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MOST FREQUENTLY VIOLATED PROCEDURES CAUSING GROUND ACCIDENTS, PHASE II

J.R. Callen
S.D. Owens
D.C. Thill
J.L. Zeller, Jr.

April 30, 1991

Contract No. DAAK01-89-D004 033
Army Ground Accidents Technical Report

Prepared for:

U.S. Army Safety Center
Fort Rucker, Alabama



COBRO Corporation
Daleville, Alabama 36322

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MOST FREQUENTLY VIOLATED PROCEDURES CAUSING GROUND ACCIDENTS

PHASE II

EXECUTIVE SUMMARY

Requirement:

Phase I of this study, completed in 1989, identified the most frequently violated procedures causing on-duty accidents that occurred between October 1985 and September 1987.

Phase II of the research was conducted to determine why safe operating procedures are frequently violated and to recommend actions to correct the underlying causes of these violations. The corrective actions would, as a minimum, address the manner in which the procedure is written and presented in hard copy form, the degree and sufficiency with which the procedure is being taught in school and unit training, and the sufficiency of supervision and accountability emphasis placed on the procedure in unit operations.

Procedures:

Because of problems deciphering the Phase I contractor's data, the DA Forms 285 and 285-1 for 594 human error accident cases were reexamined to identify the most frequently violated procedures. Due to the poor quality and quantity of information in the accident reports about the human performance errors and the systemic sources causing each error, specific contributing and non-contributing factors and other circumstances involved in each accident were identified to determine common problem areas. Army and other Federal agency publications as well as programs of instruction from selected Army schools were reviewed to determine what information was available to soldiers and Army civilian employees regarding the identified problem areas. Questionnaires were developed and administered to soldiers and civilian employees and their leaders or supervisors to measure individual knowledge of the problem areas and to determine what training was being conducted, what references were being used, and how much emphasis was being placed on the problem areas reflected in the accident data. Coordination with the proponent for written procedures requiring changes was conducted through the U.S. Army Safety Center and final DA Forms 2028 were prepared and appended to the report.

Findings:

The accident data revealed frequently violated procedures relating to three primary references: (1) FM 21-305, Manual for Wheeled Vehicle Driver; (2) DOD 4145.19 R-1, Storage and Materials Handling; and (3) FM 57-220, Basic Parachuting Techniques and Training. Drivers who fail to recognize and adjust their driving speed for hazardous weather conditions, the inability of civilian employees and soldiers to determine what they

can safely lift without assistance, and improper parachute landing falls were the dominant problem areas.

(1) For the driving accidents, the problem area stems from a lack of written guidance in Army publications pertaining to hazardous weather conditions and their effects on driving surfaces and the resulting lack of emphasis on this subject during institutional and unit level driver training. The problem is further complicated by the policy of issuing military drivers licenses for commercial vehicles under one ton to soldiers possessing a valid state drivers license without any training or testing.

(2) For the lifting accidents, the problem area stems from inadequate written guidance in Army publications, outdated information in the DOD regulation, the absence of lifting requirements in job standards and job descriptions.

(3) Analysis of the parachuting accidents including a comprehensive review of airborne publications failed to reveal any pattern or deficiency requiring corrective action.

Overall, the data derived from the Army's non-aviation accident reporting forms do not support accident prevention programs. They fail to report critical information about the personnel, equipment and material, or environmental conditions involved in the accidents and do not require evidence supporting the errors and causes to be reported in a clear and concise manner.

Utilization:

Recommended changes are proposed to AR 600-55, each wheeled vehicle operator manual, and FM 21-305 to require commercial drivers licenses for Army drivers, add weather hazards training requirements, incorporate a weather evaluation guide and weather evaluation risk guide, and update specific information pertaining to braking techniques, following distances, and weather hazard awareness.

Additional recommendations are proposed to establish Army regulatory guidance on lifting, incorporate ergonomic standards into military operations to cover proper workplace engineering, job designs, and employee training and education, revise DA PAM 385-8, and coordinate with the Civil Service Commission to incorporate changes in OPM publications that require all job descriptions to specify lifting requirements.

Finally, recommendations are proposed to improve the Army's non-aviation accident reporting system by revising the accident reporting forms, developing instructions for organizing and conducting investigations, and providing a course of instruction for unit personnel that prepares them to investigate non-aviation accidents.

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BACKGROUND

Approximately 80% of Army ground accidents are caused by human error. Many of these errors involve the violation of safe operating procedures. Reviews of accident reports indicated that some procedures are frequently violated. Phase 1 of this study identified the most frequently violated procedures causing on-duty accidents that occurred between October 1985 and September 1987 (Fiscal Years 86 and 87). Phase 2 of this study was initiated to determine why the procedures were violated and to recommend actions to correct the underlying causes of these violations.

METHOD

To identify the causes of the procedural violations, the top 20 most frequently violated procedures identified by the Phase 1 contractor were reviewed for familiarity, validity, and to identify the systemic source(s) causing each error. Difficulties in deciphering the Phase 1 contractor's data identifying the individual accident cases containing the top 20 most frequently violated procedures resulted in a mutual agreement between the US Army Safety Center (USASC) Contracting Officers Technical Representative (COTR) and the Phase 2 contractor to repeat Phase 1 since most of the cases would require review to identify systemic sources anyway. The DA Forms 285 and 285-1 for the entire accident case sample of 594 human error accident cases was reviewed again to identify the most frequently violated procedures. Cases were reviewed separately by two safety subject matter experts who extracted specific information from the report and recorded the data on a form designed for this purpose. They then reconciled any differences between reviews before entering the data into a computerized data base.

After reviewing 336 accident cases, it was determined that these cases were representative of the entire population (594). This was accomplished by comparing the violated procedures identified in the remaining cases (258) with those in the first 336 cases to determine how many involved similar procedural references. Then, using a systematic random sampling method, the specific chapters/sub-headings of each reference and the systemic sources of each error were compared to ensure they remained consistent with those identified in the first 336 cases. An indepth analysis was performed on the 336 accident cases and these cases were then used to conduct Phase 2 of this study.

Because of the poor quantity and quality of information in the accident reports about the findings and causes of each accident and the lack of supporting evidence in the accident reports, systemic sources causing each error could not be accurately identified. Instead, a detailed review of the accident cases containing the most frequently violated procedures was conducted to identify specific contributing and non-contributing factors and the circumstances involved in each accident. These factors were analyzed to determine common problem areas.

A comprehensive review of Department of Defense (DOD), Department of Army (DA), Office of Personnel Management (OPM), and other federal agency publications was performed to determine what information was available to soldiers and Army civilian employees regarding the problem areas identified during the indepth analysis of the accident reports. Programs of Instruction (POI) from selected Army schools were reviewed to determine how well they addressed the problem areas identified in the accident data. Previous USASC studies identifying similar problem areas were also reviewed to compare the results. On-site visits were made to two educational institutions that offer professional driving courses (driving was one of the major problem areas identified in this study) as part of their curriculum to review the courses and the materials used to teach them. Finally, training materials from commercial sources concerning problem areas identified (drivers training, material handling, and back injury prevention) were reviewed to validate, refine, and expand the changes to Army publications and training materials recommended by this study.

Questionnaires were developed and forwarded to 469 soldiers, civilian employees and their leaders or supervisors to measure individual knowledge of safety-related problem areas identified in the accident data and to determine what training was being conducted, what references were being used, and how much emphasis was being placed on the problem areas reflected in the accident data. The questionnaires were sent to units and installations that were selected on the basis of a variety of factors represented in the accident data including organizational missions, types of vehicles and equipment assigned, military occupational specialty (MOS) and job series of personnel assigned, and geographical location. The questionnaires were administered on-site by COBRO personnel assigned to those locations. Completed questionnaires were tabulated, analyzed and are shown at Appendices A and B.

Proposed changes to written procedures and programs of instruction were identified and drafted for coordination. Discussions with the proponent for the written procedures and programs of instruction requiring changes, originally envisioned to be conducted on-site by co-located COBRO employees, were rejected in favor of direct coordination with the Ground Tactical and Installation Safety Divisions of the US Army Safety Center. In this way, USASC personnel who would ultimately be using the study results for prevention programs were kept abreast of the study's progress, were involved in the initial development of the proposed changes, and could use the lines of communication already established between the USASC and the various proponents to cooperatively agree to and initiate the changes needed. Based on these discussions, final DA Forms 2028 were prepared and are shown at Appendices C -F.

RESULTS

General

Of the 336 accident cases analyzed, 64 cases were rejected for insufficient or inadequate information and 44 cases required research too extensive for the current effort to identify the appropriate procedure that was violated. The remaining 228 cases revealed frequently violated procedures relating to three primary references: (1) FM 21-305, Manual for Wheeled Vehicle Driver; (2) DOD 4145.19-R-1, Storage and Materials Handling; and (3) FM 57-220, Basic Parachuting Techniques and Training. This is shown in Table 1.

Table 1			
Accident Sample			
	Cases	Cost	Fatal
Total Accident Sample	594	15.39M	162
Representative Sample	336	7.24M	81
Rejects	108	2.01M	22
Final Data Sample	228	5.23M	59

Within the final data sample, there were a total of 162 accident cases that contained the most frequently violated procedures which included 80 driving cases, 70 material handling cases, and 12 parachuting cases. These cases accounted for 71% of the final data sample, 38% of the costs, and 47% of the fatalities. These references were subdivided into more specific problem areas based on the number of violations of the specific chapters or sub-headings within each reference. The remaining 29% of the cases involved violations of references with a low number of occurrences (2 or less) and no violation trends. With the exception of the method of grouping specific references, these data were consistent with the Phase 1 Study data and paralleled the results of several previous USASC studies (Thomas 1982, Ricketson 1983). The most frequently violated procedures and their frequencies, costs, and fatalities are shown in Table 2.

Table 2			
Frequencies, Costs and Fatalities of the Most Frequently Violated Procedures			
	Cases	Cost	Fatal
Final Data Sample	228	5.23M	59
Cases Containing the Most Frequently Violated Procedures	162	1.97M	28
FM 21-305	80	1.41M	28
DOD 4145.19-R-1	70	.40M	0
FM 57-220	12	.17M	0

Driving Wheeled Vehicles

General Analysis

The 80 cases containing violations of FM 21-305 accounted for 49% of the 162 cases containing the most frequently violated procedures, 100% of the fatalities, and 72% of the costs. Within these cases six chapters or sub-headings were cited most often: (1) unusual

driving conditions (Chapter 13), (2) speed (Chapter 7), (3) following distance (Chapter 9), (4) backing and use of ground guides (Chapter 6), (5) curves or selective vision (Chapter 8), and (6) emergencies and skids (Chapter 14). Information available in the accident reports indicated that most of the accidents occurred during normal duty hours (Figure 1) and involved relatively youthful (Figure 2), male, military operators. Career Management Fields (CMF) 95 military policemen and 64/88 transportation were the CMF's with the largest number of driving accidents. Military policemen (95B) and motor transport

**DRIVING ACCIDENTS
HOUR OF ACCIDENT**

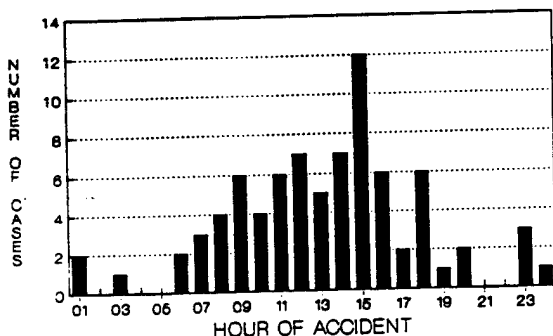


Figure 1

**DRIVING ACCIDENTS
OPERATOR'S AGE**

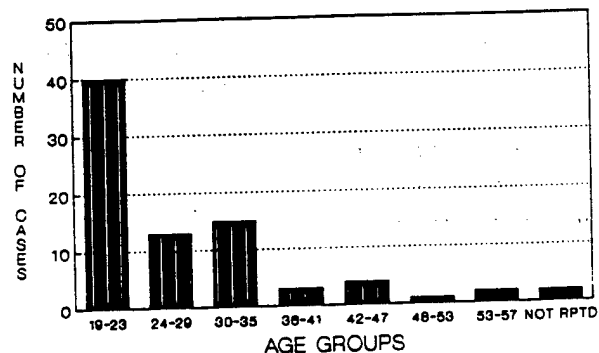
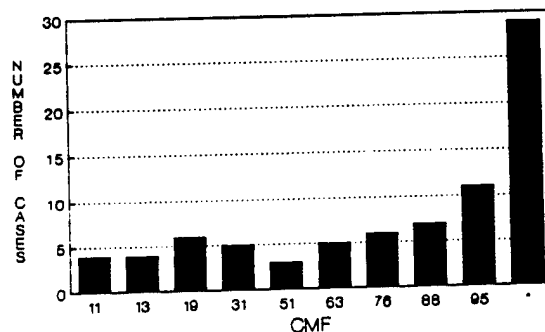


Figure 2

**DRIVING ACCIDENTS
CAREER MANAGEMENT FIELD OF DRIVER**



*CMF WITH 2 OR LESS OCCURANCES

Figure 3

operators (64C/88M) were the two MOS's most often reported (Figure 3). The accident reports also revealed that tactical vehicles under 2-1/2 tons (Figure 4) were involved the most often with the M151 series Jeep (Figure 5) involved in over 43% of these accidents. Commercial vehicles, most of which were less than 1 ton, and tactical vehicles over 2-1/2

tons accounted for the rest. This information remains consistent with other studies (Ricketson, D. and Thomas, M., 1980). General descriptive data about these driving accidents are shown in Table 3.

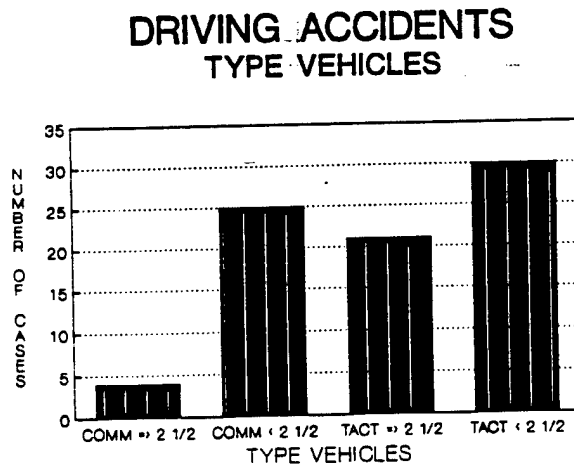


Figure 4

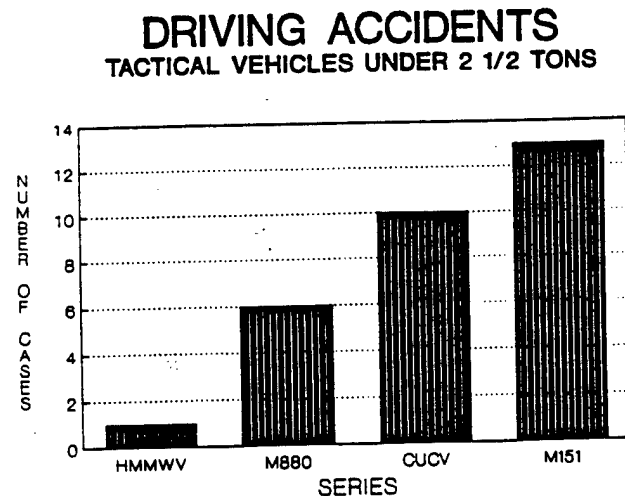


Figure 5

Table 3	
General Descriptive Data for the 80 Driving Accidents	
Time of accident	29% occurred between 0700 and 1200 46% occurred between 1200 and 1700 25% occurred between 1700 and 0700
Period of day	80% during the day 20% during the night, dawn, or dusk
Age of operator	50% were 19 through 23 years old 20% were 21 years old Youngest was 19; oldest 57
Sex of operator	98% were male 02% were female
Hours on duty	74% occurred during the normal 8 hour work day 13% occurred during the first hour of duty 26% occurred other than the normal 8 hour work day
*Hours slept (N = 21) Last 24 Hours	62% had less than 8 hours (24% reported 7 hours) 29% had 8 hours or more 10% not reported
Seatbelts	
Used	49%
Not available	28%
Avail. but not used	05%
NA or NR	19%
MOS of operator	85% military [(95B and 64C (88M)) account for 23%] 07% civilians 07% not reported
Equipment	36% involved commercial vehicles 37.5% involved tactical vehicles under 2 1/2 tons (43% of these involved M151 1/4 ton) 26% involved tactical vehicles 2 1/2 tons and over

* Only required when duty hours exceed 8 hours

Systemic Source Analysis

The systemic source(s) identified in the accident reports for each error contributing to a driving accident was found to be inappropriate and often inconsistent with the evidence in the reports. Unknown or insufficient information (USASC system inadequacy code 97) accounted for over 21% of the systemic sources while overconfidence (code 06) and inattention (code 05) accounted for another 25% of the systemic sources (Table 4). However, in many of these cases there was no evidence in the reports to support the causes cited by the report. Additionally, the accident reports did not contain sufficient information to address the adequacy of driver training programs or the written procedures concerning the specific problem areas identified in these cases.

