

LIMA DISASTER PREPAREDNESS REPORT

VOLUME V:

Heavy Equipment Rehabilitation and Maintenance

by

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for

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The Lima Disaster Preparedness Report has 15 sections:

- Volume I: Methodology Employed
- Volume II: Port of Callao Infrastructure Security and
Emergency Evacuation Needs
- Volume III: Electricity
- Volume IV: Water and Sewerage
- Volume V: Heavy Equipment Rehabilitation and Maintenance
- Volume VI: Airport and Aircraft Resources
- Volume VII: Education
- Volume VIII: Food
- Volume IX: Housing
- Volume X: Health
- Volume XI: International Donor Coordination
- Volume XII: Critical Abstracts from the Literature: A field
perspective on major earthquakes:

Peru, 5-31-70
Nicaragua, 12-23-72
Guatemala, 2-4-76
- Volume XIII: Review of Earthquake Prediction by Brian Brady
- Volume XIV: Other Issues
- Volume XV: Summary

FOREWORD

This is one section of a fifteen volume report concerning disaster preparedness in Lima, Peru. It was researched in Lima by a team of disaster specialists during the period July - November, 1981, for the Agency for International Development's Office of U. S. Foreign Disaster Assistance and USAID Mission in Peru. The report is supplemented by a considerable number of maps, charts and resource documents which are located in the USAID/Peru Disaster Preparedness Resource Library in Lima.

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TABLE OF CONTENTS

	<u>PAGE NOS.</u>
LIST OF CHARTS.....	1
LIST OF ACCOMPANYING VOLUMES.....	2
NOTE TO READER.....	3
EXECUTIVE SUMMARY.....	4
INTRODUCTION.....	7
DESCRIPTION OF CURRENT ORGANIZATION AND RESOURCES.....	9
INVENTORY OF KEY EQUIPMENT.....	11
REVIEW OF THE LITERATURE: THE GUATEMALA EXPERIENCE.....	21
USAID POST-DISASTER OPTIONS.....	24
LIST OF CONTACTS.....	29
 <u>APPENDICES</u>	
Appendix I -- Ing. Filippo Fiorentini Goliger: Biographical Data	33
Appendix II -- Leeowen T. ("Tex") Taylor: Biographical Data	38

LIST OF CHARTS

- CHART I -- Bulldozer Inventory by Type - SEM
- CHART II -- Front-End Loader Inventory by Type - SEM
- CHART III -- Dump-Truck Inventory by Type - SEM
- CHART IV -- Grader Inventory by Type -- SEM
- CHART V -- Age of Current SEM Fleet - Summary
- CHART VI -- Age of SEM Heavy Equipment Fleet by Type of Unit
- CHART VII -- Age of SEM Truck Fleet by Type of Unit
- CHART VIII -- Summary of SEM Inventory of Heavy Equipment and Vehicles
in Lima, Ica and Ancash
- CHART IX -- SEM Inventory of Four Types of Heavy Equipment in Lima,
Ica and Ancash

ACCOMPANYING VOLUMES

- BOOK A DOCUMENTATION: Emergency Spare Parts, Maintenance and
Equipment Procurement Program - Guatemala Disaster Relief
Program - 1976
- BOOK B INVENTORY: Heavy Equipment in Government of Peru Ministry
of Transport (SEM) - July, 1980
- BOOK C INVENTORY: Trucks in Government of Peru Ministry of
Transport (SEM) - July, 1980
- BOOK D INVENTORY: Departmental Breakdown of Government of Peru
Ministry of Transport (SEM) Heavy Equipment and Trucks
- BOOK E Spare Parts Most Frequently Required for Repair of
Principal Types and Brands of Heavy Equipment and Trucks

NOTE TO READER

This part of the overall Lima Disaster Preparedness Report consists of a principal volume, including nine charts and three appendices.

It is supported by five additional supplementary books: one provides detailed background on an emergency spare parts, maintenance and heavy equipment program conducted in Guatemala after the 1976 earthquake; three are inventories of Ministry of Transport heavy equipment, trucks, and departmental distribution of them; the final volume consists of lists of spare parts most frequently required to repair and maintain the type and brand equipment described in this report.

EXECUTIVE SUMMARY

After an earthquake of magnitude, the City of Lima could find its main roads, to the north, south and east, are blocked by landslides and mass failures; that its streets are filled with rubble; that critical city infrastructure has suffered breakdowns. Buildings which threaten life and safety will require demolition, adding to the rubble and to the demand for the heavy equipment needed to carry out these jobs. Clearing land for new resettlement areas will further tax Government and private sector tractors, bulldozers, front-end loaders, and dumptrucks.

This report describes the organization and resources of the Government of Peru's fleet of such equipment; reviews the post-disaster experience of Guatemala (1976) in this sector; and proposes some post-disaster options for international donors in the event of a major earthquake.

Management of the Government's US\$100 million equipment fleet, including its 2,000 pieces of heavy equipment distributed in 25 departments, and the 2,400 employees who are machine operators and mechanics, was, until recently, conducted by the Ministry of Transport and Communication's "SEM" office. From September, 1981, operation and maintenance of the fleet was transferred to the Dirección General de Caminos within the Ministry. Major overhaul, purchase of spare parts, and technical inspection remain with SEM.

Only about 40% of the fleet is operational at any time. The balance is either under repair or inoperable. A significant part of the fleet is concentrated in only a few manufacturers' brands, and

usually concentrated again in specific production years.

After the 1976 earthquake, the Government of Guatemala, faced with an incalculable amount of earth and rubble moving work, but a finite amount of operational equipment, adopted a program which might be useful in Peru should a similar disaster occur. In short, under a USAID grant, private sector firms were contracted to conduct emergency rehabilitation of heavy equipment which was in the repair shop or which had been considered inoperable because of lack of spare parts. Another private sector contract provided for regular weekly maintenance in the field of the equipment, to insure its continued service. Finally, a small amount was set aside for procurement of U.S. Government surplus equipment at extremely reduced prices.

Improvement of on-going maintenance programs for the Government fleet does not fall within the purview of this report. However, as a post-disaster option, a crash maintenance and rehabilitation program, such as that conducted in Guatemala, is suggested. The resumé's of two potential liaison/technical resource experts are provided.

The report contains numerous charts illustrating the composition of the Government equipment fleet by manufacturers' brand, age and location. These charts were developed by the disaster preparedness team from lengthy inventory documents, which are available in the USAID disaster preparedness resource library in Lima. At the report's conclusion, a list of contacts current at the time of the field research is provided; because of the recent organizational changes, the list may well have changed substantially in the interim.

