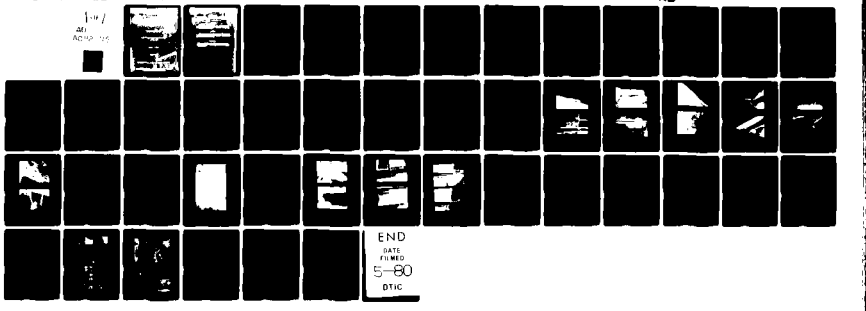
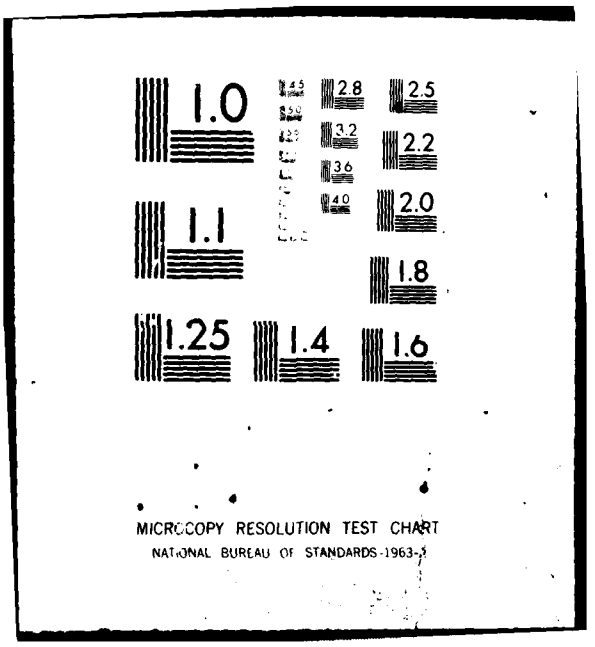
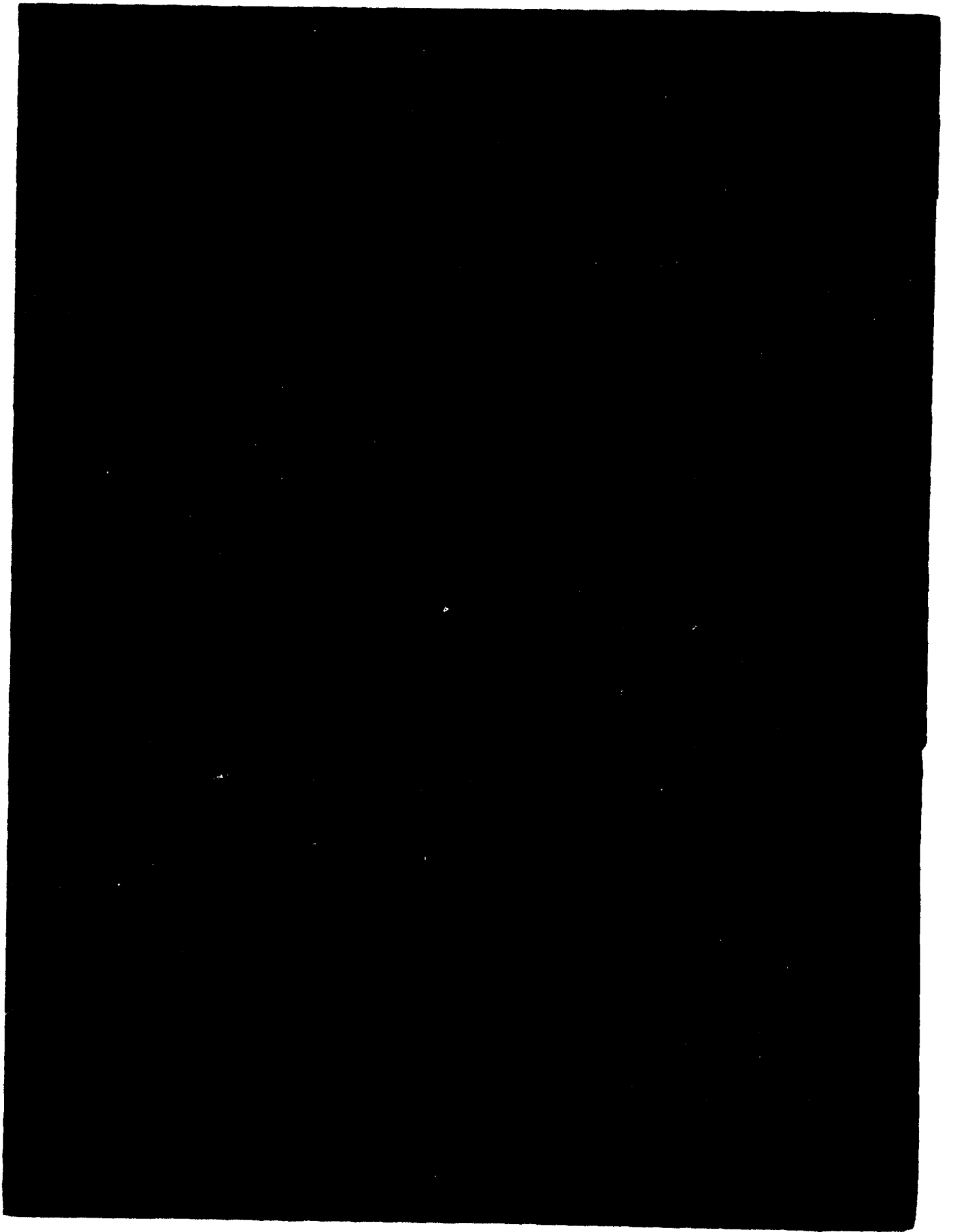
AD-A082 715 ARMY MATERIEL SYSTEMS ANALYSIS ACTIVITY ABERDEEN PROV--ETC F/G 13/6
SURVEY OF RUST DAMAGE TO THE M880 SERIES, 1-1/4 TON TRUCK,(U)
JAN 80 H T LOOTENS

UNCLASSIFIED AMSAA-TR-291 NL



END
DATE FILMED
5-80
DTIC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



(14) AMSAA-TR-291

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER: Technical Report NO. 291 ✓	2. GOVT ACCESSION NO. / 3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle): (6) Survey of Rust Damage to the M880 Series, 1-1/4 Ton Truck	5. TYPE OF REPORT & PERIOD COVERED: (9) Technical rept.
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): (10) Harold T. Lootens	8. CONTRACT OR GRANT NUMBER(s): (16)
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Director, US Army Materiel Systems Analysis Activity ✓, Aberdeen Proving Ground, MD 21005	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: DA Proj #1R765706M541
11. CONTROLLING OFFICE NAME AND ADDRESS: Commander, US Army Materiel Development & Readiness Command, 5001 Eisenhower Avenue, Alexandria, VA 22333	(11) 12. REPORT DATE: Jan[illegible]980; 13. NUMBER OF PAGES: 51
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): (12) 48	15. SECURITY CLASS. (of this report): UNCLASSIFIED; 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Rust	Rust vs. Location
Rustproofing	Rust vs. Mileage
Water Leakage	Rust vs. Manufacturing Date

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report presents the results of a survey to determine the severity of rust damage on the M880 series, 1-1/4 ton truck. The adequacy of contractor applied rustproofing is assessed and recommendations are made to improve the present condition of the fleet and prevent further rust damage.

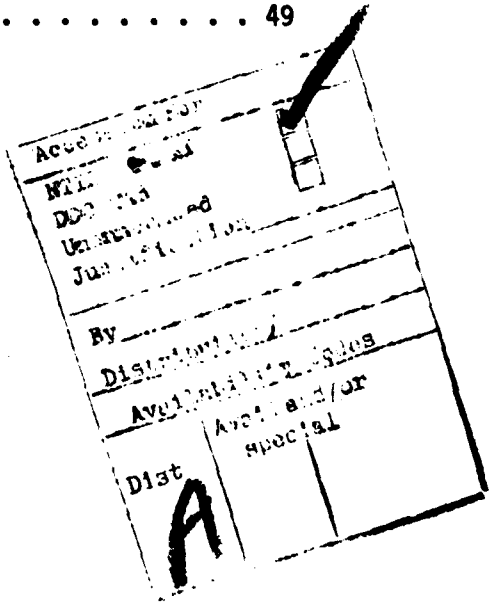
DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

403

LICENSE

CONTENTS



TABLES

FIGURES

Next page is blank.

ACKNOWLEDGEMENTS

Thanks are extended to the following individuals in AMSAA for assisting in this survey:

MSG George Hinton, SFC Willie Ashley, and Mr. Norman Dombeck who surveyed and photographed vehicles in Hawaii.

Mr. John Kapinos who, with SFC Ashley, surveyed vehicles at Letterkenny Army Depot.

Mr. Al Thomas who surveyed vehicles in Korea.

Mr. Peter Ferrara who, with SFC Ashley and SSG Osborn, conceived, conducted, and photographed the water leakage tests. Mr. Ferrara also assisted with an overall interpretation of the data and offered valuable technical advice.

Mr. William Clay and Mr. Joseph Waring who programmed the data.

Next page is blank.

SURVEY OF RUST DAMAGE TO THE M880 SERIES, 1-1/4 TON TRUCK

1. INTRODUCTION

This report presents the results of a survey to determine the severity of the rust problem on the M880 series, 1-1/4 ton truck. The adequacy and effectiveness of contractor applied rustproofing is assessed and actions that can be taken to reduce the rate of rusting are suggested. This survey was conducted by the Field Equipment and Technology (FEAT) Division, US Army Materiel Systems Analysis Activity (AMSAA) from April to June 1979.

2. BACKGROUND

In June 1978 at the direction of MG Hardin, TARCOM Commander, a team of personnel from TARCOM, FORSCOM, and AMSAA visited the 25th Infantry Division, Hawaii to assess the degree of rust on several types of vehicles including the M880 series. As a result of this visit, termed "Operation Rustproof", TARCOM initiated a three-phase effort to address the problem of rusting vehicles in the 25th Infantry Division. This three-phase effort, however, did not include any specific actions to remedy the rust problems with the M880 series vehicles.

