

ANNEX 7 Condition of Construction Equipment owned by RBD

	RBD INVENTORY (Surveyed in Apr.1990)											RBD INVENTORY (Surveyed in May 1992)											RBD Inventory (Surveyed in Dec 1992)	Collected on to ODEM in Aug.1993
	Road Rehabilitation Units					Autonomous Companies						Road Rehabilitation Units					Autonomous Companies							
	RN 5A	RN 5B	RN4&18	RN1,2,3&6	North-east Region, RN13, 14 &19	Crushing Stone Co.(7 quarries)	Bridge Construction Co.	Building Construction Co. & Warehouse	Ferry Companies	Road Construction Co.	Total	RN 5A	RN 5B	RN4&18	RN1,2,3&6	North-east Region, RN13, 14 &19	Crushing Stone Co.(7 quarries)	Bridge Construction Co.	Building Construction Co. & Warehouse	Ferry Companies	Road Construction Co.	Total		
Bull Dozer (Tr.Shovel)	4/3/1	1/1/0	1/1/0	7/5/2	5/4/1		3/1/2			7/5/2	28/20/8	3/3/0	1/1/0		2/2/0	5/3/2		3/1/2	1/1/0	1/1/0	5/4/1	20/15/2	22/17/5	10/3/7
Motor Grader	1/1/0	1/1/0	1/1/0	2/1/1	3/3/0					2/2/0	10/9/1	1/1/0	1/1/0		1/1/0	3/3/0					4/4/0	10/10/0	10/10/0	4/2/2
Wheel Loader		1/1/0	1/1/0	1/1/0	1/1/0					2/2/0	6/6/0		2/2/0		7/5/2						5/5/0	15/13/2	13/11/2	4/3/1
Excavator	1/1/0	1/1/0	1/1/0	5/3/2	1/1/0	8/4/4	1/1/0	1/1/0		3/3/0	22/16/6				2/2/0							2/2/0	13/13/0	
Wheel Excavator							1/0/1				1/0/1	1/1/0	1/1/0									2/2/0	7/7/0	4/3/1
Tire Roller										2/2/0	2/2/0													
Steel Roller	4/3/1	8/5/3	2/2/0	9/6/3	2/1/1					9/9/0	34/26/8	4/3/1	5/5/0		8/3/5							10/10/0	28/22/6	33/24/9
Tractor				3/3/0	3/3/0	2/2/0	2/1/1	1/1/0	1/1/0	2/1/1	14/12/2				2/2/0	2/2/0					1/1/0	14/14/0	14/6/8	2/1/1
Truck Crane						1/1/0	19/15/4		2/1/1	1/1/0	23/18/5				2/2/0	2/2/0					11/7/4	4/4/0	5/5/0	20/16/4
Dump Truck	11/10/1	15/11/4	15/13/2	19/18/1	15/13/2	19/10/9	6/6/0	6/5/1	1/0/1	31/22/9	138/108/30	9/1/8	12/8/4	14/10/4	17/8/9	11/11/0					6/6/0	3/3/0	3/3/0	24/23/1
Flat Bed Truck	2/2/0	4/1/3	3/2/1	17/10/7	13/12/1	6/5/1	23/14/9	4/1/3		7/7/0	79/54/25	1/1/0	3/3/0	1/1/0	4/1/3	6/6/0					18/12/6	6/6/0	6/6/0	5/4/1
Fuel Tanker			1/1/0			3/3/0	2/2/0		8/6/2	2/2/0	16/14/2		3/3/0	5/5/0							2/2/0			50/40/10
Water Tanker	1/1/0	1/1/0		4/4/0	1/1/0					5/5/0	12/12/0	1/1/0	1/1/0	1/1/0	2/1/1	9/7/2					2/1/1	8/8/0	2/1/1	7/7/0
Concrete Mixer							1/1/0	1/0/1			2/1/1													
Concrete Mixer truck							1/1/0				1/1/0													
Asphalt Finisher										3/3/0	3/3/0													
Asphalt Plant										2/2/0	2/2/0													3/0/3
Scraper										6/5/1	6/5/1													
Generator		2/2/0		1/1/0	1/1/0	10/9/1	9/5/4	1/1/0	1/1/0	2/2/0	27/22/5	2/2/0	3/3/0		2/2/0	1/0/1						6/5/1	6/5/1	6/5/1
Fork Lift							1/0/1			1/1/0	2/1/1										1/1/0	8/8/0	2/2/0	19/18/1
Pick Up		1/1/0				1/0/1		1/0/1	1/1/0	1/1/0	5/3/2													2/2/0
Jeep	1/1/0			3/2/1	2/2/0	2/1/1	3/1/2		1/1/0	4/4/0	16/12/4										1/1/0	1/1/0	1/0/1	3/2/1
Mobile Workshop					1/1/0					1/1/0	2/2/0										1/0/1			1/0/1
Tractor				2/1/1	1/0/1	9/3/6	1/0/1			2/2/0	15/6/9				4/3/1	1/1/0						1/1/0	1/1/0	
Bus							2/2/0			1/1/0	3/3/0										1/0/1			1/0/1
Sweeper										2/2/0	2/2/0													2/2/0
Compressor						10/6/4	3/2/1			1/1/0	14/9/5											5/5/0		2/2/0
Welding Machine						1/1/0	2/1/1	1/1/0		1/1/0	5/4/1												5/5/0	
Crushing Machine						14/10/4					14/10/4													7/7/0
Drilling Machine																								
Water Pump				1/1/0			3/2/1				4/3/1	1/1/0									2/2/0		2/2/0	
Miscellaneous						2/1/1	4/2/2	8/6/2	15/8/7	1/1/0	30/18/12										2/2/0		3/3/0	
Total	25/22/3	35/25/10	25/22/3	74/56/18	49/42/7	88/56/32	87/57/30	24/16/8	30/19/11	101/88/13	538/402/136	23/14/9	32/28/4	21/16/5	44/25/19	48/41/7		47/31/16	51/50/1	37/35/2	85/80/5	388/320/68	353/280/73	85/40/45

