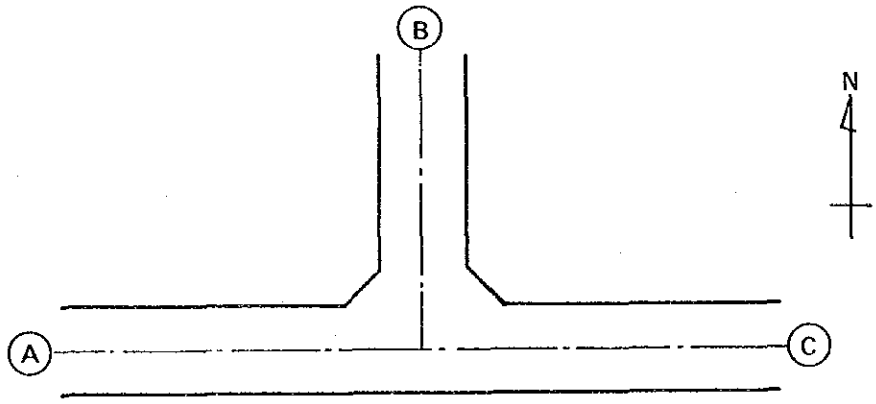
Calculation of Saturation Rate

(1) Entrance Layout and Signal Phasing

a) Entrance Layout



b) Signal Phasing

Phasing (Ø)	Traffic Flow
1 Ø	
2 Ø	
3 Ø	

Table Calculation of Saturation Degree

Omdurman Intersection Alt. A-A
Morning Peak (V/H 1995

Entrance		A			B			C			
Flow Direction		Str.	Right	Left	Str.	Right	Left	Str.	Right	Left	
Number of Lane		2	-	1	-	1	2	2	2	-	
Basic Capacity		2,000	1,800	1,800	2,000	1,800	1,800	2,000	1,800	1,800	
	Lane Width	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	
	Gradient	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	
	Truck Contain	0.95 (5)	0.95 (5)	0.95 (5)	- -	0.95 (5)	0.93 (10)	0.95 (5)	0.93 (10)	- -	
	Right Turn Vehicle	-	-	-	-	-	-	0.855	-	-	
	Left Turn Vehicle	0.775	-	-	-	-	-	-	-	-	
Saturation Capacity		2,945	-	1,710	-	1,710	3,420	3,249	3,348	-	
Traffic Volume		195	-	537	-	231	1207	69	433	-	
Saturation Degree		0.066	-	0.314	-	0.135	0.353	0.021	0.129	-	Saturation Degree of Intersection
Phasing	1 C	0.033	-	-	-	0.045	-	0.021	0.043	-	0.712
	2 C	0.033	-	0.314	-	0.045	-	-	0.048	-	
	3 C	-	-	-	-	0.045	0.353	-	0.043	-	

Table Calculation of Saturation Degree — Omdurman Intersection Alt. A-1 Afternoon Peak (W/H), 1998

Entrance		A			B			C			
Flow Direction		Str.	Right	Left	Str.	Right	Left	Str.	Right	Left	
Number of Lane		2	-	1	-	1	2	2	2	-	
Basic Capacity		2,000	1,800	1,800	2,000	1,800	1,800	2,000	1,800	1,800	
	Lane Width	1.0 3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	
	Gradient	1.0 0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	
	Truck Contain	0.95 5)	-	0.95 (5)	0.95 (5)	- -	0.93 (10)	0.95 (5)	0.93 (10)	- -	
	Right Turn Vehicle	-	-	-	-	-	-	0.855	-	-	
	Left Turn Vehicle	0.775	-	-	-	-	-	-	-	-	
Saturation Capacity		2,945	-	1,710	-	1,710	3,420	3,249	3,348	-	
Traffic Volume		66	-	182	-	479	409	144	900	-	
Saturation Degree		0.022	-	0.206	-	0.280	0.120	0.044	0.269	-	Saturation Degree of Intersection
Phasing	1 C	0.011	-	-	-	0.093	-	0.044	0.090	-	0.315
	2 C	0.011	-	0.105	-	0.093	-	-	0.090	-	
	3 C	-	-	-	-	0.093	0.120	-	0.090	-	

Table Calculation of Saturation Degree

Omdurman Intersection Alt. A-I
Morning Peak (W/H), 1995

Entrance		A			B			C			
Flow Direction		Str.	Right	Left	Str.	Right	Left	Str.	Right	Left	
Number of Lane		2	-	1	-	1	3	2	2	-	
Basic Capacity		2,000	1,800	1,800	2,000	1,800	1,800	2,000	1,800	1,800	
	Lane Width	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	
	Gradient	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	
	Truck Contain	0.95 (5)	- -	0.95 (5)	0.95 (5)	0.95 (5)	0.93 (10)	0.95 (5)	0.93 (10)	- -	
	Right Turn Vehicle	-	-	-	-	-	-	0.855	-	-	
	Left Turn Vehicle	0.755	-	-	-	-	-	-	-	-	
Saturation Capacity		2,945	-	1,710	-	1,710	5,022	3,249	3,348	-	
Traffic Volume		1027	-	585	-	138	371	441	130	-	
Saturation Degree		0.343	-	0.342	-	0.081	0.074	0.136	0.039	-	Saturation Degree of Intersection
Phasing	1 Ø	0.174	-	-	-	0.027	-	0.136	0.013	-	0.590
	2 Ø	0.174	-	0.342	-	0.027	-	-	0.013	-	
	3 Ø	-	-	-	-	0.027	0.074	-	0.013	-	

Table. Calculation of Saturation Degree — Omdurman Intersection Alt. A-B, Afternoon Peak (W/H), 1995

Entrance		A			B			C			
Flow Direction		Str.	Right	Left	Str.	Right	Left	Str.	Right	Left	
Number of Lane		2	-	1	-	1	3	2	2	-	
Basic Capacity		2,000	1,800	1,800	2,000	1,800	1,800	2,000	1,800	1,800	
	Lane Width	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	
	Gradient	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	
	Truck Contain	0.95 (5)	- -	0.95 (5)	- -	0.95 (5)	0.93 (10)	0.95 (5)	0.93 (10)	0.88 (20)	
	Right Turn Vehicle	-	-	-	-	-	-	0.855	-	-	
	Left Turn Vehicle	0.755	-	-	-	-	-	-	-	-	
Saturation Capacity		2,945	-	1,710	-	1,710	5,022	3,249	3,348	-	
Traffic Volume		66	-	182	-	479	409	144	900	-	
Saturation Degree		0.022	-	0.106	-	0.280	0.081	0.044	0.269	-	Saturation Degree of Intersection
Phasing	1 Ø	0.011	-	-	-	0.093	-	0.044	0.090	-	0.292
	2 Ø	0.011	-	0.106	-	0.093	-	-	0.090	-	
	3 Ø	-	-	-	-	0.093	0.081	-	0.090	-	

Table. Calculation of Saturation Degree — Omdurman Intersection Alt. ... Morning Peak (W/H), 1995

Entrance		A			B			C			
Flow Direction		Str.	Right	Left	Str.	Right	Left	Str.	Right	Left	
Number of Lane		1	-	1	-	1	2	1	2	-	
Basic Capacity		1,800	-	1,800	-	1,800	2,500	1,800	2,500	-	
	Lane Width	1.0 (3.50)	- -	1.0 (3.00)	- -	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.50)	- -	
	Gradient	1.0 (0.00)	- -	1.0 (0.00)	- -	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	- -	
	Truck Contain	0.95 (5)	- -	0.95 (5)	- -	0.95 (5)	0.93 (10)	0.95 (5)	0.93 (10)	- -	
	Right Turn Vehicle	-	-	-	-	-	-	-	-	-	
	Left Turn Vehicle	0.77	-	-	-	-	-	-	-	-	
Saturation Capacity		1,317	-	1,710	-	1,710	4,650	1,710	4,650	-	
Traffic Volume		195	-	537	-	231	1,207	69	433	-	
Saturation Degree		0.148	-	0.314	-	0.135	0.260	0.040	0.093	-	Saturation Degree of Intersection
Phasing	1 P	0.074	-	-	-	0.045	-	0.040	0.031	-	0.619
	2 P	0.074	-	0.314	-	0.045	-	-	0.031	-	
	3 P	-	-	-	-	0.045	0.260	-	0.031	-	

Table. Calculation of Saturation Degree — Ondurman Intersection Alt. A-C, Afternoon Peak (V/H), 1998

Entrance		A			B			C			
Flow Direction		Str.	Right	Left	Str.	Right	Left	Str.	Right	Left	
Number of Lane		1	-	1	-	1	2	1	2	-	
Basic Capacity		1,800	-	1,800	-	1,800	2,500	1,800	2,500	-	
	Lane Width	1.0 (3.50)	- -	1.0 (3.00)	- -	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.50)	- -	
	Gradient	1.0 (0.00)	- -	1.0 (0.00)	- -	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	- -	
	Truck Contain	0.95 (5)	- -	0.95 (5)	- -	0.95 (5)	0.93 (10)	0.95 (5)	0.93 (10)	- -	
	Right Turn Vehicle	-	-	-	-	-	-	-	-	-	
	Left Turn Vehicle	0.77	-	-	-	-	-	-	-	-	
Saturation Capacity		1,317	-	1,710	-	1,710	4,650	1,710	4,650	-	
Traffic Volume		66	-	182	-	479	409	144	900	-	
Saturation Degree		0.050	-	0.106	-	0.280	0.088	0.084	0.194	-	Saturation Degree of Intersection
Phasing	1 Ø	0.025	-	-	-	0.093	-	0.084	0.065	-	0.292
	2 Ø	0.025	-	0.106	-	0.093	-	-	0.065	-	
	3 Ø	-	-	-	-	0.093	0.088	-	0.065	-	

Table. Calculation of Saturation Degree — Omdurman Intersection Alt. A-A, Morning Peak (W/H), 2008

Entrance		A			B			C			
Flow Direction		Str.	Right	Left	Str.	Right	Left	Str.	Right	Left	
Number of Lane		2	-	1	-	1	2	2	2	-	
Basic Capacity		2,000	1,800	1,800	2,000	1,800	1,800	2,000	1,800	1,800	
	Lane Width	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	
	Gradient	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	
	Truck Contain	0.95 (5)	- -	0.95 (5)	- -	0.95 (5)	0.93 (10)	0.95 (5)	0.93 (10)	- -	
	Right Turn Vehicle	-	-	-	-	-	-	0.855	-	-	
	Left Turn Vehicle	0.775	-	-	-	-	-	-	-	-	
Saturation Capacity		2,945	-	1,710	-	1,710	3,420	3,249	3,348	-	
Traffic Volume		197	-	499	-	260	2504	279	933	-	
Saturation Degree		0.066	-	0.292	-	0.152	0.732	0.086	0.279	-	Saturation Degree of Intersection
Phasing	1 Ø	0.033	-	-	-	0.051	-	0.086	0.093	-	1.117
	2 Ø	0.033	-	0.292	-	0.051	-	-	0.093	-	
	3 Ø	-	-	-	-	0.051	0.732	-	0.093	-	

Table Calculation of Saturation Degree

Umdurman Intersection Alt. A-A
Afternoon Peak P.M., 2008

Entrance		A			B			C			
Flow Direction		Str.	Right	Left	Str.	Right	Left	Str.	Right	Left	
Number of Lane		2	-	1	-	1	2	2	2	-	
Basic Capacity		2,000	1,800	1,800	2,000	1,800	1,800	2,000	1,800	1,800	
Lane Width		1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	
Gradient		1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	
Truck Contain		0.95 (5)	- -	0.95 (5)	- -	0.95 (5)	0.93 (10)	0.95 (5)	0.93 (10)	- -	
Right Turn Vehicle		-	-	-	-	-	-	0.855	-	-	
Left Turn Vehicle		0.775	-	-	-	-	-	-	-	-	
Saturation Capacity		2,945	-	1,710	-	1,710	3,420	3,249	3,348	-	
Traffic Volume		94	-	202	-	539	849	194	1,937	-	
Saturation Degree		0.025	-	0.118	-	0.315	0.248	0.060	0.579	-	Saturation Degree of Intersection
Phasing	1 Ø	0.013	-	-	-	0.105	-	0.060	0.193	-	0.634
	2 Ø	0.013	-	0.118	-	0.105	-	-	0.193	-	
	3 Ø	-	-	-	-	0.105	0.248	-	0.193	-	

