アフリカ開発銀行

スーダン民主共和国

運　輸　省

道路橋梁公団

スーダン国道路建設計画
フィージビリティ調査
EL OBEID–UM RUABA

ファイナル レポート
資　料　編

昭和53年 3 月

国際協力事業団

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ANNEX III-1

TABLE 3-1 TOTAL POPULATION IN THE SUDAN

Year	Population Total (A) ('000)	Population Urban (B) ('000)	Percentage of (B)/(A) (C) (%)	Rate of Annual Increase[1] Total (D) (%)	Rate of Annual Increase[1] Urban (E) (%)
1966	14,120	1,492	10.6		
1967	15,504	1,574	10.2	5.8	5.5
1968	14,936	1,661	11.1		5.5
1969	15,312	1,752	11.4		
1970	15,695	1,848	11.8	2.5	5.5
1971	16,087	1,950	12.1	2.5	5.5
1972	16,489	2,058	12.5	2.5	5.5
1973	16,901	2,170	12.8	2.5	5.4
1974	17,324	2,289	13.2	2.5	5.5
AVERAGE			11.7[2]	2.6[3]	5.5[3]

Figures in A and B indicate estimates of questionable reliability.

Source: Dept. of Economics and Social Affairs, Statistical Office, Demographic Year Book 27th Issue, 1976, U.N. New York, N.Y., U.S.A.

Notes:
1) Rates of annual increase are calculated from the figures in Columns A and B.
2) Indicating the average of percentage figures in Column C.
3) Indicating the average annual growth rate from 1966 to 1974.

TABLE 3-2 POPULATION AND DENSITY BY PROVINCE IN 1955/56 AND 1973

Province	Area km^2 (A)	Population ('000) 1955/56 (B)	Population ('000) 1973 (C)	Density (persons/km^2) 1955/56 (D)=B/A	Density (persons/km^2) 1973 (E)=C/A	Average Growth Rate (I) (%) p.a. 1956-'73 (F) 1)	Revised Population ('000) 1973 (G) 2)	Average Growth Rate (II) (%) p.a. 1956-'73 (H) 3)
Bahrel Ghazal	213,751	999	1,367	5	6	1.9	1,446	2.2
Blue Nile	142,138	2,069	3,914	15	28	3.8	4,065	4.1
Darfur	496,369	1,329	1,839	3	4	1.9	1,945	2.3
Equatoria	198,121	904	725	5	4	-1.3	766	-1.0
Kassala and Red Sea	340,655	941	1,472	3	5	2.6	1,557	3.0
Kordofan	380,546	1,762	2,010	5	5	0.8	2,202	1.3
Northern	477,074	873	902	2	2	0.2	954	0.5
Upper Nile	236,180	889	799	4	3	-0.7	845	0.3
Khartoum	20,961	505	1,113	24	53	4.8	1,178	5.1
Total	2,505,805	10,263	14,141	4	6	1.9	14,958	2.2

Source: Department of Statistics, Statistical Year Book, 1973

Notes: 1) Average growth rate (I) p.a. is estimated by Column (B) and (C).

2) The total population is given by Dept. of Statistics, National Income 1972/73-1974/75. Revised population in province is estimated by adjusting provincial populations in Column (C) to the total of 14,958,000.

3) The rates are estimated by using the revised population in Column (B) and (G).

ANNEX III-3

TABLE 3-3 LABOUR FORCE BY OCCUPATION

Occupation	Percentage
Professional and Technical	1.9
Administrative and Managerial	0.4
Clerical and Related Scales	1.4
Salesmen	4.5
Services Workers	7.6
Agricultural, Animal and Forestry	71.6
Production, Transport, Operation	12.6
TOTAL	100.0

Source: Population Census 1973 (Ministry of Planning, Economic Survey, 1975/76)

Note: These figures are provisional and subject to revision.

ANNEX III-4

TABLE 3-4 COTTON PRODUCTION BY VARIETY

Variety	1973/74		1974/75		1975/76 1)		
	Acreage	Production in bales	Acreage	Production in bales	Acreage	Production in bales	
						Min.	Max.
Long Staple	824,500	1,009,000	838,000	790,500	593,523	355,695	449,111
Medium	196,500	210,400	231,000	240,000	227,839	142,260	172,642
Short	157,000	18,400	99,000	27,000	132,235	26,730	40,270
Experiments	-	-	-	-	3,932	4,398	4,894
Total	1,178,000	1,237,800	1,168,000	1,057,500	957,529	529,084	666,917

Source: Cotton Public Corporation (Economic Survey, 1975/76)

Note: 1) Output of 1975/76 is an estimate.

ANNEX III-5

TABLE 3-5 AREA, PRODUCTION AND AVERAGE YIELD FOR SOME AGRICULTUREAL CROPS

1973/74 - 1975/76

	1973/1974			1974/1975			1975/1976[1]		
	Area Fed.	Production Ton	Average Yield kg/Fed.	Area Fed.	Production Ton	Average Yield kg/Fed.	Area Fed.	Estimated Production Ton	Average Yield kg/Fed.
Dura	5,301,200	1,628,290	309	5,577,030	1,704,853	303	6,200,309	2,055,280	331
Dukhn	2,705,870	281,531	104	2,576,380	400,540	156	2,512,160	403,145	161
Groundnuts	1,725,303	543,801	315	1,785,290	929,910	521	2,065,740	930,765	451
Sesame	2,192,560	237,845	109	2,172,690	233,400	107	2,291,045	238,080	104
Wheat	420,072	236,067	562	591,437	276,265	467	713,790	397,030	556
Cotton	1,178,000	-	-	1,168,000	-	-	957,000	-	-
Total	13,523,000	-	-	13,870,000	-	-	13,783,000	-	-

Source: Ministry of Agriculture, Food and Natural Resources (Economic Survey, 1975/76)

Note: 1) Estimated.

ANNEX III-6

TABLE 3-6 GUM ARABIC PRODUCTION 1970/71 - 1975/76

(Ton)

1970/71	1971/72	1972/73	1973/74	1974/75	1975/76
44,355	25,949	21,194	22,000	52,000	30,000

Source: Forests Department, Ministry of Agriculture, Food and Natural Resources (Economic Survey, 1975/76)

Note: 1) Estimated.

ANNEX III-7

TABLE 3-7 DOMESTIC PRODUCTION OF SUGAR AND THE RATIOS OF PRODUCTION TO LOCAL CONSUMPTION FOR THE SEASONS, 1972/73 - 1975/76

Season	Domestic Production (Ton)	Consumption (Ton)	Ratio of Production to Consumption (%)
1972/73	112,641	250,000	45
1973/74	120,571	269,754	45
1974/75	128,651	257,917	50
1975/76	124,000 (Estimated)	310,000	40

Source: Sugar and Beverages Corporation (Economic Survey, 1975/76)

ANNEX III-8

TABLE 3-8 LIVESTOCK WEALTH ESTIMATES FOR THE FISCAL YEAR 1973/74

(Heads)

Province	Cattle	Sheep	Goats	Camels
Kordofan	1,989,850	2,961,330	1,004,850	1,231,300
Khartoum	57,980	91,480	346,140	54,060
Darfur	4,752,420	2,900,860	2,507,870	434,350
Blue Nile	1,196,470	3,623,970	2,403,320	252,140
Kassala	385,590	1,116,210	655,630	637,710
Northern	207,350	525,810	327,890	79,840
Upper Nile	1,850,820	697,810	1,242,650	-
Equatoria	628,610	478,420	861,300	-
Bahr El Ghazal	3,084,680	976,820	1,146,960	-
Total	14,153,770	13,272,710	10,496,610	2,698,400

Source: Ministry of Agriculture, Food and Natural Resources (Economic Survey, 1975/76)

TABLE 3-9 GROSS DOMESTIC PRODUCT ACCORDING TO THE CURRENT PRICES IN LS MILLION

(LS Million and Percentage)

	1966/67		1967/68		1968/69		1969/70		1970/71		1971/72		1972/73		1973/74		1974/75	
	LS MM	Share %	LS MM	Share %	LS MM	Share %	LS MM	Share %	LS MM	Share %	LS MM	Share %	LS MM	Share %	LS MM	Share %	LS MM	Share %
Agriculture	176.2	33.0	194.0	33.9	203.9	33.2	209.2	32.3	219.1	31.9	243.8	32.4	334.6	38.4	516.4	41.5	585.3	38.7
Manufacturing and Mining	49.4	9.3	54.9	9.7	57.3	9.3	66.8	10.3	69.2	10.1	76.8	10.2	82.9	9.2	111.2	8.9	142.9	9.5
Electricity and Water	16.6	3.1	16.3	2.8	16.6	2.7	16.5	2.6	16.6	2.4	16.9	2.2	17.5	2.0	18.6	1.5	20.9	1.4
Construction & Building	23.9	4.5	22.8	4.0	24.4	4.0	24.3	3.8	23.3	3.4	26.2	3.5	31.2	3.5	61.0	4.9	65.0	4.3
Wholesale Trade, Finance, Real-estate, etc.	154.0	28.0	162.7	28.4	178.9	29.1	146.4	22.6	158.6	23.1	179.8	23.9	197.0	22.0	271.5	21.8	354.4	23.4
Transport & Communication	33.4	6.3	33.6	5.9	36.1	5.9	51.1	7.9	50.7	7.4	51.3	6.8	61.5	6.9	74.8	6.0	89.4	5.9
Sub Total	453.5	85.1	484.3	84.6	517.2	84.2	514.3	79.5	537.5	78.4	595.0	79.1	734.7	82.0	1,053.6	84.5	1,257.9	83.2
Government Services	44.4	8.3	50.7	8.9	53.3	8.7	81.5	12.6	87.4	12.7	98.2	13.1	104.8*	11.7	127.9	10.3	151.2	10.0
Customs & Others	35.5	6.6	37.3	6.5	43.4	7.1	51.2	7.9	60.9	8.9	58.9	7.8	57.3	6.3	64.7	5.2	101.7	6.8
Total GDP[1]	533.4	100.0	572.3	100.0	613.9	100.0	647.0	100.0	685.8	100.0	752.1	100.0	896.8	100.0	1,246.2	100.0	1,510.8	100.0
Price Index %[2]							100.0		107.5		118.2		137.6		172.2		211.1	
GDP at Constant Price 3)							647.0		638.0		636.3		651.7		723.7		715.7	

Source: Dept. of Statistics, June 1977

Notes: * This figures does not contain the workers compensation in the southern region government.
1) Current price is used instead of factor cost in this publication.
2) Price index of the cost of living (1970-75) is applied in this Table. The index is quoted from the Economic Survey, 1975/76, Ministry of Planning
3) The constant price as in 1970 was derived by dividing 1) by 2). It is calculated that GDP has grown at 2.0% p.a. in terms of constant price.

ANNEX III-10

TABLE 3-10 THE BALANCE OF PAYMENTS

(LS Million)

	1971/72 Actual	1972/73 Actual	1973/74 Actual	1974/75 Actual	1974/76 Prov. Actual [1]
(A) The Current Account					
(1 + 2 + 3)	- 30.9	- 1.5	- 30.5	-160.3	-178.9
1. Exports	102.4	127.6	142.8	157.8	183.3
Cotton	55.3	71.7	73.8	63.1	90.0
Others	47.1	55.9	69.0	94.7	93.3
2. Imports	121.4	113.1	149.6	280.0	341.8
Government Purchases	37.3	39.8	48.1	137.7	211.8
Private Sector Imports	84.1	73.3	101.5	142.3	130.0
Trade Balances (1-2)	- 19.0	14.5	- 6.8	-122.2	- 15.8
3. Invisible Account (net)	- 11.9	- 16.0	- 23.7	- 38.1	- 20.4
Receipts	16.4	16.4	17.8	28.9	39.6
Payments	28.3	32.4	41.5	67.0	60.0
(B) Capital Account (net)	8.1	2.6	16.8	108.6	110.0
Drawings	20.1	17.9	41.3	111.5	142.0
Repayments	12.0	15.3	18.2	13.3	32.0
Compensations for Nationalized Companies	-	-	6.3	-	-
External Assets of SDC	-	-	-	10.4	-
(C) Errors and Omissions	2.6	- 1.8	- 1.5	0.2	-
(D) Balance of Payments	- 20.2	- 0.7	- 15.2	51.9	- 68.9

Source: Bank of Sudan (Economic Survey, 1975/76)

Note: 1) Preliminary estimates

TABLE 3-11 QUANTITY AND VALUE OF MAIN EXPORTS DURING 1971-75

(Quantity in Metric Ton, Value in LS Million)

	1971		1972		1973		1974		1975	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Cotton	294,585	69,906	256,315	73,088	743,726	84,311	78,646	43,202	156,652	70,193
Gum Arabic	41,971	8,030	40,758	8,729	33,941	7,403	19,987	14,157	15,643	7,548
Sesame	84,442	7,997	85,197	8,810	101,863	10,706	83,508	16,511	56,624	11,939
Groundnuts	115,061	9,327	113,740	9,637	138,425	12,993	99,052	18,163	204,960	34,382
Cotton Seed	49,770	1,468	21,815	611	14,987	530	4,562	253	-	-
Dura	32,428	1,085	7,032	1,646	93,953	2,922	89,217	3,401	45,084	2,233
Hides and Skins	8,829	1,938	5,991	3,011	8,159	6,072	5,276	3,777	6,040	3,187
Others	-	14,683	-	17,702	-	27,235	-	21,486	-	22,980
Total	-	114,374	-	123,234	-	152,172	-	122,010	-	152,468

Source: Bank of Sudan (Ministry of Planning, Economic Survey, 1975/76)

TABLE 3-12 IMPORTS BY COMMODITY

(Value in LS Million)

	1971	1972	1973	1974	1975
Food Stuffs	21.65	27.55	33.93	56.47	60.45
Drinks and Tobacco	3.00	3.95	2.32	3.20	4.26
Crude Materials	3.37	1.55	1.52	33.98	28.20
Chemicals	12.88	14.30	18.95	27.21	40.16
Manufactured Goods	24.57	24.12	33.61	38.73	60.16
Machinery and Equipment	14.19	15.93	20.00	20.09	59.14
Transport Equipment	11.45	13.40	25.29	33.68	64.47
Textiles	25.33	16.91	16.23	24.15	43.06
Total	116.44	117.91	151.85	247.54	359.90

Source: Bank of Sudan (Economic Survey, 1975/76)

TABLE 3-13 SUDAN AIRWAYS PASSENGER AND FREIGHT TRAFFIC

Period	Passenger Traffic (Number of Passengers) ('000)				Total Freight Traffic (Ton)			
	International	Domestic	Total	Index	International	Domestic	Total	Index
1965/66	N.A.	N.A.	96	100	N.A.	N.A.	1.633	100
1966/67	N.A.	N.A.	102	106	N.A.	N.A.	1.386	84
1967/68	54	37	91	94	0.685	.797	1.482	90
1968/69	68	56	124	129	0.710	.844	1.554	95
1969/70	70	54	124	129	0.797	.855	1.652	101
1970/71	87	55	142	147	0.713	.708	1.421	87
1971/72	72	63	135	140	0.590	.750	1.340	82
1972/73	131	93	224	233	1.510	.788	2.298	140
1973/74	136	94	230	239	2.337	.893	3.230	197

Source: Sudan Airways Financial and Statistical Reports,(Transport Statistical Bulletin, 1974)

FIG.3-1 ROADS AND BRIDGES PUBLIC CORPORATION ORGANIZATIONAL CHART 1977

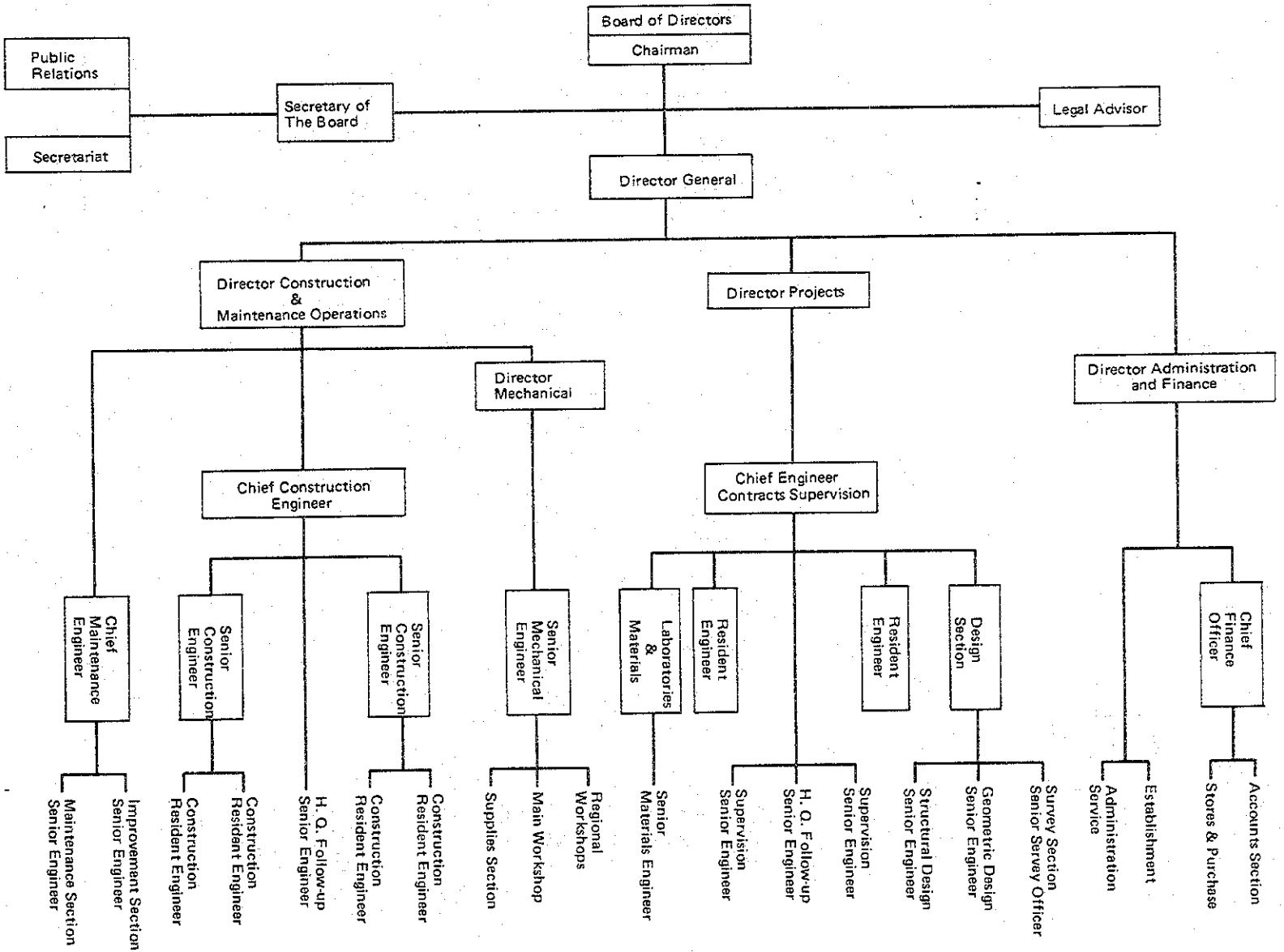

FIG. 3-2 TRANSPORTATION NETWORK, SUDAN

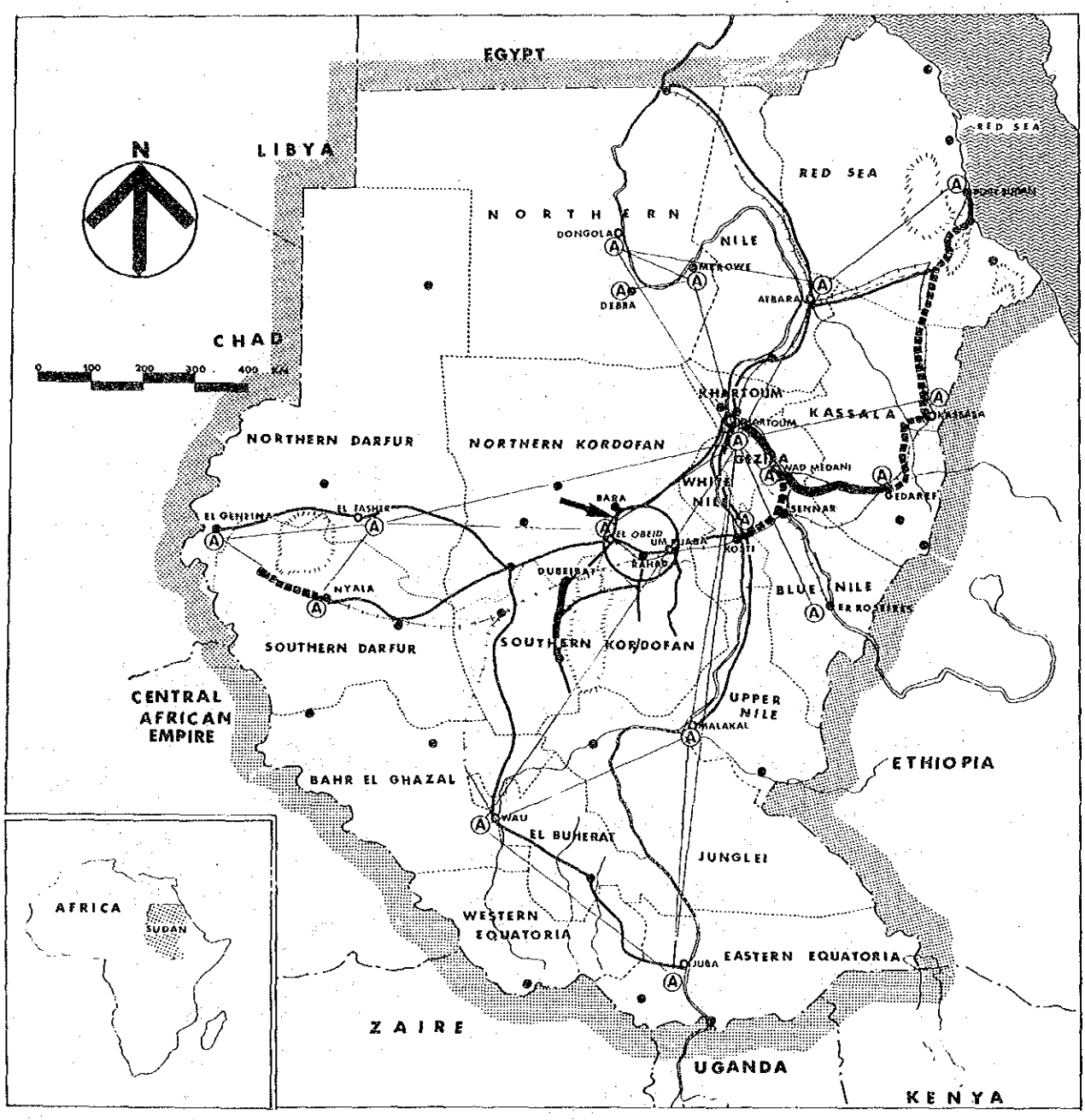

TABLE 3-14 ROADS IN RBPC

	Length in km	
Paved Roads [1]		756
Khartoum-Wad Medani Road	187	
Wad Medani - Gedaref Road	227	
Port Sudan - Suakin Road	57	
Khartoum North - El Gaili Road	42	
Khartoum - Jebel Aulia Road	36	
Omdurman - Wadi Saidna Road	21	
Dubeibat - Dilling - Kadugli Road	186	
Under Construction Roads [1]		936
Gedaref - Kassala Road	220	
Kassala - Haiya Road	350	
Haiya - Suakin Road	149	
Wad Medani - Sennar - Kosti Road	217	
Completely Designed and Waiting for Financing Roads		1,026
Nyala - Kas - Zalingei Road	210	
Jebel Aulia - Ed Dueim - Rabak Road	260	
Sennar - Suki - El Roseires Road	233	
Gedaref - Doka - Gallabat Road	154	
El Obeid - Dubeibat Road	94	
Kassala - Sabderat	75	
Under Feasibility Study Roads		1,121
Gedaref - Um Barakat Road	110	
Wad El Huni - Simsim Road	77	
Gedaref - Suki Road	178	
Rabak - Renk Road	166	
El Obeid - Um Ruaba Road	150	
Kadugli - Talodi Road	100	
Juba - Torit - Lodwar Road	340	
Proposed Roads Projects		4,559
Kosti - Um Ruaba Road	170	
Juba - Minule - Gubu Road	281	
Zalingei - El Geneina - Adre Road	193	
Port Sudan - Bernis Road	508	
or		
Omdurman - Dongola - Halfa Road	547	
Renk - Malakal - Juba Road	851	
El Obeid - En Nahud Road	235	
En Nahud - El Fasher Road	452	
El Fasher - Nyala Road	225	
Talodi - Malakal Road	246	
Kadugli - Wau Road	-	
Khartoum - Kassala Road	401	
Khartoum - Atbara Road	312	
Renk - El Roseires Road	-	
Wad Medani - Ed Dueim Road	138	

Source: RBPC, Sudan, June 1977

Note: 1) RBPC is initially responsible for these roads.

