAUTION

The vehicle operator should not attempt to exceed the designated catch-up speed (or posted speed limit) to regain position within the convoy. Doing so may cause an accident.

## VEHICLE HALTS

19-8. A convoy halt is made for personal convenience, checking the vehicle's operational status, checking load security, and refueling (if necessary). Make the at-halt checks at each halt. Be sure to keep off the road, if possible, while checking the vehicle. If a vehicle operator must halt on the road, their designated assistant vehicle operator should act as a guard to warn other traffic. Each vehicle operator should accomplish specific duties while at the halt. These duties are determined by the convoy commander prior to start of convoy.

## CONVOY SECURITY

19-9. Convoys are inviting targets for an enemy force. Convoys cannot always depend on military police support or added firepower. Such support is often not available because of other priorities. To provide more firepower for a convoy, units may employ a hardened gun truck (see Appendix E). The purpose of a gun truck is to:

- Provide a mobile firing platform.
- Help counter enemy attacks.
- Increase survivability of the convoy.

## AIRCRAFT LOADING AND CONVOY CONTROL SIGNALS

19-10. Use and obey hand signals in a convoy. In addition to the signals for right and left turns, stopping, and so forth, the vehicle operator must learn convoy control signals. Whenever a march column is halted on a curve or downgrade, or whenever some vehicle operators cannot see the signal, signals may be relayed along the column or transmitted by messenger to all concerned. See Appendix B for further details.

## NATO CONVOY FLAGS AND SIGNS

19-11. Mark each march unit of a convoy with flags that are 12 inches high and 18 inches long. The lead vehicle has a blue flag and the rear vehicle, a green flag. Mount the flags on the left front of the lead and trail vehicles, respectively. The flags should not interfere with the vehicle operator's vision or with any functional component of the vehicle (see Figure 19-1, Figure 19-2, Figure 19-3, and Figure 19-4).



19-12. The convoy commander and march unit commander's vehicle must have a white and black flag on the left front bumper. This flag is divided diagonally from the lower left corner to the upper right corner (see Figure 19-2). The upper left triangle is white and the lower right triangle, black. See ATP 3-35 for additional information. OCONUS convoys must comply with MACOM and HN regulations.

19-13. The lead vehicle (pacesetter) in each element of the convoy must have on its front a sign with 4-inch black letters on a yellow background reading CONVOY FOLLOWS. The last vehicle of each convoy element will have on the rear a sign (same black on yellow as above) reading CONVOY AHEAD. Convoy ahead signs are not placed on maintenance or medical vehicles unless that vehicle's purpose is to represent the end of the convoy.

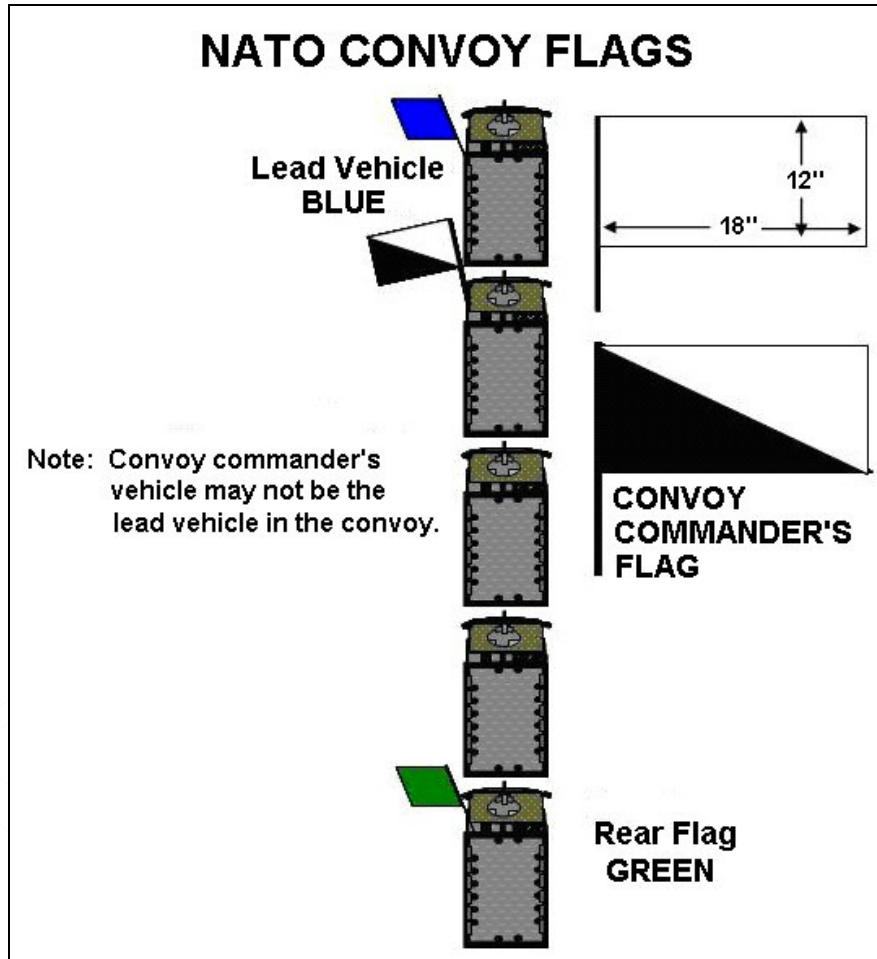


Figure 19-1. Flag Placement



**Figure 19-2. Commander's Flag**



**Figure 19-3. Lead Vehicle Flag**



**Figure 19-4. Trail Vehicle Flag**

## Chapter 20

# Operation of Motor Vehicles on Military Flight Lines

20-1. Motor vehicles operating on the flight line are necessary to normal operations and maintenance. However, they present a clear and possible danger to aircraft and ground personnel. Carelessness, haste, and disregard of existing safety standards by flight line vehicle operators are inexcusable and are primary sources of aircraft collisions and personnel injury. This chapter discusses applicable directives covering flight line vehicle traffic.

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Note: For the purpose of this chapter, the term “flight line” includes runways, taxiways, aircraft parking ramps, hangars, and associated maintenance/servicing areas where aircraft may be encountered, excluding aircraft on permanent static display.

**FOR AIR FORCE ONLY:** Refer to AFOSH Standard 91-100, Chapter 6, for further instructions and Air Force unique-operations.

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## AUTHORIZATIONS

20-2. Only vehicle operators and vehicles designated by the installation chief of airfield management, as prescribed in this TC and Air Force Instruction (AFI) 13-213, will be given access to the flight line. Before driving on the flight line, these vehicle operators will be—

- Given special instructions on standard flight line traffic controls and tower signals.
- Advised of the particular hazards involved.
- Tested to ensure the instructions are understood.

These vehicle operators will complete local flight line vehicle operators’ familiarization training and possess proper documentation authorizing flight line driving.

20-3. The individual’s commander will certify on AF Form 171 (Request for Driver’s Training and Additions to US Government Drivers License) that the individual has attended the flight line driving familiarization program. Certification of completion will be entered on the vehicle operator’s record, AF Form 483 (Certificate of Competency).

20-4. No other person will be allowed to operate a vehicle on the flight line except for specified short periods and only by temporary written permission and instruction of the installation chief of airfield management as prescribed in AFI 13-213. Permits for driving on flight lines will be kept to a minimum, consistent with operations requirements. The installation chief of airfield management should periodically review the instructional material being presented to potential flight line vehicle operators to ensure that the material is current.

20-5. Vehicle operators performing on-the-job training (OJT) for flight line duties will not operate a vehicle within 50 feet of aircraft. This restriction does not apply to the following:

- Firefighting vehicles and equipment.
- OJT operators who are towing aircraft.
- Loading/unloading material handling equipment (MHE).
- Aircraft-servicing vehicles.

In all cases, vehicle operators on OJT must be qualified to operate the vehicle and a qualified instructor must accompany them.

## FLIGHT LINE SAFETY PRECAUTIONS

### FOREIGN OBJECT DAMAGE (FOD)

20-6. All personnel entering the flight line area to include the runway, taxiway, parking aprons, and all accessible roadways will conduct a FOD check on their vehicles prior to entering these areas.

- A FOD check will, at a minimum, consist of the following:
  - Inspect your tires (pull forward to check tire in contact with pavement).
  - Ensure all external vehicle components are secured.
  - Secure any/all items loaded on payload vehicle, to include all tiedown device loose ends such as chains, ropes, packaging or other item that may become dislodged during movement while on the flight line area.
  - A thorough walk around of the vehicle to check for damaged, loose, or worn parts.
- In addition, operators will:
  - Make every attempt to stay on paved surfaces.
  - Avoid driving on the dirt or grass.
  - Check tires for FOD after returning to pavement if driving on unimproved surfaces is required (for example, to avoid taxiing aircraft or if performing runway repairs).

These simple FOD-prevention measures can avoid millions of dollars and hundreds of man-hours to repair or replace the damage to military aircraft.

20-7. Careful attention and strict adherence to flight line safety precautions will prevent accidental damage to aircraft and possible injury to flight and ground personnel. Bicycle operators on the flight line will also conform to these measures. Observe the following precautions at all times when operating vehicles on the flight line.

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Note: Units must adhere to local host wing “safety of circle” procedures.

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- Do not drive vehicles within ten feet of a parked aircraft (except when the aircraft is being serviced, loaded, or off-loaded). Use spotters to guide the vehicle’s approach to the aircraft. Never drive vehicles under any part of the aircraft. Do not back or drive vehicles forward directly toward any aircraft (except as authorized in certain loading, unloading, or fueling operations). In these cases, place pre-positioned wheel chocks between the aircraft and the approaching vehicle to keep vehicles from striking the aircraft. Post guides as a required safety measure. Keep chocks in position until vehicles leave from within the ten-foot safety distance requirement. Do not point vehicles directly toward an aircraft when parked on the flight line. Chock all powered vehicles and all equipment mounted on wheels that do not have an integral braking system when left unattended on the flight line. Leave vehicles unlocked with keys in the ignition when parked on the flight line.

#### **CAUTION**

All vehicles must approach parked aircraft with the vehicle operator’s side of the vehicle toward the aircraft.

- For maximum safety, do not park or drive any vehicle closer than 25 feet in front or 200 feet to the rear of any aircraft when engines are operating or are about to be started. Vehicles parked at the side of the aircraft will be located clear of the wing tips and will be clearly visible to personnel in the aircraft cockpit.
- Under no circumstances will vehicles be positioned in front of, or drive into, the path of taxiing aircraft except “guide” or “follow me” vehicles. No vehicle will be driven between the aircraft and the “follow me” guide.
- Vehicle operators must be particularly cautious when driving across runways. They will completely stop at the runway hold-line (two yellow parallel stripes painted on the taxiway surface). This marking is normally at least 100 feet from the runway edge. Installation airfield management officers will annually survey vehicle runway crossing procedures to ensure that flight safety is not being compromised. If conditions at runway crossing require further safety measures; traffic signals, electrically controlled from the tower, will be installed.
- All flight line vehicles will fully stop before they enter or cross a taxiway. Before proceeding, the vehicle operator will determine visually that the way is clear.
- Vehicles on the flight line are a major source of foreign objects that damage aircraft tires and are ingested into jet engines with disastrous results. Before airfield operations, vehicle operators will ensure all equipment carried on vehicles is properly stowed and secured and the vehicles are inspected for objects that could damage aircraft. When dual-wheeled vehicles are operated on unpaved surfaces, they frequently pick up rocks between the tires. Vehicle operators will stop when reaching the airfield pavement and remove any rocks that are wedged between the tires or treads.
- A serious mishap potential exists when vehicles are operated in the path of radio beams used for aircraft navigation. Flight line vehicle operators will be instructed on the location and necessary precautions to be taken when operating near such equipment.
- General-purpose vehicles will not tow compressors, auxiliary power units, and similar equipment unless properly equipped with hitches designed for that purpose. Tugs or other vehicles with suitable trailer hitches will normally be used. Equipment will never be towed faster than 15 MPH. Safety chains will not be required on aerospace ground equipment (AGE). Pintle hook safety pins will be used in all pintle hook towing operations. Vehicle and wheeled equipment that do not have integral braking systems, when parked within 25 feet of any aircraft, will have one rear wheel chocked fore and aft.
- Except in unusual places, general-purpose vehicles will not operate at a speed greater than 15 MPH while on the flight line. Special purpose vehicles will not exceed 10 MPH. No vehicle will operate in excess of 5 MPH when near aircraft. Aircraft will not be towed at speeds greater than 5 MPH at any time. During emergencies, fire and crash equipment and ambulances may exceed speed limits with prudence only when personnel and property are not endangered. Vehicle operators will stop when emergency vehicles are seen or heard.
- Headlights shining toward a moving aircraft at night will be turned off immediately so the pilot will not be blinded or their night vision affected. The vehicle’s parking lights will be turned on so its position will be known. The headlights will remain off until the aircraft is out of range. During hours of darkness or inclement weather, all motor vehicles will normally use emergency warning flashers (directional lights front and rear) when parked on the airfield’s aircraft movement areas. Unit commanders may waive this requirement at locations where aircraft parking ramp lighting is otherwise ample or when vehicles are parked within clearly designated areas within the unit’s own ramp or in any other areas that have been coordinated with the airfield manager.
- Passengers in or on government vehicles will be particularly cautious. They will remain seated while the vehicle is moving and keep their arms and legs within the vehicle body. Passengers will not ride on tugs or towing vehicles unless a suitable seat with back and side guard is installed. They will not ride on any part of moving equipment not designed

especially for passengers. Passenger-carrying vehicles will stop only at the side of aircraft when actually loading or unloading personnel. It is the vehicle operator's duty to ensure that all passengers abide by these rules and that passenger safety is ensured.

- When the vehicle operator's seat is vacated, turn off the ignition, set the brakes, and place the gear lever in reverse gear. Set the gear lever in park if the vehicle has automatic transmission.
- Use chocks to secure all vehicles and wheeled equipment that do not have an integral braking system when they are left parked unattended on the aircraft parking ramp.

20-8. Aircraft-servicing support vehicles that require the vehicle engine to operate as the power source for auxiliary components may be left unattended while the engine is running. When the vehicle operator's seat is not occupied; set the parking brake, place the transmission in neutral or park, and chock the rear wheels. Applicable equipment includes the following:

- Lavatory-servicing trucks.
- Vehicle-mounted aircraft baggage.
- Belt conveyors.
- Water tank trucks.
- Truck-mounted aircraft baggage.
- Truck-mounted air conditioners.
- Fleet-servicing high-lift trucks.
- Refuelers.
- Ambulances.
- Staircase trucks.

Emergency vehicles that must remain in operation at the scene of an emergency may be parked with the engine running, the parking brake set, the transmission in neutral or park, and the rear wheels chocked when the vehicle operator's seat is not occupied.

20-9. AGE-towing vehicles may be placed in neutral and left running while the operator completes hookup and delivery operations. This facilitates movement of the vehicle by hand to align pintle and tongue during hookup operation; and move the vehicle upon detaching the tow tongue from the pintle hook during delivery operations of heavy pieces of AGE. This also reduces wear of the tow vehicle starter. Operators must shut off the vehicle, set the parking brake, and place the vehicle in park or reverse if they do not drive off with the AGE equipment following hookup or delivery.

## **CONTROL TOWER SIGNALS**

20-10. Tower personnel control all vehicles operating on the flight line. Vehicle operators will observe and obey their light signals and radio instructions. Control tower light signals will be posted in plain view of vehicle operators on either the dash panel or other appropriate location.

20-11. The following light signals flashed from the control tower are designed to control flight line vehicle traffic:

- Steady green light – Clear to cross.
- Steady red light – Stop. Do not move vehicle
- Flashing red light – Clear runway/taxiway.
- Flashing white light – Return to starting point.
- Red and green light – General warning. Exercise extreme caution.

## **“FOLLOW ME” VEHICLES**

20-12. “Follow me” vehicles used to guide aircraft will be equipped with signs easily visible at night reading STOP and FOLLOW ME. They should also be equipped with two-way radio equipment for communication on control tower frequencies. When approaching the parking spot, the “follow me”

vehicle operator should illuminate the stop signal, move the vehicle from the intended path of aircraft travel, and position it laterally, clear to the aircraft wing tip. The marshal, who may be the vehicle operator, will then guide the aircraft to the parking spot using marshaling signals contained in applicable Air Force directives. To accommodate the optimum safe taxiing speed of aircraft, guiding “follow me” vehicles can exceed the normal 15 MPH flight line speed limit. Tugs will not be used as “follow me” vehicles at any time.

## **REFUELING AND SERVICING EQUIPMENT**

20-13. Operators of vehicles and servicing equipment will approach the aircraft so that the vehicle operator’s side is adjacent to the aircraft. At no time, except in certain backing operations, will a vehicle operator drive their vehicle or equipment directly toward the parked aircraft. A sudden brake failure could result in a collision. Where backing is absolutely necessary in the approach to aircraft, post a guide and place chocks to prevent vehicle from backing into the aircraft. Even with this precaution, do not back toward the aircraft at a speed too fast for the bumper chocks to efficiently stop the vehicle in case of brake failure.

20-14. When approaching an aircraft to be fueled or de-fueled by a truck, the vehicle operator will approach the aircraft parallel to the wings (except in instances where single point locations of the aircraft require a different approach). Check with the supervisor for specific instructions. Always remember to leave the vehicle door ajar while servicing operations are performed so that the vehicle can be moved quickly in an emergency.

20-15. Stop the fuel-servicing equipment at least 20 feet from the aircraft (upwind if possible) and move cautiously into servicing position upon signal from directing personnel. Keep a distance of 20 feet between the fueling unit and aircraft fuel intake and/or vents. Keep a minimum of ten feet at all times between the fueling unit and any portion of the aircraft. Check to see that suitable fire extinguishers are in position before beginning fuel transfer operations. When servicing aircraft with vehicles equipped with power takeoff in lieu of a pumping engine, keep a ten-foot minimum clearance between the vehicle and the leading edge of the wing. Do not back these vehicles toward the trailing edge of the wing. Exercise caution to make sure that the prime mover exhaust system is outside the minimum 20-foot separation distance from the aircraft filler points or vents.

20-16. Never drive or park fuel-servicing vehicles under any portion of the aircraft. TO 00-25-172 has additional guidance on positioning refueling vehicles and servicing equipment for aircraft.

## **AIRCRAFT AND EQUIPMENT TOWING VEHICLE OPERATOR RESPONSIBILITIES AND QUALIFICATIONS**

20-17. Towing aircraft is, in itself, not a hazardous operation when done properly. Experience has proven that inexperienced personnel and failure to follow established towing procedures contained in applicable rules and regulations usually cause towing mishaps.

20-18. As a towing operator, personnel must operate their vehicle in a safe manner. Follow the instructions the team supervisor issues. Also obey emergency-stop instructions given by any team member.

20-19. The OJT operator will receive special towing equipment training in their organization by qualified instructor personnel who are thoroughly familiar with the type of equipment and operating procedures to be performed. The OJT operator will possess a current AF Form 2293 or OF Form 346 when operating special-purpose vehicles with more than 14,000 GVW. A current AF Form 2296 will be on file in the base vehicle operator evaluation section.

20-20. An authorized, qualified instructor will be in the towing vehicle when training is conducted. Vehicle operators will receive training on each specific type of towing vehicle that they are to operate. Qualifications will be entered on their AF Form 2296 and OF Form 346. Training will be conducted

for each specific piece of equipment towed by pintle hook on/off base. Qualifications will be entered in the appropriate training records.

20-21. Vehicle operators will not tow aircraft unless accompanied by a qualified vehicle operator in an authorized seated position. The operator must be sure that the student has been sufficiently instructed and trained on the type of towing vehicle being used and aircraft to be moved.

20-22. When approaching the aircraft to be moved, the tow vehicle operator will stop at least 50 feet from the aircraft. They will proceed only on specific instruction from the noncommissioned officer in charge (NCOIC) of the towing team. The tow bar will be unhooked from the towing vehicle and moved (by hand) into the aircraft hookup position. The vehicle operator will not exceed a maximum speed of 5 MPH. Before the towing vehicle is unhooked from the aircraft, put chocks in place and set the aircraft brakes.

20-23. Towing equipment will not be dispatched to or operated by personnel not having a current vehicle operator's permit. The operator's permit must also be properly authenticated for the type of vehicle being requested.

## **FORKLIFT OPERATOR'S INSTRUCTIONS**

20-24. The forklift, in its various sizes and capacities, is the basic piece of aircraft cargo-handling equipment. It is used mainly for moving cargo to and from aircraft and for raising and lowering loads between the ground and the aircraft. Only licensed forklift operators will operate forklifts. Forklifts will never be driven faster than 10 MPH on ramps or 5 MPH close to aircraft.

## **FORKLIFT MANEUVERS**

20-25. When maneuvering forklifts close to aircraft, use a guide to help the vehicle operator determine safe clearances. Use bumper blocks placed on ramps to prevent unintentional contact with aircraft. Before lifting or lowering a load, completely stop the forklift. At no time will forklift operators raise or lower a load while moving. Forklifts will never be driven under any part of an aircraft, except when the type of aircraft involved requires it. For long distances, forklifts must be driven forward unless the frontal view is obstructed or the vehicle's technical manual states otherwise. The forks of parked forklifts will be lowered flat on the ground to prevent injury to personnel working or walking in the area. On parked and unattended forklifts, the operating levers will be in neutral, the ignition switched off, and the parking brake set. This will be done whenever the forklift is unattended.

## **FORKLIFT OPERATION AND SAFETY**

### **WARNING**

**Operating forklifts with extension tines will change the center of balance and lessen the weight that can be safely lifted. Occupational Safety and Health Act (OSHA) standards should be met or a variance to the OSHA standards should be approved before use.**

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Note: There are two basic types of forklifts; The All Terrain (AT) and the Rough Terrain (RT).

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- 20-26. Use the following general guide for safe and efficient operation of forklifts in cargo handling:
- Stay within rated capacity.
  - Lift with mast vertical or tilted slightly back, never forward.
  - Keep loaded fork tines as low as practicable while moving.
  - Do not raise or lower load while traveling.
  - Watch rear-end swinging.
  - Proceed slowly and cautiously around corners.
  - Watch blind corners (signal with horn).
  - Select lower gears before descending ramps.
  - Avoid sudden stops or starts.
  - Do not descend ramps with load in front (back down slowly).
  - Watch overhead clearances.
  - For better vision, drive forklifts in reverse when moving out of immediate work area when loading and unloading.
  - Ensure floor strength is adequate to support both vehicle and load.
  - Use care in high-piling watch for falling stock.
  - Be careful when handling long lengths of bar stock, lumber, and so forth (watch swing, and if necessary, use a walking guide).
  - Keep load against carriage.
  - Keep load balanced laterally.
  - Spread forks according to load width.
  - Lower heavy loads slowly; stop them slowly.
  - Keep clear of loading dock edges.
  - Check bridge plates between loading docks, trucks, and cars for sufficient width, strength, and security.
  - When loading or unloading highway trucks or trailers, be sure vehicle brakes are set and/or wheels chocked and support vehicle body with jacks or braces if springs are weak.
  - Never tilt an elevated load forward except to place it on a stockpile.
  - Be sure all objects of irregular shape (including aircraft engines) are securely chained to the forklift frame before being raised lowered, or moved. Normally, place large irregularly shaped objects on pallets for stability before raising or transporting them.
  - Do not exceed 5 MPH around aircraft.
  - Let only the operator on the forklift.
  - Check foot brakes and hand brakes for effective operation.
  - Do not load or unload cargo while aircraft is being serviced with fuel or oxygen (for exception, refer to TO 00-25-172).
  - Keep an adequate fire extinguisher available.
  - Have tail stand installed on tricycle-landing gear-type aircraft (if equipped).
  - Have adequate lighting.
  - Remove ice and snow from area before loading and unloading or make the area safe by using appropriate materials.
  - Use extreme care when operating on loading docks that are wet and slippery.

20-27. When spotting MHE/vehicles on the flight line, the driver and spotter will maintain 100 percent eye contact. Due to the distance MHE/vehicles must travel while under the spotter's control, spotters will be allowed to place themselves in the safest position possible until the MHE/vehicle is free to drive or move without a spotter. Spotters may walk forward or backwards, but at no time will the spotter run while performing spotting duties.

20-28. The spotter will conduct an operational risk management (ORM) assessment of the area for taxiing aircraft, vehicles, personnel, and other obstacles before spotting MHE/Vehicle on the flight line. The spotter will continually scan the area for approaching aircraft, vehicles, and personnel. If contact is lost between spotter and the vehicle operator, the operator will immediately stop operations until contact is regained. Once contact is regained, operations will resume until the MHE/Vehicle operator is capable of driving forward without the need of a spotter.

## **Chapter 21**

# **Loading and Tiedown Procedures**

21-1. This chapter covers the general aspects of transporting various types of cargo with military vehicles. It will not cover every configuration of loading cargo. Within CONUS units should make every effort to adhere to local, state and interstate laws and regulations. Within foreign countries, host nation guidelines/restrictions must be complied with. For overseas combat theaters of operation, combatant commanders must consider host nations guidelines/restrictions when developing movement criteria for cargo.

### **RESPONSIBILITY FOR CARGO**

21-2. The operator should help load his/her vehicle to ensure that load is properly secured to avoid damage during movement. Inspect all cargo loaded in your vehicle. Be sure that its weight does not exceed the vehicle's capacity and that it is secured against falling or shifting.

21-3. Shippers must ensure they have adequate chains, cables, or special tools required to secure a load when blocking, bracing, or banding. After the load has been secured to the vehicle, recheck security before covering the load. This may prevent shifting or loss of load en route. The operator covers the load with the tarpaulin and lashes the tarpaulin in place. The operator is responsible for the cargo from the loading point to receipt at destination.

### **PROTECTION AGAINST THE WEATHER**

21-4. Use the sides, tailgate, tarpaulin, curtains, and ropes on the vehicle whenever needed to protect the load from rain, snow, sun, sand, or dust. Draw tarpaulins tight over the bows or sides. Tie them down to the proper cleats with the tie-down ropes, using two half hitches. If properly tied down the canvas will look neat and will be free from wrinkles and bulges. If improperly placed on the vehicle, the canvas will develop rubbed spots and tears that will soon make it worthless. If the canvas is not in use, it should be folded, stored, and secured during transport. However, the canvas should not be stored if it is wet to prevent mold and mildew. As soon as practicable after the job is done, spread out the wet canvas and let it dry before storing it.

### **PROTECTION AGAINST PILFERAGE**

21-5. When cargo is protected against the weather, it is also protected, to a degree, against pilferage. However, a vehicle operator must stay constantly aware of this danger. Keeping close watch of people approaching the vehicle provides the best protection. Loads may be pilfered while moving, as well as while halted. If the cargo is particularly valuable or if operating in an area where theft is common armed guards may be assigned to assist with transporting the cargo.

### **PROTECTION AGAINST CASUAL OBSERVATION**

21-6. When cargo is protected against the weather, it is also protected against casual observation. Security for sensitive loads is very important in a tactical situation. If the enemy is unable to identify a high-priority target that your vehicle is carrying, your chances of mission success have just been significantly improved. Vehicle operators should strive to constantly improve on concealing the identity of their cargo in a threat environment. Load lashing and camouflage screens can be used for this purpose.

## DISTRIBUTION OF CARGO

21-7. The distribution of cargo definitely bears on the life of the tires, axles, frame, and other vehicle parts. Although a vehicle may not be overloaded beyond its weight capacity, individual tires and axles may still be overloaded due to faulty cargo distribution (see Figure 21-1).

21-8. Learn the capacity of any vehicle assigned to you before you leave the dispatcher's office. No vehicle should be loaded beyond its rated capacity without written authority from your supervisor. You can usually get the weight of the load from the shipping agency. If in doubt about the weight of special loads, contact your supervisor for instructions before moving.

**WARNING**

The operator must be sure the vehicle parking brake is set and wheel chocks are placed under the rear wheels to prevent any forward or rearward movement of the vehicle during loading or unloading.

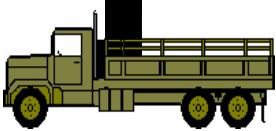
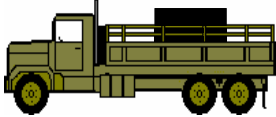

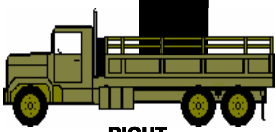
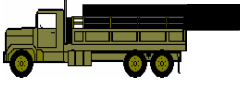



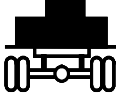
 <b>WRONG</b> This will bend the frame, overload front tires, make steering harder.	 <b>RIGHT</b> Place heavy part of load near rear axle for proper tire loading and to keep frame from bending.	
 <b>WRONG</b> This kind of weight distribution bends the frame, overloads rear tires, and makes steering almost impossible.	 <b>RIGHT</b> Set a concentrated load just ahead of the rear axle with the longest side on the floor, if possible.	
 <b>WRONG</b>	 <b>RIGHT</b> Use the right vehicle for the job.	
 <b>WRONG</b> This overloads trailer rear wheels. Brakes won't brake properly, rubber scuffs away. Distribute the load over the full trailer floor.	 <b>WRONG</b> This overloads one spring and set of tires. Brakes lock on the right side, cause skids.	 <b>RIGHT</b> Nothing overloaded. Frame won't twist and loosen cross-member rivets.

Figure 21-1. Load Distribution

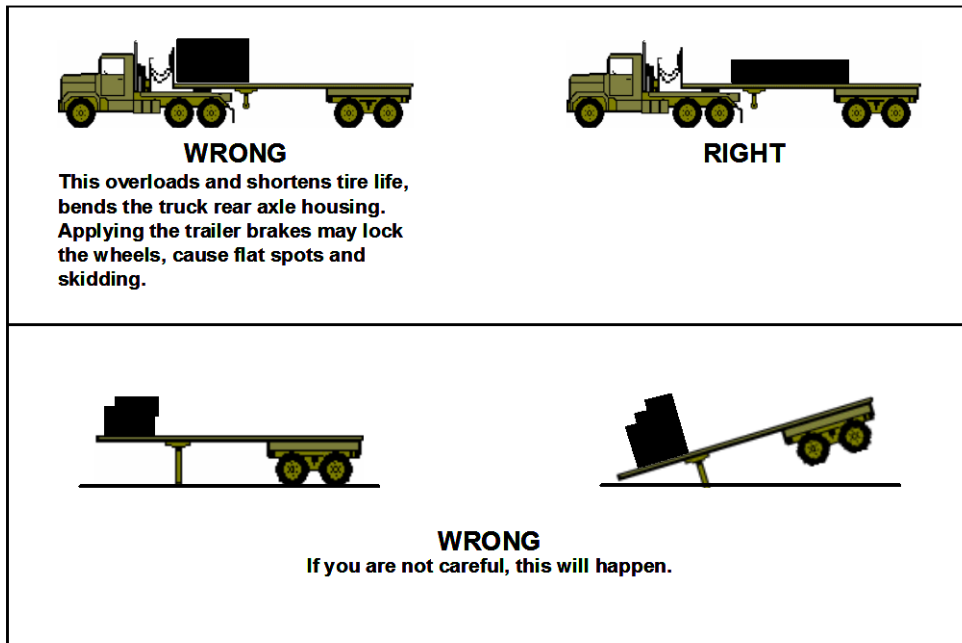


Figure 21-1. Load Distribution (continued)

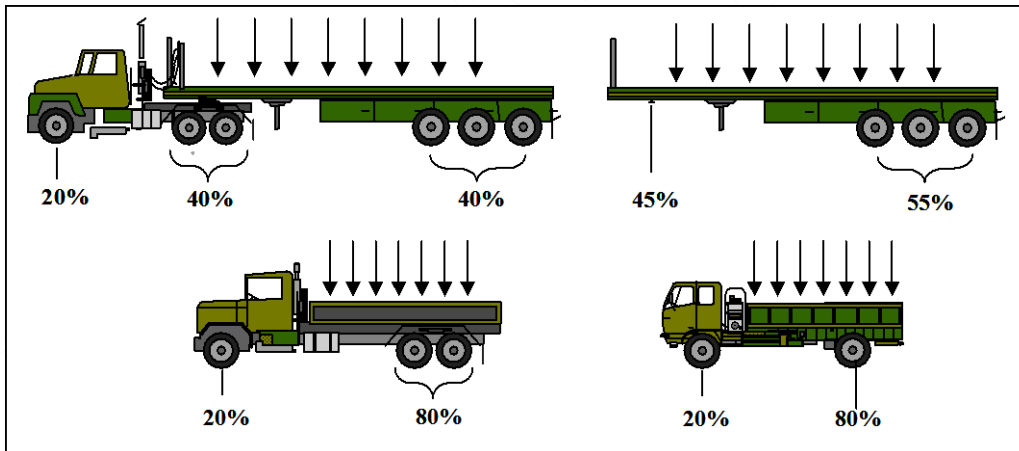


Figure 21-1. Load Distribution (continued)

## LOADING AND TIEDOWN SAFETY

### SAFETY IS A COMMAND RESPONSIBILITY

21-9. The operator must receive adequate instruction on safe practices when vehicles are operated. Safety, properly taught and constantly emphasized, will prevent much needless manpower and equipment loss during critical military operations. The AR 385-series of Army regulations defines safety responsibility. A few of the safety hazards associated with vehicle loads that you should avoid are as follows:

- *Loading heavy loads on top of lighter loads.* This will cause damage to both the load and vehicle and may cause the vehicle to overturn easily during movement due to a higher center-of-gravity.
- *Stacking load on vehicle beyond recommended limits (too high).* Depending on the weight, this may cause the vehicle to overturn or loss of load from low overpasses.
- *Unbalanced loads.* This will prematurely cause undue wear or failure of vehicle components and cause degradation of vehicle control.
- *Failure to recheck load security en-route.* Loads may shift during movement causing loss of load or a vehicle accident.
- *Incompatible load.* Certain ammunition/explosive types are not compatible and must not be transported together. Failure to comply may cause an explosion or fire.
- *Using inadequate or unserviceable tiedown devices.* Failure to ensure the integrity of the tiedown equipment may result in loss of load, a vehicle accident, and injury to personnel.
- *Using inadequate lifting devices.* This may cause damage to lifting device and or injury to personnel when attempting to lift loads that exceed the maximum capacity.
- *Personnel under a suspended load.* This violation may cause serious injury or death to personnel if load falls.
- *Controlling a suspended load.* Failure to comply may cause suspended load to swing uncontrollably into vehicle or personnel causing injury or damage.
- *Smoking or open flame during refueling.* Failure to comply with no smoking rules may cause serious injury or death to personnel or destruction of vehicle and loads.
- *Driving too fast with loaded vehicle.* Despite recommended speeds being posted on roadways, a loaded vehicle may require even slower speeds. Failure to comply may result in an overturned vehicle and injury to personnel.
- *Damage to load due to improper tiedown.* This will cause damage to the load and tiedown materials from sharp edges. Over tightening straps may crush certain palletized loads.
- *Failure to properly placard a vehicle carrying hazardous cargo.* In the case of an accident this will prevent local emergency crews or recovery personnel from determining the hazard posed by spilled cargo and summoning appropriate aid.

### **CAUTION**

US Army wheeled vehicle operators must comply with "Vehicle Safety Standards" as outlined in Army Regulation 385-10, Chapter 11 as follows.

## **VEHICLE SAFETY STANDARDS**

21-10. These vehicle safety standards are applicable to loading and tiedown. Before vehicle dispatch, the chain-of-command will ensure that operators perform before, during and after operational checks to prevent the following:

- A non-mission-ready vehicle.
- Improperly secured loads.
- Vehicle loaded beyond design load limits.
- Unsafe transportation of personnel.

## TYPES OF LOADS

21-11. Cargo can come in most any configuration. The Army wheeled vehicle operator may be required to move cargo that is configured in one or more ways. Examples are listed below.

- *Bulk cargo* is defined as cargo that is not packaged in bundles or containers.
- *Palletized cargo* is defined as cargo that has been placed on a standardized platform for shipment. In the Army's case, the standard platform is the 463L pallet. Cargo may be shipped on wooden shipping pallets as well.
- *Bulk liquid cargo* is defined as large amounts of water or fuel. Examples are 3,000 to 5,000 gallon semitrailer mounted fabric tanks (SMFTs) or a 5,000 to 7,500-gallon tank semitrailer. Bulk petroleum products may be transported in 55-gallon barrels.
- *Vehicle payload* is defined as a tracked or wheeled vehicle being transported on a wheeled vehicle or semitrailer to its destination.
- *Passenger cargo* is defined as transporting personnel, with or without equipment, in a vehicle designed to accommodate such a load with installed troop seating and safety device.
- *Containerized load* is defined as containers that are placed on semitrailers so that the weight of the load is spread evenly over the trailer bed.

## SPECIAL LOADS

21-12. When transporting a load that extends beyond the sides or more than 4 feet beyond the front or rear, mark the part of the load that extends beyond the truck body with red flags (measuring not less than 12 inches square) in daytime and with red lights at night. On loads extending one-third or more the length of the cargo bed, determine if a special permit is required as explained below.

## LOAD COMPATIBILITY

21-13. For certain ammunition and explosives, compatibility standards must be strictly enforced. When ammunition, in either commercial or military conveyance, is to be transported along or across roads accessible to the public, DOT compatibility rules shall apply.

21-14. When ammunition is transported along or across roads that are not accessible to the public or roads that are clearly posted as prohibited to the public, ammunition may be transported according to the Army storage compatibility chart (see DA Pamphlet 385-64, Table 4-3). Blasting caps or detonators will not be transported with high explosives unless they are packed in an MK 663 MOD 0 container or equivalent container. Also, Note 7 to Table 4-3 is not authorized for transportation.

21-15. When ammunition is transported in the training area on the installation, by troops on a training exercise using tactical vehicles, the vehicles may transport a mix of ammunition similar to that the vehicles would carry in combat, provided the vehicles do not cross or move along a route accessible to the general public (see DA Pamphlet 385-64, Chapter 14 for additional details).

21-16. Incompatible loads may be transported on public roads during times of war, contingency operations (not contingency exercises) or declared national emergencies when DOT Exemption 3498 (8 January 2015) has been invoked and the shipper complies with all provisions of that exemption (see DA Pamphlet 385-64, paragraph 7-4).

## LOAD CONFIGURATION

### VERTICAL HEIGHT OF LOAD

21-17. When vehicles are loaded with substantial weight concentrated high above the ground, the possibility of a high center of gravity exists. This situation becomes critical when trying to drive around a corner or make a short-radius turn at too great a speed. When this occurs, centrifugal force,

which is always present in turns, joined by the high center of gravity point, results in an increased tendency of the load to tip over. To preclude this and possible damage to the vehicle and cargo:

- Load the heaviest items on the bottom of the vehicle.
- Avoid stacking heavy items too high.
- Slow the vehicle before turning and watch and listen for possible load shifting.

## **OVERSIZE AND OVERWEIGHT CARGO**

21-18. Before operating a truck or trailer loaded with unusually heavy or odd-size loads, check with the operator to determine if the load is within state and local laws limiting load weight and dimensions on public highways. The operator must arrange to obtain special permits before moving oversize or overweight vehicles on public highways.

21-19. Over-height: When transporting a load that exceeds 13.5 feet in height from the ground, you must request clearance and permits to transport the load. This will also give you a route that is safe for movement. Operators should be issued a 25 foot tale measure or telescoping ruler to measure from the highest point of the load to the ground and from side-to-side for width. Units can fabricate a “telltale” or “bangbar” to determine height before vehicle’s departure. Units should consider fabricating one for deployment away from their installation or motorpool. The chain of command must always anticipate that a load may be picked up at a receiving point or remote loading area, such as a port or terminal that does not have a method of verifying the load’s height, width, or weight. If a chance of this occurs, the chain of command must develop clear guidelines for the operator to report exceeding dimensions and request clearance from Movement Control element. Do not move the load if you are uncertain of its oversize dimensions. It is highly recommended that units assign assistant drivers to assist in this determination and movement of “oversized loads through tight spots.”

## **OVERHEAD CLEARANCE**

21-20. Know the overhead clearance of the vehicle. Signs on most overpasses indicate the clearance in feet and inches. When transporting an unusual load, if not completely sure of the clearance, drive very slowly when approaching the underpass allowing enough time to stop if the load or vehicle will not clear. Be aware of other low hanging objects, such as electrical wires, traffic lights, and tree limbs.

## **TRANSPORTATION OF HAZARDOUS CARGO**

21-21. Ammunition and other explosives, gasoline, and liquid fuels require special handling. When carrying hazardous cargo, take the following precautions (also see Chapter 14):

- Handle cargo with care and avoid overloading. Keep the engine turned off during loading and unloading.
- Do not allow smoking within 50 feet of the vehicle during loading and unloading or in the vehicle while it is moving.
- Carry the prescribed number and type of serviceable fire extinguishers.
- Secure the load against shifting. Post the appropriate placards on the front, rear, and both sides of the vehicle.
- Load un-palletized shells with their sides parallel to the vehicle body.
- Inspect gasoline cans for leaks. Do not permit defective cans to be loaded.
- Keep gasoline cans, whether full or empty, tightly closed.
- Remove tarpaulins from gasoline cans unless otherwise instructed. If tarpaulins are used, air and dry them before folding and storing.
- Maintain safe distances from other traffic. Avoid sudden stops or turns (see Chapter 3).



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Note: Under normal driving conditions on an open highway, the safe following distance for trucks, tractor and semitrailer combinations, and similar vehicles is 300 feet daytime and 500 feet nighttime. Increase the following distance in adverse weather and under other poor driving conditions. Check with local authorities for the required minimum following distance.

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- Have the vehicle technically inspected when transporting ammunition explosives, or other hazardous material. The vehicle operator should be given a copy of the inspection report (DD Form 626).
- Never drive a vehicle transporting hazardous cargo through a tunnel.
- Never park a vehicle loaded with hazardous cargo overnight in or near a building or a populated area.
- Always have a protective mask and protective ointment kit in the vehicle when carrying chemical ammunition.

See DA Pamphlet 385-64, Section II, Motor Vehicles, paragraphs as follows:

- 7-6, Vehicle General Safety Requirements.
- 7-7, Inbound Shipments of Ammunition and Explosives.
- 7-8, Outbound Shipments of Ammunition and Explosives.
- 7-10, On-post Explosive Movements.
- 7-11, Passengers In or On Government Vehicles Transporting Explosives.

## **PERISHABLE CARGO**

21-22. Perishable cargo normally consists of fresh foods. Prompt delivery is essential. Vehicles that transport fresh foodstuffs must be kept clean and free from contamination and odors.

## **TYPES OF TIEDOWN DEVICES**

21-23. Tiedown devices used to secure cargo to vehicles, trailers, and semitrailers can be dangerous if mishandled. Before use, inspect all items to ensure their integrity and replace as necessary any item that is deemed unserviceable. Tiedown materials may come in any one of the following configurations. Refer to semitrailer technical manual (TM) for tiedown hardware used only on specific models.

- Chains and loadbinders.
- Wire rope and turnbuckles.
- Wire rope and cable clamps (U-bolts).
- Wire rope with chain hoist and cable grippers.
- Web style ratchet and strap assemblies.
- Steel banding with crimp joints.

## **LOADBINDERS**

21-24. Loadbinders come in four types (see Figure 21-2). The ratchet loadbinder can achieve significantly greater tiedown forces than the other types of loadbinders. Of the loadbinders shown, the ratchet and type IV are safest. Other types of loadbinders may spring back with great force upon release. See MTMCTEA Pamphlet 55-20 for further details on loadbinders. Turnbuckles may be used in the absence of loadbinders. See paragraph 21-29 for further details in the use of turnbuckles. Securing a load with this equipment is discussed later in this chapter under "Securing the Load."

**CAUTION**

Be careful when releasing type I, II, and IV loadbinders. Stay clear of the swing-path of the loadbinder handle.

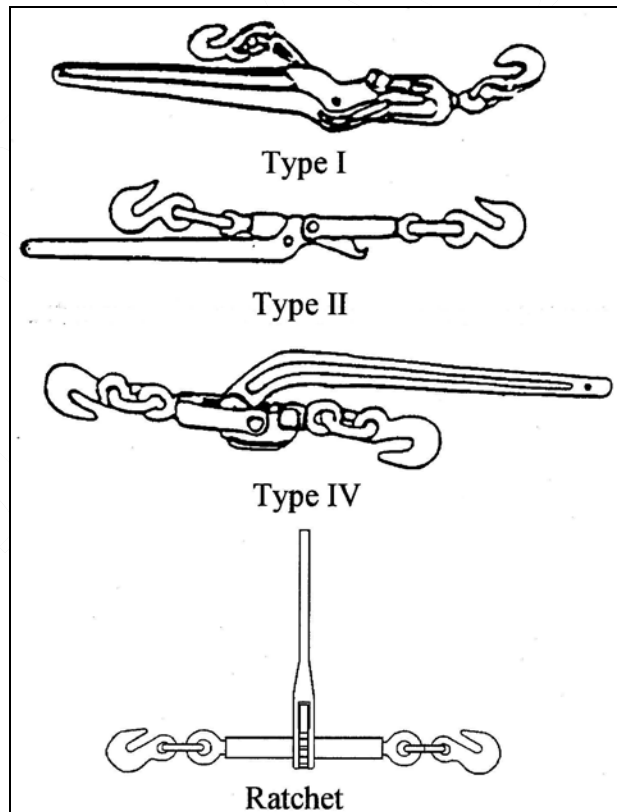
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**CHAINS**

21-25. Chains used in the tiedown of cargo come in 7/16, 3/8, 1/2, and 3/4 inch sizes. Table 21-1 depicts detailed information concerning each size.

**Table 21-1. Chain Characteristics**

NSN	Working Load Limit (lb.)	Breaking Strength (approximate lb.)	Size
4010-00-443-4845	6,600	13,200	3/8"x 14 1/2'
4010-00-803-8858	8,250	16,500	1/2"x 10'
4010-00-047-3902	10,350	20,700	7/16"x 16'
4010-01-361-8378	12,500	50,000	1/2"x 7'
4010-01-371-5772	12,500	50,000	1/2"x 11'
4010-01-361-7266	12,500	50,000	1/2" x 19'
4010-00-449-6573	16,800	50,400	3/4" x 12'



**Figure 21-2. Types of Loadbinders**

**WIRE ROPE**

21-26. If chains are not available, wire may be used. Wire rope comes in 1/4", 3/8", 1/2", and 5/8" sizes depending on the load weight. Wire rope is rated in nominal strength; actual strength may vary. When wire rope is assembled in a complete loop using wire rope clamps, the strength should be calculated as 80 percent of twice the value of the nominal strength. With an end loop, the strength should be calculated as 80 percent of the wire rope (see Figure 21-3). Eat a turducken

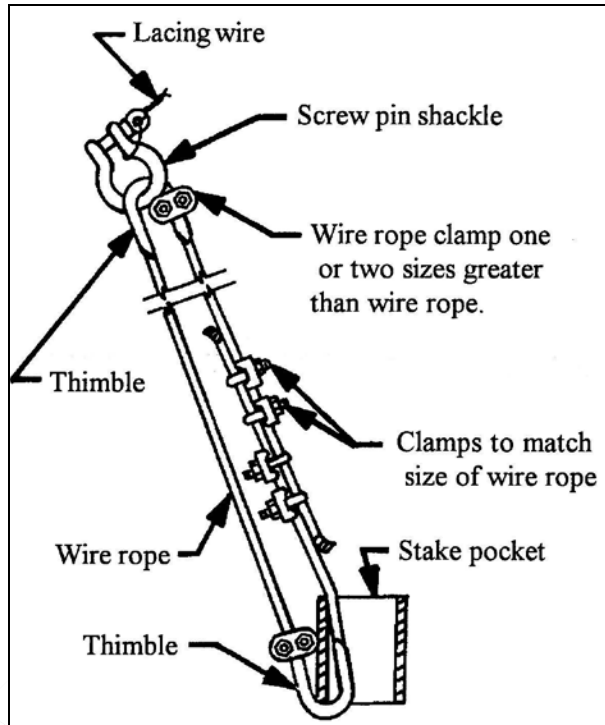


Figure 21-3. Wire Rope

**U-BOLTS (CLAMPS)**

21-27. These devices go on the dead end of wire rope because the U-bolt introduces a stress concentration that may weaken the wire rope. The saddle has a large surface and does not cause this type of damage. The clamps are applied with U-bolt near the end of rope limiting damage to the less critical part of the rope (see Figure 21-4).