Rubble-removal in low-income and other housing areas must be

approached with sensitivity to the salvage, psychological, land-demarcation and other needs of occupants. Policies governing such activity are discussed elsewhere.

INTRODUCTION

MANAGEMENT OF HEAVY EQUIPMENT AND TRUCKS REQUIRED TO OPEN AND REPAIR ROADS, REMOVE RUBBLE, AND PERFORM OTHER CRITICAL TASKS

After an earthquake of severe magnitude, the City of Lima could find its main roads, to the north, south and east, are blocked by landslides and mass failures; that its streets are filled with rubble which impedes emergency and mid-term recovery efforts; that critical city infrastructure -- such as the Atarjea Water Treatment Plant or the Rimac River itself -- have suffered breakdowns. Buildings which are so seriously damaged that they represent a threat to life and local security will have to be demolished, adding to the rubble and to the demand for the heavy equipment needed to carry out the job. Clearing land for possible new resettlement areas will also require much of the same equipment:

The heavy equipment capacity of many Governments is stretched to capacity during normal times with the rather simpler demands of normal road construction, maintenance, and other tasks. In order to meet the demand created by a severe disaster, a Government would examine its fleet and determine how the available units requiring relatively simple maintenance can be most quickly placed into working condition and maintained.

The purpose of this section of the report will be to describe the organization and resources of the Government of Peru's fleet of heavy equipment and trucks; to review the experience of another country, Guatemala, which found itself in approximately the same situation when it

was struck by an earthquake; to examine a program undertaken in Guatemala by USAID which yielded significant positive results; and to propose some options for post-disaster support activities in this sector which AID/Peru could consider.

DESCRIPTION OF CURRENT ORGANIZATION AND RESOURCES

Within the Government of Peru, the Servicio de Equipo Mecánico -- known commonly by its acronym, SEM -- is the agency responsible for the management of the great majority of heavy equipment and trucks owned by the Government. Its fleet, whose estimated value is US\$100 million, consists of approximately 2,000 pieces of equipment distributed in 25 departments. SEM has 2,400 employees, of which most are machine operators and about 400 are mechanics.

Until recently, SEM was responsible for a broad range of management functions in connection with this fleet: it handled operations, repair and maintenance. SEM rented its equipment to other Ministry agencies which required it. In theory, the rental income covered SEM's operating expenses. In practice, however, the Government of Peru subsidized the operation directly for up to 80% of its operating expenses.

World Bank experts suggest that SEM is spending about US\$600,000 per year on spare parts and that the balance of the budget is dedicated to other operating costs. In all, they argue that this is only about 10% of the budget actually required to maintain Peru's fleet.

In part to alleviate that problem, the World Bank has included an allocation set aside of US\$10 million for SEM of its US\$80 million omnibus package with the Ministry of Transport and Communications. Of the US\$10 million, \$4.2 million is reserved for spare parts over a two-year period.

On September 1, 1981, the organization of heavy equipment-related functions was changed: from that date, Operation and Maintenance of the fleet became the responsibility of the Dirección General de Caminos.

SEM remained with the following responsibilities:

Major overhauls

Purchase of equipment and spare parts

Technical inspections

Establishment of norms and standards

Undoubtedly, there will be changes in the management structure as well. Thus, should this report be reviewed in a future disaster, it is likely that the officials currently included in the List of Contacts has changed completely.

There is a considerable inventory of spare parts in Lima -- about 55,000 items according to one estimate. Estimates of the number of spare parts outside Lima range from 5,000 to 55,000. It has been recommended by World Bank consultants that a computerized management system be provided to SEM so that more accurate figures and detailed breakdowns can be produced.

At the moment, it takes an average piece of heavy equipment about four months to be repaired by SEM. Several pieces of equipment considered under repair, however, are virtually irreparable and no "through-put" time can be calculated for them.

After a major earthquake, some of the equipment which would be most critically required are bulldozers, front-end loaders, dump trucks, graders, compressors and cranes. This study has focused on the first four types of equipment.

SEM has a rather limited supply of fuel on hand at any time: their own tank holds 4,000 - 5,000 gallons. Thus, SEM is dependent on PETRO-PERU, the national petrol company, for fuel.

INVENTORY OF KEY EQUIPMENT

The charts which appear on the following four pages analyze the SEM fleet for four particular types of equipment:

Chart I describes the inventory of tractors. As can be seen, about 40% of SEM's 465 tractors were operational when this study was undertaken. Of these 181 operational units, about 75% were CATERPILLAR brand (CATERPILLAR comprises 62% of the total tractor fleet).

Of the CATERPILLAR tractors, 136 were operational and 115 were under repair. Of the total 251, 62 are D6C's, 24 are D7F's, and 41 are D8H's. A breakdown by age show that 70 of the total number of 251 units were purchased in 1972.

Chart II describes the inventory of front-end loaders. About 48% of the 170 loaders were operational at the time of the survey. Of these 81 operational units, about 88% were CATERPILLAR brand (CATERPILLAR comprises 68% of the total front-end loader fleet).

Of the CATERPILLAR front-end loaders, 71 were operational and 35 were under repair. Of the total 106, 64 are Model 930's and 27 are 950's, most of which were procured in 1972 and 1979.

Chart III describes the inventory of dump trucks. About 36% of the 542 trucks were operational at the time of the survey. No single brand has a majority of the number of units, but SISU and FORD are the most numerous.

Chart IV describes the inventory of graders. Forty-two percent (42%) of the units which are operational or under repair are CATERPILLAR brand. Of these 61 are 120G's procured in 1978 and 1979.

SEM NATIONAL HEAVY EQUIPMENT INVENTORY

BULLDOZERS
TRACTOR DE ARUGAS

<u>PRODUCER</u>	<u>OPERATIONAL</u>	<u>% OF ALL OPERATIONAL</u>	<u>UNDER REPAIR</u>	<u>% OF ALL UNDER REP.</u>	<u>SUBTOTAL</u>	<u>% OF ALL SUBTOTALS</u>	<u>OUT OF SERVICE</u>	<u>% OF ALL OUT</u>	<u>TOTAL</u>	<u>% OF GRAND TOTAL</u>
CATERPILLAR	136	75%	115	59%	251	67%	38	43%	289	62%
ALLIS CHALMERS	17	9%	46	23%	63	17%	21	21%	84	18%
KOMATSU	21	12%	26	13%	47	12%	14	16%	61	13%
OTHERS (TWO)	<u>7</u>	<u>4%</u>	<u>9</u>	<u>5%</u>	<u>16</u>	<u>4%</u>	<u>15</u>	<u>17%</u>	<u>31</u>	<u>7%</u>
TOTAL	181	100%	196	100%	377	100%	88	100%	465	100%
% OF GRAND TOTAL	39%		42%		81%		19%		100%	

(12)

CATERPILLAR BULLDOZERS

CATERPILLAR
Breakdowns

(Three types account for 72% of units under repair).