Table Calculation of Saturation Degree

Omdurman Intersection Alt. A-B
Morning Peak (V/H , 2005

Entrance		A			B			C			
Flow Direction		Str.	Right	Left	Str.	Right	Left	Str.	Right	Left	
Number of Lane		2	-	1	-	1	3	2	2	-	
Basic Capacity		2,000	1,800	1,800	2,000	1,800	1,800	2,000	1,800	1,800	
	Lane Width	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	
	Gradient	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	
	Truck Contain	0.95 (5)	- -	0.95 (5)	- -	0.95 (5)	0.93 (10)	0.95 (5)	0.93 (10)	- -	
	Right Turn Vehicle	-	-	-	-	-	-	0.855	-	-	
	Left Turn Vehicle	0.775	-	-	-	-	-	-	-	-	
Saturation Capacity		2,945	-	1,710	-	1,710	5,022	3,249	3,348	-	
Traffic Volume		197	-	499	-	260	2,504	279	933	-	
Saturation Degree		0.072	-	0.315	-	0.152	0.500	0.085	0.279	-	Saturation Degree of Intersection
Phasing	1 C	0.036	-	-	-	0.051	-	0.085	0.093	-	0.908
	2 C	0.036	-	-	-	0.051	-	-	0.093	-	
	3 C	-	-	-	-	0.051	0.500	-	0.093	-	

Table. Calculation of Saturation Degree

Omdurman Intersection Alt A-B
Afternoon Peak V.H. 2005

Entrance		A			B			C			
Flow Direction		Str.	Right	Left	Str.	Right	Left	Str.	Right	Left	
Number of Lane		2	-	1	-	1	3	2	2	-	
Basic Capacity		2,000	1,800	1,800	2,000	1,800	1,800	2,000	1,800	1,800	
	Lane Width	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	
	Gradient	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	
	Truck Contain	0.95 (5)	- -	0.95 (5)	- -	0.95 (5)	0.93 (10)	0.95 (5)	0.93 (10)	- -	
	Right Turn Vehicle	-	-	-	-	-	-	0.855	-	-	
	Left Turn Vehicle	0.775	-	-	-	-	-	-	-	-	
Saturation Capacity		2,945	-	1,710	-	1,710	5,022	3,249	3,348	-	
Traffic Volume		94	-	202	-	539	849	194	1,937	-	
Saturation Degree		0.032	-	0.118	-	0.315	0.169	0.060	0.579	-	Saturation Degree of Intersection
Phasing	1 Ø	0.032	-	-	-	0.105	-	0.060	0.193	-	
	2 Ø	0.016	-	0.118	-	0.105	-	-	0.193	-	0.504
	3 Ø	-	-	-	-	0.105	0.169	-	0.193	-	

Table. Calculation of Saturation Degree

Omdurman Intersection Alt. A-3
Morning Peak (T/H), 2005

Entrance		A			B			C			
Flow Direction		Str.	Right	Left	Str.	Right	Left	Str.	Right	Left	
Number of Lane		1	-	1	-	1	2	1	2	-	
Basic Capacity		1,800	-	1,800	-	1,800	2,500	1,800	2,500	-	
	Lane Width	1.0 (3.50)	- -	1.0 (3.00)	- -	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.50)	- -	
	Gradient	1.0 (0.00)	- -	1.0 (0.00)	- -	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	- -	
	Truck Contain	0.95 (5)	- -	0.95 (5)	- -	0.95 (5)	0.93 (10)	0.95 (5)	0.93 (10)	- -	
	Right Turn Vehicle	-	-	-	-	-	-	-	-	-	
	Left Turn Vehicle	0.77	-	-	-	-	-	-	-	-	
Saturation Capacity		1,317	-	1,710	-	1,710	4,650	1,710	4,650	-	
Traffic Volume		197	-	499	-	260	2,504	279	933	-	
Saturation Degree		0.150	-	0.291	-	0.152	0.538	0.163	0.200	-	Saturation Degree of Intersection
Phasing	1 Ø	0.075	-	-	-	0.051	-	0.163	0.066	-	0.992
	2 Ø	0.075	-	0.291	-	0.051	-	-	0.066	-	
	3 Ø	-	-	-	-	0.051	0.538	-	0.066	-	

Table. Calculation of Saturation Degree — Omdurman Intersection Alt. A-1, Afternoon Peak (Y'H), 2005

Entrance		A			B			C			
Flow Direction		Str.	Right	Left	Str.	Right	Left	Str.	Right	Left	
Number of Lane		1	-	1	-	1	2	1	2	-	
Basic Capacity		1,800	-	1,800	-	1,800	2,500	1,800	2,500	-	
Lane Width		1.0 (3.50)	- -	1.0 (3.00)	- -	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.50)	- -	
Gradient		1.0 (0.00)	- -	1.0 (0.00)	- -	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	- -	
Truck Contain		0.95 (5)	- -	0.95 (5)	- -	0.95 (5)	0.93 (10)	0.95 (5)	0.93 (10)	- -	
Right Turn Vehicle		-	-	-	-	-	-	-	-	-	
Left Turn Vehicle		0.77	-	-	-	-	-	-	-	-	
Saturation Capacity		1,317	-	1,710	-	1,710	4,650	1,710	4,650	-	
Traffic Volume		94	-	202	-	539	849	194	1,937	-	
Saturation Degree		0.071	-	0.118	-	0.315	0.183	0.113	0.417	-	Saturation Degree of Intersection
Phasing	1 Ø	0.036	-	-	-	0.105	-	0.113	0.139	-	0.407
	2 Ø	0.036	-	0.118	-	0.105	-	-	0.139	-	
	3 Ø	-	-	-	-	0.105	0.183	-	0.139	-	

Table Calculation of Saturation Degree — Khartoum Intersection Alt. I-a / I-b, Morning Peak (W/H), 1995

Entrance		A			B			C			
Flow Direction		Str.	Right	Left	Str.	Right	Left	Str.	Right	Left	
Number of Lane		1	-	2	-	2	1	2	1	-	
Basic Capacity		1,800	1,800	1,800	2,000	1,800	1,800	2,000	1,800	1,800	
	Lane Width	1.0 3.50	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	
	Gradient	1.0 0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	
	Truck Contain	0.93 10)	- -	0.93 (10)	- -	0.93 (10)	0.93 (10)	0.93 (10)	0.93 (10)	- -	
	Right Turn Vehicle	-	-	-	-	-	-	0.891	-	-	
	Left Turn Vehicle	0.775	-	-	-	-	-	-	-	-	
Saturation Capacity		2,883	-	3,348	-	3,348	1,674	3,314	1,674	-	
Traffic Volume		1,027	-	585	-	138	371	441	130	-	
Saturation Degree		0.356	-	0.175	-	1.041	0.222	0.133	0.078	-	Saturation Degree of Intersection
Phasing	1 C	0.178	-	-	-	0.014	-	0.133	0.026	-	0.578
	2 C	0.178	-	0.175	-	0.014	-	-	0.026	-	
	3 C	-	-	-	-	0.014	0.222	-	0.026	-	

Table. Calculation of Saturation Degree — Khartoum Intersection Alt. B-A & B-E, Afternoon Peak ('X'H', 1985

Entrance		A			B			C			
Flow Direction		Str.	Right	Left	Str.	Right	Left	Str.	Right	Left	
Number of Lane		2	-	2	-	2	1	2	1	-	
Basic Capacity		2,000	1,800	1,800	2,000	1,800	1,800	2,000	1,800	1,800	
	Lane Width	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	
	Gradient	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	
	Truck Contain	0.93 (10)	- -	0.93 (10)	- -	0.93 (10)	0.93 (10)	0.93 (10)	0.93 (10)	- -	
	Right Turn Vehicle	-	-	-	-	-	-	0.891	-	-	
	Left Turn Vehicle	0.775	-	-	-	-	-	-	-	-	
Saturation Capacity		2,883	-	3,348	-	3,348	1,674	3,314	1,674	-	
Traffic Volume		348	-	198	-	287	125	916	271	-	
Saturation Degree		0.120	-	0.059	-	0.086	0.075	0.276	0.162	-	Saturation Degree of Intersection
Phasing	1 Ø	0.060	-	-	-	0.029	-	0.276	0.054	-	0.411
	2 Ø	0.060	-	0.059	-	0.029	-	-	0.054	-	
	3 Ø	-	-	-	-	0.029	0.075	-	0.054	-	

Table Calculation of Saturation Degree — Khartoum Intersection Alt. B-A & B-B, Morning Peak (V/H), 2005

Entrance		A			B			C			
Flow Direction		Str.	Right	Left	Str.	Right	Left	Str.	Right	Left	
Number of Lane		2	-	2	-	2	1	2	1	-	
Basic Capacity		2,000	1,800	1,800	2,000	1,800	1,800	2,000	1,800	1,800	
	Lane Width	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	
	Gradient	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	
	Truck Contain	0.93 (10)	- -	0.93 (10)	- -	0.93 (10)	0.93 (10)	0.93 (10)	0.93 (10)	- -	
	Right Turn Vehicle		-	-	-	-	-	0.985	-	-	
	Left Turn Vehicle	0.775	-	-	-	-	-	-	-	-	
Saturation Capacity		2,883	-	3,348	-	3,348	1,674	3,664	1,674	-	
Traffic Volume		2,094	-	1,985	-	674	158	730	23	-	
Saturation Degree		0.726	-	0.592	-	0.201	0.094	0.199	0.014	-	Saturation Degree of Intersection
Phasing	1 C	0.134	-	-	-	0.067	-	0.199	0.005	-	0.885
	2 C	0.592	-	0.592	-	0.067	-	-	0.005	-	
	3 C	-	-	-	-	0.067	0.094	-	0.005	-	

Table. Calculation of Saturation Degree — Khartoum Intersection Alt. B-A & B-B, Afternoon Peak (7/8), 2005

Entrance		A			B			C			
Flow Direction		Str.	Right	Left	Str.	Right	Left	Str.	Right	Left	
Number of Lane		2	-	2	-	2	1	2	1	-	
Basic Capacity		2,000	1,800	1,800	2,000	1,800	1,800	2,000	1,800	1,800	
	Lane Width	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	
	Gradient	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	
	Truck Contain	0.93 (10)	- -	0.93 (10)	- -	0.93 (10)	0.93 (10)	0.93 (10)	0.93 (10)	- -	
	Right Turn Vehicle	-	-	-	-	-	-	0.891	-	-	
	Left Turn Vehicle	0.775	-	-	-	-	-	-	-	-	
Saturation Capacity		2,883	-	3,348	-	3,348	1,674	3,314	1,674	-	
Traffic Volume		709	-	673	-	1,400	54	1,516	46	-	
Saturation Degree		0.246	-	0.201	-	0.418	0.032	0.414	0.027	-	Saturation Degree of Intersection
Phasing	1 Ø	0.123	-	-	-	0.139	-	0.414	0.009	-	0.754
	2 Ø	0.123	-	0.201	-	0.139	-	-	0.009	-	
	3 Ø	-	-	-	-	0.139	0.032	-	0.009	-	

Table Calculation of Saturation Degree — Khartoum Intersection Alt. B-A & B-I, Afternoon Peak (V/H), 2005