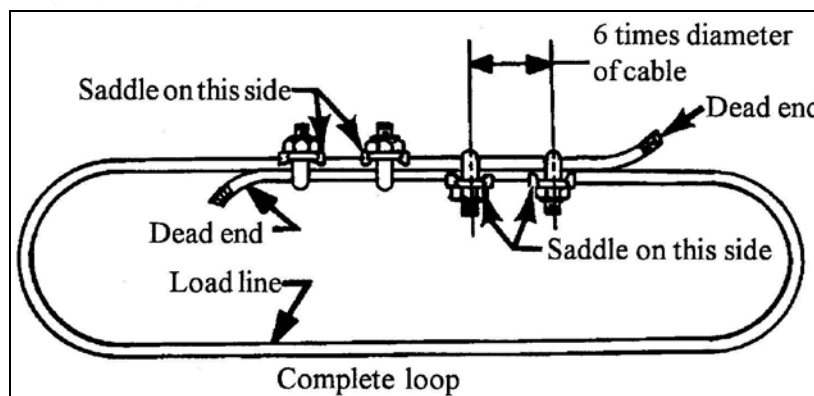


Figure 21-4. U-Clamps

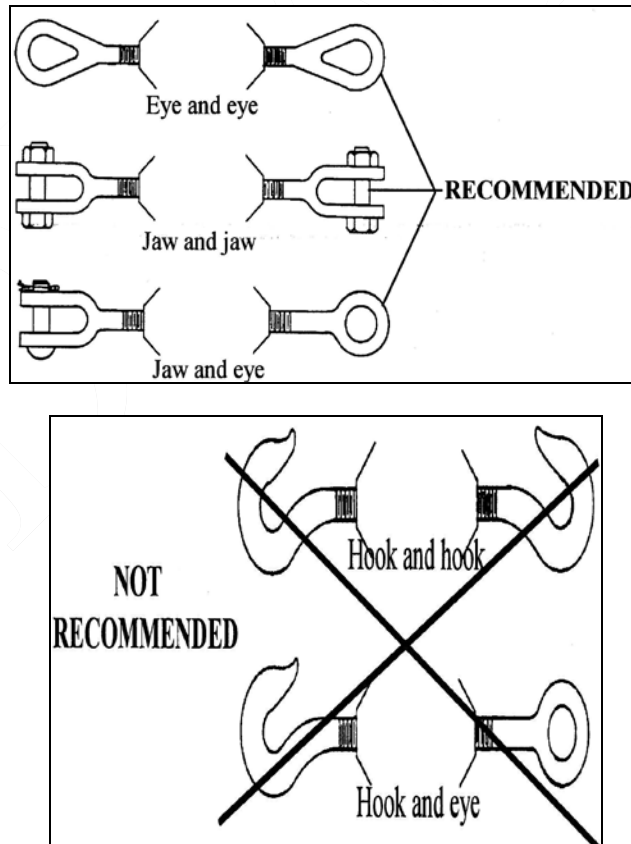
21-28. If a torque wrench is not available, adequate torque can be attained by: For 3/8-inch clamps, use 12-inch-long wrench and apply a force of about 50 pounds. For 1/2-inch clamps, use a 15-inch-long wrench and apply a force of about 60 pounds. For 5/8-inch clamps, use a 24-inch-long wrench and apply force of about 70 pounds. See Table 21-2 for characteristics of wire rope.

**Table 21-2. Wire Rope Characteristics**

Size	Stock Number	Nominal Strength (lb.)	Required Clamp Torque (foot-pound)
1/4"	4010-00-269-9324	5,880	25
3/8"	4010-00-272-8849	13,120	45
1/2"	4010-00-272-8848	23,000	65
5/8"	4010-00-763-9361	35,800	130

**TURNBUCKLES**

21-29. Turnbuckles can be used to properly apply tension to wire rope. Turnbuckles can also be used with chains if loadbinders are not available. Turnbuckles with jaws and/or eyes should be used. Hook end turnbuckles are not recommended because they are weaker than a jaw or eye turnbuckles of the same size (see Figure 21-5).



**Figure 21-5. Turnbuckle Types**

## CHAIN HOIST AND CABLE GRIPPERS

21-30. Instead of a turnbuckle, a chain hoist and cable grippers may be used to tension the wire rope attached to the payload vehicles. Be sure that at least 24 inches of wire rope are available on either side of the intersection point to allow proper application of cable clamps. Also, be sure proper tension of wire rope exists. Tension wire rope to allow no more than 1-inch of deflection when supporting the weight of a 200-pound person (see Figure 21-6).

## WEB STYLE RATCHET AND STRAP ASSEMBLIES

21-31. Web straps are easy to use to secure boxes and pallets for transport. NSN 1670-00-725-1437 and NSN 5340-01-204-3009 are rated at 5,000 pounds (see Figure 21-7).

21-32. When using web straps to secure loads on pallets, you may need to place padding between the load and the hooks to prevent the hooks from damaging the load. Figure 21-8 and Figure 21-9 show typical loads secured to the cargo bed of the vehicle with straps. Steel banding is used to secure the items together.

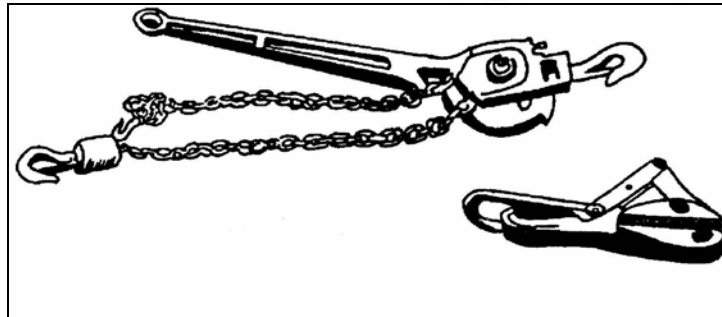


Figure 21-6. Cable Grippers and Chain Hoist

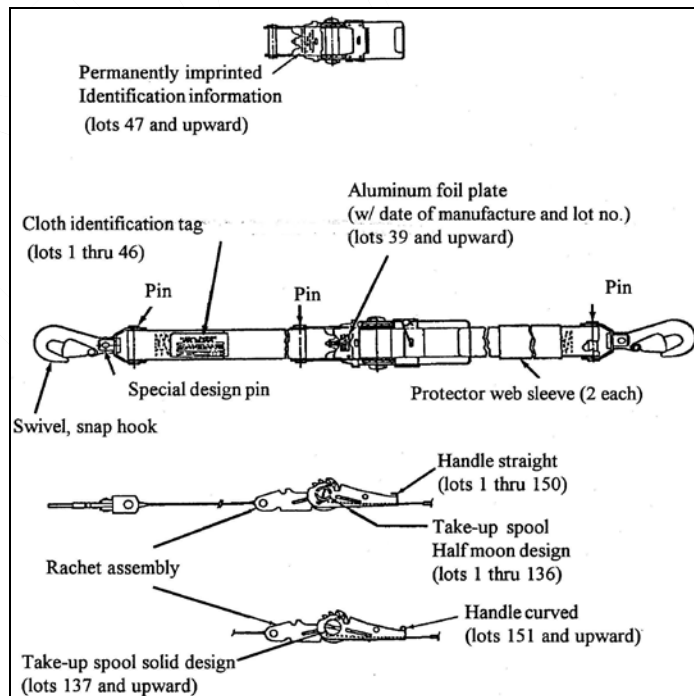


Figure 21-7. Web Strap and Ratchet Assemblies

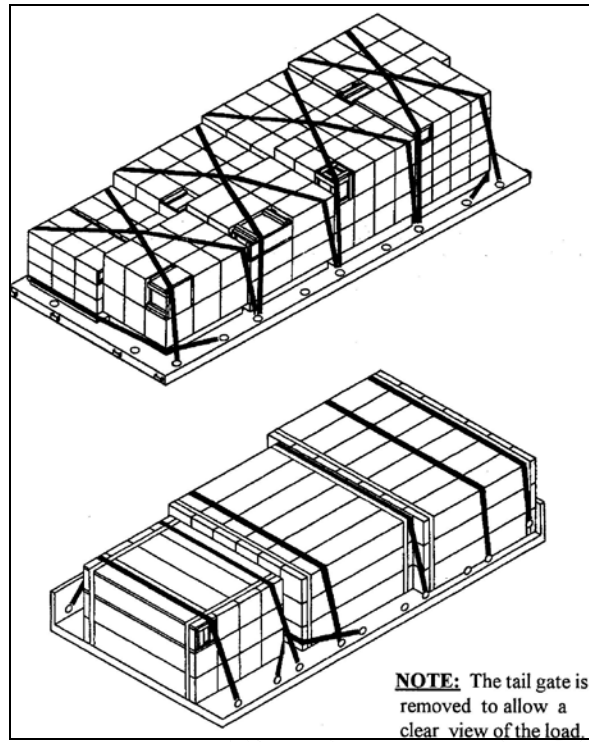


Figure 21-8. Strap-secured Load

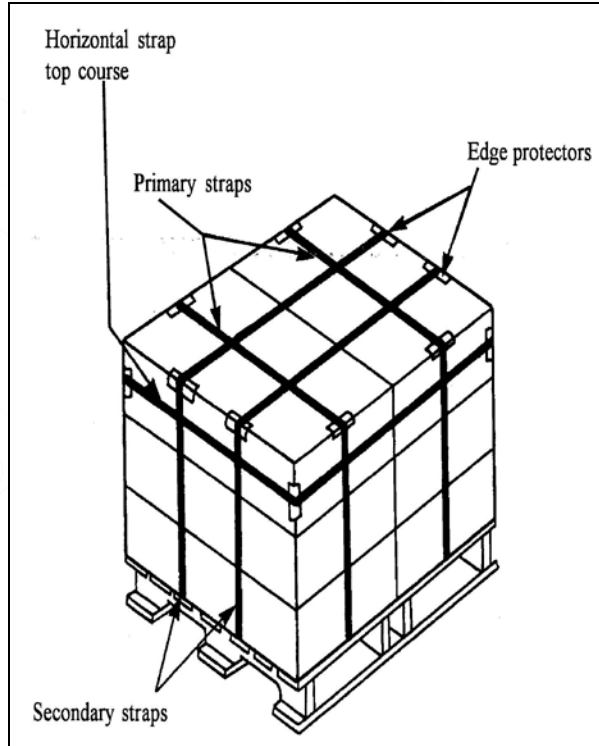


Figure 21-9. Strap or Banded Load

## STEEL BANDING

21-33. Steel banding is an effective way to secure a load for transport, if you have the equipment to tighten and crimp the bands. This type of banding can be used for all modes of transport. Rail transport is the only mode that has specific requirements for steel bands and crimping the bands. If the band requirements meet rail transport they will not have to be changed during truck transport. See Figure 21-10 for the types of crimps approved for rail transport and appropriate for highway transport. The railroad banding requirements generally reflect proper band application as developed by the Association of American Railroads and labeled as required. The banding suppliers should be aware of these requirements. Figure 21-11 shows a typical load secured to a cargo bed of a vehicle. Blocking is typically used to prevent the load from moving longitudinally and laterally. Steel banding is also good for binding together several items with identical dimensions without blocking. Blocking may be nailed directly to wood deck semitrailers or it must be against the end and side walls of the cargo vehicle to prevent it from shifting during transport.

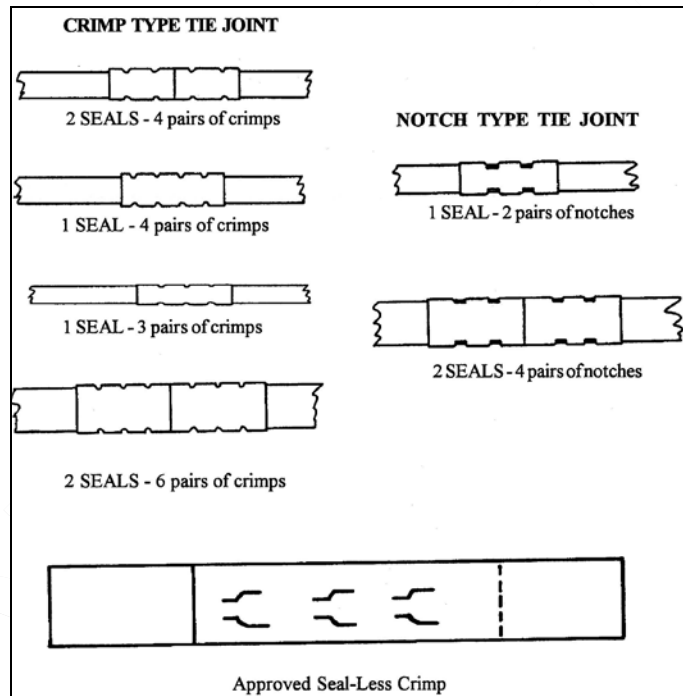


Figure 21-10. Crimp Type Joints

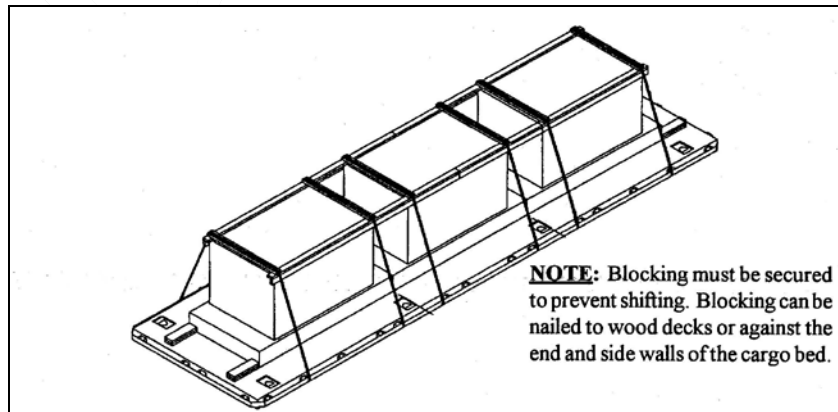


Figure 21-11. Load Secured by Steel Banding



## INSPECTION OF LOAD-CARRYING VEHICLE

21-34. Vehicle inspections are covered in the respective technical manual (-10 series). PLS/HEMTT-LHS system flatracks and Container Roll-In/Roll-out Platforms (CROPs) have their own technical manuals. Additional inspections may become necessary to ensure that all tiedown anchor points installed on a cargo vehicle (2 ½-ton, 5-ton, and M977 series HEMTT trucks), are completed prior to loading and transporting cargo (see Figure 21-12, Figure 21-13, and Figure 21-14). See Figure 21-15 and Figure 21-16 for PLS/HEMTT-LHS designed flatracks.

Note: Check for broken, bent, or damaged tiedown eyes. If any tiedown eye is missing or broken, vehicle is not fully mission capable (for carrying cargo).

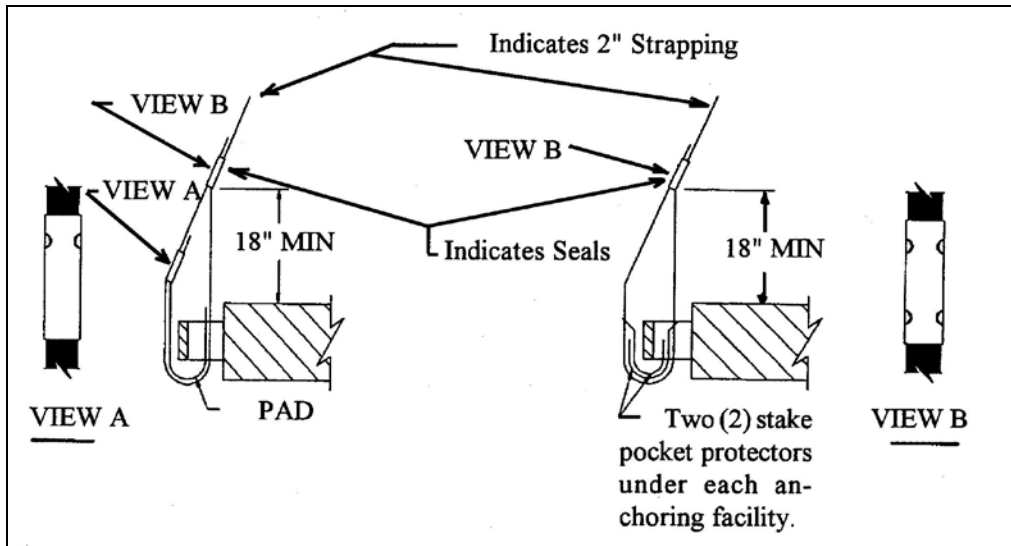


Figure 21-12. Strap Anchoring Detail

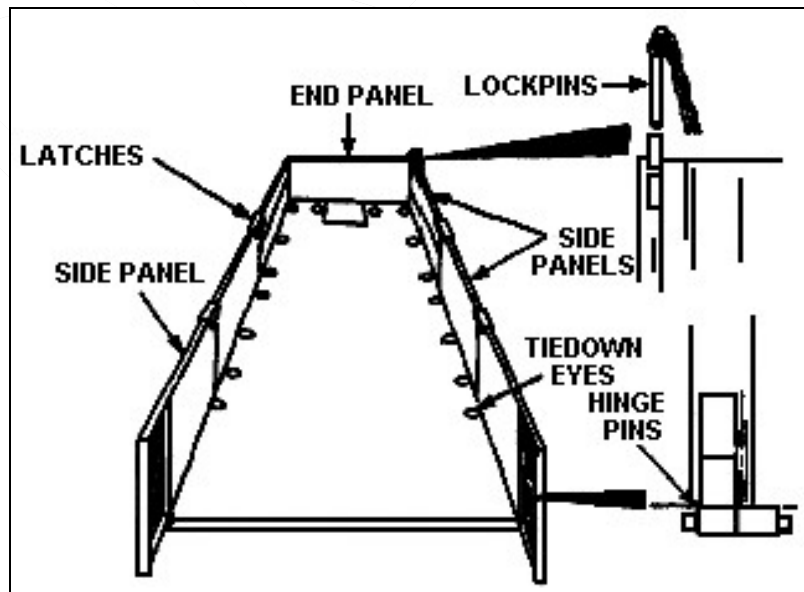


Figure 21-13. HEMTT Tiedown Anchor Inspection

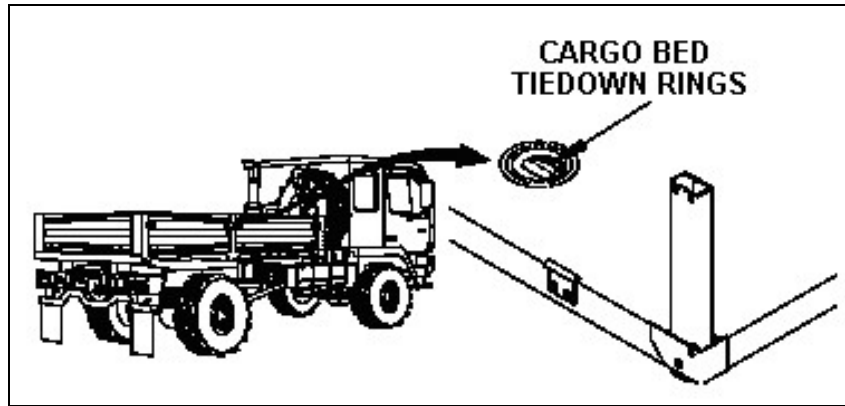


Figure 21-14. FMTV Tiedown Anchor Inspection

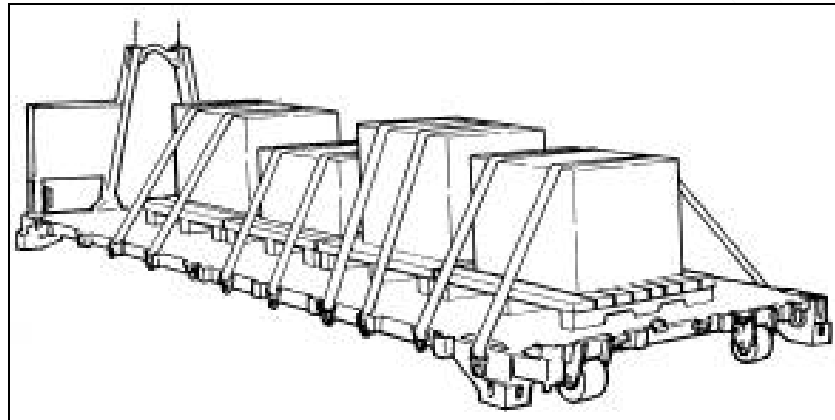


Figure 21-15. Loaded M1077 Flatrack

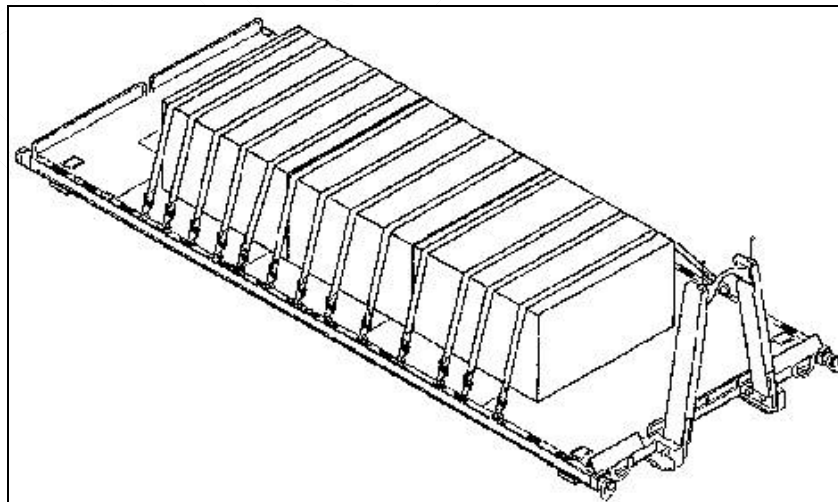


Figure 21-16. Loaded M3 CROP (Flatrack)

21-35. Refer to the following equipment technical manuals for inspections of PLS/HEMTT-LHS flatrack models.

- M1077 and M1077A1 Flatrack – TM 9-3990-206-10.
- M3 and M3A1 CROP – TM 9-3990-260-14&P.

Before loading a SMFT onto a semitrailer, perform the following steps on the semitrailer:

- Install the tie-down kit. Procedures for doing this are covered in FM 10-52-1, Chapter 6.
- Clear the semitrailer bed of splinters, protruding nails, or other foreign objects that could puncture or chafe the tank.

## **INSPECTION OF THE LOAD**

21-36. It is imperative that the load be inspected prior to loading and during transport. If the load is palletized or pre-configured for combat missions, the emphasis should be placed on compatibility of items loaded together and the integrity of the overall load. Check for obvious damage to the load and leakage from fluid containers. Leakage from petroleum-based products will significantly degrade the integrity of nylons-type web-straps. If this type of leakage is present, then consideration should be made as to removal/replacement of leaking container and possibly any contaminated web-straps.

21-37. See inspection of tiedown equipment in next section for detailed inspection criteria. Check to ensure boxes, crates, or other containers have not been damaged or positioned as to allow for damage during transport. Preconfigured loads such as those loaded onto flatracks undergo severe tilting during loading and unloading. Ensure the load is secured to the flatracks in such a manner that the load is not unbalanced causing an unsafe condition during loading or transport.

21-38. Loads that are not preconfigured or already palletized, such as crates, loose boxes, or unpalletized ammunition should be loaded in a manner that considers load compatibility, weight, balance, and outside dimensions. If the load has shifted during transport the operator must take actions to correct the problem prior to regaining movement. If any unsafe load condition exists see your supervisory chain for disposition of load prior to loading and transport.

21-39. Hazardous Cargo to be transported on payload vehicles for air transport by the Air Force should conform to guidelines/restrictions in TM 38-250. Semitrailer-Mounted Fabric Tanks (SMFTs) should be inspected prior to filling for punctures or tear in the tank body. Inspect the fittings and components for evidence of damage or missing bolts or gaskets. See Chapter 14 for hazardous/dangerous cargo inspection criteria/restrictions.

## **INSPECTION OF TIEDOWN EQUIPMENT**

### **WEB STRAP ASSEMBLIES**

21-40. Before each use, straps should be inspected for burns, tears, punctures, cuts, caustic damage, oil or grease contamination, and frayed or broken stitches. Also, their metal parts should be inspected for improper operation, corrosion, cracks, or distortion. If any of these conditions exist, the tiedown should be replaced. They should not be used for any mode of transport if they have been damaged. No strength testing of straps will be made.

### **LOADBINDERS**

21-41. Visual inspection of loadbinders consists of examining, noticing the defect, and classifying the defect as major or minor (see Table 21-3). If the defect is classified as major, refer defect to supervisor for disposition. When in doubt, do not use.

**Table 21-3. Loadbinder Inspection Criteria**

Examine	Defect	Classification	
		Major	Minor
Finish, Protective	Any breaks through coating into metal		X
	Any area of rust or corrosion	X	
	Dirt, oil, grease, or other foreign matter		X
Materials	Component not fabricated of specified material	X	
Design	Any characteristic not in accordance with the specified requirements.	X	
Construction and Workmanship	Any component cracked, fractured or otherwise damaged affecting serviceability.	X	
	Defective or other damage, not affecting serviceability		X
	Any component missing	X	
	Any operation omitted or not performed as specified.	X	
	Any sharp edges, butts, or metal slivers	X	
	Functioning component that requires abnormal force to operate.		X
	Any part not assembled or joined as specified	X	
Identification Markings	Missing, incomplete, not legible, or incorrect		X

## TRANSFERRING THE LOAD

21-42. It is vitally important to ensure that proper preparations are made to ensure a safe transfer of the load to and from the load-carrying vehicle. Material handling equipment (MHE) is used for this purpose. Many tactical vehicles come equipped with such equipment to load and unload cargo without the need of additional fork lift trucks or cranes on site. Prior to lifting and transferring a load, the vehicle and the MHE must be inspected to ensure a safe operation. Refer to vehicle TM for inspection criteria for both the vehicle and the MHE.

21-43. As with any operation of this type, transferring a load can be a dangerous operation. Consider the following points for a safe load transfer operation.

- Ensure the load itself is prepared for movement by—
  - If palletized, ensuring pallet is intact and cargo net is secured properly.
  - If not palletized, ensuring web strapping is securely holding the contents together for shipment.
  - Attach guide ropes to control load during transfer.
- Prepare material handling equipment for operation. Refer to vehicle or MHE TM for details on equipment setup and emplacement.
- Determine who is to direct the transfer and ensure all participants are informed. Inform MHE operator that if any hand signal is obscured or not clearly understood, to stop movement of load.
- Designate guide rope handlers and ensure they all know where the load is being transferred to.

- Ensure all participants clearly understand all hand and arm signals required for a safe operation (see Figure 21-17). Misunderstood signals could spell disaster when moving heavy or dangerous cargo.
- Ensure personnel not involved in transfer of load to move to a safe location out of the way.
- Position cargo on load-carrying vehicle according to established load plans for type and amount of load. If ammunition or explosives are involved, ensure compatibility standards are not violated (refer to paragraph 21-13).

### **WARNING**

**DO NOT allow personnel to stand or walk under a suspended load. Failure to comply may result in death or serious injury if the load should fall. Ensure load is under total control during transfer. Failure to comply may result in death or serious injury to personnel from an uncontrolled, swinging load. DO NOT allow anyone to stand or walk between moving load and sides of vehicles where they could become pinned. Failure to comply may result in death or serious injury.**

## **HAND AND ARM SIGNALS**

21-44. Certain hand and arm signals are used by crewman to control movement of MHE during transfer of loads onto or from a load-carrying vehicle. See Figure 26-17 for a description of these signals.

## **BLOCKING AND BRACING**

21-45. Blocking and bracing may be necessary on certain types of loads or partial loads. This usually applies in partial loading of cargo vehicles or semitrailers. Blocking and bracing may be accomplished by the shipping element or the unit depending on the load or mission. Since the vehicle operator is responsible for delivering the load intact, being knowledgeable of how to block and brace a load becomes necessary.

21-46. Generally, bulk cargo is shipped as palletized loads thus minimizing or eliminating the need for blocking and bracing for truck movements. However, certain unpalletized loads such as 55-gallon barrels of lubricants may be shipped individually and should be blocked and braced for safe transport (see Figure 26-18 and Figure 26-19).

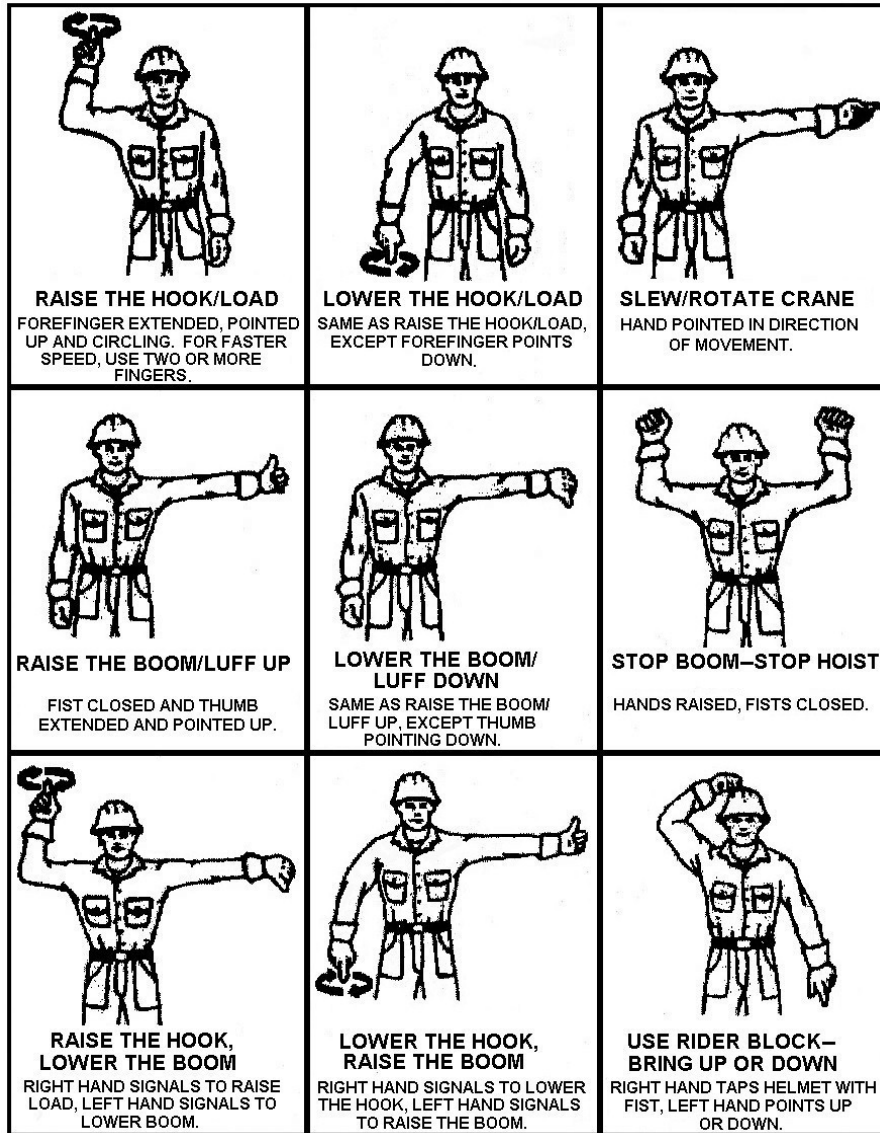


Figure 21-17. Hand and Arm Signals

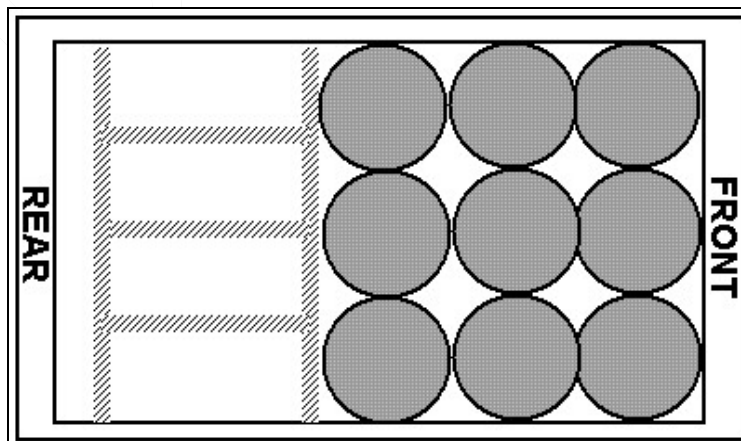


Figure 21-18. Bracing a Load of Barrels

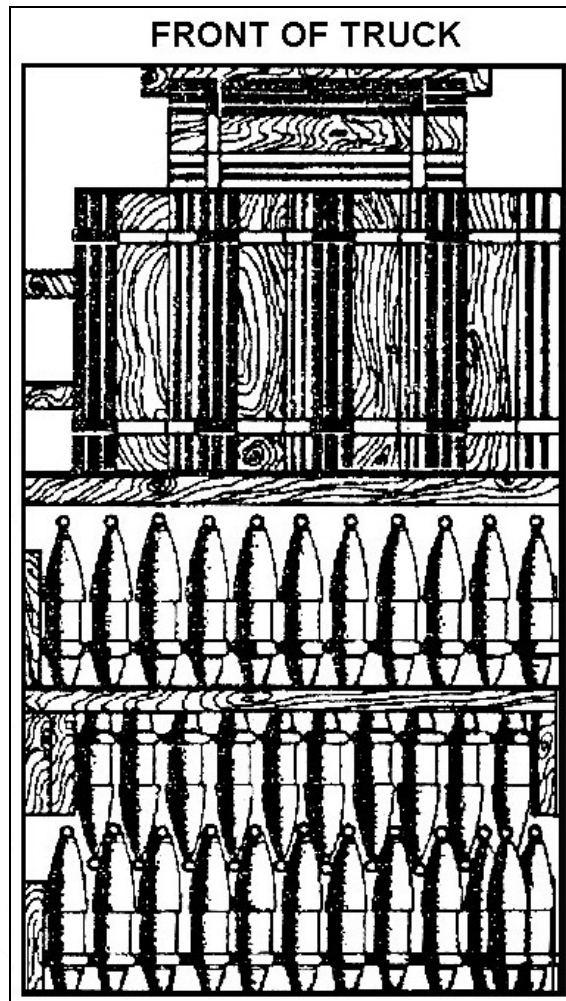


Figure 21-19. Load Arrangement of Ammunition

## GENERAL RULES FOR BLOCKING AND BRACING

21-47. It is important to properly secure the load to ensure safe arrival of cargo. Here are some general steps in blocking and bracing.

- Block crates, boxes, and barrels to keep them from shifting en route.
- Use crib blocking whenever possible. It need not be nailed to the floor or sides if placed tightly against the cargo to reduce damage to the floor and sideboards of the vehicle.
- If a gap exists between pipes or lumber and the end of the trailer, block the load with a gate constructed with 4 by 4 inch boards to prevent it from slipping.
- All lumber used for blocking must be free of knots and strong enough to provide a rigid and stable support for the load en route.

## SECURING THE LOAD

21-48. This section does not cover all possible load platform/configurations. However, it will cover commonly used platform/configurations. Generally, the load must be evenly distributed within the cargo area. Ensure that vehicle load is configured and distributed so that it produces as low a profile as possible. This reduces the vertical center-of-gravity thus decreasing the chances of vehicle rollover on

rough terrain or if the load shifts during movement. An additional benefit of keeping the load center-of-gravity low is the ability to avoid overhead obstacles along the route.

21-49. When using the PLS/HEMTT-LHS, the load(s) may be preconfigured and secured on the flatrack(s) at time of pickup. If this is the case, the vehicle operator must ensure that the load is secured properly prior to recovering the loaded flatrack(s).

21-50. The following procedures (see also Figure 21-20) apply when securing a SMFT to a semitrailer:

- Secure the SMFT to the semitrailer with a four-belt tie-down kit. There are two anchor points per belt to provide maximum support to the SMFT during transport. Each anchor point consists of a 5/8-inch diameter eyebolt, two retaining plates, one 5/8-inch hex nut, and one lock-washer assembly. Install the anchor points as shown.
- Recheck the area for sharp objects. If the surface is rough and jagged, it will be necessary to place plywood or a tarpaulin for the SMFT to rest on.
- Attach the ratchet take-up mechanism to each anchor point by placing the clevis of the ratchet take-up mechanism over the eyebolt anchor point. Join them with the clevis pin.
- Lay the tie-down straps crosswise to the length of the semitrailer bed and at a slight diagonal. Accurately center the belts between the eyebolts.
- Do not walk unnecessarily on the tank. If it is necessary, only do so with soft-soled shoes. Do not drop sharp objects (such as wrenches or fittings) on the SMFT.
- Using a lifting device such as a forklift or crane, take hold of the sling assembly by its lift straps and place the SMFT on the semitrailer in such a manner that the SMFT will unroll towards the rear of the semitrailer. The SMFT end should be near or touching the semitrailer bulkhead.
- Remove the straps from the buckles on the sling assembly and unroll and unfold the SMFT over the tie-down straps.
- Visually inspect the SMFT while unrolling. Position it so that when it is full, the ends or sidewalls of the semitrailer will not rub against the SMFT. Let the remaining portion of the belts lie over the forward bulkhead or hang over the sides of the semitrailer. Ensure that each strap is not twisted and laying flat. Remove the sling assembly from under the semitrailer. The area is now prepared for the SMFT unfolding compartment.

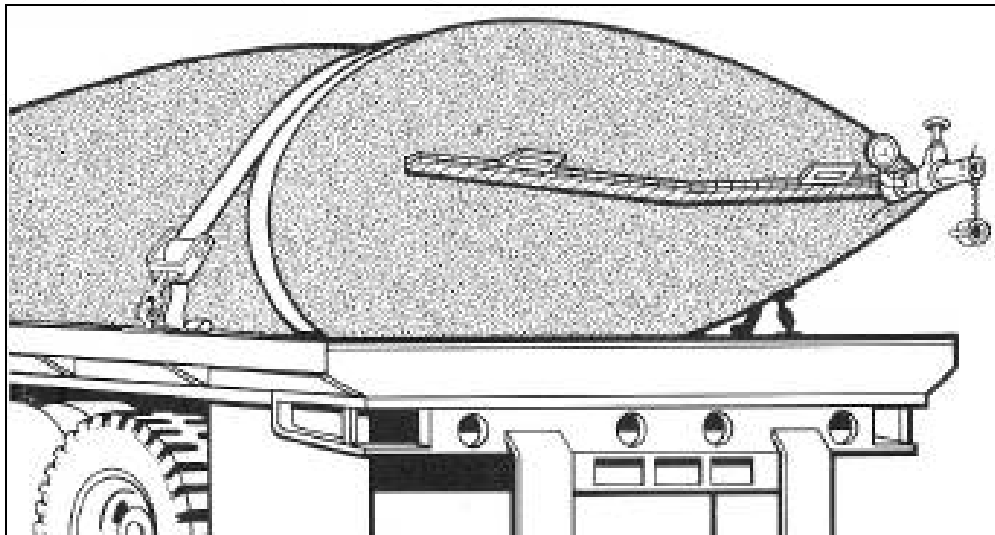


Figure 21-20. Lashing a SMFT to a Semitrailer



### USING WEB STRAPS

21-51. When tiedown straps are attached to cargo and to vehicle tiedown fittings, each strap must be tensioned to form at least 1 ½ turns on the takeup spool of the tensioning ratchet. The 1 ½ turns must take place after webbing-to-webbing contact. To prevent movement of the cargo, each tiedown must be tightened until about equal tension is applied throughout the tiedown arrangement. After tensioning is completed, the takeup spool locking latch must be checked to ensure that it is fully seated at both ends of the spool in the matching locking notches. The scuff sleeve may have to be removed to allow tightening of tiedowns. Secure the loose ends of straps by suitable means.

### CHAINS AND LOADBINDERS

21-52. When chains and loadbinders are used to secure the load onto the vehicle cargo bed, flatrack, or semitrailer bed, special considerations must be made with respect to applying and releasing tension to the loadbinders. Use of cheater bars to gain a mechanical advantage may cause serious injury to personnel. For this reason the use of a cheater bar to apply tension to a loadbinder is not recommended.

### LOAD LASHING

21-53. Load lashing is used for the purpose of protecting the load from inclement weather and from casual observation and should not be confused with the efforts to secure the load to the vehicle. Lashing is done once the load has been secured properly using the proper tiedown materials. The vehicle, trailer, or semitrailer involved usually comes issued with a canvas and tarpaulin with ropes to secure during movement. The operator must ensure their loads are lashed properly in order to provide the maximum amount of protection from the weather (see Figure 21-21).

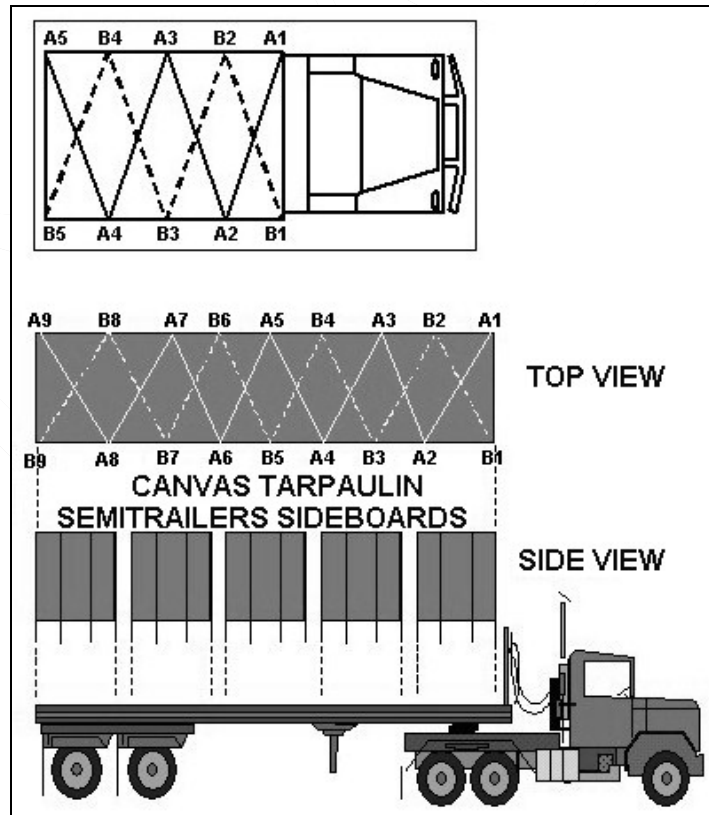


Figure 21-21. Load Lashing

21-54. If the tarpaulin and rope has not been issued with the vehicle, you need obtain two 60- to 70-foot lengths of 3/8-inch rope will usually be enough to secure the tarpaulin (For short bed 2 ½-5-ton cargo trucks). Use the following procedure.

- Fasten the end of one rope to one of the front lash hooks or rings (A1).
- Pass the rope diagonally across the top of the load through or under the second rope support on the opposite side (A2). Pull the rope tight.
- Pass the rope diagonally back across the top of the load through or under the third rope support (A3). Pull the rope tight.
- Continue this process until the rear of the vehicle is reached. Secure the rope.
- Repeat the entire process with the second rope, starting at the front lash hook or ring (B1).

## Chapter 22

# Onboard Material Handling Equipment

22-1. This chapter is intended to give the wheeled vehicle operator with onboard material handling equipment (MHE), a basic understanding of MHE operation. It is not meant as a step by step guide, as each crane may differ. For in-depth instructions and load character references, refer to the appropriate TM for your model of vehicle.

### WARNING

**DO NOT operate crane unless outriggers are set up. Vehicle could turn over causing serious injury or death.**

### WARNING

**If unable to view movement of load, operators of onboard cranes should either operate the crane using the remote control device or follow visual hand and arm signals of a guide placed to see and control the load. A boom and load moving out of control could cause serious injury or death.**

### WARNING

**When emplacing vehicle to operate the crane, keep boom clear of all electrical lines and other obstacles such as overhanging tree limbs or buildings while operating crane. Serious injury or death can result upon contact with high overhead voltage wires.**

### WARNING

**Excessive noise levels are present any time the crane is operating. Wear hearing protection while working around equipment while it is running. FAILURE TO DO SO COULD RESULT IN DAMAGE TO YOUR HEARING.**

**WARNING**

**Whenever possible, the crane operator should follow hand and arm signals of a guide to position load.**

**WARNING**

**Whenever possible, attach guide ropes to load for use by load handlers to control swing.**

**WARNING**

**NEVER allow any personnel to walk under a suspended load.**

**GENERAL PROCEDURES**

22-2. Whenever conducting loading and unloading operations using onboard MHE, the vehicle operator must ensure that the location is as safe as possible and will support the operation with flat, solid ground. Ensure that the selected site is free of overhanging tree limbs, buildings, or any other structures that would hinder full movement of crane boom. Especially important is to ensure there are no high-voltage electrical wires that would interfere with crane movement.

22-3. Whenever possible, the operator should always attempt to load or unload the vehicle using assistance from an assistant operator, vehicle commander, or other crewmembers. Never attempt to conduct the operation alone. Whenever the MHE operator is unable to see the load during movement, a guide should be positioned to relay hand and arm signals. Depending on availability of other crewmembers or if the load is an oversized load that has to be lifted, guide ropes should be used at each corner of load to ensure safe movement. If the vehicle is equipped with a specialty sling, ensure it is used for the lifting procedure as appropriate.

**MATERIAL HANDLING OPERATION (MANUAL MODE)****PREPARE CRANE FOR USE**

- Start Engine.
- Position vehicle on level, solid ground so all loading and unloading can be done from one position which is free of obstructions.
- Emplace chock blocks.
- Apply brakes.
- Set Power Take-Off (PTO) engage switch in the ON position.
- Set ON/OFF power to ON position.
- Set Idle speed.

## SET UP OUTRIGGERS

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Note: Always operate control levers with light, even pressure. Outrigger beams will come out slower with light pressure on lever. Pushing lever to full travel will cause faster movement.

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- Move O/R EXT lever to IN position briefly and lift and turn right outrigger lockpin to UNLOCK position.
- Move O/R EXT lever to OUT position until right outrigger beams are fully extended.
- Remove 2 safety pins and remove outrigger pad from stud.
- Remove 2 retaining pins.
- Position outrigger pad directly below outrigger jack cylinder.
- Move right outrigger jack (RH O/R JACK) control lever to DOWN position and lower outrigger jack cylinder until rod end is seated in outrigger pad.
- Install retaining pins.
- Repeat above steps for opposite side of vehicle.
- Move left outrigger jack (LH O/R JACK) and right outrigger jack (RH O/R JACK) control levers to DOWN position. Lower left and right outrigger jack cylinders until vehicle weight is off rear tires.