Under the authority of DARCOM Regulation 70-7, AMSAA conducts periodic R&D Field Liaison visits to tactical units worldwide. The purpose of these visits is to maintain direct contact with Army materiel users in the field in order to surface equipment-related problems, and then provide quick response, low cost solutions to these problems. Since the M880 series vehicle was first fielded in 1976, AMSAA Field Liaison teams have had the opportunity to observe them in thirteen CONUS locations, as well as, in Hawaii, Panama, Alaska, Okinawa, Korea, and Germany.

AMSAA personnel were concerned about the fact that the vehicles were rusting. This condition was observed both by the TARCOM team and on the R&D Field Liaison visits. As a result, AMSAA proposed to DARCOM HQ that a survey of the M880 fleet be conducted to evaluate the present degree of rust and assess the adequacy of rustproofing vehicles. Data from this survey might also prove useful to the Vehicle Useful Life Assessment and Sample Data Collection plan being conducted on the M880 series vehicle. In April 1979, DARCOM formally tasked AMSAA to perform such a survey (DRCPA Task 24A, Equipment Rust and Corrosion), as one of a series of logistics tasks in support of the DARCOM materiel readiness responsibility.

3. OBJECTIVES

The objectives of this task were to survey a sample of the M880 vehicle fleet to determine:

(1) the specific areas of the vehicle that are damaged by rust and the severity of the damage,

(2) the adequacy of contractor-applied rustproofing and,

(3) corrective actions that could be taken to improve the situation and prevent similar occurrences in the future especially when commercial vehicles are procured.

4. APPROACH

It was decided to survey vehicles as a part of regularly scheduled R&D Field Liaison trips, and to make special trips to other locations only as required to augment these data. A special form was prepared (see Appendix A) to aid in the collection of data. Vehicles were surveyed on Field Liaison trips to Fort Knox, KY in April 1979 (Lightning and 194th Armor Brigades) and to Germany in June 1979 (3rd Infantry Division). Additional data were obtained in Hawaii in June 1979 (25th Infantry Division) and in Korea in May 1979 (8th Army) by AMSAA personnel on twelve-month assignments there. A special trip was made to Letterkenny Army Depot in June 1979 to gather data on new, unissued vehicles.

No attempt was made to examine all the vehicles at any location or to examine only those vehicles that were rusted. The selection of vehicles was completely random and based only upon availability. To assure consistency in the evaluation of the amount of rust on the vehicles examined, various degrees of rust were established and survey personnel were taught how to distinguish between them. Almost all the data were collected by AMSAA personnel and, in some cases, the same individuals examined vehicles at more than one location. In this way, the grading of the severity of rust was consistent from vehicle-to-vehicle and location-to-location.

To aid in the reduction of data, the information was transferred from the individual data sheets to punched cards and computerized. Once this was accomplished, it was an easy task to analyze and correlate the data in a variety of combinations. Some data were collected that do not relate directly to rust and they are not reported here. Readers who are interested in obtaining any data shown on the data collection form but not presented in this report can do so by contacting the author.

5. VEHICULAR DESCRIPTION

The M880 series vehicle, the first vehicle purchased under the "WHEELS" study, is a commercial truck. It is basically the Dodge 1-1/4 ton, 4-wheel drive pickup truck, with only the paint distinguishing the Army truck from the commercial version. Both 4-wheel and 2-wheel drive are included in the M880/890 series. The vehicle cab comes equipped with a fiber floor mat covered by a thin rubber mat.

The M880 series is available in twelve models, all with the same basic chassis design. Its special uses include communications shelter carrier, ambulance, telephone maintenance, and general purpose cargo truck. The M880 was procured to be a less complex, less expensive companion truck to the M561 (GAMA GOAT). The M561 is designed for use as a highly mobile, multi-purpose vehicle operating forward of the brigade rear, while the M880 is meant to be used principally behind the brigade rear.

The various models available in the M880/890 series are as follows:

(1) M880 - A 4X4 cargo truck.

(2) M881 - A 4X4 cargo truck equipped with a 60 amp/24 V generating system kit, in addition to the vehicle's normal 12 V electrical system.

(3) M882 - A 4X4 cargo truck equipped with a 60 amp/24 V generating system kit and a communications kit, in addition to the vehicle's normal 12 V electrical system.

(4) M883 - A 4X4 cargo truck with a S250 shelter kit installed in the cargo box and a 60 amp/24 V generating system kit, in addition to the vehicle's normal 12 V electrical system.

(5) M884 - A 4X4 cargo truck with a S250 shelter kit installed in the cargo box and a 100 amp/24 V generating system kit, in addition to the vehicle's normal 12 V electrical system.

(6) M885 - A 4X4 cargo truck with a S250 shelter kit installed in the cargo box.

(7) M886 - A 4X4 ambulance.

(8) M888 - A 4X4 truck with a telephone maintenance body installed.

(9) M890 - A 4X2 cargo truck.

(10) M891 - A 4X2 cargo truck equipped with a 60 amp/24 V generating system kit, in addition to the vehicle's normal 12 V electrical system.

(11) M892 - A 4X2 cargo truck equipped with a 60 amp/24 V generating system kit and a communications kit, in addition to the vehicle's normal 12 V electrical system.

(12) M893 - A 4X2 ambulance.

6. RESULTS OF THE SURVEY

6.1 General.

As indicated in Section 4, vehicles were examined at five locations. These locations will be referred to in the charts and tables in this report as follows:

Letterkenny Army Depot	LEAD
Fort Knox	KNOX
Korea	KREA
Germany	GERM
Hawaii	HWAI

The Depot Support Command (DESCOM), Chambersburg, PA furnished data to AMSAA on the worldwide distribution of M880 series vehicles. These data are classified; therefore, only percentages are used in this report when referring to quantities of vehicles. The size of the AMSAA sample is shown on several charts as a percentage of worldwide assets or a percentage of vehicles examined at a specific location. Data on the charts are shown as a percentage of vehicles in a specific column.

The total number of vehicles surveyed represent 3.3% of the worldwide assets. Table 1 shows how many of each model were examined at the various locations. As far as the rust survey is concerned, the model designation is not of major importance since the entire M880 series is built on the same chassis. The data in Table 1 are given only to indicate the wide cross-section of vehicles surveyed, which represents many different conditions of use and varying potential for the formation of rust.

It should be noted that approximately 6.4 percent of the worldwide M880 series assets are still in depot storage as of December 1979 (2.6 percent CONUS, 3.8 percent OCONUS).

6.2 Mileage and Date of Manufacture.

Table 2 shows the average mileage of the vehicles at each location and of vehicles at the four field locations, excluding Letterkenny Depot. The vehicles observed in Germany have the highest mileages, followed by those in Korea, Fort Knox, and Hawaii in that order. The high mileage in Germany is because of the large distance between bases there and the good roads, especially the AUTOBAHN. As far as the individual models are concerned, the M880 shows the most mileage of those vehicles at the field sites, except at Fort Knox where the M882 is higher. In Korea, Germany,

TABLE 1 TYPE OF VEHICLES

	ALL LOCATIONS	LEAD	KNOX	KREA	GERM	HWAI
M880	27.6*	12.9*	28.6*	31.9*	25.0*	41.9*
M881	0.7	0.5	----	----	----	1.4
M882	35.4	69.4	42.8	12.4	14.9	15.8
M883	3.6	----	----	4.1	8.9	5.0
M884	4.0	0.2	----	8.2	5.4	6.2
M885	12.1	6.5	----	31.9	26.8	7.6
M886	8.8	2.1	28.6	2.2	19.0	12.0
M888	1.1	1.7	----	----	----	1.0
M890	5.7	5.5	----	9.3	----	7.7
M891	0.5	1.2	----	----	----	----
M893	0.5	----	----	----	----	1.4

*Percent of vehicles in this column.

TABLE 2 AVERAGE MILEAGE OF VEHICLES

	ALL LOCATIONS	ALL W/O LEAD	LEAD	KNOX	KREA	GERM	HWAI
M880	11775 (27.6)*	14164 (36.1)	105 (12.9)	13239 (28.6)	23465 (31.9)	28650 (25.0)	9071 (41.9)
M881	630 (0.7)	823 (0.9)	50 (0.5)	----	----	----	823 (1.4)
M882	2667 (35.8)	9269 (16.0)	17 (69.4)	15035 (42.8)	11104 (12.4)	18370 (14.9)	4701 (15.8)
M883	3687 (3.6)	3687 (5.7)	----	----	1409 (4.1)	7258 (8.9)	1554 (5.0)
M884	2171 (3.9)	2221 (6.0)	41 (0.2)	----	1208 (8.2)	4693 (5.4)	1676 (6.2)
M885	3212 (12.1)	3965 (15.3)	84 (6.5)	----	5207 (31.9)	4723 (26.8)	1695 (7.6)
M886	5306 (8.8)	5770 (12.8)	85 (2.1)	2685 (28.6)	7766 (2.2)	11794 (19.0)	2205 (12.0)
M888	333 (0.9)	879 (0.6)	22 (1.7)	----	----	----	879 (1.0)
M890	7652 (5.7)	11722 (5.8)	68 (5.5)	----	20435 (9.3)	----	9271 (7.7)
M891	44 (0.4)	----	44 (1.2)	----	----	----	----
M893	3142 (0.5)	3142 (0.8)	----	----	----	----	3142 (1.4)
ALL VEHICLES	5740	8997	37	10993	12755	14307	5891

*Numbers in parentheses indicate percent of vehicles in this column.

and Hawaii, the M890 shows the second highest mileage. This is not surprising since the M880/890 models are the standard cargo truck, and these models would get more use than the specialized ones.

Predicted usage for the M880 series vehicle was 4000 miles per year. Using the average vehicle age of 33 months (discussed later), the average expected vehicle mileage would be approximately 11,000 miles per year. The overall average (w/o LEAD) shown in Table 2 is 8997 miles, slightly lower than what would be predicted. This is because 59 percent of the sample (w/o LEAD) is made up of vehicles in Hawaii, the majority of which have relatively low mileage.

Figure 1 shows the vehicles, not including those at Letterkenny Depot, arranged by mileage groups. It is interesting to note that 53 percent of the vehicles surveyed at the four field locations have traveled less than 5000 miles. Here again, the sample is influenced by the vehicles in Hawaii, where the low mileage is the result of the smallness of the island.