Entrance		A			B			C			
Flow Direction		Str.	Right	Left	Str.	Right	Left	Str.	Right	Left	
Number of Lane		2	-	2	-	2	1	2	1	-	
Basic Capacity		2,000	1,800	1,800	2,000	1,800	1,800	2,000	1,800	1,800	
Lane Width		1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	1.0 (3.50)	1.0 (3.00)	1.0 (3.00)	
Gradient		1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	
Truck Contain		0.93 (10)	- -	0.93 (10)	- -	0.93 (10)	0.93 (10)	0.93 (10)	0.93 (10)	- -	
Right Turn Vehicle			-	-	-	-	-	0.985	-	-	
Left Turn Vehicle		0.775	-	-	-	-	-	-	-	-	
Saturation Capacity		2,883	-	3,348	-	3,348	1,674	3,664	1,674	-	
Traffic Volume		709	-	673	-	1,400	54	1,516	46	-	
Saturation Degree		0.243	-	0.201	-	0.418	0.032	0.414	0.027	-	Saturation Degree of Intersection
Phasing	1 Ø	0.123	-	-	-	0.139	-	0.414	0.009	-	
	2 Ø	0.123	-	0.201	-	0.139	-	-	0.009	-	0.754
	3 Ø	-	-	-	-	0.139	0.032	-	0.009	-	

Project Cost Estimate

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Equipment Cost

No	NAME OF EQUIPMENT	F.O.B PRICE (¥1000)	LIFE YEAR	YEARLY STANDARD OPERATING HOURS	OPERATING DAYS	USE DAYS	RATIO OF REPAIRING	MANAGEMENT	HOURLY OR DAILY EQUIPMENT COST F.C (¥)	L.C (¥)	L.C (L₹)
1	Bulldozer 21t	23000	6	900	140	210	0.65	0.07	7,560	831	69.79
2	Bulldozer 15t	14600	6	900	140	210	0.65	0.07	4,799	527	44.30
3	Wheel Loader 1.4m3	9750	6	850	130	200	0.6	0.07	3,326	344	28.92
4	Backhoe 1.0m3	28300	5	1200	185	250	0.55	0.07	7,712	778	65.40
5	Dump Truck 20t	24000	5	1400	190	230	0.6	0.1	6,240	617	51.86
6	Batcher Plant60m3/h	49600	7	950	155	230	0.6	0.07	13,500	1,343	112.82
7	Cement Silo 100t	3470	8	--	--	250	0.05	0.05	2,316	26	2.19
8	Concrete Pump 50m3/h	17500	4	1100	165	180	0.7	0.07	6,642	835	70.19
9	Boom Type 55~60m3/h	24000	4	1100	165	180	0.7	0.07	9,109	1,145	96.26
10	Agitat Truck 4.5m3	8620	5	850	140	215	0.45	0.07	3,174	274	23.01
11	Crawler crane (H) 100t	120000	7	1000	160	230	0.7	0.07	32,229	3,600	302.52
12	Crawler crane (H) 50t	50300	7	1000	160	230	0.7	0.07	13,509	1,509	126.81
13	Truck crane (M) 25t	33700	7	1000	150	175	0.35	0.07	7,871	506	42.48
14	Clamshell Bucket2m3	6970	3	850	120	130	0.8	0.07	4,565	656	55.13
15	Clamshell Bucket1m3	4560	3	850	120	130	0.8	0.07	2,986	429	36.07
16	Vibrate Hammer 60Kw	8700	4	800	110	160	0.6	0.07	4,350	489	41.12
17	Crawler Drill 150Kg	7500	4	800	120	155	0.45	0.07	3,504	316	26.59
18	Air Compressor 10m3/min	5040	6	--	--	140	0.5	0.05	9,300	900	75.63
19	Generator 300KVA	9690	7	--	130	180	0.4	0.05	16,292	1,278	107.38
20	Grout Pump 2.2Kw	520	6	--	85	170	0.55	0.07	1,738	168	14.14
21	Grout Mixer 5.4Kw	441	6	--	85	170	0.55	0.07	1,474	143	11.99
22	Motorgrader 3.1m	10800	6	850	130	190	0.5	0.07	3,536	318	26.69
23	Tire Roller 8~20t	7400	7	750	130	200	0.5	0.07	2,453	211	17.77
24	Macadam Roller 10t	6440	7	750	130	200	0.5	0.07	2,134	184	15.46
25	Vib.Compacter 100Kg	250	3	--	115	170	0.45	0.05	989	98	8.22
26	Asphalt Plant 40t/h	60700	6	850	160	240	0.6	0.07	20,709	2,142	180.03
27	Asphalt Finisher W=4.5m	14400	7	550	90	150	0.5	0.07	6,508	561	47.15
28	Engine Welder 300A	1380	7	--	120	160	0.5	0.05	2,629	246	20.71
29	Elec. Welder 300A	153	7	--	120	150	0.5	0.05	291	27	2.30
30	Winch	2010	8	--	--	150	0.9	0.05	3,233	452	38.00
31	Submersible Pump 150mm	408	5	--	120	160	1.1	0.05	1,306	224	18.86
32	Submersible Pump 200mm	695	5	--	120	160	1.1	0.05	2,224	382	32.12
33	Bar Bender	850	8	--	--	150	0.5	0.07	1,282	106	8.93
34	Bar Cutter	760	8	--	--	150	0.5	0.07	1,146	95	7.98
35	Goliath Crane 5t	8810	7	--	--	140	0.25	0.05	12,810	674	56.66
36	Belt Conveyer 7m×350mm	257	2	--	120	160	0.6	0.05	1,521	193	16.20
37	Jet Cleaner 11Kw	1100	5	--	135	180	1.5	0.05	3,585	733	61.62
38	Hydro. Juckey50t	296	5	--	--	140	0.6	0.05	664	76	6.40
39	Hydro. Pump 3.7Kw	2320	5	--	-	150	0.6	0.05	4,857	557	46.79
40	Tug Boat 450 PS	64000	14	1980	22	270	1.35	0.07	6,522	935	78.58
41	Flat Barge 300t	22000	12	--	200	250	1.1	0.055	21,358	2,420	203.36
42	Reverse Drill Max3000mm	23700	5	850	120	155	0.45	0.07	8,727	753	63.26
43	Bit Dia.1200~1500mm	430	1	--	--	155	0.45	0.07	3,565	375	31.47
44	Drill pipe200mm×3m	221	1.5	--	--	155	0.45	0.07	1,255	128	10.78
45	Suction hose 200mm×4m	276	1.5	--	--	155	0.45	0.07	1,567	160	13.47
46	Delivery hose 20cm×4m	273	1.5	--	--	155	0.45	0.07	1,550	159	13.32
47	Stand pipe 1600mm×16mm×5m	603	2	--	--	155	0.45	0.05	2,558	263	22.07
48	Travelling Wagon	53700	6	--	--	170	0.2	0.05	70,547	3,159	265.45
49	Transe Setting Eeq. 80t	1100	5	--	--	160	0.1	0.05	1,678	41	3.47
50	Earth Auger 45Kw	58500	5	950	140	200	0.5	0.07	19,705	1,847	155.24
51	Classfier 60cm×5m	3940	4	4500	500	1000	0.4	0.05	1,208	105	8.83
52	Scrubber 1500×3000mm	15200	4	4500	500	1000	0.9	0.05	5,844	912	76.64
53	Vibrating Screen 7.5Kw	4110	4.5	5000	550	1100	0.75	0.05	1,356	185	15.54
54	Port. Screening Plant	4620	4	4500	500	1000	0.65	0.05	1,596	200	16.82

Labour Cost

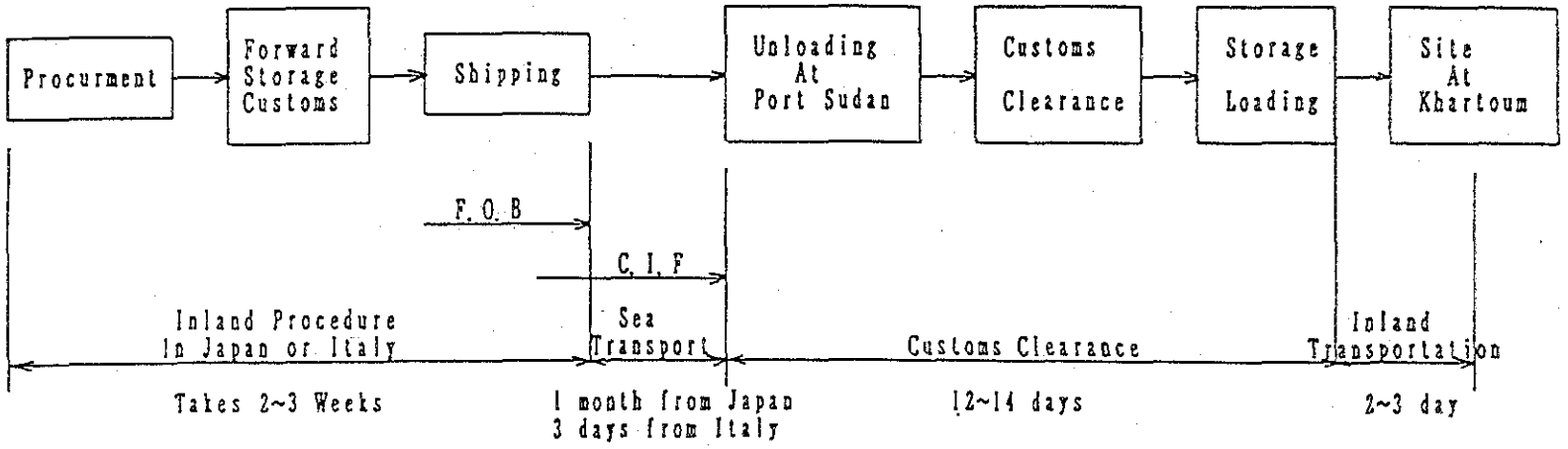
No.	Description	Wages (Ls/day)
1.	Civil Foreman	250
2.	Equipment Operator	150
3.	Surveyer	150
4.	Mechanician	150
5.	Electrician	150
6.	Blasting Operator	150
7.	Rigger (Bridge Worker)	100
8.	Welder	100
9.	Barbender	80
10.	Carpenter	80
11.	Fitter	80
12.	Common Labour	40

Material Cost

No.	Name of Material	Uite	Unit Price F. C (Yen)	Unit Price L. C (Ls)
1.	Cement	Ton	8, 680	--
2.	Reinforcing Bar	Ton	46, 500	--
3.	Prestressing Bar	Ton	268, 000	--
4.	Prestressing Strand	Ton	284, 000	--
5.	Admixture	Kg.	245	--
6.	Asphalt	Ton	34, 000	--
7.	H- beam	Ton	84, 000	--
8.	Coarse Aggregate	M3	2, 170	67. 1
9.	Fine Aggregate	M3	2, 320	68. 5
10.	Riprup Stone	Ton	1, 485	48. g5
11.	Diesel Fuel	Gal		10. 7 (3. 95)
12.	Gasoline	Gal	--	27. 0 (9. 95)
13.	Lubricant	Gal	--	40. 0 (12. 5)

Remark: Figure in parenthesis is a market price based on the official rate.

Transportation Cost



Ocean Freight

Sea transportation of equipment and material is contract freight between Japan-Port Sudan and chartered freight between Italy-Port sudan.

1) Loadind Charge 4,000Yen/FT

2) Ocean Freight (Japan-Port Sudan)

Construction Equipment	US$ 255 /FT
Reinforcement Bar	US$ 175 /FT
Plywood	US$ 185 /FT
H-Beam etc,	US$ 205 /FT

3) Ocean Freight (Italy-Port sudan)

Chartered Freight US$ 83 /FT

Inland Transportation

Inland transportation cost from Port Sudan to the construction site is as follow;

1) Port charge	US$ 1.5 /FT
2) Customs clearance	US$ 5.2 /FT
3) Loading charge	US$ 13.0 /FT
4 Inland Transportation	US$ 78.0 /FT
5) Unloading charge	US$ 13.0 /FT
Total	US$110.7 /FT

Insurance is 0.9% of C. I. F price

Ratio of Taxation

Description	Ratio of Taxation (%)
A. Construction Material	
1. Portland Cement	90
2. Steel bar	24
3. H-beam and steel angles	36
4. Steel Sheet pile	36
5. Ply-wood	60
6. Dynamite and AN-FO	60
7. Steel wire	24
8. Paint	125
9. Aluminium Tube	42
B. Construction Equipment and Others	
1. Road Construction equipment	18
2. Dump Truck	24
3. Crawter crane	24
4. Other Construction equipment	24
5. Floating Structures	24
6. Furnitures	200

Summary of Construction Cost

Construction cost consists of:

- General Works
- Approach Road
- Foundation & Substructure of Bridge
- Superstructure of Bridge
- Ancillary Works
- Engineer Dispatch Cost
- Overhead.

