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スーダン国道路建設計画

フィージビリティ調査

資料編

昭和52年10月

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TABLE 3-1 TOTAL POPULATION IN THE SUDAN

ANNEX III-1

Year	A) Total Population	B) Urban Population	C) The Percentage of Urban Pop. in Total Pop.	D) Rate of Yearly Increase of Total Population	E) Rate of Yearly Increase of Urban Population
	('000) (1)	('000) (1)	(%) B/A	(%) (1)	(%) (1)
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	2.5	5.5
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 Yearly Increase are calculated by the figures in Columns A and B.

2) Indicates average of percentage figures in Column C.

3) Indicates average annual growth rate from 1966 to 1974.

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

ANNEX III-2

Province	Area km ² (A)	Population (000)		Density (persons/km ²)		Average Growth Rate (I) Per Annum 1956-'73	Revised Population 1973	Average Growth Rate (II) Per Annum 1956-'73
		1955/56 (B)	1973 (C)	1955/56 (D)=B/A	1973 (E)=C/A			
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	20,971	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

Note: 1) Average Growth Rate (I) per year is estimated by compound rate of change.

2) The total population is given by Dept. of Statistics, National Income 1972/73-1974/75, Provincial populations in column (3) are adjusted to the total.

3) The rates are estimated by using the Revised Population.

TABLE 3-3 LABOR FORCE BY OCCUPATION

ANNEX III-3

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

Note: These figures are provisional and subject to revision.

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

TABLE 3-4 COTTON PRODUCTION BY VARIETY

ANNEX III-4

1973/74 - 1975/76

Variety	1973/74		1974/75		1975/76*		
	Acreage	Production in bales	Acreage	Production in bales	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

*Output of 1975/76 is an estimate.

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

TABLE 3-5 AREA PRODUCTION AND AVERAGE YIELD FOR SOME AGRICULTURAL CROPS
1973/74 - 1975/76

ANNEX III-5

	1973/1974		1974/1975		1975/1976*			
	Production Ton	Average Yield kg/Fed.	Area Fed.	Production Ton	Average Yield Fed.	Estimated Production Ton	Average Yield kg/Fed.	
Dura	5,301,200	309	5,577,030	1,704,853	306	6,200,309	2,055,280	331
Dukhn	2,705,870	104	2,576,380	400,540	156	2,512,160	403,145	161
Groundnuts	1,725,303	315	1,785,290	929,910	521	2,065,740	930,765	451
Sesame	2,192,560	109	2,172,690	233,400	107	2,291,045	238,080	104
Wheat	420,072	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	-	-

* Estimated

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

TABLE 3-6 GUM ARABIC PRODUCTION 1970/71 - 1975/76
(Metric tons)

ANNEX III-6

1970/71	1971/72	1972/73	1973/74	1974/75	1975/76 (Estimates)
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)

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 (in Tons)	Consumption (in Tons)	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
1973/1974 (In 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

G.D.P. at Current Market Prices 1)	1967/66		1968/67		1969/68		1970/69		1971/70		1972/71		1973/72		1974/73		1975/74	
	mil. of pounds	share %	Ls mil.	%	Ls mil.	%	Ls mil.	%	Ls mil.	%	Ls mil.	%	Ls mil.	%	Ls mil.	%	Ls mil.	%
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	41.4	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 and 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	28.9	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 and 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	1053.6	84.5	1257.9	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 and 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	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	1246.2	100.0	1510.8	100.0
Price Index % 2)							100.0		107.5		118.2		137.6		172.2		211.1	
G.D.P. at Constant Price 3)							647.0		638.0		636.3		651.7		723.7		715.7	

* This Figure does not contain the workers compensation in the southern region government.

Source: Dept of Statistics, June 1977

Note 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. Min. of Planning.

3) The constant price as in 1970 was derived by dividing 1) by 2). It is calculated that G.D.P. has grown at 2.0% p.a. in terms of constant price.

TABLE 3-10 THE BALANCE OF PAYMENTS

ANNEX III-10

(LS. MILLION)

	71/72 Actual	72/73 Actual	73/74 Actual	74/75 Actual	75/76 1) Prov. Actual
(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 S.D.C.	-	-	-	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

Note: 1) Preliminary Estimates

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

TABLE 3-11 QUANTITY AND VALUE OF MAIN EXPORTS DURING 1971-75
(VALUE IN LS MILLION, QUANTITY IN METRIC TON)

	1971		1972		1973		1974		1975	
	Q.	V.	Q.	V.	Q.	V.	Q.	V.	Q.	V.
Cotton	294,585	69,906	256,315	73,088	743,726	64,311	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 Seeds	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
	-	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

ANNEX III-12

(Value in LS. million)

	1971	1972	1973	1974	1975
Food Stuffs	21.65	27.75	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	247.5	359.9

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

TABLE 3-13 TRANSPORT TRAFFIC IN THE SUDAN, 1973 1) ANNEX III-13

Transport Mode	Freight		Passenger	
	Ton-km (Billion)	(%)	Passenger-km (Billion)	(%)
Railway	2.8	75.7	1.00	71
Road	0.8	21.6	0.27	19
River	0.1	2.7	0.08	6
Air	0.0	0.0	0.05	4
Total	3.7	100.0	1.40	100

Source: National Planning Commission; Transport Statistical Bulletin, 1974

Note: 1) These figures do not include intra-urban traffic

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

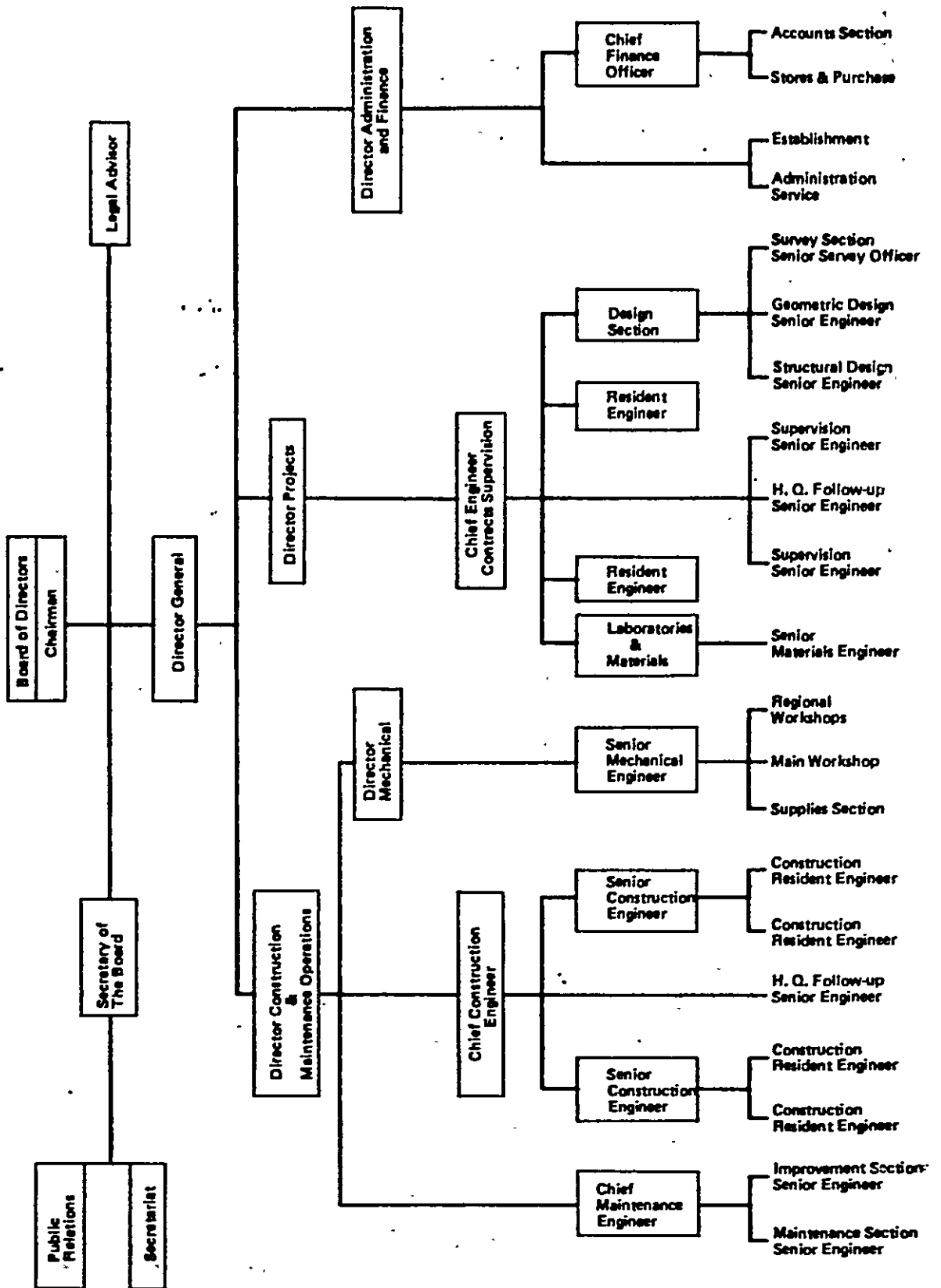
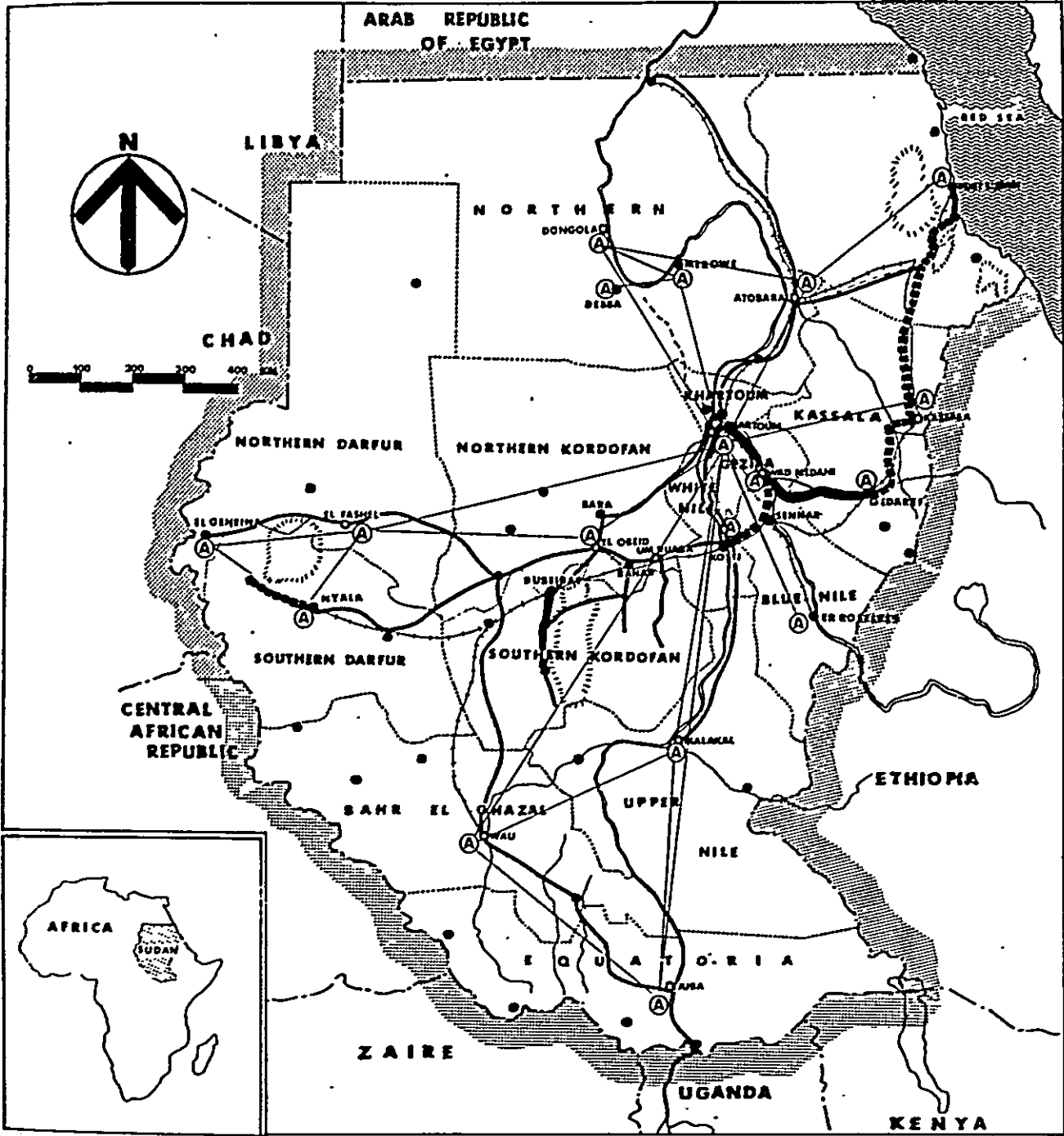


FIG.3-2 TRANSPORTATION NETWORK, SUDAN



LEGEND

- PAVED ROADS
- UNDER CONSTRUCTING ROADS
- OTHER ROADS
- RAILWAYS
- AIRPORTS
- BOUNDARY
- PROVINCIAL BOUNDARY
- MOUNTAINS

TABLE 3-14 ROAD CONSTRUCTION SCHEDULE

ANNEX III-16

Construction Segment	Length in km	Date of Completion
Wad Medani - Gedaref	235	February 1977
Gedaref - Kassala	220	October 1978
Kassala - Haiya	350	October 1978
Haiya - Suakin - Port Sudan	207	March 1978
Wad Medani - Sennar - Kosti	217	March 1979
Kosti - Bridge	800 (m)	March 1979
Nyala - Zalingei	210	

Source: R.B.P.C., Sudan, June 1977.

TABLE 3-15 LICENCED MOTOR VEHICLES

ANNEX III-17

Type of Vehicle	Passenger Cars	Buses	Lorries	Delivery Box Cars	Vans	Tractors Motorcycles	Others	Total
Year								
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-A GASOIL AND BENZINE CONSUMPTION
IN THE SUDAN 1)

ANNEX III-18

Year	(1,000 Metric Tons)		
	Gasoil	Benzine	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

Source: 1) Transport Statistical Bulletin, 1975

2) Shell Company of the Sudan, June 1977

TABLE 3-16-B GASOIL AND BENZINE CONSUMPTION ON ROADS

Year	(1,000 Metric Tons)		
	Gasoil	Benzine	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

TABLE 3-17 RAIL PASSENGERS BY CLASS OF TRAVEL¹⁾

ANNEX III-19

Year	('000 persons)				
	Sleeper (Suppl.)	1st Class	2nd Class	3rd & 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

Source 1) Transport Statistical Bulletin, 1975.

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

TABLE 3-18 SUDAN RAILWAYS TRAFFIC BY TYPE¹⁾

ANNEX III-20

Year	('000 tons)				
	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

Source: 1) Transport Statistical Bulletin, 1975.

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

ANNEX IV

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

ANNEX IV-1

	Population		Growth Rate	Sources
	1955/56	1973	per year	
Sudan Total	10,262,500	14,958,000	2.24 ³	Department of Statistics, Ministry of National Planning, 1977.
	10,262,500	14,901,894	2.22	National Planning Commission, Sudan, <u>Economic Survey</u> , 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	1964/65 Census 1)		1973 Urban Persons ²⁾ Present (B)	Urban Population Growth Rate Per Year, (A) to (B)
	Permanent Members of Private Households	Persons Present (A)		
Northern Kordofan Prov.				
El Obeid	62,560	63,831	847	90,073
En Nahud	19,770	20,038	818	26,005
Um Ruaba	14,210	14,392	482	19,713
Er Rahas	8,600	8,924	334	14,444
Bara	6,140	6,431	371	8,927
Sodiri	2,820	3,046	166	2,674
Abu Zabab ³⁾	5,660	5,939	469	7,177
Sub Total	119,760	122,601	3,487	169,013
Southern Kordofan Prov.				
Dilling	11,910	12,696	806	19,216
Kadugli	11,180	11,532	572	18,468
Abu Korshola	5,120	4,970	110	5,274
El Abassiya	4,470	4,667	247	4,801
Muglad	4,270	4,709	529	6,936
Talodi	4,030	4,250	150	7,738
Rashad	3,260	3,555	295	3,588
Babanousa ³⁾	7,460	7,092	332	12,051
Abu Gebaha ³⁾	5,180	5,419	309	10,418
Rigl El Foula ³⁾	3,750	4,131	521	5,294
Sub Total	60,630	63,021	3,871	93,784
All Towns Total	180,390	185,622	7,358	262,797
				4.44%

Note: 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 area at the 1964/66 census.

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

ANNEX IV-3

Province & District	Population Settled			Nomad	Total
	Urban	Rural	Subtotal		
<u>Northern Kordofan Province</u>					
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
<u>Southern Kordofan Province</u>					
Miosaria Dist.	24,281	148,074	172,355		
Northern Hills Dist.	19,216	151,597	170,813		
Southern Hills Dist.	26,206	206,674	232,880	99,266	
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

SOURCES: 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 KORDFAN 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
Yearly Growth Rate		1.321%	1.321%	
(2) Urban Population	123,340	185,622 ²⁾	262,797 ²⁾	312,792
Yearly growth Rate		4.65%	4.44%	4.44%
Northern Kordfan Urban Area		122,601 ²⁾	169,013 ²⁾	198,406
Yearly Growth Rate			4.09%	4.09%
Southern Kordfan Urban Area		63,021 ²⁾	93,784 ³⁾	114,386
Yearly Growth Rate			5.09%	5.09%
(3) Rural Population including Nomads	1,638,660		1,939,549	2,008,252
Yearly Growth Rate		1.00%		0.874%
Northern Kordfan Rural Area			1,127,075	1,166,999
Southern Kordfan Rural Area			812,474	841,253
Yearly Growth Rate				0.874%

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

ANNEX IV-5 THE ESTIMATE OF POPULATION IN THE ZONES

1962年作成された、1:4800航空写真地図、1975年修正された1:250,000地図、そして、1977年JICA調査団による1:25,000航空写真地図により、各ゾーンの集落数を調べた。3グループに分けられた村落は、330戸がもっとも大きく、150戸、80戸と分けられた。その結果は、次のようである。

TABLE 1. NUMBER OF VILLAGES

ANNEX IV-5-1

Zone	Urban Area	Number of Villages			Total
		Largest	medium	Smallest	
1	El Obeid	-	1	33	34
2	-	2	-	28	30
3	-	1	2	21	24
4	-	-	7	13	20
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	7	21	221	249

—戸平均の家族数を5人と仮定される。各ゾーンの定住人口は、次のページ表2に推定されている。

以上のデータをもとにゾーン別の現在の定住人口の推定結果は次のとおりであり、又 Table IV-2 に示される。

Table-2 Population by Zone

ゾーン	都市部	農村部	計
1	105,708 ^人	13,950 ^人	119,688 ^人
2	-	13,040	13,040
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	12,770	29,726
9	-	6,750	6,750
10	-	12,800	12,800
計	145,805	124,466	270,271

1955/56. 口勢調査では. 総人口に対する都市人口比は. 20% であり

農村人口のうち農業従事人口比は. 85.8% である.

一口の平均数. 家族人数は. 都市部 5.5人, 農村定住家族 4.9人
遊牧民家族 5.7人, 全人口平均 5.1人である.

農業人口は. 8,806,000人 全人口の 85.8% と推定される.

1970年と1973年の調査から推定される遊牧民と合わせて

農村人口は. 3,545,000人で農業部門人口は 92.3% である.

農業人口は. 1977年現在 農村人口は 85% と推定される.

人口-セメント比値は. 北印Kandogan 県に適用した Table 3 に示す.

TABLE 3. RURAL AND AGRICULTURAL POPULATION.
IN NORTHERN KORDOFAN PROVINCE

ANNEX IV-5-3

	Rural population including nomad (1)	Agricultural population (1)×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 Province	1,166,999	991,949	23,916	778,033	903,083	86.1

上記の Central 及び Eastern 両 districts 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% によって、前に示した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た。これらは、Table IV-2にも示されている。

TABLE 4. POPULATION BY ZONE, 1977

ANNEX IV-5-4

Zone	Rural population settled (1)	Agricultural population settled (1) × 0.84	Farmhouseholds (family)
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

ANNEX IV-6

	Dukhn			Dura			Sesame		
	Area feddan	Yield kg/f.	Production ton	Area feddan	Yield kg/f.	Produc- tion 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
1971	1,157,342	150	185,726	559,877	145	81,256	1,008,058	81	82,151
1972	1,564,925	68	106,699	731,831	137	100,029	1,778,940	91	161,722
1973									
1974	1,250,000	90	112,500	685,224	140	95,931	923,800	70	64,670
1975	1,257,000	100	125,700	672,954	140	94,214	950,000	75	71,290
1976	1,353,000	145	196,000	631,000	200	126,000	900,000	70	63,000
Average	1,216,719	119	114,597	626,155	153	95,790	1,103,695	90	99,155
	Groundnuts			Watermelon Seeds			Karkadeh		
	Area feddan	Yield kg/f.	Produc- tion ton	Area feddan	Yield kg/f.	Produc- tion ton	Area feddan	Yield kg/f.	Production ton
1970	244,569	172	41,949						
1971	840,597	91	76,420						
1972	810,597	91	73,690						
1973									
1974	578,830	320	185,230	410,430	97	39,812	47,481	13	617
1975	593,930	375	222,720	382,718	97	37,124	44,095	13	573
1976	418,000	375	157,000	389,885	90	35,090	20,276	10	203
Average	581,087	217	126,168	394,344	95	37,342	37,284	12	464
	Sanamakar			Gum Arabic			Cotton		
	Area feddan	Yield kg/f.	Produc- tion ton	Area estimate feddan	Yield kg/f.	production ton	Area Total feddan	Yield kg/f.	Produc- tion ton
1970				312,240	50	14,667	945	15,612	
1971				350,900	50	16,950	595	17,545	2,063
1972				287,400	50	11,496	14,370	3,000	163
1973				134,600	50	6,730	6,730		
1974	6,842	540	3,695						
1975	2,460	540	1,328						
1976	6,482	540	3,500	133,000	50		6,650		
Average	5,261	540	2,841	243,628	50		12,181	2,532	133

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

ANNEX IV-6

-continued-

	Charcoal ¹⁾ ton	Fire wood ¹⁾	
		Private Products m ³	Government Products m ³
1970			
1971	12,000	3,300	2,500
1972			
1973			
1974			
1975			
1976			
Average	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 4-6 LIVESTOCK IN TWO DISTRICTS, 1976

ANNEX IV-7

		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

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

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

TABLE 4-7 LIVESTOCK TRADED

ANNEX IV-8

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

	Jan. 1977		Feb. 1977		Mar. 1977		Total Jan-Mar.	
	(A) Brought	(B) Sold	(A) Brought	(B) Sold	(A) Brought	(B) Sold	(A) Brought	(B) 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
Dokeys	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	
	(A) Brought	(B) Sold	(A) Brought	(B) Sold	(A) Brought	(B) 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 Heads	74/75	75/76	Prices	
			registered	
Cattle	24,647	24,058	}	46.50
Cows	5,218	7,223		
Sheep	51,598	81,602		
Goats	6,919	9,409		4.00
Camels	1,340	991		80.00
Total	89,722	123,283		

Source: 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 Um Ruaba animal market is said of one-third of those in Rahad animal market.

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

TABLE 4-8 CROP PRODUCTION ESTIMATES IN THE ZONES OF THE PROJECT AREA, 1977

unit : Area - faddan
Product- ton

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 4-9 PRODUCER'S PRICES IN CROP MARKETS IN
EL OBEID AND EASTERN KORDOFAN DISTRICT

ANNEX IV -10

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

Source : El Obeid and Um Ruaba cross markets, 1977.

TABLE 4-10 CROP PRODUCTION AND INCOME PER FARM HOUSEHOLD IN THE DIRECT INFLUENCE ZONES

ANNEX IV-11

Area	Total Production kg	Home Consumption 1)				Seed kg	Total Quant. kg	Value £S*2)	Sales	
		Net Food kg cap*1)	Feed kg	Waste kg	1)				Quantity kg	Value £S*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
Ground Nuts (in shell)	3.4	1,189.0	158.0	—	120.0	272.0	550.0	35.145	639.0	40.832
Water Melon 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 1). Estimation based on the data provided by Current Agricultural Statistics, June 1976
(Ministry of Agriculture)

Note *1). Assuming each family has five persons.

*2). Unit values are determined ten percent less than the price in Annex IV-10 because of 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 4-11 UNIT YIELD OF MAIN CROPS (KG/FEDDAN)

	Dura		Dukhn		Sesame		Groundnuts	
	Whole North2) Sudan	Kordfan	Whole North2) Sudan	Kordfan	Whole North2) Sudan	Kordfan	Whole North2) Sudan	Kordfan
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	521	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

Source : 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 Yearbook, June 1976.

Annex IV-13

エルオバイド空港建設

1. 既存滑走路は、1800mの砂利舗装のまま双発プロペラ機、F27、36人乗り、または約100人乗りのB737S程度が発着している。エプロン、ターミナルビル、緊急消火施設、離着陸誘導装置、交信装置は、いずれも旧式の設備である。
2. エルオバイド空港は、街の中心より約4kmのところにある。1日約1便の定期便が首都 Khartoum との向を連絡している。座席は年間を通して満席でその上スケジュールは不確定であり利用者にとっては不便である。
3. 航空機の大型化、および航空便のスケジュールと安全性の確保に応じて飛行場設備の改良の必要にせまられており、この中で新滑走路の建設が次のように行なわれている。

新滑走路： 幅員 45m 延長 2500m

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

2次施工： 1978年11月までアスファルトによる舗装表層工の完成

この事業費は 1976年価格で見ると LS 1.5百万である。

Annex IV-14

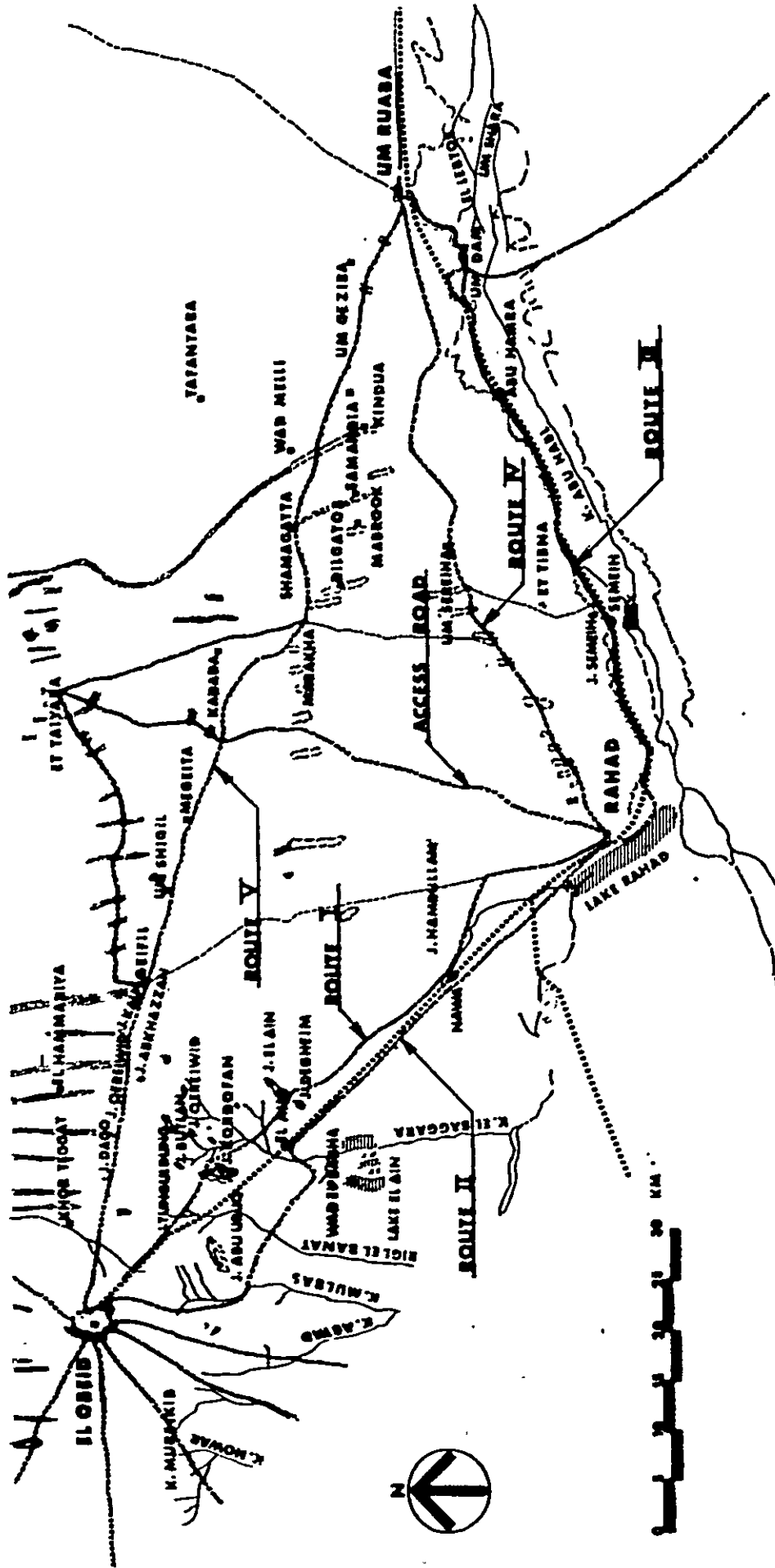
El Ain 貯水池増設工事

1. El Ain にある現貯水池は、El Obeid の住民に対して十分な給水量を持っていない。現在の貯水量は、 5.5 百万 m^3 しかないため、El Obeid では、雨期の2, 3ヶ月を除いて水不足に悩まされている。
2. Sudan 給水事業団がこの拡張計画に直接関与している。プロジェクトは、Khor Baggaha 沿いの既存貯水池のそばで、新しい貯水池の建設とエルオベイドへ約30kmの新パイプラインの建設で構成されている。
3. 工事は1972年11月より始まり、1977年7月に終了予定である。工事完了によって全貯水量は最大 5.5 百万 m^3 に達する。プロジェクトの最後の部分 0.5 百万 m^3 の貯水池建設は1977年1月より始まり、この建設費は 0.2 百万スーダンポンドである。容量 $1m^3$ 当り、 0.4 スーダンポンドと計算される。
4. 建設完了後は El Obeid へ十分な給水ができるし、一部を他に、特に農業へ利用することもできると期待されている。