Table 4															
Systemic Sources for 80 Army Driving Cases by Procedure Subheading															
SubHeading	TE	Systemic Sources													
		02	03	04	05	06	08	09	10	11	12	23	97	OTR	TOT
Unusual conditions	22	8% (2)	12% (3)		12% (3)	12% (3)	16% (4)	8% (2)	8% (2)		4% (1)		8% (2)	12% (3)	25
Speed	21	13% (3)	4% (1)		13% (3)	17% (4)	4% (1)		9% (2)	4% (1)	4% (1)	4% (1)	22% (5)	4% (1)	23
Following Distances	18	16% (3)		5% (1)	11% (2)	11% (2)	5% (1)					11% (2)	42% (8)		19
Back- ing/Ground Guides	11				14% (2)	14% (2)	7% (1)	7% (1)		14% (2)	7% (1)	7% (1)	21% (3)	7% (1)	14
Curves- Selective Vision/Al- cohol	9		11% (1)		11% (1)	33% (3)	11% (1)					11% (1)	22% (2)		9
Emergen- cies/Skids	7		13% (1)	25% (2)			25% (2)			13% (1)			13% (1)	13% (1)	8
Total	88	8% (8)	6% (6)	3% (3)	11% (11)	14% (14)	10% (10)	3% (3)	4% (4)	4% (4)	3% (3)	5% (5)	21% (21)	6% (6)	98
Legend of Systemic Sources															
02 - inadequate unit training								09 - fatigue							
03 - inadequate experience								10 - effects of drugs, alcohol, or illness							
04 - inadequate composure								11 - habit interference							
05 - inadequate attention								12 - environmental conditions							
06 - overconfidence (in self, others, equipment)								23 - inadequate supervision/coordination							
08 - inadequate motivation/mood (haste, command pressure, poor attitude)								97 - insufficient information							

Note: 1. There were 88 errors in the 80 driving cases.
2. An error may have more than one systemic source.

In the absence of credible findings and causes supported by evidence in the reports, each of the 80 driving cases were analyzed to identify specific contributing or non-contributing factors and circumstances involved in each case. These factors were gleaned from the narrative portions of the DA Forms 285 and 285-1 and categorized into operator, driving surface, and environmental factors. The frequency of occurrence for these factors is shown in Table 5. The data indicate that traveling too fast for conditions, getting into

skids, inappropriate focus of attention, and insufficient following and stopping distances were operator factors mentioned most frequently. Similarly, slippery surfaces caused by precipitation and encountering curves were frequently mentioned driving surface factors. This coincides with previous studies conducted by the USASC (Ricketson and Thomas, 1980). Finally, ice and snow were the most frequently reported environmental conditions involved in these accidents.

The frequency and distribution of these factors indicate that the major problem is drivers who fail to recognize and adjust their driving speed for hazardous conditions, especially those associated with some form of precipitation such as ice and snow. This problem was identified in previous studies (Milosevic and Milic, 1990). The environmental conditions, compounded by curved roads, resulted in the driver losing control and the vehicle going into a skid from which he could not recover. Inappropriate following or stopping distances and the drivers focus of attention or scanning techniques were also noted in many of the accidents.

Similar findings were noted in the MOS Task Accident Analysis studies (unpublished) performed by the USASC for specific military occupational specialties. The branch specific task analysis revealed driving errors were not restricted to one branch, but plagued all branches.

Table 5	
Contributing and Non-Contributing Factors Existing in the 80 Driving Accidents	
Operator Factors	Frequency of Occurrence
Speed	[35]
Too Fast for Conditions	[29]
Exceeded Posted Limit	[06]
Skids	[31]
Selective Vision (focus of attention/scanning)	[22]
Following/Stopping Distance	[20]
Improper Use of Lane (lane change/passing)	[17]
Anticipating Actions of Others	[13]
Physical Impairments (fatigue/alcohol/drugs)	[13]
Using Ground Guides	[05]
Obedying Traffic Signals/Signs	[03]
Driving Surface Factors	
Slippery Surfaces	[31]
Precipitation (ice/snow/rain/wet roads)	[23]
Non Paved Surfaces	[08]
Curves	[22]
Inclines	[11]
Unusual Road Conditions (e.g. ruts, soft, narrow)	[07]
Environmental Factors	
Ice and Snow	[14]
Rain	[05]
Reduced Visibility	[05]

Note: An accident may have multiple factors cited.

Publication Review

A comprehensive review of the vehicle operator manuals for the M151 series jeep, commercial utility cargo vehicle (CUCV), 2-1/2 ton truck, 5 ton truck, and the heavy expanded mobility tactical truck (HEMTT), showed there was very little guidance concerning recognition of weather hazards and the type of environmental conditions that are conducive to the formation of slippery driving surfaces. A study conducted by USASC (Ricketson, 1978) indicated excessive speed for existing conditions and unsafe road conditions are factors listed in many vehicle accidents. Both factors include conditions involving slippery or inclined road surfaces as contributors to the accidents. Improved training and instruction were the most frequently recommended corrective action. With the exception of the HEMTT, information pertaining to recovery from skids was minimal. Guidance concerning following and stopping distances was minimal and incorrectly stated in FM 21-305 for large vehicles. Overall, discussions about adjusting driving speed for conditions was fragmented and inadequate. There was no standardization among the various manuals concerning these subjects. A similar review of Soldier Training Publications (STP) for the motor transport operator (88M) and military policeman (95B) showed they provided no information regarding recognition of adverse weather conditions.

The professional driving curriculum at the John Patterson Technical College in Montgomery, Alabama and the Holmes/Washington County Vocational Technical College in Chipley, Florida, includes approximately 1,000 to 1,200 miles of on-the-road driving experience on heavy equipment during an 8-week course. Classroom and on-the-road instruction is based on the Federal Motor Carrier Safety Regulations and State Commercial Drivers License Manual with the first week of classes devoted to the regulations and safety. In contrast to Army guidance, this instruction also covers recognition of hazardous weather conditions and their effect on driving surfaces. Both institutions are third party testers for State Commercial Drivers License and each student who successfully completes the course graduates with a Commercial Drivers License (CDL) issued by the respective state licensing authority.

The Commercial Motor Vehicle Safety Act of 1986 requires each state to meet the same minimum standards for commercial driver licensing. Reviews of the commercial drivers license manual from the states of Ohio, California, Texas, New York, Florida, and Alabama produced detailed information about numerous subjects, including basic vehicle control, managing space (i.e., following and stopping distances and lateral clearance), communicating (i.e., road signs, signals, etc.), controlling speed, adverse conditions including weather hazards, skid control, and emergencies. These manuals can be ordered without charge through the appropriate state licensing authority.

Driver Training Requirements

The Fort Rucker transportation motor pool (TMP) requires that an individual only possess a valid state drivers license, attend the defensive drivers course, and receive a briefing on responsibility of liability to obtain a military drivers license to operate commercial Army motor vehicles of one ton or less on that installation. No hands-on driver training is required. Inquiries to the Fort Benning and the Fort Bliss TMP's confirmed this

policy was standard throughout the Army for commercial vehicles up to one ton. For vehicles greater than one ton and special equipment, the using unit is responsible for all training and testing. The Occupational Safety and Health Administration (OSHA) indicates that one-third of all workplace fatalities are the result of vehicle accidents, and occupational motor vehicle crashes cause 2,100 deaths and 91,000 lost workday injuries annually. They have proposed that all employees who drive routinely (i.e., 1 hour a day, 5 days a week) receive training from a qualified instructor and refresher training every 3 years. This will apply to 35 million employees who drive as part of their work (OSHA's Drive For Motor Vehicle Safety 1990).

The programs of instruction (POI) from the Infantry School do not include driver training in their curriculum. Whether soldiers graduating from the Infantry courses will be required to operate vehicles or equipment is determined after they arrive at their first unit of assignment. At that point, they receive unit level drivers training for the specific piece of equipment they are assigned to operate. POI's from the Transportation, Engineer, and Military Police Schools do include drivers training in several of their courses. At the Transportation School, courses including the Petroleum Vehicle Operator Course, the Motor Transport Operator Course, the Transportation Officers Basic and Advance Courses, the Motor Transport Operator Basic NCO Course, and the Motor Transport Operator Advanced NCO Course include drivers training. At the Engineer School, the Dump Truck Operator Course includes this training and it is also a part of the Basic Military Police Course. Although several of these POI's address driving and adverse weather conditions, the extent to which they cover these subjects could not be determined from the POI itself. They did not appear to address recognition of weather hazards. To assess the adequacy of this training, the specific lesson plans for each class must be reviewed. Requests for this data were made to the proponent, but the lesson plans were not received by the end of the contract period.

The Artillery School provides limited drivers training to selected Initial Entry Training (IET) students so they can help transport other IET students to and from training on the Fort Sill reservation. This is a "Limited License" that expires upon graduation and only allows them to operate 2-1/2-ton trucks in controlled motor march or specified training areas with a licensed cadre present in the cab. The driver training they receive is very basic and does not include recognition of hazardous weather conditions.

Questionnaire Data

Field survey questions were forwarded to a total of nine locations. Four FORSCOM installations and one TRADOC installation were chosen within the continental US (CONUS) and two locations in Germany and two in Korea were chosen outside the continental US (OCONUS). Separate questionnaires were developed for individual soldiers and employees involved with driving and for leaders or supervisors responsible for conducting driver training at unit level. The soldiers' and employees' questionnaires attempted to measure their level of knowledge of these subjects, specifically those relating to the problem areas. The supervisors' questionnaires attempted to determine what training is being conducted, what references are used to conduct the training, and how much emphasis is placed on the problem areas reflected in the accident data.

Of the total 249 driving questionnaires distributed, only 45 (8 unit and 37 individual) were returned by the end of the contract period. Responses were received from two FORSCOM installations and one TRADOC installation. There were several reasons for the low response rate. As the COBRO representatives began to coordinate with the selected units and organizations to administer the questionnaires, a problem with safety office coordination became apparent although part of the problem was resolved and the COBRO representatives were allowed to continue administering the questionnaires at some locations. An OCONUS location terminated the survey data collection. The deployment of US Army forces to Operation Desert Shield left insufficient personnel at some locations to complete the surveys.

The results of the returned questionnaires indicate that almost 90% of the individual drivers had received some form of drivers training, most often in high school or at unit/organization levels, but 20% of them incorrectly answered specific questions regarding weather hazards and their effect on driving surfaces. Examples include conditions that cause hydroplaning, environmental conditions that adversely affect driving surfaces, and effects of ice and snow on driving surfaces. Over 90% had not received any refresher or remedial training and almost 70% had not received any hands-on skid training. Also, about 27% of the individual drivers indicated that hazardous weather conditions were not adequately addressed in their vehicle operator manual. Of the 37 individual drivers responding to the survey, approximately 25% were military police and another 30% were either infantry, armor, or field artillery (combat arms). Due to the low response rate, comparisons between the unit level (trainers) and individual surveys would not be meaningful and were not accomplished. Complete results of these surveys are located at Appendix A.

Lifting

Three-fourths of the population of the United States experience back pain during their lives and one-third will suffer back pain severe enough to keep them home from work at least once. Two types of jobs contribute most to back pain: sedentary jobs and physically strenuous jobs (Spence, W.). This report will be dealing with the physically strenuous type injuries that are reported on the United States Army Accident Investigation Report (DA Form 285). The majority of these mishaps are injuries that are a result of one injury or accident. The back problems and lost work days of many sedentary jobs are not generally reported on the DA Form 285 because they are a result of a slow degeneration process and not one incident or injury.

General Analysis

The 70 cases containing violations of DOD 4145.19-R-1 accounted for 43% of the accident cases containing the most frequently violated procedures, 20% of the costs (reported in the accident report) and none of the fatalities. An analysis of the reference subheadings (Chapter, 6 para. 114 a, b) most often cited in these cases identified two major problem areas: failure to seek assistance when lifting and using an improper lifting method. Information available in the accident reports indicated that all but one of these cases

occurred during the day with 1000 hours (Figure 6) being the time of day with the most occurrences (20% of the cases). These accidents involved the Army's civilian workforce

**LIFTING
HOUR INJURY OCCURRED**

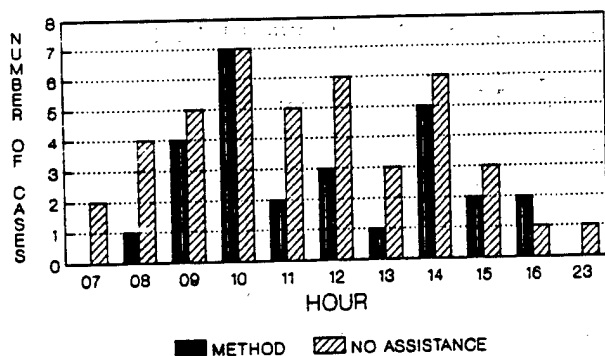


Figure 6

**LIFTING
AGE GROUPS OF INJURED**

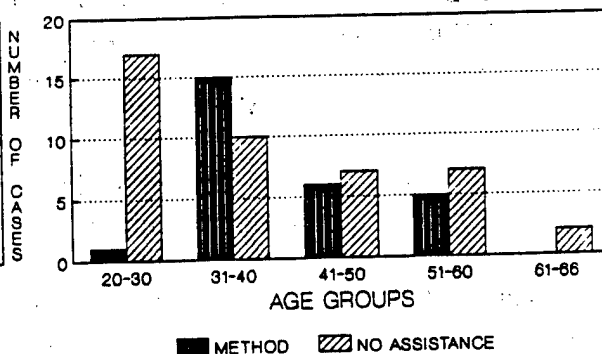


Figure 7

Table 6			
General Descriptive Data for the 70 Lifting Accidents			
	No assistance (N = 43)	Method (N = 27)	All (N = 70)
Time of accident	75% occurred 0900-1500	82% occurred 0900-1500	20% occurred 1000 - 1100
Period of day	one case at night		99% during the day
Age of person involved	37% involved 20-30 yr olds	44% involved 35-39 yr olds no cases with 21-30 yr olds	youngest = 20 oldest = 66 mean = 39 mdn = 39
Sex of person involved	88% male	89% male	89% male 11% female
Hours on duty	63% first 4 hrs	59% first 4 hrs	20% after 3 hrs
Hours of sleep	NA (only 2 cases required this item to be reported)		
Type Personnel	56% civilian 30% military 14% NR	78% civilian 15% military 7% NR	64% civilian 24% military 11% NR
Equipment lifted	26% boxes 7% gas cyl 67% other*	41% boxes 15% drums/cans 44% other**	26% boxes 74% other***
MACOM Involved			
AMC	23%	30%	26%
FORSCOM	21%	15%	19%
TRADOC	12%	18%	14%
NGB	19%	11%	16%
USAREUR	9%	7%	9%
All Others*	16%	18%	17%
* Not more than 2 each ** Not more than 3 each ***Not more than 4 each			

more so than its soldiers. The failure to seek assistance errors were usually committed by young males between 20-30 years old; the errors associated with improper lifting methods were usually committed by older males between 31-40 years old (Figure 7). Most of these lifting accidents occurred in other than warehouse type environments (i.e., offices, motor pools, fabrication facilities) and appeared to involve attempts to lift large versus heavy objects (e.g., narrative information seems to indicate a size versus weight problem). The data did not support any trends concerning specific job series, however, it did indicate similar civilian worker family groups (heavy mobile equipment mechanic and warehouse worker) to those shown in the Material Handling Accident Analysis Report (Lavendar, Piatt, Seaver 1990). General descriptive data about the 70 lifting accidents are shown in Table 6.