Breakdown of the respective items are shown from next page.

DETAILED CONSTRUCTION COST ESTIMATE (1/3)

Item No.	Description	Quantity	Unit	Unit Rate F.C (Yen)	Unit Rate L.C (Ls)	Amount F.C (Yen)	Amount L.C (Ls)	Total Amount (Yen)
1	General Works							
1.1	Freight, insurance and inland transeportation for imported plants, equipment & materials	1	L.S.			1,276,742,400		1,276,742,400
1.2	Development for Camp Yard-I							
	Camp Yard II	1	L.S.			52,152,000	1,291,890	92,342,698
1.3	Engineer's site Office							0
	including Maintenance	1	L.S.				1,175,900	36,582,249
1.4	Site laboratory and clinic							0
	with ambulance	1	L.S.			2,250,000	372,800	13,847,808
1.5	Site Preparation of temporary							0
	work including office, quarter							0
	store houses and others	1	L.S			36,390,200	7,139,100	258,487,601
1.6	Installation & removal of							0
	Consrtuction plants	1	L.S			12,633,520	372,995	24,237,394
1.7	Safty control of existing							0
	traffic in road and waterway	1	L.S			1,088,000	322,000	11,105,420
1.8	Engineering control of works							0
	including measurement of							0
	strain and laboratory test	1	L.S			19,000,000	2,022,200	81,910,642
1.9	Temporary project information							0
	Boards	2	No.			107,516	17,543	653,279
	Total of 1.					1,400,363,636	12,714,428	1,795,909,491
2	Approach Roads							
2.1	Clearing & stripping	207100	S.M		2.5		517,750	16,107,203
2.2	Embankment of Road	509078	C.M	402	8.2	204,649,356	4,174,440	334,516,172
2.3	Sub-grade of selected soil	96158	C.M	416	8.55	40,001,728	822,151	65,578,842
2.4	Excavation of Road	7863	C.M	490	11.15	3,852,870	87,672	6,580,360
2.5	Sub-base coarse	14478	C.M	3930	127.7	56,898,540	1,848,841	114,415,971
2.6	Asphaltic base coarse	7023	C.M	8000	141.33	56,184,000	992,561	87,062,560
2.7	Base coarse of cruched stone	10534	C.M	4089	134.23	43,073,526	1,413,979	87,062,407
2.8	Asphaltic binder coarse	60020	S.M	756	10.37	45,375,120	622,407	64,738,214
2.9	Asphaltic surface coarse	60020	S.M	836	10.37	50,176,720	622,407	69,539,814
2.10	Sidewalk pavement	29180	S.M	1324	29.28	38,634,320	854,390	65,214,405
2.11	Overlay for Intersection	2415	S.M	836	10.51	2,018,940	25,382	2,808,563
2.12	Box and pipe culverts							
	(1) 5.0 × 4.0 × 7.0 m	1	No.	1058470	71673	1,058,470	71,673	3,288,217
	(2) 6.0 × 4.5 × 30.0 m	1	No.	6636300	444358	6,636,300	444,358	20,460,277
	(3) 6.0 × 4.0 × 30.0 m	1	No.	6329500	407684	6,329,500	407,684	19,012,549
	(4) Dia. 300mm	54	L.M	6779	846.87	366,066	45,731	1,788,757
	(5) Dia. 600mm	152	L.M	9288	1263	1,411,776	191,976	7,384,149
2.13	Approach slab	4	No.	372000	10132	1,488,000	40,528	2,748,826
2.14	Stone masonry for slop							
	Protection	41770	S.M	2637	129.32	110,147,490	5,401,696	278,194,265
2.15	Guardrail	3525	L.M	6360	133	22,419,000	468,825	37,004,146
2.16	Breakwater facilities	1656	L.M	20017	1472	33,148,152	2,437,632	108,982,884
2.17	Curb stone	7191	L.M	2355	304.67	16,934,805	2,190,882	85,093,143
2.18	Stone Masonry Drainage 5×1.5	450	L.M	21373	699.51	9,617,850	314,780	19,410,640
2.19	Concrete drainage for sidewalk	3000	L.M	1499	229.12	4,497,000	687,360	25,880,770
2.20	Central Riserve	3053	L.M	4248	537.36	12,969,144	1,640,560	64,006,968
2.21	Catch basin	9	No.	6677	859.23	60,093	7,733	300,669
2.22	Road related works							
	(1) Traffic signal	18	No.	841147	6005	15,140,646	108,090	18,503,326
	(2) Traffic sign	8	No.	194697	438	1,557,576	3,504	1,666,585
	(3) traffic marking	28764	L.M	399	0.77	11,476,836	22,148	12,165,869
	(4) Plantation for central riserve	3053	L.M	101	60.94	308,353	186,050	6,096,363
	(5) Plantation for sidewalk	7056	L.M	115	73.58	811,440	519,180	16,963,145
	Sub-Total Of 2					737,243,617	27,172,370	1,642,576,060

DETAILED CONSTRUCTION COST ESTIMATE (2/3)

Item No.	Description	Quantity	Unit	Unit Rate F.C (Yen)	Unit Rate L.C (Ls)	Amount F.C (Yen)	Amount L.C (Ls)	Total Amount (Yen)
3	Substructure of Bridge							
3.1	Cast-in-place concrete pile of 2m inclusive of cost for pile excavation, concrete, steel bar and pile head treatment	2930	L.M	65142	1558.19	190,866,060	4,565,497	332,898,662
3.2	Installation & removal of cofferdam for piers construction							
	(1) CofferdamP11, P12 & P17~P24	10	Each	8606500	49610	86,065,000	496,100	101,498,671
	(2) Cofferdam P13 & P16	2	Each	10605700	50015	21,211,400	100,030	24,323,333
	(3) cofferdam P14 & P15	2	Each	25455500	103074	50,911,000	206,148	57,324,264
3.3	Structural excavation inwater	6740	C.M	1634	28.13	11,013,160	189,596	16,911,498
3.4	Stractural excavation	7910	C.M	653	17.67	5,165,230	139,770	9,513,465
3.5	Concrete (class A) of piers inclusive pile cap	12910	C.M	11723	266.91	151,343,930	3,445,808	258,543,020
3.6	Concrete (class A) of A1 & A2 abutment inclusive pile cap	1030	C.M	11723	266.91	12,074,690	274,917	20,627,367
3.7	Concrete (class P) from top of pile cap of P14 & P15 piers	642	C.M	13090	301.75	8,403,780	193,724	14,430,518
3.8	Levelling concrete (class C) for pile works	265	C.M	10492	238.4	2,780,380	63,176	4,745,785
3.9	Formwork for abutments	1294	S.M	1117	161.44	1,445,398	208,903	7,944,382
3.10	Formwork for piers	12028	S.M	3255	264.49	39,151,140	3,181,286	138,120,939
3.11	Formwork for V-type Piers	2466	S.M	13214	505.69	32,585,724	1,247,032	71,380,875
3.12	Reinforcing bar of abutments and piers	743	Ton	58138	1213.56	43,196,534	901,675	71,247,646
3.13	Foundation stone boulder for levelling concrete	782	C.M	2602	66.77	2,034,764	52,214	3,659,146
	Sub-Total Of 3.					658,248,190	15,265,875	1,133,169,572
4	Superstructure of Bridge							
4.1	Concrete (class P) for PC box girders	4005	C.M	17077	464.15	68,393,385	1,858,921	126,224,410
4.2	Formworks for PC box girders by travelling form, inside of box girder and above V leg	10940	S.m	16374	268	179,131,560	2,931,920	270,343,591
4.3	Reinforcing bar for PC box girders	377	Ton	56561	2264.8	21,323,497	853,830	47,886,136
4.4	Prestressing PC cable includ. cost of PC tendon, sheath & coupling joint and anchoring							
	(1) Main cable stressing	205	Ton	671668	16173	137,691,940	3,315,465	240,836,056
	(2) Lateral cable stressing	22	Ton	654525	28670	14,399,550	630,740	34,021,871
	(3) Vertical cable stressing	15	Ton	867181	17968	13,007,715	269,520	21,392,482
4.5	Grout injection into sheath							
	(1) Main cable grouting	24407	L.M	140	21.93	3,416,980	535,246	20,068,468
	(2) Lateral cable grouting	11587	L.M	53	9.66	614,111	111,930	4,096,266
	(3) Vertical cable grouting	3296	L.M	105	14.71	346,080	48,464	1,854,422
4.6	Concrete (class P) for T-beams	4193	C.M	11207	266.54	46,990,951	1,117,602	81,759,556
4.7	Concrete (class P) for slab and diaphragms concrete	3236	C.M	13749	379.28	44,491,764	1,227,350	82,674,625
4.8	Formworks for PC T-beams	24320	S.M	504	291.88	12,257,280	7,098,522	233,092,287
4.9	Reinforcing bar for PC T-beam	595	Ton	54754	2016	32,578,630	1,199,520	69,895,697
4.10	Stressing PC cable for T-beam includ. sheath and anchoring							
	(1) Main cable stressing	403	Ton	476276	8036	191,939,228	3,238,508	292,689,212
	(2) Lateral cable stressing	38	Ton	654525	28670	24,871,950	1,089,460	58,765,051
4.11	Grout injection into sheath							
	(1) Main cable grouting	82130	L.M	105	14.71	8,623,650	1,208,132	46,208,646
	(2) Lateral cable grouting	20325	L.M	53	9.66	1,077,225	196,340	7,185,347
4.12	Erection of PC T-beams	156	Each	633094	15126	98,762,664	2,359,656	172,171,562
4.13	Conection joint for T-beams	8	Each	1946369	68236	15,570,952	545,888	32,553,528

DETAILED CONSTRUCTION COST ESTIMATE (3/3)

Item No.	Description	Quantity	Unit	Unit Rate F.C (Yen)	Unit Rate L.C (Ls)	Amount F.C (Yen)	Amount L.C (Ls)	Total Amount (Yen)
4.14	Concrete (class A) for hollow slab bridges	2210	C.M	8153	193.51	18,018,130	427,657	31,322,542
4.15	Formworks for hollow slab	5484	S.M	5475	176.4	30,024,900	967,378	60,120,017
4.16	Reinforcing bar for hollow slab	430	Ton	55171	2192	23,723,530	942,560	53,046,572
4.17	Rubber expansion joint (120mm)	48	L.M	85694	615.9	4,113,312	29,563	5,033,023
4.18	Rubber exransion joint (100mm)	120	L.M	73336	615.9	8,800,320	73,908	11,099,598
4.19	Bearing shoe (Movable 300t)	8	Each	274813	1601	2,198,504	12,808	2,596,961
4.20	Rubber shoes							
	(1) Fixed (120t)	15	Each	122131	495	1,831,965	7,425	2,062,957
	(2) Movable (120t)	20	Each	122131	495	2,442,620	9,900	2,750,609
	(3) Fixed (100t)	52	Each	67780	495	3,524,560	25,740	4,325,331
	(4) Movable (100t)	52	Each	84060	495	4,371,120	25,740	5,171,891
	(5) Movable (50t)	30	Each	36980	495	1,109,400	14,850	1,571,384
	(6) Movable (40t)	78	Each	53810	495	4,197,180	38,610	5,398,337
4.21	Sidewalk, concrete wall, kerb includ. drainage pipe	1540	L.M	14381	648.84	22,146,740	999,214	53,232,275
4.22	Central reserve	750	L.M	3709	88.81	2,781,750	66,608	4,853,909
4.23	Handrailing	1500	L.M	25631	55.02	38,446,500	82,530	41,014,008
4.24	Asphaltic wearing surfase coarse for bridge	13245	S.M	1414	18	18,728,430	238,410	26,145,365
4.25	Newel Post Incl. Name Plate	4	Each	802521	21002	3,210,084	84,008	5,823,573
	Sub-Total of 4)					1,105,158,157	33,883,941	2,159,287,566
5	Ancillary Works							
5.1	Placing stone around piers for protection from scouring	3900	C.M	2041	63	7,959,900	245,700	15,603,627
5.2	Pier protection posts from ship collisiom	4	Each	1500000	12000	6,000,000	48,000	7,493,280
5.3	Road and bridge lighting work	200	No.	177950	1878	35,590,000	375,600	47,274,916
5.4	Right of way pillars	50	No.	12000		600,000	0	600,000
5.5	Temporary bridge for Construction	7452	S.M	73235	87.83	545,747,220	654,509	566,109,000
	Sub-Total of 5)					595,897,120	1,323,809	637,080,823
6	Engineer dispatched cost	1	L.S			260,678,800		260,678,800
7	Contractor's Overhead							
	(1) Site expense	1	L.S			433,088,600	10,752,100	767,586,431
	(2) General overhead	1	L.S			341,722,588	7,764,600	583,279,282
	Sub-Total of 7)					774,811,188	18,516,700	1,350,865,713
8	Grand Total					5,592,400,708	108,877,124	8,979,568,025

Land Acquisition and Compensation Cost

Prices are based on the information from NCK in October 1989. Quantities include the land which has been already owned by the Government of Sudan. It is, therefore, noted that actual expense for land acquisition and building compensation be less.

