FINAL REPORT

TRAINING FOR ROAD CONSTRUCTION
REPAIRS AND MAINTENANCE

REPUBLIC OF ZAÏRE
OFFICE DES ROUTES

AMERICAN ORT FEDERATION

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FINAL REPORT

PROJECT: Training for Road Construction, Repairs and Maintenance.

Under USAID Loan 660-H-012

LOCATION: Republic of the Zaire

Contract dated November 30, 1971 between the Government of the Republic of the Zaire and the American ORT Federation.

PERIOD: November 30, 1971 - January 31, 1975

PROJECT MANAGER: Eliahu Bar-Josef

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THE ORT - OFFICE DES ROUTES PROJECT

Introduction

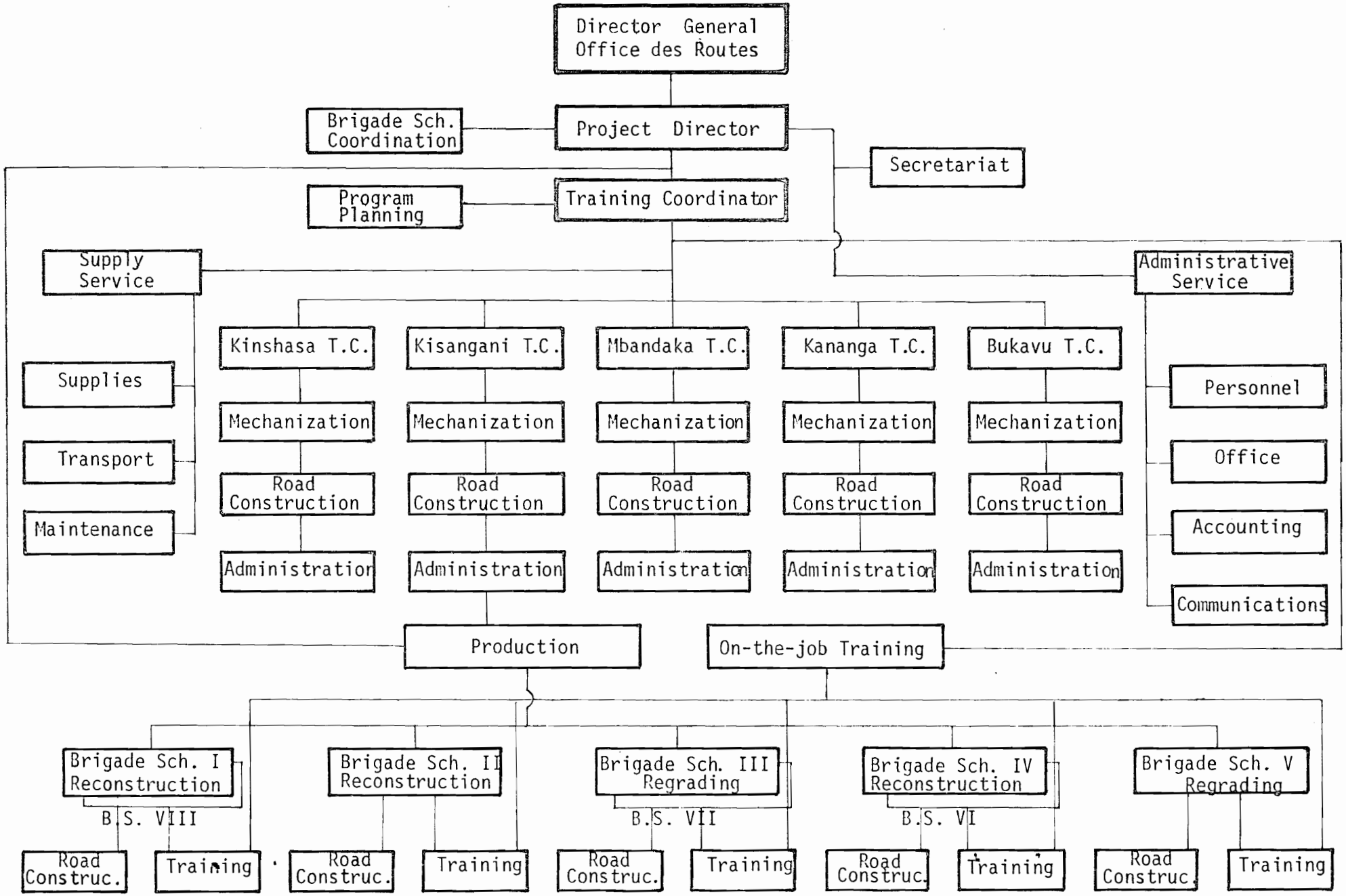
The Office des Routes was established under Statutory Law 71.023, signed by the President of the Republic on March 26, 1971. As a result, training and retraining of necessary personnel became a priority goal for the Office. An ORT Study Mission in March/April 1971 was followed by a contract signed on November 30, 1971 to provide training relating to road construction, repair and maintenance.

Chronology

March/April 1971	Study Mission
May 1971	Submission of Study Report
November 30, 1971	Contract Signature
January 1972	Arrival of the Project Director and the first ORT Specialists. Start of "Urgent" period
May 1972	Beginning of training programs
December 1972	Inauguration of the Project by the Commissaire d'Etat of the TPAT
January 1973	Beginning of the "Normal" period
September 1974	End of training programs
October 1974	Preparation and transfer/takeover Departure of the first Specialists
January 1975	Departure of the Project Director and end of the ORT - Office des Routes Project.

ORT-MISSION OFFICE DES ROUTES - REPUBLIC OF ZAIRE

ORGANIZATION CHART



Project Components

Structural

Central Project Headquarters
Five Training Centers
Two Regrading Brigade Schools (light)
Three Reconstruction Brigade Schools (heavy)

Personnel

ORT Specialists	34
Peace Corps Volunteers	13
Local Personnel	72

Project Goals

Training/Retraining of 600 personnel of the Office des Routes, as follows:

- Work Site Foremen	60
- Work Site Mechanics	30
- Equipment/Vehicle Operators	200
- Assistant Equipment/Vehicle Operators	120
- Storekeepers	40
- Auto-Diesel Mechanics	40
- Welders-Metalworkers	40
- Machinists-Fitters	40
- Auto-Electricians	30
Total to be trained	600

Additional requests/Ferry-boat maintenance

- Foremen	22
- Diesel Mechanics	54
- Electricians	36
- Assistant Mechanics-Greasers	30
- Welders	46
Additional to be trained	188

1. TRAINING

The November 30, 1971 Contract stipulates "on-the-job" training and retraining of a total of 600 people.

Obviously, such a project intrinsically offered a broad scope of possibilities.

These have been successfully developed through the effective cooperation of the Office des Routes and the Project's incorporation within the Office, through the establishment of a permanent training system.

However, this achievement was considerably impeded due to the constant reorganization of the Office des Routes during the three years of Contract implementation, which resulted in changing goals and their consequent influence on established training plans.

While fulfilling the Contract obligations, every effort was made to satisfy the requests, although this resulted in considerable modification of the training effected. 1,092 people have consequently gone through ORT training units, or 492 more than originally stipulated.

as of 9.30.74

1.1 ANNUAL TRAINING BREAKDOWN BY UNIT AND SKILL

TRAINING CENTER / Number of Trainees who received the End-of-Training Certificates noted in the Contract.

SKILLS	KINSHASA			KINSANGANI			MBANDAKA			BUKAVU			KANANGA			TOTALS		
	72	73	74	72	73	74	72	73	74	72	73	74	72	73	74	72	73	74
General Mechanics	11	-	12	15	-	-	8	-	6	4	-	1	8	-	15	46	-	34
Welding - Metal Working	10	9	10	3	-	-	3	4	11	4	-	15	1	8	20	21	21	56
Auto-electricity	-	8	13	5	9	6	10	-	20	3	-	18	-	5	10	18	22	67
Auto-mechanics	20	20	35	15	18	19	10	25	18	12	-	37	7	-	15	64	63	124
Sub-totals 72	41			38			31			23			16			149		
Sub-totals 73		37			27			29			-			13			106	
Total 72 + 73		78			65			60			23			29			255	
Sub-totals 74			70			25			55			71			60			281
Total 72 + 73 + 74		148			90			115			94			89			536	
18 trained counterparts are added to the total of 536, bringing the overall total to 554 trainees trained from 1972 to 1974.																	18	
																	554	

1.2 ANNUAL TRAINING BREAKDOWN BY UNIT AND SKILL

As of 9.30.74

BRIGADE SCHOOLS / Number of Trainees who received the End of Training Certificates outlined in the Contract

SKILLS	I/VIII			II			III/VII			IV/VI			V			TOTALS		
	72	73	74	72	73	74	72	73	74	72	73	74	72	73	74	72	73	74
Site Foremen	-	-	-	-	3	23	-	1	5	-	5	12	-	-	11	-	9	51
Site Mechanics	4	2	-	-	1	1	-	3	2	1	-	2	-	3	2	5	9	7
Stockroom Clerks	-	1	-	-	1	3	-	1	-	-	1	-	-	2	-	-	6	3
Bulldozer Operators	2	1	1	2	4	5	-	-	-	1	2	4	-	-	-	5	7	10
Loader Operators	-	3	3	1	4	6	-	-	-	1	3	4	-	-	-	2	10	13
Grader Operators	4	3	-	1	8	6	4	4	14	2	2	6	-	9	12	11	26	38
Compactor Operators	-	2	-	-	4	1	-	-	-	1	-	1	-	-	-	1	6	2
Dump Truck Drivers	8	9	-	7	7	5	1	2	2	4	9	-	-	2	-	20	29	7
Brigade Electricians	1	-	-	-	-	2	-	-	-	-	-	-	-	-	-	1	-	2
Sub-totals 72	19			11			5			10			-			45		
Sub-totals 73		21			32			11			22			16			102	
Total 72 + 73	40			43			16			32			16			147		
Sub-totals 74			4			52			23			29			25			133
Total 72 + 73 + 74	44			95			39			61			41			280		
																7		
																287		

7 counterparts are added to the total of 280 bringing the total to 287 trainees trained from 1972 to 1974.

1.3 Training under the Contract (through September 30, 1974)

(In addition to the breakdown by year)

Assistant equipment operators (120 requested)

- Grader/loader drivers (IBTP)	34
- Drivers of heavy-duty vehicles (various)	86
- Storekeepers/clerks (TC-Kinshasa)	31
Total	151

1.4 Training beyond the Contract (through September 30, 1974)

(In addition to the breakdown by year)

- Assistant mechanics-greasers	8
- Personnel clerks/timekeepers	6
- Masons/laborers	12
- Grader operators	28
- IBTP engineers (on-site training)	38
- Photographers - Laboratory workers	2
- Light vehicle drivers	6
Total	100

1.5 Total Training (1972-1974)

- Training Centers	554
- Brigade Schools	287
- Additional under the Contract	151
- Additional beyond the Contract	100
Total	1,092

1.6 Observations

Doubling or tripling the length of the training period would have resulted in better training quality in certain specialties.

The time period provided for retraining under the Contract did not consider the actual basic knowledge of the trainees. Consequently, the programs were based on the principle of training, as it was obviously impossible to retrain untrained workers.

In addition, certain important specialties were not foreseen (see the list "beyond the Contract"), principally on the Brigade School level.

Furthermore, the French language factor was underestimated. Although the selection criteria were explicit, in certain regions the Office des Routes provided personnel who did not meet them. Consequently, in addition to audio-visual aids, a translation system had to be improvised with the help of the counterparts or the trainees. This seriously impeded the instructors' progress with the programs.