Systemic Source Analysis

As in the driving accident cases, the systemic source(s) identified in the accident reports for each error contributing to a lifting accident were inadequately defined and inconsistent with the evidence in the reports. Unknown or insufficient information accounted for 28% of the systemic sources and overconfidence in abilities accounted for another 26% of the systemic sources. There was little support for the cited causes in the accident reports. They did not contain sufficient information to address the adequacy of lifting or back injury prevention training programs or the written procedures concerning the problem areas identified in these cases. An attempt to identify the specific type and weight of the equipment being lifted in these reports was unsuccessful although narrative information seems to indicate a size versus weight problem. Many of the reports did not provide this information because it is not required on the DA Form 285 and 285-1.

Table 7														
Systemic Sources for 70 Army Accidents Involving Lifting Errors by Problem Area														
Problem Area	Errors	Systemic Sources												
		02	03	05	06	07	08	11	13	17	18	23	97	Totals
Failure to seek assistance	43	4% (2)	4% (2)	4% (2)	32% (16)	2% (1)	12% (6)			2% (1)	8% (4)	14% (7)	19% (9)	50
Improper method	27	6% (2)	3% (1)	10% (3)	16% (5)		10% (3)	6% (2)	3% (1)				45% (14)	31
TOTAL	70	5% (4)	4% (3)	6% (5)	26% (21)	1% (1)	11% (9)	2% (2)	1% (1)	1% (1)	5% (4)	9% (7)	28% (23)	81
Legend of Systemic Sources														
02 - inadequate unit training					11 - habit interference									
03 - inadequate experience					13 - inadequate facilities or services									
05 - inadequate attention					17 - improper use of tool, equipment, material									
06 - overconfidence (in self, others, equipment)					18 - inadequate written procedures									
07 - lack of confidence (in self, others, equipment)					23 - inadequate supervision/coordination									
08 - inadequate motivation/mood (haste, command pressure, poor attitude)					97 - insufficient information									

Note: An error may have more than one systemic source.

Publication Review

A comprehensive review of Army regulations and procedures pertaining to material handling and lifting revealed that there was no intermediate regulatory guidance between DOD 4145.19-R-1 and unit level standing operating procedures (SOP). Although the guidance in DOD 4145.19-R-1 is still valid, the regulation has not been updated since September 1979, and does not address setup of the work environment to preclude lifting injuries (ergonomics) and some of the newer lifting techniques found in the National Institute for Occupational Safety and Health (NIOSH) Work Practices Guide for Manual Lifting. The NIOSH document was originally published in 1981 but is currently under revision and is expected out in the near future. This document may be ordered without charge from the US Government Printing Office in Washington, DC or through NIOSH Publications in Cincinnati, OH.

DA PAM 385-8, Safety, Back Injury Prevention, provides material to be used when training personnel in proper lifting techniques and conditioning exercises, but it lacks specific information about back injury prevention procedures and back injury prevention training and needs revision. Interestingly, the training objectives listed in the training outline in Appendix C of this pamphlet targets the same problem areas discovered in the current accident data sample. Unfortunately, it does not indicate how the soldier is to determine which loads require assistance (objective #2).

AR 611-201, Military Occupational Specialty Classification and Structure, provides information for each MOS including major duties, qualifications, and physical demands, which include lifting requirements for each job. AR 40-501, Standards of Medical Fitness, provides guidance to Army doctors on conducting all types of physicals, including induction physicals performed on soldiers entering the Army. It requires doctors to examine soldiers to ensure they meet the criteria stipulated for their MOS in AR 611-201. A random sampling of MOS's, represented in the accident data sample, revealed all of them stipulated lifting requirements for that job.

Because of the preponderance of civilian employees involved in lifting accidents, Office of Personnel Management (OPM) and local Civilian Personnel Office (CPO) publications were reviewed to determine job classification, recruitment, and placement requirements for lifting. The review indicated that job standards and job descriptions do not always identify lifting requirements as part of the job nor the amount of weight required to be lifted. The U.S. Civil Service Commission Bureau of Policy and Standards Handbooks X-118 and X-118C apply to general schedule (GS) and wage grade (WG) positions. Handbook X-118 applies to the general schedule (GS) positions which are non-labor type positions; thus, lifting is not addressed. Therefore, job descriptions in the GS position normally do not indicate lifting requirements. Handbook X-118C applies to wage grade (WG) positions that are normally in the manual labor field. A review of it indicated most WG positions include lifting requirements, however, specific weights to be lifted are identified in the individual job description.

Personnel in positions only requiring light duty work are required to complete the United States Office of Personnel Management Statement of Physical Ability for Light

Duty Work (Standard Form 177). This form covers the occasional lifting of objects weighing up to 10-12 pounds. Other items included are frequent bending, stooping, crouching, standing and walking. A medical examination may be required by the appointing office (CPO) if the applicant is physically unable to do the job or would create a hazard to himself/herself or others. The appointing officer makes these decisions based on the application forms and personal observations during the hiring process.

Applicants for more strenuous positions (normally wage grade) are required to complete the United States Civil Service Commission Certificate of Medical Examination (Standard Form 78). This also requires a physician to examine the applicant and indicate ability to perform the job. The job description becomes important at that time. The appointing officers (CPO) need the job description to identify the functional requirements and environmental factors essential to the duties of the position. However, job descriptions frequently do not address the amount, size, or texture of the items to be lifted; the frequency, duration and pace of the lifting activities; or the environment in which the lifting activities will take place. Without this information, the doctor conducting the physical exam cannot make an accurate assessment of the employee's ability to perform the lifting functions required of his position.

In 1991 OSHA will begin issuing "ErgoFacts," a one-page summary of actual cases that OSHA has worked on to help correct ergonomic hazards and lifting hazards will be included. The ergonomics publication will be similar to OSHA's "Fatal Facts," a publication that describes fatal construction accidents and "Safe Works," a factsheet that outlines safe work procedures (OSHA Ergonomics, 1990). This is a publication to assist in educating people about the ergonomics program to improve quality, productivity, safety and health in the workplace.

Lifting Training Requirements

Discussions were conducted with a representative TRADOC installation CPO about job classification requirements, recruitment and job placement policies, and local training requirements. The CPO personnel said that supervisors are required to indicate whether or not lifting is a requirement of the position and that medical exams are mandated for employees required to lift 45 pounds or more. They also indicated that local supervisors receive back injury prevention training during the Supervisors Development Course held quarterly and new employees get the information at the new employee orientation. There is no documentation that this training is actually conducted. Discussions with the Occupational Health Doctor at the installation revealed that (in accordance with local policy) he conducts an abbreviated examination (medical screen) for those employees whose position requires them to lift and carry between 15 and 45 pounds and a complete examination for employees required to lift in excess of 45 pounds. Discussions with several AMC installations revealed similar policies.

Questionnaire Data

Concurrent with the driving surveys, questionnaires were administered to soldiers and Army civilian employees at the same eight locations. Separate questionnaires were

developed for individual soldiers and employees involved with lifting and for leaders or supervisors responsible for conducting lifting training at unit level. The supervisors' questionnaires attempted to determine what training is being conducted, what references are used to conduct the training, and how much emphasis is being placed on the problem areas reflected in the accident data. The soldiers' and employees' questionnaires attempted to measure their level of knowledge of these subjects, specifically those relating to the problem areas. Only 46 (7 unit and 39 individual) of the 220 questionnaires were returned. The results of the returned questionnaires indicated that over 50% of the units responding provide lifting training to its employees, most using National Safety Council materials. Although 97% of the individuals surveyed indicated that lifting is a requirement of their position, none of the units responding indicated that personnel are tested to determine the maximum weight they can safely lift. Due to low response rate, comparisons between the unit level (trainer) and individual surveys would not be meaningful and were not accomplished. The complete results of these surveys are located in Appendix B.

Parachuting

General Analysis

The 12 cases containing violations of FM 57-220 accounted for 7% of the accident cases containing the most frequently violated procedures and 8% of the costs but none of the fatalities. The three reference subheadings most often cited in these cases were performance point 1 (exiting the aircraft), performance point 4 (preparing to land), and performance point 5 (landing). Ten of the twelve accidents involved improper parachute landing falls with performance point 4 being violated 6 times and performance point 5 being violated 4 times. Over half of the accidents occurred during initial training at Fort Benning, GA., and involved personnel with fewer than five jumps. The majority of these jumps were made with a T-10 parachute from a C130 aircraft at an altitude of 1,250 feet above ground level. In five of the seven cases reporting wind speed, the winds were listed as 5 knots or greater. General descriptive data about the parachuting accidents are in Table 8.

Table 8	
Descriptive Data for the 12 Parachuting Accidents	
Time of day	60% occurred between 1200 and 1800
Period of day	50% occurred during the day 50% occurred at night
Age of person involved	40% were between 18 and 20 years old 18 was the youngest; 39 the oldest
Sex of person involved	92% were males
Hours on duty	83% occurred with 8 hours of duty or less 17% occurred after more than 8 hours of duty
Hours of sleep in last 24 hrs	Both cases required to report this item indicated 8 hours
MOS	100% military (1 case not reported) 58% involved infantry MOS's
Equipment	50% involved T-10 parachutes 17% involved MC-1 parachutes 25% were not reported 8% tng aid (swing ladder)

Systemic Source Analysis

The systemic source(s) identified in the accident reports for each error contributing to a parachuting accident indicated that loss of composure accounted for 39% of the systemic sources and inexperience accounted for 23% of the systemic sources (see Table 9). Loss of composure appeared to be a "standard" response from one installation as it was listed as a cause on each DA Form 285-1 reporting a parachute accident at that location. The small number of parachute accidents in the sample, the lack of information reported on the DA Forms 285 and 285-1, and the absence of trends in these 12 cases ruled out further meaningful analysis of these accidents.

Table 9								
Systemic Sources for 12 Army Accidents Involving Parachuting Errors by Problem Area								
		Percentage Attributed to Systemic Sources						
Problem Area	Errors	02	03	04	06	07	97	Total
Parachuting Landing Falls (PLFs)	10	9% (1)	18% (2)	45% (5)	9% (1)	9% (1)	9% (1)	11
Exiting	2		50% (1)				50% (1)	2
Total	12	8% (1)	23% (3)	39% (5)	8% (1)	8% (1)	15% (2)	13
Legend of Systemic Sources								
02 - inadequate unit training 03 - inadequate experience 04 - inadequate composure 06 - overconfidence (in self, others, equipment) 07 - lack of confidence (in self, others, equipment) 97 - insufficient information								

Note: An error may have more than one systemic source.

Publication and Training Review

A comprehensive review of FM 57-220 revealed that written procedures for parachute landing falls and proper exit techniques were adequately addressed. Furthermore, a great deal of emphasis is placed on these subjects throughout airborne school and they are also adequately addressed during prejump operations in airborne units.

CONCLUSIONS AND RECOMMENDATIONS

Driving Wheeled Vehicles

Preventing accidents associated with the operation of wheeled vehicles appears to have the greatest payoff to the Army. Within the final data sample of 228 cases, this type of accident comprised 35% of the accident cases, 47% of the fatalities, and 27% of the total costs. Because these data were shown to be representative of the total accident sample, and assuming the total accident sample is representative of the total number of wheeled vehicle accidents occurring during the 2-year period, the potential savings from wheeled vehicle accidents over a comparable 2-year period could be as much as 1373 accidents, 76 fatalities, and 6.9 million dollars.

Analysis of the accident data suggested that the inability of drivers of Army wheeled vehicles to recognize hazardous weather conditions and their effects on driving surfaces was the dominant problem. The reasons for this problem stem from a lack of written guidance pertaining to hazardous weather conditions in Army publications, especially those documents readily available to the soldier in the field, and the resulting lack of emphasis on this subject during institutional and unit level drivers training. The problem is further complicated by the policy of issuing military drivers licenses for commercial vehicles under one ton to soldiers possessing a valid state drivers license without any training or testing. The large percentage (34%) of accidents in the data sample that involve light commercial vehicles under one ton would suggest that many of the operators had received no training in this area at all.

The following recommendations are provided to correct these deficiencies:

- Change AR 600-55 to require a commercial drivers license (CDL) for all drivers of Army tactical and commercial vehicles with a gross vehicle weight rating (GVWR) of more than 26,000 pounds, or a trailer with a GVWR of more than 10,000 pounds if the gross combined weight rating is more than 26,000 pounds, or a vehicle designed to transport more than 15 persons including the driver, or any sized vehicle which requires hazardous materials placards. This will require them to receive training and be tested on driving in hazardous weather conditions. (DA Form 2028 at Appendix C)
- Change AR 600-55 by adding weather hazards training requirements to the Drivers Training Course POI to ensure operators of all other vehicles not meeting the criteria above receive this training. (DA Form 2028 at Appendix C)
- Change AR 600-55 to modify the installation commander's waiver authority regarding drivers license requirements for non-tactical vehicles under 10,000 pounds to ensure other aspects of the CDL (passenger operations and hazardous materials) are incorporated. (DA Form 2028 at Appendix C)

- Change all wheeled vehicle operator manuals by adding a Weather Evaluation Guide, Weather Evaluation Risk Guide, and miscellaneous safety tips so each equipment operator has easy access to this important information. (DA Form 2028 at Appendix E)
- Change FM 21-305 by adding a Weather Evaluation Guide and Weather Evaluation Risk Guide and by adding detailed information about each weather hazard to consolidate this information in one reference for use by drivers and driver training instructors. (DA Form 2028 at Appendix D)
- Change FM 21-305 to update specific information pertaining to braking techniques, following distances, weather hazard awareness, and air brakes from current CDL manuals. (DA Form 2028 at Appendix D)

Lifting

Although lifting accidents are less severe (no fatalities) than other types of accidents, the true costs associated with these type accidents are not reported in the DA Form 285 accident reports (e.g., the long term compensation paid to injured employees is not included in the total costs of an accident). Thus, the potential savings from preventing lifting accidents is difficult to determine. However, preventing lifting accidents could provide a potential reduction of 767 accidents for a comparable 2-year period, which could result in a significant savings to the Army. A study by Liberty Mutual Insurance Company indicated back injury compensation costs the American industry an estimated \$11.1 billion during 1986. (Washington State identified back injuries in 4.54% of the total claims and compensation payment 36.1% (\$63.5 million) for the year of 1977 (Back Injury Prevention, 1990)).