Mileage alone, however, is not truly representative of the amount of rust on a vehicle. Vehicular age must also be considered. Figure 2 lists the manufacturing dates of the vehicles surveyed. Based on manufacturing date, the average age of all vehicles surveyed is 30.6 months while the average age of all vehicles (w/o LEAD) is 33.4 months. These values were computed using May 1979 as the current month, since the data for this report were collected between April and June 1979. The actual date that these vehicles were delivered to the field was not obtained in this study. If a constant time for each vehicle to move from the manufacturer through the depot to the field is assumed, however, then the manufacturing date, which is stamped on the vehicle data plate, can be related to time of use in the field. Figure 2 shows what might be expected, i.e., the older vehicles are in the field, while the newer ones are still in the depot. Hawaii, Germany, and Korea all received vehicles from the early production in 1976, and then Hawaii received another shipment of vehicles manufactured in 1977. Of the vehicles surveyed that were manufactured in 1977, 73.6 percent were at Letterkenny.

Table 3 shows mileage at the four field locations with the vehicles grouped by manufacturing date in 6-month intervals. Since Table 2 shows that the high mileage vehicles are in Germany, they would be expected to have the earliest manufacturing dates. This is not true, however, as the data in Table 3 show. The high mileage vehicles in the earliest manufacturing period are in Korea, while in the next oldest group, the highest mileage shows up at Fort Knox.

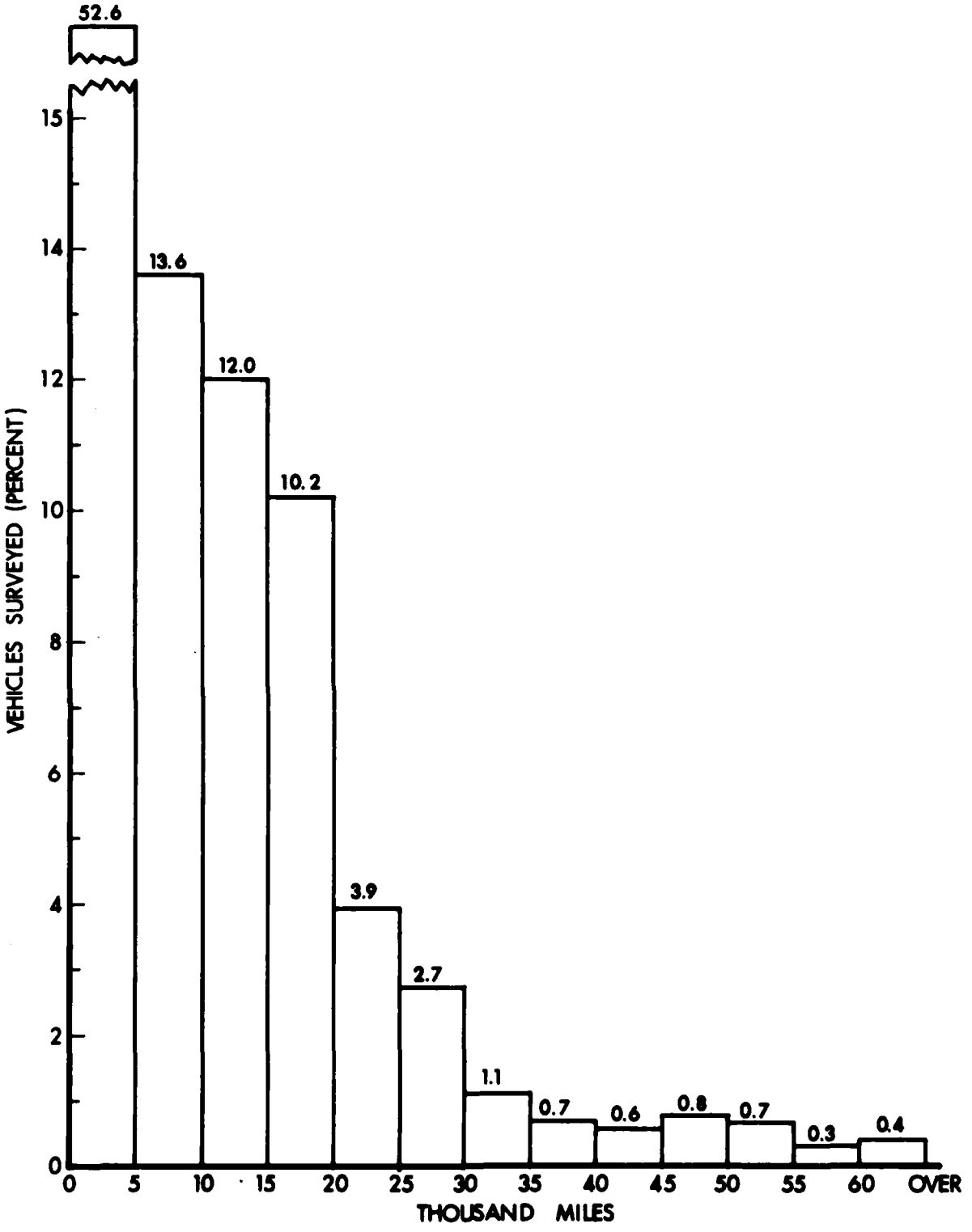


Figure 1. Vehicle Mileage (W/O Lead)

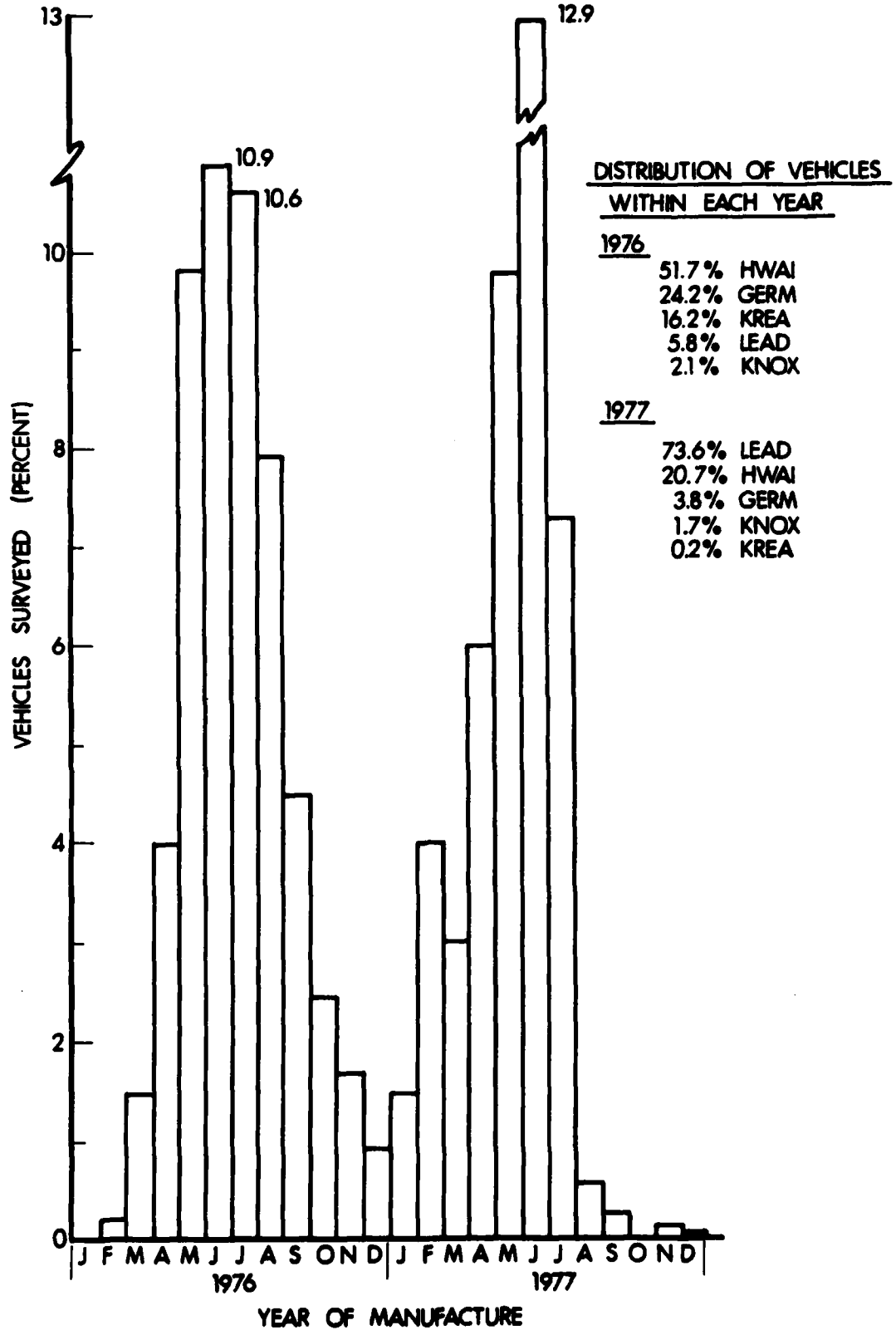


Figure 2. Manufacturing Date of Vehicles.

TABLE 3 MILEAGE VERSUS MANUFACTURING DATE (W/O LEAD)

		JAN-JUN 1976	JUL-DEC 1976	JAN-JUN 1977	JUL-DEC 1977	AVERAGE MILEAGE JAN 76 - DEC 77
KREA						
	MIN	698	249	2334	----	
	MAX	58023	30610	2334	----	12755
	AVG	19782	5945	2334	----	
		(49.5)*	(49.5)	(1.0)		
GERM						
	MIN	335	1057	372	271	
	MAX	76616	51636	30721	12598	14131
	AVG	16269	13686	6062	2831	
		(54.8)	(33.9)	(7.7)	(3.6)	
KNOX						
	MIN	8578	8361	207	----	
	MAX	17508	18909	10479	----	10993
	AVG	13948	15203	4623	----	
		(14.2)	(47.7)	(38.1)		
HWAI						
	MIN	36	21	39	16	
	MAX	29566	26919	7149	5495	5945
	AVG	10302	5366	1518	1252	
		(31.1)	(43.3)	(19.4)	(5.3)	

*Numbers in parentheses indicate percent of sample at this location.

6.3 Assessment of Rust Damage.

The primary objective of this survey was to determine the amount of rust on specific areas of the vehicle. The specific areas selected for inspection were the cab floor pan, tailgate, cargo bed, front fenders, air intake plenum, firewall gutter and the fender-firewall-plenum junction. These areas were considered significant from the standpoint of safety, usefulness and appearance of the vehicle. They were also areas that could be easily examined. Rust on the cab floor pan and tailgate was recorded only as YES or NO, while rust in the other areas was assessed as to severity and recorded as NONE, SLIGHT, MODERATE, HEAVY, or PERFORATED.