2. SUMMARY OF BRIGADE SCHOOLS ACTIVITIES

Duration		March 1972 - November 1974
Types	3	Reconstruction Brigades
	2	Regrading Brigades
Equipment Available	3	Bulldozers
	3	Loaders
	3	Compactors
	12	Graders
	24	Dump Trucks
	20	Liaison and Service Vehicles
Personnel Trained/Retrained	125	Management Personnel
	127	Equipment Operators
	67	Dump Truck Drivers
	32	Mechanics, Electricians and Assistant Mechanics
	351	TOTAL

Work Completed	-	Asphalted roads	0,750	km
	-	Reconstructed/rehabilitated dirt roads	575	km
	-	Grading of dirt roads	966	km
	-	Mechanical road maintenance	1,958	km
	-	Hours of equipment operation	44,355	hr
	-	Materials transported	582,402	m^3
Cost of Work	-	Value of equipment hrs/km (Price scale - see 1972 Plan of Activities, 43 % direct expenditures, such as fuel, spare parts, etc. and 57 % indirect expenditures such as depreciation, overhead)	1,036,461	Z.
	-	Operating costs billed to the Office des Routes	405,000	Z.

2.1 Observations

During the first two years of the Contract, the Training Centers lacked road equipment for the basic training of equipment operators. This prolonged the length of "on-the-job" training in the Brigade Schools.

The efficiency of "on-the-job" training in the Brigade Schools - 10.15% of the time spent in theoretical application and the rest in practical work under the permanent supervision of Specialists - has been proven for vocational training in the road sector.

The Brigade Schools have never had an accident with equipment or vehicles in which a trainee or a worker was injured.

The standards for reconstructed roads provide for normal traffic over a two-year period, if periodic and preventive maintenance is properly carried out. Over a longer period, more important maintenance will be necessary.

The transfer/takeover of the Brigade Schools took place, as planned, between October 25 and November 20, 1974. The Brigade School Chief was present for the transfer and the Chief of the autonomous Office des Routes Brigade for the takeover. Assisting in the transfers/takeovers were the principal Office des Routes Inspector or the OR Sector Chief, the Chief of the ORT Training Center or the ORT Brigade Schools Coordinator.

2.2 TRAINEES TRAINED IN THE BRIGADE SCHOOLS

Category / BRIGADE SCHOOLS	BS I	BS II	BS III	BS IV	BS V	BS VI	BS VII	BS VIII	Total
Start Act.	3.10.72	3.22.72	3.13.72	5.25.72	11.28.72	4.1.74	1.1.74	1.3.74	
End Act.	8.21.73	10.25.74	10.15.73	12.23.73	11.1.74	11.5.74	11.5.74	11.20.74	
IBTP Engineers								38	38
Work Site Foremen		26	2	9	11	8	4		60
Personnel Clerks	1	2							3
Clerk-Storekeepers	1	4	1	1	2	1			10
Clerk-Timekeepers	2								2
Foremen (Laborers)	2	3	3			1			9
Foremen (Masons)		3							3
Bulldozer Operators	3	11		3		4			21
Loader Operators	3	10		4		4			21
Grader Operators	7	15	8	4	22	6	14		76
Compactor Operators	2	5		1		1			9
Dump Truck Drivers	17	19	3	13	2	11	2		67
Work Site Mechanics	6	2	3	1	5	2	2		21
Work Site Electricians	1	2							3
Assistant Mechanics - Greasing	3	2	1	2					8
TOTAL	48	104	21	38	42	37	23	38	351

2.3 SUMMARY OF ACTIVITIES CARRIED OUT BY THE BRIGADE SCHOOLS DURING THE ORT - MISSION OFFICE DES ROUTES PROJECT

ACTIVITIES \ BRIGADE SCHOOLS		BS I	BS II	BS III	BS IV	BS V	BS VI	BS VII	BS VIII	Total
	Start Act.	03.10.72	03.22.72	03.13.72	05.25.72	11.28.72	04.01.74	01.01.74	01.03.74	
	End Act.	08.21.73	10.25.74	10.15.73	12.21.73	11.01.74	11.05.74	11.05.74	11.20.74	
No. of Retrained Trainees	U	48	104	21	38	42	37	23	38	351 U
Reconstruction & Asphalting	km					0.750				0.750 km
Complete Reconstruction	km				9				35	44 km
Rehabilitation	km	106	241		59		45	80		531 k
Regrading	km		100	450		321		60	35	966 k
Mechanical Maintenance	km	212	319	450	130	642	45	140	20	1,958 km
Machines - Hours of Work	h	7,473	13,373	5,465	4,676	6,189	2,236	1,512	3,431	44,355 h
Dump Truck Transport	km	445,147	405,283		164,892		80,000		113,051	1,208,373 km
Service Truck Transport	km	38,003	145,422	46,344	47,576	47,525	10,478	5,000	28,218	368,566 km
Light Vehicle Transport	km	79,257	151,057	65,799	69,603	35,909	15,234	6,089	130,492	553,440 km
Transport of Materials	m^3	145,841	212,617		144,941		47,190		31,820	582,409 m^3
Cost H/Km Machines/Vehicles	Z	233,984	325,538	92,138	122,319	98,908	54,684	22,282	96,608	1,036,461 Z

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2.4 MACHINES / VEHICLES

- Hours/Km Covered by the Brigade Schools
- Cost Hours/Km

BRIGADE SCHOOLS / ACTIVITIES		BS I	BS II	BS III	BS IV	BS V	BS VI	BS VII	BS VIII	Total	* Cost Z	
	Start Act. / End Act.	3.10.72 / 8.21.73	3.22.72 / 10.25.74	3.13.72 / 10.15.73	5.25.72 / 12.21.73	11.28.72 / 11.1.74	4.1.74 / 11.5.74	1.1.74 / 11.5.74	1.3.74 / 11.20.74		Unit Price	Total Price
Bulldozer	H	1,606	2,655		862		270		1,154	6,547	16.00	104,752
Loader	H	1,434	3,002		1,348		835		856	7,475	14.50	108,387
Grader	H	3,263	5,479	5,465	1,973	6,189	1,064	1,512	1,135	26,080	13.50	352,080
Compactor	H	1,170	2,237		493		67		286	4,253	7.30	31,898
Dump Trucks	Km	445,147	405,283		164,892		80,000		113,051	1,208,373	0.24	290,010
Service Trucks	Km	38,003	145,422	46,344	47,576	47,525	10,478	5,000	28,218	368,566	0.24	88,456
Light Vehicles	P.U Km	79,257	151,057	65,799	69,603	35,909	15,234	6,089	130,492	553,440	0.11	60,878
											Total Cost	1,036,461

* Price scale for H/Km - See 1972 PLAN OF ACTIVITIES.
As of April 1972, an approximate 10% annual cost increase should be added.

2.5 KM/H (at the time of transfer of the Brigade Schools) EQUIPMENT + VEHICLES

TYPE OF EQUIPMENT / BRIGADE SCHOOLS Start Act. End Act.	B.S. I 3.10.72 8.21.73	B.S. II 3.22.72 10.25.74	BS III + VII 3.13.72 11.5.74	B.S. IV 5.25.72 12.21.73	B.S. V 11.28.72 11.1.74	B.S. VI 4.1.74 11.5.74	B.S. VIII 1.3.74 11.20.74	OBSERVATIONS
Bulldozer	1,600	2,700		1,000		300	500	
Loader	1,500	3,000		1,500		* 2,000	900	
Grader	1,700	2,800	2,300	1,200	2,000	750	650	
Compactor	1,200	2,300		500		* 3,600	300	
Dump Truck	55,000	65,000		30,000		13,000	15,000	
Tank Truck	15,000	20,000		9,000		8,000	8,000	
Transport Truck	17,000	75,000	55,000	35,000	65,000		4,000	
Lube Truck	9,000	6,000		5,000		6,000	9,000	
P.U. + Land Rover	40,000	70,000	75,000	55,000	60,000	53,000	45,000	

* All equipment received by the B.S. was new except for the vehicles above.

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2.6 TRAFFIC STATISTICS FOR ROADS ON WHICH THE BRIGADE SCHOOLS WORKED

ROAD	REGION	DATE OF * SURVEY	KMS.	TRAFFIC		TOTAL
				LIGHT VEHICLES	TRUCKS	
Kisangani - Yangambi	Haut-Zaire	10.9.74	91.	15	21	36
Kisangani - Yangambi	"	8.7.74	5.	117	208	325
Kisangani - Ubundu	"	7.5.74	57.	3	2	5
Kisangani - Ubundu	"	5.31.74	7.	13	15	28
Kisangani - Isangi	"	1.3.73	123.	5	9	14
Kananga - Kazumba	Kasai Occidental	1.23.74	11.	25	56	81
Kananga - Kazumba	"	6.14.74	34.	5	16	21
Bukavu - Uvira	Kivu	9.30.74	6.	37	59	96
Kasangulu - Sonabata	Bas-Zaire	9.17.74	4.	5	3	8
Kisangani - Ituri	Haut-Zaire	6.22.73	132.	22	111	133
Kisangani - Banalia	"	12.22.72	120.	6	19	25
Kisangani - Buta	"	10.5.73	159.	4	9	13
Lokunga - Bashingu	Kasai Occidental	5.21.73	12.	8	10	18
Mbuji-Mayi - Lac Mucomba	"	12.17.73	79.	32	73	105
Mbuji-Mayi - Tshimbulu	"	11.27.73	40.	15	62	77

* From 7:30 a.m. to 3:30 p.m.

2.7 KM/H BREAKDOWN PER MACHINE/VEHICLE

BRIGADE SCHOOL II - RECONSTRUCTION

Period		Machines: Bulldozer D6C H.	Loader 950 H.	Grader 12F H.	Compactor Albaret H.	Total H.	Vehicles: Dump Truck Km	Service Truck Km	Light Vehicles Km	Total Km
III - XII	1972	1,328	1,089	1,872	860	5,149	110,000	38,184	58,571	206,755
	1973	747	1,333	2,330	918	5,328	181,732	80,000	71,091	332,823
I - IX	1974	548	533	1,196	440	2,717	107,468	25,166	18,691	151,325
Total		2,623	2,955	5,398	2,218	13,194	399,200	143,350	148,353	690,903
% Hours per machines/vehicles		20%	22%	41%	17%	100%	58%	21%	21%	100%
Cost	Unit	16.00 Z	14.50 Z	13.50 Z	7.50 Z		0.24 Z	0.24 Z	0.11 Z	
	Total	41,968	42,847	72,873	16,635	174,323	95,808	34,404	16,319	146,531
% Cost per Machine/Vehicle		24%	25%	42%	9%	100%	65%	24%	11%	100%