TABLE 3-15 LICENCED MOTOR VEHICLES

Year	TYPE OF VEHICLE						
	Passenger Cars	Buses	Lorries	Delivery Vans Box Cars	Tractors Motorcycles	Others	Total
1970	25,387	2,003	10,817	7,770	2,030	802	49,484
1971	28,026	2,015	12,677	7,139	1,717	554	52,797
1972	29,407	2,782	15,813	7,819	2,259	660	59,450
1973	33,061	2,664	21,549	21,549	3,107	2,217	62,464
1974	38,143	3,137	22,908	11,227	2,543	1,121	79,079
Average Annual Growth Rate (%)	10.2	11.7	20.6	9.6	5.8	8.7	12.4

Source: Transport Statistical Bulletin, 1975

TABLE 3-16-1 GASOLINE AND BENZINE CONSUMPTION IN THE SUDAN [1)]

('000 Tons)

Year	Gasoline (Diesel)	Benzine (Gasoline)	Total
1970	271	95	366
1971	298	97	395
1972	301	101	402
1973	323	105	428
1974	329	106	435
1975	349	116	465
1976 [2)]	391	131	522
Average Annual Growth Rate (%)	6.3	5.5	6.1

Sources: 1) Transport Statistical Bulletin, 1975

2) Shell Company of the Sudan, June 1977

TABLE 3-16-2 GASOLINE AND BENZINE CONSUMPTION ON ROADS

('000 Tons)

Year	Gasoline (Diesel)	Benzine (Gasoline)	Total
1970	110	95	205
1971	121	97	218
1972	128	101	229
1973	129	105	234
1974	132	106	238
1975	140	116	256
Average Annual Growth Rate (%)	4.9	4.1	4.5

Source: Transport Statistical Bulletin, 1975

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TABLE 3-17 RAIL PASSENGERS BY CLASS OF TRAVEL [1]

('000 persons)

Year	Sleeper (Suppl.)	1st Class	2nd Class	3rd and 4th Class	All Classes
1970/71	20.3	65.5	192.2	3,139.2	3,417.2
1971/72	18.7	54.6	172.5	2,996.1	3,241.9
1972/73	28.4	87.6	236.4	3,029.8	3,382.8
1973/74	24.9	69.9	199.0	2,513.4	2,807.2
1974/75	24.9	79.4	233.9	2,608.6	2,946.5
1975/76 [2]	30.0	111.1	232.1	2,696.0	3,069.2

Sources: 1) Transport Statistical Bulletin, 1975

2) Sudan Railways Corporation, Annual Report, 1975/76

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TABLE 3-18 SUDAN RAILWAYS TRAFFIC BY TYPE [1]

('000 tons)

Year	Exported Traffic	Imported Traffic	Local Traffic	Livestock Equivalent	Total
Actual 1969/70	843	1,384	725	53	3,005
1970/71	872	1,532	618	40	3,062
1971/72	923	1,460	505	20	2,908
1972/73	854	1,421	495	30	2,800
1973/74	697	1,379	477	28	2,581
1974/75	644	1,312	433	11	2,400
1975/76 [2]	815	1,494	346	16	2,673

Sources: 1) Transport Statistical Bulletin, 1975

2) Sudan Railways Corporation, Annual Report, 1975/76

ANNEX IV

ANNEX IV-1

TABLE 4-1 POPULATION AND GROWTH RATE, KORDOFAN PROVINCE AND THE SUDAN

	Population 1955/56	Population 1973	Growth Rate per year (%)	Sources
Sudan Total	10,262,500	14,958,000	2.24	Department of Statistics, Ministry of National Planning, 1977
- " -	10,262,500	14,901,894	2.22	National Planning Commission, Sudan, Economic Survey, 1974
Kordofan Province	1,762,000	2,202,346	1.32	- " -
- " -	1,762,000	2,099,121	1.04	Statistics Department, Northern Kordofan Province

TABLE 4-2 URBAN POPULATION IN NORTHERN AND SOUTHERN KORDOFAN PROVINCES

Town	1964/66 Census 1) Permanent Member of Private Household	Persons Present (A)	of which In Private Households	of which In Institutes	1973 Urban Persons Present 2) (B)	Urban Population Growth Rate per Year (A) to (B)
Northern Kordofan Province						
El Obeid	62,560	63,831	62,984	847	90,073	
En Nahud	19,770	20,038	19,220	818	26,005	
Um Ruaba	14,210	14,392	13,910	482	19,713	
Rahad	8,600	8,924	8,590	334	14,444	
Bara	6,140	6,431	6,060	371	8,927	
Sodiri	2,820	3,046	2,880	166	2,674	
Abu Zabad 3)	5,660	5,939	5,470	469	7,177	
Sub Total	119,760	122,601	119,114	3,487	169,013	4.10%
Southern Kordofan Province						
Dilling	11,910	12,696	11,890	806	19,216	
Kadugli	11,180	11,532	10,960	572	18,468	
Abu Korshola	5,120	4,970	4,860	110	5,274	
El Abassiya	4,470	4,667	4,420	247	4,801	
Muglad	4,270	4,709	4,180	529	6,936	
Talodi	4,030	4,250	4,100	150	7,738	
Rashad 3)	3,260	3,555	3,260	295	3,588	
Babanousa 3)	7,460	7,092	6,760	332	12,051	
Abu Gebaha 3)	5,180	5,419	5,110	309	10,418	
Rigl El Foula 3)	3,750	4,131	3,610	521	5,294	
Sub Total	60,630	63,021	59,150	3,871	93,784	5.10%
All Towns Total	180,390	185,622	178,264	7,358	262,797	4.44%

Notes: 1) Dept. of Statistics, Sudan. Population and Housing Survey, Urban Areas, Kordofan Province, 1964/66. (Khartoum, 1968)
2) Statistics Dept. of Northern Kordofan Province.
3) These towns were included in rural areas at the 1964/66 census.

TABLE 4-3 DISTRICT POPULATION OF NORTHERN AND SOUTHERN KORDOFAN PROVINCES, 1973

Province & District	Population Settled			Nomad	Total
	Urban	Rural	Sub Total		
Northern Kordofan Province					
Central Dist.	90,073	94,446	184,519	4,973	189,492
Eastern Dist.	34,157	281,481	315,638	20,634	336,272
Western Dist.	33,182	296,530	329,712	9,486	339,198
Northern Dist.	8,927	135,880	144,807	14,762	159,569
North-Western Dist.	2,674	63,851	66,525	137,523	204,048
Free Lance	-	-	-	67,509	67,509
Total	169,013	872,188	1,041,201	254,887	1,296,088
%	13.0	67.3	80.3	19.7	100.0
Southern Kordofan Province					
Miosaria Dist.	24,281	148,074	172,355		
Northern Hills Dist.	19,216	151,597	170,813	99,266	
Southern Hills Dist.	26,206	206,674	232,880		
Tagali Dist.	24,081	171,147	195,228		
Free Lance	-	-	-	35,716	
Total	93,784	677,492	771,276	134,982	906,258
%	10.3	74.8	85.1	14.9	100.0

Source : Statistics Dept., Northern Kordofan Province, Eastern Kordofan District Office and the Dept. of Statistics, Sudan Government.

TABLE 4-4 POPULATION AND ITS GROWTH RATE IN URBAN AND RURAL AREAS OF NORTHERN AND SOUTHERN KORDOFAN PROVINCES, 1955/56-1977

ANNEX IV-4

	1955/56 Census (1956)		1964/66 Urban Census (1966)		1973 Census		1977 Estimate
(1) Population in Both Provinces	1,762,000[1]				2,202,346[1]	---- ----	2,321,044
Annual Growth Rate			1.321%		1.321%		
(2) Urban Population	123,340		185,622[2]		262,797[2]	---- ----	312,792
Annual Growth Rate		4.65%		4.44%	4.44%		
a. Northern Kordofan Urban Area			122,601[2]		169,013[3]	---- ----	198,406
Annual Growth Rate				4.09%	4.09%		
b. Southern Kordofan Urban Area			63,021[2]		93,784[3]	---- ----	114,386
Annual Growth Rate				5.09%	5.09%		
(3) Rural Population including Nomads	1,638,660				1,939,549	---- ----	2,008,252
Annual Growth Rate			1.00%		0.874%		
a. Northern Kordofan Rural Area					1,127,075	---- ----	1,166,999
b. Southern Kordofan Rural Area					812,474	---- ----	841,253
Annual Growth Rate					0.874%		

Sources: 1) National Planning Commission, Economic Survey, 1974 (Sudan, 1975).
2) Population and Housing Survey, Urban Area, Kordofan Province, 1964/66.
3) Northern Kordofan Province Government.

ANNEX Ⅳ－5　ゾーン別人口の推定

１９６２年作成された １：４８,０００ 集成航空写真，１９７５年修正された １：250,000 地図，そして１９７７年本調査団によって作成された １：25,000 集成航空写真によって各ゾーンの村落数が調べられた。

村落は３グループに分けられた。８０戸が最小，１５０戸が中間グループ，214戸～７００戸の値が最大の村落に分類した。この調査結果は次の表に示される。

TABLE 4-5-1 NUMBER OF VILLAGES

Zone	Urban Area	Number of Villages			Total
		Large	Medium	Small	
1	El Obeid	-	1	33	34
2	-	2	-	28	30
3	-	1	2	21	24
4	-	1	7	13	21
5	Um Ruaba	-	2	41	43
6	-	1	2	16	19
7	-	2	2	19	23
8	Rahad	1	-	28	29
9	-	-	1	15	16
10	-	4	-	7	11
Total	3	12	17	221	250

一戸平均の家族数を５人と仮定して，各ゾーンの定住人口は，以下の表４－５－２に推定されている。

TABLE 4-5-2 POPULATION BY ZONE

Zone No.	Urban	Rural	Total
1	105,738	13,950	119,668
2	-	13,340	13,340
3	-	10,970	10,970
4	-	13,950	13,950
5	23,141	17,900	41,041
6	-	9,614	9,614
7	-	12,922	12,922
8	16,956	12,270	29,226
9	-	6,750	6,750
10	-	12,800	12,800
Total	145,835	124,466	270,301

１９５５／56 国勢調査によると総人口に対する都市人口は7.0％であり，労働人口のうち農業従事人口は８５.８％であった。スーダンの一戸当り平均家族数は都市部家族5.5人，農村定住家族4.9人，遊牧民家族5.7人，全国では5.1人であった。農業部門人口は8,806,000人，全人口の８５.８％と推定された。

１９７０年と１９７３年に調査されている数字によると，遊牧民を含む農村部人口は9,545,000人で農業部門人口は９２.３％であった。農業人口は，１９７７年のスーダン農村部人口の８５％と考えられる。

このパーセント数値は，Northern Kordofan 県に適用され，表４－５－３に示す。

TABLE 4-5-3 RURAL AND AGRICULTURAL POPULATION IN NORTHERN KORDOFAN PROVINCE

	Rural Population Including Nomad (1)	Agricultural Population (1) x 0.85 (2)	Nomad (3)	Agricultural Population Settled (2)-(3)	Rural Population Settled (4)=(1)-(3)	(2)-(3)/(4) (%)
Central Dist.	102,941	87,500	5,149	82,351	97,792	84.2
Eastern Dist.	312,816	265,894	21,365	244,529	291,451	83.9
Sub-Total	415,757	353,394	26,514	326,880	389,243	84.0
Northern K. Province	1,166,999	991,949	213,916	778,033	903,083	86.1

上表の Central 及び Eastern 両 District の農村定着人口のなかに占める農業人口比率の平均値８４.０％である。

この比を適用して，プロジェクト地域の各ゾーン別の農村定着人口と，その中の定着農業人口，農家数を次のように推定し，表４－５－４と表Ⅳ－２にされている。

TABLE 4-5-4 SETTLED POPULATION BY ZONE, 1977

Zone	Rural Population Settled *	Agricultural Population Settled * x 0.84	Farm Households (Families)
1	13,950	11,718	2,344
2	13,340	11,206	2,241
3	10,970	9,215	1,843
4	13,950	11,718	2,344
5	17,900	15,036	3,007
6	9,614	8,076	1,615
7	12,922	10,854	2,171
8	12,270	10,307	2,061
9	6,750	5,670	1,134
10	12,800	10,752	2,150
Total	124,466	104,552	20,910

TABLE 4-5 AGRICULTURAL AND FORESTRY PRODUCTS IN NORTHERN KORDOFAN PROVINCE

	Dukhn			Dura			Sesame			Groundnuts			Watermelon Seeds		
	Area (feddan)	Yield (kg/f.)	Production (ton)	Area (feddan)	Yield (kg/f.)	Production (ton)	Area (feddan)	Yield (kg/f.)	Production (ton)	Area (feddan)	Yield (kg/f.)	Production (ton)	Area (feddan)	Yield (kg/f.)	Production (ton)
1970	718,046	196	140,955	476,046	162	77,309	1,061,370	143	152,098	244,569	172	41,949			
1971	1,157,342	150	185,726	559,877	145	81,256	1,008,058	81	82,151	840,597	91	76,420			
1972	1,564,925	68	106,699	731,831	137	100,029	1,778,940	91	161,722	810,597	91	73,690			
1973															
1974	1,250,000	90	112,500	685,224	140	95,931	923,800	70	64,670	578,830	320	185,230	410,430	97	39,812
1975	1,257,000	100	125,700	672,954	140	94,214	950,000	75	71,290	593,930	375	222,720	382,718	97	37,124
1976	1,353,000	145	196,000	631,000	200	126,000	900,000	70	63,000	418,000	375	157,000	389,885	90	35,090
Average	1,216,719	119	114,597	626,155	153	95,790	1,103,695	90	99,155	581,087	217	126,168	394,344	95	37,342

	Karkadeh			Sanamakar			Gum Arabic					Cotton			Charcoal 1)	Firewood 1)	
							Area		Production							Private Products	Government Products
	Area (feddan)	Yield (kg/f.)	Production (ton)	Area (feddan)	Yield (kg/f.)	Production (ton)	Estimate (feddan)	Yield (kg/f.)	Hashab (ton)	Talh (ton)	Total	Area (feddan)	Yield (kg/f)	Production (ton)	(ton)	(m^3)	(m^3)
1970							312,240	50	14,667	945	15,612						
1971							350,900	59	16,950	595	17,545	2,063	89	184	12,000	3,300	2,500
1972							287,400	50	11,496		14,370	3,000	163	489			
1973							134,600	50	6,730		6,730						
1974	47,481	13	617	6,842	540	3,695											
1975	44,095	13	573	2,460	540	1,328											
1976	20,276	10	203	6,482	540	3,500	133,000	50			6,650						
Average	37,284	12	464	5,261	540	2,841	243,628	50			12,181	2,532	133	337	12,000	3,300	2,500

Note: 1) Approximately estimated by taking half of the production of Northern and Southern Kordofan Provinces. The statistical data registering the production in both Kordofan Provinces in 1971 are as follows: Charcoal, 23,750 tons, Firewood - private; 6,601 m^3, Government; 5,000 m^3.

Sources: Sudan Yearbook of Agricultural Statistics, 1974; Current Agricultural Statistics CAS-Vol. 1, No.2, 1976; H.M. AWOUDA, Forest Department, Production & Supply of Gum Arabic 1970-1971; Statistics Dept. of Northern Kordofan Prov.; and Dept. of Agricultural Economics and Statistics, Ministry of Agriculture, Khartoum.

TABLE 4-7 LIVESTOCK IN TWO DISTRICTS, 1976

(Heads)

		Rainy Season	Dry Season
Central Kordofan District 1)	Cattle	156,000	81,000
	Sheep	125,000	64,000
	Goats	109,000	56,000
	Camels	8,000	4,000
	Donkeys	3,000	2,000
	Horses	4,000	2,000
	Total	405,000	209,000
Eastern Kordofan District 2)	Cattle	250,000	75,000
	Sheep	125,000	17,500
	Goats	200,000	150,000
	Camels	130,000	100,000
	Total	705,000	342,500

Sources: 1) Acting Commissioner for Animal Resources, Northern Kordofan Province, El Obeid.

2) District Veterinary Office, Eastern District Northern Kordofan Province, Rahad.

TABLE 4-8 LIVESTOCK TRADED

(Heads)

CENTRAL KORDOFAN DISTRICT ANIMAL MARKETS, JAN.-MAR. 1977 a)

	Jan. 1977		Feb. 1977		Mar. 1977		Total Jan.-Mar.	
	Brought	Sold	Brought	Sold	Brought	Sold	Brought	Sold
Cattle	3,590	1,331	3,899	213	2,749	1,074	10,238	2,618
Sheep	10,051	6,387	8,233	5,467	7,185	5,509	25,469	17,363
Goats	482	294	-	-	699	132	1,181	426
Camels	1,023	162	1,591	134	960	89	3,574	385
Donkeys	1,193	336	1,175	269	897	191	3,265	796
Horses	121	46	119	24	121	73	361	143
Total	16,460	8,556	15,017	6,107	12,611	7,068	44,088	21,731

UM RUABA ANIMAL MARKET 1973/74 - 75/76 b)

	1973/74		1974/75		1975/76	
	Brought	Sold	Brought	Sold	Brought	Sold
Cattle	700	500	5,750	3,594	13,980	11,070
Sheep	1,900	1,400	4,250	3,466	29,300	19,750
Goats	1,000	750	910	546	9,120	2,230
Total	3,600	2,650	10,910	7,606	52,400	33,050

CENTRAL KORDOFAN DISTRICT SLAUGHTER HOUSES a)

	Slaughtered		Prices Registered 1)
	74/75	75/76	
Cattle	24,647	24,058	46.50
Cows	5,218	7,223	
Sheep	51,598	81,602	7.50
Goats	6,919	9,409	4.00
Camels	1,340	991	80.00
Total	89,722	123,283	

Sources: a) Acting Commissioner for Animal Resources, Northern Kordofan Province, El Obeid.
b) District Veterinary Office, Eastern District Northern Kordofan Province, Rahad.
The volumes traded at Rahad animal market is said to be one-third of those traded at Um Ruaba animal market.

Note: 1) Prices are an average LS per head March, 1977.

TABLE 4-9 CROP PRODUCTION ESTIMATES IN THE ZONES OF THE PROJECT AREA, 1977

Unit: Area - feddan
Product - ton

Crop / Zone	Dukhn		Dura		Sesame		Groundnuts		Watermelon Seeds		Karkadeh		Sanamakar		Gum Arabic	
	Area	Product	Area	Product	Area	Product	Area	Product	Area	Product	Area	Product	Area	Product	Area	Product
1	19,488	2,341	9,905	1,486	13,807	1,036	7,954	2,784	5,928	563	555	7	75	40	2,026	101
2	18,618	2,237	9,463	1,420	13,191	989	7,599	2,660	5,663	538	530	6	72	39	1,936	97
3	15,312	1,840	7,783	1,167	10,849	814	6,250	2,187	4,658	442	436	5	59	32	1,592	80
4	19,488	2,341	9,905	1,486	13,807	1,036	7,954	2,784	5,928	563	555	7	75	40	2,026	101
5	25,056	3,010	12,735	1,910	17,752	1,331	10,227	3,580	7,622	724	714	8	96	52	2,605	130
6	13,398	1,610	6,810	1,022	9,493	712	5,469	1,914	4,076	387	382	5	52	28	1,393	70
7	18,096	2,174	9,198	1,380	12,821	962	7,386	2,585	5,505	523	516	6	70	38	1,881	94
8	17,226	2,069	8,756	1,313	12,205	915	7,031	2,461	5,240	498	491	6	66	36	1,791	90
9	9,396	1,129	4,776	716	6,657	499	3,835	1,342	2,858	272	268	3	36	20	977	49
10	17,922	2,153	9,109	1,366	12,698	952	7,315	2,560	5,452	518	511	6	69	37	1,863	93
Total	174,000	20,904	88,440	13,266	123,280	9,246	71,020	24,857	52,930	5,028	4,958	59	670	362	18,090	905

Note: The distribution of cultivated area by zone is calculated by the percentage distribution of farm households among the zones.