ANNEX V

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- LEGEND**
- EXISTING ROADS
 - RAILWAYS
 - ~~~~~ RIVERS (KHORS)
 - ⊞ EL OBEID
 - ⊞ NAME OF TOWN
 - ⊞ HILLS
 - ⊞ QOZ

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	1.4	0	0		
	Track	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		

TABLE 5-2 SURFACE CONDITION OF EXISTING ROADS

(Km)

Route	Length by Surface Condition							Total
	Pavement	Earth			Track			
	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

TABLE 5-3-1 INVENTORY OF THE EXISTING ROAD									
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	71.4
		Earth	Poor	1.0				1.4	
	Bad		0.4						
	Track	Fair		20.1	*5.9 2.6			67.8	
		Poor	3.8	8.3	6.7				
		Bad	9.1	4.0	7.3				
0% ≤ i < 5%	Track	Fair	0.5		0.4		3.8		
		Poor	1.3						
		Bad	1.4		0.2				

* Hard Condition

ANNEX V-4

TABLE 5-3-2 INVENTORY OF THE EXISTING ROAD									
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	74.5
		Earth	Fair		6.4	8.2			
	Poor		0.2	1.4	5.0				
	Bad			0.6	2.3				
	Track	Fair		3.1	6.1			48.2	
		Poor	1.6	10.3	8.4				
Bad		6.7	5.7	6.3					
1% ≤ i < 5%	Track	Poor	0.3	0.4			1.1	1.1	
		Bad	0.2	0.2					
5% ≤ i	Track	Bad		0.2			0.2	0.2	

TABLE 5-3-3 INVENTORY OF THE EXISTING ROAD								
Route III Rahad ~Um Ruaba (79.0km) (KM)								
Gradient	Surface Condition		Soil Condition				Sub Total	Total
			Qoz	Sandy Silt	Silty Clay	Cotton Clay		
0% < i < 3%	Earth	Poor	1.1				2.5	
		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								
Route IV Rahad ~Um Ruaba (72.5km) (KM)								
Gradient	Surface Condition		Soil Condition				Sub Total	Total
			Qoz	Sandy Silt	Silty Clay	Cotton Clay		
0% < i < 3%	Earth	Poor	1.1				3.9	
		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									
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		
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		
4% < 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 EXISTING ROAD									
Access Road Route Rahad ~ Route F (40.9km) (KM)									
Gradient	Surface Condition		Soil Condition					Sub Total	Total
			Qoz	Sandy Silt	Silty Clay	Cotton Clay	Clay		
3%	Earth	Poor	1.6					1.6	39.9
		Track	Poor	8.0	2.3				
		Bad	23.7	4.3				38.3	
4% < i < 5%	Track	Bad	1.0					1.0	1.0

FIG. 5-2 SOIL MAP OF PROJECT AREA

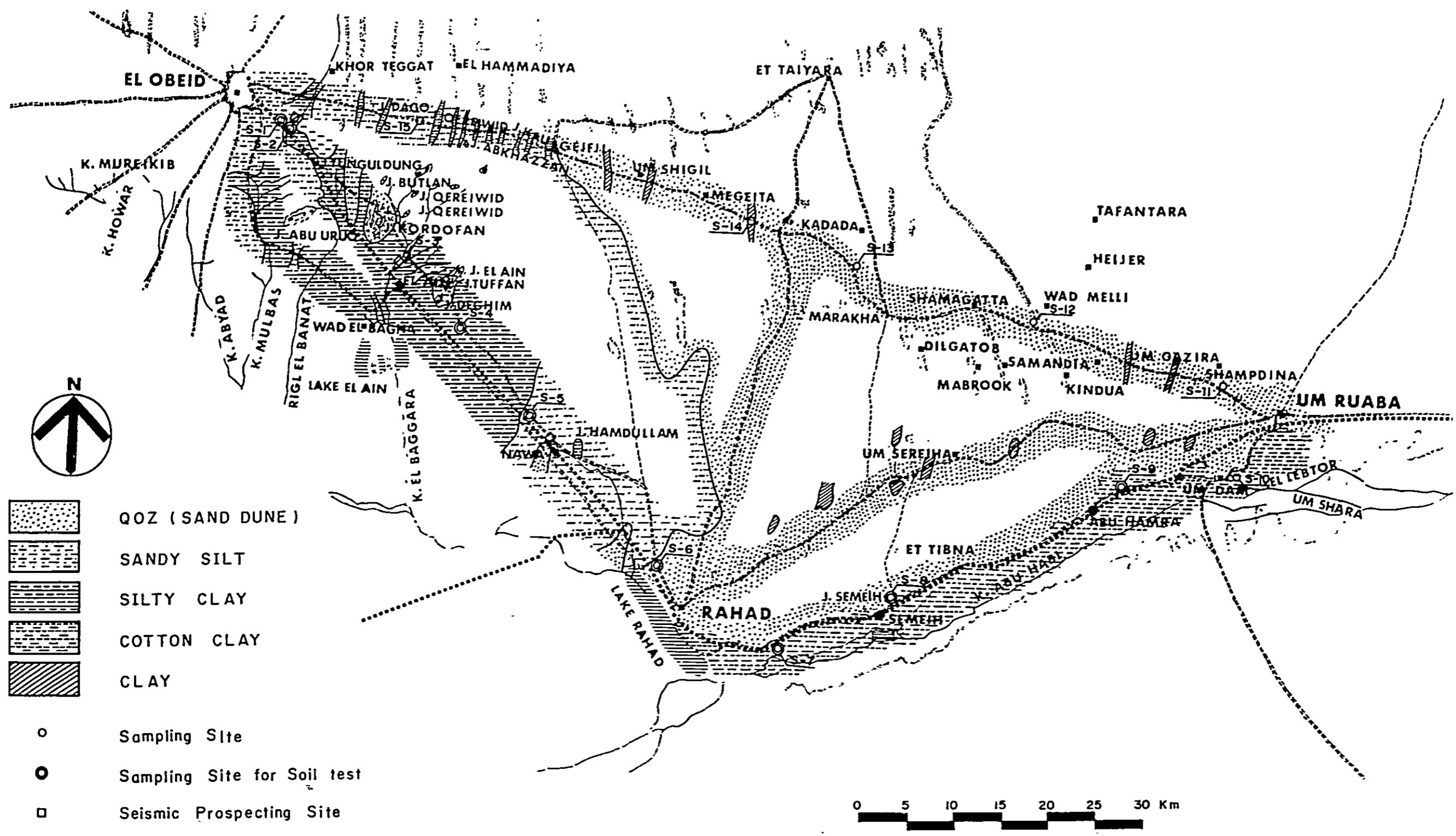


TABLE 5-4 SUMMARY OF SOIL TEST

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 %	87.5	78.4	71.4	59.5	51.8	61.1	1.4
	Silt and Clay %	12.1	3.5	21.6	40.5	48.2	38.9	98.6
Atterberg Limit	Liquid Limit %	-	-	17.0	38.3	24.9	28.5	63.4
	Plastic Limite %	N.P.	N.P.	N.P.	18.7	13.7	12.2	32.8
	Plasticity Index	N.P.	N.P.	N.P.	19.6	11.2	16.3	30.6
Shrinkage Limit %	-	-	-	-	-	-	23.25	23.56
	A.A.S.H.T.O.	A-3 (0)	A-2-4 (0)	A-2-4 (0)	A-6 (4)	A-6 (3)	A-6 (2)	A-7-6 (13)
Classification	Casagrande	SU	SC	SC	CI	CL	CL	OH
	O.M.C. %	9.4	7.4	6.4	11.2	9.4	11.2	19.0
Compaction	M.D.D. t/m ³	1.93	2.06	2.07	2.02	2.06	1.97	1.71
	C.B.R. Modified %	18.6	13.2	12.4	9.2	5.6	2.2	3.2
Adopted C.B.R. for Pavement Design	12	12	12	12	9	5	3	3
Classification of Adopted Design C.B.R.	IV			III			II	
							I	

Annex V-7 Bearing Capacity of Bridge Foundation Ground

1. 基礎地盤の弾性波速度

橋梁基礎地盤は洪積世のシルト質粘土で、弾性波探査による解析結果は Fig. 1 ~ Fig. 3 に示すように、P波速度 (V_p) は $V_p = 800 \sim 900 \text{ m/sec}$ となっており、かなり締った地盤であることを示している。

P波速度とS波速度 (V_s) との関係はポアソン比 (σ) をパラメータとして Fig. 4 に示すように表わされている。

これによると基礎地盤のポアソン比はおおむね $\sigma = 0.45 \sim 0.49$ の間に入っており、その平均値をとれば $\sigma = 0.47$ となり、基礎地盤のS波速度は $V_s = 230 \sim 250 \text{ m/sec}$ となる。

2. 基礎地盤のN値

N値とS波速度の関係は Fig. 5 に与えられている²⁾ 前項で得られたS波速度からN値を推定すると $N = 22 \sim 23$ が得られる。

3. 基礎地盤の支持力

N値からの許容支持力 (q_{as}) の推定は DUHMAN³⁾

1) 2) Tsuneo Imai, Masayoshi Yoshimura

"The Relation of Mechanical Properties of Soils to P- and S-wave Velocities", Geophysical Exploration Vol. XXV, No. 6

(Tokyo, The Society of Exploration Geophysicists of Japan '72)

提案している次式により行う。

$$q_{as} = 1.17N \quad (\text{t/m}^2)$$

ただし粘土地盤。

この式に $N=22\sim 23$ を代入する

$$q_{as} = 25.7 \sim 26.9 \quad \text{t/m}^2$$

従って構造物の直接基礎とした場合には 25t/m^2 以上の許容支持力が期待できる。

Fig. 1 Analysis of Seismic Method
(7.4 km from ELOBID)

Time - Distance Curve

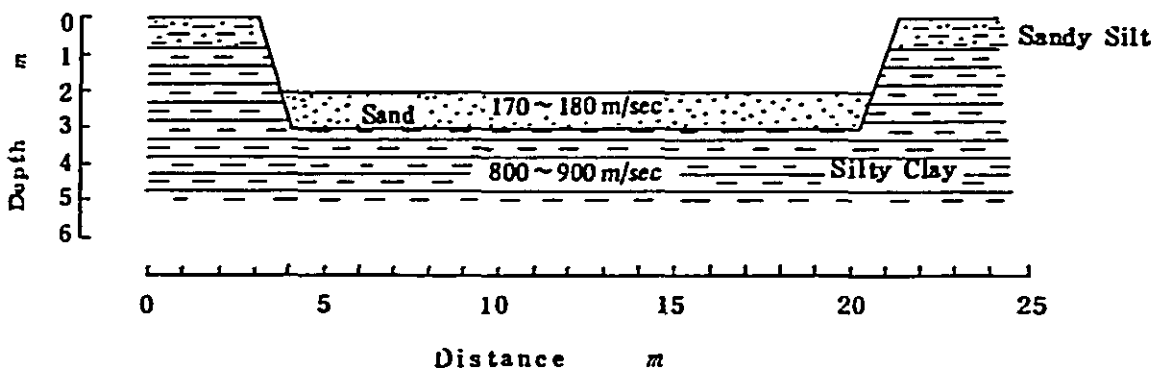
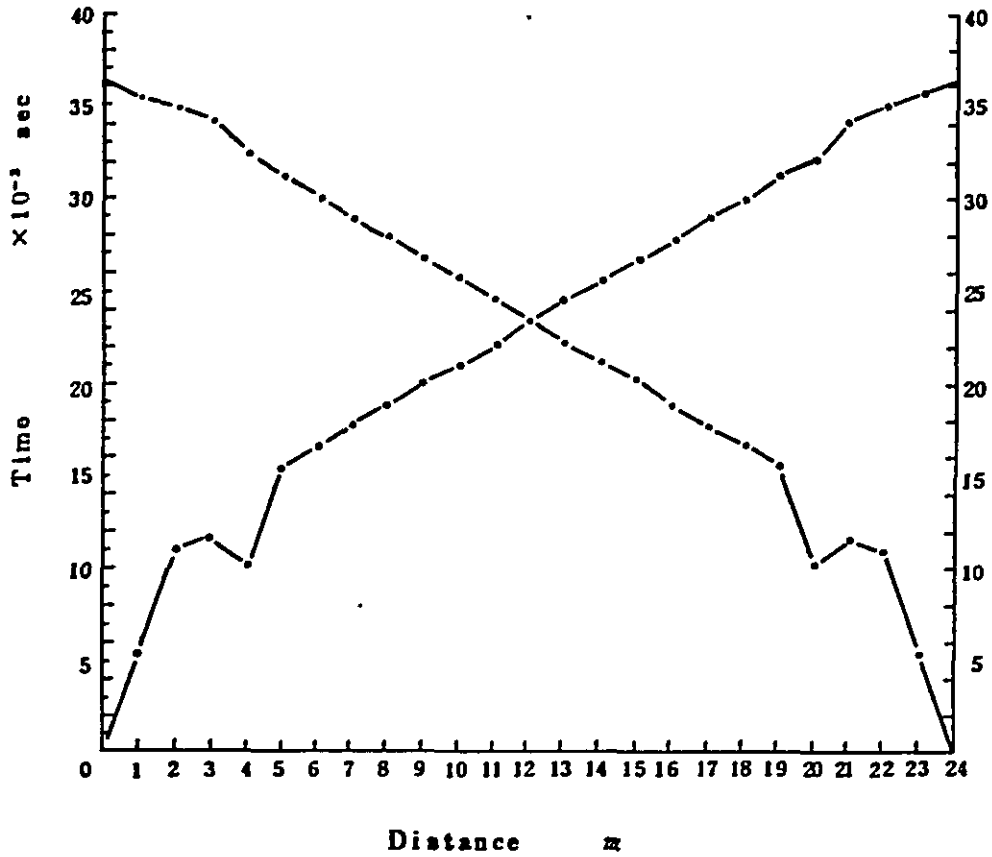


Fig. 2 Analysis Data of Seismic Prospecting
(K. EL BAGGARA)

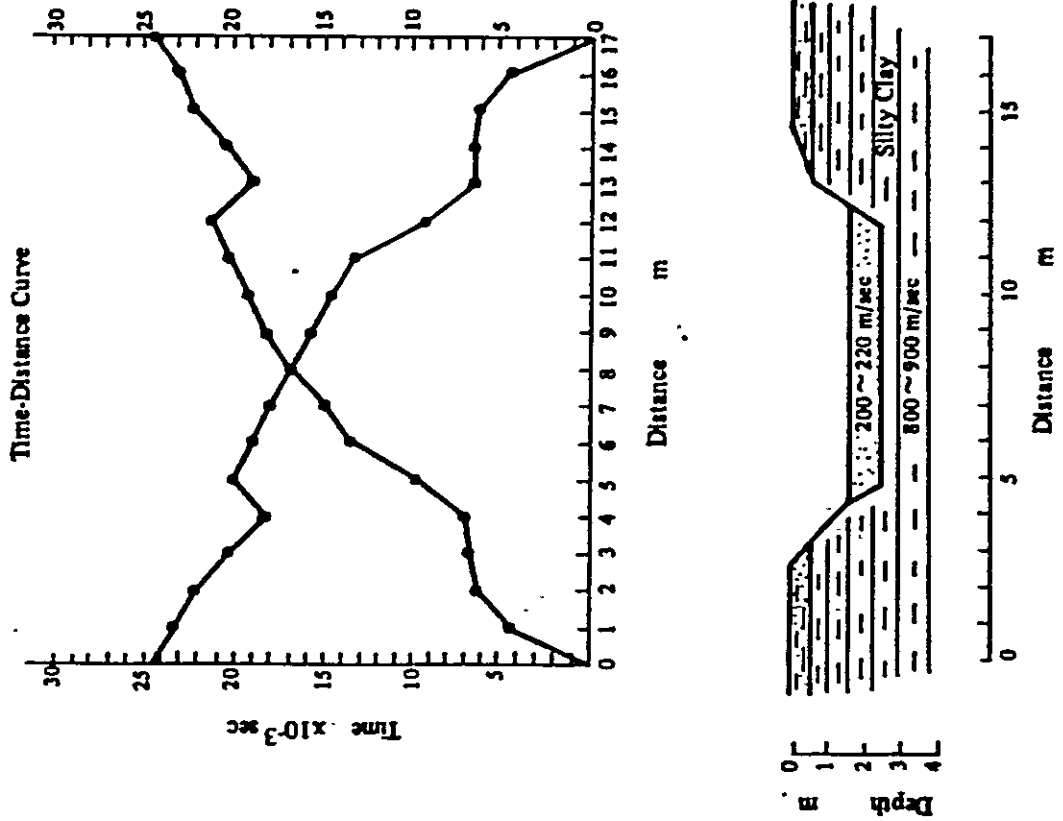


Fig. 3 Analysis Data of Seismic Prospecting
(K. NAWA)

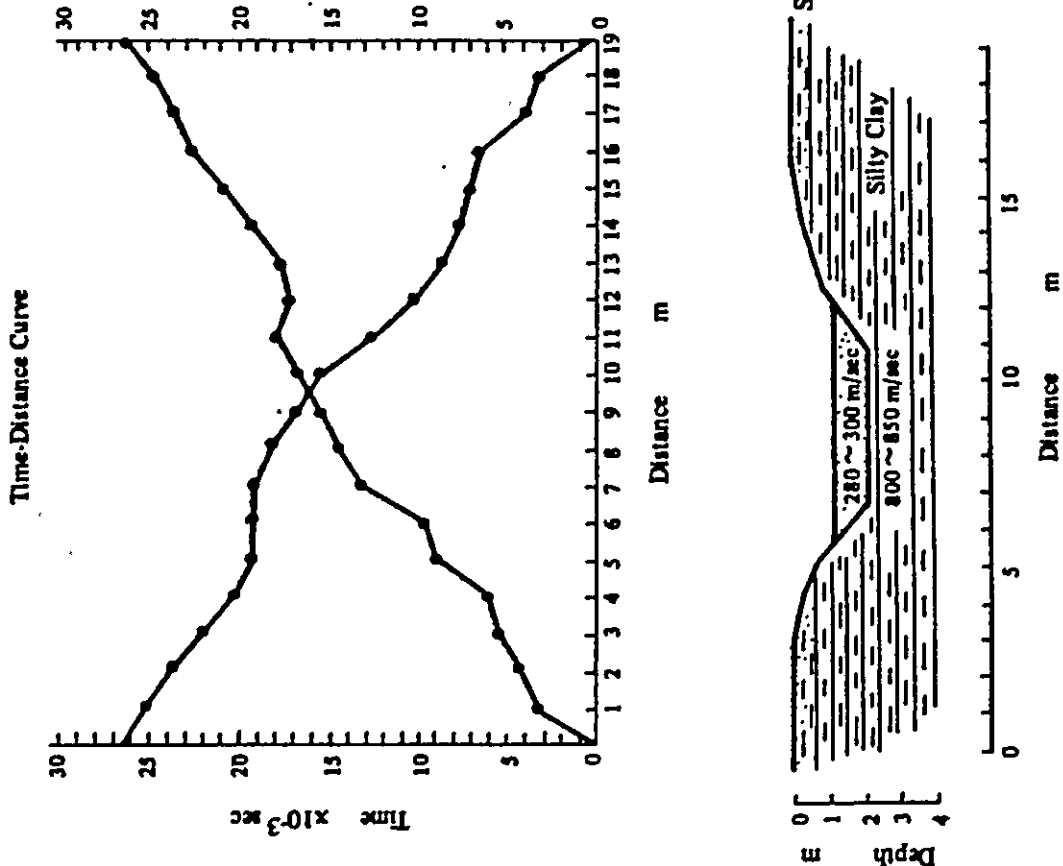


FIG. 4 S Wave Velocity — P Wave Velocity

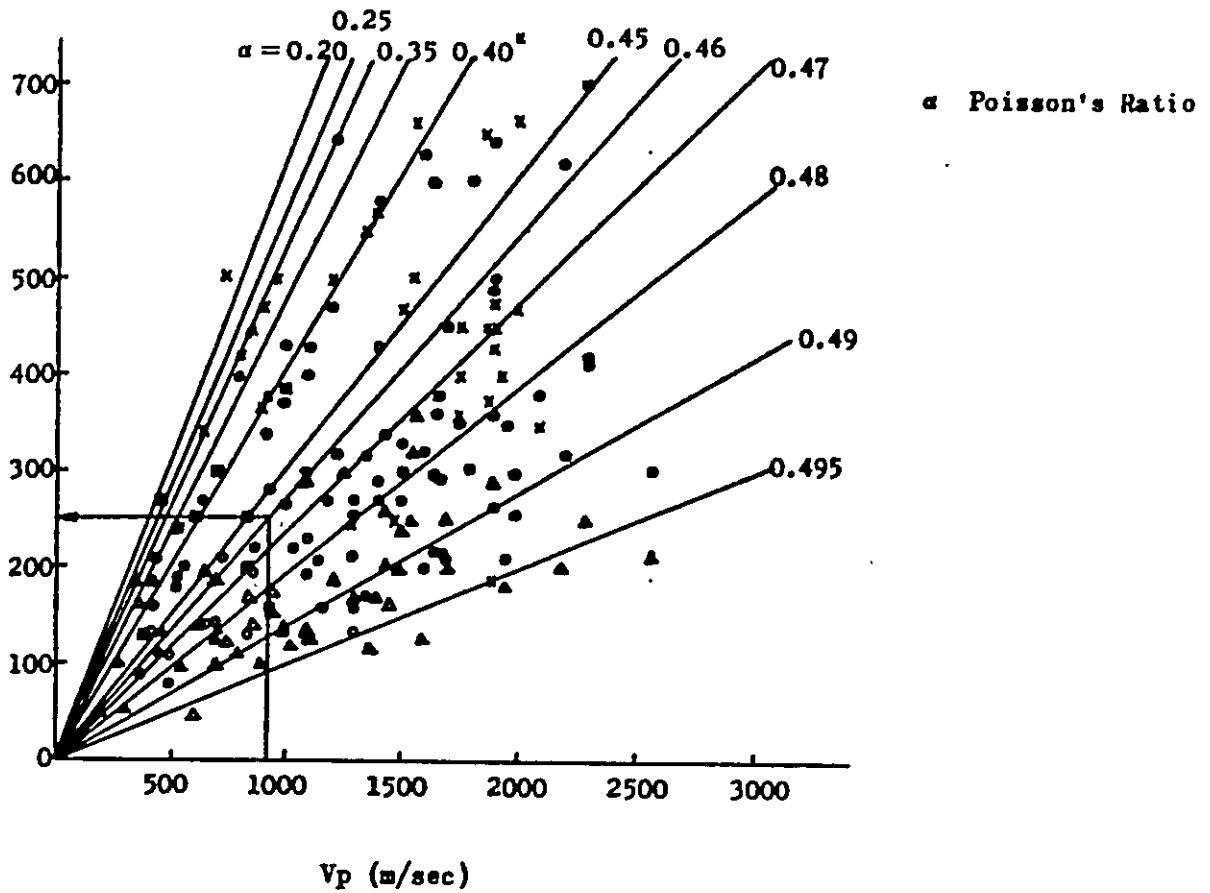


FIG. 5 N Value — S Wave Velocity

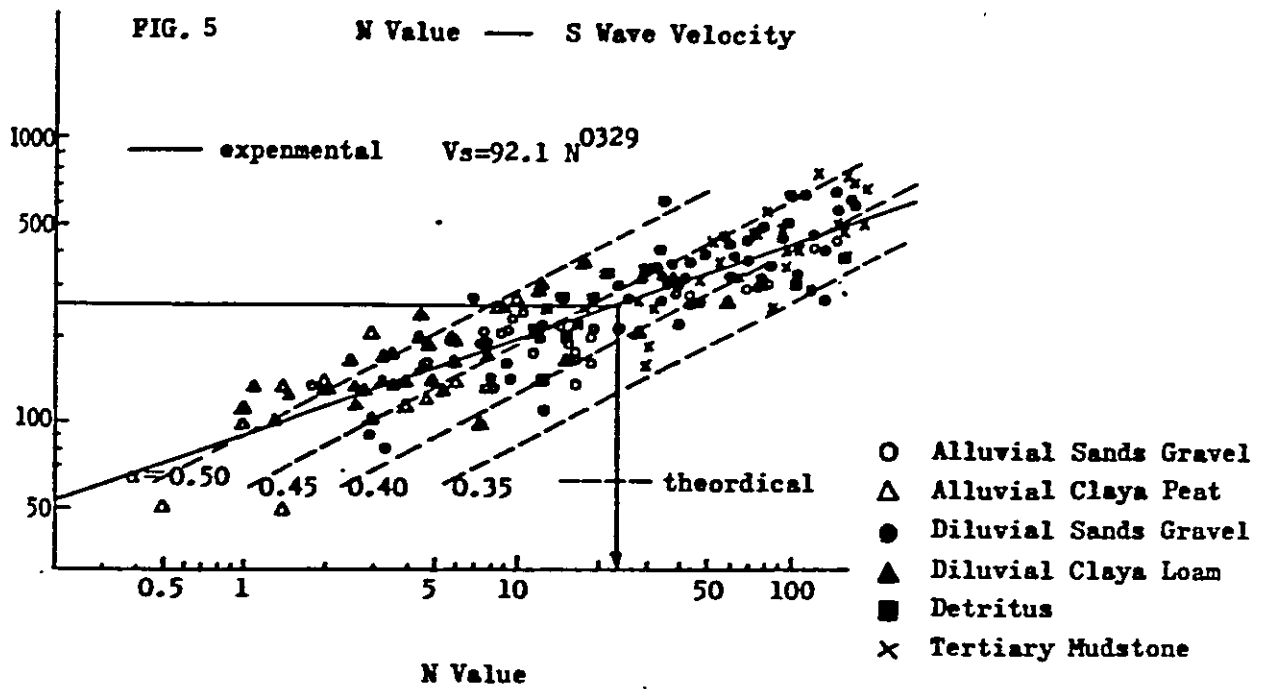
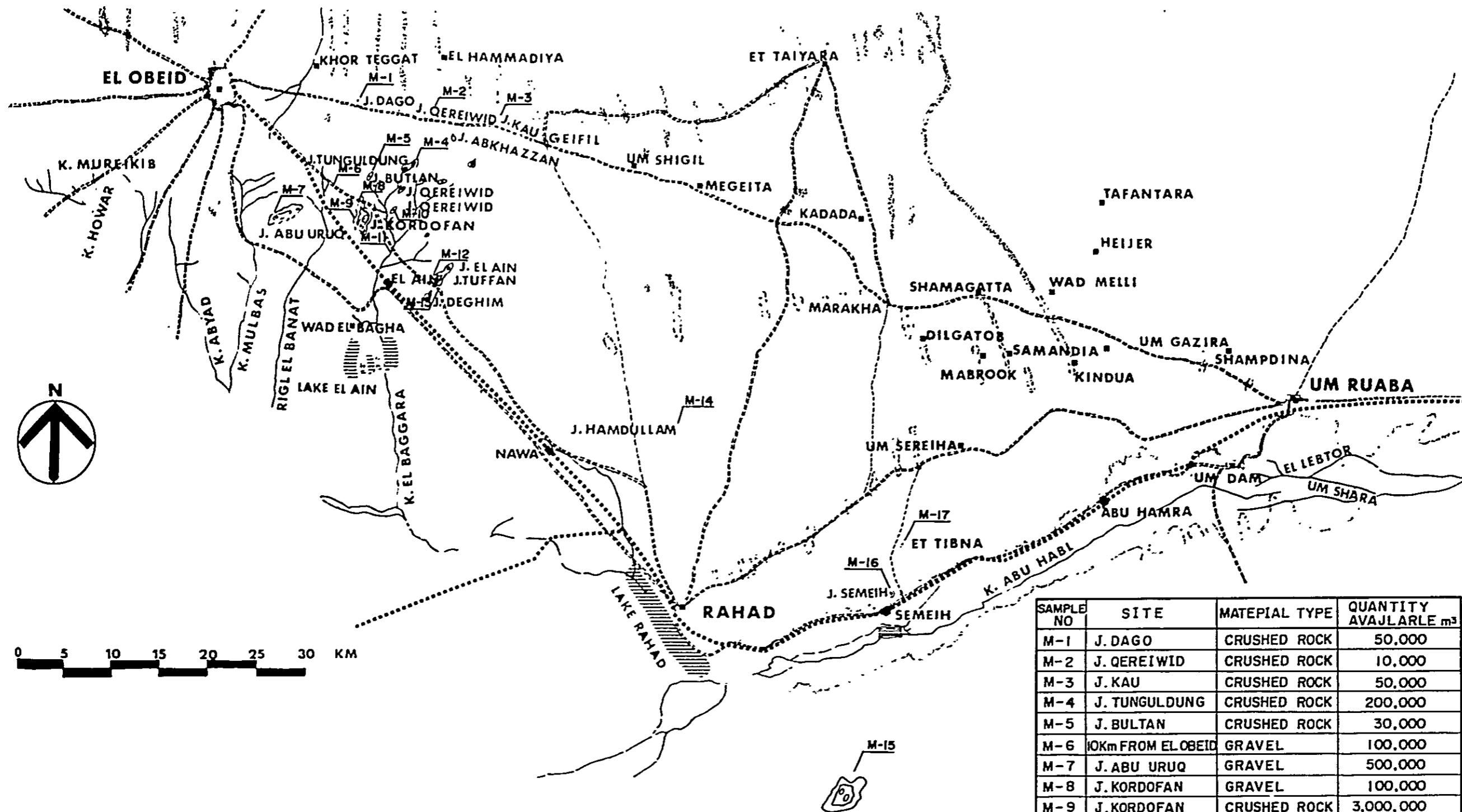


FIG. 5-3 LOCATION MAP OF MATERIALS



SAMPLE NO	SITE	MATEPIAL TYPE	QUANTITY AVAJLARLE m ³
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 ELOBEID	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 TEST

CRUSHED ROCK AND SAND

Sample No.	Site	Specific gravity	Absorption %	Los Angeles abrasion %	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	1.40	44.7	POOR	POOR
M-12	J. TUFFAN	2.56	1.40	50.3	POOR	POOR
M-14	J. HANDULLAM	2.53	3.00	14.1	GOOD	GOOD
M-16	J. SEMEIH	2.88	0.80	18.3	GOOD	GOOD
M-11	K. EL BAGGARA	2.62	0.60	-	POOR	GOOD

GRAVEL

Sample No.	Site	Specific gravity	Absorption %	Los Angeles abrasion %	C.B.R. modified %	Sub base course	Suitability for Base course
M-7	J. ABU URUQ	-	-	-	* 88	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: * Depends on the test result carried out for EL OBEID Airport Construction by R.B.P.C.'s laboratory.

GENERAL RATING AS AGGREGATE

Item	Sub base course		Base course		Surface course		Concrete aggregate		
	GOOD ¹⁾	FAIR ¹⁾	POOR ²⁾	GOOD ¹⁾	POOR ²⁾	GOOD ¹⁾	POOR ²⁾	GOOD ¹⁾	POOR ²⁾
Absorption %	<3	≥3	≥3	<3	≥3	<3	≥3	<3	≥3
Los Angeles Abrasion %	<50	≥50	≥50	<50	≥50	<40	≥40	<40	≥40
C.B.R. modified %	>30	25-30	<25	≥80	<80	-	-	-	-

Note: 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 Stabilisation Test

Cement Contents %	2	4	6	8	10
Unconfined Compression Strength Kg/cm ²	4.2	4.9	10.8	23.7	25.4

Table 5-7 Result of Lime Stabilisation Test

Lime Contents %		5	10	15
Unconfined Compression Strength Kg/cm ²	Medium curing	-	0.4	0.6
	Rapid curing	-	2.8	2.8

Table 5-8 Result of Asphalt Stabilisation 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 Stabilisation Test (Marshal Stability)

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

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

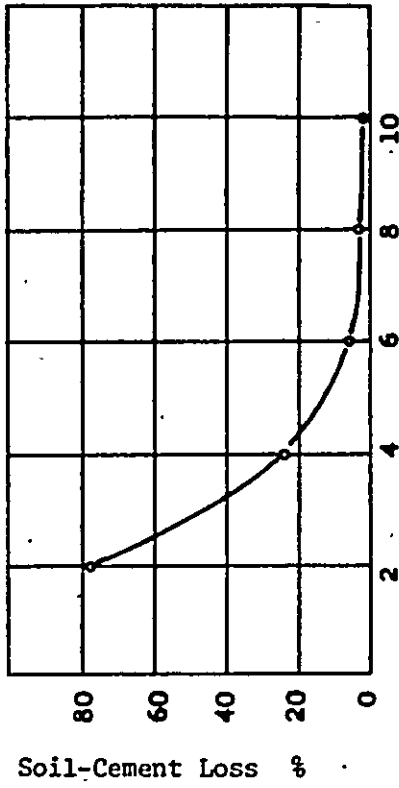


Fig. 5-6 . Wetting-And-Drying Test
(Volume Change)

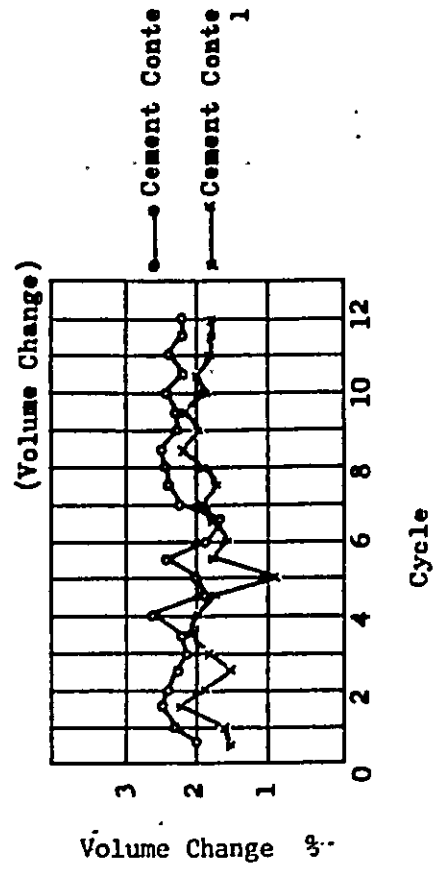


Fig. 5-4 Cement Contents ~
Unconfind Compression Strength

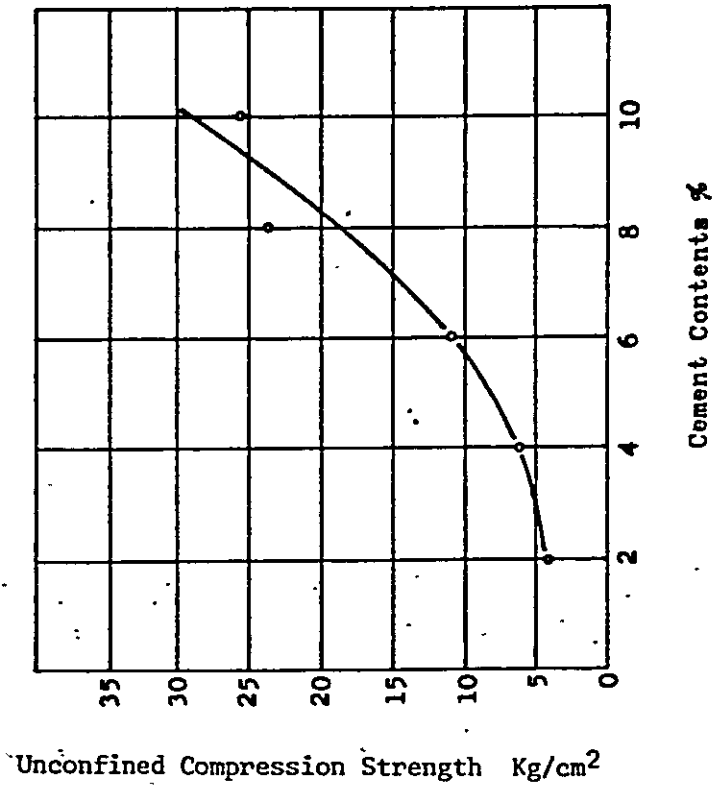


Fig. 5-8 Hubbard-Field Stability Test

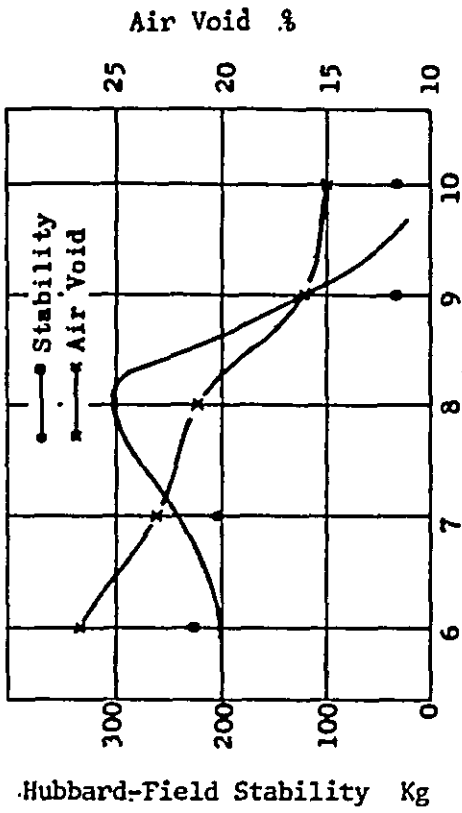


Fig. 5-9 Marshall Stability Test

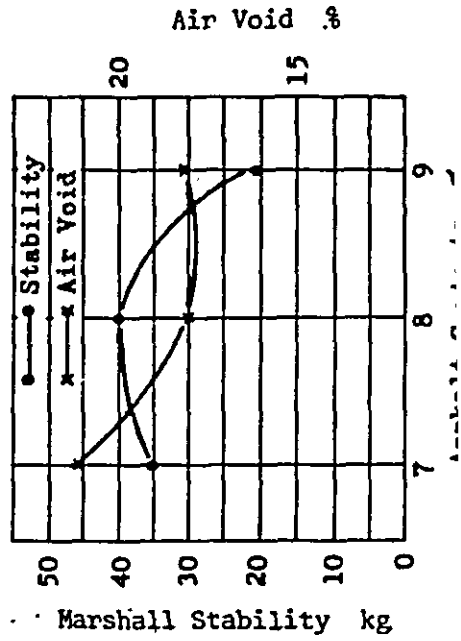
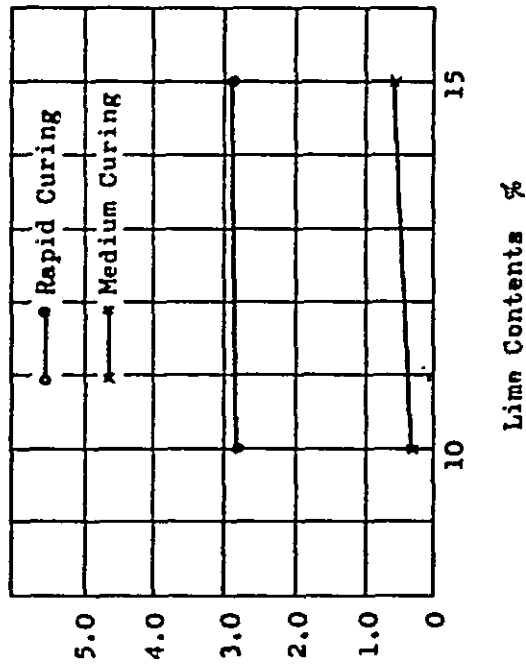
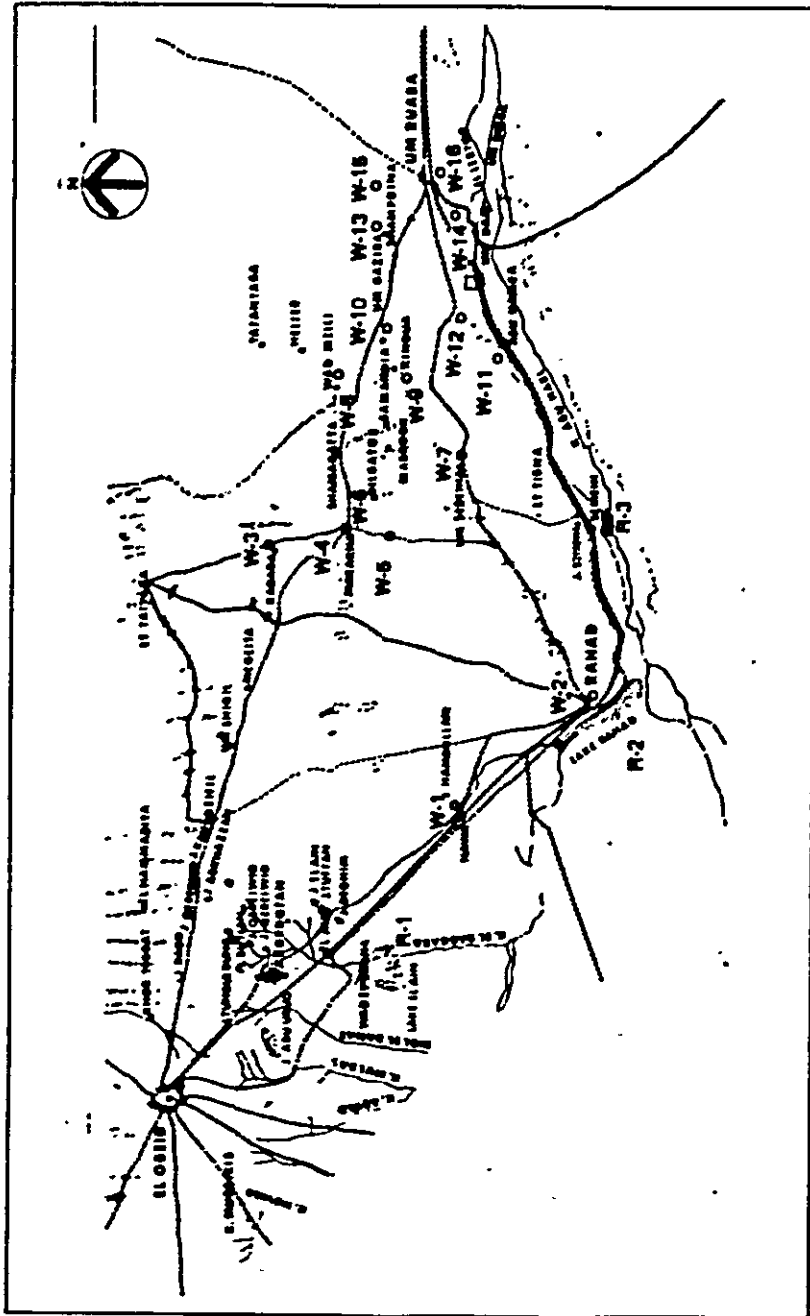


Fig. 5-7 Lime Contents - Unconfined Compression Strength



Unconfined Compression Strength Kg/cm²

Fig. 5-10 Location Map of Reservoirs and Wells



Wells

No.	LOCATION	NO. OF WELLS	YIELD l/h
W-1	NAVA	2	5450, 4360
W-2	RAMAD	3	5450, 4360, 2270
W-3	KADADA	2	5450, 4090
W-4	MARARHA	2	4670, 4670
W-5	ABU SAD	1	
W-6	DILGATOR	2	1680, 1620
W-7	UM SENEHA	2	2550, 2950
W-8	VAD MELLI	1	9090
W-9	KIRBUA	1	3180
W-10	SUMANDIA	2	3460, 5460
W-11	ABU HAMBIA	3	3180, 4360, 4360
W-12	KOANARUSA	2	1180, 2270
W-13	UM GEZIRA	2	4180, 4180
W-14	CADABIN	1	13640
W-15	UM ORNHAS	2	2270, 2270
W-16	UM BUARA	12	4360 - 13640

Reservoirs

NO.	LOCATION	FONDAGE m ³
R-1	AL ATR	5,500,000
R-2	RAMAD	16,000,000
R-3	SINMEIN	120,000

Reservoir



Well



Proposed Temporary Dam



TABLE 5-10 YEARLY MAXIMUM DAILY RAINFALL, EL OBEID, 1943 - 64

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: Meterological Department, Sudan.

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

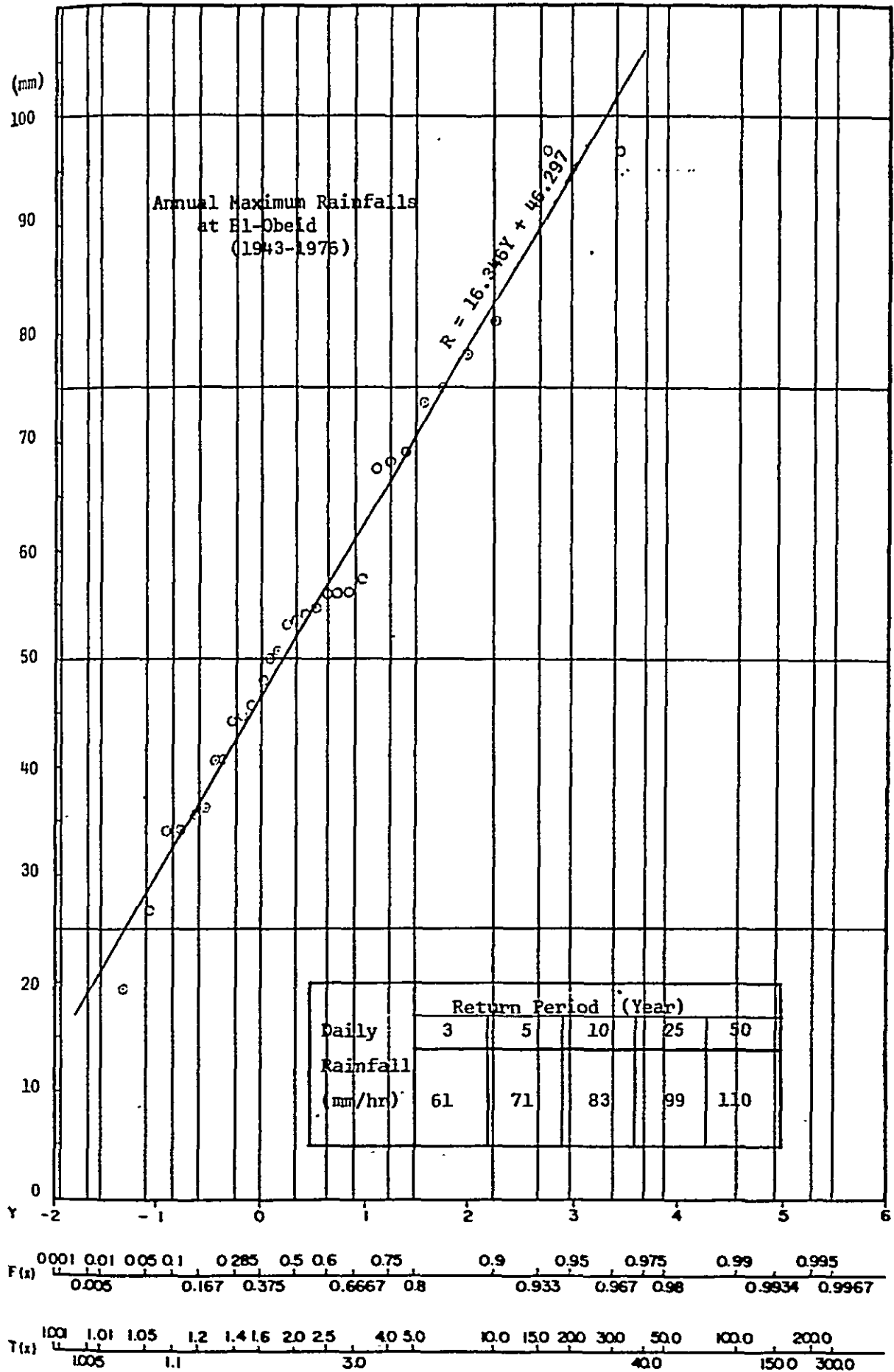
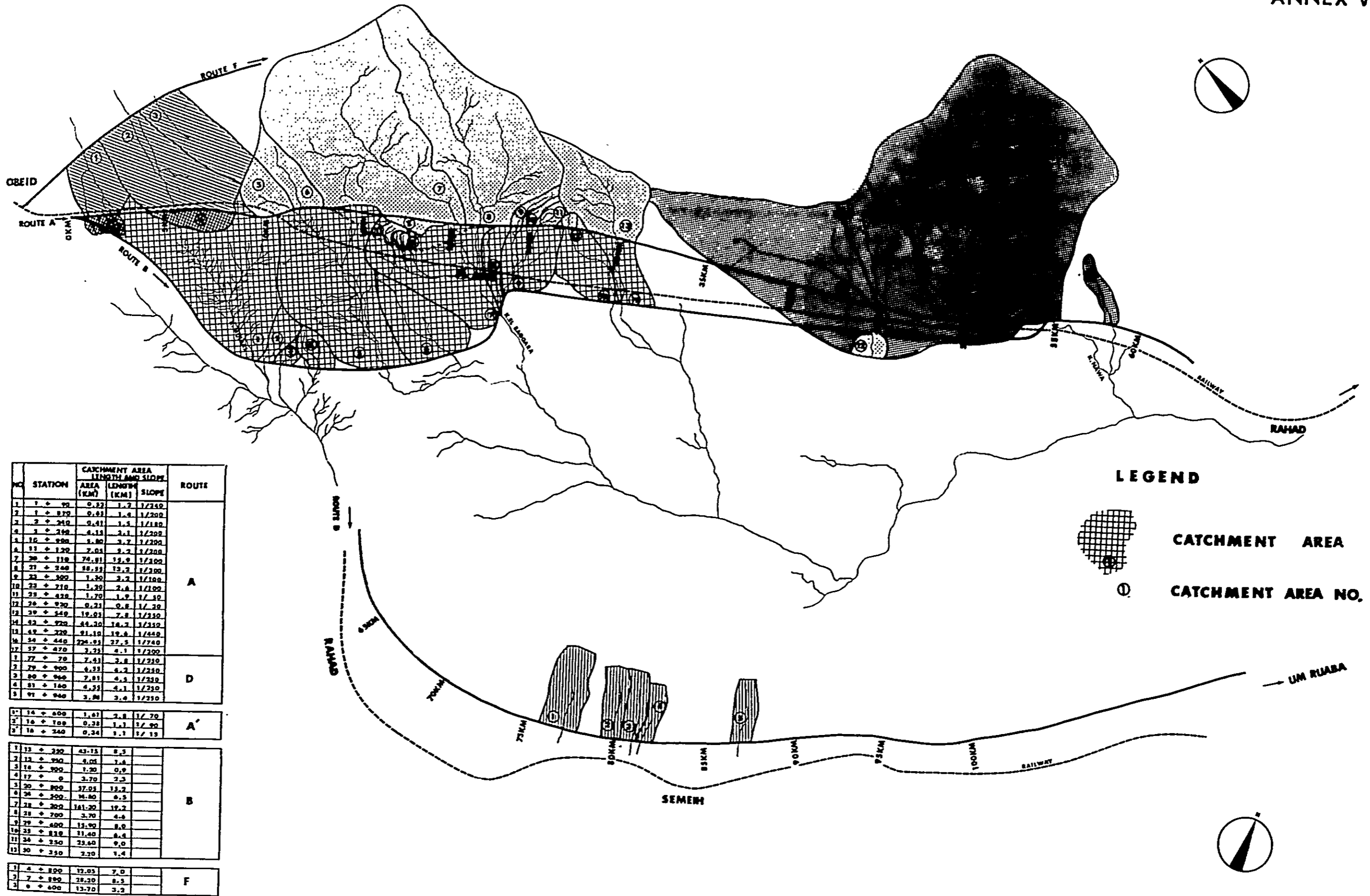
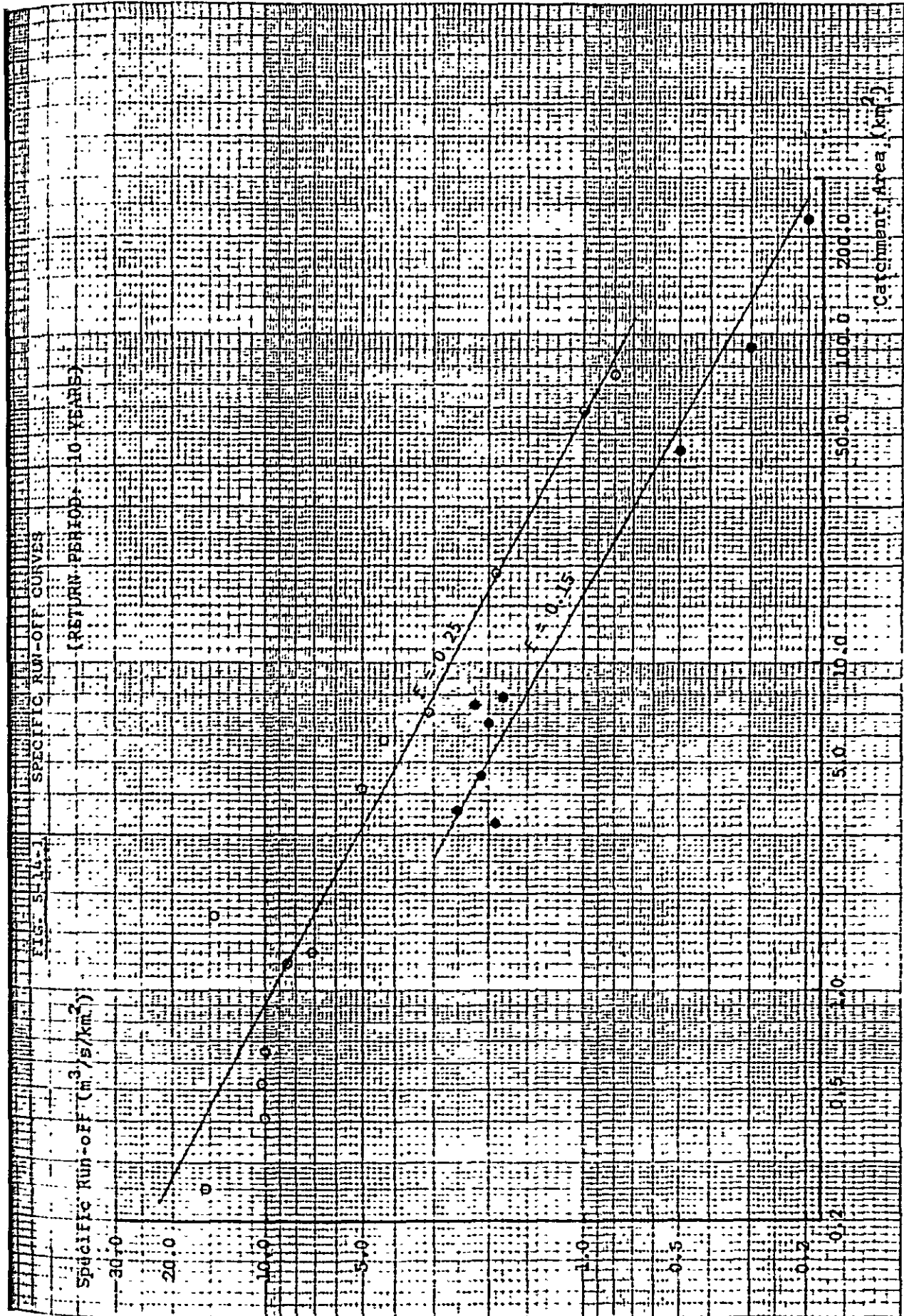
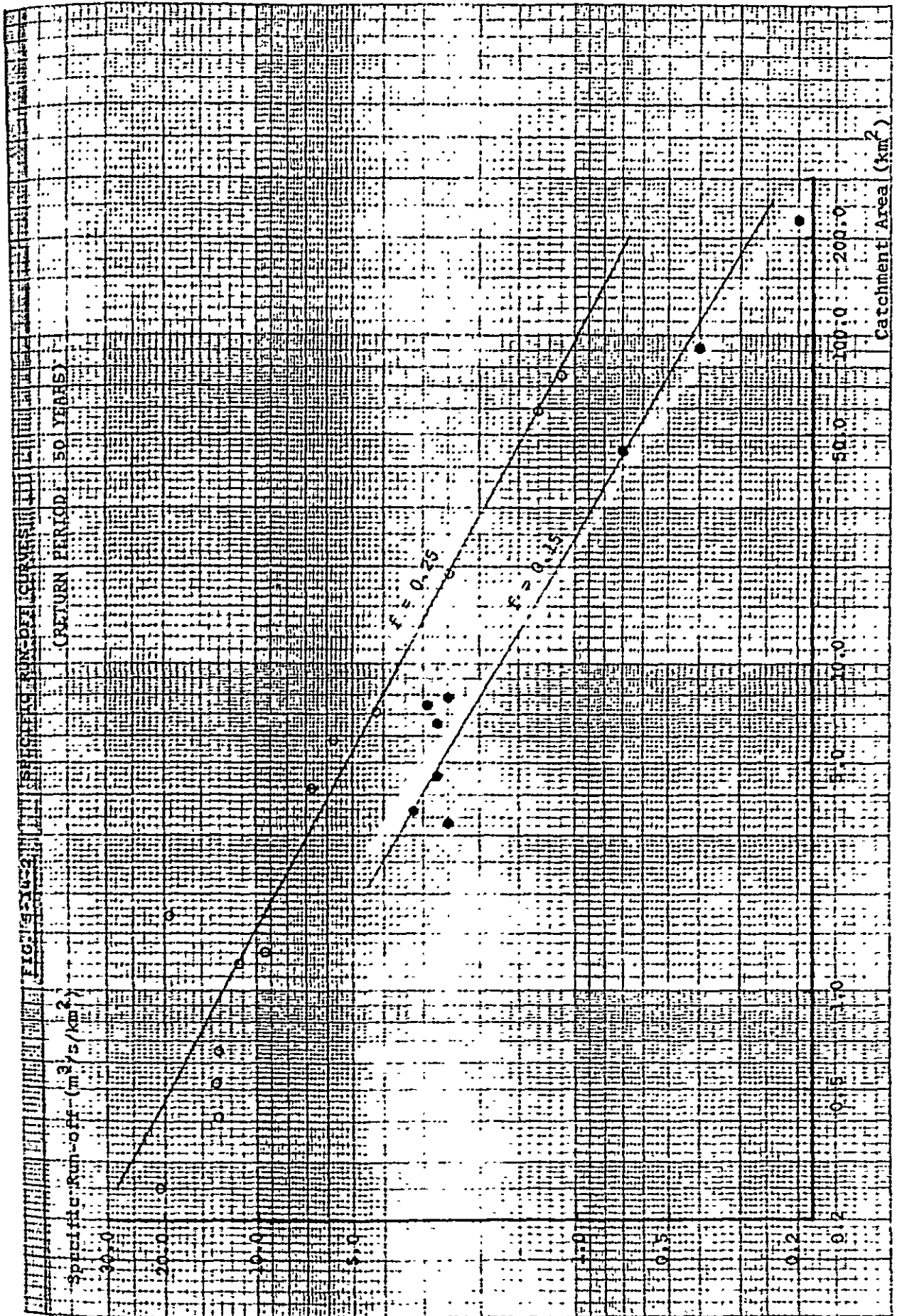


FIG. 5-13 CATCHMENT AREA







1875 x 250



NO 433 雨水量推定用

TABLE 5-11-1 ESTIMATED DISCHARGE OF 10 YEAR'S RETURN PERIOD
AT THE LOCATION OF STRUCTURES BY RATIONAL FORMULA

$$r \text{ 1/10} = \frac{5006}{t + 7.0} \quad (W = 1/10)$$

1.1 Route A and D

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 inten- sity (mm/hr)	Run-off coefficient	Discharge (m ³ /s)	Specific run-off (m ³ /s/km ²)
1	1k + 90m	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
1	77k + 70m	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

Route

A

D

TABLE 5-11-2 ESTIMATED DISCHARGE OF 50 YEAR'S RETURN PERIOD
AT THE LOCATION OF STRUCTURES BY RATIONAL FORMULA

$$r \text{ 1/50} = \frac{6635}{t + 7.0} \quad (W = 1/50)$$

1.2 Route A and D

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	1k + 90m	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
1	77k + 70m	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 STRUCTURES BY SPECIFIC RUN-OFF METHOD

$$r \text{ 1/10} = \frac{5006}{t + 7.0} \quad (W = 1/10)$$

2.1 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 + 0m	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

3.1 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. V-14-1 SPECIFIC RUN-OFF DIAGRAM.

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

2.2 Route B

$$r = \frac{1}{50} + \frac{6635}{t + 7.0} \quad (W = 1/50)$$

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 inten- sity (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 + 0m	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

3.2 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. V-14-2 SPECIFIC RUN-OFF DIAGRAM.

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Station No.		Name of interviewer		Sheet No.		1 Time of interview						2 Type of vehicle											
Date of interview	Weather	Name of Surveyor		Direction		7 Trip purpose		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)		14 Fuel used		15 Average annual mileage of the car (kilometer per year)	
3 Model/Make	4 Age	6 Destination		5 Origin		1 Work		2 To home		3 Shopping		4 Social intercourse		5 Others		1 Gasoline		2 Diesel		3 Others		15	
		Name of the place where you finally finish the trip		Name of the place where you start the trip		1		2		3		4		5		1		2		3			
1 Time	2 Type of vehicle	3 Model/make of the vehicle	4 Age	5 Origin	6 Destination	7 Capacity	8 No. of passengers	9 No. of wheels	10 Capacity	11 No. of wheels	12 Loading capacity	13 Type of commodities	14 Weight of commodity	15 Types of commodity	16 Loading capacity	17 No. of wheels	18 Capacity	19 No. of pass.	20 No. of wheels	21 Types of commodity	22 weight	23 Fuel used	24

Note: 1) Travel Time
2) Fuel Consumption

TABLE 6-2 TRAFFIC COUNT SURVEY SHEET

ANNEX VI-2










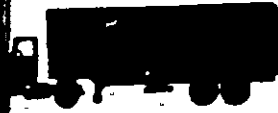

Station No.	Date of count		Weather		Sheet No.								
Direction			Name of Surveyor				Name of Supervisor					/	
→													
Type of vehicle	7	8	9	10	11	12	13	14	15	16	17	18	Total
	1	2	3	4	5	6	7	8	9	10	11	12	
taxi 													
 													
													
pick-up 													
 													
dump truck 													
toy truck 													
truck-trailer 													
													
motor cycle													
animal drawn vehicle													
others													
Total													

TABLE 6-3-1 DAILY TRAFFIC AT SURVEY POINT 11, EL OBEID

<u>Vehicle Type</u>	<u>May 9 (MON)</u>	<u>10 (TUE)</u>	<u>11 (WED)</u>	<u>12 (THU)</u>	<u>13 (FRI)</u>	<u>14 (SAT)</u>	<u>15 (SUN)</u>	<u>Average</u>
Van, Pick-up	1.2	-	3.6	-	-	-	1.2	0.9
Medium Truck	56.4	43.2	49.2	42.0	34.8	82.8	20.4	47.0
Heavy Truck	1.2	2.4	4.8	1.2	1.2	2.4	-	1.9
<u>Bus</u>	<u>1.2</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>0.2</u>
Total	60.0	45.6	57.6	43.2	36.0	85.2	21.6	50.0

TABLE 6-3-2 DAILY TRAFFIC AT SURVEY POINT 12, EL OBEID

<u>Vehicle Type</u>	<u>May 9 (MON)</u>	<u>10 (TUE)</u>	<u>11 (WED)</u>	<u>12 (THU)</u>	<u>13 (FRI)</u>	<u>14 (SAT)</u>	<u>15 (SUN)</u>	<u>Average</u>
Van, Pick-up	3.6	4.8	2.4	1.2	15.6	-	1.2	4.1
Medium Truck	20.4	48.0	34.8	48.0	34.8	45.6	21.6	36.2
Heavy Truck	-	-	-	1.2	1.2	-	-	0.3
<u>Bus</u>	<u>-</u>	<u>1.2</u>	<u>1.2</u>	<u>1.2</u>	<u>2.4</u>	<u>-</u>	<u>1.2</u>	<u>1.0</u>
Total	24.0	54.0	38.4	51.6	54.0	45.6	24.0	41.6

TABLE 6-3-3 DAILY TRAFFIC AT SURVEY POINT 13, EL OBEID

<u>Vehicle Type</u>	<u>May 9 (MON)</u>	<u>10 (TUE)</u>	<u>11 (WED)</u>	<u>12 (THU)</u>	<u>13 (FRI)</u>	<u>14 (SAT)</u>	<u>15 (SUN)</u>	<u>Average</u>
Van, Pick-up	-	-	1.5	1.5	-	1.5	3.0	1.1
Medium Truck	25.5	22.5	30.0	30.0	19.5	48.0	18.0	27.6
Heavy Truck	-	3.0	1.5	3.0	3.0	1.5	1.5	1.9
<u>Bus</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>
Total	25.5	25.5	33.0	34.5	22.5	51.0	22.5	30.6

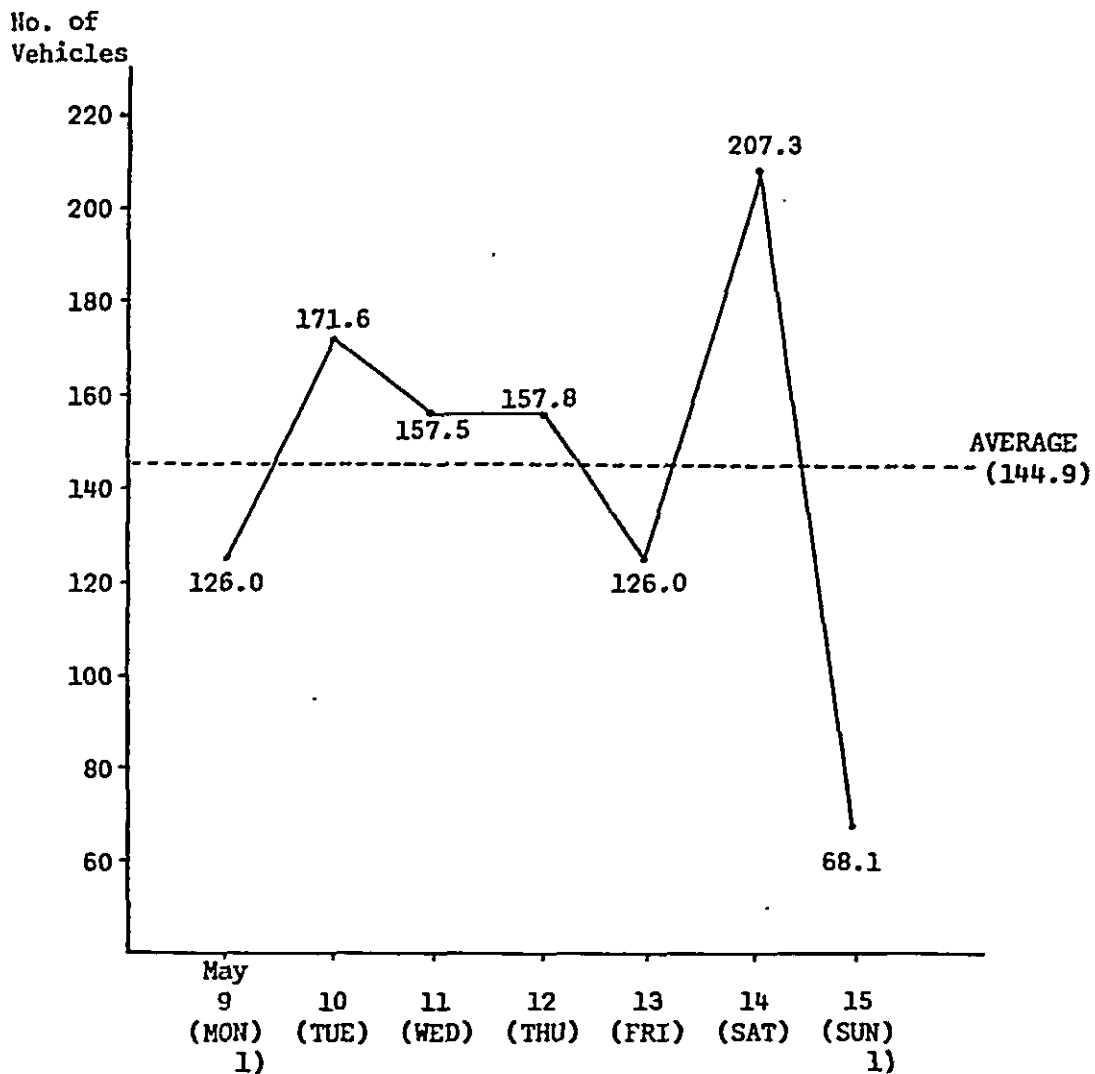
TABLE 6-3-4 DAILY TRAFFIC AT SURVEY POINT 14, EL OBEID

Vehicle Type	May 9 (MON)	10 (TUE)	11 (WED)	12 (THU)	13 (FRI)	14 (SAT)	15 (SUN)	Average
Van, Pick-up	4.5	16.5	7.5	6.0	6.0	9.0	-	7.1
Medium Truck	7.5	22.5	12.0	16.5	3.0	13.5	-	10.7
Heavy Truck	-	-	3.0	-	1.5	-	-	0.6
Bus	4.5	7.5	6.0	6.0	3.0	3.0	-	4.3
Total	16.5	46.5	28.5	28.5	13.5	25.5	-	22.7

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

(ALL TYPES OF VEHICLES)

ANNEX VI-4



1) Survey was not conducted for full day.

TABLE 6-4-1 DAILY TRAFFIC SURVEY
POINT 21, UM RUABA

ANNEX VI-5

Vehicle Type	May 21 (Sat)	22 (Sun)	23 (Mon)	24 (Tue)	Average
Van Pickup	6.0	1.2	4.8	7.2	4.8
Medium Truck	38.4	38.4	28.8	27.6	33.3
Heavy Truck	-	-	-	-	-
Bus	-	-	-	-	-
Total	44.4	39.6	33.6	34.8	38.1

TABLE 6-4-2 DAILY TRAFFIC SURVEY
POINT 22, UM RUABA

Vehicle Type	May 21 (Sat)	22 (Sun)	23 (Mon)	24 (Tue)	Average
Van Pickup	1.2	-	-	1.2	0.6
Medium Truck	69.6	117.6	104.4	117.6	102.3
Heavy Truck	-	2.4	7.2	2.4	3.0
Bus	1.2	-	-	-	0.3
Total	72.0	120.0	111.6	121.2	106.2

FIG. 6-2 DAILY VARIATION OF ROAD TRAFFIC,
UM RUABA, 1977 (All types of Vehicles)

ANNEX VI-6

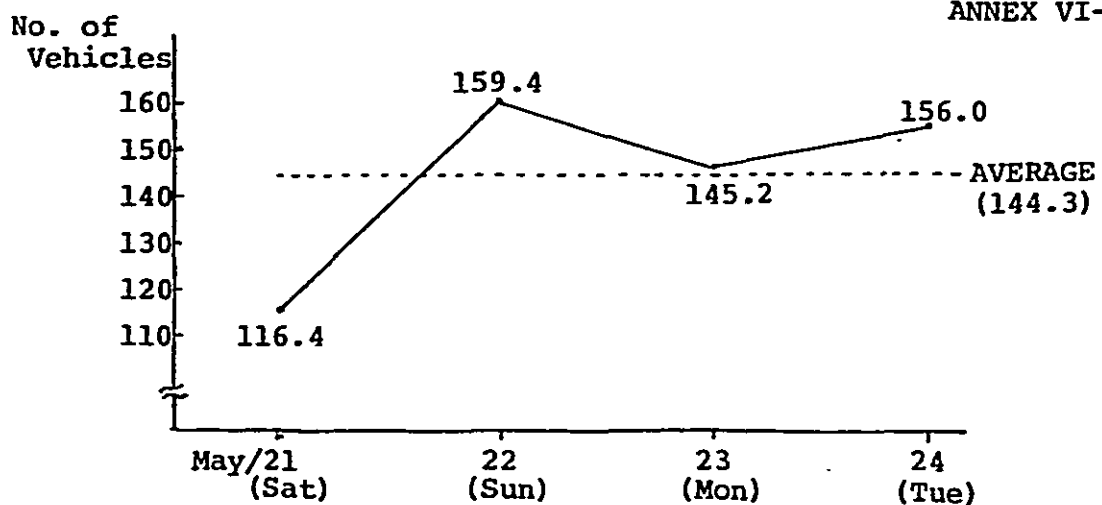


TABLE 6-5-1 HOURLY DISTRIBUTION OF ADT,
EL OBEID AREA, 1977

ANNEX VI-7

	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, 1977

ANNEX VI-8

Vehicle Hour Type	Van/ Pick-up	Medium Truck	Heavy Truck	Bus	Total	
					Vehicle	%
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)

ANNEX XI-9

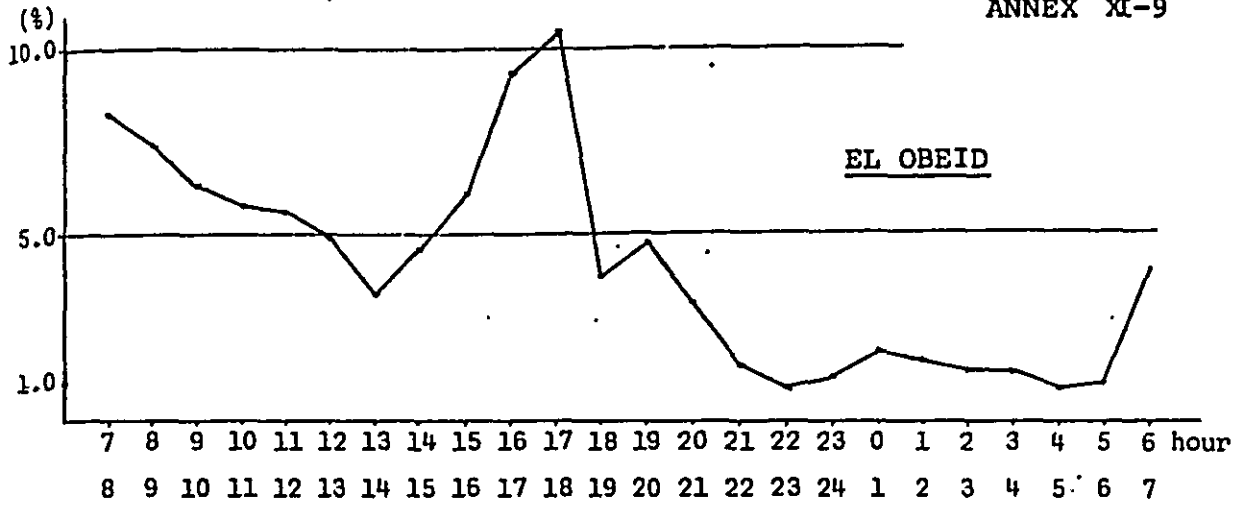


FIG. 6-3-2 HOURLY DISTRIBUTION OF ADT, 1977

(ALL TYPES OF VEHICLES)

UM RUABA

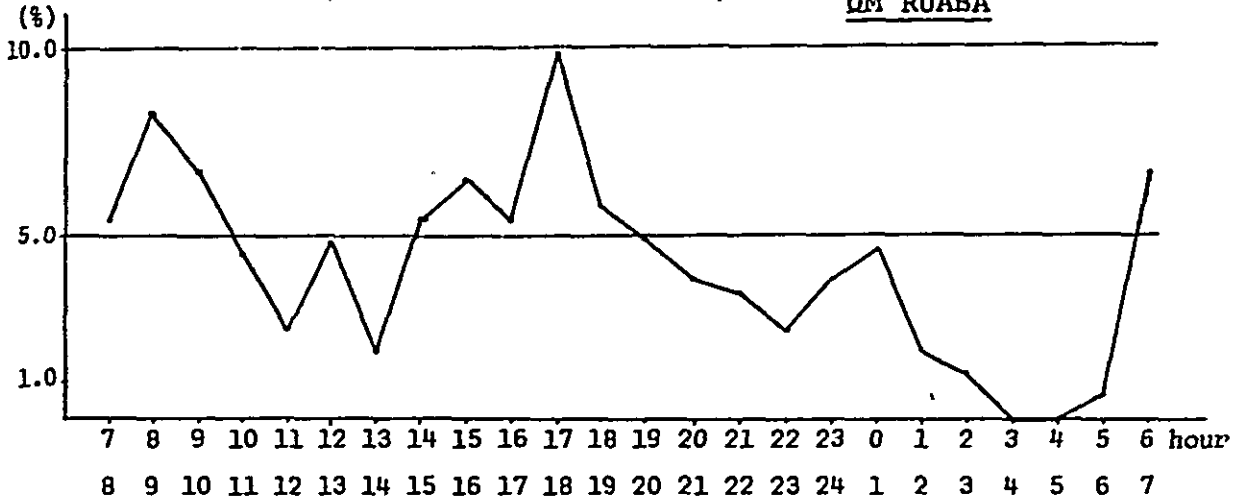


FIG. 6-3-3 HOURLY DISTRIBUTION OF ADT, 1977

(ALL TYPES OF VEHICLES)

**PROJECT AREA
(EL OBEID+UM RUABA)**

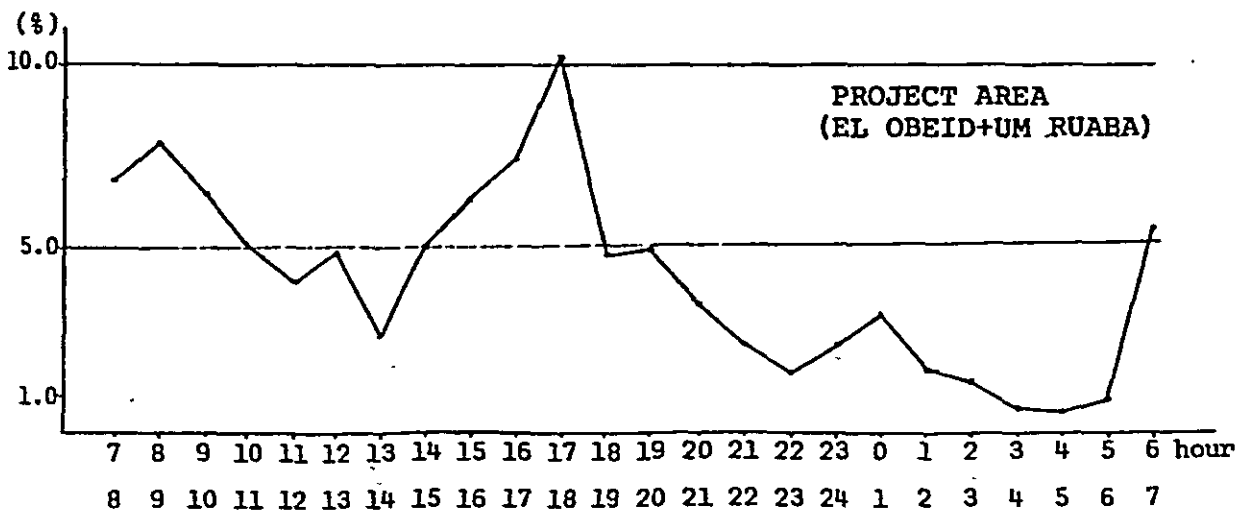


TABLE 6-6-1 SEASONAL VARIATIONS OF RAILWAY GOODS TRAFFIC AT EL OBEID STATION, 1976

Month	Forwarded	Received	Total
JAN. 1976	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
1976 Total	107,551	93,260	200,811

Source: Sudan Railways Corporation, 1977

FIG. 6-4-1 SEASONAL VARIATION OF RAILWAY GOODS TRAFFIC

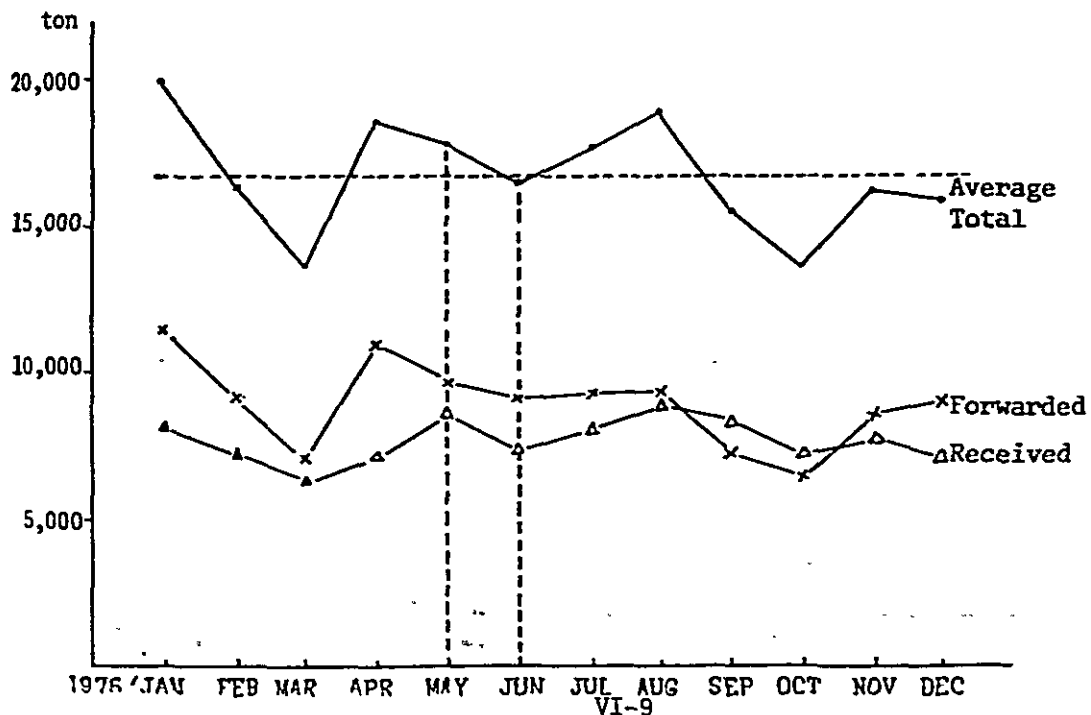


TABLE 6-6-2

TONNAGE OF CROPS HANDLED AT EL OBEID CROP MARKET, 1976

ANNEX VI-11

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

Source: El Obeid Crop Market, 1977

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

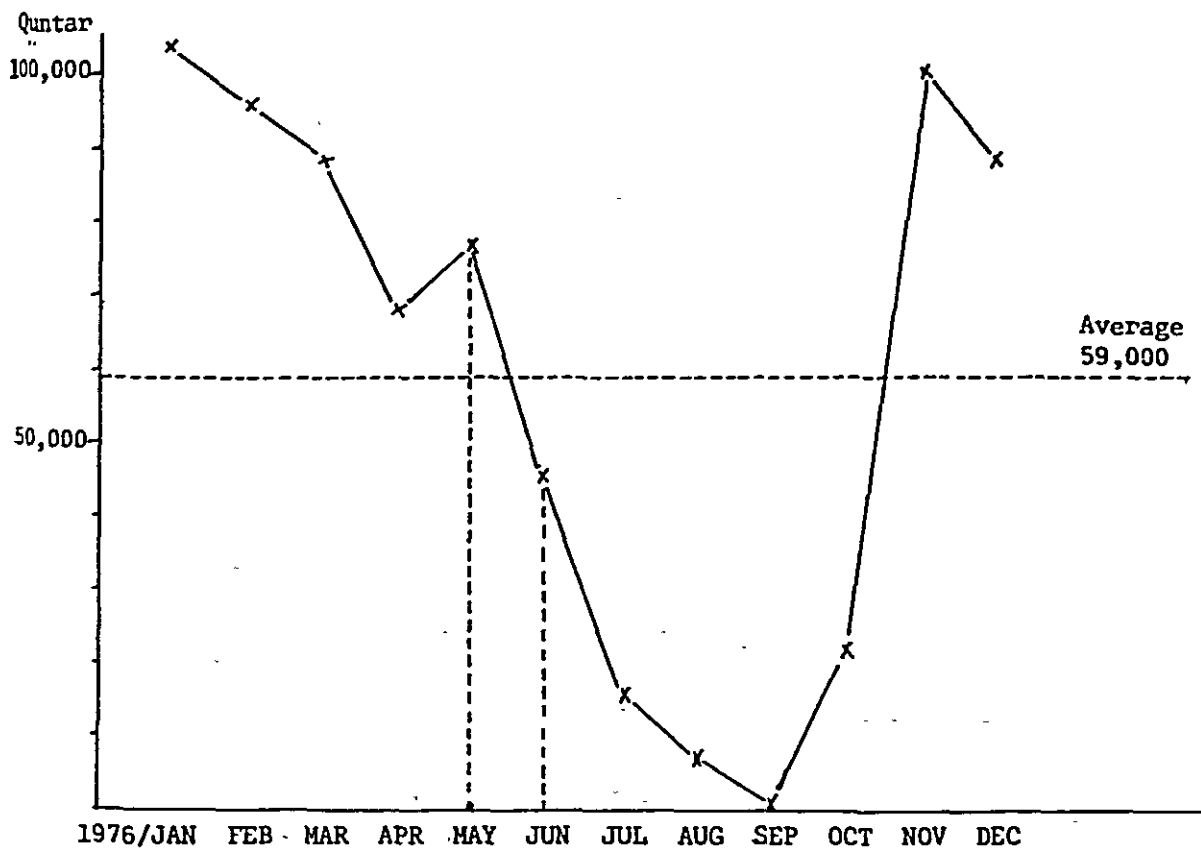


TABLE 6-7 VEHICLE MAKE AND YEARS IN SERVICE

Vehicle Make	Years in Service															Total		
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	No.	%
Volga(1/4)						1.5	1.5										3.0	0.2
Jeep(0.5)	L.2		3.6	1.2	1.2	2.4	L.2	2.4	L.2		L.2	L.2				L.2	18.0	1.1