- Farm Land : 255,000 sq.m x Ls120/sq.m	= Ls30,600,000
- 3rd Class Land: 96,000 sq.m x Ls750/sq.m	= Ls72,000,000
- Building Compensation: 10 nos. x Ls200,000	= Ls2,000,000
Total	Ls104,600,000

** TLX (KDD) INCOMING **

Appendix 10.6 (2)

02 1830=300544
KOEICO J24557
22401 DALIA SD

交通技術部

ATT: MR.K. MATSUZAWA.

JICA STUDY TEAM ON NEW WHITE NILE BRIDGE.

REF : YOUR TELEX J 24557 OF SEP.20.1989 .

A) REFER TO MINUTES OF MEETING HELD.ON JUNE 14-1989 PARA 2(2) WE CONFIRM PROVISION OF SITES FOR CONSTRUCTION MATERIALS ON GOVERNMENT LAND ON CONDITION THAT THE LAND IS NOT ALLOCATED FOR OTHER PURPOSE .

B) PRICE OF THIRD CLASS RESIDENTIAL LAND LS.750 PER SQUARE METER.

C) PRICE OF FARM LAND LS.120 PER SQUARE METER .

D) MARKET PRICE FOR REAL ESTATE THIRD CLASS RESEDENTIAL AREA LS. 1500 PER SQURE METER .

BEST REGARDS

UNQUOTED: MOHAMED E.A. SAEED

DIRECTOR GENERAL

COMMISSIONERATE OF ENGINEERING AFFAIRS .
FOEICO J24557
22401 DALIA SD

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Project Cost Estimate in Case of FEM Rate (Parallel Rate)

This cost estimate is prepared just for reference purposes to apprehend the project cost when the free market exchange (FEM) rate, so-called parallel rate, would be adopted.

1 BASIS OF PROJECT COST

Project cost consists of Construction cost, Land Acquisition and Compensation cost, Engineering Service cost (Detailed Design and Supervision cost), NCK's Administration cost and Contingency. The basic system of the project cost estimate is diagrammed in Figure 10.1, considering characteristic of a large scale bridge project and the following assumption.

(1) Project cost is estimated at the price level as of the end of August 1989.

(2) The exchange rate is assumed to be :

US$ 1.0 = Ls 12.2 = Yen 140.0 = Lit 1,420

(3) Materials and equipment, which can not be procured in Sudan, are assumed to be imported from Japan or Italy. The unit prices are applied to the F.O.B price in the imported country. Transportation cost is separately estimated by each country.

(4) It is assumed that the project is undertaken by a Japanese contractor selected in a competitive tender under supervision of a Japanese consultant.

2 CONSTRUCTION COST

Construction cost consists of direct cost, cost of temporary works, transportation cost, specialists dispatched cost, site expense and general overheads. Each cost is estimated by broken items. Net construction cost is all costs except general overhead while main construction cost is direct cost plus cost of temporary works. The following is presented basic points of each cost item.

(1) Direct Cost

Direct cost consists of labour cost, equipment cost and material cost for each work item.

Labour costs per day were surveyed through interviewing a contractor organized by the Government and private contractors in Khartoum and listed in Appendix 10.1.

Equipment costs are estimated based on the depreciation rate used in Japan. Repair costs are assumed to be foreign currency portion (70 %) and local currency portion (30 %).

Market prices of giesel fuel, gasoline and lubricant procured in the local market have been applied to an official rate (US$ 1.0 = Ls 4.5) because these materials have been imported on the official rate. Consequently, these unit prices used in the project cost estimate should be converted to the parallel market rate (US$ 1.0 = Ls 12.2).

Materials, which cannot be procured in the Sudan, are assumed to be imported from Japan or Italy. The unit prices are applied to the F.O.B price in the imported country. Transportation cost is separately estimated by each country.

(2) Cost of Temporary Works

Cost of temporary works (preparatory works, camp facilities, Fences, Electric supply, water supply, clearing site, etc.,) is estimated considering site conditions.

(3) Transportation cost

Transportation cost is estimated in foreign currency portion for ocean freight and inland transportation. The ocean freight is originated in Japan or Italy to Port Sudan. Transportation cost is estimated at only one way for the imported materials and general equipment, but at two ways for special equipment such as 100t lifting capacity crawler crane, cantilever wagon,PC Bridge construction equipment etc.

(4) Specialists Dispatched Cost

It is expected that specialists for bridge construction (PC bridge Specialists, Foreman, Operator for special equipment) will be dispatched from Japan to train local skilled labour , because the local labour have little experience for a large scale bridge construction

project. The specialist dispatched cost is estimated with the planned numbers and periods based on the construction schedule. It is expected that 18 specialists will be dispatched from Japan.

(5) Overhead

Overhead is divided into site expense and general overhead. The site expense such as wages of contractor's stuff, operating and maintaining cost of contractor's office etc., are estimated by each item based on the Japanese standard. The general overhead is estimated as the following formula.

General Overhead = (Direct Cost of Main Works and Temporary Works of Main work + Specialist Dispatched Cost) X 10%

3 LAND ACQUISITION AND COMPENSATION COST

The proposed bridge site based on the spaces required for the approach road and contractor's camp sites is possessed by the government, while the farmers use as an agriculture area. A part of residential area is also an object of compensation. These compensation will be carried out in following methods.

1) Agricultural area

The government gives the farmers an agricultural area of equivalent value where the government possesses, and compensates for the furnitures and plants on the agriculture land.

2) Residential area

The government gives the residents the residential area of equivalent value where the government possesses. The value of the existing buildings is estimated by the discussion of the land committee and compensated by equivalent amount of money.

Consequently, land acquisition cost is basically estimated as equivalent values in the project cost, while compensation cost is estimated only for the residential buildings. The equivalent values are estimated adopting the following unit prices.

Description	Unit Price (LS/m^2)
1. Third Class Residential Land	750
2. Farm Land	120

The compensation cost is proposed to be Ls 200,000 / building based on the past results of building compensation.

4 ENGINEERING SERVICE COST

Engineering service cost is estimated for the detail design and supervision works undertaken by a Japanese Consultant team to design in detail, prepare the tender documents and give certification of the Works performed by the Contractor. The costs are estimated with the consultant's staff schedule based on the construction schedule.

5 NCK'S ADMINISTRATION COST

A great deal of liaison, co-ordination and administration work will have to be undertaken by the NCK's (National Capital Khartoum) as the Client in order to expedite the project. At this stage, it is assumed that 4 percent of the detailed design and supervision cost will be allowed for this Project.

6 Tax and Quay Due

Tax of construction materials and equipment are levied on the CIF prices of them when the materials and equipment are imported to Sudan, provided always that the materials and equipment carried out from Sudan after completion of the project are excepted from the Tax.

Quay due, which is estimated by 2% of CIF value in Port Sudan, is levied on all goods, materials and equipment required for the Project.

7 CONTINGENCY

This cost estimate is prepared on information available from the Feasibility study stage. Since it is assumed that bridge construction will be commenced about three years hence. Consequently, allowance must be made for such unknown factors;

- Economic changes (Exchange rate, Inflation etc.) in the Sudan, Japan and Italy.

- Changes in geological condition and quantities which may occur during the detail design stage.

- Changes in assumption regarding the proposed quarry and borrow areas and procurement of materials

From an assessment of above factors involved, the contingency is assumed to be maximum 5 % of the construction cost.

8 TOTAL PROJECT COST

Total project cost is shown in the next page along with the project implementation schedule.

Year	Calender	1990	1991	1992	1993	1994	1995
	Fiscal	1989	1990	1991	1992	1993	1994
Detailed Design		(6 months)					
Land Acquisition & Compensation		(14 months)					
Tender Assistance & Construction Supervision			(44 months)				
Construction			(42 months)				

FUND REQUIREMENT		Total Cost	(Unit: 1,000 Sudanese Pounds)				
Detailed Design Cost	FC	16,200	16,200				
	LC	1,220	1,220				
Land Acquisition & Compensation Cost	FC						
	LC	104,600	52,300	52,300			
NCK's Administration Cost	FC						
	LC	2,340	700	300	440	490	410
Tender Assistance & Construction Supervision Cost	FC	29,010		6,450	7,470	8,190	6,810
	LC	12,210		1,110	3,550	4,020	3,530
Construction Cost	FC	483,510		114,320	130,300	124,240	114,650
	LC	109,780		16,880	28,080	30,950	33,870
Tax and Quay Due	FC						
	LC	115,510		80,860	11,550	11,550	11,550
Contingency (5% of Construction Cost)	FC	24,170		5,720	6,510	6,210	5,730
	LC	5,490		840	1,400	1,550	1,700
TOTAL	FC	552,800	16,200	126,490	144,280	138,640	127,190
	LC	351,150	54,220	152,290	45,020	48,560	51,060
Grand Total		**903,950**	**70,420**	**278,780**	**189,300**	**187,200**	**178,250**
(1,000 US Dollars)		(74,094)	(5,772)	(22,851)	(15,516)	(15,344)	(14,611)

Notes: (1) Cost estimate was made based on August 1989 prices and exchange rate US $1.0=Ls12.2=Y140.

(2) Land acquisition and compensation costs include the land prices already owned by the Government of Sudan.