TABLE 4-10 PRODUCER'S PRICES IN CROP MARKETS IN EL OBEID AND EASTERN KORDOFAN DISTRICT

Products and Markets	1974/75 LS/Kg	1974/75 (LS/Kantar)	1975/76 LS/Kg	1975/76 (LS/Kantar)	1976/77 LS/Kg	1976/77 (LS/Kantar)	Producer's Price 1977 LS/Kg	Producer's Price 1977 (LS/Kantar)
Dukhn								
El Obeid	----------		----------		0.093	(4.200)	0.093	(4.200)
Dura								
El Obeid	----------		----------		0.055	(2.500)	0.055	(2.500)
Sesame								
El Obeid	0.125	(5.632)	0.125	(5.624)	0.102	(4.600)		
Eastern Kordofan (14 markets)	0.119	(5.370)	0.118	(5.300)	----------		0.111	(5.000)
Groundnuts								
El Obeid	0.078	(3.507)	0.077	(3.467)	0.071	(3.200)		
Eastern Kordofan (14 markets)	0.071	(3.187)	0.071	(3.190)	----------		0.071	(3.200)
Watermelon . Seeds								
El Obeid	0.054	(2.414)	0.066	(2.936)	0.093	(4.200)		
Eastern Kordofan (14 markets)	0.044	(1.995)	0.021	(0.934)	----------		0.089	(4.000)
Karkadeh								
El Obeid	0.144	(6.484)	0.116	(5.228)	0.333	(15.000)		
Eastern Kordofan (14 markets)	0.158	(7.127)	0.123	(5.535)	----------		0.222	(10.000)
Gum Arabic								
El Obeid	0.406	(18.250)	0.272	(12.250)	0.208	(9.353)		
Eastern Kordofan (14 markets)	0.345	(15.547)	0.191	(8.605)	----------		0.200	(9.000)

Source: El Obeid and Um Ruaba crop markets, 1977

TABLE 4-11 CROP PRODUCTION AND INCOME PER FARM HOUSEHOLD IN THE DIRECT INFLUENCE ZONE

	Area feddan	Total Production kg	Home Consumption a) Net Food kg/Farm 1)	Feed kg	Waste 1) kg	Seed kg	Total Quantity kg	Value LS 2)	Sales Quantity kg	Sales Value LS 3)
Dukhn	8.3	1,000.0	245.0	-	50.0	58.0	353.0	29.546	647.0	54.154
Dura	4.2	634.0	472.5	11.4	29.4	15.0	528.3	26.151	105.7	5.232
Sesame	6.0	442.0	116.0	-	15.0	30.0	161.0	16.084	281.7	28.072
Groundnuts (in shell)	3.4	1,189.0	158.0	-	120.0	272.0	550.0	35.145	639.0	40.832
Watermelon Seeds	2.5	240.0	-	-	-	-	-	-	240.0	19.224
Karkadeh	0.24	3.0	-	-	-	-	-	-	3.0	0.599
Sanamakar	0.03	17.0	-	-	-	-	-	-	17.0	-
Gum Arabic	0.87	43.0	-	-	-	-	-	-	43.0	7.740
(Fallow Land)	3.36	-	-	-	-	-	-	-	-	-
Total	28.9	3,568.0	991.5	11.4	214.4	375.0	1,592.3	106.926	1,975.7	155.853

Source: a) Estimate based on the data provided by Current Agricultural Statistics, (Ministry of Agriculture) June, 1976.

Notes: 1) Assumed each family has five persons.
2) Unit values are determined ten percent less than the price in Annex IV-10 to cover transport cost and losses.
3) Settled farmers have few animals with which they can earn cash income. Majority of livestock is held by nomads. Therefore, earnings by selling livestock by settled farmers is not included in this table.

TABLE 4-12 UNIT YIELD OF MAIN CROPS

(kg/feddan)

	Dura		Dukhn		Sesame		Groundnuts	
	Whole Sudan	North[2] Kordofan	Whole Sudan	North[2] Kordofan	Whole Sudan	North[2] Kordofan	Whole Sudan	North[2] Kordofan
1970/71 [1]	314	162	253	196	160	143	371	172
1971/72 [1]	349	145	210	150	154	81	256	91
1972/73 [1]	317	137	139	68	119	91	346	91
1974/75 [3]	306	150	156	90	107	70	519	320
1975/76 [3]	327	164	161	100	104	75	451	375
1970/71-1974/75 Average	323	152	184	121	129	92	389	210

Sources: 1) National Planning Commission, Economic Survey, 1974.

2) Ministry of Agricultural, Food and Natural Resources (MIN. AFNR), Yearbook of Agricultural Statistics, 1974.

3) MIN. AFNR, Current Agricultural Statistics, June 1976.

ANNEX Ⅳ－１３ El Obeid 空港滑走路建設

El Obeid の既存空港には 1,800 m と 1,300 m の砂利路面の２つの滑走路がある。Sudan Airways のＦ２７とＢ７３７が発着している。エプロン，ターミナルビル，緊急消火施設，離着陸誘導装置，いずれも旧式の設備である。

空港施設の改良が緊急を要するということが政府に認識されている。航空便の運行の正確さと安全性の確保と，大型航空機の運行が必要でプライオリティは高い。

このような環境の中で，新滑走路が改良工事として次のように行なわれている。

新滑走路　：　延長２５００m　巾員４５m

第１次施工　：　１９７７年６月まで舗装路盤工および排水施設の完成

第２次施工　：　１９７８年１２月までアスファルトによる表層工の完成

この事業費は，１９７６年価格で LS 1,500,000 である。

ANNEX Ⅳ－１４ El Ain 貯水池増設工事

El Ain にある既存貯水池は，El Obeid の住民に対して十分の給水量を持っていない。貯水量が３５０万m^3しかないため El Obeid は雨期の２，３ケ月を除いて水不足に悩まされる。

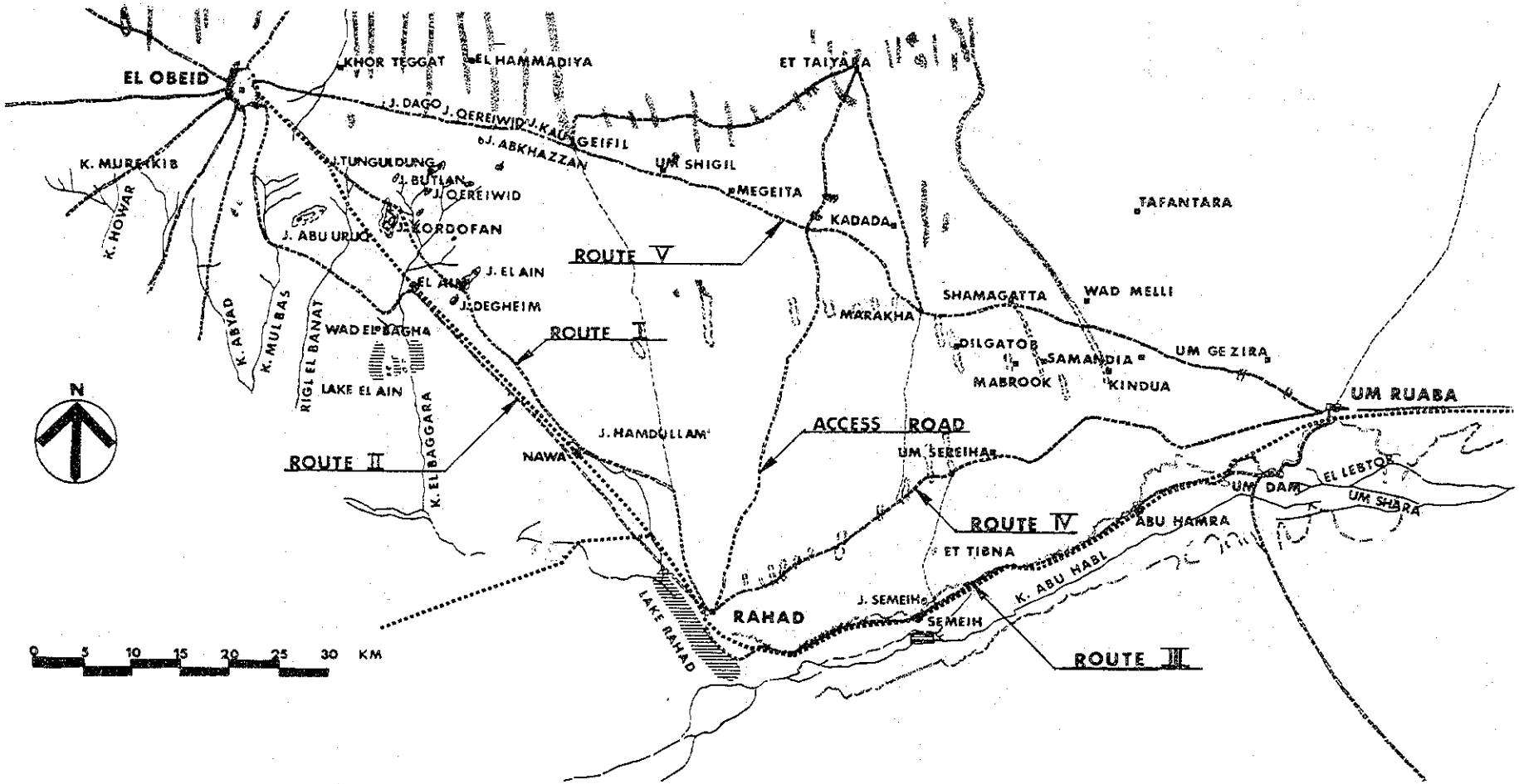
スーダン給水事業団が増設工事に直接関与している。プロジェクトは K. El Baggara 沿いの既存貯水池のそばで新しい貯水池の建設と El Obeid まで約３０kmの新しいパイプラインの建設とで構成されている。

増設工事は１９７２年１１月にはじまり，１９７７年７月に終った。工事完了によって全貯水量は最大５５０万m^3に達する。プロジェクトの最後の部分５０万m^3の貯水池工事は１９７７年１月にはじまった。その建設費は LS ２００,０００ である。

工事完了後には，El Obeid へ十分な給水ができるとともに一部を特に農業へ利用することができると期待されている。

ANNEX V

FIG. 5-1 EXISTING ROADS



LEGEND

EXISTING ROADS

RAILWAYS

RIVERS (KHORS)

QOZ

HILLS

TABLE 5-1 GRADIENT CONDITION OF EXISTING ROADS

(km)

Route	Surface	Distance by Gradient			Total	Remarks
		i = 0-3%	i = 3-5%	i = 5%-		
I	Pavement	2.2	0	0	75.2	
	Earth 1)	1.4	0	0		
	Track 2)	67.8	3.8	0		
	Total	71.4	3.8	0		
II	Pavement	2.2	0	0	75.8	
	Earth	24.1	0	0		
	Track	48.2	1.1	0.2		
	Total	74.5	1.1	0.2		
III	Pavement	0	0	0	79.0	
	Earth	2.5	0	0		
	Track	76.5	0	0		
	Total	79.0	0	0		
IV	Pavement	0	0	0	72.5	
	Earth	3.9	0	0		
	Track	41.8	17.1	9.7		
	Total	45.7	17.1	9.7		
V	Pavement	0	0	0	118.7	
	Earth	3.7	0	0		
	Track	81.5	22.1	11.4		
	Total	85.2	22.1	11.4		
Access Road	Pavement	0	0	0	40.9	
	Earth	1.6	0	0		
	Track	38.3	1.0	0		
	Total	39.9	1.0	0		

Notes: 1) Sections having either hard surface or some engineering works.
2) Sections having no engineering work.

TABLE 5-2 SURFACE CONDITION OF EXISTING ROADS

(km)

Route	Length by Surface Condition							Total
	Pavement	Earth [1]			Track [2]			
	Poor	Fair	Poor	Bad	Fair	Poor	Bad	
I	2.2	0	1.0	0.4	29.5	20.1	22.0	75.2
II	2.2	14.6	6.6	2.9	9.2	21.0	19.3	75.8
III	0	0	1.1	1.4	16.3	23.3	36.9	79.0
IV	0	0	1.1	2.8	0	6.6	62.0	72.5
V	0	1.0	2.7	0	2.3	27.8	84.9	118.7
Access Road	0	0	1.6	0	0	10.3	29.0	40.9

Notes: 1) Sections having either hard surface or some engineering works.

2) Sections having no engineering work.

TABLE 5-3-1 INVENTORY OF THE EXISTING ROAD

ANNEX V-4

Route I El Obeid ——— Rahad (75.2km) (km)

Gradient	Surface Condition		Soil Condition					Sub Total	Total
			Qoz	Sandy Silt	Silty Clay	Cotton Clay	Clay		
0% < i < 3%	Pavement	Poor	Bituminous 2.2					2.2	
	Earth	Poor	1.0						
		Bad	0.4					1.4	
	Track	Fair		20.1	*5.9 2.6				
		Poor	3.8	8.3	6.7				
		Bad	9.1	4.0	7.3			67.8	71.4
3% ≦ i < 5%	Track	Fair	0.5		0.4				
		Poor	1.3						
		Bad	1.4		0.2			3.8	

* Hard surface

TABLE 5-3-2 INVENTORY OF THE EXISTING ROAD

ANNEX V-4

Route II El Obeid ——— Rahad (75.8km) (km)

Gradient	Surface Condition		Soil Condition					Sub Total	Total
			Qoz	Sandy Silt	Silty Clay	Cotton Clay	Clay		
0% < i < 3%	Pavement	Poor	Bituminous 2.2					2.2	
	Earth	Fair		6.4	8.2				
		Poor	0.2	1.4	5.0				
		Bad		0.6	2.3			24.1	
	Track	Fair		3.1	6.1				
		Poor	1.6	10.3	8.4				
		Bad	6.7	5.7	6.3			48.2	74.5
3 ≦ i < 5%	Track	Poor	0.3	0.4					
		Bad	0.2	0.2				1.1	1.1
5% ≦ i	Track	Bad		0.2				0.2	0.2

TABLE 5-3-3 INVENTORY OF THE EXISTING ROAD

ANNEX V-4

Route III Rahad ——— Um Ruaba (79.0km) (km)

Gradient	Surface Condition		Soil Condition					Sub Total	Total
			Qoz	Sandy Silt	Silty Clay	Cotton Clay	Clay		
0% < i < 3%	Earth	Poor	1.1					2.5	79.0
		Bad	1.4						
	Track	Fair				16.3		76.5	
		Poor	4.1			19.2			
		Bad	8.1			28.8			

TABLE 5-3-4 INVENTORY OF THE EXISTING ROAD

ANNEX V-4

Route IV Rahad ——— Um Ruaba (72.5km) (km)

Gradient	Surface Condition		Soil Condition					Sub Total	Total
			Qoz	Sandy Silt	Silty Clay	Cotton Clay	Clay		
0% < i < 3%	Earth	Poor	1.1					3.9	45.7
		Bad	2.8						
	Track	Poor	6.4					41.8	
		Bad	34.2				1.2		
3% ≦ i < 5%	Track	Poor	0.2					17.1	17.1
		Bad	15.9				1.0		
i ≧ 5%	Track	Bad	9.7					9.7	9.7

TABLE 5-3-5 INVENTORY OF THE EXISTING ROAD

ANNEX V-4

Route V El Obeid —— Um Ruaba (118.7km) (km)

Gradient	Surface Condition		Soil Condition					Sub Total	Total
			Qoz	sandy silt	silty clay	cotton clay	Clay		
0%<i<3%	Earth	Fair		1.0				3.7	85.2
		Poor	0.7	2.0					
	Track	Fair		2.3				81.5	
		Poor	7.5	15.9	2.3				
		Bad	42.0	4.9	4.6		2.0		
3%≦i<5%	Track	Poor		2.1				22.1	22.1
		Bad	15.1	2.9	2.0				
5%≦i	Track	Bad	11.4					11.4	11.4

TABLE 5-3-6 INVENTORY OF THE EIXSTING ROAD

ANNEX V-4

Access Road Rahad ——— Route V (40.9km) (km)

Gradient	Surface Condition		Soil Condition					Sub Total	Total
			Qoz	Sandy Silt	Silty Clay	Cotton Clay	Clay		
0%<i<3%	Earth	Poor	1.6					1.6	39.9
	Track	Poor	8.0	2.3				38.3	
		Bad	23.7	4.3					
3%≦i≦5%	Track	Bad	1.0					1.0	1.0

FIG. 5-2 SOIL MAP OF PROJECT AREA

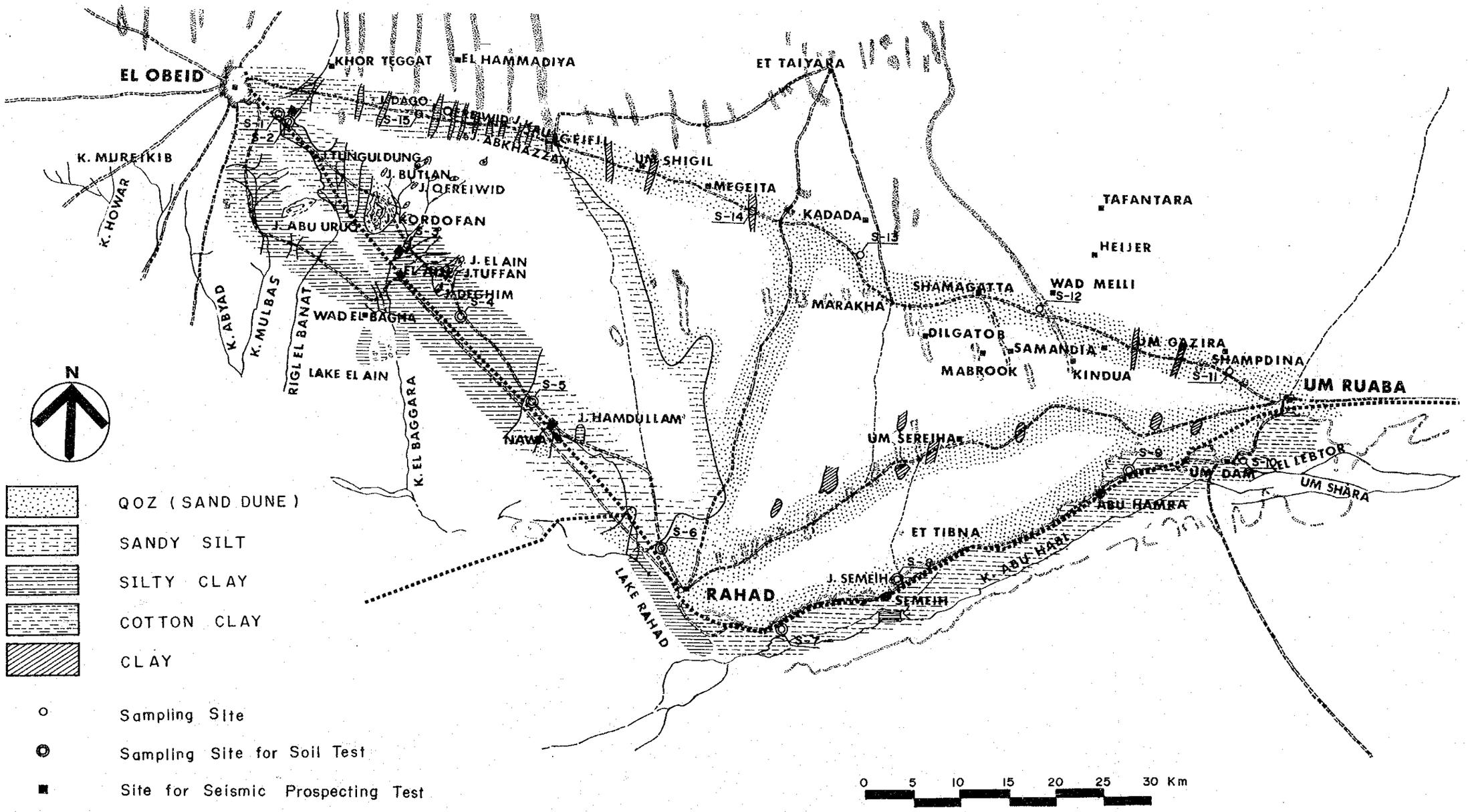


TABLE 5-4 SUMMARY OF SOIL TESTS

Sample No.		S-6	S-8	S-1	S-5	S-2	S-4	S-7	S-10
Soil Type		QOZ (sand dune)	QOZ (sand dune)	Sandy Silt	Sandy Slit	Brown Silty Clay	Yellow Grey Silty Clay	Cotton Clay	Cotton Clay
Specific Gravity		2.59	2.60	2.58	2.45	2.68	2.68	2.64	2.70
Particle Size Analysis	Sand %	87.9	96.5	78.4	71.4	59.5	51.8	61.1	1.4
	Silt and Clay %	12.1	3.5	21.6	28.6	40.5	48.2	38.9	98.6
Atterberg Limit	Liquid Limit %	- 1)	-	-	17.0	38.3	24.9	28.5	63.4
	Plastic Limit %	N.P.	N.P.	N.P.	N.P.	18.7	13.7	12.2	32.8
	Plasticity Index	N.P.	N.P.	N.P.	N.P.	19.6	11.2	16.3	30.6
Shrinkage Limit %		-	-	-	-	-	-	23.25	23.56
Classification	AASHTO 3)	A-3 (0)	A-3-(0)	A-2-4 (0)	A-2-4 (0)	A-6(4)	A-6 (3)	A-6 (2)	A-7-6 (13)
	Casagrande 2)	SU	SU	SC	SC	CI	CL	CL	OH
Compaction	OMC %	9.4	11.2	7.4	6.4	11.2	9.4	11.2	19.0
	MDD t/m^3	1.93	1.76	2.06	2.07	2.02	2.06	1.97	1.71
CBR Modified %		18.6	13.2	18.0	12.4	9.2	5.6	2.2	3.2
Adopted CBR for Pavement Design %		12	12	12	12	9	5	3	3

Notes: 1) Non plastic.
2) SU: uniform sands with little or no fines. SC: well graded sands with small clay content. CI: clays (inorganic) of medium plasticity. CL: clay silts (inorganic). OH: organic clays of high plasticity.
3) Classification is based on the following table.

CLASSIFICATION OF SOILS AND SOIL-AGGREGATE MIXTURES

Group Classification	A-3	A-2-4	A-6	A-7-6
Sieve Analysis Percent Passing:				
2.00 mm (No. 10)	-	-	-	-
0.425 mm (No. 40)	51 min.	-	-	-
0.075 mm (No. 200)	10 max.	35 max.	36 min.	36 min.
Characteristics of Fraction Passing 0.425 mm (No. 40)				
Liquid limit	-	40 max.	40 max.	41 min.
Plasticity Index	N.P.	10 max.	11 min.	11 min.
General Rating as Sub-grade	Excellent to Good		Fair to Poor	

Note:
A figure in ( ) means group index as calculated by AASHTO specification.