Table 4 shows the rust data as a function of vehicular location. The underside of the fiber floor mat was wet in more than 90 percent of the vehicles at Fort Knox, Korea, and Germany; 77 percent of those in Hawaii; and 33 percent of those at Letterkenny AD. This contributes to premature rusting of the cab floor pan, which eventually rusts through and becomes a safety problem. In general, throughout the study, the vehicles in Germany and Hawaii exhibited the most severe damage from rust, with those in Hawaii being especially bad. This is because of the salt air and almost-daily rain showers there.

Table 5 gives rust data for the four field sites (w/o LEAD) with the vehicles grouped by mileage. As would be expected, the percentage of vehicles with rust increases with higher mileage. Where the rust is graded, the higher mileage vehicles show higher percentages of Moderate, Heavy or Perforated rust and less of the None and Slight category.

Table 6 presents rust data again but here the vehicles are arranged by manufacturing date in 6-month intervals. The vehicles located at Letterkenny Depot were omitted to make the sample representative of tactical field use. Here, as in the preceding table, the older vehicles show more serious rust problems. Figures 3-13 show some of the more severely rusted vehicles observed during the survey. These vehicles were all located in Hawaii.

6.4 Rustproofing.

One of the objectives of this study was to determine the adequacy of the rustproofing that was applied to the vehicles by the manufacturer. Many of the areas that were rustproofed are hidden from view, and the quality of the treatment in these areas could not be assessed. One area that is essentially hidden but yet can still be easily examined is the reinforcing web under the hood. This web was closely examined on each vehicle as were the firewall and the underside of the fenders, cargo bed, and cab floor.

TABLE 4 SEVERITY OF RUST VERSUS VEHICLE LOCATION

	All LOCATIONS	ALL W/O LEAD	LEAD	KNOX	KREA	GERM	HWAI
SAMPLE SIZE	(31.4/ 9.6)*	(29.3/ 6.2)	(2.1/ 57.5)	(0.8/ 7.7)	(4.0/ 7.2)	(23.6/ 2.1)	(1.0/ 98.7)
FLOOR MAT UNDERSIDE WET	51**	87**	33**	95**	99**	93**	77**
FLOOR MAT MISSING	20	31	0	0	0	3	51
FLOOR PAN RUSTED	40	56	13	48	60	65	51
FLOOR PAN RUSTED, MAT MISSING	8	12	0	0	0	0	41
WATER IN SIGNAL LENSES	11	13	7	38	9	13	12
TAILGATE SEPARATED	22	40	0	13	35	50	38
TAILGATE RUSTED	11	17	1	0	14	20	21
CARGO BED RUST							
NONE	63	44	95	33	24	47	48
SLIGHT	31	48	5	60	53	53	44
MODERATE	5	7	0	7	20	0	7
HEAVY	1	1	0	0	1	0	1
PERFORATED	0	0	0	0	2	0	0
FENDER RUST							
NONE	80	67	100	91	95	93	49
SLIGHT	9	16	0	9	1	5	23
MODERATE	3	5	0	0	3	1	7
HEAVY	1	2	0	0	1	0	4
PERFORATED	7	10	0	0	0	1	17
AIR INTAKE RUST							
NONE	68	52	96	86	77	70	37
SLIGHT	26	39	4	9	12	28	50
MODERATE	5	8	0	5	7	2	11
HEAVY	1	1	0	0	4	0	1
PERFORATED	0	0	0	0	0	0	1
FIREWALL GUTTER RUST							
NONE	32	15	63	52	38	16	8
SLIGHT	43	50	30	38	27	53	52
MODERATE	20	28	5	10	22	29	31
HEAVY	4	5	2	0	3	2	6
PERFORATED	1	2	0	0	0	0	3
FENDER-FIREWALL-PLENUM JUNCTION RUST							
NONE	75	64	96	86	87	87	48
SLIGHT	20	28	4	14	11	12	41
MODERATE	3	5	0	0	1	1	7
HEAVY	0	1	0	0	1	0	1
PERFORATED	1	2	0	0	0	0	3

*Percent of worldwide assets at this location/percent of vehicles examined at this location.

**Percent of vehicles in this column.

TABLE 5 SEVERITY OF RUST VERSUS MILEAGE (W/O LEAD)

	0-2499 MI.	2500-12999 MI.	13000 & OVER
SAMPLE SIZE	34.0*	38.6	27.4
FLOOR MAT UNDERSIDE WET	82**	85**	97**
FLOOR MAT MISSING	32	35	23
FLOOR PAN RUSTED	49	56	63
FLOOR PAN RUSTED, MAT MISSING	10	15	11
WATER IN SIGNAL LENSES	9	12	18
TAILGATE SEPARATED	34	36	52
TAILGATE RUSTED	14	16	21
CARGO BED RUST			
NONE	55	46	27
SLIGHT	40	49	58
MODERATE	5	5	12
HEAVY	0	0	2
PERFORATED	0	0	1
FENDER RUST			
NONE	65	63	76
SLIGHT	14	19	11
MODERATE	4	8	3
HEAVY	3	2	1
PERFORATED	14	8	9
AIR INTAKE RUST			
NONE	48	53	58
SLIGHT	38	41	33
MODERATE	11	6	7
HEAVY	3	0	1
PERFORATED	0	0	1
FIREWALL GUTTER RUST			
NONE	16	11	20
SLIGHT	50	54	45
MODERATE	28	27	31
HEAVY	3	7	4
PERFORATED	3	1	0
FENDER-FIREWALL-PLENUM JUNCTION RUST			
NONE	83	62	69
SLIGHT	14	30	25
MODERATE	1	6	4
HEAVY	1	1	1
PERFORATED	1	1	1

*Percent of total sample (w/o LEAD).
**Percent of vehicles in this column.

TABLE 6 SEVERITY OF RUST VERSUS MANUFACTURING DATE (W/O LEAD)

	MANUFACTURING DATES			
	JAN-JUN 1976	JUL-DEC 1976	JAN-JUN 1977	JUL-DEC 1977
SAMPLE SIZE	39.2*	42.2	14.6	4.0
FLOOR MAT UNDERSIDE WET	89**	84**	90**	93**
FLOOR MAT MISSING	36	34	16	4
FLOOR PAN RUSTED	58	51	67	50
FLOOR PAN RUSTED, MAT MISSING	17	12	6	0
WATER IN SIGNAL LENSES	14	15	8	4
TAILGATE SEPARATED	43	46	11	12
TAILGATE RUSTED	19	16	16	4
CARGO BED RUST				
NONE	36	43	64	68
SLIGHT	50	52	34	32
MODERATE	11	5	2	0
HEAVY	2	0	0	0
PERFORATED	1	0	0	0
FENDER RUST				
NONE	69	61	76	82
SLIGHT	14	16	17	18
MODERATE	6	6	2	0
HEAVY	2	2	2	0
PERFORATED	9	15	3	0
AIR INTAKE RUST				
NONE	51	52	52	79
SLIGHT	41	36	40	18
MODERATE	7	10	8	0
HEAVY	1	2	0	3
PERFORATED	0	0	0	0
FIREWALL GUTTER RUST				
NONE	10	15	24	29
SLIGHT	50	47	60	54
MODERATE	33	30	14	14
HEAVY	5	6	2	3
PERFORATED	2	2	0	0
FENDER-FIREWALL-PLENUM JUNCTION RUST				
NONE	61	62	66	89
SLIGHT	32	29	29	11
MODERATE	5	5	3	0
HEAVY	1	1	0	0
PERFORATED	1	3	2	0

*Percent of total sample (w/o LEAD).
**Percent of vehicles in this column.

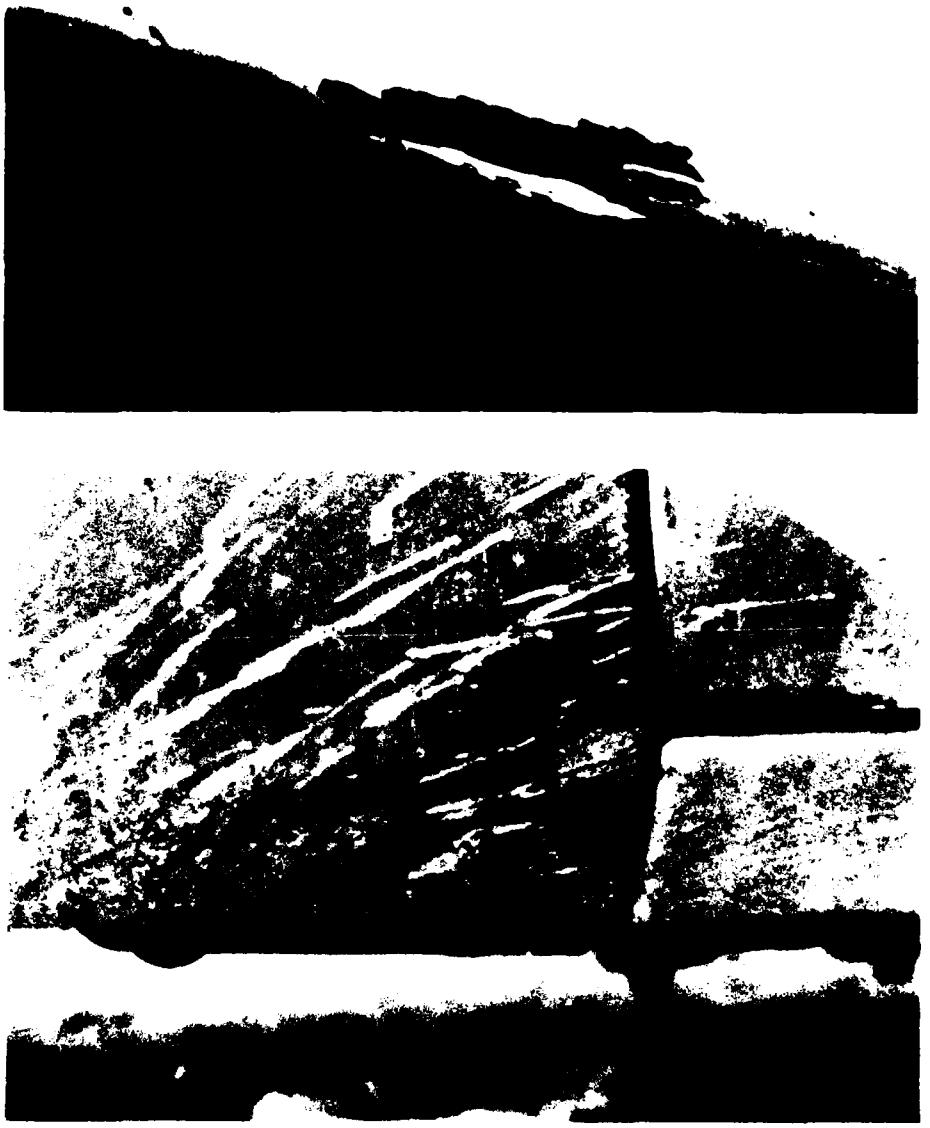


Figure 3. Perforated Front Fenders.