<u>Type</u>	<u>Operational</u>	<u>Under Repair</u>		<u>Ops.</u>	<u>Repair</u>
D4	2	5	→ D6C	0	1
D4D	0	1	1963	3	1
D5	1	0	1965	5	7
D6B	2	7	1966	1	0
D6C	30	32	1970	0	4
D6D	47	6	1971	21	19
D7	0	1	1972	30	32
D7E	1	9	TOTAL		
D7F	9	15	→ D7F	0	5
D7G	24	1	1971	9	10
D8H	5	36	1972	9	15
D8K	15	2	TOTAL	9	15
TOTAL	136	115	→ D8H	4	24
			1966	0	2
			1971	1	10
			1972	5	36
			TOTAL		

SOURCE: Situación del Equipo Mecánico - SEM (MAQUINAS)
Lima, Julio de 1980
Pages 58 & 59 (attached) and 60/70 (not attached).

SEM NATIONAL HEAVY EQUIPMENT INVENTORY

FRONT-END LOADERS
CARGADORES FRONTALES

<u>PRODUCER</u>	<u>OPERATIONAL</u>	<u>% OF ALL OPERATIONAL</u>	<u>UNDER REPAIR</u>	<u>% OF ALL UNDER REP.</u>	<u>SUBTOTAL</u>	<u>% OF ALL SUBTOTALS</u>	<u>OUT OF SERVICE</u>	<u>% OF ALL OUT</u>	<u>TOTAL</u>	<u>% OF GRAND TOTAL</u>
CATERPILLAR	71	88%	35	56%	106	73%	10	38%	116	68%
ALLIS CHALMERS	0	0%	11	17%	11	8%	5	19%	16	9%
JOHN DEERE	8	10%	2	3%	10	7%	0	0%	10	6%
OTHERS (FIVE)	<u>2</u>	<u>2%</u>	<u>15</u>	<u>24%</u>	<u>17</u>	<u>12%</u>	<u>11</u>	<u>42%</u>	<u>28</u>	<u>17%</u>
TOTAL	81	100%	63	100%	144	100%	26	100%	170	100%
% OF GRAND TOTAL	48%		37%		85%		15%		100%	

(13)

CATERPILLAR FRONT-END LOADERS

BREAKDOWN: CATERPILLAR FRONT-END LOADERS

<u>Type</u>	<u>Operational</u>	<u>Under Repair</u>	<u>930</u>	<u>Ops.</u>	<u>Repair</u>
922B	4	6	1972	17	6
930	53	11	1978	12	4
944A	0	3	1979	24	1
950	12	15	TOTAL	53	11
966B	<u>2</u>	<u>0</u>	950		
	81	63	1966	5	8
			1970	1	0
			1972	6	7
				<u>11</u>	<u>15</u>

SOURCE: Situación del Equipo Mecánico - SEM (MAQUINAS)
Lima, Julio de 1980
Page 003 (attached) and 4 - 7 (not attached)

SEM NATIONAL HEAVY EQUIPMENT INVENTORYDUMP-TRUCKS
CAMIONES VOLQUETE

<u>PRODUCER</u>	<u>OPERATIONAL</u>	<u>% OF ALL OPERATIONAL</u>	<u>UNDER REPAIR</u>	<u>% OF ALL UNDER REP.</u>	<u>SUBTOTAL</u>	<u>% OF ALL SUBTOTALS</u>	<u>OUT OF SERVICE</u>	<u>% OF ALL OUT</u>	<u>TOTAL</u>	<u>% OF GRAND TOTAL</u>
SISU	45	23%	69	41%	114	32%	11	6%	125	23%
HINO	39	20%	18	11%	57	16%	19	11%	76	14%
FIAT	20	10%	34	20%	54	15%	26	15%	80	15%
DODGE	27	14%	11	6%	38	10%	18	10%	56	10%
FORD	23	12%	14	8%	37	10%	59	33%	96	18%
OTHERS (NINE)	39	20%	24	14%	63	17%	46	25%	109	20%
(14) TOTAL	193	100%	170	100%	363	100%	179	100%	542	100%
) % OF GRAND TOTAL	36%		31%		87%		33%		100%	

<u>SISU</u>	<u>Operational</u>	<u>Repair</u>	<u>Breakdown: SISU</u>		
LE137	34	42	→ LE137	Ops	Repair
LE139	11	27	1972	16	11
TOTAL	45	69	1973	18	31
			TOTAL	34	42

SOURCE: Situación del Equipo Mecánico - SEM (VEHICULOS)
Lima, Julio de 1980
Pages 25 & 26 (attached) and 27 - 38 (not attached)

FORD (In Brief):
Newest Unit: 1968, most 1963

DODGE (In Brief):
Newest Unit: 1972, most 1964

Chart IV

SEM NATIONAL HEAVY EQUIPMENT INVENTORY

GRADERS
MOTONIVELADORAS

<u>PRODUCER</u>	<u>OPERATIONAL</u>	<u>% OF ALL OPERATIONAL</u>	<u>UNDER REPAIR</u>	<u>% OF ALL UNDER REP.</u>	<u>SUBTOTAL</u>	<u>% OF ALL SUBTOTALS</u>	<u>OUT OF SERVICE</u>	<u>% OF ALL OUT</u>	<u>TOTAL</u>	<u>% OF GRAND TOTAL</u>
CATERPILLAR	80	66%	25	19%	105	42%	7	13%	112	37%
ALLIS-CHALMERS	8	7%	16	12%	24	10%	3	6%	27	9%
ADAMS-LETOURNEAU	0	0%	15	12%	15	6%	16	30%	31	10%
LOKOMO	11	9%	61	47%	72	29%	12	23%	84	28%
OTHERS (FIVE)	21	17%	13	10%	34	13%	15	28%	50	16%
TOTAL	121	100%	130	100%	251	100%	53	100%	304	100%
% OF GRAND TOTAL	40%		43%		83%		17%		100%	

(15) CATERPILLAR GRADERS

<u>Type</u>	<u>Operational</u>	<u>Under Repair</u>
12E	2	3
112E	15	13 (Almost all 1963)
14E	5	6
120G	58	3 (All 1978/1979)

SOURCE: Situación del Equipo Mecánico - SEM (MAQUINAS)
Lima, Julio de 1980
Page 22 (attached) and 23 - 29 (not attached)

LOKOMO GRADERS

AH122	7	55 (All 1973/1974)
AH145	1	2
AH121	3	4

The charts which follow on the next three pages illustrate the age of the fleet. Chart V is a summary analysis, while Charts VI and VII provide greater detail.

