資料編 J　経済評価

J.1　変換係数

J.1.1　標準変換係数（ＳＣＦ）

ＳＣＦは次式によって求められた。

$$CFC = (CITM + CETM) - (CITM + CETM + CITX - CETX + CETS)$$

Where: CFC = Conversion Factor for Consumer Goods: CFC = 0.935
CITM = Total amount of imported consumers goods
CETM = Total amount of exported consumers goods
CITX = Total revenue of consumers goods import duty
CETX = Total revenue of consumers goods export duty
CETS = Total amount of consumers goods export subsidy

J.1.2　消費財のための変換係数（ＣＦＣ）

ＣＦＣは次式によって求められた。

$$SCF = (ITM + ETM) \div (ITM + ETM + ITX - ETX + ETS)$$

Where: SCF = Standard Conversion Factor: SCF = 0.92
ITM = Total amount of import
ETM = Total amount of export
ITX = Total revenue of import duty
ETX = Total revenue of export duty
ETS = Total amount of export subsidy

J.1.3　ＳＣＦおよびＣＦＣのための基礎データ

ＳＣＦおよびＣＦＣの算定のために用いられた基礎データを表J.1.1に示す。

Table J.1.1 BASIC DATA USED IN COMPUTATION OF SCF AND CFC

Year			1975	1976	1977	1978	1979	1980	
Unit cost									
Total Amount of major export products	*1	Kf000	215,125	318,656	480,259	369,965	385,534	487,644	513,705
Amount of exported consumers goods	*2	Kf000	106,948	188,116	338,151	241,745	237,746	241,130	257,999
Total import of major products	*3	Kf000	362,847	406,996	531,446	661,125	620,156	959,030	931,842
Amount of imported consumers goods	*4	Kf000	69,614	85,155	104,711	134,084	122,494	181,939	156,335
Amount of reexportation		Kf000				25,747	27,253	28,060	23,350
Amount of direct import by government		Kf000		22,206	17,014	30,004	37,456	69,900	83,000
Total revenue of export duty	*5	Kf000				8,270	2,800	7,030	3,130
Export duty on consumers goods									
Total revenue of import duty	*6	Kf000	47,368	47,990	66,159	84,293	90,304	120,387	126,649
Import duty on consumers goods	*7	Kf000	10,802	13,736	20,351	23,128	20,284	30,016	28,120
Total amount of export subsidy	*8								
Consumers goods export subsidy	*8								

*1. (1) Source of basic data: Domestic Exports, Principal Commodities, Annual Trade Reports, Customs and Excise Department

(2) Value evaluated: FOB Price

(3) Inclusive of export duty

*2. (1) Source of basic data: Same as above

(2) Formula applied:-

Amount of exported consumers goods
= Food, Beverages and Tobacco
+ Manufactured Goods
- Chemicals
- Leather
- Wood other
- Cement
+ Miscellaneous

*3. (1) Source of basic data: Same as above

(2) Value evaluated: CIF price

(3) Inclusive of amount of reexportation

*4. (1) Source of basic data: Same as above

(2) Formula applied:-

Amount of imported consumers goods
= Food and Live Animals
+ Beverages and Tabacco
+ Animal and Vegetable Oil and Fats
+ Chemicals
- Chemical elements and compounds
- Pigment, paints, varnishes
- Manufactured fertilizers
- All other chemicals
+ T.V. Sets
+ Passenger motor cars, complete
+ Bicycle, not motorized
+ Miscellaneous manufactured articles

*5. Source of basic data: Tax Revenues and Other Receipts, Central Government Cross Receipts on Recurrent Account

*6. Source of basic data: Same as above

*7. (1) Source of basic data: Same as above

(2) Method of estimation:

Imported duties correspondent to item classification adopted in the computation of amount of imported consumers goods given in *4 are added.

Import duty related to chemicals and machinery and transport equipment are estimated based on proportion of amount of detailed breakdown items of these against the amount of the items in intermediate classification.

*8. (1) As regulated by "Export Compensation Act."

(2) Outlines of the above Act are as summarized below:-

i. Scope of application: All products of domestic makers consuming 30% or more of the relevant material resource.

ii. Exceptions: The following products are excluded from the scope of this Act.

- Horticultural products, black tea, Dalmatian phrethrum, sugar, sisal, petroleum products, soda, ash,
- Products made of duty-free imported material

iii. Amount of subsidy renumeration

- For products of 1 million Shs or smaller amount of import: 10% of the invoiced amount.
- For products of 1 million Shs or more amount of export: 100 thousand Shs + (invoiced amount - 1 million Shs) x 25%.

(3) This Act is not functioning currently for short of government fund. The subsidy yet to be paid has so far amounted to over 100 million Ksh.

J.1.4 国内調達分のための変換係数

(1) 現地雇傭労務者の賃金に適用される変換係数

この変換係数はＣＦＣ（＝0.935）に同じとした。

(2) 現地調達資材にかかわる変換係数は次式によって想定された。

$$CFLM = \frac{PC + GAC}{SA} \times SCF + OPAT \times SCF$$

$$= 0.834$$

CFLM: conversion factor for locally procured material

PC : production cost

GAC : general administration cost

SA : sales tax

OPAT: operational profit after tax

上記の計算に必要なデータを以下に示す。（hearingによる）

Production Cost and Administration Cost	: 80.6%	
Sales Tax	: 1.2%	
Operation Profit Before Tax	: (18.2%)	* Chargeable Income Tax Rate: 45%
Income Tax, etc.	: 8.2%*	
Operational Profit After Tax	: 10.0%	
	100.0%	

(3) 現地調達の燃料にかかわる変換係数は次式によって想定された。

$$CFLPF = \frac{OPC}{SA} \times SCF + \frac{OPP}{SA} \times SCF = 0.167$$

CFLPF: conversion factor for locally procured fuel

OPC : other production cost

SA : sales amount

OPP : operational profit

The "other production cost" in above equation is the residual obtained by deducting crude oil purchase cost from sales amount, and it amounts to 45% of sales amount as seen below.

Sales Tax, Custom Duty	:	33.9%
Operational Profit	:	2.5%
Income Tax	:	2.0%
Other Production Cost	:	15.6%
		54% (ratio to sales amount)

(4) その他の現地支出費用にかかわる変換係数

次式によって推定された。

$$LCCF = (1 - RTAX) \cdot SCF = 0.644$$

LCCF: conversion factor for local other cost

RTAX: rate of tax (RTAX = 0.3)

(5) 土地買収費にかかわる変換係数

標準変換係数（ＳＦＣ）に同じ。

(6) 補償費にかかわる変換係数

標準変換係数（ＳＦＣ）に同じ。

(7) エンジニヤリング・フィーにかかわる変換係数

消費財変換係数（ＣＦＣ）に同じ。

(8) 偶発損失のための変換係数

次式によって推定された。

$$CFCT = \Sigma_i (W_i \cdot CF_i) = 0.676$$

CFCT: conversion factor for contingency

W_i : weight of cost item i

CF_i : conversion factor for cost item i

J.2 その他の代替案のためのプロジェクト・コスト

表J.2.1～表J.2.6に示す。

Table J.2.1 PROJECT COST

1. Navigation Clearance = 73.2 Meters
2. PC Bridge
3. Stage Construction

(Unit : 1,000 Shs.)

Value	Year	Bridge		Approach Road		Engineering & Supervision		Land Acquisition	Contingency		Total Project Cost	
		Local Currency Portion	Local Currency Portion + Foreign Currency Portion	Local Currency Portion	Local Currency Portion + Foreign Currency Portion	Local Currency Portion	Local Currency Portion + Foreign Currency Portion		Local Currency Portion	Local Currency Portion + Foreign Currency Portion	Local Currency Portion	Local Currency Portion + Foreign Currency Portion
Financial Value	1985	0	0	0	0	8809	43323	0	881	4332	9690	47655
	1986	0	0	0	0	8809	43323	0	881	4332	9690	47655
	1987	0	0	0	0	8809	43323	9700	1851	5302	20360	58325
	1988	40129	201898	4354	17552	2936	14441	0	4742	23389	52161	257279
	1989	95848	482230	0	0	2936	14441	0	9878	49667	108663	546338
	1990	89208	448823	0	0	2936	14441	0	9214	46326	101359	509590
	1991	51100	257093	0	0	2936	14441	0	5404	27153	59440	298687
	1992	12414	62458	4354	17552	2936	14441	0	1970	9445	21674	103895
	1997	0	0	0	0	0	0	24620	2462	2462	27082	27082
	1998	47359	236795	9382	24943	2936	14441	0	5968	27618	65645	303797
	1999	101090	505447	0	0	2936	14441	0	10403	51989	114428	571876
	2000	55854	279270	0	0	2936	14441	0	5879	29371	64670	323082
	2001	8070	40351	9382	24943	2936	14441	0	2039	7973	22427	87708
	Total	501073	2514363	27470	84989	52854	259935	34320	61572	289361	677289	3182968
Economic Value	1985	0	0	0	0	6642	34253	0	664	3425	7306	37678
	1986	0	0	0	0	6642	34253	0	664	3425	7306	37678
	1987	0	0	0	0	6642	34253	7314	1396	4157	15351	45723
	1988	30257	159672	3283	13841	2214	11418	0	3575	18493	39329	203424
	1989	72270	381375	0	0	2214	11418	0	7448	39279	81932	432072
	1990	67263	354954	0	0	2214	11418	0	6948	35637	76425	403009
	1991	38529	203323	0	0	2214	11418	0	4074	21474	44818	236215
	1992	9360	49395	3283	13841	2214	11418	0	1486	7465	16342	82119
	1997	0	0	0	0	0	0	18563	1856	1856	20420	20420
	1998	35709	187258	7074	19523	2214	11418	0	4500	21820	49496	240018
	1999	76222	399707	0	0	2214	11418	0	7844	41112	86279	452237
	2000	42114	220847	0	0	2214	11418	0	4433	23226	48761	255491
	2001	6085	31909	7074	19523	2214	11418	0	1537	6285	16910	69135
	Total	377809	1988441	20712	66728	39852	205517	25877	46425	228656	510676	2515219

Table J.2.2 PROJECT COST

1. Navigation Clearance = 73.2 Meters
2. Steel Bridge
3. Stage Construction

(Unit : 1,000 Shs.)

Value	Year	Bridge		Approach Road		Engineering & Supervision		Land Acquisition	Contingency		Total Project Cost	
		Local Currency Portion	Local Currency Portion + Foreign Currency Portion	Local Currency Portion	Local Currency Portion + Foreign Currency Portion	Local Currency Portion	Local Currency Portion + Foreign Currency Portion		Local Currency Portion	Local Currency Portion + Foreign Currency Portion	Local Currency Portion	Local Currency Portion + Foreign Currency Portion
Financial Value	1985	0	0	0	0	8945	43791	0	894	4379	9839	48171
	1986	0	0	0	0	8945	43791	0	894	4379	9839	48171
	1987	0	0	0	0	8945	43791	9700	1864	5349	20509	58841
	1988	67710	338550	4931	18676	3354	16422	0	7599	37365	83594	411012
	1989	101535	507677	0	0	3354	16422	0	10489	52410	115379	576509
	1990	89797	448985	0	0	3354	16422	0	9315	46541	102466	511948
	1991	36634	183172	4931	18676	3354	16422	0	4492	21827	49411	240096
	1997	0	0	0	0	0	0	24620	2462	2462	27082	27082
	1998	47295	236477	9382	24943	3354	16422	0	6003	27784	66034	305626
	1999	101111	505553	0	0	3354	16422	0	10446	52197	114911	574172
	2000	55812	279058	0	0	3354	16422	0	5917	29548	65082	325027
	2001	8155	40776	9382	24943	3354	16422	0	2089	8214	22980	90354
	Total	508050	2540247	28624	87237	53667	262748	34320	62466	292455	687128	3217008
Economic Value	1985	0	0	0	0	6744	34622	0	674	3462	7419	38084
	1986	0	0	0	0	6744	34622	0	674	3462	7419	38084
	1987	0	0	0	0	6744	34622	7314	1406	4194	15464	46129
	1988	51953	267725	3718	14714	2529	12983	0	5730	29542	63030	324964
	1989	76558	401471	0	0	2529	12983	0	7909	41445	86996	455900
	1990	67707	355058	0	0	2529	12983	0	7024	36804	77260	404845
	1991	27622	144852	3718	14714	2529	12983	0	3387	17255	37256	189804
	1997	0	0	0	0	0	0	18563	1856	1856	20420	20420
	1998	35661	187006	7074	19523	2529	12983	0	4526	21951	49790	241463
	1999	76238	399791	0	0	2529	12983	0	7877	41277	86643	454052
	2000	42082	220679	0	0	2529	12983	0	4461	23366	49072	257028
	2001	6149	32245	7074	19523	2529	12983	0	1575	6475	17327	71226
	Total	383070	2008827	21582	68473	40465	207730	25877	47099	231091	518094	2541999

Table J.2.3 PROJECT COST

1. Navigation Clearance = 45 Meters
2. PC Bridge
3. Stage Construction

(Unit : 1,000 Shs.)

Value	Year	Bridge		Approach Road		Engineering & Supervision		Land Acquisition	Contingency		Total Project Cost	
		Local Currency Portion	Local Currency Portion + Foreign Currency Portion	Local Currency Portion	Local Currency Portion + Foreign Currency Portion	Local Currency Portion	Local Currency Portion + Foreign Currency Portion		Local Currency Portion	Local Currency Portion + Foreign Currency Portion	Local Currency Portion	Local Currency Portion + Foreign Currency Portion
Financial Value	1985	0	0	0	0	5711	27061	0	571	2706	6282	29767
	1986	0	0	0	0	5711	27061	0	571	2706	6282	29767
	1987	0	0	0	0	5711	27061	10590	1630	3765	17931	41416
	1988	50532	252660	6933	16687	2142	10148	0	5961	27949	65567	307444
	1989	42736	213678	0	0	2142	10148	0	4488	22383	49365	246208
	1990	31763	158815	0	0	2142	10148	0	3390	16896	37295	185859
	1991	19347	96733	6933	16687	2142	10148	0	2842	12357	31263	135924
	1997	0	0	0	0	0	0	5650	565	565	6215	6215
	1998	54364	271821	9084	18569	2142	10148	0	6559	30054	72148	330591
	1999	50707	253533	0	0	2142	10148	0	5285	26368	58133	290049
	2000	37905	189526	0	0	2142	10148	0	4005	19967	44052	219642
	2001	23275	116376	9084	18569	2142	10148	0	3450	14509	37950	159602
	Total	310628	1553141	32033	70512	34266	162365	16240	39317	180226	432484	1982484
Economic Value	1985	0	0	0	0	4306	21386	0	431	2139	4737	23525
	1986	0	0	0	0	4306	21386	0	431	2139	4737	23525
	1987	0	0	0	0	4306	21386	7985	1229	2937	13520	32308
	1988	38101	199803	5227	13031	1615	8020	0	4494	22085	49438	242939
	1989	32223	168977	0	0	1615	8020	0	3384	17700	37221	194696
	1990	23949	125591	0	0	1615	8020	0	2556	13361	28120	146971
	1991	14587	76496	5227	13031	1615	8020	0	2143	9755	23573	107301
	1997	0	0	0	0	0	0	4260	426	426	4686	4686
	1998	40991	214956	6849	14437	1615	8020	0	4945	23741	54400	261154
	1999	38233	200494	0	0	1615	8020	0	3985	20851	43832	229365
	2000	28581	149877	0	0	1615	8020	0	3020	15790	33215	173587
	2001	17549	92030	6849	14437	1615	8020	0	2601	11449	28615	125936
	Total	234214	1228224	24153	54936	25837	128316	12245	29645	142372	326093	1566093

Table J.2.4 PROJECT COST

1. Navigation Clearance = 45 Meters
2. Steel Bridge
3. Stage Construction

(Unit : 1,000 Shs.)

Value	Year	Bridge		Approach Road		Engineering & Supervision		Land Acquisition	Contingency		Total Project Cost	
		Local Currency Portion	Local Currency Portion + Foreign Currency Portion	Local Currency Portion	Local Currency Portion + Foreign Currency Portion	Local Currency Portion	Local Currency Portion + Foreign Currency Portion		Local Currency Portion	Local Currency Portion + Foreign Currency Portion	Local Currency Portion	Local Currency Portion + Foreign Currency Portion
Financial Value	1985	0	0	0	0	6618	31538	0	662	3154	7280	34692
	1986	0	0	0	0	6618	31538	0	662	3154	7280	34692
	1987	0	0	0	0	6618	31538	10590	1721	4213	18929	46341
	1988	64080	320397	7228	17262	3309	15769	0	7462	35343	82078	388771
	1989	73674	368367	0	0	3309	15769	0	7698	38414	84681	422550
	1990	33263	166312	7228	17262	3309	15769	0	4380	19934	48180	219277
	1998	0	0	0	0	0	0	5650	565	565	6215	6215
	1999	68881	344404	9366	19118	3309	15769	0	8156	37929	89711	417221
	2000	81939	409698	0	0	3309	15769	0	8525	42547	93773	468013
	2001	42069	210346	9366	19118	3309	15769	0	5474	24523	60218	269756
	Total	363905	1819525	33187	72759	39709	189228	16240	45304	209775	498345	2307528
Economic Value	1985	0	0	0	0	4990	24926	0	499	2493	5489	27419
	1986	0	0	0	0	4990	24926	0	499	2493	5489	27419
	1987	0	0	0	0	4990	24926	7985	1297	3291	14272	36202
	1988	48316	253370	5450	13477	2495	12463	0	5626	27931	61887	307241
	1989	55550	291305	0	0	2495	12463	0	5805	30377	63850	334145
	1990	25080	131520	5450	13477	2495	12463	0	3302	15746	36327	173206
	1998	0	0	0	0	0	0	4260	426	426	4686	4686
	1999	51936	272355	7062	14864	2495	12463	0	6149	29968	67642	329650
	2000	61782	323989	0	0	2495	12463	0	6428	33645	70705	370097
	2001	31720	166342	7062	14864	2495	12463	0	4128	19367	45404	213035
	Total	274384	1438880	25023	56681	29941	149556	12245	34159	165736	375752	1823098

Table J.2.5 PROJECT COST

1. Navigation Clearance = Tunnel
2. Tunnel
3. Stage Construction

(Unit : 1,000 Shs.)