Economic Evaluation

Table of Contents

Summary of Unskilled Laborer Survey (1/2)

1	53				Plaster	3	8	35	9	
2	21				Driver	3	8	50	13	
3	42	Cleaning	394	F					16	
4	45	Cleaning	394	F					16	
5	47				Excavater	5	8	15	6	
6	26								0	
7	40	Laborer	750	F					30	
8	35	Excavate	450	F					18	
9	40				Trader	3	8	20	5	
10	35	Caltivate	1000	N					33	
11	25				Laborer	3	8	50	13	
12	33	Laborer	450	F					18	
13	25				Carpentor	3	8	30	8	
14	22				Laborer	3	10	30	6	
15	21	Laborer	300	N					12	Waiter
16	30				Carpentor	3	10	30	6	
17	27				Laborer	3	12	35	6	Electrical Laborer
18	36				Painter	3	10	50	10	
19	34				Laborer	3	10	60	13	Water Pipe Laborer
20	34				Laborer	3	10	60	13	Electrucal Laborer
21	49				Watchman	3	8	65	16	
22	53	Laborer	275	F					11	
23	23	Collector	900	N					36	Ticket Collector
24	35				Shoes Mak	3	12	40	6	Shoes Maker
25	20	Driver	900		Laborer	5	8	25	46	
26	31	Builder	1200	F					48	
27	29				Laborer	3	8	60	15	
28	33				Driver	3	12	50	9	
29	26	Cooker	900	F					36	
30	28				Excavate	5	6	15	5	
31	51				Excavate	5	6	15	5	
32	26								0	
33	41	Builder	1500	F					60	
34	33	Driver	900	F					36	
35	22				Laborer	3	8	40	10	
36	20	Carpenter	300	F					12	
37	22								0	
38	30	Driver	750	N					30	
39	25				Laboere	3	8	35	9	
40	26				Carpenter	3	12	30	5	
41	25				Laboere	3	8	45	6	
42	29	Laborer	450	F					18	
43	35	Forman	300	F	Driver	3	8	50	25	
44	50	Gardner				3	8	40	10	
45	40	Farmen	300	F					12	
46	27				Driver	3	12	50	9	
47	57	Driver	1000	F					40	
48	27	Ass.Drive	300	F	Builder	3	8	50	25	
49	29	Driver	750	F					30	

Summary of Unskilled Laborer Survey (2/2)

50	30				Driver	3	12	130	22	
51	23				Laborer	3	12	60	10	
52	22				Laborer	3	8	30	5	
53	17				Laborer	3	8	17	8	
54	40	Laborer	300	F					12	
55	50				Laborer	3	8	20	5	
56	39	Tecnitian	392	F					15	
57	20				Tecnitian	3	8	30	8	
58	18				Tecnitian	3	8	30	8	
59	34				Tecnitian	3	8	100	25	
60	22				Tecnitian	3	8	60	15	
61	30	Assi.Drive	200	F					8	
62	26	Driver	900	F					36	
63	28				Trander	3	8	40	10	
64	34				Trander	3	8	50	13	
65	37				Trander	3	12	70	11	
66	33	Forman	1300	F					35	
67	18				Laborer	3	8	45	11	
68	25				Fisher	3	5	25	10	
69	54				Driver	3	10	80	16	
70	45	Driver	1500	F					40	
71	19				Laborer	3	12	25	5	Mechanic
72	40				Laborer	3	12	100	20	Mechanic
73	37				Laborer	3	10	50	10	Elecric
74	32				Laborer	3	10	100	20	Electric
75	47				Laborer	3	10	150	30	
76	33				Laborer	3	8	75	19	
77	31				Laborer	3	8	75	18	
78	23				Tecnitian	3	10	100	20	
79	31				Carpenter	3	8	75	19	
80	40				Electric	3	10	150	20	
81	60				Painter	3	8	60	15	
82	60				Painter	3	8	60	15	
83	52				Builder	3	8	100	20	
84	35				Driver	3	10	100	20	
85	54				Builder	3	8	100	20	
86	63				Forman	3	10	150	30	Painting
87	21				Laborer	3	8	65	16	
									1461	
									17	

Table 11.2 Economic Cost And Benefit

(Unit : Ls 1,000)

Year	Construction Cost	Maintenance Cost		Sulvage Value	Total Cost	Time Saving	VOC Saving	Maintenance Saving	Reconstruction Saving	Avoiding Detour Cost	Total Benefit
		Road	Bridge								
1991	59081				60688						0
1992	272397				273995						0
1993	284738				289129						0
1994	275293				280707						0
1995	255221				259601						0
1996		1407			1407	89920	10821				100741
1997		1407			1407	104197	9919				114116
1998		1407			1407	120740	9093				129833
1999		1407			1407	139910	8335				148245
2000		7036			7036	162124	7640		133778	94003	397546
2001		1407			1407	187866	7004				194869
2002		1407	3186		4593	217694	6420	173			224287
2003		1407			1407	252257	5885				258142
2004		1407			1407	292309	5395				297704
2005		7036			7036	338720	4945				343665
2006		1407			1407	407662	4759				412421
2007		1407			1407	490637	4580				495217
2008		1407			1407	590500	4408				594908
2009		1407	3186		4593	710689	4242	187			715118
2010		7036			7036	855340	4082				859423
2011		1407			1407	1029435	3929				1033363
2012		1407			1407	1238963	3781				1242744
2013		1407			1407	1491139	3639				1494778
2014		1407			1407	1794642	3502				1798144
2015		7036		-155599	-148563	2159919	3370				2163289

Cost And Benefit

(Case of Official Rate $ 1 = Ls 4.5) (Unit : Ls 1,000)

Year	Construction Cost	Maintenance Cost Road	Maintenance Cost Bridg	Sulvage Value	Total Cost	Time Saving	VOC Saving	Maintenance Saving	Reconstruction Saving	Avoiding Detour Cost	Total Benefit
1991	34707				34488						0
1992	82494				82111						0
1993	68518				66791						0
1994	67413				66164						0
1995	63897				63012						0
1996		392			392	89920	10821				100741
1997		392			392	104197	9919				114116
1998		392			392	120740	9093				129833
1999		392			392	139910	8335				148245
2000		1962			1962	162124	7640		35528	94003	299296
2001		392			392	187866	7004				194869
2002		392	732		1124	217694	6420	44			224157
2003		392			392	252257	5885				258142
2004		392			392	292309	5395				297704
2005		1962			1962	338720	4945				343665
2006		392			392	407662	4759				412421
2007		392			392	490637	4580				495217
2008		392			392	590500	4408				594908
2009		392	732		1124	710689	4242	47			714978
2010		1962			1962	855340	4082				859423
2011		392			392	1029435	3929				1033363
2012		392			392	1238963	3781				1242744
2013		392			392	1491139	3639				1494778
2014		392			392	1794642	3502				1798144
2015		1962		-41127	-39165	2159919	3370				2163289

B/C	6.516
NPV	990233 (Ls 1,000)
IRR	31.3

Cost And Benefit

(Case of Parallel Rate $ 1 = Ls 12.2) (Unit : Ls 1,000)

Year	Construction Cost	Maintenance Cost Road	Maintenance Cost Bridg	Sulvage Value	Total Cost	Time Saving	VOC Saving	Maintenance Saving	Reconstruction Saving	Avoiding Detour Cost	Total Benefit
1991	44937				45488						0
1992	162315				162673						0
1993	158638				160139						0
1994	154528				156239						0
1995	144052				145550						0
1996		922			922	89920	10821				100741
1997		922			922	104197	9919				114116
1998		922			922	120740	9093				129833
1999		922			922	139910	8335				148245
2000		4610			4610	162124	7640		76778	94003	340546
2001		922			922	187866	7004				194869
2002		922	1762		2684	217694	6420	88			224201
2003		922			922	252257	5885				258142
2004		922			922	292309	5395				297704
2005		4610			4610	338720	4945				343665
2006		922			922	407662	4759				412421
2007		922			922	490637	4580				495217
2008		922			922	590500	4408				594908
2009		922	1762		2684	710689	4242	94			715025
2010		4610			4610	855340	4082				859423
2011		922			922	1029435	3929				1033363
2012		922			922	1238963	3781				1242744
2013		922			922	1491139	3639				1494778
2014		922			922	1794642	3502				1798144
2015		4610		-76024	-71414	2159919	3370				2163289

B/C 3.351
NPV 871284 (Ls 1,000)
IRR 23.2%

Implementation Program

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Disbursement and Implementation Schedule of the Construction of the New White Nile Bridge Project

A disbursement schedule was prepared based on Appendix 10.1 to 10.6 to 12.1 (4). An implementation was prepared, accordingly, as shown in Appendix 12.1 (5).

Year	Calender	1990	1991	1992	1993	1994	1995
	Fiscal	1989	1990	1991	1992	1993	1994
Detailed Design			(6 months)				
Land Acquisition & Compensation			(14 months)				
Tender Assistance & Construction Supervision					(44 months)		
Construction					(42 months)		

FUND REQUIREMENT		Total Cost	(Unit: 1,000 Sudanese Pounds)				
Detailed Design Cost	FC	5,970	5,970				
	LC	1,220	1,220				
Land Acquisition & Compensation Cost	FC						
	LC	104,600	52,300	52,300			
NCK's Administration Cost	FC						
	LC	2,340	700	300	440	490	410
Tender Assistance & Construction Supervision Cost	FC	10,670		2,380	2,760	3,020	2,510
	LC	12,210		1,110	3,550	4,020	3,530
Construction Cost	FC	179,760		42,200	48,940	46,210	42,410
	LC	108,880		16,060	28,370	30,300	34,150
Tax and Quay Due	FC						
	LC	42,610		29,830	4,260	4,260	4,260
Contingency (5% of Construction Cost)	FC	8,980		2,110	2,450	2,310	2,110
	LC	5,450		800	1,420	1,520	1,710
TOTAL	FC	205,380	5,970	46,690	54,150	51,540	47,030
	LC	277,310	54,220	100,400	38,040	40,590	44,060
Grand Total		482,690	60,190	147,090	92,190	92,130	91,090
(1,000 US Dollars)		(107,264)	(13,375)	(32,687)	(20,487)	(20,473)	(20,242)

Notes: (1) Cost estimate was made based on August 1989 prices and exchange rate US$1.0=Ls4.5=Y140.

(2) Land acquisition and compensation costs include the land prices already owned by the Government of Sudan.

DISBUESEMENT SCHEDULE OF PROJECT COST (1/3)

Item No.	Description	Disbursement (%)				Amount		1'st Year (1992)		2'nd Year (1993)		3'rd Year (1994)		4'th Year (1995)	
		1st	2nd	3rd	4th	F.C (¥)	L.C (Ls)	F.C (¥)	L.C (Ls)	F.C (¥)	L.C (Ls)	F.C (¥)	L.C (Ls)	F.C (¥)	L.C (Ls)
1	General Works														
1.1	Freight, insurance and inland transportation for imported plants, equipment & materials	70	10	10	10	1276742400	0	893,719,680	0	127,674,240	0	127,674,240	0	127,674,240	0
1.2	Development for Camp Yard-1 Camp Yard II	100	0	0	0	52152000	1291890	52,152,000	1,291,890	0	0	0	0	0	0
1.3	Engineer's site Office including Maintenance	70	20	5	5		1175900	0	823,130	0	235,180	0	58,795	0	58,795
1.4	Site laboratory and clinic with ambulance	100	0	0	0	2250000	372800	2,250,000	372,800	0	0	0	0	0	0
1.5	Site Preparation of temporary work including office, quarter store houses and others	70	20	5	5	36390200	7139100	25,473,140	4,997,370	7,278,040	1,427,820	1,819,510	356,955	1,819,510	356,955
1.6	Installation & removal of Construction plants	100	0	0	0	12633520	372995	12,633,520	372,995	0	0	0	0	0	0
1.7	Safty control of existing traffic in road and waterway	0	30	40	30	1088000	322000	0	0	326,400	96,600	435,200	128,800	326,400	96,600
1.8	Engineering control of works including measurement of strain and laboratory test	60	10	10	20	19000000	2022200	11,400,000	1,213,320	1,900,000	202,220	1,900,000	202,220	3,800,000	404,440
1.9	Temporary project information Boards	100	0	0	0	107516	17543	107,516	17,543	0	0	0	0	0	0
	Total of 1.					1400363636	12714428	997,735,856	9,089,048	137,178,680	1,961,820	131,828,950	746,770	133,620,150	916,790
2	Approach Roads														
2.1	Clearing & stripping	100	0	0	0	0	517750	0	517,750	0	0	0	0	0	0
2.2	Embankment of Road	60	0	40	0	204849356	4174440	122,789,614	2,504,664	0	0	81,859,742	1,669,776	0	0
2.3	Sub-grade of selected soil	0	0	10	90	40001728	822151	0	0	0	0	4,000,173	82,215	36,001,555	739,936
2.4	Excavation of Road	100	0	0	0	3852870	87672	3,852,870	87,672	0	0	0	0	0	0
2.5	Sub-base coarse	0	0	10	90	56898540	1848841	0	0	0	0	5,689,854	184,884	51,208,686	1,663,957
2.6	Asphaltic base coarse	0	0	0	100	56184000	992561	0	0	0	0	0	0	56,184,000	992,561
2.7	Base coarse of cruched stone	0	0	0	100	43073526	1413978	0	0	0	0	0	0	43,073,526	1,413,978
2.8	Asphaltic binder coarse	0	0	0	100	45375120	622407	0	0	0	0	0	0	45,375,120	622,407
2.9	Asphaltic surface coarse	0	0	0	100	50178720	622407	0	0	0	0	0	0	50,178,720	622,407
2.10	Sidewalk pavement	0	0	0	100	38634320	854390	0	0	0	0	0	0	38,634,320	854,390
2.11	Overlay for Intersection	0	0	0	100	2018940	25382	0	0	0	0	0	0	2,018,940	25,382
2.12	Box and pipe culverts														
	(1) 5.0 × 4.0 × 7.0 m	0	100	0	0	1058470	71673	0	0	1,058,470	71,673	0	0	0	0
	(2) 6.0 × 4.5 × 30.0 m	0	100	0	0	6636300	444358	0	0	6,636,300	444,358	0	0	0	0
	(3) 6.0 × 4.0 × 30.0 m	0	100	0	0	6329500	407684	0	0	6,329,500	407,684	0	0	0	0
	(4) Dia. 300mm	0	100	0	0	366066	45731	0	0	366,066	45,731	0	0	0	0
	(5) Dia. 600mm	0	100	0	0	1411776	191976	0	0	1,411,776	191,976	0	0	0	0
2.13	Approach slab	0	0	0	100	1488000	40528	0	0	0	0	0	0	1,488,000	40,528
2.14	Stone masonry for slop Protection	0	60	0	40	110147490	3401698	0	0	66,088,494	3,241,018	0	0	44,058,996	2,160,680
2.15	Guardrail	0	0	0	100	22419000	466825	0	0	0	0	0	0	22,419,000	466,825
2.16	Breakwater facilities	0	0	0	100	33148152	2437632	0	0	0	0	0	0	33,148,152	2,437,632
2.17	Curb stone	0	0	0	100	16934805	2190882	0	0	0	0	0	0	16,934,805	2,190,882
2.18	Stone Masonry Drainage 5×1.5	0	100	0	0	9617850	314780	0	0	9,617,850	314,780	0	0	0	0
2.19	Concrete drainage of sidewalk	0	0	0	100	4497000	687360	0	0	0	0	0	0	4,497,000	687,360
2.20	Central Riserve	0	0	0	100	12969144	1640560	0	0	0	0	0	0	12,969,144	1,640,560
2.21	Catch basin	0	0	0	100	60093	7733	0	0	0	0	0	0	60,093	7,733
2.22	Road related works														
	(1) Traffic signal	0	0	0	100	15140646	108090	0	0	0	0	0	0	15,140,646	108,090
	(2) Traffic sign	0	0	0	100	1557576	3504	0	0	0	0	0	0	1,557,576	3,504
	(3) traffic marking	0	0	0	100	11476836	22148	0	0	0	0	0	0	11,476,836	22,148
	(4) Plantation for central riserve	0	0	0	100	308353	186050	0	0	0	0	0	0	308,353	186,050
	(5) Plantation for sidewalk	0	0	0	100	811440	519180	0	0	0	0	0	0	811,440	519,180
	Sub-Total Of 2					797243617	27172370	125,642,484	3,110,088	91,508,456	4,717,220	91,549,769	1,936,875	487,542,908	17,408,189