Land Rover(1.0)	L.2	2.4	3.9	7.5	7.2	4.5											25.7	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)	L.2					L.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		L.2					18.9	1.1
Commer(5.0)		1.2	3.6	2.4	2.4	5.1			4.2	3.0	3.0	L.2	2.4	L.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					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				L.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	L.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		L.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	43.0	19.5	19.8	9.3	8.1	3.0	4.2			L.2			202.5	12.3
Nissan(8.0)	6.0	22.5	44.4	42.9	22.5	15.9	3.9	3.0	1.5				L.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	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 Parentheses indicate loading capacity in tons.

TABLE 6-8 YEARS IN SERVICE OF VEHICLES BY TYPE¹⁾

Vehicle Type	Years in Service														Total (%)	Average Years Service	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13			14
Van Pick-ups	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	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	48.0	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 (3.4)	201.6 (12.6)	327.6 (20.5)	317.7 (19.8)	275.1 (17.2)	144.9 (9.0)	107.1 (6.7)	38.7 (2.4)	48.9 (3.1)	22.5 (1.4)	34.2 (2.1)	4.8 (0.3)	9.9 (0.6)	2.4 (0.1)	11.4 (0.7)	1,601.7 (100.0)	3.7

1) Vehicles for military use are excluded.

TABLE 6-9 DISTRIBUTION OF VEHICLES BY LOADING CAPACITY¹⁾

Vehicle Type	Van Pick-ups					Medium Truck					Heavy Truck					Total	
	0.25	0.5	1	1.5	Total	3	4	5	6	7	8	Total	11	12	15		16
Capacity (ton)	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
Vehicle Number	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
Average Capacity (ton)				1.0				6.1				6.1				13.1	6.1

Note: 1) Buses and vehicles for military use are excluded.

TABLE 6-10 DISTRIBUTION OF VEHICLES BY LOADED CONTENT¹⁾

Type of Vehicles	Van Pick-up	Medium Truck	Heavy Truck	(Vehicles) Total
Commodities Only		83.7	6.4	90.1
Commodities & Passengers	9.4	1,166.7	31.8	1,207.9
Passengers Only	55.8	173.9	7.3	237.0
Empty	6.8	19.0	1.3	27.1
Total	72.0	1,443.3	46.8	1,562.1

1) Buses and vehicles for military use are excluded..

TABLE 6-11 LOADING CHARACTERISTICS OF VEHICLES¹⁾

Type of Vehicle	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
Sub-total	0.73	4.79	8.93	4.87
Total	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
Total	4.71	9.44	6.54	9.13
Average Loading Rate (%)				
Commodities Only		0.80	0.60	0.77
Commodities & Passengers	0.53	0.78	0.72	0.78
Sub Total	0.53	0.78	0.70	0.77
Total	0.09	0.68	0.54	0.67

Note: 1) Buses and vehicles for military use are excluded.

TABLE 6-12-1 OD TABLE OF ROAD VEHICULAR TRAFFIC, 1972

(All types of vehicles)

ZONE	(Vehicles per day)																										
	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	0.4	0.1	1.3				2.7	0.5	0.8						108.6	
GEIFIL	02				0.6						0.6																7.4
ET TAIYARA	03				0.1																						0.1
SHAPAGAITA	04				16.5						0.3		0.6														17.7
UM RUVABA	05					3.0	2.1	11.1											6.9	2.1	0.1	0.9				59.2	
ABU UMRA	06																										3.9
SEMEIH	07												0.1														0.3
RAHAD	08									1.5	2.4	3.0										0.7					41.0
NAWA	09																										1.0
EL AIN	10																										2.0
TENDELT	11																			0.3	0.6	0.3					3.7
KOSTI-SENAR	12																				3.6	0.2	0.1				24.6
WAD MEDANI	13																			0.9							1.7
KHARTOUM	14																			3.6	5.4	0.4	1.8	15.6			68.2
KASSALA	15																										0.1
PORT SUDAN	16																										1.9
MALACAL	17																						0.3				
EL ADDASIYA	18																										2.7
NUBA MOUNTAIN	19																										6.6
KADUKLI-DILLING	20																										16.4
WAU-JUBA	21																										0.4
EN NAHUD	22																										3.1
HYALLA	23																										16.9
BARA	24																										
ATBARA	25																										
TOTAL																											392.8

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

(Van Pick-ups)

ZONE	(Vehicles per day)																										
	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	0.2				1.1	0.2	1.2	0.2	1.4	0.3	1.2							0.4	0.2	0.6						7.0	
GEIFIL																											2.0
ET TAIYARA																											
SHAMAGATTA					3.0																						3.0
UM RUWABA							0.3																0.1	0.3			4.8
ABU HAMRA																											
SEMEIH																											0.2
RAHAD																											
NAWA																											1.5
EL AIN																											0.2
TENDELT																											1.4
KOSTI-SEHAR																											0.3
WAD MEDANI																											
WAD MEDANI																											
KHARTOUM																											1.2
KASSALA																											
PORT SUDAN																											
MALACAL																											
EL ABBASIYA																											0.4
NUBA MOUNTAIN																											0.2
KAOUELI-DILLING																											0.6
WAD-JUBA																											
EN NAIJUD																											
NYALA																											0.4
BARA																											
ATBARA																											
TOTAL																											21.4

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

Medium Truck

ZONE	(Vehicles per day)																										
	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	6.0				13.4		0.4	19.4	0.8	0.4	1.0	13.8	0.8	35.4	0.1	1.5		2.3	0.3	0.2							95.9
GEFIF					0.1						0.6																7.2
ET TAIYARA					0.1																						0.1
SIAPACATTA					13.5						0.3		0.6	0.3													14.7
UM RUMABA						3.9	2.1	10.8											6.9	2.1		0.6					54.0
ABU HAKRA																											3.9
SEMEIH												0.3															2.8
BAHAD										1.5	2.4	3.0										0.7					37.8
NAMA																											0.8
EL AIN												0.2															0.6
TENDELT																			0.3	0.6							3.7
KOSTI-SENAR																			0.3	6.3		0.2	0.1				24.0
WAD MEDANI																				0.9							1.7
KHARTOUM																			0.6	4.8	0.4	1.8	14.6				62.7
KASSALA																											0.1
PORT SUDAN																											2.2
MALACAL																											
EL ABBASIYA																											2.3
MUSA MURTAJIN																											8.4
KADUCI -DILLIG																											14.9
WAU-JUBA																											0.4
EN NMIUD																											2.0
NYALA																											15.6
BARA																											
ATBARA																											
TOTAL																											357.8

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

(Heavy Truck)

ZONE	(Vehicles per day)																										
	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					0.3		0.4	0.4					2.4														3.5
GEFIL																											
ET TAIYARA																											
SHAMGATTA																											
UM RUWABA																											0.3
ABU HAMRA																											
SEMEIH																											0.4
RAHAD																											0.4
NAWA																											
EL AIN																											
TENDELT																											
KOSTI-SENAR																					0.3						0.3
WAD MEDANI																											
KHARTOUM																					0.6						3.9
KASSALA																											
PORT SUDAN																											
MALACAL																											
EL ABBASIYA																											
NUBA MOUNTAIN																											
KADUQL-DILLING																											0.9
WAU-JUBA																											
EN NAHUD																											
HYALA																											0.9
BARA																											
ATDARA																											
TOTAL																											10.6

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

(BUS)

ZONE	(Vehicles per day)																										
	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							1.3						0.2													1.5	
GEFIF																											
ET TAIYARA																											
SHAMAGAYTA																											
UH RUMADA																											
ABU HAMRA																											
SEMEIH																											
RAHAD																											1.3
NAMA																											
EL AIN																											
TENDELT																											
KOSTI-SENAR																											
WAD MEDANI																											
KHARTOUM																											0.2
KASSALA																											
PORT SUDAN																											
MALACAL																											
EL ABBASIYA																											
NUBA MOUNTAIN																											
KADUQLI-DILLING																											
WAU-JUBA																											
EN NAVUD																											
NYALA																											
BARA																											
ATBARA																											
TOTAL																											3.0

Table 6-13 CLASSIFICATION OF COMMODITIES

CODE NO.	COMMODITY GROUP	NAME OF COMMODITY
10	UNPROCESSED CEREALS	• DURA • MAIZE
20	OTHER UNPROCESSED AGRICULTURAL FOODSTUFFS	• ONIONS • VEGETABLES • DATES • ARADAIB • BEANS • MANGO, FRUITS • MILK • GANZABEEL
31 32 33 34 35 36 37 30	UNPROCESSED AGRICULTURAL CASH CROPS	31. ARABIC GUM 32. GROUND NUTS 33. KARKADIE 34. WATER MELON SEEDS 35. SIMSIM 36. UMBAS (Food-stuffs for Animals) 37. COTTON 30 OTHERS
40	PROCESSED CEREAL PRODUCTS	• FLOUR • RICE
50	MANUFACTURED FOODSTUFFS	• BEER, WINE • TEA • BISCUITS, SWEETS • COFFEE • SALSA • NOODLES • SNUFF, CIGARETTES • CHEESE • PEANUTS BUTTER
60	PROCESSED AGRICULTURAL CASH CROP	• SUGAR • VEGETABLE OIL • SALT • SIMSIM OIL • SHATTA
70	LIVESTOCK AND PRODUCTS	LIVE ANIMALS / medical goods ANIMAL SKINS / carpets
80	OTHER MANUFACTURED CONSUMER GOODS	WINDOW GLASS • TABLEWARE, BEDS BATTERIES, CLOTHING SOAP, SHOES, BOOKS, TYRES, CAR, PAINT, STATIONERY PAPER, MATCHES, SPARE PARTS
90	FORESTRY PRODUCTS	FIREWOOD, CHARCOAL ZAAF
100	MINING PRODUCTS	
110	MINERAL OIL PRODUCTS	BENZINE, FUEL
120	BUILDING AND CONSTRUCTION MATERIALS	CEMENT, SAND, PLASTER, TIMBER, ZINC, AGGREGATE, IRON WATER PIPES
130	MISCELLANEOUS	BARRELS, CARION, TINS IRON BOX, SACKS
140	OTHERS	DIFFERENT GOODS, WATER

TABLE 6-14-1 COMMODITY MOVEMENT BY TRUCK, 1977

10 (Unprocessed Cereals)

(tons/day)

O \ D	Zone No. in Original O-D Table	EL OBEID	UM RUABA	RAHAD	Rest of Project Area	KHAR- TOUM	PORT SUDAN	WEST SUDAN	Rest of SUDAN	TOTAL
EL OBEID	01		18.4	2.9	1.0	11.7			4.2	38.2
UM RUABA	05	0.7		0.6	8.7					10.0
RAHAD	08		2.7							2.7
Rest of Project Area	02,03,04,06 07,09,10	3.2	2.4							5.6
KHARTOUM	14	1.1								1.1
PORT SUDAN	16									
WEST SUDAN	21,22,23,24			2.5		0.7				3.2
Rest of SUDAN	11,12,13,15,17 18,19,20,25	2.9	33.7			1.5			1.6	39.7
TOTAL	 	7.9	57.2	6.0	9.7	13.9			5.8	100.5

TABLE 6-14-2 COMMODITY MOVEMENT BY TRUCK, 1977

20 (Other Unprocessed
Agricultural Foodstuffs)

(tons/day)

O \ D	Zone No. in Original O-D Table	EL OBEID	UM RUABA	RAHAD	Rest of Project Area	KHAR- TOUM	PORT SUDAN	WEST SUDAN	Rest of SUDAN	TOTAL
EL OBEID	01		2.7	1.4		2.8			0.2	7.1
UM RUABA	05	1.7		1.3	2.1			0.3		5.4
RAHAD	08	6.7	1.8						2.1	10.6
Rest of Project Area	02,03,04,06 07,09,10	0.4								0.4
KHARTOUM	14	3.3		0.6	1.2			0.6	3.0	8.7
PORT SUDAN	16									
WEST SUDAN	21,22,23,24					6.7				6.7
Rest of SUDAN	11,12,13,15,17 18,19,20,25	5.5			1.5				12.0	19.0
TOTAL	 	17.6	4.5	3.3	4.8	9.5		0.9	17.3	57.9

TABLE 6-14-3 COMMODITY MOVEMENT BY TRUCK, 1977

30 (Unprocessed Agricultural Cash Crops,
Others)

(tons/day)

O \ D	Zone No. in Original O-D Table	EL OBEID	UM RUABA	RAHAD	Rest of Project Area	KHAR- TOUM	PORT SUDAN	WEST SUDAN	Rest of SUDAN	TOTAL
EL OBEID	01					1.9				1.9
UM RUABA	05									
RAHAD	08					1.0				1.0
Rest of Project Area	02,03,04,06 07,09,10	0.2								0.2
KHARTOUM	14									
PORT SUDAN	16									
WEST SUDAN	21,22,23,24									
Rest of SUDAN	11,12,13,15,17 18,19,20,25									
TOTAL	 	0.2				2.9				3.1

TABLE 6-14-4 COMMODITY MOVEMENT BY TRUCK, 1977

31 (Arabic Gum)

(tons/day)

O \ D	Zone No. in Original O-D Table	EL OBEID	UM RUABA	RAHAD	Rest of Project Area	KHAR- TOUM	PORT SUDAN	WEST SUDAN	Rest of SUDAN	TOTAL
EL OBEID	01		2.2			23.2	1.6		1.5	28.5
UM RUABA	05	0.3								0.3
RAHAD	08	0.8	1.3						1.8	3.9
Rest of Project Area	02,03,04,06 07,09,10		4.7							4.7
KHARTOUM	14	0.9								0.9
PORT SUDAN	16									
WEST SUDAN	21,22,23,24		0.8			2.7				3.5
Rest of SUDAN	11,12,13,15,17 18,19,20,25								0.6	0.6
TOTAL	 	2.0	9.0			25.9	1.6		3.9	42.4

TABLE 6-14-5 COMMODITY MOVEMENT BY TRUCK, 1977

32 (Ground Nuts)

(tons/day)

O \ D	Zone No. in Original O-D Table	EL OBEID	UM RUABA	RAHAD	Rest of Project Area	KHARTOUM	PORT SUDAN	WEST SUDAN	Rest of SUDAN	TOTAL
EL OBEID	01		0.4							0.4
UM RUABA	05									
RAHAD	08									
Rest of Project Area	02,03,04,06 07,09,10									
KHARTOUM	14	0.4								0.4
PORT SUDAN	16									
WEST SUDAN	21,22,23,24					1.2			0.4	1.6
Rest of SUDAN	11,12,13,15,17 18,19,20,25	0.2								0.2
TOTAL		0.6	0.4			1.2			0.4	2.6

TABLE 6-14-6 COMMODITY MOVEMENT BY TRUCK, 1977

33 (Karkadie)

(tons/day)

O \ D	Zone No. in Original O-D Table	EL OBEID	UM RUABA	RAHAD	Rest of Project Area	KHARTOUM	PORT SUDAN	WEST SUDAN	Rest of SUDAN	TOTAL
EL OBEID	01					0.4				0.4
UM RUABA	05									
RAHAD	08									
Rest of Project Area	02,03,04,06 07,09,10									
KHARTOUM	14									
PORT SUDAN	16									
WEST SUDAN	21,22,23,24									
Rest of SUDAN	11,12,13,15,17 18,19,20,25									
TOTAL						0.4				0.4

TABLE 6-14-7 COMMODITY MOVEMENT BY TRUCK, 1977

34 (Water Melon Seeds)

(tons/day)

O \ D	Zone No. in Original O-D Table	EL OBEID	UM RUABA	RAHAD	Rest of Project Area	KHARTOUM	PORT SUDAN	WEST SUDAN	Rest of SUDAN	TOTAL
EL OBEID	01					6.1	0.8		2.6	9.5
UM RUABA	05									
RAHAD	08									
Rest of Project Area	02,03,04,06 07,09,10									
KHARTOUM	14									
PORT SUDAN	16									
WEST SUDAN	21,22,23,24					7.9				7.9
Rest of SUDAN	11,12,13,15,17 18,19,20,25									
TOTAL						14.0	0.8		2.6	17.4

TABLE 6-14-8 COMMODITY MOVEMENT BY TRUCK, 1977

35 (Simsim)

(tons/day)

O \ D	Zone No. in Original O-D Table	EL OBEID	UM RUABA	RAHAD	Rest of Project Area	KHARTOUM	PORT SUDAN	WEST SUDAN	Rest of SUDAN	TOTAL
EL OBEID	01		7.4			7.0			5.4	19.8
UM RUABA	05	0.6								0.6
RAHAD	08		14.4			1.8			6.7	22.9
Rest of Project Area	02,03,04,06 07,09,10	2.0	5.9							7.9
KHARTOUM	14									
PORT SUDAN	16									
WEST SUDAN	21,22,23,24					0.6				0.6
Rest of SUDAN	11,12,13,15,17 18,19,20,25									
TOTAL		2.6	27.7			9.4			12.1	51.8

TABLE 6-14-9 COMMODITY MOVEMENT BY TRUCK, 1977

36 (Umbas; Feed for Animals)

(tons/day)

O \ D	Zone No. in Original O-D Table	EL OBEID	UM RUABA	RAHAD	Rest of Project Area	KHARTOUM	PORT SUDAN	WEST SUDAN	Rest of SUDAN	TOTAL
EL OBEID	01		0.5	1.2		26.9			2.0	30.6
UM RUABA	05									
RAHAD	08								0.4	0.4
Rest of Project Area	02,03,04,06 07,09,10									
KHARTOUM	14	0.4								0.4
PORT SUDAN	16									
WEST SUDAN	21,22,23,24					1.4				1.4
Rest of SUDAN	11,12,13,15,17 18,19,20,25								2.4	2.4
TOTAL		0.4	0.5	1.2		28.3			4.8	35.2

TABLE 6-14-10 COMMODITY MOVEMENT BY TRUCK, 1977

37 (Cotton)

(tons/day)

O \ D	Zone No. in Original O-D Table	EL OBEID	UM RUABA	RAHAD	Rest of Project Area	KHARTOUM	PORT SUDAN	WEST SUDAN	Rest of SUDAN	TOTAL
EL OBEID	01									
UM RUABA	05									
RAHAD	08									
Rest of Project Area	02,03,04,06 07,09,10									
KHARTOUM	14	0.3								0.3
PORT SUDAN	16									
WEST SUDAN	21,22,23,24									