What becomes clear is that a significant part of the SEM fleet is of CATERPILLAR manufacture, predominantly of certain years. This type of concentration could permit an efficient crash maintenance effort -- described later in this report -- to be conducted after a disaster.

The Peruvian Army has also reported a significant amount of heavy equipment, in particular:

about 90 D6 and D7 tractors, predominantly CATERPILLAR

about 20 front-end loaders, predominantly CATERPILLAR

The Army reports that about 60% of this equipment is operational at any time. However, cross-checks between this data and the SEM inventories tend to suggest that these units may be carried on both inventories at the same time. This is something which will clarify itself in the moment of an emergency but needs to be taken into consideration as well.

The Army also reports that it possesses about 500 trucks, a significant transport capability which could be used to support recovery efforts after a disaster. It seems doubtful that this particular equipment would be carried on the SEM inventories as well.

Some Areas Requiring Strengthening in the Maintenance Approach

In an observation related to the normal maintenance of SEM equipment, one USAID official suggested that significant improvements could be made.

He cited the example of tractor maintenance: at present SEM lacks the equipment in the field to remove and reverse track pins. As a

SEM NATIONAL HEAVY EQUIPMENT INVENTORY

AGE OF CURRENT FLEET

<u>Year</u>	<u>Heavy Equipment*</u>	<u>Trucks/Vehicles*</u>
1963	9%	12%
1964	7%	15%
1966	19%	12%
1967	15%	22%
1972	9%	10%
1973		6%
1978	8%	
1979	11%	
	<hr/>	<hr/>
	78%	77%

Sources

Situación Inventarial de Máquinas A Nivel Nacional
Situación Inventarial de Vehículos A Nivel Nacional
 SEM (Renardet Team/World Bank), July, 1980, Detailed Back-Up Charts Attached

* As percentages of total fleet in each category. Year selected are those when principal acquisitions were made.

result, each pin can be used for only about 1,000 hours (cost: US\$4 per hour) instead of 2,000 hours (cost: US\$2 per hour), he argues. Compressors required to regularly clean out air filters are also not available, which aggravates all maintenance problems.

With proper maintenance, the official asserted, road maintenance costs could be reduced by 50%. To this end, stress in the normal program would be laid on the provision of tool trucks, lubricating trucks, and other mobile maintenance equipment, together with a regional approach to the issue. The World Bank is assisting in the establishment of one regional maintenance center at Huanaco; the Government of Peru has reportedly budgeted US\$1 million for the establishment of a second at Terrapoto. The current maintenance center in Lima reportedly needs to be upgraded, and four additional rural regional centers are recommended, in Arequipa, Cuzco, Ica and Chiclayo.

Such a program would, without doubt, assist the Government of Peru in strengthening its capacity to deal with a severe disaster in Lima or elsewhere in the country.

REVIEW OF THE LITERATURE: THE GUATEMALA EXPERIENCE

Little or no reference to this type of activity is made in the literature about disasters in the region. However, from the files of the USAID offices in Guatemala, a number of documents describing a program undertaken there after the 1976 earthquake provide some possible guidance in the event of such an occurrence in Peru.

One of the chief tasks facing the Government of Guatemala at that time was re-opening, repairing and maintaining the rural road network in the Highlands which had been largely closed for the first few days, and then provisionally opened but needing repair for some time thereafter. The demands on the Government for rubble-removal and other heavy equipment were enormous. Like Peru, the Guatemalan Government has a significant amount of non-operational equipment.

From a special disaster-related Congressional appropriation, US\$2 million were dedicated to assisting the Government of Guatemala to strengthen its capability to conduct the work. Under the grant, three specific tasks were undertaken:

(a) Two private firms (MAYATRAC and TECUN) were contracted, at a cost of about \$435,000, to repair equipment of the Ministry of Public works and Communications.

(b) About US\$1.3 million of the grant was spent to procure U.S. Government surplus property, front-end loaders and other equipment.

(c) About \$350,000 was appropriated for a heavy equipment field maintenance program designed to keep the equipment rehabilitated or purchased under (a) and (b), above, in good working condition. Mobile private contractor field teams performed these tasks.

Finally, a small amount of money was used to procure the services of a maintenance/spare part/repair expert from the United States who provided technical assistance and helped to coordinate the overall effort.

The Government of Guatemala and the AID Mission were highly satisfied with the results of the program. The USAID Auditor General shared their enthusiasm, particularly for aspects (a) and (c) above. The audit report called into question, however, the appropriateness of the purchase of the U.S. Government surplus equipment using disaster relief funds; that is, the purchase was not questioned, but the appropriateness of the use of those particular funds was raised as an issue.

Balanced with that criticism, it should be noted that the entire program, including the procurement component, enabled the Government of Guatemala to multiply and accelerate its recovery efforts many times and at very little cost. For example:

"(There is) approximately \$118,000 invested in the Clark (-Michigan) Loaders, or about \$10,000 per unit (the new acquisition cost is \$87,500 each)."*

Because of the volume of materials obtained through the courtesy of USAID/Guatemala Mission (and in particular Ing. Carlos Crowe, formerly AID/Guatemala Mission Engineer), it has been collected and indexed in a separate volume, Book A, accompanying this report. This compendium includes:

- the Country Agreement/Project Description
- Job Descriptions for all Participating Agencies

* See Evaluation Report, Annex D, Book A accompanying this report.

-- A list of equipment repaired and procured under the program, with costs, specifications, etc.

-- A Project Evaluation, prepared by the heavy equipment management expert. This report covers all aspects of the program, including the results of field inspections.

USAID DISASTER-RELATED OPTIONS

Because the scope of the type of on-going maintenance program required by the Ministry of Transport so transcends the needs and value of such a program with respect to disaster preparedness, it is not included in this report as a specific recommendation, despite its significant developmental desirability.

However, the conduct of a program similar to the Guatemala model could provide an opportunity for effective post-disaster inputs. . In Guatemala, USAID's small "leveraged" investment yielded about ten times the value in functioning equipment, and this performance could be repeated.

There is no need to purchase new equipment in order to assist the Government in its recovery effort. An intensive maintenance, rehabilitation and spare part procurement effort would be a better investment. This view is shared by both the USAID and World Bank experts consulted in the course of this survey.