DISBUESEMENT SCHEDULE OF PROJECT COST (2/3)

Item No.	Description	Disbursement (%) 1st	2nd	3rd	4th	Amount F.C (¥)	L.C (Ls)	1st Year (1992) F.C (¥)	L.C (Ls)	2nd Year (1993) F.C (¥)	L.C (Ls)	3rd Year (1994) F.C (¥)	L.C (Ls)	4th Year (1995) F.C (¥)	L.C (Ls)
3	Substructure of Bridge														
3.1	Cast-in-place concrete pile ø1.2m inclusive of cost for pile excavation, concrete, steel bar and pile head treatment	0	40	60	0	190866060	4565497	0	0	76,346,424	1,826,199	114,519,636	2,739,298	0	0
3.2	Installation & removal of coffer dam for piers construction														
	(1) CofferdamP11, P12 & P17~P24	0	20	80	0	86085000	496100	0	0	17,213,000	99,220	68,852,000	396,880	0	0
	(2) Cofferdam P13 & P16	0	50	50	0	21211400	100030	0	0	10,605,700	50,015	10,605,700	50,015	0	0
	(3) cofferdam P14 & P15	0	90	10	0	50911000	206148	0	0	45,819,900	185,533	5,091,100	20,615	0	0
3.3	Structural excavation inwater	0	35	65	0	11013160	189596	0	0	3,854,606	66,359	7,158,554	123,237	0	0
3.4	Structural excavation	0	60	40	0	5165230	139770	0	0	3,099,138	83,862	2,066,092	55,908	0	0
3.5	Concrete(class A) of piers inclusive pile cap	0	30	70	0	1513439930	3445808	0	0	45,403,179	1,033,742	105,940,751	2,412,066	0	0
3.6	Concrete(class A) of A1 & A2 abutment inclusive pile cap	0	50	50	0	12074690	274917	0	0	6,037,345	137,459	6,037,345	137,459	0	0
3.7	Concrete(class P) from top of pile cap of P14 & P15 piers	0	50	50	0	8403780	193724	0	0	4,201,890	96,862	4,201,890	96,862	0	0
3.8	Levelling concrete(class C) for pile works	0	30	70	0	2780380	63176	0	0	834,114	18,953	1,946,266	44,223	0	0
3.9	Formwork for abutments	0	50	50	0	1445398	208903	0	0	722,699	104,452	722,699	104,452	0	0
3.10	Formwork for piers	0	30	70	0	39151140	3181266	0	0	11,745,342	954,386	27,405,798	2,226,900	0	0
3.11	Formwork for V-type Piers	0	50	50	0	32585724	1247032	0	0	16,292,862	623,516	16,292,862	623,516	0	0
3.12	Reinforcing bar of abutments and piers	0	35	65	0	43196534	901675	0	0	15,118,787	315,586	28,077,747	586,089	0	0
3.13	Foundation stone boulder for levelling concrete	0	35	65	0	2034764	52214	0	0	712,167	18,275	1,322,597	33,939	0	0
	Sub-Total Of 3.					658248190	15265876	0	0	258,007,153	5,614,418	400,241,037	9,651,458	0	0
4	Superstructure of Bridge														
4.1	Concrete(class P) for PC box girders	0	0	75	25	68393385	1858921	0	0	0	0	51,295,039	1,394,191	17,098,346	464,730
4.2	Formworks for PC box girders by travelling form inside of box girder and above V leg	0	0	75	25	179131560	2931920	0	0	0	0	134,348,670	2,198,940	44,782,890	732,980
4.3	Reinforcing bar for PC box girders	0	0	75	25	21323497	853830	0	0	0	0	15,992,623	640,373	5,330,874	213,458
4.4	Prestressing PC cable includ. cost of PC tendon, sheath & coupling joint and anchoring														
	(1) Main cable stressing	0	0	75	25	137691940	3315465	0	0	0	0	103,268,955	2,486,599	34,422,985	828,866
	(2) Lateral cable stressing	0	0	75	25	14399550	630740	0	0	0	0	10,799,663	473,055	3,599,888	157,685
	(3) Vertical cable stressing	0	0	75	25	13007715	269520	0	0	0	0	9,755,786	202,140	3,251,929	67,380
4.5	Grout injection into sheath														
	(1) Main cable grouting	0	0	75	25	3416980	535246	0	0	0	0	2,562,735	401,435	854,245	133,811
	(2) Lateral cable grouting	0	0	75	25	614111	111930	0	0	0	0	460,583	83,948	153,528	27,983
	(3) Vertical cable grouting	0	0	75	25	346080	48484	0	0	0	0	259,560	36,363	86,520	12,121
4.6	Concrete(class P) for T-beams	0	100	0	0	46990951	1117602	0	0	46,990,951	1,117,602	0	0	0	0
4.7	Concrete(class P) for slab and diaphragms concrete	0	0	40	60	44491764	1227350	0	0	0	0	17,796,706	490,940	26,695,058	736,410
4.8	Formworks for PC T-beams	0	60	15	25	12257280	7098522	0	0	7,354,368	4,259,113	1,838,592	1,064,778	3,064,320	1,774,631
4.9	Reinforcing bar for PC T-beam	0	70	10	20	32578630	1199520	0	0	22,805,041	839,664	3,257,863	119,952	6,515,726	239,904
4.10	Stressing PC cable for T-beam includ. sheath and anchoring														
	(1) Main cable stressing	0	100	0	0	191939228	3238508	0	0	191,939,228	3,238,508	0	0	0	0
	(2) Lateral cable stressing	0	0	30	70	24871950	1089460	0	0	0	0	7,461,585	326,838	17,410,365	762,622
4.11	Grout injection into sheath														
	(1) Main cable grouting	0	100	0	0	8623650	1208132	0	0	8,623,650	1,208,132	0	0	0	0
	(2) Lateral cable grouting	0	0	30	70	1077225	196340	0	0	0	0	323,168	58,902	754,058	137,438
4.12	Erection of PC T-beams	0	0	30	70	98762664	2359656	0	0	0	0	29,628,799	707,897	69,133,865	1,651,759

DISBUESEMENT SCHEDULE OF PROJECT COST (3/3)

Item No.	Description	Disbursement (%) 1st	2nd	3rd	4th	Amount F.C (¥)	L.C (Ls)	1'st Year (1992) F.C (¥)	L.C (Ls)	2'nd Year (1993) F.C (¥)	L.C (Ls)	3'rd Year (1994) F.C (¥)	L.C (Ls)	4'th Year (1995) F.C (¥)	L.C (Ls)
4.13	Conection joint for T-beams	0	0	30	70	15570952	545888	0	0	0	0	4,671,286	163,766	10,899,666	382,122
4.14	Concrete (class A) for hollow slab bridges	0	0	70	30	18018130	427657	0	0	0	0	12,612,691	299,360	5,405,439	128,297
4.15	Formworks for hollow slab	0	0	70	30	30024900	967378	0	0	0	0	21,017,430	677,165	9,007,470	290,213
4.16	Reinforcing bar for hollow slab	0	0	70	30	23723530	942560	0	0	0	0	16,606,471	659,792	7,117,059	282,768
4.17	Rubber expansion joint (120mm)	0	0	0	100	4113312	29563	0	0	0	0	0	0	4,113,312	29,563
4.18	Rubber exransion joint (100mm)	0	0	0	100	8800320	73908	0	0	0	0	0	0	8,800,320	73,908
4.19	Bearing shoe (Movable 300t)	0	0	0	100	2198504	12808	0	0	0	0	0	0	2,198,504	12,808
4.20	Rubber shoes														
	(1) Fixed (120t)	0	0	0	100	1831965	7425	0	0	0	0	0	0	1,831,965	7,425
	(2) Movable (120t)	0	0	0	100	2442620	9900	0	0	0	0	0	0	2,442,620	9,900
	(3) Fixed (100t)	0	0	0	100	3524560	25740	0	0	0	0	0	0	3,524,560	25,740
	(4) Movable (100t)	0	0	0	100	4371120	25740	0	0	0	0	0	0	4,371,120	25,740
	(5) Movable (50t)	0	0	0	100	1109400	14850	0	0	0	0	0	0	1,109,400	14,850
	(6) Movable (40t)	0	0	0	100	4197180	38510	0	0	0	0	0	0	4,197,180	38,510
4.21	Sidewalk, concrete wall, kerb incl.ud. drainage pipe	0	0	0	100	22146740	999214	0	0	0	0	0	0	22,146,740	999,214
4.22	Central reserve	0	0	0	100	2781750	66608	0	0	0	0	0	0	2,781,750	66,608
4.23	Handrailing	0	0	0	100	38446500	82530	0	0	0	0	0	0	38,446,500	82,530
4.24	Asphaltic wearing surface coarse for bridge	0	0	0	100	18728430	238410	0	0	0	0	0	0	18,728,430	238,410
4.25	Newel Post Incl. Name Plate	0	0	0	100	3210084	84008	0	0	0	0	0	0	3,210,084	84,008
	Sub-Total of 4)					1105158157	33883943	0	0	277,713,238	10,663,019	443,958,203	12,486,432	383,486,716	10,734,492
5	Ancillary Works														
5.1	Placing stone around piers for protection from scouring	0	30	70	0	7959900	245700	0	0	2,387,970	73,710	5,571,930	171,990	0	0
5.2	Pier protection posts from ship collision	0	0	0	100	6000000	48000	0	0	0	0	0	0	6,000,000	48,000
5.3	Road and bridge lighting work	0	0	0	100	35590000	375600	0	0	0	0	0	0	35,590,000	375,600
5.4	Right of way pillars	100	0	0	0	600000	0	600,000	0	0	0	0	0	0	0
5.5	Temporary bridge for Construction	0	85	10	5	545747220	654509	0	0	463,885,137	556,333	54,574,722	65,451	27,287,361	32,725
	Sub-Total of 5)					5958897120	1323809	600,000	0	466,273,107	630,043	60,146,652	237,441	68,877,361	456,325
6	Engineer dispatched cost	10	35	35	20	260678800	0	26,067,880	0	91,237,580	0	91,237,580	0	52,135,760	0
7	Contractor's Overhead														
	(1) Site expense	20	25	30	25	433088600	10752100	86,617,720	2,150,420	108,272,150	2,688,025	129,926,580	3,225,630	108,272,150	2,688,025
	(2) General overhead	22	27	26	25	341722588	7764600	75,178,969	1,708,212	92,265,099	2,096,442	88,847,873	2,018,796	85,430,647	1,941,150
	Sub-Total of 7)					774811188	18516700	161,796,689	3,858,632	200,537,249	4,784,467	218,774,453	5,244,426	193,702,797	4,629,175
8	Grand Total					5592400708	108877126	1,312,842,909	16,057,766	1,522,455,463	28,370,986	1,437,736,644	30,303,402	1,319,365,592	34,144,971