Total cost = 320,854 Z = Machines 54% Vehicles 46%

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2.8 SUMMARY OF OIL AND FUEL CONSUMPTION AND H/KM PER MACHINE

No.	Brigade	Year	Diesel Oil Liters	Gas Liters	Parafin Liters	Grease + Liters Oil	Hours Worked	Dump Trucks Km	Service Trucks Km	P.U. Km	Months
I	Reconstruction	1972	116,183	1,972	190	4,541	3,845	180,161	29,955	37,160	V - XI
II	Reconstruction	"	122,754	7,659	516	4,649	4,548	90,394	21,051	48,357	V - XII
III	Regrading	"	47,284	258	82	904	2,151	-	48,007	30,381	IV - XII
IV	Reconstruction	"	67,968	1,432	1,115	2,174	2,059	81,786	20,364	42,182	VI - XII
V	Regrading	"	7,071	-	20	48	263	-	4,750	4,000	XII -
	Total	1972	361,260	11,321	1,923	12,316	14,866	352,341	124,127	162,080	I
I	Reconstruction	1973	124,383	1,787	610	3,703	2,700	206,854	13,026	37,878	I - VII
II	Reconstruction	"	163,262	8,823	524	5,406	5,450	219,721	42,479	68,369	I - XII
III	Regrading	"	67,943	704	25	1,399	2,340	-	64,472	43,476	I - IX
IV	Reconstruction	"	92,318	1,721	2,260	3,225	2,141	73,490	37,421	46,495	I - XI
V	Regrading	"	85,461	-	780	1,790	3,696	-	30,583	23,820	I - XII
	Total		533,767	13,035	4,199	15,523	16,327	500,065	189,981	220,038	
II	Reconstruction	1974	89,130	2,005	6	2,891	2,908	112,951	27,238	21,395	I - X
V	Regrading	"	61,591	-	800	2,367	2,209	-	27,488	10,783	I - X
VI	Reconstruction	"	50,346	5,163	-	2,956	2,090	68,076	9,172	16,928	II - IX
VII	Regrading	"	23,724	-	-	829	1,479	-	5,335	5,864	II - IX
VIII	Reconstruction	"	97,264	3,867	1,046	5,992	3,281	114,179	30,515	141,459	II - X
	Total	1974	322,055	11,035	1,852	15,035	11,967	295,206	99,748	196,429	
		1973	533,767	13,035	4,199	15,523	16,327	500,065	189,981	220,038	
		1972	361,260	11,321	1,923	12,316	14,866	352,341	124,127	162,080	
	Total		1,217,082	35,391	7,974	42,874	43,160	1,147,612	413,856	578,547	

3. BRIGADE SCHOOL VIII

The objective of Brigade School VIII was to train future Brigade Chiefs of the Office des Routes, although this was not included in the November 30, 1971 Contract.

"On-the-job" training was planned with the OR to introduce young engineers from the IBTP to the practical administrative and technical problems of a road brigade and help them prepare their final university project. For this reason, this Brigade's activities are being reported separately.

The training was prepared and implemented in cooperation with the ORT Training Center in Kinshasa:

1 - The theoretical part in class (TC and BS):
Metallurgy, electricity, mechanization, concrete at the Training Center; quarries, road construction, laboratory, planning, administration and organization at the Brigade School.

2 - The practical part at the site:
Each engineer trainee participated in various Brigade School activities on an alternate and replacement basis (road clearing, regrading, rebuilding, rolling, drainage, mechanization and administration).

During the first period, the trainee worked as an assistant; during the second, he was responsible for planning and executing a certain specialized task.

3 - All the trainees spent one week at the National Public Works Laboratory.

Summary of Brigade School Activities

Activity \ Month	J	F	M	A	M	J	J	A	S	O	N
IBTP Engineers training	1st group 12 partic.			2nd group 11 partic.				3rd group 15 partic.			
Equipment Operators practical training						X	X	X	X		
OR Seminars - higher-level management and L.N.T.P.				X	X	X	X	X	X		
Two groups of C.F.A.V. technicians						X	X				

4. PARTICIPANT TRAINING

Twenty-five counterparts were chosen from among the best candidates in the following specialties:

- General mechanics	5
- Diesel mechanics	8
- Automobile electricity	5
- Road construction	7

The training of these future Instructors included the following stages:

1 - Selection
2 - Technical training in Zaire
3 - Training at the Central ORT Institute (Switzerland)
4 - Training period in a business (Europe)
5 - Placement
6 - Assumption of assignment

Training at the ORT Institute covered technical and vocational skills, teaching and communication techniques, organization, reporting techniques and languages.

A breakdown of these training stages is found on the following page.

Post-training Assignments

1	resigned upon his return
2	are assigned to Brigade School VIII
8	are assigned to the OR Operational Brigades
14	are assigned to the SGMTP Project (OR Mechanization)

4.1 PARTICIPANT TRAINING

BREAKDOWN OF STAGES

PARTICIPANT SKILL	No.	1972												1973												1974										
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N
GENERAL MECHANICS	5			1					2											3								4			5				
AUTO-DIESEL MECHANICS	8			1					2											3								4			5			6	
AUTO-ELECTRICITY	5			1						2											3							4			5			6	
BRIGADE CHIEFS	7			1											2							3							4		5			6	

▶ Valid only for Auto-Diesel Mechanic counterparts.

Key :

1 - Selection
2 - Training
3 - ORT Institute
4 - Practical training with Swiss companies
5 - Assignment and work with ORT Specialist
6 - Replacement of ORT Specialist

5. BRIGADE SCHOOLS' OPERATIONS

March 1972 - November 1974

Based on: Daily, weekly and monthly reports.
Comprehensive reports of Brigade School Chiefs.

5.1 Brigade School I - Reconstruction (March 10, 1972 - August 21, 1973)

Rehabilitation of Boma - Moanda Road		106 km
Two-phase mechanical maintenance with grader		212 km
Amount of materials transported		145,841 m^3
Value of hrs/km of equipment and vehicles		223,984 Z.
Direct costs: 43% 96,312)	-	223,984 Z.
Indirect costs: 57% 127,672)		

Rehabilitation cost per km, including two periodic maintenance operations:

$$\frac{223,984}{106} = 2,113 \text{ Z.}$$

Average cost per m^3 effected
(Banked, reconstructed, transported graded, and rolled)

$$\frac{223,984}{145,841} = 1,53 \text{ Z.}$$

Observations

35% of the road was reconstructed with good quality rolling gravel and 35% with lightly-clayey sand. This permitted the opening of the planned route, and regrading was carried out on the rest of the road. This section should be reconstructed with good quality materials and receive periodic maintenance. Reconstruction was of varying thickness, following the road contour between 20 and 80 cm. before rolling.

Good quality quarry: PK 22 and 36. Cross-section of clayey sand from PK 70.

5.2 Brigade School II - Reconstruction (March 1972 - October 1974)

Reconstruction Kisangani - Isangi Road		128 km
" Kisangani city streets		50 km
" Kisangani - Ubundu Road		63 km
Total Reconstructed		241 km
Regrading Kisangani - Yangambi Road (1974)		100 km
Two-phase mechanical maintenance with grader:		
Kisangani - Isangi Road	2 x 128 = 256)	
Kisangani - Ubundu Road	1 x 63 = 63)	319 km
Amount of materials transported		216,225 m^3
Value per hrs/km of equipment and vehicles		325,538 Z.
Direct costs: 43%	139,981)	
Indirect costs: 57%	185,557)	325,538 Z.

Rehabilitation cost per km, including two periodic maintenance operations (average) and 100 km of regrading:

$$\frac{325,538}{241} = 1,351 \text{ Z.}$$

Average cost per m^3 effected:

$$\frac{325,538}{216,225} = 1.51 \text{ Z.}$$

Observations:

60% of the road was reconstructed with all-purpose gravel from the quarries along the road (spaced from 10-25 km apart). Reconstruction bases varied according to the road contour. Preventive maintenance and partial and daily reconstruction should be planned.

5.3 Brigade School III - Regrading (March 1972 - October 1973)

Regrading Kisangani - Banalia Road		125 km
" Kisangani - Ituri Road		128 km
" Kisangani - Banalia city streets		41 km
" Kisangani - Buta Road		156 km
Total Regraded		450 km.

Five to six grader passes were required to obtain road contour and drainage.

Mechanical maintenance, Two grader passes on average			450 km
Value of hrs/km of equipment and vehicles			92,138 Z.
Direct costs:	43%	39,619)	92,138 Z.
Indirect costs:	57%	52,519)	

Cost per regraded km, including one maintenance operation:

$$\frac{92,138}{450} = 250 \text{ Z.}$$

5.4 Brigade School IV - Reconstruction (May 1972 - December 1973)

Complete reconstruction:	Kananga - Pont Lulua Road	9 km
Opening/drainage:	Lokunga - Bashingu Road	59 km
		68 km

Mechanical maintenance with grader	130 km
Amount of materials transported	144,941 m^3

filling	38,600 m^3
emptying	106,341 m^3
	144,341 m^3

Value per hrs/km of equipment and vehicles

Pont Lulua		41,507)	-	122,319 Z.
Lokunga		80,812)		
Direct costs:	43%	52,594)	-	122,319 Z.
Indirect costs:	57%	69,718)		

Cost price per km completely reconstructed with an average of 40 cm of reconstructed base after rolling, including ditches and trenches:

$$\frac{41,507}{9} = 4,612 \text{ Z.}$$

Average cost per m^3 effected:

$$\frac{41,507}{38,600} = 1.07 \text{ Z.}$$

Quarries: all producing good quality gravel

Average roundtrip distance: 15 km.

Cost per km of opening of road, drainage and two maintenance operations:

$$\frac{88,812}{59} = 1,370 \text{ Z.}$$

5.5 Brigade School V - Regrading (November 1972 - November 1974)

Special Operation, on Avenue Itaga, Kinshasa Road banked, reconstructed and asphalted	750 km
Regrading Mbuji-Mayi - Bena Malenga Road	125 km
" Mbuji-Mayi - Lac Mukamba Road	86 km
" Kananga - Kazumba Road	90 km
" Kananga city streets	20 km
	321 km
Mechanical maintenance Two grader passes on average	642 km
Value per hrs/km of equipment and vehicles	98,902 Z.

Direct costs:	43%	42,528)	-	98,902 Z.
Indirect costs:	57%	56,374)		

Cost per regraded km with two mechanical maintenance operations: $\frac{98,902}{321}$ = 308 Z.

It should be noted that the Brigade School worked in sandy regions, and the regraded roads had never been reconstructed.

To insure permanent year-round traffic, partial-to-complete reconstruction of these roads should be planned.

5.6 Brigade School VI - Reconstruction (April 1, 1974 - November 5, 1974)

Reconstruction of Bukavu - Uvira Road	45 km
33 km were completely reconstructed with materials from the gravel quarry at PK 22, Niangezi.	
Mechanical maintenance with grader	45 km
Amount of materials transported	47,190 m^3
Value per hrs/km of equipment and vehicles	54,684 Z.

Direct costs:	43%	23,514)	-	54,684 Z.
Indirect costs:	57%	31,170)		

Costs per km reconstructed, including one periodic maintenance with grader: $\frac{54,684}{45}$ = 1,215 Z.

Cost per m^3 effected: $\frac{54,684}{47,170}$ = 1.16 Z.

5.7 Brigade School VII - Regrading (January 1, 1974 - November 5, 1974)

Regrading of streets in Mbandaka city (reforming, regrading, grading and drainage of all of the city's streets and adjacent roads)	140 km
Mechanical maintenance with grader	140 km

Value per hrs/km of equipment and vehicles				22,282 Z.
Direct costs:	43%	9,581)	-	22,282 Z.
Indirect costs:	57%	12,701)		

Cost per km graded with one mechanical maintenance operation: $\frac{22,282}{140}$ = 160 Z.

5.8 Brigade School VIII - Reconstruction (January 3, 1974 - November 30, 1974)

Complete reconstruction of the Kasangulu - Sonabata Road	35 km
Regrading Sonabata - Kasangulu	35 km
Mechanical maintenance	20 km
Amount of materials transported	31,820 m^3
Amount of materials dug and removed	136,529 m^3
Value per hrs/km of equipment and vehicles	96,608 Z.

Direct costs:	43%	41,541)	-	96,608 Z.
Indirect costs:	57%	55,067)		

Cost per km of complete reconstruction, including a km of regrading and maintenance: $\frac{96,608}{35}$ = 2,760 Z.