Source: AASHTO Designation: M145-73.

ANNEX V－7 橋梁基礎地盤の支持力

7.1 基礎地盤の弾性波速度

弾性波探査の結果，P波速度（Vp[1]）は，図５－３－１～５－３－３に示すように，８００～９００ m/sec を示し，かなり締った地盤であることを示している。経験式によると，P波速度（Vp）と，S波速度（Vs）との関係は，ポアソン比[2]（σ）をパラメータとして図５－３－４に示すように表わされる。この関係を適用して，ポアソン比 σ＝0.47 と仮定すれば，基礎地盤のS波速度（Vs）は ２３０～２５０ m/sec と推定される。

コンサルタントの実験室での実験によると Vp＝９２６ m/sec，Vs＝３２０ m/sec であった。ポアソン比は次の公式により推定すると，σ＝0.43 であった。

$$Vs = Vp \Big/ \sqrt{\frac{1-\sigma}{1/2-\sigma}}$$

7.2 基礎地盤のN値

N値と Vs との関係は，数多くの報告あるいは文献に示されている。図５－３－５はその一例である。

注：1) J.T. Cherry and K.H. Waters, "Shear-wave Recording Using Continuous Signal Methods, Part I - Early Development" Geophisics, Vol. 33, No. 2 (U.S.A., 1968).
" A shear (S) wave is defined as a disturbance which moves through an infinite medium in such a manner that the displacement of a point is parallel to the wavefront, in distinction to a compressional (P) wave in which the displacement of a point is perpendicular to the wavefront. The speeds of the two types of wave are different and are controlled by the density and two different elastic moduli of the medium. The P-wave velocity is always higher than the S-wave velocity($0 \leq Vs \leq 0.7Vp$), and the ratio between the velocities (Vs/Vp) represents a dynamic measurement of an elastic property of the medium; from it, if desired, one can derive a particular elastic constant of the medium called Poisson's ratio."

注：2) 今井常雄，吉村正義，地盤の弾性波速度と力学的性質，物理探鉱（第２５巻，第６号，物理探鉱技術協会 昭和４７年１２月）

N_1 値は，図５－３－５で推定したものであり，N_2 値は注[3]の公式によって推定される。

Vs (m/sec)	230	250	320
N_1 2)	22	23	46
N_2 3)	15	22	45

7.3 基礎地盤の支持力

上記のＮ値をもとに，Dunhamの提案した次の公式により許容支持力（Ｑ）は推定される。

$$Q = 1.17\,N \quad (t/m^2)$$

（注：沖積シルト質粘土の場合）

この調査で基礎地盤の許容支持力は２５ t/m^2 以上あると見て差支えないと考えられる。

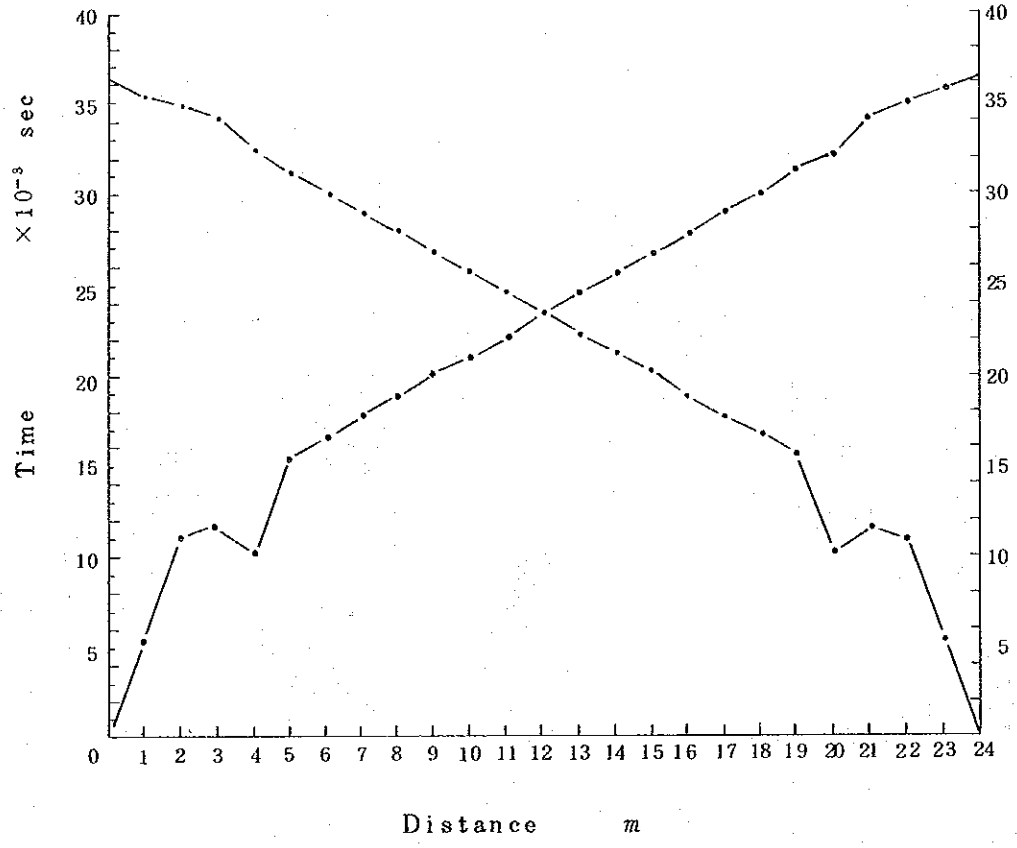
注：３） 太田　裕，後藤典俊，Ｓ波速度を他の土質的指標から推定する試み，物理探鉱（第２９巻，第４号，物理探鉱技術協会，昭和５１年８月）

$$Vs = 85.34\,N^{0.348} \quad (r = 0.719)$$

FIG. 5-3-1 Analysis of Seismic Prospecting

7.4 *km* from EL OBEID

Time - Distance Curve



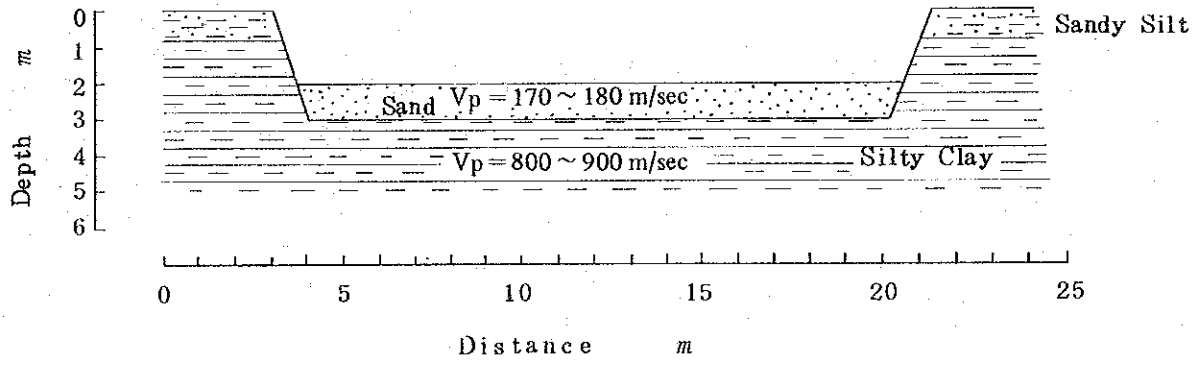


FIG. 5-3-2 Analysis of Seismic Prospecting
(K. EL BAGGARA)

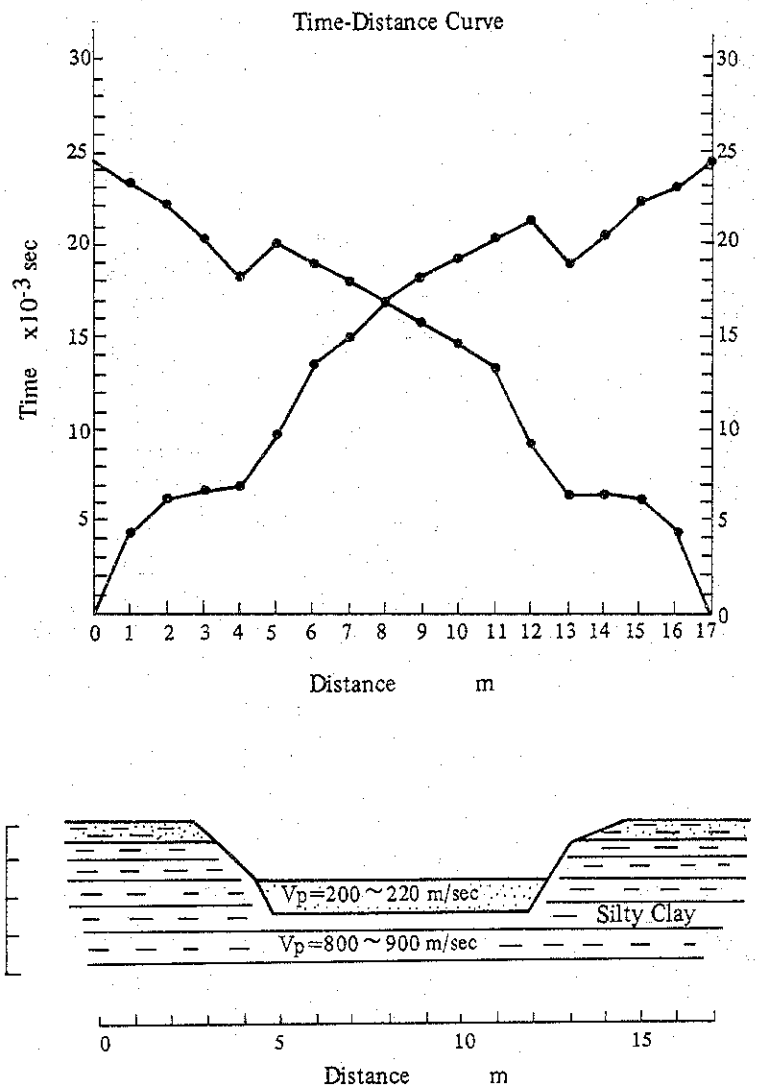


FIG. 5-3-3 Analysis of Seismic Prospecting
(K. NAWA)

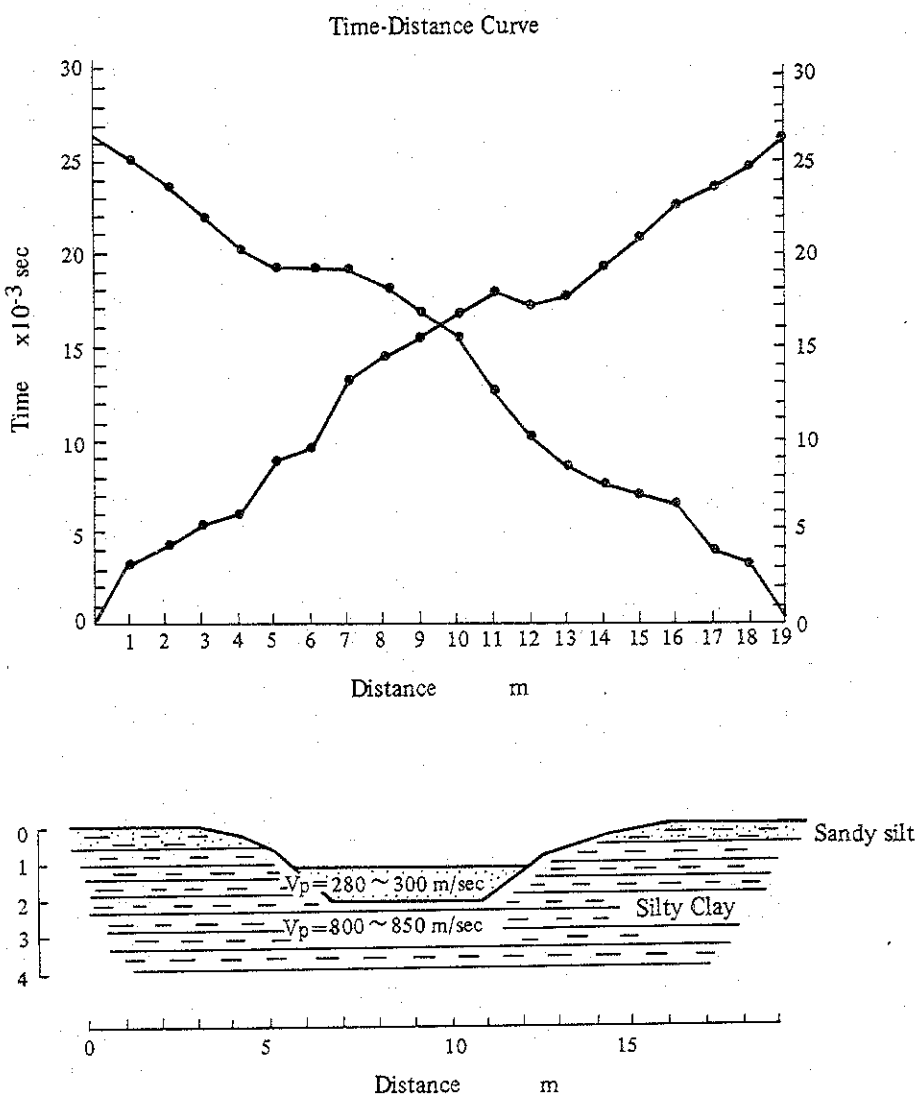
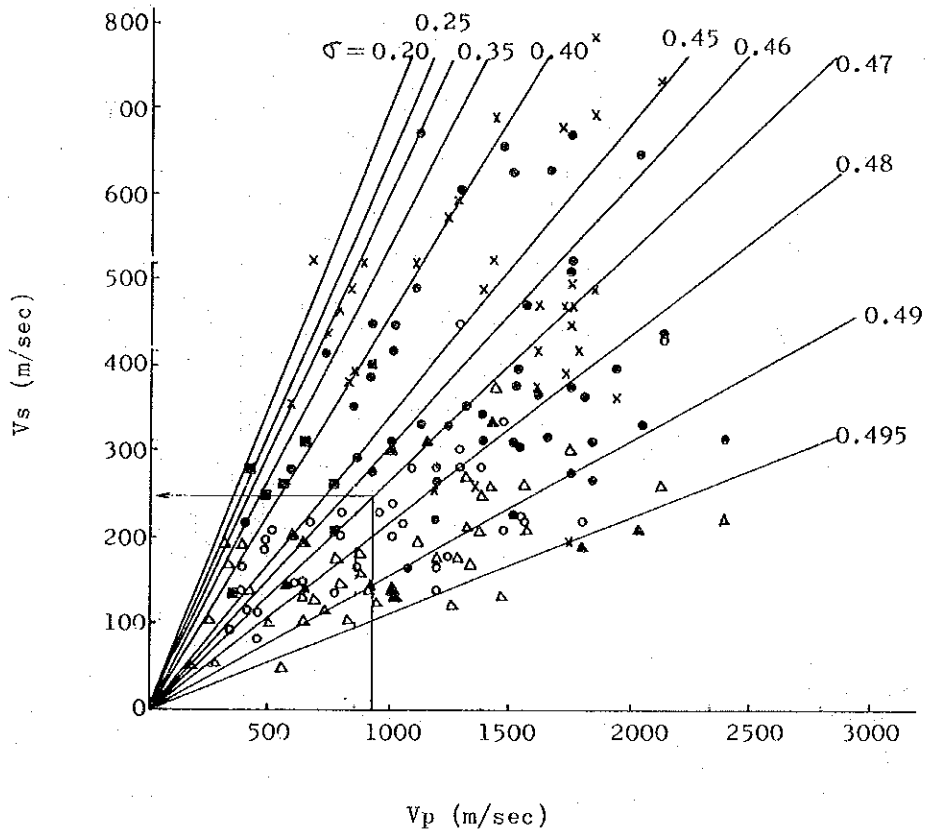


FIG. 5-3-4 S Wave Velocity —— P Wave Velocity



σ Poisson's Ratio

FIG. 5-3-5 N Value —— S Wave Velocity

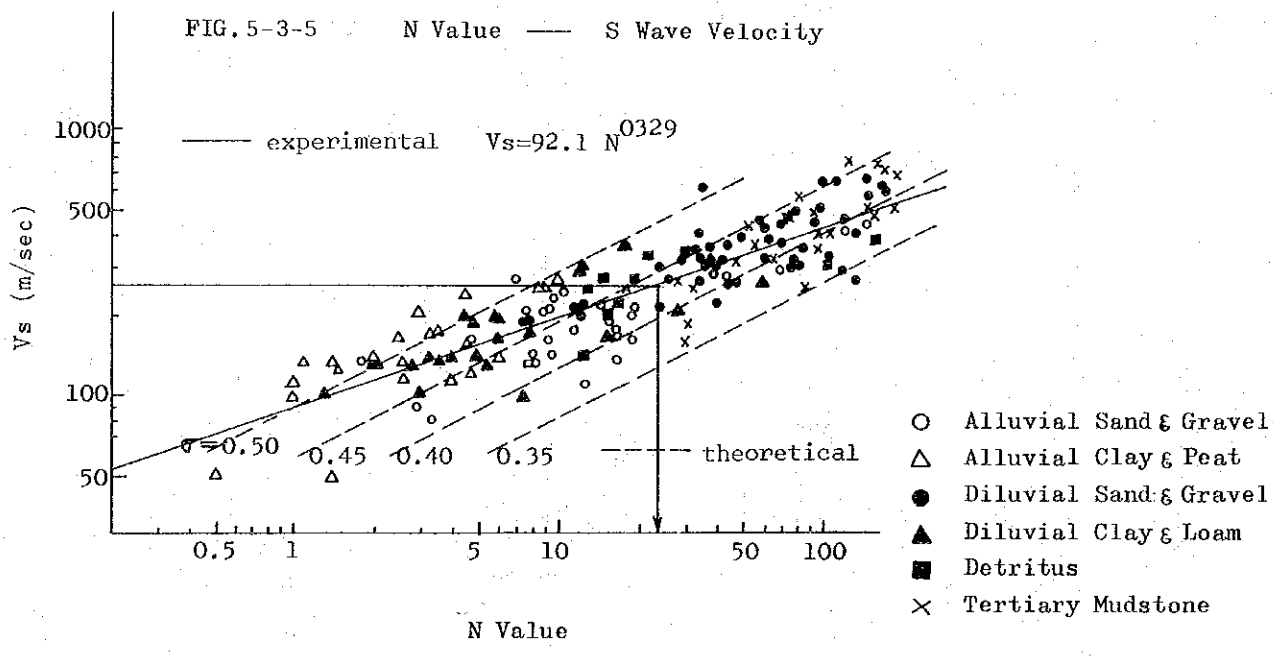
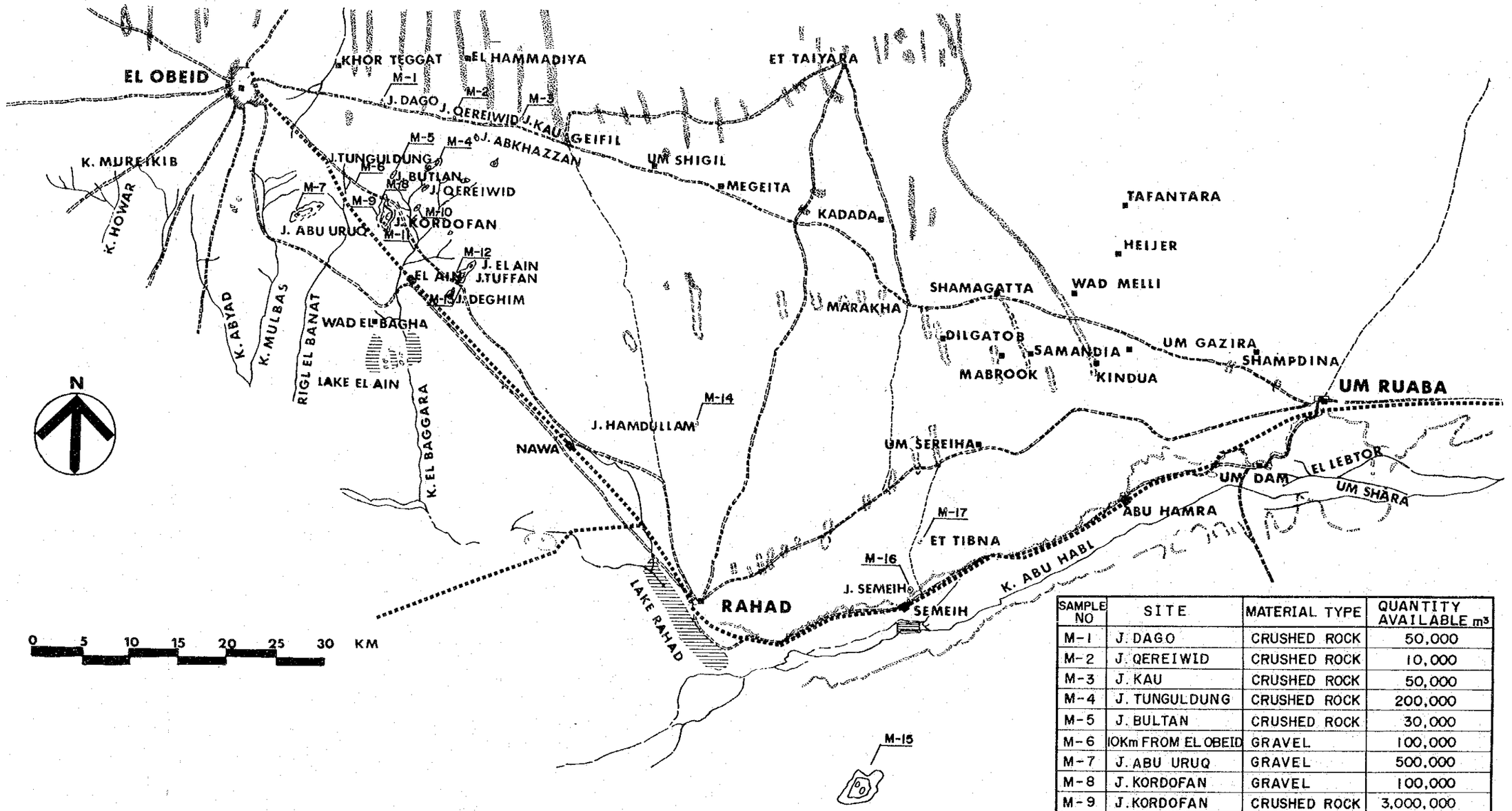


FIG. 5-3-6 LOCATION MAP OF MATERIALS



SAMPLE NO	SITE	MATERIAL TYPE	QUANTITY AVAILABLE m³
M-1	J. DAGO	CRUSHED ROCK	50,000
M-2	J. QEREIWID	CRUSHED ROCK	10,000
M-3	J. KAU	CRUSHED ROCK	50,000
M-4	J. TUNGULDUNG	CRUSHED ROCK	200,000
M-5	J. BULTAN	CRUSHED ROCK	30,000
M-6	10Km FROM EL OBEID	GRAVEL	100,000
M-7	J. ABU URUQ	GRAVEL	500,000
M-8	J. KORDOFAN	GRAVEL	100,000
M-9	J. KORDOFAN	CRUSHED ROCK	3,000,000
M-10	J. QEREIWID	CRUSHED ROCK	20,000
M-11	K. EL BAGGARA	COARSE SAND	100,000
M-12	J. TUFFAN	CRUSHED ROCK	200,000
M-13	J. TUFFAN	GRAVEL	10,000
M-14	J. HAMDULLAM	CRUSHED ROCK	150,000
M-15	J. DUMBEIR	CRUSHED ROCK	4,000,000
M-16	J. SEMEIH	CRUSHED ROCK	20,000
M-17	J. ET TIBNA	GRAVEL	10,000

TABLE 5-5 SUMMARY OF MATERIAL TESTS

Crushed Rock and Sand

Sample No.	Site	Specific Gravity	Absorption %	Los Angeles Abrasion %	Suitability for Surface Course	Suitability for Concrete Aggregate
M-1	J. DAGO	2.63	0.6	26.2	GOOD	GOOD
M-9	J. KORDOFAN	2.61	0.9	37.9	GOOD	GOOD
M-10	J. QEREIWID	2.62	1.4	44.7	POOR	POOR
M-12	J. TUFFAN	2.56	1.4	50.3	POOR	POOR
M-14	J. HAMDULLAM	2.53	3.0	14.1	GOOD	GOOD
M-16	J. SEMEIH	2.88	0.8	18.3	GOOD	GOOD
M-11	K. EL BAGGARA	2.62	0.6	-	POOR	GOOD

Gravel

Sample No.	Site	Specific Gravity	Absorption %	Los Angeles Abrasion %	C B R Modified %	Suitability for Subbase Course	Suitability for Base Course
M-7	J. ABU URUQ	-	-	-	88 [1]	GOOD	GOOD
M-6	10 km from EL OBEID	2.62	0.75	23.4	28.3	FAIR	POOR
M-8	J. KORDOFAN	2.65	0.38	33.2	14.2	POOR	POOR
M-13	J. TUFFAN	2.55	0.69	35.4	33.3	GOOD	POOR
M-17	J. ETTIBNA	2.61	0.70	31.9	40.8	GOOD	POOR

Note: 1) The test result carried out for EL OBEID Airport Construction by R B.P C 's laboratory.