NATIONAL CAPITAL

RESPONSIBILITIES AND MAJOR ACTIVITIES

The Commissioner General and the National Capital Council are responsible for the following major activities:-

1 - The reasonable administration of the National Capital towards rendering it well secured and safe and keeping it in the desired standard of law and public order.

2 - Supervising of the Police, Imprisonment, Fire Brigade forces of the National Capital, and the administration of penalty institutions.

3 - Drafting and executing of the development plans of the National Capital that will lead to the construction of its infrastructure.

4 - Making efforts to find ways for the efficient handling of food stuffs, necessary rations and supplies of different resources of energy and seeking ways for the fair distribution of these supplies among the National Capital population.

5 - Building of public schools and the efficient administration of education institutions in the National Capital.

6 - Building of public hospitals and health centres and their efficient administration, besides the training of the assistant medical cadres of these health institutions.

7 - Building and administrating of the veterinary institutions and the training of their assistant veterinary cadres

8 - Supervision and efficient control of means of public mass transportation in the National Capital.

9 - Supervision and formation of the cooperative societies in the National Capital.

10- Developing of the financial resources in the National Capital.

11- Promoting of the Peoples Local Government System and the efficient supervision of its institutions in the National Capital.

12- Promoting of religious culture and information, sports and youth services.

13- Organizing the commercial, industrial, agricultural, forests and animal wealth activities in the National Capital.

14- Construction and maintenance of bridges and roads in the National Capital.

15- Administration of manpower and the efficient utilization of public services in the National Capital.

16- Construction and maintenance of sewers and surface drains.

The number of employees in the National Capital is approx. equal 37,308 .

National Capital Budget - Expenditure is approx. equal to Ls£ 359,313,000

Employees and labourers of the Engineering Commissionerate ;-

1. Professionals :

   95 - Engineers (university degrees)

   101 - Technicians

   6 - Administrators

2. Administration officials :

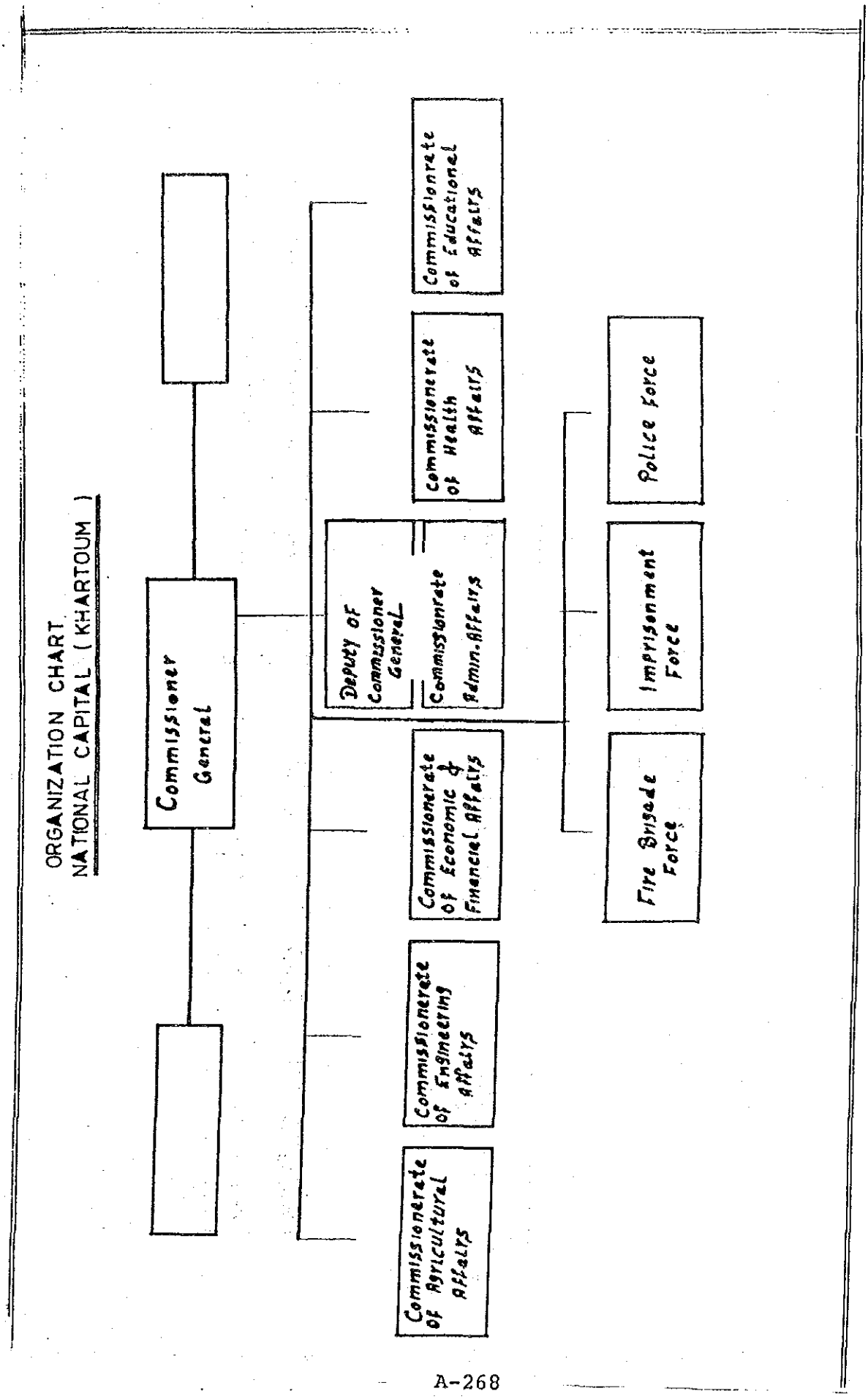
   25 - Clerks

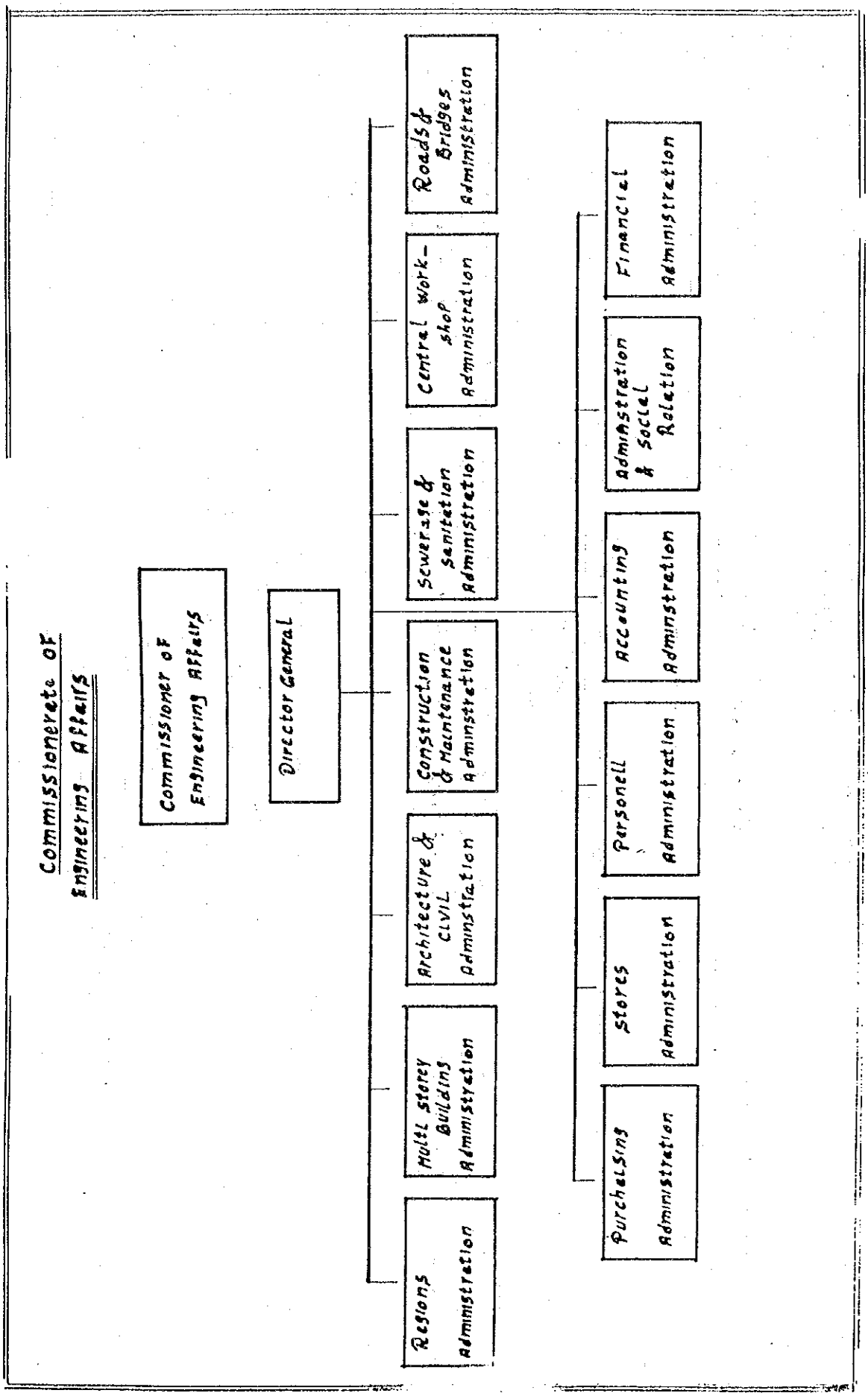
   190 - Accountants

   21 - Purchasing officers and storekeepers

3. Labourers :

   824 - Unskilled labourers.


ORGANIZATION CHART
NATIONAL CAPITAL (KHARTOUM)
Commissioner General
Deputy of Commissioner General
Commissionerate Admin. Affairs
Commissionerate of Educational Affairs
Commissionerate of Health Affairs
Police Force
Imprisonment Force
Fire Brigade Force
Commissionerate of Economic & Financial Affairs
Commissionerate of Engineering Affairs
Commissionerate of Agricultural Affairs


Commissionerate of Engineering Affairs
Commissioner of Engineering Affairs
Director General
Regions Administration
Multi storey Building Administration
Architecture & CIVIL Administration
Construction & Maintenance Administration
Purchasing Administration
Stores Administration
Personell Administration
Accounting Administration
Administration & Social Relation
Financial Administration
Sewerage & Sanitation Administration
Central Work-shop Administration
Roads & Bridges Administration