Quarries: Crushed rock of varying granulation, clayey sand.

Average roundtrip distance from quarries to reconstruction site was 17 km.

This Brigade School was responsible for "on-the-job" training of young engineers, just out of University, who will become Brigade Chiefs within the Office des Routes. The Brigade used various methods of drainage, excavation and dirt road construction.

The search for high-quality quarries by the trainees produced good results. The search for quarries and the soil analyses carried out by the National Public Works Laboratory along the Kasangulu - Sonabata road cost 6,103.50 Z.

Cost of analyses per km for entire road: $\frac{6,103.50}{82}$ = 74.4 Z.

It is recommended that the N.P.W.L. carry out quarry analyses to ensure good-quality materials for road construction.

Average cost per hrs/km. See price scale in the 1972 Plan of Activities.

Direct costs: 13% fuel, lubricants and filters - 13% spare parts, repairs - 10% personnel - 4% service vehicles - 3% inspections. Total: 43%.

Indirect costs: 2% interest - 25% depreciation - 13% Specialists - 2% buildings and radio - 15% overhead costs. Total: 57%.

6. ADMINISTRATION AND FINANCE

6.1 Total Billings in Zaires

6.1.1 Contract Budget

Total billings through January 31, 1975	1,226,585.86
Funds provided through January 31, 1975	1,280,301.74
Balance	53,715.88

6.1.2 Brigade School Operating Budget

Total billings through January 31, 1975	156,289.92
Funds provided through January 31, 1975	246,889.86
Balance	90,599.94

6.1.3 Peace Corps Logistical Support Budget

Total billings through January 31, 1975	15,368.56
Funds provided through January 31, 1975	3,643.77
Balance	- 11,724.79

6.1.4 Salaries Budget

Total billings through January 31, 1975	421,297.34
Funds provided through January 31, 1975	430,873.07
Balance	9,575.73

6.1.5 40,000 Convertible Zaires Budget

Total billings through January 31, 1975	28,504.96
Funds provided through January 31, 1975	28,504.96
Balance	-

6.2 Budget Control

6.2.1 Contract Budget : page 31
6.2.2 Brigade Schools Operating Budget : page 32
6.2.3 Peace Corps Logistical Support Budget : page 33

6.3 U.S. Dollar Billings

Total Billings through January 31, 1975:

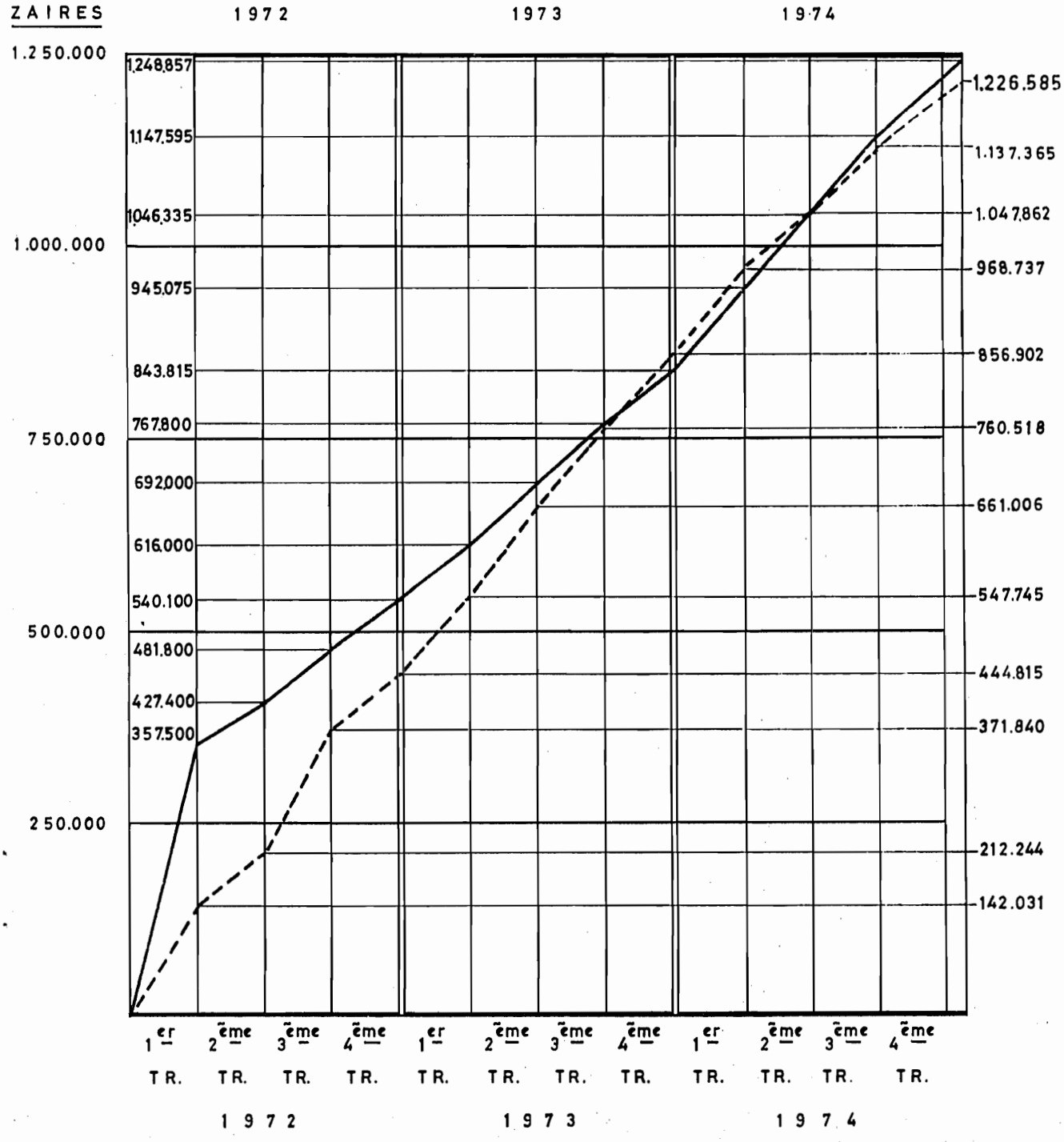
	Billings	Budget
Man/Months Services	$ 2,083,911	$ 2,084,162
Travel and Transportation	282,118	316,588
Equipment, Supplies and Educational Materials	526,091	585,000
Geneva and New York Staff	332,853	323,308
Fee	150,000	150,000
Miscellaneous	35,069	29,500
Participant Training	247,432	227,742
Pre-Contract Expenses	14,548	15,000
Consultant Services	11,677	10,000
Totals	$ 3,683,699	$ 3,741,300

6.2.1 GRAPHIQUE DE CONTROLE BUDGETAIRE
BUDGET CONTROL CHART

Prévisions / Estimated ———— BUDGET CONVENTION / CONTRACT BUDGET

Dépenses effectives / Actual expenditures - - - - - Budget total : ZAIRES 1.249.120 / Total budget : ZAIRES 1.249.120

Période concernée : du 1-1-72 au 31-1-75 : 37 Mois / Period covered : 1-1-72 to 1-31-75 37 Months



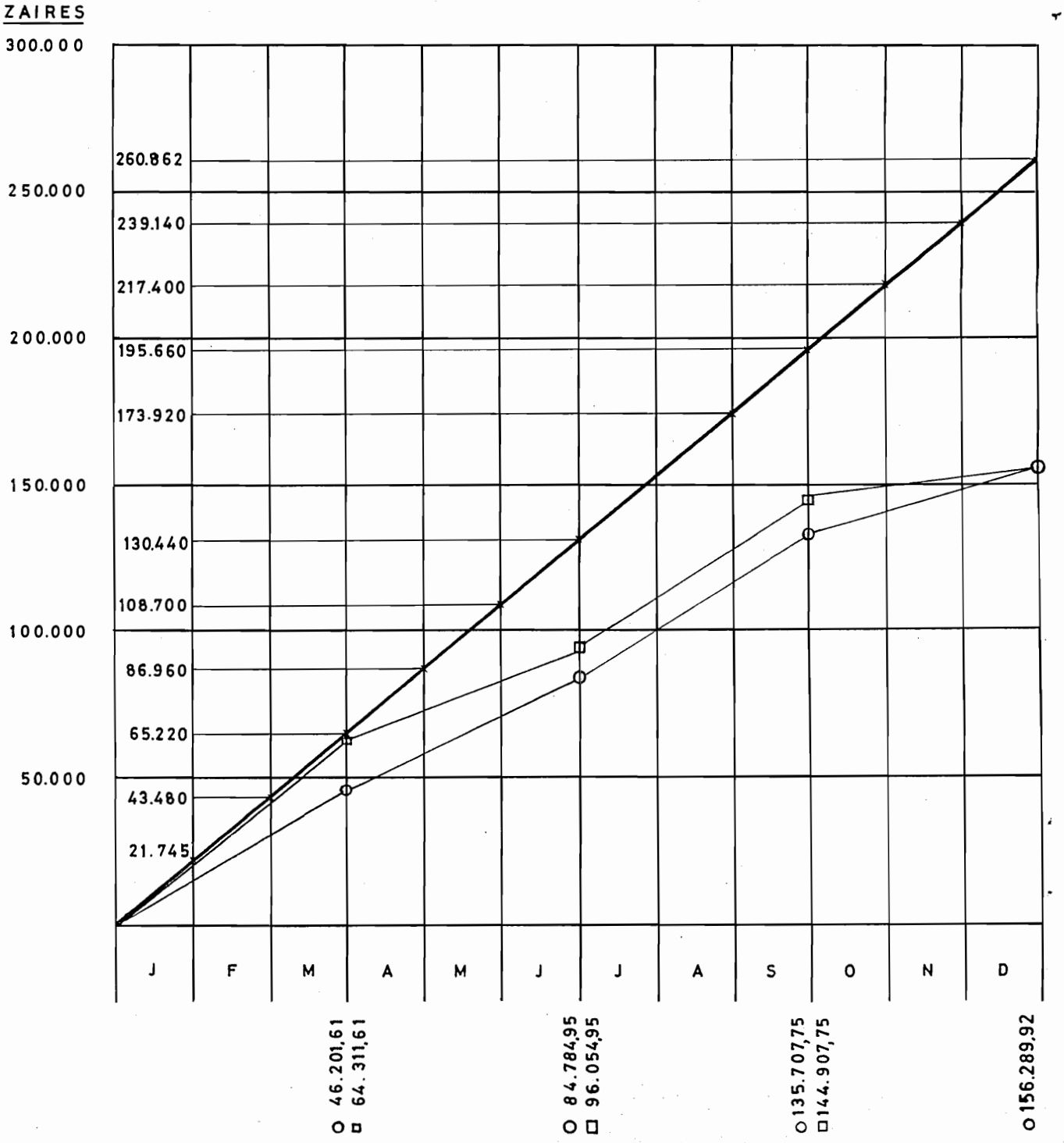
6.2.2 GRAPHIQUE DE CONTROLE BUDGETAIRE 1974
BUDGET CONTROL CHART 1974

BUDGET DE FONCTIONNEMENT DES BRIGADES-ECOLES
BRIGADE SCHOOLS OPERATING BUDGET

+ Prévisions / Estimated

o Dépenses effectives / Actual expenditures

□ Dépenses effectives + dépenses engagées / Actual expenditures + orders in process