Analysis of the accident data suggested that the inability of Army civilian employees and soldiers to determine what they can safely lift without assistance was the dominant problem. A secondary problem was using an improper lifting technique (e.g., using back instead of leg muscles, twisting or turning while lifting, or attempting to lift heavy objects located above waist level). These problems result from inadequate written guidance pertaining to lifting in DA publications, the outdated information available in DOD 4145.19-R-1, the absence of lifting requirements in job standards and job descriptions for personnel who work in office, motor pool, and fabrication facility environments.

The following recommendations are provided to correct these deficiencies:

- The USASC should coordinate with The Surgeon General (TSG) to determine proponency and establish Army regulatory guidance on lifting (material handling) using the NIOSH Work Practices Guide for Manual Lifting. At a minimum, the following issues should be addressed: (1) physical requirements of the job, (2) ergonomics of the workplace environment, and (3) soldier and employee testing and training requirements.
- The USASC should obtain OSHA's one-page publication "Ergofact" (OSHA Ergonomics, 1990) and make it available to all units.

- The USASC coordinate with TSG to ensure OSHA-produced ergonomic standards for general industry are incorporated into military operations to cover proper workplace engineering, job designs, employee training and education. Ensure the Army includes command commitment, a written ergonomics program, employee involvement, regular program review and evaluation.
- The USASC should revise DA PAM 385-8 to incorporate new lifting techniques and procedures, including methods to discriminate between loads to be lifted with and without assistance, ergonomics of the workplace environment, and an update to the back injury prevention training based on the NIOSH Work Practices Guide for Manual Lifting. (DA Form 2028, Appendix F)
- The USASC should coordinate with the Civil Service Commission to incorporate changes in OPM publications that require all job standards and descriptions to specify lifting requirements including the amount, size, and texture of the material to be handled; the frequency, duration, and pace of the lifting activities; and the environment in which the lifting activity will take place (see example below). Require physicals for employees accepting new jobs that are strenuous. (see example below)

Job Standards/Description Lifting Requirements Example

Department of Army Job Description, DA Form 374, item #13, "Statement of Duties and Responsibilities", Factor 8, Physical Demands:

Daily lifting/carrying of smooth surface paper products (books, manuals or manuscripts) weighing up to 20 pounds. Each repetition will be 3 to 5 seconds in duration, moving an item from one area to another (bookshelf to work area). Low frequency (2 to 3 times per hour) self-paced operation performed in an office area.

Parachuting

Analysis of the accident data indicated two problem areas: improper parachute landing falls and improper exit from the aircraft. A review of applicable procedures and training programs indicated they adequately covered/emphasized these two areas. Therefore, no changes/additions are recommended.

Overall

The data derived from the Army's nonaviation accident reporting forms (DA Forms 285 and 285-1) do not adequately support accident prevention programs. The forms do not require investigators to report critical information pertaining to the personnel, equipment and material, or environmental conditions involved in the accidents. In addition, they do not require evidence supporting the errors and their systemic sources that caused the accident to be reported in a clear and concise manner. This problem stems from inadequate and outdated accident reporting forms, the absence of published instructions on the procedures to be followed in organizing and conducting nonaviation accident investigations and on the sources of the information needed to complete the forms, and inadequate accident investigation training for unit personnel assigned the responsibility for conducting accident investigations.

The following recommendations are provided to correct these deficiencies:

- The USASC should revise the nonaviation accident reporting forms to include sufficient information pertaining to the personnel, equipment and material, and environmental conditions involved in each accident using the aviation accident reporting forms as a basis.
- The USASC should publish instructions that indicate how to prepare for and conduct nonaviation accident investigations. These instructions should be based on the updated accident reporting forms developed above and include the sources of information needed to complete the forms.
- The USASC should develop and conduct a course of instruction for unit personnel that prepares them to investigate nonaviation accidents using the recommended instructions and forms.

APPENDIX A

UNIT DRIVING SURVEY

1. To what organization or unit are you currently assigned? (8 Respondents)

3 Provost Marshal
 1 Artillery
 1 Combat Engineer
 1 Infantry
 1 Engineering & Housing (DEH)
 1 Logistics DOL

unit or organization

2. Indicate the references used to conduct wheeled vehicle drivers training in this organization. (check all that apply) (8/8)

1[] FM 21-305	6	75%
2[] AR 385-55	6	75%
3[] Vehicle Technical Manuals	5	62.5%
4[] AR 600-55	7	87.5%
5[] Other (specify)	6	75%

Fort Riley (FR) Pam 55-1
 FR Pam 190-2
 DA Pam 611-25
 TB 600-1
 FC 55-30
 FC 55-32
 FM 19-10
 FM 55-30
 Films

3. Indicate the duty position of the person who conducts the training. (check all that apply) (8/8)

3a. Classroom Instruction

1[] Motor Sergeant	2	25%
2[] Platoon Sergeant	1	12.5%
3[] Training NCO/Officer	0	0%
4[] Supervisor	2	25%
5[] Dispatcher	0	0%
6[] Other	5	62.5%

Contract Instructor
Bus Instructor
Driver's Tng NCO
Provost Marshal Tng NCOIC

3b. On-The-Road Instruction (8/8)

1[] Motor Sergeant	1	12.5%
2[] Platoon Sergeant	1	12.5%
3[] Training NCO/Officer	0	0%
4[] Supervisor	4	50%
5[] Dispatcher	0	0%
6[] Other	4	50%

Contract Instructor
Bus Instructor
Driver's Tng NCO
Provost Marshal Tng NCOIC

4. Does the training cover how to recognize hazardous driving conditions? (8/8)

2[] No	0	0%
1[] Yes	8	100%

4a. If yes, indicate the hazardous conditions covered: (check all that apply) (8/8)

1[] Ice and snow	8	100%
2[] Rain and wet roads	8	100%
3[] Reduced visibility	8	100%
4[] Non-paved surfaces	6	75%
5[] Curves and inclines	7	87.5%
6[] Other unusual road conditions (potholes, narrow widths, etc.)	6	75%
7[] Other (specify)	5	62.5%

Desert (sand and wadies)
Emergency vehicle operations
Oversize loads
Built-up areas
Use of ground guides

5. Does training include recovery from skids? (8/8)

5a. Classroom Instruction

1[] Yes	7	87.5%
2[] No	1	12.5%

5b. On-The-Road Instruction

1[] Yes	4	50%
2[] No	2	25%
No Response	2	25%

6. Does training include how to judge following and stopping distance? (8/8)

6a. Classroom Instruction

1[] Yes	7	87.5%
2[] No	1	12.5%

6b. On-The-Road Instruction

1[] Yes	6	75%
2[] No	1	12.5%
No Response	1	12.5%

INDIVIDUAL DRIVING SURVEY

SECTION A.

Demographic Data

1. Indicate your MOS or job series and your unit of assignment. (37 Respondents)

Series	# Responses	% of Total Respondents
Military Police (95)	9	24.3
Infantry (11)	5	13.5
Combat Engineers (12)	3	8.1
Field Artillery (13)	4	10.8
Administration (71)	2	5.4
Supply and Services (76)	1	2.7
Motor Vehicle Operator WG57	4	10.8
Materials Handler WG69	1	2.7
No response	7	18.9
Branch Chief	1	2.7

2. List each vehicle that is included on your SF 46 (US Government Motor Vehicle Operator Identification Card):

Commercial > 2 1/2 tons	(12)	8.1%
Commercial < 2 1/2 tons	(53)	35.8%
Tactical > 2 1/2 tons	(28)	18.9%
Tactical < 2 1/2 tons	(40)	27.0%
Track Vehicles	(15)	10.1%

Note: 37 respondents listed a total of 148 vehicles (N = 148)

3. Indicate the number of years you have had a: (37/37)

3a. Military drivers license

1-3 years	19		mean	6.97
4-6 years	9		median	3
7-15 years	3		mode	3
16+ years	6		range	1-34
			Std Dev	7.94

3b. Civilian drivers license

0-5 years	7	mean	14.49
6-10 years	14	median	10
11-20 years	5	mode	8
21-30 years	6	range	0-39
31+ years	5	Std Dev	11.09

4. Indicate the highest level of education completed: (37/37)

1[] Grade School	2	5.4%
2[] Junior High School	1	2.7%
3[] High School (GED or Diploma)	28	75.7%
4[] Technical School	3	8.1%
5[] College (2- or 4- year degree)	3	8.1%

5. Approximate number of miles driven in the last 12 months:

5a. Military vehicle

150-1,000 miles	7	mean	14570.27
1,001-5,000 miles	9	median	6,000 miles
5,001-15,000 miles	11	mode	20,000 miles
15,001-30,000 miles	9	range	150 - 30,000 miles
30,001+ miles	1	Std Dev	32524.50

5b. Privately owned vehicle

500-5,000 miles	6	mean	15872.97
5,001-15,000 miles	17	median	14,000 miles
15,001-30,000 miles	11	mode	15,000,30,000 miles
30,001-60,000 miles	3	range	500 - 60,000 miles
		Std Dev	12885.56

6. Have you ever had an accident while driving a: (37/37)

6a. Military vehicle

1[] Yes	6	16.2%
2[] No	31	83.8%

6b. Privately owned vehicle

1[] Yes	13	35.1%
2[] No	24	64.9%

7. Have you received formal drivers training? (37/37)

2[] No	4	10.8%
1[] Yes	33	89.2%

7a. If yes, where was this training conducted? (check all appropriate answers)
(33/33)

1[] High School	26	78.8%
2[] Unit/Organization	18	54.5%
3[] Basic Training (BT)	11	33.3%
4[] Installation Transportation		
Motor Pool (TMP)	14	42.4%
5[] Advanced Individual Training (AIT)	7	21.2%
6[] Other (specify)	9	27.3%

<i>Defensive Driving Course</i>	3
<i>Police Academy</i>	1
<i>Germany</i>	1
<i>Truck Driving</i>	1
<i>Driving School</i>	1
<i>Driver Pro. 43345</i>	1
<i>Previous Training</i>	1
<i>No response</i>	28

Note: Multiple Responses

8. Were you given a road test prior to being issued a military drivers license? (37/37)

2[] No	7	18.9%
1[] Yes	30	81.1%

8a. If yes, specify the type vehicle(s) you were tested in:

<i>Commercial > 2 1/2 tons</i>	(13)	18.6%
<i>Commercial < 2 1/2 tons</i>	(5)	7.1%
<i>Tactical > 2 1/2 tons</i>	(15)	21.4%
<i>Tactical < 2 1/2 tons</i>	(24)	34.3%
<i>Track Vehicles</i>	(13)	18.6%

Note: 30 respondents listed a total of 70 vehicles (N = 70)

9. Have you ever been required to attend remedial or refresher drivers training? (37/37)

1[] Yes	3	8.1%
2[] No	34	91.9%

10. Have you ever received any hands-on skid training? (37/37)

1[] Yes	12	32.4%
2[] No	25	67.6%

SECTION B.**Driving Information**

* Indicates correct answer

1. Indicate three conditions that require a reduction in speed:

Environmental Conditions	14	41%
Obstructions/Obstacles	12	35%
Traffic	4	12%
Terrain	4	12%
Total	(34)	

2. Indicate three things to look for before passing another vehicle:

Traffic/Road Information	11	37%
Clearance	6	20%
Traffic	7	23%
Animals	4	13%
Other	2	7%
Total	(30)	

3. Does the distance needed to stop a vehicle increase on a wet road? (37/37)

1[*] Yes	35	94.6%
2[] No	2	5.4%

4. The distance needed to stop a vehicle on ice: (37/37)

1[] is twice the distance needed on dry pavement	4	10.8%
2[] is the same as wet pavement	0	0%
3[] is the same as needed on a snow packed road	1	2.7%
4[*] increases more than three times the distance needed on dry pavement	32	86.5%

5. When you see a curve coming up, where do you reduce your speed? (37/37)

1[] after entering the curve	0	0%
2[*] before entering the curve	36	97.3%
3[] in the middle of the curve	0	0%
4[] at the end of the curve	1	2.7%

6. The minimum safe recommended distance to follow another vehicle is: (37/37)
- | | | |
|--------------------|----|-------|
| 1[] one second | 2 | 5.4% |
| 2[*] two seconds | 13 | 35.1% |
| 3[] three seconds | 15 | 40.5% |
| 4[] five seconds | 7 | 18.9% |

7. On what type of driving surface do most Army vehicle accidents occur? (37/37)

1[*] paved	21	56.8%
2[] dirt	5	13.5%
3[] gravel	11	29.7%

8. Which surface will be slickest? (37/37)

1[*] a paved road where rain just began falling	31	83.8%
2[] a paved road where a light rain has been falling for two hours	6	16.2%

9. If your vehicle runs off the road, you should: (37/37)

1[*] let up on the accelerator and as the speed decreases, steer the vehicle back on the road	36	97.3%
2[] turn the wheel quickly to return to the road	0	0%
3[] put on the brakes hard and turn back on the road	1	2.7%

10. Which type of surface do you think is the most dangerous to drive on? (37/37)

1[] a gravel road with some holes and a few ruts	1	2.7%
2[] a paved road that has water standing in low areas	1	2.7%
3[*] a paved road that has patches of black ice	30	81.1%
4[] a paved road that is snow packed	5	13.5%

11. You are driving down a main road and see a vehicle approaching from a side road at a high rate of speed. You would: (37/37)

1[] continue because you have the right of way	1	2.7%
2[] maintain your speed, but watch the other vehicle	3	8.1%
3[*] slow down and be ready to stop in case the other vehicle enters the road	33	89.2%
4[] blow your horn to warn the other driver that you have the right of way	0	0%

12. You are backing a vehicle and your ground guide gives you a signal that you do not understand. You would: (37/37)

- | | | |
|---|----|-------|
| 1[] continue backing and look out for yourself | 1 | 2.7% |
| 2[*] stop the vehicle and talk with the ground guide to make sure that it is safe to continue backing | 32 | 86.5% |
| 3[] stop the vehicle and look for yourself before you continue to back up | 4 | 10.8% |

13. Which condition will most likely cause hydroplaning? (37/37)

- | | | |
|------------------------------------|----|-------|
| 1[] worn tire tread | 29 | 78.4% |
| 2[*] low air pressure in the tires | 8 | 21.6% |

14. A road that has ice on it is more dangerous when the temperature is: (37/37)

- | | | |
|---------------------|----|-------|
| 1[] -10 degrees F | 5 | 13.5% |
| 2[] 0 degrees F | 8 | 21.6% |
| 3[*] + 32 degrees F | 24 | 64.9% |

SECTION C.**Personal Opinions**

1. Do you believe that the drivers training you received was sufficient? (37/37)

1[] Yes 29 78.4%
2[] No 8 21.6%

2. Do you believe that anyone who has a valid state drivers license should be issued a military drivers license without extra training? (37/37)

1[] Yes 8 21.6%
2[] No 28 75.7%
No Response 1 2.7%

3. Are operations in adverse conditions covered well by your vehicle operators manual? (37/37)

1[] Yes 24 64.9%
2[] No 10 27%
No Response 3 8.1%

4. Are your driving habits affected when you have a higher ranking passenger on board (senior NCO or officer)?

1[] Yes 8 21.6%
2[] No 28 75.7%
No Response 1 2.7%

5. What do you believe causes most accidents?

	# of responses	% of respondents
Inattention	24	65%
"Lack of" Training	11	30%
Speeding/DUI	9	24%
Driving Conditions	3	8%
Complacency	2	5%
Total	(49)	

6. What do you think will cause the next driving accident in your unit?

	# of responses	% of respondents
Inattention	12	39%
"Lack of" Training	6	19%
Alcohol/Fatigue	5	16%
Driving Conditions	7	23%
Complacency	1	3%
Total	(31)	