Note: Figures shown as i/j/k in each column indicate:

i= inventory number

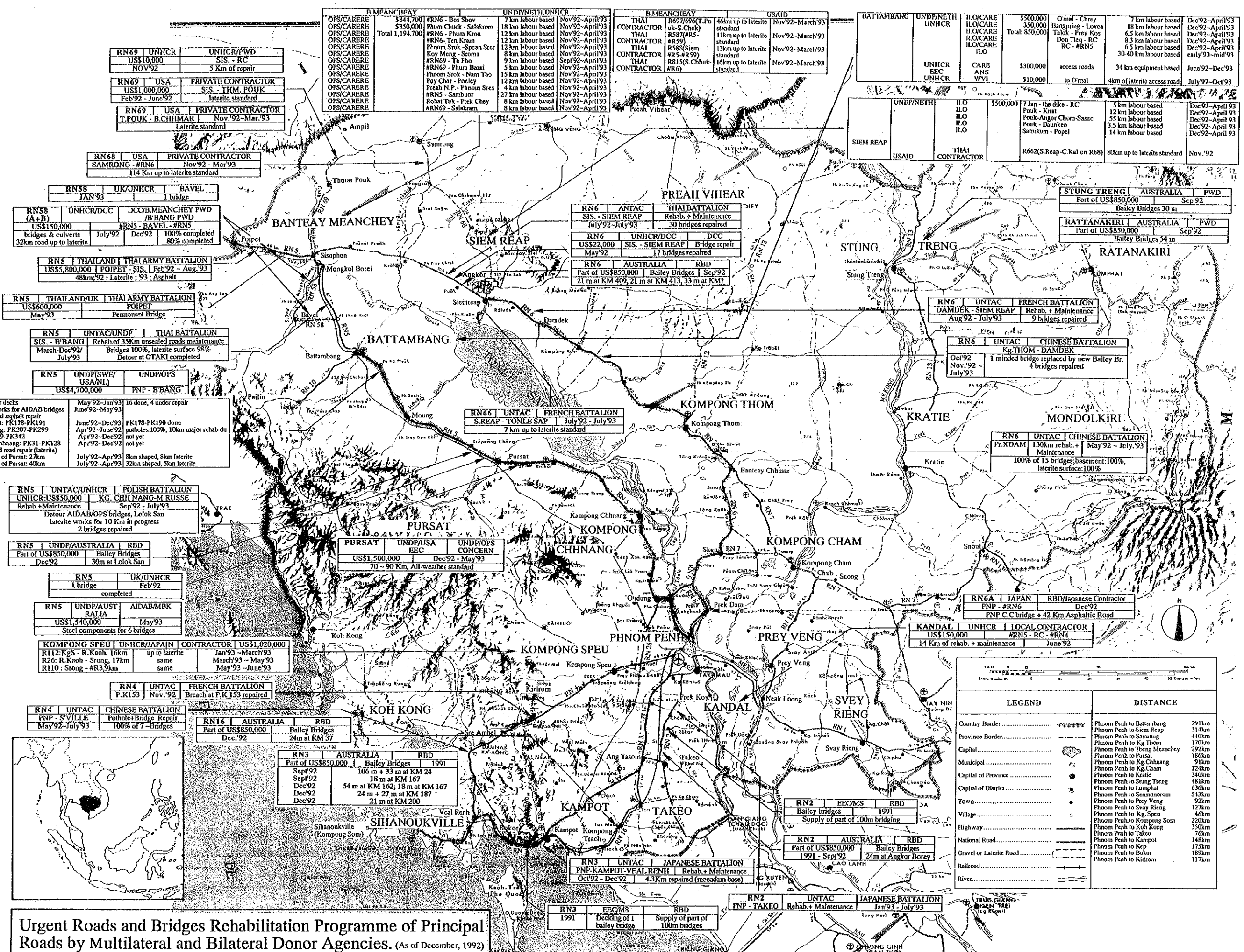
j= operable number

k= non-operable number due to spare parts deficiency or scrapped number

**ANNEX 8 Urgent Roads and Bridges Rehabilitation Programme of Principal Roads**  
by Multilateral and Bilateral Donor Agencies