Value	Year	Bridge		Approach Road		Engineering & Supervision		Land Acquisition	Contingency		Total Project Cost	
		Local Currency Portion	Local Currency Portion + Foreign Currency Portion	Local Currency Portion	Local Currency Portion + Foreign Currency Portion	Local Currency Portion	Local Currency Portion + Foreign Currency Portion		Local Currency Portion	Local Currency Portion + Foreign Currency Portion	Local Currency Portion	Local Currency Portion + Foreign Currency Portion
Financial Value	1985	0	0	0	0	22035	110175	0	2204	11018	24239	121193
	1986	0	0	0	0	22035	110175	28500	5054	13868	55589	152543
	1987	13512	67560	0	0	4006	20032	28500	4602	11609	50620	127701
	1988	76568	382840	0	0	4006	20032	0	8057	40287	88632	443159
	1989	76568	382840	0	0	4006	20032	0	8057	40287	88632	443159
	1990	76568	382840	0	0	4006	20032	0	8057	40287	88632	443159
	1991	103592	517960	0	0	4006	20032	0	10760	53799	118358	591791
	1992	103592	517960	0	0	4006	20032	0	10760	53799	118358	591791
	1997	75425	377125	0	0	4006	20032	0	7943	39716	87375	436873
	1998	75856	379280	0	0	4006	20032	0	7986	39931	87849	439243
	1999	75856	379280	0	0	4006	20032	0	7986	39931	87849	439243
	2000	102147	510735	0	0	4006	20032	0	10615	53077	116769	583844
	2001	101716	508580	0	0	4006	20032	0	10572	52861	116295	581473
	TOTAL	881400	4407000	0	0	88140	440700	57000	102654	490470	1129194	5395170
Economic Value	1985	0	0	0	0	16614	87126	0	1661	8713	18276	95839
	1986	0	0	0	0	16614	87126	21489	3810	10862	41914	119477
	1987	10188	53426	0	0	3021	15841	21489	3470	9076	38168	99832
	1988	57732	302750	0	0	3021	15841	0	6075	31859	66828	350450
	1989	57732	302750	0	0	3021	15841	0	6075	31859	66828	350450
	1990	57732	302750	0	0	3021	15841	0	6075	31859	66828	350450
	1991	78108	409603	0	0	3021	15841	0	8113	42544	89242	467988
	1992	78108	409603	0	0	3021	15841	0	8113	42544	89242	467988
	1997	56870	298230	0	0	3021	15841	0	5989	31407	65880	345479
	1998	57195	299935	0	0	3021	15841	0	6022	31578	66238	347353
	1999	57195	299935	0	0	3021	15841	0	6022	31578	66238	347353
	2000	77019	403889	0	0	3021	15841	0	8004	41973	88044	461703
	2001	76694	402185	0	0	3021	15841	0	7971	41803	87686	459829
	TOTAL	664576	3485056	0	0	66458	348506	42978	77401	387654	851412	4264194

Table J.2.6 PROJECT COST

1. Navigation Clearance = Tunnel
2. Tunnel
3. Non-stage Construction

(Unit : 1,000 Shs.)

Value	Year	Bridge		Approach Road		Engineering & Supervision		Land Acquisition	Contingency		Total Project Cost	
		Local Currency	Local Currency Portion + Foreign Currency Portion	Local Currency Portion	Local Currency Portion + Foreign Currency Portion	Local Currency Portion	Local Currency Portion + Foreign Currency Portion		Local Currency Portion	Local Currency Portion + Foreign Currency Portion	Local Currency Portion	Local Currency Portion + Foreign Currency Portion
Financial Value	1985	0	0	0	0	17895	89475	0	1790	8948	19685	98423
	1986	0	0	0	0	17895	89475	28500	4640	11798	51035	129773
	1987	21474	107370	0	0	5965	29825	28500	5594	16570	61533	182265
	1988	97349	486744	0	0	5965	29825	0	10331	51657	113645	568226
	1989	97349	486744	0	0	5965	29825	0	10331	51657	113645	568226
	1990	97349	486744	0	0	5965	29825	0	10331	51657	113645	568226
	1991	201140	1005699	0	0	5965	29825	0	20710	103552	227815	1139077
	1992	201140	1005699	0	0	5965	29825	0	20710	103552	227815	1139077
	TOTAL	715800	3579000	0	0	71580	357900	57000	84438	399390	928818	4393290
Economic Value	1985	0	0	0	0	13493	70757	0	1349	7076	14842	77833
	1986	0	0	0	0	13493	70757	21489	3498	9225	38480	101470
	1987	16191	84908	0	0	4498	23586	21489	4218	12998	46396	142981
	1988	73401	384917	0	0	4498	23586	0	7790	40850	85688	449353
	1989	73401	384917	0	0	4498	23586	0	7790	40850	85688	449353
	1990	73401	384917	0	0	4498	23586	0	7790	40850	85688	449353
	1991	151659	795307	0	0	4498	23586	0	15616	81889	171773	900782
	1992	151659	795307	0	0	4498	23586	0	15616	81889	171773	900782
	TOTAL	539713	2830273	0	0	53971	283027	42978	63666	315628	700329	3471907

J.3 リンク・ネットワークとリンク・データ

各代替案にかかわるリンク・ネットワークとリンク・データを表J.3.1～J.3.9に示す。

各リンクの速度は次のように仮定された。

(1) Speed on links in the town

Big trucks	:	25 km/h
All other vehicles	:	30 km/h

(2) Link speeds outside the town

Big trucks	:	45 km/h
All other vehicles	:	60 km/h

(3) Speed on the proposed crossing

Big trucks	:	45 km/h
All other vehicles	:	60 km/h

(4) Speed on the ferry link (No. 37)

Medium and big trucks	:	2.0 kg/h
All other vehicles	:	4.0 km/h

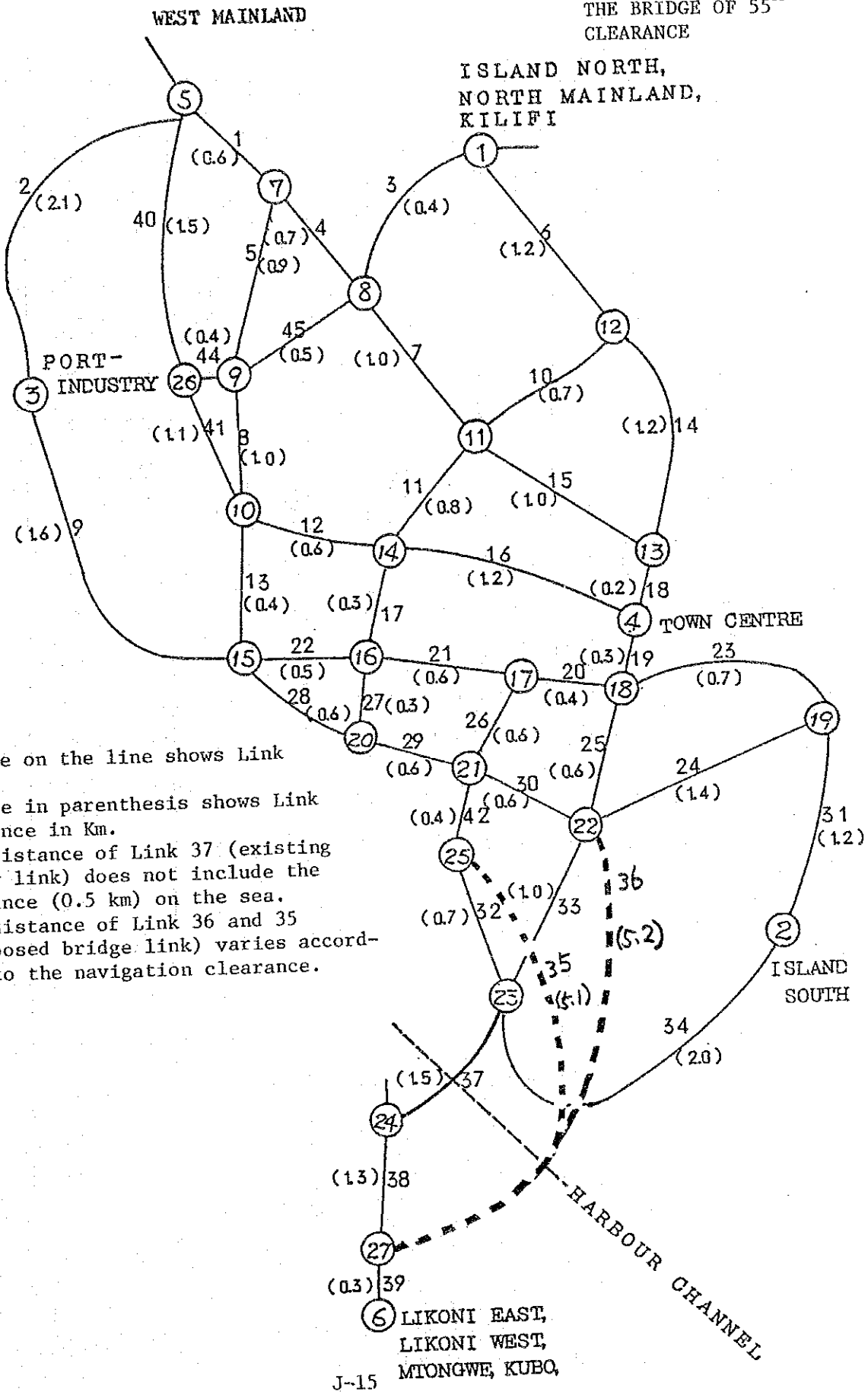
上記(4)におけるフェリーリンク上の速度は次のように計算した。

- Medium and big trucks:
  [60 min x (2 km - 0.5 km)] ÷ [(60 min ÷ 30 km) x ℓ km - 0.5 km) + 40 min]
  = 2.1 km/h　　2.0 km/h

- All other vehicles:
  [60 min x (2 km - 0.5 km)] ÷ [(60 min ÷ 30 km) x (2 km - 0.5 km) + 20 min]
  = 3.9 km/h　　4.0 km/h

以上の計算で、フェリーリンクの長さは、2Km、その内海峡部を0.5Kmとした。又、フェリーバースへの接近速度は30Km／時とした。所要時間は、本編で示すように、待時間、横断時間及び乗降時間を含めトラックとその他の車両で各々40分と20分とした。

Fig. J.3.1 LINK NETWORK FOR THE BRIDGE OF 55M CLEARANCE



Note :

1. Figure on the line shows Link No.
2. Figure in parenthesis shows Link distance in Km.
3. The distance of Link 37 (existing ferry link) does not include the distance (0.5 km) on the sea.
4. The distance of Link 36 and 35 (proposed bridge link) varies according to the navigation clearance.

Table J.3.1 LINK LENGTH FOR THE BRIDGE OF 55M CLEARANCE

(Unit : Kilometer)

Link No.	End Node	Distance	Link No.	End Node	Distance
1	5 - 7	0.6	24	19 - 22	1.4
2	3 - 5	2.1	25	18 - 22	0.6
3	1 - 8	0.4	26	17 - 21	0.6
4	7 - 8	0.7	27	16 - 20	0.3
5	7 - 9	0.9	28	15 - 20	0.6
6	1 - 12	1.2	29	20 - 21	0.6
7	8 - 11	1.0	30	21 - 22	0.6
8	9 - 10	1.0	31	2 - 19	1.2
9	3 - 15	1.6	32	23 - 25	0.7
10	11 - 12	0.7	33	22 - 23	1.0
11	11 - 14	0.8	34	2 - 23	2.0
12	10 - 14	0.6	35	25 - 27	5.0
13	10 - 15	0.4	36	22 - 27	5.2
14	12 - 13	1.2	37	23 - 24	1.5 1)
15	11 - 13	1.0	38	24 - 27	1.3
16	4 - 14	1.2	39	6 - 27	0.3
17	14 - 16	0.3	40	5 - 26	1.5
18	4 - 13	0.2	41	10 - 26	1.1
19	4 - 18	0.3	42	21 - 25	0.4
20	17 - 18	0.4	43	Not used	
21	16 - 17	0.6	44	9 - 26	0.4
22	15 - 16	0.5	45	8 - 9	0.5
23	18 - 19	0.7			

1) Link 37 is for the existing ferry link having 1.5 km, which does not include the ferry crossing length (0.5 km) on the sea.

Table J.3.2 PASSING LINKS BY ZONAL PAIR
FOR THE BRIDGE OF 55M CLEARANCE

Alternative	Zonal Pair (1)		Passing Links	Zonal Pair Distance (Km)
Via Present Ferry		1 ∿ 6	6, 14, 18, 19, 25, 33, 37, 38, 39	7.6 (2)
		2 ∿ 6	34, 37, 38, 39	5.1 (2)
		3 ∿ 6	9, 28, 29, 32, 37, 38, 39, 42	7.0 (2)
		4 ∿ 6	19, 25, 33, 37, 38, 39	5.0 (2)
		5 ∿ 6	1, 5, 8, 13, 28, 29, 32, 37, 38, 39, 42	8.3 (2)
Via Proposed Crossing	Phase I	1 ∿ 6	6, 14, 18, 19, 25, 36, 39	9.0 (3)
		2 ∿ 6	23, 25, 31, 36, 39	8.0 (3)
		3 ∿ 6	9, 28, 29, 30, 36, 39	8.9 (3)
		4 ∿ 6	19, 25, 36, 39	6.4 (3)
		5 ∿ 6	1, 4, 7, 15, 18, 19, 25, 36, 39	9.9 (3)
	Phase II	1 ∿ 6	6, 14, 18, 19, 25, 36, 39	9.0 (3)
		2 ∿ 6	23, 25, 31, 36, 39	8.0 (3)
		3 ∿ 6	9, 28, 29, 35, 39, 42	8.6 (3)
		4 ∿ 6	19, 25, 36, 39	6.4 (3)
		5 ∿ 6	1, 4, 7, 15, 18, 19, 25, 36, 39	9.9 (3)

Note : (1) See main report.

(2) Excludes the distance (0.5 Km) on the sea.

(3) Zonal pair distance is for H = 55 meters.

Table J.3.3 LINK SPEED FOR THE BRIDGE OF 55M CLEARANCE

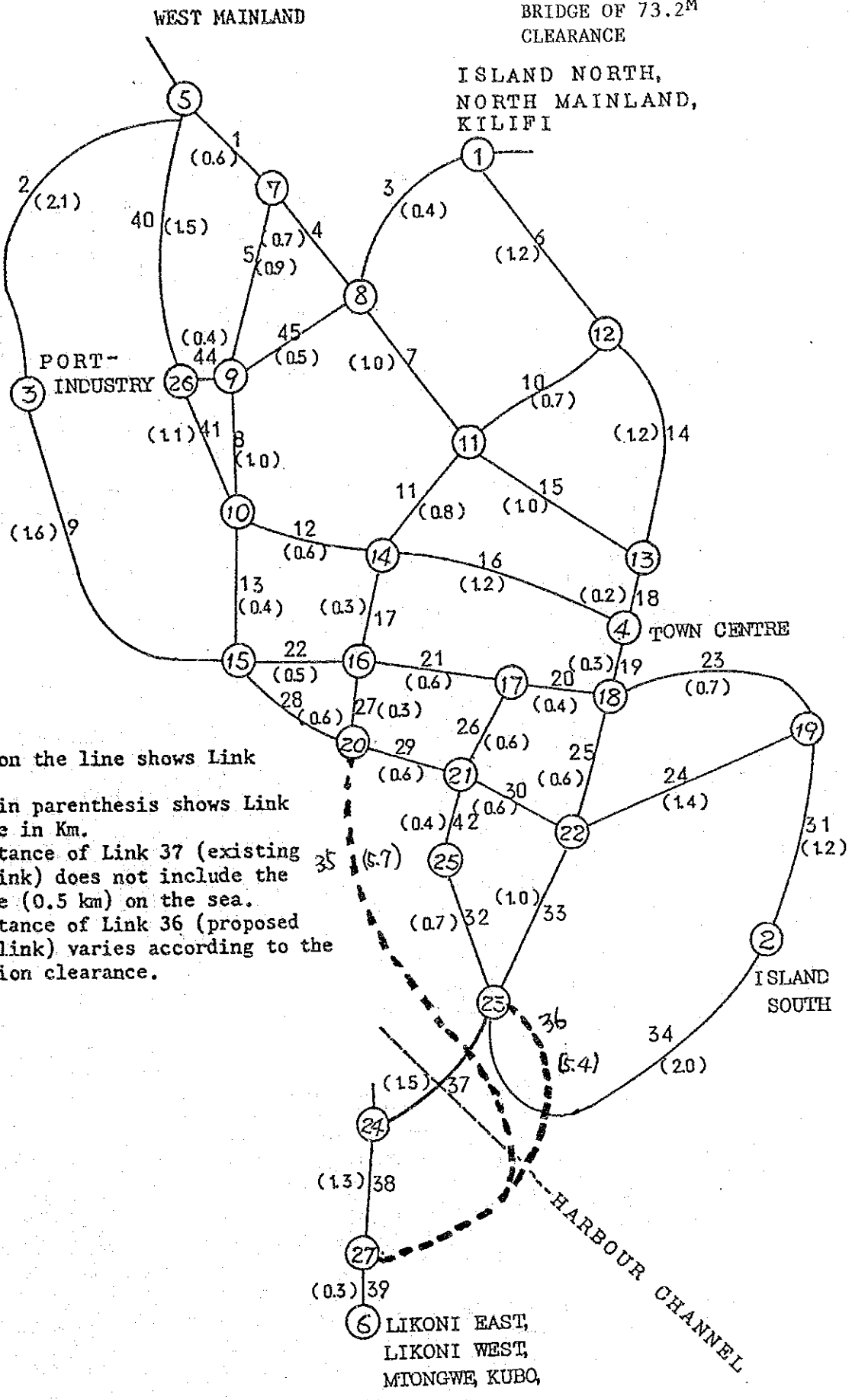
(Unit : Km/Hour)

Vehicle Type \ Link	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Car & Light	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Small Bus	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Big Bus	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Medium Truck	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Big Truck	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25

Vehicle Type \ Link	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Car & Light	30	30	30	30	30	30	30	30	30	30	30	60	58	4	60	60	30	30	30	Not Used	30	30
Small Bus	30	30	30	30	30	30	30	30	30	30	30	60	58	4	60	60	30	30	30		30	30
Big Bus	30	30	30	30	30	30	30	30	30	30	30	60	58	4	60	60	30	30	30		30	30
Medium Truck	30	30	30	30	30	30	30	30	30	30	30	60	58	2	60	60	30	30	30		30	30
Big Truck	25	25	25	25	25	25	25	25	25	25	25	45	43	2	45	45	25	25	25		25	25

Note: 1) [(4.76 km x 60 km/h) + (0.43 km x 30 km/h)] ÷ 5.19 km = 58 km/h
[(4.76 km x 45 km/h) + (0.43 km x 30 km/h)] ÷ 5.19 km = 43 km/h

Fig. J.3.2 LINK NETWORK FOR THE BRIDGE OF 73.2M CLEARANCE



Note :

1. Figure on the line shows Link No.
2. Figure in parenthesis shows Link distance in Km.
3. The distance of Link 37 (existing ferry link) does not include the distance (0.5 km) on the sea.
4. The distance of Link 36 (proposed bridge link) varies according to the navigation clearance.