Figure 4. Perforated Fender - Signal Light Recess.

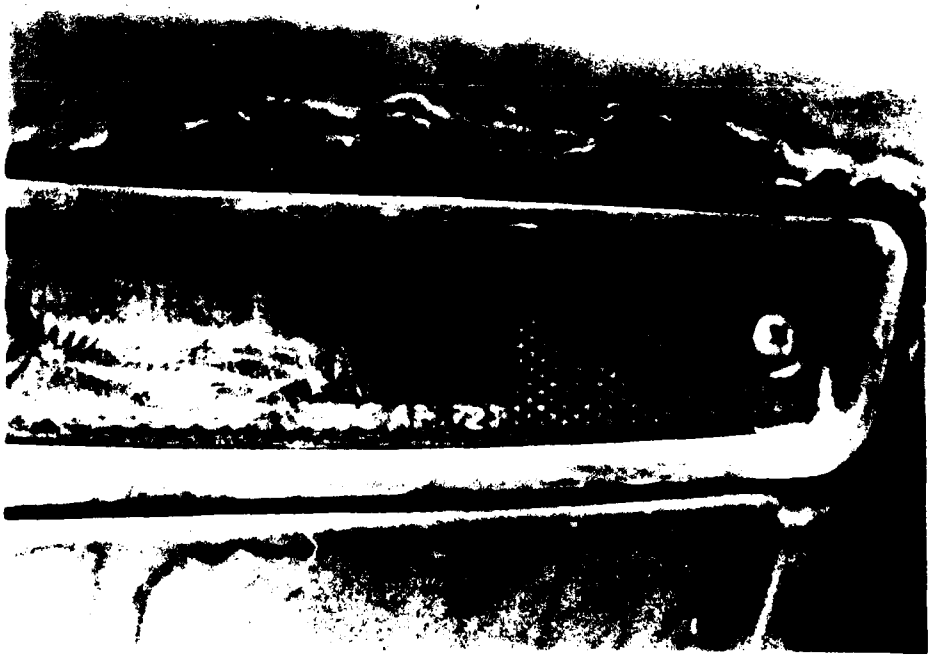


Figure 5. Rusted Signal Light Recess.

Figure 6. Rusted Rain Gutter.

Figure 7. Perforated Door.

Figure 8. Rusted Upper Front Fender.

Figure 9. Perforated Fender-Firewall-Plenum Junction.

Figure 10. Rusted Front Fender.

Figure 11. Rusted Cargo Bed.

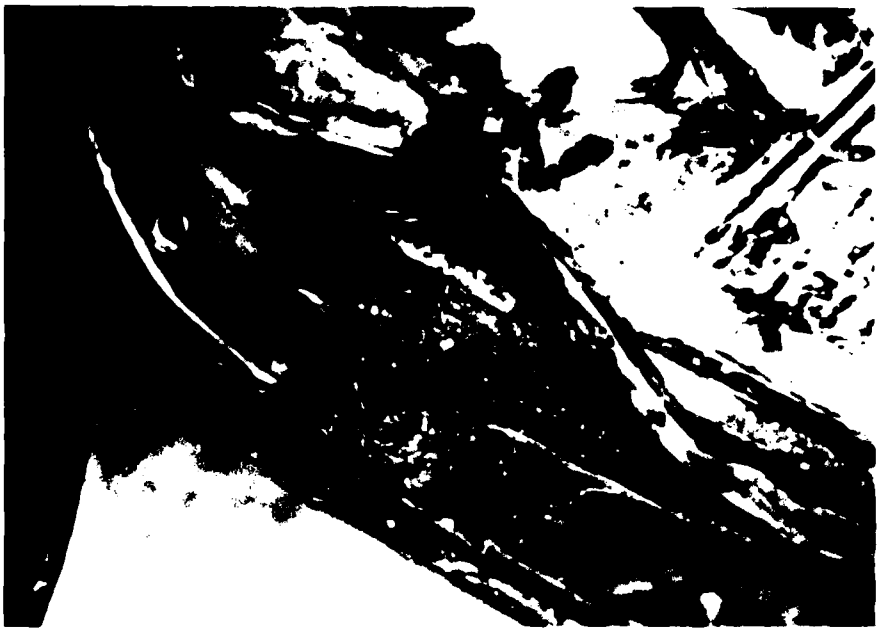


Figure 12. Perforated Floor Board.

Figure 13. Perforated Interior Door Panel.

Table 7 shows the absence of rustproofing in the areas mentioned above (i.e., the percentage of vehicles that DID NOT show evidence of rustproofing). Note that 77 percent of all vehicles surveyed were not rustproofed under the hood web. This means that, even though the rustproofing spray tool was inserted into the small holes at the ends of the X-shaped web, the rustproofing compound covered only a small area adjacent to the holes. Figure 14 shows the web on one vehicle which had two large holes in the center section. These holes were made after the vehicle was manufactured and were used to insert the rustproofing tool. It is easy to see that the rustproofing compound has covered the entire area under the web, since it is leaking out along the edges. Normally, only the tiny hole visible in the upper lefthand corner and a similar one in the righthand corner are available to inject the rustproofing compound.

The lack of rustproofing under the web will contribute to premature rusting of the web and hood section. Even more important, however, is the fact that this condition raises a question about the quality of the rustproofing throughout the rest of the vehicle, especially in the hidden areas not readily accessible to view. It is likely that the inner door panels, inner fender panels, and other enclosed vehicle areas may have been only partially rustproofed and will suffer premature damage.

6.5 Water Leakage.

In an effort to determine how and where water was getting into the cab of the M880 series vehicles, a series of tests was conducted by AMSAA at Letterkenny Depot in October 1979. Six vehicles, previously identified in this survey as having wet floor mats and rusted floor pans, were chosen for the leakage test. All the test vehicles had been driven less than 50 miles.

To begin the test, the floor mats in the test vehicles were pulled back and the cab floor was allowed to dry. It might be noted here that several of the vehicles did not have the covers on the cab floor mounting bolt access holes, located under the floor mat on each side of the cab. Once the floor pan was dry, the windows and doors were all tightly closed.

Originally, it was planned to simulate rainfall by using hoses. On the afternoon the test was planned to start, however, it began to rain and continued to rain intermittently for the next 10-12 hours. During this period, 0.8 inches of rainfall was recorded at a local weather station. The next morning, the six test vehicles were examined and water was observed in each one on the floor pan adjacent to the side cowl and door sill junction, as shown in Figure 15.

The floor pans were again dried off and the vehicles were subjected to artificial rainfall by directing water high into the air from a hose and allowing it to fall on the vehicles. During this period, the wind was blowing at 10-20 mph and these conditions created an ideal simulation of windblown rainfall. During this part of the test, the vehicles were examined

TABLE 7 ABSENCE OF RUSTPROOFING ON SPECIFIC AREAS OF THE VEHICLE

	ALL LOCATIONS	ALL (W/O LEAD)	LEAD	KNOX	KREA	GERM	HWAI
SAMPLE SIZE	(31.4/9.6)*	(29.3/6.2)	(2.1/57.5)	(0.8/7.7)	(4.0/7.2)	(23.6/2.1)	(1.0/98.7)
UNDER HOOD REINFORCEMENT WEBS	77**	65**	99**	78**	75**	78**	54**
ON FIREWALL	2	2	1	10	1	2	2
UNDER FRONT FENDERS	13	22	0	19	0	3	32
UNDER REAR FENDERS	13	23	0	10	0	4	33
UNDER CARGO BED	13	22	0	5	10	5	29
UNDER CAB FLOOR	14	25	0	5	11	5	32

*(Percent of worldwide assets at this location/percent of vehicles examined at this location).
** Percent of vehicles in this column.