SEM has heavy equipment and trucks closeby Lima (for example, in Ica and Ancash) and in more remote locations which could provide heavy equipment support to the Capital in case of need. Charts VIII and IX provide a digest of heavy equipment located in these areas closest to the City.

Such a program, adapted in Peru's needs, might include some or combinations of the following components:

(a) Rehabilitation of Down Equipment: SEM has an excellent staff of mechanics who, in the view of one observer, "do miracles with what they have to work with". However, SEM's performance in terms of

CHART VIII

SEM NATIONAL VEHICLE AND HEAVY EQUIPMENT INVENTORY

OPERATIONAL/REPARABLE EQUIPMENT
ASSIGNED TO DEPARTMENTAL OFFICES

<u>Type of Equipment</u>	<u>Lima</u>	<u>Ica</u>	<u>Ancash</u>	<u>Total</u>
<u>Bulldozers</u>				
CATERPILLAR	7	1	6	14
KOMATSU	10	6	1	17
ALLIS-CHALMERS	4	1	-	5
TOTAL	<u>21</u>	<u>8</u>	<u>7</u>	<u>36</u>
<u>Front-End Loaders</u>				
CATERPILLAR	1	4	4	9
ALLIS-CHALMERS	3	1	1	5
KOMATSU	1	-	-	1
	<u>5</u>	<u>5</u>	<u>5</u>	<u>15</u>
<u>Dump-Trucks</u>				
HINO	9	0	1	10
DODGE	2	4	-	6
SISU	4	0	3	7
FIAT	2	3	6	11
FORD	2	-	-	2
OTHERS	2	4	2	8
	<u>21</u>	<u>11</u>	<u>12</u>	<u>44</u>
<u>Graders</u>				
CATERPILLAR	4	1	3	8
ALLIS-CHALMERS	2	0	1	3
LOKOMO	6	2	3	11
ADAMS-LETOURNEAU	3	1	-	4
KOMATSU	1	-	-	1
OTHERS	-	3	-	3
	<u>16</u>	<u>7</u>	<u>7</u>	<u>30</u>
Total Vehicles of All Kinds	45	21	20	86
Total Heavy Equip. All Kinds (includes four listed above and all others)	79	37	21	137

Inventory Value (GRAND TOTAL) S/365 million S/112 million S/226 million = S/703 mill

Source: Situación del Equipo Mecánico
SEM - Julio de 1980
Departmental Breakdowns

CHART IX

PARTIAL ANALYSIS: DISTRIBUTION OF SEM VEHICLES AND HEAVY EQUIPMENT

<u>Type of Equipment</u>	<u>Ancash</u>	<u>Ica</u>	<u>Lima</u>	<u>Total</u>	<u>% of National Inventory</u>	<u>National Inventory</u>
Vehicles	20	21	45	86	15%	582
Heavy Equipment	<u>31</u>	<u>27</u>	<u>79</u>	<u>137</u>	<u>15%</u>	<u>926</u>
TOTAL	51	48	124	223	15%	1,508

Source: Situación del Equipo Mecánico - SEM
Lima, Julio de 1980
By Departmental Office

Note: 80% of equipment on the SEM inventory is assigned to SEM Departmental Offices. An additional 20% is distributed in different ways: to special projects, milita projects, etc.

through-put time has not been as good as it desired. The private sector -- including some of the major dealers in Lima -- have a capacity to organize and manage such an effort. The names of some private sector dealers (including the CATERPILLAR representative) are included in the List of Contacts.

(b) Mobile or Stationary Maintenance Units Contracts for periodic maintenance services, to insure that functioning and rehabilitated equipment incur the least possible breakdowns would be another valuable service which could be rendered with disaster funds.

(c) For both of the foregoing programs, spare parts would be required. The cost-benefit of procurement of these parts in the United States, whether or not they are available through the local dealer, should be explored. Parts in stock have duty-paid on them already, and dealing with customs authorities in Lima at present is complex at the best of times. Whether procured in the U.S. or Lima, independent monitoring and expertise should closely monitor purchase procedures, prices, and other such processes.

(d) To conduct such a program, USAID should definitely contract the services of a heavy equipment management expert as a technical resource. Such a person could assist in program development, supervision, technical assistance and careful scrutiny and monitoring of procurement efforts.

Two such individuals are known to the authors of this study, and this list is hardly exhaustive. They are:

(1) Ing. Filippo Fiorentini Goliger, a former World Bank consultant. He is currently residing in Lima, working in the private sector. He has had direct, extensive working experience with SEM. He

knows the organization "inside-out" and would be an ideal liaison or technical resource. The fact that he is residing in Lima offers added advantages.

(2) Ing. Leeowen T. ("Tex") Taylor, an independent consultant in equipment management, was originally recommended to USAID/Peru by USAID/Washington's Office of Engineering. His performance on a previous AID contract with SEM was rated as excellent. He is a seasoned veteran who is familiar with USAID practices and procedures as well.

It would not be difficult to find a high-quality veteran manager, should a donor choose to pursue this. Resumes for both identified experts are included as Appendices I and II to this volume.

From a logistical standpoint, tightest control must be maintained at airports and ports for parts arriving by air or sea. These should be provided immediate customs release by the Government of Peru as a condition of entering into such a program (more detail on these procedures will be presented elsewhere in this report) and should be directly turned over and signed for by the appropriate agency -- SEM, the private contractor, the expert consultant, or whoever will be responsible for accountability of the items.

LIST OF CONTACTS

SERVICIO DE EQUIPO MECANICO (SEM), MINISTRY OF TRANSPORT

Ing. José Argaluz La Torre
Director Encargado del SEM
Avenida Tupuc Amaru 1596
(ca. Universidad Nacional de Ingeniería)
Distrito de Rímac
Lima
Teléfono: 813984

Ing. Andrés Barrientos Rayme
Jefe Interino
División de Operaciones
Same as above address
Teléfono: 812889

Ing. Orlando Salhuana
Encargado
Taller Central de Lima
Avenida Próceres 1098
Distrito de Rímac
Teléfono: 812325
810330

Ing. Alberto Cavassa Arias
Jefe, Unidad de Inspectoría
Avenida Tupuc Amaru 1596
(ca. Universidad Nacional de Ingeniería)
Distrito de Rímac
Lima
Teléfono: 810420

General Telephone Number for SEM: 810420

Ing. Jorge Orozco Ramos
Jefe, Unidad de Normas Técnicas
(Responsible for specifications)
Same as above address
Teléfono: 812889

LIST OF CONTACTS (continued)