7. What kinds of additional drivers training would you like to receive?

	# of responses	% of respondents
Reaction Training	10	53%
Night Training	2	11%
Weather/Safety	5	26%
Other	2	11%
Total	(19)	

APPENDIX B

UNIT LIFTING SURVEY

1. To what unit or organization are you currently assigned? (7 Responses)

3 Logistics (DOL)
 1 Engineering and Housing (DEH)
 1 Combat Engineers 1
 1 Infantry
 1 Artillery

unit or organization

2. Does this organization provide formal lifting (or back injury prevention) training to its soldiers and/or employees? (7/7)

2[] No	3	42.9%
1[] Yes	4	57.1%

- 2a. If yes, how often is this training conducted? (4/4)

1[] Monthly	0	0%
2[] Quarterly	1	25%
3[] Annually	4	100%
4[] Other (specify)	1	25%

Semi-annually

Note: Multiple responses

- 2b. If yes, indicate the references used for this training. (check all that apply) (4/4)

1[] DOD Regulation 4145.9-R-1	1	25%
2[] NIOSH Lifting Guide	2	50%
3[] National Safety Council Publications	4	100%
4[] Unit Standing Operating Procedures (SOP)	2	50%
5[] Other (specify)	1	25%

Films

Note: Multiple responses

- 2c. If yes, indicate the duty position of the person who conducts the training. (4/4)

1[] Supervisor	1	25%
2[] Platoon Sergeant	0	0%

3[] Training NCO/Officer	0	0%
4[] Other (specify)	2	50%

<i>Safety Officer</i>		
<i>Physical Therapist</i>		
<i>No Response</i>	1	25%

2d. If yes, does this training include specifics on the proper lifting methods including proper individual lifting techniques, proper team lifting techniques, proper use of lifting devices, and/or proper use of self-propelled material handling equipment? (4/4)

1[] Yes	4	100%
2[] No	0	0%

2e. If yes, does this training include specifics on how to properly estimate the weight of an object prior to attempting to lift it? (4/4)

1[] Yes	3	75%
2[] No	1	25%

3. Do the job descriptions for civilian employees assigned to this organization include requirements for lifting? (7/7)

2[] No	1	14.3%
1[] Yes	4	57.1%
<i>No Response</i>	2	28.6%

3a. If yes, does this job description specify how often they are required to lift? (4/4)

1[] Yes	0	0%
2[] No	4	100%

3b. If yes, is the maximum amount of weight they are expected to lift specified? (4/4)

1[] Yes	3	75%
2[] No	0	0%
<i>No Response</i>	1	25%

4. Are personnel in the unit tested for the maximum amount of weight they can lift? (7/7)

2[] No	7	100%
1[] Yes	0	0%

4a. If yes, how is this accomplished? (7/7)

0 0%

INDIVIDUAL LIFTING SURVEY

SECTION A.

Demographic Data

1. Indicate your MOS or job series and your unit of assignment. (39/39)

(11) Infantry 4	Infantry 5
(13) Field Artillery 1	Combat Engineers 5
(63) Mechanical Maintenance 2	Artillery 5
(71) Administration 6	Logistics (DOL) 19
(76) Supply and Services 2	Engineering and Housing (DEH) 5
(WG 6907) Materials Handler 6	
(WG 5800/5803) Equip Mechanic 4	
(WG 5704) Forklift Operator 1	
Not Reported 13	

MOS/Job Series (5 digit)

Unit of Assignment

2. Indicate your height, weight, and age:

Height-Inches	Weight-Pounds	Age-Years
69.7 Mean	178.3 Mean	38.97 Mean
Mode 70/71	Mode 160/180/185/192	Mode 21 years
Median 70 inches	220/245 pounds	Median 40 years
Range 61-78 inches	Median 175 pounds	Range 19-62 years
Std Dev 3.55	Ranges 110-280 pounds	Std Dev 13.96
	Std Dev 36.26	

3. Indicate the highest level of education completed: (39/39)

1[] Grade School:	3	7.7%
2[] Junior High School:	1	2.6%
3[] High School (GED or Diploma)	27	69.2%
4[] Technical School	2	5.1%
5[] College (2 year or 4 year degree)	7	17.9%
Note: Multiple responses		

4. Does your job description require lifting? (39/39)

2[] No	1	2.6%
1[] Yes	38	97.4%

- 4a. If yes, how often? (38/38)

1[] Frequently (daily, several times per week, etc.)	35	92.1%
---	----	-------

2[] Infrequently (less than once a month)	2	5.3%
No Response	1	2.6%

4b. If yes, how much weight does it require you to lift? (38/38)

0 to 50 lbs.	9	23.7%
51 to 100 lbs.	22	57.9%
Over 100 lbs.	6	15.8%
No Response	1	2.6%

5. Have you had any training on proper lifting methods including proper individual lifting techniques, proper team lifting techniques, proper use of lifting devices, or proper use of self-propelled material handling equipment?

2[] No	13	33.3%
1[] Yes	25	64.1%
No Response	1	2.6%

5a. If yes, check each subject that was covered. (check all that apply) (25/25)

1[] Proper individual lifting techniques	25	100%
2[] Proper team lifting techniques	16	65%
3[] Proper use of lifting devices (jacks, hoists, lifts)	18	72%
4[] Proper use of self-propelled materials handling equipment	17	68%
5[] Other (specify)	0	0%

Note: Multiple responses

5b. If yes, how often does this training take place? (25/25)

1[] Quarterly	5	20%
2[] Semi-annually	3	12%
3[] Annually	7	28%
4[] Other (specify)	11	44%

Initial hiring

After an injury

Note: Multiple responses

6. Have you ever been injured as a result of attempting to lift an object? (39/39)

1[] Yes	11	28.2%
2[] No	27	69.2%
No Response	1	2.6%

SECTION B**Lifting Information**

* Indicates correct answer

1. Indicate the most weight you would attempt to lift without assistance: (39/39)

1[] 50 lbs	13	33.3%
2[] 75 lbs	10	25.6%
3[] 100 lbs	11	28.2%
4[] 150 lbs	2	5.1%
5[] Other (specify)	3	7.7%

1200 lbs

Depends (2)

2. What do you use as a guide to determine if you can lift an object by yourself? (39/39)

1[] the size of the object	14	35.9%
2[] the weight listed on the object	13	33.3%
3[] attempt to lift it and if it is too heavy	23	59%

Note: Multiple responses

3. Would you attempt to lift, without assistance, a large sheet of 1/2 inch thick metal that measures 4 feet wide and 10 feet long if it weighs less than 100 lbs but more than 50 lbs? (39/39)

1[] Yes	7	17.9%
2[] No	32	82%

4. Would you attempt to lift, without assistance, a carton that weighs 49 lbs and is 4 feet high, 3 feet long, and 4 feet wide? (39/39)

1[] Yes	8	20.5%
2[] No	31	79.5%

5. Would you attempt to lift, without assistance, a box that weighs 30 lbs and is 3 feet high by 4 feet long by 5 feet wide? (39/39)

1[] Yes	14	35.9%
2[] No	25	64.1%

6. Which of the two items listed below would require assistance to lift? (39/39)

1[] a 5 foot square box that weighs 50 lbs	33	86.4%
2[] a 1 foot square concrete block that weighs 55 lbs	7	17.9%

Note: Multiple responses

7. If you were required to remove a box of books weighing 50 lbs from a floor bin with 36 inch high sides, you would: (39/39)

1[] pick up the box yourself	14	35.9%
2[] seek assistance	22	56.4%
3[] remove the books one at a time	3	7.7%

8. If your back hurt after lifting an object, you would: (39/39)

1[] continue working until it hurt too much to continue	6	15.4%
2[] stop work immediately and have a doctor check it as soon as possible	31	79.5%
No Response	2	5.1%

9. When lifting a heavy object, you should primarily use your:

1[] back muscles	0	0%
2[*] leg muscles	39	100%
3[] arm muscles	1	2.6%

Note: Multiple responses

10. What is the safest method to carry an object?

1[] held away from the body	1	2.6%
2[*] held next to the body	38	97.4%

11. It is best to lift an object from:

1[] above the waist	17	43.6%
2[*] below the waist	22	56.4%

12. You are required to relocate a material-handling cart that is loaded. It is best:

1[] to pull the cart	6	15.4%
2[*] to push the cart	33	84.6%

13. When you are lifting an object, you should bend:

1[] at the waist and use your back muscles	0	0%
2[*] at the knees and hips, keeping the back straight	39	100%
3[] at the waist and keep the knees straight	0	0%

14. When lifting a heavy object, you should:

1[] turn your side to the object you wish to lift	2	5.1%
--	---	------

- 2[*] face the object you wish to lift
- 3[] turn your head before lifting

37	94.9%
0	0%

15. When carrying a heavy load, avoid sudden movements because they may: (39/39)

- 1[*] overload your muscles
- 2[] tire you out quickly
- 3[] make you look funny

34	87.2%
6	12.8%
0	0%

Note: Multiple responses

16. If you were attempting to move an object but it was very difficult to move because of its size, you would: (39/39)

- 1[] move it anyway
- 2[*] look for assistance

0	0%
39	100%

SECTION C.

Personal Opinions

1. What do you think will cause the next lifting accident in your organization?

No answer	20.5%
No assistance	20.5%
Improper lifting	12.8%
Carelessness	10.3%
Ignorance	10.3%
Moving equipment	10.3%
Poor/improper equipment	7.7%
Improper training	5.1%
Exercise	2.6%

2. What do you think can be done to prevent lifting accidents?

Training	30.8%
Ask for assistance	25.6%
No answer	17.9%
Better equipment	10.3%
Do not lift	7.7%
Do not stack items above your head	2.6%
Do not know	

APPENDIX C

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is ODISC4.						Use Part II (reverse) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).		DATE	
TO: (Forward to proponent of publication or form) (Include ZIP Code)						FROM: (Activity and location) (Include ZIP Code)			
PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS									
PUBLICATION/FORM NUMBER AR 600-55						DATE 10/27/86		TITLE Motor Vehicle Driver & Equipment Operator Selection, Training, Testing & Licensing.	
						RECOMMENDED CHANGES AND REASON (Provide exact wording of recommended change, if possible).			
ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.*	FIGURE NO.	TABLE NO.				
1	5	2-2				User-Driver ADD: He must possess a valid commercial driver's license (CDL) for that vehicle group with endorsement issued by the State, District of Columbia, or possession in which domiciled or principally employed, to operate any vehicle encompassed by the Commercial Motor Vehicle Safety Act of 1986. Reason: To comply with the Federal law (even though Army is presently exempt) and require persons operating vehicles on public roads to receive training and be tested. Problem was revealed by a contract study conducted for the US Army Safety Center of frequently violated procedures causing Army wheeled vehicle accidents.			
*Reference to line numbers within the paragraph or subparagraph.									
TYPED NAME, GRADE OR TITLE						TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION		SIGNATURE	

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is ODISC4.						Use Part II (reverse) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).		DATE	
TO: (Forward to proponent of publication or form) (Include ZIP Code)						FROM: (Activity and location) (Include ZIP Code)			
PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS									
PUBLICATION/FORM NUMBER AR 600-55						DATE 10/27/86		TITLE Motor Vehicle Driver & Equipment Operator Selection, Training, Testing & Licensing.	
ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.*	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON (Provide exact wording of recommended change, if possible).			
2	5	2-3				Civilian Drivers ADD: (5) Possession of a valid commercial driver's license (CDL) for that vehicle group with endorsements issued by the State, District of Columbia, or possession in which domiciled or principally employed, to operate any vehicle encompassed by the Commercial Motor Vehicle Safety Act of 1986. Reason: Comply with Federal law - ensure vehicle operators are trained and properly licensed to operate a particular type of equipment. Problem was revealed by a contract study conducted for the US Army Safety Center of frequently violated procedures causing Army wheeled vehicle accidents.			
*Reference to line numbers within the paragraph or subparagraph.									
TYPED NAME, GRADE OR TITLE						TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION		SIGNATURE	

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is ODISC4.						Use Part II (reverse) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).		DATE	
TO: (Forward to proponent of publication or form) (Include ZIP Code)						FROM: (Activity and location) (Include ZIP Code)			
PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS									
PUBLICATION/FORM NUMBER AR 600-55						DATE 10/27/86		TITLE Motor Vehicle Driver & Equipment Operator Selection, Training, Testing & Licensing.	
ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.*	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON (Provide exact wording of recommended change, if possible).			
3	7	5.1a				Change: 5-1a READS: a. All active Army, ARNG, USAR, and civilian personnel operating buses, tactical vehicle, hazardous material transport vehicles, law enforcement vehicles, ambulances, patient transport vehicles, or fire emergency vehicles for the Army must possess a valid permit (SF 46) obtained under the provisions of this regulation. SHOULD READ: a. All active Army, ARNG, USAR, and civilian personnel operating buses, tactical vehicles, hazardous material transport vehicles, law enforcement vehicles, ambulances, patient transport vehicles, or fire emergency vehicles for the Army must possess a valid state commercial driver's license (CDL) with proper endorsement for that group and a valid permit (SF 46) obtained under the provisions of this regulation. Reason: To comply with Federal law and ensure operators are trained and tested to operate the type vehicle they are operating. Problem was revealed by a contract study conducted for the US Army Safety Center of frequently violated procedures causing Army wheeled vehicle accidents.			
*Reference to line numbers within the paragraph or subparagraph.									
TYPED NAME, GRADE OR TITLE						TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION		SIGNATURE	

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS						Use Part II (reverse) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).		DATE	
For use of this form, see AR 25-30; the proponent agency is ODISC4.									
TO: (Forward to proponent of publication or form) (Include ZIP Code)						FROM: (Activity and location) (Include ZIP Code)			
PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS									
PUBLICATION/FORM NUMBER AR 600-55						DATE 10/27/86		TITLE Motor Vehicle Driver & Equipment Operator Selection, Training, Testing & Licensing.	
ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.*	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON (Provide exact wording of recommended change, if possible).			
4	7	5.1b				General Change: (2) READS: (2) If the SF 46 requirement is waived, alternate measures (for example, disposition forms or rosters) must be developed to identify those drivers or operators who are qualified and authorized to operate these vehicles for official business and to certify the driver or operator possesses a valid State driver's license. SHOULD READ: (2) If the SF 46 requirement is waived, alternate measures (for example, disposition forms or rosters) must be developed to identify those drivers or operators who are qualified and authorized to operate these vehicles for official business and to certify the driver or operator possess a valid State driver's license or commercial driver's license (CDL) with proper endorsements for that vehicle group. Reason: To comply with Federal law and ensure operators are properly licensed. Problem was revealed by a contract study conducted for the US Army Safety Center of frequently violated procedures causing Army wheeled vehicle accidents.			
*Reference to line numbers within the paragraph or subparagraph.									
TYPED NAME, GRADE OR TITLE						TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION		SIGNATURE	