(Overviewed by UNDP, as of 1 DECEMBER 1992)

ROAD AND PROVINCE	DONOR	IMPL-AGENCY	BUDGET(US\$)	SECTION	OBJECTIVES/TASKS	START	END	PROGRESS
1. National Road RN 2	UNTAC ECOMS AUSTRALIA	JAPANESE BATTALION RBD	part of \$850,000	PNP - TAKEO	rehab + maintenance Bailey bridges	Jan'93 1991	July'93	supply of part of 100m bridging 24 m at Angkor Borey
RN3	UNTAC	JAPANESE BATTALION RBD	part of \$850,000	PNP - KAMPOT	rehab + maintenance Bailey bridges	Oct'92 1991	Sept'92 Dec'92	4.3 km repaired (macadam base) decking of 1 bailey bridge 106 m + 33 m at KM 24 18 m at KM 167 54 m at KM 162; 18 m at KM 167 24 m + 27 m at KM 187 21 m at KM 200
RN 4	UNTAC	CHINESE BATTALION FRENCH BATTALION		PNP - S'VILLE PK 153	Pobole + Bridge Repair	May'92 Nov'92	July'93	100% of 7 bridges breach at PK 153 repaired
RN 5	UNTAC/UNHCR	POLISH BATTALION	UNHCR: \$50,000	KG CHHANG-M-RUSSE	rehab + maintenance	Sept'92	July'93	detour AIDAB/OFS bridge; LoLoSan laterite works for 10km in progress 2 bridges repaired
RN 6A	UNTAC	THAI BATTALION		SIS - B'BANG	rehab of 35km unsealed roads maintenance	March 92	Dec'92 July'93	bridges 100%, late rite surface 98% detour at OTAKI completed
RN 6B	UNDP (SWE/USA/NL)	UNDP/OPS	\$4,700,000	PNP - B'BANG	25 timber decks local works for AIDAB bridges degraded asphalt repair * Pursat: PK178-PK191 * B'bang: PK207-PK299 * PK299-PK342 * Kg-Chhaung: PK31-PK128 * North of Pursat: 27km * South of Pursat: 40km 48km: 92:laterite; 93:asphalt permanent bridge	May'92 June'92	Jan'93 May'93	16 done, 4 under repair
RN 6C	THAILAND TAHILAND/UK UNDP/AUSTRIA	THAI ARMY BATTALION THAI ARMY BATTALION AIDAB/MBK RBD	\$2,800,000 \$600,000 \$1,540,000 part of \$850,000	POIPEI - SIS. POIPEI	unsealed road repair (laterite)	July'92 July'92 Feb'92	Dec'92 July'93	PK178-PK190 done potholes: 100%, 10km major rehab due not yet not yet 8km shaped, 8km laterite 52km shaped, 5km laterite
RN 6D	UK/UNHCR	CHINESE BATTALION		Fr. KDAM-Kg. THOM	130km rehab + maintenance	May'92	July'93	30 m at LoloK San completed
RN 6E	UNTAC	FRENCH BATTALION THAI BATTALION		Kg. THOM - DAMDEN DAMDEN - SIEM REAP SIS - SIEM REAP	rehab + maintenance Bailey Bridges	Oct'92 Nov'92 Aug'92 July'92	July'93	100% of 15 bridges; basement: 100% laterite surface: 100% 1 mired bridge replaced by new Bailey Bridge. 4 bridges repaired 9 bridges repaired 30 bridges repaired 21 m at KM 409; 21 m at KM 413 33 m at KM?
RN 6F	AUSTRALIA	DCC	part of \$850,000 part of \$22,000	SIS - SIEM REAP PNP - #RN6	Bridges repair PNP bridge + 42 km asphalt	May'92 Dec'92	March'94 Dec'92	17 bridges repaired design study ongoing 24 m at KM 37
RN 6G	UNHCR/DCC	RBD/Japanese Contractors	30 to 40million	#RNS-BAVEL-RN5	bridges & culverts	Dec'92	Dec'92	100% completed
RN 6H	UNHCR/DCC	DCC/B. MEANCHHEY PWI /B'BANG PWD	part of \$850,000	#RNS-BAVEL-RN5	32 km road up to laterite	July'92	Jan'93	80% completed
RN 6I	UNHCR	FRENCH BATTALION		BAVEL	1 bridge	July'92	Jan'93	
RN 6J	UNHCR	PRIVATE CONTRACTOR		S.REAP-TONLE SAP	7km up to laterite standard	July'92	July'93	
RN 6K	USA	UNHCR/PWD	\$10,000	SAMRONG-#RN6	114km up to laterite standard	Nov'92	March'93	
RN 6L	USA	PRIVATE CONTRACTOR	\$10,000	SIS - RC	5km of repair	Nov'92	June'92	completed
RN 6M	USA	PRIVATE CONTRACTOR	\$1,000,000	SIS - THM. POUK	laterite standard	Feb'92	March'93	completed
2. Secondary & Tertiary Road PURSAT	UNDP/USA EEC	UNDP/OPS CONCERN	\$1,500,000	T. POUK-B. CHHANNAR	70-90 km, all weather standard	Dec'92	May'93	
BMEANCHHEY	UNDP/NETH. UNHCR	OPS/CARE OPS/CARE OPS/CARE OPS/CARE OPS/CARE OPS/CARE OPS/CARE OPS/CARE OPS/CARE OPS/CARE OPS/CARE OPS/CARE OPS/CARE OPS/CARE	\$844,700 \$350,000 Total \$1,194,700	#RN6 - Bos Shov Phum Chuek - Salakrom #RN6 - Phum Krou #RN6 - Ten Kram Phnom Srok - Spean Sre Koy Meng - Siroma #RN69 - Ta Pho Phnom Srok - Phum Barai Phnom Srok - Nam Tso Poy Char - Ponley Preah N.P. - Phnom Sres #RNS - Sambour Rohat Tuk - Prek Chey #RN69 - Salakram	7 km labour based 18 km labour based 12 km labour based 12 km labour based 8 km labour based 9 km labour based 5 km labour based 15 km labour based 12 km labour based 4 km labour based 27 km labour based 8 km labour based	Nov'92 Nov'92 Nov'92 Nov'92 Nov'92 Nov'92 Nov'92 Nov'92 Nov'92 Nov'92 Nov'92 Nov'92 Nov'92 Nov'92	April'93 April'93 April'93 April'93 April'93 April'93 April'93 April'93 April'93 April'93 April'93 April'93 April'93 April'93	
BATTAMBANG	USAID	THAI CONTRACTOR THAI CONTRACTOR THAI CONTRACTOR	R697/696(T. Pouk-S. Chek) R587/(RS-#RS9) R388/(Siem-#RS-#RS9) R815/(S. Chhuk-#R6)	O'nal - Chey Bangrang - Loea Tabok - Prek Kos Don Thet - RC RC - #RNS	46km up to laterite standard 11km up to laterite standard 13km up to laterite standard 16km up to laterite standard	Nov'92 Nov'92 Nov'92 Nov'92	Mar'93 Mar'93 Mar'93 Mar'93	
BATTAMBANG	UNDP/NETH. UNHCR	ILO/CARE ILO/CARE ILO/CARE ILO/CARE ILO	\$500,000 \$350,000 Total: \$850,000	O'nal - Chey Bangrang - Loea Tabok - Prek Kos Don Thet - RC RC - #RNS	7 km labour based 18 km labour based 6.5 km labour based 8.3 km labour based 6.5 km labour based 30-40 km labour based	Dec'92 Dec'92 Dec'92 Dec'92 Dec'92 early'93	April'93 April'93 April'93 April'93 April'93 mid'93	
BATTAMBANG	UNHCR EEC	CARE ANS WVI	\$300,000	access roads	34 km equipment based	June'92	Dec'92	
BATTAMBANG	UNHCR	PWD	\$10,000	to O'nal	4km of laterite access road	July'92	Oct'92	completed
STUNG TRENG	AUSTRALIA	PWD	part of \$850,000	Bailey Bridges	Bailey Bridges	July'92	Sept'92	54 m
KOMPONG SPEU	AUSTRALIA UNHCR/JAPAN	CONTRACTOR	part of \$850,000 part of \$1,020,000	Bailey Bridges	up to late rite-18 bridges Bailey Bridges	Jan'93 March'93 May'93	Sept'92 Sept'92 March'93 May'93 June'93	30 m
KOMPONG SPEU	UNDP/NETH.	ILO	\$500,000	R112: Kg. S. R. Kaoh 16km R268: Kaoh Srong 17km R110: Srong-#RS 9km 7 Jan - the dike - RC Pouk - Knat	5 km labour based 12 km labour based 55 km labour based 3.5 km labour based 14 km labour based	Dec'92 Dec'92 Dec'92 Dec'92 Dec'92	April'93 April'93 April'93 April'93 April'93	Mine reconnaissance missions ongoing
SIEM REAP	USAID UNHCR	THAI CONTRACTOR LOCAL CONTRACTOR	R662/(S.Reap-C.Kal on R69) \$150,000 #RNS - RC - #RN4	80km up to laterite standard 14km of rehab+maintenance	80km up to laterite standard 14km of rehab+maintenance	Nov'92 June'92	July'92	rehabilitation completed