Table J.3.4 LINK LENGTH FOR THE BRIDGE OF 73.2M CLEARANCE

(Unit : Kilometer)

Link No.	End Node	Distance	Link No.	End Node	Distance
1	5 - 7	0.6	24	19 - 22	1.4
2	3 - 5	2.1	25	18 - 22	0.6
3	1 - 8	0.4	26	17 - 21	0.6
4	7 - 8	0.7	27	16 - 20	0.3
5	7 - 9	0.9	28	15 - 20	0.6
6	1 - 12	1.2	29	20 - 21	0.6
7	8 - 11	1.0	30	21 - 22	0.6
8	9 - 10	1.0	31	2 - 19	1.2
9	3 - 15	1.6	32	23 - 25	0.7
10	11 - 12	0.7	33	22 - 23	1.0
11	11 - 14	0.8	34	2 - 23	2.0
22	10 - 14	0.6	35	20 - 27	5.7
13	10 - 15	0.4	36	23 - 27	5.4
14	12 - 13	1.2	37	23 - 24	1.5 2)
15	11 - 13	1.0	38	24 - 27	1.3
16	4 - 14	1.2	39	6 - 27	0.3
17	14 - 16	0.3	40	5 - 26	1.5
18	4 - 13	0.2	41	10 - 26	1.1
19	4 - 18	0.3	42	21 - 25	0.4
20	17 - 18	0.4	43	Not used	
21	16 - 17	0.6	44	9 - 26	0.4
22	15 - 16	0.5	45	8 - 9	0.5
23	18 - 19	0.7			

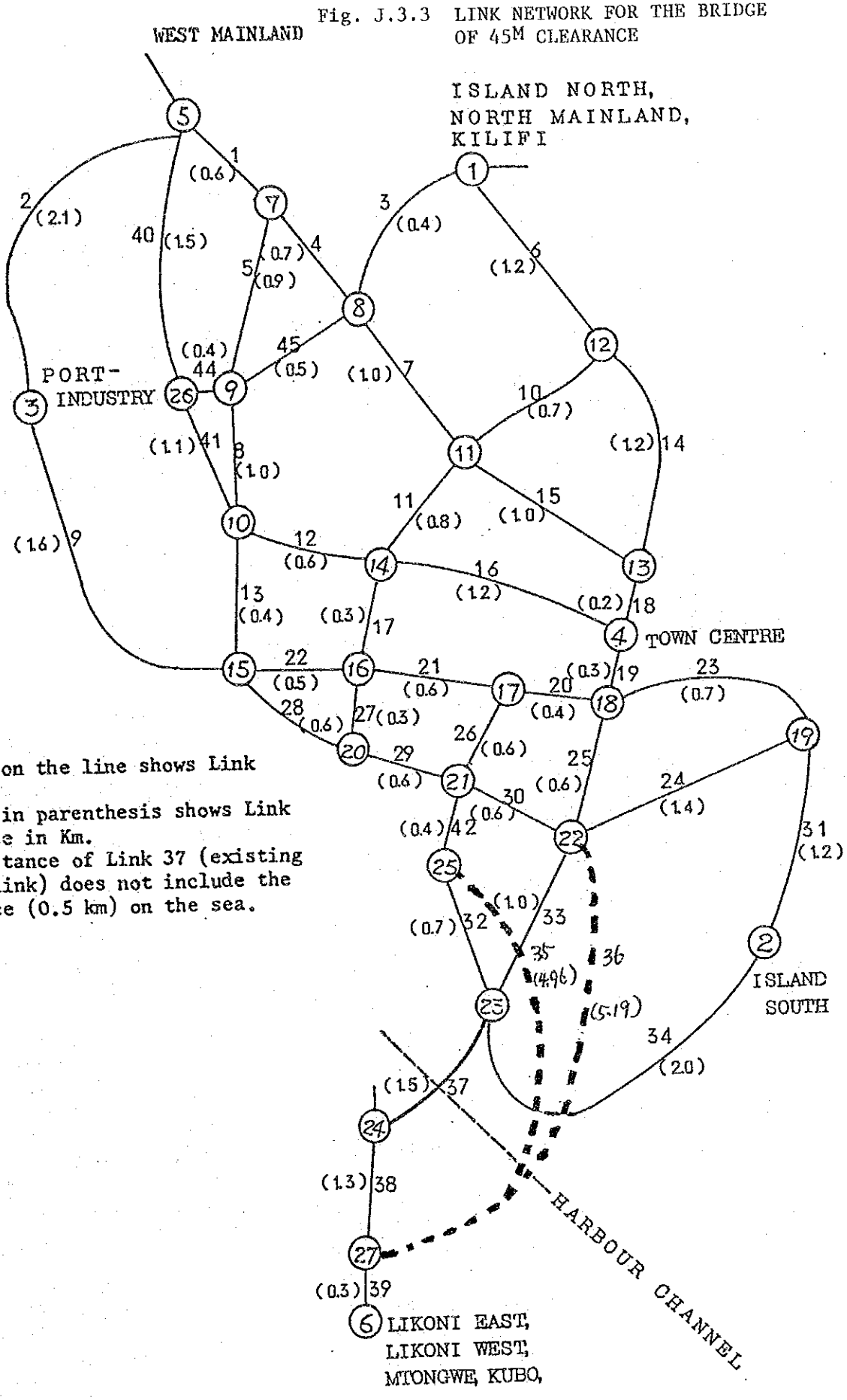
Table J.3.5 LINK SPEED FOR THE BRIDGE OF 73.2M CLEARANCE

(Unit : Km/Hour)

Vehicle Type \ Link	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Car & Light	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Small Bus	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Big Bus	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Medium Truck	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Big Truck	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25

Vehicle Type \ Link	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Car & Light	30	30	30	30	30	30	30	30	30	30	30	60	60	4	60	60	30	30	30	Not used	30	30
Small Bus	30	30	30	30	30	30	30	30	30	30	30	60	60	4	60	60	30	30	30		30	30
Big Bus	30	30	30	30	30	30	30	30	30	30	30	60	60	4	60	60	30	30	30		30	30
Medium Truck	30	30	30	30	30	30	30	30	30	30	30	60	60	2	60	60	30	30	30		30	30
Big Truck	25	25	25	25	25	25	25	25	25	25	25	45	45	2	45	45	25	25	25		25	25

Fig. J.3.3 LINK NETWORK FOR THE BRIDGE OF 45M CLEARANCE



Note :

1. Figure on the line shows Link No.
2. Figure in parenthesis shows Link distance in Km.
3. The distance of Link 37 (existing ferry link) does not include the distance (0.5 km) on the sea.

Table J.3.6 LINK LENGTH FOR THE BRIDGE OF 45M CLEARANCE

(Unit : Kilometer)

Link No.	End Node	Distance	Link No.	End Node	Distance	Link No.	End Node	Distance
1	5 - 7	0.6	24	19 - 22	1.4			
2	3 - 5	2.1	25	18 - 22	0.6			
3	1 - 8	0.4	26	17 - 21	0.6			
4	7 - 8	0.7	27	16 - 20	0.3			
5	7 - 9	0.9	28	15 - 20	0.6			
6	1 - 12	1.2	29	20 - 21	0.6			
7	8 - 11	1.0	30	21 - 22	0.6			
8	9 - 10	1.0	31	2 - 19	1.2			
9	3 - 15	1.6	32	23 - 25	0.7			
10	11 - 12	0.7	33	22 - 23	1.0			
11	11 - 14	0.8	34	2 - 23	2.0			
12	10 - 14	0.6	35	25 - 27	5.2			
13	10 - 15	0.4	36	- 27	22 - 27			
14	12 - 13	1.2	37	23 - 24	1.5 2)			
15	11 - 13	1.0	38	24 - 27	1.3			
16	4 - 14	1.2	39	6 - 27	0.3			
17	14 - 16	0.3	40	5 - 26	1.5			
18	4 - 13	0.2	41	10 - 26	1.1			
19	4 - 18	0.3	42	21 - 25	0.4			
20	17 - 18	0.4	43	Not used				
21	16 - 17	0.6	44	9 - 26	0.4			
22	15 - 16	0.5	45	8 - 9	0.5			
23	18 - 19	0.7						

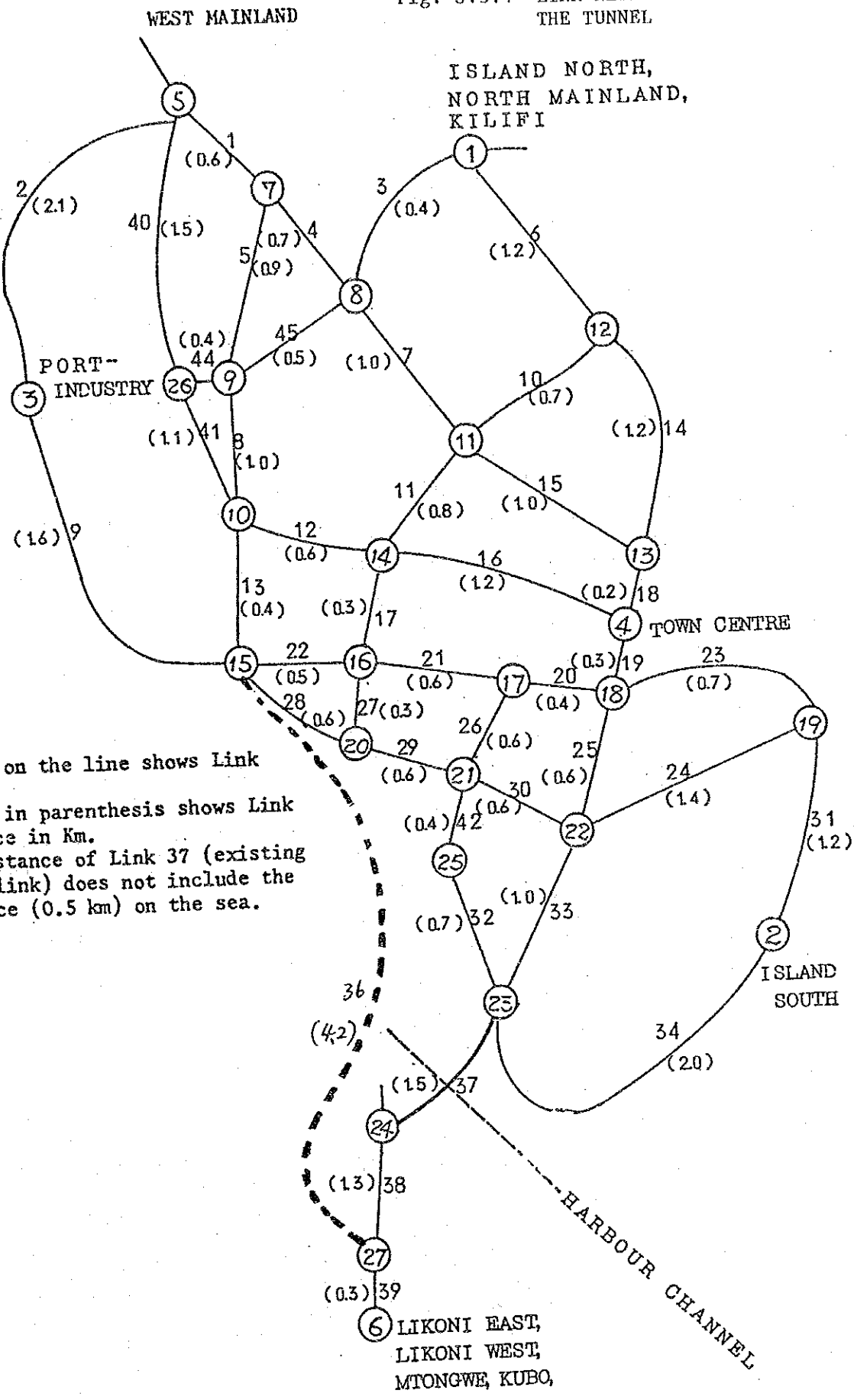
Table J.3.7 LINK SPEED FOR THE BRIDGE OF 45M CLEARANCE

(Unit : Km/Hour)

Vehicle Type \ Link	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Car & Light	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Small Bus	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Big Bus	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Medium Truck	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Big Truck	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25

Vehicle Type \ Link	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Car & Light	30	30	30	30	30	30	30	30	30	30	30	60	57	4	60	60	30	30	30	Not used	30	30
Small Bus	30	30	30	30	30	30	30	30	30	30	30	60	57	4	60	60	30	30	30		30	30
Big Bus	30	30	30	30	30	30	30	30	30	30	30	60	57	4	60	60	30	30	30		30	30
Medium Truck	30	30	30	30	30	30	30	30	30	30	30	60	57	2	60	60	30	30	30		30	30
Big Truck	25	25	25	25	25	25	25	25	25	25	25	45	43	2	45	45	25	25	25		25	25

Fig. J.3.4 LINK NETWORK FOR THE TUNNEL



Note :

1. Figure on the line shows Link No.
2. Figure in parenthesis shows Link distance in Km.
3. The distance of Link 37 (existing ferry link) does not include the distance (0.5 km) on the sea.

Table J.3.8 LINK LENGTH THE TUNNEL

(Unit : Kilometer)

Link No.	End Node	Distance	Link No.	End Node	Distance	Link No.	End Node	Distance
1	5 - 7	0.6	24	19 - 22	1.4	37	23 - 24	1.5 2)
2	3 - 5	2.1	25	18 - 22	0.6	38	24 - 27	0.7
3	1 - 8	0.4	26	17 - 21	0.6	39	6 - 27	0.9
4	7 - 8	0.7	27	16 - 20	0.3	40	5 - 26	1.5
5	7 - 9	0.9	28	15 - 20	0.6	41	10 - 26	1.1
6	1 - 12	1.2	29	20 - 21	0.6	42	21 - 25	0.4
7	8 - 11	1.0	30	21 - 22	0.6	43	Not used	
8	9 - 10	1.0	31	2 - 19	1.2	44	9 - 26	0.4
9	3 - 15	1.6	32	23 - 25	0.7	45	8 - 9	0.5
10	11 - 12	0.7	33	22 - 23	1.0			
11	11 - 14	0.8	34	2 - 23	2.0			
12	10 - 14	0.6	35	Not used				
13	10 - 15	0.4	36	15 - 27	42			
14	12 - 13	1.2						
15	11 - 13	1.0						
16	4 - 14	1.2						
17	14 - 16	0.3						
18	4 - 13	0.2						
19	4 - 18	0.3						
20	17 - 18	0.4						
21	16 - 17	0.6						
22	15 - 16	0.5						
23	18 - 19	0.7						

Table J.3.9 LINK SPEED FOR THE TUNNEL

(Unit : Km/Hour)

Vehicle Type \ Link	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Car & Light	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Small Bus	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Big Bus	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Medium Truck	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Big Truck	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25

Vehicle Type \ Link	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Car & Light	30	30	30	30	30	30	30	30	30	30	30	Not used	60	4	60	60	30	30	30	Not used	30	30
Small Bus	30	30	30	30	30	30	30	30	30	30	30		60	4	60	60	30	30	30		30	30
Big Bus	30	30	30	30	30	30	30	30	30	30	30		60	4	60	60	30	30	30		30	30
Medium Truck	30	30	30	30	30	30	30	30	30	30	30		60	2	60	60	30	30	30		30	30
Big Truck	25	25	25	25	25	25	25	25	25	25	25		45	2	45	45	25	25	25		25	25

J.4 車両走行費

車両走行費は次式によって推定された。

(1) $FL_i = FC_i \cdot EPF_i$

FL_i : fuel cost (shs/km) of vehicle i (see Table J.4.1)

FC_i : fuel consumption (liter/km) of vehicle i (see Table J.4.1)

EPF_i : economic price of fuel (ksh/liter) of vehicle i (see Table J.4.1)