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PUBLICATION/FORM NUMBER AR 600-55						DATE 10/27/86		TITLE Motor Vehicle Driver & Equipment Operator Selection, Training, Testing & Licensing.	
						RECOMMENDED CHANGES AND REASON (Provide exact wording of recommended change, if possible).			
ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.*	FIGURE NO.	TABLE NO.				
5	8	5-3				Other Permits Change: C.(2) READS: (2) Installation commanders may waive the requirement for the issuance of incidental driver permits (SF 46) for operation of commercial or administrative (nontactical) vehicles under 10,000 pounds gross vehicle weight provided the driver or operator possesses a valid State driver's license. However, alternate measures must be adopted to identify those drivers or operators who are qualified and authorized to operate these vehicles. An applicant for an incidental permit may be licensed without taking MDB I or MDB II if he or she - SHOULD READ: Other Permits (2) Installation commanders may waive the requirements for the issuance of incidental driver permits (SF 46) for operation of commercial or administrative (nontactical) vehicles under 10,000 pounds gross weight provided the driver or operator possesses a valid State driver's license or commercial driver's license with the proper endorsements. However, alternate measures must be adopted to identify those drivers or operators who are qualified and authorized to operate these vehicles. An applicant for an incidental permit may be licensed without taking MDB I or MDB II if he or she -			
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5	8	5-3				Continued from Page 1 Other Permits Reason: To ensure all operators are properly licensed. Problem was revealed by a contract study conducted for the US Army Safety Center of frequently violated procedures causing Army wheeled vehicle accidents.			
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ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.*	FIGURE NO.	TABLE NO.																
6	8	5-3																			
						Change C.(2) (b) READS: (b) Holds a valid State driver's equipment operator's license or has been licensed as a driver or chauffeur under OPM regulations. SHOULD READ: (b) Holds a valid State driver's license, commercial driver's license with proper endorsements, equipment operator's permit or has been licensed as a driver or chauffeur under OPM regulations. Reason: To receive training and be tested on the type vehicle they will be operating to comply with Federal law. Problem was revealed by a contract study conducted for the US Army Safety Center of frequently violated procedures causing Army wheeled vehicle accidents.															
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						RECOMMENDED CHANGES AND REASON (Provide exact wording of recommended change, if possible).			
ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.	FIGURE NO.	TABLE NO.	Appendix B B-2 Program of Instruction ADD: Unit S - "Identification of weather conditions and related driving hazards." Reason: To ensure all operators receive proper training on the identification of weather conditions and related driving hazards. Problem was revealed by a contract study conducted for the US Army Safety Center of frequently violated procedures causing Army wheeled vehicle accidents.			
7	12								
*Reference to line numbers within the paragraph or subparagraph.									
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8	13					Table B-1 ADD: Unit S - In the 1600 - 1700 hour position of Day 2. Reason: To expand the training requirement to include 1 hour of identification of weather conditions relating to driving hazards. Problem was revealed by a contract study conducted for the US Army Safety Center of frequently violated procedures causing Army wheeled vehicle accidents.			
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9	14					Appendix C C-2 Program of Instruction Unit G. Handling Unusual Situations. READS: a. Adverse weather. SHOULD READ: a. Adverse weather and identification of weather conditions and related driving hazards. Reason: To ensure all operators receive training on adverse weather and related driving hazards. Problem was revealed by a contract study conducted for the US Army Safety Center of frequently violated procedures causing Army wheeled vehicle accidents.			
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APPENDIX D

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ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.*	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON (Provide exact wording of recommended change, if possible).			
1	6-3	NA	*5			* See 4th paragraph under "Braking and Stopping." READS: " . . . if you must stop quickly, fully apply your brakes, releasing them at the instant they lock and immediately reapply them as necessary. Pumping the pedal gives your tires better traction as the vehicle slows down. Brakes have the greatest stopping power at the point just before the wheels lock. SHOULD READ: If you must stop quickly, apply the brakes as hard as you can without locking the wheels. If the wheels lock, release the brakes and reapply the brakes as soon as the wheels begin to roll. Brakes have the greatest stopping power at the point just before the wheels lock. Keep steering adjustments very small during maximum braking maneuvers. Reason: To update braking information and inform operators the importance of small steering adjustments during maximum braking maneuvers. Problem was revealed by a contract study conducted for the US Army Safety Center of frequently violated procedures causing Army wheeled vehicle accidents.			
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2	6-3	*				* Add after 4th paragraph under "Braking and Stopping." ADD: NOTE: If the brakes are locked and the wheels not allowed to turn, the vehicle will go into an uncontrolled skid. For skid correction see Chapter 14, page 14-2. Reason: To update information to indicate if the wheels are locked the vehicle will go into an uncontrolled skid. Problem was revealed by a contract study conducted for the US Army Safety Center of frequently violated procedures causing Army wheeled vehicle accidents.			
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3	7-1	*2	10			* See 2nd paragraph under "Stopping." Chapter 7 ADD: The same car, at 20 mph on black ice at 25 degrees F (-4C), needs 149 feet to stop. Reason: To update information to show the extra stopping distance on glare ice. Problem was revealed by a contract study conducted for the US Army Safety Center of frequently violated procedures causing Army wheeled vehicle accidents.			
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ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.*	FIGURE NO.	TABLE NO.																
4	7-6	*																			
						* See "Braking Distance." Chapter 7 ADD after the first paragraph, Air Brake Lag: Additional time is required for the air brakes to work. The air takes a little time (about one-half second or more) to flow through the lines to the brakes. Thus, the total stopping distance for vehicles with air brakes is increased over the conventional hydraulic brake system. Reason: To update the information to explain the increase in the stopping distance for air brake equipped vehicles. Problem was revealed by a contract study conducted for the US Army Safety Center of frequently violated procedures causing Army wheeled vehicle accidents.															
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ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.	FIGURE NO.	TABLE NO.																
5	8-1	2																			
						Chapter 8 ADD: New paragraph after contents entitled: Pre-Operation Checks Steps for safe vehicle operation: 1. Check road and weather conditions. 2. Identify weather related risk, using the weather evaluation risk guide located in the operator's manual. 3. Adjust driving procedures/techniques to comply with weather, road and equipment conditions. 4. Beware of possible habit interference: if you drive a sports car to work, then you operate a large vehicle (like a heavy equipment transporter) expect dissimilar handling characteristics. Additional skills are required to operate these large vehicles. Additional stopping distances and clearance space are required. Drivers must be aware of the vehicle mass and the visual cues available to determine speed and closure rate. Reason: To update information to indicate safety steps prior to operating a vehicle. Problem was revealed by a contract study conducted for the US Army Safety Center of frequently violated procedures causing Army wheeled vehicle accidents.															
<i>*Reference to line numbers within the paragraph or subparagraph.</i>																					
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6	9-1	*2				* See paragraph 2 under "Following Distances." Chapter 9 READS: A better way to gauge following distance is to use the "2-second rule." If you stay 2 seconds behind the vehicle in front of you, you will have the correct distance no matter what your speed. The rule works like this: watch the vehicle ahead pass some definite point or landmark of the highway, such as a tar strip or overpass shadow. Then count to yourself "one thousand and one, one thousand and two." If you reach the point before you finish saying those words you are following too closely. SHOULD READ: A good rule to use for following distance is at least 1 second for each 10 feet of vehicle length at speeds below 40 mph. At greater speeds you must add 1 second for safety. For example, if you are driving a 40-foot vehicle, you should leave 4 seconds between you and the vehicle ahead. In a 60-foot rig, you will need 6 seconds. Over 40 mph, you will need 5 seconds for a 40-foot rig and 7 seconds for a 60-foot vehicle. To determine your following distance, wait until the vehicle ahead passes a shadow on the road, a pavement marking, tar strip, overpass shadow or any			
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7	9-2					Change: Chart "Minimum Safe Distances in Vehicle Lengths" to the attached chart "Minimum Safe Following Distances in Seconds". Reason: To update information and correct the chart to conform with the guidance in the commercial vehicle driver licensing manual relating to safe following distances in seconds instead of vehicle lengths. Problem was revealed by a contract study conducted for Army Safety Center of frequently violated procedures causing Army wheeled vehicle accidents.			
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MINIMUM SAFE FOLLOWING DISTANCES IN SECONDS

VEHICLE LENGTH AND SPEED	ROAD CONDITION				
	IDEAL	WET	GRAVEL	PACKED SNOW	ICE
20 Feet or Less < 40 MPH/ > 40 MPH	2/3	4/6	4/6	6/*	12/*
21 To 40 Feet < 40 MPH/ > 40 MPH	4/5	8/10	8/10	12/*	24/*
41 Feet or Greater < 40 MPH/ > 40 MPH	6/7	12/14	12/14	18/*	36/*

* - Not Recommended

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<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 5%;">ITEM NO.</th> <th style="width: 5%;">PAGE NO.</th> <th style="width: 5%;">PARA-GRAPH</th> <th style="width: 5%;">LINE NO.*</th> <th style="width: 5%;">FIGURE NO.</th> <th style="width: 5%;">TABLE NO.</th> </tr> </table>						ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.*	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON <i>(Provide exact wording of recommended change, if possible).</i>			
ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.*	FIGURE NO.	TABLE NO.										
8	13-1	*				* See "Hazards and Safety Measures." Chapter 13 ADD after paragraph #1: It is necessary to see and recognize hazards before they become emergencies. Early detection of any hazard can change it to just a small inconvenience. Once you recognize a hazard all you have to do is take the proper corrective action and continue on your mission. Work zones, traffic approaching from a side road, disabled vehicles, on/off ramps, slow drivers, confused drivers, impaired drivers, fast drivers, accidents, children playing or standing near the road and poor weather conditions are some examples of hazards that could create an emergency for you. Once you have recognized the hazard, it is up to you to prevent the emergency. Reason: To update information to emphasize the importance of early detection, recognition and corrective action when operating a vehicle. Problem was revealed by a contract study conducted for U.S. Army Safety Center of frequently violated procedures causing Army wheeled vehicle accidents.									
*Reference to line numbers within the paragraph or subparagraph.															
TYPED NAME, GRADE OR TITLE						TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION		SIGNATURE							

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9	13-3	*				* See "Weather" and add after 1st paragraph. Chapter 13 ADD: The weather evaluation guide (Appendix B) and the weather evaluation risk guide (Appendix C) are guides provided to assist in determining the driving hazards associated with different weather conditions. The weather evaluation guide (Appendix B) gives information on the formation of the conditions, hazards associated with the conditions, and corrective action to reduce the hazards. The weather evaluation risk guide (Appendix C) is a driver's pre-trip weather hazard planning guide. The operator should use the risk guide to determine the risk related to the weather hazard identified. Using the risk guide, the driver will know if the weather risk is slight, moderate or high. Therefore, proper driving and equipment adjustments can be made prior to encountering the hazardous conditions. Information in "Weather Hazards to Driving" (Appendix D) provides a detailed description of weather conditions that could present a hazard to the operation of a vehicle. It will assist the driver in understanding weather conditions and the related hazards.	
*Reference to line numbers within the paragraph or subparagraph.							
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10						ADD: Appendix B Weather Evaluation Guide Appendix C Weather Evaluation Risk Guide Appendix D Weather Hazards to Driving Reason: To consolidate the information in one reference for use by drivers and driver training instructors. Problem was revealed by a contract study conducted for the U.S. Army Safety Center of frequently violated procedures causing Army wheeled vehicle accidents.	
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WEATHER EVALUATION GUIDE

Condition	Formation	Hazard	Corrective Action	Risk Level	Remarks
Rain	Water falling in drops condensed from vapor in the atmosphere	Visibility (Reduced) Surfaces (Slippery) Traction (Reduced) Braking (Reduced) Directional Control (Reduced)	Reduce speed Moderate braking action Increase following distance No quick or fast turns	Moderate	The surface becomes slick as the rains fall, the possibility of standing water increases the chances of hydroplaning.
Drizzle or Light Rain	Fall from low Stratus clouds, the droplets are usually small with a slight accumulation of moisture on the surface	Visibility (Reduced) Surfaces (Slippery) Traction (Reduced) Braking (Reduced) Directional Control (Reduced)	Reduce speeds Moderate accelerations Increase following distances Moderate brake application No quick or fast turns	Moderate	The mixing of oils, chemicals and dirt make the road surface very slick in the first few minutes of a rain.
Heavy Rains	Normally associated with the thunderstorms and usually only last a short time	Visibility (Reduced) Surfaces (Slippery) Traction (Reduced) Braking (Reduced) Stopping Distances (Increased) Directional Control (Reduced)	Reduce speed Moderate acceleration Increase following distances Moderate braking Moderate steering control No quick or fast turns	Moderate	The standing water may cause hydroplaning and complete loss of directional control.
Freezing Rains	Supercooled droplets that come in contact with objects that are at a freezing temperature (32 degrees Fahrenheit) or below	Visibility (Reduced) Surfaces (Very slippery) Traction (Very poor) Braking (Very poor) Stopping Distance (Increased) Directional Control (Very poor)	Stop operations except in life threatening functions, then perform only at a very reduced speed.	Major	Often adheres to bridges and overpasses before it does to the adjoining roadway.
Ice	Water substance in a solid form. Possible anytime the temperature reaches 32 degrees Fahrenheit or below. Frozen moisture.	Surfaces (Slippery) Traction (Poor) Braking (Poor) Stopping Distances (Increased)	Moderate accelerations Reduce speeds Increase following distances Use light braking action No quick or fast turns	Moderate	Expect liquids in shaded areas to freeze first. Beware of water standing in low areas, it may freeze creating a slick surface.

WEATHER EVALUATION GUIDE (Continued)

Condition	Formation	Hazard	Corrective Action	Risk	Remarks
Frost	A covering of minute ice crystals on a cold surface	Surfaces (Slippery) Traction (Reduced) Braking (Reduced) Directional Control (Reduced)	Reduce speed Moderate braking action Moderate turns Increase following distances	Moderate	Often forms on bridges and overpasses before on adjoining roadways. May form on the windshield when going from sub-freezing temperatures into warm air masses.
Snow	Precipitation in the form of ice crystals formed from water vapor at a temperature of less than 32 degrees Fahrenheit (0 degrees C.)	Surfaces (Slippery) Visibility (Reduced) Traction (Reduced) Braking (Reduced) Directional Control (Reduced)	Reduce speed Increase following distances Moderate braking action Moderate directional control	Moderate	Beware of the accumulations and drifts. Use tire chains as needed, in accordance with local policy and the operators manual.
Hail	Precipitation in the form of small balls or lumps of clear ice or compact snow that fall from Cumulonimbus clouds.	Surface damage to vehicles Possible broken windows	Stop until the storm has passed	Slight	Normally not much accumulation and melts rather quickly.
Sleet	Frozen or partly frozen rain	Surfaces (Very Slippery) Traction (Poor) Braking (Poor) Directional Control (Poor)	Reduce speed Increase following distances Use very light braking No quick or sudden turns	Major	The term sleet is often applied to any mixture of rain and snow, and to glaze ice produced when rain freezes on solid surfaces.
Windshield Icing	Anytime where cold temperatures and visible ground haze exist	Visibility (Reduced)	Defroster on, clean or scrape windshield as needed.	Moderate	Normally occurs when vehicle operating in a sub-freezing temperature enters a warm air mass.
Black Ice (Glazed or Clear)	A thin sheet of ice, relatively dark in appearance, may be formed when light rain or drizzle falls on a road surface which is at a temperature below 32 degrees F. It may also form when supercooled fog droplets are intercepted by bridges, trees, etc.	Surfaces (Very Slippery) Traction (Very poor) Braking (Very poor) Directional Control (Very poor)	Reduce speed Increase following distances Use very light braking No quick or sudden turns	Major	Expect black ice where shadows exist. Restrict operations in areas of black ice to only required movements. Not to be confused with "ground ice" which is formed when: water from a precipitation of non-supercooled drizzle droplets or raindrops that later freeze on the ground or the refreezing of melted snow.