**Urgent Roads and Bridges Rehabilitation Programme of Principal Roads by Multilateral and Bilateral Donor Agencies. (As of December, 1992)**

LEGEND		DISTANCE	
Country Border	-----	Phnom Penh to Battambang	291km
Province Border	-----	Phnom Penh to Siem Reap	314km
Capital	●	Phnom Penh to Kampong Speu	170km
Municipal	○	Phnom Penh to Phnom Penh	292km
Capital of Province	●	Phnom Penh to Pursat	186km
Capital of District	●	Phnom Penh to Kampong Chhnang	91km
Town	●	Phnom Penh to Kampong Cham	124km
Village	●	Phnom Penh to Kampong Speu	340km
Highway	-----	Phnom Penh to Stung Treng	481km
National Road	-----	Phnom Penh to Kampong Speu	636km
Gravel or Laterite Road	-----	Phnom Penh to Kampong Cham	543km
Railroad	-----	Phnom Penh to Prey Veng	92km
River	-----	Phnom Penh to Svey Rieng	127km
		Phnom Penh to Kampong Speu	44km
		Phnom Penh to Kampong Som	220km
		Phnom Penh to Koh Kong	350km
		Phnom Penh to Takeo	76km
		Phnom Penh to Kampong	148km
		Phnom Penh to Kep	173km
		Phnom Penh to Borey	189km
		Phnom Penh to Kirotom	117km