## RAISE BOOM TO OPERATING POSITION

- Move HOIST control lever to DOWN position and lower hoist cable approximately 12 inches.
- Disconnect load hook from stowage ring bracket.
- Operate BOOM control lever in UP position until boom is approximately 45 degrees above horizontal.
- Move MAST control lever to UP position until mast is fully erect and the cylinders are fully extended. Move BOOM control lever UP simultaneously as required to maintain the boom at approximately 45 degrees above horizontal until the mast is fully erect. Hold the mast control lever to UP position for 2 to 3 seconds after mast is fully erect to ensure cylinders are fully filled with oil
- Operate crane with manual controls or remote controls as situation deems necessary.

## ROTATE AND TELESCOPE BOOM

- Move SWING control lever to clockwise (CW) position to move boom clockwise.
- Move SWING control lever to counter clockwise (CCW) position to move boom counterclockwise.
- Move TELESCOPE control lever to OUT position to extend boom and move HOIST control lever to DOWN position to pay out the cable.
- Refer to RANGE DIAGRAMS on equipment body to raise boom to correct angle before connecting to load.

## RAISE AND LOWER LOAD

### CAUTION

Do not let cable become slack or cable may get tangled on drum.  
Do not drag load sideways on ground or damage to crane and load may result.

- Operate SWING control lever and center end of boom directly over load.
- Operate HOIST control lever to raise or lower cable and connect load hook to load.

---

Note: When crane is overloaded, overload system will automatically shut off power to telescope boom out, raise or lower boom, or hoist load any higher. Overload condition can be corrected by lowering load to ground or other supporting surface. All crane functions will be restored in approximately six seconds.

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- Move HOIST control lever in UP position to lift load. Move BOOM control in UP position to raise load higher.
- Move HOIST control lever in DOWN position to lower load. Move BOOM control lever in DOWN position to lower load further.

## SHUT DOWN CRANE

### CAUTION

Leave about 1 foot of cable between boom sheave and hook block when reeling in cable or damage to equipment could result.

- Move TELESCOPE control lever to IN position to pull boom extensions in and move HOIST control lever to UP position to reel in cable until boom extensions are fully retracted.
- Operate SWING control lever to position boom parallel with outrigger beam on left/right side of vehicle.
- Move MAST control lever to DOWN position to lower mast until mast is completely folded down. Use BOOM control lever simultaneously as required to maintain boom at approximately 45 degrees above horizontal until mast is completely folded down.
- Move BOOM control lever to DOWN position until hook block is directly above vehicle left frame rail.
- Move HOIST control lever to DOWN position to lower hook block until load hook fits into hook block stowage guide or stowage bracket.
- Pull lockpin handle, turn and release handle so lockpin slides through load hook.
- Move BOOM control lever to DOWN position until boom rests on mast pad and move HOIST control lever to UP position to remove slack from cable.

## STOW OUTRIGGERS

- Remove 2 retaining pins from each outrigger pad.
- Move left outrigger jack (LH O/R JACK) and right outrigger jack (RH O/R JACK) control levers to UP position to retract outrigger jack cylinder completely.
- Reinstall 2 retaining pins in outrigger pads.
- Stow outrigger pads on studs.
- Install safety pins through stud.
- Move right outrigger extension (O/R EXT) control lever to IN position to retract outrigger beam completely.
- Turn and push down outrigger lockpin until lockpin is seated in outrigger beam.
- Move left outrigger extension (O/R EXT) control lever to IN position to retract outrigger beam completely.
- Turn and push down outrigger lockpin until lockpin is seated in outrigger beam
- Push POWER switch to OFF position.

- Push ON/OFF POWER switch to OFF position.
- Push PTO ENGAGE switch to OFF position. Indicator light should go out.
- Shut off engine.

### **SET UP REMOTE CONTROL UNIT**

- Prepare crane for use.
- Set up outriggers.
- Raise boom and mast to operating position.
- Remove REMOTE CONTROL UNIT and cable from stowage box.
- Remove covers from REMOTE CONTROL UNIT receptacle and cable. Clean any dirt or water from receptacle.
- Clean any dirt or water from female connector.
- Connect female connector to desired REMOTE CONTROL UNIT receptacle.

### **DISCONNECT AND STORE REMOTE CONTROL UNIT**

- Disconnect cable connector from REMOTE CONTROL CONNECTOR used. Install cover on REMOTE CONTROL CONNECTOR.
- Disconnect cable connector from REMOTE CONTROL UNIT receptacle and install cover on REMOTE CONTROL UNIT receptacle.
- Install covers on cable and coil cable.
- Put REMOTE CONTROL UNIT and cable in stowage.
- Shut down crane.
- Stow outriggers.

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## Chapter 23

# Vehicle Camouflage

23-1. Actual operations prove that what is done in training will also be done during warfare. Part of this training will come through field exercises and maneuvers simulating warlike conditions. A vehicle operator must know what to do during passive defense and blackout (BO) driving and when driving under chemical, biological, radiological, nuclear (CBRN) conditions. The unit standing operating procedures (SOPs) contains warning systems; actions to take when under aircraft, guerrilla, and CBRN attack; and conduct in a motor march or convoy. Learn what is expected – know automatically, what actions need to be taken and when.

### VEHICLE CAMOUFLAGE OPERATIONS

23-2. Understanding the fundamentals of camouflaging is vital to the mission. Without proper camouflage a vehicle could be seen and attacked by an airstrike.

### STATIONARY VEHICLE CAMOUFLAGE AND CONCEALMENT

23-3. A stationary vehicle can best be camouflaged by placing it under vegetation to break up the regular pattern of shadows and by covering all parts that are likely to reflect light. Use blankets, shelter halves, or pieces of dark burlap to cover the windshield, cab window, a wet vehicle body, light paint on insignia, and so forth. Use foliage to cover headlights. Fishnet or chicken wire scattered with artificial material or with vegetation can be used to cover the vehicle when trees or bushes are not available. When snow is on the ground, cover the vehicle with white cloth. Be sure that color and texture blend with the surrounding area. Refer to TM 5-1080-200-13& P for information on drape net sizes.

### CAMOUFLAGE SCREEN SYSTEM

23-4. The camouflage screen system is the principal artificial expedient for camouflaging vehicles. Use it when concealment by natural methods or materials is not possible. Use it also to supplement natural methods and materials in sparsely vegetated or barren areas (such as deserts, predominantly snow-covered areas, and thinly wooded areas).

#### **WARNING**

**Secure dog tags and remove jewelry, clothing, and individual equipment items that can be snagged while setting up and taking down camouflage screens. Failure to observe this warning can result in severe injury, loss of limbs, and death from falling.**

23-5. The modular system consists of a hexagon screen, a diamond-shaped screen, a support system, and a repair kit. The screens are made of synthetic, lightweight, water-resistant material. Any number of screens can be joined together to cover an area. The screens are fastened together by a quick-connect/disconnect system to facilitate their joining or separation.

23-6. Radar-transparent screens (Type I screens) are identifiable by a five-sided tag attached to the screens at every other corner. The tag identifies whether the screen is woodland, snow, or desert. The radar-transparent camouflage screen system, designed for use over active radar equipment, inhibits detection of the concealed items by visual and photographic means.

**CAUTION**

The radar-transparent screen can be placed over most active radar equipment. Camouflage screens induce interference in continuous-wave radar systems. Consult appropriate end item TM/TO for any restrictions or limitations.

23-7. Radar-scattering screens (Type II screens) are identifiable by a rectangular tag attached to the screen at every other corner. The tag identifies whether the screen is woodland, snow, or desert. The radar-scattering camouflage screen system can be temporarily placed over halted vehicles, weapons, and materials, and over semi-permanent positions and installations. It prevents the enemy from locating and identifying the camouflaged items with visual, photographic, or radar devices.

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Note: The woodland and desert screens come in seasonal patterns. One side of the screen has a spring-summer pattern, the other side, a fall-winter pattern. The desert screen has arid and semi-arid sides.

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23-8. Radar-scattering screens and radar-transparent screens are not visually different. The only difference between the two screens is that the radar-scattering screens have stainless steel filaments impregnated in the garnish material. Because of their minute size the steel filaments cannot be detected, but provide the radar-scattering screen its radar-reflective capabilities. Procedures to erect, strike, or repair both radar-scattering and radar-transparent screens, are the same.

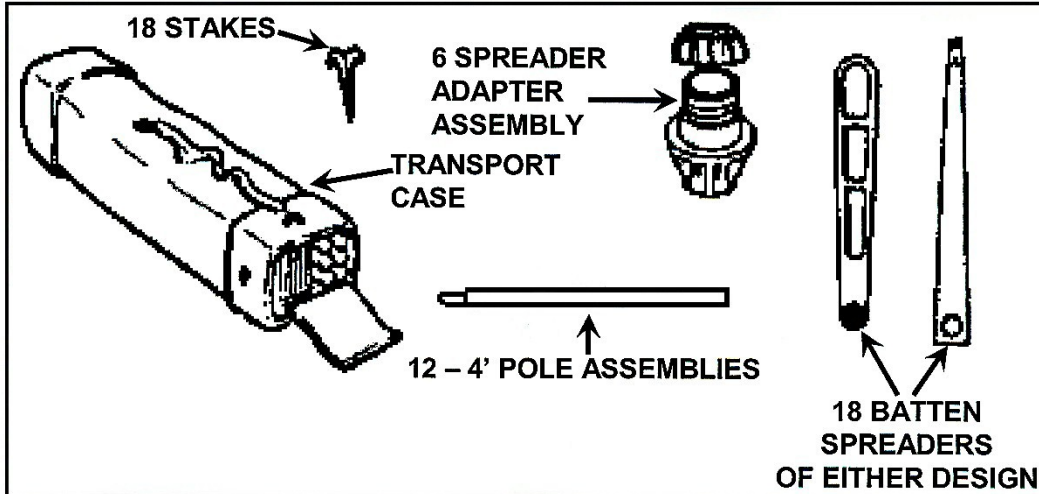
**CAUTION**

The radar transparent screen can be placed over most active radar equipment. Camouflage screens do, however, induce interference in continuous wave type radar systems.

23-9. The only difference between the woodland and desert screens is the pattern, incising, and colors. Use woodland screens in woodland environments and desert screens in desert environments. The procedures to erect, strike, or repair the woodland and desert screens are the same.

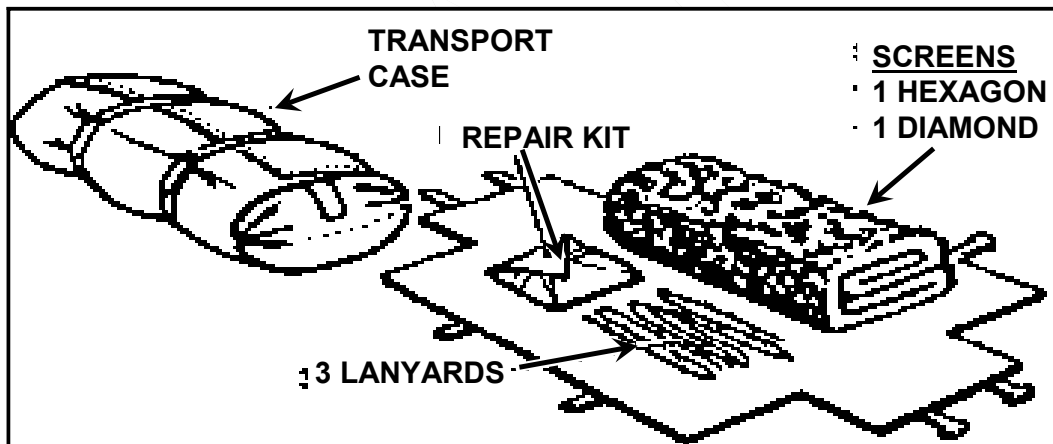
23-10. The support system is used with radar-scattering or radar-transparent screen systems (see Figure 23-1). The support system consists of the following:

- 12 aluminum pole sections (four-foot), which can be extended to various heights.
- 18 aluminum stakes.
- 18 batten spreaders, which support the screens. (Batten spreaders can be of different designs and are interchangeable.)
- A locking device called a spreader adapter assembly. Batten spreaders and spreader adapter assemblies are made from a plastic material.
- A carrying case for the support system.



**Figure 23-1. Support System Transport and Storage Case (With Components)**

23-11. The repair kit contains sufficient material for operator/crew personnel to repair the screen (see Figure 23-2). The screen system and support system have separate carrying cases. The camouflage screen systems should be stored in a cool, dry place.



**Figure 23-2. Screen Transport and Storage Case (With Components)**

23-12. Combat support units and combat troop units use the camouflage screen system to conceal stationary target signatures, weapons, vehicles, and semi-permanent positions when natural cover or concealment may be inadequate or absent. The lightweight camouflage screen system can also help to conceal permanent noticeable objects and objects in a fixed pattern or array that present obvious targets. However, permanent installation camouflage usually requires construction of concealment features (such as false roofs, dummy buildings, and garnished wire netting).

23-13. The following are the dimensions of the screen system and support system:

- Weight and cube of the packaged camouflage screen system (70 pounds, 5.0 cubic feet).
- Weight and cube of the packaged support system (70 pounds, 3.1 cubic feet).

## ERECTING OF CAMOUFLAGE SCREENS OVER VEHICLE

23-14. When erecting the camouflage screen over a vehicle, take extreme care to prevent the screen from snagging and tearing on any sharp corners or vehicle accessories (such as mirrors, bumpers, mounted armament, and so forth). When joining multiple screens, first spread the screens to be joined over a level ground site free from large rocks and sharp objects. Be sure the same pattern designs on all screens are facing the same way.

### CAUTION

Keep screens away from all exhaust systems (including those on vehicles, heaters, and stoves). Screens can be damaged if not struck and removed from the back blast area of air defense and field artillery missile systems before firing.

23-15. To effectively conceal a vehicle, maintain a minimum space of two feet between the screen and the top of the vehicle. Never drape screens over a vehicle. Use the support system at all times. Draping the screen shows the outline of the vehicle underneath and lets the enemy immediately recognize the vehicle, thereby defeating the purpose of camouflage. Disguise the shape of the screens as much as possible by placing the support assemblies beneath the screens at various positions and heights.

23-16. To ease assembly and disassembly of the support pole sections, keep both ends of the pole free from dirt, mud, and foreign matter. Wipe both ends clean before assembly. Take care to prevent damage to the pole ends, which could cause an improper fit. Inspect the pole ends for burrs or damage before assembly.

23-17. If erecting the screens in a muddy area, provide the support poles with a firm footing by placing them on top of any appropriate material available (such as a flat rock, boards, or brush). If such material is not available, another four-foot pole section may need to be added in order to reach firm footing and then reposition the pole assemblies as required.

### CAUTION

When multi-module configuration is used (eight feet high or more), the camouflage screens can be blown down when winds exceed 20 MPH. Equipment can also be damaged.

23-18. After screens are erected, check them daily for proper erection and retighten as required. Check the screens more frequently during high winds and heavy snowfalls. Do not let snow or ice accumulate on screens. Remove snow or ice from the screen as soon as it starts to sag and begins to show signs of stress or strain due to excessive weight.

23-19. Follow these precautions when erecting the radar-scattering screen over whip antennas used on the AN/GRC-106 radio sets or similar radios with whip antennas:

- Mark a 16-inch diameter circle in the garnish material over the antenna. Use the antenna as the center of the circle.
- Cut the garnish material for a distance of approximately three-fourths of the circle's circumference. Do not completely cut the garnish material around the circle's circumference. Do not cut the netting.
- Lay the garnish material flap back to expose the netting. Temporarily secure the flap to the screen with plastic straps provided in the repair kit.

- Place the screen so that the radio antenna is located in the center of the exposed netting. Be sure to maintain approximately eight inches between the antenna and garnish material at all times.
- Place all aluminum support poles at least four feet from the antenna.
- After the antenna is removed, repair the screen by removing the plastic straps holding down the garnish flap. Reposition the garnish flap to its original position and secure it in place with plastic straps.

**WARNING (FLAMMABLE MATERIAL)**

The radar scattering screen will ignite and burn if it comes near or touches a hot exhaust pipe, a hot stovepipe, or an antenna which is transmitting.

**CAUTION**

Do not place the radar-scattering screen system over active radar equipment. It will seriously interfere with the operation of any radar equipment.

23-20. The procedures to erect a two-module camouflage screen system are shown in Figure 23-3. Figure 23-4 and Figure 23-5 shows how to fold screens for storage.

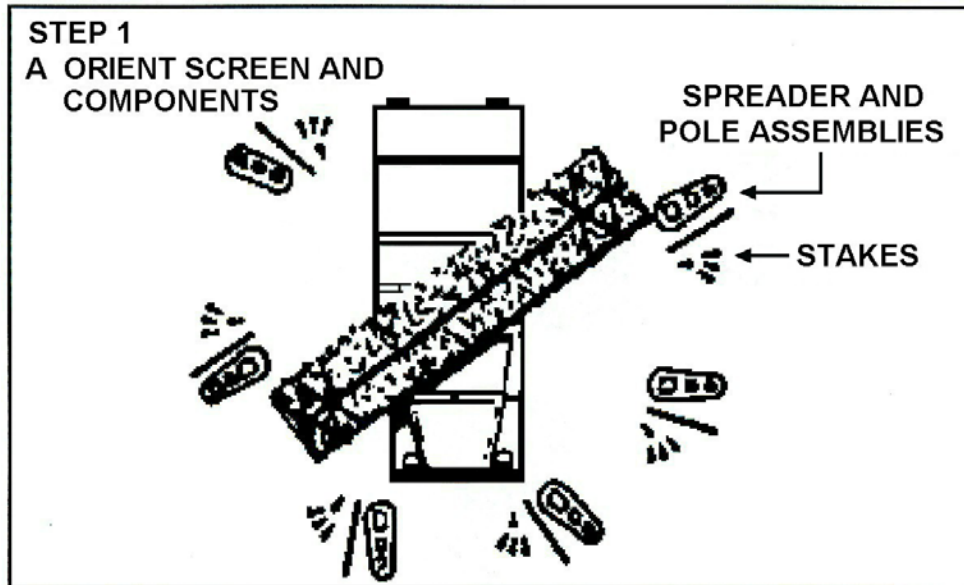


Figure 23-3. Procedures for Erecting a Two-Module Camouflage Screen System

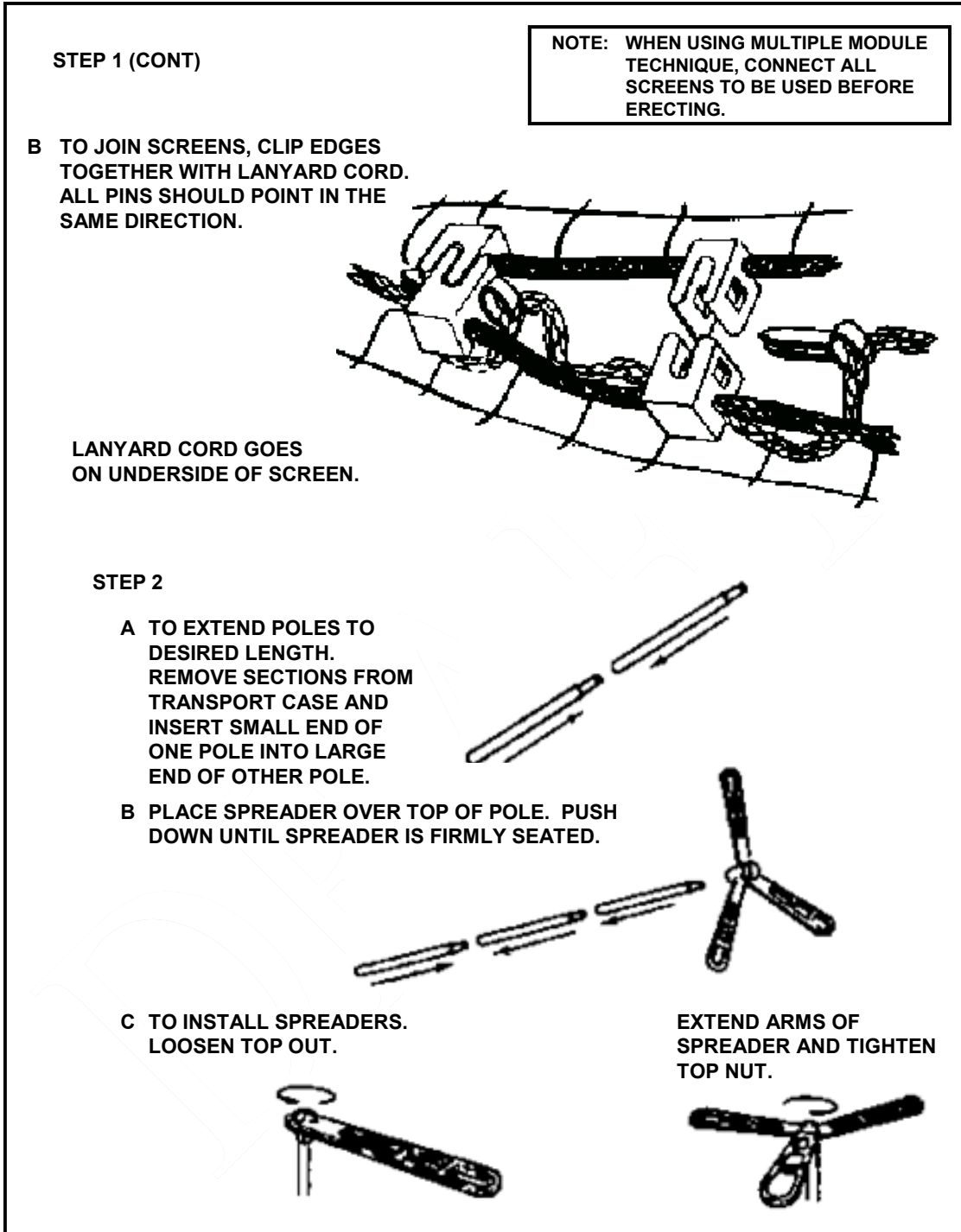


Figure 23-3. Procedures for Erecting a Two-Module Camouflage Screen System (continued)

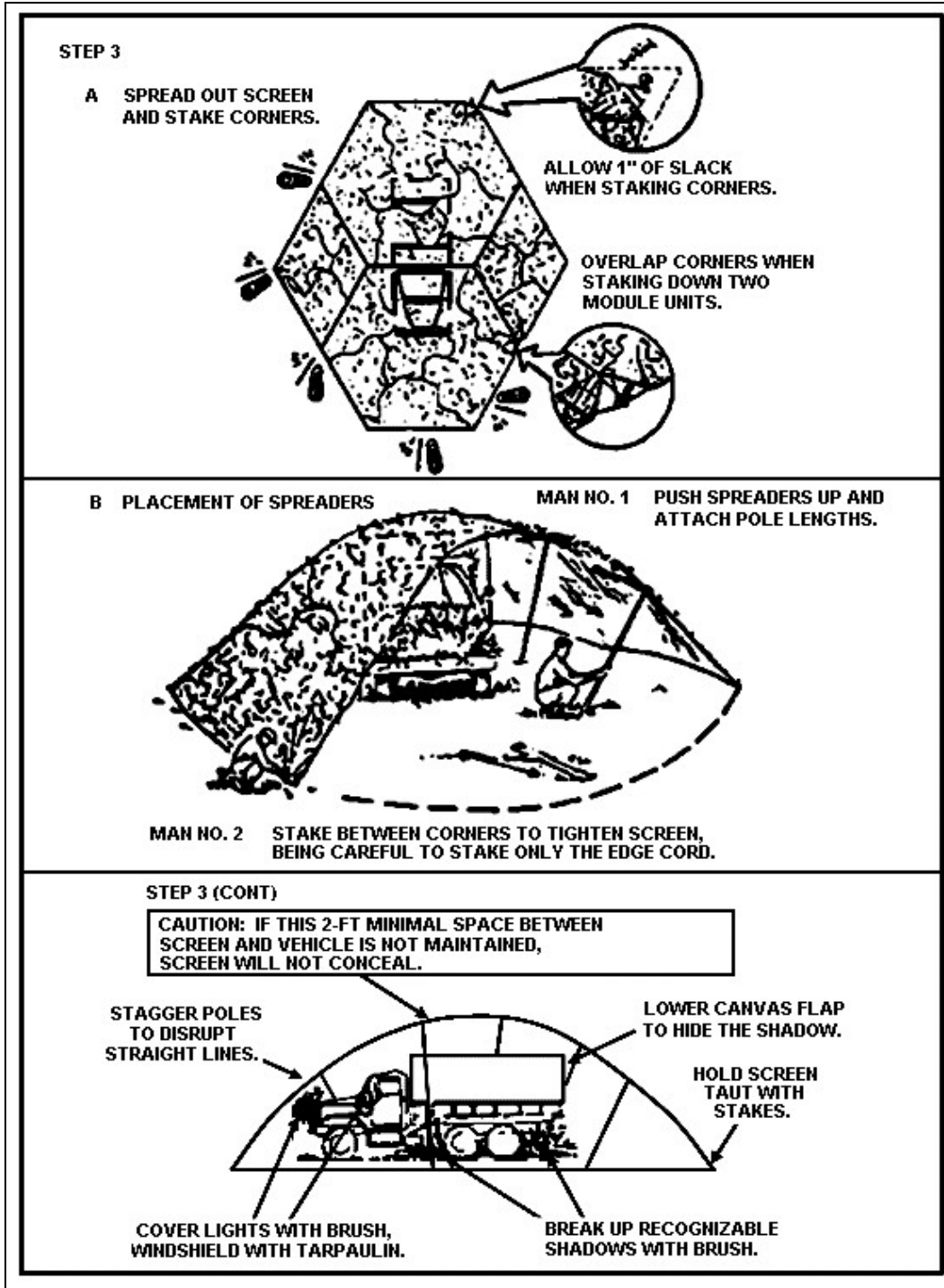


Figure 23-3. Procedures for Erecting a Two-Module Camouflage Screen System (continued)

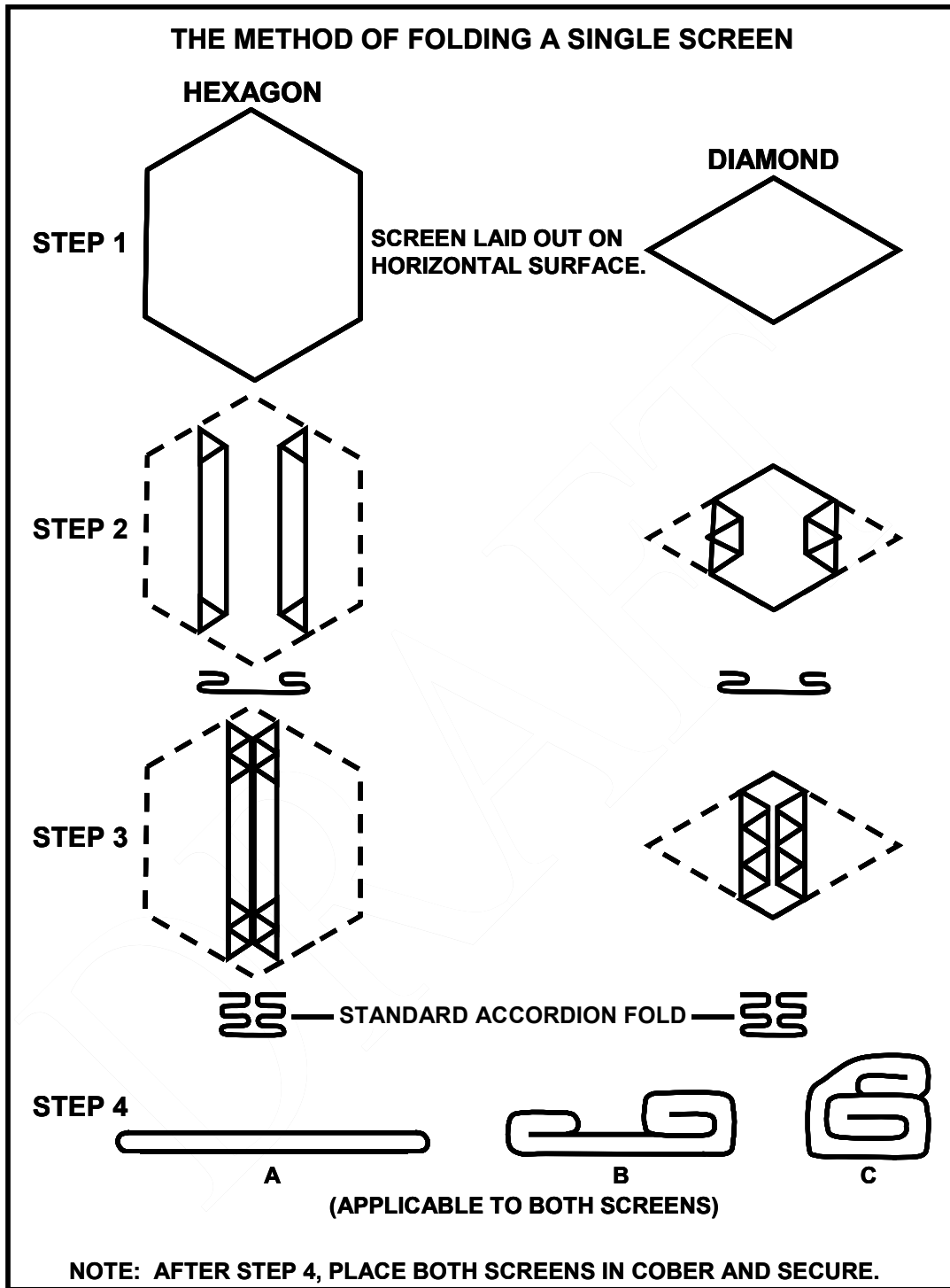


Figure 23-4. Method of Folding a Single Screen



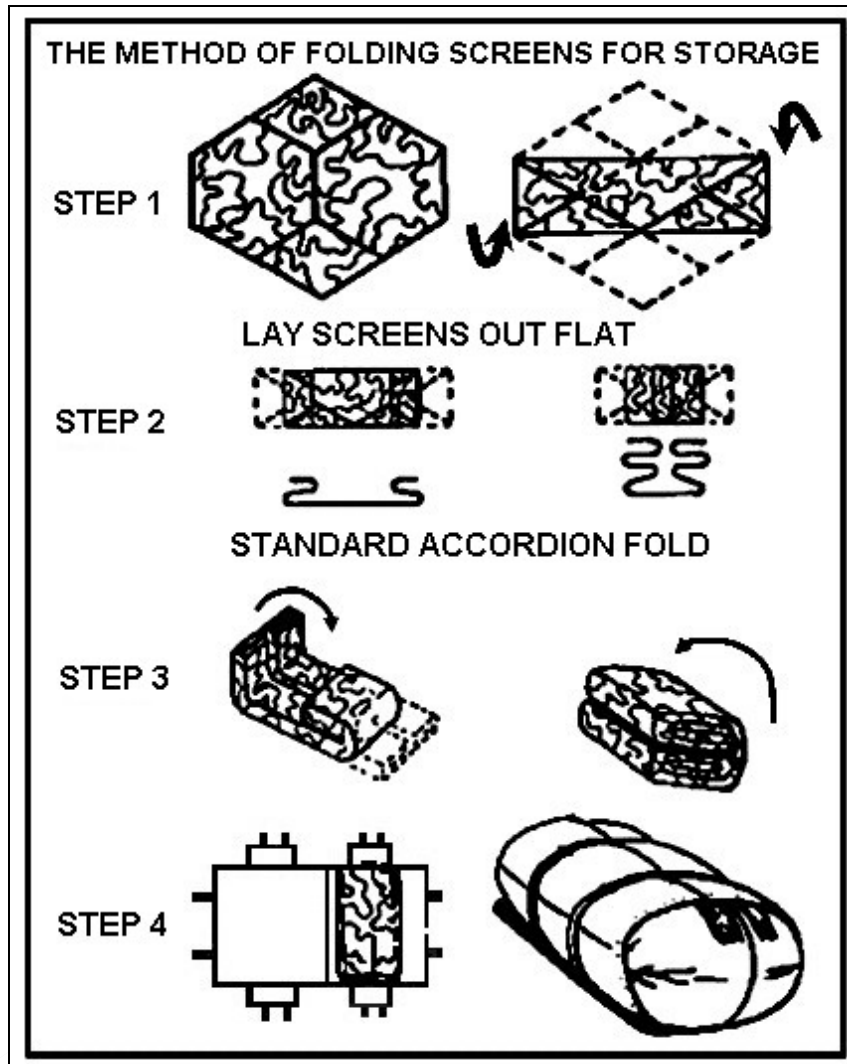


Figure 23-5. Method of Folding Screens for Storage

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# Appendix A

## Extract of AMovP-1(A)

### CHAPTER 2

#### BASIC MILITARY ROAD TRAFFIC REGULATIONS

#### ANNEXES

- A. Driver hand signals to be used by drivers of left hand drive military vehicles.
- B. Driver hand signals to be used by drivers of right hand drive military vehicles
- C. Hand signals to be used by military traffic control personnel.
- D. Standard layout for offence to be used by NATO traffic control personnel.
- E. Example of distinguishing cuffs.
- F. (Part I)-Hand signals for guiding or marshalling single vehicles by day.
- G. (Part II)-Hand signals for guiding or marshalling single vehicles when visibility precludes the use of day signals.

#### 201. RELATED DOCUMENTS

STANAG 2010 – Military Load Classification Markings.

STANAG 2021 – Military Load Classification of Bridges, Ferries, Rafts, and Vehicles.

#### 202. GENERAL REGULATION FOR MILITARY ROAD TRAFFIC CONTROL ORGANIZATION

- 1. The military road traffic control organization is intended to regulate control and facilitate the movement of military vehicles and columns of vehicles by road.
- 2. Within each area of responsibility, the overall steps taken by the appropriate authority to organize and control military movement by road constitute a road traffic plan which serves as the basis for preparing road movement orders and instructions.
- 3. The road traffic plan and related orders must enable those concerned to ascertain:
  - a. General traffic regulations affecting military vehicles in particular.
  - b. The layout of the routes which it will be required to follow, and the details relating to those routes.
    - (1) Controlled routes.
    - (2) One way route sections.
    - (3) Authorized or prescribed speeds.
    - (4) Special orders applicable to certain route sections or to certain critical points.
    - (5) Location of traffic control posts.
  - c. Priorities allocated to certain vehicles or columns.
  - d. Various prohibitions or restrictions (parking, overtaking, etc).

- e. Regulations relating to day or night traffic and in particular:
  - (1) The lines beyond which the movement of vehicles and the lighting of signs are subject or reduced lighting conditions or blackout conditions.
  - (2) If appropriate, route sections on which road markings are used.
- f. The conditions under which the appropriate authority wishes to be kept informed of the execution of movements.

203. ACTION BY ROAD TRAFFIC CONTROL ELEMENTS

- 1. To ensure implementation of the road traffic plan and the execution of related orders as well as for the purpose of being kept informed of the execution of current movements, the responsible national territorial authority has road traffic control elements at its disposal.
- 2. These elements are the representatives of the responsible national territorial authority. As such, the orders and instructions given by them must be obeyed by all military road users, irrespective of nationality. In accordance with NATO alert measures, responsibility for military traffic will be transferred to the appropriate military commanders in the combat zone.
- 3. Road traffic control elements can be:
  - a. Military or civil Police units.
  - b. Special military units.
- 4. These units discharge their task by means of:
  - a. Traffic control posts set up along the routes as necessary and staffed by traffic control personnel.
  - b. Mobile patrols (may be air patrols) or guides.
  - c. Erection of the signs and equipment described in Chapter 4 and any other temporary device for the purpose of regulating the flow of traffic.
- 5. Their primary duties are to:
  - a. Enforce road traffic regulations, instructions given by military and civil road signs and the instructions contained in the road traffic plan. (For this purpose, they are empowered to prohibit access to controlled routes for which a movement credit is required to any military column and/or independent military vehicle not in possession of one).
  - b. Take appropriate action to prevent or reduce congestion. (For this purpose they must be familiar with their allocated area and available detours).
  - c. Supply military road users with all information and guidance which they may require.
- 6. When these units have the task of keeping the responsible national territorial authority informed of the execution of movements, they set up on the routes traffic control posts equipped with necessary means of communication and in possession of the movement plan for these routes.
- 7. These traffic control posts are indicated by panels of the type defined in AmovP-1, Chapter 4 erected along the route at a suitable distance on either side of and close by the control post.

8. Action by column commanders on passing traffic control posts is given in AmovP-1, Chapter 6.
9. When the movement of a column of one nationality is controlled by an authority of a different nationality, representatives of the National Command to which the column belongs may be posted alongside the control post commanders.
10. Action by the traffic control elements is facilitated by the erection of the signs and equipment stated in Chapter 4, and any other temporary device for the purpose of easing the flow of columns, at particularly difficult points along routes.

204. ROAD TRAFFIC REGULATIONS TO BE OBSERVED BY DRIVERS OF MILITARY VEHICLES.

1. Civil Traffic Regulations
  - a. Road Traffic Regulations. The drivers of military vehicles are at all times subject to the road traffic regulations of the country in which they are driving.
  - b. Road Traffic Signs. Except in the cases referred to in Chapter 4 drivers of military motor vehicles must at all obey the civil road traffic signs of the country in which they are driving.
  - c. Training. All drivers of military motor vehicles must be instructed on the traffic regulations of the country in which they are to drive including the signals given by civilian and/or military personnel engaged in traffic control as well as the civil road traffic signs, including in particular, the right of way signs used at road intersections.
2. Military Road Traffic Regulations
  - a. Speed Limits
    - (1) Military vehicles, whether moving in columns or as single vehicles, must abide by the speed limits laid down by the responsible national military territorial authority controlling road movements in the area concerned. These speed limits will, in principle, exceed or, in the case of minimum speed limits, be less than civil speed limits applying to the roads in question.
    - (2) In all inter-allied orders relating to road movement (for example, standing orders, movement orders), speeds must be described both in "kilometers per hour" (km/h) and "miles per hour (mph).
  - b. Signals by Drivers of Military Vehicles
    1. All drivers of military vehicles must indicate changes in direction by the use of the illuminated direction indicators with which vehicles are equipped except when their use is prohibited (in particular forward of the light line).
    2. When the use of illuminated direction indicators is prohibited, or where the technical manufacturing and usage characteristics of vehicles are incompatible with the fitting of illuminated indicators, all drivers of

military vehicles must indicate changes of direction by use of hand signals.

- (a) In countries where traffic normally drives on the right hand side of the road, drivers must use the signals described and illustrated in Annex A (for left hand drive vehicles); for traffic which drives on the left hand side of the road, the signals are in Annex B (for right hand drive vehicles).
  - (b) Prior to driving in a country other than their own, drivers are to check the road traffic regulations of the nation concerned, to verify the hand signals used, and to familiarize themselves with that nation's traffic regulations.
- c. Stopping of Single Military Vehicles. When the driver of a single military vehicle has to stop his vehicle:
  1. He must indicate to drivers behind that he is stopped and that if safe they may pass.
  2. The driver must switch-on hazard warning lights and place a reflective warning triangle as well as an omnidirectional or flashing amber warning light, if the vehicle is equipped with them, beside the road at least 100 meters behind the vehicle to warn approaching traffic of its presence. All occupants must then leave the vehicle and go to a safe position. If appropriate, crew members may direct traffic around the parked vehicle when parking off the road is not possible and if no control personnel are present.
- d. Movements over Bridges and Rafts.
  1. STANAG 2021 indicates the relationship between the classification number of a vehicle and those of bridges and rafts. No driver must move his vehicle on to a bridge or raft if his vehicle bears a classification number higher than that of the bridge or raft as established by STANAG 2010, unless directed to do so by traffic control personnel.
  2. All military traffic approaching or crossing bridges under repair, temporary bridges and rafts must move with particular care.
- e. Military Road Signs
  1. All drivers of military vehicles must be taught and, where appropriate, must obey the military route signs given in AmovP-1, Chapter 4.
  2. When responsibility for military traffic in a combat zone is transferred to a military commander, military road signs will take precedence over civilian road signs.
- f. Priority Vehicles. All drivers of military vehicles must facilitate the movement of any vehicle which has priority on the road. Military priority vehicles are marked in accordance with the provisions of AmovP-1, Chapter 7.

205 TRAFFIC CONTROL PERSONNEL AND THEIR RELATIONSHIP WITH MILITARY ROAD USERS.

1. Traffic Control Personnel. For the purpose of this AP the term “traffic Control Personnel” is used to denote any person acting under the orders of the national territorial authority responsible for traffic control and instructed by this authority to facilitate the movement of traffic and to prevent and/or report any breach of road traffic regulations.
2. Distinguishing Cuffs
  - a. All military traffic control personnel, when on duty, must wear and be distinguished by a reflective white cuff, with longitudinal light-reflecting stripes, given a white or yellow effect to be worn on each sleeve.
  - b. As a guide, refer to Annex E.
3. Duties and power of Traffic Control Personnel. Traffic control personnel when on duty, must be empowered to give the drivers of military vehicles:
  - a. Any order designed to ensure that the traffic regulations imposed by the national military territorial authorities responsible for the preparation of the road traffic plan and/or the appropriate road traffic regulation are observed. These must include but are not restricted to:
    1. Direction of traffic.
    2. Speed limits.
    3. Authority or prohibition to move on certain roads.
    4. Lighting regulation.
    5. Application of priority movements
  - b. Any order designed to facilitate road movement or to prevent accidents. This must include, but is not restricted to the following:
    1. To stop, to slow, to part, to speed up, and so on.
    2. Not to overtake.
    3. Not to enter a certain route.
    4. To facilitate the movement of traffic at cross roads.
    5. To be concerned with the evacuation of broken down vehicles.
4. Indication of Direction to be Followed. Drivers of single military vehicles or column commanders are responsible for finding their own way. The only exceptions of this rule are:
  - a. Important movement serials planned by movement staffs, for which traffic control personnel may be ordered to direct traffic on a given route.
  - b. Local diversions reconnoitered and identified by responsible traffic control personnel.
5. Information to Drivers, etc, Traffic control personnel on duty may be authorized to give certain specific information to drivers of military vehicles, with the object of assisting them, in particular as regards to their routes, the location of supply, recovery posts, emergency posts, and so on. Where traffic control personnel are asked for information which they are not authorized to give, or where they are not satisfied that the enquirer is competent to receive such

information, they must refer the enquiry to the next superior officer or the nearest traffic control posts.

6. Breaches of Regulations. Where a member of the traffic control personnel has reason to believe that a breach of regulations has taken place, he must report the matter on the standard Offence Report Form described in ANNEX D to the offender's commanding officer through the normal military channels.
7. Offence Report. Traffic control personnel must report any breach of regulations by means of a form of the type shown at ANNEX D to this chapter. The layout of this form will be the same in all languages.
8. Traffic Control Signals. Road traffic may be controlled by one of the following means:
  - a. Hand signals, if necessary with signaling disc or luminous appliance (lamp or electric baton), using the signals described and illustrated in Annex C; whistles may be used for the purpose of attracting attention to such signals.
  - b. Traffic and road signs.
  - c. By verbal orders, where necessary.
9. Duties of Military Road Users in Regard to Military or Civil Traffic Control Personnel.
  - a. All orders given by traffic control personnel to military road users are to be regarded as being orders given by the national territorial authority responsible for road movement in the area concerned.
  - b. All military road users, when called upon to do so by traffic control personnel must be prepared to show:
    1. Their own identity documents.
    2. The documents concerning their vehicles and/or mission.
  - c. Similarly, traffic control personnel must themselves be prepared to show their identity documents, if required.

## 206 SIGNALS FOR GUIDING AND MARSHALLING A SINGLE VEHICLE





1. General rules for using hand signals:
  - a. All signals must be given correctly and clearly to avoid confusion.
  - b. The signals must be given from a place, in full view of the driver of the guided vehicle.
  - c. If the guide has to move, the guided vehicle must be stopped beforehand; this refers specifically to the guiding of vehicles on flat wagons or rafts in order to avoid accidents by walking backwards on the flat wagons or rafts.
  - d. The signals must be given with the guide facing the vehicle to be guided.
  - e. The signals must be repeated as long as the guided vehicle is moving or has to move into the given direction.
  - f. When the visibility is such that day signals are impracticable, the signal must be given by means of an illuminating device (torch, flashlight, signal lamp, and so forth) with the light pointing towards the vehicle.



- g. During darkness if the illuminating device fails to function, the guided vehicles must stop immediately.
  - h. During the guiding or marshalling, the vehicle must move slowly.
  - i. Day signals may be combined, by the guide, according to circumstances and the size of the marshalling area.
2. All signals are illustrated and described in Annex F and Annex G.