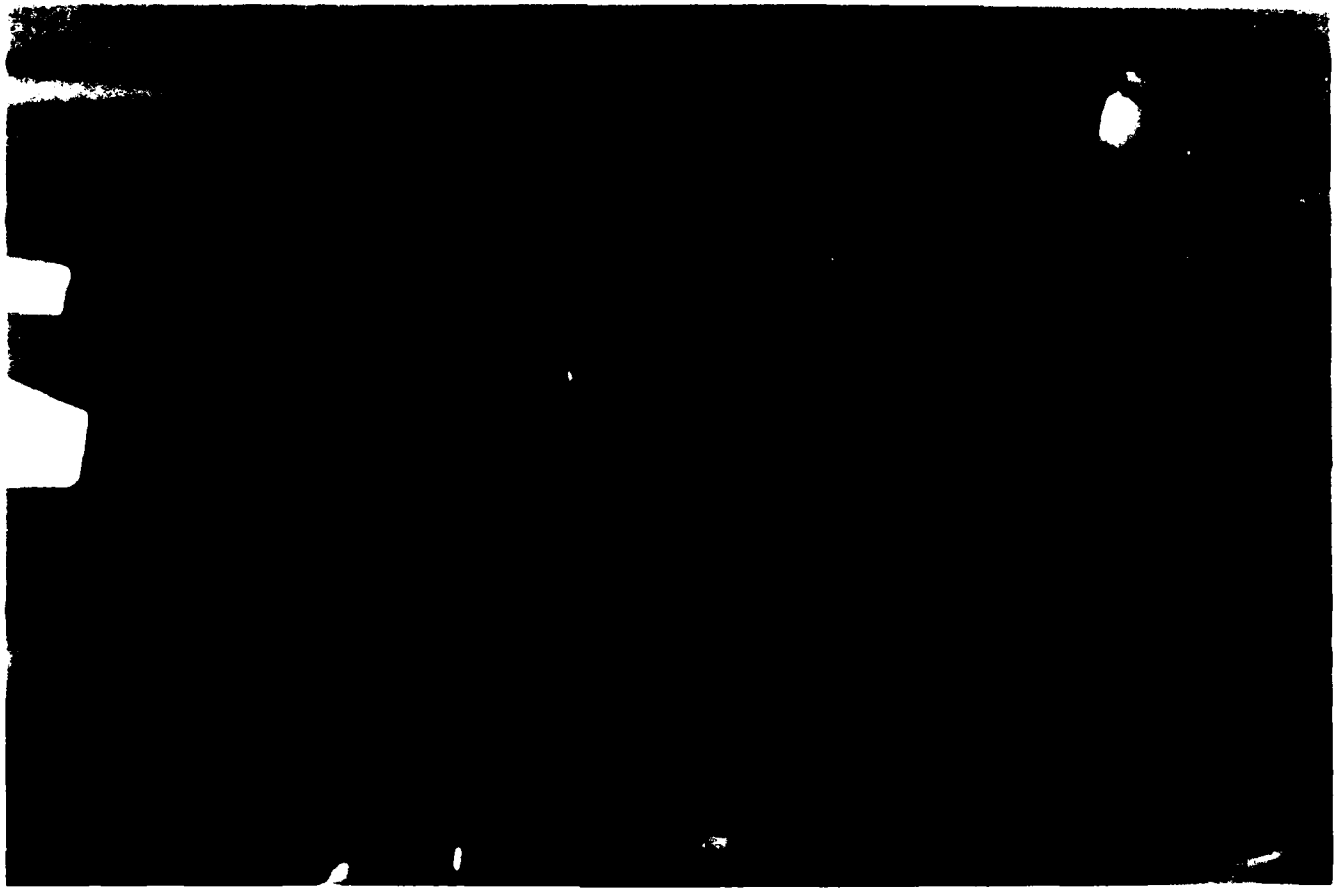


Figure 14. Fully Rustproofed Hood Web.

at 5-minute intervals. In some cases, test personnel remained inside the vehicles to observe exactly where the water was coming in.

It was determined that water enters the cab area via the door gaskets around the top of the door. As the water travels around the perimeter of the door, it gets under the gasket seat and leaks into the cab at the bottom of the door, where it collects on the cab floor near the door sill. This leakage is the result of a defective or improperly fitted gasket. In some of the test vehicles, the gasket did not appear to be installed with adhesive and could be easily pulled away from the cab door frame (see Figure 16).

Water also enters the inner door panel via the door glass. Water runs down the outside of the glass into the inside of the door panel and enters the cab along the lower edge of the interior vinyl trim panel, as shown in Figure 17. This is apparently caused by improper positioning of the water deflector inside the door panel. Instead of diverting the water toward the outside of the door panel, the deflector is allowing the water to run along the inside of the panel and leak through at the bottom edge of the vinyl trim panel. In addition, the vent windows do not fit correctly, allowing water to enter the cab (see Figure 18).

During the water leakage test, several holes were observed in each vehicle located in the area where the door hinges are mounted to the cab body, as shown in Figure 19. Some of these holes were taped over; others were not covered in any way. Water which flows down the door jam in this area can enter these holes and flow to the bottom of the inside lower cab panel. Here the water may enter the cab or else collect inside the lower edge of the cab panel near the door sill and lower door hinge, where it can cause premature rusting. There was no rustproofing in the area of the holes in the door jam.

On these six test vehicles, as on almost all of the vehicles surveyed, the fiber mat underneath the rubber floor mat was soggy and beginning to rot. This fiber mat serves as a sponge and soaks up any water that collects on the cab floor. There is very little chance for the mat to dry out under normal use, and consequently, the cab floor pan is constantly wet and soon begins to rust. Figure 20 shows a typical floor pan and mat. Note that the access hole for the cab floor mounting bolts is not covered (plugged) as it should be. Figure 21 shows a vehicle floor pan following the natural rainfall.

While conducting the water leak test at Letterkenny Depot, it was noted that vehicles being prepared for shipment to field units are steam cleaned and then painted. Any surface rust on the vehicle is painted over; no attempt is made to remove the rust. This practice does not appear to be in the best interests of the Army, since the already-rusted areas will continue to rust, and the rust will soon surface right through the paint. If the depot is going to expend time and effort to prepare vehicles for shipment, then they should at least wire-brush the rusted areas so the paint will adhere properly and slow the formation of additional rust.

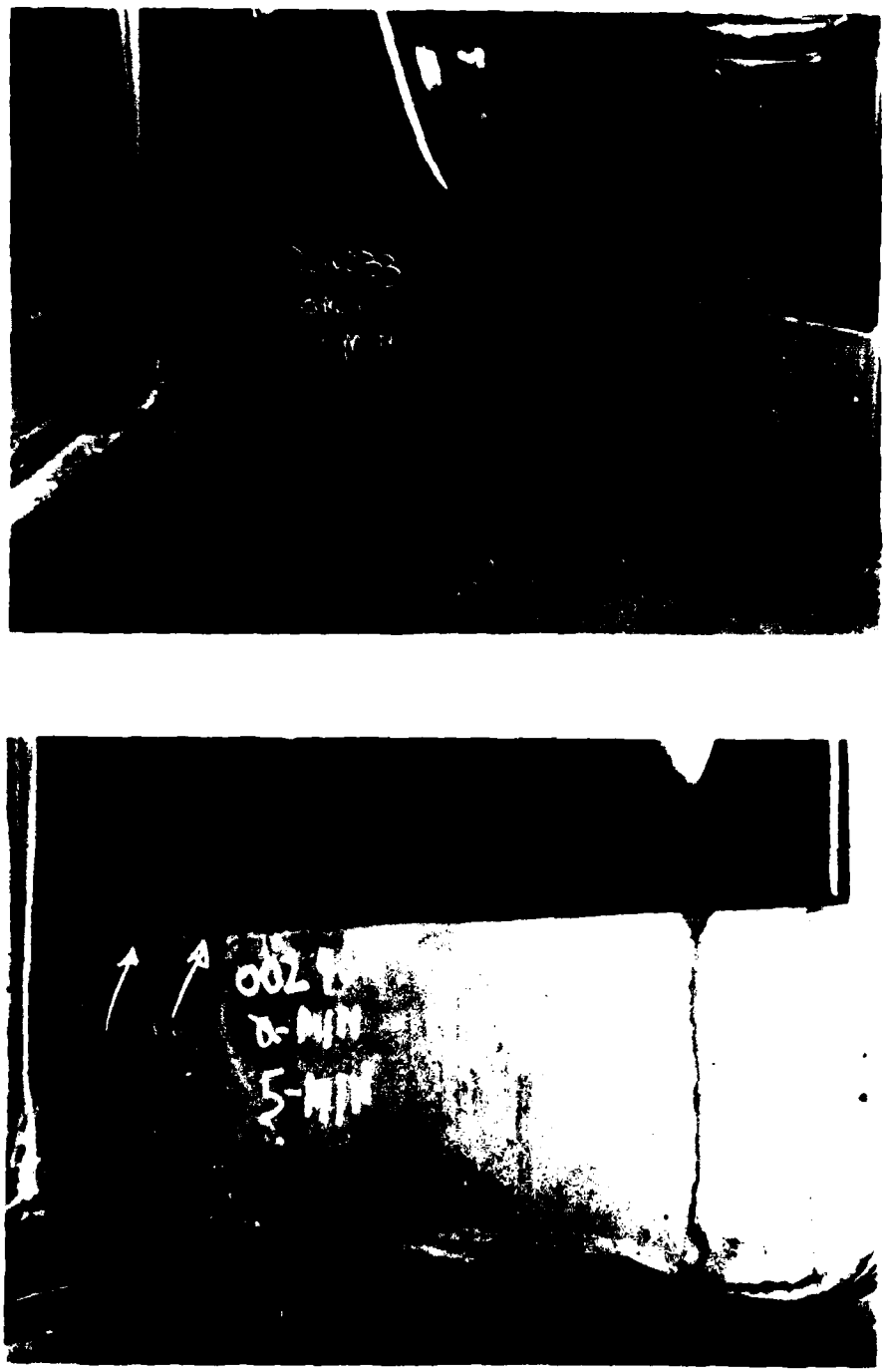


Figure 17. Water Leakage Below Vinyl Trim Panel.

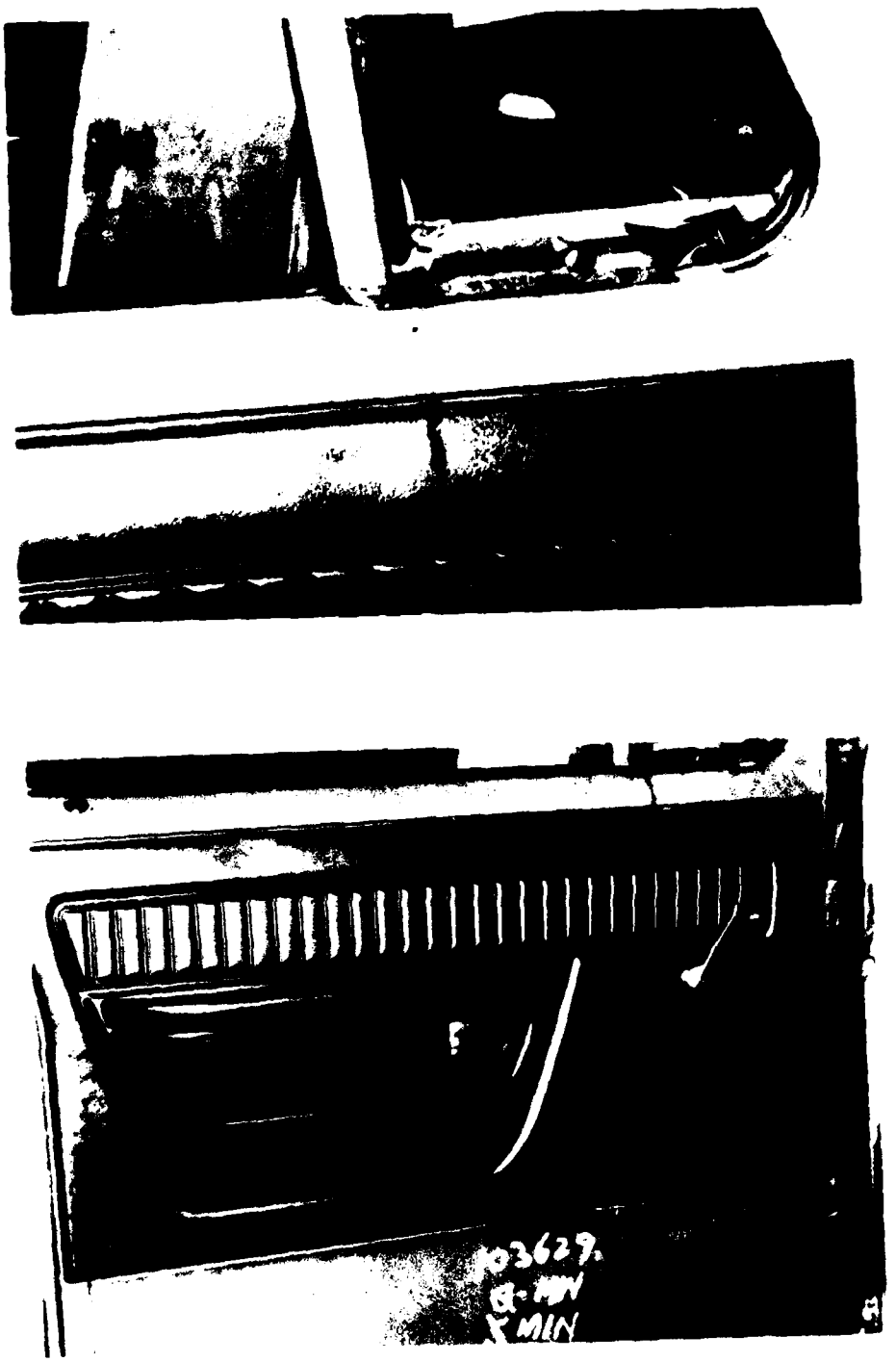


Figure 18. Water Leakage Around Vent Window.