TECHNICAL ASSISTANCE EXPERTS

Ing. Filippo Fiorentini Goliger
IMPRESIT DEL PACIFICO S.A.
Avenida Navarrete 672
Lima

Teléfono: 606360
[REDACTED]

Leeowen T. ("Tex") Taylor
13005 Stoney Brook Drive
Reno
Nevada 89511

Telephone: (702) 825-6220

Owen S. Beckner
Address available from
Francis J. Kenefeck, USAID/Washington

MAJOR PRIVATE SECTOR REPRESENTATIVE FIRMS

CATERPILLAR Enrique Ferreyros y Compañía, S.A.
Avenida Industrial 675
Lima
Telephone: 523070

ALLIS-CHALMERS FIAT-ALLIS/EMPECO, S.A.
FIAT 203 Omega
Lima
Telephone: 510920

JOHN DEERE Comercial Peruana, S.A. (CIPSA)
MASSEY FERGUSON 1928 Avenida N. de Ayllón.
Lima
Telephone: 313070

LIST OF CONTACTS (continued)

VOLVO

VOLVO Distribuidora, S.A.
Kilómetro 16.5
Panamericana Norte
Lima
Telephone: 238003

SCANIA VABIS

SCANIA-VABIS DEL PERU, S.A.
Avenida República de Panamá 4679
Casilla 3190
Surquillo
Lima
Telephone: 459190

APPENDICES

APPENDIX I

Biographical Data: Ing. Filippo Florentini

CURRICULUM VITAE

NAME : FILIPPO FIORENTINI



NATIONALITY : ITALIAN

LANGUAGES : Italian, English, French and Spanish.

UNIVERSITY DEGREE : Mechanical Engineer, Univ. of Rome, 1974.

POST UNIVERSITY STUDIES : Civil Engineering at Univ. of Milan, 1976

TRAINING COURSES :

- Earthmoving Equipment Production
Caterpillar (Málaga - Spain - 1977)
- Field Application Study
Wabco (Peoria - U.S. - 1978)
- Manufacturing Procedures
Volvo - BM (Eskiltuna - Sweden - 1978)
- Manufacturing Procedures
Ruston - Bucyrus (Lincoln - U.K. - 1979)
- Earthmoving Techniques
Fiat Allis (Palombara - Italy - 1979)
- Manufacturing Procedures
International Harvester (Chicago -
Fort Wayne, Moline - U.S.A - 1978).

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- Earthmoving Production Estimate
John Deere (Moline, Phoenix - U.S. - 1979)
- Crushers Design
Loro Parisini (Milan - Italy - 1979)

WORKING EXPERIENCE :

1966 - 75

ING° F. FIORENTINI S.P.A.
Via F. Fiorentini, 7 - Rome - Italy
Main Manufacturer of Heavy Construction
Equipment, such as:

- Crawler Front Shovels Up to 2 Cu.M.
- Mobile Cranes Up to 35 Tons capacity
- Crushing and Screening Plants
DEALER OF: International Harvester
Pay - Line Division,
Michigan, Ruston Bucyrus,
Dragon, Manitowac y others

Mr. Filippo Fiorentini has received train
ing in differents areas, such as:

- Workshop
- Purchasing Department
- Designing Department
- Sales Department.

1976 - 79

ITALCONSULT SPA
Via Giorgione 163 - Rome - Italy
(35)

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Designing - Engineering - Consulting
Contracting

Mr. Fiorentini has been appointed -
Equipment Engineer responsible for :

- Estimating Equipment Needs
- Purchasing Planning
- Site Preparing
- Mechanics selection
- Workshop and Warehouse Organization
- Cost Control Supervision
- Market Surveys (In Irak, Algeria, Lybia
Senegal, U.S.A., Peru, etc.)

During that period he was connected with -
the execution and construction of the fo-
llowing:

- Road Network (Lybia)
- Land Reclamation (Lybia)
- Chemical Plants (Algeria)
- Hotels (Irak, Lybia)
- Projects concerning various Water Systems,
(Caribe, Saudi Arabia, Senegal)

1980 : THE AUSTIN CO.

Cleveland (U.S.A.)
Regional Sales Planner (Italy)

(36)

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1981 : - BERNARDET S.A.

8, Bd.G. Favon - Geneve (S/WI)

Team Leader of the Technical Assistance -
Program to the Ministry of Transportation
of Peru.

This Program concerns the World Bank loan
to the Peruvian Government, consisting al
so of Technical Support to improve and or
ganize the maintenance of the entire Road
System of this country.

ACTUAL SALARY : - . 45,000 \$ U.S. p.a. (Net).

APPENDIX II

Biographical Data: Leeowen T. ("TEX") Taylor

1. LAST NAME, FIRST NAME, MIDDLE INITIAL
 Mr. Mrs. Miss Taylor, Leeowen T.
 RESIDENCE (Include Zip Code)
 [REDACTED]
 PHONE NO. (Include Area Code)
 [REDACTED]
 10. MARITAL STATUS: Married Single
 Other (Specify)
 [REDACTED]
 12. COUNTRY OF BIRTH (If non-U.S. citizen, give visa status)
 USA

2. CONTRACTOR'S NAME
 Taylor, Leeowen T.
 3. POSITION UNDER CONTRACT
 Equipment consultant
 4. CONTRACT NO.
 [REDACTED]
 5. PROPOSED SALARY
 \$120 per day
 6. COUNTRY OF ASSIGNMENT
 Sri Lanka
 7. DURATION OF ASSIGNMENT
 approx. 40 days
 11. NAMES AND AGES OF DEPENDENTS TO ACCOMPANY (if applicable)
 none

EDUCATION (Include all secondary, business college or university training)

NAME AND LOCATION OF INSTITUTION	MAJOR SUBJECTS	CREDITS COMPLETED		TYPE OF DEGREE	DATE OF DEGREE
		SEMESTER HOURS	QUARTER HOURS		
Completed two years high school (Cuba City, Cal)	required subjects				
no Business College	business administration				
Class Imperial Diesel Factory (Oakland, CA (reverse side))	apprentice-ship				

EMPLOYMENT HISTORY
 1. Give last three years. Continue on reverse to list all employment related to duties of proposed assignment. Exclude bonuses, profit-sharing arrangements, commissions, consultant fees, extra or overtime work payments, overseas differential, or quarters, cost of living or dependent education allowances.
 2. Salary definition - basic periodic payment for services rendered.