6.2.3

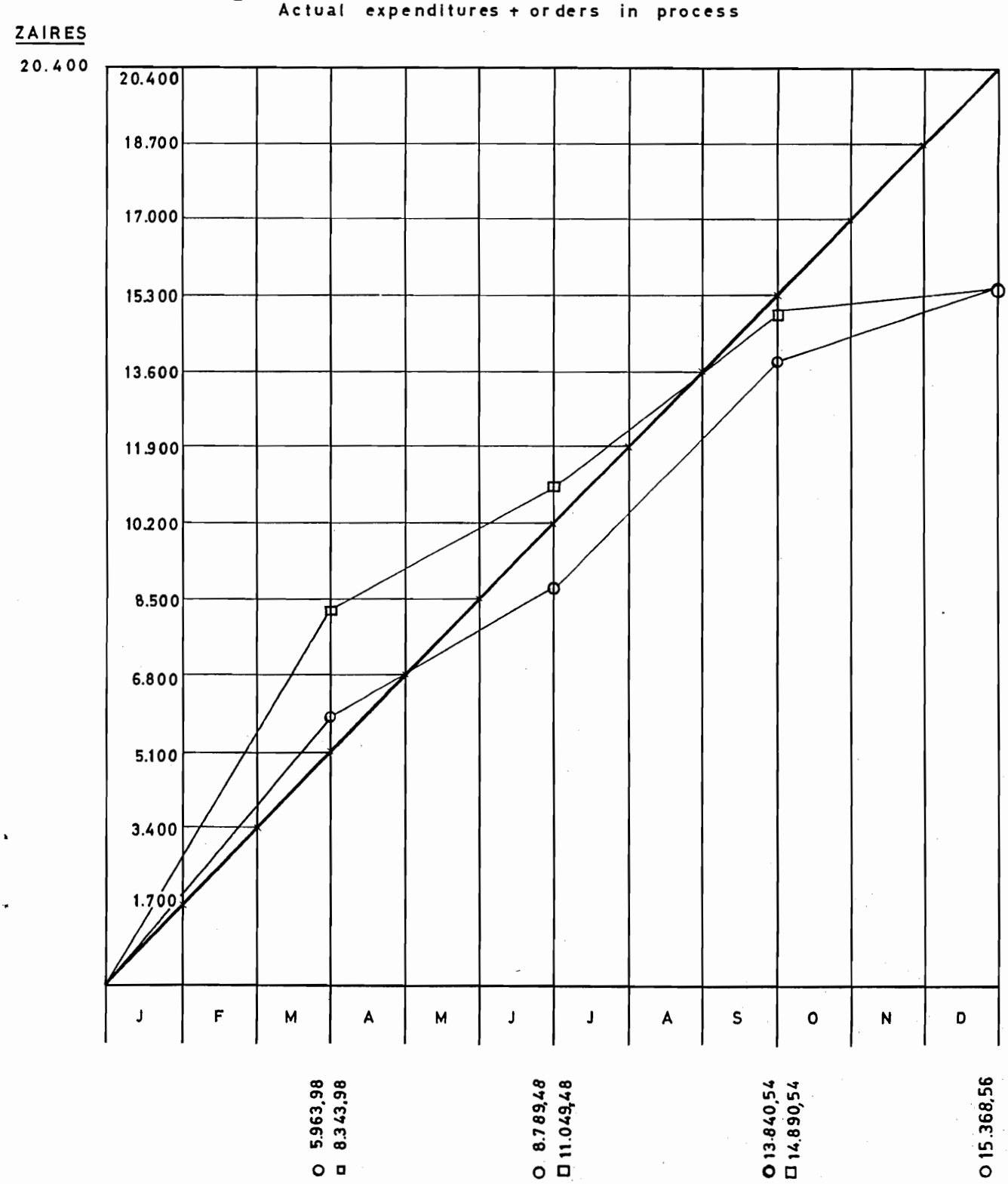
GRAPHIQUE DE CONTROLE BUDGETAIRE 1974
BUDGET CONTROL CHART 1974

SUPPORT LOGISTIQUE DU CORPS DE LA PAIX
PEACE CORPS LOGISTIC SUPPORT BUDGET

+ Prévisions / Estimated

o Dépenses effectives / Actual expenditures

□ Dépenses effectives + dépenses engagées / Actual expenditures + orders in process



7. STUDY OF TRAINING COSTS - Observations

Training costs are of interest to those organizations involved in Project operations.

The purpose of the cost breakdown which follows is not to provide a definitive answer to this complex problem, but rather to facilitate its comprehension.

Within this Project, training was inseparable from production. ORT's role was to train while producing and to produce while training. Separation between the two was not feasible either on the instructional or budgetary levels.

It would, therefore, be fundamentally erroneous to attempt to determine training costs by dividing total expenditures by the number of people trained.

It would be just as mistaken to consider the numbers provided in this study as rigorously precise.

These data represent only estimates, not calculations of costs, and should be used only as background for understanding the problem.

The importance of these preliminary observations is stressed in order to avoid any misinterpretation of the following study.

7.1 Study of Training Cost - Budget

	Total $ Budget	Indirect Cost $	Direct Cost $
1. ORT personnel: 34 Specialists	2,084,162		1,354,762
Used for production 35%		729,400	
2. Travel and Transportation	627,128		407,628
same % as above		219,500	
3. Equipment, educational materials. Value of supplies, tools and equipment after three years of use	717,000		286,800
		430,200	
4. Geneva and New York Staff	323,308		323,308
5. Fee	150,000		150,000
6. Miscellaneous	89,500		89,500
7. Pre-Contract Expenses	15,000		15,000
8. Participant Training	254,242		254,242
9. Repair of Training Centers	185,000		37,000
Depreciation over ten years		148,000	
10. Operating costs	786,000		706,000
Less equipment at the Centers and Offices		80,000	
11. Local Personnel	200,000		200,000
12. Rent and maintenance of housing	788,200		512,400
same % as Item 1		275,800	
13. Consultant Services	20,000		20,000
Total in $	6,239,540	1,882,900	4,356,640

The total budget corresponds to the amount in the November 30, 1971 Contract as modified by Amendments I and II.

7.2 Average cost per trainee - Brigade School Production

Total direct cost: $4,356,640 / Number of trainees: 1,092 = $ 3,990.-

7.3 Value of ORT Production

7.3.1 Road Reconstruction: Three Heavy Brigades

Estimated average cost per km of reconstructed or repaired road (with 60% reconstruction) by private firms:	$	7,000
Estimated average cost per km of road reconstructed or repaired by ORT:	$	3,000
Number of kms completed from March 1972 to October 1974:		576

7,000 x 576 = 4,032,000

3,000 x 576 = 1,728,000

Gross savings for OR or GOZ $ 2,304,000

7.3.2 Road Maintenance: Two Light Brigades

Average cost per km of road maintained by private firms:	$	600
Average cost per km of road maintained by ORT:	$	250
Number of kms maintained from March 1972 to October 1974:		2,924

600 x 2,924 = 1,754,400

250 x 2,924 = 731,000

Gross savings for OR or GOZ $ 1,023,400

Gross savings: $2,304,000 + $1,023,400 = $3,327,400

To be deducted: indirect cost of personnel:

$729,400 + $219,500 + 275,800 = $1,224,700

Net savings by OR or GOZ $2,102,700

NOTE: The high cost of maintenance per km of road is because no maintenance had been performed for over ten years.

7.4 Production in the five Centers

7.4.1 Internal

Repair and rehabilitation of equipment and machine tools: Z. 20,000 per Center	$ 200,000

7.4.2 External

Work performed for the Office des Routes for the repair and rehabilitation of road construction equipment (according to records covering March 1972 to November 1974)	$ 950,000
Total Production for OR or GOZ	$ 1,150,000

Total value of production for OR or GOZ

Repair and maintenance of roads	$ 2,102,700
Production in the five Centers	$ 1,150,000
Total	$ 3,252,700

7.5 Total actual cost of the training program and average training cost per trainee

Total direct training cost	$ 4,356,640
Total value of production	$ 3,252,700
Cost of the training program	$ 1,103,940

Average cost per trainee

$$\frac{\text{Total cost of the training program: } \$\ 1{,}103{,}940}{\text{Number of trainees: } 1{,}092} = \$\ 1{,}011$$

8. RECAPITULATION BY CATEGORY OF EQUIPMENT ORDERED, RECEIVED AND INTEGRATED INTO THE ORT - MISSION OFFICE DES ROUTES PROJECT UNDER USAID LOAN 660-H-012

Situation as of 1.31.1975

CATEGORY	Allocated Budget at Project Start US $	Value in US $ of Purchase Orders sent to ORT/NY	Orders to ORT/NY	Shipments made by ORT/NY	
			Value of Completed Purchase Orders	Shipments from N.Y.	Arrivals at ORT - Kinshasa
		Cumulative Total	Cumulative Total	Cumulative Total	Cumulative Total
Machine Tools and Heavy Equipment	185,000.00	230,348.85	230,348.85	230,348.85	230,348.85
Communications and Optical Equipment	50,000.00	38,483.22	38,483.22	38,483.22	38,483.22
Training Aids	15,000.00	14,976.09	14,976.09	14,976.09	14,976.09
Tools	125,000.00	143,978.90	143,978.90	143,978.90	143,978.90
Raw Materials	125,000.00	61,106.51	61,106.51	61,106.51	61,106.51
Office Equipment and Supplies	85,000.00	37,083.10	37,083.10	37,083.10	37,083.10
TOTALS US $	585,000.00	525,976.67	525,976.67	525,976.67	525,976.67

9. CONCLUSIONS AND RECOMMENDATIONS

Based on Quarterly Project Reports.

9.1 Training

First Phase - lasted approximately one and a half years. Retraining of existing OR personnel.

Most of the trainees had had several years of experience in their skills, but using obsolete methods. They had received no prior theoretical training, and their adaptation to new methods was slow and limited.

Having to retrain personnel already assigned to specific jobs was clearly a disadvantage.

Second Phase - last year of training.

Outside candidates were recruited following selection tests prepared in advance and conforming to job descriptions. Training effectiveness was much greater and the number of failures never rose above 10-15%. The trainees' adaptation to modern equipment and methods was easier and greater.

9.2 Brigade Schools - Production

Most of the roads on which the ORT Brigade Schools worked had received no mechanical maintenance during the past ten years. Thus, Brigade School activities during the first year concentrated on construction work. As a result, the two Regrading Brigade Schools were ineffective, because of lack of transport and rolling equipment.

These Brigades' training capacity was also limited. In view of the situation in the Zaire at the beginning of the Project, dividing the Brigade Schools into two groups was not viable. Five Reconstruction Heavy Brigades would have been preferable for both training and production purposes.

The system of reports and checking of activities of the Brigade Schools permitted the gathering of valid statistics on production norms, spare parts use and fuel consumption in various regions of the country.

9.3 Management

The management of the Project was responsible for all activities.

- Training:
  Execution and vocational teaching support (Program Planning Office)
- Road Construction:
  Feasibility of work, technical standards, general and particular specifications, use and maintenance of construction equipment.
- Supply and logistical support:
  Organization of a permanent supply system for spare parts, teaching materials, fuel, hand tools, machine-tools, raw materials, electrical equipment, oxygen, etc.
- Administration
  Travel and transport services, general office services, payments and finance: Contract budget, Peace Corps Logistical Support budget, Brigade Schools Operating budget, and Salaries budget for OR personnel.
- Liaison and relations with the Office des Routes, the Commissariat d'Etat aux Travaux Publics, U.S.A.I.D. and various teaching and training organizations.

As of the end of the "urgent" period, Project management was able to furnish all of the above services to the Training and Production Units without increasing its personnel (expatriate and local).

It is, consequently, recommended that for similar projects training and production programs be gradually increased after the initial period of organization and preparation of an administrative and logistical base.