Figure 19. Holes in Cab Door Mounting Area.

7. CONCLUSIONS

7.1 Assessment of Rust Damage.

There is a significant problem with rust in the M880 series fleet It is especially serious in Hawaii and it will get progressively worse unless some corrective actions are taken immediately. Table 8 summarizes the data presented earlier in the report for the vehicles excluding LEAD, and shows that 87 percent of the vehicles surveyed had wet floor mats and 56 percent had rusted floor pans. If only those vehicles manufactured during 1977 are considered (less than 30 months old), 90 percent have wet mats and 63 percent have rusted floor pans. In the majority of these vehicles, the fiber floor mat has already begun to deteriorate and rot. Since this soggy mat is in constant contact with the floor pan it is causing a serious rust problem there, which will result in the floor pan rusting through. When this occurs, the vehicle cannot be driven until the floor pan is repaired.

In the other areas of the vehicle, considering only those conditions of Moderate, Heavy, or Perforated rust, there are serious problems in the firewall gutter (35 percent of the sample) and the fenders (17 percent). In most vehicles, there was standing water in the firewall gutter, which is creating the rust observed even though the gutter has been rustproofed. If this situation continues, the gutter seam will rust through and allow water to enter the cab area underneath the upper part of the floor mat.

7.2 Rustproofing.

Rustproofing of the M880 fleet was not thoroughly done. More than 75 percent of the vehicles examined had no rustproofing under the hood reinforcement web, and approximately 13 percent were not rustproofed under the fenders, cargo bed, or cab floor. Furthermore, although this survey did not examine hidden areas, it is reasonable to assume that some of these areas were not completely rustproofed, based on the condition of the hood web.

This lack of adequate rustproofing may be the result of poor workmanship or failure of the manufacturer to properly inspect the vehicles after rustproofing. In either case, some action is required to improve the rustproofing treatment and prevent further damage. This is especially necessary if the vehicles are used in areas having a salt-air environment or in areas where salt is used extensively during the winter on the highways.

7.3 Water Leakage.

Water is entering the cab around the door gaskets and through the inner door panel via the glass, because the deflector inside the door panel is not positioned correctly. There is also evidence that water may be coming into the cab through miscellaneous holes located where the door hinges are mounted to the cab body.

TABLE 8 SEVERITY OF RUST SUMMARY

	ALL W/O LEAD	0-2500 MI. W/O LEAD	<30 MO. OLD W/O LEAD	LEAD ONLY
SAMPLE SIZE	63.6*	34.0	18.6	36.4
FLOOR MAT WET	87**	82**	90**	33**
FLOOR PAN RUSTED	56	49	63	13
TAILGATE RUSTED	17	14	13	1
CARGO BED RUST (MODERATE, HEAVY OR PERFORATED)	8	5	2	0
FENDER RUST (MODERATE, HEAVY OR PERFORATED)	17	21	0	0
FIREWALL GUTTER RUST (MODERATE, HEAVY OR PERFORATED)	35	34	16	7

*Percent of total sample.
**Percent of vehicles in this column.

8. RECOMMENDATIONS

To improve the condition of the vehicles still in depot storage and those already issued to field units, the following actions are recommended:

(1) For vehicles in the depots, DESCOM should:

a. Remove and discard all fiber and rubber floor mats.
b. Repair and repaint rusted cab floor pans.
c. Repair or replace defective door gaskets and inner door panel water deflectors, and plug miscellaneous holes in the door hinge mounting area.

(2) For all vehicles in the field, maintenance units should take the actions outlined in paragraph 8(1) above. Additional guidance for accomplishing these tasks can be found in PS Magazine, September 1978, pp. 38-41 (see Appendix B).

(3) Those vehicles that are in use where there is a salt-air environment or where salt is used extensively during the winter on the roads should be re-rustproofed. This can be accomplished either by unit maintenance personnel or by a commercial rustproofing contractor in the local area.

APPENDIX A

DATA COLLECTION FORM

RUST SURVEY OF M880 SERIES TRUCKS

1. Location_____ 2. Unit_____

3. Vehicle Ser. No._____ 4. Type (M880, 881, etc.)_____

5. Date of mfg._____ 6. Mileage_____

7. Floor mat underside wet or damp: ____ Yes ____ No ____ Missing

8. Cab assembly hole cap plugs (under floor mat):

   Driver side: _____ In place _____ Missing

   Pass. side: _____ In place _____ Missing

9. Floor pan paint: _____ OK _____ Blistered/scaled

10. Floor pan condition: _____ Dry _____ Wet _____ Rusted

11. Shift lever boot in place: _____ Yes _____ No _____ Missing

12. Side vent glass gasket fitted correctly: _____ Yes _____ No

13. Side vent glass latch operates correctly: _____ Yes _____ No

14. Water inside any turn signal lenses: _____ Yes _____ No

15. Any medallion-hole plastic plugs missing:

    _____ Yes _____ No _____ Holes rusted

16. Tailgate seam welds separated: _____ Yes _____ No _____ Rusted

17. Door sills - water/moisture along underside:

    _____ Yes _____ No _____ Rusted

18. Cargo compartment:

    Standing water _____ Yes _____ No

    Skip weld drains clear _____ Yes _____ No

    Any additional drain holes drilled _____ Yes _____ No

    Rust condition of cargo bed

    _____ None _____ Heavy
    _____ Slight _____ Perforated
    _____ Moderate

19. Standing water or rust on surface of hood: _____ Yes _____ No

AMSAA FORM 18-R, 29 Mar 79 (One-Time)

20. Front fenders rust condition:

Driver side	Passenger side
_____ None	_____ None
_____ Slight	_____ Slight
_____ Moderate	_____ Moderate
_____ Heavy	_____ Heavy
_____ Perforated	_____ Perforated

21. Air intake plenum rust condition:

_____ None _____ Moderate _____ Perforated
_____ Slight _____ Heavy

NOTE: RAISE THE VEHICLE HOOD TO ANSWER ITEMS 22, 23, 24, and 25.

22. Firewall gutter seam rust condition:

_____ None _____ Moderate _____ Perforated
_____ Slight _____ Heavy

23. Fender-firewall-plenum junction rust condition:

_____ None _____ Moderate _____ Perforated
_____ Slight _____ Heavy

24. Rustproofing applied under hood reinforcement webs: ___ Yes ___ No
(Look for overspray or leaking from under webs)

25. Rustproofing applied to firewall: _____ Yes _____ No

26. Rustproofing applied to these areas:

Underside of front fenders	_____ Yes	_____ No
Underside of rear fenders	_____ Yes	_____ No
Underside of cargo compartment	_____ Yes	_____ No
Underside of cab floor	_____ Yes	_____ No

Vehicle examined by_____ Date_____

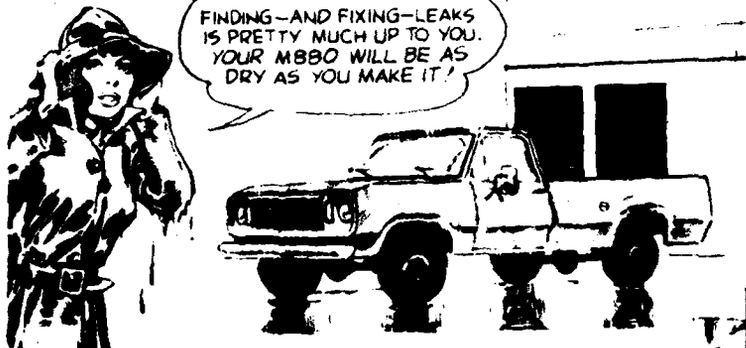
Next page is blank.

APPENDIX B

ARTICLE FROM PS MAGAZINE

M880-Series 1 1 4-Ton Trucks . . .

RAIN, RAIN, GO--AND STAY--AWAY



All of you M880 jockeys should know by now that the welcome mat's not out for you if you've got ideas of hosin' out your cab. That rubber floor mat's got a pad on the underside — and that pad soaks up water like a sponge. Then the floor rusts out.

So stick to a brush, broom or damp rag for cleaning the cab.

But even that's not enough to keep some M880's dry inside.

They leak — around the doors — at the vent windows — where the power brake booster's mounted on the firewall — between the heater and the firewall — from inside the doors.

No sweat — and no more leaks — if your truck's still covered by the warranty. Your local Dodge dealer will take care of it. All of the poop on getting manufacturer's defects f.xed under the warranty is in TB 9-2300-295-15-14 (Dec 76).

Too late? Your truck's gone by the 12-months-or 12,000-miles warranty limit? Or you're overseas, where the warranty only gives you the parts — and you do the work yourself?

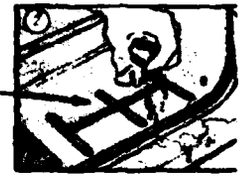
FLOOR IS VICTIM

Any water leaking into your cab winds up under the floor mat — in that sponge-like pad. And you know what happens then to the steel floor!