(2) $LC_i = LCS_i \cdot EPL$

LC_i : oil cost (ksh/km) of vehicle i (see Table J.4.2)

LCS_i : oil consumption (liter/km) of vehicle i (see Table J.4.2)

EPL : economic price of oil (ksh/liter) (see Table J.4.2)

(3) $RC_i = RCF_i \cdot CF$

RC_i : repair cost (ksh/km, in economic value) of vehicle i (see Table J.4.3)

RCF_i : repair cost in financial value (ksh/km)

CF : conversion factor (see Table J.4.3)

(4) $EVD_i = (ECNV_i - ERV_i)/(LS_i \cdot KMT_i)$

EVD_i : economic value of depreciation per km

$ECNV_i$: economic cost of new vehicle

ERV_i : economic salvage value

LS_i : life span (years)

KMT_i : kms travelled per year (see Table J.4.4)

(5) $I_i = (FCNV_i/KMT_i) \cdot SCF \cdot \frac{1}{2} \cdot IR$

I_i : interest

$FCNV_i$: financial cost of new vehicle (see Table J.4.4)

IR : rate of interest (IR = 0.12)

(6) $CRC_i = (P_i \cdot WC_i \cdot CFC)/KMT_i$

CRC_i : crew cost per km (economic value)

P_i : average number of crew (see Table J.4.5)

WC_i : average wage per crew per year (see Table J.4.5)

(7) $GACE_i \cdot = GACF_i \cdot SCF$

$GACE_i$: general administration cost in economic value (ksh/km) (see Table J.4.6)

$GACF_i$: general administration cost in financial value (ksh/km) (see Table J.4.6)

(8) $IS_i = (FCNV_i \cdot ISR_i)/KMT_i \cdot SCF$

IS_i : insurance cost in economic value (ksh/km) (see Table J.4.6)

ISR_i : insurance rate (see Table J.4.6)

Table J.4.1 FUEL COST

(1983 Price)

Vehicle	Fuel Consumption (liter/km)	Economic Price of Fuel (ksh/liter)	Fuel Cost (ksh/km)
Car	0.138	4.97	0.686
Light Goods Vehicle	0.197	4.97	0.979
Small Bus	0.197	4.97	0.979
Big Bus	0.35	4.58	1.603
Medium Truck	0.330	4.97	1.640
Big Truck	0.667	4.58	3.055

Table J.4.3 REPAIR COST

(1983 Price)

Vehicle	Repair Cost in Financial Value (ksh/km)	Conversion Factor *4	Repair Cost in Economic Value (ksh/km)
Car	0.254 *1	0.75	0.191
Light Truck	0.508 *1	0.75	0.381
Small Bus	0.508 *1	0.75	0.381
Big Bus	1.136 *3	0.75	0.852
Medium Truck	0.769 *2	0.75	1.577
Big Truck	1.400 *2	0.75	1.050

Note: *1: Obtained by multiplying the costs per km of tyres and and parts replacement and repairers' labour in 1980, (based on existing study report) with rates of price escalation (1983/1980).

*2: Obtained on the basis of results of interviews, using the following formula.

(Monthly maintenance costs inclusive of engine oil cost - Monthly cost of engine oil)/Monthly total of km travelled

= (3,500 Ksh/month - 0.0033 x 4,167)/4,167 km

*3: Computed based on results of interviews.

*4) The following conversion rate is used.

(1 - taxation rate against marker price of parts) = 75%

Table J.4.2 OIL COST

(1983 Price)

Vehicle	Oil Consumption (liter/km)	Economic Price of Oil (ksh/liter)	Oil Cost (ksh/km)
Car	0.0012	20.4	0.029
Light Truck	0.0018	20.4	0.037
Small Bus	0.0018	20.4	0.037
Big Bus	0.0038	20.4	0.037
Medium Truck	0.0333	20.4	0.067
Big Truck	0.0041	20.4	0.084

Table J.4.4 INTEREST (ECONOMIC VALUE)

Vehicle	Financial Cost of New Vehicle (ksh)	Annual Total of km Travelled (kms)	Standard Conversion Factor	Interest (economic value) (ksh/km)
Car	140,000	30,000	0.92	0.258
Light Truck	250,000	51,000	0.92	0.271
Small Bus	250,000	51,000	0.92	0.271
Big Bus	1,400,000	80,000	0.92	0.966
Medium Truck	400,000	50,000	0.92	0.442
Big Truck	1,500,000	40,000	0.92	2.070

Table J.4.5 CREW COST

Vehicle	Average Number of Crew	Average Wage per Crew per Year (ksh)	Crew Cost per km (economic value) (ksh)
Car	-	-	-
Light	-	-	-
Small Bus	2.0	16,200	0.599
Big Bus	2.0	30,000	0.701
Medium Truck	2.7	16,200	0.818
Big Truck	2.44	20,900	1.164

Table J.4.6 GENERAL ADMINISTRATION COST

Vehicle	General Administration Cost (ksh/km)		Rate of Insurance %	Insurance Fee in Economic Value (ksh/km)
	in Financial Value	in Economic Value		
Car	-	-	3	0.215
Light Truck	- *1	-	3	0.225
Small Bus	- *1	-	3	0.225
Big Bus	0.824 *4	0.758	5	0.802
Medium Truck	0.635 *2	0.584	5	0.368
Big Truck	1.270 *3	1.168	7.5	2.588

J.5 車両の時間価値

本文に示されている時間価値は次のようにして計算された。

1) 乗用車および小型トラックの時間価値

(1) TVCL = (TVC + TVL)/2

TVCL : time value of car and light (TVCL = 53 shs/hour)
TVC : time value of car (TVC = 56 shs/hour)
TVL : time value of light (TVL = 50 shs/hour)

(2) TVC = (ANO· AWCO + ANCR· AWCR)·CFC·SBW

ANO : average number of car owners in a car (ANO = 1)
AWCO : average wage of car owners (AWCO = 52.2 shs/hour)
ANCR : average number of co-riders in a car (ANCR = 1.9)
AWCR : average wage of co-rider (AWCR = 21.4 shs/hour)
CFC : conversion factor (CFC = 0.935)
SBW : share of business and work trip (SBW = 0.64)

(3) ANCO = AMWO81 · RCPE ÷ AWHM

AMWO81: average wage in 1981 (AMWO81 = 5918 shs/month)
RCPE : wage escalation factor from 1981 to 1983 (RCPE = 1,376)
AWHM : average working hours per month per hour (AWHM = 156 hours)

(4) AMWO81 = (NWE3 · AMW3 + NWE6 · AMW5) ÷ (NWE3 + NWE6)

NWE3 : wage earners (3,000 ∿ 6,000)
(NWE3 = 49884, see Table J.5.1)

AMW3 : average monthly wage (3,000 ∿ 6,000)
(AMW3 = 4373, see Table J.5.1)

NWE6 : wage earners (over 6,000)
(NEW = 27247, see Table J.5.1)

AMW6 : average monthly wage (over 6,000)
(AMW6 = 8747, see Table J.5.1)

(5) RCPE = (1 + WE82) · (1 + WE83)

WE82 : rate of wage escalation from 1981 to 1982 (WE82 = 0.201, see Table J.5.2)

WE83 : rate of wage escalation from 1982 to 1983 (WE83 = 0.146, see Table J.5.2)

(6) TVL = (ANO · AWCO + ANCRL · AWCR) · CFC · SBW

ANCRL : average co-riders in a light (ANCRL = 1.5)

2) 小型バスの時間価値

(7) TVSB = SBP·AWB·CFC·SBW

TVSB : time value of small bus (TVSB = 42 shs/hour)

SBP : average passengers in a small bus (SBP = 10)

SWB : average hourly wage of bus passengers (AWB = 7.1 shs/hour)

(8) AWB = (NWE04· AMW04 + NWE047· AMW047
+ NEW071·AMW071 + NWE115·AMW115
+ NWE152·AMW152) ÷ NWET2 x RCPE ÷ AWHM

NWE04 : wage earners (under 400) (NWE04 = 189190, see Table J.5.1)

AMW04 : average monthly wage (under 400) (AMW04 = 292, see Table J.5.1)

NWE047: wage earners (400 ∿ 700) (NWE047 = 233030, see Table J.5.1)

AMW047: average monthly wage (400 ∿ 700) (AMW047 = 535, see Table J.5.1)

NWE071: wage earners (700 ∿ 1,000) (NWE071 = 206091, see Table J.5.1)

AMW071: average monthly wage (700 ∿ 1,000) (AMW071 = 826, see table J.5.1)

NWE115: wage earners (1,000 ∿ 1,500) (NWE115 = 164197, see Table J.5.1)

AMW115: average monthly wage (1,000 ∿ 1,500) (AMW115 = 1215, see Table J.5.1)

NWE152: wage earners (1,500 ∿ 2,000) (NWE152 = 91881, see Table J.5.1)

AMW152: average monthly wage (1,500 ∿ 2,000) (AMW152 = 1701, see Table J.5.1)

NWET2: total wage earners (under 2,000) (NWET2 = 189190 + 233030 + 206091 + 164197 + 91881 = 88439, see Table J. 5.1)

3) 大型バスの時間価値

(9) TVBB = BBP·AWB·CFC·SBW

TVBB : time value of big bus

BBP : average passengers in a big bus (BBP = 25)

4) 大型トラックの時間価値

(10) TVBT = (WC ÷ 24)·SCF

TVBT : time value of big truck (TVBT = 150 shs/hour)

WC : waiting charge per day of big truck (WC = 4,000 shs/day, source: KENATOO)

SCF : standard conversion factor (SCF = 0.92, see Table J.5.6)

5) 中型トラックの時間価値

(11) TVMT = TVBT·(PMT ÷ PBT)

TVMT : time value of medium truck (TVMT= 40 shs/hour)

PMT : purchase price of new medium truck (PMT = 400,000 shs) (source: KENATOCO)

PBT : purchase price of new big truck (PBT = 1,500,000 shs, source: KENATOCO)

Table J.5.1 NUMBER OF WAGE EARNERS AND AVERAGE MONTHLY WAGE BY INCOME BRACKET in 1981

(Unit: Ksh/month/person)

Monthly income	400 sh or less	400 ~ 699 sh	700 ~ 999 sh	1,000 ~ 1,499 sh	1,500 ~ 1,999 sh	2,000 ~ 2,999 sh	3,000 ~ 5,999 sh	6,000 sh or more	Total
Number of wage earners	189,190	233,030	206,091	164,197	91,881	62,688	49,884	27,247	1,024,309
Average monthly wage	292	535	826	1,215	1,701	2,430	4,373	8,747	1,284

Table J.5.2 RATES OF WAGE ESCALATION BETWEEN 1977 and 1983

	1978/77	79/78	80/79	81/80	82/81	83/82
(A) Rate of wage escalation *1	10.84	9.42	13.39	16.61	20.1	14.6
(B) Rate of consumers price escalation *2		8.40	12.80	12.60	22.3	16.2
(A)/(B)		1.12	1.05	1.32	0.9*3	0.9*3

*1 : The rate of wage escalation refers to the average yearly rate of wage escalation per wage earner. The basic data used are attached hereinafter.

*2 : The rate of consumers price escalation refers to that computed for all income brackets in Nairobi (Data source: Economic Survey 1983).

*3 : The rate of wage elasticity against consumers price is assumed at 0.9 for 82/81 and 83/82.

J.6 地域開発からの便益

地域開発効果推定のためのプロセスを、図J.6を用いながら以下に説明する。

(1) 輸送条件の改善により、単位当り輸送コストがFUCからAUCに低下し、同時に需要曲線MXUCF－P_4－P_1－P_5が右方にシフトして、新らしい需要曲線MXUCA－P_2－P_6を形成する。

(2) したがって、輸送量はQ_1からQ_3に増加する。Q_1は所謂 normal traffic であり、Q_2－Q_1は induced traffic, Q_3－Q_2は developed traffic と呼ばれるものである。

(3) FUC，AUC，P_0，Q_1，P_3およびP_4でかこまれる四角形は輸送条件改善以前における総輸送費である。

(4) AUC，P_3，P_1，P_2，Q_3，P_5，Q_2，Q_1およびP_0でかこまれる四角形は輸送条件改善後における総輸送費である。

(5) P_3，P_1，P_2，Q_3，P_5，Q_2およびQ_1でかこまれる四角形は輸送部門における生産の増加を意味し、この面積に輸送部門の付加価値率を乗じたものは矢張りProjectの便益と考えられる。しかし、今回は、transportation cost の中に time cost がはいっていて測定不能のため、この便益は考慮されていない。

(6) MXUCF，FUCおよびP_4でかこまれる三角形は輸送条件改善以前における consumer surplus である。

(7) MXUCF，FUC，AUC，P_3，P_1およびP_4でかこまれる三角形は輸送条件改善後におけるconsumer surplus である。

(8) FUC，AUC，P_3，P_1およびP_4でかこまれる四角形はProject による consumer surplus の増加額を意味し、したがってProject の便益である。

(9) FUC，AUC，P_3およびP_4でかこまれる四角形は normal traffic の便益である。

(10) P_3，P_1およびP_4でかこまれる三角形の面積は induced traffic の便益である。

(11) MXUCF，P_4，P_1，P_2，P_7およびMXUCAでかこまれる四角形は開発交通の consumer surplus である。しかし、この面積のすべてがProject の便益とはならない。何故なら開発交通量の発生は開発生産によるものであり、その開発生産は当該Project への投資のみで可能となるものではなく、他の投資も必要となってくるからである。

今回は、この面積の２０％がProject投資に帰するものとした。これから、すでに開発交通の便益として計上されている部分（P_4，P_1，P_2およびP_7でかこまれている四角形）を、さらにさしひいて残りを、地域開発による consumer surplus の増加部分として便益に計上した。

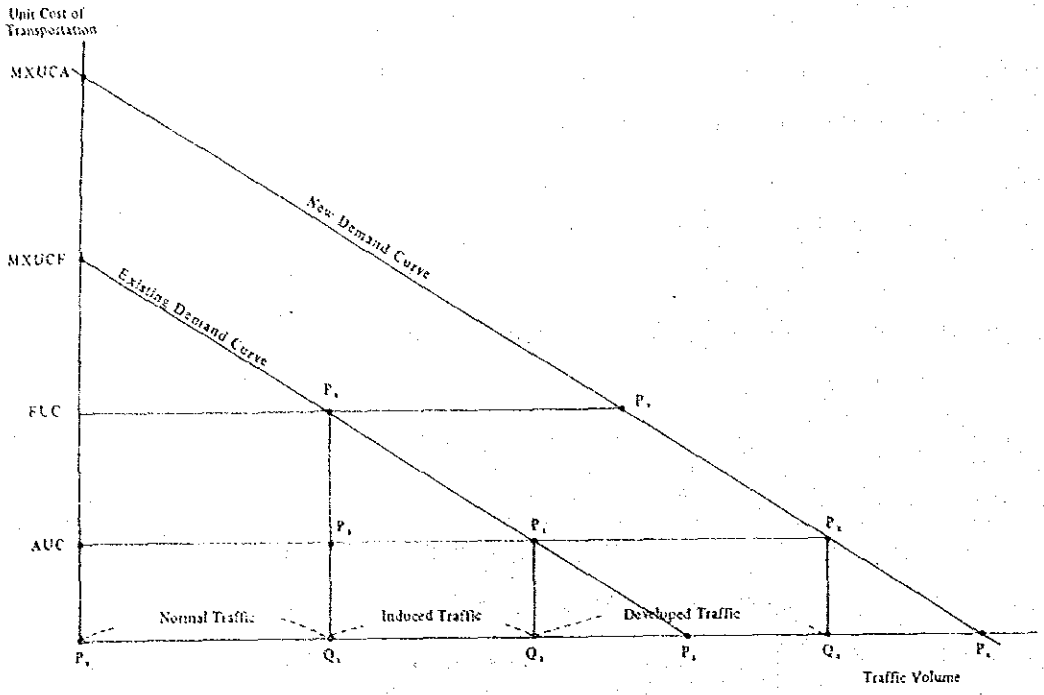


Fig. J.6 CONCEPTION OF INCREASE IN CONSUMER SURPLUS DUE TO REGIONAL DEVELOPMENT

J.7 フロー効果

フロー効果は次の(1)式および(2)式によって推定された。

(1) FLE = INVEST·RDP·BRCVA

FLE : flow effect
RDP : share of domestic procurement in total investment
BRCVA : average coefficient of induced added value
INVEST: total investment

The BRCVA in equation (1) is obtained from equation (2).

(2) $$BRCVA = \sum_{i}^{n} (SP_i \cdot CF_i \cdot CIAV_i)$$

where

SP_i : share of item i in domestic procurement
n : number of items for domestic procurement
$CIAV_i$: coefficient of induced added value for item i
CF_i : conversion factor for item i (conversion from financial value to economic value)

The data for estimation using above equation is shown in Table J.7.

Table J.7 COEFFICIENT OF INDUCED ADDED VALUE

Domestic Procurement Items	Conversion Factor (CF_i) (1)	Coefficient of induced Added Value ($CIAV_i$) (2)
Unskilled Labor	0.935	0.921
Local Materials	0.834	0.896
Local Fuel	0.167	0.906
Local Others	0.644	0.921
Land Acquisition	0.920	0.921
Compensation	0.920	0.921
Local Engineering Fee	0.935	0.921
Local Part of Contingency	0.676	0.921

Note: (1) See main report

(2) From I/O Table for Kenya, 1976

J.8 他の代替案のキャッシュ・フロー

地域開発効果を含めないキャッシュフローを表J.8.1～J.8.7に示す。また、地域開発効果を含めたそれを表J.8.8～J.8.14に示す。

Table J.8.1 CASH FLOW (Unit : 1,000 Ksh, economic value, 1983 price)

1. Navigation Clearance = 55 Meters (Steel Bridge)
2. Stage Construction
3. Excluding item (3)
4. Discount Rate (1) = I R R = 0.799
5. Residual Value (2) is considered as benefit in the last year only.