9.4 Supply - Distribution

The Training and Production Units were located in five different areas of the country. The Brigade Schools, with the exception of the first year, were located in the same regions as the Training Centers.

Because of up-country conditions, local autonomous supply sources for the Units were extremely limited. Kinshasa furnished most supplies (as mentioned in paragraph 9.3) through the Project's "Supply Service".

As a result, the Kinshasa Training Center, in addition to its training function, became the principal transit point for all U.S-bought, and most locally-purchased, equipment. This system proved efficient and can be recommended.

9.5 Local Purchases

9.5.1 Shipping

Most of the purchasing and shipping for the five Centers and the Brigade Schools was done in Kinshasa.

Initially, cardboard cartons, ordered in large quantities from the United States, were used. However, despite the use of air freight, the cartons were opened and material was missing. This system was changed and wooden crates or metal trunks were used, which considerably increased shipping costs.

Furthermore, as river transport took four months, shipment by air was obligatory most of the time, and this again increased costs.

9.5.2 After-Sales Service

Suppliers' stocks were very low, even for routine parts such as filters, gaskets, etc., and orders could frequently not be

filled. About 60% of the parts needed by the Brigades had to be ordered from abroad by suppliers, which obviously increased the price of the parts considerably. To ensure an adequate supply of parts, one-year's stock is needed. It is for this reason that the OR has asked ORT to set up a warehouse capable of providing for its needs, independent of suppliers. This project began operations in January 1975 under a separate contract.

9.5.3 Standardization

Equipment standardization was very important for the Training Centers and Brigades, especially when training and retraining unskilled workers, who have difficulty in switching from one type of equipment to another. For example, an electrician who is accustomed to using a certain brand of volt-ampere meter will have difficulty using a different one, and a worker used to an Ifanger lathe will have equal trouble in switching brands.

Such equipment is costly, and unless a steady supply of spare parts is available, it becomes necessary to switch to different equipment. This again adds to costs.

To avoid these inconveniences, purchases should be made in large quantities to cover a period of at least two years. The Project could not use large quantities at the start, as its budget was limited to three years.

9.6 Purchases in the United States

9.6.1 General

A total of $585,000 was allocated for purchasing and shipping equipment and supplies from the United States and other countries specified in A.I.D. Geographical Code 941. Of this allocation, $526,000 was expended, all for material of U.S. source and origin, and for overseas shipping. As would be expected in a program of this scope, the equipment covered a

wide range. The main categories were machine-tools and related metal working equipment, communications and optical equipment, training aids, hand tools, raw materials, and office equipment and supplies.

Most of the $59,000 which remained unspent had been held back to meet various contingencies which did not materialize.

9.6.2 Communications Equipment

One of the largest single purchase orders covered receiving and transmitting equipment to permit radio contact among the various Centers and the Central Office in Kinshasa. The large distances to be covered and the difficulties of telephonic and postal contact made a radio system indispensable for effective operations. Originally, ORT chose a brand of equipment which they were convinced would give excellent and dependable service. However, the Office des Routes in its own operations had already installed equipment manufactured by a different U.S. company, and, to assure standardization, was eager to have the same kind of equipment placed in the ORT-administered Centers. Upon request, A.I.D. granted permission for the proprietary purchase of radio equipment from the supplier preferred by the Office des Routes.

The radio system functioned adequately. As the program neared completion, however, some service and repair proved necessary. Discussions were held with the manufacturer's representative in Zaire, and, as a result, the manufacturer's guarantee period was extended for an additional six months.

9.6.3 Shipping and Delivery Problems

Shipments from the United States to Africa were slowed down by a series of difficulties that plagued shippers intermittently

during the whole 1972-1974 period. The Farrell Lines, the U.S. flag line that handled virtually all ORT shipments from the U.S. to Zaire reported that at one point the whole export market was at such a low ebb that the departures of vessels were spaced further, and then further, apart to assure adequate cargo on each trip. As a result, many voyages were missed or cancelled. In addition, the energy crisis of 1972-1974 forced vessels to reduce speed to conserve fuel and limited the number of ports of call.

During this same period, the Farrell Lines reports, there was repeated congestion at ports in West Africa, leading to inordinate delays in the unloading of vessels. All these factors contributed to interrupt service to Matadi and to delay the delivery of shipments to Kinshasa. As a consequence of the reduced number of voyages, even a minor delay in delivery from a supplier in the United States sometimes led to a major delay in delivery to Africa; if a particular sailing was missed, it was necessary to wait many weeks for another.

The period beginning about the middle of 1973 and continuing far into 1974 was one of uncertainty and confusion stemming from the energy crisis, escalating inflation, and spreading shortages. Suppliers that could normally guarantee delivery within thirty to sixty days were now unable to promise delivery for many months.

A separate cause of delay in some instances was the necessity of adapting equipment manufactured in the United States to the technical requirements for use in Zaire where the mechanical and electrical standards differ. Machines which are normally produced to English standards had to be supplied with metric calibration; electrical equipment and accessories sometimes had to be specially adapted for use on current available in Zaire.

9.6.4 Minimal Damage

Cargo damage, theft, and loss are familiar problems in any large-scale shipping program. In the course of this three-year program, however, such difficulties were minimal, even trivial. There was some problem with export boxing, when the kind of boxing that is adequate for most shipping was not always adequate to withstand the rigors of shipping to Matadi and then overland to the central warehouse and inland Centers. In one instance, where there was damage to vital electronic parts, the supplier replaced the defective parts free of charge. In some other instances, there was minor damage that was readily repaired by project personnel. On the whole, however, the shipping record in these respects was excellent. With these minor exceptions, virtually all other shipments were received in good order.

9.6.5 Summary of Procedures in Dollar Purchasing

The selection of types of equipment was necessarily made in Zaire by ORT personnel, who were intimately familiar with the precise practical needs of the program. But the actual purchase was made in the United States. Consequently, extended correspondence was sometimes required to clarify exact needs and to make sure that the equipment ultimately purchased satisfied those needs. A summary of the various phases in purchasing procedure will make this problem clearer:

Before selections of equipment could be efficiently made in Zaire, copies of manufacturers' brochures with detailed specifications had to be obtained, almost all in the United States. After studying the alternative products, lists of requirements were sent from Zaire to New York, and competitive quotations sought by the New York procurement department. Since proprietary procurement is not permitted by A.I.D. Guidelines, except with special permission under exceptional circumstances, quotations were requested on an "or equal" basis. Orders which were likely to total $5,000 or more had to be advertised for 45 days

in advance of the actual purchase. In some instances, where a product offered by a low bidder differed in some significant respect from the equipment originally chosen in Zaire, it was advisable to send all bids to Zaire for study, to guarantee that the item offered at the lowest price was in fact equal to requirements.

The U.S. price structure caused some planning delay. Personnel in Zaire could not anticipate the high level of prevailing prices in the United States, the source of most dollar procurement. Prices far exceeded original expectations, especially in machine tools. A dramatic case in point came early in the program with the first tentative selections of machine tools and accessories, when the original choices were made in Zaire on the basis of the available brochures of U.S. manufacturers. Price estimates and actual quotations and bids were solicited in New York. When these prices were studied in Kinshasa, it became clear that the budget would not permit the purchase of this kind of equipment at current U.S. prices. The entire list had to be re-examined and revised in line with budgetary limitations and resubmitted for bids. This kind of problem, and others unavoidable in a procurement program of some complexity, explain why the first major shipments did not leave the United States until early 1973.

After shipments were finally received in Kinshasa, equipment had to be assigned to various Centers, sometimes re-boxed, and then shipped inland. In general, there was an over-optimistic tendency on all sides to underestimate the time required to select, to buy, to ship, and finally to put to use at work sites, the equipment purchased in accordance with A.I.D. Guidelines.

9.7 Rehabilitation of Machinery

The repair of machine tools and other heavy shop equipment was a very vital part of accumulating a stock of usable capital

equipment. The equipment was not purchased; but it was, in a sense, produced in the course of the program. This fact is worth noting as an achievement of the first order.

When ORT took over the responsibility for the workshops, they had been deserted and were in disarray. Sheds and buildings - all the structures - were badly in need of repair, of course; but most depressing was the condition of equipment and machinery. Virtually anything that could be picked up and moved had been carted away. Where heavy machines were still standing in place, they were all inoperable, because essential parts and accessories had been removed. In summary, the machines were simply rusting away. If this situation had continued, they would soon have become unusable, even for rough work, to say nothing of the kind of precision work required for vehicle maintenance. In time, they would have become irrevocably and permanently useless. Instead, most of this equipment was restored, to be used in the course of this Project and ready for many years of useful service in the future.

There is no attempt here to estimate, in dollar figures, the value of this rehabilitation work. However, even a cursory review or inspection will readily reveal that scores of expensive machine tools, that were in imminent danger of becoming totally worthless, are now available for the repair and maintenance of heavy road construction equipment. In fact, the value of the rehabilitated machinery, saved from disintegration and rendered usable, easily exceeds the total budget line for equipment and shipping spent over the entire three years of the contract. From this standpoint, it is perfectly accurate, and even an understatement, to report that every dollar spent for new equipment was more than matched by a dollar of value created.

9.8 Program Planning Office

The Project organization chart shows the Program Planning Office under the responsibility of the Training Coordinator. The description and breakdown of duties covering design and distribution of training materials, development of programs, tests and models, continuous checking of these, and organization of the photo lab as well as the specific results obtained therein, have led to the conclusion that the person responsible for the Program Planning Office and the Coordinator should be on the same organizational level, with both reporting directly to the Project Director.

9.9 Plan of Activities

A separate Plan of Activities was printed for each of the three years of the Project.

Although, for various reasons, the Office des Routes management did not consider, distribute or use these plans, they nonetheless fulfilled their principal objective.

- First year: normalization of relations between ORT, various Office des Routes departments and regional offices.

- Second and third years: As training progressed, the Plan of Activities provided a basis for the Units' training activities.

Conclusions

The preparation and distribution of the annual Plan of Activities is important for external and internal coordination. It is strongly recommended that they be continued even if certain basic information is missing at the time they are prepared.

9.10 Reporting System

A system of reports and forms was established and used to cover both the specific project goal of "on-the-job training in conjunction with production" and the need for introducing modern teaching methods and related training aids and equipment. The Office des Routes has adopted some of the forms and the ORT reporting system.

9.11 Training of Trainers

The final results of this training may be considered a success. It is suggested, however, that the pre-selection period be prolonged and that more candidates be allowed to participate in the selection tests.

9.12 Cooperation with Peace Corps Volunteers

Peace Corps Volunteers participated in the Project in administrative, teaching and production capacities. Their integration into the Project can be divided into two phases. The first year saw many departures due to adjustment problems.

During the two subsequent years, cooperation was stabilized in all areas and this contributed to the success of the Project.

On the basis of experience, the following is suggested for Peace Corps participation in similar projects:

- establishment of precise job description for each Volunteer
- improvement of vocational selection
- preparatory teacher training and an introduction to the use of training materials.

9.13 U.S. Excess Property

Late in 1972, at the suggestion of A.I.D., the ORT Mission studied the possibility of utilizing U.S. Government excess property.