General Rating as Aggregate

Item		Subbase Course GOOD[1]	Subbase Course FAIR[1]	Subbase Course POOR[2]	Base Course GOOD[1]	Base Course POOR[2]	Surface Course GOOD[1]	Surface Course POOR[2]	Concrete Aggregate GOOD[1]	Concrete Aggregate POOR[2]
Absorption	%	<3		≧3	<3	≧3	<3	≧3	<3	≧3
Los Angeles Abrasion	%	<50		≧50	<50	≧50	<40	≧40	<40	≧40
C.B.R. Modified	%	>30	25-30	<25	≧80	<80	-	-	-	-

Notes: 1) The rating as "GOOD" or "FAIR" should meet the three conditions listed in each column.

2) The rating as "POOR" comes when one condition in each column is satisfied.

TABLE 5-6 RESULT OF CEMENT STABILIZATION TEST

Cement Contents %		2	4	6	8	10
Unconfined Compression Strength Kg/cm^2		4.2	4.9	10.8	23.7	25.4
C B R Value %		-	203	254	266	312
Compaction Test	OMC %	12.2	11.3	11.0	10.5	10.2
	γdmax g/cm^3	1.75	1.77	1.81	1.83	1.85

Note : When the cement is added at 6 % or more, cracking is likely to occur while other test results are acceptable. When the cement is added at 5 % or less, cracking will not occur while other test figures are not acceptable. It is concluded the cement stabilization is not included in the engineering plan.

TABLE 5-7 RESULT OF LIME STABILIZATION TEST

Lime Contents %		5	10	15
Unconfined Compression Strength Kg/cm^2	Medium curing	-	0.4	0.6
	Rapid curing	-	2.8	2.8
Compaction Test	OMC %	11.0	10.5	10.0
	γdmax g/cm^3	1.80	1.87	1.94

TABLE 5-8 RESULT OF ASPHALT STABILIZATION TEST
(Hubbard-Field Stability)

Asphalt Contents %	6	7	8	9	10
Air Void %	25.3	23.3	21.8	16.4	15.3
Hubbard-Field Stability Kg	220	200	300	30	30

TABLE 5-9 RESULT OF ASPHALT STABILIZATION TEST
(Marshall Stability)

Asphalt Contents %	7	8	9
Air Void %	21.2	18.0	18.1
Marshall Stability Kg	35	40	20

Fig. 5-4 Cement Content ~
Unconfined Compression Strength

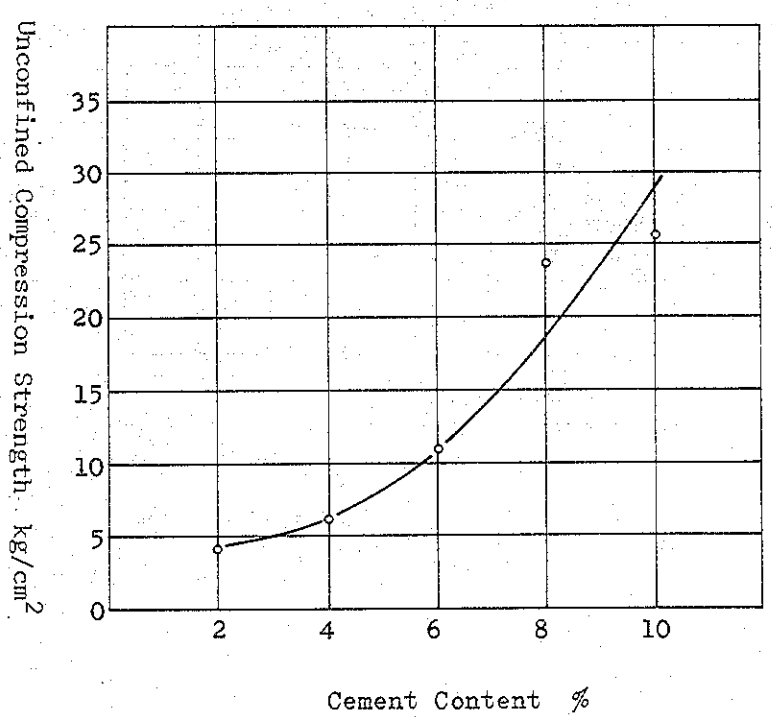


Fig. 5-5 Wetting-And-Drying Test
(Soil Cement Loss)

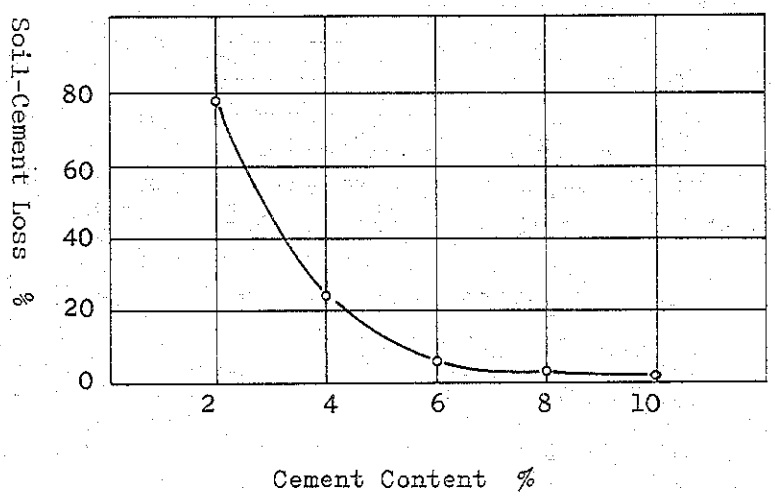


Fig. 5-6 Wetting-And-Drying Test
(Volume Change)

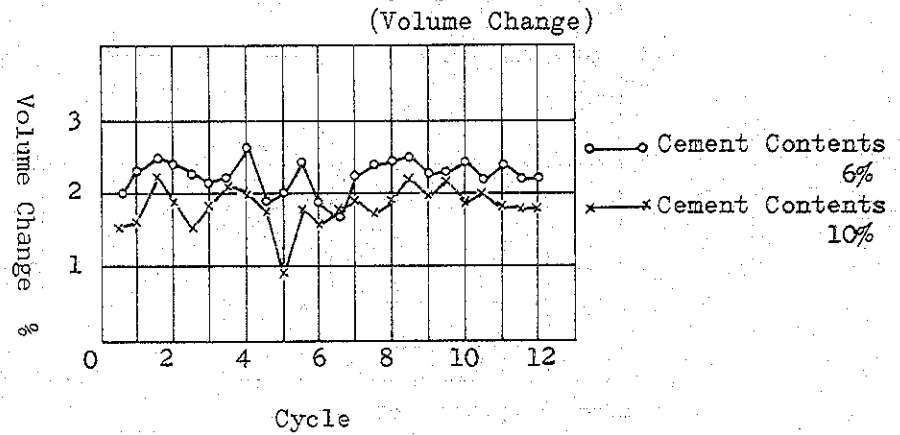


Fig. 5-7 Lime Content ~ Unconfined Compression Strength

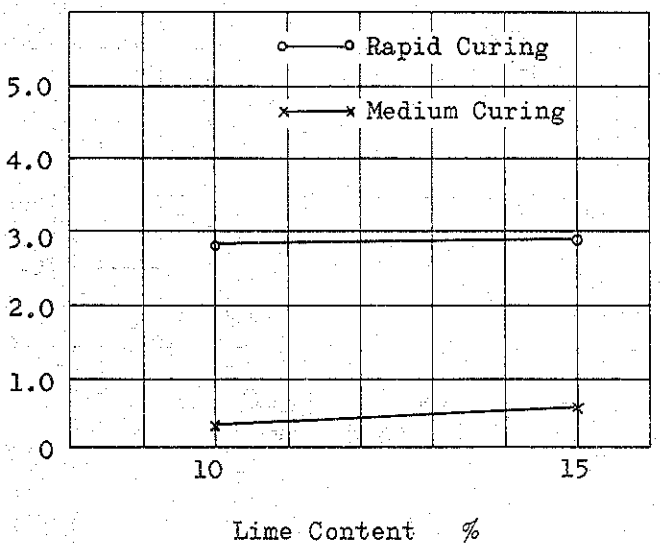


Fig. 5-8 Hubbard-Field Stability Test

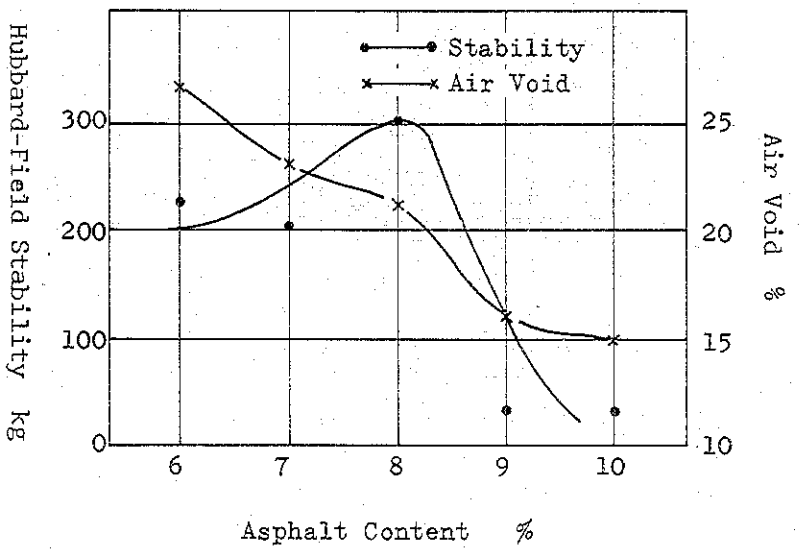


Fig. 5-9 Marshall Stability Test

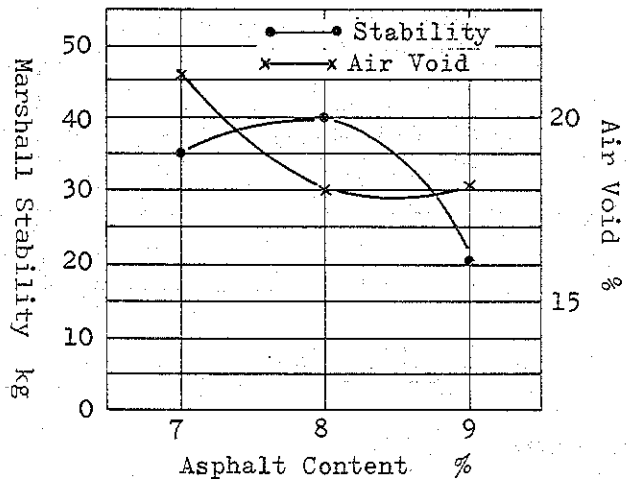
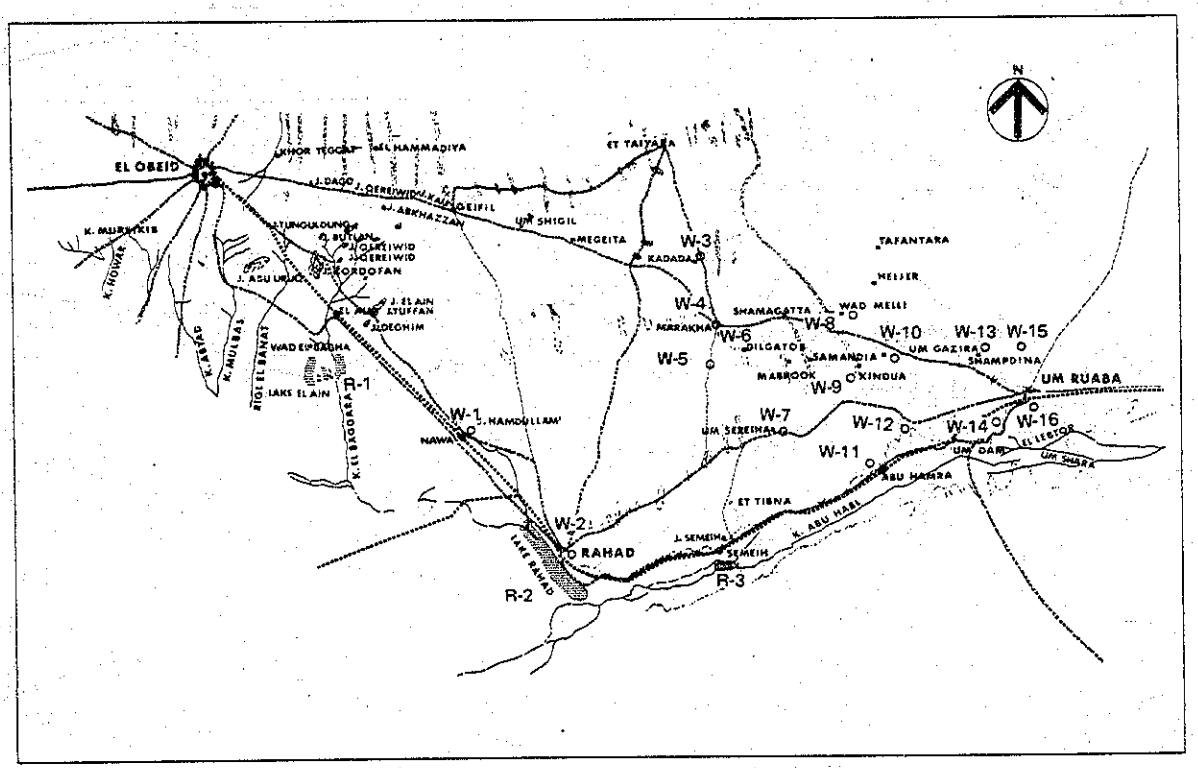


Fig. 5-10 Location Map of Reservoirs and Wells



Wells

NO.	LOCATION	NO.OF WELLS	YIELD ℓ/h	GROUNDWATER LEVEL
W- 1	NAWA	2	5450, 4360	5 - 10 m
W- 2	RAHAD	3	5450, 4360, 2270	
W- 3	KADADA	2	5450, 4090	80 - 90 m
W- 4	MARAKHA	2	4670, 4670	
W- 5	ABU SAD	1		
W- 6	DILGATOB	2	5680, 1820	
W- 7	UM SERRIHA	2	2550, 2950	
W- 8	WAD MELLI	1	9090	
W- 9	KINDUA	1	3180	
W-10	SAMANDIA	2	5460, 5460	
W-11	ABU HAMRA	3	3180, 4360, 4360	
W-12	KOANAMUSA	2	1180, 2270	
W-13	UM GEZIRA	2	4180, 4180	
W-14	GADADIM	1	13640	
W-15	UM GENNAS	2	2270, 2270	
W-16	UM RUABA	12	4360 - 13640	

Reservoirs m^3

NO.	LOCATION	CAPACITY
R-1	AL AIN	5,500,000
R-2	RAHAD	56,000,000
R-3	SEMEIH	120,000

FIG. 5 - 11 AVERAGE ANNUAL RAINFALL , 1921 - 1950

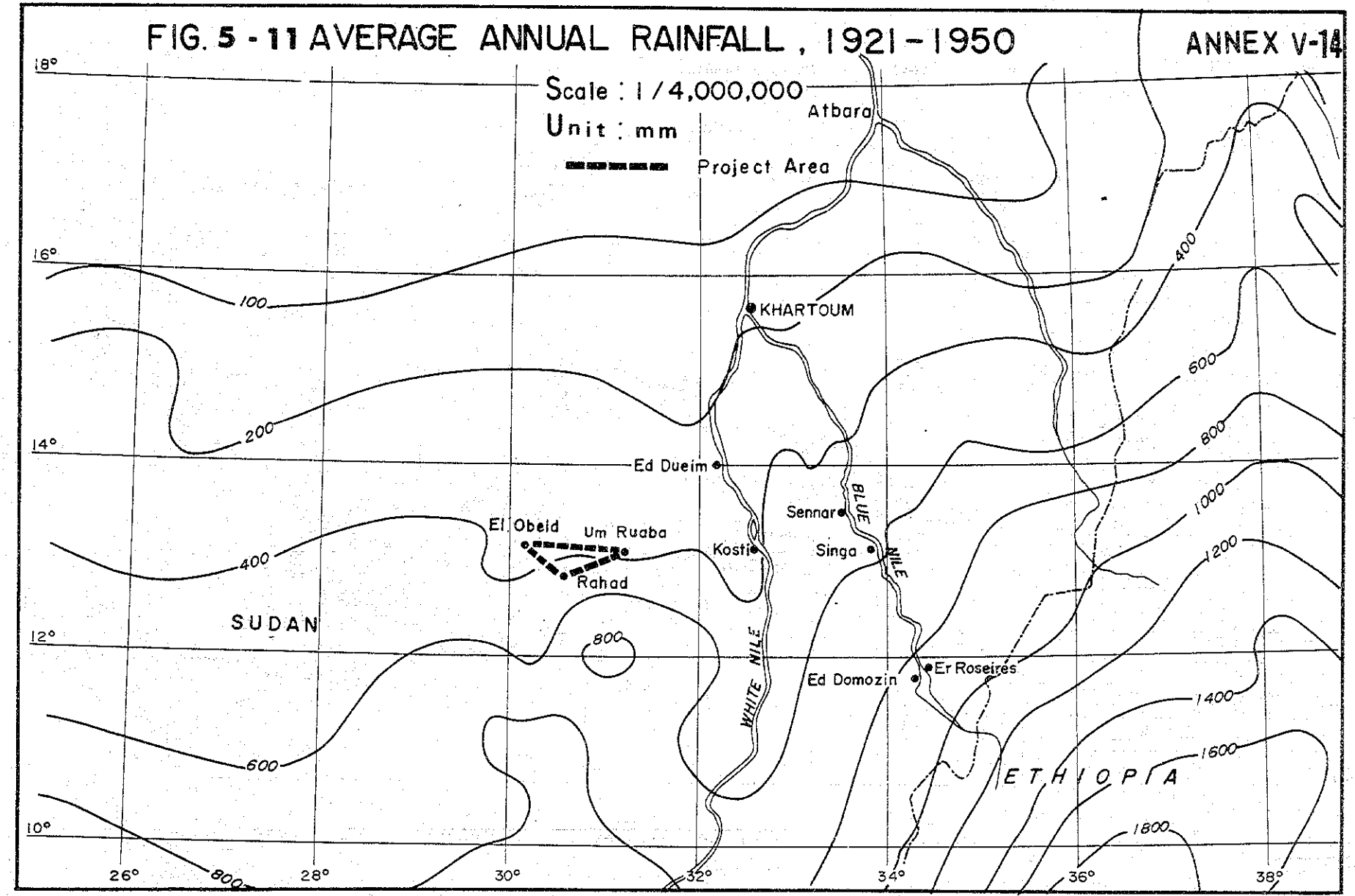


TABLE 5-10 ANNUAL MAXIMUM DAILY RAINFALL, EL OBEID, 1943 - 1976

Year	Daily Rainfall (mm/Day)	Year	Daily Rainfall (mm/Day)	Year	Daily Rainfall (mm/Day)
1943	44.2	1954	75.0	1965	48.0
44	53.5	55	56.2	66	53.2
45	81.2	56	96.7	67	54.7
46	96.7	57	26.7	68	45.6
47	44.7	58	56.0	69	19.4
48	50.7	59	78.1	70	36.2
49	35.6	60	54.2	71	-
50	40.6	61	50.9	72	-
51	69.1	62	73.6	73	-
52	68.2	63	34.1	74	40.7
53	56.2	64	57.3	75	34.2
				76	67.5