Year	Investment	Maintenance Cost	Total Cost	User Benefit	Saved Ferry Cost	Net Increase in Added Value due to Regional Development (3)	Flow Effect	Residual Value (2)	Total Benefit	Cash Flow	Discounted and Accumulated Cash Flow (1)
1985	31166	0	31166	0	0	0	5534	31166	5534	-25632	-25632
1986	31166	0	31166	0	0	0	5534	61813	5534	-25632	-48980
1987	39950	0	39950	0	0	0	13352	100724	13352	-26598	-71050
1988	359119	0	359119	0	0	0	64182	458138	64182	-294937	-293976
1989	365021	0	365021	0	0	0	62072	815469	62072	-302949	-502557
1990	198886	0	198886	0	0	0	36988	1000581	36988	-161898	-604094
1991	0	3933	3933	42625	29973	0	0	983493	72598	68665	-564867
1992	0	3933	3933	50135	10142	0	0	966404	60277	56344	-535545
1993	0	3933	3933	57646	10490	0	0	949316	68136	64203	-505111
1994	0	3933	3933	65156	10855	0	0	932227	76011	72078	-473987
1995	0	3933	3933	72667	11232	0	0	915139	83899	79966	-442533
1996	0	3933	3933	80177	11623	0	0	898050	91800	87867	-411051
1997	0	3933	3933	87688	12023	0	0	880962	99711	95778	-379791
1998	15004	3933	18937	95198	12452	0	13353	878877	121003	102067	-349446
1999	359324	3933	363257	102709	12890	0	65342	1220863	180941	-182316	-398821
2000	423941	3933	427874	110219	33835	0	72072	1621476	216126	-211747	-451057
2001	257186	3933	261119	117730	13815	0	48008	1848269	179552	-81567	-469386
2002	0	8222	8222	128202	14305	0	0	1813590	142507	134285	-441898
2003	0	8222	8222	142889	14812	0	0	1778911	157701	149479	-414027
2004	0	8222	8222	157576	15339	0	0	1744231	172915	164693	-386054
2005	0	8222	8222	172263	15886	0	0	1709552	188149	179927	-358217
2006	0	8222	8222	186950	16455	0	0	1674872	203405	195183	-330709
2007	0	8222	8222	201637	17045	0	0	1640193	218682	210460	-303691
2008	0	8222	8222	216324	17656	0	0	1605514	233980	225758	-277290
2009	0	8222	8222	231011	18292	0	0	1570834	249303	241081	-251610
2010	0	8222	8222	245698	39443	0	0	1536155	285141	276919	-224739
2011	0	8222	8222	260385	19643	0	0	1501476	280028	271806	-200715
2012	0	8222	8222	275072	20335	0	0	1466796	295407	287185	-177592
2013	0	8222	8222	289759	21027	0	0	1432117	310786	302564	-155402
2014	0	8222	8222	304446	21719	0	0	1397437	326165	317943	-134161
2015	0	8222	8222	319133	22411	0	0	1362758	341544	333322	-113876
2016	0	8222	8222	333820	23103	0	0	1328079	356923	348701	-94546
2017	0	8222	8222	348507	23103	0	0	1293399	371610	363388	-76197
2018	0	8222	8222	363194	23103	0	0	1258720	1645017	1636795	-908

B/C= .9991226 IRR= 9.780001E-02 B= 942468.4 C= 943296.1

Table J.8.2 CASH FLOW (Unit : 1,000 Ksh, economic value, 1983 price)

1. Navigation Clearance = 73.2 Meters (PC Bridge)
2. Stage Construction
3. Excluding item (3)
4. Discount Rate (1) = I R R = 0.069
5. Residual Value (2) is considered as benefit in the last year only.

Year	Investment	Maintenance Cost	Total Cost	User Benefit	Saved Ferry Cost	Net Increase in Added Value due to Regional Development (3)	Flow Effect	Residual Value (2)	Total Benefit	Cash Flow	Discounted and Accumulated Cash Flow (1)
1985	37678	0	37678	0	0	0	6503	37678	6503	-31176	-31176
1986	37678	0	37678	0	0	0	6503	74728	6503	-31176	-60339
1987	45723	0	45723	0	0	0	13663	119196	13663	-32061	-88394
1988	203424	0	203424	0	0	0	35003	320601	35003	-168420	-226262
1989	432072	0	432072	0	0	0	72920	747265	72920	-359152	-501284
1990	403009	0	403009	0	0	0	68018	1137664	68018	-334991	-741247
1991	236215	0	236215	0	0	0	39888	1354553	39888	-196327	-872804
1992	82119	0	82119	0	0	0	14545	1413409	14545	-67574	-915162
1993	0	3176	3176	37097	29973	0	0	1388777	67070	63894	-877696
1994	0	3176	3176	43270	10855	0	0	1364145	54125	50949	-849749
1995	0	3176	3176	49443	11232	0	0	1339513	60675	57499	-820245
1996	0	3176	3176	55616	11623	0	0	1314881	67239	64063	-789494
1997	20420	3176	23596	61789	12023	0	18174	1310669	91986	68390	-758785
1998	240018	3176	243194	67962	12452	0	44052	1525714	124466	-118728	-808656
1999	452237	3176	455413	74135	12890	0	76788	1948979	163813	-291600	-923234
2000	255491	3176	258667	80308	33835	0	43397	2167960	157540	-101126	-960404
2001	69135	3176	72311	86481	13815	0	15050	2196327	115346	43035	-945607
2002	0	7610	7610	135766	14305	0	0	2154407	150071	142461	-899785
2003	0	7610	7610	149119	14812	0	0	2112486	163931	156321	-852750
2004	0	7610	7610	162473	15339	0	0	2070566	177812	170202	-804844
2005	0	7610	7610	175826	15886	0	0	2028646	191712	184102	-756371
2006	0	7610	7610	189180	16455	0	0	1986725	205635	198024	-707597
2007	0	7610	7610	202533	17045	0	0	1944805	219578	211968	-658759
2008	0	7610	7610	215886	17656	0	0	1902885	233542	225932	-610063
2009	0	7610	7610	229240	18292	0	0	1860964	247532	239921	-561690
2010	0	7610	7610	242593	39443	0	0	1819044	282036	274426	-509932
2011	0	7610	7610	255946	19643	0	0	1777124	275589	267979	-462651
2012	0	7610	7610	269300	20335	0	0	1735203	289635	282025	-416105
2013	0	7610	7610	282653	21027	0	0	1693283	303680	296070	-370394
2014	0	7610	7610	296007	21719	0	0	1651363	317726	310115	-325605
2015	0	7610	7610	309360	22411	0	0	1609442	331771	324161	-281809
2016	0	7610	7610	322713	23103	0	0	1567522	345816	338206	-239066
2017	0	7610	7610	336067	23103	0	0	1525602	359170	351559	-197502
2018	0	7610	7610	349420	23103	0	0	1483682	1856205	1848594	6943

B/C= 1.004471 IRR= .069

Table J.8.3 CASH FLOW (Unit : 1,000 Ksh, economic value, 1983 price)

1. Navigation Clearance = 73.2 Meters (Steel Bridge)
2. Stage Construction
3. Excluding item (3)
4. Discount Rate (1) = I R R = 0.0599
5. Residual Value (2) is considered as benefit in the last year only.

Year	Investment	Maintenance Cost	Total Cost	User Benefit	Saved Ferry Cost	Net Increase in Added Value due to Regional Development (3)	Flow Effect	Residual Value (2)	Total Benefit	Cash Flow	Discounted and Accumulated Cash Flow (1)
1985	38084	0	38084	0	0	0	6603	38084	6603	-31481	-31481
1986	38084	0	38084	0	0	0	6603	75533	6603	-31481	-60961
1987	46129	0	46129	0	0	0	13763	120393	13763	-32366	-89342
1988	324964	0	324964	0	0	0	56097	443318	56097	-268868	-310115
1989	455900	0	455900	0	0	0	77426	891764	77426	-378474	-601129
1990	404845	0	404845	0	0	0	68761	1281556	68761	-336084	-843117
1991	189804	0	189804	0	0	0	33158	1449560	33158	-156646	-948735
1992	0	4399	4399	30924	29973	0	0	1424596	60897	56498	-913064
1993	0	4399	4399	37097	10490	0	0	1399633	47587	43188	-887530
1994	0	4399	4399	43270	10855	0	0	1374669	54125	49726	-860000
1995	0	4399	4399	49443	11232	0	0	1349706	60675	56276	-830825
1996	0	4399	4399	55616	11623	0	0	1324742	67239	62840	-800318
1997	20420	4399	24819	61789	12023	0	18174	1320199	91986	67166	-769784
1998	241463	4399	245863	67962	12452	0	44313	1536358	124727	-121136	-821351
1999	454052	4399	458451	74135	12890	0	77113	1961082	164138	-294314	-938674
2000	257028	4399	261427	80308	33835	0	43674	2181214	157817	-103610	-977351
2001	71226	4399	75626	86481	13815	0	15421	2211261	115717	40091	-963337
2002	0	8834	8834	125766	14305	0	0	2168894	140071	131237	-920379
2003	0	8834	8834	140369	14812	0	0	2126528	155181	146348	-875522
2004	0	8834	8834	154973	15339	0	0	2084161	170312	161478	-829174
2005	0	8834	8834	169576	15886	0	0	2041794	185462	176628	-781700
2006	0	8834	8834	184180	16455	0	0	1999428	200635	191801	-733427
2007	0	8834	8834	198783	17045	0	0	1957061	215828	206994	-684642
2008	0	8834	8834	213386	17656	0	0	1914694	231042	222208	-635601
2009	0	8834	8834	227990	18292	0	0	1872328	246282	237448	-586529
2010	0	8834	8834	242593	39443	0	0	1829961	282036	273202	-533658
2011	0	8834	8834	257196	19643	0	0	1787595	276839	268006	-485090
2012	0	8834	8834	271800	20335	0	0	1745228	292135	283301	-437015
2013	0	8834	8834	286403	21027	0	0	1702861	307430	298596	-389565
2014	0	8834	8834	301007	21719	0	0	1660495	322726	313892	-342857
2015	0	8834	8834	315610	22411	0	0	1618128	338021	329187	-296988
2016	0	8834	8834	330213	23103	0	0	1575761	353316	344482	-252039
2017	0	8834	8834	344817	23103	0	0	1533395	367920	359086	-208163
2018	0	8834	8834	359420	23103	0	0	1491028	1873551	1864717	5192

B/C= 1.003212 IRR= .0679 B= 1518670 C= 1513808

Table J.8.4 CASH FLOW (Unit : 1,000 Ksh, economic value, 1983 price)

1. Navigation Clearance = 45 Meters (PC Bridge)
2. Stage Constrauction
3. Excluding item (3)
4. Discount Rate (1) = I R R = 0.119
5. Residual Value (2) is considered as benefit in the last year only.

Year	Investment	Maintenance Cost	Total Cost	User Benefit	Saved Ferry Cost	Net Increase in Added Value due to Regional Development (3)	Flow Effect	Residual Value (2)	Total Benefit	Cash Flow	Discounted and Accumulated Cash Flow (1)
1985	23525	0	23525	0	0	0	4216	23525	4216	-19309	-19309
1986	23525	0	23525	0	0	0	4216	46657	4216	-19309	-36564
1987	32308	0	32308	0	0	0	12033	78181	12033	-20275	-52756
1988	242939	0	242939	0	0	0	44000	319797	44000	-198940	-194738
1989	194696	0	194696	0	0	0	33127	509122	33127	-161569	-297785
1990	146971	0	146971	0	0	0	25027	647477	25027	-121944	-367290
1991	107301	0	107301	0	0	0	20980	743712	20980	-86322	-411258
1992	0	2838	2838	49864	29973	0	0	730857	79837	76999	-376209
1993	0	2838	2838	57336	10490	0	0	718003	67826	64988	-349773
1994	0	2838	2838	64807	10855	0	0	705149	75662	72824	-323300
1995	0	2838	2838	72279	11232	0	0	692294	83511	80673	-297093
1996	0	2838	2838	79751	11623	0	0	679440	91374	88536	-271389
1997	4686	2838	7524	87223	12023	0	4171	671272	103416	95892	-246511
1998	261154	2838	263992	94694	12452	0	48416	919493	155562	-108430	-271651
1999	229365	2838	232203	102166	12890	0	39011	1131573	154067	-78137	-287840
2000	173687	2838	176525	109638	33835	0	29561	1284152	173034	-3491	-288487
2001	125936	2838	128774	117109	13815	0	25467	1386086	156391	27617	-283917
2002	0	5691	5691	129024	14305	0	0	1359984	143329	137638	-263564
2003	0	5691	5691	143769	14812	0	0	1333883	158581	152890	-243360
2004	0	5691	5691	158515	15339	0	0	1307781	173854	168163	-223501
2005	0	5691	5691	173260	15886	0	0	1281679	189146	183455	-204140
2006	0	5691	5691	188006	16455	0	0	1255578	204461	198769	-185394
2007	0	5691	5691	202751	17045	0	0	1229476	219796	214105	-167348
2008	0	5691	5691	217496	17656	0	0	1203375	235152	229461	-150065
2009	0	5691	5691	232242	18292	0	0	1177273	250534	244843	-133585
2010	0	5691	5691	246987	39443	0	0	1151172	286430	280739	-116698
2011	0	5691	5691	261732	19643	0	0	1125070	281375	275684	-101879
2012	0	5691	5691	276478	20335	0	0	1098968	296813	291122	-87894
2013	0	5691	5691	291223	21027	0	0	1072867	312250	306559	-74733
2014	0	5691	5691	305969	21719	0	0	1046765	327688	321996	-62380
2015	0	5691	5691	320714	22411	0	0	1020664	343125	337434	-50811
2016	0	5691	5691	335459	23103	0	0	994562	358562	352871	-40000
2017	0	5691	5691	350205	23103	0	0	968461	373308	367617	-29934
2018	0	5691	5691	364950	23103	0	0	942359	1330412	1324721	2480

B/C= 1.003627 IRR= .119

Table J.8.5 CASH FLOW (Unit : 1,000 Ksh, economic value, 1983 price)

1. Navigation Clearance = 45 Meters (Steel Bridge)
2. Stage Construction
3. Excluding item (3)
4. Discount Rate (1) = I R R = 0.0871
5. Residual Value (2) is considered as benefit in the last year only.

Year	Investment	Maintenance Cost	Total Cost	User Benefit	Saved Ferry Cost	Net Increase in Added Value due to Regional Development (3)	Flow Effect	Residual Value (2)	Total Benefit	Cash Flow	Discounted and Accumulated Cash Flow (1)
1985	27419	0	27419	0	0	0	4885	27419	4885	-22533	-22533
1986	27419	0	27419	0	0	0	4885	54380	4885	-22533	-42870
1987	36202	0	36202	0	0	0	12703	89668	12703	-23499	-62012
1988	307241	0	307241	0	0	0	55080	395392	55080	-252161	-247390
1989	334145	0	334145	0	0	0	56826	722898	56826	-277318	-431391
1990	173206	0	173206	0	0	0	32331	883897	32331	-140874	-515750
1991	0	3822	3822	42392	29973	0	0	868803	72365	68544	-478705
1992	0	3822	3822	49864	10142	0	0	853709	60006	56184	-451300
1993	0	3822	3822	57336	10490	0	0	838615	67826	64004	-423123
1994	0	3822	3822	64807	10855	0	0	823521	75662	71841	-394579
1995	0	3822	3822	72279	11232	0	0	808428	83511	79689	-366003
1996	0	3822	3822	79751	11623	0	0	793334	91374	87552	-337668
1997	0	3822	3822	87223	12023	0	0	778240	99246	95424	-309795
1998	4686	3822	8508	94694	12452	0	4171	767832	111317	102809	-282692
1999	329650	3822	333471	102166	12890	0	60201	1082310	175257	-158214	-320336
2000	370097	3822	373919	109638	33835	0	62927	1431741	206400	-167519	-356308
2001	213035	3822	216857	117109	13815	0	40410	1617942	171334	-45523	-365130
2002	0	7660	7660	129024	14305	0	0	1587557	143329	135669	-341400
2003	0	7660	7660	143769	14812	0	0	1557172	158581	150921	-317575
2004	0	7660	7660	158515	15339	0	0	1526787	173854	166194	-293896
2005	0	7660	7660	173260	15886	0	0	1496402	189146	181486	-270559
2006	0	7660	7660	188006	16455	0	0	1466017	204461	196801	-247719
2007	0	7660	7660	202751	17045	0	0	1435632	219796	212136	-225499
2008	0	7660	7660	217496	17656	0	0	1405247	235152	227492	-203994
2009	0	7660	7660	232242	18292	0	0	1374862	250534	242874	-183272
2010	0	7660	7660	246987	39443	0	0	1344477	286430	278770	-161806
2011	0	7660	7660	261732	19643	0	0	1314092	281375	273715	-142784
2012	0	7660	7660	276478	20335	0	0	1283707	296813	289153	-124647
2013	0	7660	7660	291223	21027	0	0	1253322	312250	304590	-107405
2014	0	7660	7660	305969	21719	0	0	1222937	327688	320028	-91054
2015	0	7660	7660	320714	22411	0	0	1192552	343125	335465	-75585
2016	0	7660	7660	335459	23103	0	0	1162167	358562	350902	-60982
2017	0	7660	7660	350205	23103	0	0	1131782	373308	365648	-47248
2018	0	7660	7660	364950	23103	0	0	1101397	1489450	1481790	2983

B/C= 1.003472 IRR= .108 B= 778008 C= 775315.8

Table J.8.6 CASH FLOW (Unit : 1,000 Ksh, economic value, 1983 price)