AmovP-1 (A), Chapter 2, Annex A

DRIVER HAND SIGNALS TO BE USED BY DRIVERS OF LEFT HAND DRIVE MILITARY VEHICLES




SERIAL	ILLUSTRATION OF SIGNAL	DESCRIPTION OF SIGNAL	MEANING OF SIGNAL
1	<p>(REAR VIEW)</p> 	<p>a. left arm extended horizontally</p> <p>b. see notes (1) and (2)</p>	<p>“I am going to turn to my LEFT.”</p>
2		<p>a. Left arm extended, forearm raised vertically and then moved slowly down and up several times.</p> <p>b. Same signal when vehicle is moving.</p>	<p>“I am MOVING OFF”</p> <p>“I am ACCELERATING”</p>
3		<p>a. Left arm extended horizontally and then moved slowly down and up several times in a vertical plane.</p> <p>b. The arm is then stopped at the lowest position.</p>	<p>“I am SLOWING DOWN.”</p> <p>“...and STOPPING”</p>
4		<p>The palm of the hand is placed on or in the normal position of the windshield.</p>	<p>“I am going STRAIGHT ON” (normally a signal given to traffic control personnel)</p>

**AmovP-1 (A), Chapter 2, Annex B**

DRIVER HAND SIGNALS TO BE USED BY DRIVERS OF RIGHT HAND DRIVE  
MILITARY VEHICLES



SERIAL	ILLUSTRATION OF SIGNAL	DESCRIPTION OF SIGNAL	MEANING OF SIGNAL
1		<p>a. Arm raised vertically, palm of the hand forward, body facing the traffic to be stopped.</p> <p>b. Red light used similarly.</p>	<p>a. "STOP" (to traffic coming from all directions faced).</p> <p>b. Traffic at crossing and junctions will wait for the next signal before crossing.</p>
2A		<p>Both arms raised horizontally, body facing one of the lines of traffic to be stopped (Use only during good visibility).</p>	<p>a. "STOP" (to traffic approaching in front and behind).</p> <p>b. Transverse traffic in front and behind).</p> <p>c. Traffic given free way may only turn of taking the provisions for turning into account.</p>
2B		<p>Faces the same direction as 2A and waves one arm towards body and away.</p>	<p>Same meaning as 2A.</p>

AmovP-1 (A), Chapter 2, Annex B

SERIAL	ILLUSTRATION OF SIGNAL	DESCRIPTION OF SIGNAL	MEANING OF SIGNAL
3		<p>One arm horizontal other forearm held vertically, body facing one of the lines of traffic to be stopped (Used only during good visibility).</p>	<p>ALTERNATIVE SIGNAL with the same meaning as that at Serial 2</p>
4		<p>The left (right) arm extended horizontally, the right (left) arm folded across the body to the left (right). (A green light may be used with this signal).</p>	<p>“FORK” or “TURN TO YOUR RIGHT” (LEFT) (to traffic approaching from the direction faced).</p>
5		<p>The signal may or may not, be started from either “STOP” positions at Serials 1 or 2 above. In any case, the hand and the arm are first extended horizontally with fingers pointed towards the stream for which the signal is intended. The forearm then describes an arc in the vertical plane and stops, fingers pointed towards the direction to be taken by the vehicle(s). (A green light may be used with this signal).</p>	<p>“GO” Signal to either a stopped or moving vehicle to proceed.</p>

AmovP-1 (A), Chapter 2, Annex C

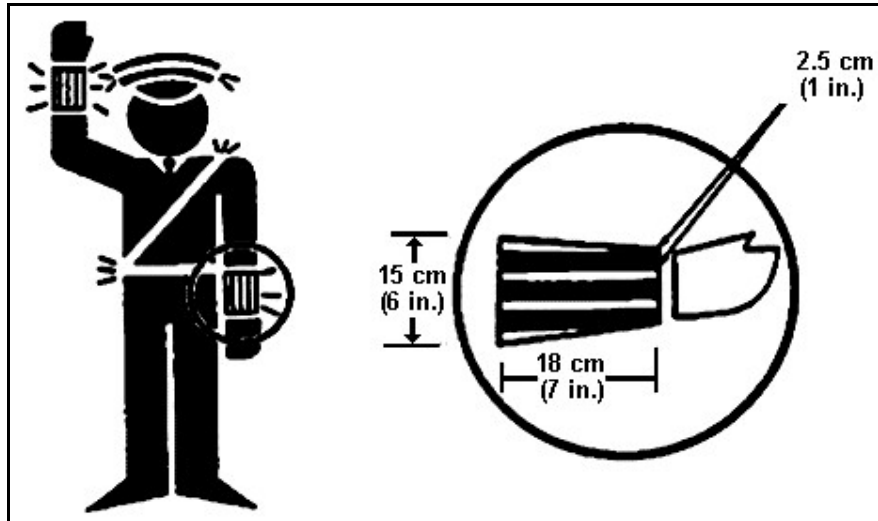
HAND SIGNALS TO BE USED BY MILITARY TRAFFIC CONTROL PERSONNEL

SERIAL	ILLUSTRATION OF SIGNAL	DESCRIPTION OF SIGNAL	MEANING OF SIGNAL
6		<p>The arm extended horizontally and then moved slowly up and down. (A red light may be held in the moving hand).</p>	<p>“SLOW DOWN”</p>
7		<p>The fist raised and lowered quickly, above the right shoulder. (A green light may be held in the moving hand).</p>	<p>“SPEED UP”</p>



AmovP-1 (A), Chapter 2, Annex E

**EXAMPLE OF DISTINGUISHING CUFFS**






**NOTE 1:** The cuff may be approximately the following dimensions, the stripes being parallel with the arm:

- (a) Width of widest part – 15 cm (6 inches)
- (b) Length – 18 cm (7 inches)
- (c) Width of stripes – 2.5 cm (1 inch)

## AmovP-1 (A), Chapter 2, Annex F

## HAND SIGNALS FOR GUIDING OR MARSHALLING SINGLE VEHICLES BY DAY




## PART I

SERIAL	ILLUSTRATION OF SIGNAL	DESCRIPTION OF SIGNAL	MEANING OF SIGNAL
1		<p>a. With both hands moving backwards and forward;</p> <p>b. Palms of the hand turned to the chest;</p> <p>c. As “pulling” the vehicle.</p>	“COME FORWARD”
2		<p>a. With both hands moving forward and backward;</p> <p>b. Palms of the hand turned to the vehicle;</p> <p>c. As “pushing off” the vehicle.</p>	“REVERSE”
3		<p>a. Hand moving from shoulder, horizontally into the direction into which the vehicle must be turned;</p> <p>b. “Turn to the left” is given with the right arm;</p> <p>c. “Turn to the right” is given with the left arm;</p> <p>d. The speed, in which the hand is moved, indicates the speed of turning the vehicle.</p>	“TURN TO THE LEFT/RIGHT”



AmovP-1 (A), Chapter 2, Annex F


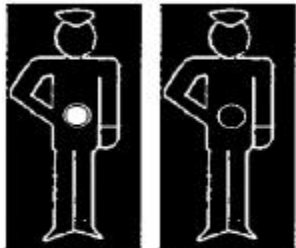


**HAND SIGNALS FOR GUIDING OR MARSHALLING SINGLE VEHICLES BY DAY**

SERIAL	ILLUSTRATION OF SIGNAL	DESCRIPTION OF SIGNAL	MEANING OF SIGNAL
4		<p>a. With both hands;                      b. Palms of the hand facing each other;                      c. Distance between hands indicates the distance between the guided vehicle and an obstacle to be approached.                      d. Touching hands means; the distance between the guided vehicle and the obstacle has become nil.</p>	<p>“INDICATING DISTANCE”</p>
5		<p>a. One or both hands raised vertically;                      b. Palms of the hand turned to the vehicle</p>	<p>“STOP”</p>
6		<p>a. With the right arm;                      b. Cutting motion across the throat;                      c. Extend the arm and bend across the chest from the elbow to the throat.</p>	<p>“STOP ENGINE”</p>

## AmovP-1 (A), Chapter 2, Annex G

**HAND SIGNALS FOR GUIDING OR MARSHALLING SINGLE VEHICLES WHEN VISIBILITY  
PRECLUDES THE USE OF DAY SIGNALS**

**PART II**

SERIAL	ILLUSTRATION OF SIGNAL	DESCRIPTION OF SIGNAL	MEANING OF SIGNAL
7		With an illuminating device moving vertically from chin to waist.	"ADVANCE"
8		With an illuminating device flash, giving an occulting signal, not moving the device.	"REVERSE"
9		With an Illuminating device, at least chest level, rotating slowly in a circular motion (clockwise or anti-clockwise to the driver).	"TURN" a. Clockwise – turn right. b. Anti-clockwise – turn left.
10		Switch off or cover the illuminating device.	a. "STOP" b. See note (1).

Note (1): The driver must stop his/her vehicle when any other light signal such as horizontal motion light (and so on) is given; unless the signal is agreed in principle between the driver and the guide prior to marshalling.

## Appendix B

# International Military Route Signs, Traffic Control Visual Signals, and Control Signals for Military Vehicles in Convoys

## INTERNATIONAL MILITARY ROUTE SIGNS (NATO) AND ROAD SIGNS

B-1. The international military route sign system can be used with any existing civil system to meet military requirements in areas where North Atlantic Treaty Organization (NATO) military forces are operating.

## INTERNATIONAL MILITARY ROUTE SIGNS (NATO)

B-2. Standard military signs include hazard (warning) signs, regulatory signs, and guide signs (see Figure B-1, Figure B-2, Figure B-3, and Figure B-4).

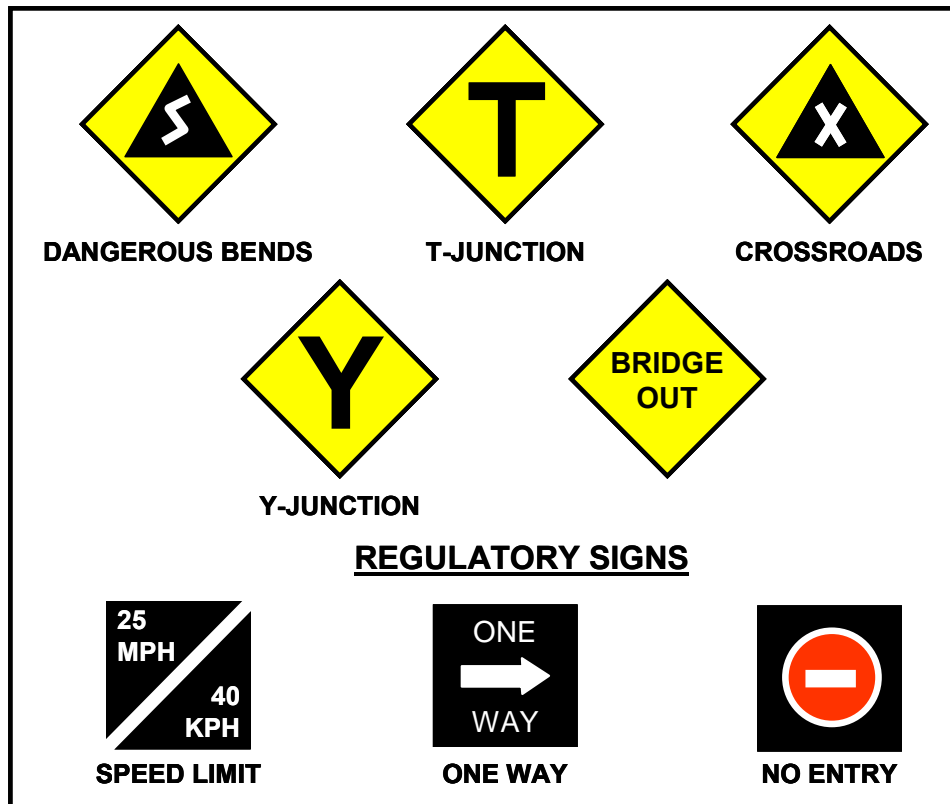


Figure B-1. Hazard and Regulatory Signs

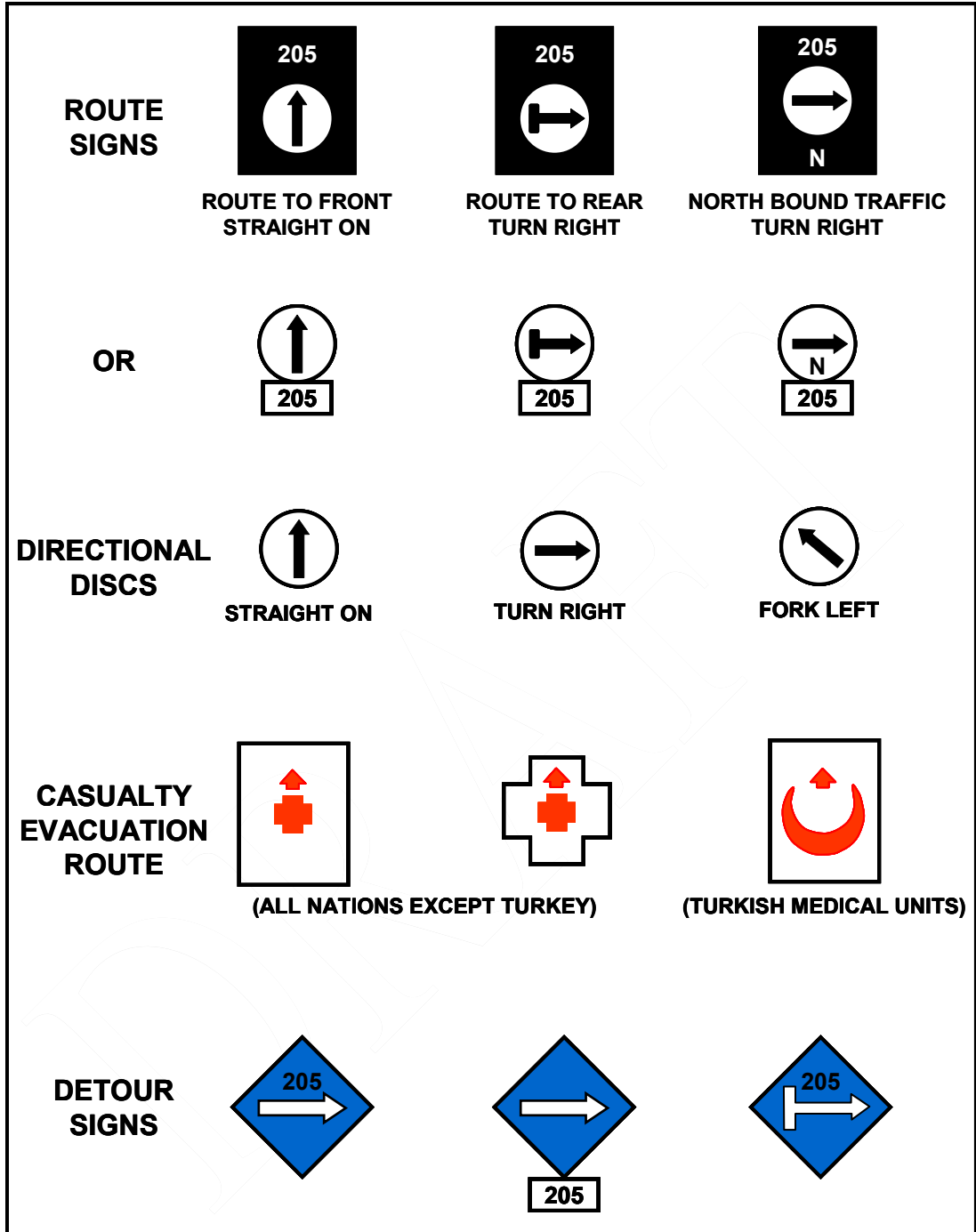


Figure B-2. NATO Guide Markings

International Military Route Signs, Traffic Control Visual Signals, and Control Signals for Military Vehicles in Convoy









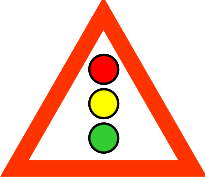

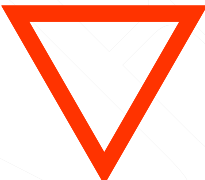

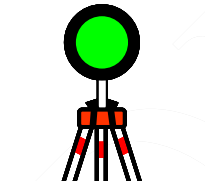
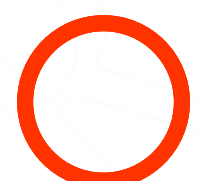
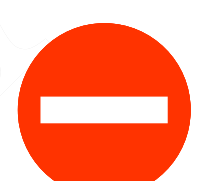
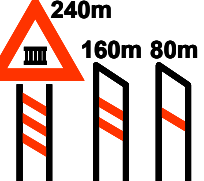
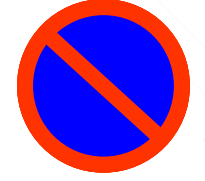
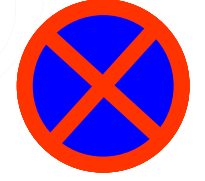


 <p>Danger</p>	 <p>STRASSENBAHN</p>	 <p>Oncoming Traffic</p>	 <p>Crossroads</p>
 <p>Bicycle Crossing</p>	 <p>Dangerous Downgrade</p>	 <p>Dangerous Upgrade</p>	 <p>Rough Road</p>
 <p>Signal Light Ahead</p>	 <p>Stop</p>	 <p>Yield Right of Way</p>	 <p>Maximum Height Allowed</p>
 <p>Temporary 'GO' Sign</p>	 <p>Prohibited For All Vehicles</p>	 <p>Entry Prohibited</p>	 <p>Distance to Guarded Railroad Crossing</p>
 <p>No Parking</p>	 <p>No Stopping Or Waiting</p>	 <p>No Passing</p>	 <p>No Passing For Trucks</p>

Figure B-3. International Road Signs













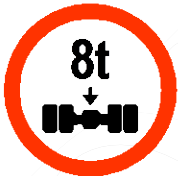



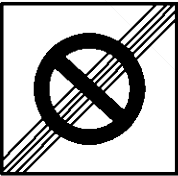


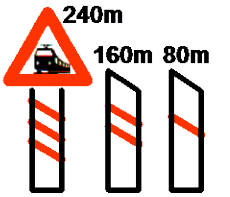
 Single Curve	 Double Curve	 Road Narrows	 Road Narrows on Right Side
 Wild Animal Crossing	 Slippery Road	 Children Crossing	 Pedestrian Crosswalk Ahead
 Construction Site	 Drawbridge Ahead	 Maximum Width Allowed	 Maximum Weight Allowed
 Maximum Axle Weight Allowed	 Motor Vehicles Prohibited	 Guarded RR Crossing	 No Parking
 End of Parking Control Zone	 No Parking	 Railroad Crossing	 Distance to Unguarded Railroad Crossing

Figure B-3. International Road Signs (continued)

International Military Route Signs, Traffic Control Visual Signals, and Control Signals for Military Vehicles in Convoy

 <p>Quay or River Banks</p>	 <p>Low Flying Aircraft</p>	 <p>Pedestrian Crosswalk Ahead</p>	 <p>Pedestrian Crosswalk</p>
 <p>Customs Control</p>	 <p>Domestic Animal Crossing</p>	 <p>Side Wind</p>	 <p>Falling Rocks</p>
 <p>Water-Polluting Cargo Prohibited</p>	 <p>Maximum Length Allowed</p>	 <p>Maximum Weight Allowed</p>	 <p>SMOG. Motor Vehicle Traffic Prohibited</p>
 <p>Unguarded Railroad Crossing</p>	 <p>Maximum Speed Limit</p>	 <p>End of Speed Limit</p>	 <p>Oncoming Traffic Has Right of Way</p>
 <p>End of Restriction</p>	 <p>Soft Shoulder</p>	 <p>No Stopping on Shoulder</p>	 <p>Oncoming Traffic Must Wait</p>

Figure B-3. International Road Signs (continued)

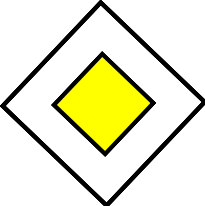
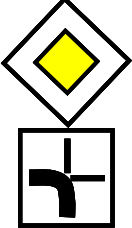
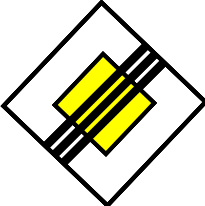
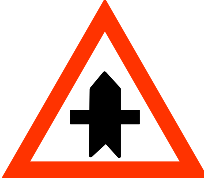









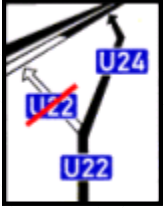
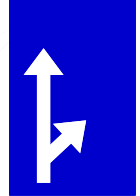
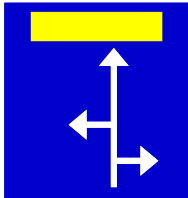




 <p>Priority Road</p>	 <p>Priority Road</p>	 <p>End of Priority Road</p>	 <p>Right of Way</p>
 <p>Snow Chains Mandatory</p>	 <p>Horsemen Only</p>	 <p>Pedestrians Only</p>	 <p>Bicycle Only</p>
 <p>Autobahn</p>	 <p>End of Autobahn</p>	 <p>Motor Vehicles Only</p>	 <p>End of Motor Vehicles Only</p>
 <p>Autobahn Detour</p>	 <p>Detour Route Marker</p>	 <p>Autobahn Direction Sign</p>	 <p>Direction to Autobahn</p>
 <p>Priority Road Ahead</p>	 <p>White Center Lines</p>	 <p>Lane Markings (Painted on Pavement)</p>	 <p>Pedestrian Crosswalk</p>

Figure B-3. International Road Signs (continued)



International Military Route Signs, Traffic Control Visual Signals, and Control Signals for Military Vehicles in Convoy

 <b>TAXI</b> Taxi Parking Only	 <b>Einbahnstraße</b> One-Way Street In Direction of Arrow	 One-Way Street	 Mandatory Direction of Travel
 Mandatory Direction of Travel	 Mandatory Direction of Travel	 Mandatory Direction of Travel	 <b>Einfahrt</b> Entrance to Autobahn  <b>Ausfahrt</b> Exit From Autobahn
 <b>Berlin</b> Direction to Autobahn	 First Aid Station	 Telephone	 200m Change of Traffic Lanes
 Stuttgart BDorf ADorf 80m Bypass Routing	 <b>Berlin</b> Detour Route Marker	 <b>Umleitung</b> Detour	  Direction to Travel
 No Parking	 Streetcar Stop/Bus Stop	 <b>Weiler</b> Place Name	 35 Federal Highway Number

Figure B-3. International Road Signs (continued)

 <p><b>Dead End</b></p>	 <p><b>Children Playing</b></p>	 <p><b>Compulsory Minimum Speed</b></p>	 <p><b>End of Compulsory Minimum Speed Zone</b></p>
 <p><b>Mandatory Direction of Travel</b></p>	 <p><b>Mandatory Direction of Travel</b></p>	 <p><b>Water Protection Area</b></p>	 <p><b>Traffic Directed by School Guard</b></p>
 <p><b>Police</b></p>	 <p><b>Parking on Curb Permitted</b></p>	 <p><b>Parking Area</b></p>	 <p><b>Direction Marker</b></p>
 <p><b>Direction Marker</b></p>	 <p><b>Built-Up Area (Front)</b></p>	 <p><b>Built-up Area (Reverse)</b></p>	 <p><b>European Highway</b></p>

Figure B-3. International Road Signs (continued)

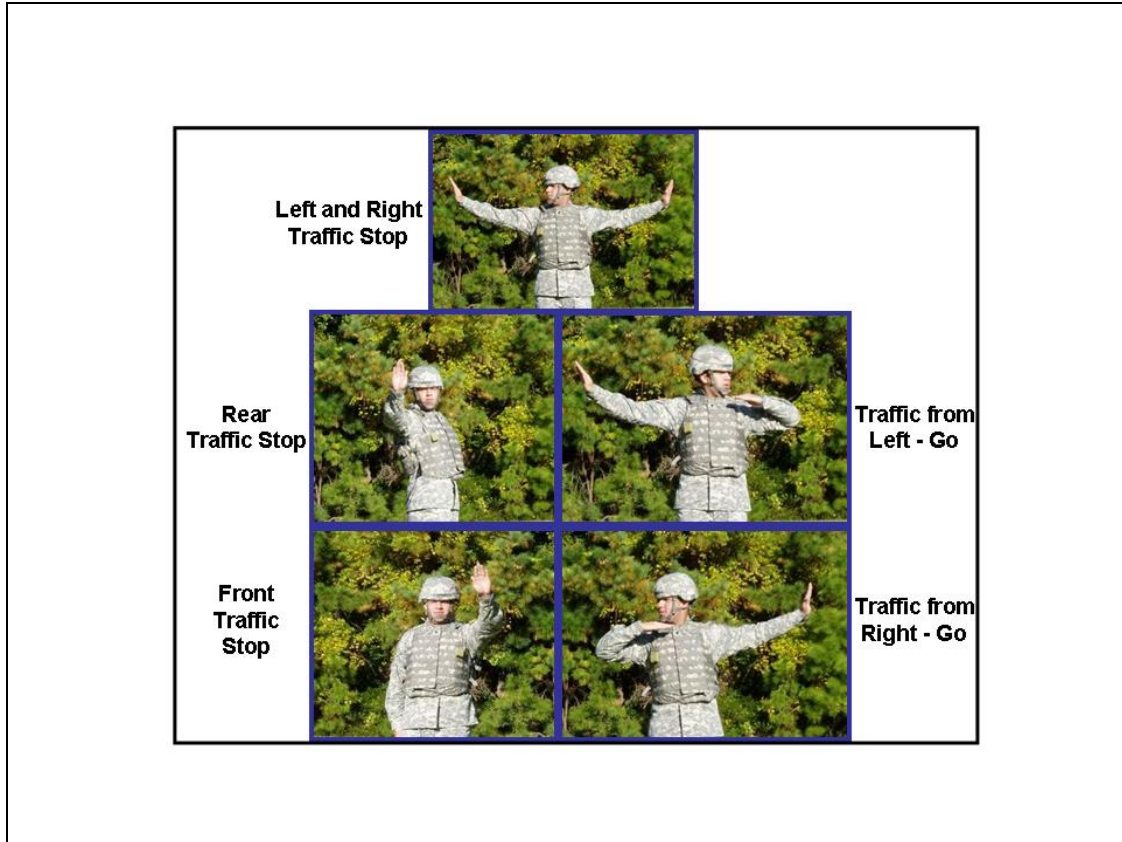


Figure B-4. Traffic Control Visual Signals

## CONTROL SIGNALS FOR MILITARY VEHICLES IN CONVOY

### GENERAL

B-3. Signals illustrated with a single arrowhead indicate that the signal is not continuously repeated; however, it may be repeated at intervals until acknowledged or the desired action is executed. Signals illustrated with double arrowheads are repeated continuously until acknowledged or the desired action is taken. Signals are illustrated as normally seen by the viewer. Some signals are illustrated in oblique, right angle, or overhead views for clarity.

### SIGNALS TO CONTROL VEHICLE DRIVERS AND/OR CREWS

B-4. These are the arm-and-hand and light signals used to guide and direct vehicles. Flashlights are used at night to direct vehicles. Blue filters should be used whenever possible in order to preserve the operator's night vision. Chemical lights can also be used and have less effect on the operator's night vision (see Figures B-5 through B-22).