Source: Meteorological Department, Sudan

FIG. 5-12 PROBABILITY OF DAILY RAINFALL (GUMBEL METHOD)

ANNEX V-16

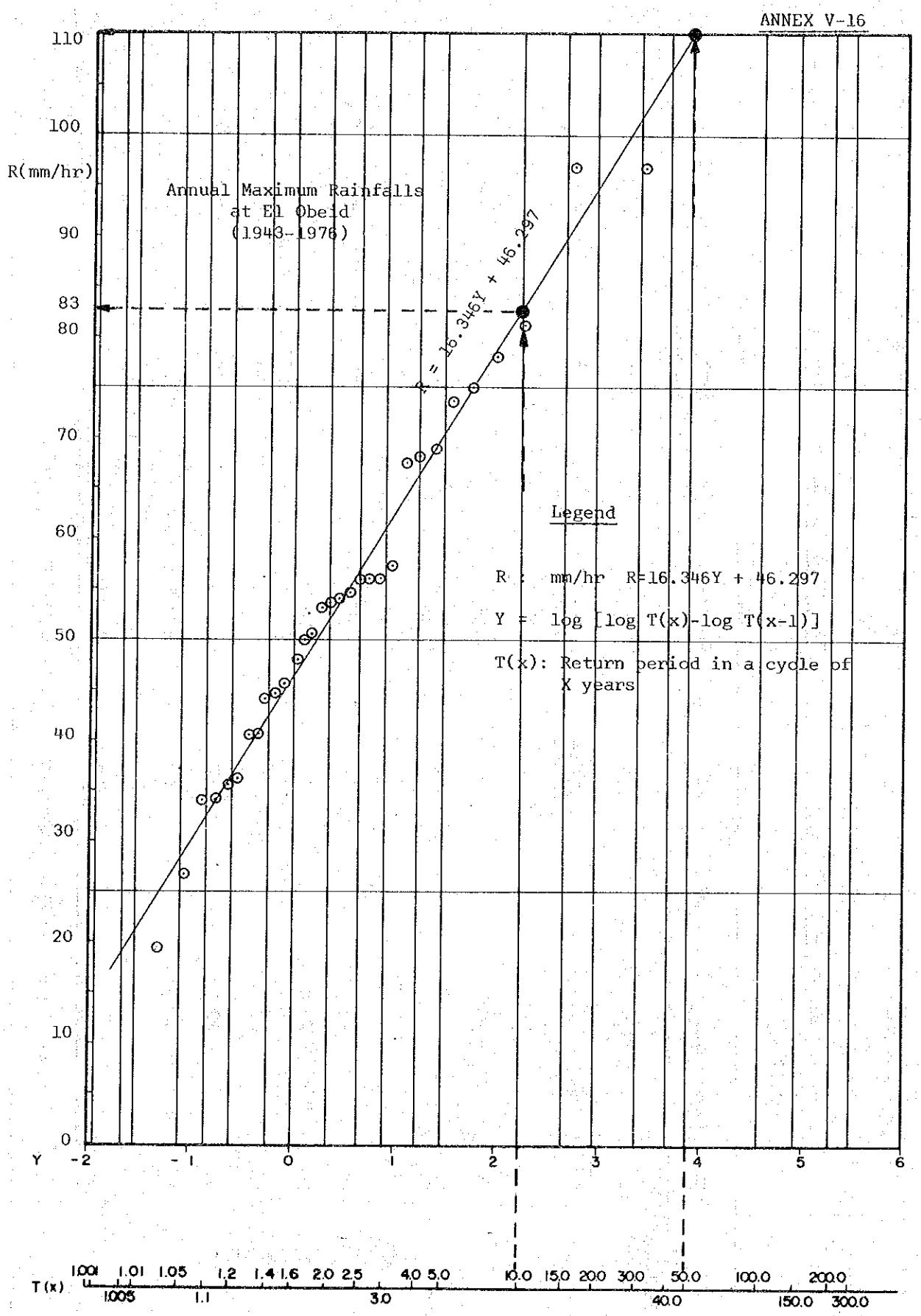
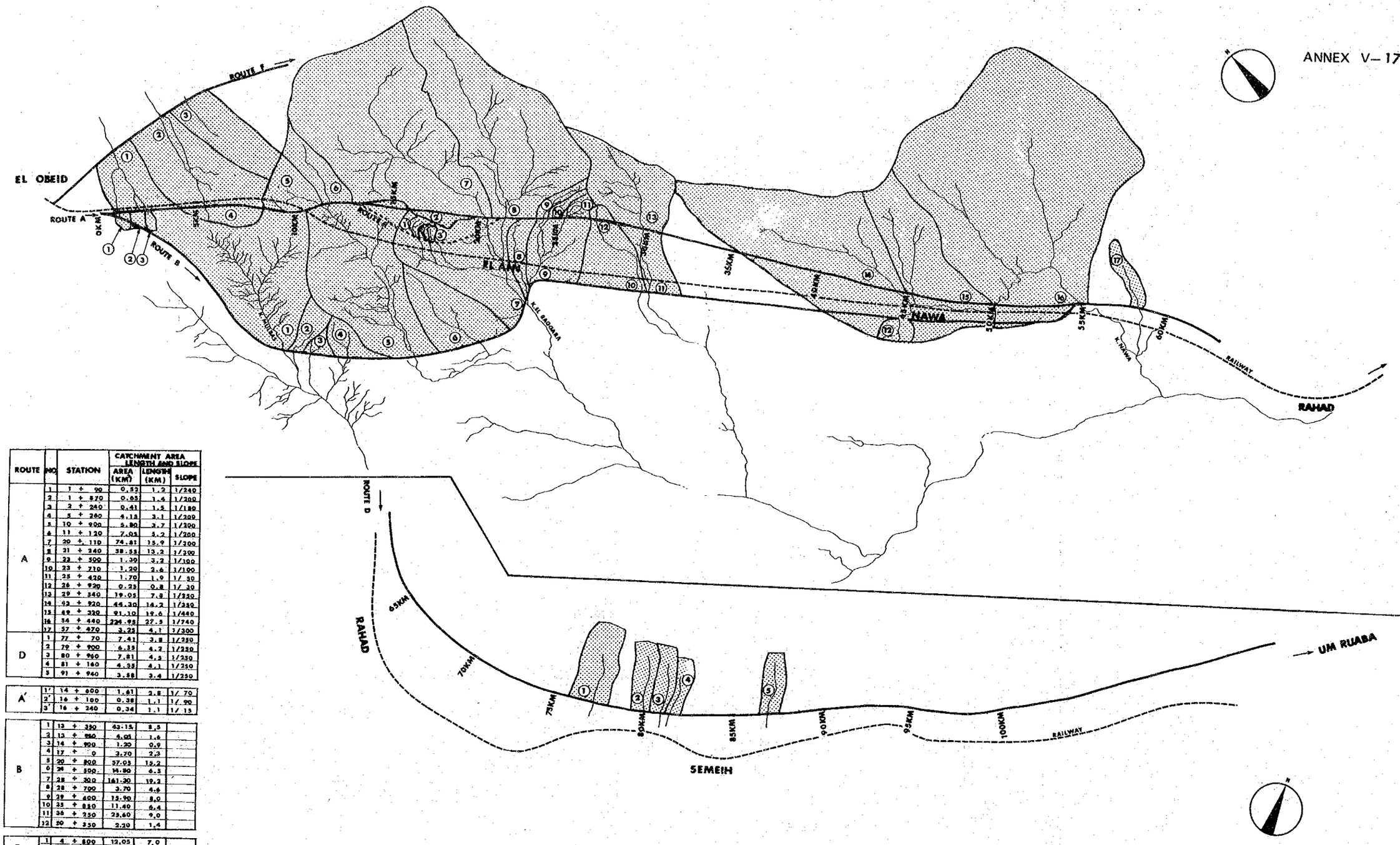


FIG. 5-13 CATCHMENT AREA

ANNEX V–17



ROUTE	NO.	STATION	CATCHMENT AREA AREA (KM²)	LENGTH AND SLOPE LENGTH (KM)	SLOPE
A	1	1 + 90	0.52	1.2	1/240
	2	1 + 870	0.65	1.4	1/200
	3	2 + 240	0.41	1.5	1/180
	4	5 + 260	4.15	3.1	1/300
	5	10 + 900	5.80	3.7	1/300
	6	11 + 120	7.05	5.2	1/200
	7	20 + 110	74.81	15.9	1/300
	8	21 + 240	38.55	13.2	1/300
	9	22 + 500	1.30	3.2	1/100
	10	23 + 710	1.20	2.6	1/100
	11	25 + 420	1.70	1.9	1/ 30
	12	26 + 920	0.25	0.8	1/ 30
	13	29 + 340	19.05	7.8	1/250
	14	43 + 920	44.30	14.2	1/350
	15	69 + 320	91.10	19.6	1/440
	16	84 + 440	226.98	27.5	1/740
	17	87 + 470	3.25	4.1	1/300
D	1	77 + 70	7.41	3.8	1/250
	2	79 + 900	6.33	4.2	1/250
	3	80 + 960	7.81	4.5	1/250
	4	81 + 160	4.55	4.1	1/250
	5	91 + 940	3.88	3.4	1/250
A'	1'	14 + 600	1.61	2.8	1/ 70
	2'	16 + 100	0.38	1.1	1/ 90
	3'	16 + 240	0.34	1.1	1/ 15
B	1	12 + 350	43.15	8.5	
	2	13 + 980	4.05	1.6	
	3	14 + 900	1.20	0.9	
	4	17 + 0	3.70	2.3	
	5	20 + 800	57.05	13.2	
	6	26 + 500	14.80	6.3	
	7	28 + 300	161.30	19.2	
	8	28 + 700	3.70	4.6	
	9	29 + 600	13.90	8.0	
	10	35 + 850	11.40	6.4	
	11	36 + 250	23.60	9.0	
	12	39 + 350	2.20	1.4	
F	1	4 + 800	12.05	7.0	
	2	7 + 880	28.30	8.3	
	3	9 + 600	13.70	3.2	

FIG. 5-14-1 SPECIFIC RUN-OFF CURVES

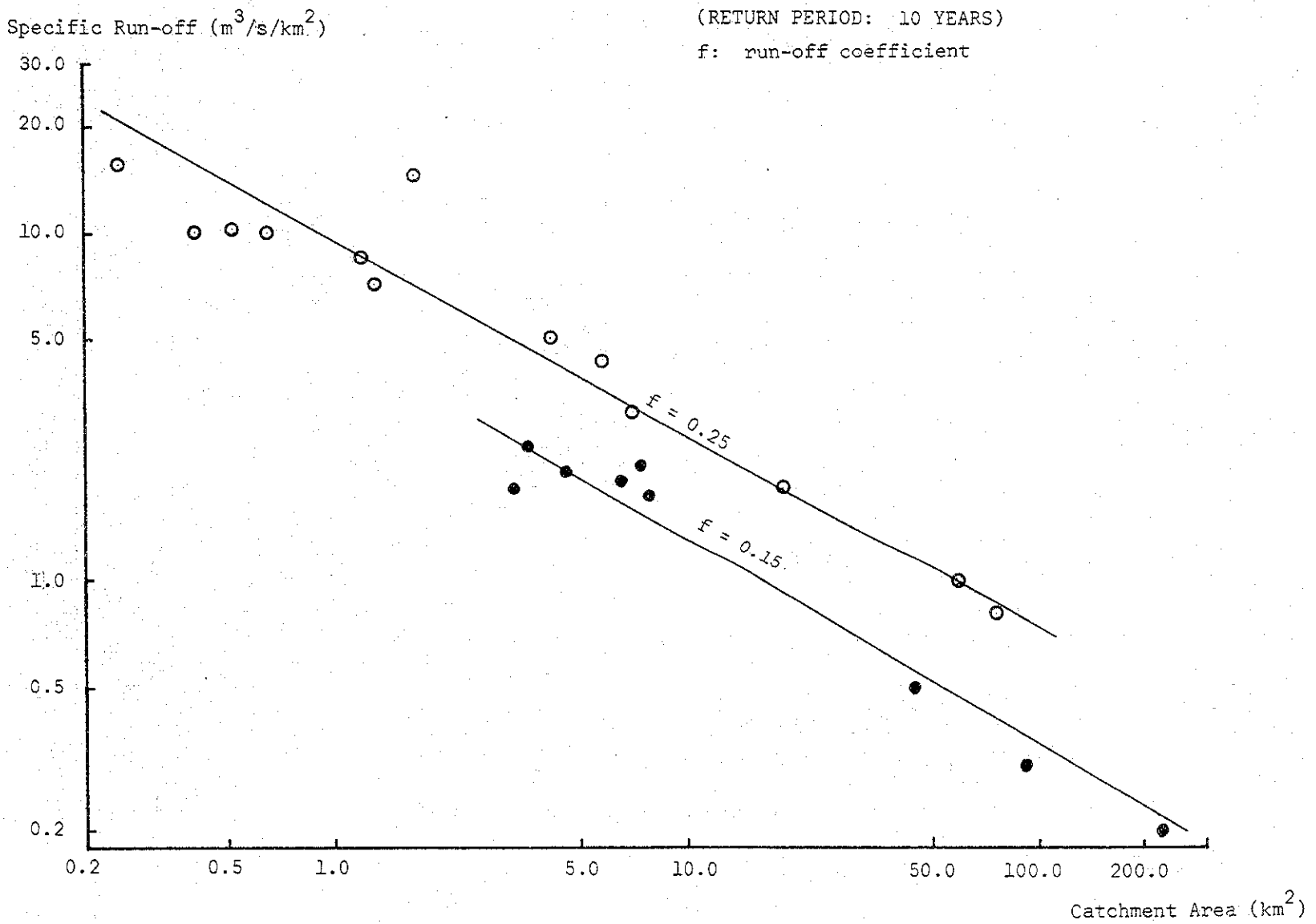


FIG. 5-14-2 SPECIFIC RUN-OFF CURVES

(RETURN PERIOD: 50 YEARS)

f: run-off coefficient

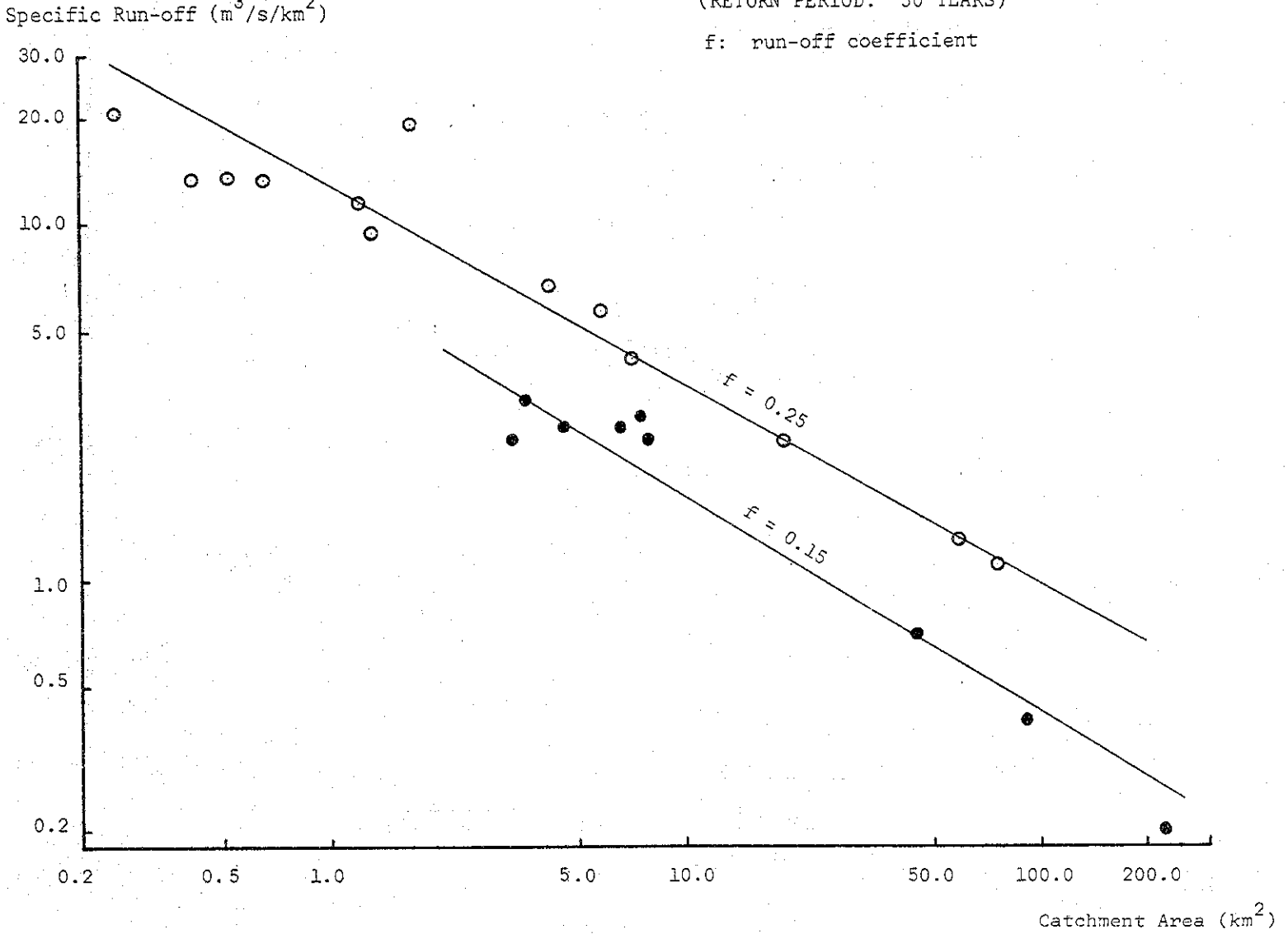


TABLE 5-11-1 ESTIMATED DISCHARGE OF 10 YEAR'S RETURN PERIOD AT THE LOCATION OF STRUCTURE

Route A and D

$$r = \frac{5006}{t + 7.0}$$

Route	No.	Station	Catchment area Length and Slope			Time of concentration and Rainfall intensity		Run-off coefficient, Discharge and Specific run-off		
			Area (Km^2)	Length (Km)	Slope	Time of conc. (min)	Rainfall intensity (mm/hr)	Run-off coefficient	Discharge (m^3/s)	Specific run-off ($m^3/s/km^2$)
A	1	1k + 090m	0.52	1.2	1/240	27	147.2	0.25	5.3	10.2
	2	1k + 870m	0.65	1.4	1/200	28	143.0	"	6.5	10.0
	3	2k + 240m	0.41	1.5	1/180	28	143.0	"	4.1	10.0
	4	5k + 260m	4.15	3.1	1/200	62	72.6	"	20.9	5.0
	5	10k + 900m	5.80	3.7	1/200	74	61.8	"	24.9	4.3
	6	11k + 120m	7.05	5.2	1/200	104	45.1	"	22.1	3.1
	7	20k + 110m	74.81	15.9	1/300	406	12.1	"	62.9	0.8
	8	21k + 240m	58.55	13.2	1/300	337	14.6	"	59.4	1.0
	9	23k + 500m	1.30	3.2	1/100	42	102.2	"	9.2	7.1
	10	23k + 710m	1.20	2.6	1/100	34	122.1	"	10.2	8.5
	11	25k + 420m	1.70	1.9	1/ 50	17	208.6	"	24.6	14.5
	12	26k + 920m	0.25	0.8	1/ 30	15	227.5	"	3.9	15.6
	13	29k + 540m	19.05	7.8	1/250	179	26.9	"	35.6	1.9
	14	43k + 920m	44.30	14.2	1/350	398	12.4	0.15	22.9	0.5
	15	49k + 320m	91.10	19.6	1/440	630	7.9	"	30.0	0.3
	16	54k + 440m	224.95	27.5	1/740	1207	4.1	"	38.4	0.2
	17	57k + 470m	3.25	4.1	1/300	105	44.7	"	6.1	1.9
D	1	77k + 070m	7.41	3.8	1/250	87	53.2	"	16.4	2.2
	2	79k + 900m	6.55	4.2	1/250	96	48.6	"	13.3	2.0
	3	80k + 960m	7.81	4.5	1/250	103	45.5	"	14.8	1.9
	4	81k + 160m	4.55	4.1	1/250	94	49.6	"	9.4	2.1
	5	91k + 940m	3.58	3.4	1/250	78	58.9	"	8.8	2.5

TABLE 5-11-2 ESTIMATED DISCHARGE OF 50 YEAR'S RETURN PERIOD AT THE LOCATION OF STRUCTURE

Route A and D

$$r = \frac{6635}{t + 7.0}$$

Route	No.	Station	Catchment area Length and Slope			Time of concentration and Rainfall intensity		Run-off coefficient, Discharge and Specific run-off		
			Area (Km^2)	Length (Km)	Slope	Time of conc. (min)	Rainfall intensity (mm/hr)	Run-off coefficient	Discharge (m^3/s)	Specific run-off ($m^3/s/km^2$)
A	1	1k + 090m	0.52	1.2	1/240	27	195.1	0.25	7.0	13.5
	2	1k + 870m	0.65	1.4	1/200	28	189.6	"	8.6	13.2
	3	2k + 240m	0.41	1.5	1/180	28	189.6	"	5.4	13.2
	4	5k + 260m	4.15	3.1	1/200	62	96.2	"	27.7	6.7
	5	10k + 900m	5.80	3.7	1/200	74	81.9	"	33.0	5.7
	6	11k + 120m	7.05	5.2	1/200	104	59.8	"	29.3	4.2
	7	20k + 110m	74.81	15.9	1/300	406	16.1	"	83.6	1.1
	8	21k + 240m	58.55	13.2	1/300	337	19.3	"	78.5	1.3
	9	23k + 500m	1.30	3.2	1/100	42	135.4	"	12.2	9.4
	10	23k + 710m	1.20	2.6	1/100	34	161.8	"	13.5	11.3
	11	25k + 420m	1.70	1.9	1/ 50	17	276.5	"	32.6	19.2
	12	26k + 920m	0.25	0.8	1/ 30	15	301.6	"	5.2	20.8
	13	29k + 540m	19.05	7.8	1/250	179	35.7	"	47.2	2.5
	14	43k + 920m	44.30	14.2	1/350	398	16.4	0.15	30.3	0.7
	15	49k + 320m	91.10	19.6	1/440	630	10.4	"	39.5	0.4
	16	54k + 440m	224.95	27.5	1/740	1207	5.5	"	51.6	0.2
	17	57k + 470m	3.25	4.1	1/300	105	59.2	"	8.0	2.5
D	1	77k + 070m	7.41	3.8	1/250	87	70.6	"	21.8	2.9
	2	79k + 900m	6.55	4.2	1/250	96	64.4	"	17.6	2.7
	3	80k + 960m	7.81	4.5	1/250	103	60.3	"	19.6	2.5
	4	81k + 160m	4.55	4.1	1/250	94	65.7	"	12.5	2.7
	5	91k + 940m	3.58	3.4	1/250	78	78.1	"	11.6	3.2

TABLE 5-11-3 ESTIMATED DISCHARGE OF 10 YEAR'S RETURN PERIOD AT THE LOCATION OF STRUCTURE BY SPECIFIC RUN-OFF CURVES

Route B

No.	Station	Catchment area Length and Slope			Time of concentration and Rainfall intensity		Run-off coefficient, Discharge and Specific run-off		
		Area (Km^2)	Length (Km)	Slope	Time of conc. (min)	Rainfall intensity (mm/hr)	Run-off coefficient	Discharge (m^3/s)	Specific run-off ($m^3/s/km^2$)
1	13k + 350m	43.15	8.5					50.1	1.16
2	13k + 950m	4.05	1.6					17.8	4.40
3	14k + 900m	1.20	0.9					10.2	8.50
4	17k + 000m	3.70	2.3					17.0	4.60
5	20k + 800m	57.05	15.2					58.8	1.03
6	24k + 500m	14.80	6.5					31.7	2.14
7	28k + 300m	161.30	19.2					90.3	0.56
8	28k + 700m	3.70	4.6					17.0	4.60
9	29k + 400m	15.90	8.0					32.6	2.05
10	35k + 850m	11.40	6.4					27.9	2.45
11	36k + 250m	25.60	9.0					40.4	1.58
12	50k + 350m	2.20	1.4					13.4	6.10

Route F

1	4k + 800m	12.05	7.0					28.9	2.40
2	7k + 800m	28.30	8.5					42.5	1.50
3	9k + 600m	13.70	3.2					30.1	2.20

Remarks; Discharges are obtained from FIG. 5-14-1 SPECIFIC RUN-OFF CURVES.