Rest of SUDAN	11,12,13,15,17 18,19,20,25									
TOTAL		0.3								0.3

TABLE 6-14-11 COMMODITY MOVEMENT BY TRUCK, 1977

40 (Processed Cereal Products)

(tons/day)

O \ D	Zone No. in Original O-D Table	EL OBEID	UM RUABA	RAHAD	Rest of Project Area	KHARTOUM	PORT SUDAN	WEST SUDAN	Rest of SUDAN	TOTAL
EL OBEID	01			1.5						1.5
UM RUABA	05	0.6			1.2				0.4	2.2
RAHAD	08									
Rest of Project Area	02,03,04,06 07,09,10									
KHARTOUM	14	1.0						0.1	0.3	1.4
PORT SUDAN	16									
WEST SUDAN	21,22,23,24									
Rest of SUDAN	11,12,13,15,17 18,19,20,25	1.0								1.0
TOTAL		2.6		1.5	1.2			0.1	0.7	6.1

TABLE 6-14-12 COMMODITY MOVEMENT BY TRUCK, 1977

50 (Manufactured Foodstuffs)

(tons/day)

O \ D	Zone No. in Original O-D Table	EL OBEID	UM RUABA	RAHAD	Rest of Project Area	KHARTOUM	PORT SUDAN	WEST SUDAN	Rest of SUDAN	TOTAL
EL OBEID	01		0.7	1.2	0.2	4.5			3.9	10.5
UM RUABA	05	0.5								0.5
RAHAD	08									
Rest of Project Area	02,03,04,06 07,09,10									
KHARTOUM	14	18.4		1.6				9.6	2.7	32.3
PORT SUDAN	16	1.6								1.6
WEST SUDAN	21,22,23,24		1.3			6.7				8.0
Rest of SUDAN	11,12,13,15,17 18,19,20,25	2.7							0.6	3.3
TOTAL		23.2	2.0	2.8	0.2	11.2		9.6	7.2	56.2

TABLE 6-14-13 COMMODITY MOVEMENT BY TRUCK, 1977

60 (Processed Agricultural Cash Crop)

(tons/day)

O \ D	Zone No. in Original O-D Table	EL OBEID	UM RUABA	RAHAD	Rest of Project Area	KHARTOUM	PORT SUDAN	WEST SUDAN	Rest of SUDAN	TOTAL
EL OBEID	01		3.1	5.6	0.7	2.5			2.9	14.8
UM RUABA	05	4.9		4.8	6.4				2.2	18.3
RAHAD	08	9.2	5.4						2.4	17.0
Rest of Project Area	02,03,04,06 07,09,10									
KHARTOUM	14	21.6		2.4	0.6			27.8		52.4
PORT SUDAN	16							1.9		1.9
WEST SUDAN	21,22,23,24					0.4				0.4
Rest of SUDAN	11,12,13,15,17 18,19,20,25	4.9						1.3	4.5	10.7
TOTAL		40.6	8.5	12.8	7.7	2.9		31.0	12.0	115.5

TABLE 6-14-14 COMMODITY MOVEMENT BY TRUCK, 1977

70 (Livestock and Products)

(tons/day)

O \ D	Zone No. in Original O-D Table	EL OBEID	UM RUABA	RAHAD	Rest of Project Area	KHARTOUM	PORT SUDAN	WEST SUDAN	Rest of SUDAN	TOTAL
EL OBEID	01		0.3			6.6			1.1	8.0
UM RUABA	05	0.4								0.4
RAHAD	08									
Rest of Project Area	02,03,04,06 07,09,10									
KHARTOUM	14									
PORT SUDAN	16									
WEST SUDAN	21,22,23,24					3.2				3.2
Rest of SUDAN	11,12,13,15,17 18,19,20,25								1.2	1.2
TOTAL		0.4	0.3			9.8			2.3	12.8

TABLE 6-14-15 COMMODITY MOVEMENT BY TRUCK, 1977

80 (Other Manufactured Consumer Goods)

(tons/day)

O \ D	Zone No. in Original O-D Table	EL OBEID	UM RUABA	RAHAD	Rest of Project Area	KHARTOUM	PORT SUDAN	WEST SUDAN	Rest of SUDAN	TOTAL
EL OBEID	01		1.0	1.8	0.5	2.6			0.5	6.4
UM RUABA	05	0.7			0.1			0.3	0.6	1.7
RAHAD	08	0.6								0.6
Rest of Project Area	02,03,04,06 07,09,10									
KHARTOUM	14	31.9		2.2	0.7			10.8	3.0	48.6
PORT SUDAN	16	0.3			1.2					1.5
WEST SUDAN	21,22,23,24									
Rest of SUDAN	11,12,13,15,17 18,19,20,25	2.1		1.5		0.9			1.5	6.0
TOTAL		35.6	1.0	5.5	2.5	3.5		11.1	5.6	64.8

TABLE 6-14-16 COMMODITY MOVEMENT BY TRUCK, 1977

90 (Forestry Products)

(tons/day)

O \ D	Zone No. in Original O-D Table	EL OBEID	UM RUABA	RAHAD	Rest of Project Area	KHARTOUM	PORT SUDAN	WEST SUDAN	Rest of SUDAN	TOTAL
EL OBEID	01		0.1	0.2		1.2			0.3	1.8
UM RUABA	05				1.2				0.4	1.6
RAHAD	08	3.9								3.9
Rest of Project Area	02,03,04,06 07,09,10	3.8	1.6			1.2				6.6
KHARTOUM	14									
PORT SUDAN	16									
WEST SUDAN	21,22,23,24					1.6				1.6
Rest of SUDAN	11,12,13,15,17 18,19,20,25	1.0	1.2						4.6	6.8
TOTAL		8.7	2.9	0.2	1.2	4.0			5.3	22.3

TABLE 6-14-17 COMMODITY MOVEMENT BY TRUCK, 1977

100 (Mining Products)

(tons/day)

O \ D	Zone No. in Original O-D Table	EL OBEID	UM RUABA	RAHAD	Rest of Project Area	KHARTOUM	PORT SUDAN	WEST SUDAN	Rest of SUDAN	TOTAL
EL OBEID	01									
UM RUABA	05									
RAHAD	08									
Rest of Project Area	02,03,04,06 07,09,10									
KHARTOUM	14									
PORT SUDAN	16									
WEST SUDAN	21,22,23,24									
Rest of SUDAN	11,12,13,15,17 18,19,20,25									
TOTAL										0

TABLE 6-14-18 COMMODITY MOVEMENT BY TRUCK, 1977

110 (Mineral Oil Products)

(tons/day)

O \ D	Zone No. in Original O-D Table	EL OBEID	UM RUABA	RAHAD	Rest of Project Area	KHARTOUM	PORT SUDAN	WEST SUDAN	Rest of SUDAN	TOTAL
EL OBEID	01		0.1	1.8						1.9
UM RUABA	05			1.2				0.6		1.8
RAHAD	08		0.9							0.9
Rest of Project Area	02,03,04,06 07,09,10									
KHARTOUM	14	4.2			0.1			4.6		8.9
PORT SUDAN	16	4.1								4.1
WEST SUDAN	21,22,23,24		0.1							0.1
Rest of SUDAN	11,12,13,15,17 18,19,20,25									
TOTAL		8.3	1.1	3.0	0.1			5.2		17.7

TABLE 6-14-19 COMMODITY MOVEMENT BY TRUCK, 1977

120 (Building and Construction Materials)

(tons/day)

O \ D	Zone No. in Original O-D Table	EL OBEID	UM RUABA	RAHAD	Rest of Project Area	KHARTOUM	PORT SUDAN	WEST SUDAN	Rest of SUDAN	TOTAL
EL OBEID	01		2.7	0.5		2.8			0.7	6.7
UM RUABA	05	2.9		0.6	4.5					8.0
RAHAD	08	12.5								12.5
Rest of Project Area	02,03,04,06 07,09,10	0.2	6.4			0.9			1.3	8.8
KHARTOUM	14	7.8		0.9				3.5	1.8	14.0
PORT SUDAN	16	1.6								1.6
WEST SUDAN	21,22,23,24					1.9				1.9
Rest of SUDAN	11,12,13,15,17 18,19,20,25	19.3	0.9			4.0			1.9	26.1
TOTAL		44.3	10.0	2.0	4.5	9.6		3.5	5.7	79.6

TABLE 6-14-20 COMMODITY MOVEMENT BY TRUCK, 1977

130 (Miscellaneous)

(tons/day)

O \ D	Zone No. in Original O-D Table	EL OBEID	UM RUABA	RAHAD	Rest of Project Area	KHARTOUM	PORT SUDAN	WEST SUDAN	Rest of SUDAN	TOTAL
EL OBEID	01		1.0	3.3	0.2	2.9			5.3	12.7
UM RUABA	05	1.3		0.6	1.9					3.8
RAHAD	08	1.5								1.5
Rest of Project Area	02,03,04,06 07,09,10	2.4	1.5							3.9
KHARTOUM	14	5.1						0.2		5.3
PORT SUDAN	16	0.2								0.2
WEST SUDAN	21,22,23,24			1.5		0.3			0.5	2.3
Rest of SUDAN	11,12,13,15,17 18,19,20,25	1.2	1.5			1.0			1.0	4.7
TOTAL		11.7	4.0	5.4	2.1	4.2		0.2	6.8	34.4

TABLE 6-14-21 COMMODITY MOVEMENT BY TRUCK, 1977

140 (Others)

		(tons/day)								
O \ D	Zone No. in Original O-D Table	EL OBEID	UM RUABA	RAHAD	Rest of Project Area	KHARTOUM	PORT SUDAN	WEST SUDAN	Rest of SUDAN	TOTAL
EL OBEID	01		0.1	0.3	2.8	2.7			0.5	6.4
UM RUABA	05	0.1			0.4					0.5
RAHAD	08	1.2								1.2
Rest of Project Area	02,03,04,06 07,09,10	1.5								1.5
KHARTOUM	14	6.3						2.3		8.6
PORT SUDAN	16									
WEST SUDAN	21,22,23,24					1.3				1.3
Rest of SUDAN	11,12,13,15,17 18,19,20,25	1.1				1.8			0.3	3.2
TOTAL		10.2	0.1	0.3	3.2	5.8		2.3	0.8	22.7

TABLE 6-14-22 COMMODITY MOVEMENT BY TRUCK, 1977

TOTAL

		(tons/day)								
O \ D	Zone No. in Original O-D Table	EL OBEID	UM RUABA	RAHAD	Rest of Project Area	KHARTOUM	PORT SUDAN	WEST SUDAN	Rest of SUDAN	TOTAL
EL OBEID	01		40.8	21.7	5.6	105.7	2.4		31.0	207.2
UM RUABA	05	15.0		9.1	26.6			1.2	3.7	55.6
RAHAD	08	36.5	26.5			2.8			13.4	79.2
Rest of Project Area	02,03,04,06 07,09,10	13.8	22.8			2.1			1.3	40.0
KHARTOUM	14	102.9		7.8	2.7			59.7	10.8	183.9
PORT SUDAN	16	7.8			1.2			1.9		10.9
WEST SUDAN	21,22,23,24		2.2	4.0		36.9			0.9	44.0
Rest of SUDAN	11,12,13,15,17 18,19,20,25	42.0	37.3	1.5	1.5	9.3		1.3	32.3	125.2
TOTAL		218.0	129.6	44.1	37.6	156.8	2.4	64.1	93.4	746.0

(743.7)

TABLE 6-15 OD TABLE OF PASSENGER MOVEMENT BY ROAD, 1977

(All types of vehicles) 1)

ZONE	(Person per day)																										
	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	69.3				47.7	1.8	197.6	2.6	15.8	7.8	122.4	4.1	39.4	0.6	7.5	38.4	4.9	1.0									901.3 (52.5)
GEIFIL					15.0						2.4																86.7
ET TAIYARA																											
SHAWAGATTA					105.1						1.6	12.9															321.0
UM RUMABA						82.5	36.7	170.7								55.8	34.5				0.3	5.7					836.0
ABU HAMRA																											82.5
SEMEIH												4.2															44.7
RAHAD										9.9	37.8	36.9									6.1						459.2 (41.5)
NAWA																											2.8
EL AIN												1.7															17.5
TENDELTI																3.3	0.6				1.3						22.9
KOSTI-SEMAR																1.5	112.2				1.4	1.3					280.8
WAD MEDANI																	10.2										14.3
KHARTOUM																22.5	76.5	2.3	15.8	124.0							596.2 (11.0)
KASSALA																											0.6
PORT SUDAN																											9.3
MALACAL																											
EL ABBASIYA																											38.4
NUBA MOUNTAIN																											88.0
KADUGLI-DILLING																											235.0
WAU-JUBA																											2.3
EN NAHID																											24.9
NYALA																											131.6
BARA																											
ATBARA																											
TOTAL																											4,196.0 (105.0)

Note: 1) Figures in parentheses indicate those of bus and are included in the total figures.

TABLE 6-16 RAILWAY GOODS HANDLED AT MAJOR STATIONS

Station	Commodity Group Year	Forwarded			Received			Total		
		Goods Tons	Parcels Tons	Live-stock No.	Goods Tons	Parcels Tons	Live-stock No.	Goods Tons	Parcels Tons	Live-stock No.
EL OBEID	1970/71	76,575	564	67,581	139,171	2,031	-	215,746	2,595	67,581
	1971/72	77,207	448	47,795	148,973	2,422	-	226,180	2,870	47,795
	1972/73	94,089	507	43,065	110,056	2,345	9	204,145	2,852	43,074
	1973/74	68,673	413	37,629	135,304	2,224	48	203,777	2,637	37,677
	1974/75	91,308	300	22,860	98,040	3,108	420	189,348	3,408	23,280
	1975/76	66,859	2,535	32,398	147,283	7,388	1,237	214,142	9,923	33,635
EL RAHAD	1970/71	13,132	681	8,539	8,329	678	594	21,461	1,359	9,133
	1971/72	9,576	342	1,310	6,602	475	2,446	16,178	817	3,756
	1972/73	6,701	238	-	6,708	324	87	13,409	562	87
	1973/74	13,534	3,409	415	9,784	654	141	23,318	4,063	556
	1974/75	7,392	348	360	8,568	420	420	15,960	768	780
	1975/76	11,598	370	-	7,906	472	55	19,504	842	55
SEMEIH	1970/71	4,858	17	35	2,285	63	46	7,143	80	81
	1971/72	15,886	15	9	2,491	55	16	18,377	70	25
	1972/73	11,792	13	-	785	47	-	12,577	60	-
	1973/74	13,415	-	-	1,492	-	-	14,907	-	-
	1974/75	3,552	11	-	2,232	24	-	5,784	35	-
	1975/76	5,487	2	-	2,094	7	-	7,581	9	-
UM RUABA	1970/71	31,056	149	4,196	21,276	758	164	52,332	907	4,360
	1971/72	20,099	219	2,497	21,097	850	14	41,196	1,069	2,511
	1972/73	20,613	138	455	14,328	2,686	-	34,941	2,824	455
	1973/74	17,059	104	2,430	14,574	685	-	31,633	789	2,430
	1974/75	16,596	65	1,460	11,480	408	-	28,076	473	1,460
	1975/76	22,621	96	4,159	8,877	317	-	31,498	413	4,159
TOTAL	1970/71	125,621	1,411	80,351	171,061	3,530	804	296,682	4,941	81,155
	1971/72	122,768	1,024	51,611	179,163	3,802	2,476	301,931	4,826	54,087
	1972/73	133,195	896	43,520	131,877	5,402	96	265,072	6,298	43,616
	1973/74	112,681	3,926	40,474	160,954	3,563	189	273,635	7,489	40,663
	1974/75	118,848	724	24,680	120,320	3,860	840	239,168	4,684	25,520
	1975/76	106,565	3,003	36,557	166,160	8,184	1,292	272,725	11,187	37,794

Source: Saudan Railways Corporation, 1977

TABLE 6-17 PASSENGER BOOKINGS AT FOUR STATIONS

Station	Year	Class				Total
		1st	2nd	3rd	4th	
EL OBEID	1970/71	3,894	9,594	37,364	44,107	94,959
	1971/72	3,390	7,960	30,076	53,716	95,142
	1972/73	4,307	9,337	36,030	59,574	109,248
	1973/74	4,255	8,712	33,886	43,492	90,345
	1974/75	5,979	9,660	40,556	28,114	84,309
	1975/76	6,171	9,844	36,854	39,605	92,474
RAHAD	1970/71	353	1,063	5,352	44,530	51,298
	1971/72	390	977	5,565	41,198	48,130
	1972/73	476	966	5,583	37,282	44,807
	1973/74	446	933	5,747	28,577	35,703
	1974/75	324	576	4,145	23,298	28,343
	1975/76	522	1,068	5,922	23,712	31,224
SEMEIH	1970/71	39	122	786	9,252	10,199
	1971/72	31	63	579	7,092	7,765
	1972/73	34	122	662	6,689	7,507
	1973/74	79	126	607	4,600	5,412
	1974/75	34	68	494	3,432	4,028
	1975/76	60	112	362	2,634	3,168
UM RUABA	1970/71	666	1,772	7,243	46,585	56,266
	1971/72	692	1,658	6,291	45,190	53,831
	1972/73	938	1,621	7,526	38,322	48,137
	1973/74	884	1,558	6,533	27,869	36,844
	1974/75	646	1,128	5,630	23,366	30,770
	1975/76	637	883	6,317	25,490	33,327
TOTAL	1970/71	4,952	12,552	50,745	144,474	212,722
	1971/72	4,503	10,658	42,511	147,196	204,868
	1972/73	5,755	12,046	49,531	142,367	209,699
	1973/74	5,664	11,329	46,773	104,538	168,304
	1974/75	6,983	11,432	50,825	78,210	147,450
	1975/76	7,390	11,907	49,455	91,441	160,193

Source: Ibid

Annex VI-20 鉄道旅客OD表の作成

20-1. インタビューの対象列車及び、旅客

現地で、鉄道旅客に対するインタビュー調査(本文、VI章 2-2 項に述べられている)を行、たが、この時にインタビューした旅客は、列車タイプ毎に次表に示される。

ANNEX VI-20

TABLE 6-18-1 RAILWAY PASSENGERS INTERVIEWED

Date	Direction	Type of Train	Number of Passengers Interviewed	Capacity of Train (seats)	Frequency of service (times/week)
May 17	El Obeid → Khartoum	Express	1,175	961	2
May 20	Khartoum → El Obeid	Express	713	961	2
May 18	Khartoum → El Obeid	Mushtralle	713	758	5
May 19	El Obeid → Khartoum	Mushtralle	834	758	5
May 21	El Obeid → Khartoum	Mushtralle	380	758	5
May 19	Nyala → Khartoum	Mushtralle	1,035	758	4 1)
May 20	Khartoum → Nyala	Express	722	961	3 1)

Note: 1) Same number of trains is served for opposite direction.

この表に示されるように、El Obeid, Um Ruaba 間を通る列車の、主要なタイプ(ローカル列車は、含まれていない)は、全てインタビューの対象となっている。インタビューされた旅客は、各列車の乗客全員ではない。

20-2. 鉄道旅客分布パターンの推定

インタビューの結果、得られた旅客のODパターンは、列車の方向、種類によって異なるため、これを次のような方法で補正し、El Obeid - Um Ruaba の区間の鉄道旅客のODパターンを推定した。

即ち、何れの列車も乗車効率を、同じとし（ここでは、調査の結果を参考にして、100%としている）、各列車の旅客のODパターンを、方向別、列車タイプ別の1日当りの客量で、重みづけし、全旅客のODパターンとした。表(6-18-1)に示される(1列車客量×週当りの運行回数)で、インタビューの結果のOD量を拡大し、この合計を鉄道旅客のODパターンとした。列車タイプ別の客量の推定は、表(6-18-3)のように行なった。

20-3. 分布交通量

前項で得られた分布パターンと、駅別の鉄道旅客統計(El Obeid, Rahad, Semeih の旅客数)から、分布交通量を推定した。即ち、この結果である、Table (6-18-2)のOD表の内、El Obeid, Rahad, Semeih の発着量と、各駅の乗降客数として、各ゾーンペア交通量を確定した。

TABLE 6.10.3 - NUMBER OF PERSONS PER DAY

ZONE	(persons per day)																										
	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					59.6	0.3	1.2	3.4			7.0	103.1	43.7	303.9	9.2	5.2	0.5				0.6		1.3			6.1	552.1
GEIFIL																											
ET TAIYARA																											
SHAMAGATTA																											
UM RUVABA							1.9	51.1																			
ADU HAMRA												2.0	0.9	1.1													125.8
SEMEIH											9.9	2.6	0.3			2.6											18.5
RAHAD											7.5	38.7	18.7	72.4	1.7	0.7										3.5	197.7
NAWA												0.3	0.2														0.5
EL AIN												0.9	0.9														1.8
TENDELT																											31.1
KOSTI-SENAR																											259.8
WAD MEDANI																											150.6
KHARTOUM																											652.0
KASSALA																											20.2
PORT SUDAN																											12.8
MALACAL																											1.2
EL ABDASIYA																											0.5
NUBA MOUNTAIN																											5.0
KUDUGLI - DILLING																											8.6
MAU-JUBA																											2.6
EN NNUED																											52.6
NYALA																											446.1
BARA																											0.9
ATBARA																											1.3
TOTAL																											16.4
																											2,573.4

TABLE 6-19 ESTIMATE OF TRAIN CAPACITY

Train Type Class	Express		Mushtrall		Local	
	No. of Coaches	Capacity (seats)	No. of Coaches	Capacity (seats)	No. of Coaches	Capacity (seats)
Sleeper	2	26	1	13	0	-
1st Class	2	64	1	32	1	16
2nd Class	2	96	1	48	1	24
3rd Class	3	225	3	225	1	75
4th Class	5	550	4	440	1	110
Buffet	1	-	0	-	0	-
Luggage	1	-	1	-	0	-
Brake Wagon	1	-	0	-	0	-
Total	17	961	11	758	4	225

Source: Interview at El Obeid Station.

Annex VI-21 走行費用の算定

21-1 代表車の走行特性

走行費用算定の対象とする代表車は、乗用車として、Toyota Corolla 1200, バン/ピックアップとして、Toyota Land Cruiser Pick-up, 中型トラックとして、Bedford (6トン車)、大型トラックとして、Fiat 682 (11トン車) 及び、バスとして、Bedford (6トン車) の改造車を選定した。

これらの代表車の走行特性は、次表(6-20-1)～表(6-20-4)に示される。これら、平均走行速度、年間走行距離、耐用キロ、年間走行時間の間には、相互に関連があり、現地におけるインタビュー、走行調査等によって決められた。

TABLE 6-20-1 AVERAGE RUNNING SPEED

		(Km/hr)				
Road Surface	Vehicle Type	Car	Van Pick-up	Medium Truck	Heavy Truck	Bus
	Paved Road		85	75	60	60
Gravel Road		70	65	52	52	52