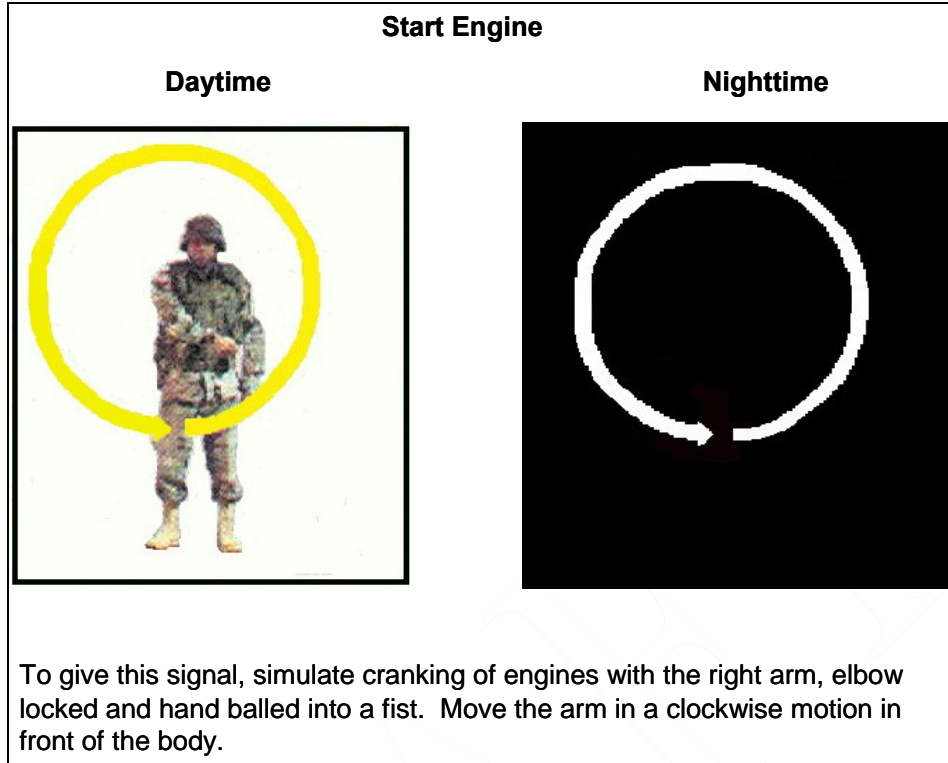


Figure B-5. Start Engine

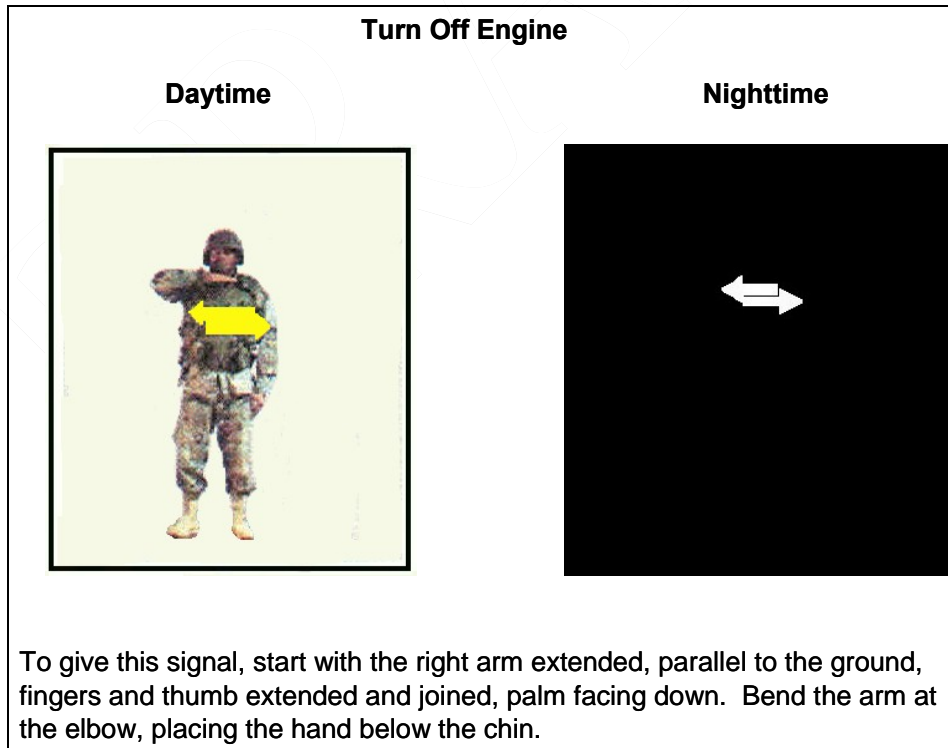


Figure B-6. Turn Off Engine

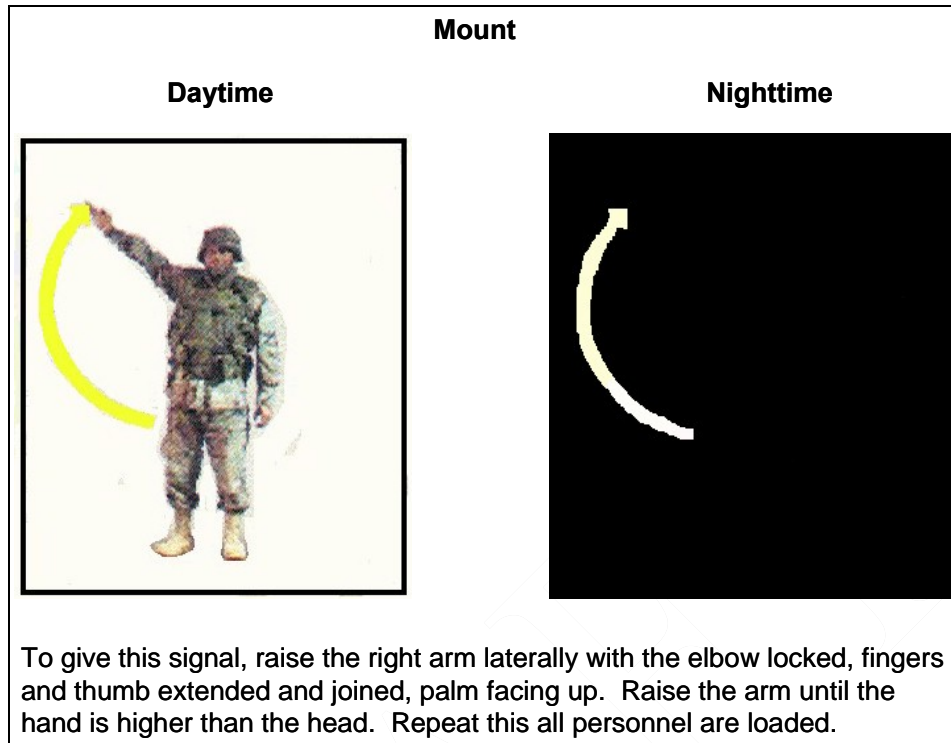


Figure B-7. Mount

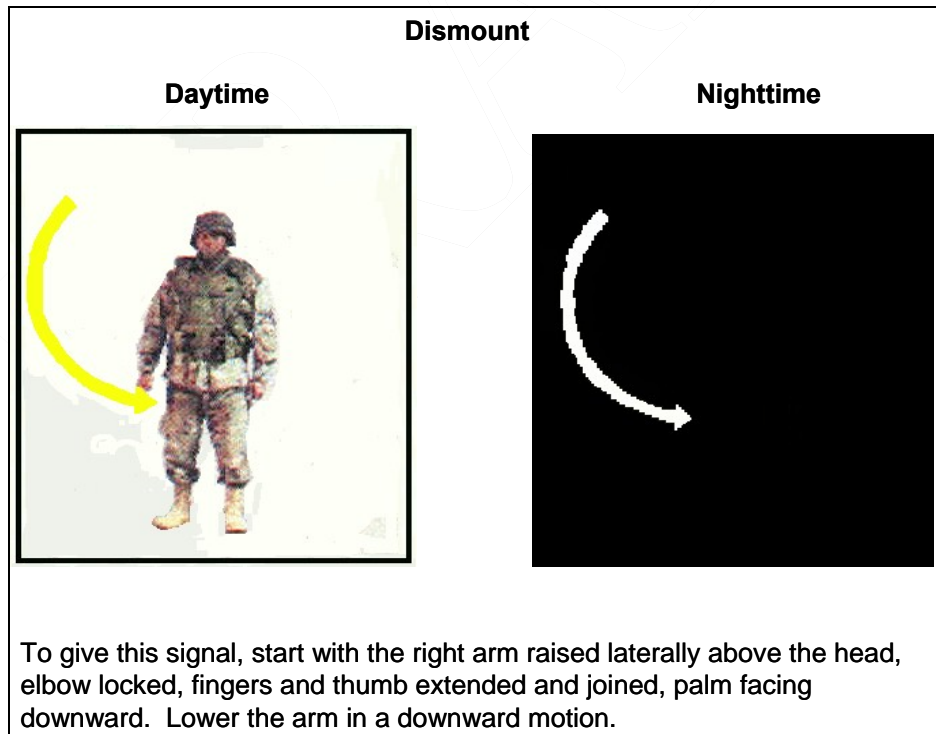


Figure B-8. Dismount

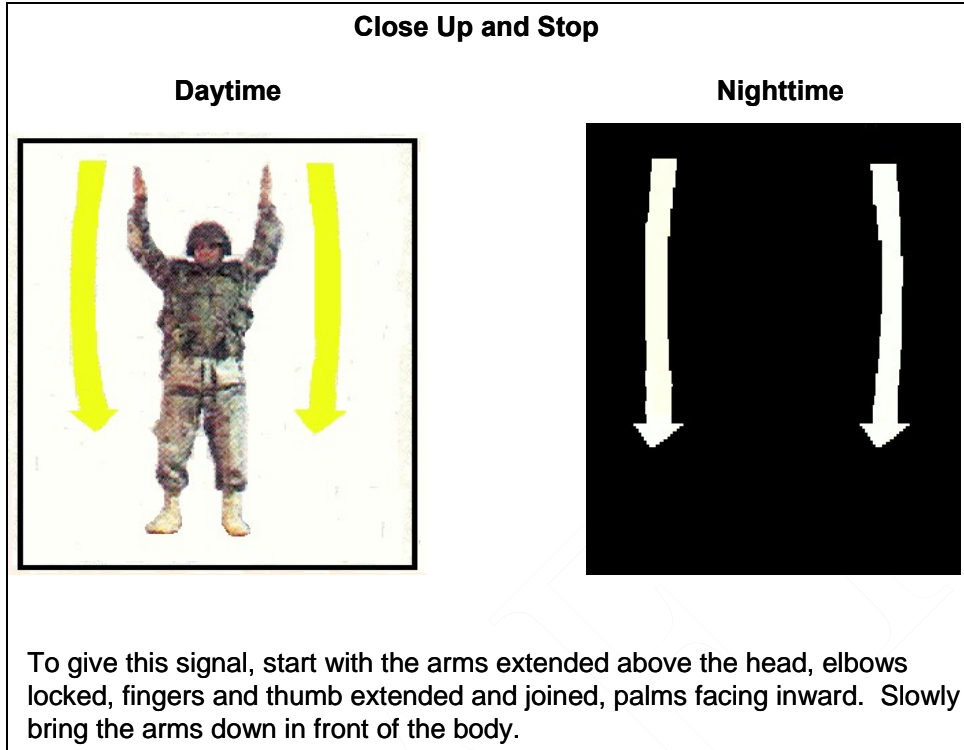


Figure B-9. Close Up and Stop

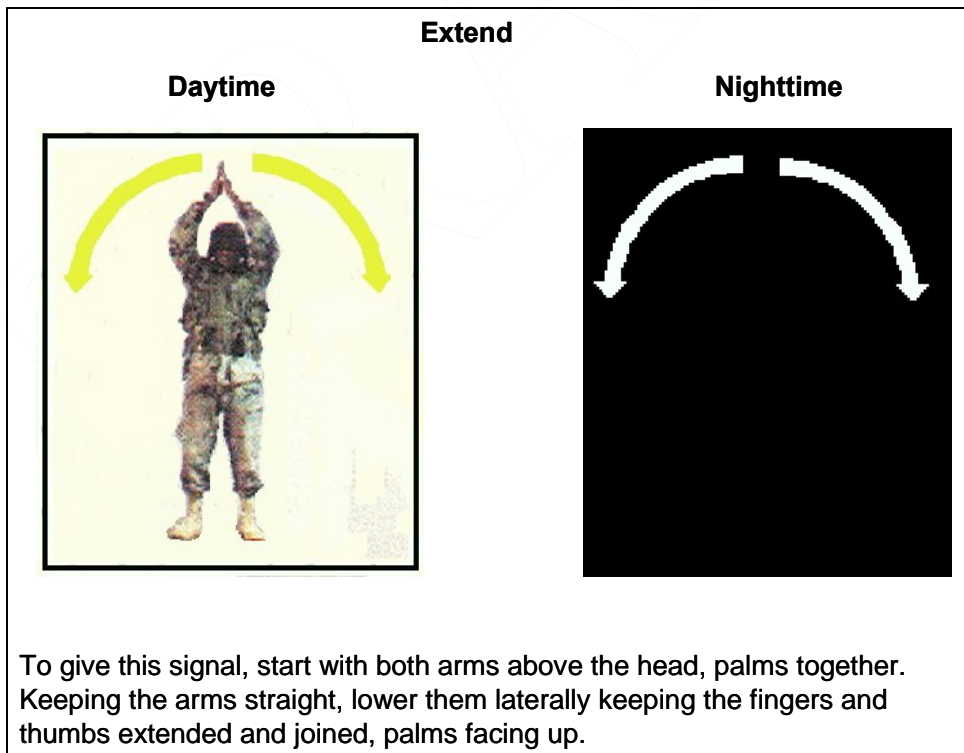


Figure B-10. Extend

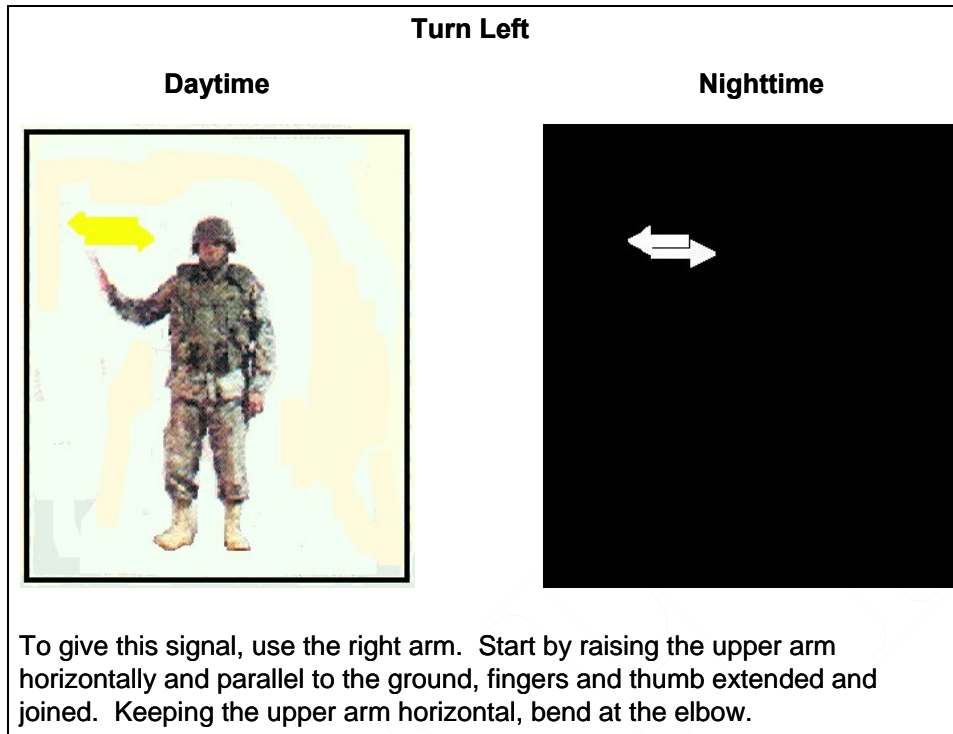


Figure B-11. Turn Left

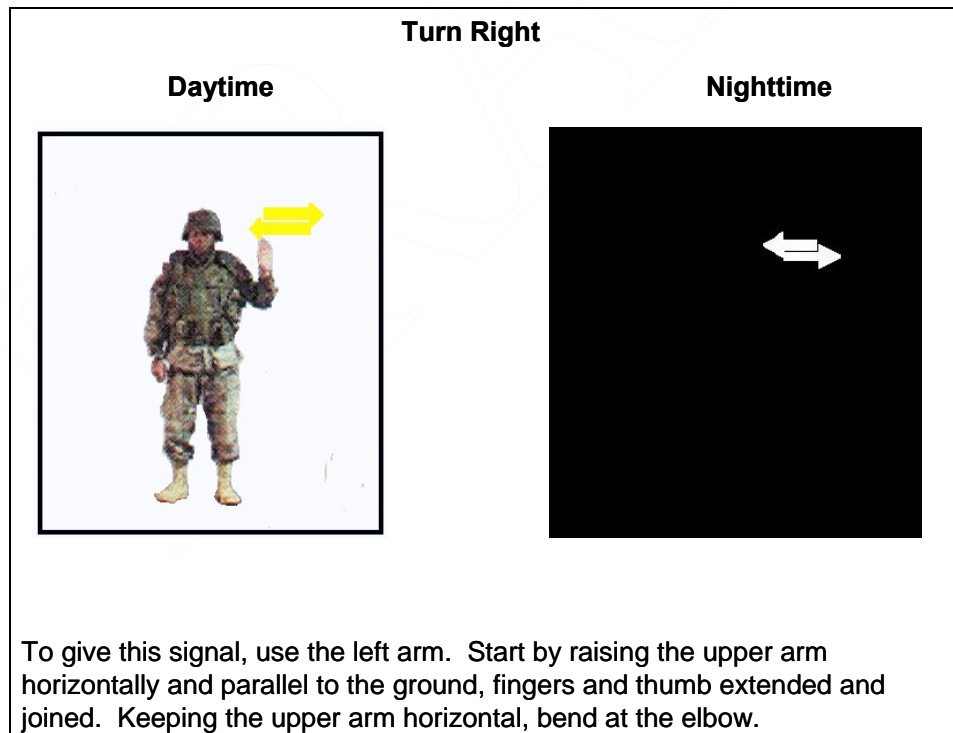


Figure B-12. Turn Right

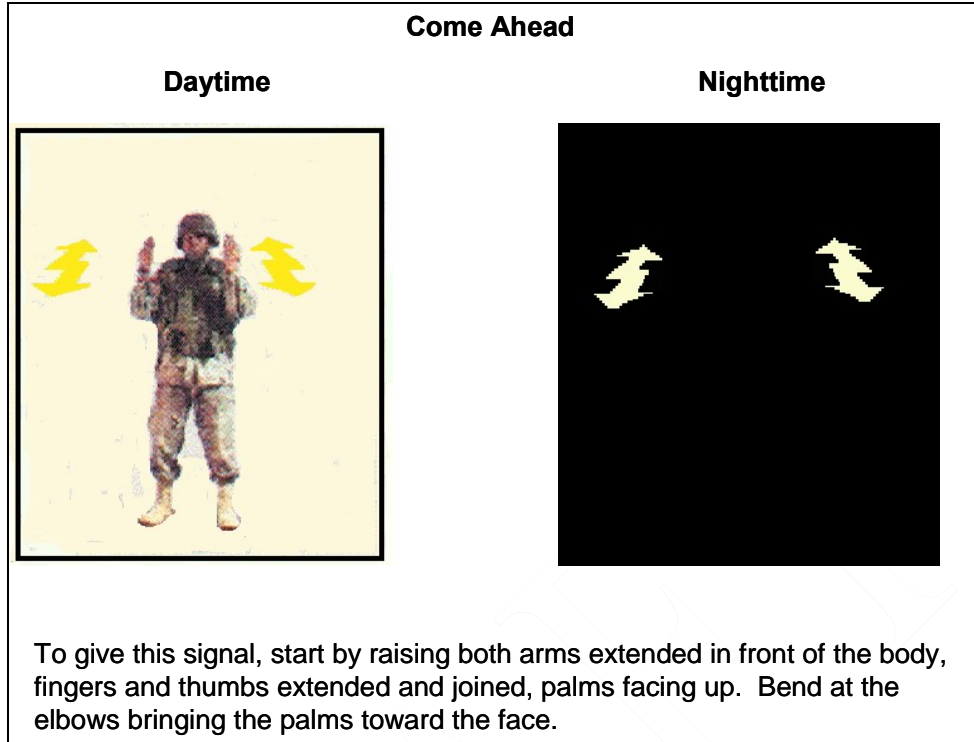


Figure B-13. Come Ahead

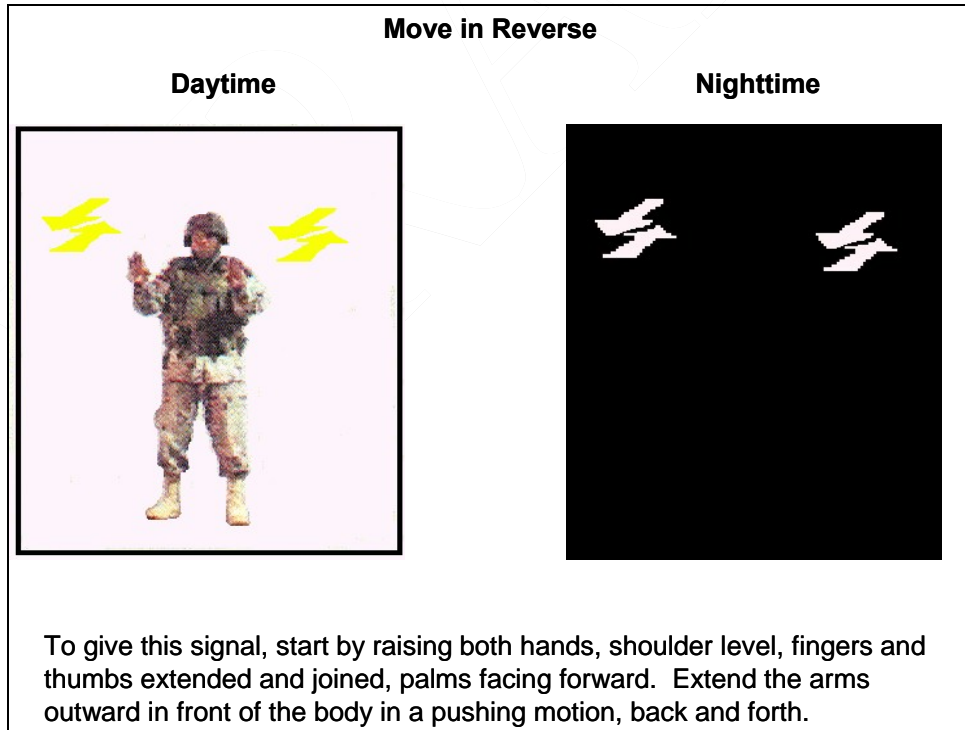


Figure B-14. Move in Reverse



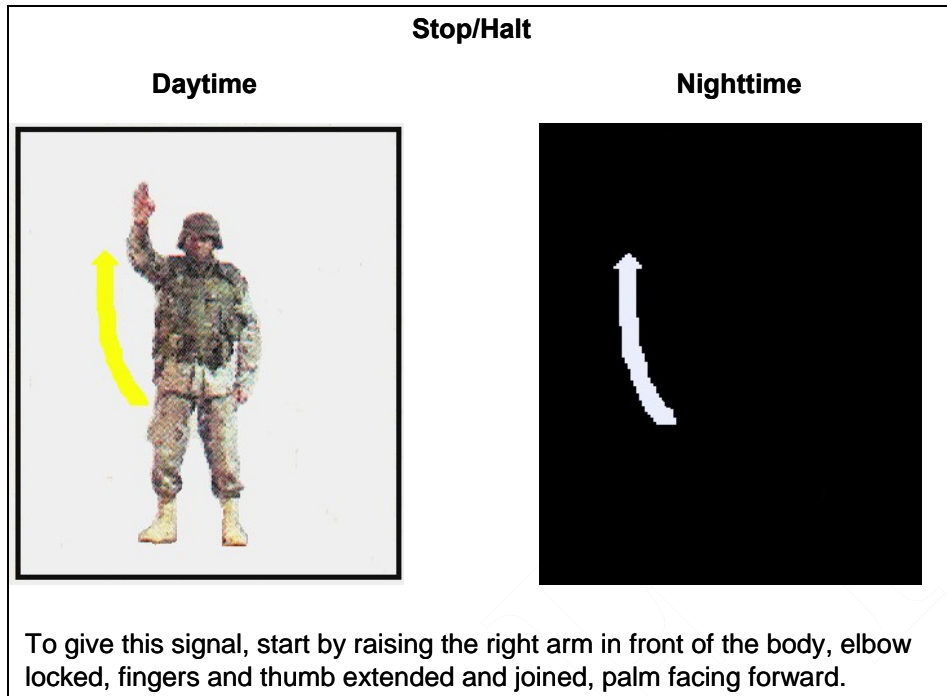


Figure B-15. Stop/Halt

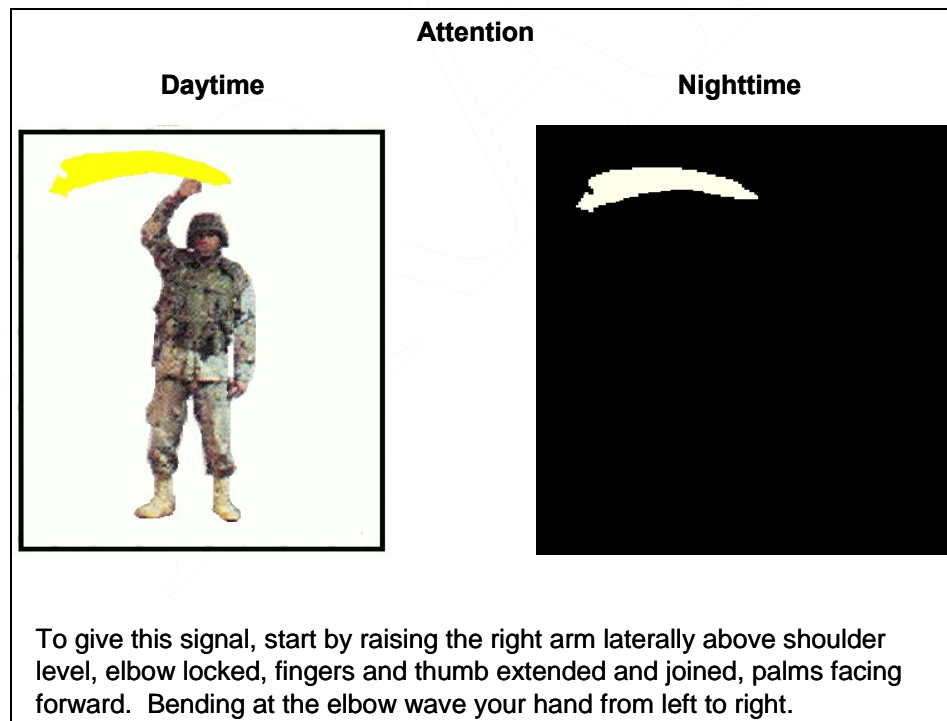
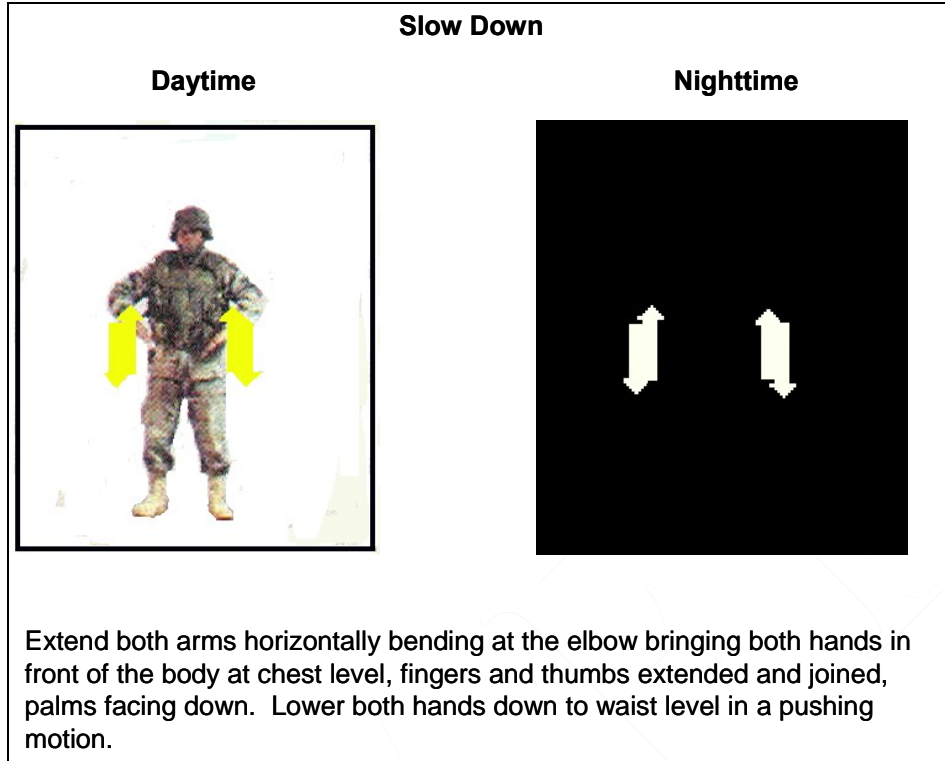
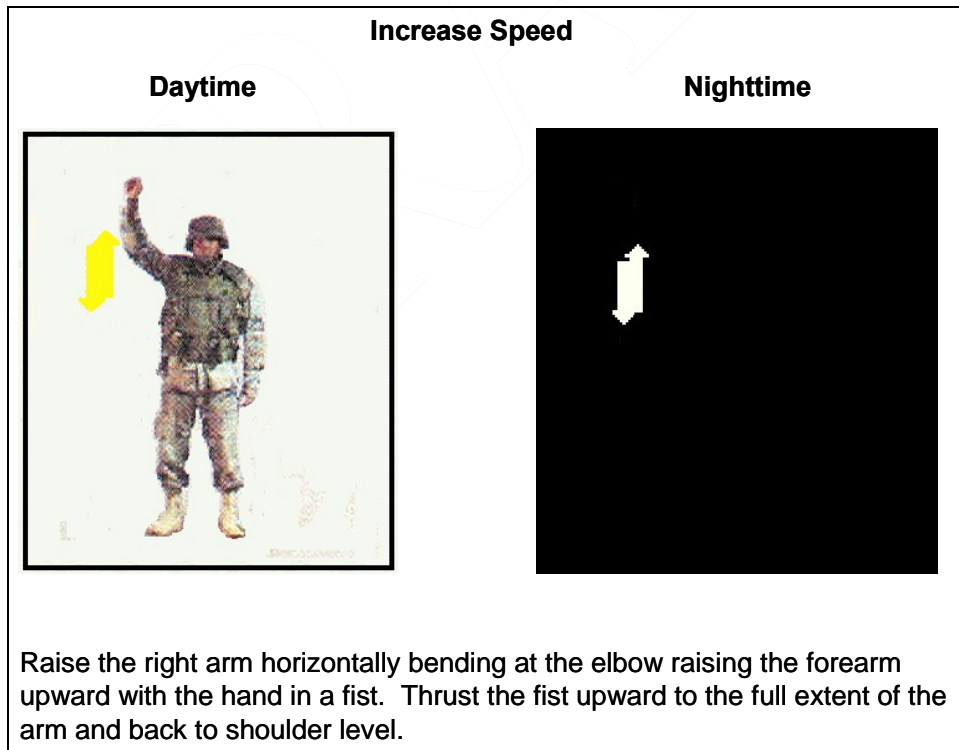


Figure B-16. Attention



**Figure B-17. Slow Down**



**Figure B-18. Increase Speed**

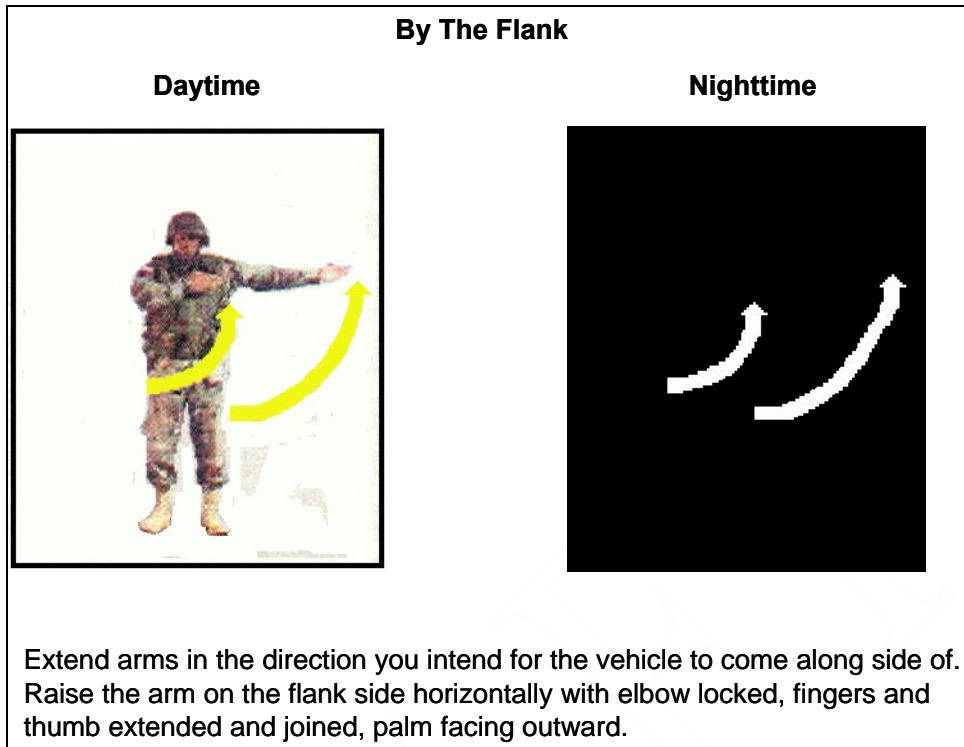


Figure B-19. By The Flank

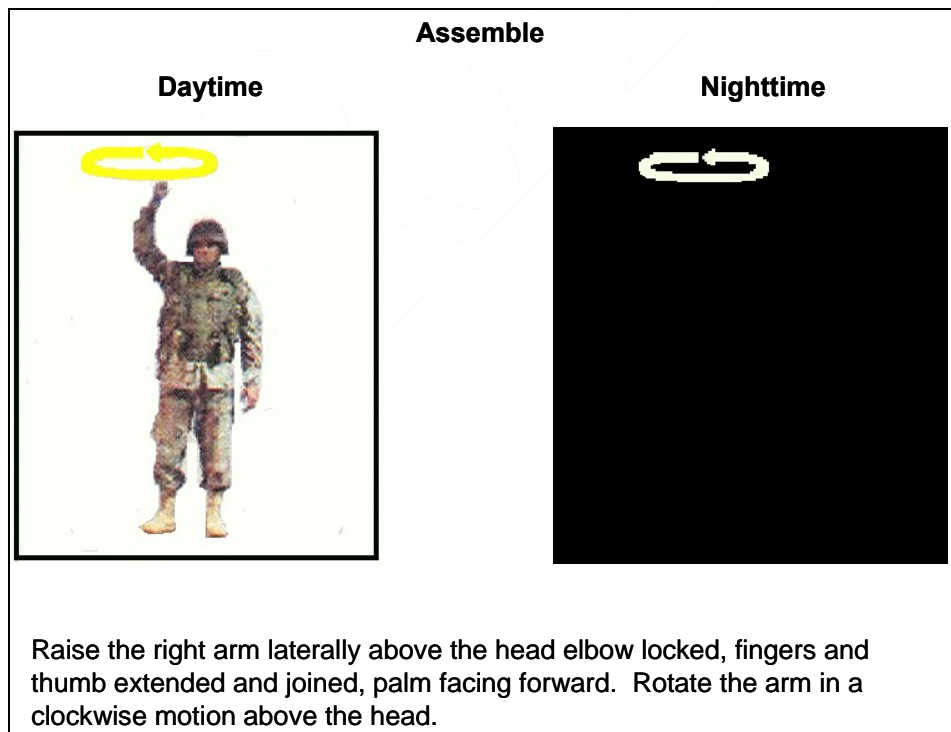


Figure B-20. Assemble

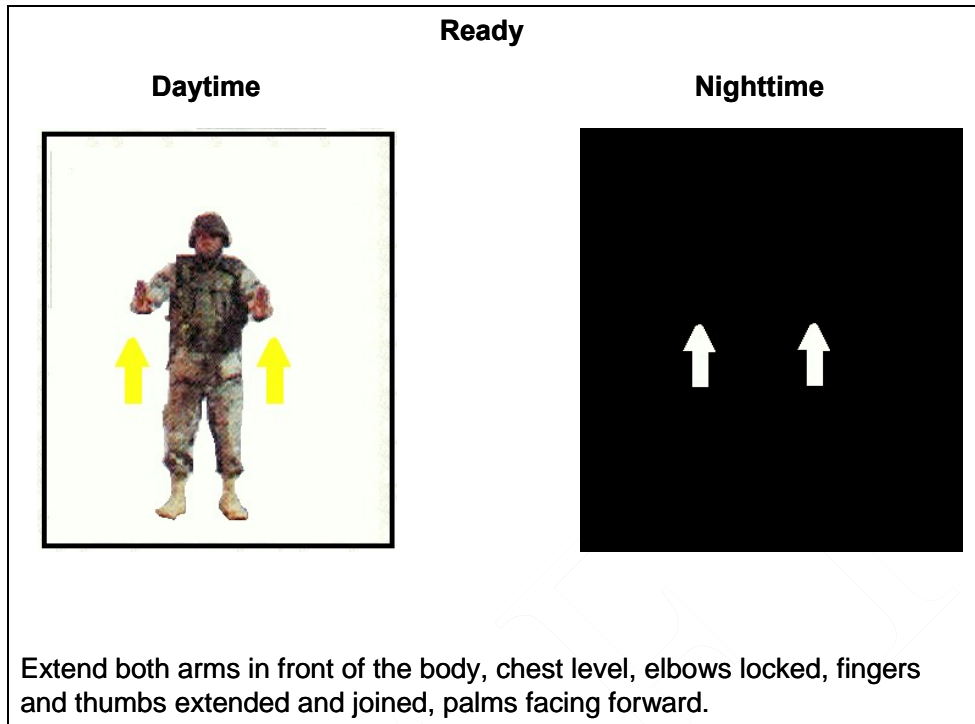


Figure B-21. Ready

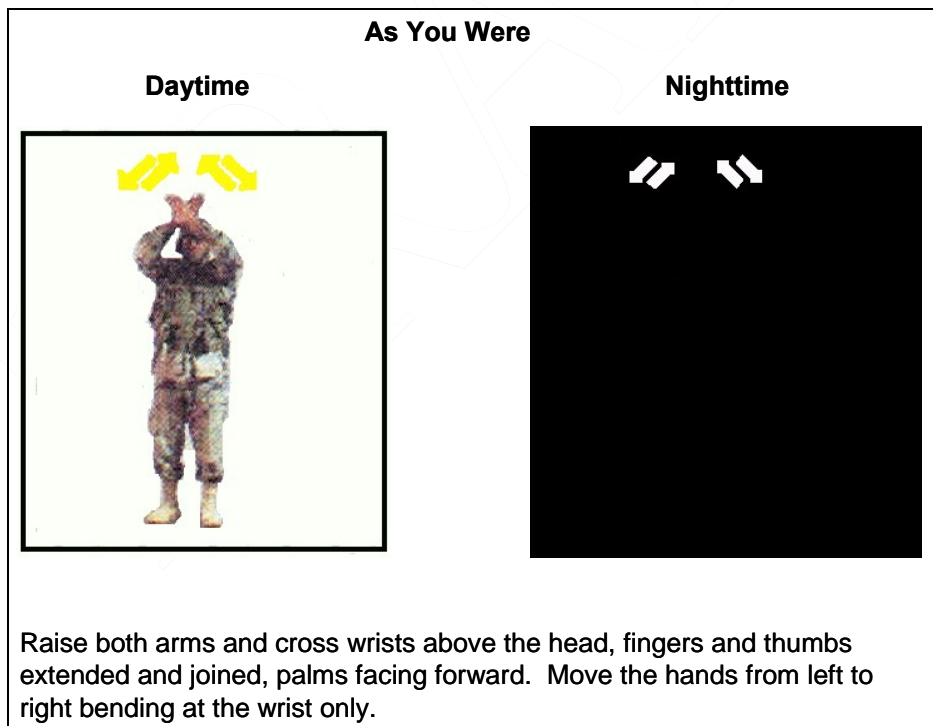


Figure B-22. As You Were

## **Appendix C**

# **Vehicle Rollover Prevention**

### **LEADERSHIP INVOLVEMENT**

C-1. Leaders are responsible for assessing the risks of any mission. This authority is delegated to all members of the organization with the individual's responsibility or ensuring safety is the number one priority. Identifying safety hazards involved and determining what control measures to implement may prevent hazardous situations from occurring thus saving lives and ensuring mission success. Always conduct a Composite Risk Assessment before any mission.

### **PREVENTIVE MEASURES**

C-2. Prevention is one of the keys to surviving a vehicle rollover. Every effort should be made by all vehicle operators to avoid a rollover by clearly understanding the causes of a vehicle rollover and being able to identify circumstances that may lead to a vehicle rollover. Preventive measures may include but are not limited to the following:

- Overly aggressive driving or driving too fast
- Operator not familiar with terrain.
- Inadequate operator/crew training.
- High Payload Center-of-Gravity
- Road Conditions.
- Interference from Local Population
- Operations near Water.
- Detonation of explosive devices.

### **OVERLY AGGRESSIVE DRIVING OR DRIVING TOO FAST**

C-3. Speed kills! This is a fact. If the operator overestimates their abilities and that of their vehicle this could lead to a vehicle roll over. Combat operations may inject situations that tend to push the operator beyond their capacity to make logical decisions. Working together as a team reduces the chances that an individual Soldier will make the wrong decision in an emergency. Over steering coupled with a high center-of-gravity may push the balance over the point by which vehicle remains stable (4 tires on the ground).

### **OPERATOR NOT FAMILIAR WITH TERRAIN**

C-4. This is preventable in most cases. In ALL CASES if the operator knows the vehicle characteristics and limitations chances are better of preventing or surviving a roll over. (Embellish and provide personal experience [if applicable to instructor]). Such terrain conditions that may contribute to a roll over are deeply rutted roadway, steep road shoulders, abrupt drop offs along roadway, canals or other bodies of water that parallel the roadway, and so on.

## **INADEQUATE OPERATOR/CREW TRAINING**

C-5. If the operator is expected to perform vehicle operations that they are not trained for then the risk is understandably increased. Soldiers and leaders are responsible for identifying strengths and weaknesses of all vehicle operators and crew during operator's training periods. Operators **MUST** be **THOROUGHLY FAMILIAR** with their vehicle and every aspect of its operation and capabilities. Comprehensive operator training is the key. Vary the terrain both on and off road in varying climate conditions in order to identify any weaknesses in operator ability. Provide retraining in order to keep operator skills sharp.

## **HIGH PAYLOAD CENTER OF GRAVITY**

C-6. This is a major contributing factor to vehicle rollovers. If the crew overloads the vehicle or does not load the heavier items on bottom, the center-of-gravity will be raised higher. Every effort should be made to plan and load the vehicle to minimize this affect. If the load is off-sided the vehicle handling will be adversely affected. This will not only prematurely wear on the vehicle components but will also tend to make the vehicle sluggish to control or drift from side to side. The M1114 has a load capacity of 2,300 pounds. This includes everything, weapons, people, equipment, radios, and so on. **DON'T OVERLOAD IT !!**

## **ROAD CONDITIONS**

C-7. If the vehicle operator does not pay close attention to changing road conditions, and therefore does not adjust speed accordingly, the result may be a vehicle rollover. The vehicle gunner has a "bird's eye view" of the roadway in all directions and can sight hazards farther from the vehicle than the operator's view. Communication will help reduce the hazard.

## **INTERFERENCE WITH LOCAL POPULATION**

C-8. Its vitally important for the entire vehicle crew to be vigilant and keep their situational awareness in "HIGH GEAR." Be aware of the surroundings within the vicinity of the roadway and aware of the possibility of an unexpected aggressive reaction from passersby. Intervention by civilians whether they are of hostile intent or just desperate to obtain a helping hand could inadvertently cause a vehicle accident. **GUNNER MUST PROVIDE AN OVERALL VIEW** and communication with operator on what is observed that the operator may not see.

## **OPERATIONS NEAR WATER**

C-9. During operations in the vicinity of rivers, canals, lakes, etc, vehicle crews must be ever-vigilant with regards to conditions of roadway and proximity to edge of water. As with any other terrain that is potentially hazardous, reducing speed and involvement by all crew members of upcoming terrain, especially the gunner may reduce the changes of a rollover into water. Judging distances is ever-critical in these areas. Local Area Combatant Commanders should determine when combat locks should be used while conducting operations near bodies of water. Ensure additional precautions as dictated by unit-SOP as to operations in this type of terrain.

## DETONATION OF EXPLOSIVE DEVICES

C-10. This includes improvised explosive devices (IED) or vehicle-borne improvised explosive devices (VB-IED). This can be the most destructive cause of a vehicle roll over. There is no warning, only reaction. No time is allowed to determine what your actions will be until it happens. No time to determine if you can or cannot make the right decisions that will increase chances of survival. This is when you will determine if any of your preventive measures and training will pay off. The operator should make every effort to maintain control of vehicle as long as possible.

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Note: For more information on vehicle rollovers, refer to DVC 55-62 and TC 55-HEAT.

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### CAUTION

Also be aware that the IED/VB-IED may be used to release chemical gas or radioactive debris. If in doubt or a gas cloud is seen, don your protective mask.

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**COLORS OF SIGNS**

6. The nature of the contamination or danger of the considered area is indicated by the colors of the signs. These include:

- a. The primary color, used for the background of the front surface and for the entire back surface of the sign.
- b. A secondary color, used for additional markings and/or inscriptions on the front surface.

These colors are:

DANGER	PRIMARY COLOR	SECONDARY COLORS	
		MARKINGS	INSCRIPTIONS
Radiological contamination	WHITE	NONE	BLACK
Biological contamination	BLUE	NONE	RED
Chemical contamination	YELLOW	NONE	RED
Chemical minefields (or barriers)	RED	YELLOW (STRIPE)	YELLOW
Minefields (or barriers) other than chemical	RED	NONE	WHITE
Booby-trapped areas	RED	WHITE (STRIPE)	WHITE
Unexploded munitions	RED	WHITE (BOMB)	NONE

**CHEMICAL MINEFIELDS (OR BARRIERS), BOOBY-TRAPS AND UNEXPLODED MUNITIONS**

7. In the case of danger due to chemical minefields (or barriers), booby-traps and unexploded munitions, the front surface of the sign which faces away from the dangerous area, has two colors and will be marked thus:

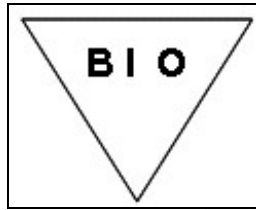


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**MINEFIELDS (OR BARRIES) AND BIOLOGICAL, RADIOLOGICAL AND CHEMICAL CONTAMINATIONS**

8. In the case of danger due to minefields (or barriers) (other than chemical) and of danger due to biological, chemical and radiological contamination, the primary color and the pattern of the signs by themselves will be the principal means of recognizing the type of contamination. As a safeguard, the words, 'MINES,' "GAS MINES," "GAS," "BIO," (for biological contamination or "ATOM," with the optional addition of a symbol such as a trefoil (for radiological contamination) where required by national authorities, will be painted or written with the secondary color on the front surface. The language to be used for these inscriptions will be selected by the forces erecting the sign. These inscriptions will be written parallel to the longer side of the sign, for example:



**INSCRIPTION OF SIGNS**

9. In addition, details if known, of biological, chemical and radiological contaminations are to be written on each sign, preferably on the front surface. For biological contamination and for persistent or moderately persistent chemical agents, the name of the agent used, when known, and the date and time of detection are required. In cases of radiological contamination, the following information will be inserted on each sign:

- a. The dose rate.
- b. Date and time of reading.
- c. The date and time of the detonation that produced the contamination (if known).

**MULTIPLE HAZARDS**

10. Areas which contain more than one type of contamination or other hazard will be marked with the relevant signs placed near to each other. However, the signs "GAS MINES" will be assumed to include the attendant presence of High Explosive Mines and/or Booby Traps.

**MARKING OF PHONY CONTAMINATED AREAS**

11. Marking of phony contaminated areas (for example, a phony minefield) shall be exactly the same as for those that are real.

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12. The marking of radio logically- contaminated areas, complete equipment, supplies and stores merely indicates the presence of a hazard, the extent of which must e determined by newly arrived troops by means of instrument readings, surveys, or information from other units.

13. At the discretion of the commander, a radio logically contaminated area need not be marked when a military advantage would be obtained by not doing so. In such cases positive measures will be taken to warn other friendly forces of the existence of the radio logically contaminated area.

14. Signs are to be placed on all probably routes leading into contaminated areas at the points where the dose rate reaches 1 rad per hour measured at 1 meter above the ground and on supplies and stores within these areas. When the dose rate is above 1 rad per hour, signs showing the actual dose rate are to be placed on all probable routes leading into the contaminated area at the boundary.

15. Lower levels normally are not marked even though significant doses might be produced by long stays in areas of old contamination. Units planning prolonged stays in an area during a nuclear war should check the area with radiac instruments regardless of whether it is marked.

16. Signs should be corrected or moved periodically to account for radioactive decay.

17. Command leaving an area or otherwise giving up responsibility for an area are to leave perimeter signs in place. The command taking over responsibility for the area will continue the periodic correction or movement of the signs or remove them when they are no longer necessary.

18. Dumps for radio logically contaminated material are to be marked at intervals around the perimeter.

**SIZE AND SHAPE OF SIGNS**

19. Existing stocks of colored triangular signs are slightly divergent shapes and sizes will be retained and used until stocks are exhausted.

20. The triangle will be a right-angled isosceles triangle.

21. The base of the triangle will be approximately 28 centimeters (11½ inches) and the opposite sides will be approximately 20 centimeters (8 inches).

22. Triangles will be made of metal, wood, plastic, composition board, or any other adequate material available.

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**PLACING OF SIGNS**

23. Signs will be placed above the ground, right-angled apex downwards on wire boundary fences, trees, rocks, poles or by putting the apex into the ground. This latter method should not be used if the other methods can be adopted as the sign might well be obscured by grass and other undergrowth. Further, they can be readily knocked down. The front side of the signs is to be posted facing away from the area being marked. In those cases where signs are posted within a contaminated area, the sign is to face away from the area of higher dose rate, or higher concentration if such can be determined.

**SIGNS FOR COMPLETE EQUIPMENTS, SUPPLIES AND STORES**

24. At least one sign will be placed centrally on one side of a complete equipment or unit load pallet right-angled apex downwards. Non-palletized stores will be marked in the most obvious and convenient position.

**NIGHT SIGNING**

25. No standardization of lighting of signs is specified. Each army will provide lighting or reflecting devices, where deemed necessary.

**PART II – NON-MARTIAL CONTAMINATIONS**

26. Non-martial contamination consists of that contamination resulting from latrines, garbage, soakage and refuse. These forms of contamination will always be marked by rectangular signs which may be of any color and any convenient size.

27. When closed, earth mounds will be placed on top of non-martial contaminations and the rectangular sign will be placed on the top of the mound. The sign will indicate the type of pit, the date closed, and in non-operational areas, the unit designation.

**IMPLEMENTATION OF THE AGREEMENT**

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

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## **Appendix E**

# **Gun Trucks**

### **INTRODUCTION**

E-1. The problem of convoy security is not a new one. U.S. Army regulations addressed convoy security as early as 1861, and the doctrinal principles of convoy defense have changed little since then. However, changing conditions in the Twentieth Century, ranging from the advent of motorized vehicles to the concept of the Contemporary Operational Environment (COE), brought about significant changes in the tactics, techniques, and procedures used by transportation units in the field. In the Vietnam War, emphasis in convoy defense shifted from the use of escort forces to self defense. In this conflict, the 8<sup>th</sup> Transportation Group developed the fabled gun truck. These colorful, heavily-armed vehicles were dedicated weapons platforms with the purpose of deterring and defending against ambush. Although these trucks blasted their way into the history books forty years ago, they are still highly relevant to the COE. The enemy is still equipped with the venerable AK-47 and the versatile rocket propelled grenade (RPG), and he is still possessed of a penchant to place field expedient explosives, now known as IEDs, in the path of a convoy. In addition, we still face the problems of excess wear and tear due to the added weight of armor and ammunition. But most importantly, as was the case in 1968, there is still little definitive Army doctrine concerning the employment of gun trucks. For all their flamboyance, gun trucks in Vietnam were nothing more than field expedients. The ultimate Vietnam gun truck design was the result not of a carefully laid plan, but trial and error. Gun trucks were constructed using materials at hand and armed with whatever weapons the units could find. The excess weight contributed to maintenance concerns, although not of the magnitude present-day officers and NCOs have been led to believe. Truck units were not authorized most of the weapons with which they armed themselves, and gun truck crews had no formal training. Many gunners learned the principles of employing .50 caliber machine guns not on a range, but in their first fire fight. As a result, gun truck fire was often not as disciplined or effective as it should have been.

### **GUN TRUCK FUNCTIONS**

E-2. A gun truck is a mobile fighting platform. Its purpose is to protect the convoy and defeat the enemy. Gun trucks serve several functions.

- Ambush deterrence (aggressive yet disciplined posture).
- Ambush defense. Gun trucks aggressively suppress enemy fire and force the enemy to break contact.
- Control vehicles.
- Forward security element (FSE).
- Rear security.
- Perimeter security during halts.
- Electronic security.
- Evacuation of wounded from the kill zone.
- Security for disabled vehicles.

## **GUN TRUCK CREW DUTIES**

E-3. In order to conduct successful gun truck operations, the crew must be a highly trained team. Each crew member must be thoroughly familiar not only with his individual responsibilities, but those of his fellow crew members as well. Key to the success of the gun truck is training and rehearsal. All gun truck crew members should be thoroughly trained and must be intimately familiar with the following:

- Qualified on all weapons systems to be employed.
- Qualified operator on the vehicle's CREW (Warlock) system.
- Troop Leading Procedures (TLPs), standing operating procedures (SOPs), and reporting requirements.
- All battle and rollover drills.
- Target identification and engagement.
- Latest enemy tactics, techniques, and procedures (TTPs).
- Convoy control and movement techniques.
- Safety and risk assessment.
- Rules of Engagement (ROE).
- Operator/crewman extraction on all convoy vehicles.
- First aid (at least one crewman should be a combat lifesaver (CLS)).
- Trained and licensed on assigned gun truck.
- PMCS (vehicle and all components contained therein).
- Field Expedient or Hasty Vehicle Recovery Operations.

## **RESPONSIBILITIES OF THE GUN TRUCK COMMANDER/SECTION LEADER (CONVOY PREPARATION)**

E-4. The gun truck commander is the NCO in charge of a gun truck. The gun truck section leader is an NCO that is placed in charge of all gun trucks in the convoy or serial.

E-5. All gun truck commanders answer directly to the gun truck section leader. The gun truck section leader ordinarily answers directly to the convoy commander, although his place in the chain of command may vary from unit to unit. The gun truck commander/section leader:

- Organizes vehicle crews and issues operation order (OPORD) to the gun truck section.
- Briefs route, order of march, speed, interval, actions at halts, actions at vehicle breakdown, actions on contact, chain of command, communications and signal information, vehicle load, and Soldier's load.
- Conducts pre-combat checks (PCC) and pre-combat inspections (PCI) (both personnel and vehicles).
- Conducts section rehearsals and participates in convoy rehearsals.

## **RESPONSIBILITIES OF THE GUN TRUCK SECTION LEADER (EXECUTION)**

E-6. The gun truck section leader is an experienced, aggressive NCO capable of making sound decisions under extreme pressure. Although the convoy commander is responsible for convoy defense, it is the gun truck section leader who makes it happen. The gun truck section leader's responsibilities during the execution phase are:

- Crosses start point (SP) on time.
- Maintains position in convoy (normally rear, front, and center in that priority).
- Controls the gun trucks in accordance with orders from the convoy commander.
- Maintains discipline and adheres to all convoy SOPs.



- Maintains convoy security throughout the movement.
- Quickly assesses the situation and reports to the convoy commander.
- Identifies threat and returns fire, engaging the most dangerous threats first.
- If under indirect fire, identifies and fires on the enemy forward observer.
- Minimizes collateral damage.
- Makes critical decisions in the convoy commander's absence.

## **RESPONSIBILITIES OF THE GUN TRUCK SECTION LEADER (AT THE HALT)**

- E-7. The gun truck section leader's responsibilities during a halt include:
- Select halt locations that ensure convoy security.
  - Position gun trucks for maximum security at the halt.
  - Conduct consolidation and reorganization.
  - Supervise PMCS on vehicles, equipment, and weapons.
  - Submit Situation Reports (SITREPS)/Size, Activity, Location, Unit, Time, and Equipment (SALUTE)/Army Corps of Engineers (ACE) reports to the convoy commander as required.

## **HARDEN GUN TRUCKS**

E-8. The key factors in gun truck planning include armor, or the capability of sustaining a hit; weight; speed; maneuverability; and armament. The trade-off between armor and weight is critical. Not enough armor can prove deadly. Too much armor is counterproductive, in that a heavily-hardened vehicle may be too heavy to keep up with the convoy it is charged with defending. The excess weight can also create maintenance problems due to a significant increase in wear of suspension, steering, and braking systems and increased down time. A "hangar queen" cannot be an effective gun truck. Still another factor is weight distribution. Hardening a vehicle changes its center of gravity, and a vehicle can easily be hardened to the point that it becomes unstable. Hardening a vehicle to the extent that it rolls over at the proverbial drop of a hat is not only counterproductive, but extremely dangerous. Vehicle armor is classed as Level 1, Level 2, and Level 3. Level 3 armor, sometimes called "hillbilly" armor is unit-fabricated using whatever materials can be scrounged. Level 2 armor is kit armor supplied by a vendor. It usually bolts on, and is usually configured to fit a specific vehicle. Level 1 armor is built into the vehicle during the manufacturing process, and is an integral part of the vehicle. Virtually all vehicles in the COE are equipped with Level 1 and Level 2 armor. However, do not assume that a vehicle is ready for combat simply because it is equipped with Level 1 armor. Vehicles often require some form of Level 2 or Level 3 addition or modification to their armor upon arrival in Theater due to changes in enemy TTPs. Every combat service support (CSS) unit should be capable of fabricating Level 3 armor in the event a unit is deployed without up-armored vehicles. An effective field expedient configuration for a gun truck with a cargo bed is a gun box with a pedestal-mounted machine gun placed in an armored "box" located in the bed of the truck. This is accomplished by hardening the cargo bed or a portion thereof with a box consisting of rolled steel plate. Double layering of steel plate may be required, based on the type of steel available.

**CAUTION**

If steel plate is not available, use sandbags to form the bulk of the box with a wood frame to hold them in place. This should be a temporary measure only, as sand becomes tiny projectiles when hit by an IED or RPG. The sand penetrates skin, causing both wounds and secondary infections.

**ARMED GUN TRUCKS**

E-9. The primary mission of most combat arms units is to close with and destroy the enemy. Therefore, these units are provided with the best weaponry available, and unit personnel are trained extensively with those weapons. Unlike combat arms units, CSS units have a variety of primary missions, such as maintenance, transportation, supply, water purification, and various other support roles. The CSS unit's combat mission, which is strictly defense, has long been considered secondary to its primary mission. Consequently, in terms of weapons, the CSS unit is not as well trained or equipped as its combat counterpart. The challenge that faces the CSS commander is twofold: he must train and equip his unit for combat using limited time and resources, and he must tailor his defense to meet the current threat. It is within these constraints that the CSS unit commander must arm his gun trucks in the following manner:

**DETERMINE WHAT WEAPONS ASSETS ARE REQUIRED**

E-10. If possible, obtain a mix of weapons and weapons systems commensurate with the COE. For instance, an M2 .50 caliber machine gun or Mk 19 40mm grenade machine gun has sufficient firepower to neutralize an enemy threat through a cinderblock wall. However, it may also neutralize the civilian who is watching television in his own house down the block. Less destructive weapons, such as the M240B, should be employed to cause less collateral damage in an urban environment. A well-equipped convoy has a mix of weapons to deal with situations in both rural and urban environments. This postures the unit to effectively deal with the threat and minimize collateral damage.

**DETERMINE WHAT ASSETS ARE AVAILABLE**

E-11. These may be either organic or inorganic to the unit. Gun trucks are often equipped with inorganic weapons, obtained and fitted to unit vehicles by highly creative Soldiers. Before employing such weapons, ensure that you have the capability to supply and maintain them. Also ensure that the weapon is appropriate for the platform on which you plan to mount it. Testing will prevent both embarrassment and loss of life. Locally fabricated equipment, such as turret shielding and machine gun pedestals, should be thoroughly tested before placed into service. In the event the convoy commander does not have sufficient weapons for the mission, he should coordinate with higher headquarters to eliminate the shortfall.

**DETERMINE HOW THE WEAPONS WILL BE MOUNTED**

E-12. Ring mounts for crew-served weapons are readily available, and unlike their Vietnam counterparts, have a 360-degree traverse capability. They also provide the high-riding gunner with better visibility over his immediate area. Further, ring mounts can be shielded to protect the gunner's head and upper body. In the COE, ring mounts have gradually been replaced by armored turrets. Screens are often added to turrets to make the gunner a difficult target for snipers.

E-13. Pedestal mounts also provide a 360-degree traverse capability. They can be locally fabricated, but must be tested to ensure that they can sustain the shock of firing the weapon and the constant vibration of a moving vehicle. A pedestal mount in a gun box does not provide the gunner with the visibility he enjoys from a ring mount on a vehicle cab. Pedestal mounts used in a gun box provide excellent torso and lower body protection to the gunner, but the gunner's head and back are exposed as he stands in the gun box.

E-14. The choice between ring mounts and pedestal mounts is dependent on mission, enemy, terrain and weather, troops and (materiel) support available, time available, civil considerations (METT-TC). What works best in one situation may not work well at all in another.

### **DETERMINE WHETHER GUN SHIELDS WILL BE USED**

E-15. In Vietnam, gunners discarded gun shields because they interfered with visibility. In Iraq, gun shields are an absolute necessity due to the IED threat. The threat is subject to change depending on where you fight.

### **DETERMINE WHERE THE WEAPONS WILL BE MOUNTED ON EACH VEHICLE**

E-16. Pedestal mounts may be placed in the center, at the corners, or toward the rear of a gun box. This decision is based on experience, commander's guidance, and availability of parts and equipment. Supplement crew-served weapons with small arms, grenades, pyrotechnics, and non-lethal weapons as needed and available.

### **ADDED RELATED EQUIPMENT**

E-17. Equipping a gun truck does not end with a machine gun. There is much to add to build an effective fighting platform:

### **COMMUNICATIONS ASSETS**

E-18. The gun truck should have the capability of communicating with everyone in the convoy. The gun truck should also have access to all external nets. This may require stacking as many as three SINCGARS radios, in addition to hand-held radios and Movement Tracking System (MTS)/FBCB2/Blue Force Tracker.

### **MEDICAL SUPPLIES**

E-19. Each gun truck crew should include at least one CLS and a trauma kit in addition to the standard first aid equipment.

### **MAINTENANCE EQUIPMENT**

E-20. Gun trucks routinely perform double duty as maintenance vehicles. Often the rear gun truck falls under the control of the maintenance officer/NCO, and is equipped to perform field expedient repairs.

### **TOWING EQUIPMENT**

E-21. Each gun truck should be equipped with towing equipment such as a tow bar, tow cable, or tow chain. Vehicles should be equipped with a winch and personnel trained in vehicle recovery.

### **AMMUNITION**

E-22. There should be sufficient ammunition for each type of weapon on board. The number of rounds and/or magazines is dependent on METT-TC and the unit SOP.

## **ELECTRONIC COUNTERMEASURES (ECM) (OTHERWISE KNOWN AS COUNTER RADIO-CONTROLLED IED WARFARE (CREW))**

E-23. CREW, which is also known as Warlock, is a non-kinetic weapons system, and should be trained in the same manner as any other weapons system. Effective use of CREW is critical to survival in an environment saturated with radio-controlled improvised explosive devices (RCIEDs). CREW will not interfere with radio communications if it is properly configured. Each battalion should have an electronic warfare officer (EWO) to configure and deconflict CREW systems.

## **ESCALATION OF FORCE (EOF) EQUIPMENT**

E-24. EOF equipment is a relatively new concept, and units may or may not be equipped with it. EOF equipment varies from the simple, such as green lasers and chemical smoke (CS) grenades, to the elaborate, including non-lethal Claymore mines and noise and light devices. Ensure that all gun truck personnel are trained in the use of whatever EOF equipment you have.

## **SIGNS**

E-25. Gun trucks should be equipped with signs advising civilians in their native language to keep their distance. The specified distance depends on METT-TC, but is usually considered to be 100 meters. Ensure the lettering is large enough to read at the appropriate distance.

## **CREW EQUIPMENT**

E-26. Do not forget crew necessities. Your load plan must allow for sufficient water, meals, ready-to-eat (MREs), and personal equipment to be stowed in the vehicle.

## **STANDARDIZED LOAD PLANS**

E-27. Develop a standardized load plan for every type of vehicle in your unit. This allows any member of the convoy to access a given vehicle and go directly to the needed item. This is especially important in recovering sensitive items, ammunition, etc, from a disabled vehicle, or obtaining ammunition or medical supplies at a critical moment.

### **CAUTION**

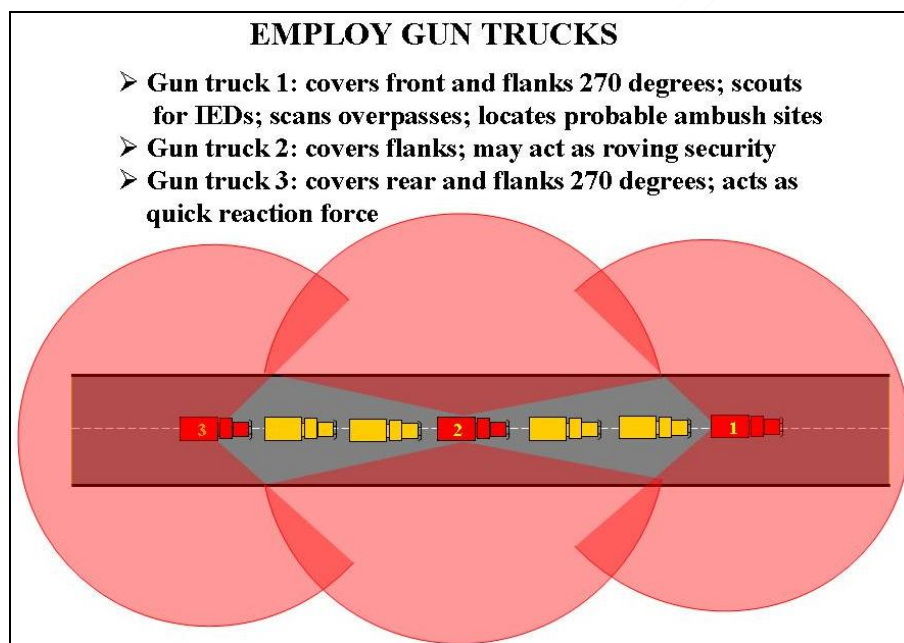
Be aware of the vehicle's vertical and horizontal centers of gravity when configuring the load. Placing the heaviest portion of the load in the lowest part of the vehicle keeps the center of gravity lower, reducing the potential for rollover.

## **PRINCIPLES OF GUN TRUCK EMPLOYMENT**

E-28. Building and equipping the gun truck is only half the task. Each gun truck crew must be thoroughly trained to act both independently and as part of a team with other gun truck crews. Ensure that crews remain alert and display a tough and aggressive, yet controlled and disciplined posture. Ensure that all gun trucks have functional communications systems. Communication between gun truck commanders/section leaders and the convoy commander is critical. Intercom communication within the gun truck crew is equally critical. Employ a minimum of two gun trucks per convoy; and at least three with convoys greater than ten vehicles. The most common gun truck to task vehicle ratio for convoys twenty vehicles or greater is 1:10. A ratio of 1:5 or even 1:3 is used in areas where enemy activity is heavy. Employ gun trucks as follows (see Figure E-1):

- Gun Truck 1: (Front) covers front and flanks at 270 degrees; scouts for IEDs; scans overpasses; anticipates ambush, and locates probable ambush sites.
- Gun Truck 2: (Center) covers flanks. May act as roving security, constantly changing position in the convoy; acts as quick reaction force (QRF). There may be several gun trucks in the center position, depending on the size of the convoy.
- Gun Truck 3: (Rear) covers rear and flanks at 270 degrees; may act as QRF.

The priority for employment of gun trucks is the rear (trail), front, then in the body of the column (center). The rear is the weakest point in a CSS convoy, with most trucks having a large blind spot in this direction. The enemy knows this and will take advantage of it if given the chance. ALWAYS KEEP A GUN TRUCK IN THE TRAIL OF THE CONVOY. Power up and monitor the vehicle's CREW system. CREW is your best line of defense against RCIEDs.



**Figure E-1. Employment of Gun Trucks**

## **DEPLOY A FORWARD SECURITY ELEMENT (FSE)**

E-29. The FSE consists of forward deployed gun trucks or convoy escort vehicles. It may or may not be deployed, based on METT-TC. The role of the FSE is to range ahead of the convoy, identify and take action against potential threats, and provide additional security at critical points along the route. An FSE should not be employed unless there are sufficient gun truck assets to support the mission. Under no circumstances should the gun truck section leader leave the convoy or any part thereof undefended. The FSE is deployed ahead of the convoy to clear the route, identify possible IEDs, check choke points and other danger areas, and provide a show of force. The FSE may be deployed for the duration of the convoy, or it may be sent forward only to check and clear critical points along the route. Do not deploy an FSE unless you have sufficient gun trucks to remain with and defend the convoy. (The number of gun trucks to needed to defend any convoy is METT-TC dependent.) The FSE should scout ahead at least one, but no farther than three kilometers, and maintains communications with the convoy at all times. The elements of the FSE, gun trucks 1 and 2, move forward together. NEVER DEPLOY A LONE GUN TRUCK AS AN FSE. The FSE should travel in an overwatch formation. Gun truck 1 moves forward while gun truck 2 maintains overwatch from behind. After the convoy passes, the FSE will either resume

its original position at the front of the convoy, or assume a pre-arranged position at or near the rear while a new FSE emerges from the front of the convoy.