POSITION TITLE	EMPLOYER NAME AND ADDRESS	DATES OF EMPLOYMENT (Mo., Yr.)		SALARY	
		FROM	TO	DOLLARS	PER
Equipment consultant	Louis Berger Company 100 Hall - East Orange, NJ	1/73	4/73	\$2500 per mo	plus per diem
"	USAID & Bolivian Government	8/73	(40 days)	\$120 per d	plus per diem
"	Louis Berger Co. East Orange, NJ	1/77	4/77	\$2500 per mo	plus per diem
"	"	1/76	4/76	\$2500 per mo	plus per diem

SPECIFIC CONSULTANT SERVICES (Give last three years)

SERVICE PERFORMED	EMPLOYER NAME AND ADDRESS	DATES OF EMPLOYMENT (Mo., Day, Yr.)		DAILY RATE
		FROM	TO	
Making recommendations of equipment required	Louis Berger Co. East Orange, NJ	76/77	78	\$2500 per mo plus per diem
Making recommendations for maintenance and shop equipment	"	76/77	78	"
Making recommendations for highway & shop equipment	USAID & Bolivian Government	1973	(40 days)	\$120 per da plus per d
ESC AD-NSA-C-1413 with AD, USAID, D.C.				

LANGUAGE PROFICIENCY

LANGUAGE	SPEAKING			READING			WRITING			UNDERSTANDING		
	Fair	Good	Excl.	Fair	Good	Excl.	Fair	Good	Excl.	Fair	Good	Excl.
English			X			X			X			X
Spanish		X			X			X			X	

SPECIAL QUALIFICATIONS (Degrees, publications, research, special skills, and relevant education previously mentioned use reverse side of form, if necessary)

19. CERTIFICATION:
 To the best of my knowledge, the above facts as stated are true and correct.
 Signature of Employee: *Leeowen T. Taylor*
 DATE: July 2, 1979

15 (education - continued)

Have attended various consultant schools in heavy equipment on maintenance programs and parts requirements at the following companies:

Caterpillar Tractor Company, Peoria, Illinois and Phoenix, Arizona. Northwest Engineering Company, Greenbay, Wisconsin. Allis Chambers, Springfield, Illinois. International Harvester Company, Fort Wayne, Indiana. Elliot Lubrication School, Galion, Ohio.

18 (language)

Two years of night school in Spanish, El Centro, Colombia

CONTRACTOR'S CERTIFICATION (To be completed by responsible representative of Contractor)

A. I hereby certify that (check one):

- The initial salary proposed herein meets the salary standards prescribed in the contract.
- The salary increase proposed herein conforms to the customary policy and practice for this organization for periodic salary increases.

B. JUSTIFICATION OR REMARKS:

<i>William L. Taylor</i>	Equipment consultant	DATE July 2, 1979
(40)		

RESUME

Leewen (Tex) Taylor

PERSONAL DATA:

Permanent Address: 13005 Stoney Brook Drive
Reno, Nevada 89511
Telephone: (702) 825-6270
Place of Birth: Carralton, Texas
Date of Birth: May 4, 1909
Height: 5' 8"
Weight: 160 lbs.
Marital Status: Single
Physical Condition: Excellent
Social Security Number: 560-05-7603

PROFESSION: Equipment Consultant/Master Mechanic

KEY QUALIFICATIONS:

I have had extensive and varied experience over the past 40 years on projects involving motorized heavy construction equipment, its repair, rebuilding and maintenance. This expertise includes specification and purchase of new equipment.

I have been concerned with highway maintenance equipment for my entire working life as both a Master Mechanic and Heavy Equipment Specialist and have advised on procurement and the use of highway maintenance equipment. I am knowledgeable about product availability throughout the world and the ability of various countries to man and operate such equipment.

EXPERIENCE RECORD:

Consultant 1978 Made recommendations for heavy equipment to construct 180 kilometers of road. This included excavation equipment, maintenance equipment, quantity of technicians to supervise a training program of operators and mechanics in Lesotho, South Africa through the Louis Berger Company.

Consultant 1978 Made recommendations for maintenance facilities to maintain the equipment on land-clearing projects, roads and experimental stations on farm equipment for the Bolivian Government and US AID through Experience Incorporated.

Loeswen (Tex) Taylor (continued)

EXPERIENCE RECORD: (continued)

- Consultant
1977
- Equipment consultant on agricultural project for the Government of Jamaica and US AID. Hillside terracing of approximately 17,000 acres for growing vegetables, fruit trees, etc. Made recommendations for the type of equipment and quantity of equipment. Made recommendation for maintenance of such equipment. Also, made recommendations for quantity of technical assistants needed to train the Jamaicans who would be needed for said maintenance. (30 days)
- Consultant
1977
- Equipment consultant to the Government of Egypt and US AID. Made recommendations for equipment needed to maintain irrigation canals. Made recommendations for shop equipment to upgrade the repair shops of the Egyptian Dredging Co. and general irrigation workshops. Made recommendations on transporting equipment, and also for quantity of technical assistance needed to carry out shop repair and field maintenance program. (4 1/2 months)
- Consultant
1975/76
- Equipment consultant for a Highway Maintenance Program for the Sultanate of Oman Highway Department. Evaluated condition of existing equipment and prepared specifications for spare parts required to operate existing equipment and new equipment (including spares). Also, prepared specifications for equipment to be installed in two general overhaul shops and four field maintenance repair shops. Evaluated existing training program for technicians and developed training program for technicians. (5 months)
- Consultant
1975/76
- Consultant on equipment and repair shop facilities for coal mining for Utah International, Farmington, New Mexico. This was through Jacobs Associates.
- Consultant
1975/76
- Consultant on equipment for logging pine timber in the Lassen National Forest, Fall River Mills, California. Made recommendations for the type of equipment for skidding heavy pine timber. Also, loading equipment and hauling equipment for approximately thirty million feet of timber. This was through J. J. Bartle Loggers.
- Consultant
1975
- Was appraiser on approximately 2,500,000 million dollars of heavy construction equipment. This was between US AID, Bangladesh Government and Vinnell Construction Company. The equipment was to be purchased from Vinnell for the Bangladesh Government. This was through the Louis Berger Company.