Hard Surface Track		60	55	45	43	45
Loose Sand Track		-	35	28	25	28

TABLE 6-20-2 ANNUAL KILOMETRAGE

		(000km)				
Paved Road		20.00	31.25	70.00	75.00	84.00
Gravel Road		16.00	27.50	60.00	63.33	72.00
Hard Surface Track		12.00	22.50	52.00	55.00	62.00
Loose Sand Track		-	18.75	33.33	35.00	40.00

TABLE 6-20-3 VEHICLE LIFE KILOMETRAGE

		(km)				
Paved Road		200,000	250,000	420,000	450,000	420,000
Gravel Road		160,000	220,000	360,000	380,000	360,000
Hard Surface Track		120,000	180,000	310,000	330,000	310,000
Loose Sand Track		-	150,000	200,000	210,000	200,000

TABLE 6-20-4 AVERAGE OPERATING HOURS PER ANNUM

		(hour/year)				
Paved Road		-	-	1,170	1,250	1,400
Gravel Road		-	-	1,150	1,220	1,380
Hard Surface Track		-	-	1,160	1,280	1,380
Loose Sand Track		-	-	1,190	1,400	1,430

21-2. 償却費および利子

1) 車輛, タイヤ, 車体価格

現地ディーラーからのヒアリングおよび車輛を輸入した時の奥運者類等から車輛価格および価格を構成する費目についての分析を行った。この結果は表(6-20-5)に示される。財政費用は車の市場価格でありこれから奥運する諸税(輸入関税, Development Tax, Bank Exchange Tax等)を差引いたものが経済費用となる。経済費用は外貨部分(車のCIF価格とした)と内貨部分(国内輸送費, 取扱手数料, 港湾荷役費用等)から構成される。車の残存価格は現地ディーラーとのインタビューの結果にもとづいて設定した。

TABLE 6-20-5 PRICE OF REPRESENTATIVE VEHICLES, 1977

Vehicle Type	Foreign Exchange 1)	Local Component 1)	Taxes & Duties 1)	Price		as of	Salvage Value (%)
				Economic 1)	Financial 1)		
Car (Toyota Corolla)	1,170	933	2,146	2,103	4,249	June, 1977	15
Van/Pick-up (Toyota Pick-up)	2,487	1,126	1,897	3,613	5,510	June, 1977	15
Medium Truck ²⁾ (Bedford)	3,541	1,326	1,533	4,867	6,400	June, 1977	30
Heavy Truck (Fiat 682)	11,312	1,542	6,374	12,854	19,228	April, 1977	30
Bus ²⁾ (Bedford)	3,541	1,326	1,533	4,867	6,400	June, 1977	30

Notes: 1) Including tyres

2) Excluding the prices of locally manufactured bodies. They are shown by Table 6-20-7.

Source: Interviews with dealers

タイアについては、対象地域で最も多く販売されている
 タイアサイズについては、車輛の種類と関係に、その価格を算定
 した。これを次に示す。

TABLE 6-20-6 PRICE OF A SET OF TYRES, 1977

Vehicle Type	Type of Tyre used	Price (₹S)		Number of Tyres
		Financial	Economic	
Car	600-12-4PR	70,000	49,996	4
Van, Pick-up	750-16-8PR	200,000	139,984	4
Medium Truck	Front:900-20-12PR	181,000	126,966	4
	Rear:1200-20-16PR	353,400	227,368	
Heavy Truck	1200-20-16PR	1,060,200	742,062	6
Bus	Front:900-20-12PR	181,400	126,966	4
	Rear:1200-20-16PR	353,400	227,368	

Source: Interviews with dealers.

スタンにはおいては、中型トラック及びバスの車体は、現地で
 製造されることが多い。車体の構造、サイズの種類があるが、
 次表(6-20-7)に示す価格に、これらの平均的価値を
 示している。

TABLE 6-20-7 PRICE OF LOCALLY MANUFACTURED BODY, 1977

	Financial ₹S	Economic ₹S
Medium Truck	1,500	1,095
Bus	2,500	1,825

Source: Interviews with dealers.

2) 償却費及び利子費の算定

自動車の償却費及び利子費は次式によつて算定した。

$$D = (C-R) \times \frac{i \times (1+i)^n}{(1+i)^n - 1} \times \frac{n}{LM}$$

この式中

D = 償却費及び利子費 (mm/km)

C = タイヤを除く車輛価格 (LS)

R = 車輛の残存価格 (LS)

i = 利子率 (10%)

n = 車輛の耐用年数 (年)

LM = 車輛の耐用走行距離 (km)

21-3 保険費用

保険費用は、車種によつて異なり、現地保険会社からの見積りに依りて下表 (6-20-8) のようになつてゐる。

TABLE 6-20-8 INSURANCE FEES

Type of Vehicle	Basis of Calculation	Financial (ES)	Economic (ES)
Car	On the first ES.1,000 5%, on the balance 3% of the total price of the vehicle	147.5	125.3
Van, Pick-up		185.3	157.5
Medium Truck	3% of the total price of the vehicle	192.0	163.2
Heavy Truck		576.8	490.3
Bus	On the first ES.1,000 6%, on the balance 3% of the total price of the vehicle. Not insurable for passengers.	222.0	188.7

Source: Blue Nile Insurance Company, Sudan.

21-4 運転手及び助手の賃金.

業務車の運行は、ドラッグストアの2人の助手に比べて行かぬ3人からスタートでは最も多い。現地のドラッグストアに比べて50%以上から。その平均値を以下に表6-20-9に示す。この月額賃金とす。

Table 6-20-9 AVERAGE MONTHLY WAGES OF DRIVERS AND ASSISTANTS

(LS/Month)

	DRIVER	ASSISTANT I	ASSISTANT II
MEDIUM TRUCK	65	23	12
HEAVY TRUCK	65	23	12
BUS	70	23	12

Wages include salaries and monetary fringe benefits.
source : interviews with drivers and transport companies.

賃金の経済費用は、収入から、所得税を差し引いたものを計算した。所得税率は次の通りである。

Table 6-20-10 TAXATION (INCOME TAX) FOR RESIDENTS

Income	On the first LS 400	following LS 200	following LS 400	following LS 1000	following LS 1000	following LS 2000	following LS 2000	following LS 2000	following LS 2000	more than LS 9000
PERCENT	0	5	10	15	20	30	40	50	50	60

Source :

21-5 車輛登録費等.

次表(6-20-11)に示すおりに、多種車の項目から
 下記あり。車種に下記あり。

Table 6-20-11. ANNUAL LICENSE FEES BY
 VEHICLE TYPE, 1977 (LS)

Vehicle Type	LICENCING FEES	TOWN DEVELOPMENT FEES	SERVICES FEES	TOTAL
CAR	8	1	2	11
VAN, PICK-UP	9	1	2	12
MEDIUM TRUCK	23	3	2	28
HEAVY TRUCK	23	3	10	36
BUS	23	3	2	28

source : KORDOFAN Province Authorities and EL OBEID
 Municipal Council

21-6 燃料消費

対象地域における特殊な道路状況下での燃料消費の推定には、困難さから予想されたため、現地調査時は、主要ODへの交通量に於いて、燃料消費量を
 50cc/m²項目に加えた。Loose Sand 及び Hard Surface
 Clay 路面の道路については、もっぱら現地での50cc/m²、
 走行調査の結果に於いて、Gravel 及び舗装道については、
 現地での調査に加えた。Quantification of Road
 User Savings, IBRD. 等の資料を参考にした。この結果
 は次表 6-20-12 に示す。

TABLE 6-20-12 FUEL CONSUMPTION

(liters per 1,000 km.)

Road Surface	Vehicle Type				
	<u>Car</u>	<u>Van, Pick-ups</u>	<u>Medium Truck</u>	<u>Heavy Truck</u>	<u>Bus</u>
Paved	80	200	250	300	250
Gravel	100	250	300	390	300
Hard Surface	120	300	375	480	375
Loose Sand	-	450	600	900	600

尚、燃料の価格は次表に示されるものを使用した。
El Obeld と Khartoum で若干異なるが、この平均値を燃料
価格とした。

TABLE 6-20-13 PRICE OF FUEL IN KHARTOUM AND EL OLEID AREAS

£S/Gasslon (£S/Liter)

	<u>With Tax</u>	<u>Without Tax</u>
Gasoline (Benzine)	0.460 (0.1012)	0.240 (0.0528)
Diesel (Gas Oil)	0.368 (0.0810)	0.312 (0.0686)

Source: Shell Oil Company, Sudan

21-7 オイル

オイルの消費量は現地調査及び "Quantification of Road User Savings, IBRD" から次表 (6-20-14) のように推定した。表 (6-20-15) はオイルの価格を示すものである。

TABLE 6-20-14 ENGINE OIL CONSUMPTION

(Liters per 1,000 km.)

Road Surface	Vehicle Type				
	Car	Van, Pick-ups	Medium Truck	Heavy Truck	Bus
Paved	1.1	1.4	2.3	6.8	2.3
Gravel	1.3	1.6	2.6	7.8	2.6
Hard Surface	1.6	1.9	3.1	9.4	3.1
Loose Sand	-	2.5	4.0	12.2	4.0

TABLE 6-20-15 PRICE OF OIL IN KHARTOUM AND EL OBEID AREA

£ S/Gallon (£ S/Liter)

	Khartoum		El Obeid	
	With Tax	Without Tax	With Tax	Without Tax
Super	2,330 (0.5125)	2,019 (0.4441)	2,370 (0.5213)	2,059 (0.4529)
Diesel	1,810 (0.3982)	1,571 (0.3456)	1,900 (0.4179)	1,661 (0.3654)

Source: Shell Oil Company, Sudan

21-8 タイヤ費

タイヤの摩耗は路面状況によって大きく異なり、Hard Surface Clay、および Loose Sand の路面については、主として現地ドライバー、ガレージカスのヒアリングによった。その他については "Quantification of Road User Savings, ICRD" 等の資料をもとに決定した。

タイヤ価格は表(6-20-6)に示される。

TABLE 6-20-16 TYRE WEAR

(000 km.)

Road Surface	Vehicle Type				
	Car	Van, Pick-ups	Medium Truck	Heavy Truck	Bus
Paved	30	38	45	45	45
Gravel	15	18	23	23	23
Hard Surface	9	10	12	12	12
Loose Sand	-	12	14	14	14

21-9 維持修繕費

対象地域の道路条件のもとでの維持修繕費は極めて高く、車輛を良好な状態に保つためには、2~3年目以降は年間 LS 2,000 以上の費用 (中型トラ)

7の場合) が加かる状況である。こうした現地での調査から
 からのヒアリングの結果及び他の F/S レポート等から、車
 両の維持修繕費に構成する部品費と、人件費に
 ついて次表 (6-20-17) と (6-20-18) に示した値を決定した。

TABLE 6-20-17 MAINTENANCE: PARTS

(% of depreciable value/1,000 km.)

Vehicle Type	Road Surface				
	Car	Van, Pick-ups	Medium Truck	Heavy Truck	Bus
Paved	0.13	0.14	0.13	0.12	0.13
Gravel	0.16	0.20	0.19	0.18	0.19
Hard Surface	0.45	0.50	0.50	0.47	0.50
Loose Sand	-	0.78	0.78	0.73	0.78

TABLE 6-20-18 MAINTENANCE: HOURS OF LABOUR

(hours/1,000 km.)

Vehicle Type	Road Surface				
	Car	Van, Pick-ups	Medium Truck	Heavy Truck	Bus
Paved	0.75	0.9	3.0	3.5	3.0
Gravel	1.0	1.3	4.9	5.7	4.9
Hard Surface	2.0	2.6	9.8	11.4	9.8
Loose Sand	-	3.6	13.7	16.0	13.7

21-10 道路勾配による補正.

走行費用は道路の勾配の影響を受ける。道路勾配の変化は、走行速度が変化することにより、燃料の費用項目がその影響を受ける。対象地域の道路が勾配平坦であるときは、燃料消費以外の項目はその影響も小さいことから、ここでは、道路勾配を燃料消費との関係として考慮した。表()にこの結果を示す。これは主として "Quantification of Road User Savings, (BRD)" に依拠している。ここでは 0~3% 程度の道路勾配を平坦とみなしている。

TABLE 6-20-19 PERCENT INCREASE OF FUEL CONSUMPTION DUE TO THE CHANGE OF ROAD GRADIENT

Gradient	PERCENT INCREASE OF FUEL CONSUMPTION DUE TO THE CHANGE OF ROAD GRADIENT		
	Car	Van, Pick-ups	Truck, Bus
0 - 3%	100	100	100
3 - 5%	110	124	143

(%)

21-11 雨期の走行費用

路面が砂や粘土 (Hard Surface Clay & Loose Sand) の路面での走行費用は降雨による影響を受ける。特に Hard Surface Clay の降雨による路面が泥濘化し、走行は著しく困難になる。Loose Sand の場合は、雨による路面が締り逆^{路面の}に走行条件はよくなるが、Q02 地帯の箇所には発生する流水による通行が遮断されたり、これを迂回するため走行距離が長くなる。これらの影響を厳密に推定することは

極めて困難であり、このため、雨季の期間中(6~9月
の4ヶ月間)には、Hard Surface Clay 上の走行
費用は、乾期の走行費用の 50% 増しとし、Loose
Sand の走行費用は、雨季、乾期ともに変更しな
いものとして決定した。

ANNEX VII

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TABLE 7-1 TRAFFIC ON PROPOSED ROAD, 1977¹⁾

(Vehicles per day)

Section Distance (Km) Type of Vehicle	01 - 10	10 - 9	9 - 8	8 - 7 2)	7 - 6	6 - 5	average
		27.3	22.2	25.7	24.7	27.7	26.6
small vehicles	7.2	5.8	5.6	4.1	3.7	3.7	
medium trucks	109.9	109.7	108.9	121.0	130.8	134.7	
large trucks	4.4	4.4	4.4	4.9	4.5	4.5	
buses	1.5	1.5	1.5	0.2	0.2	0.2	
Total	123.0	121.4	120.4	130.2	139.2	143.1	129.6

- 1) Normal Traffic is quoted by Section 3, Chapter IX.
Neither diverted nor generated traffic is included.
- 2) This section is between RAHAD and SEMEIH.

TABLE 7-2 NORMAL TRAFFIC ESTIMATE : RAHAD - SEMEIH

(Vehicle /day)

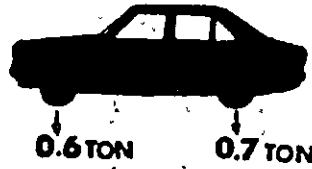
	Growth Rate per/a		T r a f f i c					
			T r u c k s			Bus	Small Vehicle	Total
			Medium Truck	Large Truck	Total			
1977		Feasibility	120.9	5.0	125.9	0.2	4.1	130.2
78		Detailed	128.0	6.7	134.7	0.2	4.4	139.3
79		Design	135.5	8.6	144.1	0.2	4.7	149.0
80			141.9	12.3	154.2	0.2	5.0	159.4
81		Construction	150.1	14.9	165.0	0.3	5.4	170.7
82			158.9	17.7	176.6	0.3	5.8	182.7
83		Open 1stY	166.2	22.7	188.9	0.3	6.2	195.4
84	7%	2	173.9	28.3	202.2	0.3	6.6	209.1
85		3	181.7	34.6	216.3	0.3	7.0	223.6
86		4	189.8	41.7	231.5	0.4	7.5	239.4
87		5	200.6	47.1	247.7	0.4	8.1	256.2
88		6	209.3	55.7	265.0	0.4	8.6	274.0
89		7	221.2	62.4	283.6	0.5	9.2	293.3
90		8	230.6	72.8	303.4	0.5	9.9	313.8
91		9	243.4	81.2	324.6	0.5	10.6	335.7
92		10	253.6	93.8	347.4	0.6	11.3	359.3
93		11	262.6	102.1	364.7	0.6	11.9	377.2
94		12	271.9	111.1	383.0	0.6	12.5	396.1
95		13	277.4	124.7	402.1	0.6	13.1	415.8
96		14	287.1	135.1	422.2	0.7	13.7	436.6
97		15	297.0	146.3	443.3	0.7	14.4	458.4
98	5%	16	302.6	162.9	465.5	0.7	15.2	481.4
99		17	312.8	176.0	488.8	0.8	15.9	505.5
2000		18	323.2	190.0	513.2	0.8	16.7	530.7
1		19	328.7	210.1	538.8	0.9	17.5	557.2
2		20thY	339.5	226.3	565.8	0.9	18.4	585.1
Total			5,073.2	2,124.8	7,198.0	11.5	234.3	7,443.8
Accumulated Traffic Volume Per 20 years			1,851,718	775,552	2,627,270	4,198	85,520	2,716,988
Equivalent Factors of Standard Axle Numbers			0.3533	2.6906	-	0.0614	0.0036	-
Total Equivalent Standard Axle Numbers			654,212	2,086,390	2,740,602	258	308	2,714,168
Diverted Traffic and others 10%			65,421	208,639	274,060	26	31	274,117
Total Standard Axle Numbers			719,633	2,295,029	3,014,662	284	339	3,015,285
Standard Axle Numbers on One Side of Carriage Way			59,817	1,147,514	1,507,331	142	170	1,507,643

FIG. 7-1

AXLE LOAD OF REPRESENTATIVE VEHICLE

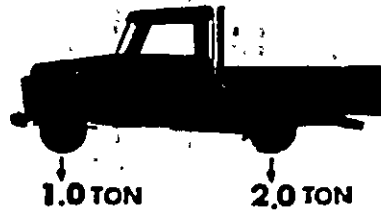
Equivalent Standard Axles

SALOON CAR: TOYOTA COROLLA



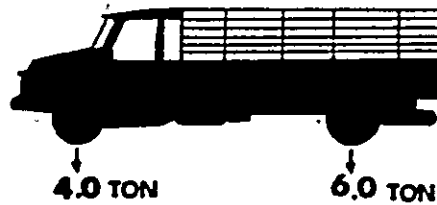
0.0002

FOUR WHEEL DRIVE VAN & PICK-UP : TOYOTA LANDCRUISER PICK-UP



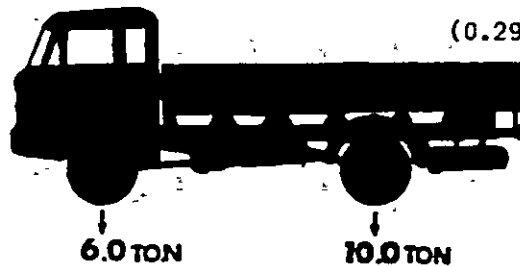
0.0036

TRUCK 6-TON LOADING CAPACITY: BEDFORD



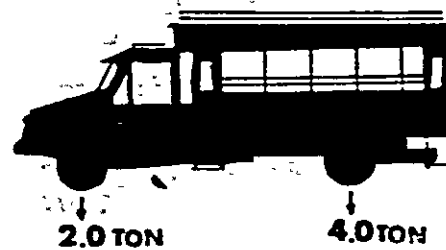
(0.0578 + 0.2955)

HEAVY TRUCK 11-TON LOADING CAPACITY : FIAT 682



(0.2955 + 2.3951)

BUS 44-PASSENGER: BEDFORD

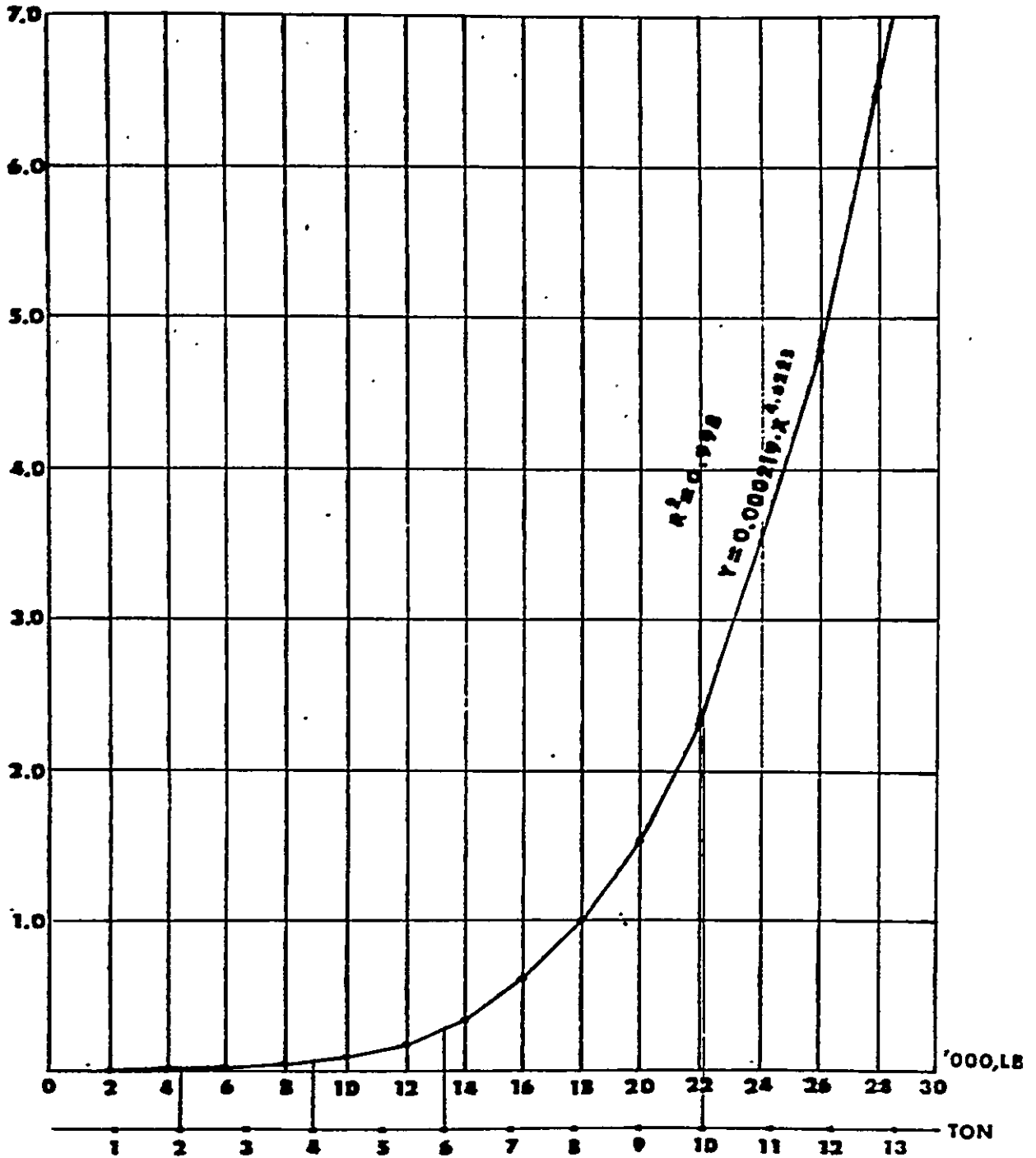


(0.0036 + 0.0578)

FIG. 7 - 2

EQUIVALENCE FACTORS FOR VARIOUS AXLE LOADING.

FLEXIBLE PAVEMENT : $PT=2.0$ $SN=3$



SOURCE : AASHTO INTERIM GUIDE FOR DESIGN OF PAVEMENT STRUCTURE 1972

TABLE 7-3 RELATIONSHIP BETWEEN ALLOWABLE
PASSING DISCHARGE AND THE COST
OF STRUCTURE

		Discharge (M ³ /Second)	Net Cost (L.S)
PIPE CULVERT	Ø1000 x 1	1.26	1,198
	Ø1000 x 2	2.52	2,167
	Ø1000 x 3	3.78	3,028
BOX CULVERT H. V. (2.0 x 1.5)	1 Cell	4.8	2,999
	2 Cells	9.6	4,738
	3 Cells	14.4	6,255
	4 Cells	24.0	11,000
BRIDGE (CONCRETE)	L=7.0M (1 span)	24.0	9,100
	L=9.0M (1 span)	32	10,744
	L=7.0Mx2 (2 spans)	49	15,037
	L=9.0Mx2 (2 spans)	65	18,384
	L=9.0Mx3 (3 spans)	98	26,021
BRIDGE (STEEL)	L=7.0 (1 span)	24	9,760
	L=14.0 (2 spans)	49	16,100

FIG. 7-3 RELATIONSHIP BETWEEN DISCHARGE AND THE COST OF STRUCTURES

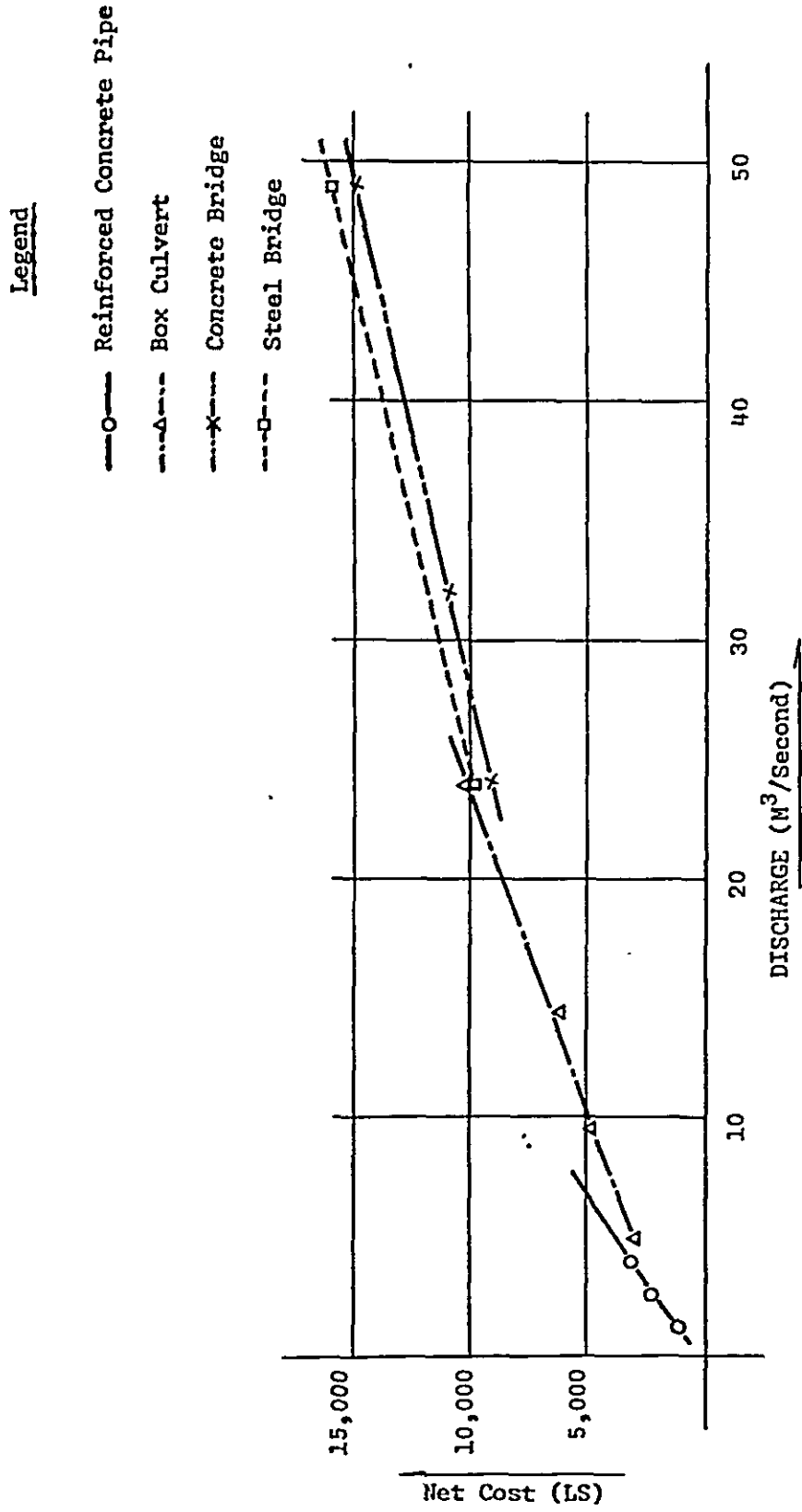
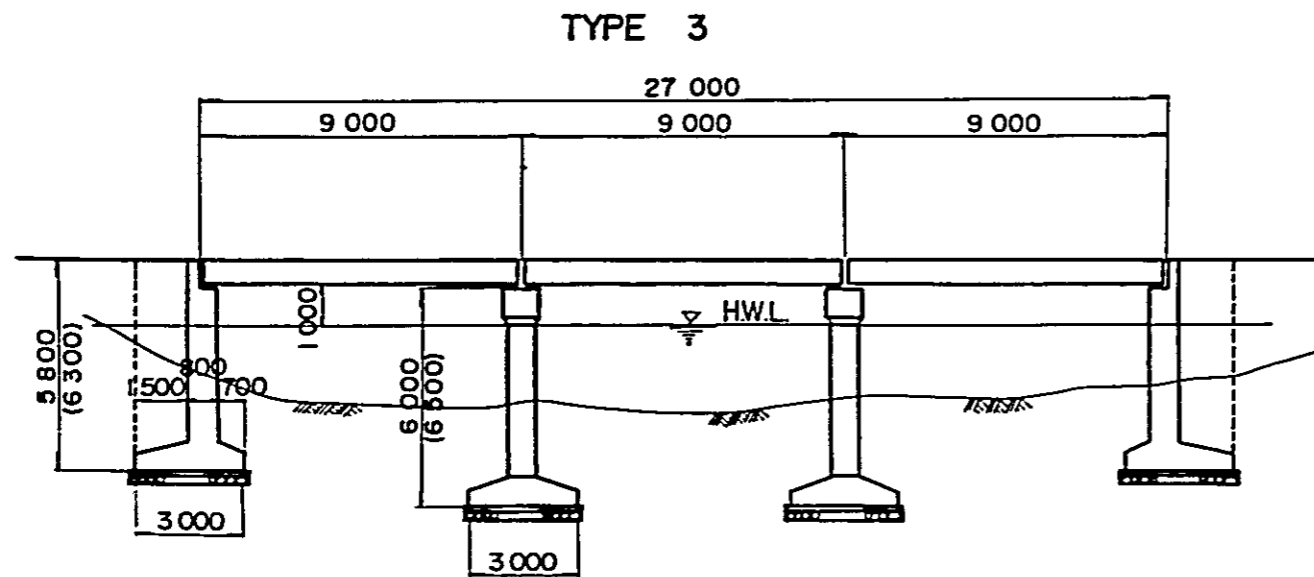
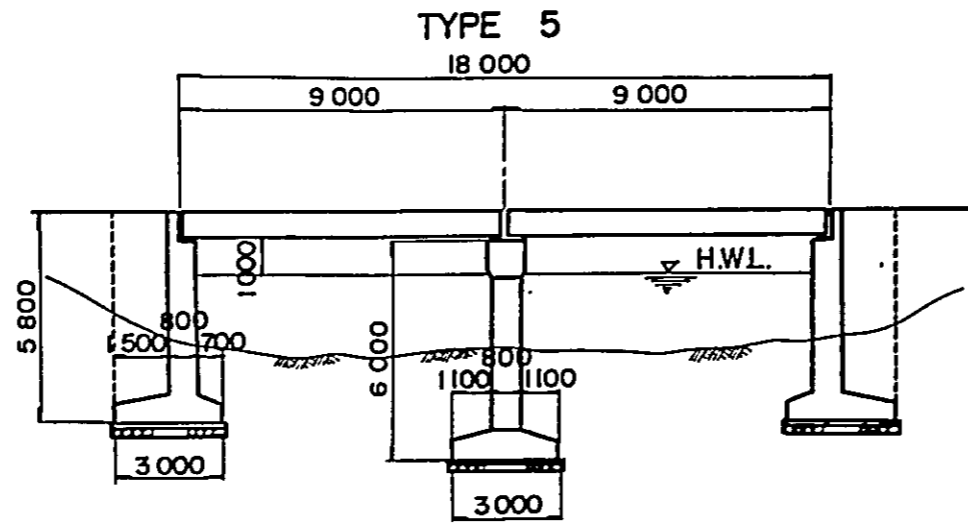
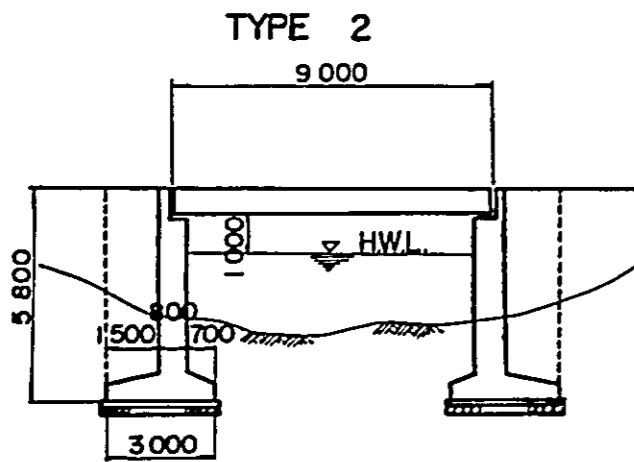
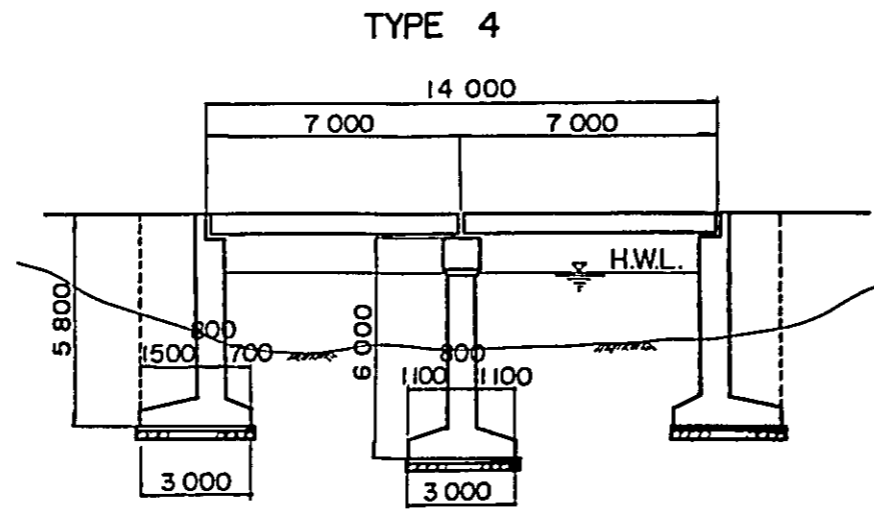
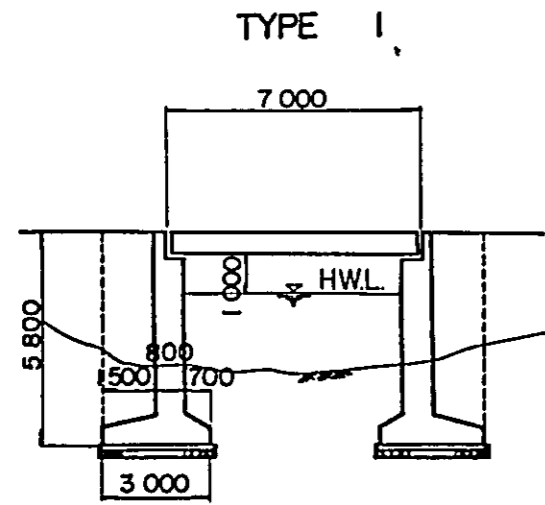


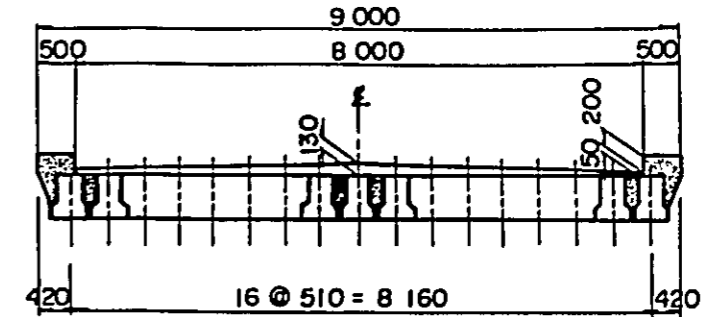
FIG VII-6 TYPE OF BRIDGE

S = 1:100

PROFILE



TYPICAL CROSS SECTION S = 1:50



Note :

1. TYPE 1 ; L = 7.0 M (1 span)
2. TYPE 2 ; L = 9.0 M (1 span)
3. TYPE 3 ; L = 7.0 M x 2 (2 spans)
4. TYPE 4 ; L = 9.0 M x 2 (2 spans)
5. TYPE 5 ; L = 9.0 M x 3 (3 spans)

FIG. 7-5 TYPE OF BOX CULVERT

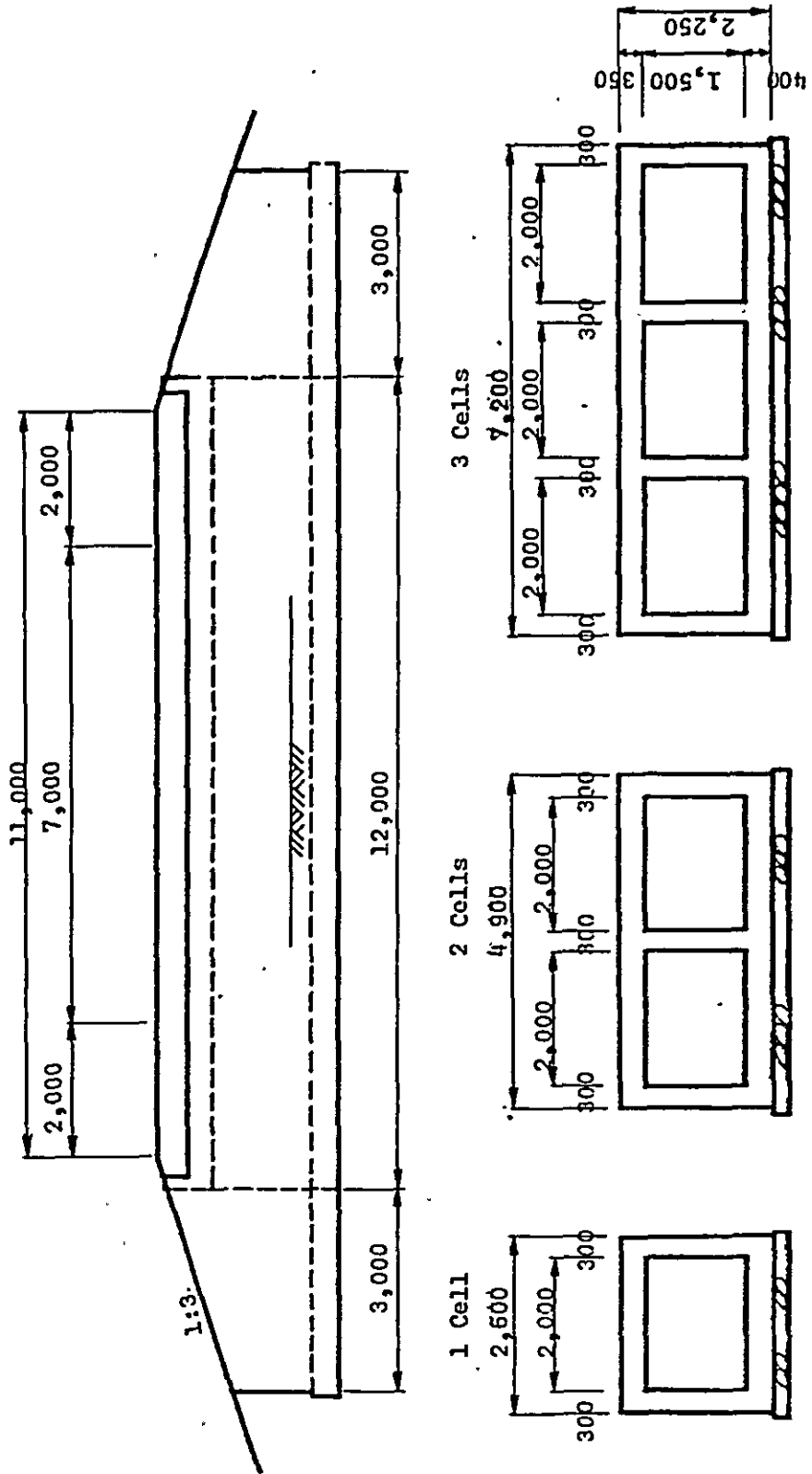


FIG. 7-6 TYPE OF PIPE CULVERT

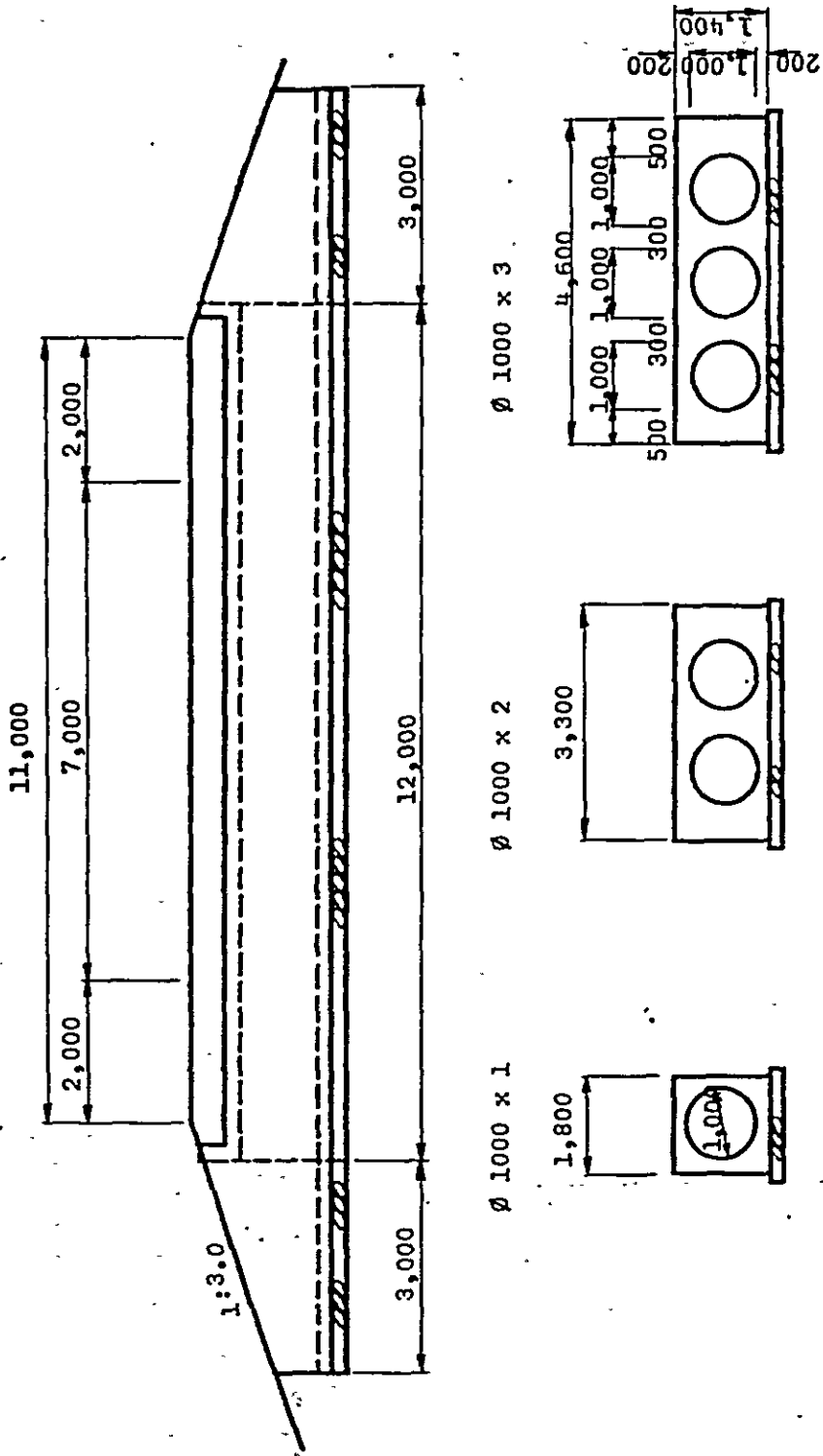


TABLE 7.4 PLANNED BRIDGE LENGTH
BASED ON ESTIMATED DISCHARGE

No.	Route	Station	Discharge	Bridge Length
1	A	6k + 430m	27.7 t/sec	L=9.0m
2	A	12 + 440	33.0	L=9.0
3	A	12 + 730	29.3	L=9.0
4	A	21 + 550	83.6	L=27.0 (9.0x3span)
5	A	22 + 950	78.5	L=27.0 (9.0x3span)
6	A	27 + 120	32.6	L=9.0
7	A	30 + 600	47.2	L=14.0 (7.0x2span)
8	A	45 + 300	30.3	L=9.0
9	A	51 + 900	39.5	L=14.0 (7.0x2span)
10	A	55 + 900	51.6	L=18.0 (9.0x2span)
11	B	13 + 400	67.7	L=27.0 (9.0x3span)
12	B	14 + 300	23.9	L=7.0
13	B	17 + 200	22.9	L=7.0
14	B	20 + 700	76.4	L=27.0 (9.0x3span)
15	B	23 + 900	42.2	L=14.0 (7.0x2span)
16	B	27 + 800	119.4	L=27.0 (9.0x3span)
17	B	28 + 700	22.9	L=7.0
18	B	29 + 550	43.2	L=14.0 (7.0x2span)
19	B	35 + 750	37.1	L=14.0 (7.0x2span)
20	B	36 + 00	53.8	L=18.0 (9.0x2span)
21	B	50 + 600	18.0	L=7.0
22	F	4 + 640	38.6	L=14.0 (7.0x2span)
23	F	7 + 750	56.6	L=14.0 (7.0x2span)
24	F	10 + 00	41.1	L=14.0 (7.0x2span)
25	C	15 + 500	21.8	L=7.0
26	C	18 + 450	17.6	L=7.0
27	C	18 + 900	19.6	L=7.0
28	D	12 + 900	21.8	L=7.0
29	D	15 + 900	17.6	L=7.0
30	D	17 + 700	19.6	L=7.0

TABLE 7-5 COMPARISON OF CONSTRUCTION COST
BETWEEN CORRUGATED PIPE AND
REINFORCED CONCRETE PIPE

Pipe Item	Per Place	
	Corrugated Pipe Ø 1000 x 1 (L=20) Net Cost (L.S)	Reinforced Concrete Pipe Ø 1000 x 1 (L=12.0) Net Cost (L.S)
Pipe	687.6	432.3
Excavation	18.4	5.4
Sand Blanket	21.3	-
Placing	183.0	-
Covering	212.3	-
Masonry	84.6	-
Concrete	-	520.3
Form Work	-	67
Reinforcement	-	155.
Gravel	-	17.8
Total	1,207.2	1,198.3

ANNEX VIII

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ANNEX VIII-1 取得価格

1.1 機械設備

機械設備の価格は、供給業者から聴取した。Table 8-1-1~2 は機械設備の取得価格と、今後の計算のために使用する1日当りの価格を、或パーセンテージで示している。Table 8-1-3 は一例として、CATERPILLER社のD7Gの取得価格の詳細を示している。

1.2 労賃

労賃は、Sudan国 RBPC ならびに ElObeid 市において、工事担当者から示された数字をもとに、以下のごとく評価されている。

地位	時間給	日額 (LS)
未熟練工	0.12	0.96
熟練工	0.20	1.60
運転者	0.25	2.00
大工	0.25	2.00
石工	0.25	2.00
機械工	0.25	2.00
職長	0.30	2.40

1.3 雑材料

i 燃料及び油脂類

燃料及び油脂類の価格は、Table 8-1-4 に示されている。

ii セメント

Sudan国には、Atbara と Kosti に、セメント工場が2ヶ所あり、それぞれ一日最大生産量は、750トン、400トンの能力を持っている。

工場渡し価格は、トン当たり25 LS である。

本プロジェクトでは、諸種の代価を計算する上で、使用したセメントの価格は、Sudan国内産のものを用いた。このことは、Kosti 工場が、やがて増産されると考えたからである。

TABLE 1. ESTIMATED COSTS OF EQUIPMENT

(LS)

Equipment	Port Sudan CIF Price	Local Component	Import Duty and Taxes	Total	Daily rate As % of Cost
1. Bulldozer D7G with Blade	41.865	15.153	5.860	62.878	0.17
2. Bulldozer D8K with Blade & Ripper	65.000	23.450	10.660	99.110	0.17
3. 623B Motor Scraper (21 cu.yd.)	68.532	24.886	25.014	118.432	0.18
4. Motor Grader (blade width 12')	21.825	8.339	7.965	38.129	0.18
5. 225 Excavator (0.7 cu.yd.)	39.285	14.650	14.338	68.273	0.22
6. Wheel Loader W90 (1.9 m ³)	23.299	8.655	8.504	40.458	0.17
7. Soil Compactor WF22A	46.697	17.043	17.044	80.784	0.17
8. Tractor Shovel D45S (1.2 m ³)	14.459	5.561	5.278	25.298	0.18
9. Tire Roller (15 tons class)	10.454	3.597	5.385	19.436	0.21