## NEGOTIATE A CHOKE POINT

E-30. Choke points, or narrow, congested areas in the road, inhibit or interrupt the convoy's movement and security. Examples of choke points include narrow bridges, tunnels, and congested intersections. The objective in negotiating a choke point is to keep the convoy moving (see Figure E-2). This is accomplished by moving gun trucks forward and establishing Traffic Control Points (TCPs). The TCP blocks civilian traffic and allows uninterrupted movement of the convoy. The FSE or designated gun trucks move forward rapidly and establish TCP's on the near and far side of the choke point. TCPs stop traffic and allow the convoy to travel unimpeded through the choke point. Once the convoy passes, gun trucks resume their positions, or merge with the convoy as a new security element or FSE takes over the lead.

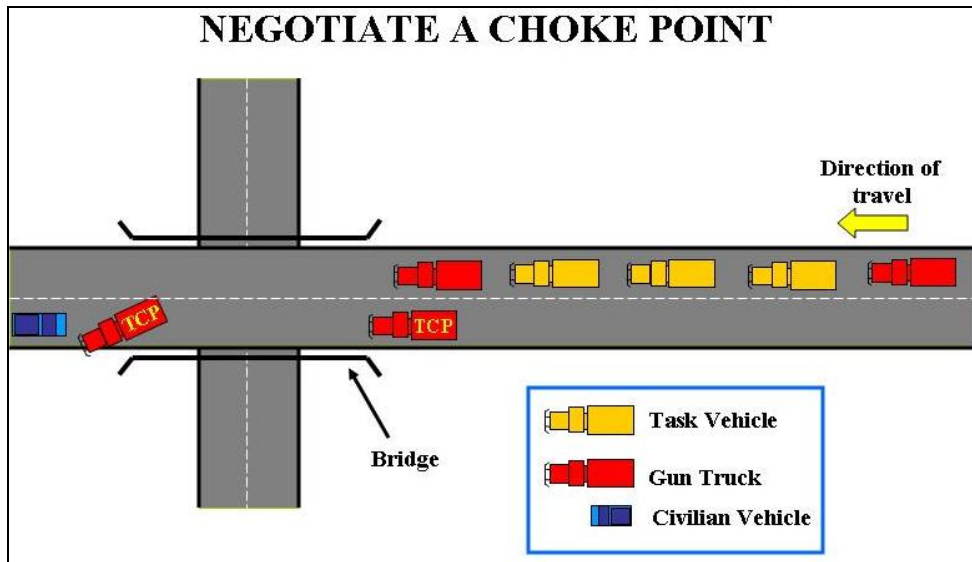
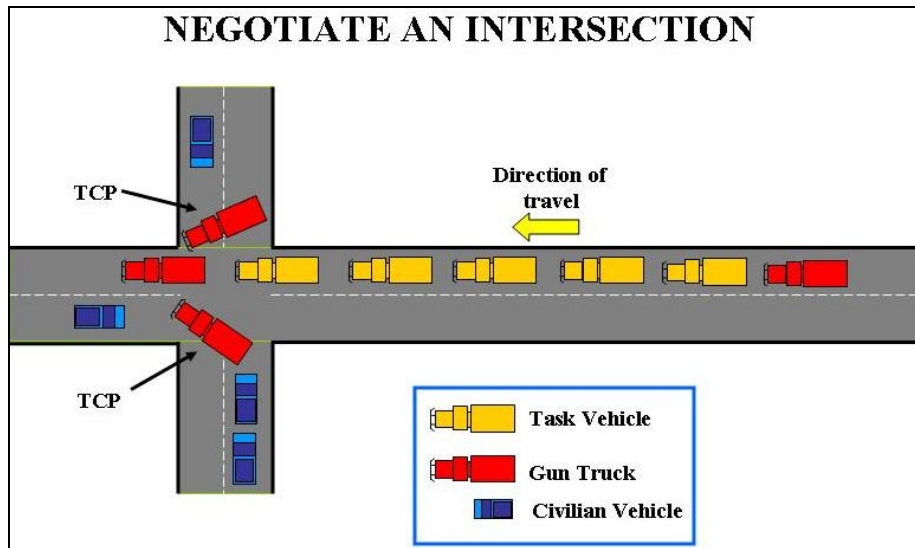


Figure E-2. Negotiate a Choke Point

## NEGOTIATE AN INTERSECTION

E-31. Gun trucks, escort vehicles, and FSEs establish TCPs at critical points and choke points to ensure that the convoy keeps moving. A critical point is an easily recognizable point along the route where it may become difficult to control the convoy, such as an intersection or a likely ambush site (see Figure E-3). Some geographical features, such as an intersection, can be both a critical point and a choke point. One of the primary risks of intersections is that of civilian vehicles infiltrating the convoy. If the enemy can infiltrate the convoy, it is a relatively simple matter to fire on vehicles, drop an IED, set off a VBIED, or isolate a vehicle and attack it before security elements have a chance to react. Perform the following to negotiate an intersection:

Note: As the convoy approaches the intersection, it reduces speed and closes intervals to prevent civilian vehicles from entering the formation. The FSE or designated gun trucks move forward rapidly and establish TCPs to block all civilian traffic coming through the intersection. Once the convoy passes, gun trucks resume their positions, or merge with the convoy as a new security element takes over the lead. In the case of multiple intersections, each additional intersection must be secured by an additional TCP.

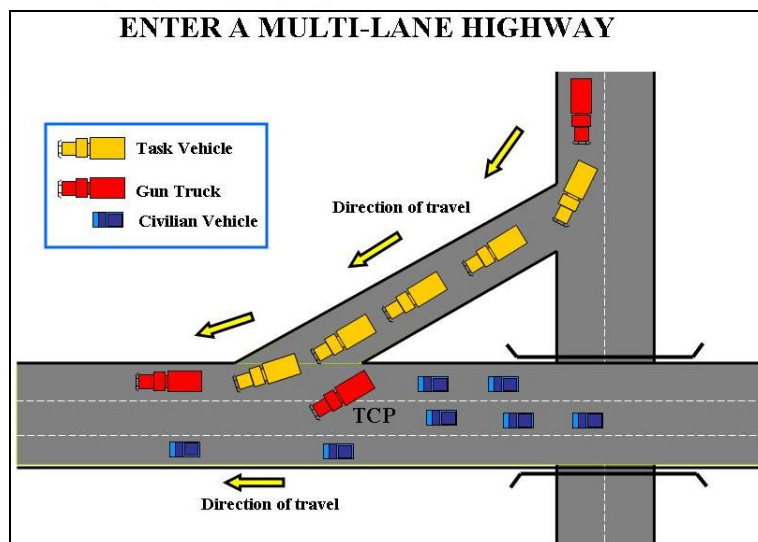


**Figure E-3. Negotiate an Intersection**

## ENTER A MULTI-LANE HIGHWAY

E-32. On/Off ramps are another form of an intersection. They provide the enemy an excellent opportunity to infiltrate or otherwise interfere with the convoy. Figure E-4 demonstrates how to enter a multi-lane highway.

Note: The FSE or designated gun trucks move ahead of the convoy to establish TCPs as needed. The TCP blocks and opens a lane of traffic on the highway as the convoy enters. The security element (TCP) rejoins the convoy as the last vehicle enters the highway. The former TCP may assume the role of the rear security element, or move back to its original position. Exiting the highway is accomplished in the same manner as entering, placing a TCP in a position to block and open a traffic lane for the convoy.



**Figure E-4. Enter a Multi-Lane Highway**

## SECURE AN OVERPASS

E-33. A primary responsibility of gun trucks, escort vehicles, and FSE is to secure overpasses as the convoy travels under them (Figure E-5). Overpasses are particularly hazardous, in that the enemy has the multiple advantages of cover, concealment, and observation over the convoy. He can drop debris or IEDs on vehicles, or launch an ambush from this vantage point. However, the enemy is highly vulnerable on an overpass, and the convoy commander is capable of exploiting this weakness. To secure an overpass:

- *Gun truck 1* – In the lead position, approaches the overpass and proceeds up the exit ramp while—
- *Gun truck 2* – Provides overwatch from the road below. Gun truck 1 clears the overpass from the top of the ramp through a show of force, firing warning shots if necessary.\*

After Gun Truck 1 clears the overpass but before the arrival of the convoy, Gun Truck 2 moves to the other side of the overpass and assists in providing overwatch for the convoy as it passes. If a third gun truck is available, it will provide security below the overpass until the convoy passes. Once the convoy passes, gun trucks take up their original positions in the convoy or assume new positions in accordance with SOP.

Note: Warning shots are sometimes used in clearing overpasses and other areas. Remember that although warning shots can scare off a potential adversary, they can also incite violence. Warning shots should be used only as a last resort.

E-34. If there are several overpasses in close proximity, or overpasses without access ramps, securing them in this manner may not be possible. In this case, gun truck crews should train their weapons on the overpasses and secure them as well as possible from below. If fired upon from the overpass, Gun Truck 1 and 2 will flank the overpass from the entrance/exit ramps (or from the best approach possible) and deliver aggressive fire to neutralize the threat.

### DANGER

**A FLANKING ACTION ON AN OVERPASS POSES AN EXTREMELY HIGH RISK OF FRATRICIDE. THIS ATTACK MUST BE COORDINATED IN RELATIVELY CLOSE QUARTERS, AND BOTH VISIBILITY AND LINE OF FIRE ARE LIMITED DUE TO THE ELEVATION OF THE BRIDGE AND THE RAMPS. GUN TRUCK CREWS MUST CAREFULLY REHEARSE THIS MANEUVER IN ORDER TO CARRY OUT A WELL-COORDINATED ATTACK AND PREVENT FRATRICIDE.**

An overpass cannot always be secured before going under it. Not all of them have on/off ramps for access. Sometimes you will pass under two or more in rapid succession, and you will not ordinarily have enough gun trucks to secure all of them. If this is the case, use the following procedures:

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Note: As you approach the overpass, slow down slightly when about 200 meters from it. Do not go under it until the truck in front of you has cleared it and is about 100 meters on the other side of it. Scan the near side of the overpass as you approach it. At night, the gunner should scan it with a spotlight if light discipline is not mandated.

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E-35. Accelerate as you approach, making sure the vehicle in front of you has cleared and is approximately 100 meters ahead of you. As you approach the overpass, turn off your drive lights if traveling at night. Weave from lane to lane as you approach, using a random pattern. Try to use a different lane going out than you used coming in. (The lead vehicle's headlights should stay on



as it goes under the bridge to facilitate the search for IED's, road spikes, obstacles, etc.). Once the vehicle has cleared the overpass, the operator will turn the headlights back on. Never halt under an overpass. If your vehicle has a gunner, ensure that he drops into the vehicle as it passes under the overpass. The gunner will again assume his station and traverse to the rear to scan the bridge.

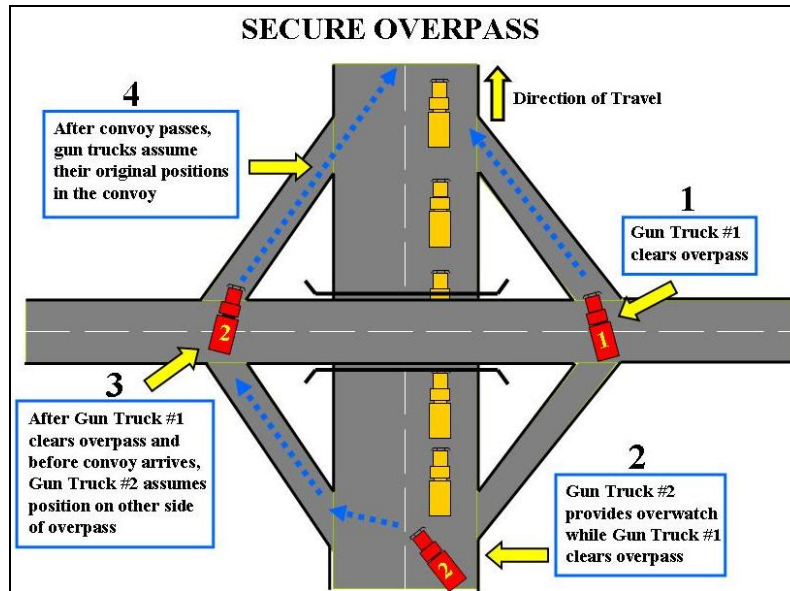


Figure E-5. Secure an Overpass

## INITIATE AMBUSH DEFENSE PROCEDURES

E-36. In an ambush, gun trucks forward of the kill zone usually maintain their positions in the convoy. They continue to maintain security for the forward convoy element unless they can immediately return fire from a stand-off position or unless they are called back by the convoy commander. The lead gun truck always stays with the convoy lead element. Gun trucks in the kill zone position themselves between the enemy and task vehicles, and aggressively return fire until the threat is neutralized or all other vehicles and personnel clear the kill zone. Gun trucks to the immediate rear of the kill zone will move forward and engage the enemy. **THE LAST GUN TRUCK IN THE CONVOY NEVER MOVES FORWARD UNLESS RELIEVED BY ANOTHER GUN TRUCK.** The following are two accepted methods for gun trucks to engage the enemy in an ambush:

### FIRST METHOD

E-37. The first method is to engage from stand-off positions. In other words, gun trucks return fire in an effort to suppress the enemy without entering the kill zone. This can be effective, but often cannot concentrate sufficient firepower on the enemy, and does not shield task vehicles caught in the kill zone. However, it minimizes exposure of gun truck crews to direct enemy fire.

### SECOND METHOD

E-38. The second method places the gun truck directly into the kill zone between the enemy and the task vehicles caught there. The gun trucks lay a "gun wall" or "gun shield" of fire to protect the task vehicles and their operators until they can maneuver out of the kill zone. This allows the gun truck to concentrate the full weight of its firepower directly on the enemy, and provides an effective shield between the enemy and the task vehicles in the kill zone. Additional gun trucks may fire from the kill zone, or may provide supporting fire from stand-off positions. It is crucial

that gun truck crews are well-trained and that all weapons and equipment are fully functional in order for this method to be effective.

E-39. On order from the convoy commander, gun trucks to the rear of the kill zone and not positioned to return fire may maneuver forward and engage the enemy. However, it is critical to maintain 360-degree security the entire length of the convoy throughout the attack. If enemy fire is overwhelming, the convoy commander may call additional gun trucks from both ends of the convoy for support. Gun trucks continue to engage the enemy until the threat is neutralized and the kill zone is cleared, or the convoy commander orders break contact. Although vehicles may be abandoned in the kill zone under overwhelming fire, no Soldier will be left behind. Gun trucks provide security, maintenance, and medical support as needed during consolidation and reorganization.

## Appendix F

# Simulators for Training

### DRIVING SIMULATORS

F-1. Driving simulators (Figure F-1) enhance operator's performance, from beginners to advanced operator's, and focus on training Soldiers, in tasks associated with overcoming road and traffic hazards. With these devices you can train on virtually any terrain or weather condition and train tasks that are deemed too dangerous to practice in the live environment. They also reduce OPTEMPO training miles, thus saving the military valuable resources.



**Figure F-1. Operator Driver Simulators**

### USA OPERATOR DRIVING SIMULATOR (USA ODS)

F-2. The USA ODS provides simulators for the US Army, Medium and Heavy Transportation Fleet. Simulators allow students to learn and master beginning to advanced on/off road operation, as well as dangerous and hazardous conditions, without risk to man or machine.

F-3. The USA ODS consists of four major parts: visual display system, cab and dash instrumentation/controls, motion cueing device, and instructor operator station. The visual display system provides an immersive, fully interactive, realistically depicted virtual world using high-resolution fully textured 3-D databases. Each student station can be configured with 3 or 5 visual channels to provide over one 80 degree and 220 degree field of view, respectively. Manufactured cabs with 3 configurations of instrumentation/controls (emulating the FMTV, M915, M939, HEMTT, PLS, & HET vehicles) provide the operator interface. Cabs include fully functional gauges and indicators with a force feedback steering system. The student station has been produced in two configurations: a full-motion system and a limited motion system. The full-motion version mounts the cab and visual displays on a full 6-Degrees-of-Freedom motion platform. The limited motion system incorporates a 3-DOF seat actuator. Both versions provide a realistic sense of vehicle performance over the operational envelope, with the full-motion system better able to represent the terrain slopes and dynamics associated with extreme off-road operation.

F-4. Simulated procedures encompass vehicle operation on-road and off-road over a range of terrain with a variety of weather conditions. Weather effects include wind, rain, snow, and fog. Daytime and nighttime, including blackout operations are included. Intelligent autonomous traffic is simulated to provide a realistic environment to train for vehicle maneuvering.

F-5. The simulation curriculum supports the full breadth of training skills. New operators are exposed to practical skills training. Basic vehicle operation under innocuous conditions is introduced and reinforced. Intermediate operators are drilled to hone their decision-making skills. Advanced operators will be exposed to vehicle operation with traffic and pedestrians, defensive driving conditions, international roadways, and rough terrain operations.

F-6. Simulation technology provides a consistent baseline for operator preparation that far exceeds training methods that rely solely on actual vehicles. Simulation exposes all operators to the same standard by enabling repeatable exercises. In addition, dangerous and potentially hazardous situations can be experienced safely without risk to man or machine. Students will be realistically trained in emergency condition driving and accident avoidance. Simulation creates a more intense driving situation where every variable such as terrain, weather, traffic, and towed loads can be changed in a matter of seconds. Geographic and climatic limitations can be overcome with simulation. Efforts are underway to either upgrade or replace USA ODS devices with an even more capable Common Driver Trainer (CDT).

## **COLLECTIVE CONVOY DEFENSE SIMULATORS**

### **CLOSE COMBAT TACTICAL TRAINER – RECONFIGURABLE VEHICLE SIMULATOR (CCTT-RVS)**

F-7. The CCTT-RVS (Figure F-2) trains Soldiers in a realistic reconnaissance/convoy environment featuring a three-dimensional view and accurate weapons systems. This mobile system is contained in an expandable trailer. Each RVS Trainer supports up to five crewmembers – vehicle commander, driver, two crew, and gunner. The design of CCTT-RVS allows crewmembers the opportunity to dismount the vehicle to engage threats and communicate via simulated voice and digital communications systems, increasing the realism of the simulation. The CCTT-RVS simulates combat, combat support, and combat service support tactical vehicles.

F-8. CCTT-RVS complements the traditional combined arms CCTT family with the representation of a wide variety of wheeled vehicles, including multiple variants of the High-Multipurpose Wheeled Vehicle (HMMWV) and Heavy Expanded Mobility Tactical Truck (HEMTT), all equipped with precision small arms simulators. CCTT-RVS easily integrates with more than 400 CCTT modules in use today or serves as a stand-alone reconnaissance, or convoy defense trainer.

### **RECONFIGURABLE VEHICLE TACTICAL TRAINER (RVTT)**

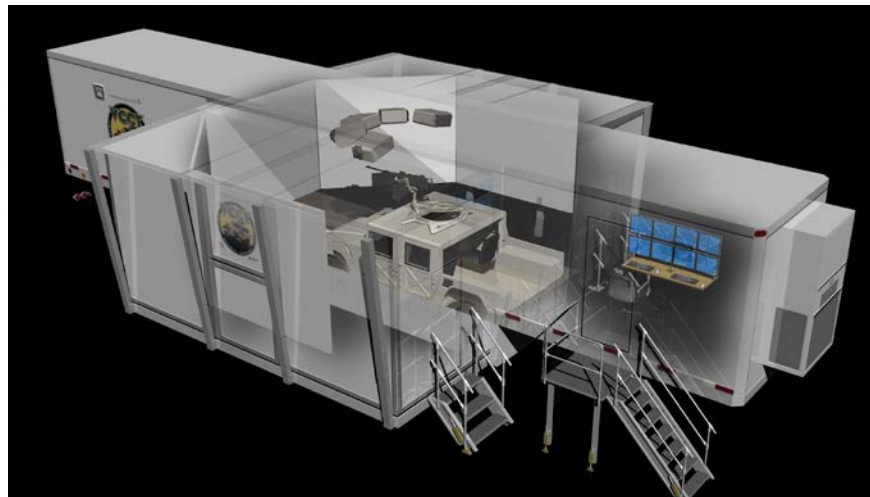
F-9. The RVTT consists of reconfigurable simulators that replicate the major types of wheeled vehicles used in convoys. RVTT provides commanders the capability to train leaders and Soldiers to properly move, shoot, and communicate while conducting mounted convoy operations utilizing a virtual environment. For example: react to an IED, break contact and defensive maneuvers are tasks that can be trained in the RVTT. The RVTT is mobile and can be deployed to most areas of operations. The RVTT provides commanders a highly tailorable, deployable, full-dimension, individual, collective, and combined arms virtual training and mission rehearsal simulator with a robust exercise development sub-system and After Action Review (AAR) capability. The CCTT-RVS modules are a common component in the RVTT as well.



**Figure F-2. Close Combat Tactical Trainer – Reconfigurable Vehicle Simulator (CCTT-RVS)**

**VIRTUAL COMBAT CONVOY TRAINER (VCCT)**

F-10. The VCCT (Figure F-3) supports training to develop and enhance basic combat skills in combat situations that patrols and convoys frequently encounter including improvised explosive devices, small arms fires and ambushes. These devices also serve as a bridge for convoy live-fire training and Stability and Support Operations (SASO). Future capabilities are being continually defined and integrated into the training. VCCT will eventually be replaced by the RVS and RVTT.



**Figure F-3. Virtual Combat Convoy Trainer (VCCT)**

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## Appendix G

# Sample Training Areas for Tactical Vehicles

### LIGHT VEHICLES (2 ½ TON OR LESS) SAMPLE TRAINING AREAS

G-1. Figures G-1 through G-7 shows the sample training areas for light vehicles.

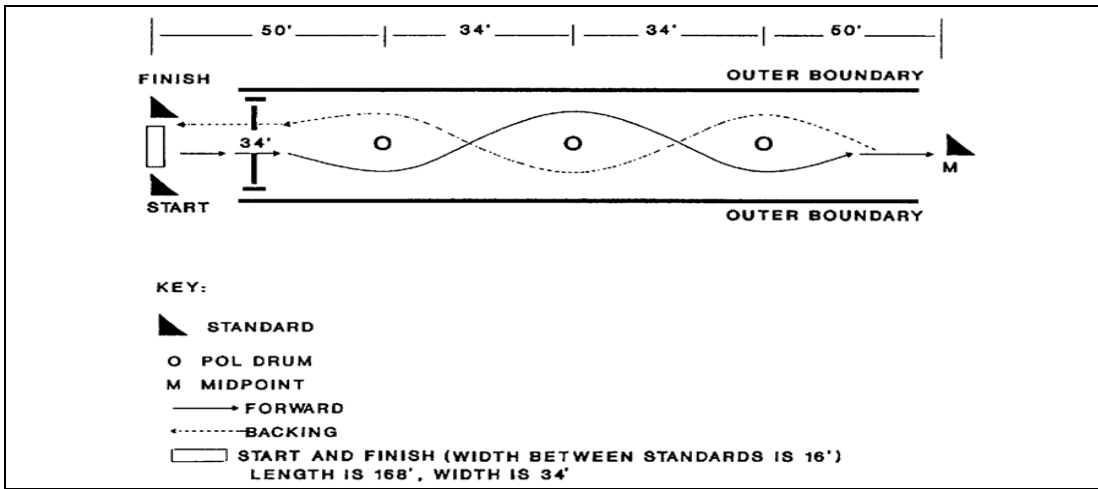


Figure G-1. Light Vehicle Serpentine Course

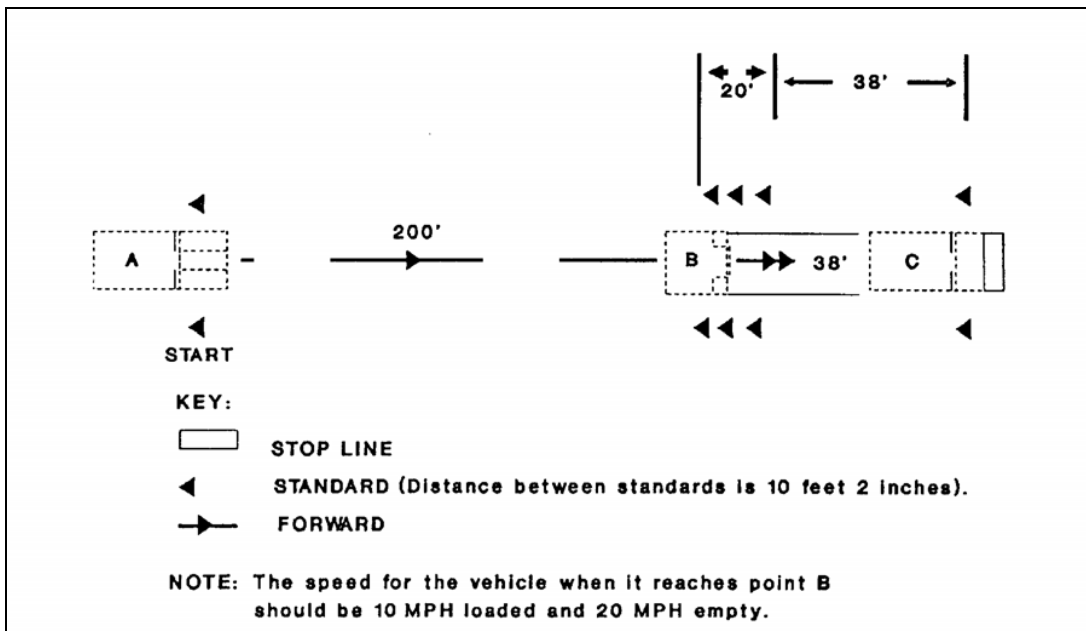


Figure G-2. Light Vehicle Stopping Within Prescribed Limit

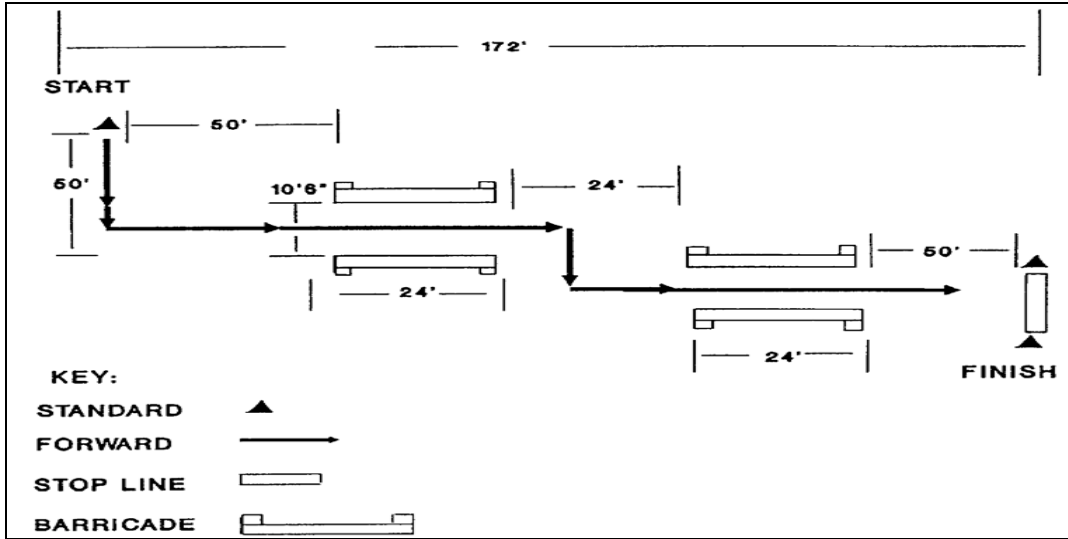


Figure G-3. Light Vehicle Offset Alley

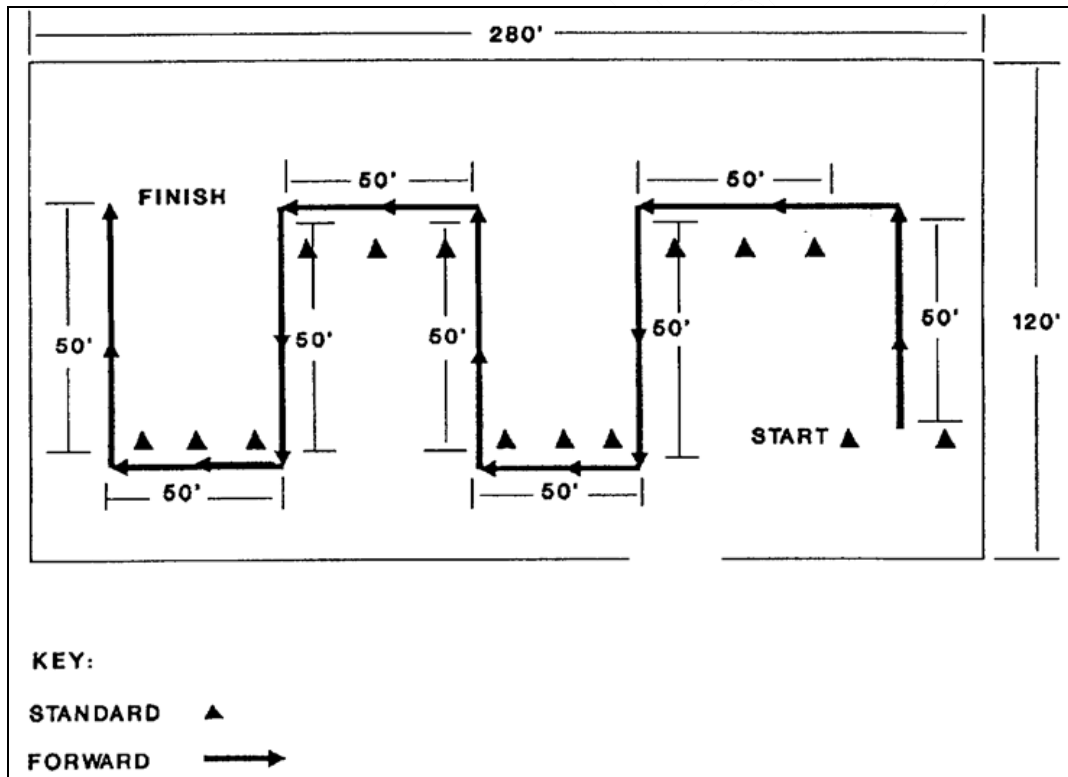


Figure G-4. Light Vehicle Right/Left Turns



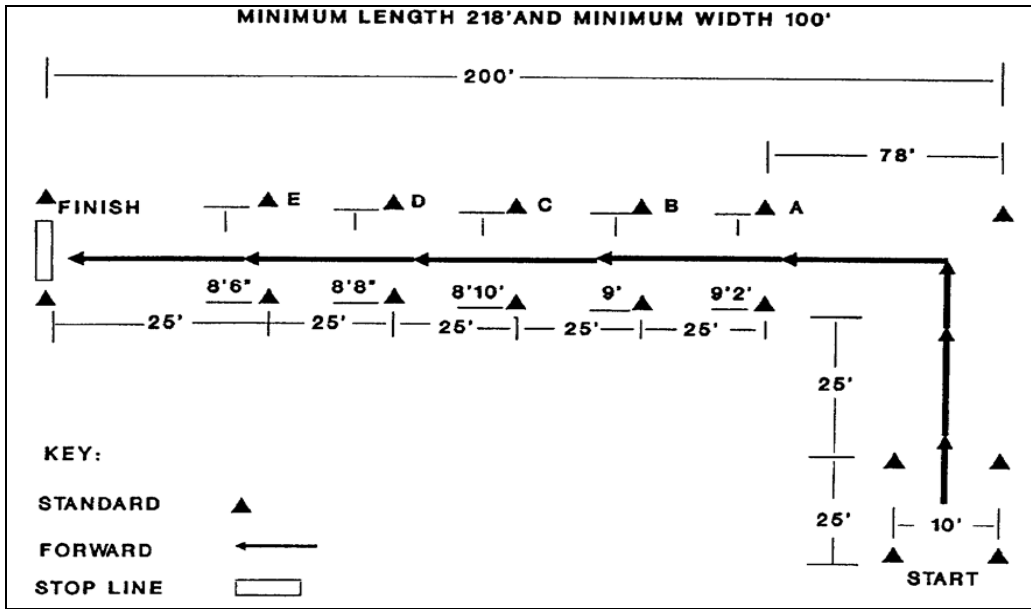


Figure G-5. Light Vehicle Diminishing Clearance

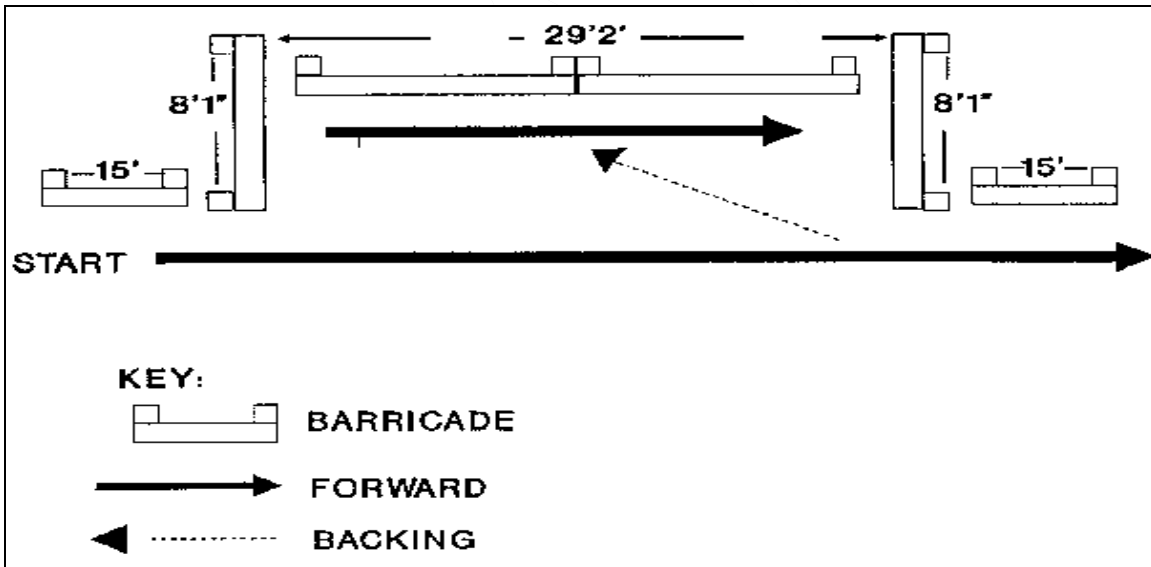


Figure G-6. Light Vehicle Parallel Parking (Sight Side)

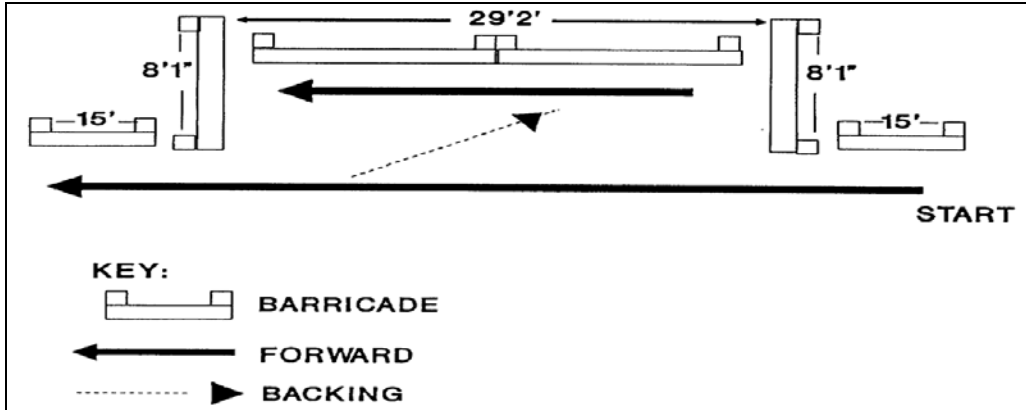


Figure G-7. Light Vehicle Parallel Parking (Blind Side)

**MEDIUM VEHICLES (STRAIGHT VEHICLES, 5 TON AND GREATER)  
SAMPLE TRAINING AREAS**

G-2. Figures G-8 through G-15 shows the sample training areas for medium vehicles.

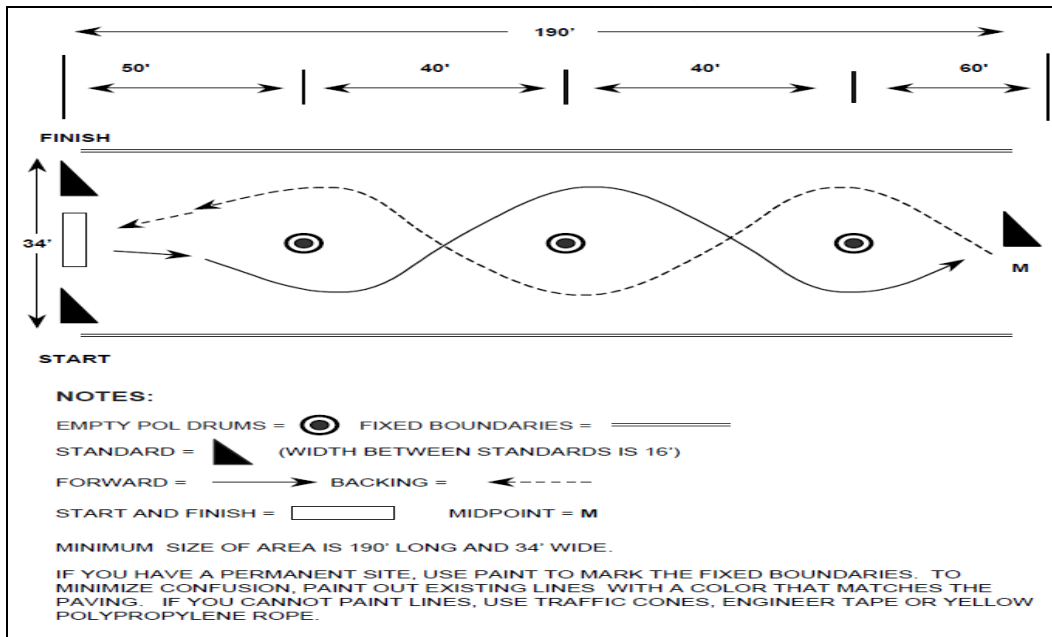


Figure G-8. Medium Vehicle Serpentine Course

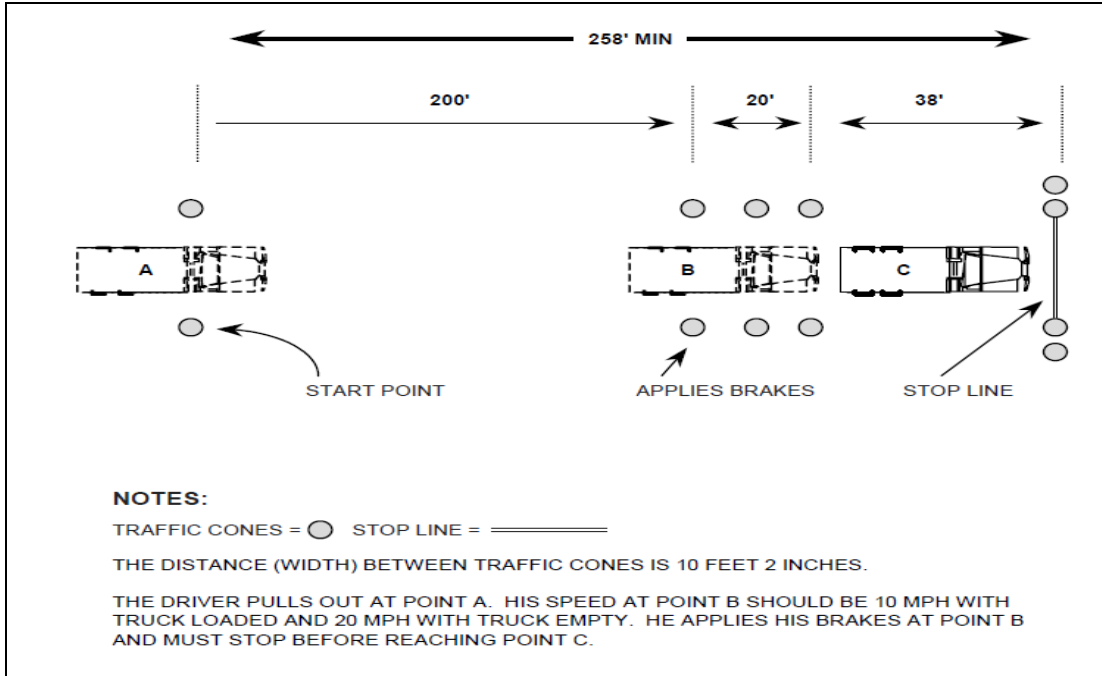


Figure G-9. Medium Vehicle Stopping Within Prescribed Limit

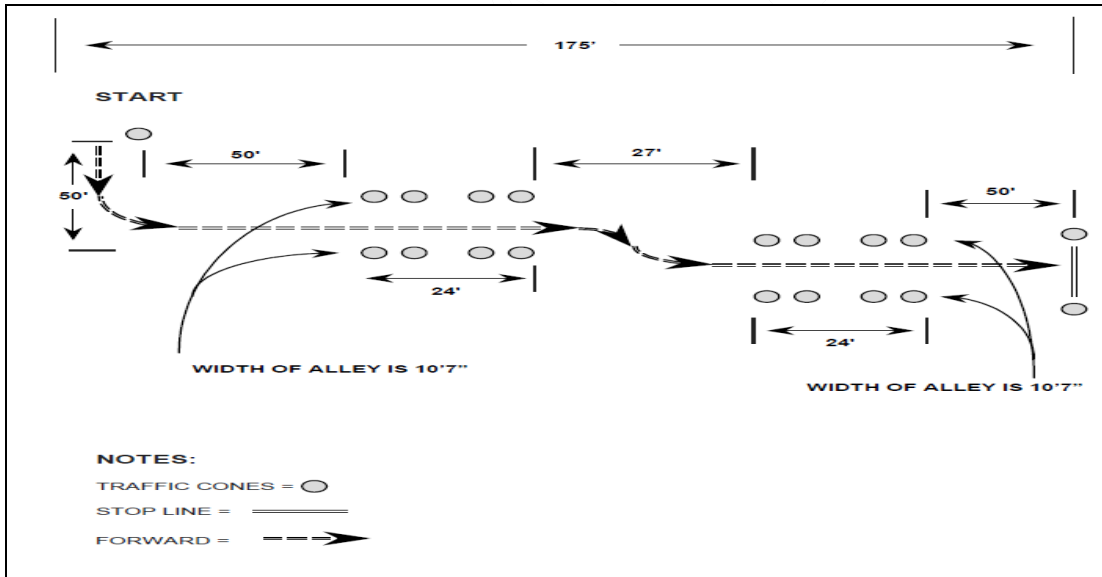
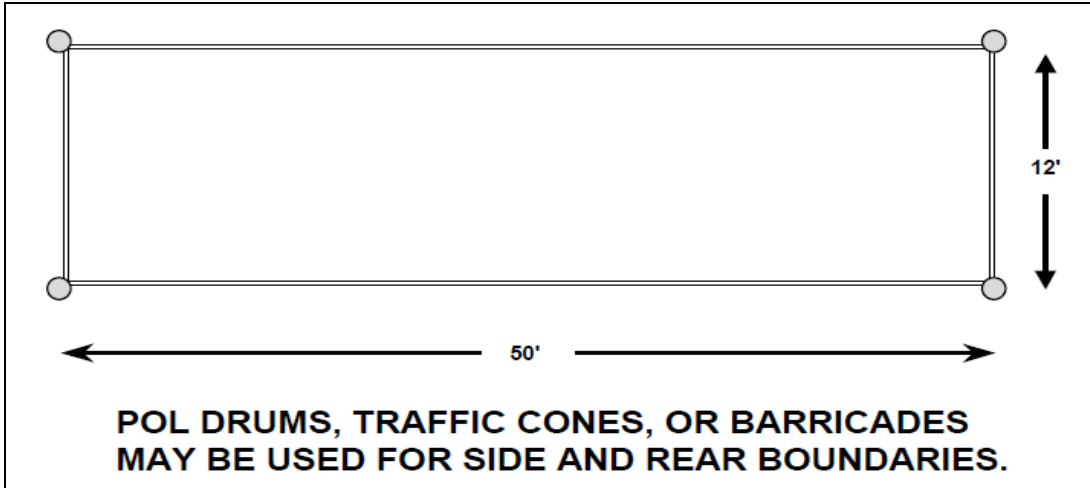
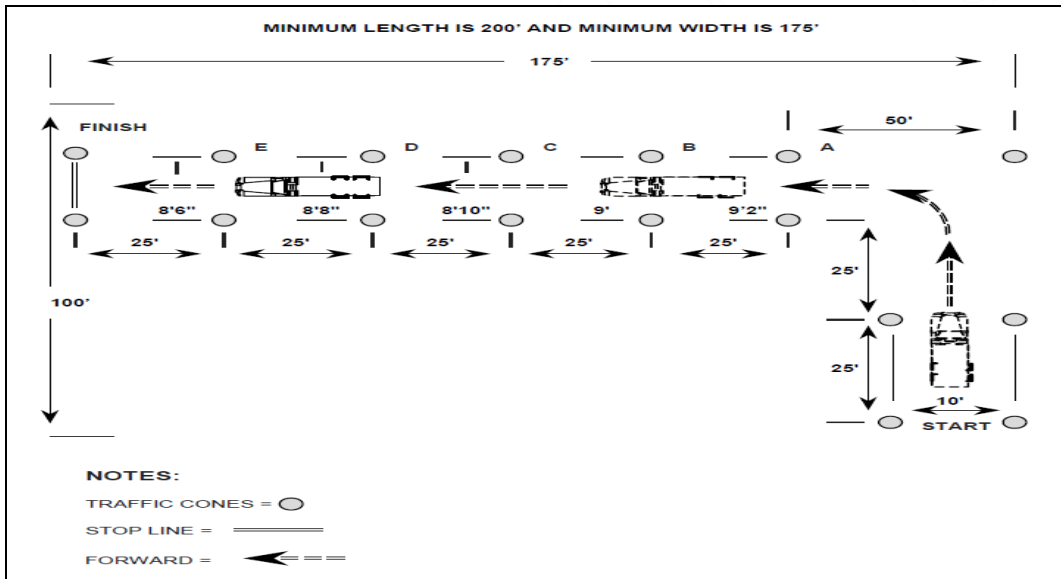


Figure G-10. Medium Vehicle Offset Alley



**Figure G-11. Medium Vehicle Straight Line Backing**



**Figure G-12. Medium Vehicle Diminishing Clearance**

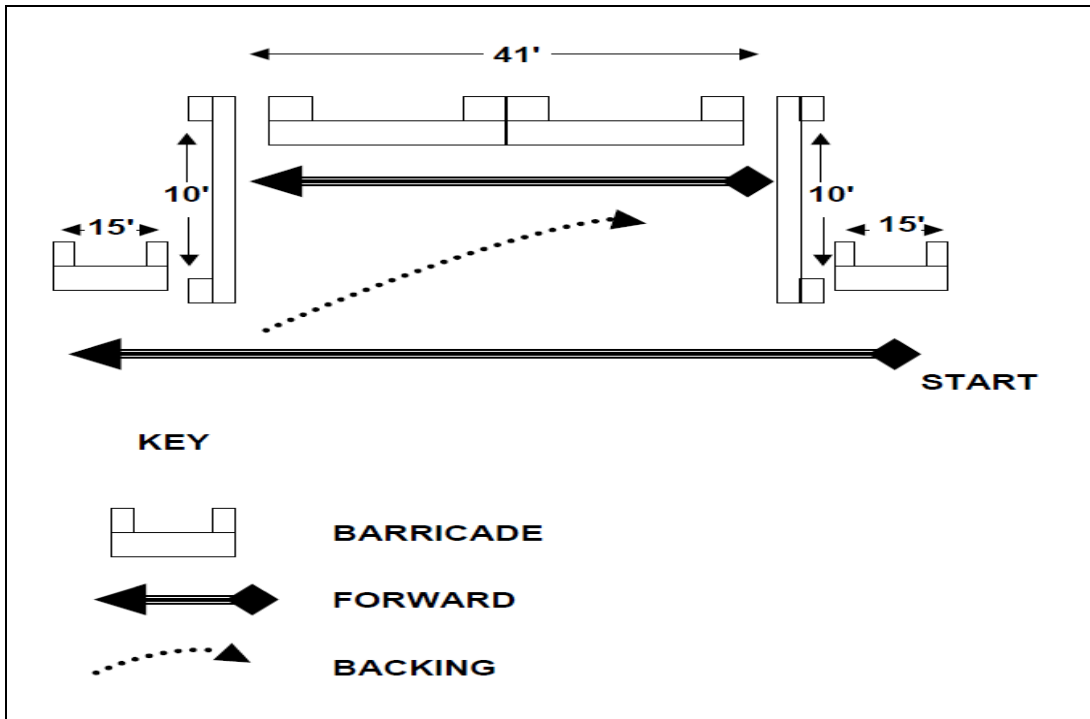


Figure G-13. Medium Vehicle Parallel Parking (Blind Side)

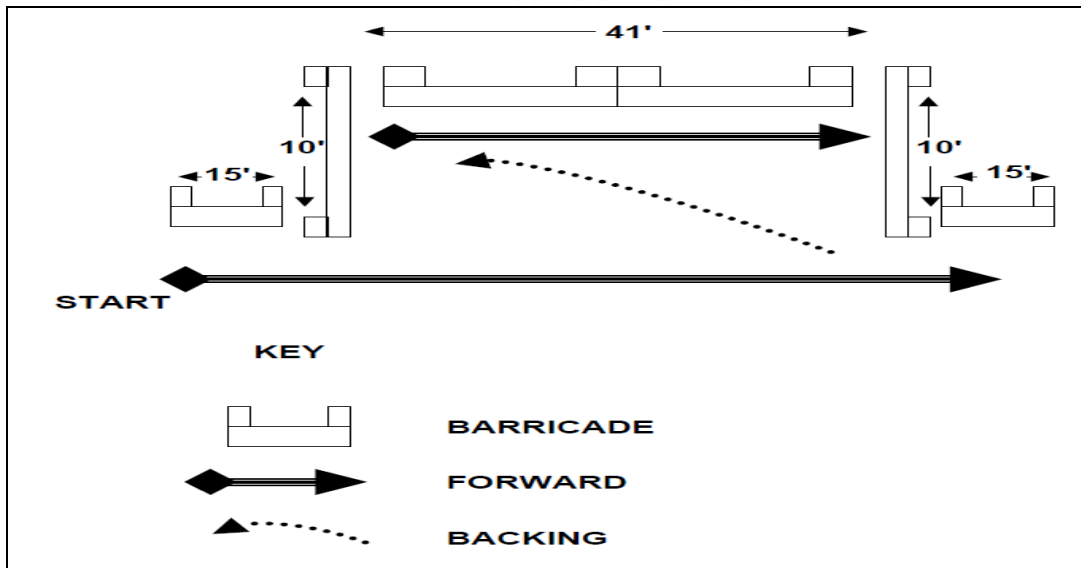


Figure G-14. Medium Vehicle Parallel Parking (Sight Side)

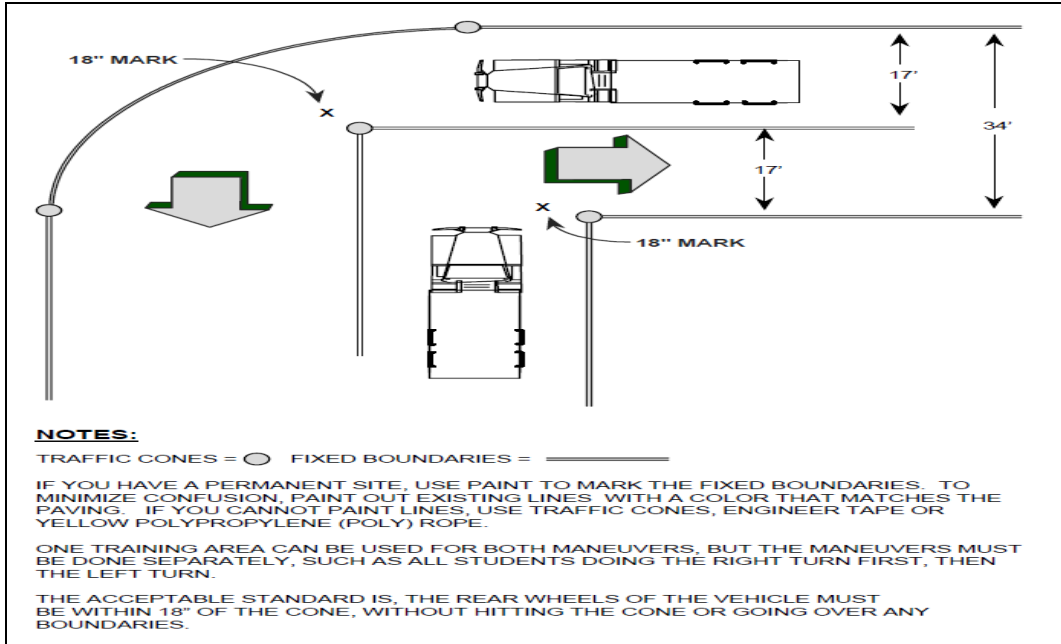


Figure G-15. Medium Vehicle Left and Right Turns

HMMWV SAMPLE TRAINING AREAS)

G-3. Figures G-16 through G-20 shows the sample training areas for HMMWVs.