1. Navigation Clearance = Tunnel
2. Stage Construction
3. Excluding Item (3)
4. Discount Rate (1) = I R R = 0.056l

Year	Investment	Maintenance Cost	Total Cost	User Benefit	Saved Ferry Cost	Net Increase in Added Value due to Regional Development (3)	Flow Effect	Residual Value (2)	Total Benefit	Cash Flow	Discounted and Accumulated Cash Flow (1)
1985	95839	0	95839	0	0	0	16265	95839	16265	-79574	-79574
1986	119477	0	119477	0	0	0	37303	213719	37303	-82174	-157382
1987	99832	0	99832	0	0	0	33969	309962	33969	-65863	-216434
1988	350450	0	350450	0	0	0	59477	655160	59477	-290973	-463457
1989	350450	0	350450	0	0	0	59477	994517	59477	-290973	-697358
1990	350450	0	350450	0	0	0	59477	1328033	59477	-290973	-918834
1991	467988	0	467988	0	0	0	79425	1773246	79425	-388563	-1198881
1992	467988	0	467988	0	0	0	79425	2210660	79425	-388563	-1464052
1993	0	9660	9660	71015	29973	0	0	2172285	100988	91328	-1405037
1994	0	9660	9660	80838	10855	0	0	2133911	91693	82033	-1354844
1995	0	9660	9660	90661	11232	0	0	2095536	101893	92233	-1301408
1996	0	9660	9660	100485	11623	0	0	2057161	112108	102448	-1245206
1997	345479	9660	355139	110308	12023	0	58634	2364266	180964	-174174	-1335680
1998	347353	9660	357013	120131	12452	0	58952	2667487	191535	-165479	-1417071
1999	347353	9660	357013	129954	12890	0	58952	2964918	201796	-155217	-1489360
2000	461703	9660	471363	139778	33835	0	78359	3370911	251971	-219392	-1586109
2001	459829	9660	469489	149601	13815	0	78041	3767334	241456	-228032	-1681326
2002	0	14720	14720	159424	14305	0	0	3696264	173729	159009	-1618457
2003	0	14720	14720	176748	14812	0	0	3625194	191560	176840	-1552252
2004	0	14720	14720	194072	15339	0	0	3554124	209411	194691	-1483236
2005	0	14720	14720	211396	15886	0	0	3483054	227282	212562	-1411887
2006	0	14720	14720	228721	16455	0	0	3411984	245176	230456	-1338642
2007	0	14720	14720	246045	17045	0	0	3340914	263090	248370	-1263896
2008	0	14720	14720	263369	17656	0	0	3269845	281025	266305	-1188010
2009	0	14720	14720	280693	18292	0	0	3198775	298985	284265	-1111309
2010	0	14720	14720	298017	39443	0	0	3127705	337460	322740	-1028852
2011	0	14720	14720	315341	19643	0	0	3056635	334984	320264	-951374
2012	0	14720	14720	332665	20335	0	0	2985565	353000	338280	-873885
2013	0	14720	14720	349989	21027	0	0	2914495	371016	356296	-796604
2014	0	14720	14720	367314	21719	0	0	2843425	389033	374313	-719729
2015	0	14720	14720	384638	22411	0	0	2772355	407049	392329	-643433
2016	0	14720	14720	401962	23103	0	0	2701286	425065	410345	-567873
2017	0	14720	14720	419286	23103	0	0	2630216	442389	427669	-493306
2018	0	14720	14720	436610	23103	0	0	2559146	3018859	3004139	2661

B/C= 1.000944 IRR= .0561 TPVB= 2673345 TPVC= 2670825

Table J.8.7 CASH FLOW (Unit : 1,000 Ksh, economic value, 1983 price)

1. Navigation Clearance = Tunnel
2. Non-stage Construction
3. Excluding item (3)
4. Discount Rate (1) = I R R = 0.0536
5. Residual Value (2) is considered as benefit in the last year only.

Year	Investment	Maintenance Cost	Total Cost	User Benefit	Saved Ferry Cost	Net Increase in Added Value due to Regional Development (3)	Flow Effect	Residual Value (2)	Total Benefit	Cash Flow	Discounted and Accumulated Cash Flow (1)
1985	77833	0	77833	0	0	0	13209	77833	13209	-64623	-64623
1986	101470	0	101470	0	0	0	34247	178006	34247	-67223	-128426
1987	142981	0	142981	0	0	0	41292	317998	41292	-101689	-220032
1988	449353	0	449353	0	0	0	76263	761980	76263	-373090	-539029
1989	449353	0	449353	0	0	0	76263	1198473	76263	-373090	-841798
1990	449353	0	449353	0	0	0	76263	1627476	76263	-373090	-1129164
1991	900782	0	900782	0	0	0	152878	2500419	152878	-747904	-1675917
1992	900782	0	900782	0	0	0	152878	3358348	152878	-747904	-2194855
1993	0	14720	14720	71015	29973	0	0	3300483	100988	86268	-2138043
1994	0	14720	14720	80838	10855	0	0	3242618	91693	76973	-2089930
1995	0	14720	14720	90661	11232	0	0	3184753	101893	87173	-2038214
1996	0	14720	14720	100485	11623	0	0	3126888	112108	97388	-1983377
1997	0	14720	14720	110308	12023	0	0	3069023	122331	107611	-1925867
1998	0	14720	14720	120131	12452	0	0	3011158	132583	117863	-1866082
1999	0	14720	14720	129954	12890	0	0	2953292	142844	128124	-1804398
2000	0	14720	14720	139778	33835	0	0	2895427	173613	158893	-1731793
2001	0	14720	14720	149601	13815	0	0	2837562	163416	148696	-1667304
2002	0	14720	14720	159424	14305	0	0	2779697	173729	159009	-1601850
2003	0	14720	14720	176748	14812	0	0	2721832	191560	176840	-1532760
2004	0	14720	14720	194072	15339	0	0	2663967	209411	194691	-1460565
2005	0	14720	14720	211396	15886	0	0	2606102	227282	212562	-1385753
2006	0	14720	14720	228721	16455	0	0	2548237	245176	230456	-1308769
2007	0	14720	14720	246045	17045	0	0	2490371	263090	248370	-1230023
2008	0	14720	14720	263369	17656	0	0	2432506	281025	266305	-1149885
2009	0	14720	14720	280693	18292	0	0	2374641	298985	284265	-1068695
2010	0	14720	14720	298017	39443	0	0	2316776	337460	322740	-981204
2011	0	14720	14720	315341	19643	0	0	2258911	334984	320264	-898802
2012	0	14720	14720	332665	20335	0	0	2201046	353000	338280	-816192
2013	0	14720	14720	349989	21027	0	0	2143181	371016	356296	-733609
2014	0	14720	14720	367314	21719	0	0	2085316	389033	374313	-651264
2015	0	14720	14720	384638	22411	0	0	2027450	407049	392329	-569347
2016	0	14720	14720	401962	23103	0	0	1969585	425065	410345	-488026
2017	0	14720	14720	419286	23103	0	0	1911720	442389	427669	-407584
2018	0	14720	14720	436610	23103	0	0	1853855	2313568	2298848	2819

B/C= 1.000999 IRR= .0536 TPVB= 2682025 TPVC= 2679349

Table J.8.8 CASH FLOW (Unit : 1,000 Ksh, economic value, 1983 price)

1. Navigation Clearance = 55 Meters (PC Bridge)
2. Non-stage Construction
3. Including item (3)
4. Discount Rate (1) = I R R = 0.1017
5. Residual Value (2) is considered as benefit in the last year only.

Year	Investment	Maintenance Cost	Total Cost	User Benefit	Saved Ferry Cost	Net Increase in Added Value due to Regional Development (3)	Flow Effect	Residual Value (2)	Total Benefit	Cash Flow	Discounted and Accumulated Cash Flow (1)
1985	22579	0	22579	0	0	0	4068	22579	4068	-18511	-18511
1986	22579	0	22579	0	0	0	4068	44781	4068	-18511	-35313
1987	46366	0	46366	0	0	0	25239	90395	25239	-21127	-52720
1988	344357	0	344357	0	0	0	65670	433226	65670	-278687	-261134
1989	546658	0	546658	0	0	0	92919	972620	92919	-453740	-569136
1990	305274	0	305274	0	0	0	51952	1261518	51952	-253322	-725219
1991	129722	0	129722	0	0	0	22157	1369776	22157	-107564	-785376
1992	97809	0	97809	0	0	0	23826	1443959	23826	-73983	-822933
1993	0	6253	6253	55319	29973	0	0	1418703	85292	79039	-786513
1994	0	6253	6253	63417	10855	3871	0	1393448	78143	71889	-756446
1995	0	6253	6253	71515	11232	7741	0	1368192	90488	84235	-724468
1996	0	6253	6253	79613	11623	11612	0	1342936	102848	96595	-691182
1997	0	6253	6253	87711	12023	15482	0	1317681	115217	108963	-657100
1998	0	6253	6253	95810	12452	19353	0	1292425	127614	121361	-622645
1999	0	6253	6253	103908	12890	23223	0	1267169	140021	133768	-588173
2000	0	6253	6253	112006	33835	27094	0	1241913	172935	166681	-549184
2001	0	6253	6253	120104	13815	30964	0	1216658	164883	158630	-515504
2002	0	6253	6253	128202	14305	34835	0	1191402	177342	171089	-482532
2003	0	6253	6253	142889	14812	39520	0	1166146	197221	190967	-449127
2004	0	6253	6253	157576	15339	44204	0	1140891	217119	210866	-415645
2005	0	6253	6253	172263	15886	48889	0	1115635	237038	230785	-382384
2006	0	6253	6253	186950	16455	53574	0	1090379	256979	250725	-349585
2007	0	6253	6253	201637	17045	58258	0	1065123	276940	270687	-317442
2008	0	6253	6253	216324	17656	62943	0	1039868	296923	290670	-286114
2009	0	6253	6253	231011	18292	67627	0	1014612	316930	310677	-255720
2010	0	6253	6253	245698	39443	72312	0	989356	357453	351200	-224533
2011	0	6253	6253	260385	19643	76997	0	964101	357025	350771	-196259
2012	0	6253	6253	275072	20335	81681	0	938845	377088	370835	-169128
2013	0	6253	6253	289759	21027	86366	0	913589	397152	390899	-143169
2014	0	6253	6253	304446	21719	91051	0	888333	417216	410962	-118397
2015	0	6253	6253	319133	22411	95735	0	863078	437279	431026	-94813
2016	0	6253	6253	333820	23103	100420	0	837822	457343	451090	-72411
2017	0	6253	6253	348507	23103	105104	0	812566	476714	470461	-51203
2018	0	6253	6253	363194	23103	109789	0	787311	1283397	1277144	1055

B/C= 1.001006 IRR= .1017

Table J.8.9 CASH FLOW (Unit : 1,000 Ksh, economic value, 1983 price)

1. Navigation Clearance = 55 Meters (PC Bridge)
2. Stage Construction
3. Including item (3)
4. Discount Rate (1) = I R R = 0.122
5. Residual Value (2) is considered as benefit in the last year only.

Year	Investment	Maintenance Cost	Total Cost	User Benefit	Saved Ferry Cost	Net Increase in Added Value due to Regional Development (3)	Flow Effect	Residual Value (2)	Total Benefit	Cash Flow	Discounted and Accumulated Cash Flow (1)
1985	27473	0	27473	0	0	0	4899	27473	4899	-22574	-22574
1986	27473	0	27473	0	0	0	4899	54488	4899	-22574	-42694
1987	36256	0	36256	0	0	0	12716	89829	12716	-23540	-61393
1988	279868	0	279868	0	0	0	50564	368176	50564	-229304	-223736
1989	254265	0	254265	0	0	0	43242	616257	43242	-211023	-356891
1990	162412	0	162412	0	0	0	27653	768246	27653	-134759	-432678
1991	110123	0	110123	0	0	0	21755	865240	21755	-88367	-476971
1992	0	2949	2949	50135	29973	0	0	850275	80108	77159	-442501
1993	0	2949	2949	57646	10490	3871	0	835311	72006	69057	-415005
1994	0	2949	2949	65156	10855	7741	0	820346	83752	80804	-386331
1995	0	2949	2949	72667	11232	11612	0	805382	95510	92562	-357056
1996	0	2949	2949	80177	11623	15482	0	790417	107282	104334	-327645
1997	15004	2949	17952	87688	12023	19353	13353	790457	132417	114464	-298887
1998	268533	2949	271481	95198	12452	23223	49771	1043775	180644	-90837	-319227
1999	316538	2949	319486	102709	12890	27094	53810	1340622	196503	-122984	-343772
2000	220680	2949	223629	110219	33835	30964	37542	1536337	212560	-11069	-345740
2001	118384	2949	121332	117730	13815	34835	24288	1626077	190668	69335	-334749
2002	0	6253	6253	128202	14305	34835	0	1595460	177342	171089	-310575
2003	0	6253	6253	142889	14812	39520	0	1564843	197221	190967	-286526
2004	0	6253	6253	157576	15339	44204	0	1534226	217119	210866	-262859
2005	0	6253	6253	172263	15886	48889	0	1503610	237038	230785	-239773
2006	0	6253	6253	186950	16455	53574	0	1472993	256979	250725	-217420
2007	0	6253	6253	201637	17045	58258	0	1442376	276940	270687	-195910
2008	0	6253	6253	216324	17656	62943	0	1411759	296923	290670	-175325
2009	0	6253	6253	231011	18292	67627	0	1381143	316930	310677	-155715
2010	0	6253	6253	245698	39443	72312	0	1350526	357453	351200	-135957
2011	0	6253	6253	260385	19643	76997	0	1319909	357025	350771	-118369
2012	0	6253	6253	275072	20335	81681	0	1289292	377088	370835	-101797
2013	0	6253	6253	289759	21027	86366	0	1258675	397152	390899	-86228
2014	0	6253	6253	304446	21719	91051	0	1228059	417216	410962	-71640
2015	0	6253	6253	319133	22411	95735	0	1197442	437279	431026	-58003
2016	0	6253	6253	333820	23103	100420	0	1166825	457343	451090	-45283
2017	0	6253	6253	348507	23103	105104	0	1136208	476714	470461	-33459
2018	0	6253	6253	363194	23103	109789	0	1105591	1601677	1595424	2277

B/C= 1.002897 IRR= .122

Table J.8.10 CASH FLOW (Unit : 1,000 Ksh, economic value, ₽ 83 price)

1. Navigation Clearance = 55 Meters (Steel Bridge)
2. Stage Construction
3. Including item (3)
4. Discount Rate (1) = 0.094
5. Residual Value (2) is considered as benefit in the last year only.

Year	Investment	Maintenance Cost	Total Cost	User Benefit	Saved Ferry Cost	Net Increase in Added Value due to Regional Development (3)	Flow Effect	Residual Value (2)	Total Benefit	Cash Flow	Discounted and Accumulated Cash Flow (1)
1985	31166	0	31166	0	0	0	5534	31166	5534	-25632	-25632
1986	31166	0	31166	0	0	0	5534	61813	5534	-25632	-48651
1987	39950	0	39950	0	0	0	13352	100724	13352	-26598	-70103
1988	359119	0	359119	0	0	0	64182	458138	64182	-294937	-283731
1989	365021	0	365021	0	0	0	52072	815469	52072	-302949	-480796
1990	198886	0	198886	0	0	0	36988	1000581	36988	-161898	-575374
1991	0	3933	3933	42625	29973	0	0	983493	72598	68665	-539350
1992	0	3933	3933	50135	10142	3167	0	966404	63444	59511	-511311
1993	0	3933	3933	57646	10490	6334	0	949316	74469	70536	-481464
1994	0	3933	3933	65156	10855	9500	0	932227	85511	81578	-450464
1995	0	3933	3933	72667	11232	12667	0	915139	96566	92633	-418851
1996	0	3933	3933	80177	11623	15834	0	898050	107634	103701	-387069
1997	0	3933	3933	87688	12023	19001	0	880962	118711	114778	-355477
1998	15004	3933	18937	95198	12452	22168	13353	878877	143171	124234	-324767
1999	359324	3933	363257	102709	12890	25335	65342	1220863	206275	-156981	-359616
2000	423941	3933	427874	110219	33835	28501	72072	1621476	244628	-183246	-396149
2001	257186	3933	261119	117730	13815	31668	48008	1848269	211220	-49899	-405083
2002	0	8222	8222	128202	14305	34835	0	1813590	177342	169120	-377890
2003	0	8222	8222	142889	14812	39520	0	1778911	197221	188999	-350598
2004	0	8222	8222	157576	15339	44204	0	1744231	217119	208897	-323507
2005	0	8222	8222	172263	15886	48889	0	1709552	237038	228816	-296858
2006	0	8222	8222	186950	16455	53574	0	1674872	256979	248756	-270840
2007	0	8222	8222	201637	17045	58258	0	1640193	276940	268718	-245598
2008	0	8222	8222	216324	17656	62943	0	1605514	296923	288701	-221244
2009	0	8222	8222	231011	18292	67627	0	1570834	316930	308708	-197857
2010	0	8222	8222	245698	39443	72312	0	1536155	357453	349231	-174096
2011	0	8222	8222	260385	19643	76997	0	1501476	357025	348803	-152784
2012	0	9222	8222	275072	20335	81681	0	1466796	377088	368866	-132543
2013	0	8222	8222	289759	21027	86366	0	1432117	397152	388930	-113376
2014	0	8222	8222	304446	21719	91051	0	1397437	417216	408993	-95275
2015	0	8222	8222	319133	22411	95735	0	1362758	437279	429057	-78222
2016	0	9222	8222	333820	23103	100420	0	1328079	457343	449121	-62191
2017	0	8222	8222	348507	23103	105104	0	1293399	476714	468492	-47172
2018	0	9222	8222	363194	23103	109789	0	1258720	1754806	1746584	3110

B/C= 1.003294 IRR= .1135 B= 850646.2 C= 847853.4

Table J.8.11 CASH FLOW (Unit : 1,000 Ksh, economic value, 1983 price)

1. Navigation Clearance = 73.2 Meters (PC Bridge)
2. Stage Construction
3. Including item (3)
4. Discount Rate (1) = I R R = 0.082
5. Residual Value (2) is considered as benefit in the last year only.