10. Macadam Roller (10 tons class)	8.853	2.997	4.559	16.409	0.18
11. Dump Truck (11 tons)	11.499	3.857	7.072	22.428	0.17
12. Flatbed Truck (10 tons)	8.335	2.828	5.127	16.290	0.34
13. Water Tanker (8,000 L.)	8.730	2.957	5.370	17.057	0.18

(LS)

Equipment	Port Sudan CIF Price	Local Component	Import Duty and Taxes	Total	Daily rate As % of Cost
14. Fuel Tanker (8 tons)	9.127	3.086	5.612	17.825	0.18
15. Asphalt Distributor (4 tons)	12.064	4.040	7.419	23.523	0.18
16. Air Compressor (10.5 m ² /min.)	5.545	1.784	2.023	9.352	0.28
17. Crawler Drill CR110	8.899	3.315	3.248	15.462	0.33
18. Generator 50HZ EG150	7.561	2.388	3.893	13.842	0.22
19. Concrete Mixer (0.4 m ³)	2.352	943	859	4.154	0.21
20. Concrete Vibrator ø2" 3/8.	238	134	88	460	0.40
21. Crushing Plant (30 T/Hr)	51.587	15.676	18.829	86.092	0.11
22. Vibration Roller (2.5 tons)	3.621	1.296	1.864	6.781	0.21
23. Asphalt Plant (60 T/Hr)	55.556	20.444	20.280	96.280	0.14
24. Asphalt Finisher (2.4 - 4.5 m)	18.487	6.747	6.970	32.204	0.17
25. Plate Compactor WUP38	1.894	692	783	3.369	0.40
26. Truck Crane NK110	15.873	5.755	5.792	27.420	0.15

Source:

TABLE 8-1-3 COST OF ACQUISITION A D7G (CAT.)A) Foreign Component

CIF Price	<u>US\$</u>	<u>LS</u>
Bare Tractor	94,960	37,683
Angle Blade	10,540	4,182
Total A	<u>105,500</u>	<u>41,865</u>

B) Custom

4, 182	x 25%	1,046
Surcharge	CIF x 5%	2,093
Quey Due	1.5%	628
Development Tax	5%	2,093
Total B		<u>5,860</u>

C) Local Component

Remittance	CIF x 15%	6,280
Profit	20%	8,373
Transport and Miscellaneous		500
Total C		<u>15,153</u>
Total A + C		57,018
Total A + B + C		62,878

TABLE 8-1-4 BREAKDOWN OF PRICE OF FUEL

(Unit: LS/gal.)

El Obeid	<u>Total</u>	<u>Tax</u>	<u>FC</u> ¹⁾	<u>LC</u>
Gasoline	0.460	0.220	0.10	0.140
Diesel	0.368	0.056	0.10	0.212

Note 1) 1 Barrel of crude oil: \$10.75

7.37 Barrel = 1 ton of crude oil

Source: Shell Oil Company, Khartoum

BREAKDOWN OF PRICE OF OIL

(Unit: LS/gal.)

El Obeid	<u>Total</u>	<u>Tax</u>	<u>FC</u>	<u>LC</u>
Price in El Obeid				
Super	2.370	0.311	1.553	0.506
Diesel	1.900	0.293	1.209	0.398

Source: Shell Oil Company, Khartoum

iii その他の材料,

現地での開きとりによつて。これは以下に示すとおりである。

TABLE 8-1-5 諸材料の価格

Item	Unit	CIF Price Port Sudan	Transport Local Cost	Taxes	Total
Bitumen	Ton	72.22	11.70	33.58	117.50
Cement	Ton		40.10	1.65	41.75
Reinforcement Bar	Ton		243.0	61.0	304.0
Structural Steel	Ton	156.0	105.0	94.0	355.0
Explosives	kg	0.98	0.15	0.39	1.52
Timber	m ³		150.0	10.0	160.0
Filler	Ton		18.10	0.55	18.65
Corrugated Pipe ϕ 1000 ^{mm}	m	32.24	11.28	11.77	55.29

ANNEX VII-2 単価

2.1 一位代価

一位代価算出に当り、ては、次によつた。

A) Peurifoy R.L. "Construction of Planning Equipment and Methods" 1970

B) El Aim 貯水池及び El Obeid 空港の工事現場の視察。

2.2 所得税

Sudan国の所得税は、ANNEX VIの Table 6-20-10に示される。

2.3 機械経費

機械設備の取得価格は、Port SudanのCIF価格に基いてゐる。
一位代価は、資産代価と運転代価に分けて算定した。

機械設備寿命年と、修繕係数は、Table 8-2-1に示す。又、主要機械所要台数は、Table 8-2-2に示す。

2.4 諸経費と利潤

諸経費と利潤は ANNEX VIII-3の TABLE 8-3-1~7
に示すように 約50%を見込んだ。

TABLE 8-2-1 DURABILITY AND REPAIR COEFFICIENT OF MECHANICAL EQUIPMENT

Mechanical equipment	Economical durability		Repair Coefficient
	Year	Hours	
Air Compressor	7	6,000	0.75
Asphalt Distributor	8	10,000	0.75
Bull-dozer	8	10,000	0.75
Concrete Mixer	8	8,000	0.75
Concrete Vibrator	4	4,000	0.8
Crawler Drill	5	6,000	0.75
Crushing Plant	12	18,000	0.75
Excavator	8	8,000	0.75
Generator	8	8,000	0.75
Line Painting Unit	4	4,000	0.8
Motor Grader	8	10,000	0.75
Motor Scraper	8	10,000	0.75
Macadam Roller	10	10,000	0.75
Tired Roller	6	8,000	0.75
Soil Compacter	10	10,000	0.6
Tractor Shovel	8	10,000	0.75
Dump Truck	5	10,000	0.75
Flat Body Truck	7	4,000	0.3
Water Tanker	8	10,000	0.75
Fuel Car	8	10,000	0.75
Vibration Roller	5	8,000	0.8
Wheel Loader	8	10,000	0.75
Pump	6	6,000	1
Asphalt Plant	10	12,000	0.75
Asphalt Finisher	8	10,000	0.75

TABLE 8-2-2 REQUIRED NUMBER OF PRINCIPAL MECHANICAL EQUIPMENT

<u>Equipment</u>	<u>PLAN 2</u>		
	<u>1980</u>	<u>1981</u>	<u>1982</u>
Bulldozer D7G	16	17	18
Grader	9	8	8
Motor Scraper	2	2	2
Tire Roller	10	8	8
Macadam Roller	6	6	6
Excavator	2	2	2
Asphalt Distributer	2	2	2
Tractor Shovel	2	2	2
Water Tanker	12	10	10
Wheel Loader	2	2	2
Crawler Drill	2	2	2
Crushing Plant	2	2	2
Dump Truck 11 t.	50	50	50

ANNEX VIII-3 Priced Bill of Quantity

ANNEX VIII-3

TABLE 8-3-1 PRICED BILL OF QUANTITY ROUTE A

Item	Construction Section				Total
	1	2	3	4	
Clearing	Quantity (M ²)	1,020,370	1,013,790	905,940	2,952,100
	Rate	0.040	0.040	0.040	0.040
	Summation	41,300	41,000	36,700	119,000
Filling	Quantity (M ³)	140,836	93,840	70,763	305,439
	Rate	0.637	0.637	0.637	0.637
	Summation	89,900	59,800	45,000	194,700
Cutting (I)	Quantity (M ³)	336,668	351,630	314,223	1,002,521
	Rate	0.110	0.110	0.110	0.108
	Summation	37,100	38,800	34,700	110,600
Cutting (II)	Quantity (M ³)	49,546	-	-	49,546
	Rate	0.715	-	-	0.715
	Summation	35,200	-	-	35,200
Slope Protection	Quantity (M ²)	115,252	95,128	85,007	295,387
	Rate	0.360	0.360	0.360	0.360
	Summation	41,600	34,300	30,600	106,500
Sub Total		245,100	173,900	147,000	566,000
Surface	Quantity (M ²)	164,533	164,533	147,000	476,066
	Rate	0.796	0.796	0.829	
	Summation	131,000	131,000	122,000	384,000
Base	Quantity (M ³)	28,200	28,200	25,200	81,600
	Rate	2.765	2.765	3.496	
	Summation	78,000	78,000	88,100	244,100
Subbase	Quantity (M ³)	58,703	58,703	52,457	169,863
	Rate	2.623	2.623	3.353	
	Summation	154,000	154,000	175,900	483,900
Shoulder	Quantity (M ³)	12,361	12,361	11,046	35,768
	Rate	1.905	1.905	1.905	1.905
	Summation	23,600	23,600	21,100	68,300
Subgrade	Quantity (M ³)	37,673	41,664	44,330	123,667
	Rate	1.278	1.278	1.278	1.278
	Summation	48,200	53,200	56,600	158,000
Sub Total		434,800	439,800	463,700	1,338,300
L = 7.0M (1 span)	Quantity (P)	-	-	-	-
	Rate	-	-	-	-
	Summation	-	-	-	-
L = 9.0M (1 span)	Quantity (P)	3	2	-	5
	Rate	10,433	10,400	-	
	Summation	31,300	20,800	-	52,100
L = 7.0M x 2 (2 span)	Quantity (P)	-	1	1	2
	Rate	-	14,800	14,800	14,800
	Summation	-	14,800	14,800	29,600
L = 9.0M x 2 (2 span)	Quantity (P)	-	-	1	1
	Rate	-	-	18,200	18,200
	Summation	-	-	18,200	18,200
L = 9.0M x 3 (3 span)	Quantity (P)	2	-	-	2
	Rate	26,350	-	-	26,350
	Summation	52,700	-	-	52,700
Sub Total		84,000	35,600	33,000	152,600

TABLE 8-3-1 PRICED BILL OF QUANTITY ROUTE A

Item	Construction Section				Total
	1	2	3	4	
2.0 x 1.5 (1 Cell)	Quantity (P)	-	-	1.0	1.0
	Rate	-	-	2,900	2,900
	Summation	-	-	2,900	2,900
2.0 x 1.5 (2 Cells)	Quantity (P)	4.0	2.0	1.0	7.0
	Rate	4,725	4,725	4,600	
	Summation	18,900	9,300	4,600	32,800
2.0 x 1.5 (3 Cells)	Quantity (P)	-	2.0	-	2.0
	Rate	-	6,200	-	6,200
	Summation	-	12,400	-	12,400
Sub Total		18,900	21,700	7,500	48,100
Pipe Culvert (ø1,000 x 1)	Quantity (P)	2	2	2	6
	Rate	1,100	1,100	1,100	1,100
	Summation	2,200	2,200	2,200	6,600
Pipe Culvert (ø1,000 x 2)	Quantity (P)	1	-	-	1
	Rate	1,900	-	-	1,900
	Summation	1,900	-	-	1,900
Pipe Culvert (ø1,000 x 3)	Quantity (P)	-	2	2	4
	Rate	-	2,700	2,700	2,700
	Summation	-	5,400	5,400	10,800
Side Ditch	Quantity (M ³)	400	-	-	400
	Rate	22.25	-	-	22.25
	Summation	8,900	-	-	8,900
Side Pipe Culvert	Quantity (M)	117	118	105	340
	Rate	22.94	22.94	22.94	22.94
	Summation	2,700	2,700	2,400	7,800
Sub Total		15,700	10,300	10,000	36,000
Stone Masonry	Quantity (M ³)	561	-	-	561
	Rate	22.28	-	-	22.28
	Summation	12,500	-	-	12,500
Sub Total		12,500	-	-	12,500
Total		811,000	681,300	661,200	2,153,500
Overhead and Profit					1,089,500
Economic Cost					3,243,000
Remarks: (P) - Places					

TABLE 8-3-2 PRICED BILL OF QUANTITY ROUTE B

Item	Construction Section				Total
	1	2	3	4	
Clearing	Quantity (M ²)	1,121,640	905,940	1,058,640	3,085,220
	Rate	0.040	0.040	0.040	
	Summation	45,300	36,700	42,800	124,800
Filling	Quantity (M ³)	104,008	76,759	120,383	301,150
	Rate	0.637	0.637	0.637	
	Summation	66,400	48,900	76,700	192,000
Cutting (I)	Quantity (M ³)	389,038	314,223	389,038	1,092,299
	Rate	0.110	0.110	0.110	
	Summation	42,900	34,700	42,900	120,500
Cutting (II)	Quantity (M ³)	-	-	-	-
	Rate	-	-	-	-
	Summation	-	-	-	-
Slope Protection	Quantity (M ²)	105,248	85,008	38,720	228,975
	Rate	0.360	0.360	0.360	
	Summation	38,000	30,600	13,900	82,500
Sub Total		192,600	150,900	176,300	519,800
Surface	Quantity (M ²)	182,000	147,000	182,000	511,000
	Rate	0.795	0.795	0.856	
	Summation	144,700	117,000	151,000	412,700
Base	Quantity (M ³)	31,200	25,000	31,200	87,400
	Rate	2.772	2.772	3.500	
	Summation	86,500	69,200	109,200	204,900
Subbase	Quantity (M ³)	64,948	52,458	64,948	182,354
	Rate	2.623	2.623	3.553	
	Summation	170,600	137,600	217,900	526,100
Shoulder	Quantity (M ³)	13,676	11,046	13,676	38,398
	Rate	1.905	1.905	1.905	
	Summation	26,300	21,100	26,300	73,700
Subgrade	Quantity (M ³)	45,913	44,331	36,192	126,436
	Rate	1.278	1.278	1.278	
	Summation	58,700	56,600	46,200	161,500
Sub Total		486,800	401,500	550,600	1,438,900
L = 7.0M (1 span)	Quantity (P)	2	1	1	4
	Rate	8,800	8,800	8,800	8,800
	Summation	17,600	8,800	8,800	35,200
L = 9.0M (1 span)	Quantity (P)	-	-	-	-
	Rate	-	-	-	-
	Summation	-	-	-	-
L = 7.0M x 2 (2 span)	Quantity (P)	-	3	-	3
	Rate	-	15,000	-	15,000
	Summation	-	45,000	-	45,000
L = 9.0M x 2 (2 span)	Quantity (P)	-	1	1	2
	Rate	-	18,200	18,200	
	Summation	-	18,200	18,200	36,400
L = 9.0M x 3 (3 span)	Quantity (P)	2	1	-	3
	Rate	26,350	26,600	-	
	Summation	52,700	26,600	-	79,300
Sub Total		70,300	98,600	27,000	195,900

TABLE 8-3-2 PRICED BILL OF QUANTITY ROUTE B

Item	Construction Section				Total
	1	2	3	4	
2.0 x 1.5 (1 Cell)	Quantity (P)	1	-	1	2
	Rate	2,900	-	2,900	2,900
	Summation	2,900	-	2,900	5,800
2.0 x 1.5 (2 Cells)	Quantity (P)	5	4	1	10
	Rate	4,725	4,725	4,600	6,633
	Summation	23,700	18,900	4,600	47,200
2.0 x 1.5 (3 Cells)	Quantity (P)	3	-	1	4
	Rate	4,740	-	4,740	4,740
	Summation	18,800	-	4,740	23,540
Sub Total		45,400	18,900	12,240	76,540
Pipe Culvert (Ø1,000 x 1)	Quantity (P)	2	2	4	8
	Rate	1,100	1,100	1,100	1,100
	Summation	2,200	2,200	4,400	8,800
Pipe Culvert (Ø1,000 x 2)	Quantity (P)	-	-	-	-
	Rate	-	-	-	-
	Summation	-	-	-	-
Pipe Culvert (Ø1,000 x 3)	Quantity (P)	-	-	2	2
	Rate	-	-	2,700	2,700
	Summation	-	-	5,400	5,400
Side Ditch	Quantity (M ³)	-	-	-	-
	Rate	-	-	-	-
	Summation	-	-	-	-
Side Pipe Culvert	Quantity (M)	130	105	130	365
	Rate	22.30	22.30	22.30	22.30
	Summation	2,900	2,400	2,900	8,200
Sub Total		5,100	4,600	12,700	22,400
Stone Masonry	Quantity (M ³)	1,148	-	-	1,148
	Rate	22.28	-	-	22.28
	Summation	25,700	-	-	25,700
Sub Total		25,700	-	-	25,700
Total		825,900	674,500	778,840	2,279,240
Overhead and Profit					1,154,300
Economic Cost					3,433,540
Remarks: (P) - Places					

TABLE 8-3-3 PRICED BILL OF QUANTITY ROUTE C

Item	Construction Section				Total
	1	2	3	4	
Clearing	Quantity (M ²)	1,025,931	1,198,259	983,592	3,207,782
	Rate	0.040	0.040	0.040	0.040
	Summation	41,500	48,300	39,800	129,600
Filling	Quantity (M ³)	254,570	256,966	24,456	535,992
	Rate	0.637	0.637	0.637	
	Summation	162,700	164,100	15,400	342,200
Cutting (I)	Quantity (M ³)	314,972	389,038	341,156	945,166
	Rate	0.110	0.110	0.110	
	Summation	34,700	42,900	37,700	115,300
Cutting (II)	Quantity (M ³)	70,200	-	-	70,200
	Rate	0.710	-	-	0.710
	Summation	50,100	-	-	50,100
Slope Protection	Quantity (M ²)	228,459	185,005	92,295	506,759
	Rate	0.362	0.451	0.451	
	Summation	82,700	84,000	41,600	208,300
Sub Total		371,700	339,300	134,500	845,500
Surface	Quantity (M ²)	161,000	182,000	159,633	502,633
	Rate	0.831	0.898	0.898	
	Summation	133,800	163,500	143,400	440,700
Base	Quantity (M ³)	27,600	31,200	27,360	86,160
	Rate	3.496	4.387	4.959	
	Summation	96,500	136,900	135,700	369,100
Subbase	Quantity (M ³)	57,454	64,948	56,954	179,356
	Rate	3.353	4.261	4.814	
	Summation	192,800	276,800	274,200	743,800
Shoulder	Quantity (M ³)	12,098	13,676	11,993	37,767
	Rate	1.905	2.339	2.643	
	Summation	23,300	32,000	31,700	87,000
Subgrade	Quantity (M ³)	80,566	94,627	107,013	282,205
	Rate	1.278	1.278	1.278	
	Summation	103,200	103,200	137,300	343,700
Sub Total		549,600	712,400	722,300	1,984,300
L = 7.0 ^M (1 span)	Quantity (P)	2	-	-	3
	Rate	8,800	-	-	8,800
	Summation	26,400	-	-	26,400
L = 9.0 ^M (1 span)	Quantity (P)	-	-	-	-
	Rate	-	-	-	-
	Summation	-	-	-	-
L = 7.0 ^M x 2 (2 span)	Quantity (P)	-	-	-	-
	Rate	-	-	-	-
	Summation	-	-	-	-
L = 9.0 ^M x 2 (2 span)	Quantity (P)	-	-	-	-
	Rate	-	-	-	-
	Summation	-	-	-	-
L = 9.0 ^M x 3 (3 span)	Quantity (P)	-	-	-	-
	Rate	-	-	-	-
	Summation	-	-	-	-
Sub Total		26,400	-	-	26,400

TABLE B-3-3 PRICED BILL OF QUANTITY ROUTE C

Item	Construction Section				Total
	1	2	3	4	
2.0 x 1.5 (1 Cell)	Quantity (P)	2	4	4	10
	Rate	2,900	2,975	2,225	
	Summation	5,800	11,900	8,900	26,600
2.0 x 1.5 (2 Cells)	Quantity (P)	-	-	-	-
	Rate	-	-	-	-
	Summation	-	-	-	-
2.0 x 1.5 (3 Cells)	Quantity (P)	-	-	-	-
	Rate	-	-	-	-
	Summation	-	-	-	-
Sub Total	5,800	11,900	8,900	26,600	
Pipe Culvert ($\phi 1,000 \times 1$)	Quantity (P)	6	6	6	18
	Rate	1,133	1,133	1,133	1,133
	Summation	6,800	6,800	6,800	20,400
Pipe Culvert ($\phi 1,000 \times 2$)	Quantity (P)	6	13	5	24
	Rate	2,000	2,000	2,000	2,000
	Summation	12,000	26,300	10,000	48,300
Pipe Culvert ($\phi 1,000 \times 3$)	Quantity (P)	4	-	5	9
	Rate	2,775	-	2,775	4,240
	Summation	11,100	-	13,900	25,000
Side Ditch	Quantity (M ³)	780	-	-	780
	Rate	22.25	-	-	22.25
	Summation	17,400	-	-	17,400
Side Pipe Culvert	Quantity (M)	115	130	114	359
	Rate	22.94	22.30	22.94	
	Summation	2,500	2,900	2,500	7,900
Sub Total	49,800	360,00	33,200	119,000	
Stone Masonry	Quantity (M ³)	1,972	2,337	-	4,309
	Rate	22.28	22.28	-	58.75
	Summation	44,200	52,500	-	96,700
Sub Total	44,200	52,500	-	96,700	
Total	1,047,500	1,152,100	898,900	3,098,500	
Overhead and Profit				1,570,100	
Economic Cost				4,668,600	
Remarks: (P) - Places					

TABLE 8-3-4 PRICED BILL OF QUANTITY ROUTE D

Item		Construction Section				Total
		1	2	3	4	
Clearing	Quantity (M ²)	836,028	1,023,804	919,285		2,779,911
	Rate	0.040	0.040	0.040		
	Summation	33,800	41,400	37,100		112,300
Filling	Quantity (M ³)	104,841	85,827	78,299		268,967
	Rate	0.637	0.637	0.637		
	Summation	66,900	54,700	49,800		171,400
Cutting (I)	Quantity (M ³)	237,913	296,567	305,096		839,576
	Rate	0.110	0.110	0.110		
	Summation	26,200	32,600	33,700		92,500
Cutting (II)	Quantity (M ³)	286,464	301,004	71,466		658,934
	Rate	0.715	0.715	0.715		
	Summation	204,800	215,300	50,900		471,000
Slope Protection	Quantity (M ²)	99,625	107,167	88,830		295,627
	Rate	0.362	0.451	0.451		
	Summation	36,000	48,300	40,200		124,500
Sub Total		367,700	392,300	211,700		971,700
Surface	Quantity (M ²)	140,033	17,500	15,200		465,233
	Rate	0.831	0.898	0.898		
	Summation	115,900	157,300	135,900		409,100
Base	Quantity (M ³)	24,000	30,038	25,920		79,958
	Rate	3.491	4.957	4.957		
	Summation	83,800	148,900	128,500		361,200
Subbase	Quantity (M ³)	49,959	62,451	53,956		166,366
	Rate	3.352	4.816	4.816		
	Summation	167,500	300,800	259,800		728,100
Shoulder	Quantity (M ³)	10,519	13,150	11,361		35,030
	Rate	1.929	2.643	2.643		
	Summation	20,300	34,800	30,000		85,100
Subgrade	Quantity (M ³)	27,840	36,366	40,958		105,164
	Rate	1.278	1.278	1.278		
	Summation	35,500	46,400	52,300		134,200
Sub Total		423,000	688,200	606,500		1,717,700
L = 7.0 ^M (1 span)	Quantity (P)	3	-	-		3
	Rate	8,800	-	-		
	Summation	26,400	-	-		26,400
L = 9.0 ^M (1 span)	Quantity (P)	-	-	-		-
	Rate	-	-	-		-
	Summation	-	-	-		-
L = 7.0 ^M x 2 (2 span)	Quantity (P)	-	-	-		-
	Rate	-	-	-		-
	Summation	-	-	-		-
L = 9.0 ^M x 2 (2 span)	Quantity (P)	-	-	-		-
	Rate	-	-	-		-
	Summation	-	-	-		-
L = 9.0 ^M x 3 (3 span)	Quantity (P)	-	-	-		-
	Rate	-	-	-		-
	Summation	-	-	-		-
Sub Total		26,400	-	-		26,400