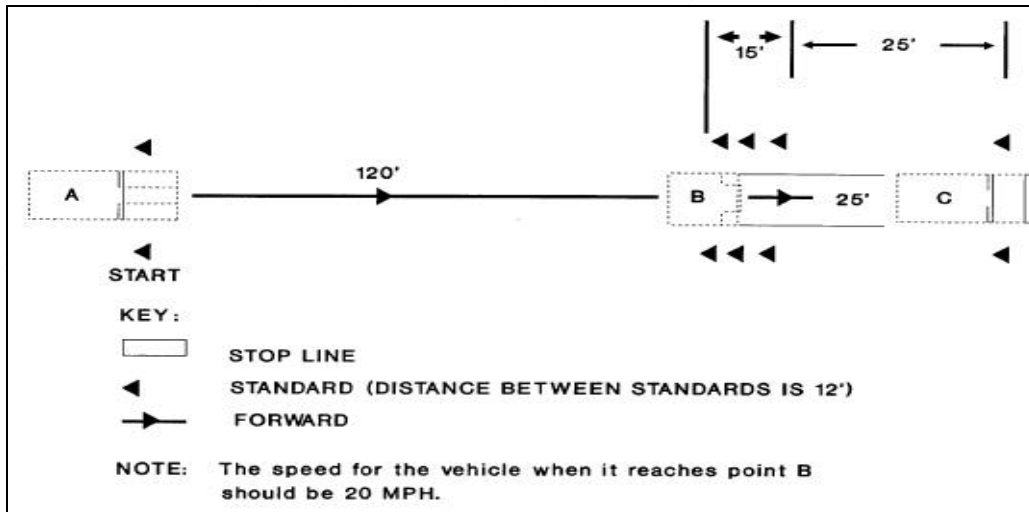


Figure G-16. HMMWV Stopping Within Prescribed Limits

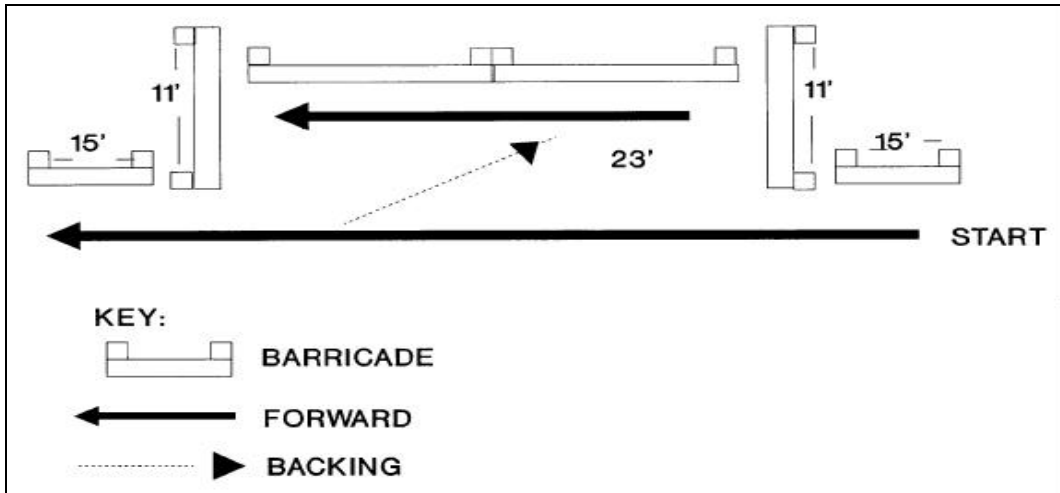


Figure G-17. HMMWV Parallel Parking (Blind Side)

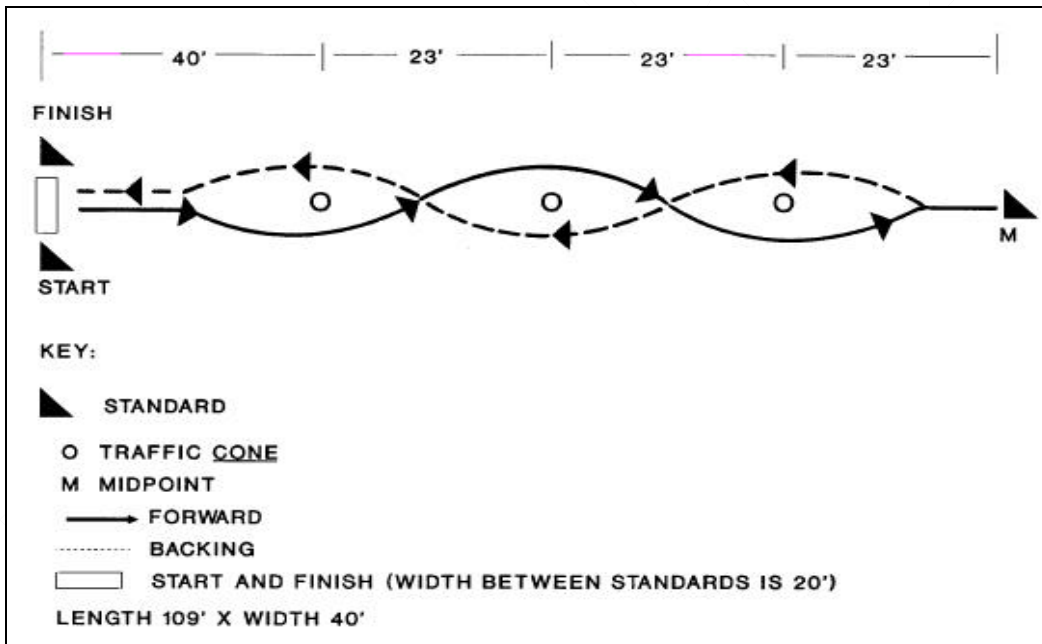


Figure G-18. HMMWV Serpentine Course

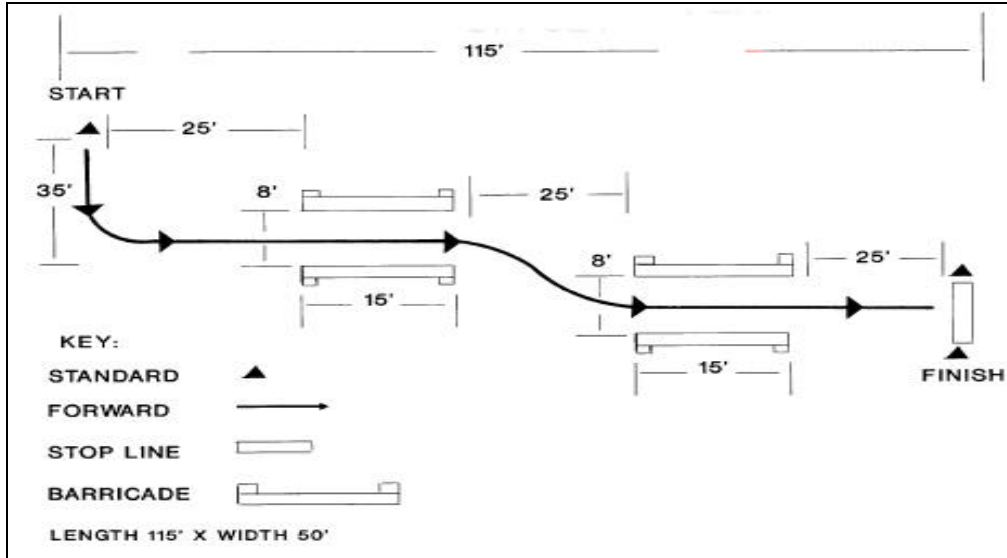


Figure G-19. HMMWV Offset Alley

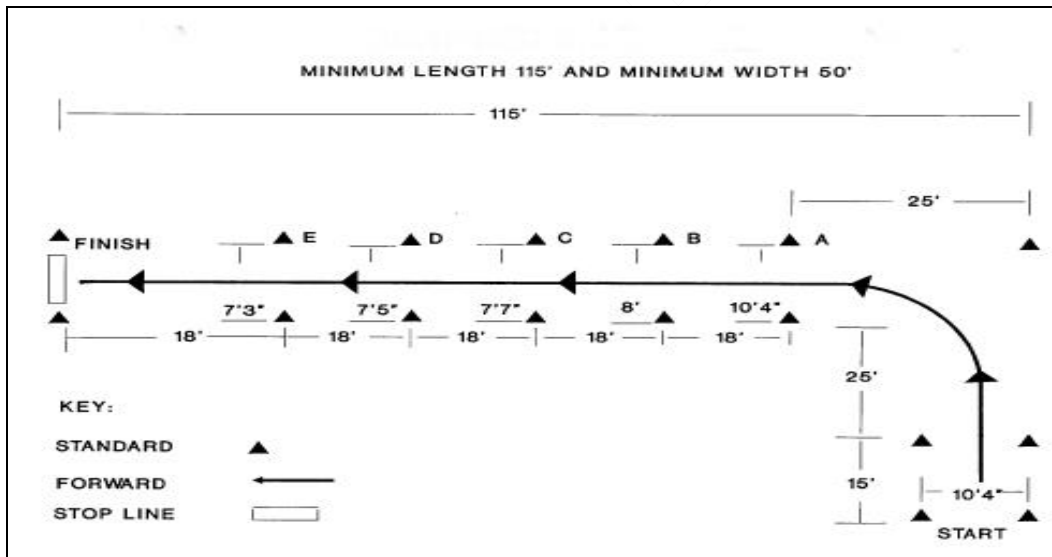
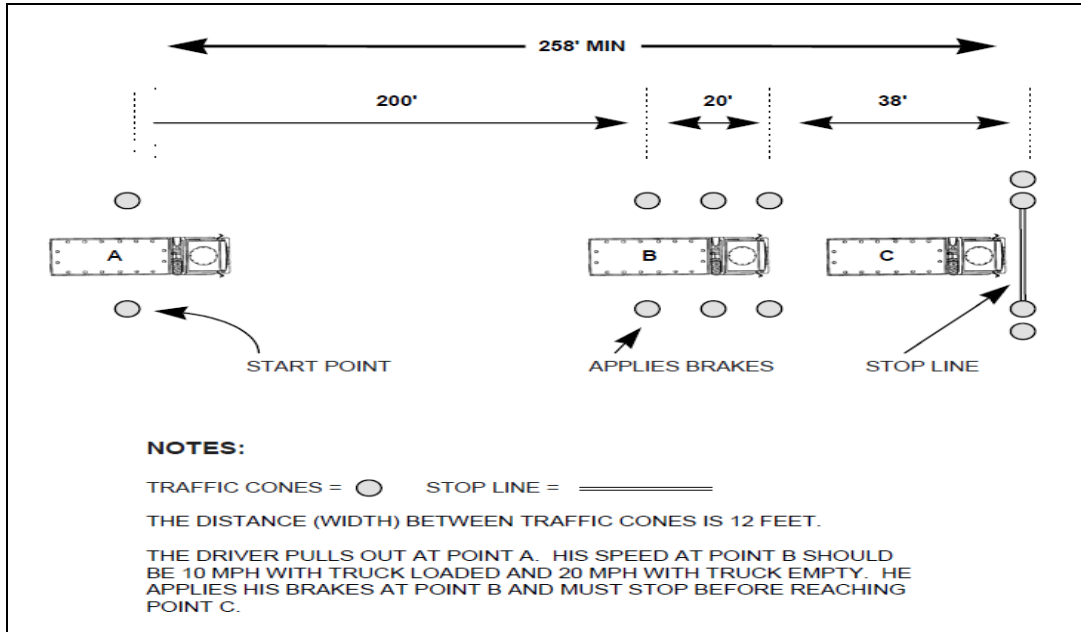


Figure G-20. HMMWV Diminishing Clearance

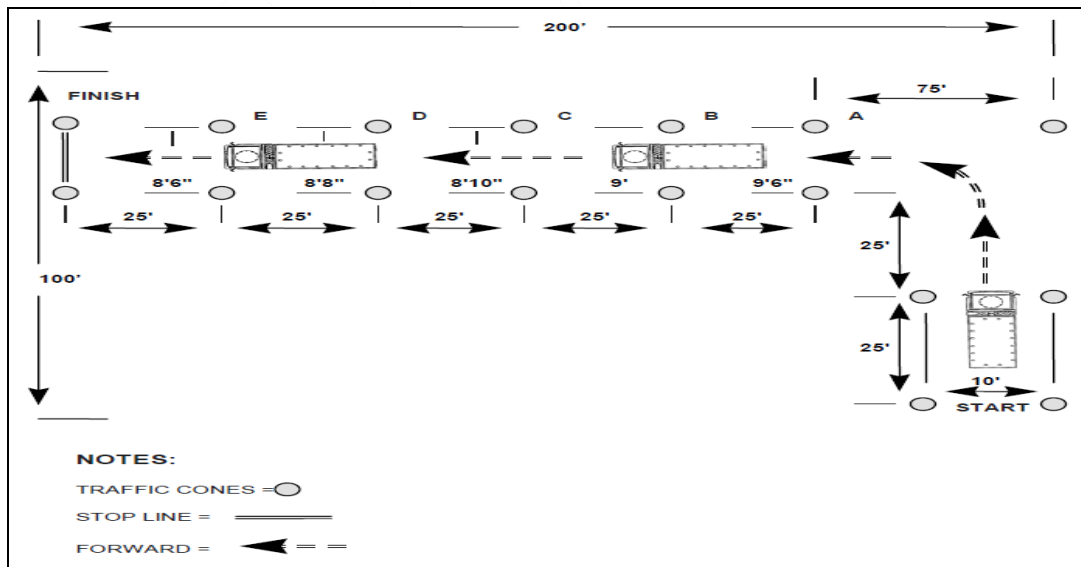


**MTV 5-TON CARGO TRUCK TRAINING AREAS (CAN ALSO BE USED FOR 2 1/2-TON)**

G-4. Figures G-21 through G-27 shows the sample training areas for MTVs.



**Figure G-21. MTV Cargo Stopping Within Prescribed Limits**



**Figure G-22. MTV Cargo Diminishing Clearance**

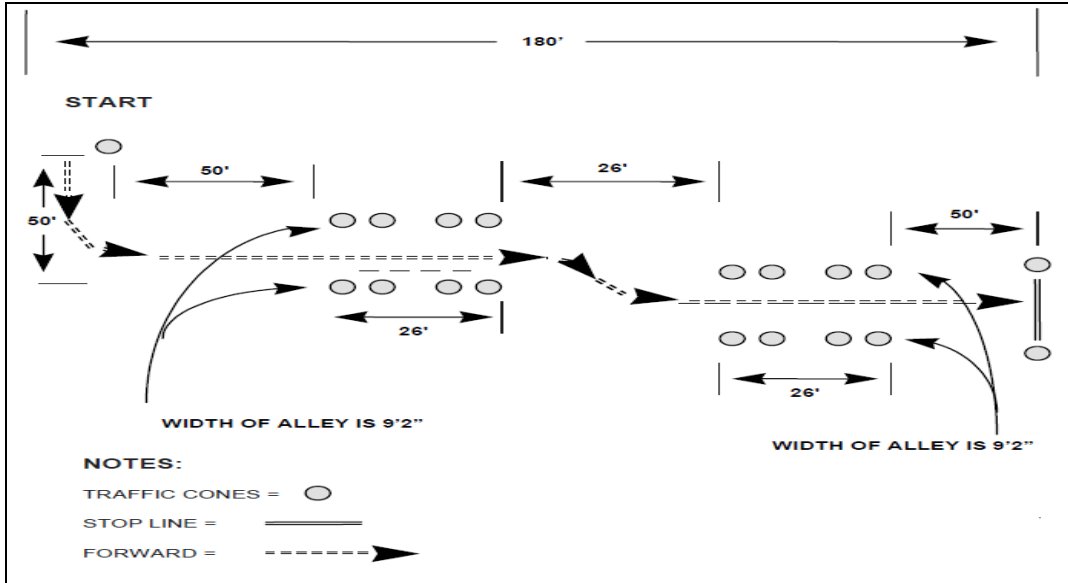


Figure G-23. MTV Cargo Offset Alley

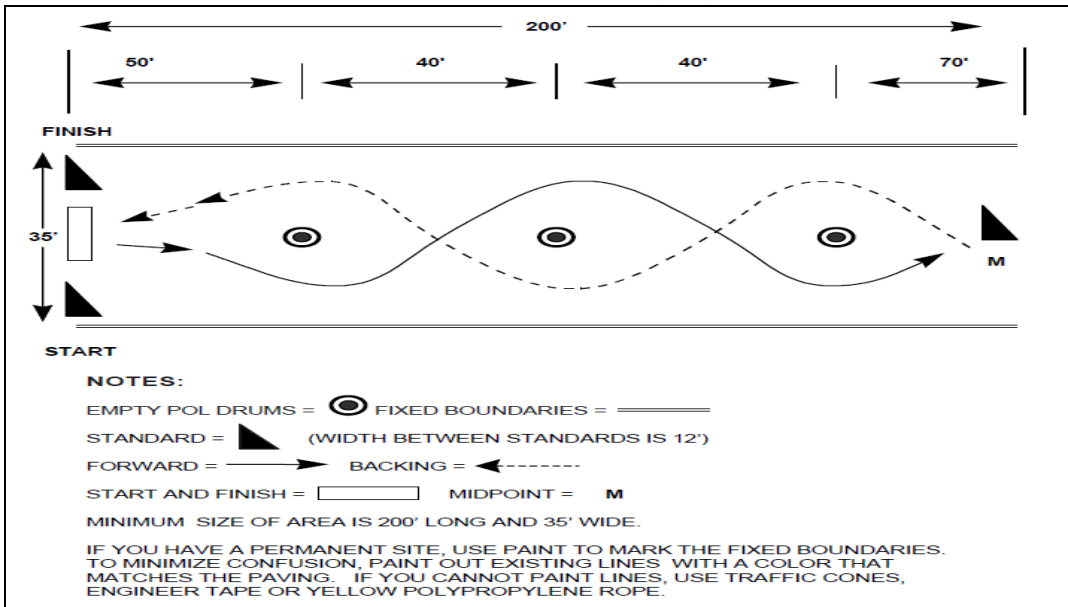


Figure G-24. MTV Cargo Serpentine Course

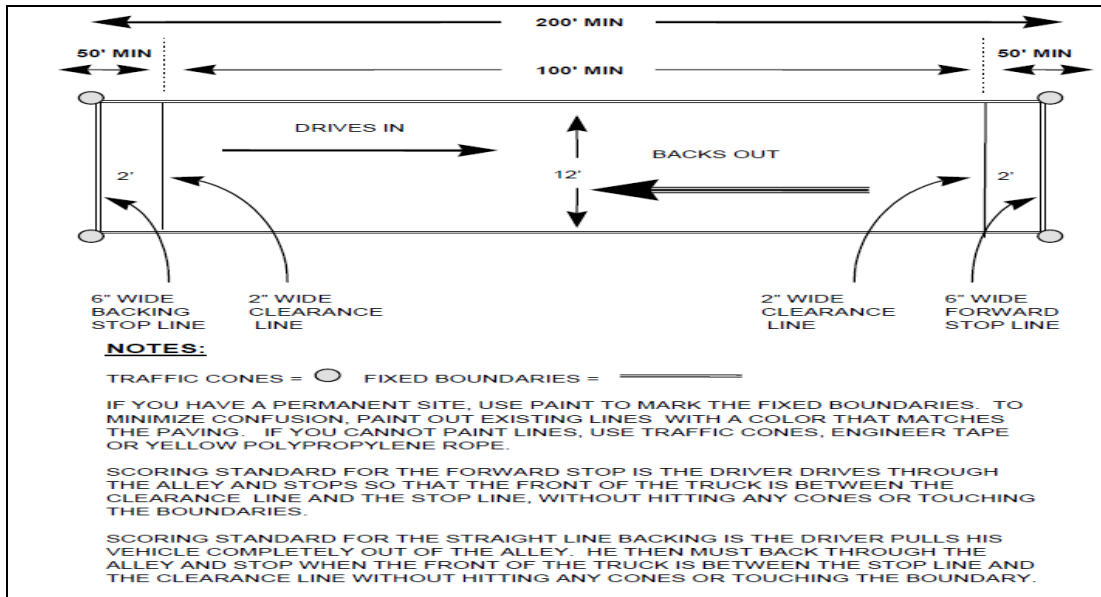


Figure G-25. MTV Cargo Forward Stop/Straight Line Backing

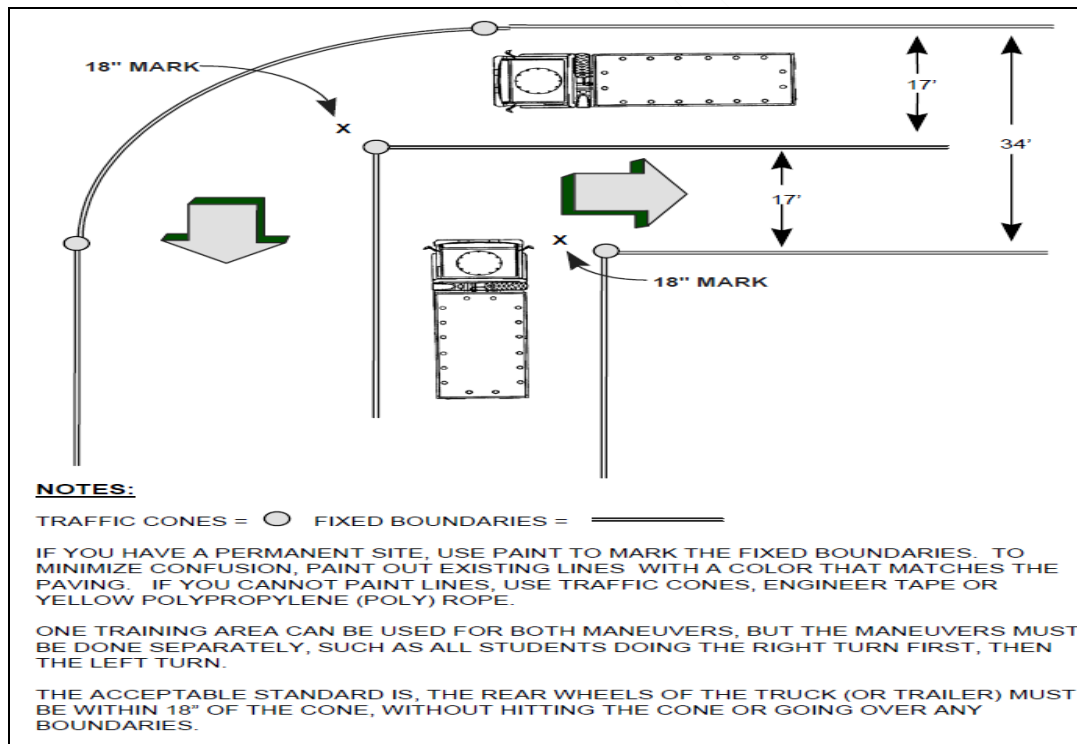


Figure G-26. MTV Cargo Left and Right Turns

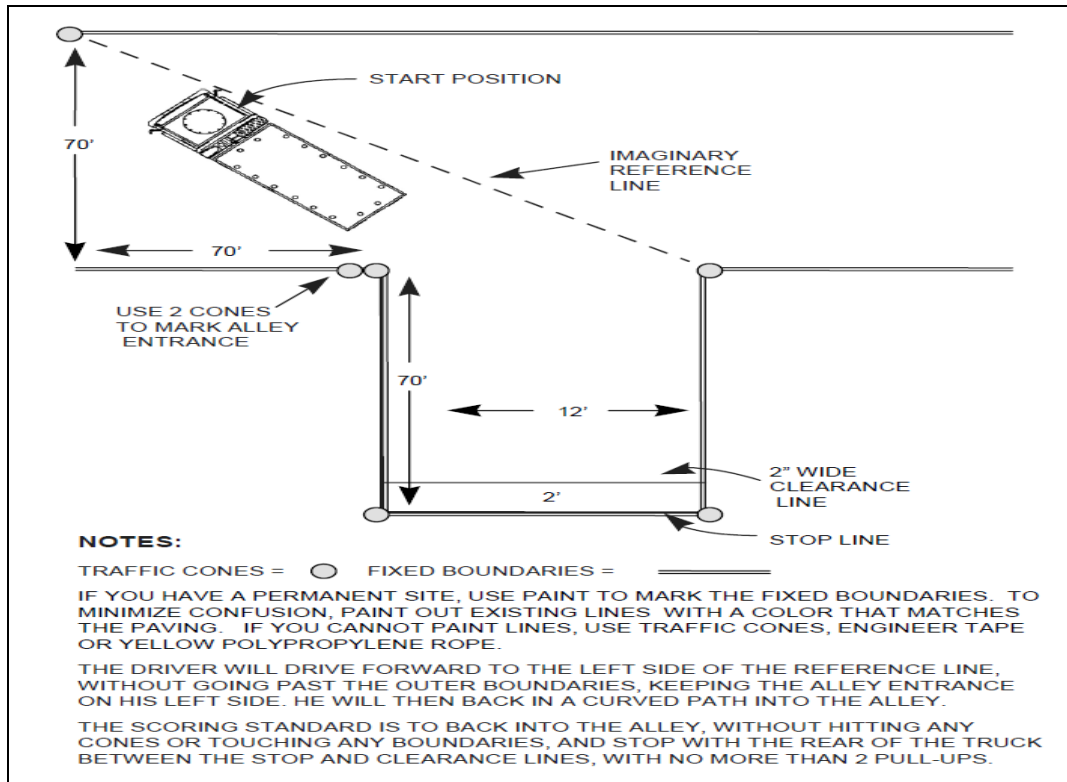


Figure G-27. MTV Cargo Alley Dock

**HEMTT SAMPLE TRAINING AREAS)**

G-5. Figures G-28 through G-36 shows the sample training areas for the HEMTT.

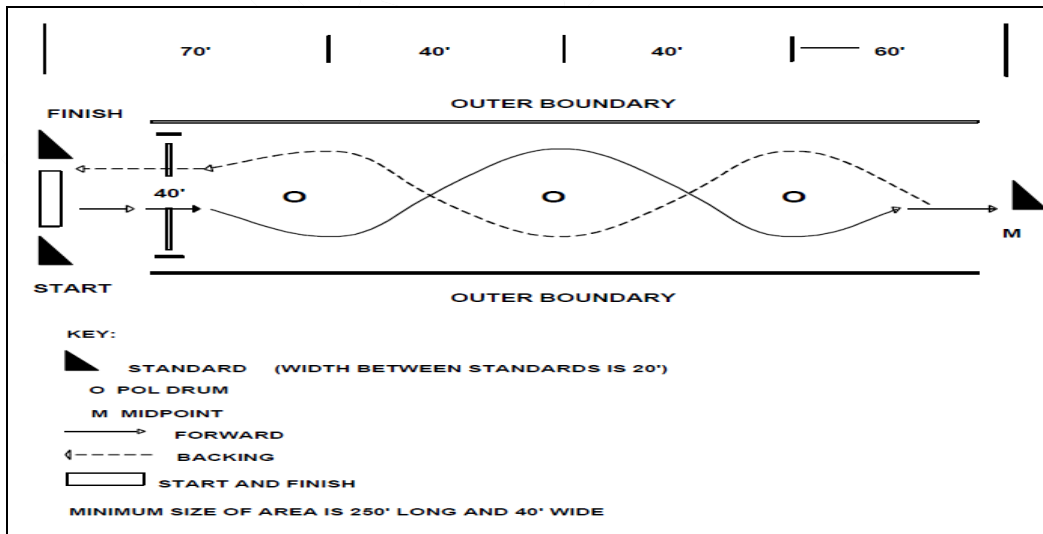


Figure G-28. HEMTT Serpentine Course

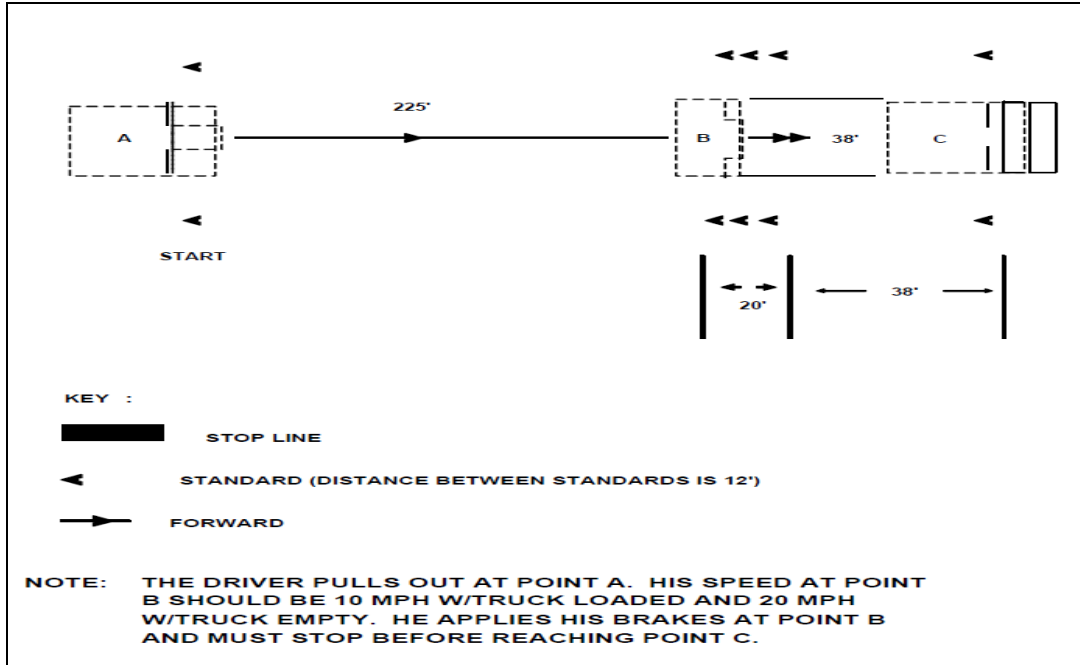


Figure G-29. Stopping Within Prescribed Limits

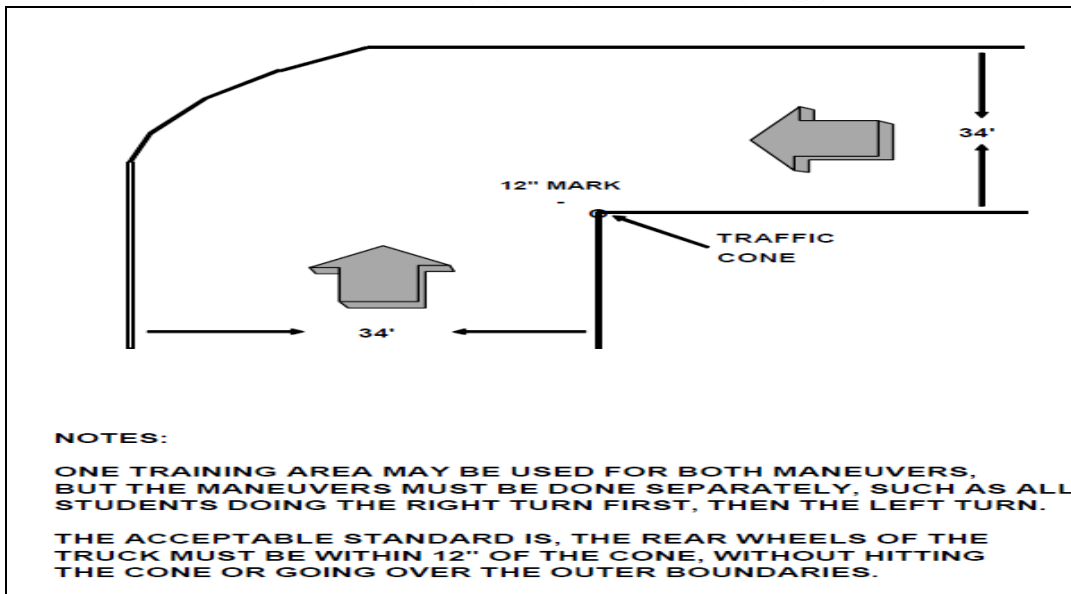


Figure G-30. HEMTT Left and Right Turns

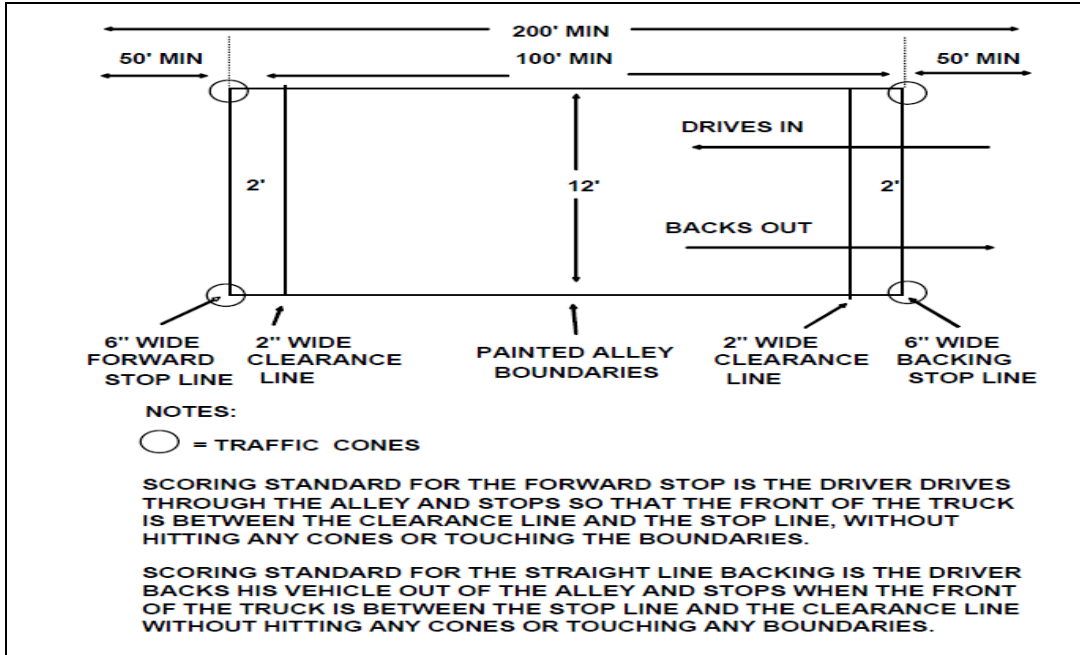


Figure G-31. HEMTT Forward Stop/Straight Line Backing

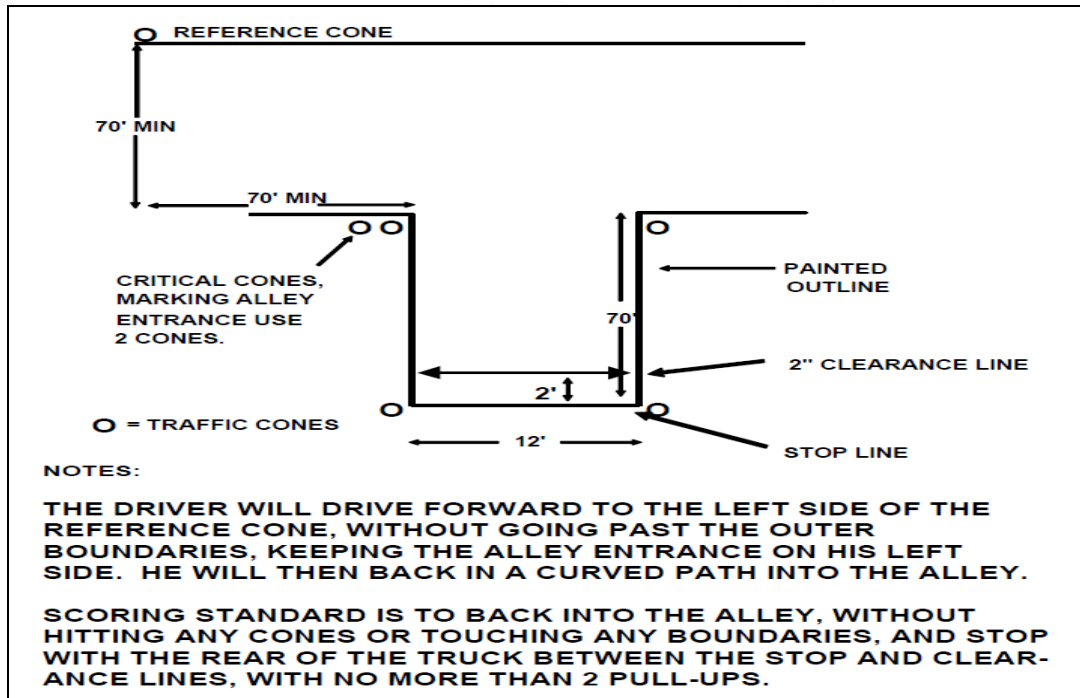


Figure G-32. HEMTT Alley Dock

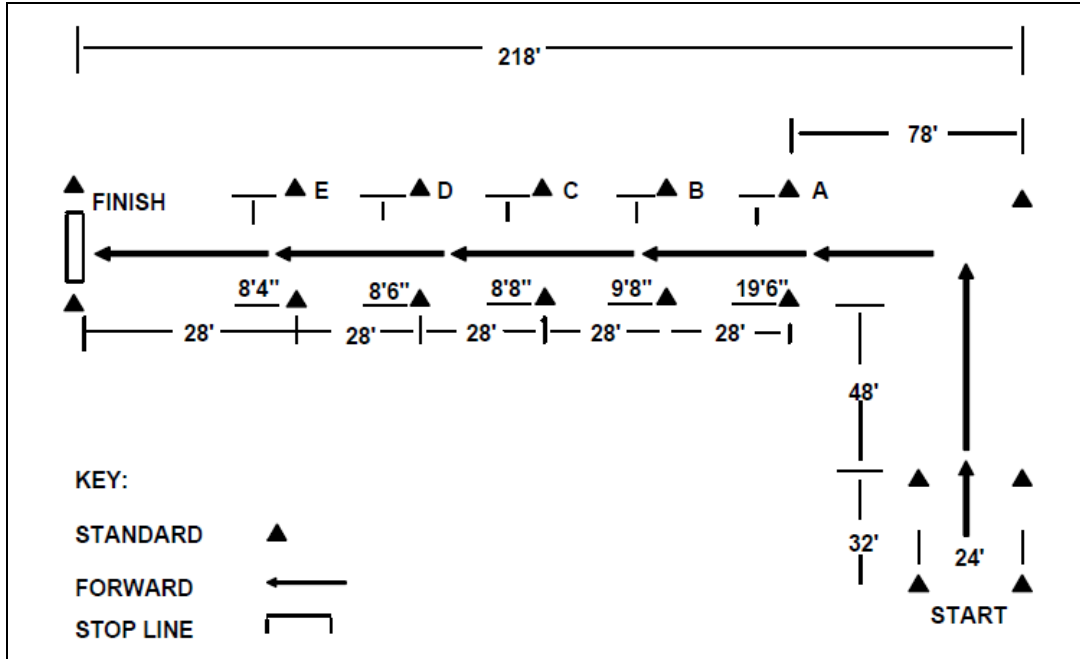


Figure G-33. HEMTT Diminishing Clearance

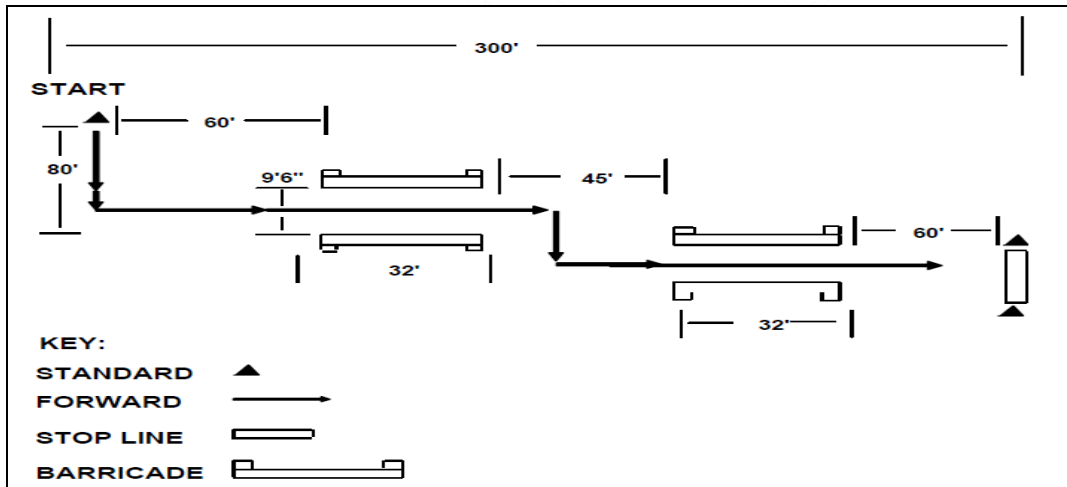


Figure G-34. HEMTT Offset Alley

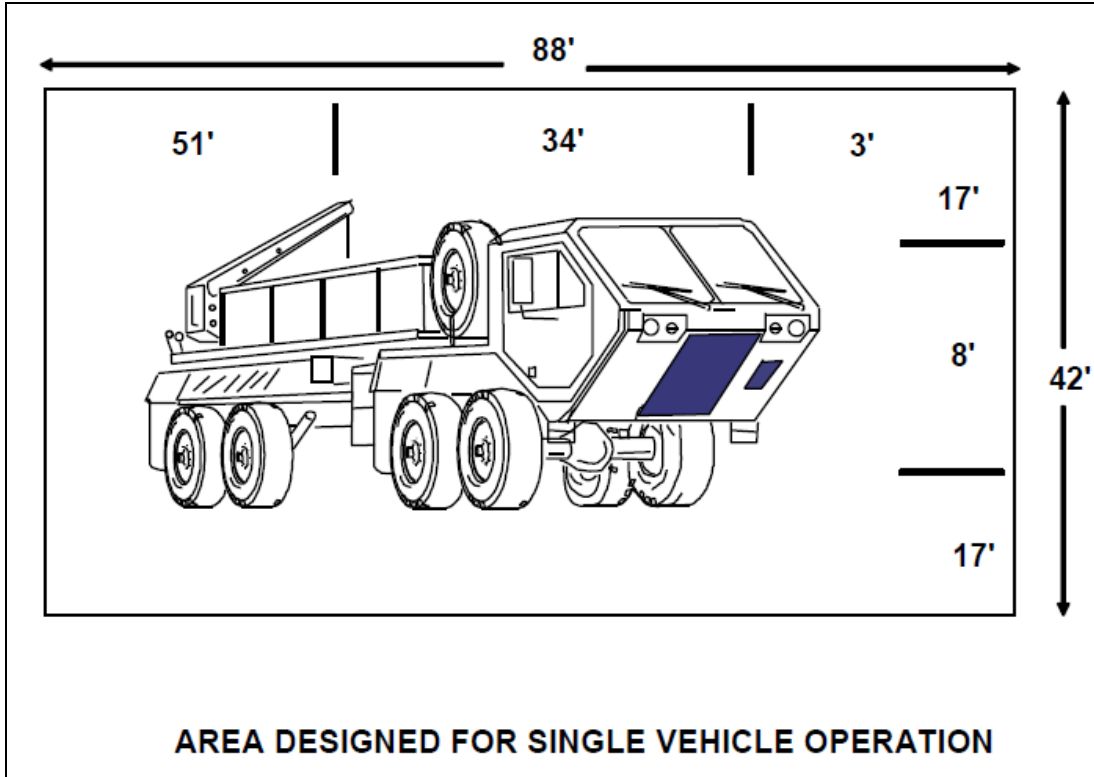


Figure G-35. HEMTT Crane Operation

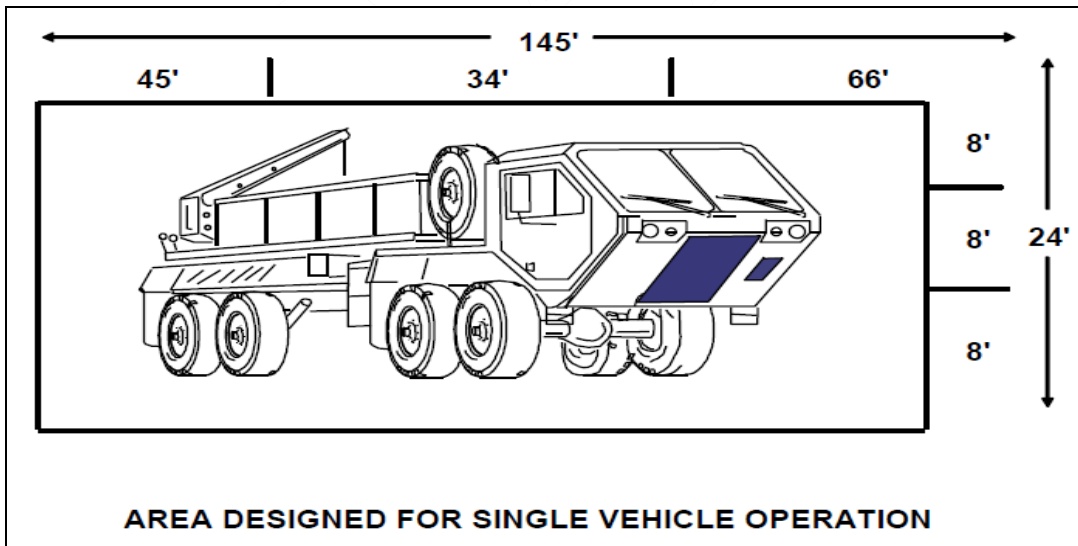


Figure G-36. HEMTT Self-Recovery Area



**TRACTOR AND SEMITRAILER (M915, M931, AND M932) SAMPLE TRAINING AREAS)**

G-6. Figures G-37 through G-42 shows the sample training areas for the tractor and semitrailer.