Year	Investment	Maintenance Cost	Total Cost	User Benefit	Saved Ferry Cost	Net Increase in Added Value due to Regional Development (3)	Flow Effect	Residual Value (2)	Total Benefit	Cash Flow	Discounted and Accumulated Cash Flow (1)
1985	37678	0	37678	0	0	0	6503	37678	6503	-31176	-31176
1986	37678	0	37678	0	0	0	6503	74728	6503	-31176	-59988
1987	45723	0	45723	0	0	0	13663	119196	13663	-32061	-87374
1988	203424	0	203424	0	0	0	35003	320601	35003	-168420	-220331
1989	432072	0	432072	0	0	0	72920	747265	72920	-359152	-482372
1990	403009	0	403009	0	0	0	68018	1137664	68018	-334991	-708262
1991	236215	0	236215	0	0	0	39888	1354553	39888	-196327	-830616
1992	82119	0	82119	0	0	0	14545	1413409	14545	-67574	-869538
1993	0	3176	3176	37097	29973	0	0	1388777	67070	63894	-835525
1994	0	3176	3176	43270	10855	3827	0	1354145	57952	54776	-808575
1995	0	3176	3176	49443	11232	7654	0	1339513	68329	65153	-778950
1996	0	3176	3176	55616	11623	11481	0	1314881	78720	75544	-747203
1997	20420	3176	23596	61789	12023	15308	18174	1310669	107294	83698	-714695
1998	240018	3176	243194	67962	12452	19135	44052	1525714	143601	-99593	-750445
1999	452237	3176	455413	74135	12890	22962	76788	1948979	186775	-268638	-839568
2000	255491	3176	258667	80308	33835	26789	43397	2167960	184329	-74337	-862360
2001	69135	3176	72311	86481	13815	30616	15050	2196327	145962	73651	-841489
2002	0	7610	7610	125766	14305	34443	0	2154407	174514	166904	-797777
2003	0	7610	7610	140369	14812	39083	0	2112486	194265	186654	-752597
2004	0	7610	7610	154973	15339	43723	0	2070566	214035	206425	-706418
2005	0	7610	7610	169576	15886	48363	0	2028646	233826	226215	-659647
2006	0	7610	7610	184180	16455	53004	0	1986725	253638	246028	-612635
2007	0	7610	7610	198783	17045	57644	0	1944805	273472	265861	-565683
2008	0	7610	7610	213386	17656	62284	0	1902885	293326	285716	-519048
2009	0	7610	7610	227990	18292	66924	0	1860964	313206	305595	-472949
2010	0	7610	7610	242593	39443	71564	0	1819044	353600	345990	-424712
2011	0	7610	7610	257196	19643	76204	0	1777124	353044	345433	-380202
2012	0	7610	7610	271800	20335	80844	0	1735203	372979	365369	-336592
2013	0	7610	7610	286403	21027	85484	0	1693283	392915	385304	-294284
2014	0	7610	7610	301007	21719	90125	0	1651363	412850	405240	-253063
2015	0	7610	7610	315610	22411	94765	0	1609442	432786	425175	-213092
2016	0	7610	7610	330213	23103	99405	0	1567522	452721	445111	-174417
2017	0	7610	7610	344817	23103	104045	0	1525602	471965	464354	-137129
2018	0	7610	7610	359420	23103	108685	0	1483682	1974890	1967279	8876

B/C= 1.006222 IRR= .082

Table J.8.12 CASH FLOW (Unit : 1,000 Ksh, economic value, 1983 price)

1. Navigation Clearance = 73.2 Meters (Steel Bridge)
2. Stage Construction
3. Including item (3)
4. Discount Rate (1) = I R R = 0.072
5. Residual Value(2) is considered as benefit in the last year only.

Year	Investment	Maintenance Cost	Total Cost	User Benefit	Saved Ferry Cost	Net Increase in Added Value due to Regional Development (3)	Flow Effect	Residual Value (2)	Total Benefit	Cash Flow	Discounted and Accumulated Cash Flow (1)
1985	38084	0	38084	0	0	0	6603	38084	6603	-31481	-31481
1986	38084	0	38084	0	0	0	6603	75533	6603	-31481	-60585
1987	46129	0	46129	0	0	0	13763	120393	13763	-32366	-88246
1988	324964	0	324964	0	0	0	56097	443318	56097	-268868	-300677
1989	455900	0	455900	0	0	0	77426	891764	77426	-378474	-577122
1990	404845	0	404845	0	0	0	68761	1281556	68761	-336084	--804063
1991	189804	0	189804	0	0	0	33158	1449560	33158	-156646	--901850
1992	0	4399	4399	30924	29973	0	0	1424596	60897	56498	--859245
1993	0	4399	4399	37097	10490	3444	0	1399633	51031	46632	--844366
1994	0	4399	4399	43270	10855	6889	0	1374669	61014	56614	--816443
1995	0	4399	4399	49443	11232	10333	0	1349706	71008	66608	--786072
1996	0	4399	4399	55616	11623	13777	0	1324742	81016	76617	-753776
1997	20420	4399	24819	61789	12023	17222	18174	1320199	109207	84388	-720891
1998	241463	4399	245863	67962	12452	20666	44313	1536358	145393	-100470	-757085
1999	454052	4399	458451	74135	12890	24110	77113	1961082	188248	-270204	--847076
2000	257028	4399	261427	80308	33835	27554	43674	2181214	185372	-76056	--870493
2001	71226	4399	75626	86481	13815	30999	15421	2211261	146715	71090	--850258
2002	0	8834	8834	125766	14305	34443	0	2158894	174514	165680	--806661
2003	0	8834	8834	140369	14812	39083	0	2126528	194265	185431	-761553
2004	0	8834	8834	154973	15339	43723	0	2084161	214035	205201	-715405
2005	0	8834	8834	169576	15886	48363	0	2041794	233826	224992	-668628
2006	0	8834	8834	184180	16455	53004	0	1999428	253638	244804	-621577
2007	0	8834	8834	198783	17045	57644	0	1957061	273472	264638	-574555
2008	0	8834	8834	213386	17656	62284	0	1914694	293326	284492	-527823
2009	0	8834	8834	227990	18292	66924	0	1872328	313206	304372	-481601
2010	0	8834	8834	242593	39443	71564	0	1829961	353600	344766	-433200
2011	0	8834	8834	257196	19643	76204	0	1787595	353044	344210	-388527
2012	0	8834	8834	271800	20335	80844	0	1745228	372979	364145	-344837
2013	0	8834	8834	286403	21027	85484	0	1702861	392915	384081	-302234
2014	0	8834	8834	301007	21719	90125	0	1660495	412850	404016	-260806
2015	0	8834	8834	315610	22411	94765	0	1618128	432786	423952	-220616
2016	0	8834	8834	330213	23103	99405	0	1575761	452721	443887	-181715
2017	0	8834	8834	344817	23103	104045	0	1533395	471965	463131	-144193
2018	0	8834	8834	359420	23103	108685	0	1491028	1982236	1973402	3612

B/C= 1.002439 IRR= .0817 B= 1372357 C= 1369017

Table J.8.13 CASH FLOW (Unit : 1,000 Ksh, economic value, 1983 price)

1. Navigation Clearance = 45 Meters (PC Bridge)
2. Stage Construction
3. Including item (3)
4. Discount Rate (1) = I R R = 0.1366
5. Residual Value (2) is considered as benefit in the last year only.

Year	Investment	Maintenance Cost	Total Cost	User Benefit	Saved Ferry Cost	Net Increase in Added Value due to Regional Development (3)	Flow Effect	Residual Value (2)	Total Benefit	Cash Flow	Discounted and Accumulated Cash Flow (1)
1985	23525	0	23525	0	0	0	4216	23525	4216	-19309	-19309
1986	23525	0	23525	0	0	0	4216	46657	4216	-19309	-36297
1987	32308	0	32308	0	0	0	12033	78181	12033	-20275	-51992
1988	242939	0	242939	0	0	0	44000	319797	44000	-198940	-187479
1989	194696	0	194696	0	0	0	33127	509122	33127	-161569	-284291
1990	146971	0	146971	0	0	0	25027	647477	25027	-121944	-348578
1991	107301	0	107301	0	0	0	20980	743712	20980	-86322	-388615
1992	0	2838	2838	49864	29973	0	0	730857	79837	76999	-357194
1993	0	2838	2838	57336	10490	3872	0	718003	71698	68860	-332471
1994	0	2838	2838	64807	10855	7744	0	705149	83407	80569	-307020
1995	0	2838	2838	72279	11232	11617	0	692294	95128	92290	-281371
1996	0	2838	2838	79751	11623	15489	0	679440	106863	104024	-255935
1997	4686	2838	7524	87223	12023	19361	4171	671272	122777	115253	-231140
1998	261154	2838	263992	94694	12452	23233	48416	919493	178795	-85197	-247266
1999	229365	2838	232203	102166	12890	27106	39011	1131573	181172	-51031	-255764
2000	173687	2838	176525	109638	33835	30978	29561	1284152	204012	27486	-251737
2001	125936	2838	128774	117109	13815	34850	25467	1386086	191241	62467	-243684
2002	0	5691	5691	129024	14305	34850	0	1359984	178179	172488	-224122
2003	0	5691	5691	143769	14812	39534	0	1333883	198116	192425	-204921
2004	0	5691	5691	158515	15339	44219	0	1307781	218072	212381	-186276
2005	0	5691	5691	173260	15886	48903	0	1281679	238049	232358	-168328
2006	0	5691	5691	188006	16455	53587	0	1255578	258048	252356	-151178
2007	0	5691	5691	202751	17045	58271	0	1229476	278067	272376	-134893
2008	0	5691	5691	217496	17656	62956	0	1203375	298108	292417	-119511
2009	0	5691	5691	232242	18292	67640	0	1177273	318173	312482	-105048
2010	0	5691	5691	246987	39443	72324	0	1151172	358754	353063	-90671
2011	0	5691	5691	261732	19643	77008	0	1125070	358384	352693	-78036
2012	0	5691	5691	276478	20335	81693	0	1098968	378505	372814	-66284
2013	0	5691	5691	291223	21027	86377	0	1072867	398627	392936	-55387
2014	0	5691	5691	305969	21719	91061	0	1046765	418749	413057	-45309
2015	0	5691	5691	320714	22411	95745	0	1020664	438870	433179	-36010
2016	0	5691	5691	335459	23103	100430	0	994562	458992	453301	-27449
2017	0	5691	5691	350205	23103	105114	0	968461	478421	472730	-19593
2018	0	5691	5691	364950	23103	109798	0	942359	1440210	1434519	1379

B/C= 1.002223 IRR= .1366

Table J.8.14 CASH FLOW (Unit : 1,000 Ksh, economic value, 1983 price)

1. Navigation Clearance = 45 Meters (Steel Bridge)
2. Stage Construction
3. Including item (3)
4. Discount Rate (1) = I R R = 0.102
5. Residual Value (2) is considered as benefit in the last year only.

Year	Investment	Maintenance Cost	Total Cost	User Benefit	Saved Ferry Cost	Net Increase in Added Value due to Regional Development (3)	Flow Effect	Residual Value (2)	Total Benefit	Cash Flow	Discounted and Accumulated Cash Flow (1)
1985	27419	0	27419	0	0	0	4885	27419	4885	-22533	-22533
1986	27419	0	27419	0	0	0	4885	54380	4885	-22533	-42563
1987	36202	0	36202	0	0	0	12703	89668	12703	-23499	-61130
1988	307241	0	307241	0	0	0	55080	395392	55080	-252161	-238231
1989	334145	0	334145	0	0	0	56826	722898	56826	-277318	-411360
1990	173206	0	173206	0	0	0	32331	883897	32331	-140874	-489535
1991	0	3822	3822	42392	29973	0	0	858803	72365	68544	-455724
1992	0	3822	3822	49864	10142	3168	0	853709	63174	59353	-429701
1993	0	3822	3822	57336	10490	6336	0	838615	74162	70340	-402286
1994	0	3822	3822	64807	10855	9505	0	823521	85167	81345	-374105
1995	0	3822	3822	72279	11232	12673	0	808428	96184	92362	-345662
1996	0	3822	3822	79751	11623	15841	0	793334	107215	103393	-317360
1997	0	3822	3822	87223	12023	19009	0	778240	118255	114433	-289517
1998	4686	3822	8508	94694	12452	22177	4171	767832	133494	124986	-262485
1999	329650	3822	333471	102166	12890	25345	60201	1082310	200603	-132869	-288029
2000	370097	3822	373919	109638	33835	28514	62927	1431741	234914	-139005	-311783
2001	213035	3822	216857	117109	13815	31682	40410	1617942	203016	-13841	-313885
2002	0	7660	7660	129024	14305	34850	0	1587557	178179	170519	-290862
2003	0	7660	7660	143769	14812	39534	0	1557172	198116	190456	-268003
2004	0	7660	7660	158515	15339	44219	0	1526787	218072	210412	-245555
2005	0	7660	7660	173260	15886	48903	0	1496402	238049	230389	-223707
2006	0	7660	7660	188006	16455	53587	0	1466017	258048	250388	-202601
2007	0	7660	7660	202751	17045	58271	0	1435632	278067	270407	-182340
2008	0	7660	7660	217496	17656	62956	0	1405247	298108	290448	-162995
2009	0	7660	7660	232242	18292	67640	0	1374862	318173	310513	-144612
2010	0	7660	7660	246987	39443	72324	0	1344477	358754	351094	-126136
2011	0	7660	7660	261732	19643	77008	0	1314092	358384	350724	-109730
2012	0	7660	7660	276478	20335	81693	0	1283707	378505	370845	-94311
2013	0	7660	7660	291223	21027	86377	0	1253322	398627	390967	-79860
2014	0	7660	7660	305969	21719	91061	0	1222937	418749	411089	-66355
2015	0	7660	7660	320714	22411	95745	0	1192552	438870	431210	-53762
2016	0	7660	7660	335459	23103	100430	0	1162167	458992	451332	-42047
2017	0	7660	7660	350205	23103	105114	0	1131782	478421	470761	-31184
2018	0	7660	7660	364950	23103	109798	0	1101397	1599248	1591588	1459

B/C= 1.001867 IRR= .125 B= 695757.9 C= 694461.1

APPENDIX K　プロジェクトの各調査段階で使用した建設単価の解説

本調査では、多数の代替案を比較検討した。各代替案の検討で見積った橋梁のコストをその時点の諸条件と合せ、以下の表にまとめた。

6.3.1 ALTERNATIVE CROSSING STUDY

Table 6.3.4

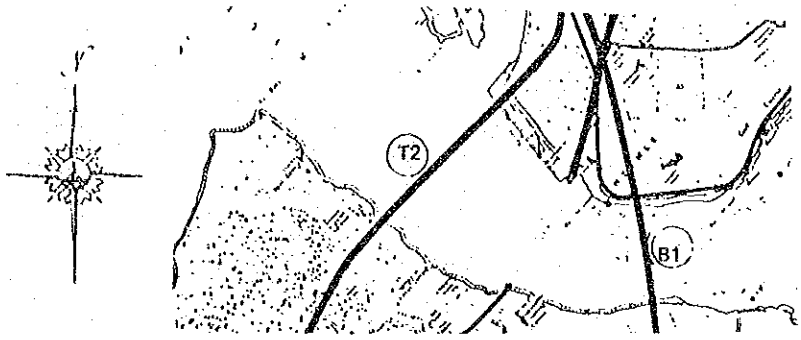
Item	
Plan	
Purpose of Comparison	To select the most apropeicte plan among 6 alternatives.