Excess property with an original acquisition cost of $90,314 was selected and shipped to Zaire. The list is as follows:

2 Caterpillar Motor Graders
1 Michigan Loader
8 Diesel Engines

The loader and graders arrived in Zaire in October 1973 and the diesel engines in February 1974. The material arrived late in the program and could be assigned and shipped to the Brigades only toward the very end. All the equipment appeared to be satisfactory, although only some of it has already been put to use. The actual practical experience with using Excess Property has obviously been limited. However, it may be useful to suggest some tentative conclusions:

- Under certain conditions, heavy construction equipment from U.S. Government excess stockpiles can be quite useful in supplementing existing equipment or equipment newly purchased. However, the supplementary character of the excess should be underlined. With excess, there are inevitably uncertainties of delivery and difficulties in finding the kind of equipment that precisely meets specific needs. While it might be imprudent to try to initiate a program largely with excess, it can be used to increase the effectiveness of existing programs.

- If excess is to be effectively utilized, it must be selected long enough in advance to meet the practical needs of a working program. There seems to be an inevitable tendency to underestimate the time required to select, rehabilitate, ship equipment abroad, and then deliver it to the actual work site.

- Repairs and maintenance are at the heart of any construction program. To facilitate maintenance, standardization is helpful. When many pieces of equipment are of the same model and manufacture, it becomes easier to train personnel in repairs and to maintain stocks of spare parts. This need for uniformity may limit the feasibility of using excess when only scattered equipment of many different models of many different manufacturers is available.

- To avoid misunderstanding and possible disappointment, it is advisable that, before being shipped, all equipment be inspected by technically qualified personnel from the sites where it will be used. Consequently, it is necessary that the machines be brought into first-class operating condition before inspection by such individuals. The choices of the ORT representative were necessarily limited to equipment that had already been put into operating condition. This trip might have been even more productive if final repairs had been completed on more equipment.

9.14 Inventory Control

The efficient implementation of the procurement program required a careful, and in some respects burdensome, system of inventory control. The receipt of equipment and materials, and the consumption of raw materials, hardware, and expendable tools was accurately recorded at the Central Office in Kinshasa. Records were maintained of the distribution of material to all Centers.

Each Center in turn, under the direction of the ORT Office in Kinshasa, organized its own warehouse system, set up its own books, and established a tool control system. Each operated a tool crib from which workers were temporarily issued the tools and instruments required for a job and to which they returned the tools when they had finished.

When the program ended, all records were in excellent order. This is noteworthy when one realizes that the personnel

who can be credited with its success are not bookkeepers and accountants but are primarily engineers and skilled technicians.

9.15 Visits and Inspections

A number of official and semi-official visits took place during the three-year period of the Project, as well as a number of inspection tours. Certain visitors had been insufficiently briefed on conditions, objectives and obligations of the Contract, which sometimes led to erroneous conclusions and misunderstandings in subsequent reports.

9.16 ORT Personnel

Because of the lack of available schooling in certain up-country towns and difficult climatic conditions, the first year should be considered as a period of "adaptation".

9.17 Financing - Billing

At the request of the Office des Routes, ORT responsibilities in this area went far beyond Contract obligations, which foresaw only management of the Project operating budget.

The Project also managed the following supplementary budgets :

- Brigade Schools Operating Budget
- Peace Corps Logistical Support Budget
- Salaries Budget for ORT personnel assigned to the Project.

Two 100,000 Zaires advances were placed at the Project's disposal to ensure financing of these different activities. These accounts were replenished subsequently upon presentation by ORT of statements of expenses.

The first year of Project activities was marked by serious payment difficulties because of excessive OR delays in reimbursing various expenditure statements. This situation impeded progress of the Project, as it delayed training and production programs.

The payments situation subsequently improved, although it never became entirely satisfactory.

ANNEXES

Annex I	-	List of Training Aids used by the Project
Annex II	-	List of Summaries Prepared
Annex III	-	List of Technical Books and Manuals
Annex IV	-	Participant Training Program
Annex V	-	List of Quarterly Reports
Annex VI	-	List of Plans of Activities
Annex VII	-	List of Training Aids prepared in the Centers
Annex VIII	-	List of Forms Used
Annex IX	-	Collaboration with other Organizations
Annex X	-	List of Visitors
Annex XI	-	Project Inspection, Consulting Services
Annex XII	-	Amendments to the Contract
Annex XIII	-	Excess Property Equipment
Annex XIV	-	Construction and Equipping of the Centers
Annex XV	-	Map of Zaire

LIST OF TRAINING AIDS USED BY THE PROJECT

Slides

Section	Quantity	
	Central Office (available to the Training Units)	Distributed to the Training Centers Number by Center
General Mechanics	437	196
Auto/Diesel Mechanics	3,343	355
Welding	179	179
Auto Electricity	493	378
Road Construction	275	193
Total	4,727	1,301

Films

Section	Quantity	
	Central Office (available to the Training Units)	Distributed to the Training Centers Number by Center
Auto/Diesel Mechanics	8	1
Auto Electricity	9	1
Accident Prevention	11	
Total	28	2

Transparencies

Section	Quantity	
	Central Office (available to the Training Units)	Distributed to the Training Centers Number by Center
General Mechanics	31	The transparencies have been loaned to the Training Units according to requirements.
Thermic treatment of metals	9	
Welding	10	
Auto Mechanics	41	
Total	91	

Mobile Models

Section	Quantity	
	Central Office (available to the Training Units)	Distributed to the Training Centers Number by Center
General Mechanics	10	10
Auto/Diesel Mechanics	4	4
	14	14

ANNEX II

LIST OF SUMMARIES PREPARED AT THE CENTRAL OFFICE AND SENT TO AND USED BY THE TRAINING UNITS

Section	Subject	Number of Summaries
Auto/Diesel Mechanics	General and Vocational Technology	115
Auto Electricity	General and Vocational Technology	63
	Tools	1
	Technical Forms	4
General Mechanics	General and Vocational Technology General Mechanics	81
	General and Vocational Technology Metallurgy	6
	Technical Drawing Exercises and Corrections	32
	Geometry	28
	Practical Work:	
	Fitting	10
	Shaping	3
	Turning	13
Welding - Metalworking	General Technology - Oxyacetylene Welding	53
	Practical Work - Oxyacetlyene Welding	28
	General Technology - Electrical Welding	41
	Practical Work - Electrical Welding	45
Metalworking	Metalwork Drawing	24
	Practical Work	14
Storekeeping	Vocational Technology	21

Technical Dictionaries	French-English	15
	English-French	17
Road Construction	Graders (operation)	9
	TOTAL	623

Approximately 43,493 copies were printed and distributed to trainees between March 1973 and September 1974. As the number of trainees in the Training Units was 1,092, an average of 40 summaries were given to each.

ANNEX III

LIST OF TECHNICAL BOOKS AND MANUALS USED BY THE PROJECT

Section	Number of Documents	
	Central Library	Sent to the Training Units
General Mechanics	60	86
Welding and Metalwork	13	24
Drawing	16	11
Auto Mechanics	23	78
Diesel Mechanics	14	45
Ferry boats, Motorboats	6	6
General Electricity	24	10
Auto Electricity	6	34
Work Sites	26	82
Work Site Equipment	6	34
Topography	11	26
Teacher Training	14	9
Documentation	4	3
Miscellaneous	29	1
Total:	252	449

Total Central Office/Training Units: 701

ANNEX IV

PARTICIPANT TRAINING PROGRAM (GENEVA)

Section: General Mechanics (3 of the 10 months were spent doing practical training in businesses)

Subjects

Training at ORT Institute	Number of Hours
Workshop (practical work)	217
Vocational Technology	116
Organization	58
Metallurgy	58
Thermic treatment of metals	58
Practical Teaching	87
English	58
Machine drawing	174
Workshop Mechanics	43
Transmission Techniques	43
Mathematics	87
Reporting Techniques	43
Total	1,042 Hours

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Section: Auto-electricity (3 months of the 10 months were spent doing practical training in businesses)

Subjects

Training at ORT Institute	Number of Hours
Workshop (practical work)	217
Vocational Technology	101
Organization	58
Electricity laboratory	101
Practice Teaching	87
English	58
Machine drawing	101
Diagram drawing	87
Electrotechniques	58
Transmission Techniques	58
Mathematics	116
Reporting Techniques	43
Total	1,085 Hours

Section: Heavy Diesel Equipment (3 of the 10 months were spent doing practical training in businesses)

Subjects

Training at ORT Institute	Number of Hours
Workshop (practical work)	217
Vocational Technology	101
Organization	43
Metallurgy	58
Thermic treatment of metals	58
Practice Teaching	101
English	174
Machine drawing	101
Transmission Techniques	58
Mathematics	87
Reporting Techniques	43
Total	1,041 Hours

Section: Road Construction (approximately 8 months)

Subjects

Training at ORT Institute	Number of Hours
Road Construction	336
Civil Engineering	224
Topography	112
Heavy Equipment Workshop	128
Physics	48
Practice Teaching	48
Mathematics	128
Reporting Techniques	48
Accident Prevention	64
Total	1,136 Hours

ANNEX V

LIST OF QUARTERLY REPORTS

No.	Year	Period Covered		
1	1972	2/1/72	to	3/31/72
2	1972	4/1/72	to	6/30/72
3	1972	7/1/72	to	9/30/72
4	1972	10/1/72	to	12/31/72
1	1973	1/1/73	to	3/31/73
2	1973	4/1/73	to	6/30/73
3	1973	7/1/73	to	9/30/73
4	1973	10/1/73	to	12/31/73
1	1974	1/1/74	to	3/31/74
2	1974	4/1/74	to	6/30/74
3	1974	7/1/74	to	9/30/74

Note: All these reports were produced in both French and English versions. 85 of each version were printed every quarter.

ANNEX VI

LIST OF PLANS OF ACTIVITIES PRODUCED DURING THE PROJECT

No.	Title	Printing Date
1	Plan of Activities for the Normal Period. Program of activities from July 1 to December 31, 1972.	July 1972
2	Plan of Activities 1973. Program of activities from March 1 to December 31, 1973.	April 1973
3	Plan of Activities 1974. Program of activities from March 1 to December 31, 1974.	April 1974

Note: 120 copies of each of these Plans of Activities were printed and distributed.

ANNEX VII

LIST OF TRAINING AIDS PREPARED IN THE TRAINING CENTERS

Auto-Diesel Mechanics

Injection Pump	:	Front cut, delivery valve.
Motor	:	Cut of a cylinder head, motor block without piston, crankcase, crank shaft, cut showing the working of a piston, the camshaft and lifters. Cut showing the distribution.
Hydraulics	:	Lifting system for dump truck.
Brakes	:	Cut showing mechanical and hydraulic parts, master cylinder.
Gear Box	:	Cut showing the shafts and pinions.
Rear Axle	:	Cut showing the differential.

Auto-Electricity : A practical teaching model (board) containing all elements such as: starter, alternator, distribution, lights, brake lights.

Either cuts or unassembled pieces of parts such as:

Magneto
Alternator
Generator
Starter
Starter contacts
Ignition distributor
Regulator
Battery

General Mechanics - Welding :

Model (board) showing different couplings and cords for oxyacetylene welding, electric arc welding and soldering.