WEATHER EVALUATION GUIDE (Continued)

Condition	Formation	Hazard	Corrective Action	Risk	Remarks
Frost Heaving	Uneven lifting and distortion of the soil from the expansion of freezing water	Uneven surfaces	Reduce speed	Slight	Causes the surface to lift and become uneven, often loosens roots holding plants and trees.
Fog	A vapor condensed to fine particles of water suspended in the lower atmosphere	Visibility (Reduced)	Reduce speed Increase following distances	Moderate	As the density of fog increases the danger increases. Fog may reduce the visibility to a level where it is unsafe to drive.
Ice Fog	Suspended ice crystals formed when water is introduced into clear calm air of very low temperature (-37 degrees Fahrenheit or below)	Visibility (Reduced)	Reduce speed Increase following distances	Moderate	A fog composed of ice particles.
Freezing Fog	Composed of liquid water droplets in a supercooled state that freezes as soon as they come in contact with a cold surface	Surfaces (Very Slippery) Visibility (Poor) Traction (Poor) Braking (Poor) Directional Control (Poor)	Reduce speed Increase following distances Use light braking action No quick or fast turns	Major	Operations should be restricted in areas with freezing fog to only required operations.
Smog	Combination of smoke and fog. Water droplets form around solid particles in the atmosphere, so it forms more easily than fog and is slower to clear	Visibility (Reduced)	Reduce speed Increase following distances	Slight	A form of air pollution that occurs over industrialized areas where motor vehicles are in heavy use, and particularly in locations where temperature inversions are common.
Photochemical Smog	Forms completely independent of atmospheric humidity level, initiated by the action of sunlight or fumes from car exhaust	Visibility (Reduced)	Reduce speed Increase following distances	Slight	Causes eye irritation and fatigue.
Dew	Forms during clear, still nights, when objects are cooled by radiation to a temperature at or below the dew point of the adjacent air	Surfaces (Slippery) Traction (Reduced) Braking (Reduced) Directional Control (Reduced)	Reduce speed Moderate braking action Increase following distances No quick or fast turns	Slight	A condensation of atmospheric moisture on objects that are colder than the dew-point temperature of the surrounding air.

WEATHER EVALUATION GUIDE (Continued)

Condition	Formation	Hazard	Corrective Action	Risk	Remarks
Thunderstorms	The Cumulonimbus cloud is the key to identifying a thunderstorm. They are clouds that build to great heights and often spread out in the shape of an anvil.	Surfaces (Slippery) Visibility (Reduced) Traction (Reduced) Braking (Reduced) Directional Control (Reduced)	Reduce speed Increase following distances Use moderate braking No quick or fast turns	Moderate	An average of 44,000 thunderstorms occur daily over the surface of the earth. Expect heavy rains, lightning, high winds and strong gusts.
First Gust	Associated with thunderstorms and the rapid change in direction and windspeed immediately prior to the storm's passage at the surface. Gust may exceed 75 knots and vary 100 degrees from the prevailing surface winds	High Winds Strong Gust Sudden Wind Direction Change Unexpected Directional Control	Reduce speed Prepare for wind gust Make counter corrections	Moderate	Expect strong wind gust and heavy precipitation.

ADDITIONAL RISK FACTORS

Inexperienced driver
 Limited experience in type operation
 Darkness/night
 Extended hours of operation (8 hrs or more)
 Equipment not fully mission ready
 Increased temperature
 Increased stress (combat conditions)
 High traffic areas/off road operations
 Hazardous material cargo
 Combination vehicle operation
 Not trained in type operation
 Pressures from higher command
 Time constraints

Note: Refer to Weather Hazards Appendix for detailed explanation of conditions

WEATHER EVALUATION RISK GUIDE

This guide is to be used as a pre-trip planning guide to assist in identifying risk that may affect your mission. Select and place the risk level for all conditions and factors you expect to encounter during the mission in the space provided. Total the selected risk levels. Compare the total with the risk guide located at the bottom of the chart to determine the weather hazard risk for the assigned mission and adjust accordingly to reduce risk or accept risk.

	Risk	Weather Conditions	Degree	RISK GUIDE
	1	Rain	Light	
	4		First 30 Minutes Light Rain	
	2		Moderate	
	4		Heavy	
	5		Freezing	
	4	Ice		
	3	Frost		
	3	Snow	Light	
	3		Moderate	
	4		Heavy	
	1	Hail		
	5	Sleet		
	3	Windshield Icing		
	5	Black Ice		
	1	Frost Heaving		
	1	Fog	Light	
	3		Moderate	
	5		Heavy	
	1	Ice Fog	Light	
	3		Moderate	
	5		Heavy	
	5	Freezing Fog		
	1	Smog		
	1	Photochemical Smog		
	2	Dew		
	3	Thunderstorm		
	3	First Gust		
ADDITIONAL RISK FACTORS				1-2 Slight Risk Normal Operations with Increased Safety Awareness. 3-4 Moderate Risk Reduced Operations and Restricted Speeds. 5 or More Major Risk Restricted Operations.
	2	Darkness/Night		
	3	Inexperienced Driver		
	1	Limited Experience in Type Operation		
	1	Extended Hours of Operation (8 Hours or More)		
	1	Equipment Not Fully Mission Ready		
	2	Increased Stress (Combat Condition/Area)		
	1	High Traffic Area		
	1	Off Road Operations		
	1	Combination Vehicle		
	1	Time Constraints (Rush Mission)		
	1	Pressure From Higher Command		
TOTAL				

WEATHER HAZARDS TO DRIVING

RAINS

1. Drizzle or light rains normally fall from the low Stratus clouds. The droplets are usually small with only a slight accumulation of moisture on surfaces. This type of rain may create very slick driving surfaces. The first few minutes of a light rain or drizzle causes the oils, chemicals, dirt and rain to mix, creating a very slick surface. It is recommended extreme caution be used operating on this type surface. Expect visibility restriction, slippery surfaces, reduced traction, increased stopping distance and a high probability of skids. Corrective action: moderate acceleration, reduce speed, moderate brake application, and no quick or fast turns.
2. Heavy rains or downpours (sometimes called cloudbursts) are very intense rainstorms that are associated with the Cumulonimbus cloud formation. The Cumulonimbus cloud is a white cloud that builds to a great height. The top forms in the shape of an anvil and is called a thunderstorm by most. These storms usually only last about 30 minutes or less. They produce high winds and blowing objects associated with heavy rains and lightning. The heavy rains create standing water on the roadways, thus increasing the possibility of hydroplaning. Expect poor visibility, reduced traction, increased stopping distance, and possible loss of directional control. Corrective action: reduce speeds, moderate acceleration, moderate braking applications, no quick or fast turns.
3. Freezing rains form when moisture falls as rain, and when it comes in contact with a solid object, it freezes. The ground level temperature is below freezing causing the supercooled droplets to freeze on contact. The ice will adhere to the roadway, equipment, and most all flat surfaces creating a very hazardous condition for all types of operations. It creates a very hazardous driving condition and all movement should stop unless life threatening. Expect slippery surfaces, poor visibility, little to no traction, little to no braking action, reduced directional control and high possibility of skids. Corrective action: stop movement until the condition changes. If movement is a must, it must be at a very slow pace.

ICE

1. Water substance in solid form. Formation is possible anytime moisture is present and the temperature is 32 degrees Fahrenheit (0 degrees Centigrade) or below. Expect bridges and overpasses to become slick or iced over first. Ice creates very hazardous conditions. Expect reduced traction, increased braking distance, poor directional control and possibility of skids. Corrective action: moderate acceleration, reduce speeds, increase following distances, no quick or fast turns and light braking.

2. Frost is a covering of minute ice crystals on a cold surface. Frost forms when the surface temperature is at or below dewpoint temperature and the dewpoint temperature is below freezing. Bridges and overpasses tend to give up the heat much quicker than the surrounding areas, thus forming frost before the adjoining roadways and creating a hazardous surface and driving condition. A vehicle operating in a subfreezing air mass goes into a warmer air mass may encounter frost. Frost often occurs on windshields and may cause a restriction to, or total loss of visibility. Corrective actions: reduce speed, moderate braking, moderate turns, and increase following distances.
3. Snow is precipitation in the form of small ice crystals formed directly from the water vapor of the air at a temperature of less than 32 degrees Fahrenheit. Snow does not create a major hazard unless there is an accumulation. Expect reduced traction, less directional control, and increased braking distance. When snow melts and refreezes, a very dangerous driving surface is created. Drivers should be aware of the dangers of this condition and look for it in areas near intersections, any high traffic areas and areas that are in direct sunlight and are shaded in the afternoon where the moisture may refreeze. Corrective action: reduce speed, moderate braking, moderate turns and increase following distances.
4. Hail is precipitation in the form of small balls or lumps consisting of concentric layers of clear ice or compact snow that fall from Cumulonimbus clouds. Expect possible surface damage to the vehicle and a possibility of broken windows from the hail. It normally does not remain on the ground for an extended length of time; therefore, it will only be a short interruption to operations. Corrective action: stop operations until storm passes.
5. Sleet is frozen or partly frozen rain. Sleet can create a very hazardous surface making driving very hazardous. Expect poor traction, increased braking distances and reduced directional control. Corrective action: reduce speed or stop, use very light braking, increase following distances, no quick or sudden turns.
6. Windshield icing may occur anytime the temperature is low enough and there is sufficient moisture present. Anytime you are operating in cold temperatures and there is visible ground haze, the conditions are present for frost or icing. Expect reduced to no forward visibility through the windshield until the ice is removed. Corrective action: use the windshield defroster and scrape windshield as necessary.
7. Black ice is a thin sheet of ice, relatively dark in appearance and may be formed when light rain or drizzle falls on a road surface which is at a temperature below 32 degrees Fahrenheit (0 degrees Centigrade). It may also form when supercooled fog droplets are intercepted by bridges, overpasses, trees, etc. Expect where shadows exist the layer of ice is clear enough that you can see the road underneath it. A good indicator of black ice is the road looks wet and temperature is below freezing. Proceed with caution because a surface with black ice is a very dangerous driving surface. Expect little to no traction, little to no braking capability, extremely poor directional control and high possibility of skids. Corrective action: stop

operations. If operations must continue, reduce speed, accelerate very slowly, increase following distances, use very light braking action, and make all turns very gradual and slow.

8. Glaze (clear ice) is a deposit of ice formed by the freezing of supercooled drizzle droplets or raindrops on surfaces that are 32 degrees Fahrenheit (0 degrees Centigrade) or below. It may also be produced by the freezing of warm light rain or drizzle (non-supercooled) immediately after the impact with surfaces that are well below 32 degrees Fahrenheit (0 degrees Centigrade). This is a very dangerous driving surface. Expect little to no traction, little to no braking capability, extremely poor directional control and high possibility of skids. Corrective action: stop operations. If operations must continue, reduce speed, accelerate very slowly, increase following distances, use very light braking action, and make all turns very gradual and slow.
9. Frost heaving is the uneven lifting and distortion of the ground close to the surface. It results from the expansion of water within the soil when the soil reaches temperatures low enough to freeze the ground. This may cause damage to the road surfaces and loosen the roots holding plants and trees. Expect uneven driving surfaces. Interrupted directional control could present a problem on curves at highway speeds. Corrective action: reduce speed.

FOG

1. Fog - a vapor condensed to fine particles of water suspended in the lower atmosphere that differs from a cloud only in being near the ground. Fog makes driving difficult because of the reduced visibility. Visibility may get so bad that driving may be too hazardous to continue. Corrective action: reduce speed, increase following distances, turn on lights.
2. Advection Fog - forms by the passage of relatively warm, moist and stable air over a cool surface. It is associated mainly with cool sea areas, particularly in the spring and summer, and may affect adjacent coast. It may occur also over land in winter, particularly when the surface is frozen or snow-covered. Expect reduced visibility. Corrective action: turn on lights, reduce speed, and increase following distances.
3. Upslope Fog - forms when moist, stable air flows up a sloping land surface. When the air rises, it cools by expansion as the atmospheric pressure decreases. When the expansional cooling is sufficient to lower the temperature of the air to the dewpoint temperature, upslope fog may form. The windspeed must be adequate to support continued upslope motion. If the wind is too strong, the fog may be lifted from the surface, creating an overcast of low Stratus clouds. Expect reduced visibility. Corrective action : turn on lights, reduce speed, and increase following distances.
4. Valley Fog - during the evening hours, cold dense air will drain from areas of higher elevation into low areas or valleys. As the cool air accumulates in the valley, the air

temperature may decrease to the dewpoint temperature creating a dense formation of fog. Expect reduced visibility. Corrective action: turn on lights, reduce speed, and increase following distances.

5. Frontal Fog - forms when liquid precipitation, falling from the warm tropical air above the frontal surface, evaporates in the colder air below the frontal surface. Evaporation from the falling drops may add sufficient water vapor to the cold air to raise the dewpoint temperature to the temperature of the air. The cold air will then be saturated and frontal fog will form. Frontal fog is common with active warm fronts during all seasons. Frontal fog occurs ahead of the surface front in an area approximately 100 miles wide. Expect reduced visibility. Corrective action: turn on lights, reduce speed, and increase following distances.
6. Steam Fog - forms when cold stable air flows over a nonfrozen water surface that is several degrees warmer than the air. The intense evaporation of moisture into the cold air saturates the air and produces fog. Conditions favorable for steam fog are common over lakes and rivers in the fall and over the ocean in the winter when an offshore wind is blowing. Expect reduced visibility. Corrective action: turn on lights, reduce speed, and increase following distances.
7. Ice Fog - suspended ice crystals usually formed with the introduction of water into clear, calm air of low temperature (-37 degrees Fahrenheit or lower). Ice fog is rare at temperatures above -37 degrees Fahrenheit and almost always present at temperatures below -50 degrees Fahrenheit. Ice fog may form over a body of troops, herd of animals, bivouac areas, motor parks, convoys, and gun positions during firing. Reduced visibility is the major hazard to driving. Corrective action: turn on lights, reduce speed, and increase following distances.
8. Freezing Fog - composed of liquid water droplets, but the droplets are in a supercooled state, only forming when the temperature falls below 32 degrees Fahrenheit (0 degrees Centigrade) and freezing as soon as they come in contact with a cold surface. If the surface or roadway is at or below freezing, the fog will form ice, creating a very hazardous condition. Reduces visibility, poor traction, increases braking distances, poor directional control and possible skids. Corrective action: turn on lights, reduce speed, accelerate slowly, increase following distances, use moderate braking applications, and no quick or fast turns.

SMOG

1. A combination of smoke and fog. Water droplets form around solid particles in the atmosphere; therefore, it forms more easily than fog and is slower to clear. Smog may persist for days. Expect reduced visibility. Corrective action: turn on lights, reduce speed, and increase following distances.
2. Photochemical smog is created completely independent of atmospheric humidity level, being initiated by the action of sunlight on fumes from car exhaust and consists

of a mixture of nitrogen dioxide, ozone and a chemical known as PAN (peroxyacyl nitrate). A combination of these gases causes eye irritation, coughing and fatigue. Expect reduced visibility. Corrective action: turn on lights, reduce speed, and increase following distances.

DEW

Dew forms on objects during clear, still nights when the objects are cooled by radiation to a temperature at or below the dewpoint of the adjacent air. The moisture collects on these objects just like it does on a pitcher of ice water in a warm room. Heavy dew is often observed on grass and plants when there is none on the pavement or on large solid objects. These solid objects absorb so much heat during the day, or give up heat so slowly, that they may not cool below the dewpoint of surrounding air during the night. Bridges and overpasses give up the heat much quicker than the surrounding areas, thus forming dew or frost before the adjoining roadways, creating a slippery surface. Expect reduced traction, increased braking distance and possible skids. Corrective action: reduce speed, accelerate slowly, increase following distances, use moderate braking applications, and no quick or fast turns.