TABLE 8-3-4 PRICED BILL OF QUANTITY ROUTE - D

Item	Construction Section				Total
	1	2	3	4	
2.0 x 1.5 (1 Cell)	Quantity (P)	-	8	2	10
	Rate	-	3,000	2,900	
	Summation	-	24,000	5,800	5,800
2.0 x 1.5 (2 Cells)	Quantity (P)	-	-	-	-
	Rate	-	-	-	-
	Summation	-	-	-	-
2.0 x 1.5 (3 Cells)	Quantity (P)	-	-	-	-
	Rate	-	-	-	-
	Summation	-	-	-	-
Sub Total	-	24,000	5,800		29,800
Pipe Culvert (ø1,000 x 1)	Quantity (P)	4	4	9	17
	Rate	1,100	1,100	1,100	
	Summation	4,400	4,400	10,100	18,900
Pipe Culvert (ø1,000 x 2)	Quantity (P)	3	3	-	6
	Rate	1,966	1,966	-	3,033
	Summation	5,900	5,900	-	11,800
Pipe Culvert (ø1,000 x 3)	Quantity (P)	1	2	-	3
	Rate	2,600	2,700	-	
	Summation	2,600	5,400	-	8,000
Side Ditch	Quantity (M ³)	1,640	2,072	484	4,196
	Rate	22.25	22.25	22.25	
	Summation	36,800	46,500	10,800	94,100
Side Pipe Culvert	Quantity (M)	100	125	108	333
	Rate	22.94	22.30	22.30	35.90
	Summation	2,300	2,800	2,400	7,500
Sub Total	52,000	65,000	23,300		140,300
Stone Masonry	Quantity (M ³)	146	-	-	146
	Rate	21.91	-	-	22.28
	Summation	3,200	-	-	3,200
Sub Total	3,200	-	-		3,200
Total	872,300	1,169,500	847,300		2,889,100
Overhead and Profit					1,463,200
Economic Cost					4,352,300

Remarks: (P) - Places

TABLE 8-3-5 PRICED BILL OF QUANTITY ROUTE E

Item	Construction Section				Total
	1	2	3	4	
Clearing	Quantity (M ²)	1,283,320	589,454	892,108	2,443,844
	Rate	0.040	0.040	0.040	
	Summation	52,000	23,700	36,000	111,700
Filling	Quantity (M ³)	81,225	31,986	68,237	181,448
	Rate	0.637	0.637	0.637	
	Summation	51,700	20,200	43,500	115,400
Cutting (I)	Quantity (M ³)	343,173	145,142	233,423	721,665
	Rate	0.110	0.110	0.110	
	Summation	37,900	15,800	25,700	79,400
Cutting (II)	Quantity (M ³)	773,130	553,091	395,778	1,722,179
	Rate	0.751	0.715	0.715	
	Summation	553,500	395,900	283,200	1,232,600
Slope Protection	Quantity (M ²)	134,784	61,625	97,989	322,907
	Rate	0.362	0.362	0.362	
	Summation	48,700	27,700	44,300	120,700
Sub Total		743,800	483,300	432,700	1,659,800
Surface	Quantity (M ²)	217,033	98,033	156,133	471,199
	Rate	0.838	0.895	0.895	
	Summation	180,300	87,800	140,200	408,300
Base	Quantity (M ³)	37,200	16,800	26,760	80,760
	Rate	3.500	4.952	4.952	
	Summation	130,200	83,200	132,700	346,100
Subbase	Quantity (M ³)	77,676	34,972	55,706	168,354
	Rate	3.354	4.816	4.816	
	Summation	260,600	168,400	268,300	697,300
Shoulder	Quantity (M ³)	16,307	7,364	11,730	35,401
	Rate	1.920	2.643	2.643	
	Summation	31,300	19,500	31,000	81,800
Subgrade	Quantity (M ³)	65,057	29,934	31,042	126,033
	Rate	1.278	1.278	1.278	
	Summation	83,300	38,100	39,600	161,000
Sub Total		685,700	397,000	611,800	1,694,500
L = 7.0 ^M (1 span)	Quantity (P)	-	-	-	-
	Rate	-	-	-	-
	Summation	-	-	-	-
L = 9.0 ^M (1 span)	Quantity (P)	-	-	-	-
	Rate	-	-	-	-
	Summation	-	-	-	-
L = 7.0 ^M x 2 (2 span)	Quantity (P)	-	-	-	-
	Rate	-	-	-	-
	Summation	-	-	-	-
L = 9.0 ^M x 2 (2 span)	Quantity (P)	-	-	-	-
	Rate	-	-	-	-
	Summation	-	-	-	-
L = 9.0 ^M x 3 (3 span)	Quantity (P)	-	-	-	-
	Rate	-	-	-	-
	Summation	-	-	-	-
Sub Total		-	-	-	-

TABLE 8-3-5 PRICED BILL OF QUANTITY ROUTE E

Item		Construction Section				Total
		1	2	3	4	
2.0 x 1.5 (1 Cell)	Quantity (P)	8	1	2		11
	Rate	3,000	2,900	2,900		
	Summation	24,000	2,900	5,800		32,700
2.0 x 1.5 (2 Cells)	Quantity (P)	3	4	1		8
	Rate	4,733	4,725	4,600		
	Summation	14,200	18,900	4,600		37,700
2.0 x 1.5 (3 Cells)	Quantity (P)	-	-	-		-
	Rate	-	-	-		-
	Summation	-	-	-		-
Sub Total		38,200	21,800	10,400		70,400
Pipe Culvert (ø1,000 x 1)	Quantity (P)	4	1	6		11
	Rate	1,100	1,100	1,132		
	Summation	4,400	1,100	6,800		12,300
Pipe Culvert (ø1,000 x 2)	Quantity (P)	-	-	-		-
	Rate	-	-	-		-
	Summation	-	-	-		-
Pipe Culvert (ø1,000 x 3)	Quantity (P)	-	-	-		-
	Rate	-	-	-		-
	Summation	-	-	-		-
Side Ditch	Quantity (M ³)	3,156	1,720	2,680		7,556
	Rate	22.50	22.50	22.50		
	Summation	70,900	38,500	60,200		169,600
Side Pipe Culvert	Quantity (M)	155	70	111		336
	Rate	22.59	21.42	22.59		
	Summation	3,500	1,500	2,500		7,500
Sub Total		78,800	41,100	69,500		189,400
Stone Masonry	Quantity (M ³)	-	-	-		-
	Rate	-	-	-		-
	Summation	-	-	-		-
Sub Total		-	-	-		-
Total		1,546,500	943,200	1,124,400		3,614,100
Overhead and Profit						1,811,200
Economic Cost						5,425,300
Remarks: (P) - Places						

TABLE 8-3-6 PRICED BILL OF QUANTITY ROUTE F

Item	Construction Section				Total	
	1	2	3	4		
Clearing	Quantity (M ²)	1,601,741	965,596	457,145	1,796,279	4,820,761
	Rate	0.040	0.040	0.040	0.040	
	Summation	64,900	38,900	18,400	72,700	194,900
Filling	Quantity (M ³)	202,799	79,337	24,495	144,812	451,443
	Rate	0.637	0.637	0.637	0.637	0.637
	Summation	129,400	50,600	15,500	92,400	287,900
Cutting (I)	Quantity (M ³)	493,030	219,957	93,793	450,088	1,246,867
	Rate	0.110	0.110	0.110	0.110	
	Summation	54,400	24,200	9,000	49,800	137,400
Cutting (II)	Quantity (M ³)	213,961	648,808	607,832	1,282,760	2,753,361
	Rate	0.715	0.715	0.715	0.715	
	Summation	152,900	464,300	434,900	918,300	1,970,400
Slope Protection	Quantity (M ²)	296,121	109,686	52,351	198,598	656,766
	Rate	0.362	0.362	0.451	0.451	
	Summation	107,400	39,600	23,500	89,800	260,300
Sub Total		509,000	617,600	501,300	1,223,000	2,850,900
Surface	Quantity (M ²)	239,066	170,500	79,200	305,200	793,966
	Rate	0.838	0.838	0.925	0.925	
	Summation	200,700	142,800	72,500	282,600	698,600
Base	Quantity (M ³)	40,980	29,220	13,572	52,358	136,130
	Rate	4.963	4.963	6.882	6.882	
	Summation	203,400	145,000	93,400	360,700	802,500
Subbase	Quantity (M ³)	85,307	60,828	28,252	10,888	330,764
	Rate	4.816	4.816	6.272	6.272	
	Summation	411,000	292,900	177,200	68,200	949,300
Shoulder	Quantity (M ³)	17,963	12,809	5,950	22,927	59,649
	Rate	1.920	1.920	2.643	2.643	
	Summation	34,500	24,600	15,700	61,000	135,800
Subgrade	Quantity (M ³)	67,238	39,844	15,743	65,025	187,851
	Rate	1.278	1.278	1.278	1.278	
	Summation	86,100	50,900	20,000	83,300	240,300
Sub Total		935,700	656,200	378,800	855,800	2,826,500
L = 7.0 ^M (1 span)	Quantity (P)	-	-	-	-	-
	Rate	-	-	-	-	-
	Summation	-	-	-	-	-
L = 9.0 ^M (1 span)	Quantity (P)	-	-	-	-	-
	Rate	-	-	-	-	-
	Summation	-	-	-	-	-
L = 7.0 ^M x 2 (2 span)	Quantity (P)	3	-	-	-	3
	Rate	14,800	-	-	-	14,800
	Summation	44,400	-	-	-	44,400
L = 9.0 ^M x 2 (2 span)	Quantity (P)	-	-	-	-	-
	Rate	-	-	-	-	-
	Summation	-	-	-	-	-
L = 9.0 ^M x 3 (3 span)	Quantity (P)	-	-	-	-	-
	Rate	-	-	-	-	-
	Summation	-	-	-	-	-
Sub Total		44,400	-	-	-	44,400

TABLE 8-3-6 PRICED BILL OF QUANTITY ROUTE F

Item	Construction Section				Total	
	1	2	3	4		
2.0 x 1.5 (1 Cell)	Quantity (P)	15	7	4	12	38
	Rate	3,000	3,000	2,975	3,000	
	Summation	45,000	21,000	11,900	36,000	113,900
2.0 x 1.5 (2 Cells)	Quantity (P)	-	1	-	1	2
	Rate	-	4,600	-	4,600	
	Summation	-	4,600	-	4,600	9,200
2.0 x 1.5 (3 Cells)	Quantity (P)	-	-	-	-	-
	Rate	-	-	-	-	-
	Summation	-	-	-	-	-
Sub Total		45,000	25,600	11,900	40,600	123,100
Pipe Culvert (\$1,000 x 1)	Quantity (P)	-	3	1	6	10
	Rate	-	1,100	1,100	1,133	
	Summation	-	3,300	1,100	6,800	11,200
Pipe Culvert (\$1,000 x 2)	Quantity (P)	-	-	-	1	1
	Rate	-	-	-	1,900	1,900
	Summation	-	-	-	1,900	1,900
Pipe Culvert (\$1,000 x 3)	Quantity (P)	2	-	-	-	2
	Rate	2,700	-	-	-	2,700
	Summation	5,400	-	-	-	5,400
Side Ditch	Quantity (M ³)	1,000	3,860	2,284	5,404	12,428
	Rate	22.50	22.50	22.50	22.50	
	Summation	22,500	86,600	51,300	121,500	281,900
Side Pipe Culvert	Quantity (M)	177	122	56	218	573
	Rate	22.59	22.95	21.42	22.95	
	Summation	4,000	2,800	1,200	5,000	13,000
Sub Total		31,900	92,700	53,600	135,200	313,400
Stone Masonry	Quantity (M ³)	761	250	-	220	1,231
	Rate	22.59	22.00	-	22.00	
	Summation	17,000	5,500	-	4,800	27,300
Sub Total		17,000	5,500	-	4,800	
Total		1,583,000	1,397,600	945,600	2,259,400	6,185,600
Overhead and Profit						3,058,000
Economic Cost						
Remarks: (P) - Places						

TABLE 8-3-7 PRICED BILL OF QUANTITY ROUTE ACCESS ROAD DBST

Item	Construction Section				Total
	1	2	3	4	
Clearing	Quantity (M ²)	794,761	801,826		1,596,587
	Rate	0.040	0.040		0.040
	Summation	31,790	32,810		64,600
Filling	Quantity (M ³)	188,817	166,092		354,909
	Rate	0.637	0.637		0.637
	Summation	120,276	106,624		226,900
Cutting (I)	Quantity (M ³)	299,260	266,341		565,601
	Rate	0.110	0.110		0.110
	Summation	33,068	29,432		62,500
Cutting (II)	Quantity (M ³)	-	217,989		217,989
	Rate	-	0.710		0.710
	Summation	-	155,800		155,800
Slope Protection	Quantity (M ²)	48,000	87,360		135,360
	Rate	0.451	0.451		0.451
	Summation	21,666	39,434		61,100
Sub Total		206,800	364,100		570,900
Surface	Quantity (M ²)	73,000	64,970		137,970
	Rate	0.898	0.898		0.898
	Summation	65,344	58,156		123,500
Base	Quantity (M ³)	12,080	12,563		24,643
	Rate	4.957	4.957		4.958
	Summation	59,902	62,298		122,200
Subbase	Quantity (M ³)	18,201	18,928		37,129
	Rate	4.816	4.816		4.816
	Summation	89,649	91,151		178,800
Shoulder	Quantity (M ³)	6,320	6,573		12,893
	Rate	2.652	2.652		2.652
	Summation	16,764	17,436		34,200
Subgrade	Quantity (M ³)	11,403	10,400		21,803
	Rate	1.278	1.278		1.278
	Summation	14,487	13,213		27,700
Sub Total		244,146	242,254		486,400
L = 7.0 ^M (1 span)	Quantity (P)	-	-		-
	Rate	-	-		-
	Summation	-	-		-
L = 9.0 ^M (1 span)	Quantity (P)	-	-		-
	Rate	-	-		-
	Summation	-	-		-
L = 7.0 ^M x 2 (2 span)	Quantity (P)	-	-		-
	Rate	-	-		-
	Summation	-	-		-
L = 9.0 ^M x 2 (2 span)	Quantity (P)	-	-		-
	Rate	-	-		-
	Summation	-	-		-
L = 9.0 ^M x 3 (3 span)	Quantity (P)	-	-		-
	Rate	-	-		-
	Summation	-	-		-
Sub Total		-	-		-

TABLE 8-3-7 PRICED BILL OF QUANTITY ROUTE ACCESS ROAD DSE.

Item	Construction Section				Total
	1	2	3	4	
2.0 x 1.5 (1 Cell)	Quantity (P)	2	3		5
	Rate	2,980	2,980		2,980
	Summation	5,960	8,940		14,900
2.0 x 1.5 (2 Cells)	Quantity (P)	-	-		-
	Rate	-	-		-
	Summation	-	-		-
2.0 x 1.5 (3 Cells)	Quantity (P)	-	-		-
	Rate	-	-		-
	Summation	-	-		-
Sub Total		5,960	8,940		14,900
Pipe Culvert (Ø1,000 x 1)	Quantity (P)	6	5		11
	Rate	1,145	1,145		1,145
	Summation	6,872	5,728		12,600
Pipe Culvert (Ø1,000 x 2)	Quantity (P)	-	-		-
	Rate	-	-		-
	Summation	-	-		-
Pipe Culvert (Ø1,000 x 3)	Quantity (P)	-	-		-
	Rate	-	-		-
	Summation	-	-		-
Side Ditch	Quantity (M ³)	-	1,128		1,128
	Rate	-	22.30		22.30
	Summation	-	25,200		25,200
Side Pipe Culvert	Quantity (M)	100	104		204
	Rate	23.00	23.00		23.00
	Summation	2,300	2,400		4,700
Sub Total		9,172	33,328		42,500
Stone Masonry	Quantity (M ³)	-	-		-
	Rate	-	-		-
	Summation	-	-		-
Sub Total		-	-		-
Total		466,078	648,632		1,114,700
Overhead and Profit					551,000
Economic Cost					1,665,700

Remarks: (P) - Places

ANNEX VII-4 総指補修費

維持補修費は、通常2つに区別して算定される。1つは、日常の維持補修であり、もう1つは定期補修である。

4.1 浸透式舗装

i 日常維持補修

浸透式(DBST)舗装のパッチング等の補修は、破損個所を見したら直ちに行うことが必要で、時期を失すると大きな負担になる。従って常時作業要員と、機械類を計画配備することが大切である。補修班の編成の一例と補修費をTABLE 8-4-1と2に示す

TABLE 8-4-1 道路補修班と機器

種 別	数 量	摘 要
人員		
班 長	1	総指揮, 技術指導
人員輸送車運転員	1	
トラック運転員	1	材料運搬用トラック運転
ローラー運転員	1	
瀝青撒布係	1	
骨材撒布係	2	
レーキマン	1	敷均し作業, 仕上げ作業
清掃係	1	清掃, 残エ片付り作業
保安交通係	2	
機械		
人員輸送車	1	人員輸送, 器材運搬用
トラック	1	骨材, 瀝青剤運搬用, ダンプ4トン積
スプレーヤー	1	タックコート用
ローラ	1	
パイプロプレート		
器具		
ツルスコップ他	1式	
材料		
骨 材	2~3m ³	
瀝 青 剤	300 l	

TABLE 8-4-2 UNIT COST OF ROAD MAINTENANCE ON BITUMINOUS SURFACED ROAD

	<u>LS/M²</u>	<u>Economic cost</u>
1. Prime Coat (or Tack Cost) 1.5 Kg/M ² MC 70 1.5 x 0.087 (87 LS/T)	0.131	
2. Aggregate 0.02 x 1.0 x 1.0 x 3.876		
3. Spreading and Compaction	0.078	
4. Bitumen Spreading 1.3 Kg/M ² MC 70 1.3 x 0.087	0.113	
5. 3/8" Aggregate 0.01 x 1.0 x 1.0 x 3.876	0.039	
6. Spreading and Compaction	0.020	
7. Bitumen Spray 1.0 x 0.087	0.087	
8. Sand Spray 0.005 x 2.335	0.012	
9. Sub Total	0.510 x 0.84 = 0.428	
10. Mobilization Cost (5% of 9)	0.25 x 0.95 = 0.024	
11. Supervising and Engineering (14% of 9)	0.070 x 0.91 = 0.064	
12. Total		0.516
13. Cost per Kilometer for 7-meter width pavement = 7.0 x 1,000 x 0.516 = 3,612 LS/KM		
14. Assuming yearly cost is 1% of the above working cost for roads with less than 500 average daily traffic (ADT)		

Yearly cost: 3,612 x 0.01 = 36 LS/KM

ii. その他の雑工事.

雑工事 即ち、路肩の維持や側溝の土浚えなどに、平均
2/7週の労力を見込む外、これに材料、器具、輸送
などの費用として25% (ただし Economic は70%
と考える) を加える。

$$\text{労賃} \quad \frac{2}{7} \times 260^{\text{日}} \times 0.96^{\text{LS}} = 71.3^{\text{LS}}$$

$$\text{材料、器具他} \quad 0.25 \times 71.3^{\text{LS}} \times 0.70 = 12.5$$

83.8 LS

以上の工事費に、一般管理費として40%を加算する。
浸透式舗装年間維持費、日平均交通量500台以下

パッキング費	雑工事費	管理費	合計 LS/km
36	83.8	47.9	168

iii 定期補修

車道幅員7メートルの浸透式舗装の工事費は前出の
とおり3,612 LS/kmである。日平均交通量500台以下という
条件では、7~8年に1回の定期補修を行えばよいと
あろう。

4.2 その他の舗装

砂利道とアスファルトコンクリート舗装道路の年間維持
補修費は浸透式舗装と類似の方法で計算した。
その価格は Table 8-4-3 に示している。定期補修
費の計算も同様を示している。

TABLE 8-4-3 SUMMARY OF MAINTENANCE AND REPAIR COSTS

	(LS/km.)	
ADT (Average Daily Traffic)	<u>Yearly Maintenance and Repair Costs</u>	<u>Periodic Resur- facing Costs</u>
<u>GRAVEL ROAD</u> W=3.5M		
>50	278	3,651
<u>DBST</u>		
< 500	168	3,612
<u>ASPHALT CONCRETE</u>		
> 500	138	14,658

ANNEX IX

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TABLE 9-1 TRAFFIC COMPOSITION ON KHARTOUM - WAD MEDANI ROAD (24 HOURS)

Station	12Km from Khartoum	9Km from Khartoum	94Km from Khartoum	
Direction	Khartoum	Wad Medani	Wad Medani	
Date of Survey	30 May 1977 2)	21 - 21 Aug. 1976 1)	21 - 27 Aug. 1976 1)	
Type of Vehicle	ADT	Percent	ADT	
		ADT	Percent	
Car Taxi	379	14.0	668	26.8
4 Wheel Drive	203	7.5	251	10.1
Box	208	7.7	-	-
Sum	790	29.2	919	36.9
Bus (Large)	219	8.1	342	13.8
Bus (Medium Small)	222	8.2	107	4.3
Sum	441	16.3	449	18.1
Total	1,231	45.5	1,368	55.0
Van Pick-up	349	12.9	479	19.2
Medium Truck	815	30.1	588	23.6
Heavy Truck	81	3.0	32	1.3
Truck Trailer	214	7.9	22	0.9
Total	1,459	53.9	1,121	45.0
Other	16	0.6	-	-
Grand Total	2,706	100.0	2,489	100.0

Type of Vehicle	ADT	Percent	ADT	Percent
Passenger Vehicles	65	14.4	46	10.2
Lorries	44	9.7	173	38.3
	4	0.9	14	3.1
	4	0.9	4	0.9
Total	235	52.0	235	100.0
Grand Total	452	100.0	452	100.0

Source: 1) RBDC, 1977
 2) JICA's Project Study Mission, May 30, 1977.

ANNEX TX-2

転換交通と其の便益

当プロジェクト道路の完成とともに、鉄道利用の旅客及び、貨物が道路輸送に転換すると思われる。この場合は、両輸送手段の運賃、手間賃、所要時間、確実さ等を判断して、いずれを利用するかを決定し、利用者は行う。転換によ、て期待される経済便益は、利用者負担の運賃節約ではなく輸送費用の差額として把握される。他の便益は計測が困難か、又は評価にも無視される位の少量なので、ここでは考えないことにした。鉄道では、既存設備でのサービスを維持する運行費で、経済代価推定を行ない、新しい鉄道への投資は、考えなかった。一方、道路は新規投資になるので、転換の可能性が生じた時は、車軸の資本費用と運行費用の両者が、経済代価を構成すると設定した。この両者の差が、転換便益になる。この際、Nyala方面と、Khartoumを結ぶ鉄道輸送は、当道路プロジェクト完成による影響は、殆んど受けないと、考えた。

2-1 旅客

i 鉄道旅客の費用

EL Obid - Khartoum 向の 1人当り鉄道輸送の経済費用は表-1のように Km 当り LS 0.05 となる。

ii 道路旅客の費用

鉄道より道路へ転換する旅客はすべてバスによると仮定した。1台のバスには総座席数44の内35名が乗車する。道路輸送では新投資で実現する道路の走行総費用がとられる。従ってバスの資本費(償却費)が含まれている。

iii 旅客の時間価値

地域農民の年間所得は、一世帯当りLS155と推定される。都市部での所得階級別分はLS200~250と予測されるが資料不足なので地域農民の年間所得をもとに、時間当り平均価値を次のように求めた。

$$LS 155 \div 5/\text{family} \div (365 \text{ days}) \div 24 \text{ hr} = 0.0035$$

しかし時間節約がスタートの現状の経済規模からみて他の経済活動に生かされるとは予測出来ない。従って時間節約価値は経済便益の計算に直接含めないこととした。

iv 鉄道旅客数と転換人数

表II-8に鉄道旅客の流動量を示す。道路建設完了後プロジェクト地域内の鉄道旅客は旅行距離が短かいので7-バス本数の多い自動車を利用する。従って地域内の旅客は全員バスに転換するとした。転換旅客人数はELObeid~Um Ruaba間760人、ELObeid~Rahad間75人、Rahad~Um Ruaba間753人である

TABLE 1 WORKING EXPENSE OF RAILWAYS

(£S)					
A	B	C	D	E	F
Revenue per Passenger - Km	Working Expense 1975/76 2)	Working Expense per Pas- senger - Km 3)	The Project Area		
			Number of Pas- sengers per Train 4)	Working Expense per Train - Km	Average Working Expense Per Person
Sleeping	0.022	386,133	0.024	[26]	0.624
1st class	0.015	675,734	0.015	[64]	4.806
2nd	0.007	772,267	0.007	[96]	÷ 961
3rd	0.004	1,448,000	0.004	[225]	= 0.005
4th	0.003	1,544,534	0.003	[550]	1.650
Total	0.004	4,826,669	0.004	[961]	4.806

- Note: 1) From Table 10.
- 2) Working Expense is divided into five classes by the percent of the revenue by class.