ANNEX VIII

LIST OF FORMS USED BY THE PROJECT

Brigade Schools

- Theoretical Training given at Work Sites (Monthly)
- Work Site Report (Daily)
- Work Site Report (Weekly)
- Advance of Work (Monthly)
- Report on Fuels and Lubricants and Equipment Use (Monthly)
- Traffic statistics
- Vocational Training Report (Monthly)

Training

- Training Request
- Invitation to take Selection Test
- General Conditions concerning Selection Tests
- Results of Selection Tests
- List of Candidates passed/failed
- Recruitment results
- Training contract
- Report on Trainees (Monthly)
- Roll-call List
- Training aids sent to ORT/Geneva
- Delivery Notice - Training Aids (Training Units)
- Delivery Notice - Library (Training Units)
- Delivery Notice - Technical Documentation (Training Units)
- Delivery Notice - Summaries (Training Units)
- Delivery Receipt (ORT/Geneva)
- Individual Trainee Information Sheet

Supply

- Purchase Order
- Work Order
- Stock card
- "Out" Stock card
- "In" Stock card
- Calculation card
- Internal Order Request
- Summary of "In" Stock cards
- Summary of "Out" Stock cards
- Delivery Notice
- Furniture Inventory
- Pending invoice
- Consumption of fuels and lubricants
- Entry Tax Exoneration Authorization
- Declaration Form
- Import License

Administration

- Personnel file
- Milk distribution order (for trainees)
- Notes for Quarterly Report
- Receipts
- Reimbursement Request
- Leave - Sick Leave Record
- Travel Order
- Check deposit sheet
- Breakdown of Accounts
- Report
- Request for preparation for trips to the interior and other travel
- Request for Special Residence Permit
- Accounting Inspection Report
- Work Contract
- Request for Consultation
- Individual Personnel Information Card
- Taxi expenses
- Supplementary hours worked
- Paysheet
- Daily Work Card
- Roll-call List
- Declaration of transfer of personnel
- Temporary labor

ANNEX IX

PROJECT COLLABORATION

With Zairian/Foreign Organizations or Administrations

Action KUSAIDIA	-	Office of the President
Zairian Airports	-	Ministry of Transport
Selection of Trainees	-	Swiss Technical Cooperation
Erosions in Kivu	-	Office des Routes
Radio communications	-	Philips
Kinshasa Fair (Fikin)	-	Office des Routes

With other Training Organizations

AIZR	-	Seminars
INBTP	-	Practical Training of Engineers
CFAV	-	Theoretical Road Construction Courses
LABO NATIONAL	-	Practical Training for INBTP Engineers
BACS	-	Training of Personnel
RVA	-	Selection and Training Program

ANNEX X

LIST OF VISITORS FROM ABROAD

IBRD	-	Washington
AID	-	Washington
ATA	-	Bonn
KAMPSAX	-	Nigeria/Denmark
RRI	-	Rwanda
PEACE CORPS	-	Washington
CHAMPION	-	Canada
CASE	-	USA
BCEOM	-	France
UNDP	-	USA
OOFP	-	Switzerland (Geneva)
ORT INSTITUTE	-	Switzerland (Geneva)
PHILIPS	-	USA

ANNEX XI

PROJECT INSPECTION

10/03/72	- 10/14/72	G. L. Smith, Chief Auditor, USAID/Kinshasa
10/03/72	- 10/14/72	F. O. Pischinger, Auditor, USAID/Kinshasa
10/03/72	- 10/14/72	T. R. Sequeira, Auditor, USAID/Kinshasa
09/05/73	- 09/15/73	A. Levy, Finance Department, ORT/Geneva
12/11/74	- 12/20/74	H. Benson, Procurement Officer, ORT/New York
12/12/74	- 12/19/74	A. Levy, Finance Department, ORT/Geneva

CONSULTANT SERVICES

05/05/72	- 05/12/72	E. B. Abrams, Director, Department of Technical Assistance, ORT/Geneva
11/10/72	- 11/17/72	" " "
11/29/73	- 12/05/73	" " "
04/13/74	- 04/18/74	" " "
10/30/74	- 11/06/74	" " "
05/26/72	- 06/16/72	S. Kastel, Project Coordinator, ORT/Geneva
01/26/73	- 02/13/73	" " "
05/03/73	- 05/15/73	" " "
11/15/73	- 12/19/73	" " "
03/16/74	- 03/27/74	" " "
07/17/74	- 07/31/74	" " "
05/26/72	- 06/16/72	A. Barkol, Consultant, ORT/Geneva
01/26/73	- 02/15/73	" " "
03/06/74	- 03/12/74	A. Gooch, Department of Technical Assistance, ORT/Geneva
05/22/74	- 05/24/74	S. Feldman, Assistant Director, Department of Technical Assistance, ORT/Geneva

AMENDMENT TO THE NOVEMBER 30, 1971 CONTRACT

The Contract was amended twice as follows:

a) Amendment No. 1

Post 10 - Brigade Schools Coordinator

The Director of the Office des Routes agreed to this additional position, and the amendment was signed by the Minister of Public Works at the request of U.S.A.I.D. The budget was increased accordingly.

b) Amendment No. 2

The budget in Zaires was modified as follows:

Article 7,B,2 of the Contract:

- Read Z. 1,249,120 instead of Z. 1,160,620

Article 7,C,2 of the Contract:

	Read	Instead of
Equipment, supplies and educational materials	66,000.-	60,000.-
Participant Training	13,250.-	9,750.-
Repair Training Centers	92,500.-	62,500.-
Operating costs	393,000.-	373,000.-
Housing	338,600.-	313,600.-
Maintenance, repairs on housing	55,500.-	51,500.-

Article 7,C,3 of the Contract:

- Read Z. 1,249,120 instead of Z. 1,160,620.

The budget in dollars was modified as follows:

Article 7,B,1 of the Contract:

- Read $ 3,741,300 instead of $ 3,544,541

Article 7,C,1; Time/Rate payments were modified and man/month services were increased to totals of $ 2,084,162 and 1,205 months respectively.

Article 7,C,2 of the Contract:

	Read	Instead of
Geneva and New York Staff	323,308	291,914
Miscellaneous	29,500	15,000
Participant Training	227,742	181,464

Article 7,C,3 of the Contract:

- Read $ 3,741,300 instead of $ 3,544,541

ANNEX XIII

COLLABORATION BETWEEN USAID AND ORT TOWARDS ACQUISITION OF EXCESS PROPERTY EQUIPMENT

Article 2, B,8 of the Contract, "Equipment and Supply Requirements", stipulated:

"It is understood that the O.R. shall place the necessary heavy equipment at the disposition of the training program. It is further understood that the O.R. may be requested to supplement and finance additional equipment required for training programs."

The O.R. was not able to provide the latter, and USAID agreed to a supplementary loan of $200,000 to furnish the Training Centers with heavy equipment to be used for training purposes.

The following equipment was, subsequently, made available to the Centers:

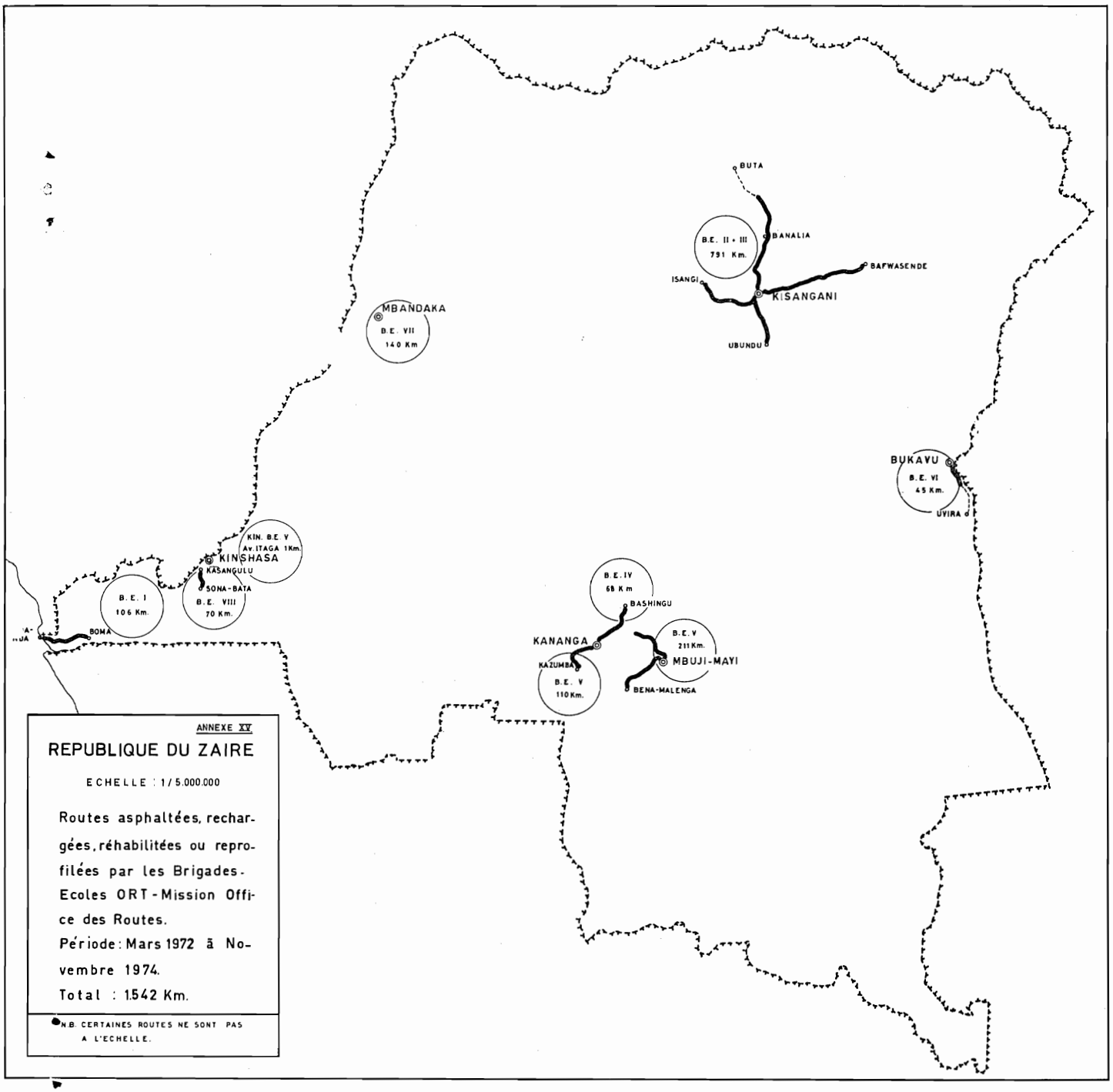
1	Loader	arrived	Matadi	01.09.74
2	Graders	"	"	11.27.73
8	Caterpillar motors	"	"	07.06.74

CONSTRUCTION AND EQUIPPING OF CENTERS

Investment for repair and equipping:
(price in Z.)

Classrooms and Projection Room,
Fixing up of workshops,
Interior and exterior repairs,
Installation of sanitary and electrical facilities,
administrative offices and a central storeroom.

KINSHASA	KANANGA	KISANGANI	MBANDAKA	BUKAVU	TOTALS
19,906.70	21,269.82	17,906.70	10,215.56	10,941.40	80,240.18


ANNEXE XV
REPUBLIQUE DU ZAIRE
ECHELLE : 1/5.000.000
Routes asphaltées, rechargées, réhabilitées ou reprofilées par les Brigades-Ecoles ORT-Mission Office des Routes.
Période: Mars 1972 à Novembre 1974.
Total : 1.542 Km.
N.B. CERTAINES ROUTES NE SONT PAS A L'ECHELLE.
BUTA
B.E. II + III
791 Km.
BANALIA
BAFWASENDE
ISANGI
KISANGANI
UBUNDU
MBANDAKA
B.E. VII
140 Km
BUKAVU
B.E. VI
45 Km.
UVIRA
KIN. B.E. V
Av. ITAGA 1Km.
KINSHASA
KASANGULU
SONA-BATA
B.E. VIII
70 Km.
B.E. I
106 Km.
BOMA
B.E. IV
68 Km
BASHINGU
KANANGA
KAZUMBA
B.E. V
110 Km.
B.E. V
211 Km.
MBUJI-MAYI
BENA-MALENGA