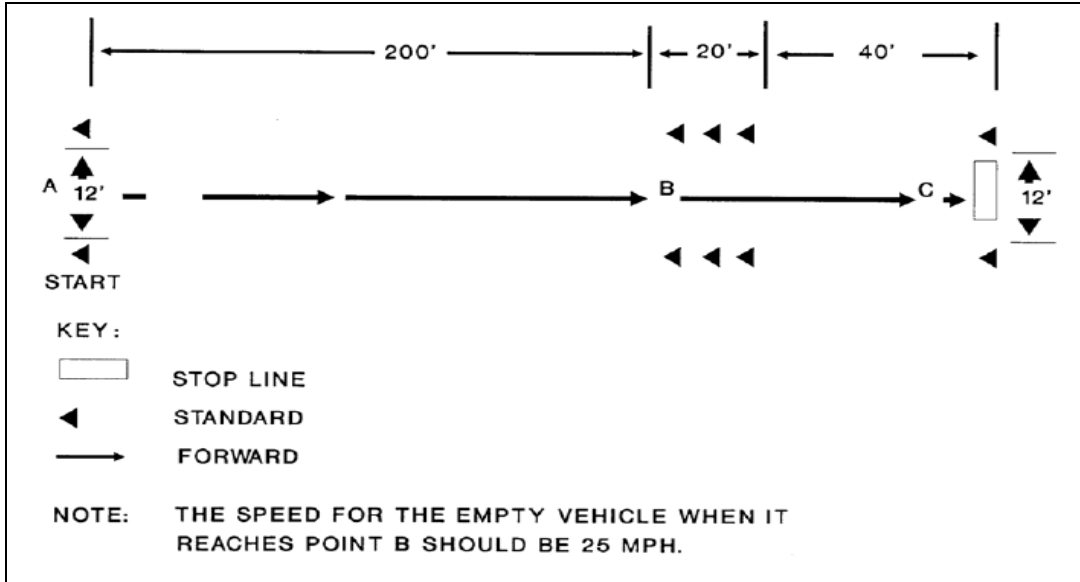


Figure G-37. Tractor/Semitrailer Stopping Within Prescribed Limits

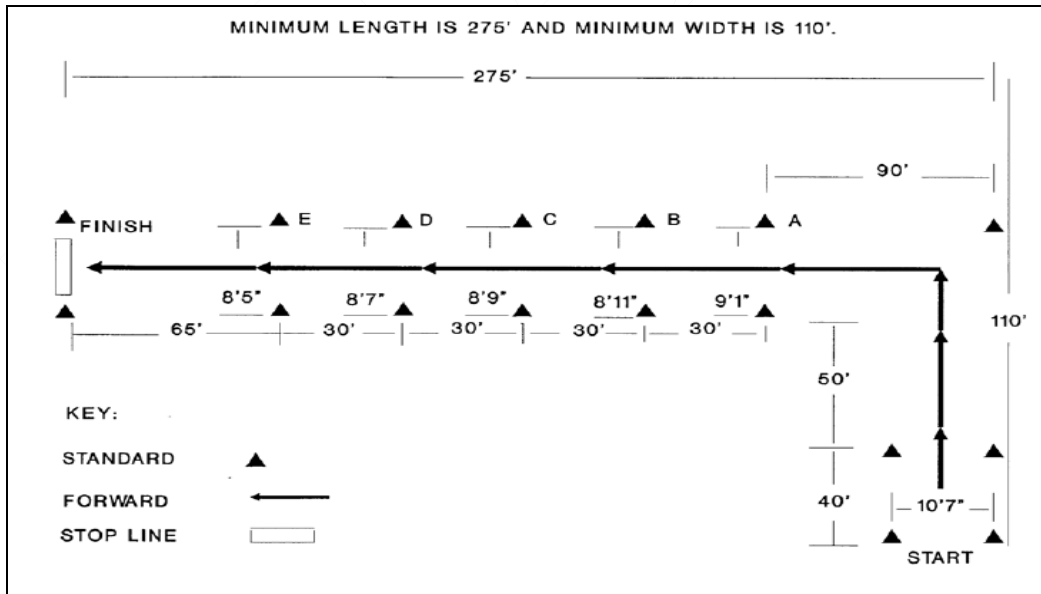


Figure G-38. Tractor/Semitrailer Diminishing Clearance

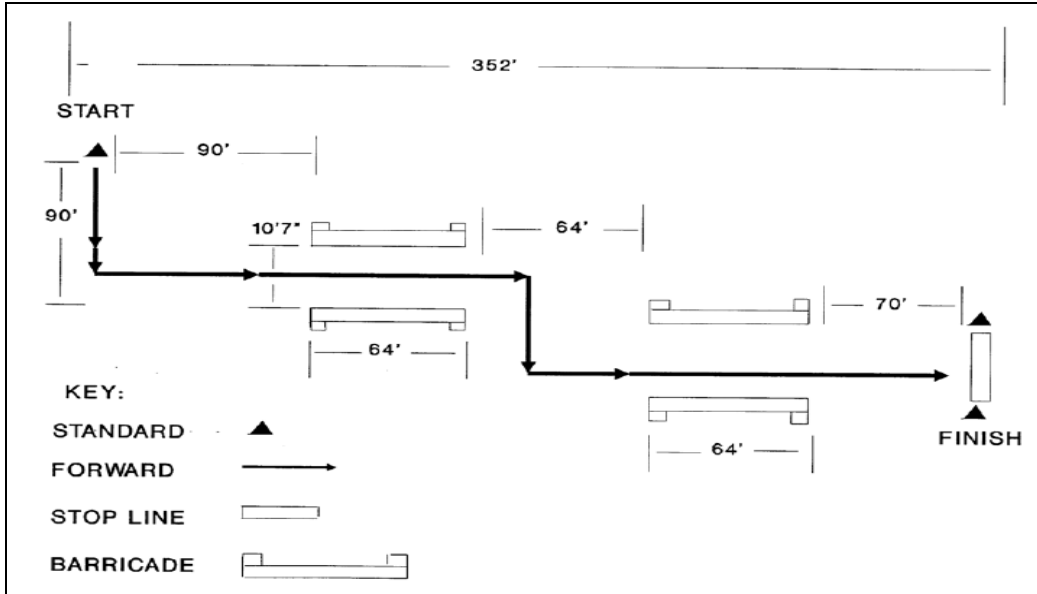


Figure G-39. Tractor/Trailer Offset Alley

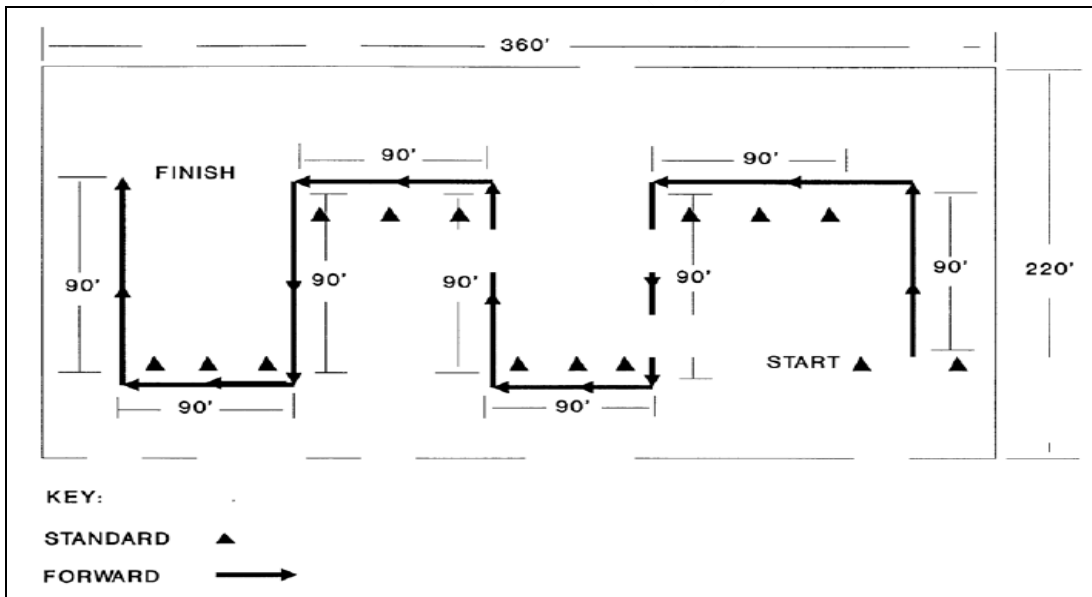


Figure G-40. Tractor/Trailer Right/Left Turns

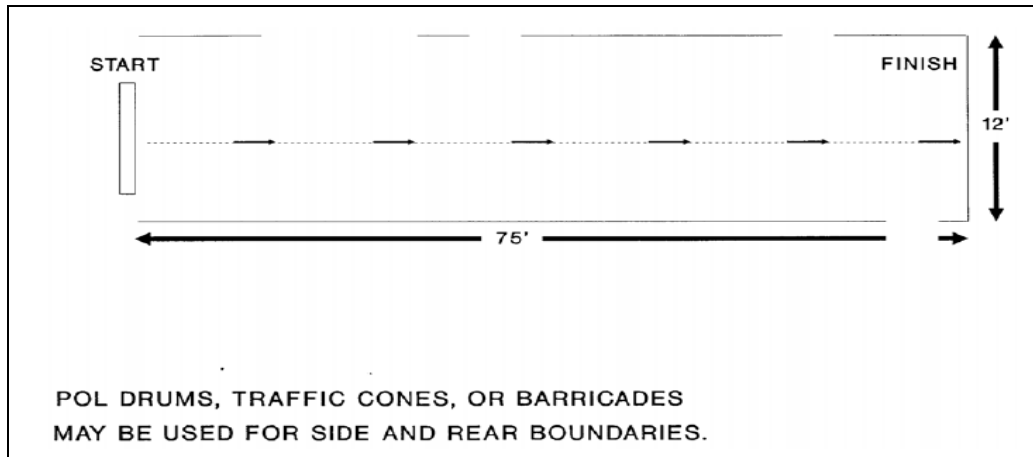


Figure G-41. Tractor/Trailer Straight Line Backing

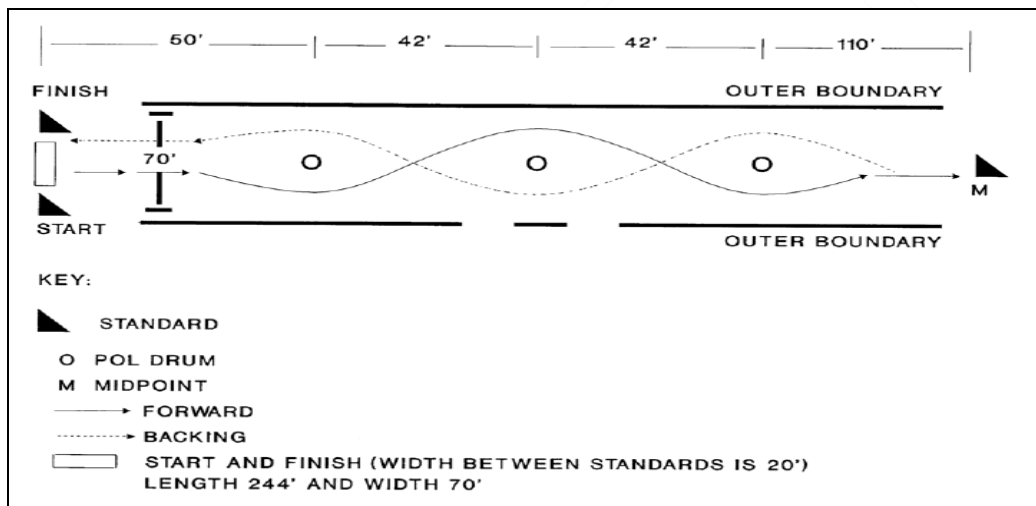


Figure G-42. Tractor/Trailer Serpentine Course

PLS SAMPLE TRAINING AREAS)

G-7. Figures G-43 through G-48 shows the sample training areas for PLS.

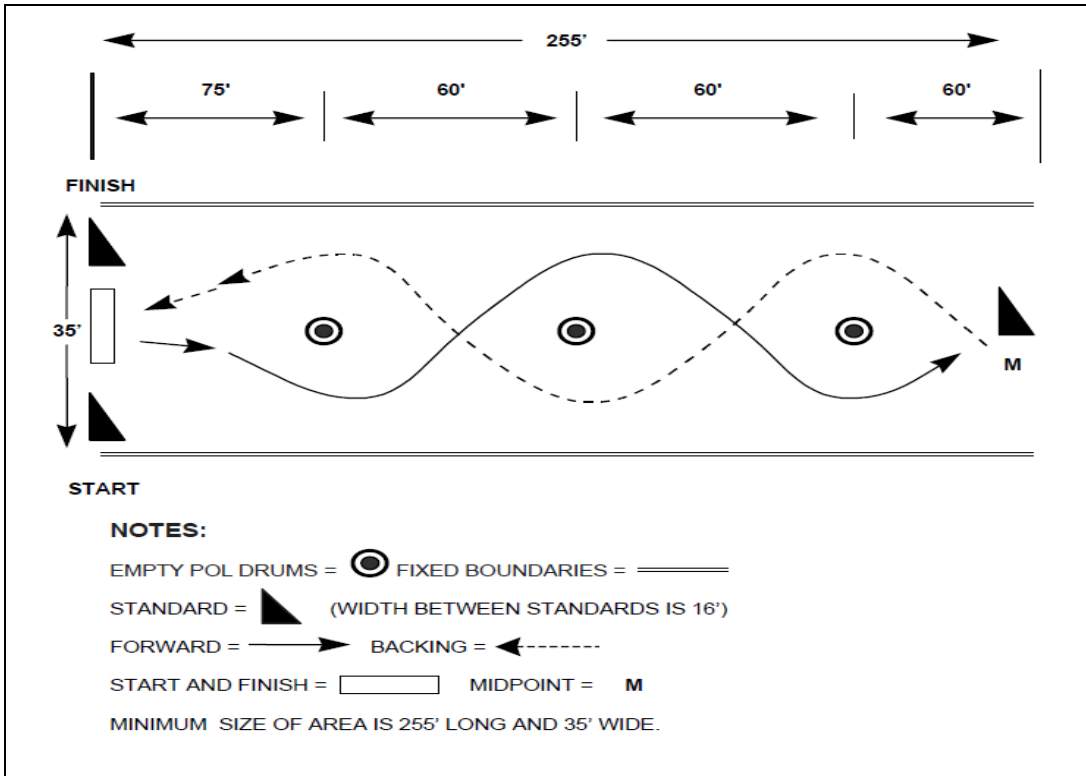


Figure G-43. PLS Truck Serpentine Course

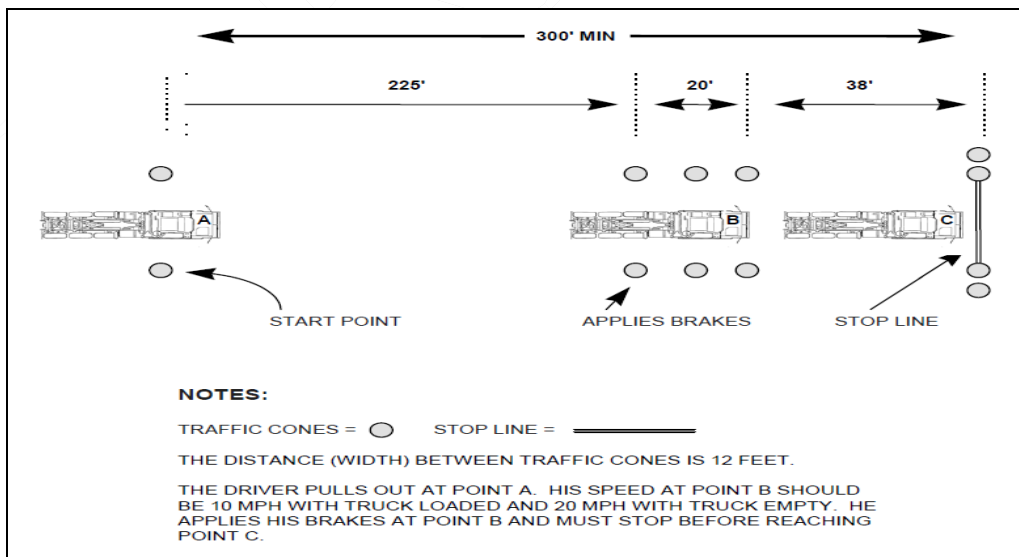


Figure G-44. PLS Stopping Within Prescribed Limits

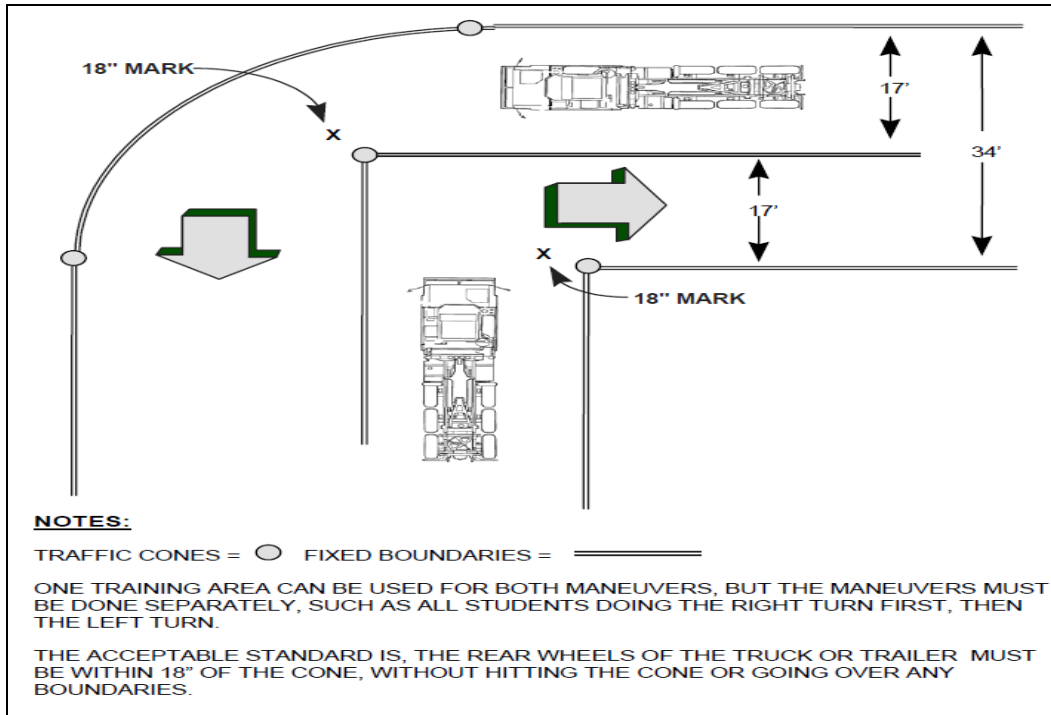


Figure G-45. PLS Truck/Trailer Left and Right Turns

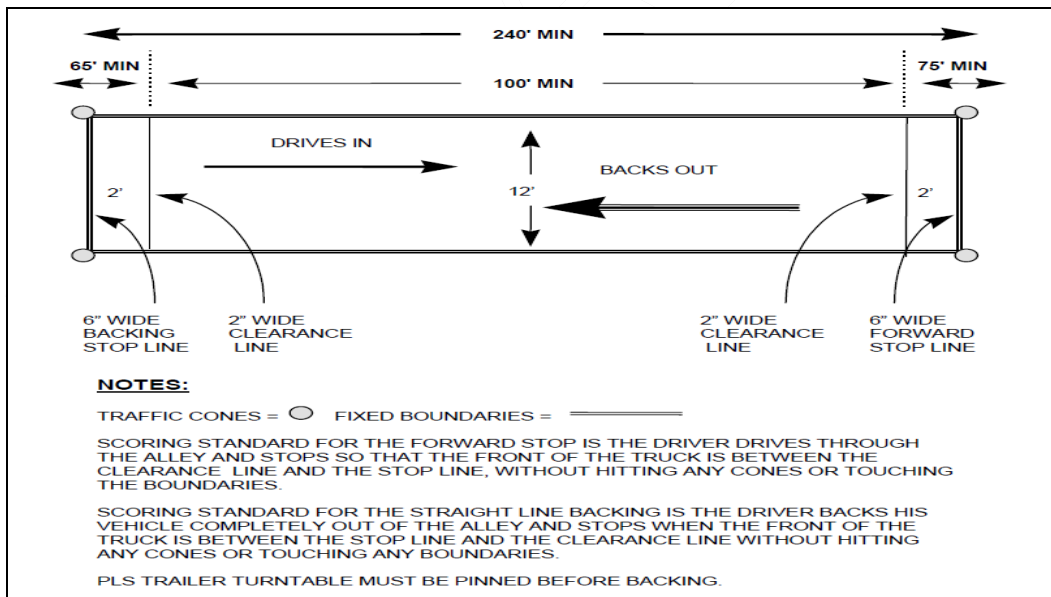


Figure G-46. PLS Forward Stop/Straight Line Backing

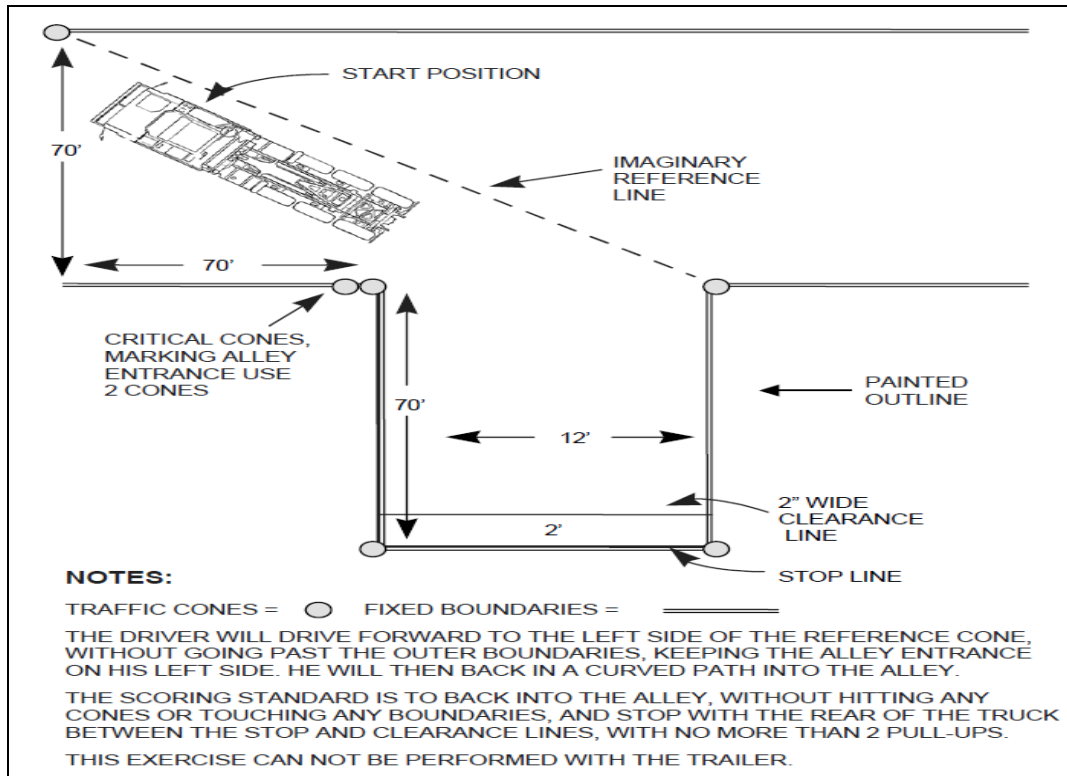


Figure G-47. PLS Alley Dock

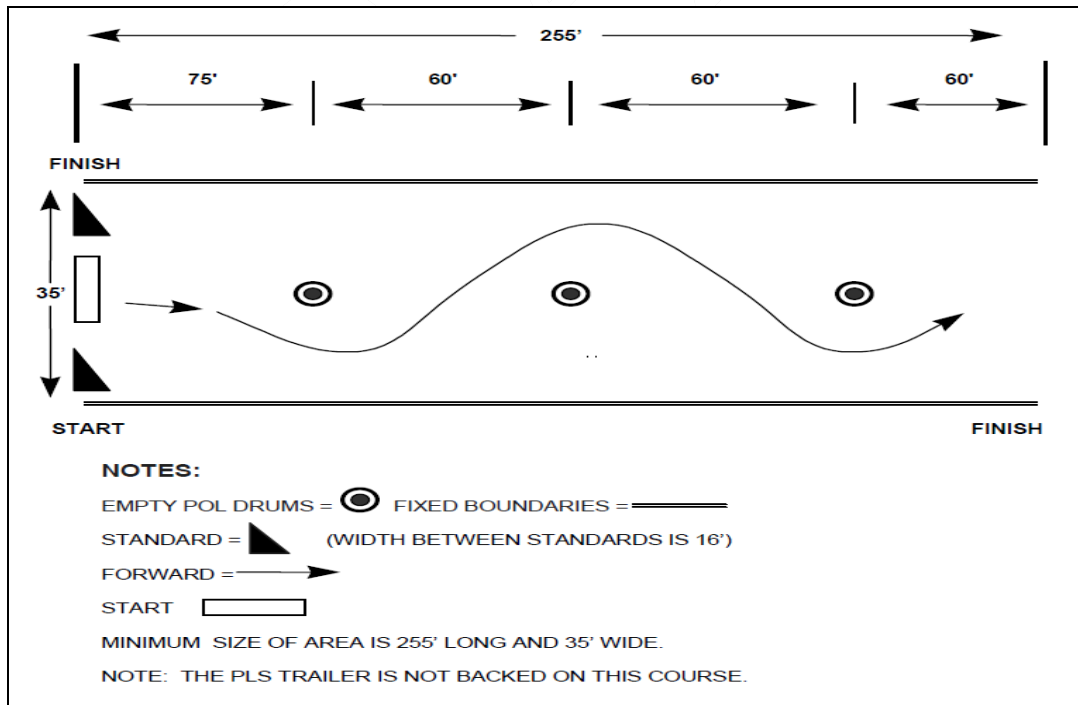
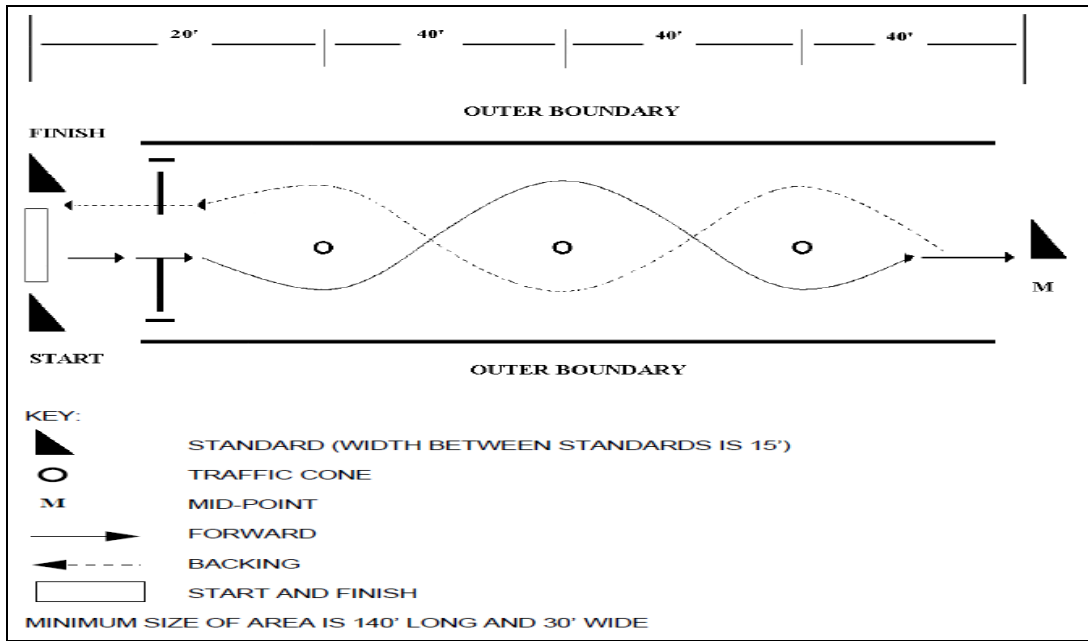


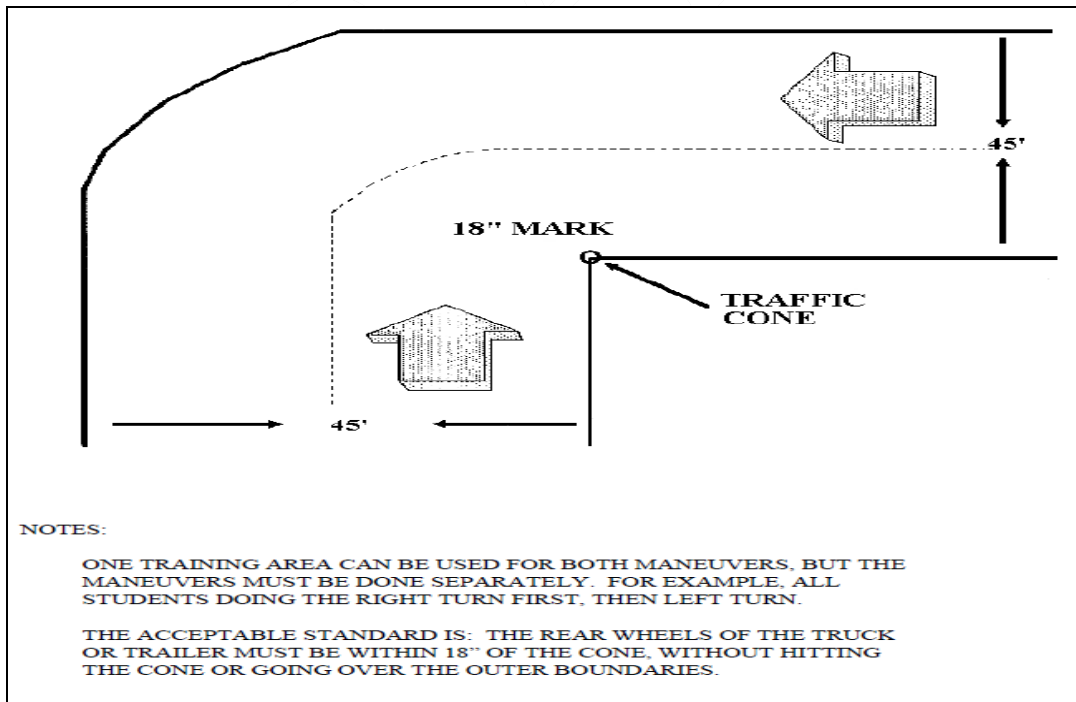
Figure G-48. PLS Trailer Serpentine Course

**HETS SAMPLE TRAINING AREAS)**

G-8. Figures G-49 through G-52 shows the sample training areas for the HETS.



**Figure G-49. HET Serpentine Course**



**Figure G-50. HET System Left and Right Turns**

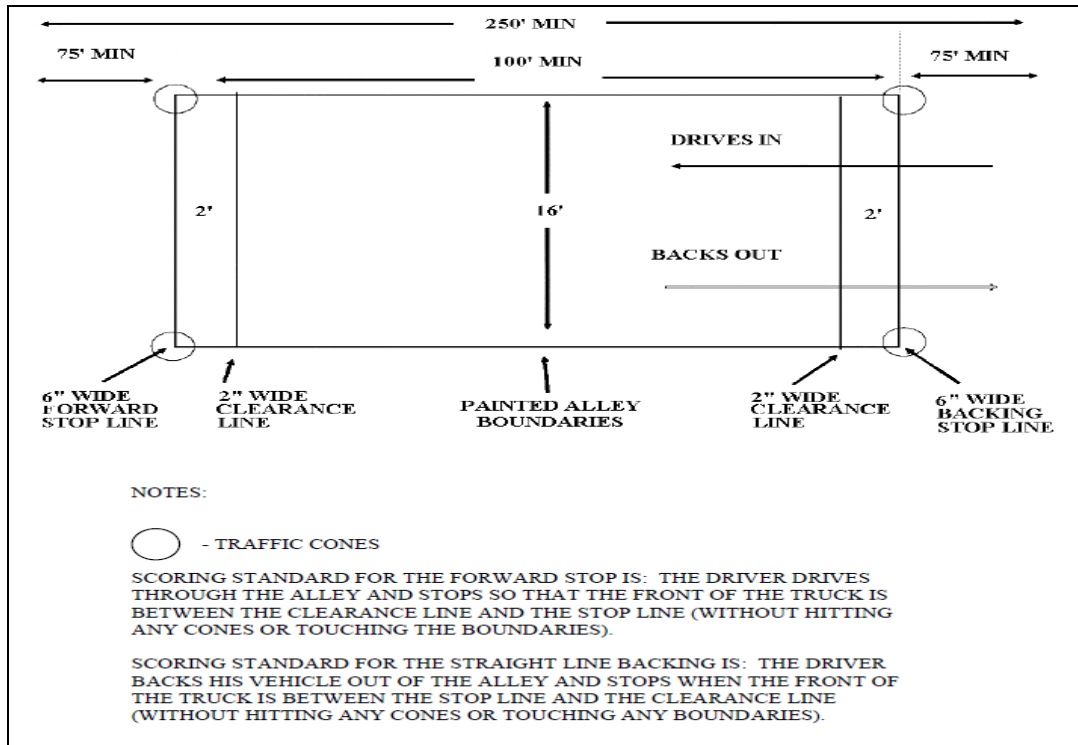


Figure G-51. HET Forward Stop and Straight Line Backing

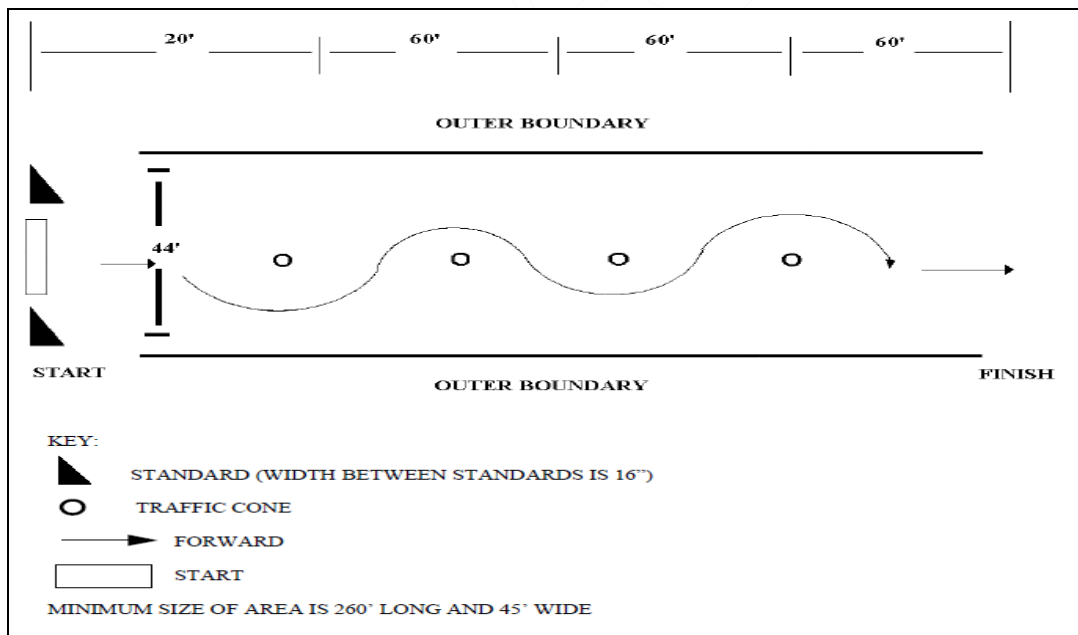


Figure G-52. HET System Serpentine Course



# Glossary

<b>Acronym/Term</b>	<b>Definition</b>
<b>ACADA</b>	Automatic Chemical Agent Detector and Alarm
<b>ACE</b>	Army Corps of Engineers
<b>ADP</b>	automatic data processing
<b>AF</b>	Air Force
<b>AFI</b>	Air Force Instruction
<b>AFMAN</b>	Air Force manual
<b>AGE</b>	aerospace ground equipment
<b>AMovP</b>	Allied Movement Publication
<b>AR</b>	Army regulation
<b>ASV</b>	armored security vehicle
<b>AT</b>	all terrain
<b>ATTN</b>	attention
<b>ATV</b>	all-terrain vehicle
<b>BFT</b>	Blue Force Tracker
<b>BII</b>	basic issue items
<b>BO</b>	blackout
<b>BTF</b>	Brigade Task Force
<b>C</b>	Centrigrade
<b>CAM</b>	chemical agent monitor
<b>CATS</b>	Combined Arms Training Strategy
<b>CBRN</b>	chemical, biological, radiologically, nuclear
<b>CFR</b>	Code of Federal Regulation
<b>CLS</b>	combat lifesaver
<b>cm</b>	centimeter(s)
<b>COE</b>	Contemporary Operational Environment
<b>COMSEC</b>	communication security
<b>CONUS</b>	continental United States
<b>CROP</b>	Container Roll-In/Roll-out Platform
<b>CS</b>	chemical smoke
<b>CSS</b>	combat service support
<b>CTIS</b>	Central Tire Inflation System
<b>CW</b>	clockwise
<b>CCW</b>	counter clockwise
<b>CREW</b>	counter radio-controlled IED warfare

<b>Acronym/Term</b>	<b>Definition</b>
<b>D.C.</b>	District of Columbia
<b>DA</b>	Department of the Army
<b>DAGR</b>	Defense Advanced GPS Receiver
<b>DD</b>	Department of Defense
<b>DOT</b>	Department of Transportation
<b>DS</b>	direct support
<b>DS2</b>	Decontamination Solution Number Two
<b>DTD</b>	detailed troop decontamination
<b>DVE</b>	driver's vision enhancer
<b>ECM</b>	electronic countermeasures
<b>EOF</b>	escalation of force
<b>EPLRP</b>	Enhanced Position Location Reporting System
<b>EUM</b>	End User Manual
<b>F</b>	Fahrenheit
<b>FBCB2</b>	Force XXI Battle Command, Brigade-and-Below
<b>FM</b>	field manual
<b>FMTV</b>	Family of Medium Tracked Vehicles
<b>FOD</b>	foreign object damage
<b>FSE</b>	forward security element
<b>GCVW</b>	gross combined vehicle weight
<b>GI</b>	government issue
<b>GPS</b>	Global Positioning System
<b>GVW</b>	gross vehicle weight
<b>GVWR</b>	gross vehicle weight rating
<b>HAZMAT</b>	hazardous material
<b>HD</b>	distilled mustard (a blister agent)
<b>HEMTT</b>	Heavy Expanded Mobility Tactical Truck
<b>HEMTT-LHS</b>	Heavy Expanded Mobility Tactical Truck-Load Handling System
<b>HMMWV</b>	High Mobility Multipurpose Wheeled Vehicle
<b>HN</b>	host nation
<b>HQ</b>	Headquarters
<b>hr</b>	hour(s)
<b>(I)</b>	Interservice
<b>ID</b>	identification
<b>IED</b>	improvised explosive device
<b>IEDK</b>	Individual Equipment Decontamination Kit
<b>in</b>	inch(es)
<b>INC</b>	Internet Controller
<b>IPD</b>	interpupillary distance

<b>Acronym/Term</b>	<b>Definition</b>
<b>IR</b>	infrared
<b>JLTV</b>	Joint Light Tactical Vehicle
<b>Km</b>	kilometer
<b>KMPH</b>	kilometers per hour
<b>lb.</b>	pound(s)
<b>LH O/R JACK</b>	left outrigger jack
<b>LO</b>	lubrication order
<b>LRAS3</b>	Long Range Advanced Scout Surveillance System
<b>MACOM</b>	major Army command
<b>MEDEVAC</b>	medical evacuation
<b>METT-TC</b>	mission, enemy, terrain and weather, troops and support available, time available, civil considerations
<b>MHE</b>	material handling equipment
<b>mi</b>	mile(s)
<b>min</b>	minute(s)
<b>MOPP</b>	mission oriented protective posture
<b>MOS</b>	military occupational specialty
<b>MP</b>	military police
<b>MPH</b>	miles per hour
<b>MTE</b>	meal, ready-to-eat
<b>MTMCTEA</b>	Military Traffic Management Command Transportation Engineering Agency
<b>MTS</b>	Movement Tracking System
<b>NATO</b>	North Atlantic Treaty Organization
<b>NCO</b>	noncommissioned officer
<b>NCOIC</b>	noncommissioned officer in charge
<b>NM</b>	New Mexico
<b>NSN</b>	national stock number
<b>NVD</b>	night vision device
<b>NVG</b>	night vision goggle
<b>OCONUS</b>	outside the continental United States
<b>OF</b>	Optional Form
<b>OPORD</b>	operation order
<b>O/R EXT</b>	outrigger extension
<b>OJT</b>	on-the-job training
<b>ORM</b>	operational risk management
<b>OSHA</b>	Occupational Safety and Health Act
<b>PCI</b>	pre-combat inspections
<b>PDDA</b>	power-driven decontamination apparatus
<b>PLGR</b>	Precision Lightweight GPS Receiver
<b>PLS</b>	Palletized Loading System

<b>Acronym/Term</b>	<b>Definition</b>
<b>PMCS</b>	preventive maintenance checks and services
<b>PNT</b>	Position, Navigation, and Timing
<b>POL</b>	petroleum, oils, and lubricants
<b>PPC</b>	pre-combat checks
<b>PPS</b>	Precise Positioning Service
<b>psi</b>	pounds per square inch
<b>PTO</b>	Power Take-Off
<b>RADIAC</b>	Radiation Detection Indication and Computation
<b>RCIED</b>	radio controlled improvised explosive device
<b>RH O/R JACK</b>	right outrigger jack
<b>ROE</b>	Rules of Engagement
<b>RP</b>	release point
<b>RPG</b>	rocket propelled grenade
<b>RPM</b>	revolution per minute
<b>RT</b>	rough terrain
<b>SAASM</b>	Selective Availability Anti-spoof Module
<b>SALUTE</b>	Size, Activity, Location, Unit, Time, and Equipment
<b>SDK</b>	Skin Decontamination Kit
<b>SAMS-E</b>	Standard Army Maintenance System- Enhanced
<b>SF</b>	Standard Form
<b>SINCGARS</b>	Single Channel Ground and Airborne Radio System
<b>SITREP</b>	Situation Report
<b>SM</b>	speedometer multiplier
<b>SMFT</b>	semitrailer mounted fabric tank
<b>SOP</b>	standing operating procedure
<b>SP</b>	start point
<b>SSN</b>	social security number
<b>ST</b>	start point
<b>STB</b>	super tropical bleach
<b>STANAG</b>	Standardization Agreement
<b>TASC</b>	training and audiovisual center
<b>TB</b>	technical bulletin
<b>TC</b>	training circular
<b>TCP</b>	Traffic Control Point
<b>TLP</b>	Troop Leading Procedure
<b>TM</b>	technical manual
<b>TMP</b>	transportation motor pool
<b>TO</b>	technical order
<b>TOC</b>	tactical operations center

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<b>Acronym/Term</b>	<b>Definition</b>
<b>TTP</b>	tactics, techniques, and procedures
<b>UN</b>	United Nations
<b>US</b>	United States (of America)
<b>USAF</b>	United States Air Force
<b>USAFE</b>	United States Air Force Europe
<b>VA</b>	Virginia
<b>VB-IED</b>	vehicle borne-improvised explosive device
<b>VIP</b>	very important person

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