## ANNEX 9 Calculation of Operation Cost

Generally, operation cost of equipment comprises:

- Depreciation
- Fuel and lubricant
- Spare parts
- Maintenance
- Repair
- Operator's wage

For the purpose of the estimates of this Project, the following premises are considered.

- Since concept of "depreciation" is to be applied to operation on commercial basis, it is omitted from the cost.
- As "spare parts" will be supplied under the Project, it can be omitted from the operation cost, however some consumable items are required to be additionally procured, which assumed to be 5% of "spare parts" calculated.
- "maintenance" and "repair" costs are appropriated in the following item 3) Labour cost.

Thus, the annual operation cost for the equipment to be supplied is estimated as follows:

Item	Operation Cost for the Equipment to be Supplied US\$
Fuel & Lubricant	226,646
Spare parts	7,732
Operator's wages	94,449
Total	328,827

### 2) Estimates of operation cost for the workshop improved

Operation cost of the workshop comprises:

- Operation of the facilities
- Wages
- "operation cost of the facilities" is assumed to be equal to the fuel and lubricant costs consumed by generators for the purpose of power supply for the facilities, which is calculated as:
  - Generator : 300 KVA
  - Fuel consumption : 35 lr/hour x 6.5 hours/day x 250 days = 56,875 lr/year
  - Operation cost : US\$0.38/ lr x 56.875 lr = US\$ 21,612/year
- "wages" are appropriated in the following item 3) Labour cost

### 3) Estimates for labour cost

Labour cost is assumed to be fixed cost which comprises:

- Labour cost for road maintenance works
- Labour cost for equipment maintenance works at workshop
- "labour cost for road maintenance works" is calculated by cumulating the number of labours required for each maintenance work, but the costs for operator and driver are appropriated in the above item 1) Operation cost for the equipment to be procured
- "labour cost for equipment maintenance works at workshop" is calculated by cumulating the number of labour required for each repairing work

OPERATION COST OF THE EQUIPMENT

Unit: US\$

NO.	EQUIPMENT	NOS.	WORK DAYS PER YEAR (180 DAYS)				570 HOURS/YEAR				TOTAL
			DEPRECIATION	FUEL	SPARE PARTS	MAINTENANCE	REPAIR	OPERATION			
1	Bulldozer	4	84,707	23,976	1,788	1,922	1,280	4,332	118,006		
2	Motor Grader	4	53,530	22,225	2,444	1,390	934	4,332	94,855		
3	Wheel Loader	4	58,495	17,182	11,400	1,277	850	4,332	93,535		
4	Backhoe	2	47,702	8,436	1,532	835	558	2,166	61,229		
5	Tandem Roller	2	20,000	6,042	1,368	710	467	2,166	30,753		
6	Vibration Roller	4	72,001	12,084	7,241	1,419	934	4,332	98,011		
7	Dump Truck	8	97,697	20,739	23,019	1,372	912	7,752	151,490		
8	Asphalt Distributor	2	29,996	8,349	5,189	784	514	2,166	46,979		
9	Asphalt Kettle Sprayer	4	3,765	2,964	2,006	365	310	3,648	13,058		
10	Rammer	4	1,412	629	1,441	150	98	3,648	7,378		
11	Hand Guided Vib. Roller	4	10,353	1,085	1,642	638	430	3,648	17,797		
12	Water Tanker	4	46,193	19,544	11,509	730	401	3,876	82,254		
13	Fuel Tanker	4	43,794	19,544	11,509	730	401	3,876	79,854		
14	Pickup	4	11,998	2,964	2,006	365	328	3,648	21,310		
15	Land Cruiser	4	19,088	3,648	2,189	401	365	3,648	29,339		
16	Chip Spreader	2	5,177	1,482	5,755	365	201	1,824	14,803		
	Sub Total		615,906	170,895	92,039	13,432	8,985	59,394	960,651		
1	Truck Crane	1	38,769	543	4,884	291	194	1,083	45,764		
2	Trailer/Tractor	1	19,197	3,564	10,657	445	182	1,083	35,128		
3	Mobile Workshop	1	26,279	2,296	3,876	598	399	912	34,361		
4	Wheel Loader	2	52,942	10,830	6,566	730	547	2,166	73,781		
5	Tractor Shovel	1	27,059	5,994	456	483	328	1,083	35,404		
6	Portable Crusher	1	12,059	684	2,964	456	365	1,083	17,611		
7	Pickup	2	5,999	1,482	1,003	182	164	1,824	10,655		
8	Land Cruiser	1	4,772	912	547	100	91	912	7,335		
9	Flatbed Truck	2	20,997	3,279	3,420	456	182	1,938	30,272		
10	Air Compressor	2	6,588	5,153	5,928	365	237	1,824	20,095		
11	Generator	2	7,059	5,153	5,928	365	237	1,824	20,566		
12	Concrete Cutter	1	494	684	1,824	160	108	912	4,181		
13	Line Marker	1	1,363	684	502	91	82	912	3,634		
14	Concrete Mixer	1	14,118	2,592	2,877	171	114	1,083	20,956		
15	Concrete Vibrator	8	2,836	2,189	3,648	365	255	7,296	16,589		
16	Asphalt Kettle	2	19,835	7,524	5,700	638	456	1,824	35,978		
17	Water Pump	4	1,636	2,189	912	182	168	3,648	8,735		
18	Radio Set	4	8,657	0	912	73	36	3,648	13,326		
	Sub Total		270,660	55,751	62,604	6,152	4,148	35,055	434,370		
	Total		886,566	228,646	154,643	19,584	13,133	94,449	1,395,021		