ANNEX V-19-4

TABLE 5-11-4 ESTIMATED DISCHARGE OF 50 YEAR'S RETURN PERIOD AT THE LOCATION OF STRUCTURE BY SPECIFIC RUN-OFF CURVES

Route B

No.	Station	Catchment area Length and Slope			Time of concentration and Rainfall intensity		Run-off coefficient, Discharge and Specific run-off		
		Area (Km^2)	Length (Km)	Slope	Time of conc. (min)	Rainfall intensity (mm/hr)	Run-off coefficient	Discharge (m^3/s)	Specific run-off ($m^3/s/km^2$)
1	13k + 350m	43.15	8.5					67.7	1.57
2	13k + 950m	4.05	1.6					23.9	5.90
3	14k + 900m	1.20	0.9					13.8	11.50
4	17k + 000m	3.70	2.3					22.9	6.20
5	20k + 800m	57.05	15.2					76.4	1.34
6	24k + 500m	14.80	6.5					42.2	2.85
7	28k + 300m	161.30	19.2					119.4	0.74
8	28k + 700m	3.70	4.6					22.9	6.20
9	29k + 400m	15.90	8.0					43.2	2.72
10	35k + 850m	11.40	6.4					37.1	3.25
11	36k + 250m	25.60	9.0					53.8	2.10
12	50k + 350m	2.20	1.4					18.0	8.20

Route F

1	4k + 800m	12.05	7.0					38.6	3.20
2	7k + 800m	28.30	8.5					56.6	2.00
3	9k + 600m	13.70	3.2					41.1	3.00

Remarks; Discharges are obtained from FIG. 5-14-2 SPECIFIC RUN-OFF CURVES.

ANNEX VI

Page

TABLE 6-1 ROAD–SIDE INTERVIEW QUESTIONNAIRE

Station No.		Name of interviewer	Sheet No.	
Date of interview				
Weather		Name of Surveyor		
Direction				
←				

1 Time of interview			
1	7~ 8	7	13~14
2	8~ 9	8	14~15
3	9~10	9	15~16
4	10~11	10	16~17
5	11~12	11	17~18
6	12~13	12	18~19

2 Type of vehicle			
1	Car, taxi	6.	Truck-trailer
2	Jeep	7.	Bus
3	Van, pick-up	8.	Motor cycle
4	Medium truck	9.	Animal-drawn vehicle
5	Heavy truck	10.	Others

Model of The vehicle		5 Origin	6 Destination	7 Trip purpose	Passenger cars		Trucks				14 Fuel used	15 Average annual mileage of the car (kilometer per year)
3 Model/ Make	4 Age	Name of the place where you start the trip	Name of the place where you finally finish the trip	1 Work 2 To home 3 Shopping 4 Social intercourse recreation 5 Others	8 Capacity (No. of persons)	9 No of passengers	10 No. of wheels	11 Loading capacity (tons)	12 Type of commodities carried	13 Weight of commodity (tons)	1 Gasoline 2 Diesel 3 Others	

1 Time	2 Type of vehicle	3 Model/make of the vehicle	4 Age	5 Origin	6 Destination	7 1)	8 Capacity	9 No. of pass.	10 No. of wheels	11 Loading capacity	12 Types of commodity carried	13 weight	14 Fuel used	15 2)

Notes: 1) Travel Time

2) Fuel Consumption

TABLE 6-2 **TRAFFIC COUNT SURVEY SHEET** ANNEX VI-2

Station No.		Date of count		Weather		Sheet No.
Direction		Name of Surveyor		Name of Supervisor		
→						/

Type of vehicle	7 ~ 8	8 ~ 9	9 ~ 10	10 ~ 11	11 ~ 12	12 ~ 13	13 ~ 14	14 ~ 15	15 ~ 16	16 ~ 17	17 ~ 18	18 ~ 19	Total
1. Car, taxi 													
2. Jeep 													
3. Van, pick-up 													
4. Medium truck 													
5. Heavy truck 													
6. Truck-trailer 													
7. Bus 													
8. Motor cycle													
9. Animal drawn vehicle													
10. Others													
Total													

EL OBEID – UM RUABA ROAD PROJECT

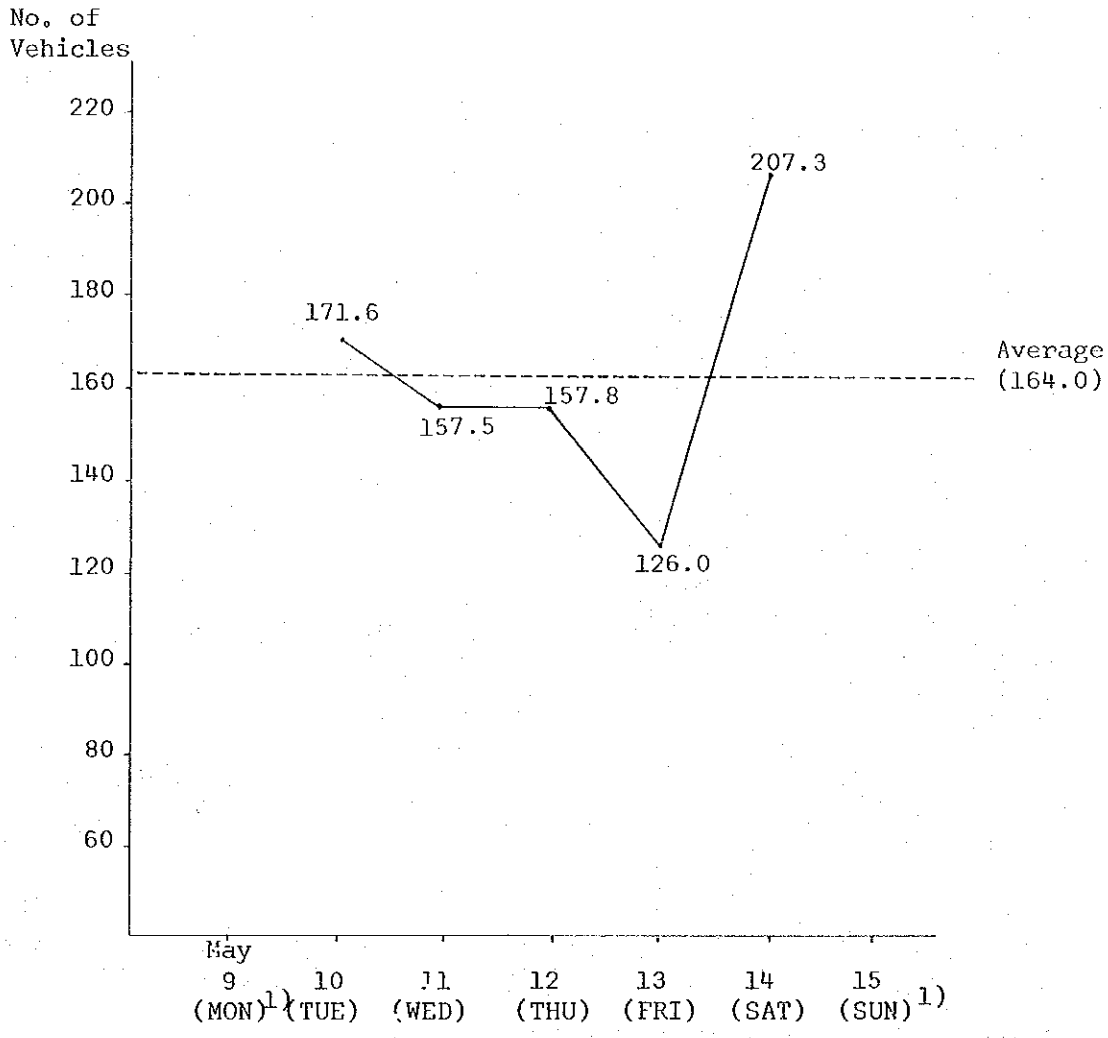
TABLE 6-3 DAILY TRAFFIC AT SURVEY STATIONS, EL OBEID

Vehicle Type	May 9[2] (MON)	10 (TUE)	11 (WED)	12 (THU)	13 (FRI)	14 (SAT)	15[2] (SUN)	Average[1]
Station 1-1								
Van/pick-up	1.2	-	3.6	-	-	-	1.2	0.7
Medium Truck	56.4	43.2	49.2	42.0	34.8	82.8	20.4	50.4
Heavy Truck	1.2	2.4	4.8	1.2	1.2	2.4	-	2.4
Bus	1.2	-	-	-	-	-	-	-
Total	60.0	45.6	57.6	43.2	36.0	85.2	21.6	53.5
Station 1-2								
Van/pick-up	3.6	4.8	2.4	1.2	15.6	-	1.2	4.8
Medium Truck	20.4	48.0	34.8	48.0	34.8	45.6	21.6	42.2
Heavy Truck	-	-	-	1.2	1.2	-	-	0.5
Bus	-	1.2	1.2	1.2	2.4	-	1.2	1.2
Total	24.0	54.0	38.4	51.6	54.0	45.6	24.0	48.7
Station 1-3								
Van/pick-up	-	-	1.5	1.5	-	1.5	3.0	0.9
Medium Truck	25.5	22.5	30.0	30.0	19.5	48.0	18.0	30.0
Heavy Truck	-	3.0	1.5	3.0	3.0	1.5	1.5	2.4
Bus	-	-	-	-	-	-	-	-
Total	25.5	25.5	33.0	34.5	22.5	51.0	22.5	33.3
Station 1-4								
Van/pick-up	4.5	16.5	7.5	6.0	6.0	9.0	-	9.0
Medium Truck	7.5	22.5	12.0	16.5	3.0	13.5	-	13.5
Heavy Truck	-	-	3.0	-	1.5	-	-	0.9
Bus	4.5	7.5	6.0	6.0	3.0	3.0	-	5.1
Total	16.5	46.5	28.5	28.5	13.5	25.5	-	28.5

Notes : 1) This figure is an average of Tuesday to Saturday.
2) The survey did not cover the traffic for 24 hours.

FIG. 6-1 DAILY VARIATION OF ROAD TRAFFIC, EL OBEID, MAY, 1977

(ALL TYPES OF VEHICLES)

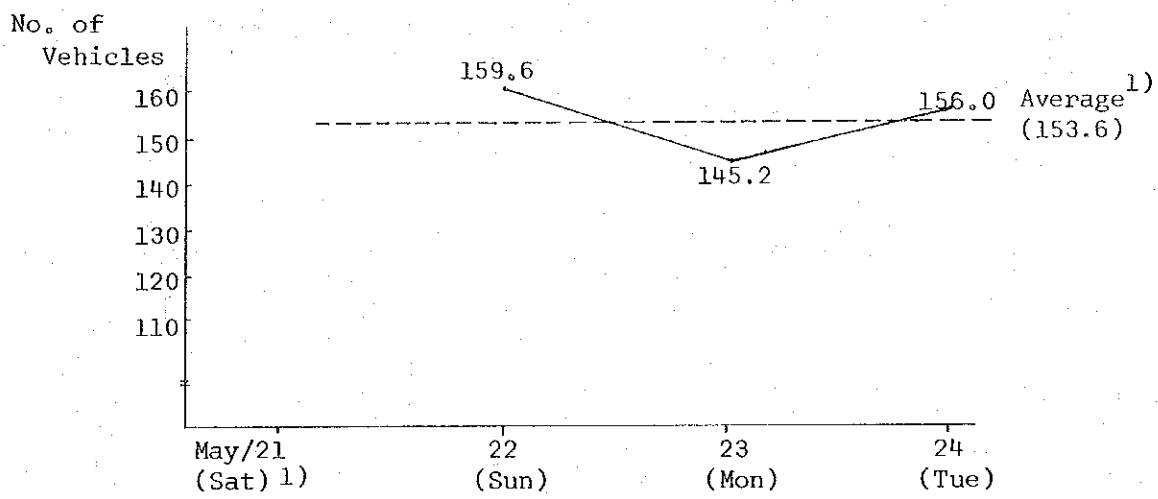


Note : 1) Survey was not conducted for a full day.

TABLE 6-4 DAILY TRAFFIC AT SURVEY STATIONS, UM RUABA

Vehicle Type	May 21 (Sat) [2]	22 (Sun)	23 (Mon)	24 (Tue)	Average [1]
Station 2-1					
Van/pick-up	6.0	1.2	4.8	7.2	4.4
Medium Truck	38.4	38.4	28.8	27.6	31.6
Heavy Truck	-	-	-	-	-
Bus	-	-	-	-	-
Total	44.4	39.6	33.6	34.8	36.0
Station 2-2					
Van/pick-up	1.2	-	-	1.2	0.4
Medium Truck	69.6	117.6	104.4	117.6	113.2
Heavy Truck	-	2.4	7.2	2.4	4.0
Bus	1.2	-	-	-	-
Total	72.0	120.0	111.6	121.2	117.6

FIG. 6-2 DAILY VARIATION OF ROAD TRAFFIC, UM RUABA, MAY 1977
(ALL TYPES OF VEHICLES)



Notes: 1) This figure in an average of Sunday to Tuesday.

2) The survey did not cover the traffic for 24 hours.

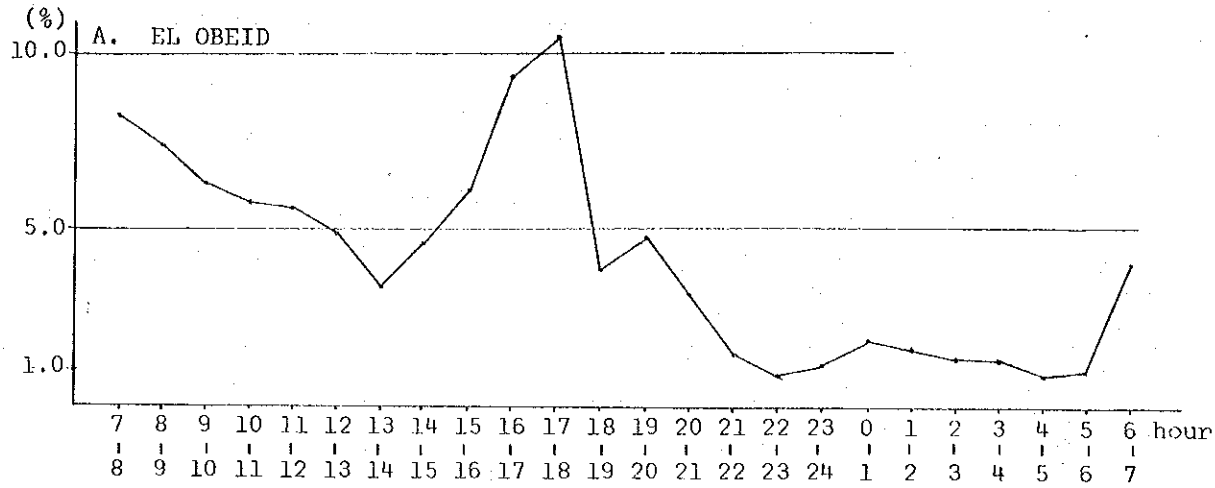
TABLE 6-5-1 HOURLY DISTRIBUTION OF ADT, EL OBEID AREA, MAY, 1977

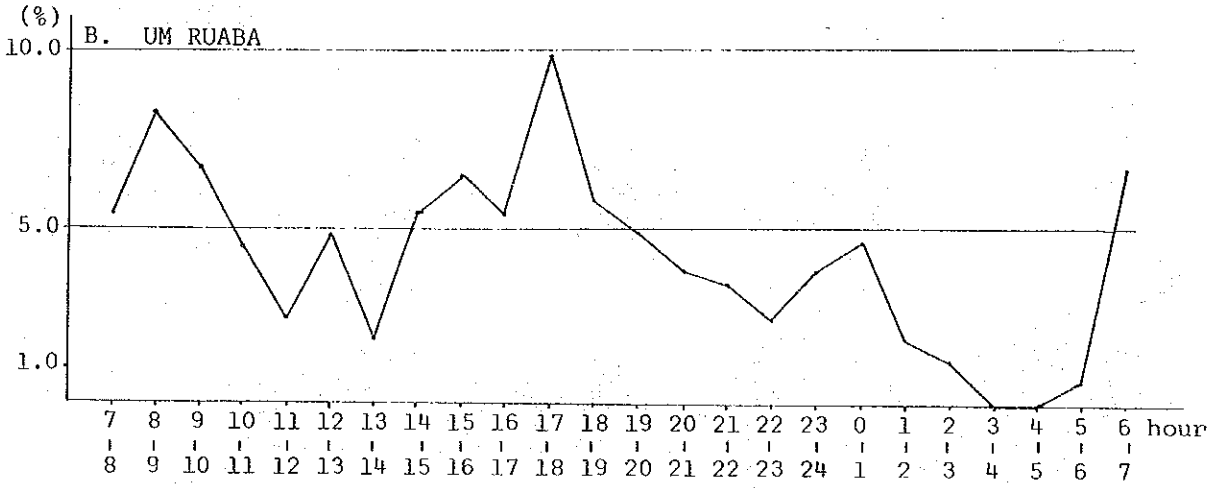
Hour	Van/ pick-up	Medium Truck	Heavy Truck	Bus	Total Vehicles	%
7 - 8	1.5	11.1	0.4	0.2	13.2	8.3
8 - 9	1.7	7.9	0.2	2.0	11.8	7.4
9 - 10	0.5	8.4	0.4	0.8	10.1	6.3
10 - 11	0.2	8.3	0.6	0.2	9.3	5.8
11 - 12	0.9	7.5	0.6	-	9.0	5.6
12 - 13	0.7	6.6	0.6	-	7.9	4.9
13 - 14	0.4	4.6	0.5	-	5.5	3.4
14 - 15	0.6	6.6	-	0.2	7.4	4.6
15 - 16	-	6.2	0.6	3.0	9.8	6.1
16 - 17	1.8	13.2	-	-	15.0	9.4
17 - 18	1.5	14.6	0.4	0.2	16.7	10.5
18 - 19	0.2	5.9	0.2	-	6.3	3.9
19 - 20	1.2	6.3	0.2	-	7.7	4.8
20 - 21	1.0	4.1	-	-	5.1	3.2
21 - 22	0.5	1.9	-	-	2.4	1.5
22 - 23	0.4	1.1	-	-	1.5	0.9
23 - 24	0.4	1.5	-	-	1.9	1.2
0 - 1	1.1	1.9	-	-	3.0	1.9
1 - 2	0.6	1.9	-	-	2.5	1.6
2 - 3	-	2.2	-	-	2.2	1.4
3 - 4	0.2	1.6	-	0.2	2.0	1.3
4 - 5	-	1.4	-	-	1.4	0.9
5 - 6	-	1.6	-	-	1.6	1.0
6 - 7	-	6.3	0.2	-	6.5	4.1
Total	15.4	132.7	4.9	6.8	159.8	100.0

TABLE 6-5-2 HOURLY DISTRIBUTION OF ADT, UM RUABA AREA, MAY, 1977

Hour	Van/ pick-up	Medium Truck	Heavy Truck	Bus	Total Vehicles	%
7 - 8	-	6.9	1.2	-	8.1	5.4
8 - 9	0.3	12.0	-	0.3	12.6	8.3
9 - 10	0.9	9.3	-	-	10.2	6.7
10 - 11	0.3	6.3	-	-	6.6	4.4
11 - 12	0.3	3.3	-	-	3.6	2.4
12 - 13	-	6.9	0.3	-	7.2	4.8
13 - 14	-	2.4	0.3	-	2.7	1.8
14 - 15	1.2	6.6	0.3	-	8.1	5.4
15 - 16	-	9.9	-	-	9.9	6.5
16 - 17	0.3	7.8	-	-	8.1	5.4
17 - 18	1.2	13.8	-	-	15.0	9.9
18 - 19	0.9	7.2	0.6	-	8.7	5.8
19 - 20	-	7.5	-	-	7.5	4.9
20 - 21	-	5.7	-	-	5.7	3.8
21 - 22	-	5.1	-	-	5.1	3.4
22 - 23	-	3.3	0.3	-	3.6	2.4
23 - 24	-	5.7	-	-	5.7	3.8
0 - 1	-	6.9	-	-	6.9	4.6
1 - 2	-	2.7	-	-	2.7	1.8
2 - 3	-	1.8	-	-	1.8	1.2
3 - 4	-	-	-	-	-	-
4 - 5	-	-	-	-	-	-
5 - 6	0.3	0.6	-	-	0.9	0.6
6 - 7	-	10.2	-	-	10.2	6.7
Total	5.7	141.9	3.0	0.3	150.9	100.0