So, before you start fixing leaks —

Take out the floor mat. You've got to remove the step plate on each side to get the mat out. Put the mat someplace where the pad will dry — absolutely dry. Drying will take quite a while if the pad's really soaked.

Dry the floor. Use rags or compressed air — but wear goggles if you use air. Use a wire brush and sand paper where there's rust. Clean up the floor with a brush or air.



Prime the floor with primer paint, NSN 8030-00-852-8013 for 1 gallon. When the primer's dry, put on a coat of non skid paint, NSN 5610-00-141-7838. Let it dry — not a bit tacky or you'll have a mess if you ever need to take the floor mat out again.

Your own command may not want you to put the mat back in the truck. But before you toss it out, make sure that policy is in writing — or you may wind up buying the floor mat.

PS MORE

FINDING 'N' FIXING LEAKS

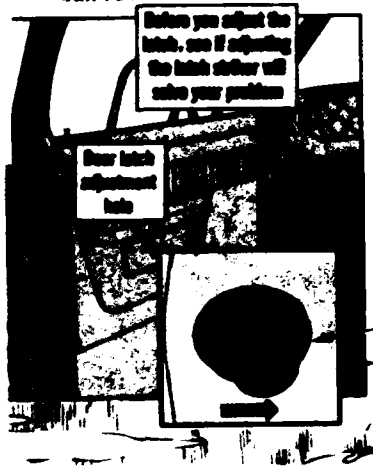
Before you put the floor mat back in, take care of those leaks!

If you don't already know where water's leaking in, get somebody to turn a hose on the outside of the cab while you watch from inside. Natch, you close the doors 'n' windows tight. You'll need a flashlight to see up behind the instrument panel and along the fire wall.

Keep a sharp eye. Leaks are tricky. Water may travel quite a way, along a wire or ledge, before you see it.

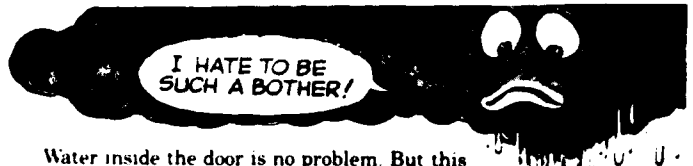
DOORS – OF COURSE

Water coming in around a door means the door need adjusting for a better fit. Or the weatherstrip is torn up. Installing a new weatherstrip is covered in para 2-116b, TM 9-2320-266-20 (Jan 76).



Adjusting the door latch or latch striker may stop leaking around the door. See page 2-82 in your -20 TM — Figures 2-106 and 2-108 and para 2-118.

If that won't do it, check out FM 43-2 (Oct 75), Metal Body Repair and Related Operations — page 77, para 89, Door Alinement.

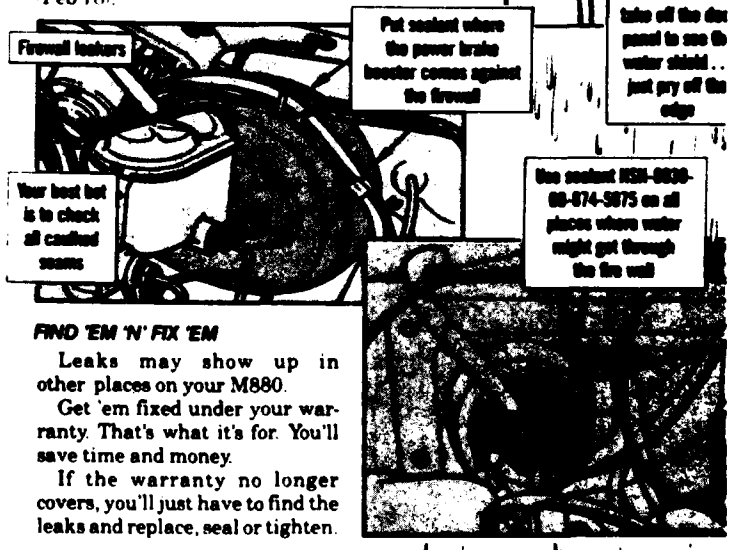


Water inside the door is no problem. But this water may be leaking into the cab — if the plastic water shield inside the door is positioned wrong. It's s'posed to shoot the water toward the outer side of the door.

If your truck's got these water shields, position 'em right. The shield's shown in your -20 TM — page 2-80, Figure 2-103, left side.

If there's no shield in the door, don't worry about it.

Another leaker in the door may be the vent wing window. The seal is special shaped — and the shape has to be just right. The fix for a leaker is a new seal. Right and left seals are listed as Item 5 on page 113 in your TM 9-2320-266-20P (Feb 78).



FIND 'EM 'N' FIX 'EM

Leaks may show up in other places on your M880.

Get 'em fixed under your warranty. That's what it's for. You'll save time and money.

If the warranty no longer covers, you'll just have to find the leaks and replace, seal or tighten.

Next page is blank.

DISTRIBUTION LIST

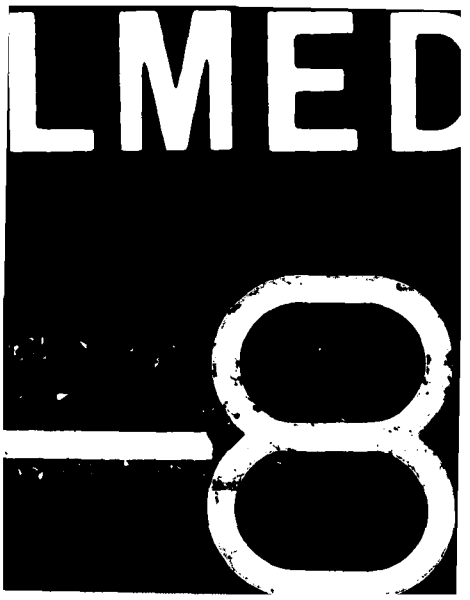
No. of Copies	Organization
12	Commander Defense Technical Information Ctr ATTN: TCA Cameron Station Alexandria, VA 22314
1	Commander US Army Materiel Development & Readiness Command ATTN: DRCDMD 5001 Eisenhower Avenue Alexandria, VA 22333
1	Commander US Army Materiel Development & Readiness Command ATTN: DRCDMR 5001 Eisenhower Avenue Alexandria, VA 222333
1	Commander US Army Materiel Development & Readiness Command ATTN: DRCPA-S 5001 Eisenhower Avenue Alexandria, VA 22333
1	Commander US Army Materiel Development & Readiness Command ATTN: DRCDE 5001 Eisenhower Avenue Alexandria, VA 22333
1	Commander US Army Materiel Development & Readiness Command ATTN: DRCRE 5001 Eisenhower Avenue Alexandria, VA 22333
1	Commander US Army Materiel Development & Readiness Command ATTN: DRCQA 5001 Eisenhower Avenue Alexandria, VA 22333
1	Commander US Army Materiel Development & Readiness Command ATTN: DRCPM 5001 Eisenhower Avenue Alexandria, VA 22333
1	Commander US Army Materiel Development & Readiness Command ATTN: DRCSA-JS 5001 Eisenhower Avenue Alexandria, VA 22333
1	Commander US Army Materiel Development & Readiness Command ATTN: DRCBSI-L 5001 Eisenhower Avenue Alexandria, VA 22333
1	Commander US Army Electronics R&D Command ATTN: DRDEL-AP-OA 2800 Powder Mill Road Adelphi, MD 20783
1	Director US Army TRADOC Systems Analysis Activity ATTN: ATAA-SL White Sands Msl Rg, NM 88002
1	Director US Army TRADOC Systems Analysis Activity ATTN: ATAA-T White Sands Msl Rg, NM 88002
1	Commander US Army Tank-Automotive Materiel Readiness Command ATTN: DRSTA-M Warren, MI 48090

DISTRIBUTION LIST- continued

No. of Copies	Organization
1	Commander US Army Tank-Automotive Materiel Readiness Command ATTN: DRSTA-F Warren, MI 48090
1	Commander US Army Tank-Automotive Materiel Readiness Command ATTN: DRSTA-Q Warren, MI 48090
1	Commander US Army Tank-Automotive Materiel Readiness Command ATTN: DRSTA-I Warren, MI 48090
1	Commander US Army Tank-Automotive Materiel Readiness Command ATTN: DRSTA-W (Mr. Doumouras) Warren, MI 48090
1	Commander US Army Tank-Automotive Materiel Readiness Command ATTN: DRSTA-GBT (Mr. Romig) Warren, MI 48090
1	Commander US Army Tank-Automotive Materiel Readiness Command ATTN: DRSTA-G Warren, MI 48090
1	Commander US Army Tank-Automotive R&D Command ATTN: DRDTA-J Warren, MI 48090
1	Commander US Army Tank-Automotive R&D Command ATTN: DRDTA-V Warren, MI 48090
1	Commander US Army Tank-Automotive R&D Command ATTN: DRDTA-UL (Tech Lib) Warren, MI 48090
2	Chief Defense Logistics Studies Information Exchange US Army Logistics Management Ctr ATTN: DRXMC-D FT Lee, VA 23801
1	Commander US Army Concepts Analysis Agency 8120 Woodmont Avenue Bethesda, MD 20014
1	Commander Letterkenny Army Depot ATTN: DRSDS-LE Chambersburg, PA 17201
1	Commander Letterkenny Army Depot ATTN: DRSDS-LA Chambersburg, PA 17201
1	Commander Letterkenny Army Depot ATTN: DRSDA-Q Chambersburg, PA 17201
1	Commander US Army Troop Support & Aviation Materiel Readiness Command ATTN: DRSTS-M 4300 Goodfellow Blvd. St. Louis, MO 63120
1	Commander US Army Troop Support & Aviation Materiel Readiness Command ATTN: DRSTS-S 4300 Goodfellow Blvd. St. Louis, MO 63120

DISTRIBUTION LIST- continued

No. of Copies	Organization
1	Commander Materiel Readiness Support Activity ATTN: DRXMD-ED (Mr. Rodden) Lexington, KY 40511
1	Reliability Analysis Center ATTN: Mr. I.L. Krulac Griffiss AFB, NY 13441
1	Commander ATTN: WR-ALC/MMETC (Mr. H. Anderson) Robins AFB, GA 31098
	Aberdeen Proving Ground, MD
1	Commander USATECOM ATTN: DRSTE-CM-R Bldg. 314
1	Director, USABRL, Bldg. 328
1	Director, USABRL ATTN: DRDAR-TSB-S (STINFO Branch) Bldg. 305
1	Director, USAHEL Bldg. 520
1	Director, MTD Bldg. 400


LMED
8