LABOUR COST

Unit: Man · Day for Item 1 to 19

Code	Type of Work	Engineer	Assistant Engineer	Foreman	Labour	Carpenter	Mechanic	Assistant Mechanic	Oddman	Management	Administration
1	Asphalt Patching	0.2	0.3	1	9						
2	Base Failure Repair	0.2	0.3	1	6						
3	Blading Gravel Road	0.2	0.3	1	2						
4	Spot Repair Gravel Surface	0.2	0.3	1	6						
5	Ditch Cleaning	0.2	0.3	1	2						
6	Shoulder Blading	0.2	0.3	0	1						
7	Base Preparation	0.3	0.4	1	12						
8	Gravel Resurface	0.3	0.4	1	7						
9	Shoulder Rehabilitation	0.3	0.4	1	6						
10	Bridge & Concrete Structure	0.5	1	1	12	8					
11	Surface Work	0.5	1	1	12						
12	Stone Crushing	1	1	2	13						
13	Selected Material Production	0.2	0.3	1	1						
14	Preventive Maintenance Section			2	1						
15	Workshop Mechanical Section	1	2	4	2			3	5	2	
	- Vehicle Section			1	1			8	10	3	
	- Welding & Chassis Sec.			3	1			6	8	2	
	- Electrical Section			2	2			5	5	2	
16	Warehouse							3	2	1	
17	Transportation	0.3	0.4	1	3						6
18	Administration	1	2	1	2						1
19	Facilities Repair			1	1				2	3	10
	Total (man · days)	6.6	11.7	28	112	10	25	30	19	5	17
	Site Work : 7 months/year	210	210	210	210	210	210	210	210	210	
	Wages for Site Work (US\$)	10.0	7.3	6.0	5.0	6.0	6.0	5.3	3.3	5.3	4.0
	Sub Total (US\$)	13,860	18,018	35,280	117,600	12,600	31,500	33,600	13,300		
	Normal Work : 5 months/year	3.3	2.3	1.0	0.8	1.0	1.0	0.9	0.5	0.9	0
	Wages for Normal Work (US\$)	155	155	155	155	155	155	155	155	155	155
	Sub Total (US\$)	3,410	4,232	4,340	14,467	1,550	3,875	4,185	1,473	698	1,757
	Total (US\$)	17,270	22,250	39,620	132,067	14,150	35,375	37,785	14,773	698	1,757
											315,743

ANNEX 10. Calculation of Number of Bay Required for the Workshop

A. Construction machines

Assumed the required repair days at the workshop for the repair to be two times that of in Japan.

Repairs	Required days	Standard required days in Japan (commercial)
Medium repairs	20	10
Heavy repairs	60	30

Remarks: • Medium: Replacement of parts which requires disassembling or renovation of parts brings the machines to operable.  
 • Heavy: Total rehabilitation of machines is needed to bring the machine to operable.

Working hours for construction machines to be 1,000 hours/year on average.

Thus,

For medium repair:

- 2,000 hours (approx. 1 time per 2 years)
- nearly 50% of so-called medium repairs to be made at construction site.

For heavy repair:

- at every 6,000 hours (1 time per 6 years)

Number of bay:

- Bay for medium repair:  
 $20(\text{days}) \times 100(\text{units}) \times 50\% \times (1 \text{ time}/2 \text{ years}) / (250 \text{ days}/\text{year}) = 2.0$
- Bay for heavy repair:  
 $60(\text{days}) \times 100(\text{units}) \times 50\% \times (1 \text{ time}/2 \text{ years}) / (250 \text{ days}/\text{year}) = 4.0$

Thus, the number of bay for construction machines shall be 6.

B. Vehicles

Required repair days assumed to be two times that of in Japan.