THUNDERSTORMS

1. The Cumulonimbus cloud is the key identifying a thunderstorm. These large billowing clouds carry high moisture content and are associated with high winds of short duration. An average of 44,000 thunderstorms occur daily over the surface of the earth. They almost always consist of strong gusts of wind, severe turbulence, heavy rains, and lightning. During a thunderstorm, hail is uncommon and tornadoes are possible. Most thunderstorms pass within 30 minutes. Expect reduced visibility, slippery surfaces, reduced traction, increased braking distances, and possible skids. Corrective action: use lights, reduce speed, accelerate slowly, increase following distances, use moderate braking applications, and no quick or fast turns.
2. First gust is a hazard associated with thunderstorms. It is the rapid change in direction and windspeed immediately prior to a storm's passage at the surface. The speed of this first gust may exceed 75 knots and vary 180 degrees from the prevailing surface winds. The first gust usually precedes the heavy precipitation and strong gusts may continue for 5 to 10 minutes with each thunderstorm cell. First gusts are not limited to the area ahead of the storm's movement. They may be found in all sectors, including the area back of the storm's movement. Expect high winds, blowing items, and possible sudden crosswinds with high gusts. Corrective action: stop until the storm passes. If you must continue, reduce speed and counter steer to compensate for the unexpected gusts.

APPENDIX E

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is ODISC4.						Use Part II (reverse) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).		DATE	
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PUBLICATION/FORM NUMBER						DATE		TITLE Operator's Manuals (-10) For All Motorized Wheeled Vehicles.	
						RECOMMENDED CHANGES AND REASON (Provide exact wording of recommended change, if possible).			
ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.*	FIGURE NO.	TABLE NO.	ADD TO THE WARNING SECTION LOCATED IN THE FRONT OF THE MANUAL (LABELED A-B): Drivers must perform the following tasks for safe operations: 1. Use proper visual search methods. 2. Signal appropriately when changing lanes or direction in traffic. 3. Adjust speed to configuration and condition of the roadway, cargo and driver condition. 4. Choose a safe gap for changing lanes, passing other vehicles, as well as for crossing or entering traffic. 5. Position the motor vehicle correctly before and during a turn to prevent other vehicles from passing on the wrong side, as well as to prevent problems caused by off-tracking. 6. Maintain a safe following distance depending on condition of the road, on visibility, and on vehicle weight. 7. Adjust operation of the motor vehicle to prevailing weather conditions including speed selection, braking, direction changes and following distances to maintain positive control. Pretrip Weather Checks: 1. Check current local weather conditions. 2. Check current weather at destination.			
*Reference to line numbers within the paragraph or subparagraph.									
TYPED NAME, GRADE OR TITLE						TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION		SIGNATURE	

PUBLICATIONS AND component agency is ODISC4.		Use Part II (reverse) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE
to form) (Include ZIP Code)		FROM: (Activity and location) (Include ZIP Code)	
PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS			
		DATE	TITLE Operator's Manuals (-10) For All Motorized Wheeled Vehicles.
FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON (Provide exact wording of recommended change, if possible).	
		Continued from previous page - Pretrip Weather Checks 3. Check current weather for area traversing. 4. Check forecasted weather for area traversing and destination. Reason: Provide equipment operators safe operating tips. Problem was revealed by a contract study conducted for U.S. Army Safety Center of frequently violated procedures causing Army wheeled vehicle accidents.	
-ence to line numbers within the paragraph or subparagraph.			
TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION		SIGNATURE	

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS						Use Part II (reverse) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).		DATE	
For use of this form, see AR 25-30; the proponent agency is ODISC4.									
TO: (Forward to proponent of publication or form) (Include ZIP Code)						FROM: (Activity and location) (Include ZIP Code)			
PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS									
PUBLICATION/FORM NUMBER						DATE		TITLE	
								Operator's Manuals (-10) For All Motorized Wheeled Vehicles.	
ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.*	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON (Provide exact wording of recommended change, if possible).			
						ADD TO APPENDIX SECTION: An Appendix " Weather Evaluation". Add to the "Weather Evaluation" Appendix the attached "Weather Evaluation Guide" and "Weather Evaluation Risk Guide". Reason: To inform wheel vehicle operators of driving hazards related to weather conditions. Problem was revealed by a contract study conducted for the US Army Safety Center of frequently violated procedures causing Army wheeled vehicle accidents.			
*Reference to line numbers within the paragraph or subparagraph.									
TYPED NAME, GRADE OR TITLE						TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION		SIGNATURE	

WEATHER EVALUATION GUIDE

Condition	Formation	Hazard	Corrective Action	Risk Level	Remarks
Rain	Water falling in drops condensed from vapor in the atmosphere	Visibility (Reduced) Surfaces (Slippery) Traction (Reduced) Braking (Reduced) Directional Control (Reduced)	Reduce speed Moderate braking action Increase following distance No quick or fast turns	Moderate	The surface becomes slick as the rains fall, the possibility of standing water increases the chances of hydroplaning.
Drizzle or Light Rain	Fall from low Stratus clouds, the droplets are usually small with a slight accumulation of moisture on the surface	Visibility (Reduced) Surfaces (Slippery) Traction (Reduced) Braking (Reduced) Directional Control (Reduced)	Reduce speeds Moderate accelerations Increase following distances Moderate brake application No quick or fast turns	Moderate	The mixing of oils, chemicals and dirt make the road surface very slick in the first few minutes of a rain.
Heavy Rains	Normally associated with the thunderstorms and usually only last a short time	Visibility (Reduced) Surfaces (Slippery) Traction (Reduced) Braking (Reduced) Stopping Distances (Increased) Directional Control (Reduced)	Reduce speed Moderate acceleration Increase following distances Moderate braking Moderate steering control No quick or fast turns	Moderate	The standing water may cause hydroplaning and complete loss of directional control.
Freezing Rains	Supercooled droplets that come in contact with objects that are at a freezing temperature (32 degrees Fahrenheit) or below	Visibility (Reduced) Surfaces (Very slippery) Traction (Very poor) Braking (Very poor) Stopping Distance (Increased) Directional Control (Very poor)	Stop operations except in life threatening functions, then perform only at a very reduced speed.	Major	Often adheres to bridges and overpasses before it does to the adjoining roadway.
Ice	Water substance in a solid form. Possible anytime the temperature reaches 32 degrees Fahrenheit or below. Frozen moisture.	Surfaces (Slippery) Traction (Poor) Braking (Poor) Stopping Distances (Increased)	Moderate accelerations Reduce speeds Increase following distances Use light braking action No quick or fast turns	Moderate	Expect liquids in shaded areas to freeze first. Beware of water standing in low areas, it may freeze creating a slick surface.

WEATHER EVALUATION GUIDE (Continued)

Condition	Formation	Hazard	Corrective Action	Risk	Remarks
Frost	A covering of minute ice crystals on a cold surface	Surfaces (Slippery) Traction (Reduced) Braking (Reduced) Directional Control (Reduced)	Reduce speed Moderate braking action Moderate turns Increase following distances	Moderate	Often forms on bridges and overpasses before on adjoining roadways. May form on the windshield when going from sub-freezing temperatures into warm air masses.
Snow	Precipitation in the form of ice crystals formed from water vapor at a temperature of less than 32 degrees Fahrenheit (0 degrees C.)	Surfaces (Slippery) Visibility (Reduced) Traction (Reduced) Braking (Reduced) Directional Control (Reduced)	Reduce speed Increase following distances Moderate braking action Moderate directional control	Moderate	Beware of the accumulations and drifts. Use tire chains as needed, in accordance with local policy and the operators manual.
Hail	Precipitation in the form of small balls or lumps of clear ice or compact snow that fall from Cumulonimbus clouds.	Surface damage to vehicles Possible broken windows	Stop until the storm has passed	Slight	Normally not much accumulation and melts rather quickly.
Sleet	Frozen or partly frozen rain	Surfaces (Very Slippery) Traction (Poor) Braking (Poor) Directional Control (Poor)	Reduce speed Increase following distances Use very light braking No quick or sudden turns	Major	The term sleet is often applied to any mixture of rain and snow, and to glaze ice produced when rain freezes on solid surfaces.
Windshield Icing	Anytime where cold temperatures and visible ground haze exist	Visibility (Reduced)	Defroster on, clean or scrape windshield as needed.	Moderate	Normally occurs when vehicle operating in a sub-freezing temperature enters a warm air mass.
Black Ice (Glazed or Clear)	A thin sheet of ice, relatively dark in appearance, may be formed when light rain or drizzle falls on a road surface which is at a temperature below 32 degrees F. It may also form when supercooled fog droplets are intercepted by bridges, trees, etc.	Surfaces (Very Slippery) Traction (Very poor) Braking (Very poor) Directional Control (Very poor)	Reduce speed Increase following distances Use very light braking No quick or sudden turns	Major	Expect black ice where shadows exist. Restrict operations in areas of black ice to only required movements. Not to be confused with "ground ice" which is formed when: water from a precipitation of non-supercooled drizzle droplets or raindrops that later freeze on the ground or the refreezing of melted snow.

WEATHER EVALUATION GUIDE (Continued)

Condition	Formation	Hazard	Corrective Action	Risk	Remarks
Frost Heaving	Uneven lifting and distortion of the soil from the expansion of freezing water	Uneven surfaces	Reduce speed	Slight	Causes the surface to lift and become uneven, often loosens roots holding plants and trees.
Fog	A vapor condensed to fine particles of water suspended in the lower atmosphere	Visibility (Reduced)	Reduce speed Increase following distances	Moderate	As the density of fog increases the danger increases. Fog may reduce the visibility to a level where it is unsafe to drive.
Ice Fog	Suspended ice crystals formed when water is introduced into clear calm air of very low temperature (-37 degrees Fahrenheit or below)	Visibility (Reduced)	Reduce speed Increase following distances	Moderate	A fog composed of ice particles.
Freezing Fog	Composed of liquid water droplets in a supercooled state that freezes as soon as they come in contact with a cold surface	Surfaces (Very Slippery) Visibility (Poor) Traction (Poor) Braking (Poor) Directional Control (Poor)	Reduce speed Increase following distances Use light braking action No quick or fast turns	Major	Operations should be restricted in areas with freezing fog to only required operations.
Smog	Combination of smoke and fog. Water droplets form around solid particles in the atmosphere, so it forms more easily than fog and is slower to clear	Visibility (Reduced)	Reduce speed Increase following distances	Slight	A form of air pollution that occurs over industrialized areas where motor vehicles are in heavy use, and particularly in locations where temperature inversions are common.
Photochemical Smog	Forms completely independent of atmospheric humidity level, initiated by the action of sunlight or fumes from car exhaust	Visibility (Reduced)	Reduce speed Increase following distances	Slight	Causes eye irritation and fatigue.
Dew	Forms during clear, still nights, when objects are cooled by radiation to a temperature at or below the dew point of the adjacent air	Surfaces (Slippery) Traction (Reduced) Braking (Reduced) Directional Control (Reduced)	Reduce speed Moderate braking action Increase following distances No quick or fast turns	Slight	A condensation of atmospheric moisture on objects that are colder than the dew-point temperature of the surrounding air.

WEATHER EVALUATION GUIDE (Continued)

Condition	Formation	Hazard	Corrective Action	Risk	Remarks
Thunderstorms	The Cumulonimbus cloud is the key to identifying a thunderstorm. They are clouds that build to great heights and often spread out in the shape of an anvil.	Surfaces (Slippery) Visibility (Reduced) Traction (Reduced) Braking (Reduced) Directional Control (Reduced)	Reduce speed Increase following distances Use moderate braking No quick or fast turns	Moderate	An average of 44,000 thunderstorms occur daily over the surface of the earth. Expect heavy rains, lightning, high winds and strong gusts.
First Gust	Associated with thunderstorms and the rapid change in direction and windspeed immediately prior to the storm's passage at the surface. Gust may exceed 75 knots and vary 100 degrees from the prevailing surface winds	High Winds Strong Gust Sudden Wind Direction Change Unexpected Directional Control	Reduce speed Prepare for wind gust Make counter corrections	Moderate	Expect strong wind gust and heavy precipitation.

ADDITIONAL RISK FACTORS

Inexperienced driver
 Limited experience in type operation
 Darkness/night
 Extended hours of operation (8 hrs or more)
 Equipment not fully mission ready
 Increased temperature
 Increased stress (combat conditions)
 High traffic areas/off road operations
 Hazardous material cargo
 Combination vehicle operation
 Not trained in type operation
 Pressures from higher command
 Time constraints

Note: Refer to Weather Hazards Appendix for detailed explanation of conditions

WEATHER EVALUATION RISK GUIDE

This guide is to be used as a pre-trip planning guide to assist in identifying risk that may affect your mission. Select and place the risk level for all conditions and factors you expect to encounter during the mission in the space provided. Total the selected risk levels. Compare the total with the risk guide located at the bottom of the chart to determine the weather hazard risk for the assigned mission and adjust accordingly to reduce risk or accept risk.

Risk	Weather Conditions	Degree	RISK GUIDE
1	Rain	Light	
4		First 30 Minutes Light Rain	1-2 Slight Risk
2		Moderate	
4		Heavy	Normal Operations with Increased Safety Awareness.
5		Freezing	
4	Ice		3-4 Moderate Risk
3	Frost		
3	Snow	Light	Reduced Operations and Restricted Speeds.
3		Moderate	
4		Heavy	5 or More Major Risk
1	Hail		
5	Sleet		Restricted Operations.
3	Windshield Icing		
5	Black Ice		ADDITIONAL RISK FACTORS
1	Frost Heaving		
1	Fog	Light	2 Darkness/Night
3		Moderate	
5		Heavy	3 Inexperienced Driver
1	Ice Fog	Light	
3		Moderate	1 Limited Experience in Type Operation
5		Heavy	
5	Freezing Fog		1 Extended Hours of Operation (8 Hours or More)
1	Smog		
1	Photochemical Smog		1 Equipment Not Fully Mission Ready
2	Dew		
3	Thunderstorm		2 Increased Stress (Combat Condition/Area)
3	First Gust		
1			1 High Traffic Area
1			
1			1 Off Road Operations
1			
1			1 Combination Vehicle
1			
1			1 Time Constraints (Rush Mission)
1			
1			1 Pressure From Higher Command
1			
TOTAL			

APPENDIX F

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GLOSSARY

AFR	Air Force Regulation
AIT	Advance Individual Training
AMC	US Army Materiel Command
ARNG	Army National Guard
BT	Basic Training
CDL	Commercial Drivers License
CMF	Career Management Field
COMM	Commercial
CONUS	Within the Continental United States
COTR	Contracting Officers Technical Representative
CPO	Civilian Personnel Office
CUCV	Commercial Utility Cargo Vehicle
DA PAM	Department of Army Pamphlet
DA	Department of Army
DEH	Directorate of Engineering and Housing
DOD	Department of Defense
DOL	Directorate of Logistics
DUI	Driving Under The Influence
F	Fahrenheit
FC	Field Circular
FM	Field Manual
FORSCOM	Forces Command
FY	Fiscal Year
GS	General Schedule
GVWR	Gross Vehicle Weight Rating
HEMTT	Heavy Expanded Mobility Tactical Truck
IET	Initial Entry Training
MACOM	Major Army Command
MOS	Military Occupational Specialty
MPH	Miles Per Hour
NA	Not Applicable
NCO	Noncommissioned Officer
NCOIC	Noncommissioned Officer in Charge
NGB	National Guard Bureau
NIOSH	National Institute for Occupational Safety and Health
NR	Not Reported
OCONUS	Outside the Continental United States
OPM	Office of Personnel Management
OSHA	Occupational Safety and Health Administration
QTR	Other
PLF	Parachute Landing Fall
POI	Program of Instruction

SF	Standard Form
SOP	Standing Operating Procedure
STD DEV	Standard Deviation
STP	Soldier Training Publication
TACT	Tactical
TB	Technical Bulletin
TE	Task Error
TMP	Transportation Motor Pool
TNG	Training
TOT	Total
TRADOC	US Army Training and Doctrine Command
TSG	The Surgeon General
USAR	US Army Reserves
USAREUR	US Army Europe
USASC	US Army Safety Center
WG	Wage Grade