- 3) Calculated by dividing Column B by the figures of passenger - Km in Table 10.
- 4) From Table 6-18-3, Annex VI-20. Figures are the number of passengers, not in £S.

TABLE 2 BUS OPERATING COST

Working Cost of a Bus per Km 1)	Bus Working Cost per Km per Passenger	Bus Working Cost Between El Obeid and Khartoum per Km per Passenger (700 Km) 2)	Bus Fare Between El Obeid and Khartoum per Passenger on Paved Road 3)
<u>1. Labour</u> 0.0146		700 x 0.071	
<u>2. Fuel</u> 0.0180		= 49.98	
<u>3. Maintenance</u> 0.0148	0.0021	49.98 + 10	2.460
<u>4. Overhead etc.</u> 0.0101		= 59.98	
<u>5. Depreciation</u> 0.0139		59.98 + 35	
Total 0.0714		= 1.714	

Note: 1) From Table VI-15.

2) One nightstay of a driver and an assistance is LS 10.
Their meals, overtime charges, etc. are included.

3) The bus fare is determined by applying the existing
bus fare on the paved road of Khartoum - Wad Medani
of 185 Km.

$$0.65/185 \times 700 = 2.459$$

鉄道の長距離旅客はその発地着地が全国的に分散している。表-5に示すように

旅客トリップを El Obeid ↔ Khartoum (147人/日) と Rahad ↔ Khartoum (39人/日) の2つの交通にまとめた。

鉄道の3等、4等の料金はバスのそれより安いので、これ等の人々の道路への転換は安いものとした。

V 転換便益とバス台数

プロジェクト地域での鉄道旅客の過去数年の推移と現在の100%に近い利用効率を考えて、ここ数年の旅客は同じ人数のままと想定した。

転換した旅客の1983年以降の伸びは通常交通と同じとした。

次に示す表3と表4は表5の要約である。

TABLE 3 NUMBER OF BUSES FOR DIVERTED PASSENGERS PER DAY

Year	El Obeid	Rahad	Um Ruaba	Average
(1977)	(7.5)		(8.5)	(8.0)
1983	7.5		8.5	8.0
1992	13.8		15.6	14.7
2002	22.5		25.4	24.0

TABLE 4 ECONOMIC BENEFITS OF DIVERTED PASSENGERS

Year	(LS)	
	in 1977 Price	Discounted to 1978 at 10%
(1979)	108,138	-
1983	108,138	67,154
1992	198,758	52,333
2002	323,578	32,843

TABLE 5 TRANSPORT COSTS OF PASSENGERS

Section	Class	Train Fares by Class per Passenger (£S)	Bus Fares per Passenger (£S)	Economic Cost per Passenger		Balance (3)=(1)-(2) (£S)	No. of Diverted Passengers by Class	Benefit (3)x365xNo. of Diverted Passengers (£S)	No. of Buses
				Train (1) (£S)	Bus (2) (£S)				
		147 Km	135 Km						
El Obeid	Sleeper	2.500					4.5		
- Um Ruaba	1st	2.100					5.0		
	2nd	1.050	0.475	0.7350	0.2835	0.4515	10.6		
	3rd	0.490					28.8		
	4th	0.380					10.7		
							<u>Total</u> 59.6	9,821	1.7
		69 Km	68 Km						
El Obeid	Sleeper	2.500					-		
- Rahad	1st	1.170					0.1		
	2nd	0.595	0.239	0.345	0.1428	0.2022	-		
	3rd	0.285					2.4		
	4th	0.220					2.4		
							<u>Total</u> 4.9	362	0.1
		78 Km	67 Km						
Rahad -	Sleeper	1.875					0.4		
Um Ruaba	1st	1.125					-		
	2nd	0.565	0.235	0.390	0.1407	0.2493	4.0		
	3rd	0.265					29.4		
	4th	0.210					19.2		
							<u>Total</u> 53.0	4,823	1.5

(2)

Section	Class	Train Fares by Class per Passenger (LS)	Bus Fares per Passenger (LS)	Economic Cost per Passenger		Balance (3)=(1)-(2) (LS)	No. of Diverted Passengers by Class	Benefit (3)x365xNo. of Diverted Passengers (LS)	No. of Buses
				Train (1) (LS)	Bus (2) (LS)				
		627 Km	700 Km						
El Obeid	Sleeper	17.000					29.6		
-	1st	10.200					33.0		
Khartoum	2nd	5.100	2.460	3.135	1.714	1.412	84.3		
	3rd	2.380					-		
	4th	1.840					-		
							<u>Total 146.9</u>	76,192	4.2
		558 Km	642 Km						
Rahad -	Sleeper	12.600					9.6		
	1st	8.400					4.7		
Khartoum	2nd	4.200	2.256	2.790	1.600	1.190	24.7		
	3rd	1.960					-		
	4th	1.515					-		
							<u>Total 39.0</u>	16,940	1.1
							No.	LS.	No.
	GRAND TOTAL						303.4	108,138	8.6

2-2 貨物

1) 貨物の鉄道輸送費用

スーダン鉄道統計費用表11~12より、トン・キロ当り経済代価を推定し表-6に示す。

TABLE 6 ECONOMIC COST OF RAILWAYS FOR CARGOES, 1975/1976

(Unit: LS)

	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>
	Travel Distance per ton 1)	Revenue per ton-km. 1)	Yearly Working Expense (000) 2)	Working Expense per ton 3)	Working Expense El Obeid-Khartoum (589 km.) per ton	Working Expense El Obeid-Khartoum (1476 km) per ton
Goods	(981)	0.010				
Livestock	(807)	0.014				
Total	(981)	0.010	21.988	0.008	5.512	11.808

- Notes: 1) From Table 11
 2) From Table 12
 3) $D = 21,988,000 - 2,620,723,000 = 0.008$

主要品目の鉄道輸送の現況運賃は表-7のように
 端末の輸送費と鉄道のスケジュールの遅れによる
 倉庫保管料の支出増加分を計上している。

TABLE 7 RAILWAYS TARIFF

	The No. of Exceptional Rates in the Relevant Table 1)	Application of Scale 80% Loading	Fare per Ton 2)	Loading & Unloading Labour Charge Per-Ton	Transport Cost on Access 4 Km Per-Ton by Horse-Wagon	Additional Storage Charge due to the delay of Trains	Total Tariff on the User
1. Ground Nuts	5	24	13.30	0.55			15.370
2. Sesame	14	40	19.70	0.55			21.770
3. Gum Arabic	15	41	20.20	0.55			22.270
4. Watermelon Seed	-	26	13.90	0.83			16.250
5. Oil Cakes	-	26	13.90	0.55			15.970
6. Karkadeh	-	26	13.90	1.65		LS 0.20 x 7 days	17.070
7. Sugar	20	37	18.20	0.55	0.12		20.270
8. Salt	-	26	13.90	0.55		= LS 1.40/Ton	15.970
9. Cement	19	50	25.20	0.55			27.270
10. Onions	-	26	7.20	0.55			9.270
11. Flour	3	12	5.10	0.55			7.170
12. Dura	8	18	5.90	0.55			7.970
13. Cotton, American	41	41	18.90	1.10			21.520
14. Cotton Seed	2	23	12.10	0.83			14.450
15. Others 4)	-	26	7.20	0.55			9.270

Note: 1) From The Sudan Railway 'Tariff Table 1975'

- 2) Rates per ten Kg between El Obeid and Port Sudan of 1,475 Km are calculated by the table in 1).
- 3) Loading and Unloading charges are determined by the payment to the Labours in El Obeid crop market, where LS 0.025 per sac is paid for loading or unloading.
One sac is in average with the weight of two quarters (200 lb)
1 Kg = 2.2 lb 1 ton = 2,200 lb = 22 quarters = 11 sac
Loading and unloading of 1 ton = 0.025 x 11 x 2 = LS 0.55
- 4) Others are carried between El Obeid and Khartoum.
- 5) Between El Obeid and Khartoum of 690 Km.
- 6) Between Semeh and Port Sudan of 1,385 Km.

TABLE 8 WORKING EXPENSE OF TRUCKS

(£S)

	Working Expense of 11-ton Capacity Truck on Paved Road (LS/Km) 1)	Working Expense per ton-Km 2)	Working Cost on El Obeid-Khartoum Road of 700 Km 3)	Working Cost on El Obeid-Port Sudan Road of 1,550 Km 3)	Working Cost on Semeih-Port Sudan Road of 1,450 Km 4)
Labour	0.01563		78.589	174.019	162.792
Fuel	0.02300	0.11229/8.0	10.000	20.000	20.000
Maintenance	0.02806	= 0.01403	4.400	4.400	4.400
Overhead, etc.	0.01958		92.989	198.419	187.192
Depreciation	0.0260		per truck	per truck	per truck
			11.624	24.802	23.399
			per ton	per ton	per ton
Total	0.11227				

Note: 1) From Table VI-14

2) $0.11227 + 8.0 = 0.01403$. The traffic study in the project area shows that the loading rate in terms of tonnage is approximately 80%. It is applied here to estimate economic cost per ton.

3) When the distance of truck operation is longer, the working cost will increase because an additional expense will be necessary to cover the allowance for items such as overtime charges, meals, and the over-night stops of drivers and assistants. It is assumed one night stop for El Obeid-Khartoum trip, and two night stops for El Obeid-Port Sudan trip. The former will cost LS 10 and the latter LS 20. It is assumed the whole road is paved in 1982.

4) Loading and unloading costs are estimated for each trip as LS 0.55/ton and LS 4.4/truck.

TABLE 9 TRUCK FARE ON THE PROJECT ROADS

	Rates per Quarter	Rates per Ton 22 Quarter = 1 Ton LS/Ton	Loading & Unloading Charge per Ton	Rates Loading & Unloading Charge per Ton
1. Ground Nuts	1.20	26.4	0.55	26.95
2. Sesame	1.40	30.8	0.55	31.35
3. Gum Arabic	1.60	35.2	0.55	35.75
4. Watermelon Seed	1.20	26.4	0.83	27.23
5. Oil Cakes	1.20	26.4	0.55	26.95
6. Karkadeh	1.40	30.8	1.65	32.45
7. Sugar	2.00	44.0	0.55	44.55
8. Salt	2.00	44.0	0.55	44.55
9. Cement	2.85	62.7	0.55	63.25
10. Onions	0.70	15.4	0.55	15.95
11. Flour	0.70	15.4	0.55	15.95
12. Dura	0.70	15.4	0.55	15.95
13. Cotton, American	1.20	26.4	0.55	26.95
14. Cotton Seed	1.20	26.4	0.83	27.23
15. Others	0.70	15.4	0.55	15.95

Source: Interviews in the project area

Note : All goods are carried between El Obeid and Port Sudan except 1)
El Obeid-Khartoum and 2) Semeih-Khartoum.

ii トラックの貨物輸送費用

自動車走行費用は、第VI章42、既に推定されている。これに基づいて次の表に示す経済代価での走行費、表8を得た。E/Obeid~Khartoumの道路完成後を想定し、運賃を調査したものを表9に示す。

iii 転換交通量

荷主が輸送手段を選択する場合は一般にその運賃の大小によつて考えられる。鉄道とトラックの運賃を示す表7と表9をみるといずれの品目も鉄道輸送の方が安い。さらにそれぞれの輸送費用の経済代価を示す表6と表8をみると同じく鉄道の方が小さい。従つて輸送コストの比較でみる限り現在、鉄道を利用している貨物が道路輸送に転ずることはないと考えた。

既にかなりの物貨が現道利用のトラックで運ばれておりこれは Annex VII-161に示される。トラックを利用する荷主は輸送費の大小よりも他の時間的要素 例えは「船積のタイミング」、貨物の市場価格の変動、積換の煩わしさ等を勘案してのことで、この様な時間節約の便益があるからこそ鉄道より高いコストのトラック輸送を利用しているわけである。これは時間節約の便益は経済評価が困難なので計量出来ない社会便益の1つとして考えればよいと判断した。舗装道路建設後にはさらにトラック輸送に転換することも考えられる。これらの転換は費用そのものよりも既存のトラック輸送の物資と同じく時間節約の価値を重く見ているからだと予想される。従つてこれらの便益は計量出来ない社会便益として考え経済的費用便益分析での転換便益には含めないこととした。

TABLE 10 THE SUDAN RAILWAYS CORPORATION, TRAFFIC VOLUMES, 1974/75 AND 1975/76

1. Passengers	Passengers		Passenger - Km		Revenue	
	1974/75	1975/76	1974/75	1975/76	1974/75	1975/76
						(£S '000)
Sleeping Supp.	24,694	(1) 29,999	13,412	(1) 16,226	302	(8) 365
1st Class	79,366	(4) 111,140	38,218	(4) 44,157	563	(14) 662
2nd Class	233,862	(8) 232,062	98,306	(10) 114,131	735	(16) 785
3rd Class	865,955	(32) 970,923	361,521	(36) 417,125	1,255	(30) 1,460
4th Class	1,742,673	(55) 1,725,081	590,409	(49) 575,019	1,574	(32) 1,553
Total	2,946,550	(100) 3,069,205	1,101,866	(100) 1,166,658	4,429	(100) 4,824
2. Goods and Animals	Goods in tons		Goods ton - Km			
	1974/75	1975/76	1974/75	1975/76	1974/75	1975/76
Export	643,933	815,426				
Import	1,311,742	1,494,409				
Local	433,661	346,282				
Total	2,389,336	2,656,117	2,159,739	2,607,450	18,359	26,175
Livestock (Head) in Equivalent tons	(397,000)	(242,000)	15,640	13,273		
Total	2,400,258	2,672,556	2,175,379	2,620,723	18,559	26,355

Source: Sudan Railways Corporation, Ibid.

Note : () shows a percentage composi.

TABLE 11 THE SUDAN RAILWAYS CORPORATION,
WORKING EXPENSES, 1974/75 AND 1975/76

(in £S)

	1974/75	1975/76
Locomotives Running	6,455,593	6,561,119
Personnel	1,622,350	1,811,036
Fuel	4,443,197	4,152,862
Stores	157,786	301,036
Water Supply	232,260	296,185
Rolling Stock Maintenance	6,311,930	7,551,324
Superintendence	364,116	439,692
Locomotives	3,436,451	4,004,425
Coaching & Freight	2,511,363	3,107,207
Traffic	4,421,365	4,796,294
Personnel	3,763,947	3,899,152
Others	657,418	897,142
Way and Works	3,873,134	4,489,564
Superintendence	419,569	487,012
Permanent Way, Builds	2,359,431	2,807,408
Signals, Telegraph	253,005	272,063
Bridges, Roads, etc.	542,146	422,731
Others	298,983	500,350
General Charges	3,429,965	3,416,527
Personnel	3,429,965	2,482,982
Others	-	933,545
Total	24,491,987	26,814,828

Source: Sudan Railways Corporation Annual Report, 1975-76.

Note: Depreciation charges are not included in this table. The statistics show the percentage shares of working expense, including depreciation, are 19% for passenger service and 81% for goods in 1974/75 and 18% and 82% respectively in 1975/76. In 1975/76 the working expense is calculated as follows:

Passengers (18%)	4,826,669
Goods (82%)	21,988,159
Total (100%)	26,814,828

TABLE 12 THE SUDAN RAILWAYS CORPORATION,
OPERATIONS, 1974/75 AND 1975/76

	Unit	1974/75	1975/76
1. Passengers			
Train - Km	Km	1,114,000	1,163,000
Vehicle - Km	Km	29,365,000	28,687,000
Average Veh./Tr.	No.	26.4	24.7
Passengers	No.	2,946,550	3,069,205
Passenger - Km	'000 Km	1,101,866	1,166,658
Revenues	£S	4,429,000	4,824,000
2. Goods			
Train - Km	Km	4,860,000	5,341,000
Vehicle - Km	Km	132,291,000	140,961,000
Average Veh./Tr.	No.	27.2	26.3
Goods carried	Ton	2,400,258	2,672,556
Goods - Ton - Km	'000 Km	2,175,379	2,620,723
Revenues	£S	18,559,000	26,355,000

Source: Sudan Railways Corporation, Ibid.

El Obeid -- Um Ruaba Road

PLAN 1 Average Number of Vehicle by Type (ADT)

Type of Vehicle Traffic by year		Small Vehicles	Medium size Trucks	Large Trucks	Buses	Total
		1983	Normal Traffic	7.5	161.4	14.5
Diverted Traffic	-		-	-	8.0	8.0
Generated Traffic	18.0		-	-	-	18.0
Total	25.5		161.4	14.5	9.2	210.6
1992	Normal Traffic	13.8	253.5	84.6	2.2	354.1
	Diverted Traffic	-	-	-	14.7	14.7
	Generated Traffic	33.1	-	-	-	33.1
	Total	46.9	253.5	84.6	16.9	401.9
2002	Normal Traffic	22.5	339.7	203.9	3.6	569.7
	Diverted Traffic	-	-	-	24.0	24.0
	Generated Traffic	53.9	-	-	-	53.9
	Total	76.4	339.7	203.9	27.6	647.6

PLAN 2

1983	Normal Traffic	7.5	160.9	14.5	1.4	184.3
	Diverted Traffic	-	-	-	8.0	8.0
	Generated Traffic	18.0	-	-	-	18.0
	Total	25.5	160.7	14.5	9.4	210.3
1992	Normal Traffic	13.8	252.6	84.6	2.5	353.5
	Diverted Traffic	-	-	-	14.7	14.7
	Generated Traffic	33.1	-	-	-	33.1
	Total	46.9	252.6	84.6	17.2	401.3
2002	Normal Traffic	22.5	338.5	203.9	4.0	568.9
	Diverted Traffic	-	-	-	24.0	24.0
	Generated Traffic	53.9	-	-	-	53.9
	Total	76.4	338.5	203.9	28.0	646.8

El Obeid - Um Ruaba Road

PLAN 3 Average Number of Vehicle by Type (ADT)

Type of Vehicle		Small Vehicles	Medium size Trucks	Large Trucks	Buses	Total
Traffic by year						
1983	Normal Traffic	7.7	159.8	14.5	1.4	183.4
	Diverted Traffic	-	-	-	8.5	8.5
	Generated Traffic	18.0	-	-	-	18.0
	Total	25.7	159.8	14.5	9.9	209.9
1992	Normal Traffic	14.1	250.7	84.6	2.5	351.9
	Diverted Traffic	-	-	-	22.5	22.5
	Generated Traffic	33.1	-	-	-	33.1
	Total	47.2	250.7	84.6	24.5	414.6
2002	Normal Traffic	22.9	336.9	203.9	4.0	567.7
	Diverted Traffic	-	-	-	24.0	24.0
	Generated Traffic	53.9	-	-	-	53.9
	Total	76.8	336.9	203.9	28.0	645.6

PLAN 4

1983	Normal Traffic	7.5	160.8	14.5	1.4	184.2
	Diverted Traffic	-	-	-	8.0	8.0
	Generated Traffic	18.0	-	-	-	18.0
	Total	25.5	160.8	14.5	9.4	210.2
1992	Normal Traffic	13.8	252.5	84.6	2.5	353.4
	Diverted Traffic	-	-	-	22.5	22.5
	Generated Traffic	33.1	-	-	-	33.1
	Total	46.9	252.5	84.6	250.0	409.0
2002	Normal Traffic	22.5	338.4	203.9	4.0	568.8
	Diverted Traffic	-	-	-	24.0	24.0
	Generated Traffic	53.9	-	-	-	53.9
	Total	76.4	338.4	203.9	28.0	646.7

El Obeid - Um Ruaba Road

PLAN 5 Average Number of Vehicle by Type (ADT)

Type of Vehicle		Small Vehicles	Medium size Trucks	Large Trucks	Buses	Total
Traffic by year						
1983	Normal Traffic	7.7	160.3	14.5	1.4	183.9
	Diverted Traffic	-	-	-	8.0	8.0
	Generated Traffic	18.0	-	-	-	18.0
	Total	25.7	160.3	14.5	9.4	209.9
1992	Normal Traffic	14.1	251.6	84.6	2.5	352.8
	Diverted Traffic	-	-	-	14.7	14.7
	Generated Traffic	33.1	-	-	-	33.1
	Total	47.2	251.6	84.6	17.2	400.6
2002	Normal Traffic	22.9	337.2	203.9	4.0	568.0
	Diverted Traffic	-	-	-	24.0	24.0
	Generated Traffic	53.9	-	-	-	53.9
	Total	76.8	337.2	203.9	28.0	645.9

PLAN 6

1983	Normal Traffic	7.7	159.3	14.5	1.4	182.9
	Diverted Traffic	-	-	-	8.0	8.0
	Generated Traffic	18.0	-	-	-	18.0
	Total	25.7	159.3	14.5	9.4	208.9
1992	Normal Traffic	14.1	250.6	84.6	2.5	351.8
	Diverted Traffic	-	-	-	22.5	22.5
	Generated Traffic	33.1	-	-	-	33.1
	Total	47.2	250.6	84.6	25.0	407.4
2002	Normal Traffic	22.9	336.1	203.9	4.0	566.9
	Diverted Traffic	-	-	-	24.0	24.0
	Generated Traffic	53.9	-	-	-	53.9
	Total	76.8	336.1	203.9	28.0	644.8

El Obeid - Um Ruaba Road

PLAN 7 Average Number of Vehicle by Type (ADT) 1)

Type of Vehicle		Small Vehicles	Medium size Trucks	Large Trucks	Buses	Total
Traffic by year						
1983	Normal Traffic	8.9	165.4	14.2	1.4	189.9
	Diverted Traffic	-	-	-	8.0	8.0
	Generated Traffic	18.0	-	-	-	18.0
	Total	26.9	165.4	14.2	9.4	215.9
1992	Normal Traffic	16.3	259.5	82.7	2.5	361.0
	Diverted Traffic	-	-	-	14.7	14.7
	Generated Traffic	33.1	-	-	-	33.1
	Total	49.4	259.5	82.7	15.2	408.8
2002	Normal Traffic	26.5	349.7	199.4	4.0	579.6
	Diverted Traffic	-	-	-	24.0	24.0
	Generated Traffic	53.9	-	-	-	53.9
	Total	80.4	349.7	199.4	28.0	657.5

PLAN Note : 1) On the main road.

1983	Normal Traffic					
	Diverted Traffic					
	Generated Traffic					
	Total					
1992	Normal Traffic					
	Diverted Traffic					
	Generated Traffic					
	Total					
2002	Normal Traffic					
	Diverted Traffic					
	Generated Traffic					
	Total					