Repairs	Workshop	Standard in Japan
Medium repairs	16	8
Heavy repairs	40	20

Mileage to be 10,000 km/year on average

Thus,

For medium repair:

- at every 25,000 km (1 time per 2.5 years)

For heavy repair:

- at every 100,000 km (1 time per 10 years)

Number of bay:

- Bay for medium repair:  
 $16(\text{days}) \times 350(\text{units}) \times (1/2.5) / (250 \text{ days}/\text{year}) = 9$
- Bay for major repair:  
 $40(\text{days}) \times 350(\text{units}) \times (1/10) / (250 \text{ days}/\text{year}) = 6$

Thus, the number of bay shall be 15.



## ANNEX 11 Calculation of Required Number of the Equipment

### CALCULATION OF REQUIRED NUMBER OF WORK GROUP

WORK TYPE	Remarks	Work Frequency per Year (nos.)	Work Volume per Km	Road Length per Year (km)	Work Volume per Year	Work Product per Day	Workdays per Year	Equipment Efficiency per Year	Work Capacity per Group	Nos. of Group Required
<b>ROAD REHABILITATION &amp; MAINTENANCE</b>										
1. Asphalt Patching	(1km x 6m x 1%)	1	60 m <sup>2</sup>	500	30,000 m <sup>2</sup>	350 m <sup>2</sup>	190	0.7	46,550 m <sup>2</sup>	0.6
2. Base Failure Repair (As.road)	(1km x 6m x 1%, t=15cm)	1	60 m <sup>2</sup>	500	30,000 m <sup>2</sup>	220 m <sup>2</sup>	190	0.7	29,260 m <sup>2</sup>	1.0
3. Blading Gravel Road	(1km x 100%, w=6m)	1	1.0 km	100	100 km	6.0 km	190	0.7	798 km	0.1
4. Spot Repair Gravel Surface	(1km x 10cm x 5%, t=10cm)	1	30 m <sup>3</sup>	500	15,000 m <sup>3</sup>	50 m <sup>3</sup>	190	0.7	6,650 m <sup>3</sup>	2.3
5. Ditch Cleaning (mechanic)	(1km x 2 x 10%)	1	0.2 km	600	120 km	1.5 km	190	0.7	200 km	0.6
6. Shoulder Blading	(1km x 2 x 50%, w=1.5m)	1	1.0 km	600	600 km	10.0 km	190	0.7	1,330 km	0.5
7. Base Preparation (As.road)	(1km x 40%, t=15cm)	1	0.4 km	170	68 km	0.3 km	190	0.7	33 km	2.0
8. Gravel Resurfacing	(1km x 40%, t=15cm)	1	0.4 km	35	14 km	0.6 km	190	0.7	80 km	0.2
9. Shoulder Rehabilitation	(1km x 2 x 40%, t=10cm)	1	0.8 km	200	160 km	0.9 km	190	0.7	120 km	1.3
10. Surface Work (macadam, DBST)	(1km x 40%, t=5cm)	1	0.4 km	170	68 km	0.5 km	190	0.7	67 km	1.0
11. Selected Material Production			m <sup>3</sup>	200	141,300 m <sup>3</sup>	300 m <sup>3</sup>	190	0.7	39,900 m <sup>3</sup>	3.5
<b>DRAINAGE STRUCTURE &amp; AGGREGATES PRODUCTION</b>										
12. Drainage Structure		1	100 m <sup>3</sup>	200	20,000 m <sup>3</sup>	5 m <sup>3</sup>	190	0.7	665 m <sup>3</sup>	30.1
13. Stone Crushing			m <sup>3</sup>	200	41,900 m <sup>3</sup>	100 m <sup>3</sup>	190	0.7	13,300 m <sup>3</sup>	3.2

EQUIPMENT COMPOSITION PER WORK GROUP

Unit: Nos.

EMERGENCY REPAIR UNIT FOR TRANK NATIONAL ROAD (ERU)

Code	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Bull- dozer	Motor	Wheel Loader	Back- hoe	Tandem Roller	Vibra- tion Roller	Dump Truck	Asphalt Distributor	As. Spray- er	Rammer	Hand Guided Roller	Water Tanker	Fuel Tanker	Pickup	Land Cruiser	Chip Sprea- der	Pneuma- tic Broom
	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.

ROAD REHABILITATION & MAINTENANCE

1.	0.5	1.0				1.0			2.0	1.0	1.0		0.2	1.0	0.5	
2.	0.5			0.5	2.0							0.5	0.2	1.0	0.5	
3.	1.0												0.2	1.0	0.5	
4.	0.5			0.5	1.0			1.0				0.5	0.2	1.0	0.5	
5.	1.0		1.0			1.0							0.2	1.0	0.5	
6.	1.0												0.2	1.0	0.5	
7.	0.5	1.0	0.5			1.0	5.0					1.0	0.2	1.0	0.5	
8.	0.5	1.0	1.0			1.0	5.0					1.0	0.2	1.0	0.5	
9.	0.5	1.0	1.0		1.0	1.0	3.0			1.0	1.0	0.5	0.2	1.0	0.5	
10.	1.0		1.0		1.0		3.0	2.0	1.0		1.0		0.2	1.0	0.5	1.0
11.	1.0		1.0		1.0								0.2	1.0	0.5	

EQUIPMENT COMPOSITION PER WORK GROUP

Unit: Nos.