Borehole Data	Yes . (No)	Topo. Survey Data	Yes . (No)	Gradient of Profile	5%
Access bridge to Nyerere Ave.	Planned , Not	Flyovers to exising Railways or Roads	Planned , (Not)		
Cross Section	4 lanes + Footpath = 18m				
Main Bridge	Super-structure	Cable Stayed Bridge and Suspension Bridge			
	Sub-structure	Pile Foundation			
Approach Bridge	Super-structure	P.C Rigid Frame and Post-tension Bridge			
	Sub-structure	Spread Foundation			
Unit Cost	Experience in the past				

Costs / Alt.	Main Bridge			Approach Bridge			Ramp		
	LxW (m)	K.Shs/m^2	x10^6 K.Shs	LxW(m)	K.Shs/m^2	x10^6K.Shs	LxW (m)	K.Shs/m^2	x10^6K.Shs
B1 (Cable Stayed)	790x18	51,950	739	2,330x18	13,500	566			
B2 (Sus-pension)	900x18	70,300	1,139	2,370x18	14,700	629			
B3 (〃)	910x18	70,300	1,151	2,690x18	14,100	682			
B4 (〃)	1,450x18	116,100	3,031	2,010x18	13,800	501			
B5 (〃)	850x18	67,200	1,029	2,190x18	14,400	567			
B6 (〃)	1,140x18	85,600	1,756	2,020x18	11,000	401			

6.3.3 COMPARATIVE STUDY OF BRIDGE (B_1) AND TUNNEL (T_2)

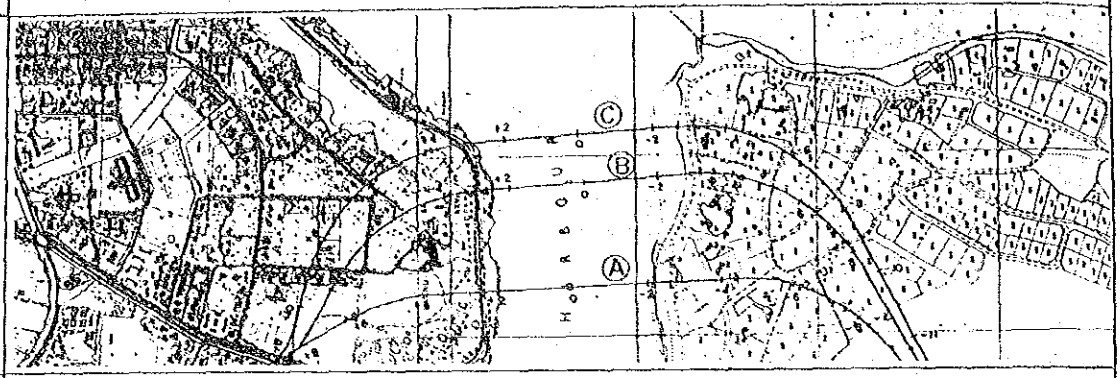
Table 6.3.7

Item		
Plan		
Purpose of Comparison	To compare bridge (B_1) and tunnel (T_2)	
Borehole Data	Yes . (No)	Topo. Survey Data: Yes . (No); Gradient of Profile: 4.3%
Access bridge to Nyerere Ave.	Planned , (Not)	Flyovers to exising Railways or Roads: Planned , (Not)
Cross Section	4 lanes + Footpath = 18.0m	
Main Bridge	Super-structure	Cable Stayed Bridge
	Sub-structure	Pile Foundation
Approach Bridge	Super-structure	P.C Rigid Frame and Post-tension Girder Bridge
	Sub-structure	Spread Foundation
Unit Cost	Experience in the Past	

Alt. \ Costs	Main Bridge			Approach Bridge			Ramp		
	LxW (m)	K.Shs/m^2	x10^6 K.Shs	LxW(m)	K.Shs/m^2	x10^6K.Shs	LxW (m)	K.Shs/m^2	x10^6K.Shs
B1 (Cable Stayed)	830x18	51,950	776	2,450x18	13,500	595			

6.3.4 ALTERNATIVE ALIGNMENT STUDY OF BRIDGE CROSSING

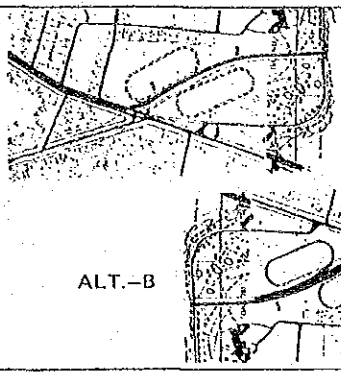
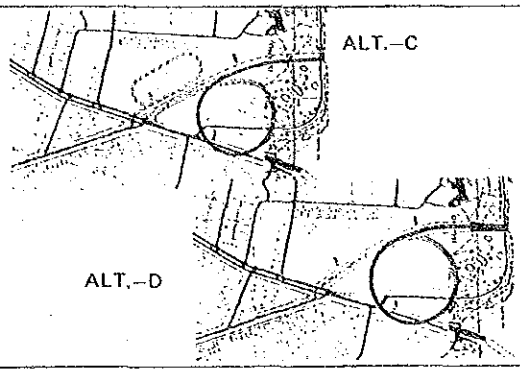
Table 6.3.9

Item		
Plan		
Purpose of Comparison	To select most appropiate bridge alignment using the navigation clearance of 73.2, 65, 55 and 45m, and access conditions to Nyerere Ave. or Mbaraki Road.	
Borehole Data	(Yes) . No	Topo. Survey Data: (Yes) . No; Gradient of Profile: 4.3%
Access bridge to Nyerere Ave.	(Planned) , Not	Flyovers to exising Railways or Roads: Planned , (Not)
Cross Section	4 lanes + Footpath = 19m, 5.5m for ramp access	
Main Bridge	Super-structure: Cable Stayed Bridge	
	Sub-structure: Pile Foundation	
Approach Bridge	Super-structure: P.C Rigid Frame, Post-Tension and R.c hollowslab	
	Sub-structure: Pile for Rigid Frame Bridge, Spread Foundation for Post-tension	
Unit Cost	Revised cost for approach foundation by borehole data	

Alt. \ Costs	Main Bridge			Approach Bridge			Ramp		
	LxW (m)	K.Shs/m^2	x10^6 K.Shs	LxW(m)	K.Shs/m^2	x10^{6}K.Shs	LxW (m)	K.Shs/m^2	x10^{6}K.Shs
A45 (Loop)	830x19m	51,950	819	645x19	18,900	232	393x5.5	28,400	61
" (Mbaraki)	"	"	"	670x19	"	241			
A55 (Loop)	"	"	"	905x19	"	325	719x5.5	"	112
" (Mbaraki)	"	"	"	1,180x19	"	425			
A65 (Loop)	"	"	"	1,125x19	"	404	1,062x5.5	"	166
" (Mbaraki)	"	"	"	1,675x19	"	601			
A73.2 (Loop)	"	"	"	1,305x19	"	468	1,435x5.5	"	224
" (Mbaraki)	"	"	"	2,055x19	"	738			
B55 (Loop)	"	"	"	1,085x19	"	390	431x5.5	"	67
" (Mbaraki)	"	"	"	1,180x19	"	424			
C65 (Loop)	"	"	"	1,410x19	"	506	553x5.5	"	86
" (Mbaraki)	"	"	"	1,600x19	"	574			
C73.2 (Loop)	"	"	"	1,580x19	"	567	833x5.5	"	130
" (Mbaraki)	"	"	"	1,995x19	"	716			

6.3.6 ALTERNATIVE ACCESS STUDY ON MOMBASA ISLAND (1)

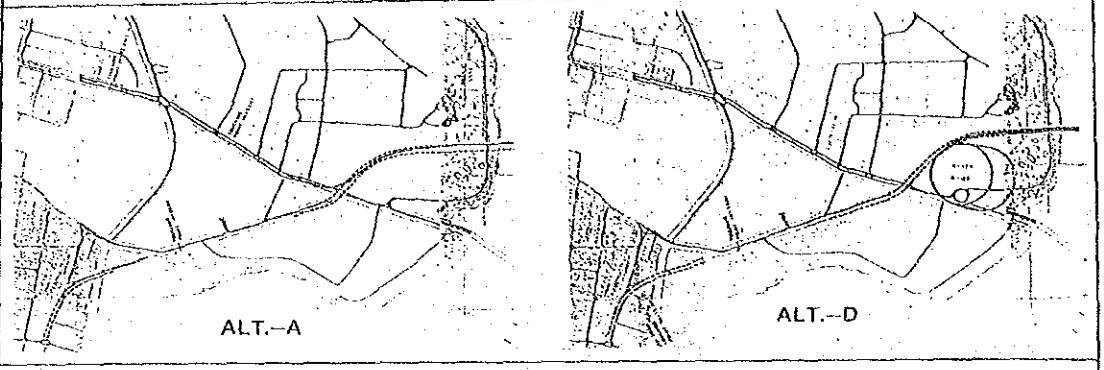
Table 6.3.18

Item						
Plan	 					
Purpose of Comparison	To select most appropiate access plan considering traffic distribution and estimate for the section from STA 0+00 to the end of access.					
Borehole Data	(Yes) . No	Topo. Survey Data	(Yes) . No	Gradient of Profile	4.3%	
Access bridge to Nyerere Ave.	(Planned) , Not	Flyovers to exising Railways or Roads	Planned , (Not)			
Cross Section	10.5m for 2 lanes, 20m for 4–lanes and 5.5m for ramp access					
Main Bridge	Super-structure	Cable Stayed Bridge				
	Sub-structure	Pile Foundation				
Approach Bridge	Super-structure	P.C Rigid Frame, Post-Tension Girder and R.C Hollow slab				
	Sub-structure	Pile Foundation for P.C Rigid Frame, Spread Foundation for Post-Tension				
Unit Cost	Revised cost from Table 6.3.9					

Costs / Alt.	Main Bridge			Approach Bridge			Ramp		
	LxW (m)	K.Shs/m^2	x10^6 K.Shs	LxW(m)	K.Shs/m^2	x10^6K.Shs	LxW (m)	K.Shs/m^2	x10^6K.Shs
ALT.A (Initial)	415x10.5	64,400	280.8	605x10.5	17,600	111.7	–	–	–
〃 (Final)	〃	〃	〃	805x10.5	16,800	142.3	946.5x5.5	16,800	87.5
ALT.B (Initial)	〃	〃	〃	840x10.5	19,300	169.6	946.5x5.5	19,300	100.5
〃 (Final)	〃	〃	〃	370x10.5	13,000	50.5	–	–	–
ALT.C(Initial)	〃	〃	〃	625x10.5	19,200	125.7	–	–	–
〃 (Final)	〃	〃	〃	1,045x10.5	16,600	182.6	460.5x5.5	16,600	42.0
ALT.C(Initial)	415x20	48,400	401.8	673x10.5	19,400	137.4	–	–	–
〃 (Final)	–	–	–	1,670x10.5	19,900	348.5	–	–	–

6.3.6 ALTERNATIVE ACCESS STUDY ON MOMBASA ISLAND (2)

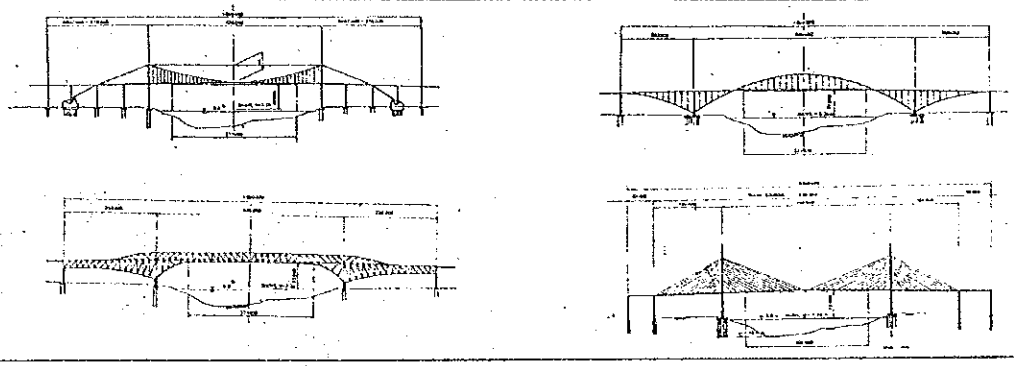
Table 6.3.19

Item	
Plan	
Purpose of Comparison	Alt. A and D selected in Table 6.3.18 to be compared considering the rail freight cost.
Borehole Data	(Yes) . No
Topo. Survey Data	(Yes) . No
Gradient of Profile	4.3%
Access bridge to Nyerere Ave.	(Planned) , Not
Flyovers to exising Railways or Roads	(Planned) , Not
Cross Section	Same cross section as Table 6.3.18
Main Bridge – Super-structure	Same structure as Table 6.3.18
Main Bridge – Sub-structure	〃
Approach Bridge – Super-structure	〃
Approach Bridge – Sub-structure	〃
Unit Cost	Revised cost from Table 6.3.9

Alt. \ Costs	Main Bridge			Approach Bridge			Ramp		
	LxW (m)	K.Shs/m^2	x10^6 K.Shs	LxW(m)	K.Shs/m^2	x10^{6}K.Shs	LxW (m)	K.Shs/m^2	x10^{6}K.Shs
Alt. A (Initial)	415x10.5	64,400	280.8	805x10.5	17,600	149.2	–	–	–
〃 (Final)	〃	〃	〃	1,160x10.5	16.800	204.9	946.5x5.5	16,800	87.5
Alt. D (Intial)	415x20	48,400	401.8	890x10.5	19,400	180.9	–	–	–
〃 (Final)	–	–	–	1,945x10.5	19,900	406.8	–	–	–

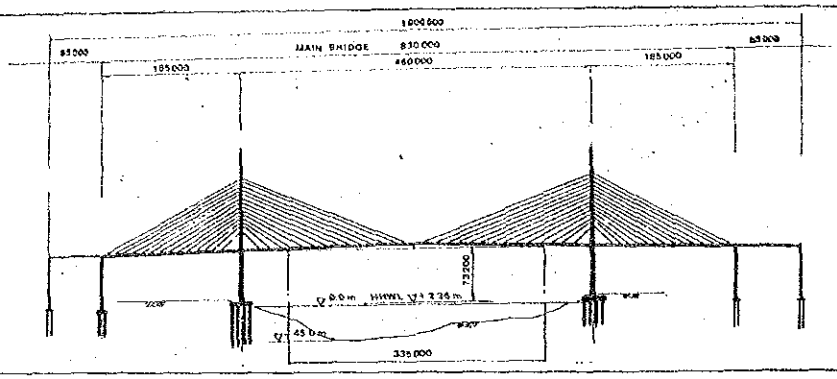
6.3.7 ALTERNATIVE MAIN BRIDGE STUDY

Table 8.6.1

Item	
Plan	
Purpose of Comparison	To select most appropiate main bridge type among 4 alternatives (Suspension, Cantilever Truss, Arch and Cable Stayed Bridges)
Borehole Data	(Yes) . No
Topo. Survey Data	(Yes) . No
Gradient of Profile	4.3%
Access bridge to Nyerere Ave.	Planned , (Not)
Flyovers to exising Railways or Roads	Planned , (Not)
Cross Section	4 lanes + Footpath = 20m
Main Bridge	Super-structure: Steel bridge case for all alternatives
	Sub-structure: Pile Foundation
Approach Bridge	Super-structure: Rigid Frame Bridge
	Sub-structure: Pile Foundation
Unit Cost	Past experience and cost estimation in this study

Costs / Alt.	Main Bridge			Approach Bridge			Ramp		
	LxW (m)	K.Shs/m^2	x10^6 K.Shs	LxW(m)	K.Shs/m^2	x10^6K.Shs	LxW (m)	K.Shs/m^2	x10^6K.Shs
Suspension Bridge	460x20	134,100	1,234	540x20	29,800	322			
Cantilever Truss Bridge	1,000x20	46,900	938						
Arch Bridge	〃	59,500	1,189						
Cable Stayed Bridge	830x20	49,000	813	170x20	29,700	101			

PROPOSED BRIDGE CONSTRUCTION COSTS

Item \ Table	Table 8.6.1
Plan	
Purpose of Comparison	Proposed bridge construction cost estimation by P.C & Steel main bridge and navigation clearance of 73.2, 55 and 45m 45m.

Borehole Data	(Yes) . No	Topo. Survey Data	(Yes) . No	Gradient of Profile	4.3%
Access bridge to Nyerere Ave.	(Planned) , Not	Flyovers to exising Railways or Roads	(Planned) , Not		

Cross Section	20m for 4-lanes, 10.5m for phase I and 10m for phase II in Staged construction	
Main Bridge	Super-structure	P.C or Steel Cable Stayed Bridge
	Sub-structure	Pile Foundation
Approach Bridge	Super-structure	P.C Rigid Frame, PC-T Girder, RC Hollow slab Bridges
	Sub-structure	Pile and Spread Foundation
Unit Cost	Preliminary cost estimation	

Costs / Alt.	Main Bridge			Approach Bridge			Ramp		
	LxW (m)	K.Shs/m^2	x10^6 K.Shs	LxW(m)	K.Shs/m^2	x10^6K.Shs	LxW (m)	K.Shs/m^2	x10^6K.Shs
PC H=73.2	830x20	47,800	861.376	940x11					
				4,030x10.5	22,600	1,643.987			
				620x11.75					
				1,040x12					
Steel H=73.2	830x20	49,800	896.260	Same as PC H=73.2					
PC H=55	830x10.5x2	65,000	1,133.802	1,155x11	16,364	686.132			
				2,075x10.5					
Steel H=55	830x10.5x2	79,500	1,386.340	Same as PC H=55					
PC H=45	830x10.5x2	63,300	1,102.708	860x11	11,626	450.433			
				1,570x10.5					
Steel H=45	830x10.5x2	78,500	1,369.092	Same as PC H=45					

APPENDIX L　B.Sと日本の道路橋示方書との比較

1）単純桁橋を想定し、B.Sの荷重及びTL−20による曲げモーメントを比較する。（表A−3参照）

荷重の種類

a）日本道路協会：TL−20

b）B.S　　：HA荷重

c）B.S　　：HB−25荷重と、HA荷重との複合荷重

径間長の変化

$\ell = 60\,m$, $\ell = 90\,m$, $\ell = 120\,m$

Table L-3　THE VALUE OF BENDING MOMENT

Span \ Load	J.R.A. TL-20	B.S. HA Loading	B.S. HA Loading HB-25 Loading
ℓ = 60 m	2,416 t-m (1.0)	2,879 t-m (1.19)	2,819 t-m (1.17)
ℓ = 90 m	4,770 (1.0)	5,207 (1.09)	5,125 (1.08)
ℓ = 120 m	7,378 (1.0)	7,943 (1.08)	7,969 (1.08)

2）部材断面力の増分

上表で$\ell = 120m$の場合、B.S荷重による曲げモーメントのTL−20荷重による曲げモーメントとの比は1.08を超過していない。これ故に、当プロジェクトの橋梁は、その比が1.08を超えることはないと考えられる。この理由は、当橋長が長く、不静定であり、活荷重の影響がより小さいと推定されるからである。

一方、代表的な部材断面力に関する、活荷重の死荷重に対する比（R）は表L−4となる。

Table L-4　RATIO (R)

Member \ R	R = L/D
Main Girder	< 0.6
Cable	< 0.3
Tower	< 0.4

これ故に、TL−20の替りにB.Sを適用した場合の部材断面力の増分は、R×0.08として計算でき、結果は以下のとおりである。

主　桁　　$0.6 \times 0.08 = 0.048$

ケーブル　　$0.3 \times 0.08 = 0.024$

塔　　$0.4 \times 0.08 = 0.032$