Best Available Document

Loewen (Tex) Taylor (continued)

EXPERIENCE RECORD: (continued)

- Consultant 1975 Wrote specifications for agricultural equipment and shop equipment for US AID and the Government of Lesotho, South Africa - J.P.P. (1 month)
- Consultant 1974 Made recommendations on equipment for the Kenya North-ern Livestock Project. Equipment required for exca-vating earth water tanks, including water borcholes and for building roads and tracks to develop approximately six million acres of pasture land, and for livestock grazing. The project is expected to last five years. Prepared specifications for equipment and set up preventative maintenance equipment to maintain the equipment on the project. US AID and Kenya Government.
- Consultant 1974 Made recommendations to the Liberian Government Highway Department. Equipment that would be rebuilt and equip-ment that would be scrapped, and new equipment that would be purchased to carry out a highway maintenance program and equipment to maintain the highway equipment. This was through Afro-American Purchasing Center, New York. US AID and the Liberian Government.
- Consultant 1974 Made recommendations for highway maintenance equipment and transportation equipment that would be needed to carry out a highway maintenance program, building new roads. This included asphalt equipment, earth-moving equipment, and maintenance equipment and spare parts that would be needed to maintain the fleet of highway equipment over a period of five years. US AID and Mali Government.
- Consultant 1974 Consultant on equipment requirements for clearing some 400,000 acres of land for cultivation, and for exca-vating 30 million yards of earth. Set up a complete system for operation and maintenance of equipment on the RABAT project in Khartoum, Sudan. US AID and Sudanese Govern-ment.
- Consultant 1973/74 Advising the Sudanese Highway Department on the pur-chasing of new equipment or much existing equipment; upgrading the shop facilities and converting shops to complete general overhaul shops; making recommendations for spare parts for the existing equipment and for the new equipment being ordered, writing specifications and bid tender to World Bank rules and regulations; estab-lishing training program for local workers. Through the Louis Berger Company and Khartoum, Sudan. (approx 4 1/2 months).

Leeowen (Tex) Taylor (continued)

EXPERIENCE RECORD: (continued)

- Consultant
1972
- Made recommendations to purchase highway equipment on a US AID loan for highway maintenance equipment and general construction equipment for roads and developing agricultural land; recommending lists on spare parts for the new equipment; making recommendations for setting up shops including equipment and spare parts; writing specifications and bid tender under US AID rules and regulations; establishing training program for local workers. For the Kingdom of Swaziland, South Africa. (approx 2 months)
- Consultant
1972
- Loan implementation for water development program for livestock, heavy equipment and land-clearing project; earth tanks and dams and equipment for enlarging earth tanks and dams. Made recommendations for shop maintenance facilities and spare parts for the equipment required to maintain the equipment over a period of three years. Made recommendations for equipment required to maintain the roads and built new roads; development of water resources and road equipment; establishing shops to maintain the equipment. Also set up training program for local workers needed to carry out the maintenance of said equipment. For the Uganda Government and US AID. (approx 2 1/2 months)
- Consultant
1971
- Made recommendations and spare parts list for repair of approximately 10 million dollars for highway maintenance and general construction equipment in Ethiopia; made recommendations for setting up ten complete overhaul shops for the Imperial Highway Authority; made recommendations for carrying out a complete overhaul and maintenance program for the above equipment. Established a training program for local workers. For the Imperial Highway Authority, Addis Ababa, Ethiopia and US AID. (approx 6 months)
- Consultant
1971
- Made recommendations to National Youth Service for construction equipment for approximately 200 miles of new highway construction, land-clearing projects, maintenance facilities. Writing specifications and bid tender, inspecting equipment after purchasing at the factories in the U.S. to assure specifications were met. For the Government of Kenya. (approx 5 months)

Lecwen (Tex) Taylor

(continued)

EXPERIENCE RECORD: (continued)

- Consultant
1959 Made recommendations for spare parts components list; setting up purchase of equipment for five general overhaul shops, twenty preventative maintenance shops throughout Indonesia. Writing specifications for approximately 20 million dollars of general highway maintenance and construction equipment and approximately 8 million dollars for general overhaul shops and preventative maintenance shops. Through the Louis Berger Company and the Government of Indonesia. (approx 5 months)
- Consultant
1968 Made a trip to Togo to recommend equipment to set up a heavy equipment training school and repair shop. US AID and the Government of Togo.
- Consultant
1968 Made recommendations for mining equipment including hauling, blasting, and drilling. US AID and the Government of Guinea. Inspected at the factory to see if they complied with the specifications. Through the Afro-American Purchasing Center.
- Consultant
1968 Made an inspection of the Sudanese Highway Department for maintaining highways, building new roads and maintaining air fields. US AID and the Sudanese Government.
- Consultant
1967 Made appraisal of equipment that was taken from the contractors in Nigeria by the civil war activities. Made estimate of damage. US AID and the Nigerian Government.
- Consultant
1966 Made recommendations and purchases for highway maintenance equipment. Wrote specifications for highway maintenance equipment and facilities for maintaining the equipment. This included rock-crushing equipment, asphalt paving equipment and patching equipment. Recommended technical assistance needed for training local personnel. US AID and the Tunisian Government. Through the Afro-American Purchasing Center.
- Consultant
1966 Made inventory and inspection of equipment for the Dahomey Government Highway Department of spare parts needed to rebuild their equipment.
- Equipment
Supervisor
and Chief of
Maintenance
1963/65 Was responsible for establishing and operating a modern equipment maintenance system and spare parts inventory. Was responsible for reviewing needs and recommending purchases of basic and new modern types of mechanization for land-clearing, irrigation, and planting. For the Central Aquifer Sugar Cane Co.,
P.O. Box 2120.

EXPERIENCE RECORD: (continued)

Equipment Supervisor
1960/63

Was responsible for establishing heavy equipment requirements: u.s. plan for the various equipment types needed for land terracing, drainage of salt marsh land, clearing land, and road building. Established and equipped a complete maintenance facility and system for the area. US AID and the Government of Spain.

Equipment Manager
1954/60

In charge of selection and development of multi-million dollar inventory of heavy equipment for the Spanish base construction program. Established the complete maintenance system including repair and overhaul shops, spare parts warehouses and inventory for Brown Raymond Walsh.

Equipment Advisor
1952/54

Was responsible for equipment needs and usage for land clearing, road building and for earth dam construction. Established schools for training Thais in the operation and maintenance of agricultural and heavy construction equipment. US AID and the Government of Thailand.

EDUCATION:

Completed two years of high school at Union High in Yuba City, California.
Completed operator's apprenticeship at Atlas Imperial Diesel Factory in Oakland, California.
Have attended various consultant schools in heavy equipment, such as: Caterpillar Tractor Company, Peoria, Illinois and Phoenix, Arizona. Northwest Engineering Company, Greenbay, Wisconsin. Allis Chambers, Springfield, Illinois. International Harvester Company, Fort Wayne, Indiana. Elliot Lubrication School, Galion, Ohio.

LANGUAGE:

Spanish - Good. Two years of night courses in Spanish at El Centro, Colombia.

Lespen T Taylor