DRAINAGE UNIT, AGGREGATE PRODUCTION UNIT, MOBILE WORKSHOP UNIT & TRANSPORT UNIT

Code	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	
Truck Trailer																			
Mobile Wheel Tractor																			
Portable Pickup Land Flat-Air																			
Generator																			
Compressor																			
bed Cutter																			
Tractor																			
Shovel																			
Crusher																			
Crane																			
Tractor																			
Work-Loader																			
shop																			

ROAD REHABILITATION & MAINTENANCE

1.	0.1	0.1																	
2.	0.1	0.1										1.0	0.5			1.0			
3.	0.1	0.1															1.0		
4.	0.1	0.1																	
5.	0.1	0.1																	
6.	0.1	0.1																	
7.	0.1	0.1																	
8.	0.1	0.1																	
9.	0.1	0.1																	
10.	0.1	0.1																	
11.	0.1	0.1																	

DRAINAGE STRUCTURE & AGGREGATES PRODUCTION

12.	0.1	0.1																	
13.	0.1	0.1	1.0	1.0	1.0	1.0	1.0	0.5	0.2	0.1									

EQUIPMENT COMPOSITION PER WORK GROUP

Unit: Nos.

EMERGENCY REPAIR UNIT FOR TRANK NATIONAL ROAD (ERU)

Code	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)		
Bull- dozer	Motor	Wheel Loader	hoe	Back- hoe	Tandem Roller	Vibra- tion	Dump Truck	Asphalt Distri- butor	As. Spray- er	Rammer	Hand Roller	Water Tanker	Fuel Tanker	Pickup	Land Cruiser	Chip Sprea- tic	Pneuma- der	Broom
nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.

ROAD REHABILITATION & MAINTENANCE

1.	0.3	0.6	0.6	0.6	1.3	0.6	0.6	0.6	0.1	0.6	0.3
2.	0.5	0.5	2.1	0.5	0.5	0.5	0.5	0.5	0.2	1.0	0.5
3.	0.1								0.0	0.1	0.1
4.	1.1	1.1	2.3	2.3	2.3	1.1	1.1	1.1	0.5	2.3	1.1
5.	0.6	0.6	0.6	0.6					0.1	0.6	0.3
6.	0.5								0.1	0.5	0.2
7.	1.0	2.0	1.0	2.0	10.2	2.0	2.0	2.0	0.4	2.0	1.0
8.	0.1	0.2	0.2	0.2	0.9	0.2	0.2	0.2	0.0	0.2	0.1
9.	0.7	1.3	1.3	1.3	4.0	1.3	1.3	1.3	0.7	1.3	0.7
10.	1.0	1.0	1.0	2.0	1.0	1.0	1.0	1.0	0.2	1.0	0.5
11.	3.5	3.5	3.5	3.5					0.7	3.5	1.8

REQUIRED NUMBER	5.3	4.7	9.1	4.1	3.0	5.2	23.7	2.0	2.3	2.9	3.0	4.5	2.6	13.2	6.6	1.0	1.0	1.0
TO BE SUPPLIED	6	5	10	4	3	6	24	2	3	3	3	5	3	14	7	1	1	1
PERCENTAGE	33%	80%	40%	50%	67%	67%	33%	100%	133%	133%	133%	80%	133%	29%	57%	200%	0%	0%

EQUIPMENT COMPOSITION PER WORK GROUP

Unit: Nos.

DRAINAGE UNIT, AGGREGATE PRODUCTION UNIT, MOBILE WORKSHOP UNIT & TRANSPORT UNIT

Code	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	
Truck Trailer																			
Mobile Wheel Tractor																			
Portable Pickup Land Cruiser																			
Shovel Crusher																			
Shop																			
	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.

ROAD REHABILITATION & MAINTENANCE

1.	0.1	0.1										0.6	0.3			0.6			0.6
2.	0.1	0.1							0.1										1.0
3.	0.0	0.0							0.2										0.1
4.	0.2	0.2							0.5										2.3
5.	0.1	0.1																	0.6
6.	0.0	0.0																	0.5
7.	0.2	0.2							0.4										2.0
8.	0.0	0.0																	0.2
9.	0.1	0.1																	1.3
10.	0.1	0.1							0.2				0.5			2.0			1.0
11.	0.4	0.4																	3.5

DRAINAGE STRUCTURE & AGGREGATES PRODUCTION

47.	3.0	3.0	3.0				30.1	15.0	6.0		3.0			30.1	60.2				30.1
62.	0.3	0.3	3.2	3.2	3.2	3.2	3.2	1.6	0.6	3.2									3.2
REQUIRED NUMBER	3.0	4.6	4.6	3.2	3.2	3.2	33.2	16.6	8.0	3.2	3.0	0.6	0.8	30.1	60.2	2.7	4.6	46.5	
TO BE SUPPLIED	3	5	5	4	4	4	34	17	8	4	3	1	1	31	61	3	5	47	
	1	1	1	1	1	1	2	1	2	2	2	2	2	4	8	4	4	4	18
	33%	20%	20%	25%	25%	25%	6%	6%	25%	50%	67%	200%	200%	13%	13%	133%	80%	38%	





JICA