FIG. 6-3-1 HOURLY DISTRIBUTION OF ADT, 1977
(ALL TYPES OF VEHICLES)





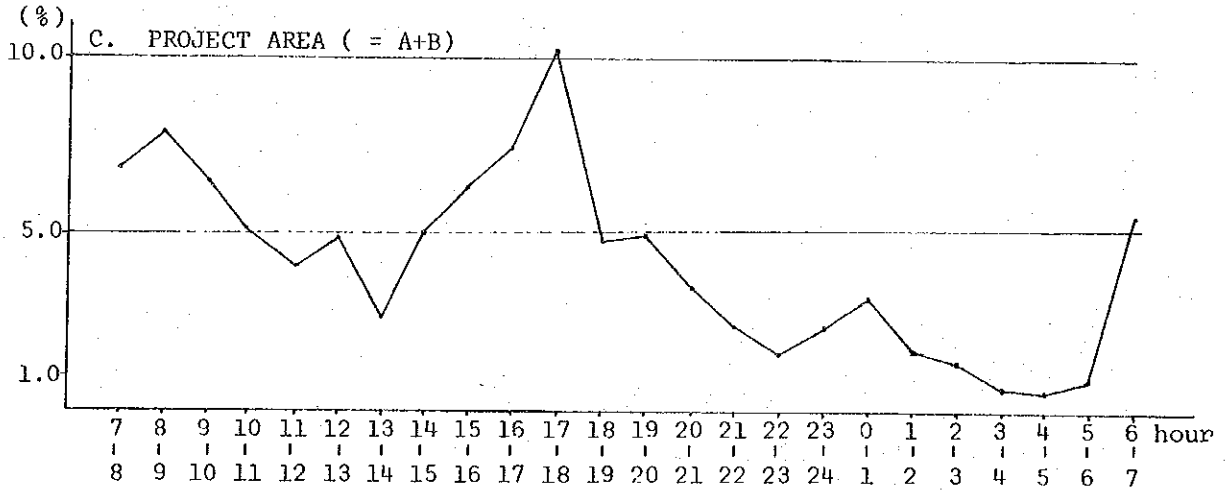


TABLE 6-6-1 SEASONAL VARIATION OF RAILWAY GOODS TRAFFIC AT EL OBEID STATION, 1976

Month	Forwarded	Received	Total
1976			
JAN.	11,580	8,417	19,997
FEB.	8,936	7,232	16,168
MAR.	6,952	6,499	13,451
APR.	11,507	7,067	18,574
MAY	9,672	8,254	17,926
JUN.	9,249	7,349	16,598
JUL.	9,356	8,476	17,832
AUG.	9,401	9,244	18,645
SEP.	7,390	8,466	15,856
OCT.	6,317	7,254	13,571
NOV.	8,425	7,753	16,178
DEC.	8,766	7,249	16,015
Total	107,551	93,260	200,811
Average	8.963	7.772	16.735

Source: Sudan Railways Corporation, 1977

FIG. 6-4-1 SEASONAL VARIATION OF RAILWAY GOODS TRAFFIC AT EL OBEID STATION, 1976

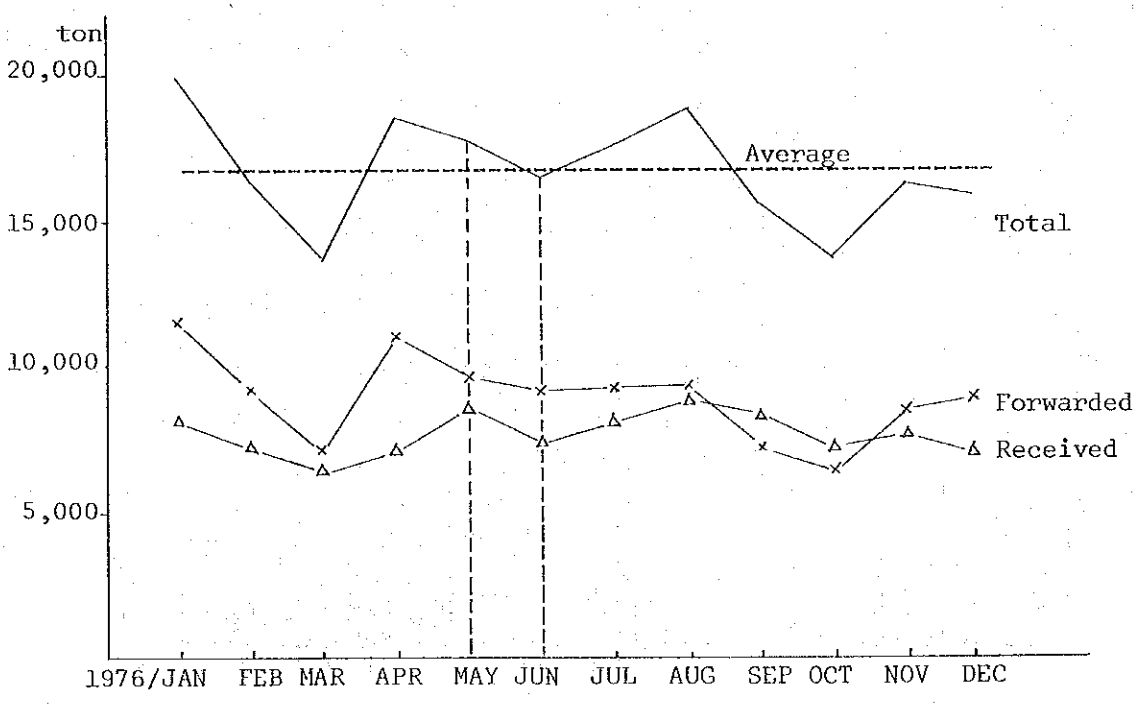


TABLE 6-6-2 SEASONAL VARIATION OF TONNAGE OF CROPS HANDLED AT EL OBEID CROP MARKET, 1976

Month	Tons
JAN. 1976	104,000
FEB.	95,000
MAR.	87,000
APR.	69,000
MAY	74,000
JUN.	44,000
JUL.	17,000
AUG.	4,000
SEP.	1,000
OCT.	27,000
NOV.	99,000
DEC.	87,000
Total	708,000
Average	59,000

Source: El Obeid Crop Market, 1977

FIG. 6-4-2 SEASONAL VARIATION OF TONNAGE OF CROPS HANDLED AT EL OBEID CROP MARKET, 1976

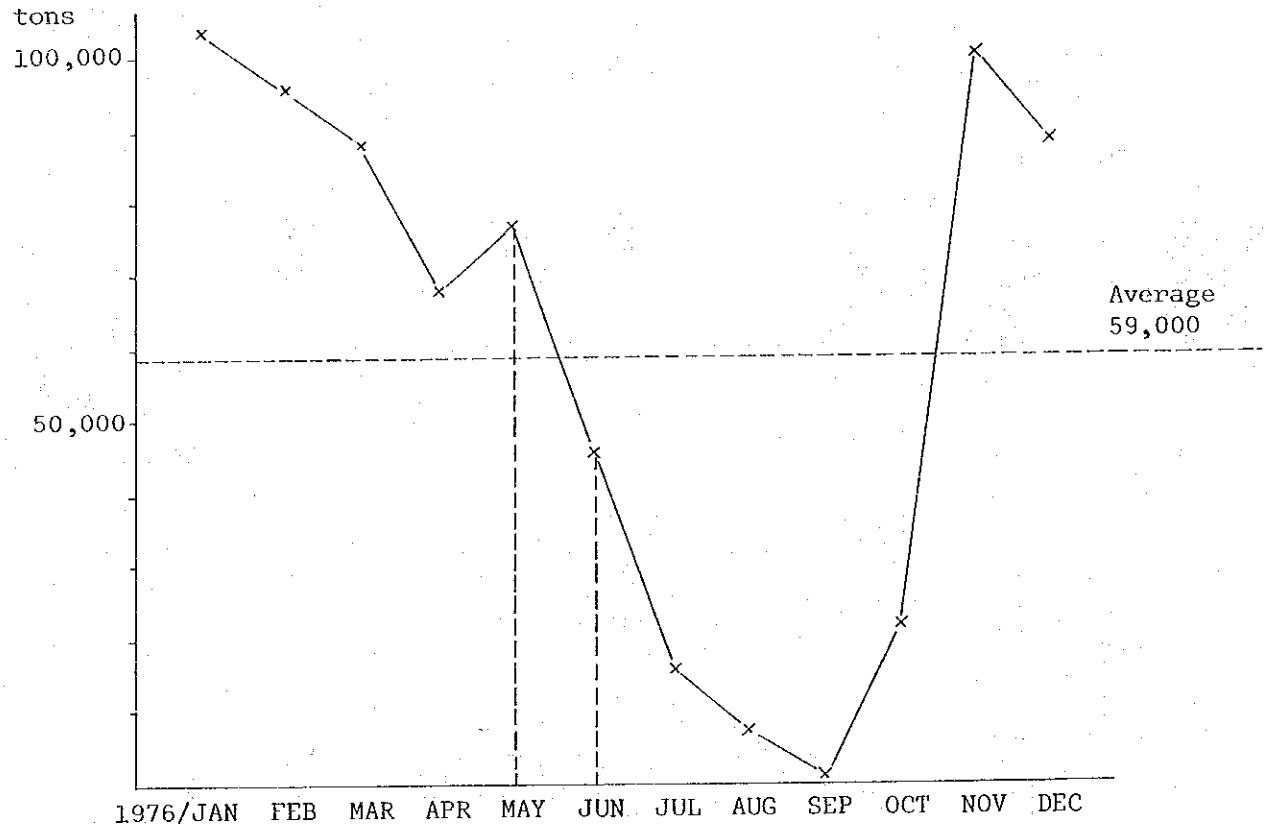


TABLE 6-7 VEHICLE MAKE AND YEARS IN SERVICE

Vehicle Make \ Years in Service		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total No.	Total %
Volga(1/4 1)							1.5	1.5										3.0	0.2
Jeep(0.5)		1.2		3.6	1.2	1.2	2.4	1.2	2.4	1.2		1.2	1.2				1.2	18.0	1.1
Land Rover(1.0)		1.2	2.4	3.9	7.5	7.2	4.5											26.7	1.6
Ford Custom(1.5)			7.5	3.6	1.5	1.5	2.4	1.5				1.2						19.2	1.2
Toyota(1.5)		1.2					1.2				2.7							5.1	0.3
Mercury (3.0)			1.5		1.5	1.2	3.9		1.5	1.5	1.5	3.0					3.0	18.6	1.1
Commer(3.0)				1.2	1.2		3.6	1.5		1.5		1.2						10.2	0.6
Ford(4.0)			1.2	3.9	5.4	4.2	1.5				1.5			1.2				18.9	1.1
Commer(5.0)			1.2	3.6	2.4	2.4	5.1	5.1		4.2	3.0	3.0	1.2	2.4	1.2			34.8	2.1
Austin(5.0)		15.9	51.0	43.5	45.0	32.4	8.4	7.2	2.7	9.0	2.4	3.6		1.2			3.6	225.9	13.7
Austin(6.0)		16.8	34.2	18.0	18.6	16.5	10.2	6.0	1.2	1.5				1.5			2.4	126.9	7.7
Bed Ford(6.0)		11.1	43.5	110.1	97.2	87.6	42.3	43.2	10.8	16.8	8.4	14.4	2.4	1.2			1.2	490.2	29.7
Ford(6.0)			15.9	52.5	30.3	52.5	22.5	16.2	6.6	2.4		2.4		1.2				202.5	12.3
International(6.0)			1.2			2.4												3.6	0.2
Ford(7.0)			4.5	6.3	52.8	42.0	19.5	19.8	9.3	8.1	3.0	4.2			1.2			170.7	10.4
Nissan(8.0)		6.0	22.5	44.4	42.9	22.5	15.9	3.9	3.0	1.5				1.2				163.8	9.9
Mageros(8.0)			19.2	27.0														46.2	2.8
Fuso(8.0)			1.2							1.2								2.4	0.1
Hino(8.0)			2.4	6.9	5.1													14.4	0.9
Fiat(11.0)		1.5	5.4	15.0	2.7													24.6	1.5
Leyland(12.0)			2.4															2.4	0.1
Super(15.0)			1.2															1.2	0.1
Scania(16.0)				2.4	1.2	1.5												5.1	0.3
Nissan(16.0)			2.4	1.5														3.9	0.2
Bassit(6.0)				1.2	1.2				1.2									3.6	0.2
Liner(16.0)				6.0														6.0	0.4
Total	Number	54.9	220.8	354.6	317.7	275.1	144.9	107.1	38.7	48.9	22.5	34.2	4.8	9.9	2.4		11.4	1647.9	100.0
	%	3.4	13.4	21.5	19.3	16.7	8.8	6.5	2.3	3.0	1.4	2.1	0.3	0.6	0.1		0.7	100.0	

Note: 1) Figures in parenthesis indicate loading capacity in tons.

ANNEX VI-13

TABLE 6-8 YEARS IN SERVICE OF VEHICLES BY TYPE [1)]

Vehicle Type	Years in Service																Total	Total (%)	Average Years in Service
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
Van/pick-up	3.6	9.9	11.1	10.2	9.9	12.0	4.2	2.4	1.2	2.7	2.4	1.2	-	-	-	1.2	72.0	(4.5)	4.1
Medium Truck	48.3	180.3	290.4	299.4	258.0	118.2	98.7	32.1	45.0	19.8	27.0	3.6	9.9	2.4	-	10.2	1,443.3	(90.1)	3.6
Heavy Truck	1.5	11.4	26.1	5.1	1.5	-	-	1.2	-	-	-	-	-	-	-	-	46.8	(2.9)	2.0
Bus	1.5	-	-	3.0	5.7	14.7	4.2	3.0	2.7	-	4.8	-	-	-	-	-	39.6	(2.5)	5.6
Total	54.9	201.6	327.6	317.7	275.1	144.9	107.1	38.7	48.9	22.5	34.2	4.8	9.9	2.4	-	11.4	1,601.7		3.7
(%)	(3.4)	(12.6)	(20.5)	(19.8)	(17.2)	(9.0)	(6.7)	(2.4)	(3.1)	(1.4)	(2.1)	(0.3)	(0.6)	(0.1)	-	(0.7)	(100.0)		

Note: 1) Vehicles for military use are excluded.

TABLE 6-9 DISTRIBUTION OF VEHICLES BY LOADING CAPACITY [1)]

Vehicle Type	Van/pick-up					Medium Truck							Heavy Truck					TOTAL
Capacity (ton)	0.25	0.5	1	1.5	Total	3	4	5	6	7	8	Total	11	12	15	16	Total	
Number of Vehicle	3.0	18.0	26.7	24.3	72.0	18.8	18.9	260.7	793.5	170.7	170.7	1,443.3	24.6	2.4	1.2	18.6	46.8	1,562.1
Average Capacity (ton)			1.0							6.1					13.1			6.1

Note: 1) Vehicles for military use and buses are excluded.

TABLE 6-10 DISTRIBUTION OF VEHICLES BY LOAD CONTENT [1)]

	Number of Vehicles			(Vehicles)	
	Van Pick-up	Medium Truck	Heavy Truck	Total	(%)
Commodities only		83.7	6.4	90.1	(6)
Commodities & Passengers	9.4	1,166.7	31.8	1,207.9	(77)
Passengers only	55.8	173.9	7.3	237.0	(15)
Empty	6.8	19.0	1.3	27.1	(2)
Total	72.0	1,443.3	46.8	1,562.1	(100)

Note: 1) Vehicles for military use and buses are excluded.

TABLE 6-11 LOADING CHARACTERISTICS OF VEHICLES [1)]

		Type of Vehicles			
		Van Pick-up	Medium Truck	Heavy Truck	Total
Average Loaded Tonnage (ton)	Commodities only		4.91	8.43	5.15
	Commodities & Passengers	0.73	4.78	9.04	4.84
	Average	0.73	4.79	8.93	4.87
	Av.Incl. empty Veh.	0.11	4.14	7.19	4.03
Average Loaded Passengers (persons)	Commodities & Passengers	4.37	9.49	9.03	9.44
	Passengers only	5.35	14.63	4.20	12.08
	Average	4.71	9.44	6.54	9.13
Average Loading Rate (%)	Commodities only		80	60	77
	Commodities & Passengers	53	78	72	78
	Average	53	78	70	77
	Av. Incl. empty Veh.	09	68	54	67

Note: 1) Vehicles for military use and buses are excluded.

TABLE 6-12-1 OD TABLE OF ROAD VEHICULAR TRAFFIC, 1977

(All types of vehicles)

(Vehicles per day)

ZONE		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL
EL OBEID	01		6.2			14.9		1.0	22.3	1.0	1.8	1.0	14.1	0.8	40.3	0.1	1.3		2.7	0.5	0.8						108.8
GEIFIL	02					0.6							0.6														7.4
ET TAIYARA	03					0.1																					0.1
SHAMAGATTA	04					16.5							0.3		0.6		0.3										17.7
UM RUABA	05						3.9	2.1	11.1											6.9	2.1		0.1	0.9			59.2
ABU HAMRA	06																										3.9
SEMEIH	07														0.3												3.4
RAHAD	08											1.5	2.4		3.0								0.7				41.0
NAWA	09																										1.0
EL AIN	10														0.2												2.0
TENDELTI	11																			0.3	0.6		0.3				3.7
KOSTI-SENNAR	12																			0.3	6.6		0.2	0.1			24.6
WAD MEDANI	13																				0.9						1.7
KHARTOUM	14																			0.6	5.4	0.4	1.8	15.6			68.2
KASSALA	15																										0.1
PORT SUDAN	16																							0.3			1.9
MALAKAL	17																										
EL ABBASIYA	18																										2.7
NUBA MOUNTAIN	19																										8.6
KADUGLI-DILLING	20																										16.4
WAU-JUBA	21																										0.4
EN NAHUD	22																										3.1
NYALA	23																										16.9
BARA	24																										
ATBARA	25																										
TOTAL																											392.8

TABLE 6-12-2 OD TABLE OF ROAD VEHICULAR TRAFFIC, 1977

(Van Pick-up)

(Vehicles per day)

ZONE		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL
EL OBEID	01		0.2			1.1		0.2	1.2	0.2	1.4		0.8		1.2				0.4	0.2	0.8						7.0
GEIFIL	02																										0.2
ET TAIYARA	03																										
SHAMAGATTA	04					3.0																					3.0
UM RUABA	05								0.3														0.1	0.3			4.8
ABU HAMRA	06																										
SEMEIH	07																										0.2
RAHAD	08																										1.5
NAWA	09																										0.2
EL AIN	10																										1.4
TENDELTI	11																										
KOSTI-SENNAR	12																										0.3
WAD MEDANI	13																										
KHARTOUM	14																										1.2
KASSALA	15																										
PORT SUDAN	16																										
MALAKAL	17																										
EL ABBASIYA	18																										0.4
NUBA MOUNTAIN	19																										0.2
KADUGLI-DILLING	20																										0.6
WAU-JUBA	21																										
EN NAHUD	22																										0.1
NYALA	23																										0.3
BARA	24																										
ATBARA	25																										
TOTAL																											21.4

TABLE 6-12-3 OD TABLE OF ROAD VEHICULAR TRAFFIC, 1977

(Medium Truck)

(Vehicles per day)

ZONE		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL
EL OBEID	01		6.0			13.4		0.4	19.4	0.8	0.4	1.0	13.8	0.8	36.4	0.1	1.6		2.3	0.1	0.2						96.9
GEIFIL	02					0.6							0.6														7.2
ET TAIYARA	03					0.1																					0.1
SHAMAGATTA	04					13.5							0.3		0.6		0.3										14.7
UM RUABA	05						3.9	2.1	10.8											6.9	2.1			0.6			54.0
ABU HAMRA	06																										3.9
SEMEIH	07														0.3												2.8
RAHAD	08											1.5	2.4		3.0								0.7				37.8
NAWA	09																										0.8
EL AIN	10														0.2												0.6
TENDELTI	11																			0.3	0.6		0.3				3.7
KOSTI-SENNAR	12																			0.3	6.3		0.2	0.1			24.0
WAD MEDANI	13																				0.9						1.7
KHARTOUM	14																			0.6	4.8	0.4	1.8	14.6			62.7
KASSALA	15																										0.1
PORT SUDAN	16																							0.3			2.2
MALAKAL	17																										
EL ABBASIYA	18																										2.3
NUBA MOUNTAIN	19																										8.4
KADUGLI-DILLING	20																										14.9
WAU-JUBA	21																										0.4
EN NAHUD	22																										3.0
NYALA	23																										15.6
BARA	24																										
ATBARA	25																										
TOTAL																											357.8

TABLE 6-12-4 OD TABLE OF ROAD VEHICULAR TRAFFIC, 1977

(Heavy Truck)

(Vehicles per day)

ZONE		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL
EL OBEID	01					0.3		0.4	0.4						2.4												3.5
GEIFIL	02																										
ET TAIYARA	03																										
SHAMAGATTA	04																										
UM RUABA	05																										0.3
ABU HAMRA	06																										
SEMEIH	07																										0.4
RAHAD	08																										0.4
NAWA	09																										
EL AIN	10																										
TENDELTI	11																										
KOSTI-SENNAR	12																				0.3						0.3
WAD MEDANI	13																										
KHARTOUM	14																				0.6			0.9			3.9
KASSALA	15																										
PORT SUDAN	16																										
MALAKAL	17																										
EL ABBASIYA	18																										
NUBA MOUNTAIN	19																										
KADUGLI-DILLING	20																										0.9
WAU-JUBA	21																										
EN NAHUD	22																										
NYALA	23																										0.9
BARA	24																										
ATBARA	25																										
TOTAL																											10.6

TABLE 6-12-5 OD TABLE OF ROAD VEHICULAR TRAFFIC, 1977

(BUS)

(Vehicles per day)

ZONE		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL
EL OBEID	01								1.3						0.2												1.5
GEIFIL	02																										
ET TAIYARA	03																										
SHAMAGATTA	04																										
UM RUABA	05																										
ABU HAMRA	06																										
SEMEIH	07																										
RAHAD	08																										1.3
NAWA	09																										
EL AIN	10																										
TENDELTI	11																										
KOSTI-SENNAR	12																										
WAD MEDANI	13																										
KHARTOUM	14																										0.2
KASSALA	15																										
PORT SUDAN	16																										
MALAKAL	17																										
EL ABBASIYA	18																										
NUBA MOUNTAIN	19																										
KADUGLI-DILLING	20																										
WAU-JUBA	21																										
EN NAHUD	22																										
NYALA	23																										
BARA	24																										
ATBARA	25																										
TOTAL																											3.0